Office of
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February 2019

FERC/DEIS-0293

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

Don Pedro Hydroelectric Project
Project No. 2299-082—California

La Grange Hydroelectric Project
Project No. 14581-002—California

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE, Washington, DC 20426

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FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Draft Environmental Impact Statement

Attached is the draft environmental impact statement (draft EIS) for the Don Pedro Hydroelectric Project (No. 2299-082) and the La Grange Hydroelectric Project (No. 14581-002). The Don Pedro Project is located on the Tuolumne River in Tuolumne County, California. It occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). The La Grange Project is located on the Tuolumne River in Stanislaus and Tuolumne Counties, California. It occupies 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by these projects under the Sierra Resource Management Plan.

This draft EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicants, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicants' proposals and alternatives for relicensing the Don Pedro Project and for issuing an original license for the La Grange Project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The draft EIS will be part of the record from which the Commission will make its decision. The draft EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about February 22, 2019.

Copies of the draft EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington, D.C. 20426. The draft EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Draft Environmental Impact Statement

COVER SHEET

a. Title:	Relicensing the Don Pedro Hydroelectric Project, FERC Project No. 2299-082, and issuing an original license for the La Grange Hydroelectric Project, FERC Project No. 14581-002.
b. Subject:	Draft Environmental Impact Statement
c. Lead Agency:	Federal Energy Regulatory Commission
d. Abstract:	The Don Pedro Project is located on the Tuolumne River in Tuolumne County, California. It occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). The La Grange Project is located on the Tuolumne River immediately downstream of the Don Pedro Project in Stanislaus and Tuolumne Counties, California. It occupies 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by these projects under the Sierra Resource Management Plan. Turlock Irrigation District and Modesto Irrigation District, collectively, Districts or applicants, filed an application for a new major license with the Federal Energy Regulatory Commission (Commission) to continue to operate and maintain the 168-megawatt (MW) Don Pedro Hydroelectric Project. In addition to providing for hydroelectric power generation, Don Pedro Reservoir provides water supply for the irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, flood control benefits along the Tuolumne and San Joaquin Rivers, and a water-banking arrangement for the benefit of the City and County of San Francisco. The Districts filed an application for an original license with the Commission to continue to operate and maintain the 4.7-MW La Grange Hydroelectric Project. This existing, unlicensed project was determined to require licensing in an order issued by the Commission on December 19, 2012. The order found that the project is located on a navigable river and occupies federal lands. The staff's recommendation is to license the projects as proposed by the Districts with some staff modifications and additional measures.

e. Contact:	James Hastreiter Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, D.C. 20426 (503) 552-2760
f. Transmittal:	This draft environmental impact statement to relicense the Don Pedro Hydroelectric Project and to issue an original license for the La Grange Hydroelectric Project is being made available for public comment on or about February 22, 2019, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR, Part 380).

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321–4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

> That the project adopted . . . shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e) . . . [4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Public Law 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a).

[5] 16 U.S.C. § 803(g).

[6] 18 CFR § 385.206 (2018).

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ACRONYMS AND ABBREVIATIONS

7DADM	7-day average daily maximum
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
AIRs	additional information requests
APE	area of potential effects
BA	Biological Assessment
base case	model scenario for environmental baseline (no action)
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin Basins
BAWSCA	Bay Area Water Supply and Conservation Agency
Bay-Delta Plan	Water Quality Control Plan for the Francisco Bay/Sacramento-San Joaquin Delta Estuary
BCDC	San Francisco Bay Conservation and Development Commission
BLM	U.S. Department of the Interior, Bureau of Land Management
BMI	benthic macroinvertebrates
BMPs	best management practices
B.P.	Before Present
ºC	degrees Celsius
California DFA	California Department of Food and Agriculture
California DFW	California Department of Fish and Wildlife
California DWR	California Department of Water Resources
California SHPO	California State Historic Preservation Officer
CCSF	City and County of San Francisco
certification	water quality certification
CESA	California Endangered Species Act
CFR	Code of Federal Regulation
cfs	cubic feet per second
CGREA10%	model scenario for Conservation Groups' recommended project operations
CHTR	collection, handling, transport, and release
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Commission	Federal Energy Regulatory Commission
Conservation Groups	California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River,

	Golden West Women Flyfishers, Central Sierra Environmental Resource Center and Tuolumne River Conservancy
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
DFWREA	model scenario for California Department of Fish and Wildlife's recommended project operations
DO	dissolved oxygen
DPP-1r	model scenario for the Districts' preferred proposed project operations
DPP-1r-NoIG	model scenario for the Districts' proposed project operations with interim minimum instream flows
DPS	Distinct Population Segment
ECHOREA-NoIG	model scenario for ECHO: The Wilderness Company's recommended project operations
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ºF	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FR	*Federal Register*
FWS	U.S. Department of the Interior, Fish and Wildlife Service
FWSREA	model scenario for U.S. Department of the Interior, Fish and Wildlife Service's recommended project operations
GDP	gross domestic product
Hetch Hetchy System	Hetch Hetchy Water and Power System
HHLSM	water system operations model for the San Francisco Public Utilities Commission
HPMP	Historic Properties Management Plan
LWM	large woody material (also referred to as large woody debris)
mgd	million gallons per day
mg/L	milligrams per liter
MID	Modesto Irrigation District
mm	millimeter
MW	megawatt
MWh	megawatt-hour

National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NMFSREA	model scenario for ECHO: The Wilderness Company's recommended project operations
NTU	nephelometric turbidity unit
PA	Programmatic Agreement
Park Service	National Park Service
RM	river mile
RST	rotary screw trap
RWS	Regional Water System
SD1	Scoping Document 1
SD2	Scoping Document 2
SFPUC	San Francisco Public Utilities Commission
SHIRA	Spawning Habitat Integrated Rehabilitation Approach
SRP	special run pool
STM Work Group	Stanislaus, Tuolumne and Merced Work Group
SWBREA	model scenario for State Water Resources Control Board's recommended project operations
TBIREA-NoIG	model scenario for The Bay Institute's recommended project operations
TCP	traditional cultural property
TID	Turlock Irrigation District
TPAC	Tuolumne Partnership Advisory Committee
TREG	Tuolumne River Ecological Group
TRMP	Terrestrial Resources Management Plan
TRTAC	Tuolumne River Technical Advisory Committee
U.S.C.	United States Code
USGS	U.S. Department of the Interior, Geological Survey
VRMS	Visual Resource Management System
Water Board	State Water Resources Control Board
WNS	white-nose syndrome
WUA	weighted usable area

EXECUTIVE SUMMARY

On April 28, 2014, Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts or applicants) filed an application for a new major license with the Federal Energy Regulatory Commission (Commission or FERC) to continue to operate and maintain the Don Pedro Hydroelectric Project (FERC No. 2299-082). Subsequently, the Districts filed an amended application on October 11, 2017. The 168-megawatt (MW) project is located at river mile (RM) 54.8 on the Tuolumne River in Tuolumne County, California. The Don Pedro Project currently occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generates an average of about 550,000 megawatt-hours (MWh) of energy annually.

On October 11, 2017, the Districts filed an application for an original license with the Commission to continue to operate and maintain the La Grange Hydroelectric Project (FERC No. 14581-002).[7] The 4.7-MW project is located at RM 52.2 on the Tuolumne River in Stanislaus and Tuolumne Counties, California, immediately downstream of the Don Pedro Project. The proposed project boundary would occupy 14 acres of federal land administered by BLM. The project generates an average of about 18,077 MWh of energy annually.

Project Description and Operation

Don Pedro Project

The Don Pedro Project includes the following existing facilities: (1) a 580-foot-high, 1,900-foot-long, earth and rockfill dam; (2) a reservoir with a gross storage capacity of 2,030,000 acre-feet and a usable storage capacity of 1,721,000 acre-feet; (3) a 30-foot-high, 45-foot-wide, 135-foot-long, gated spillway including three 45-foot-wide by 30-foot-high radial gates; (4) a 995-foot-long, ungated ogee emergency spillway with a crest elevation of 830 feet National Geodetic Vertical Datum of 1929[8]; (5) a set of outlet works that are located at the left abutment of the dam and consist of three individual gate housings in the diversion tunnel, each containing two 4-foot-by-5-foot slide gates; (6) a 3,500-foot-long, concrete-lined diversion tunnel with a total hydraulic capacity of 7,500 cubic feet per second (cfs); (7) a 2,960-foot-long power tunnel located in the left abutment of the dam that transitions from an 18-foot-diameter, concrete-lined section to a

[7] On December 19, 2012, the Commission issued an order finding that the existing, unlicensed La Grange Project requires licensing because it is located on a navigable river and occupies federal lands (141 FERC ¶ 62,211).

[8] All elevation data in this draft EIS are given in National Geodetic Vertical Datum of 1929.

16-foot-diameter, steel-lined section; (8) a 21-foot-high, 12-foot-wide, emergency closure fixed-wheel gate; (9) a powerhouse located immediately downstream of the dam containing a 72-inch hollow jet valve and four Francis turbine-generator units with a total nameplate capacity of 168,015 kilowatts and a maximum hydraulic capacity of 5,500 cfs; (10) a switchyard located on top of the powerhouse; (11) a 75-foot-high, earth and rockfill dike (Gasburg Creek Dike) with a slide-gate controlled 18-inch-diameter conduit located near the downstream end of the spillway; (12) three small embankment dikes—dike A located between the main dam and spillway and dikes B and C located east of the main dam; (13) recreation facilities on Don Pedro Reservoir, including Fleming Meadows, Blue Oaks, and Moccasin Point; and (14) appurtenant facilities and features including access roads.

