BUREAU OF RECLAMATION

Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project for Water Year 2022

Central Valley Project, California

California-Great Basin Region

Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address eople, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

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.

Annual Report on the Long-Term Operation of the Central Valley Project and State Water Project for Water Year 2022 Central Valley Project, California

Central Valley Project, California

California-Great Basin Region

prepared by

Bureau of Reclamation
California Department of Water Resources, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife

Cover Photo: Shasta Dam in September 2021. Photo Credit: Derek Rupert.

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Introduction

This Annual Report for Water Year (WY) 2022 fulfills the annual reporting requirements for the Long-Term Operation (LTO) of the Central Valley Project (CVP), and State Water Project (SWP) describes compliance with the Incidental Take Statements (ITS), Reasonable and Prudent Measures (RPMs), and Terms and Conditions of the 2019 National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) Biological Opinions. The Proposed Action, implemented through Reclamation's Record of Decision (ROD), dated February 19, 2020, includes coordination with the California Department of Water Resources (DWR) to mitigate, protect, restore, and enhance fish and wildlife, deliver water, and generate power in the Central Valley and Bay-Delta, consistent with Endangered Species Act (ESA) requirements for Delta smelt (Hypomesus transpacificus), Southern distinct population segment (sDPS) of North American green sturgeon (Acipenser medirostris), California Central Valley (CCV) steelhead (Oncorhynchus mykiss), Central Valley (CV) spring-run Chinook salmon (Oncorhynchus tshawytscha) and Sacramento River winter-run Chinook salmon (Oncorhynchus tshawytscha) and their designated critical habitats, Southern Resident killer whale (Orcinus orca) as well as other fish and wildlife species.

Background

The Proposed Action included water and power operations, monitoring, habitat and facility improvements, intervention, and special studies. Bureau of Reclamation (Reclamation) and DWR incorporated conservation measures to avoid, minimize, and compensate for incidental take of listed species, as well as to contribute to the recovery and enhancement of species and their habitats. These measures would be anticipated to improve production, growth, and survival of listed species over time. Reclamation and DWR committed to review the implementation of the Proposed Action at four-year intervals (i.e., 2024 and 2028) through an independent panel of experts to review the Upper Sacramento River Performance Metrics; Old and Middle Rivers management, and measures to improve survival through the south Delta and Delta Smelt Summer-Fall Habitat Actions. After coordinating with the State of California, Reclamation requested reinitiation of consultation on the long-term operations of the CVP and SWP on September 30, 2021 and NMFS and USFWS agreed to reinitiated consultation on October 1. During reinitiated consultation, Reclamation and DWR will continue to implement the 2020 ROD, as modified by any applicable court orders.

Seasonal operation and tributary reports are attached to this document to provide detailed discussion on the implementation of specific components of the Proposed Action. Conclusion sections in this Annual Report identify overall clarifications and recommendations to improve implementation.

Reclamation and DWR worked extensively with NMFS and USFWS to incorporate programmatic conservation measures within Reclamation's authority, available appropriations, and state cost share capabilities. The Proposed Action included a science-based framework using structured decision making to prioritize actions for fish. This Annual Report describes progress in defining, planning, permitting, and implementing a number of these components during WY 2022. The WY 2022 started on October 1, 2021 and ended on September 30, 2022, but some instances of information included in this Annual Report may be outside of the WY.

Systemwide Operations Summary

The continued drought conditions in 2022 required extensive coordination, planning and actions by federal, state, and local entities to accommodate diminished water supplies. During the WY, Reclamation met multiple time per week with agencies, the State Water Resources Control Board (SWRCB), water right holders, and other stakeholders to coordinate operations and responses to the challenging water year. A general operational summary by month is provided below with additional discussion in seasonal reports and special drought reports.

In WY 2022, drought conditions and implementation of the court ordered Interim Operations Plan (IOP) resulted in significant uncertainty regarding CVP operations, particularly in the upper Sacramento River, where diversions and summer releases were reduced significantly compared to any prior year. In the Delta, Reclamation followed the IOP and requested a temporary change to Delta water quality requirements in April-June 2022 in a Temporary Urgency Change Petition, which the SWRCB granted through a Temporary Urgency Change Order (TUCO). On the San Joaquin River, significant releases from Friant Dam were required to meet senior water right demands south of the Delta in spring 2022 that could not be met through Delta water supplies as the system was originally designed.

October 2021

WY 2022 began October 1, 2021 following two dry hydrologic year types in WY 2020 (classified as Dry) and 2021 (classified as Critical). WY 2021 was the driest water year since 1977 for the CVP and SWP and was preceded by WY 2020 which was in the top ten driest years on record. The two-year inflow for 2020-2021 was the second lowest on record (after 1976-77). Storage at the start of the WY 2022 began with Shasta at 1.1 million acre feet (MAF), Folsom at 230 thousand acre feet (TAF), Trinity at 710 TAF, and New Melones at 843 TAF.

During October, the Delta Cross Channel gates were typically opened during the weekends and then closed during the week for Rio Vista Flow standards. The October Delta Outflow Standard was 3,000 cubic feet per second (cfs).

A fall pulse flow on the Stanislaus River was initiated October 17th and continued through November 4th.

In anticipation of drought conditions continuing into 2022, DWR and Reclamation initiated early drought action activities in 2021. These actions included the approval to delay the removal of the West False River Drought Barrier to November 2022.

October ended with 12.7 inches of measurable precipitation recorded on the Northern Sierra Precipitation: 8-Station Index (8-Station Index), a summary of precipitation spanning Mount Shasta City in the Sacramento River Basin above Shasta Dam, to Pacific

House in the American River Basin above Folsom Dam. Average historical precipitation in October is 2.8 inches. In the San Joaquin, the 5-Station Index (5-Station Index) reported 6.6 measurable inches of precipitation for the month of October where the monthly historical average is 2.1 inches.

November 2021

The fall pulse flow on the Stanislaus River continued through November 4th. By late November, all CVP reservoirs were at or close to minimum releases. The November Delta Outflow Standard was 3,500 cfs. Sacramento River flows decreased to 4,600 cfs by November 2nd.

November received 3.1 inches of precipitation for the 8-Station Index where the historical average is 5.3 inches. In the San Joaquin, the 5-Station Index reported 0.9 inches of precipitation for the month of November where the monthly historical average is 3.6 inches.

December 2021

DWR and Reclamation submitted a Temporary Urgency Change Petition (TUCP) to the SWRCB requesting a modification of certain water rights Decision 1641 (D-1641) objectives during February 1 through April 30, 2022. The purpose of these requested modifications were to conserve upstream storage through operational flexibility. This modification was requested under the assumption that WY 2022 would continue with dry conditions from 2021.

By early December, all reservoirs were at or close to minimum releases. The December Delta Outflow Standard was 3,500 cfs. In late December, both CVP and SWP reduced exports due to the triggering of a “First Flush” fishery action. Exports were reduced for 14 consecutive days to target an Old and Middle River index objective of no more negative than -2,000 cfs.

December saw 14.4 inches of precipitation for the 8-Station Index where the average is historically 10.0 inches. In the San Joaquin, the 5-Station Index reported 12.7 inches of precipitation for the month of December where the monthly average is historically 6.5 inches.

January 2022

On January 18, 2022, DWR and Reclamation withdrew the TUCP because of improved storage conditions in Folsom and Oroville reservoirs.

Lake Oroville end-of-January storage was about 1.6 MAF (46% of capacity and 80% of historical average) and higher than it was at the end of January 2021. During January,

Lake Oroville surpassed its 2021 peak storage of about 1.5 MAF, last seen in April 2021. However, with the extreme dry January and recent increased Feather River releases, Lake Oroville storage was projected to stabilize or decrease until additional hydrology was seen in the watershed.

Lake Shasta end-of-January storage was 1.62 MAF (36% of capacity and 55% of historical average). Folsom Reservoir end-of-January storage was approximately 533 TAF (55% of capacity and 119% of historical average) and encroached, but was below, its flood pool space during the month of January. Trinity Reservoir was well below average with an end-of-January storage of about 763 TAF (31% of capacity and 49% of historical average).

In the San Joaquin watershed, storage in New Melones Reservoir ended January with a storage of 993 TAF, which is 41% of capacity and 71% of historical average, and about 550 TAF lower than this time last year.

Releases to the Sacramento River from Keswick Reservoir were at the minimum of 3,250 cfs. Total releases to the Feather River from Lake Oroville were at a minimum of 950 cfs throughout most of January. However, because of the extreme dry January conditions, releases from Lake Oroville were increased to 3,000 cfs at the end of January to meet increased Delta Outflow required by D-1641.

In January 2022, the West False River barrier was notched by removing rock from approximately 400 feet from the center section to allow boat and fish passage.

Releases from Folsom ranged between 5,000 cfs at the beginning of January to 2,000 cfs, which were necessary to maintain Folsom reservoir below the flood control limit. Releases from New Melones were maintained at a minimum flow of 200 cfs and were increased late January to meet the D-1641 February Vernalis base flow.

January provided just 1.3 inches of precipitation for the 8-Station Index where the historical average is 9.1 inches. In the San Joaquin, the 5-Station Index reported no measurable precipitation for the month of January where the historical monthly average is 7.7 inches.

February 2022

The following initial CVP allocations were issued on February 23: Sacramento River Irrigation water service and repayment contractors north-of-Delta were allocated 0% of their contract total. Municipal and industrial (M&I) water service and repayment contractors north-of-Delta were provided water for public health and safety needs consistent with the CVP M&I Water Shortage Policy. Sacramento River Settlement Contractors' (SRSC) water supply was made available for diversion in accordance with associated contracts. The 2022 water year was designated as a critical year, as defined in their Settlement Contracts. American River M&I water service and repayment contractors north-of-Delta who are serviced by Folsom Reservoir on the American River were

allocated 25% of their historical use. In-Delta Contractors M&I water service and repayment contractors who are serviced directly from the Delta were allocated 25% of their historical use. Irrigation water service and repayment contractors south-of-Delta were allocated 0% of their contract total. M&I water service and repayment contractors south-of-Delta were allocated 25% of their historical use. For San Joaquin River Exchange Contractors and San Joaquin Settlement Contractors, the 2022 water year was designated as a critical year, as defined in their contracts. For water supply for wildlife refuges (Level 2), north- and south-of-Delta, the 2022 water year was designated as a critical year, as defined in their contracts. Friant Division contractors' water supply was delivered from Millerton Reservoir on the upper San Joaquin River via the Madera and Friant-Kern canals. The first 800,000 acre-feet of available water supply is considered Class 1; Class 2 is considered the next amount of available water supply up to 1.4 MAF. Given the hydrologic conditions, the Friant Division water supply allocation was 15% of Class 1 and 0% of Class 2.

The Delta Outflow objective for February was 11,400 cfs. February saw just 0.4 inches of precipitation for the 8-Station Index where the historical average is 8.9 inches. In the San Joaquin, the 5-Station Index reported only 0.2 inches of precipitation for the month of February where the historical monthly average is 6.9 inches.

A Shasta Critical Year determination was made for Settlement Contractors and wildlife refuges (based on a threshold of 3.2 MAF). Meet and confer discussions continued with SRSC outlining several voluntary actions to support temperature management downstream of Shasta Reservoir. Reclamation and DWR requested actions from partner agencies and stakeholders to include in the Drought Toolkit and consider implementation of measures in the current year. The SRSC identified specific actions for the Drought Contingency Plan.

March 2022

March Sacramento River Unimpaired Runoff forecasts from DWR provided a 4-Station Index of 38% of average at 90% exceedance. Reclamation announced that south of Delta agricultural allocations were no longer available and maintained M&I allocations. Meet and confer discussions continued with the SRSC for sharing a reduced delivery schedule and several options for shifting anticipated transfer volumes to support Shasta temperatures. Delta Outflow standards required Reclamation to begin increasing releases at both Shasta and Folsom. Reclamation began evaluating a potential warm water bypass at Shasta to conserve cold water for later in the summer. Reclamation began working with the SRSC to evaluate delays in their diversions, changes to the pattern of Trinity River Basin imports, and a warm-water power bypass. Reclamation began discussing San Luis operations with DWR and developing contingency plans for meeting San Joaquin River Exchange Contractor, San Joaquin River Settlement Contractors, and Level 2 Refuge Water Supply demands south of the Delta. Reclamation's operational outlooks planned to operate Shasta primarily for Sacramento River Settlement Contracts and Delta Outflow and salinity standards while protecting a minimum power, temperature, and facility function storage at Lake Oroville. Coordination with DWR identified a potential need for

a Coordinated Operation Agreement debt for the SWP and for Reclamation to potentially borrow a volume of water in San Luis to meet CVP south of Delta deliveries.

The United States District Court for the Eastern District of California ordered implementation of the IOP on March 11 and 14, 2022, which directed CVP and SWP operations for the remainder of the water year.

Federal and state agencies, along with the SRSC announced an approach to address CVP operations on the Sacramento River (mid-April through November) during the third consecutive year of drought.

March saw 1.3 inches of precipitation for the 8-Station Index where the historical average is 8.1 inches. In the San Joaquin, the 5-Station Index reported only 1.7 inches of precipitation for the month of March where the historical monthly average is 6.3 inches.

April 2022

Storage conservation at Shasta, Trinity, Folsom, New Melones and Oroville reservoirs continued to be a priority during the winter and spring. The 2022 TUCO, which was conditionally approved on April 4, allowed the CVP and SWP to decrease reservoir releases in April and continue conserving storage in the spring to help meet needs in the summer.

Effective April 1, water supply for all CVP M&I water service contractors were reduced to Public Health and Safety.

Releases from New Melones Reservoir from mid-April to mid-May were consistent with the Stepped Release Plan Spring Pulse Flow.

Due to the inability of Reclamation to provide enough water from the Delta in 2022 for the contractual demands of senior water rights contractors in Mendota Pool, Reclamation began making releases from Friant Dam on April 1, 2022, to meet these demands. As a result, the San Joaquin River Restoration Program had to cease San Joaquin River releases on April 11, 2022, due to the unavailability of river capacity for the Restoration Program flows.

April saw 6.1 inches of precipitation for the 8-Station Index where the historical average is 4.3 inches. In the San Joaquin, the 5-Station Index reported only 2.2 inches of precipitation for the month of April where the historical monthly average is 3.5 inches. April brought above average precipitation, which did help in increasing storages in Folsom and Oroville reservoirs; however, it did not alleviate the overall deficit in the amount of precipitation during the previous three months.

May 2022

Throughout much of May, storage in Lake Oroville remained well below average for the time of year, whereas Folsom was above average after the April storms into May.

Lake Shasta storage was about 1.82 MAF (40% of capacity and 48% of historical average). Trinity Reservoir storage was about 747 TAF (31% of capacity and 39% of historical average)- an all-time low for the time of year. Folsom Lake storage was approximately 857 TAF (87% of capacity and 110% of historical average). Due to both early season snowmelt and April's above average precipitation, storage continued to increase during this month.

In the San Joaquin watershed, storage in New Melones Reservoir was 887 TAF, which was 37% of capacity and 59% of historical average.

Releases from New Melones were made to target a Vernalis flow of 710 cfs per the TUCO.

DWR and Reclamation developed preliminary operational forecasts through September 2022, using the 90% exceedance forecast from the May 1, 2022, Bulletin 120 forecast developed by DWR's Division of Flood Management. The operational forecast included in the Drought Plan reflected a potential outcome given the hydrologic forecast on May 1 and assumptions on initial regulatory and policy decisions regarding prioritization of a limited water supply. The forecast was designed to make the most efficient use of the limited water resources in 2022 for multiple beneficial uses while meeting regulatory requirements and managing the potential risks of continued drought conditions into next year. There were four main goals of Project operations within the forecasts: (1) Meet health and safety requirements throughout the SWP and CVP service areas, including those that rely on Project exports; (2) Preserve upstream storage to the extent possible for temperature management, instream uses in the water year, and carry-over storage for future drought protection; (3) Meet regulatory and senior/riparian water right obligations throughout the basins; and (4) Deliver available project water not needed to meet the previous three goals.

Reclamation submitted on May 2, 2022, the Sacramento River Temperature Management Plan for Water Year 2022 (Temperature Management Plan). The Temperature Management Plan was developed pursuant to the 2020 Record of Decision and the proposed action analyzed in the 2019 NMFS Biological Opinion for the LTO of the CVP and SWP as modified by the IOP adopted by the court on March 11 and 14, 2022 and in compliance with Order 90-5. The Temperature Management Plan was accepted in May 2022.

For the American River, on May 11, 2022, Reclamation suggested to delay the release of the Draft Lower American River (LAR) Temperature Management Plan (TMP) until June 1, 2022. In the absence of a May 15, 2022 Draft TMP for review and implementation, Reclamation committed to operating at an upper temperature limit not to exceed 68° F at Hazel Ave. The extension was based on hydrologic changes that had been relatively

unpredictable. Reclamation wanted to utilize the May 2022 forecast for modeling which would allow for a better operational response to temperature management through October 15.

Reclamation operated Shasta Reservoir and the Sacramento River consistent with a multi-agency agreement on maximum average Keswick releases of 4,500 cfs from May through August.

The Delta Cross Channel gates were opened for several days at the end of May for the Memorial Day weekend.

May saw 0.6 inches of precipitation for the 8-Station Index where the historical average is 2.8 inches. In the San Joaquin, the 5-Station Index reported no measurable precipitation for the month of May where the historical monthly average is 2.1 inches.

June 2022

Small storms in June resulted in an above average June, but the extremely dry conditions during most of the precipitation season left the water year well below average.

Although the historic January through March dry conditions were setting up conditions for additional D1641 modifications beyond June 2022, April storm events and subsequent storage gains improved conditions in both Oroville and Folsom, and based on the May 1 B120 forecast, Reclamation and DWR did not submit an additional TUCP for July and August.

By mid-June, releases to the Sacramento River from Keswick Reservoir were at 4,000 cfs and were expected to increase to 4,500 cfs in late June or early July. Total releases to the Feather River from Lake Oroville were 3,500 cfs.

Releases from Folsom were at 2,250 cfs for both storage conservation and to conserve cold water for temperature management later in the summer and fall. The LAR TMP was released on June 1, 2022.

Releases from New Melones for the month of June targeted to achieve a monthly average Vernalis flow of 710 cfs as per the TUCO.

Combined LTO exports were approximately 1,200 cfs in June. Low exports from SWP were projected to continue. The Delta Cross Channel gates were kept closed throughout June to maintain water quality at Emmaton/Threemile Slough.

On the American River, updated modeling results in May 2022 showed improvement and resulted in a feasible temperature target of 66°F at Hazel Ave. Based on these various model runs, the LAR TMP goal targeted 66°F or below at Hazel Ave. from June 1, 2022 to October 31, 2022 and targeted 58°F from November 1, 2022 until December 31, 2022.

July 2022

The SWRCB curtailed about 5,800 water rights in the Sacramento and San Joaquin rivers watersheds. In total, the Board curtailed 9,842 water rights in 2022 in the Sacramento and San Joaquin watersheds, more than half of the nearly 16,700 existing rights.

On July 8, Reclamation increased the 2022 water allocation for Friant Division Class 1 contractors from 15 percent to 20 percent, and then to 30 percent on July 20.

August 2022

Several water chilling units were employed at Livingston Stone National Fish Hatchery to cool and stabilize the entire water supply to benefit winter-run Chinook salmon in preparation for a third year of unprecedented drought. With the help of these chillers, the hatchery continued to provide a critical safety net for winter-run Chinook salmon while in-river conditions remained poor.

