



— BUREAU OF —
RECLAMATION

Long-Term Operation – Biological Assessment

Chapter 1 – Introduction

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Chapter 1 Introduction

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) operates the Central Valley Project (CVP). The California Department of Water Resources (DWR) operates the State Water Project (SWP). Reclamation and DWR coordinate operations under the 1986 Coordinated Operation Agreement, as amended in 2018, between the federal government and the State of California, as authorized by Public Law 99-546. A February 18, 2020 Record of Decision (2020 ROD) implements the Proposed Action consulted upon for 2019 Biological Opinions from the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). On September 30, 2021, Reclamation requested to reinitiate consultation on the Long-Term Operation of the CVP and SWP under Section 7 of the Endangered Species Act (ESA) of 1973, as amended, due to anticipated modifications to the previous Proposed Action that may cause effects on federally listed species or designated critical habitat not analyzed in the current 2019 Biological Opinions. Modifications would address the review of the 2019 Biological Opinions required by Executive Order 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*, and voluntarily reconcile CVP operating criteria with requirements of the SWP under the California Endangered Species Act. USFWS and NMFS acknowledged the reinitiation request on October 1, 2021, and offered technical assistance.

This Biological Assessment supports Reclamation's consultation and conference under the requirements of ESA Section 7 and documents the potential effects of the Proposed Action on federally listed, or proposed, aquatic endangered and threatened species that have the potential to occur in California's Central Valley and designated critical habitat for these species. It also fulfills consultation requirements for the Magnuson-Stevens Fishery Conservation and Management Act of 1976 for Essential Fish Habitat (EFH). To help facilitate the process, since there are separate areas of responsibility within NMFS and USFWS, a separate Biological Assessment will support consultation on the Trinity River Basin aquatic species, and a separate Biological Assessment will support consultation on terrestrial species.

1.1 Background

Reclamation operates the CVP for the congressionally authorized purposes of (1) river regulation, improvement of navigation, and flood control; (2) irrigation and domestic uses, and fish and wildlife mitigation, protection, and restoration; and (3) power and fish and wildlife enhancement. The CVP consists of 20 dams and reservoirs that together can store nearly 12 million acre-feet (MAF) of water. Reclamation holds over 270 contracts and agreements for water supplies that depend upon CVP operations. Through operation of the CVP, Reclamation delivers water in 29 of California's 58 counties, which include approximately:

- 5 MAF of water for farms
- 600 thousand acre-feet (TAF) of water for municipal and industrial uses (enough water to supply about 2.5 million people for a year)

- 355 TAF of water for wildlife refuges

Reclamation operates the CVP under water rights granted by the State of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Sacramento–San Joaquin Delta (Delta). The CVP generates approximately 4.5 million megawatt hours of electricity annually on average.

DWR operates the SWP under water rights granted by the State of California, including those intended to protect agricultural and fish and wildlife beneficial uses in the Delta. DWR operates the SWP for the primary purpose of water supply deliveries and flood control, and the SWP provides additional benefits including power generation and environmental stewardship. The SWP's main facilities are Oroville Dam, the Harvey O. Banks Pumping Plant (Banks Pumping Plant), and San Luis Reservoir. These facilities are operated and connected by a network of canals, aqueducts, and other facilities of the SWP to deliver, on average, approximately 2.6 MAF of contracted water supplies annually. DWR holds contracts with 29 public agencies in the Feather River Area, North Bay Area, South Bay Area, San Joaquin Valley, Central Coast, and Southern California for water supplies from the SWP.

Reclamation formulated alternatives through the National Environmental Policy Act scoping process, coordination with public water agencies pursuant to the Water Infrastructure Improvement for the Nation Act, interagency coordination teams, outreach to interested parties, and Reclamation's decades of experience in operating the CVP. Reclamation selected Alternative 2: Multi-Agency Deliberation as the Proposed Action upon which to consult. Alternative 2 contains the actions required to achieve interagency consensus from CDFW, DWR, NMFS, and USFWS.