In addition to providing for hydroelectric power generation, Don Pedro Reservoir provides water supply for the irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, flood control along the Tuolumne and San Joaquin Rivers, and a water-banking arrangement with the City and County of San Francisco (CCSF), which helps to supply water to over 2 million people in the Bay Area. The Don Pedro Project is hydrologically linked with the CCSF's upstream Hetch Hetchy Water and Power System (Hetch Hetchy System), a series of reservoirs, diversion conduits, and powerhouses located on the Upper Tuolumne River.[9]

Flow releases from the project are scheduled based on requirements for: (1) flood flow management, including pre-releases in advance of anticipated high flows during wet years, (2) the Districts' irrigation and municipal and industrial demands, (3) storage of up to 570,000 acre-feet of water to manage flow releases from the Hetch Hetchy System in compliance with agreements with the CCSF, and (4) protection of aquatic resources in the lower Tuolumne River in accordance with the terms of the FERC license. Scheduled flow releases are generally provided through the four turbine-generator units (up to 5,500 cfs) located in the Don Pedro Powerhouse. Flows are delivered to the powerhouse via the power tunnel, which has an inlet centerline elevation of 534.3 feet and connects to a manifold that feeds each unit. A bifurcation in the manifold passes flow to Unit 4 and/or to a hollow jet discharge valve. The valve discharge is limited to 800 cfs when Unit 4 is operating, but the valve can release up to 3,000 cfs when Unit 4 is not operating. Units 1, 2, and 3 discharge to the Tuolumne River directly from the powerhouse. Unit 4 discharges through a 190-foot-long, 13-foot horseshoe-shaped tunnel to the diversion tunnel, which discharges downstream of the powerhouse. An additional 7,500 cfs can be

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[9] The Hetch Hetchy System is not a part of the licensed project. The CCSF owns and operates it to provide hydroelectric power and water supply pursuant to the authority conferred in the Raker Act (38 Stat. 242 (1913)). The Raker Act requires the Hetch Hetchy System to release a specified amount of water to the Districts. Section 29 of the Federal Power Act (16 U.S.C. § 823 (2006)) prohibits the Commission from modifying or repealing any provisions of the Raker Act.

passed through the low level outlet works tunnel that discharges downstream of the powerhouse. The gated spillway can release up to 172,500 cfs if reservoir water levels approach elevation 830 feet. If the reservoir water elevation exceeds 830 feet, up to 300,000 cfs can pass over the crest of the emergency ungated spillway (based on maximum elevation 850 feet).

When electrical demand is high, flow releases at the project may be increased to generate more electricity, subject to meeting the flow schedule requirements. These flow releases are limited by the small amount of usable storage available in the La Grange Reservoir, which is not sufficient to allow it to re-regulate high variations in hourly outflows, and also by the capacity of the TID main canal. Outflows from the Don Pedro Powerhouse may vary by about 1,200 cfs between on-peak and off-peak periods, which can result in daily water fluctuations of about 1.8 inches in Don Pedro Reservoir.

During the winter, inflows are stored for water supply and only limited hydropower generation occurs. The releases during this period consist of releases to satisfy minimum flows to the lower Tuolumne River, to provide water to fill downstream irrigation storage reservoirs, or to manage flood storage.

La Grange Project

The La Grange Project includes the following existing facilities: (1) a 310-foot-long, 131-foot-high, masonry arch diversion dam (La Grange Diversion Dam); (2) a reservoir with a total storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet; (3) the MID canal headworks, the first 400 feet of the MID canal, and the "hillside" discharge gates (two 42-inch-diameter and one 60-by-60-inch) that are part of MID's retired irrigation canal facilities[10] and are currently used to provide flows to the plunge pool downstream of the dam; (4) the TID irrigation intake and tunnel, which provides flow to the penstock intake structure and to the headworks of the TID upper main canal; (5) a penstock intake structure containing a trashrack and three 7.5-foot-wide by 14-foot-tall concrete intake bays with manually operated gates and two automated 5-foot-high by 4-foot-wide sluice gates that can be used to discharge flow to the river via a sluice channel; (6) two penstocks leading to a powerhouse with two Francis turbine-generator units with a maximum combined generating capacity of 4.7 MW and a maximum combined hydraulic capacity of approximately 580 cfs; (7) a

[10] Because of maintenance and repair issues along the MID upper main canal, MID abandoned the upper portion of its canal on the west side of the dam and constructed a new intake and diversion tunnel about 100 feet upstream of La Grange Diversion Dam, which is not part of the La Grange Project.

700-foot-long excavated tailrace; and (8) a substation.[11] The project's estimated average annual generation was about 18,077 MWh from 1997 through 2016.

The La Grange Project operates run-of-river. Flows released from Don Pedro Reservoir flow into La Grange Reservoir and are diverted into the TID and MID intakes and tunnels or pass over the spillway. Part of the flow that passes into the TID tunnel intake is diverted at the forebay through the penstock intake structure to the penstocks leading to the powerhouse, which has an operating range of 100 to 580 cfs. The sluice gates in the penstock structure can also be used to release flow into the tailrace. The rest of the flow to the forebay passes through the TID main canal intake structure at the forebay and flows into the canal. The Districts normally release a flow of approximately 5 to 10 cfs about 400 feet downstream of La Grange Diversion Dam via gates at the end of the retired MID intake canal. This release is made to support favorable water quality for resident and migratory fish species, to maintain a stable flow regime for fish present in the plunge pool, and to allow sufficient egress back to the tailrace channel for any fish that enter the TID sluice gate channel.

Existing Environmental Measures

In 1995, the Districts entered into a Settlement Agreement with the California Department of Fish and Wildlife (California DFW); the U.S. Department of the Interior, Fish and Wildlife Service (FWS); CCSF; and four non-governmental organizations that provided for minimum flow releases from the Don Pedro Project to the lower Tuolumne River to improve conditions for fall-run Chinook salmon. The Commission issued an order on July 31, 1996, amending the Don Pedro license to incorporate the lower Tuolumne River minimum flow provisions contained in the Settlement Agreement. The summertime minimum flows range from 50 to 250 cfs, a substantial increase over the prior summertime minimum flow of 3 cfs; fall through winter minimum flows vary from 150 to 300 cfs, depending on water year type. To account for varying inflow, the Agreement established 10 water year type classifications: (1) critical and below; (2) median critical; (3) intermediate critical-dry; (4) median dry; (5) intermediate dry-below normal; (6) median below normal; (7) intermediate below normal-above normal; (8) median above normal; (9) intermediate above normal-wet; and (10) median wet/maximum. The water year classifications are determined using the California State Water Resources Control Board's San Joaquin Basin 60-20-20 Water Supply Index and the California Department of Water Resources April 1 San Joaquin Valley unimpaired runoff forecast. The Settlement Agreement and license amendment also provide for the annual release of pulse flows to stimulate the upstream migration of adult salmon in the

[11] Although the Districts described the MID and TID canal headworks as non-project facilities, in SD2 we determined that the MID canal headworks, the first 400 feet of the MID canal, the "hillside" discharge gates, and the TID irrigation intake and tunnel are project facilities, because they are necessary for operation of the project.

fall and in the spring to facilitate the outmigration of juvenile salmon, the volume of which also varies with water year type.

In accordance with the Settlement Agreement, the Districts also monitor the fall-run Chinook salmon population in the lower Tuolumne River and file annual reports summarizing the results of its monitoring activities.

Proposed Facility Modifications

Don Pedro Project

The Districts propose to install and operate two in-river infiltration galleries[12] at approximately RM 25.9[13] on the lower Tuolumne River. The infiltration galleries would be used to withdraw some of the water required to meet municipal and industrial needs and reduce the amount of water withdrawn at the La Grange Diversion Dam, which would result in additional flow in the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries.

La Grange Project

The Districts do not propose to construct any new project facilities at the La Grange Project other than those proposed as environmental measures, described below.

Proposed Project Boundary

The existing project boundary for the Don Pedro Project encloses all of the project facilities described above. The Districts propose to expand the existing project boundary to include the proposed fish counting/barrier weir and infiltration galleries within non-contiguous portions of the Don Pedro Project boundary.

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[12] One of these infiltration galleries (IG-1) was installed in 2001 during the restoration of special-run pool-9 at RM 25.8 located below the Geer Road Bridge. IG-1 consists of 15 perforated, horizontal stainless steel pipes, each 42-feet long and 24-inches in diameter placed within graded rock filters. The second infiltration gallery would be of similar design and installed just upstream of IG-1. We do not consider the infiltration galleries to be project facilities because their primary purpose is to provide water for consumptive use, and they are not necessary to maintain or operate the project.

[13] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS, we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

The proposed project boundary for the La Grange Project would enclose the dam, a portion of MID's retired canal, spillway pool, TID's diversion tunnel, forebay, penstock, powerhouse, substation, and tailrace, and the La Grange Reservoir up to elevation 300 feet.

Proposed Project Operation

Don Pedro Project

Other than the flow-related measures to enhance aquatic and recreational resources and the lower minimum reservoir elevation during extended drought conditions, which are described below, the Districts propose to operate the Don Pedro Project consistent with existing operation. Except in years with high flows, the infiltration galleries would operate from June 1 through October 15. To improve boating, the infiltration galleries would be turned off during certain summer weekends and holidays. The infiltration galleries would have a combined capacity of 200 to 225 cfs.

La Grange Project

Other than the minimum flow release of 5 to 10 cfs to the plunge pool downstream of the La Grange Diversion Dam described below, the Districts do not propose to make substantive changes to the operation of the La Grange Project.

Proposed Environmental Measures

The Districts propose the following environmental measures:

Don Pedro Project

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 feet to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions.
- Implement the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application).
- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating.

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)[14]	RM 25.9	RM 51.7 (La Grange Gage)
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100	150
July 1 through October 15	350	150	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[14] U.S. Department of the Interior, Geological Survey (USGS) gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

- Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.[15]
- Provide spring pulse flows in the following amounts to facilitate the outmigration of juvenile fall Chinook salmon from the lower Tuolumne River. The timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application.

    - Wet and above normal water years: 150,000 acre-feet
    - Below normal water years: 100,000 acre-feet
    - Dry water years: 75,000 acre-feet
    - Sequential dry water years: 45,000 acre-feet
    - First critical water year: 35,000 acre-feet
    - Sequential critical water years: 11,000 acre-feet

- Develop a spill management plan to maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates.
- Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5[16] to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat.
- Implement a predator control and suppression program that includes sponsoring fishing derbies and removal and/or isolation of predatory fish via electrofishing, seining, fyke netting, and other collection methods to control

[15] Flushing flows are proposed to occur only during these water year types, when they would have less effect on the amount of water available for consumptive use than they would in dry or critical water years.