Flows from Lewiston Dam were increased as a preventative baseflow to ameliorate hostile conditions in the lower Klamath River. An unusually early run of fall-run Chinook salmon in the lower river revealed concerning levels of ich and columnaris, two diseases that have contributed to major fish kill events in prior years.

September 2022

During a record-setting heat wave, the CVP provided more than 31 million kilowatt-hours of peak demand time electricity for California electric power customers (One kilowatt-hour is a standard measurement of energy that equals 1,000 watts of electricity used during one hour).

WY 2022 ended with reservoir storages of Trinity Reservoir at 553 TAF, Lake Shasta at 1.5 MAF, Folsom Reservoir at 345 TAF, and New Melones Reservoir at 619 TAF. Because of the historic three consecutive dry years, Reclamation and its partners began WY 2023 preparing for continued dry conditions.

The end of water year storage in major system reservoirs (i.e., Shasta, Trinity, Oroville, Folsom, and New Melones) was approximately 3.6 MAF in 2021; the end of WY 2022 storage during the month of September was projected to be 4.2 MAF, about half the historical average for this time of year.

Due to the water year conditions and through the monthly American River Group (ARG), discussion of implementation of a Folsom Dam power bypass, starting in October 2022, was analyzed to discuss the potential improvement in water temperatures in the lower American River to reduce pre-spawn and egg mortality for fall-run Chinook salmon, provide more suitable temperatures for hatchery operations, and reduce stress on rearing

juvenile steelhead. The power bypass proposed included a power bypass at Folsom Dam to start on October 20, 2022 with flows not to exceed 500 cfs as needed to meet the temperature target of 62°F (at Hazel Avenue) and starting October 29th, 2022 the temperature target to meet would be 60°F (at Hazel Avenue) and ending with a temperature target of 56°F by November 1, 2022.

WY 2022 was the third consecutive dry year in California and as such Reclamation operated the CVP to prioritize public health and safety and endangered fish needs.

WY 2022 was in the top 10 driest years on record. The two-year inflow for WY 2020 and WY 2021 was the second lowest on record (after 1976-77). The following table provides recent end of water year storages between Shasta, Oroville and Folsom.

Table 1. End of water year storages (thousands of acre feet)

Location	WY20	WY21	WY22	15-yr avg.	15-yr avg.
Shasta	2,200	1,074	1,515	2,259	67%
Oroville	1,631	788	1,230	1,545	80%
Folsom	423	230	345	435	79%
total	4,254	2,092	3,090	4,239	73%

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Upper Sacramento River

Listed species in the upper Sacramento River, from Keswick Dam to Red Bluff Diversion Dam (Figure 1) include winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, southern DPS green sturgeon, and their critical habitats.

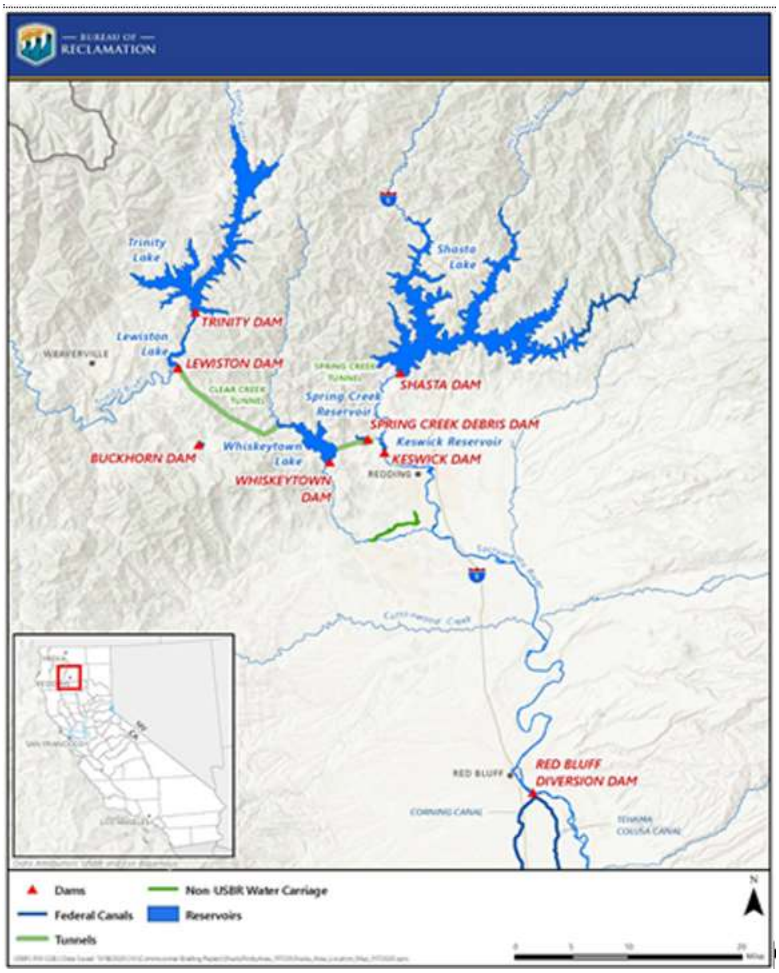

Figure 1. The Upper Sacramento River System.

Key components of the LTO include actions to rebuild storage for the upcoming water temperature management season, spring pulse flows for juvenile CV spring-run Chinook salmon migration, and cold water pool management for winter-run Chinook salmon incubation and emergence.

Fall and Winter Refill and Redd Maintenance

Under the Fall and Winter Refill and Redd Maintenance action, Reclamation rebuilds storage and cold water pool for the subsequent year during the fall and winter while also trying to minimize the amount of winter-run and fall-run Chinook salmon redd dewatering. Additional information is provided in the 2022 Seasonal Report for Shasta Lake Storage Rebuilding and Spring Pulse (Appendix A).

Redd Maintenance Performance

After discussion with the Upper Sacramento Scheduling Team (USST), the scenario labeled "Alternative J" was selected as the preferred flow schedule, as reflected by the change orders (Figure 2). Data regarding the dewatering estimates are provided in the seasonal reports (Appendix A and B)

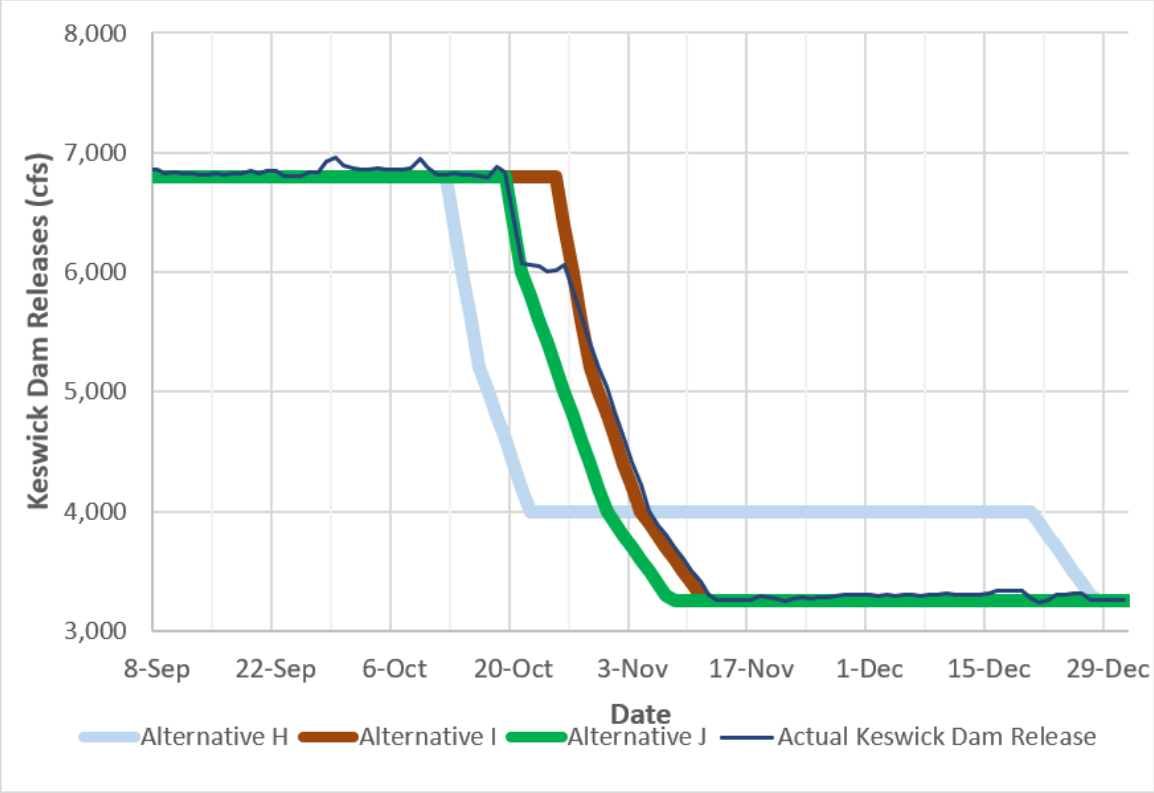

Figure 2. Fall flow reduction alternatives and actual Keswick Dam releases for September through December 2021.

Flow reduction scenario comparison for Alternatives 6, 7, 8, and 9. Actual or estimated emergence dates of winter-run Chinook salmon redds and actual or estimated dewatering flow for the September-October estimated redd emergence dates as compared to Keswick Reservoir flow (in cfs) of proposed management alternatives. Circles represent emerged, dewatered, or remaining redds. Numbers inside the circles indicate how many redds share that estimated emergence date and actual/estimated dewatering flow. Circles that are above/to the right of a flow alternative line are expected to be dewatered given that

management alternative is followed. Circles that are below/to the left of/on a flow alternative line are not expected to be dewatered, given that management alternative is followed. Black line represents the change order flows.

The 2019 NMFS Biological Opinion concludes that operations are expected to result in the incidental take of juvenile listed salmonids through stranding or redd dewatering throughout the upper Sacramento River from Keswick Dam to Red Bluff Diversion Dam. Take of winter-run Chinook salmon from changes in flow during the temperature management season is reasonably expected to result in egg mortality from the dewatering of up to one percent of redds. Less than one percent (0.03 percent) of winter-run Chinook salmons redds were dewatered during the summer/fall 2021. Reclamation did not exceed this take limit.

Take of CV spring-run Chinook salmon resulting from flow changes from summer releases down to 3,250 cfs is reasonably expected to result in egg mortality from the dewatering of up to three percent of redds. The anticipated level of take will be exceeded if flow decreases occur at a rate greater than the ramping rates described in the proposed action with the exception of flood control and emergency conditions. Keswick Dam release change orders adhered to the ramping rates described in the Proposed Action adopted in the ROD and, therefore, did not exceed the established take limit of three percent for CV spring-run Chinook salmon.

February Projection of Water Operations

The majority of precipitation in California typically falls in February and March; however, the first information on the potential water year is provided at the end of January. Reclamation included in the Proposed Action and NMFS included RPM 1.e.:

> *In February of each year, Reclamation shall create and post a projection of water operations, as described in [Appendix C] of the biological assessment.*

Reclamation provided a projection of water operations to NMFS as part of the Sacramento River Temperature Task Group (SRTTG) meetings beginning February 24, 2022.

Spring Pulse Flows

The Proposed Action states that:

> *Reclamation anticipates that a projected May 1 storage greater than 4 MAF provides sufficient cold water pool management for Tier 1 and may release the spring pulse if it does not impact the ability to meet project objectives. Reclamation could also determine, in coordination with the Upper Sacramento scheduling team, that while the reservoir is less than 4 MAF, there is sufficient water to do a pulse of up to 150 TAF.*

NMFS included a limitation on spring pulse flows in RPM 1.b:

Reclamation shall not implement the Spring Pulse Flow if the release would cause Reclamation to drop into a lower Tier of the Shasta summer temperature management.

Due to low Shasta Lake storage and projected May 1 storage not exceeding 4 MAF, the action did not occur.

Shasta Lake Storage

The closer Shasta Reservoir is to full by the end of May, the greater the likelihood of being able to meet the winter-run Chinook salmon temperature targets throughout the entire temperature control season. The Proposed Action states in a summary that:

The PA includes several operational components that are intended to contribute to increased spring Shasta storage levels …

By late March 2022, prior to agricultural demands/diversions, total Shasta Lake storage volume was low. May 1 storage in Shasta Lake was 1.81 MAF, approximately 47.5 percent of the average. Cumulative inflow (TAF) to Shasta Lake from October 1 to May 1 compared to the increase in storage (TAF) from October 1 to May 1 for a period of record of WY 2009 – WY 2021 is shown in Figure 3. In WY 2022, Shasta Lake had slightly more cumulative inflow than WY 2014; however, WY 2020, 2021, and 2022 have three of the lowest cumulative inflow volumes for the period of record 2009 – 2022.

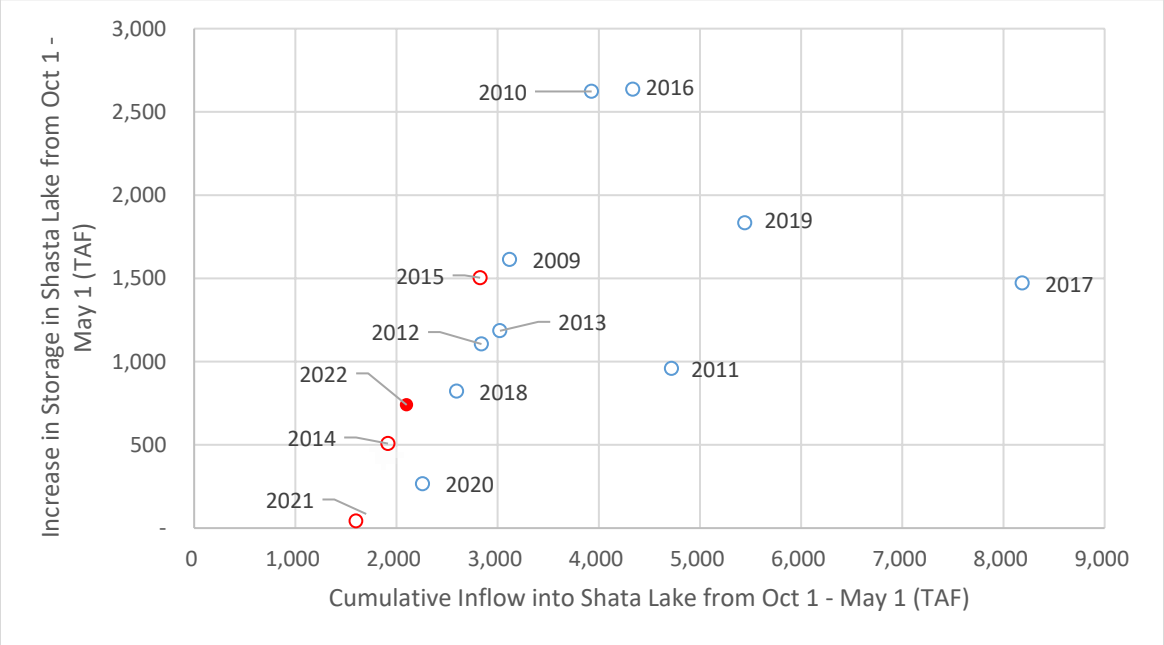

Figure 3. Shasta Lake Storage Performance from WY 2009 – WY 2022. Critically dry water year types are shown in red; all others are shown in blue.

Shasta Lake cold water pool volumes for recent critical and dry hydrologic year-types and WY 2022 are shown in Figure 4. The Temperature Control Device (TCD) on Shasta Dam selectively draws water from different elevations in the lake, allowing Reclamation to use

warmer surface water earlier in the season and preserve cold water for the temperature management season later in the year while maintaining hydropower generation. The dry conditions and low reservoir storage this year prevented using the TCD upper gates which utilizes the highest elevations and warmest water in the reservoir and only the TCD middle gates were available to use in the spring. These TCD limitations resulted in using larger volumes of water from elevations of cooler temperatures than desired during the early temperature management period, when typically the upper gate are accessible to blend with these middle gate elevations. Implementation of a cold water bypass was discussed in July and August. Ultimately it was determined a cold water bypass should not be pursued. Unless there is an issue with how the TCD functions, typically the TCD has removed the need for a power bypass. Reclamation has attempted power bypasses since the TCD was installed but has not seen much difference in water temperatures in the river.

According to the 2020 ROD,

> *During Tier 3 and 4 years, Reclamation shall Meet and Confer with USFWS, NMFS, DWR, CDFW, and the Sacramento River Settlement Contractors (SRSC) on voluntary measures to be considered.*

In February 2022, a multi-agency team discussed increasing Livingston Stone NFH winter-run Chinook salmon production targets for WY 2022. Typically, the USFWS would collect 60 females and 100 males out of the Keswick fish trap; however, due to poor conditions and anticipated low survival of Brood Year (BY) 2022 natural winter-run Chinook salmon, they were granted approval to increase collection for production of hatchery juveniles. Reclamation also prepared chillers for use later in the season in the event that deliveries to the hatchery became too warm. Additionally, a Shasta Critical Year determination was made in February, which resulted in 75% of contract totals under the Sacramento River Settlement Contracts. Due to the very low storage at Shasta Lake and the two back-to-back years of low egg to fry survival for the endangered winter-run Chinook salmon, Reclamation, DWR, NMFS, FWS, CDFW, and the SWRCB worked with the Sacramento River Settlement Contractors (SRSC) to develop an approach for a Keswick Dam release plan that conserved Shasta Lake storage and prioritized temperature management in the Sacramento River. This release plan was used to determine the available water for diversion by the SRSC and the wildlife refuges north of the Delta. The estimate was that approximately 18% of the contract totals would be available for diversion in WY 2022 based on the release assumptions.