Appendix A, *Facilities Description*, describes the facilities addressed by the Long-Term Operation (LTO), their capabilities, and their requirements. Appendix B, *Water Operations and Ecosystem Analyses*, identifies the likely direction and magnitude of potential hydrologic modifications. Appendix C, *Species Spatial-Temporal Domains*, provides an evaluation of when federally listed species are present, which informed deconstruction of potential seasonal operations (described in Appendix D, *Seasonal Operations Deconstruction*). The deconstruction of potential seasonal operations used conceptual models to link water operations to stressors on fish populations and identify when and where the operation of the CVP and SWP may affect listed fish species and their critical habitat. Development of the environmental baseline simulations relied upon exploratory modeling (described in Appendix E, *Exploratory Modeling*) to simulate potential water operations under a range of criteria. Additional appendices: Appendix F modeling; G, *Specific Facility and Water Operations Deconstruction*; Appendix H, *Conservation Measure Deconstruction*; Appendix I, *Old and Middle River Flow Management*; Appendix J, *Winter and Spring Pulses and Delta Outflow— Smelt, Chinook Salmon, and Steelhead Migration and Survival*; Appendix K, *Summer and Fall Delta Outflow and Habitat*; Appendix L, *Shasta Coldwater Pool Management*; Appendix M, *Folsom Reservoir Flow and Temperature Management*; Appendix N, *New Melones Stepped Release Plan*; Appendix O, *Tributary Habitat Restoration*; Appendix P, *Delta Habitat*; Appendix Q, *Georgiana Slough Non-Physical Barrier*; and Appendix R, *Head of Old River Barrier*) support estimating the magnitude of effects.

Operational actions to address multiyear droughts in coordination with the diversion of water by the Sacramento River Settlement Contractors (SRSCs) are included as part of the Proposed

Action along with the actions that will result in the incidental take of listed species for monitoring and science. Analysis of operation under a potential future Temporary Urgency Change Petition will be provided in subsequent supplemental information. Other nonflow actions associated with a potential memorandum of agreement with the SRSCs to address winter-run Chinook salmon recovery and multiyear drought will require separate consultation(s).

The State Water Resources Control Board (Water Board) is currently considering Voluntary Agreements with other water right holders in its update to the Bay-Delta Water Quality Control Plan. If approved, the Voluntary Agreements would provide additional flows, facility improvements, and habitat restoration that benefit listed species, with a proposed funding mechanism to implement these enhancements. This Proposed Action consults on the potential operation of SWP facilities in the Delta and operation of the CVP consistent with the currently proposed Voluntary Agreements. The analysis covers Reclamation and DWR Voluntary Agreement actions under an early implementation condition, a condition if Voluntary Agreements are not approved and no substitute Water Quality Control Plan is implemented, and a condition where full Voluntary Agreements are implemented. Voluntary Agreements are anticipated to benefit federally listed species and their designated critical habitats.

The Proposed Action includes consideration of future new storage and conveyance. The operation of the CVP with an expanded San Luis Reservoir capacity is included in the site-specific facilities. The planned operation of the Delta Conveyance Project and Sites Reservoir will be included as framework programmatic components in subsequent supplemental information.

Ongoing actions with independent utility that may have separate Section 7 consultations and are not being reinitiated by this Proposed Action but warrant consideration for their effects on listed aquatic species are listed as independent but related within Chapter 2, *Environmental Baseline*.

1.2 Action Area

For the purposes of this Biological Assessment, the action area encompasses the following reservoirs, rivers, and the land between the levees adjacent to the rivers.

- Clear Creek from Whiskeytown Reservoir to its confluence with the Sacramento River: A portion of the water from the Trinity River Basin is stored in Trinity Lake behind Trinity Dam, reregulated in Lewiston Lake, and diverted through the Clear Creek Tunnel and Carr Powerplant into Whiskeytown Reservoir on Clear Creek and then into the Sacramento River through the Spring Creek Tunnel and Spring Creek upstream of Keswick Dam. This Biological Assessment covers Clear Creek.
- Sacramento River from Shasta Lake downstream to the Delta: A portion of the water from the upper Sacramento River is stored in Shasta Lake and re-regulated in Keswick Reservoir. Water in Shasta Lake may be diverted at Shasta Dam or released into the Sacramento River. Water from the upper Sacramento River, imports from the Trinity River Basin, releases from other reservoirs owned or operated by local agencies, and other inflows enter the Sacramento River and may be diverted into the Tehama-Colusa and Corning Canals at the Red Bluff Pumping Plant.