[16] The location of this facility is also provided as RM 25.7 at some places in the Don Pedro amended final license application.

and suppress striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir.

- Conduct coarse sediment augmentation in the lower Tuolumne River between RM 39 and RM 52 over a 10-year period, annual surveys of fall-run Chinook salmon and *O. mykiss*[17] spawning use of new gravel patches for 5 years following completion of gravel augmentation, and a spawning gravel evaluation in year 12, to improve spawning conditions for fall-run Chinook salmon and *O. mykiss*.
- Provide gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam, during years when sufficient spill is projected to occur, to improve salmonid spawning habitat.
- Implement a fall-run Chinook salmon spawning superimposition[18] reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used suitable habitat.
- Conduct a 5-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning, to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).
- Develop a plan to implement the Lower Tuolumne River Habitat Improvement Program and associated $38 million capital fund and annual funding accounts. The plan would address establishment of the fund account, management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to the operation, maintenance, monitoring, and reporting associated with enhancement projects.
- Create a TPAC to provide recommendations on development and implementation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program. The committee would consist of the Districts,

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[17] The term *O. mykiss* is used to represent both resident and anadromous life history forms of rainbow trout/steelhead, *Oncorhynchus mykiss*.

[18] Redd superimposition occurs when later arriving female salmonids dig redds on top of existing redds, which can result in mortality to incubating eggs.

FWS, and CCSF. Other parties, including National Marine Fisheries Service (NMFS) and California DFW would be encouraged to participate in the committee as full members.

- Implement the Aquatic Invasive Species Management Plan (filed as appendix E-4 of the Don Pedro amended final license application) that includes measures to prevent the introduction and spread of aquatic invasive species.
- Shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years.
- Implement the Terrestrial Resources Management Plan (TRMP) (filed as appendix E-6 of the Don Pedro amended final license application) that includes measures for controlling non-native plant species, protecting special-status species, revegetating disturbed areas, protecting bald eagles from disturbance, excluding bats from project facilities, and recording and reporting incidental observations of western pond turtles.
- Implement the Recreation Resource Management Plan (filed as appendix E-7 of the Don Pedro amended final license application) that includes measures to address existing and future recreation resource needs within the project boundary.
- Construct a new boat launch facility to provide boating access upstream of old Don Pedro Dam when reservoir levels are low.[19]
- Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) that includes measures for the collection, storage, and disposal of woody material to minimize hazards to boating and other recreational uses in Don Pedro Reservoir.
- Provide the following flows to enhance conditions for non-motorized, recreational river boating on the lower Tuolumne River:
    - From April 1–May 31 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. During this time period, the infiltration galleries would either be shut off, or additional flows to be withdrawn for water supply purposes would be released to the La Grange gage.

[19] The final license application does not identify the proposed location, however, we assume the boat launch would be located on the northeast shoreline in the vicinity of the location of old Don Pedro Dam shown in figure 1.1.1-1. Old Don Pedro Dam, which was inundated when the new Don Pedro Dam was constructed, is located 1.6 miles upstream of new Don Pedro Dam.

- From June 1–June 30 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of RM 25.9.[20]
- From July 1–October 15, a flow of at least 350 cfs in wet, above normal, and below normal water years and at least 300 cfs in dry and critical water years as measured at the La Grange gage. In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the 3-day July 4 holiday, the 3-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August.

- Provide a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting/barrier weir.
- Install a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.
- Annually notify BLM about the location and type of any project road maintenance projects on BLM lands and convene a meeting to confer on project details if requested by BLM.
- Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.
- Implement the Historic Properties Management Plan (HPMP) (filed as appendix E-8 of the Don Pedro amended final license application) that includes specific actions and processes to manage historical properties.

La Grange Project

- Conduct dissolved oxygen (DO) monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel, from September 1 to November 30 each year for the first 2 years of a new operating license. If results indicate that a specific cause for

[20] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS, we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

low DO exists, the Districts would develop and file an action plan in year 3 of the license.

- Provide a minimum flow of approximately 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times to ensure consistent and adequate flow to support aquatic resources.
- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.
- Construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir, including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes).
- Implement the HPMP filed on July 10, 2018, to manage potential effects on historic properties.

Public Involvement

Before filing its license applications, the Districts conducted pre-filing consultation under the Commission's integrated licensing process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to formal filing of the application with the Commission.

As part of the National Environmental Policy Act scoping process for the Don Pedro Project, Commission staff distributed a scoping document (SD1) to stakeholders and other interested parties on April 8, 2011. Two scoping meetings were held on May 11, 2011, in Turlock and Modesto, California, and an environmental site review was conducted on May 10, 2011. Based on comments made during the scoping meetings and written comments filed with the Commission, Commission staff issued a revised scoping document (SD2) on July 25, 2011.

For the La Grange Project, Commission staff distributed SD1 to stakeholders and other interested parties on May 23, 2014. Two scoping meetings were held on June 18, 2014, in Turlock and Modesto, California, and an environmental site review was conducted on June 19, 2014. Based on comments made during the scoping meetings and written comments filed with the Commission, Commission staff issued a revised scoping document (SD2) on September 5, 2014.

On November 30, 2017, Commission staff issued a notice that the Districts' applications for a new license for the Don Pedro Project and an original license for the La Grange Project are ready for environmental analysis, and requesting comments, terms and conditions, recommendations, and prescriptions.

Alternatives Considered

This draft environmental impact statement (draft EIS) analyzes the effects of continued project operation and recommends conditions for any new licenses that may be issued for these projects. In addition to the Districts' proposals, the draft EIS considers three alternatives for each project: (1) no action, meaning the projects would continue to be operated as they currently are with no changes; (2) the Districts' proposals with staff modifications (staff alternative); and (3) the staff alternative with all mandatory conditions.

Staff Alternative—Don Pedro Project

Under the staff alternative, the project would include many of the Districts' proposed measures, with the exception of the following: the minimum flows proposed to be in effect after the infiltration galleries are operational, the new fish counting/barrier weir at RM 25.5, the predator control and suppression program, the 10-year coarse sediment augmentation program, the fall-run Chinook salmon spawning superimposition reduction program, the 5-year program of gravel cleaning and monitoring, the Lower Tuolumne River Habitat Improvement Program, the TPAC, the new whitewater boat take-out facility upstream of the Ward's Ferry Bridge, the new boat launch facility to provide boating access upstream of old Don Pedro Dam, and the new boat take-out/put-in facility at the fish counting/barrier weir.

Instead of the minimum flows that are proposed to be in effect after the infiltration galleries are operational, we recommend that the proposed interim flows, which would be monitored at the existing USGS gage downstream of La Grange Diversion Dam, remain in effect for the duration of any new license issued for the project. As noted previously, we do not consider the infiltration galleries to be project facilities because their primary purpose is to provide water for consumptive use, and they are not necessary to maintain or operate the project. However, our recommendation does not preclude the Districts from constructing and operating the infiltration galleries or the proposed infiltration gallery pipeline gage, or from implementing their proposed "with infiltration galleries" flow regime.

We do not recommend the permanent barrier/counting weir or implementing a predator control and suppression plan because they would not likely be effective and could have adverse effects on federally listed steelhead. Similar predator removal efforts by the California Department of Water Resources did not noticeably reduce salmon mortality, and the permanent barrier/counting weir could act as a migration barrier to salmonids. Implementation of other habitat-related measures recommended by the resource agencies and staff (i.e., flow and gravel augmentation measures), however, would decrease the amount of available predator habitat (by proving flows above the suitable range for predatory species) and increase the quality and quantity of available salmonid spawning habitat.

Instead of the 10-year coarse sediment augmentation program proposed by the Districts, we recommend that the Districts develop a plan to augment gravel annually for the term of any new license, because Don Pedro Reservoir would continue to capture gravel for the duration of the license.

We do not recommend implementing the proposed fall-run Chinook spawning superimposition program because this measure could result in the "take" of federally listed steelhead due to potential injury from the temporary barrier that the Districts would install annually, and because other measures recommended by staff, including flow and gravel augmentation measures, would likely provide a greater benefit to Chinook salmon populations than this proposed measure. We also do not recommend that the Districts develop a 5-year program of gravel cleaning and monitoring. Continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality that is caused by the interruption of gravel transport by Don Pedro Reservoir.

We do not recommend developing a plan to implement the Lower Tuolumne River Habitat Improvement Program because it is unclear: (1) precisely what habitat restoration projects would be funded, (2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights needed to access a property for restoration and maintenance activities for each proposed improvement site, (4) how compliance with the ESA and National Historic Preservation Act (NHPA) would be obtained at each site, and (5) the details on the project design and scope of operation and maintenance activities that would occur at each habitat improvement site so that the Commission can determine whether the site should be included within the project boundary.

We do not recommend requiring the Districts to create a TPAC to guide implementation of the proposed spill management plan and Lower Tuolumne River Habitat Improvement Program because the Commission has no authority to require other agencies to participate in such a committee. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program, if that program is implemented in the future.

We do not recommend the installation of a whitewater boat take-out facility upstream of Ward's Ferry as a license requirement because the measure has no nexus to the continued operation of the project. The Don Pedro Project does not affect the timing or quantity of flow in the whitewater boating reach. Instead, whitewater boating use and the resulting congestion and other associated problems at Ward's Ferry Bridge are related to the U.S. Department of Agriculture, Forest Service whitewater boating permitting decisions, flows provided by power generation from CCSF's Holm Powerhouse (non-project), and Tuolumne County road management. We also do not recommend construction of a new boat launch at Don Pedro Reservoir upstream of old Don Pedro

Dam. The existing boat launches provide adequate boating access to Don Pedro Reservoir unless hydrologic conditions drier than those that occurred during the 42-year period of record occur in the future, which would likely be very infrequent. We also do not recommend that the Districts provide a new boat take-out/put-in to facilitate boat passage past the proposed fish counting/barrier weir, because we do not recommend construction of the weir.