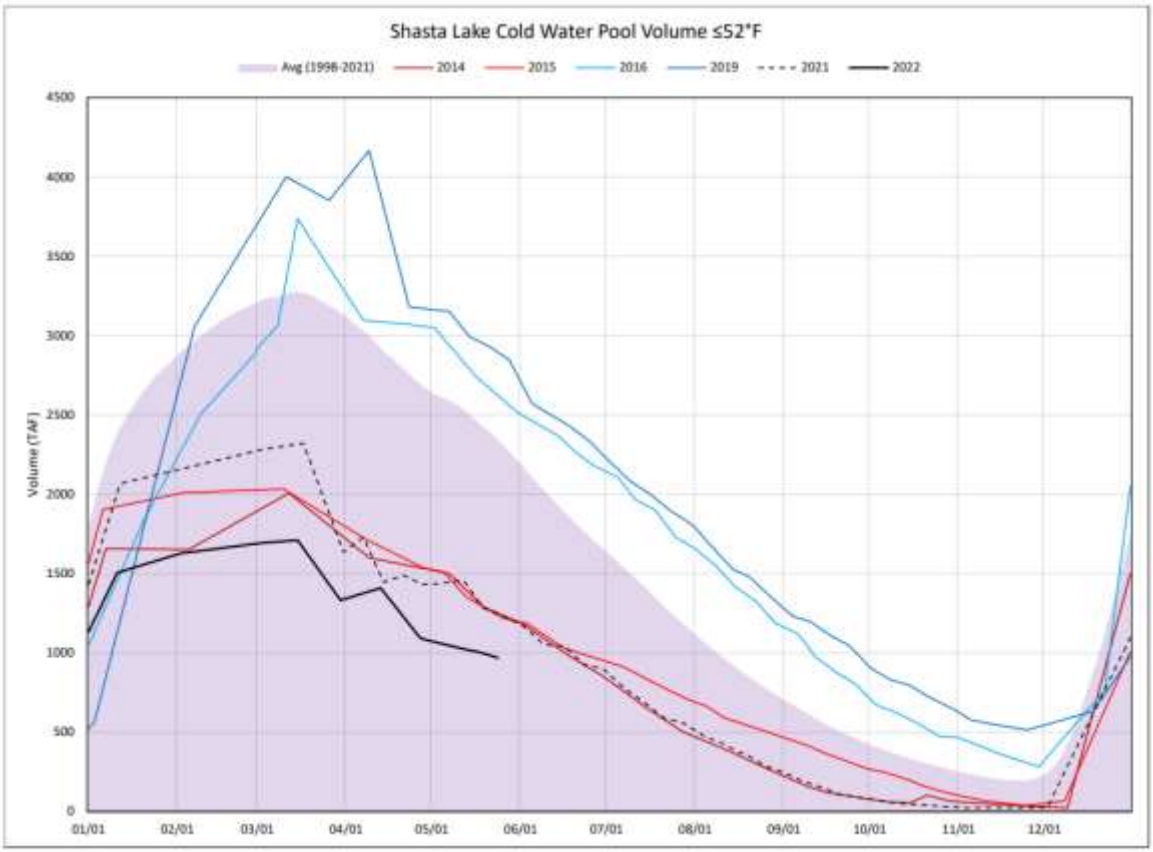

Figure 4. Shasta Lake cold water pool volumes <52 °F for select years and WY 2022

Cold Water Pool Management

The Shasta Cold Water Pool Management Seasonal Report provides an integrated view of the system and the factors affecting the coordinated operation of the CVP and SWP and focuses on actions taken specifically by Reclamation for Shasta Lake's cold water pool management. The NMFS ITS identified the incidental take of winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead anticipated from water temperature effects and from flow management of the operation of the Upper Sacramento River (Shasta and Sacramento Division; NMFS Biological Opinion, pages 800 - 803). In a Tier 4 year, NMFS anticipates the temperature-dependent egg mortality of winter-run Chinook salmon will be 77 percent or greater. In 2022, Reclamation's forecasted TDM estimates ranged from 70% – 82% using redd data from 2016 – 2021. Reclamation's hindcast TDM estimate was 18% using redd data from 2022.

NMFS further included as part of the ITS that the anticipated level of take for winter-run Chinook salmon will be exceeded if there are two consecutive years of egg-to-fry survival of less than 15 percent followed by a third year of less than 21 percent based on fry production at Red Bluff Diversion Dam. Egg-to-fry survival in 2020 and 2021 was less

than 15 percent; therefore, the agencies were facing third year conditions for 2022 and sought extraordinary actions to reduce temperature-dependent egg mortality and increase egg-to-fry survival. In addition to systemwide drought actions and other pre-season actions described above, Shasta Dam releases were significantly reduced in order to maintain available cold water pool and reduce temperature-dependent egg mortality. While these release reductions were successful in keeping temperature-dependent egg mortality low, egg-to-fry survival is still estimated to be less than 21 percent. Each year, NMFS includes a preliminary estimate of egg-to-fry survival in the Juvenile Production Estimate letter. The BY 2022 Juvenile Production Estimate letter includes an estimated 2.17% egg-to-fry survival. NMFS noted that "naturally-spawning winter-run Chinook salmon adults with low thiamine levels spawned eggs low in thiamine which likely resulted in a decreased number of successful fry upstream of RBDD" (pg. 3).

The NMFS ITS included that the anticipated level of take for CV spring-run Chinook salmon and CCV steelhead will be exceeded if a condition for exceedance of take of winter-run Chinook salmon is met.

Because the anticipated level of take was exceeded for winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead, Reclamation is required to reinitiate consultation (50 CFR 402.16). Reclamation reinitiated consultation with NMFS and USFWS in September 2021 and is anticipating completion of re-consultation in 2024.

Commitment to Cold Water Management Tiers

The Proposed Action provides for the Tier to be determined based on May 1 storage and that, *"Once the initial tier is selected by May 15th, Reclamation will not cause a shift into a warmer tier during real-time implementation of the Shasta Cold Water Management Plan except in the event of responding to emergency and/or unforeseen conditions"* (Reclamation's Proposed Action for Long-term Operations – Commitment to Cold Water Management Tiers 4.10.1.4.2).

Tier 4 conditions were identified in the Sacramento River Temperature Management Plan, which is provided as part of the Shasta Cold Water Pool Management Seasonal Report (Appendix B) and is posted to the SRTTG web page at https://www.usbr.gov/mp/bdo/water-year-2021-rivertask.html. Reclamation operated consistent with the Temperature Management Plan.

Sacramento River Temperature Management Plan

To obtain technical assistance on the management of the cold water pool in Shasta Lake, Reclamation included collaborative development of a Temperature Management Plan in the Proposed Action, and NMFS included RPM 1.a:

- *In coordination with NMFS and the Sacramento River Temperature Task Group, Reclamation shall consider technical assistance from NMFS regarding the development of annual temperature management plans, regardless of Shasta storage or tiered temperature management stratum. Reclamation shall submit the final temperature management plan to NMFS by May 20 of each year.*

Reclamation coordinated with NMFS through the SRTTG and completed the Sacramento River Temperature Management Plan in 2022. It is provided as part of Appendix B.

Upper Sacramento Performance Metrics

The Upper Sacramento Performance Metrics are included in the Shasta Cold Water Pool Management Seasonal Report in Appendix B. The objectives of the annual and multi-year hindcast evaluations are to:

- Meet performance metrics objectives and expectations. Identify if results reflect the modeled and analyzed results and show a tendency towards performing as least as well as modeled;
- Evaluate whether either the total egg-to-fry survival or the temperature-dependent egg mortality exceeded the Tier objective; and
- Contribute to determining whether an independent review of the year is required. (Biological Assessment page 4-37)

NMFS required as RPM 1.d.:

- *By February of each year, Reclamation shall provide a hindcast report of temperature-dependent mortality for winter-run Chinook salmon based on realized temperature management.*

Additionally, the Proposed Action describes how these metrics will be updated:

- *Prior to the initial Four-Year Review independent panel, Reclamation shall refine performance objectives for temperature dependent mortality and the total survival of winter-run Chinook salmon from egg incubation to juvenile migration at Red Bluff Diversion Dam. Reclamation expects to participate in an effort by NMFS to establish early life stage survival rates that are required for a positive cohort replacement rate.*

Tier 4 years have no specific performance criteria for TDM or egg-to-fry survival and rely on interagency coordination to achieve the best negotiated outcome. Reclamation's Hindcast TDM estimate using the SacPAS both the stage dependent mortality model and stage independent mortality model is 18%. A final estimate for egg-to-fry survival to Red Bluff Diversion Dam is not available at this time. However, as mentioned above, the NMFS Juvenile Production Estimate letter estimated egg-to-fry survival for WY 2022 at 2.17%. Refer to the Shasta Cold Water Pool Seasonal Report for more information on recent preliminary and historical estimates of winter-run Chinook salmon early life stage survival and mortality.

Conservation Measures

The Proposed Action included conservation measures to avoid and minimize or compensate for CVP and SWP project effects, including take, on listed species as well as

contribute to the recovery and enhancement of species and their habitats. These measures may also improve production, growth, and survival of listed species. The following provides the status of each conservation measure at the end of WY 2022.

- **Rice Decomposition Smoothing:** The purpose of this action is to lower peak rice decomposition demand by working with the Sacramento Valley CVP contractors and the SRSCs to synchronize their diversions. In most years, there is a demand for fall rice decomposition water; however, in fall of 2021, essentially no rice decomposition water was used.

- **Spring Management of Spawning Locations:** The purpose for this action is to establish experiments to refine the state of the science and determine if colder water releases in April and May induces earlier peak winter-run Chinook salmon spawning in the Sacramento River, and if warmer April and May Sacramento River temperatures induces later peak spawning. A subgroup of the USST met from July – October 2021 and developed a final research strategy to inform this effort. The meeting notes and research strategy can be found at: https://www.usbr.gov/mp/bdo/spring-mgmt-spawning-locations.html

- **Temperature Modeling Platform:** The Proposed Action included: a collaborative model development effort to develop a new temperature model for the upper Sacramento River (Shasta and Keswick reservoirs).

    - NMFS included as RPM 1.c.:

        - *...Reclamation shall develop a stratification model for Shasta Reservoir and evaluate this model for implementation as part of the development of annual temperature management plans. The initial stratification model shall be available for pilot application and evaluation no later than January 1, 2022, unless NMFS and Reclamation agree to extend the date. At the end of the three-year period starting once the stratification model is available, Reclamation and NMFS shall submit the model to the Four-Year Review Panel for advice on the model's accuracy and utility as a forecasting tool, and Reclamation will decide whether implementation is appropriate.*

    - As part of the Water Temperature Modeling Platform (WTMP) effort, reservoir models should have sufficient vertical resolution to represent seasonal stratification under various thermal regimes. For seasonally stratified reservoirs, geometric representation will include sufficient spatial resolution to capture isothermal conditions, onset of stratification, persistent seasonal stratification, and fall breakdown of stratification. Models representing the larger reservoirs that hold considerable cold water will represent detailed stratification.

    - In WY 2022, the modeling technical committee met regularly. On July 19-20, the Delta Science Program facilitated a mid-term independent review panel focused on the implementation of the water temperature modeling

platform and the effectiveness of its modeling. The mid-term panel's initial finding report can be found at Water Temperature Model Development Independent Advisory Panel (ca.gov).

- Shasta Temperature Control Device Performance Evaluation: The charter was completed on January 28, 2021. A technical team was established and worked towards identifying whether there are problems or limitations with the function of the TCD under low storage conditions. A draft report – *Shasta Temperature Control Device Performance Evaluation* - is undergoing finalization.
- **Lower Intakes near Wilkins Slough:**
    - In WY 2021, a charter was completed on December 10, 2020. The goal of the charter is to enable operation of pumps in the vicinity of Wilkins Slough to operate at flows below the current regulatory minimum of 5,000 cfs, for planning purposes as low as 3,000 cfs.
    - The first action under this charter is the Meridian Farms Pump Replacement, Phase II. The Meridian Farms Pump Replacement grant was awarded in September, 2021.
    - New applications for lowering other pumps in the affected area are solicited as part of Year 1 Notice of Funding Opportunity (NOFO) for Habitat & Facilities Improvement. NOFO (Year 2 closed November 14, 2022) Completion is anticipated within five years of award.
- **Spawning & Rearing Habitat Restoration:** Reclamation partnered with USFWS, Chico State University, Sacramento River Forum, SRSC, Tehama RCD, Yurok Tribe, River Partners, NMFS, and CDFW to complete the East Sand Slough side channel and Keswick Dam spawning gravel augmentation projects along the Sacramento River. The team continues to refine the East Sand Slough channel to maintain flow and habitat under low Sacramento River flows. The Keswick gravel is in place to be transported downstream by high flows when they occur. Information on these projects is at https://www.sacramentoriver.org/forum/index.php?id=channels
- **Small Screen Program:** Under the Small Screen Program, Reclamation and DWR work together within existing authorities to screen small diversions throughout the Central Valley, CVP and SWP streams, and the Delta. A Small Screen Program Project Charter was developed and completed on January 14, 2021. Applications solicited as part of NOFO - Habitat & Facilities Improvement. Year 1 NOFO closed on November 30, 2021. Year 2 NOFO closed on November 14, 2022. Completion date requirement is to be within five years of award. Project Management teams are forming in parallel with NOFO.

Winter-run Chinook Salmon Conservation Hatchery / Tier 4 Intervention Measures: In WY 2022, there was increased production of winter-run Chinook Salmon at Livingston Stone NFH to mitigate for the anticipated temperature related mortality for eggs naturally spawned in the Sacramento River. Due to low storage in Shasta Lake and limited

coldwater pool, increased fish production at the Livingston Stone NFH was highly reliant on water chillers to maintain the cool and stable water temperatures necessary for successful reproduction. To fulfill this need, Reclamation contracted the rental of more than 2,500 tons of chilling capacity, including seven chillers and 12 diesel generators. This system successfully produced acceptable water temperatures to promote a high rate of reproductive success. The 2022 brood year production included the offspring of adults trapped at Battle Creek and the Keswick Dam fish traps and juveniles resulting from matings of captive broodstock reared at Livingston Stone NFH. The collection of brood fish from Battle Creek was terminated in March 2022, due to the increased broodstock targets and need to conserve adult holding space for brood fish collected from the mainstem Sacramento River; Battle Creek winter-run Chinook salmon collected prior to this decision were integrated into the mainstem Sacramento River supplementation program. In the absence of winter-run Chinook salmon brood fish from Battle Creek, captive broodstock were used to achieve full production targets for the Battle Creek Jumpstart program.

Fishery agencies and the Winnemem Wintu tribe incubated 20,000 winter-run eggs in streamside incubators in the McCloud River at Ah Di Nah as an additional emergency drought action. The eggs survived at rates comparable to hatchery survival despite high turbidity conditions from mudflows down Mount Shasta. CDFW used rotary screw traps and fyke nets to capture the emigration juveniles before they entered Shasta Lake. The transported the captured juveniles to the lower Sacramento River in Redding and released them there. These juveniles will be trackable using parental based genetics methods to determine adult returns.

Additionally, DWR began first year testing of a juvenile salmonid collection system in the McCloud Arm of the reservoir. The project tested hydraulics of the system and future years will include a juvenile collection trap.

The project strives to increase capture efficiency for juveniles leaving the McCloud River. A project goal is to create a cold water refuge for Chinook salmon in years when conditions in the lower Sacramento River are suboptimal.

Refer to the Shasta Cold Water Pool Management Seasonal Report (Appendix B) for more information

Battle Creek Salmon and Steelhead Restoration Project and Battle Creek Reintroduction Plan: NMFS required as RPM 1.f.:

> *Reclamation shall work with NMFS, USFWS, and CDFW to complete a Battle Creek Acceleration Plan by December 31, 2020. The plan shall address the Battle Creek Salmon and Steelhead Restoration Program and the Battle Creek Winter-run Chinook Salmon Reintroduction Plan, and work with USFWS to identify Livingston Stone National Fish Hatchery facility improvements necessary to support the Battle Creek Winter-run Chinook Salmon Reintroduction Plan.*

The Battle Creek winter-run reintroduction group identified monitoring activities to improve the reintroduction process. Reclamation entered into an interagency agreement

with USFWS to monitor winter-run Chinook salmon reintroduction activities in Battle Creek. The monitoring activities are:

- Evaluate genetic diversity and life history strategies in upper Sacramento River (below Keswick Dam) and tributary Chinook salmon and steelhead, including Battle Creek, using both genetics and otoliths.

Battle Creek Restoration Project Status Updates from WY22

Phase 1A – This phase consists of removal of Wildcat Diversion Dam and Wildcat Canal; construction of fish screens and fish ladders on North Battle Creek Feeder and Eagle Canyon Diversion Dams; and, construction of a fish barrier weir on Baldwin Creek (that maintains five cfs of flow in Baldwin Creek for suitable salmon and steelhead habitat, and protects the upstream Darrah Springs State Trout Hatchery from being infected with diseases that anadromous fish could carry).

- In April 2022, NMFS signed a memo indicating that incidental take for a 6-inch gate opening height operating scenario is covered under the Phase 1A Biological Opinion and Incidental Take Statement. The goal is to have the facilities accepted and transferred to PG&E in 2022.

Phase 2 – This phase consists of removal of South Diversion Dam, South Canal, Soap Creek Feeder Diversion Dam, Lower Ripley Creek Feeder Diversion Dam, and Coleman Diversion Dam; construction of a South Powerhouse tailrace tunnel connector to Inskip Canal; and, construction of a fish screen and fish ladder on Inskip Diversion Dam.

- No updates occurred in WY22

PG&E's Intent to Not Renew FERC License in 2026:

The Phase 2 contract to remove South Diversion Dam, South Canal, Soap Creek Feeder Diversion Dam and Lower Ripley Creek Feeder Diversion Dam is currently planned to be awarded in September 2024.

- **Winter-Run Chinook Salmon Conservation Hatchery Production:** Due to the drought conditions in WY 2022, the Livingston Stone National Fish Hatchery increased their production of winter-run Chinook salmon. The additional fish would help mitigate for lost in-river production. The adult collection and egg take goals were effectively tripled. USFWS, who operates Livingston Stone National Fish Hatchery, spawned 169 female salmon and 186 male salmon to produce approximately 800,000 eyed eggs. Due to the warm and fluctuating water temperatures from Shasta Lake, Reclamation rented water chillers to maintain satisfactory water quality for hatchery operations. Refer to the Shasta Cold Water Pool Management Seasonal Report (Appendix B) for more information.
- **Non-Flow Projects for Salmonids:** For details on completed projects, see the WY 2020 and 2021 Annual Report and its appendices.

Conclusion

Reclamation and DWR are in compliance with the 2019 NMFS ITS for the upper Sacramento River.

During WY 2022, the SRTTG followed the Shasta Cold Water Pool Management Guidance Document and met regularly to discuss planning, implementation, and performance of the Temperature Management Plan. WY 2022 was a critically dry year following a critically dry year in 2021 and a dry year in 2020. WY 2022 also had the driest January through March period on record. There were many efforts to manage Keswick releases in 2022; releases in May through September 2022 ranged from approximately 1,800 – 3,800 cfs less than compared to releases in the average critical year. The 2022 Temperature Management Plan detailed a Tier 4 performance category and specified temperature targets at the SAC gage. Reclamation's hindcast temperature-dependent mortality estimates were 18% in 2022. The 2022 Juvenile Production Estimate letter estimated 2.17% egg-to-fry survival. There are no specific Tier 4 Upper Sacramento River Performance Metrics for temperature-dependent mortality in the 2020 ROD. No need was identified by the agencies for an independent panel review for WY 2022.

Guidance Documents Revisions in WY 2022.

- None

Seasonal Reports

- Shasta Storage Rebuilding and Spring Pulse Seasonal Report
- Shasta Cold Water Pool Seasonal Report

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Clear Creek

WY 2022 was a critically dry water year. Clear Creek management in a critically dry water year includes one spring pulse flow, anticipated difficulties in meeting water temperature criteria, and the possibility for flows below normal base flow minimums.

Water Temperature Management

In WY 2022, meeting the water temperature criteria for Clear Creek was challenging, as Whiskeytown Reservoir's cold water was very low, and additional water volume was not available. Trans-basin deliveries from Trinity Reservoir through the Carr Tunnels were reduced and occasionally reduced to near zero flow during some portions of summer-fall 2022, which limited water volume for temperature management. Even with the difficulties encountered, the mean daily water temperatures over the management season (June 1–October 31, 2022) remained below or near the criteria (i.e., the mean daily water temperatures did not exceed 1° F above the criteria).

Clear Creek's mean daily water temperature criterion transitions from 60°F to 56°F for the spawning/egg incubation period of September 16 to October 31, which crosses water years. In October 2021, the 56°F criterion was met for 30 of 31 days (97%; Figure 5). From September 16 through September 30, 2022, the 56°F criterion was met for 3 of 15 days (20%). Overall, in WY 2022, the 56°F criterion was met for 33 of 46 days (72%). These temperatures were delivered via Whiskeytown Dam's lower guard gates, which provided the coldest possible water from the reservoir.

Mean daily water temperatures at Igo gauge remained below 60°F for 93% of the 107-day adult spring-run Chinook Salmon holding period (June 1–September 15, 2022; Figure 5). These temperatures were delivered to Clear Creek via a 50:50 mix of water from Whiskeytown Dams's upper and lower guard gates.