- American River from Folsom Reservoir downstream to its confluence with the Sacramento River: A portion of the water from the American River is stored in Folsom Reservoir and re-regulated in Lake Natoma. Water in Folsom Reservoir may be diverted at Folsom Dam, diverted into the Folsom South Canal, or released into the American River.
- Stanislaus River from New Melones Reservoir to its confluence with the San Joaquin River: A portion of the water from the Stanislaus River is stored in New Melones Reservoir. Water in New Melones Reservoir may be released into the Stanislaus River.
- San Joaquin River from Friant Dam downstream to the Delta: A portion of the water from the upper San Joaquin River is stored in Millerton Reservoir behind Friant Dam. Water is diverted into the Madera and Friant-Kern Canals or released into the San Joaquin River.
- Delta, Suisun Bay, and Suisun Marsh: The Sacramento River and San Joaquin River carry water to the Delta. As water moves down the mainstem of the Sacramento River, gates at the Delta Cross Channel are operated for water quality and flood management. Water in the Delta may be exported into the Contra Costa Canal at Rock Slough and delivered to the Contra Costa Water District. The C.W. Bill Jones Pumping Plant is at the southern end of the Delta, lifting water into the Delta-Mendota Canal (DMC). CVP water is conveyed in the DMC for direct diversion or for delivery to San Luis Reservoir. Water from the San Luis Reservoir is conveyed through the San Luis Canal and Pacheco Tunnel. The DMC-California Aqueduct Intertie connects the CVP and SWP conveyance facilities after export from the Delta. Prior to the C.W. Bill Jones Pumping Plant, the Tracy Fish Collection Facility salvages salmonids and other species. Water flowing through the Delta passes into Suisun Bay and Suisun Marsh then into the San Francisco Bay and the Pacific Ocean.

The action area also includes areas downstream of the Feather River and SWP facilities in the Delta, Cache Slough Complex, and Suisun Marsh. Feather River operations of Lake Oroville and Oroville Dam are not addressed as part of this consultation.

- In the Cache Slough Complex, the Barker Slough Pumping Plant lifts water into the North Bay Aqueduct.
- In Montezuma Slough, the Suisun Marsh Salinity Control Gates are tidally operated to maintain fresh water in Montezuma Slough and the Suisun Marsh.
- The Banks Pumping Plant at the southern end of the Delta, behind Clifton Court Forebay, lifts water into the California Aqueduct, which conveys water to the San Luis Reservoir for storage and to the South Bay Aqueduct for deliveries to the SWP contractors. The DMC-California Aqueduct Intertie connects the CVP and SWP conveyance facilities after water export from the Delta. Prior to the Banks Pumping Plant, the Skinner Delta Fish Protection Facility salvages salmonids and other species. The SWP also pumps water through the Banks Pumping Plant and conveys it through the California Aqueduct to the Cross Valley Canal for CVP water service contractors when the systems have capacity.

The CVP and SWP affect the abundance of Central Valley (CV) Chinook salmon originating from the Sacramento and San Joaquin Rivers, which is a prey species for Southern Resident Killer Whale. The effects of this Proposed Action are limited to the range of Chinook Salmon, which includes the nearshore Pacific Ocean on the coast from Point Conception to Cape Falcon in Oregon. The action area includes the Lower Klamath River due to the effects of Trinity River Division operations, which are consulted upon separately but may result in an updated analysis of Southern Resident Killer Whale.