The staff alternative also includes the following recommended modifications of the Districts' proposal and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of best management practices (BMPs) for erosion control; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of surface water quality monitoring would occur during and after ground-disturbing activities.

Aquatic Resources

- Modify the proposed Spill Prevention Control and Countermeasure Management Plan to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed; (2) a description of equipment and procedures to be used to address hazardous substance spills; (3) a provision to notify the State Water Resources Control Board (Water Board), California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.
- Develop a drought management plan to include: (1) definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) which license requirements would be temporarily modified during drought conditions; and (3) how the project would be operated when drought conditions occur.

- Develop a plan to monitor water temperatures in Don Pedro Reservoir near the dam and in the lower river at the gage below La Grange (RM 51.7), Basso Bridge (RM 47.5), Roberts Ferry (RM 39.5), and above the proposed infiltration galleries (upstream of RM 25.9) whenever reservoir elevations are lower than 600 feet; including provisions for reporting monitoring results and identifying any actions proposed to address water temperatures that exceed the suitable range for survival of Tuolumne River salmonids.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in the license.
- Develop a large woody material (LWM) management plan to increase the amount of LWM downstream of the La Grange Diversion Dam via measures to guide the placement of LWM, monitoring of enhanced sites, and revising the plan based on monitoring data.
- Develop a coarse sediment management plan that includes gravel augmentation in the lower Tuolumne River between RM 39 and RM 52.
- Modify the proposed Aquatic Invasive Species Management Plan to include: (1) educating recreational users on ways to reduce the spread of invasive species; (2) continuing the boater self-inspection permit program; (3) implementing BMPs, such as identifying aquatic invasive species that may be introduced by a given activity, identifying critical control points (locations and times), and implementing measures to prevent the spread of aquatic invasive species during routine operation and maintenance; (4) implementing public boating access restrictions and consultation with BLM, FWS, and California DFW regarding control measures if aquatic invasive species are discovered; (5) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, California DFW, and the Commission; and (6) reassessing the vulnerability of Don Pedro Reservoir for the introduction of invasive species if dreissenid mussel species are identified in Tuolumne River or if calcium concentration of 13 mg/L or higher are documented in Don Pedro Reservoir.

Terrestrial Resources

- Modify the proposed TRMP to include:
    - Conducting pre-construction surveys for special-status or threatened and endangered plants or animals before the start of any project-related ground disturbance involving heavy machinery, where suitable habitat exists, and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.

- Focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources; and implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.

- Surveys for special-status plants within the Red Hills Area of Critical Environmental Concern (ACEC) every 5 years and every 10 years elsewhere within the project boundary, and the installation of interpretive signs about the unique plant communities of the Red Hills ACEC requesting that recreationists stay on trails.

- Recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.

- A bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31); resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.

- A description of specific locations where ground squirrel activity is problematic and where the Districts' proposed rodent control activities could occur; conducting surveys of ground squirrel burrows for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox and California tiger salamander during other biological surveys.

- Decontaminating equipment during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

- BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Recreation Resources

- Modify the proposed Recreation Resource Management Plan to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) an annual coordination meeting with BLM and other interested parties to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) a description of the BLM guidance for design and construction of project recreation facilities that would be located on BLM-managed land, to develop facilities consistent with agency requirements; (6) consultation with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands; (7) the visitor center near Fleming Meadows as a project facility where visitors can learn about the project and obtain information about project recreation facilities and points of public recreation access; (8) a description of the operation and maintenance of Fleming Meadows visitor center; (9) identification of land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, which includes proposed accessibility upgrades and allows adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities; (11) specific

measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (12) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce erosion and vegetation damage caused by user-created trails; and (13) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir.

- Modify the proposed Woody Debris Management Plan to include designated disposal site maps, treatment descriptions, and description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. This measure will prevent large concentrations of wood from accumulating and becoming boating hazards and obstructing water surface and shoreline use.
- Modify the proposed boatable flows to require that the proposed 3-day July 4 holiday boating flow be scheduled to occur on the 3-day weekend that occurs closest to the July 4 holiday, to coincide with the most popular time for recreation use. If July 4 falls on a Wednesday, the Districts would provide this 3-day boating flow either the weekend before or the weekend after the holiday.

Land Use and Aesthetics

- Implement a BLM-approved Fire Prevention and Response Management Plan to ensure that project operation and maintenance activities are conducted in a manner that would not contribute to the ignition and spread of wildfires.
- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.
- Develop a visual resources management plan that addresses effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

Cultural Resources

- Modify the proposed HPMP to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the dispute resolution stipulation of the anticipated Programmatic Agreement (PA), and to include additional information that addresses all of the California State Historic Preservation Officer's specific comments in previous correspondence and in any correspondence received subsequent to the date of this EIS. Appendices

should identify each comment and the extent to which they were addressed in the final HPMP.

Staff Alternative—La Grange Project

Under the staff alternative, the project would include all of the Districts' proposed measures, with the exception of constructing a recreational foot trail to the La Grange Reservoir as a license condition for the La Grange Project. Instead, we recommend this measure as a license condition for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway.

Under the staff alternative, the La Grange Project would include the following revisions to the proposed project and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of BMPs for erosion control; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of surface water quality monitoring would occur during and after ground-disturbing activities.

Water Quality

- Develop a plan to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.
- Develop a spill prevention control and countermeasure management plan to include: (1) a description of how hazardous substances at the project would be transported, stored, handled, and disposed; (2) a description of equipment and procedures to be used to address hazardous substance spills; (3) a provision to notify the Water Board, California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure similar spills do not occur in the future.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange USGS gage.

- Develop an operation compliance monitoring plan.
- Develop an aquatic invasive species management plan to include: (1) educating recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program; (3) implementing BMPs for minimizing the spread of invasive species during project operation and maintenance; (4) consulting with California DFW and BLM if aquatic invasive species are discovered; and (5) recording and communicating incidental observation of aquatic invasive species to BLM, FWS, California DFW, and the Commission .

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operation and maintenance activities within the La Grange Project boundary to include:
    - A noxious weed survey of the La Grange Project in the first year of license issuance and every 5 years, with future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control methods where feasible (instead of herbicides), in areas with sensitive resources.
    - A survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities.
    - Recording the locations of elderberry plants during special-status plant surveys and surveying for elderberry plants within 165 feet of project-related ground disturbances with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.
    - A bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.

- Protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species.
- BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a fire prevention and response management plan for the La Grange Project.

Cultural Resources

- Modify the proposed HPMP to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the anticipated PA.

Staff Alternative with Mandatory Conditions—Don Pedro Project

In this draft EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project.

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project

boundary (BLM Don Pedro revised 4(e) condition 2); (2) annually consult with BLM to review lists of special-status plant and wildlife species (BLM Don Pedro revised 4(e) condition 9); (3) develop a Ward's Ferry day-use facility engineered plan (BLM Don Pedro revised 4(e) condition 13); (4) implement pesticide use restrictions on BLM land (BLM Don Pedro revised 4(e) condition 32); (5) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM Don Pedro revised 4(e) condition 35); (6) provide minimum instream flows to be specified by the Water Board (Water Board preliminary 401 conditions 1 and 2); (7) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (8) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (9) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the project (Water Board preliminary 401 condition 9).

Incorporation of these mandatory conditions into a new license would cause us to eliminate the following environmental measures that we include in the staff alternative: (1) implement the Districts' proposed interim minimum flows, spring pulse flows, flushing flows, and boating flows for the duration of any license; and (2) construct and maintain shoreline access trails on each side of Ward's Ferry Bridge.

Staff Alternative with Mandatory Conditions—La Grange Project

In this draft EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project.

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) provide for annual environmental training of employees and contractors, rather than bi-annual as proposed (BLM La Grange preliminary 4(e) condition 2); (2) annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project area (BLM La Grange preliminary 4(e) condition 6); (3) implement pesticide use restrictions on BLM land (BLM La Grange preliminary 4(e) condition 23); (4) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM La Grange preliminary 4(e) condition 26); (5) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (6) develop

a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (7) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the project's operation and maintenance (Water Board preliminary 401 condition 9).

Incorporation of these mandatory conditions into a new license would cause us to eliminate the following environmental measure that we include in the staff alternative: develop a plan in consultation with the Water Board, California DFW, FWS, and NMFS to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.

No-Action Alternative

Under the no-action alternative, the Districts would continue to operate the Don Pedro Project and the La Grange Project as they currently do and no new environmental measures would be implemented.

Environmental Effects of the Staff Alternative

The primary issues associated with licensing the Don Pedro and La Grange Projects are effects of continued project operation on instream flows, water supply, flood storage, sediment transport, water quality, fishery resources and fish passage, terrestrial resources, threatened and endangered species, recreation, land use, cultural resources, and socioeconomics. Below, we briefly discuss the anticipated environmental effects of issuing a new license for the project under the staff alternative.

Don Pedro Project

Geology and Soils

Proposed construction activities at the Don Pedro Project include extending the existing riprap protection on the upstream face of Don Pedro Dam, constructing a fish counting/barrier weir, constructing a new boat launch facility just upstream of old Don Pedro Dam, creating a foot path trail along the river-right shoreline of the La Grange Reservoir, and enhancing existing recreational facilities. Although several of these proposed activities are not included in the staff alternative, any construction activities involving vegetation removal or ground disturbance could lead to erosion, increased turbidity in adjacent waterways, and siltation of aquatic habitats. The staff-recommended soil erosion and sediment control plan would include BMPs that should limit any adverse effects of erosion on terrestrial and aquatic habitats.

Under current conditions, Don Pedro Dam traps sediment, limiting the recruitment of coarse sediment downstream. Implementing the staff-recommended coarse sediment augmentation plan in the Tuolumne River downstream of La Grange Diversion Dam would benefit aquatic resources by moving coarse gravels into fish spawning and rearing

habitat, increasing the likelihood of riparian woody species establishment, and improving habitat for sensitive amphibians and other wildlife.