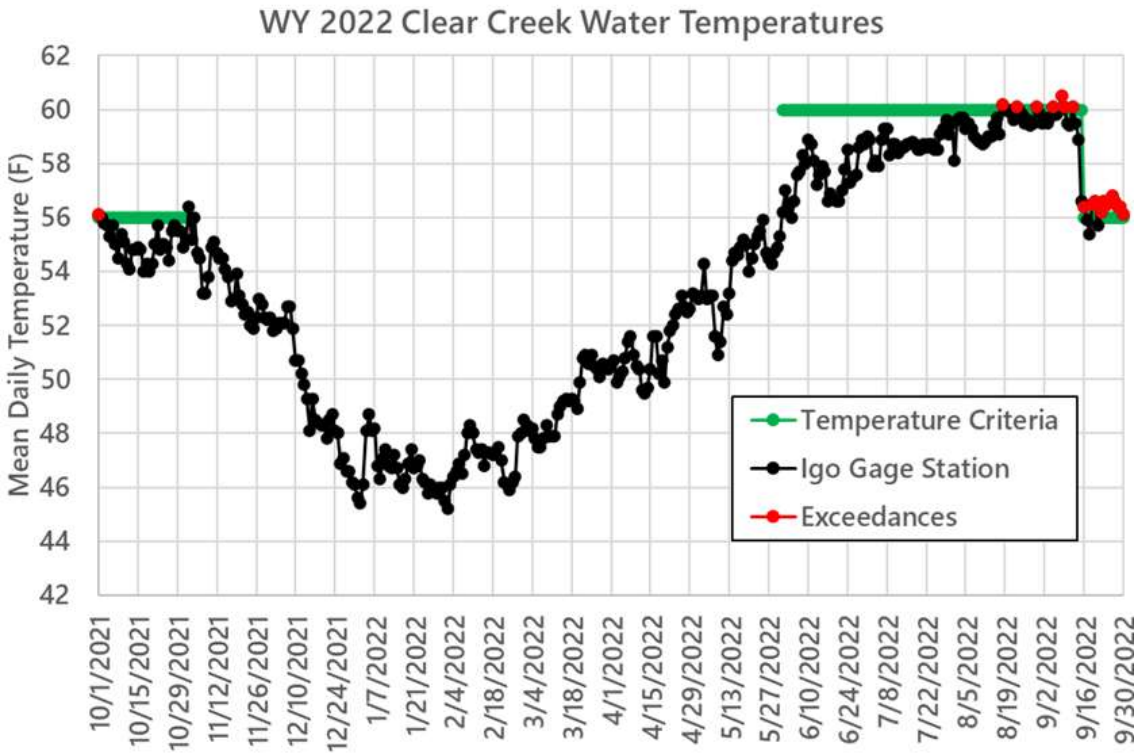

Figure 5. Mean daily water temperature on Clear Creek at the Igo gaging station in WY 2022 compared to the mean daily temperature criteria for CV spring-run Chinook salmon holding (60 °F June 1 to September 15) and spawning and egg incubation (56 °F September 16 to October 31) periods. Red dots highlight days of temperature criteria exceedances.

WY 2022 was a "critically dry" year, under which Reclamation proposed to operate to the water temperature criteria to the extent possible. The extent of incidental take is measured by the appropriate life stage habitat between Whiskeytown Dam and the Igo gauge exposed to water temperatures that exceed the proposed water temperature management target (2019 NMFS Biological Opinion, page 804). The level of incidental take anticipated from water temperature effects described in the 2019 NMFS Biological Opinion would be exceeded if 1) "the daily average temperature at the Igo gauge exceeds 60°F from June 1 through September 14 for longer than seven consecutive days or exceeds 61°F for any single day" and 2) "if the average daily water temperature [between September 16 through October 31] exceeds 59°F for longer than seven consecutive days [at the Igo gage]," for those years when Trinity Reservoir end-of-April storage is below 1.5 million acre-feet (such as WY 2022). As these water temperature criteria were not exceeded in WY 2022, the anticipated level of take was not exceeded in Clear Creek.

The NMFS Biological Opinion's included as RPM 2 states the following:

- To minimize incidental take under 60° F daily average water temperature criteria for adult CV spring-run Chinook salmon holding, and 56° F daily average water

temperature criteria for CV spring-run Chinook salmon egg incubation, Reclamation shall, consistent with the proposed action and in consideration of Shasta Cold Pool Management:

- Continue maintenance of temperature control curtains (Oak Bottom and Spring Creek) in Whiskeytown Reservoir.
- Through coordination with the Clear Creek Technical Team, consider real-time species information when making decisions regarding operational adjustments.
- In critical years, Reclamation shall coordinate with NMFS through Clear Creek Technical Team and/or the Sacramento River Temperature Task Group on the timing, frequency, duration and magnitude of flows below 150 cfs.

The Oak Bottom and Spring Creek Temperature Control Curtains remained in place and operational during WY 2022.

Flow Management

Through the CCTT, USFWS, CDFW, and Reclamation provided real-time fish data (e.g., weir passage, spawning sightings) to evaluate options when making operational adjustments at Whiskeytown Dam.

Flow scheduling in WY 2022 was coordinated through the CCTT. These coordinated flow management actions included Minimum Base Flows, Water Temperature Management, and Spring Pulse Flows. Channel Maintenance Flows were discussed, but not implemented, as it was a critical dry year.

During a critical year, the anticipated level of take associated with base flows in Clear Creek identified that flows may go below 150 cfs depending on available water supply.

- **Base Flow Management:** In WY 2022, Clear Creek's minimum base flows were met for the year. Flows from Whiskeytown provided 200 cfs from October through May and 150 cfs June through September.
- **Spring Attraction Pulse Flow:** Reclamation proposed to implement one spring pulse flow on Clear Creek during critically dry water years, such as WY 2022. A single spring pulse flow occurred on June 17 through June 27, 2022, which had a 500 cfs peak. While this pulse is consistent with the Proposed Action and corresponding Biological Opinion, the pulse volume was reduced from the CCTT proposal due to the on-going drought conditions. The originally proposed single pulse flow had an 840 cfs peak and would have utilized approximately 6,200 acre-feet, while the implemented pulse used 3,000 acre-feet.

- **Channel Maintenance Flows:** No Channel Maintenance Flows were released in 2022, as it was designated a critical dry water year type. There were also no Gloryhole spills in WY 2022.

    - NMFS included as RPM 2.d.: *To minimize the adverse effects of flow fluctuations associated with CVP-controlled water operations on all life stages of listed anadromous fish species in Clear Creek, Reclamation shall:*

        - *Coordinate flow release schedules with NMFS, USFWS, and CDFW via Clear Creek Technical Team or a comparable inter-agency fish monitoring group.*

Reclamation and the CCTT worked to produce flow management actions (e.g., maintain normal base flows in a critical water year) that improved the habitat for listed species in Clear Creek and that reduced adverse conditions associated with flow management actions.

Fish Habitat Restoration and Management

No new fish habitat restoration efforts were implemented on Clear Creek in WY 2022.

Segregation Weir

NMFS additionally required as RPM 2.c.:

> *Reclamation shall continue implementation of a weir annually to separate CV spring-run Chinook salmon and fall-run Chinook salmon during spawning to minimize the effects of redd superimposition and hybridization.*

The segregation weir was installed and operated beginning on August 10, 2022, to separate CV spring-run Chinook salmon and fall-run Chinook salmon during spawning. The segregation weir was installed at the Reading Bar location. The weir was removed on November 2, 2022.

Temperature Modeling Platform

NMFS additionally required as RPM 2.b.:

> *Reclamation shall ensure that the proposed temperature modeling platform for the Sacramento River will consider Clear Creek system, including Whiskeytown Reservoir, to enable better temperature forecasting and planning in Clear Creek. Reclamation shall undertake a study to collect and analyze temperature data in Whiskeytown Reservoir and Clear Creek to determine the magnitude and potential impact on temperatures from power peaking and flat loading of hydropower*

production. The data collected shall be analyzed and shared with NMFS and considered for implementation in the temperature model.

The Temperature Model Platform for the CVP is discussed in the Upper Sacramento River section under Conservation Measures.

Conclusion

Reclamation is in compliance with the 2019 NMFS Biological Opinion ITS and the Proposed Action adopted in the 2020 Reclamation ROD in Clear Creek. For WY 2022, recommendations were not identified to improve implementation of the Biological Opinions and the Proposed Action adopted in the ROD in the Clear Creek watershed. For additional information on Clear Creek management, see Appendix D for the Clear Creek Technical Team's (CCTT) Summary of Activities for WY 2022.

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Feather River

The Oroville Facilities (Oroville Dam and related facilities, including the Feather River Fish Hatchery) are part of the SWP. DWR has been operating the Oroville Facilities under a Federal Energy Regulatory Commission (FERC) license and is currently undergoing a relicensing process (FERC Project No. 2100-134). USFWS and NMFS completed section 7 consultations and issued biological opinions to FERC on April 9, 2007, and December 5, 2016, respectively, regarding the effects of relicensing the Oroville Facilities for 50 years. Because the effects of the operations of the Oroville Facilities were considered in these consultations with FERC, the Relicensing of the Oroville Facilities Hydroelectric Project Biological Opinions are incorporated into the LTO consultation by reference, only, to satisfy the ESA section 7(a)(2) responsibility as a component of ongoing operations of the CVP and SWP, and operations of the Oroville Facilities are not included in this report.

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American River

The lower American River extends approximately 30 river miles from Folsom Reservoir through Lake Natoma downstream to its confluence with the Sacramento River. CCV steelhead and its critical habitat are present in the lower American River. Additionally, spring-run Chinook salmon critical habitat is designated in the lower American River. There is also evidence for non-natal rearing of winter-run Chinook salmon in the lower American River.

During winter, Reclamation operates for flood control and building storage, considering both the channel capacity within the lower American River and Folsom Reservoir flood conservation space. During January through May, Reclamation provides redd dewatering protective adjustments. During spring, Folsom Reservoir continues to build additional storage until flows are needed to support instream demands on the lower American River, Delta requirements, and other CVP needs. During spring, this may include a spring pulse flow to provide juvenile salmonid emigration cues. Summer operations are focused around water temperature control, Delta outflows, and exports. Fall operations are guided by water temperature control and fish spawning habitat. Throughout the entire year, there are minimum flows adopted from the 2017 Flow Management Standard intended to improve cold water pool and habitat conditions for steelhead and fall-run Chinook salmon. The American River Group (ARG) Annual Summary of Activities report is presented in Appendix E.

Minimum Release Requirements

In WY 2022, the minimum flows of the Proposed Action Flow Management Standard were met in all months which include considerations to minimize red dewatering. Ramping rates were followed except for a few variations in January 2022, discussed with NMFS, to allow accelerated ramping during a short flow decrease to provide safer conditions for installation of rotary screw traps for juvenile monitoring. Nimbus releases never exceeded 50,000 cfs from January to May in WY 2022.

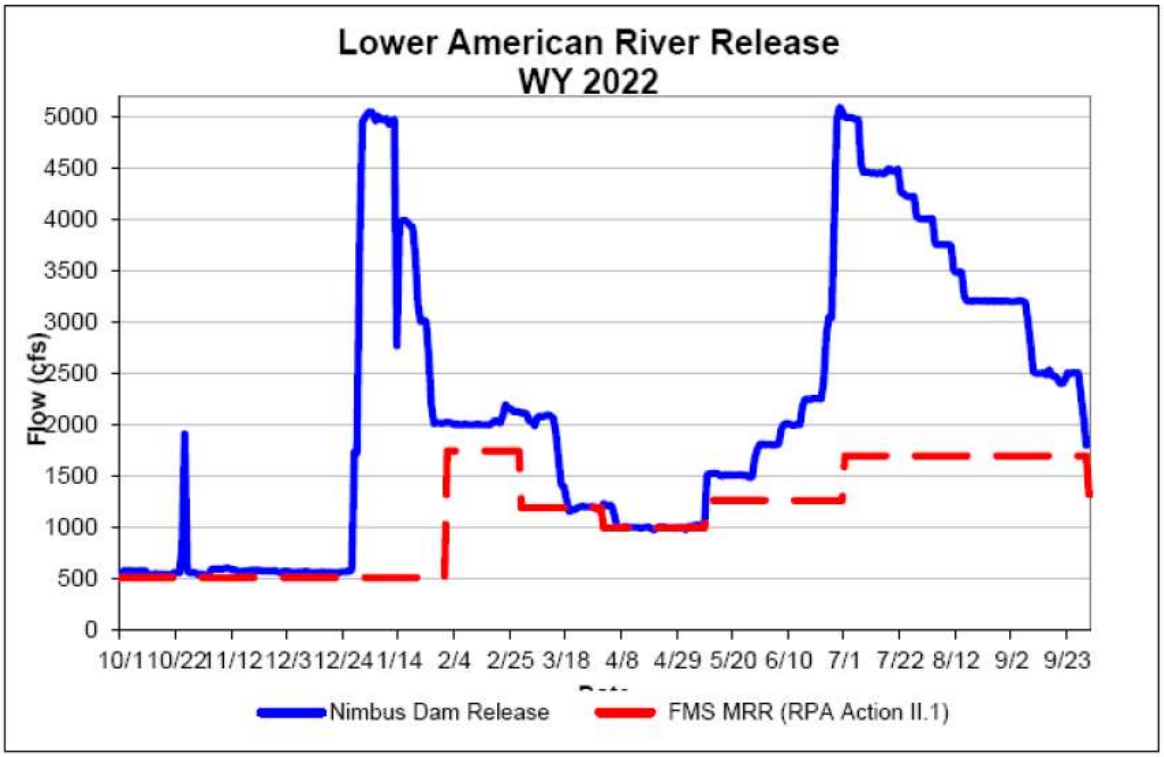

Figure 6. Summary of WY 2022 Nimbus Dam Releases to the Lower American River Releases.

Water Temperature Management

In the fall of 2021, Reclamation approved a power bypass at Folsom Dam to provide cooler water temperatures for steelhead (rearing juveniles) and fall-run Chinook salmon (adult holding and spawning; egg incubation). The power bypass is summarized in the Conservation Measures section under the Drought Temperature Management measure.

The 2022 Temperature Management Plan (TMP) for the lower American River (LAR) was developed according to the Proposed Action adopted in the 2020 ROD.

Based on April 2022 modeling of hydrology and Folsom Reservoir storage conditions, water temperatures were expected to exceed 68°F at Hazel Avenue for most of the summer. Updated modeling results in May 2022 projected that a water temperature target of 66°F at Hazel Avenue during the summer months was feasible.

After reviewing the current hydrological conditions, operations forecast, Folsom Reservoir temperature profile, and temperature modeling utilizing the May 2022 forecast, the TMP specified targets of 66°F or below at Hazel Ave. from June 1, 2022 to October 31, 2022 and 58°F or below at Hazel Ave. from November 1, 2022 until December 31, 2022.

The 2019 NMFS Biological Opinion specifies that

In a critical year, or year following critical year, Reclamation will meet with NMFS, FWS, CDFW, and the SWRCB to discuss and determine the best use of the limited cold water pool for that year. (2019 NMFS, p 806).

The TMP summer temperature target of 66°F at Hazel Avenue from June 1, 2022 to October 31, 2022 is consistent with discussions with the ARG at the May 19, 2022 ARG monthly meeting and the May 25, 2022 ad hoc meeting that included NMFS, USFWS, CDFW, and the SWRCB.

The WY 2022 TMP also included a commitment to continue to review the hydrology and Folsom cold-water pool on a bi-weekly timeframe and update the TMP accordingly. Those discussions resulted in Reclamation implementing a power bypass in October and November of 2022 which will be described in the WY 2023 LTO Annual Report.

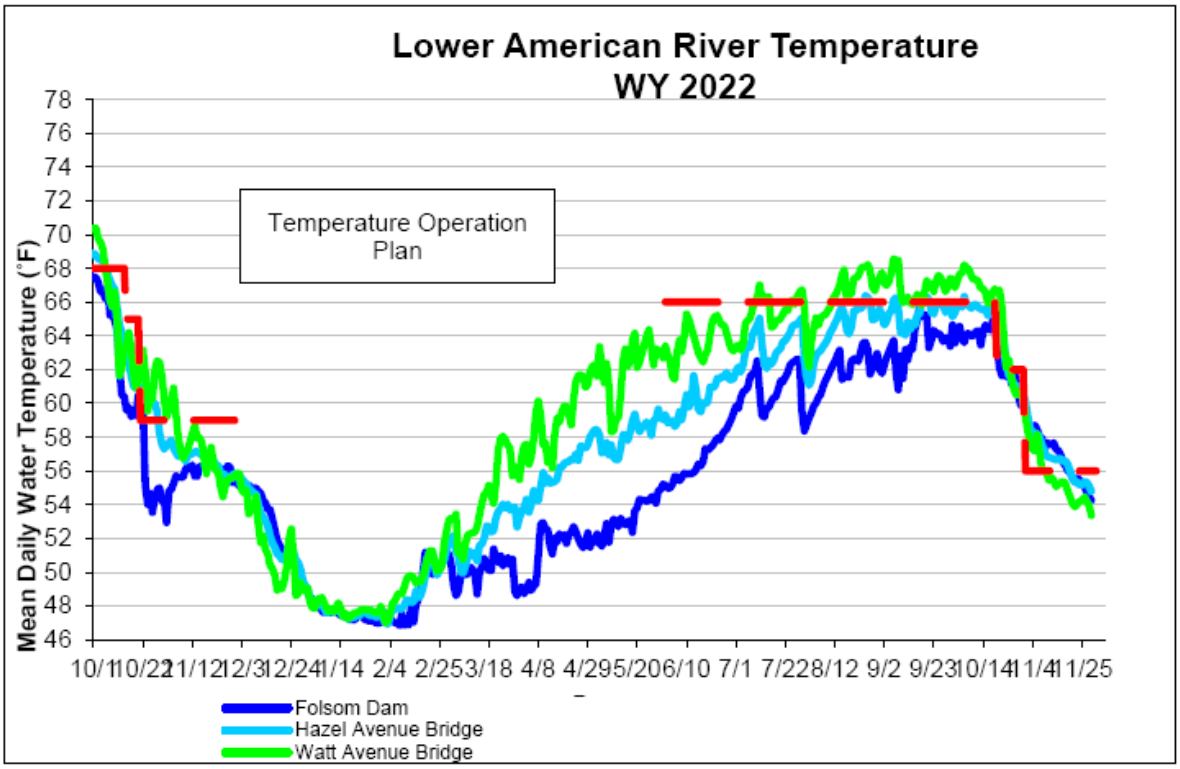

Figure 7. Summary of WY 2022 Water Temperatures in the Lower American River

Conservation Measures

Reclamation included conservation measures in the Proposed Action that were adopted in the ROD to avoid and minimize or compensate for CVP and SWP effects, including incidental take on listed species. These measures may also improve production, growth, and survival of listed species.

Spawning and Rearing Habitat Restoration: In 2022, Reclamation provided funding through the CVPIA to the Sacramento Water Forum for salmonid habitat restoration projects on the lower American River at Nimbus Basin and Lower Sailor Bar. The State of California provided additional funding. These restoration projects created a new side channel along the south side of the river at lower Sailor Bar and enhanced the existing Upper Sunrise Side Channel and the Nimbus Basin Side Channel. The projects placed approximately 41,000 cubic yards of gravel to replace natural recruitment and maintain and increase spawning and rearing habitat.