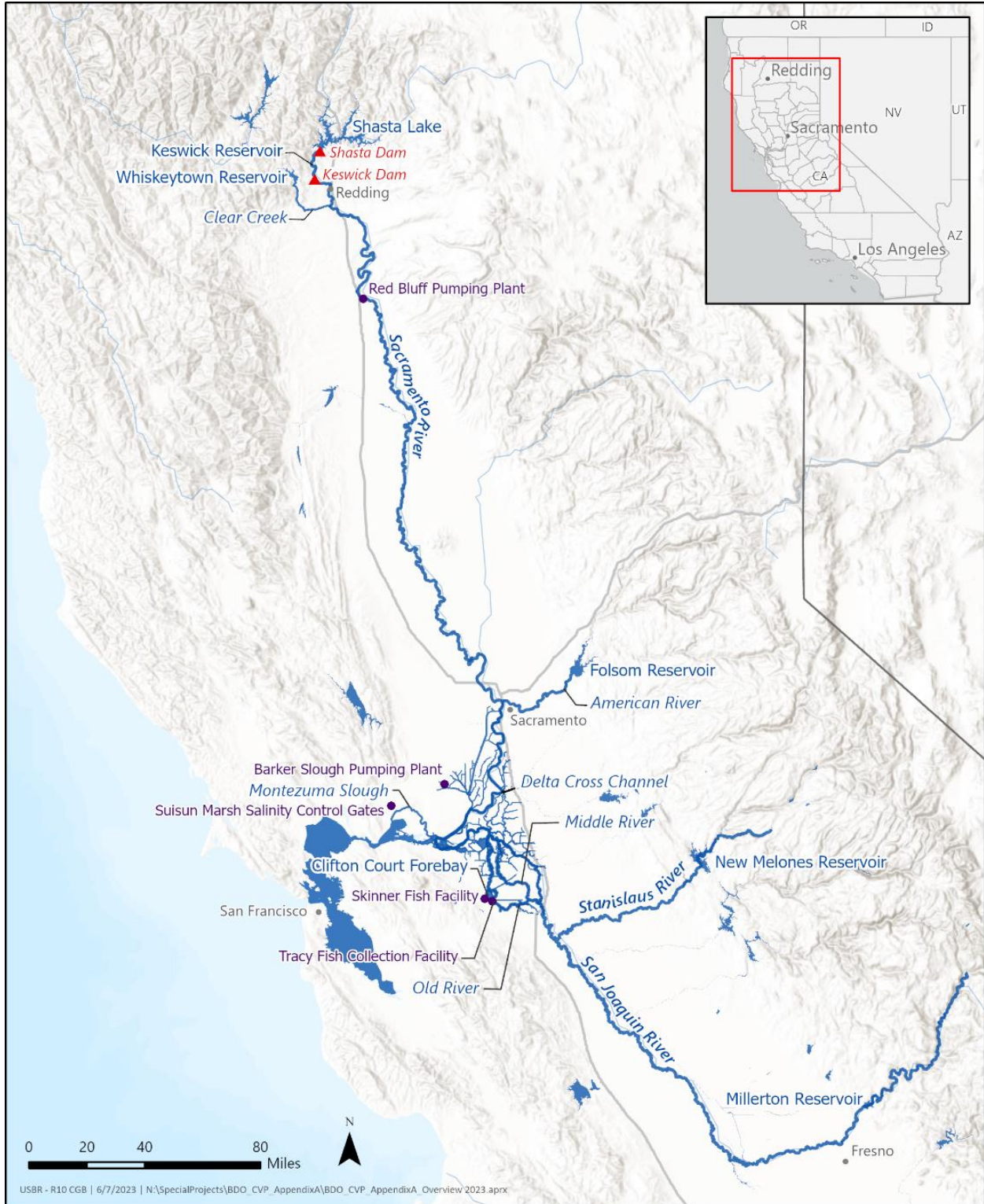


Figure 1-1. Action Area for Section 7 Consultation on the Long-Term Operation of the Central Valley Project and State Water Project

Entities using project water within the CVP and SWP service areas are responsible for decisions on the use of project water after diversion. The action area for the Proposed Action extends to the point of diversion, except as described in the framework programmatic sections of the Proposed Action. ESA Section 7 consultations on water delivery contracts and water acquisitions and transfers cover effects of Reclamation’s discretionary actions beyond the point of diversion.