Aquatic Resources

Project operation can require the use and storage of hazardous materials and pesticides to maintain project facilities. Such materials could pass into ground and surface water at the project via inadvertent spills. Implementing the proposed Spill Prevention Control and Countermeasure Management Plan, with staff-recommended modifications to include descriptions of spill containment measures and cleanup protocols, would ensure proper storage facilities and cleanup supplies are available and that spill prevention and cleanup protocols are in place, which would help mitigate the risk of a spill that could adversely affect water quality, fisheries, and wildlife.

In drought years, temporary changes in flow or water level requirements may be warranted to meet water supply or environmental concerns. Implementing the staff-recommended drought management plan would allow any such temporary changes that may be required under drought conditions to be determined in consultation with the appropriate resource agencies and stakeholders. In addition, staff's recommendation to monitor water temperatures in Don Pedro Reservoir and in the lower Tuolumne River when reservoir levels fall below 600 feet, and to identify any actions proposed to address water temperatures that exceed the suitable range for survival of Tuolumne River salmonids, if needed, would address any effects of low reservoir elevations on biota in the lower Tuolumne River.

Implementing the proposed interim minimum flows would protect and enhance aquatic habitat conditions during low-water periods by ensuring suitable habitat for multiple lifestages of fish and macroinvertebrates. Providing the proposed fall flushing flow of 1,000 cfs in wet, above normal, and below normal water years would clean gravels of accumulated algae and fines prior to the peak Chinook salmon spawning, and the proposed spring pulse flows would facilitate outmigration of juvenile fall Chinook salmon. Developing an operation compliance monitoring plan would help to ensure that the project is operated in conformance with the flow and water level requirements included in the license.

The staff-recommended coarse sediment management plan, along with the proposed gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam, would mitigate annual project effects on gravel supply in the lower Tuolumne River. In addition, the staff-recommended LWM management plan to increase the amount of LWM downstream of the La Grange Diversion Dam would mitigate projects effects on LWM supply, and enhance aquatic habitat in the lower Tuolumne River.

Invasive aquatic organisms can reduce habitat quality for native species. Implementing the proposed Aquatic Invasive Species Management Plan, with staff-recommended modifications to include provisions for additional signage and

information to educate the public on ways to reduce the spread of invasive species, continuation of boat inspections, implementation of BMPs for controlling invasive species, and temporary prevention of access to certain areas on project land where needed to stop the spread of invasive species, would help to control invasive species and to protect habitat for native fish and plants.

Terrestrial Resources

Construction and maintenance of project recreation sites, campgrounds, roads, and trails could affect plants and animals through mortality, injury, or displacement as a result of habitat destruction, modification, or fragmentation. The Districts' proposed Don Pedro TRMP provides for noxious weed management, special-status plant management, valley elderberry longhorn beetle host plant management, and revegetation following ground-disturbing activities. The staff-recommended modification to include pre-construction surveys for special-status or threatened and endangered species prior to any project-related ground disturbance involving heavy machinery would help to minimize these effects.

Changes in flow magnitude due to project operation and maintenance could affect riparian vegetation along the lower Tuolumne River. The Districts propose to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph in the Tuolumne River. This measure would promote seed dispersal and germination of cottonwoods and willows, which provide important ecological structure and function to riparian ecosystems.

Changes in project vegetation management, human disturbance (e.g., recreation), reservoir water level fluctuations, and facility maintenance could alter the composition of vegetation communities by increasing establishment and spread of noxious weeds. Project operation and maintenance activities could also affect several special-status plants, especially at developed recreational areas and in the Red Hills ACEC. Over half of the known special-status plant occurrences in the Don Pedro Project had noxious weeds growing in their proximity. The Districts' proposed Don Pedro TRMP includes: (1) BMPs to prevent the introduction, establishment, and spread of noxious weeds; (2) surveys for noxious weeds every 10 years; and (3) management guidelines for existing and newly established infestations. As proposed, the Districts' surveys would track the extent and limit the spread of noxious weeds at the Don Pedro Project. Staff's recommended modifications to the TRMP would reduce adverse effects by emphasizing manual control in areas with special-status or threatened and endangered species, where feasible; focusing the Districts' noxious weed surveys on areas that support occurrences of special-status or threatened and endangered plants; and controlling a giant reed population along the Don Pedro Powerhouse access road. Staff's modifications would further protect special-status plants by providing for: (1) pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; (2) establishing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation

management or ground-disturbing activities; and (3) installing interpretive signs about the unique plant communities of the Red Hills ACEC. In addition, rather than the District's proposal to survey only known occurrences of special-status plants every fifth year, staff's recommended modification would help prevent project effects on all special-status plant populations by including surveys for special-status plants within the Red Hills ACEC every 5 years and every 10 years elsewhere within the project boundary.

Human activity near project facilities that provide roosting habitat for special status bats could disturb these species. The Districts' proposed Don Pedro TRMP provides guidelines for managing bats, including humane exclusion devices at project facilities with routine staff presence. Staff's recommended modifications to the TRMP would minimize adverse effects on special-status bats by: (1) installing and annually inspecting bat exclusion devices at all project facilities with evidence of bat roosting; (2) conducting an updated survey of project facilities for more accurate decisions about where to install bat exclusion devices; and (3) performing surveys every 5 years of project facilities with potential for bat occurrence, including facilities without installed exclusion devices.

Project activities that could affect nesting or winter-roosting bald eagles on Don Pedro Reservoir include woody debris management, helicopter use for project inspections, road and recreation area maintenance, and recreational uses (e.g., camping, hiking, boating, and off-highway vehicle use). The Districts' Don Pedro TRMP provides for surveys and protective measures to prevent disturbance during bald eagle mating and rearing. However, a stand-alone bald eagle and special-status bird management plan would better provide for agency consultation and compliance monitoring. Staff recommends including the following additional measures: (1) annual surveys for bald eagle nesting, wintering, and night roosting, in accordance with California DFW and FWS guidelines to identify areas where limited operating periods are needed; (2) establishing 0.25-mile protective buffers around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform recreationists of temporary closures during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds. These additional protective measures would further reduce project effects on bald eagles and other special-status birds. Project operation and maintenance and recreation activities could also disturb other birds of prey that potentially nest and forage at the Don Pedro Project, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Staff's recommended modification would provide for collecting incidental observations of all raptor species, including burrowing owl, while performing other activities at the Don Pedro Project, and consulting with FWS and California DFW

to identify suitable protective buffer distances around any active nests of these special-status birds. This measure would avoid or minimize project effects on these special-status birds.

Vegetation management or other project activities such as construction or maintenance of recreation areas that involve project-related ground disturbance or herbicide use near wetlands or aquatic habitats could result in adverse effects on sensitive amphibians. Staff's recommended modification to the Don Pedro TRMP would provide BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas, which would ensure that wetlands and riparian habitats are not negatively affected by project activities.

Water level fluctuations of Don Pedro Reservoir affect western pond turtles by affecting water temperatures and the availability of both basking substrates and shoreline vegetation. Also, recreational users of Don Pedro Reservoir affect the behavior of western pond turtles, which could decrease their survival and reproduction. Recording incidental observations of western pond turtles during other biological surveys, as proposed in the Districts' TRMP, would indicate if project effects are a concern. The plan includes annual consultation with the BLM and California DFW, which would provide for any future protective measures for western pond turtle, if necessary.

The Districts' periodic use of smoke and carbon monoxide to control rodents around developed recreation areas could affect burrowing wildlife, including burrowing owl, a California species of special concern. Staff's modification to the Districts' Don Pedro TRMP would reduce project effects on burrowing owl by providing for incidental observations of burrowing owls, describing specific locations where rodent control activities could occur, conducting surveys of ground squirrel burrows for occupancy by burrowing owls in accordance with California DFW protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows.

Threatened and Endangered Species

Proposed construction activities at the Don Pedro Project include extending the existing riprap protection on the upstream face of Don Pedro Dam, constructing a fish counting/barrier weir, constructing a new boat launch facility just upstream of old Don Pedro Dam, creating a foot path trail along the river-right shoreline of La Grange Reservoir, and enhancing existing recreational facilities. Although several of these measures are not included in the staff alternative, such construction and maintenance activities could result in water quality-related impacts on federally listed fish species and their designated critical habitat. The staff-recommended soil erosion and sediment control plan would include measures to limit any adverse effects of erosion on terrestrial and aquatic habitats, and the proposed Spill Prevention Control and Countermeasure Management Plan, with staff-recommended modifications, would minimize the extent of

any hazardous material spill and include protocols to prevent adverse effects on federally listed species in the event of a spill.

Some of the measures included in the staff alternative are specifically designed to benefit California Central Valley steelhead, while others are intended to benefit non-ESA listed fall-run Chinook salmon or the aquatic ecosystem in general. The Districts' proposed and staff-recommended interim minimum flow regime (base flows) in the Tuolumne River are expected to improve aquatic habitat and temperature conditions for *O. mykiss* downstream of La Grange Diversion Dam, and our recommended ramping rate restrictions would reduce any risk of stranding juvenile steelhead.

Although designed to encourage fall-run Chinook smolt outmigration and increase survival, the staff-recommended spring pulse flows would reduce water temperatures and extend the beneficial plume of colder water provided by base flows farther downstream relative to that provided by the base flows alone, which would benefit *O. mykiss*. In wet, above normal, and below normal water years, the Districts' proposed flushing flows would clean gravels of accumulated algae and fines prior to the onset of spawning in the spring and would not be expected to have significant effects on water quality.