Mobilization of construction equipment for the Lower Sailor Bar Restoration Project started on August 1, 2022. The construction was completed on September 30, 2022. The Lower Sailor Bar Restoration Project consisted of the following:

- 3 spawning riffles (13.5 acres)
- 37,000 cubic yards of spawning gravel
- 2,500 feet of side channel (4.9 acres)
- Approx. 80 woody habitat structures
- Seeding
- Willow planting
- Onsite borrow

Mobilization of construction equipment for the Nimbus Basin Restoration Project started on September 6, 2022. The construction was completed on October 7, 2022. The Nimbus Basin Restoration Project consisted of the following:

- One spawning riffle (3.7 acres)
- 4,200 cubic yards of spawning gravel
- 800 feet of side channels and floodplain grading (2.5 acres)
- 30 repurposed woody habitat structures
- Seeding
- Willow planting
- Offsite borrow

Figure 8. Aerial view of completed project at Lower Sailor Bar, September 30, 2022. The two side channels can be seen on the south side of the river and the three lighter colored areas are the gravel placements.

Figure 9. Completed project at Nimbus Basin, October 22, 2022. Salmon can be seen holding along the upstream part of the riffle (small black dots).

- **Nimbus Fish Hatchery:** A Nimbus Fish Hatchery – Hatchery and Genetics Management Plan (HGMP) is currently in draft format.
- **Drought Temperature Management:** Hydrologic conditions at the start of WY 2022 were very dry, based on the antecedent conditions during WY 2021 which was classified as Critical, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641). Reclamation supported water temperature management during the recent dry conditions through the use of power bypass operations at Folsom Dam. When temperature operations exhaust the reservoir's cold water pool at the lowest shutter locations, Reclamation has the operational ability to release the coolest water from the river outlets at the lowest elevation outfall in Folsom Dam in an effort to achieve targeted temperatures in the LAR to the extent physically controllable. Releases from the river outlets cannot be used to generate power and thus this operation is referred to as a "power bypass".
- In October and November 2021 of WY 2022 a power bypass was implemented as summarized below:

- The power bypass commenced on October 11 with 50 cfs and was followed by an addition of approximately 50 cfs per day for three days up to approximately 150 cfs (to avoid cold water shock to fish in Lake Natoma) with the goal of reaching a LAR daily average water temperature of 62° F measured at Hazel Avenue to limit pre-spawn mortality and limit induction of spawning. On October 25 the bypass was increased to 350 cfs (via approximately 100 cfs/day increments) to target 56° F LAR daily average water temperature measured at Hazel Avenue by November 1. The power bypass decreased to 250 CFS on November 26 and to 0 CFS by Nov 27. Due to continuing warm temperatures at Hazel Avenue, a power bypass of 200 cfs was again instituted on November 28, then decreased to 100 CFS on December 3, and ended on December 5.

Incidental Take Statement

Reclamation's proposed action in the American River Division will create circumstances of water temperature and flow that are reasonably expected to result in the take of CCV steelhead (NMFS Biological Opinion, page 805).

Water Temperature

The 2019 NMFS Biological Opinion ITS describes take for CCV Steelhead egg-to-fry life stage on the American River as:

> *"The extent of take associated with suboptimal water temperatures is all redds exposed to temperatures above 54° F in the vicinity of Watt Avenue December 1 through May 31. The anticipated level of take of CCV steelhead during the egg-to-fry life stage during these months is expected to be minimal because of the small proportion of eggs or alevins still incubating in the month of May."*

Conditions during WY 2022: WY 2022 was a Critical year. The daily temperature at Watt Avenue was exceeded for six days in December, 22 days in March, 30 days in April, and 31 days in May (Figure 7).

The 2019 NMFS Biological Opinion ITS describes take for CCV Steelhead juveniles on the American River as:

> *"The ecological surrogate to define the amount or extent of take of CCV steelhead juvenile life stage is daily average temperature at Watt Avenue May 15 to October 31. The anticipated level of take will be exceeded if temperatures at Watt Avenue exceed 68°F from May 15 to October 31 for more than seven consecutive days unless it is a critical year based on the Sacramento Valley index or a year following one or more critical years. In critical years, and years immediately after a critical year, anticipated level of take is exceeded if water temperature exceeds 68°F at Hazel Avenue."*

The Temperature Management Plan for WY 2022 included a Hazel Avenue temperature target of 66° F. Water temperatures during the water temperature management season

(June 1-October 20 [historically, starting in May, but delayed due to uncertainties related to drought actions]) were at the agreed upon temperature management thresholds of 66° F for most of the summer (see Figure 7). The critical year water temperature threshold of 68°F at Hazel Ave. identified in the Biological Opinion was not exceeded in WY 2022 (Figure 7).

Reasonable and Prudent Measures

This section of the WY 2022 Annual Report describes compliance with the RPMs of the 2019 NMFS Biological Opinion. The 2019 USFWS Biological Opinion did not include RPMs for the American River. The 2019 NMFS Biological Opinion included the following RPM (and associated Terms and Conditions) to minimize impacts of incidental take of the listed fish species in the American River:

RPM 3: Reclamation shall minimize the impact of the amount or extent of incidental take of listed species during operations of the American Division.

- Seasonal operational decisions that affect water temperature and river flows shall be coordinated through the American River Group.

Operational decisions made by Reclamation concerning lower American River temperature management, flow schedule development, and implementation and pulse flow development were communicated and coordinated with the ARG throughout this reporting period. NMFS, CDFW, Reclamation, and other ARG stakeholders provided real-time fish data to evaluate options when making operational adjustments at Folsom Dam.

- Spring Pulse Flow:
    - Spring pulse flow, as defined in the Proposed Action and adopted in the ROD, was not required or implemented during WY 2022.
- Water Temperature Management:
    - Water temperature-based take of the egg-to-fry lifestage for winter and spring (54°F at Watt Ave) occurred on 89 days of the applicable timeframe in WY2022. The summer and fall incidental take limit (in a critical year, 68°F at Hazel Ave) based on water temperature management requirement was not exceeded in WY 22. The water temperature management was coordinated through the American River Group.
- Monthly ARG Meeting:
    - The monthly ARG meeting is a venue for various stakeholders to provide input on hydrologic, operational, biological, and water temperature management, as well as provide fisheries monitoring information. Reclamation takes this input into consideration when making operational decisions. Monthly ARG meeting notes are taken and posted to the ARG webpage.

- https://www.usbr.gov/mp/bdo/american-river-group.html

- Fisheries Management Discussions:
    - Periodic discussions took place outside of ARG monthly meetings between Reclamation, the fisheries agencies, and other ARG stakeholders. The purpose of these meetings was to discuss lower American River fisheries management concerns and constraints with an emphasis on improving interagency communication and cooperation.

Conclusion

Reclamation did meet the temperature requirements in the 2019 NMFS Biological Opinion and the Proposed Action adopted in the 2020 Reclamation ROD on the lower American River through compliance with the WY 2022 Temperature Management Plan for the Lower American River. WY 2022 was a critical year. In accordance with the 2019 NMFS Biological Opinion and the Proposed Action adopted in the 2020 Reclamation ROD on the lower American River, Reclamation met with NMFS, USFWS, CDFW, and the SWRCB to discuss and determine the best use of the limited cold water pool for that year. The TMP summer temperature target of 66°F at Hazel Avenue was decided to be the best use of the limited cold water and is consistent with discussions with the ARG, where NMFS supported the TMP target given the WY 2022 conditions. Reclamation and DWR complied with NMFS's requirements to discuss and determine the best use of the limited cold water pool for that year, including implementation of a power bypass in the fall of 2021.

For WY 2022, there were no clarifications that were necessary or recommendations identified to improve implementation of the NMFS Biological Opinion and the Proposed Action adopted in the ROD in the American River watershed.

- Guidance Documents Revisions for WY 2022:
    - 2017 Flow Management Standard Minimum Release Requirement

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Delta

Federally listed species in the Delta include Delta smelt, winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS North American green sturgeon. Operations involve the Delta Cross Channel (DCC) gates, Suisun Marsh Salinity Control Gates (SMSCG), diversion facilities (Jones Pumping Plant and Banks Pumping Plant, Barker Slough, North Bay Aqueduct, Contra Costa CVP facilities), and the South Delta agricultural barriers (Figure 10).

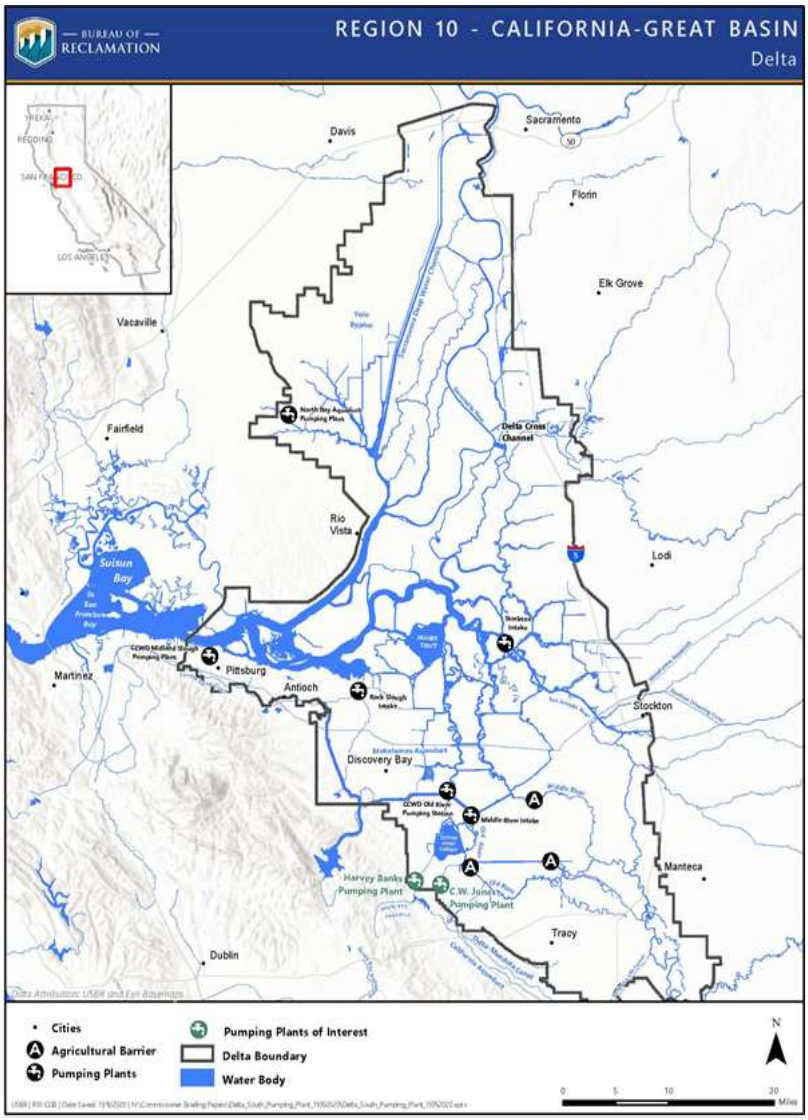

Figure 10. Map of the Delta with CVP and SWP Infrastructure.

Key operational components of the Proposed Action include the closure of the DCC gates, export reductions to manage Old and Middle River (OMR) reverse flows, and the Delta smelt Summer and Fall Habitat Action.

Delta Cross Channel

The OMR Flow Management Seasonal Report (Appendix F) describes DCC Operations during WY 2022. The Proposed Action described closures by calendar date and action triggers from the Knights Landing Catch Index (KLCI) and the Sacramento Catch Index (SCI). The anticipated level of take will be exceeded if the number or duration of openings exceed those described in the Proposed Action (NMFS Biological Opinion, page 809).

Reclamation included the following triggers in the Proposed Action (page 4-56):

- Action Triggers – Water quality criteria per D-1641 are met, and either the Knights Landing Catch Index or Sacramento Catch Index is greater than five fish per day. Action Responses – Within 48 hours, close the Delta Cross Channel gates and keep closed until the catch index is less than three fish per day at both the Knights Landing and Sacramento monitoring sites (NMFS Biological Opinion, page 417).
- Action Trigger – Water quality criteria are met per D-1641 and either the Knights Landing Catch Index or Sacramento Catch Index is greater than 3.0 fish per day but less than or equal to 5 five fish per day. Action Responses – Within 48 hours, close the Delta Cross Channel gates and keep closed for 3 days.

NMFS required that normal rounding rules to the tenths place be used to streamline implementation of the DCC gate triggers (RPM 5.d.i. page 819 of the NMFS Biological Opinion).

The DCC gate operations were consistent with the schedule described in the Proposed Action, including the D-1641 operations requirement except for the following actions. In WY 2022, KLCI or SCI exceedances (>3.0 fish per day) required action responses of DCC gate closures October 29, 2021 through November 5, 2021 and November 13, 2021 through November 19, 2021. The DCC gates were closed for the season, starting on November 30, 2021. A brief, one-hour opening and closing of the DCC gates was required on April 6, 2022, for annual maintenance to assure facility functionality. The DCC gates were again re-opened, consistent with D-1641, for the Memorial Day weekend, May 27, 2022, through May 31, 2022. Due to the ongoing drought conditions, the DCC gates remained closed through June to protect Delta salinity conditions (Appendix F).

OMR Management

The OMR Guidance Document describes the implementation guidance in coordination with DWR, NMFS, USFWS, and CDFW. The WY 2022 OMR Flow Management Seasonal Report (Appendix F) describes operations during WY 2022 and includes the

Guidance Document. The Incidental Take Report is included as Appendix H. Reclamation and DWR operate to an OMR index computed using an equation as opposed to the United States Geological Survey (USGS) Tidally Filtered Method to calculate OMR flow.

OMR Flow Management for the WY 2022 management season spanned January 3, 2022 to June 28, 2022. OMR index values (1-day, 5-day, and 14-day) for WY 2022 are plotted in Figure 11. In WY 2022, the OMR flow management season was initiated at the end of the Integrated Early Winter Pulse Protection. While OMR flow management limits were in effect during WY 2022, often other D-1641 Delta, IOP, or TUCO requirements were controlling (Figure 12). From January 1, 2022, through June 28, 2022, the daily OMR index was more positive than -5,000 cfs 168 out of 181 days.

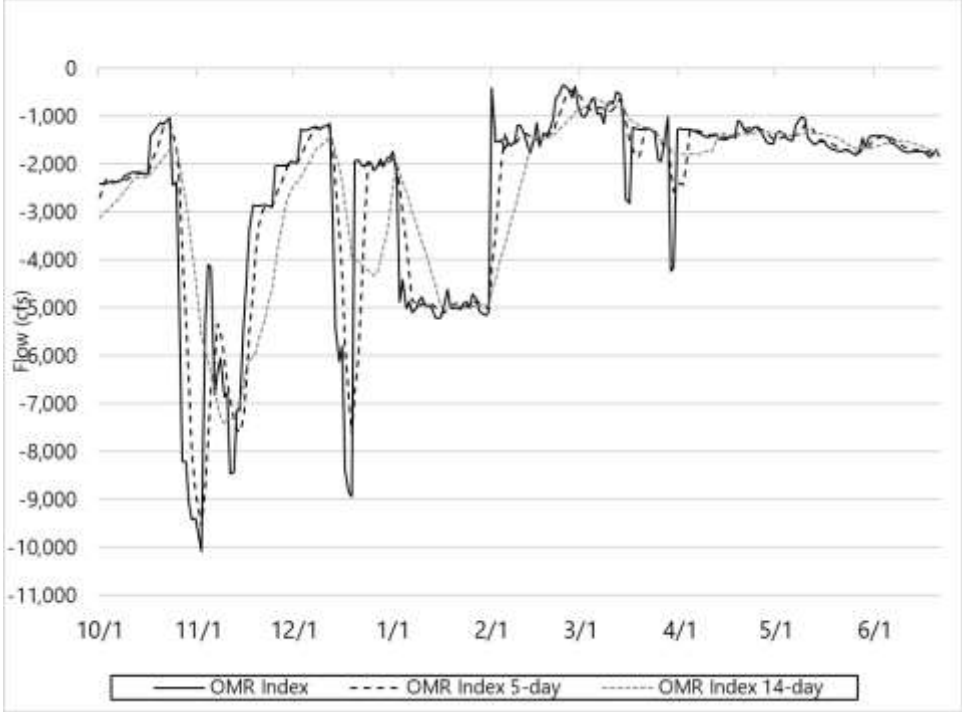

Figure 11. OMR index values measured in cubic feet per second [cfs] (1-day, 5-day, and 14-day) in WY 2022.

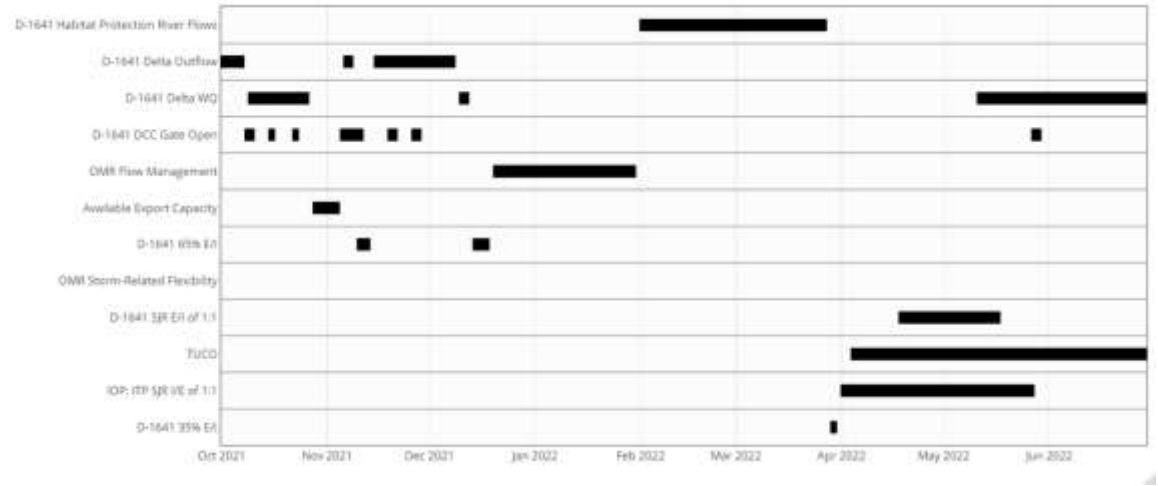

Figure 12. Daily Delta controlling factors for WY 2022. A detailed breakdown of the controlling factors for WY 2022 are provided in Appendix C.

Exports at the CVP and SWP export facilities and operations of the DCC Gates, with the few exceptions noted, were consistent with the ROD, consistent with implementation of the IOP, and within the effects anticipated by the 2019 USFWS and NMFS Biological Opinions. The CVP and SWP did not exceed the amount of annual take specified in the incidental take statement of listed fish species described in the 2019 USFWS and NMFS Biological Opinions. Salmonid entrainment levels did not trigger OMR reverse flow reductions and losses did not exceed thresholds.

NMFS required as RPM 9:

> *Reclamation and DWR shall implement a program to accelerate steelhead research and monitoring to develop juvenile population abundance estimates and consider using these estimates to develop revised incidental take levels and scale juvenile steelhead salvage and loss to a population abundance estimate.*

- *Phase 1 (Beginning October 2020):*
    - *Consistent with the proposed action, implement steelhead research and monitoring actions to develop a juvenile production estimate for steelhead-producing tributaries with CVP or SWP facilities.*
    - *Reclamation and DWR will coordinate with NMFS, CDFW, USFWS, CSAMP, and others as necessary, regarding juvenile production estimates on non-project tributaries.*
    - *Develop an initial report for consideration of the four-year panel review (2024).*
    - *Prepare summary report of population abundance estimates by September 2025.*

See section on “Steelhead Lifecycle Monitoring Program” and “San Joaquin Basin Steelhead Collaborative” below.