1.3 Aquatic Species Considered

Aquatic species considered in this Biological Assessment include those that are federally listed, as well as those proposed for listing. The following input was used to determine which listed species should be considered.

- ESA-listed species and species proposed for listing distributional maps and literature review of species life-history requirements and habitat use
- Environmental documentation prepared in support of other Reclamation projects
- Discussions with federal and state agencies
- NMFS species list
- USFWS Information for Planning and Conservation system.
- California Natural Diversity Database RareFind 5 online application

Aquatic species subject to consultation under the jurisdiction of NMFS are shown in Table 1-1.

Table 1-1. Federally Listed Species and Critical Habitat under the Jurisdiction of the National Marine Fisheries Service

| Species | Status | Critical Habitat |
|---|------------|------------------------------------|
| Sacramento River Winter-Run Chinook Salmon ESU (<i>Oncorhynchus tshawytscha</i>) | Endangered | Designated in action area |
| CV Spring-Run Chinook Salmon ESU (<i>Oncorhynchus tshawytscha</i>) | Threatened | Designated in action area |
| CV Steelhead DPS (<i>Oncorhynchus mykiss</i>) | Threatened | Designated in action area |
| Green Sturgeon Southern DPS (<i>Acipenser medirostris</i>) | Threatened | Designated in action area |
| Southern Resident Killer Whale (<i>Orcinus orca</i>) | Endangered | Designated, but not in action area |

ESU = Evolutionarily Significant Unit; CV = Central Valley; DPS = Distinct Population Segment.

Aquatic species subject to consultation under the jurisdiction of USFWS are shown in Table 1-2.

Table 1-2. Federally Listed Species and Critical Habitat and Species Proposed for Listing under the Jurisdiction of the U.S. Fish and Wildlife Service

| Species | Status | Critical Habitat |
|---|----------------------|---------------------------|
| Delta smelt (<i>Hypomesus transpacificus</i>) | Threatened | Designated in action area |
| Longfin smelt (<i>Spirinchus thaleichthys</i>) | Proposed for Listing | Not Designated |

1.4 Consultation History

Reclamation has consulted with the USFWS and NMFS on CVP operations as species were listed and critical habitat designated since the early 1990s. The most recent consultation on CVP and SWP long-term operations was completed in 2019, with a February 2020 ROD. The USFWS and NMFS 2019 Biological Opinions were challenged in federal court with litigation stayed pending a voluntary remand. The consultation history includes the following dates.

- 1992: Reclamation provided an Interim Central Valley Project Operations Criteria and Plan (OCAP).
- 1993: NMFS issued a Biological Opinion for winter-run Chinook salmon (listed in 1991) with a finding of jeopardy and a Reasonable and Prudent Alternative (RPA).
- 1995: USFWS issued a Biological Opinion for Delta smelt (listed in 1993, with splittail proposed in 1994) with a finding of non-jeopardy and reasonable and prudent measures to minimize incidental take.
- 2004: Reclamation provided a Biological Assessment with a determination of likely to adversely affect winter-run Chinook salmon, spring-run Chinook salmon, and CV steelhead; and determined that the Proposed Action may affect but is not likely to adversely affect Coho salmon and Delta smelt. There were no effects on Central California Coast (CCC) steelhead.
- 2004: NMFS issued a Biological Opinion for winter-run Chinook salmon, spring-run Chinook salmon, CV steelhead, and Coho salmon with a finding of non-jeopardy and reasonable and prudent measures to minimize incidental take.
- 2004: USFWS issued a Biological Opinion for Delta smelt with a finding of non-jeopardy and reasonable and prudent measures to minimize incidental take.
- 2005: The Department of the Interior is sued on the July 30, 2004, USFWS Biological Opinion and Reclamation reinitiated consultation with USFWS.