The staff-recommended coarse sediment management plan would maintain the availability of high quality *O. mykiss* spawning habitat, and placing the gravel following the *O. mykiss* fry rearing period would minimize any risk of smothering *O. mykiss* fry within substrate interstices. Furthermore, the Districts' proposed gravel mobilization flows of 6,000 to 7,000 cfs would likely reduce fine sediment storage in the river channel and in spawning gravels, which could increase *O. mykiss* egg-to-emergence survival and fry production and benthic macroinvertebrates production; increase fine sediment storage on floodplains, which could improve regeneration of native riparian plant species during wetter water years; and increase lateral channel migration, bar formation, and large wood introduction, which together could create new floodplain habitat and complex hydraulic environments for improved adult *O. mykiss* holding, spawning, and juvenile rearing. Although these mobilization flows could cause localized, short-duration pulses in turbidity, no significant associated effects on *O. mykiss* are anticipated. These flows would be released at a time when high flows naturally occur (i.e., March–June of wet and above normal water years), and would have effects similar to what would take place in a natural system during a minor channel-forming event.

Shaping the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years is expected to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. Increasing natural recruitment of snowmelt-dependent hardwoods would likely increase the number of stands of trees that could contribute large wood to the channel over the long-term and provide cover and shade for aquatic species, which could have a beneficial cooling effect on water temperature in localized areas. Benefits to the overall ecosystem could translate into benefits for *O. mykiss* occupying the lower river.

Implementing the staff-recommended LWM management plan should improve microhabitats for *O. mykiss* by increasing structural and hydraulic complexity in the channel and would improve spawning habitat for *O. mykiss* as localized scour displaces fines from gravel beds. In addition, LWM augmentation would create pools by forcing flows to scour channel beds and banks and afford structural partitioning that provides protection from predation and visual isolation that lowers interspecies competition. It is anticipated that LWM would be placed after the fry rearing period, which would minimize the risk of disturbance of *O. mykiss* fry within substrate interstices.

Based on the above analysis, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to California Central Valley steelhead relative to the environmental baseline. However, it is likely that some individual *O. mykiss* could be injured or killed during the placement of gravel or LWM during implementation of the staff-recommended measures. Considering the potential for incidental take of individuals associated with the proposed action,[21] we determine that issuing a new license for the Don Pedro Project as proposed with staff-recommended measures is "likely to adversely affect" the California Central Valley steelhead, and "may affect, but is not likely adversely affect" the designated critical habitat for this species.

The Evolutionarily Significant Unit (ESU) for Central Valley spring-run Chinook salmon and its critical habitat do not include the San Joaquin River or the Tuolumne River, even though attempts to introduce the species into the San Joaquin River and its tributaries were initiated in spring 2014 under the San Joaquin River Restoration Settlement Act. The settlement act specifies that Central Valley spring-run Chinook salmon ESU introduction, if it were to occur, would be as a non-essential experimental population. Therefore, the proposed action would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat.

North American green sturgeon are not known to occur in the Tuolumne or San Joaquin Rivers. Designated critical habitat for the Southern DPS of North American green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento-San Joaquin River Delta, and San Francisco Estuary. The staff alternative would result in some slight increases in flow within the Delta during certain periods of the year. Considering that the Tuolumne River is part of a much larger San Joaquin River watershed and that the Sacramento River watershed also contributes to Delta inflow, the minor increase in flow contributed from the Tuolumne River would have no detectable effects on habitat conditions within portions of the Delta that are occupied by Southern DPS of North American green sturgeon or its designated critical

[21] If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made (FWS and NMFS, 1998).

habitat. Therefore, the proposed action would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Project maintenance, including control of ground squirrels with smoke and carbon monoxide, could affect San Joaquin kit fox and California tiger salamander, both of which use ground-squirrel burrows as sheltering habitat. Use of herbicides during vegetation management near project waters could also affect California tiger salamander. Staff-recommended measures for protocol-level surveys for San Joaquin kit fox and California tiger salamander prior to conducting ground squirrel control activities, and implementing avoidance measures for any occupied or potentially occupied burrows, would minimize these potential effects. The staff recommendation would reduce potential effects on California tiger salamander through the Districts' modification of the Don Pedro TRMP to include BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. Therefore, relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the San Joaquin kit fox and the California tiger salamander.

Damage to elderberry plants resulting from project construction and maintenance activities could affect valley elderberry longhorn beetles, which use the plants for reproduction. The staff-recommended surveys for elderberry plants and establishing protective buffers prior to activities that result in vegetation disturbance would help protect the valley elderberry longhorn beetle from project-related activities. Staff also recommends modifying the TRMP to apply FWS's *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* for future project activities in order to update the Districts' management based upon the latest understanding of the species' ecology. This includes recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. Therefore, relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the valley elderberry longhorn beetle.

Adverse effects on Layne's butterweed and Red Hills vervain within the Don Pedro Project could be caused by project-related activities that include recreation on lands within the Red Hills ACEC and the treatment of noxious weeds in their vicinity. Staff-recommended measures for surveying and flagging sensitive plants prior to noxious weed control, and using manual control measures rather than herbicides near sensitive plants, would reduce the potential for adverse effects on Layne's butterweed and Red Hills vervain. Staff's recommended measure for installing signage that informs visitors of potential effects of recreation on special-status plants in the Red Hills ACEC would further reduce effects on these species. We conclude relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the Layne's butterweed and the Red Hills vervain.

Continued project operation, as proposed with staff-recommended measures, would have "no effect" on California red-legged frog because this species is not known to occur at or near the project. Staff's recommended modification to the TRMP would limit effects on suitable habitat for the species by providing avoidance and minimization measures when project-related ground disturbances involving heavy machinery are planned within 300 feet of wetlands and riparian areas.

Recreation, Land Use, and Aesthetics

Numerous recreation opportunities exist at the project. Implementing the Districts' proposed Recreation Resource Management Plan with staff-recommended modifications would: (1) expand recreation opportunities by adding new project recreation facilities and providing pedestrian access to La Grange Reservoir[22]; (2) improve the current recreation experience by scheduling and accomplishing deferred maintenance and accessibility upgrades at project recreation facilities; (3) provide for public safety by ensuring recreation facilities are properly operated and maintained through the license term; (4) address effects of recurrent dispersed recreation use on natural resources; (5) provide necessary coordination with BLM to ensure recreation facilities are designed and resources are managed consistent with agency requirements; and (6) minimize the potential for trespassing on private land and at project infrastructure (e.g., install signs, fencing). Implementing the staff-recommended measure to include the visitor center to be operated and maintained as a project recreation facility, within the scope of the Recreation Resource Management Plan, would address the need to provide public information (e.g., locations of project recreation facilities, points of public access, wildlife viewing) and education (e.g., explaining project operation, preventing spread of invasive species, and protecting environmental resources as described in various project resource management plans) to project visitors. Providing the staff-recommended shoreline access trails with appropriate slope, width, and tread at the project reservoir shoreline near Ward's Ferry Bridge would improve footing for those accessing the shoreline and reduce erosion potential. Modifying the Woody Debris Management Plan, as recommended by staff, to specify disposal methods and locations and consult with BLM would improve public access to the shoreline near Ward's Ferry Bridge and ensure that disposal methods comply with BLM requirements.

The Districts' proposed scheduled flow releases would increase boating opportunities in the reach of the lower Tuolumne River from La Grange Diversion Dam to the location of the proposed infiltration galleries from June through October 15, and boating flows would be improved downstream of the infiltration galleries during April

[22] The Districts propose this measure as part of the La Grange Project; however, the staff alternative recommends this measure as part of the Don Pedro Project because the trailhead is within the Don Pedro Project boundary.

and May of all water year types, and in wet, above normal and below normal water years boating conditions would be enhanced during several prescheduled weekend releases.

Expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies is currently uncertain. Implementing the staff-recommended measure to develop, in consultation with BLM and Tuolumne County, a transportation system management plan for all project roads and trails would ensure that project roads and trails are maintained to current agency standards, allowing continued and improved public access to and through project.

Revising the Districts' Fire Prevention and Response Plan in consultation with BLM, would improve public safety by ensuring that project operation and maintenance activities are conducted in a manner that would not contribute to the ignition and spread of wildfires, and guiding the response should wildfires occur.

Activities such as constructing new facilities, vegetation clearing, and painting project infrastructure change the visual appearance of the landscape. Developing the staff-recommended visual resources management plan would address effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities. Monitoring visual resources over the license term would provide a basis for determining whether additional treatments would be necessary to achieve visual quality objectives.

Cultural Resources

Project-related effects on cultural resources within the area of potential effects could occur from project operation, recreational use, new construction, and mitigation measures associated with other environmental resources. These cultural resources include 105 archaeological resources, a number of historic structures, and one TCP that are eligible or potentially eligible for listing in the National Register of Historic Places. The Districts' HPMP filed with its license application includes measures that are consistent with most of the Commission and Advisory Council on Historic Preservation's 2002 guidelines. However, revision of the HPMP to clarify that all parties involved in any dispute on cultural resources management or the HPMP will follow the process provided in the dispute resolution stipulation of the PA, and to address the California State Historic Preservation Officer's May 7, 2018, September 19, 2018, and October 25, 2018, comments and any other subsequent correspondence, would ensure that historic properties are protected over the license term.[23] To meet section 106 of the NHPA requirements, the Commission intends to execute a PA with the California State Historic Preservation Officer for the project for the protection of historic properties that would be

[23] The Districts are expected to file a revised HPMP with the Commission at the end of January 2019.

affected by project construction, operation, and maintenance activities. The terms of the PA would require the Districts to implement the revised HPMP.

Socioeconomic Resources

The Districts' proposed construction of recreational amenities including building a new visitor center, construction of a new non-motorized trail to La Grange Reservoir, and constructing the staff-recommended shoreline access trails at Ward's Ferry would require employing a small number of construction personnel for a period of 2 years. Employment in the study area would only temporarily increase and would not be readily noticeable during the duration of construction of the proposed facilities. The construction of recreation amenities is unlikely to have any noticeable effect on population, housing, or income in the study area. Improved recreational facilities could attract increased recreation use and therefore increased recreation spending resulting in minor, beneficial effects within the three county service area of the Districts.