NMFS required as RPM 10:

> *Within 5 years, Reclamation and DWR shall assess a potential Delta Performance Objective for young-of-year CV spring-run Chinook salmon*
>
> - *Reclamation and DWR shall conduct a set of CWT-tagged juvenile Chinook salmon releases during winter and spring to provide increased information on presence and loss of Sacramento basin natural and hatchery spring run Chinook salmon through recovery in fishery and fish collection facility monitoring surveys.*
> - *Develop an initial report for consideration of the four-year panel review (2024).*
> - *Prepare summary report of findings by September 2025.*
> - *Consider and revise incidental take estimate, based on new information.*

Reclamation in collaboration with DWR, NMFS, CDFW, and USFWS prepared a charter document (Spring-Run Chinook Salmon Population Assessment and Delta Performance Measure Development Charter) to develop the most suitable measure, or set of measures, to assess CV spring-run Chinook salmon populations consistent with the requirements of the NMFS Biological Opinion (RPM 10). The project will support development of Delta Performance Objective for young-of-the-year CV spring-run Chinook salmon. The project will track progress towards implementation of RPM 10 through technical teams.

In WY 2022, OMR flows did not exceed those prescribed by the incidental take statement in the 2019 USFWS Biological Opinion. No need was identified by the agencies for an independent panel review for WY 2022.

USFWS required under RPM 1.3:

> *If it is determined that an independent panel is necessary to determine the efficacy of the proposed OMR Management actions, Reclamation shall seek technical assistance from the Service on development of the charter for that panel.*

USFWS required under RPM 1.4:

> *If Reclamation or DWR determine that a Turbidity Bridge Avoidance action is not necessary because the event is not believed to be related to an actual turbidity bridge, they will provide the supporting information, including the reason why the action is not warranted, within 24 hours, and the Service will respond within 24 hours. The action will be initiated until Reclamation, DWR, and the Service are in agreement that an action is not necessary.*

The CVP and SWP export facilities operated to the Turbidity Bridge Avoidance action from February 1, 2022, to April 1, 2022. A ripe female Delta smelt was collected by Spring Kodiak Trawl (SKT) on March 17, 2022, which off-ramped turbidity bridge

avoidance for the CVP. ITP COA 8.5.1 does not contain an offramp for the detection of a ripe female Delta smelt, so the turbidity bridge avoidance action for the SWP did not offramp until April 1, 2022. In addition, Delta smelt OMR Management requirements were not controlling at that time. Turbidity conditions are always considered by the SMT in developing the assessments of fish distribution and risk of entrainment. For more information, see the OMR Flow Management Seasonal Report (Appendix F).

Daily turbidity levels in Old River at Bacon Island did not exceed the 12 NTU (turbidity) threshold (read as FNU) during the action period in WY 2022.

USFWS required under RPM 1.5:

> *Reclamation and DWR shall monitor OMR flow and turbidity levels (the surrogate parameter identified in the Amount or Extent of Anticipated Take section) at locations identified in the PA on a real-time basis. Reclamation and DWR shall ensure monitoring stations have appropriate redundancy to reduce the likelihood of data collection failure due to malfunction. This information shall be made available to the Service on a real-time basis to document the management of the system. This can be done through Bay Delta Live or a similar system. If the Service determines that conditions have led to the exceedance of anticipated take, reinitiation would be required.*

The required monitoring was in place for WY 2022, with the required redundancy, and information provided to the USFWS via Bay Delta Live, SacPas, and Proposed Action Assessments produced weekly; thus, Reclamation and DWR were in compliance.

USFWS required under RPM 1.6:

> *Reclamation and DWR shall use Service life cycle models or other Service-approved models when available for the purposes of estimating proportion of the population affected by entrainment.*

Reclamation and DWR were in compliance with this RPM as informed by the Delta smelt Life Cycle Entrainment Model (CGB-1000 2.2.4.21 dated March 13, 2020) in WY 2022.

USFWS required under RPM 1.7:

> *Reclamation shall seek technical assistance from the Service on the development of the charter for the independent panel for the proposed Four-Year Review of the "OMR management and measures to improve survival through the south Delta".*

Development of the Independent Panel charter will include USFWS technical assistance; Reclamation is in compliance.

Tracy Fish Collection Facility and John E. Skinner Delta Fish Protective Facility

Reclamation screens fish from the inlet channel leading to the Jones Pumping Plant at its confluence with Old River with the Tracy Fish Collection Facility (TFCF).

NMFS required RPM 5.b.

- *Reclamation and DWR shall monitor and calculate salvage and loss for winter-run Chinook salmon, CV spring-run Chinook salmon, CV fall-run Chinook salmon, CV late fall-run Chinook salmon, CCV steelhead, and salvage of sDPS green sturgeon at the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility.*
    - *Reclamation and DWR shall prepare and submit to NMFS daily reports from October 1 through June 30 of each water year (or provide data online) regarding the observations of both salmonids and sDPS green sturgeon in the fish salvage facilities. Daily salvage sheets and the operational information needed to calculate salvage and loss shall be provided to NMFS (to a list of recipients updated each water year) or made available online. If, during the period from July 1 to September 30, salmonids and/or sDPS green sturgeon are observed in salvage, Reclamation and/or DWR shall notify NMFS through electronic mail and include the daily salvage sheets and operational information, or direct NMFS to where this information is available online.*
    - *During the October through June period of each water year, DWR and Reclamation shall prepare and submit to NMFS, Delta operations for salmonids and sturgeon and other relevant technical teams weekly reports summarizing salvage and loss over the previous week and for the water year to date (or provide data online).*
    - *No later than December 31, Reclamation and DWR shall submit to NMFS an annual report summarizing salvage and loss over the previous water year (October 1 to September 30).*
- *Reclamation and DWR shall undertake tissue sampling programs from natural origin salmonids, and coded wire tag samples from adipose fin-clipped juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead and CV late-fall run Chinook salmon at the Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility, for genetic analysis or tag removal/reading pursuant to appropriate sampling protocols and statistical power analyses.*
    - *Reclamation and DWR shall submit incidental take reports from Tracy Fish Collection Facility and Skinner Delta Fish Protective Facility by December 31 of each year, to include the genetic results of the tissue samples.*

- *Reclamation and DWR shall develop and submit for review and concurrence by NMFS a plan for tissue and whole fish or head processing and storage by December 31, 2020.*

The TFCF staff distributes daily salvage sheets and operational information needed to calculate salvage and loss to a distribution list that includes NMFS recipients. The Technical Service Center (TSC) currently enters TFCF salvage and operational data into a database and makes these data/information available online through the Reclamation Information Sharing Environment (RISE) website (https://data.usbr.gov/catalog/4494). The TSC also prepares and submits daily/weekly reports that summarize observations of salmonids and sDPS green sturgeon.

The Standard Operating Procedures (SOP) for Fish Handling Related to the Collection, Sampling, Transport, and Release of Salvaged Fish at the CVP's TFCF was developed and submitted to NMFS and USFWS on October 23, 2020. This SOP includes protocols for tissue processing/coded wire tag sampling to meet RPM 5.b.ii.b.

The SOP for the Skinner Delta Fish Protective Facility was developed and submitted to NMFS and USFWS on May 8, 2020.

NMFS additionally required RPM 5.c.

> *Reclamation and DWR shall minimize incidental take through the application of best management practices at the fish salvage facilities by developing coordinated protocols within 18 months of the effective date of this Opinion for the following three topics. By the effective date of the Opinion, Reclamation and DWR shall provide the protocols currently being used.*
>
> - *Protocols for fish sampling and handling (from salvage through release), including a description of training procedures and the process for quality assurance and quality control of data.*
> - *Protocols for daily estimation of salvage or loss for each ESA-listed anadromous fish that include relevant calculations and identify the data and information sources necessary to perform the relevant calculations used to estimate fish salvage or loss. Each facility shall include in their protocol a process to provide to NMFS, FWS, CDFW, DWR, and Reclamation staff the relevant data and information necessary to calculate fish salvage or loss. The protocol should specify whether and how pumping will be restricted during any salvage disruption, and whether and how salvage disruptions will be reflected in the estimation of salvage or loss. The protocol should include procedures used to implement the single year and cumulative loss thresholds for Delta operations.*
> - *Procedures for reporting salvage and loss for each ESA-listed anadromous fish (or relevant surrogate), including a description of the general content, frequency, and distribution of reports. Salvage and loss shall be reported daily (excepting weekends and holidays) from October 1 through June 30 and DWR and*

Reclamation shall submit to NMFS an annual report summarizing salvage and loss over the previous water year no later than December 31 of each year.

Reclamation submitted to NMFS an annual report summarizing salvage and loss over the previous water year on December 30, 2022 in order to be in compliance with RPM 5.c.iii..

The Proposed Action included and USFWS subsequently required as RPM 1.1 in its Biological Opinion:

Reclamation and DWR shall ensure the frequency of sampling for the south Delta export facilities (Banks and Jones) will be at least 25% of the time the export facilities are in operation. If this cannot be achieved, the Service shall be notified on a real-time basis.

USFWS required as RPM 1.2 in its Biological Opinion:

Reclamation and DWR shall update and provide fish salvage protocols for Skinner Fish Facility and the Tracy Fish Collection Facility to the Service within 1 year of the issuance of this biological opinion. Annual reports of salvage activities will be submitted to the Service documenting the operation and monitoring activities of the fish salvage facilities.

Reclamation submitted to USFWS an annual report summarizing salvage operation and monitoring activities of the TFCF on December 30, 2022.

Results are reported in the Incidental Take Report (Appendix H). Data were provided on CDFW's FTP site Fish Salvage Monitoring (ca.gov), and on the SacPAS website: http://www.cbr.washington.edu/sacramento/.

Loss is also reported through the weekly assessment and outlook documents posted here: Water Year 2022 Meeting Notes | Delta Monitoring Work Group | Water Operations and Watershed Monitoring Technical Team | BDO | Area Offices | California-Great Basin | Bureau of Reclamation (usbr.gov)

Annual report of salvage activities documenting the operation and monitoring of the fish salvage facilities (Appendix G)

A charter for the TFCF on Improvements and Operations of the facility per the 2019 Long Term Operations of the CVP and SWP Proposed Action was drafted on March 1, 2021 and is currently under Reclamation review.

A charter for the Skinner Delta Fish Protective Facility Operations for WY 21 was completed on January 6, 2021.

In WY 2022, Reclamation and DWR were in compliance with the requirements of the Proposed Action and Biological Opinions for operations in the Delta.

Delta Smelt Summer-Fall Habitat

Since the WY 2022 was classified as Critically Dry, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641), Reclamation and DWR did not implement Delta smelt Summer-Fall Habitat Actions. This action is proposed to occur in below normal and above normal WYs. Additionally, no food enhancement actions will occur until site-specific section 7 consultation is completed. Reclamation and DWR did conduct aquatic environmental monitoring as described in the NFMS 2020 Biological Opinion and USFWS 2020 Biological Opinion, which also helps to inform this action. Reclamation, DWR, USFWS, NMFS, and CDFW developed the WY 2022 Delta smelt Summer Fall Habitat Seasonal Report (Appendix I) that provides habitat and monitoring information on this year.

NMFS additionally required RPM 5.i in its Biological Opinion.:

> *Reclamation and DWR shall coordinate with NMFS through the Sacramento River Temperature Task Group temperature planning processes and the coordination group for the Delta smelt Summer-Fall Habitat action regarding approaches to for using storage releases for the Delta smelt Summer-Fall Habitat action.*

In WY 2022, the Summer-Fall habitat action was not implemented.

USFWS included as RPM 2 in its Biological Opinion:

> *Minimize the adverse effects of habitat degradation in summer and fall by studying the effectiveness of the Summer-Fall Habitat Action implementation. As appropriate, representatives from Reclamation, DWR, CDFW, NMFS, and the Service will participate in the Delta Coordination Group as part of this planning process.*
>
> - *Reclamation and DWR, in coordination with the Service and Delta Coordination Group, will define specific parameters for implementation of the Summer-Fall Habitat Action. Additionally, mutually agreeable methods for determining parameters for successful recruitment of delta smelt will be developed. These parameters shall include habitat acreages and population trends. This method shall be in place prior to implementation of the Summer-Fall Habitat Action.*
> - *Reclamation and DWR shall provide annual reports documenting the planning,*
> - *implementation, and monitoring of the Summer-Fall Habitat Action. In years that an action will be implemented, Reclamation shall provide a draft of the implementation plan to the Service by May 1 and a final report of the action by May 1 of the following year.*
> - *Reclamation and DWR shall develop a monitoring plan to assess the efficacy of implementing the Summer-Fall Habitat Action. The plan shall be vetted by the Delta Coordination Group and included in the annual implementation plan. A full report of results shall be provided within one year of the completion of the action.*

- *Reclamation shall seek technical assistance from the Service on the development of the charter for the independent panel for the proposed Four-Year Review of "Delta smelt Summer and Fall Habitat Actions."*
- *Reclamation and DWR will comply with all monitoring and reporting requirements as identified in the Reporting Requirements section.*

Reclamation and DWR, with review by the Delta Coordination Group, developed the Delta smelt Summer-Fall Habitat Action Monitoring and Science Plan.

Details are provided in the WY 2022 Delta smelt Summer Fall Habitat Seasonal Report (Appendix I). See above for more information on the Delta smelt Summer-Fall Habitat action. Reclamation will work with the USFWS on the charter for the independent panel Four Year Review of Delta smelt Summer and Fall Habitat Actions, which will be documented in the appropriate annual report. For WY 2022, Reclamation and DWR were in compliance.

Suisun Marsh Preservation Agreement and Salinity Control Gates

Reclamation and DWR continued to implement the Suisun Marsh Preservation Agreement in WY 2022 to meet water quality standards in accordance with D-1641. WY 2022 was classified as critically dry, as defined by the Sacramento Valley 40-30-30 index WY hydrologic classification (SWRCB D-1641). DWR operated the SMSCG to meet Table 3 salinity standards of SWRCB D-1641 for Suisun Marsh in a Critically Dry Year. Also, since it was a Critically Dry Year, Reclamation and DWR did not implement increased SMSCG operations, included in the Delta smelt Summer-Fall Habitat Action. The SMSCG operations were operated in a manner consistent with the Proposed Action and the ROD; therefore, the anticipated level of take of listed salmonids and sDPS green sturgeon was not exceeded.

The Roaring River Distribution System (RRDS) and the Morrow Island Distribution System (MIDS) are used to deliver fresh water flowing into Montezuma and Suisun sloughs to adjacent wetlands and to drain water from these wetlands. The use of these distribution systems entrains fish. The entrainment of Delta smelt is based on the ecological conditions (i.e., fish screen approach velocities). The approach velocities at the RRDS fish screen are calculated using the stage information behind and in front of the fish screens. The flows are calculated automatically by the program controls, and the RRDS operators move the gates based on the calculated velocities. The approach velocity at the fish screens did not exceed the proposed maximum approach velocity of 0.2 ft/second and 0.7 ft/second during mid- September – mid October fall flood up operations. The amount or extent of the anticipated level of take in the 2019 USFWS Biological Opinion is not considered to be exceeded. For WY 2022, Reclamation and DWR were in compliance.

Agricultural Barriers

DWR installed three agricultural barriers to maintain water levels in the South Delta to support local non-project diversions. NMFS required RPM 5.h.

- *DWR shall send notice of intent to construct the barriers to NMFS at least 14 days prior to start of construction. This information shall include anticipated start dates and completion dates for each of the barriers. In the fall, DWR shall provide NMFS with the anticipated schedule for removal of the barriers, and notification when the removal has been completed.*
- *DWR shall provide documentation to NMFS indicating the anticipated schedule for culvert operations, including potential early closures and water elevation conditions, by the completion of barrier installation each season. Updates to barrier operations shall be provided to NMFS on a weekly basis until mid-June.*

Installation of the agricultural barriers started on May 10, 2022 at Middle River (MR), May 11 at Old River near Tracy (ORT), and on May 20 at Grant Line Canal (GLC). The construction of the MR Barrier was completed on May 18 with all 6 flap gates tied open and ORT Barrier on May 28 with all 9 flap gates tied open. On June 1, all flap gates at the MR and ORT Barriers were released to tidal operation. The construction of the GLC Barrier was completed, and the weir was fully closed on June 6 and all 6 flap gates were released to tidal operation on June 7. Approval from USFWS was granted for the raising of the MR Barrier weir crest by 1 foot. The weir crest was raised on June 27. To provide passage for adult salmon as described in the Proposed Action for the agricultural barriers, the MR, and ORT Barriers were notched on September 13. Flashboards at the GLC structure were also adjusted on September 13.

Barrier removal started on November 3 with the breaching of the ORT Barrier on November 4, GLC Barrier on November 7, and lastly, MR Barrier on November 17. The removal of the MR Barrier was completed on November 21, ORT Barrier on November 23 and GLC Barrier on November 30. DWR operated the South Delta Temporary Barriers Project in compliance with all applicable federal and state permits, including the Temporary Barriers Project Biological Opinions and as described in the Biological Assessment Appendix A, Section A.5-2 Temporary Agricultural Barriers. Specific dates for implementation of the South Delta Temporary Barriers Project are described in the Biological Assessment Appendix A Table A.5-3 (page A-96). For WY 2022, Reclamation and DWR were in compliance.

Water Transfers

During Water Year 2022, reductions in water availability to Senior Water users from the Project north of Delta due to drought conditions resulted in no water being made available for transfer from North to South of the Delta through reductions in consumptive use. Due to late April and early May storms, conditions in Folsom Reservoir resulted in improved storage. Combined with better than average snowpack in the San Joaquin River watershed,

Senior Water contractors serviced by the LTO were able to make 60-thousand-acre feet of water available for transfer to South of Delta contractors through reductions in consumptive use.

Contra Costa Water District Operations – Rock Slough Intake Infrastructure and Operations

In WY 2022, maximum daily average pumping from the Rock Slough Intake was 108 cfs permitted by the 2019 NMFS and USFWS Biological Opinions; the total diversions from Rock Slough Intake was 28 TAF, below the 195 TAF diversion limit permitted by the 2019 NMFS and USFWS Biological Opinions. For WY 2022, Reclamation was in compliance.

North Bay Aqueduct and Barker Slough Pumping Plant

The Proposed Action described an annual maximum diversion of 125 TAF. WY 2022 annual diversions were 35 TAF. NMFS incidental take uses an ecological surrogate of the maximum diversion rate of 175 cfs (NMFS Biological Opinion, page 811), and the maximum diversion for WY 2022 was 144 cfs (on 6/2/2022). USFWS incidental take used an environmental surrogate of 30 TAF for the months of March, April, and May (USFWS Biological Opinion, page 397). WY 2021 diversions for March through May was 12 TAF. Table 1 shows the monthly average diversions.

Table 2. Barker Slough Pumping Plant (BSPP) monthly average diversions during WY 2022.