- 2005: USFWS issued its Reinitiation of Formal and Early Section 7 Endangered Species Consultation on the Coordinated Operations of the Central Valley Project and State Water Project and the Operations Criteria and Plan to address potential critical habitat issues.
- 2006: Reclamation requested reinitiation of consultation on CVP/SWP operations based on new species listings and designated critical habitats. However, NMFS stated that there was not enough information in Reclamation's request to initiate consultation.
- 2006 to 2008: Staff from the California Department of Fish and Wildlife (CDFW), DWR, NMFS, the USFWS and Reclamation (OCAP Working Team) met monthly to bi-weekly to discuss the development of the Biological Assessment.
- 2006: Reclamation requested informal consultation on coordinated operations of the CVP and SWP and their effects on Delta smelt.
- 2007 Judge Wanger issued a summary judgment that invalidated the 2005 Biological Opinion and ordered a new Biological Opinion be developed by September 15, 2008.
- 2008: Reclamation provided a Biological Assessment citing the pelagic organism decline and listing of green sturgeon as the reasoning for reinitiation of consultation and with a determination of will adversely affect Delta smelt; a determination of likely to adversely affect Delta smelt critical habitat, CV steelhead and its designated critical habitat, winter-run Chinook salmon and its designated critical habitat, spring-run Chinook salmon and its designated critical habitat, and green sturgeon; a determination of may affect but not likely to adversely affect Coho salmon and its designated critical habitat, and southern resident killer whale; and a determination of not likely to adversely affect CCC steelhead and its designated critical habitat, southern resident killer whale designated critical habitat. The Biological Assessment also made the determination that the Proposed Action may adversely affect EFH of the northern anchovy and starry flounder and will adversely affect fall-run and late fall-run Chinook salmon EFH.
- 2008: USFWS issued a Biological Opinion for Delta smelt with a finding of jeopardy and adverse modification to its designated critical habitat and provided an RPA.
- 2009: NMFS issued a Biological Opinion and conference opinion with a finding of jeopardy to winter-run Chinook salmon, spring-run Chinook salmon, CV steelhead, green sturgeon, and southern resident killer whale and adverse modification to designated critical habitat of winter-run Chinook salmon, spring-run Chinook salmon, CV steelhead, and proposed designated critical habitat green sturgeon, and provided an RPA.
- 2016: Reclamation, with DWR as the Applicant, jointly requested reinitiation of ESA Section 7 consultation with USFWS and NMFS on the Coordinated Long-Term Operation of the CVP and SWP based on new information related to multiple years of drought, recent data demonstrating low Delta smelt populations and extremely low listed-salmonid population levels for the endangered winter-run Chinook salmon, and new information available and expected to become available as a result of ongoing work through collaborative science processes.

- 2019: Reclamation provided a Biological Assessment for seven fish species, 17 terrestrial species, and southern resident killer whale, and an EFH assessment for Pacific Coast salmon, coastal pelagic species, and Pacific Coast groundfish.
- 2019: NMFS issued a Biological Opinion with a finding of non-jeopardy for winter-run Chinook salmon, spring-run Chinook salmon, CV steelhead, green sturgeon, and southern resident killer whale and no adverse modification to their designated critical habitat and provided reasonable and prudent measures to minimize incidental take.
- 2019: USFWS issued a Biological Opinion with a finding of non-jeopardy for Delta smelt and all terrestrial species evaluated and no adverse modification to their designated critical habitat and provided reasonable and prudent measures to minimize incidental take.
- 2021: Reclamation sent USFWS and NMFS a request to reinitiate consultation. USFWS and NMFS responded to the request and offered technical assistance.

While Reclamation is consulting only upon the Proposed Action, the technical appendices to this Biological Assessment also support the Environmental Impact Statement on the 2021 Endangered Species Act Reinitiation of Section 7 Consultation on the Long-Term Operation of the Central Valley Project and State Water Project in the *Federal Register* (FR) on February 28, 2022 (87 FR 11093). The analysis of alternatives in the Environmental Impact Statement informs the public and the decision-maker of the effects of the alternatives, including the Proposed Action, relative to the No Action Alternative.