The flow regime proposed by the Districts would increase the amount of water that is released past La Grange Diversion Dam to meet environmental objectives, but this would reduce the total amount of water available for consumptive uses. Modeling performed by the Districts indicates that their flow proposal would not affect the number of years in which water supply rationing occurs; however, the magnitude of rationing would increase. The San Francisco Public Utilities Commission is expected to acquire new water resources to avoid sustaining major economic losses to jobs and businesses in the supply area. The expected annual cost to replace maximum water deficits under a critically dry year under the Districts' proposal would be $57 million compared to $18 million under current conditions. The staff-recommended drought management plan would create a process for the Districts to identify any temporary operational changes that may be needed under extreme drought conditions, which would allow for some socioeconomic relief in dry water years to reduce adverse socioeconomic impacts.

Irrigation water from the project directly supports agricultural production and other industries in the study area. The percent of demand met for irrigation water under the Districts' proposed flow regime would be nearly identical to current conditions except under a critical water year, when only 88 percent of irrigation demand would be met compared to 92 percent under current conditions.

The Districts' economic analysis indicates the economic effects on agriculture within the three-county area of the Districts' proposed flow regime could be substantial and may include the loss of jobs and income that would affect the overall economic conditions in the area. Over time, individual farmers may react to shortages of water and increased cost of replacement water, if available, in a number of ways that may temper some of the socioeconomic impacts of the staff-recommended flow regime. Additionally, some decline in land value associated with agricultural and water supply losses is expected.

La Grange Project

Aquatic Resources

Possible effects on anadromous fish could include reductions in availability of spawning or rearing habitat or stranding downstream of La Grange when river flows are reduced by project operation or seasonal changes in minimum flow requirements. Implementing the staff-recommended streamflows, flow recession rates, and other measures discussed for the Don Pedro Project would ultimately protect fishery resources downstream of the La Grange Project. The staff recommendation to include a ramping rate requirement for the La Grange Project would minimize the risk of fish stranding by ensuring that any changes in the rate of flow releases from Don Pedro Reservoir, and diversions from La Grange Reservoir for consumptive use, do not cause rapid reductions in the flow released into the Tuolumne River downstream of the La Grange Project. The recommended operation compliance monitoring plan would help to ensure that project operation meets requirements related to flow releases downstream of the La Grange Project.

In response to periodic low DO levels observed downstream of the La Grange Powerhouse, the Districts propose DO monitoring in the vicinity of the La Grange Powerhouse. Expanding the Districts' proposal, as recommended by staff, to develop a monitoring plan to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace would help to maintain DO levels that are supportive of aquatic resources in the project vicinity.

Terrestrial Resources

The Districts have not performed surveys for noxious weeds, special-status plants, or any special-status terrestrial wildlife at the La Grange Project. Surveys and management guidelines for noxious weeds and special-status plants would help to ensure that continued project operation does not result in the spread of noxious weeds or the decline of special-status plant populations. Staff recommends developing a La Grange TRMP that would include: (1) a noxious weed survey during the first year of license issuance and every 5 years, focusing on areas that support occurrences of special-status or threatened and endangered plants; (2) an emphasis on the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with special-status or threatened and endangered species; (3) a survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; (4) pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; and (5) establishing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities in their vicinity. These measures would help to prevent the spread and proliferation of noxious weeds and protect special-status plants.

The Districts did not mention special-status bats in their license application for the La Grange Project, although several of the same species of bats documented at the Don Pedro Project may occur at the La Grange Project. Staff recommends including provisions in a La Grange TRMP to protect special-status bats, including a bat survey of all areas with potential for conflict with humans. The survey would determine whether bat exclusion measures are needed and, if so, require installing and annually inspecting bat exclusion devices. Additionally, because bat roosting behavior and human activities could change, resurveying project facilities with potential for bat occurrence every 5 years for evidence of bat use would afford greater protection for special-status bats.

Water level fluctuations of the La Grange Reservoir could affect western pond turtle habitat by affecting water temperatures and the availability of both basking substrates and vegetated, shallow shoreline areas that are necessary for juvenile western pond turtles. Because there were no surveys for western pond turtles conducted at the La Grange Project, staff cannot determine if operation and maintenance would affect the species. Project effects on the species could be avoided or minimized by our staff-recommended measure to include protective measures for western pond turtles in a La Grange TRMP, which include recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project, and consulting with FWS and California DFW to develop protective measures for the species, if necessary.

Potential project effects on California tiger salamanders, as well as California red-legged frogs and other sensitive amphibians, could most effectively be avoided or mitigated by limiting adverse effects on their aquatic habitat. To protect sensitive amphibians, staff recommends including provisions in a La Grange TRMP for BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas to avoid adverse effects on sensitive aquatic species.

The Districts did not conduct surveys for bald eagles at the La Grange Project. However, because of the abundance of fish, the La Grange Reservoir likely supports bald eagles, at least occasionally. Human recreation, primarily fishing, could affect bald eagle foraging in the La Grange Reservoir and farther downstream on the lower Tuolumne River. Our analysis supports the resource agencies' recommendations and mandatory conditions to minimize potential project effects through the development of a bald eagle management plan for the La Grange Project. Staff recommends that the Districts develop a La Grange bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS, and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform

recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Threatened and Endangered Species

The Districts' proposal to provide a minimum flow of at least 5 cfs would support favorable water quality and maintain a stable flow regime for fish present in the plunge pool, which would minimize potential adverse effects on California Central Valley steelhead. Installing a fish exclusion barrier at the sluice gate channel entrance, as proposed by the Districts, and implementing the staff-recommended ramping rates would minimize the potential for salmonid stranding and mortality. Developing a plan to monitor DO in the vicinity of the La Grange Powerhouse and mitigate any adverse project effects on DO, as recommended by staff, would protect steelhead from adverse effects from low DO concentrations.

Routine project maintenance and non-routine ground-disturbing activities have the potential to result in water quality-related impacts on federally listed fish species and their designated critical habitat. The staff-recommended soil erosion and sediment control plan would include BMPs that would limit any adverse effects of erosion on terrestrial and aquatic habitats. Additionally, staff's recommended spill prevention control and countermeasure management plan would minimize the extent of any hazardous material spill and include protocols to prevent adverse effects on federally listed species in the event of a spill.

The staff-recommended ramping rate restrictions would reduce the risk of steelhead stranding and redd dewatering in the gravel-bedded reach of the lower river. The staff-recommended pulse flows, coarse sediment management plan, gravel mobilization flows, and LWM management plan recommended for the Don Pedro Project would further benefit steelhead and salmon through reductions in water temperature, expansion of rearing habitat, and increases in habitat diversity. However, it is possible that some individual *O. mykiss* could be injured or killed during installation of the fish exclusion barrier at the entrance to the sluice gate channel or during activities associated with the staff-recommended water quality monitoring. Considering the potential for incidental take of individuals associated with the proposed action, we determine that issuing a license for the La Grange Project as proposed with staff-recommended measures is "likely to adversely affect" the California Central Valley steelhead, and "may affect, but is not likely to adversely affect" the designated critical habitat for this species.

Designated critical habitat for Central Valley spring-run Chinook salmon occurs within a small part of the Delta portion of the action area, and the staff alternative would not affect this portion of the Delta. Therefore, the proposed action would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat.

Although designated critical habitat for North American green sturgeon includes all portions of the Delta, the minor increase in flow contributed from the Tuolumne River under the staff alternative would have no detectable effects on habitat conditions within the Delta. Therefore, the proposed action would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Licensing the La Grange Project, as proposed with staff-recommended measures, would have "no effect" on Hartweg's golden sunburst, succulent owl's clover, colusa grass, hairy orcutt grass, Chinese camp brodiaea, Red Hills vervain, Layne's butterweed, or Green's tuctoria because suitable habitat for these species does not occur at the La Grange Project. Project operation, as proposed with staff-recommended measures, would have "no effect" on California red-legged frog because this species does not occur in the area of project effects.

It is not likely that the San Joaquin kit fox occurs within the La Grange Project boundary. The Districts do not perform rodent control or any other activities that would adversely affect ground squirrel burrows or other suitable San Joaquin kit fox habitat within the project boundary. Project maintenance activities that result in ground disturbance or include the use of herbicides could affect habitat for valley elderberry longhorn beetle and California tiger salamander. The staff recommendation would reduce potential effects on these species through the Districts' preparation of a La Grange TRMP that includes BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. To manage elderberry shrubs for the conservation of the valley elderberry longhorn beetle, staff recommends including provisions in a La Grange TRMP for recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs.

We conclude that licensing the La Grange Project, as proposed with staff-recommended measures, "may affect, but is not likely to adversely affect" the San Joaquin kit fox, the Central Valley DPS of California tiger salamander, and the valley elderberry longhorn beetle.

Recreation, Land Use, and Aesthetics

Developing the staff-recommended fire prevention and response plan, in consultation with BLM, would improve public safety by ensuring that project operation and maintenance activities are conducted in a manner that would not contribute to the ignition and spread of wildfires, and guiding the response should wildfires occur.

Cultural Resources

Project-related effects on cultural resources within the area of potential effects could occur from project operation, recreational use, new construction, and mitigation

measures associated with other environmental resources. These cultural resources include two historic structures that are eligible for listing in the National Register of Historic Places. The HPMP filed in on July 10, 2018, includes measures that are consistent with the Commission's and the Advisory Council on Historic Preservation's 2002 guidelines. To meet section 106 of the NHPA requirements, the Commission intends to execute a PA with the California State Historic Preservation Officer for the project for the protection of historic properties that would be affected by project construction, operation, and maintenance activities. Revision of the HPMP to clarify that all parties involved in dispute resolution would follow the Dispute Resolution stipulation that would be contained within the PA would ensure consistency regarding this measure. The terms of the PA would require the Districts to implement the revised HPMP.

Socioeconomic Resources

The La Grange Project does not store water for consumptive use, provides no flood control benefits, and has no recreation facilities associated with the project. Therefore, the Districts' proposal would not result in any adverse effects on socioeconomic resources.

License Conditions

Staff recommendations for conditions for any licenses for the projects are based on the analysis presented in this draft EIS. Draft license articles are attached in appendices A and B.

Conclusions

Based on our analysis, we recommend licensing the projects as proposed by the Districts, with some staff modifications and additional measures.