Month	Monthly Volume (TAF)	Monthly Average (cfs)
October 2021	2.8	46
November 2021	3.0	51
December 2021	1.7	28
January 2022	1.6	26
February 2022	2.7	48
March 2022	1.2	20
April 2022	4.1	68
May 2022	6.3	102
June 2022	4.4	74
July 2022	2.6	42
August 2022	3.3	54
September 2022	1.7	29

- *Cleaning of sediment from in front of the fish screens shall occur during the summer in-water work window of July 1 through October 31 or if ambient water temperature is greater than 77° F.*

- *Observers shall be present during sediment cleaning to look for entrained fish in the dredge material discharge as it is pumped into the dredge spoils pit. Any observed fish shall be collected and identified to species. If the species is a salmonid, total body length shall be measured and assigned to race by length at date using the Delta model. Tissue samples shall be collected all natural origin salmonids, and coded-wire tag (CWT) samples from adipose fin-clipped juvenile winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead, for genetic analysis or tag removal/reading pursuant to appropriate sampling protocols. All observed sDPS green sturgeon shall be collected. Any living specimens shall be resuscitated if possible, and released away from the Barker Slough Pumping Plant facilities. All dead specimens shall be retained, frozen, and NMFS notified for final disposition.*

- *Cleaning of aquatic weeds from in front of the fish screens shall occur during the in-water work window of July 1 through October 31 or when ambient water temperatures are greater than 25oC.*

- *Observers shall look for any salmonids or sDPS green sturgeon entangled in the weed mass as it is placed in the trucks and as it is dumped in the disposal site area. Any observed fish shall be collected and identified to species. If it is a salmonid, total body length shall be measured and assigned to race by length at date using the Delta model. All observed sDPS green sturgeon shall be collected. Any living specimens shall be resuscitated if possible, and released away from the Barker Slough Pumping Plant facilities. All dead specimens shall be retained and NMFS notified for final disposition.*

- *An annual report shall be sent to NMFS-California Central Valley Office by December 31 of each year for the previous water year's operations. The report shall contain information regarding the dates of sediment removal or vegetation cleaning, the number of observed fish, including the number of salmonids and sDPS green sturgeon, if any, and the final disposition of the fish. If salmonids are observed, the report shall include the body lengths and run assignments for each fish.*

Aquatic weeds were removed from the BSPP fish screens 17 times, with weeds loads ranging from none to moderate. Weed removal occurred year-round (October 2021 through September 2022 – see Table 2 below). A biological monitor was present during the weed removal events and no listed fish species were found in the removed aquatic weeds. All work occurred immediately in front of the fish screens and on top of the concrete apron that extends out into the BSPP Forebay. No weed removal activities occurred outside of the embayment created by the floating booms.

No sediment removal activities occurred during the reporting period.

Table 3. Weed Removal Events

Month	Number of Weed Removal Events	Number of Observed ESA-listed Fish Species	Number of Observed non-ESA-listed Fish Species
October 2021	1	0	0
November 2021	1	0	0
December 2021	2	0	0
January 2022	2	0	0
February 2022	1	0	0
March 2022	1	0	0
April 2022	1	0	0
May 2022	2	0	0
June 2022	2	0	0
July 2022	1	0	0
August 2022	2	0	0
September 2022	1	0	0

USFWS included as RPM 4.1. Minimize the adverse effects of the operation of the North Bay Aqueduct.

> *DWR shall ensure that regular fish screen maintenance is performed at the North Bay Aqueduct. This maintenance is necessary to avoid incidental take of juvenile and adult delta smelt and to avoid exceeding the incidental take of larvae. DWR shall annually report to the Service with details on fish screen maintenance at these facilities.*

On December 15, 2022, DWR provided USFWS maintenance and inspection reports for the fish screens at the North Bay Aqueduct. The reports include maintenance and inspection logs, fish screen cleaning logs, and an underwater inspection of the intake at BSPP.

Clifton Court Aquatic Weed and Algal Bloom Management

DWR controls aquatic weeds and algal blooms in Clifton Court Forebay to avoid degrading drinking water quality through production of taste and odor compounds and algal toxins, and prevent pump cavitation at Banks Pumping Plant to reduce the mortality of ESA listed fish species. The Proposed Action identified a normal timeframe and magnitude of application. Beyond the commitments incorporated into the Proposed Action, NMFS additionally required RPM 5.g.:

- *DWR shall provide notification of intent to conduct aquatic weed removal activities to NMFS at least two weeks prior to starting, including the types of*

herbicides intended to be used for that application and the areas that will be treated.

- *DWR shall send copies of the water quality monitoring results for the concentration of herbicides in the Clifton Court Forebay following treatment to NMFS within 10 business days of DWR's receipt of the results.*
- *DWR shall report to NMFS any fish observed exhibiting unusual behavior or found dead or moribund following herbicide treatment within 10 business days of the incident. All dead specimens shall be retained and NMFS notified for final disposition.*

The normal timeframe for herbicide treatment as part of the Clifton Court Aquatic Weed and Algal Bloom Management action, as described in the Proposed Action and adopted in the ROD, is June 28 to August 31. DWR conducted herbicide treatment in CCF once during the normal timeframe in WY 2021, on June 28, 2021.

In addition, following the procedure also described in the Proposed Action and adopted in the ROD, DWR, through Reclamation, notified and conferred with USFWS and NMFS on October 25, 2021, for another herbicide treatment in CCF in WY 2022, outside of the normal timeframe. In response to the notification and DWR's assessment of the effects to listed species of the herbicide treatment, both USFWS and NMFS sent emails agreeing that ESA listed fish species were not anticipated to be present nor at risk from the proposed treatment, so the herbicide treatment proceeded on November 4, 2021.

Additional Conservation Measures

Reclamation included additional conservation measures in the Proposed Action that were adopted in the ROD to avoid and minimize or compensate for CVP and SWP project effects on listed species as well as contribute to the recovery and enhancement of species and their habitats. These measures may also improve production, growth, and survival of listed species.

- **San Joaquin Basin Steelhead Telemetry Study:** During WY 2022, three release groups of hatchery steelhead were released in March (492 fish) and April (484 fish). Each release group consisted of fish released at three locations (Durham Ferry, Stockton, and Head of Old River), and the combined (across locations) minimum survival estimate to Benicia Bridge was 8% for March releases and 10% for April releases. The SaMT used real-time detection information from these releases to inform distribution estimates of San Joaquin Basin study steelhead within the Delta during the WY 2022 OMR Management Season. For more information see Calfish Track (CalFishTrack (noaa.gov)).
- **Steelhead Lifecycle Monitoring Program:** Special studies targeting earlier life stages (e.g., egg-to-fry survival) began in winter/spring of 2022.

Discussion focused on the location of the Sacramento River tributary for the second life-cycle monitoring program started in spring 2021. State and federal partners identified in

the non-flow action steelhead charter will be participating in this discussion. Initial discussion focused on opportunities to enhance or support ongoing Sacramento Basin steelhead monitoring while identifying efficient ways to permit additional life-cycle monitoring activities. Candidate tributaries will include CVP watersheds and tributaries with existing monitoring infrastructure.

- **San Joaquin Basin Steelhead Collaborative:** A complete draft of the science plan based on the steelhead collaborative workshop held in 2021 is scheduled to be completed by January 2023 and will be circulated for review by partner agencies.
- **San Joaquin River Scour Hole Predation Reduction:** The project is in the design phase.
- **Tidal Habitat Restoration:** Completed in WY 2022, the Bradmoor Island Project restored or enhanced approximately 744 acres of tidal habitat, with 490 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The goal of the Bradmoor Island Project was to restore tidal wetlands in an area where tidal restoration has a high potential to directly benefit listed fish species by creating rearing habitat and increasing food production and availability in Suisun Marsh. Groundbreaking for the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project occurred in April 2022. Construction is anticipated to last two calendar years.
- **Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project:** Construction of the Fremont Weir component is anticipated to be completed by the end of 2023. Construction for the supplemental fish passage structure is scheduled for 2024.
    - NMFS included as RPM 1.g.:
        - *In order to minimize project related impacts to fish growth and survival on the lower Sacramento River, Reclamation shall complete construction of the Fremont Weir component of the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project by 2022.*
    - Reclamation and DWR have been constructing the gated notch structure at Fremont Weir during WY 2022. Construction will continue into WY 2024. Reclamation has coordinated with USFWS and NMFS to inform them of the current construction timeline.
- **Predator Hot Spot Removal:** Reclamation would coordinate with water users to minimize lighting at fish screen and bridges and possible remove abandoned structures. NMFS required as RPM 5.a.
    - *Develop and implement a predator management experiment to reduce the mortality of emigrating juvenile salmonids at "hot spots" in the Bay-Delta.*

- Reclamation has completed the Predator Contact Points study. Results are being incorporated into the SIT DSMs. Final reports will be delivered by the end of September 2023.

- **Delta Cross-Channel Gate Improvements:**
    - The Accountability Report for the Value Planning Study, the Draft DEC Report, and Joint Resolution Memo for the DEC review are all scheduled to be completed in early 2023.

- **Tracy Fish Collection Facility Improvements:** A report on the TFCF Operations Improvement is in progress, and the first review occurred in January 2022.
    - A report describing operational and structural changes to the TFCF is posted to:
    - https://www.usbr.gov/mp/TFFIP/docs/1a-tr93-history-of-the-tfcf-final508.pdf
    - As part of the Tracy Fish Facility Improvement Program (TFFIP), the proposal package for FY 2022 is posted on Reclamation's website here:
    - https://www.usbr.gov/mp//TFFIP//docs/study-plan/tffip-fy22-proposal-package-final-508.pdf
    - The Tracy Technical Advisory Team (TTAT) has developed a process and deadlines for research proposals, including scientific and technical review and selection for FY 2023.

- **Clifton Court Forebay Mortality Reduction**: An Annual Report for the first year of the Enhanced Predatory Fish Removal and Relocation Study (EPFRRS) was completed in February of 2022. The second field season for EPFRRS was conducted from January through May of 2022. A pilot deployment of a large Kodiak trawl was conducted, but was discontinued after thirteen trawls on March 3, 2022, due to very low catch per unit effort. Again, low flows through the CCF and high ambient air and water temperatures led to an early close of the field season. Electrofishing fished for 2 fewer days in May than other gear types, due to exceeding the temperature threshold (18°C). The study was halted on May 13, 2022, when the threshold for the remaining gear-types (21°C) was exceeded. A total of 20,834 predatory fish were relocated from Clifton Court Forebay to Bethany Reservoir during the 2022 field season; 10,452 catfish, 9,043 Striped Bass, 688 black bass, and 647 sunfish.

- NMFS included as RPM 5.f.:
    - DWR shall incorporate the following terms and conditions related to the Predator Relocation Electrofishing Study/Predatory Fish Relocation Study:

- The initial "run" of Chinook salmon shall be determined based on length at date criteria if the fish is actually capture and handled prior to release.
- Information shall be collected, to the extent possible, regarding whether the fish have an intact adipose fin or not, and any external signs of sutures or an incision, indicating that it is a special study fish (acoustic tags).
- For those natural Chinook salmon captured, tissue samples shall be taken for DNA analysis and archived with CDFW.
- All salmonids and sDPS green sturgeon shall be immediately processed and returned to Clifton Court Forebay in good health as quickly as possible. v. If salmonids are observed in the electric field of the electrofishing boats, but are not captured, field crews shall note the approximate size and whether there is an adipose fin or not, if possible. vi. When salmonids or sDPS green sturgeon are observed in the electric field, electrofishing shall stop in that area, and the boat shall move to another area of the Clifton Court Forebay at least 400 yards away from the previous site, and DWR project managers shall be notified immediately.

The 2022 field season incorporated the three successful methodologies from 2021, and tested one additional technology that was modified from previous predator removal efforts to maximize predatory fish capture. The four methods employed included electrofishing, hoop traps, beach seine, and Kodiak Trawl. Target fish taxa included black bass, Striped Bass, and catfish, with opportunistic removal of sunfish. Over the 32 field days in 2022, a total of 20,186 fish from the target fish species were transported and 20,833 total fish were transported. Based on predatory fish lengths and length-weight relationships established in prior removal studies, estimated biomass removed was 7,998.1 lbs. Listed individuals were caught in all gear types. There was a total of 13 listed fish captured and 29 observed during EPFRRS. None of the 12 Chinook salmon or 28 CCV steelhead captured had intact adipose fins. One green sturgeon was captured in the beach seine.

- **Salvage Release Sites:** In September 2020, Reclamation finalized the Antioch Fish Release Site Replacement Physical Hydraulic Model (Hydraulic Laboratory Report HL-2020-03). The report is posted on the TFFIP website here:
    - https://www.usbr.gov/mp/TFFIP/docs/hl-2020-03-antiochfishreleasesite-hydraulicmodel-final508.pdf
    - The model determined that the proposed operating procedure adequately cleared debris from the release pipe for all debris except for large amounts of small floating debris. In these cases, small floating debris was difficult to pass.
    - Construction of the replacement fish release site at Antioch began January 2021 and was substantially completed on October 5, 2022. The release pipe must be evaluated prior to full operation.

- **Small Screen Program:** Under the Small Screen Program, Reclamation and DWR work together within existing authorities to screen small diversions throughout the Central Valley, CVP/SWP streams, and the Delta. A Small Screen Program Charter was completed in January 2021.
- **Supplementation Efforts for Delta smelt:** USFWS finalized and delivered a Delta smelt Supplementation Strategy on October 21, 2020, completing the first phase proposed by Reclamation as steps toward supplementation of Delta smelt. In addition, the agencies met monthly though the Culture and Supplementation of smelt (CASS) which facilitated research and progress on cultured Delta smelt. The Experimental Release of Delta smelt released ~55,733 in winter 2021-2022. A similar release of ~50,000 Delta smelt is planned for winter 2022-2023. In 2022, the Fish Conservation and Culture Laboratory (FCCL) increased production of Delta smelt to roughly 50,000 for supplementation. As called for by the Supplementation Strategy, increases in production methods are being refined to reflect best practices in both genetic management of Delta smelt and increasing production.
    - USFWS included as RPM 3.1.
        - Reclamation shall ensure development of a supplementation strategy for the FCCL supplementation program as described in the PA. This strategy will be in place one year from the issuance of the Biological Opinion.
    - The FCCL has begun increasing production of Delta smelt to reach maximum production capacity in two more years as part of Phase 2. As called for by the supplementation strategy, increases in production methods are being refined to reflect best practices in both genetic management of Delta smelt and increasing production.
- **Delta Fish Species Conservation Hatchery:** The need for expanded production capacity is closely tied to the successful Delta smelt supplementation by both USFWS and CDFW. Discussions between Reclamation, DWR, USFWS, and CDFW are ongoing with regard to production goals and necessary research to support supplementation decisions.
- **Sediment Supplementation Feasibility Study**: There is no update on the status of the Sediment Supplementation Feasibility Study for WY 2022.

Conclusion

This report and the seasonal reports, guidance documents, and other documentation indicate that for WY 2022, Reclamation and DWR were in compliance with the 2019 NMFS and USFWS Biological Opinions and the Proposed Action adopted in the 2020 Reclamation ROD.

The WY 2020 Annual Report clarified the operational dates in the 2019 NMFS and USFWS Biological Opinions and the Proposed Action adopted in the 2020 Reclamation ROD for the agricultural barriers and should be consistent with the dates in the Temporary Barriers Project Biological Opinions and as described in the Biological Assessment Appendix A, Section A.5-2 Temporary Agricultural Barriers (Biological Assessment Appendix A Table A.5-3 [page A-96]).

Since WY 2022 was Critically Dry, Reclamation and DWR did not implement increased SMSCG operations or X2 management associated with the Delta smelt Summer-Fall Habitat Action. As described in the seasonal report, Delta smelt habitat in WY 2022 was limited due to salinity conditions in the late summer and fall.

The CVP and SWP did not exceed the amount or extent of incidental take specified in the incidental take statement of listed fish species described in the 2019 NMFS and USFWS Biological Opinions. Exports at the CVP and SWP export facilities and operations of the DCC gates were consistent with the Proposed Action adopted in the ROD and within the effects anticipated by the 2019 NMFS and USFWS Biological Opinions. As detailed above, salmonid losses were below thresholds established in the Proposed Action, and there were no OMR reverse flow reductions based on exceedances of the thresholds described in the Proposed Action. Many other factors controlled the operation and reductions in exports and were not necessarily due to OMR flow management.

OMR flows did not exceed those described in the Proposed Action and addressed in the ITS in the 2019 USFWS Biological Opinion. Exceedance of a single-year threshold or 50 percent of the cumulative loss threshold for listed salmonids did not occur. As flows and levels of incidental take were not exceeded, there was no need identified for an independent panel review for WY 2022.

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Stanislaus River

The Stanislaus River has a length of 60 river miles from New Melones Reservoir to its confluence with the San Joaquin River (Figure 13). New Melones Reservoir seasonal operations follow a set of objectives. During winter, Reclamation operates for flood control and building storage, considering both the channel capacity within the Stanislaus River and New Melones Reservoir flood conservation space. During spring, New Melones Reservoir continues to build additional storage until flows are needed to support downstream regulatory demands. Summer operations are focused on water deliveries into the canals at Goodwin Dam. During the summer, Reclamation also maintains applicable dissolved oxygen standards (applicable year-round, but requiring operational changes primarily during the summer) on the lower Stanislaus River for species protection and releases from the Stanislaus River also support salinity and flow standards on the San Joaquin River. Throughout the year, Reclamation operates the minimum flow schedule in the Stepped Release Plan (SRP), which provides base flows and key ecological flow features for fish.

Figure 13. Stanislaus River Watershed

Flow Management

Reclamation operates New Melones Reservoir to provide releases at Goodwin Dam in accordance with an SRP that varies by WY type. In WY 2022, with feedback from the Stanislaus Watershed Team (SWT), Reclamation implemented reshaped flows in the fall, winter, and spring to optimize biological benefits. The reshaped fall pulse flows helped improve instream conditions and provided an attraction cue for adult salmonids returning to spawn in the Stanislaus River. Higher flows were expected to reduce water temperature (or at least buffer daily maximum water temperature) to provide conditions suitable for the migration and holding of adult salmonids. By starting the fall pulse flow the second week of October and extending the reshaped fall pulse flow into November, SWT expected the higher-than-base flows to help buffer water temperatures during the seasonal transition to cooler air temperatures. The winter instability flows allowed for short-term inundation of shallow water habitat which provided benefits to rearing salmonids such as: temporary spatial refuges from large predators, increased temperatures that may allow short-term increases in growth rate, and increased capture of terrestrial food and nutrients within the main channel. The spring pulse flows cued anadromy and improved migratory conditions in both the Stanislaus River and in the mainstem San Joaquin River and southern delta. In the Stanislaus River, higher flows were expected to reduce water temperature (or at least buffer daily maximum water temperature) and inundate some shallow water habitat which may provide juvenile salmonids with short-term growth benefits as well as potential refuge from predation. In the mainstem San Joaquin River and south delta, higher flows from the Stanislaus River (and other San Joaquin tributaries) were expected to convey out-migrating salmonids more rapidly along their migratory pathway, which could improve outmigration success. The Stanislaus River Summary of Activities for WY 2022 report is included as Appendix J.

Table 4. WY 22 New Melones Seasonal Operations Summary

Seasonal Operations	Flow Quantity/Description	SRP	Operations Outline
Fall 2021 Pulse Flow (October 12 – November 4)	The Alt-1 schedule had the same total volume (41,455 AF, including base flows) for the October 1 -November 15 period as the default SRP Critical schedule	SRP Critical Schedule (41,455 AF) reshaped for increased flow variability and pulse duration.	For WY 2022, Reclamation implemented a reshaped fall pulse flow according to the flow schedule described in Alternative 1.
Winter Instability Flows (January)	The Alt-1 schedule had the same volume (1.19 TAF) as the default SRP Dry schedule. Reshaping the sub-daily flow pattern to increase the peak flow to over 1100 cfs with increased ramping rates.	SRP Dry schedule (1.19 TAF) reshaped to include higher peak flows and variability.	On January 28, 2022, Reclamation implemented a January 2022 WIF with peaks of 1100 cfs with a doubled ramping rate. The WIF ended on January 30, 2022.