1.5 Organization

The following chapters provide the Biological Assessment of the LTO.

- Chapter 2, *Environmental Baseline*: The chapter identifies the existing structures and nondiscretionary operations of the CVP and SWP in each watershed. The chapter describes the limitations of Reclamation’s discretion in the Proposed Action. The chapter describes environmental conditions and climate in the action area, providing a landscape-level description of hydrology, anticipated climate change, and past periods of drought. Chapter 2 describes the past and present operations of the CVP and SWP under prior ESA consultations. Chapter 2 describes federal, state, and private actions that have occurred within the action area and have influenced the current status of the species. Additionally, this chapter references related but independent activities that are occurring in the action area that have ongoing effects on federally listed species in the action area.
- Chapter 3, *Proposed Action*: The Proposed Action represents coordination and consensus between USFWS, NMFS, CDFW, DWR and Reclamation, on the discretionary operation of CVP reservoirs and CVP and SWP export facilities in the Delta with Voluntary Agreement flow commitments by settlement and exchange contractors, which are anticipated to be adopted by the Water Board as part of their Water Quality Control Plan update. The Proposed Action also addresses climate change, by including actions to recognize extreme dry conditions that may occur during operations. Finally, the Proposed Action includes a commitment to monitoring and a refined approach to governance.

These programs will allow for science-based adaptive operational adjustments; certainty that critical monitoring will be carried forward to track species response to operations and incidental take of listed species; and improved coordination and processing of real-time risk assessments and a commitment to consensus-based decision-making.

- Chapter 4, *Seasonal Operations*: This chapter presents seasonal and interannual changes associated with the Proposed Action.
- Chapter 5, *Sacramento River Winter-Run Chinook Salmon*: This chapter analyzes the effects of the Proposed Action on winter-run Chinook salmon and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species response to current and future stressors not associated with the Proposed Action.
- Chapter 6, *Central Valley Spring-Run Chinook Salmon*: This chapter analyzes the effects of the Proposed Action on spring-run Chinook salmon and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species response to current and future stressors not associated with the Proposed Action.
- Chapter 7, – *Central Valley Steelhead*: This chapter analyzes the effects of the Proposed Action on CV steelhead and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species’ response to current and future stressors not associated with the Proposed Action.
- Chapter 8, *Green Sturgeon*: This chapter analyzes the effects of the Proposed Action on green sturgeon and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species’ response to current and future stressors not associated with the Proposed Action.
- Chapter 9, *Delta smelt*: This chapter analyzes the effects of the Proposed Action on Delta smelt and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species’ response to current and future stressors not associated with the Proposed Action.
- Chapter 10, *Longfin smelt*: This chapter analyzes the effects of the Proposed Action on longfin smelt and its designated critical habitat. It also provides species-specific status and conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species’ response to current and future stressors not associated with the Proposed Action.
- Chapter 11, *Killer Whale*: This chapter analyzes the effects of the Proposed Action on killer whale and its designated critical habitat. It also provides species-specific status and

conditions of designated critical habitat within the environmental baseline to facilitate an aggregate analysis of the Proposed Action effects in conjunction with the species' response to current and future stressors not associated with the Proposed Action.

- Chapter 12, *Cumulative Effects*: This chapter encompasses only the effects of future state or private activities reasonably certain to occur on federally species and designated critical habitats within the action area. These activities include activities such as unscreened water diversions, state or local levee maintenance, oil and gas production and powerplants, and the point and non-point source chemical contaminant discharges related to agricultural and urban land use.
- Chapter 13, *Conclusion*: A summary of findings regarding potential effects on listed species individuals as a direct or indirect result of the Proposed Action, interaction among effects of the Proposed Action (both adverse and beneficial), and an estimate of anticipated incidental take.

Findings are further supported by technical appendices providing analyses on the following topics.

- Appendix A, *Facilities Description*: The geographical location, authorization, operational specifications, water and power contracts, and other pertinent information for facilities of the CVP and SWP
- Appendix B, *Water Operations and Ecosystem Analyses*: Changes in flows and environmental parameters as a result of the Proposed Action and alternatives
- Appendix C, *Species Spatial-Temporal Domains*: The timing and location of species identified through ongoing monitoring programs
- Appendix D, *Seasonal Operations Deconstruction*: Application of conceptual models to identify stressors on individual species and potential effects on their critical habitats as a result of the hydrologic alteration from the operation of the CVP and SWP
- Appendix E, *Exploratory Modeling*: Operational scenarios on the layering of permits and programs on hydrology and the resulting tradeoffs on the availability of water within a year and in subsequent years
- Appendix F, *Life Cycle Analyses*: Modeling of the Proposed Action and alternatives
- Appendix G, *Specific Facility and Water Operations Deconstruction*: Application of conceptual models to specific water operations and facility operations not addressed through other site-specific measures
- Appendix H, *Conservation Measure Deconstruction*: Application of conceptual models to conservation measures proposed to address stressors from seasonal operations deconstruction that are not addressed in subsequent action-specific appendices
- Appendix I, *Old and Middle River Flow Management*: Actions to minimize potential effects on the species from entrainment due to operation of the Delta Cross Channel and exports by the CVP and SWP in the south Delta

- Appendix J, *Winter and Spring Pulses and Delta Outflow: Smelt, Chinook Salmon, and Steelhead Migration and Survival*: Actions to minimize or compensate for potential effects on species from storing water in the spring, and to benefit or promote the recovery from potential effects experienced by analyzed species in their environment that are not associated with the Proposed Action
- Appendix K, *Summer and Fall Delta Outflow and Habitat*: Actions to minimize or compensate for effects on species from reduced Delta outflow during certain years, and to benefit or promote recovery from potential effects experienced by analyzed species in their environment that are not associated with the Proposed Action
- Appendix L, *Shasta Coldwater Pool Management*: Actions to minimize or compensate for potential effects on species from operation of Shasta and Whiskeytown dams and the appurtenant temperature facilities, and to benefit or promote recovery from potential effects experienced by analyzed species in their environment that are not associated with the Proposed Action
- Appendix M, *Folsom Reservoir Flow and Temperature Management*: Actions to minimize or compensate for potential effects on species from the operation of Folsom and Nimbus dams and the appurtenant temperature facilities, and to benefit or promote recovery from potential effects experienced by analyzed species in their environment that are not associated with the Proposed Action
- Appendix N, *New Melones Stepped Release Plan*: Actions to minimize or compensate for potential effects on species from the operation of New Melones Dam, and to benefit or promote recovery from potential effects experienced by analyzed species in their environment that are not associated with the Proposed Action
- Appendix O, *Tributary Habitat Restoration*: Addresses the effects of spawning and rearing habitat restoration actions for the Sacramento River, American River, Stanislaus River, Clear Creek, and San Joaquin River by reviewing relevant habitat, biological, and water supply metrics, along with datasets, literature, and models
- Appendix P, *Delta Habitat*: Addresses the effects of Delta habitat restoration on refuge habitat and food availability and quality by reviewing relevant habitat, biological, and water supply metrics, along with datasets, literature, and models
- Appendix Q, *Georgiana Slough Non-Physical Barrier*: Actions to minimize potential effects on the species from entrainment due to exports by the CVP and SWP in the south Delta
- Appendix R, *Head of Old River Barrier*: A review of the decision not to include the Head of Old River Barrier as part of the Proposed Action that was documented in the 2020 ROD
- Appendix S, *Governance*: Ongoing coordination and collaboration on the implementation of the Proposed Action following the anticipated issuance of Biological Opinions and execution of a ROD
- Appendix T, *Drought*: Actions taken during drought and dry year conditions

- Appendix U, *Monitoring*: Projects to monitor the potential effects of the CVP and SWP on listed species and inform conditions in the environmental baseline for the analyzed species

Appendices include attachments with detailed technical analyses.