Seasonal Operations	Flow Quantity/Description	SRP	Operations Outline
Winter Instability Flows (February)	Reclamation's Goodwin releases in February due to downstream regulatory demands exceeded any reshaped, scheduled WIF. These downstream regulatory demand releases satisfied the volume of the February WIF in SRP Dry year.	SRP Dry schedule	Reclamation water flows exceeded WIF requirements for SRP Dry schedule. SWT provided recommended flow schedule for February in the Stanislaus River. This flow schedule included: maintain flows at less than 1500 CFS to allow the weir to operate, plan for 450 CFS weekly at Goodwin Canyon for CDFW steelhead survey and provide two days at 300 cfs to allow safe retrieval of steelhead egg cages. Reclamation was able to accommodate those components of the flow schedule for February 22.
Spring Pulse Flows	The Alt-1 schedule had the same volume (67,420 AF, including base flows) for the Apr 15 – May 15 period as the default SRP Critical schedule. The single pulse identified in the default SRP schedule was reshaped into a multi-peak pulse period to increase flow variability.	SRP Critical schedule (67,240 AF, including base flows) reshaped to increase flow variability	For WY 2022, Reclamation implemented a reshaped spring pulse flow according to the flow schedule described in Alt-Critical-1

Conservation Measures

Reclamation included conservation measures in the Proposed Action that were adopted in the ROD, to avoid and minimize or compensate for CVP project effects in the Stanislaus River, including take, on listed species. These measures may also improve production, growth, and survival of listed species.

- **Spawning and Rearing Habitat Restoration:**
    - In WY 2022, Reclamation is ahead of schedule in implementing gravel placement projects on the Stanislaus River.
    - Reclamation coordinated with project partners to plan future habitat restoration projects. However, additional spawning and rearing habitat projects were not constructed during WY 2022.
- **Water Temperature Management Study**
    - Reclamation will study approaches to improve water temperature for listed species on the lower Stanislaus River, including the evaluation of the utility of conducting water temperature measurements/profiles in New Melones Reservoir. Reclamation is currently working on a Central Valley Project Water Temperature Modeling Platform project. The objectives of this project to develop a set of physically based tools within a modeling platform capable of providing recommendations for short and long-term temperature prediction to assist resource managers of major CVP reservoirs (Sacramento River, American River and Stanislaus River) to have better understanding of balancing operations and water resources for downstream and temperature needs.

Incidental Take Statement

The 2019 NMFS Biological Opinion found the action is reasonably expected to create the stressors of water temperature and flow conditions resulting in take of CCV steelhead in the Stanislaus River.

Water Temperature

CCV steelhead egg-to-fry lifestage: The extent of take is all redds exposed to temperatures above 54° F in the vicinity of Orange Blossom Bridge (OBB) December 1 through May 31. Water temperatures at OBB exceeded 54° F during 71 days in the period between December 2021 - May 2022 (Figure 14), with all but two exceedances occurring after mid-March. However, few steelhead eggs were expected to be incubating during the times when the 54° F water temperatures were exceeded. Every year operations have exceeded water temperatures of 54° F with the exception of WYs 2006 and 2019 (2001-2023; Figure 15). Temperature management capabilities are limited on the Stanislaus River. New Melones Dam does not have a temperature control device.

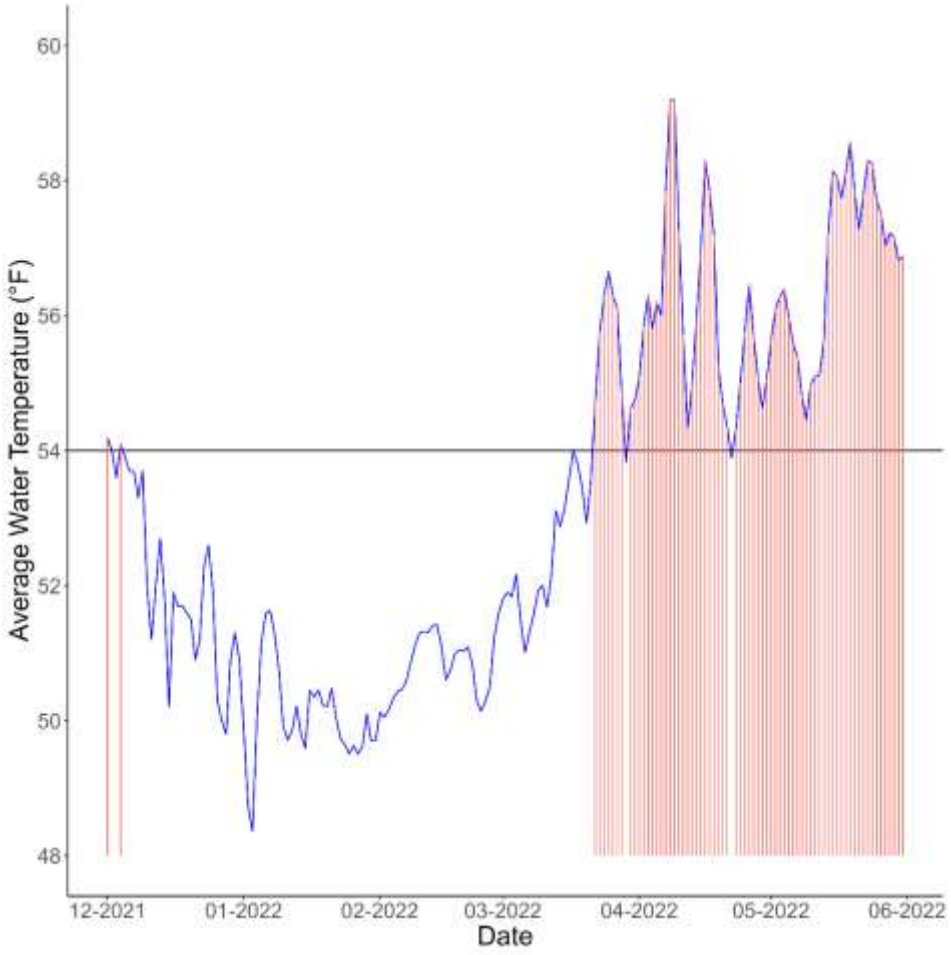

Figure 14. Water Temperatures at Orange Blossom Bridge between December 2021 -June 2022

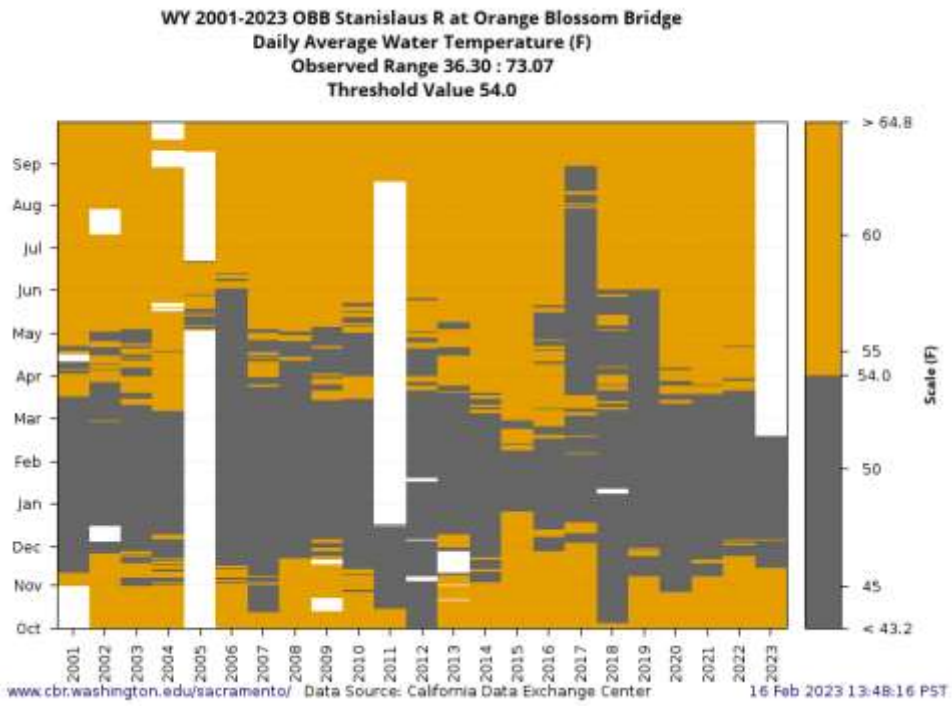

Figure 15. WY 2001-2023 Daily Average Water Temperatures at Orange Blossom Bridge

CCV steelhead juveniles: The anticipated level of take will be exceeded if temperatures at OBB exceed 68° F between May 15 to October 31 for more than seven consecutive days unless Reclamation and NMFS agree that it is an acceptable exceedance given the hydrologic and meteorological conditions for that year. From May 15 to October 31, daily average temperatures at Orange Blossom Bridge did not exceed 68° F for more than seven consecutive days (Fig. 18).

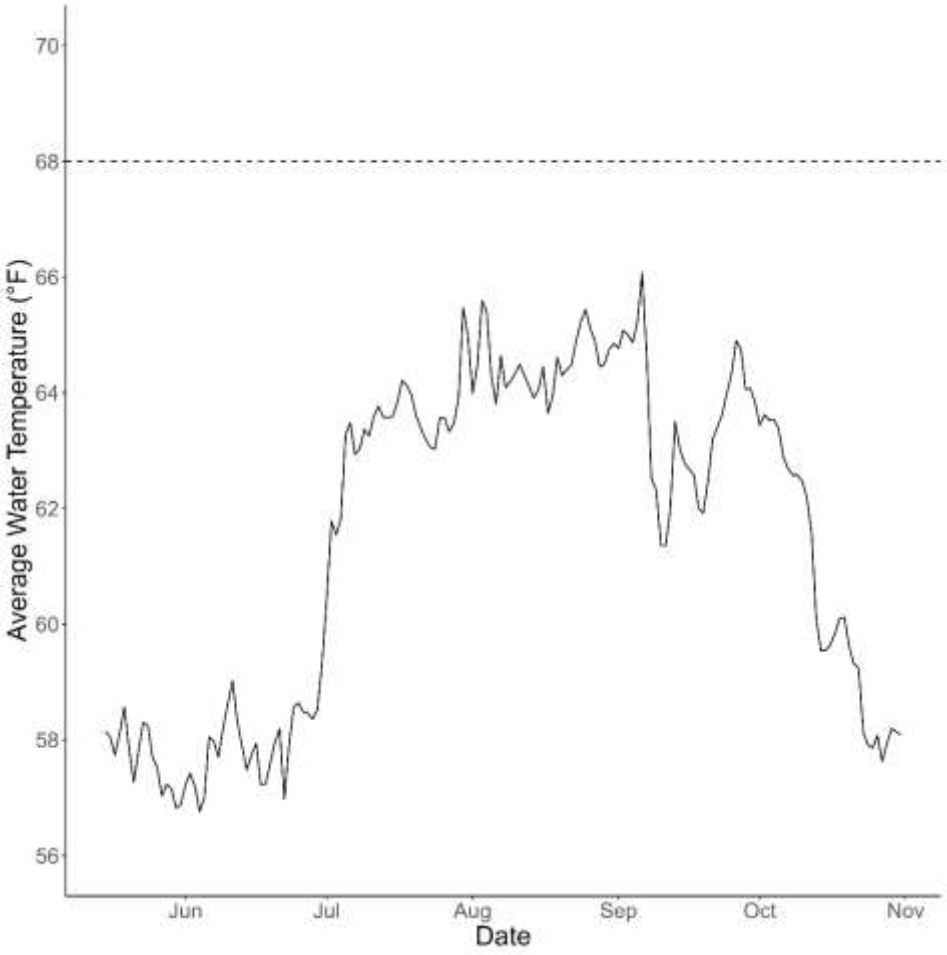

Figure 16. WY 2022 daily average temperatures at Orange Blossom Bridge (May 15-October 31). Dashed line represents the 68° F threshold.

Flow

As described in the NMFS Biological Opinion (page 807), with regard to flow, take will be exceeded if flow releases to the Stanislaus River measured at Goodwin Dam decrease to levels lower than the SRP, or those scheduled by the SWT. In WY 2022, flow releases were consistent with flows described in the SRP or those scheduled by the SWT. For more information, see Appendix J.

Reasonable and Prudent Measures

The 2019 NMFS Biological Opinion included the following RPM (and associated Terms and Conditions) to minimize impacts of incidental take of the listed fish species in the Stanislaus River):

RPM 4: Reclamation shall minimize the impact of the amount or extent of incidental take of listed species during operations of the Eastside Division.

- The shift in compliance location for dissolved oxygen from Ripon to Orange Blossom Bridge from June 1 to September 30 shall not go into effect until NMFS confirms that Reclamation has satisfied both of the following conditions:
    - Provide confirmation that a dissolved oxygen gauge has been installed, and
    - Consistently providing accurate dissolved oxygen data at Orange Blossom Bridge.
- Reclamation shall complete the Final Temperature Management Study by December 31, 2025.

No changes have yet been made regarding the shift in compliance location for dissolved oxygen. The Temperature Model Platform for the CVP is discussed above in the Upper Sacramento River section under Conservation Measures.

- Reclamation shall provide to NMFS an annual water temperature data set and will provide summary statistics.

See above under the Stanislaus River ITS section.

- Reclamation shall provide to NMFS an annual report of incidental take associated with monthly temperatures and provide an assessment of temperature conditions over the year including monthly average data at Orange Blossom Bridge.

See above under the Stanislaus River ITS section.

Conclusion

Reclamation was in compliance with the 2019 NMFS Biological Opinion ITS and the 2020 Reclamation ROD during WY 2022.

For WY 2022, the year type for SRP implementation was based on the 60-20-20 Index using the 90% exceedance for river operation and 75% exceedance for implementation of D-1641. Both indices were critical for WY 2022.

Guidance Documents Revisions in WY 2022.

- None

San Joaquin River

The San Joaquin River, from the confluence of the Stanislaus River downstream to and including the Sacramento–San Joaquin Delta

Figure 17. San Joaquin River (Photo credit: USFWS)

Conservation Measures

Reclamation included conservation measures in the Proposed Action to avoid and minimize or compensate for CVP and SWP project effects, including take, on listed species. These measures may also improve production, growth, and survival of listed species.

Lower San Joaquin River Rearing Habitat: Reclamation is implementing this effort as part of the conservation measure described in the NMFS 2019 Biological Opinion, consistent with the Collaborative Planning action. This would involve a large-scale floodplain habitat restoration effort in the Lower San Joaquin River. This effort did not occur during WY 2022.

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Additional Actions and RPMs

The Proposed Action and ITSs include programmatic CVP-wide measures that do not fall within the watersheds.

Collaborative Planning

The Proposed Action identified that Reclamation would pursue and implement certain actions through collaborative planning with the goal of continuing to identify and undertake actions that benefit listed species. Collaborative planning will make use of the CSAMP, CVPIA, Interagency Ecological Program, and Delta Plan Interagency Implementation Committee, successors to the forums, or complementary forums, e.g., Voluntary Agreement forums.

NMFS included as RPM 8.a.:

> *Reclamation and DWR shall convene an annual Director's meeting through CSAMP to review the past year's collaborative planning actions and coordinate on future year priorities.*

Habitat and facility improvements are summarized in the Habitat Restoration 2022 Report (Reclamation 2023)

Reporting on Incidental Take

NMFS required RPM 7:

> *Reclamation and DWR shall monitor and report the amount and extent of incidental take described in Section 2.1 as necessary to implement this Opinion.*
>
> - *Reclamation and DWR shall monitor the amount and extent of incidental take through the continued use of programs and processes described in [Appendix C]. Reclamation and DWR also shall annually maintain and update [Appendix C] as appropriate to describe the intended monitoring programs and how they will be used to monitor the amount and extent of take, how they will be applied to CVP and SWP water operation decision making and how they will be used for validation and effectiveness monitoring of Collaborative Planning actions.*

USFWS required RPM 1.8.:

> *Reclamation and DWR will comply with all monitoring and reporting requirements as identified in the Reporting Requirements section.*

Through the development of Seasonal Reports, and this Annual Report for WY 2022, Reclamation and DWR have satisfied reporting requirements in WY 2022.

Accommodation of Research

NMFS required RPM 7:

> *Reclamation and DWR shall monitor and report the amount and extent of incidental take described in Section 2.1 as necessary to implement this Opinion.*

- Reclamation and DWR shall coordinate with the Interagency Ecological Program Biotelemetry Project Work Team to accommodate research that requires special handling of salvaged fish, release of adipose fin-clipped sutured fish; checking for acoustic tags which furthers minimizes take of listed fish, unless not practicable.

Reclamation and DWR coordinated with the Interagency Ecological Program's Biotelemetry Project Work Team by providing information on ITAG [Interagency Telemetry Advisory Group] annual work plan for tagging, array, and reporting), and accommodated research, as necessary, for WY 2022. Reclamation provided support for training for acoustic telemetry tagging, handling, and release at Coleman National Fish Hatchery. The annual ITAG reports describing activities are posted to CalFish Track: Central Valley Enhanced Acoustic Telemetry Project CalFishTrack (noaa.gov).

Western Yellow-billed Cuckoo

Reclamation and USFWS have been coordinating to improve baseline survey data of Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (YBCU) in the project area to further the understanding of potential areas of impact to YBCU. This effort may also provide baseline survey data to other related projects. Ultimately this information may be useful in the conservation of the species, including a potential ecological surrogate model. Reclamation and USFWS have developed a YBCU Surveys LTO Implementation Charter.

Efforts to date include developing protocols, estimating costs, and creating options for implementation.

Southern Resident Killer Whale

NMFS anticipated the proposed action would result in incidental take in the form of harm to Southern Resident Killer Whale (SRKW) individuals in the K and L pods by reducing prey availability and impairing feeding behavior when SRKWs forage for longer periods without success, migrate to alternate locations to seek prey, and experience nutritional stress and related health effects (NMFS Biological Opinion, page 813).

The 2019 NMFS Biological Opinion relied on effects to Chinook salmon populations and the protection and habitat restoration measures used for Chinook salmon throughout the watershed. Therefore, actions that result in adverse effects or protections for Chinook salmon would result in adverse effects or protections for killer whale. Exceedance of take related to Chinook salmon would be viewed as an exceedance of the anticipated take of SRKW as well.

Reclamation and DWR did not exceed take related to Chinook salmon populations. Therefore, actions did not result in the exceedance of the anticipated take of SRKW.

NMFS included RPM 6:

> *Reclamation shall minimize the impact of the amount or extent of incidental take of Southern Resident killer whales during operations.*
>
> - *Reclamation shall continue to support the USFWS' study of alternative release sites for Coleman National Fish Hatchery produced fall-run Chinook salmon for the next two years to determine if trucking to an alternative release site can increase juvenile survival to the ocean and adult returns to the Sacramento River.*

USFWS trucked fall-run Chinook salmon to the alternative release sites in 2021. This should result in more adult Chinook salmon available to SRKWs than would otherwise occur. USFWS released additional Chinook fry, above the standard release numbers, into the Sacramento River in 2022 to test whether this practice can provide additional salmon to the common property fishery. Reclamation funded CDFW, USFWS, and Pacific States Marine Fisheries Commission to tag fish and compile data.