In section 4.2 of this draft EIS, we estimate the likely cost of alternative power for each of the three alternatives identified above. For the Don Pedro Project, our analysis shows that, during the first year of operation under the no-action alternative, project power would cost $31,338,650, or $51.13 per MWh, less than the likely alternative cost of power. Under the proposed action alternative, project power would cost $28,864,300, or $45.57/MWh, less than the likely alternative cost of power. Under the staff alternative, project power would cost $34,428,600, or $54.35/MWh, less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $33,228,050, or $52.46/MWh, less than the likely alternative cost of power.

For the La Grange Project, our analysis shows that, during the first year of operation under the no-action alternative, project power would cost $321,900, or $17.81 per MWh, less than the likely alternative cost of power. Under the proposed action alternative, project power would cost $471,940, or $26.11/MWh, less than the likely alternative cost of power. Under the staff alternative, project power would cost

$418,380, or $23.14/MWh, less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $450,810, or $24.94/MWh, less than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the projects would provide a dependable source of electrical energy for the region (651,489 MWh annually); (2) the 237.2 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by the Districts, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Don Pedro Hydroelectric Project
FERC Project No. 2299-082—California

La Grange Hydroelectric Project
FERC Project No. 14581-002—California

1.0 INTRODUCTION

1.1 APPLICATION

1.1.1 Don Pedro Project

On April 28, 2014, Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts or applicants) filed an application for a new major license with the Federal Energy Regulatory Commission (Commission or FERC) to continue to operate and maintain the Don Pedro Hydroelectric Project (FERC No. 2299-082). Subsequently, the Districts filed an amended application on October 11, 2017. The 168-megawatt (MW) project is located at river mile (RM) 54.8 on the Tuolumne River in Tuolumne County, California (figure 1.1.1-1). The Don Pedro Project currently occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generated an average of about 550,000 megawatt-hours (MWh) of energy annually from 1997 through 2016.

1.1.2 La Grange Project

On October 11, 2017, the Districts filed an application for an original license with the Commission to continue to operate and maintain the La Grange Hydroelectric Project (FERC No. 14581-002). In an order issued by the Commission on December 19, 2012, this existing, unlicensed project was required to be licensed because the project is located on a navigable river and occupies federal lands (141 FERC ¶ 62,211). The 4.7-MW project is located at RM 52.2 on the Tuolumne River in Stanislaus and Tuolumne Counties, California, immediately downstream of the Don Pedro Project (figure 1.1.1-1). The proposed project boundary for the La Grange Project would occupy 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generated an average of about 18,077 MWh of energy annually from 1997 through 2016.

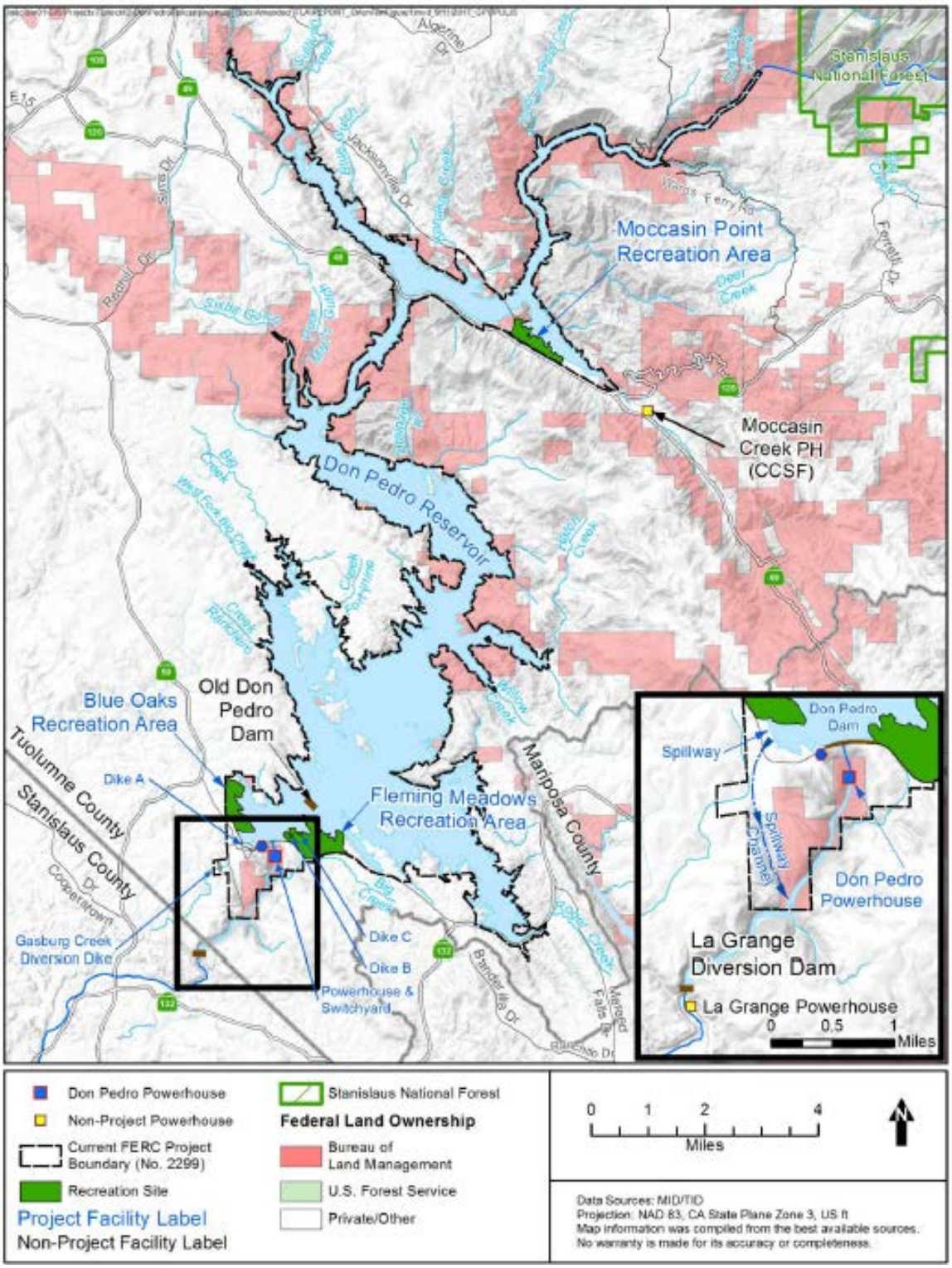

Figure 1.1.1-1. Don Pedro and La Grange Projects vicinity map, showing locations of major facilities and existing project boundary for the Don Pedro Project (Source: Districts, 2017a).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Don Pedro Project is to continue to provide: (1) water supply for irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, (2) flood control benefits along the Tuolumne and San Joaquin Rivers, (3) a water-banking arrangement for the City and County of San Francisco (CCSF), and (4) a source of hydroelectric power. The purpose of the La Grange Project is to provide water supply for irrigation and municipal and industrial uses and a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to the Districts for the Don Pedro Project and an original license for the La Grange Project and what conditions should be placed on any licenses issued.

In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreation opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Don Pedro Project and an original license for the La Grange Project would allow the Districts to generate electricity at the projects for the terms of the licenses, making electrical power from a renewable resource available to their customers.

This draft environmental impact statement (draft EIS) assesses the effects associated with operation of the projects and alternatives to the proposed projects. It also includes recommendations to the Commission on whether to issue a new license for the Don Pedro Project and an original license for the La Grange Project, and if so, includes recommended terms and conditions to become a part of any licenses issued.

In this draft EIS, we assess the environmental and economic effects of continuing to operate the projects: (1) as proposed by the applicants; (2) with our recommended measures; and (3) with any mandatory conditions prescribed by state and federal agencies. We also consider the effects of the no-action alternative. Important issues that are addressed include the effects of continued project operation on instream flows, water supply, flood storage, sediment transport, water quality, fishery resources and fish passage, terrestrial resources, threatened and endangered species, recreation, land use, cultural resources, and socioeconomics.

1.2.2 Need for Power

The Don Pedro and La Grange Projects would continue to provide hydroelectric generation to meet part of California's power requirements, resource diversity, and capacity needs. The Don Pedro Project has an installed capacity of 168.015 MW and generates about 550,000 MWh per year. The La Grange Project has an installed capacity of 4.7 MW and generates about 18,077 MWh per year.

The North American Electric Reliability Corporation annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The projects are located in the California/Mexico subregion of the Western Electric Coordinating Council of North American Electric Reliability Corporation. According to North American Electric Reliability Corporation's 2017 forecast, anticipated resources are expected to be greater than the required reserve margin between 2018 and 2027 (NERC, 2017).

We conclude that power from the projects would continue to meet a need for power in the California/Mexico subregion in both the short and long term. The projects provide low-cost power that displaces generation from non-renewable resources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the Don Pedro and La Grange Projects are subject to numerous requirements under the FPA and other applicable statutes, as summarized below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA provides that the Commission must require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the U.S. Department of the Interior. The U.S. Department of the Interior and National Marine Fisheries Service (NMFS), by letters filed on January 29, 2018, request that a reservation of authority to prescribe fishways under section 18 be included in any licenses issued for the projects.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation must be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. BLM filed preliminary conditions for the Don Pedro and La Grange Projects on January 29, 2018, and revised conditions for the Don Pedro Project on August 23, 2018 (appendices C and D), pursuant to section 4(e) of the FPA. These conditions are described under section 2.2.5, *Modifications to Applicants' Proposal—Mandatory Conditions*.

Alternative Section 4(e) Conditions under the Energy Policy Act of 2005

The Energy Policy Act of 2005 provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. On February 28, 2018, the Commission received a copy of the Districts filing to BLM disputing issues of material fact with respect to Don Pedro preliminary 4(e) condition nos. 4, 12, and 13; filing two alternative 4(e) conditions in response to BLM preliminary section 4(e) condition 13; and requesting a trial-type hearing. On August 23, 2018, BLM filed a revised set of conditions, withdrawing preliminary condition 12 and modifying conditions 4 and 13. On August 28, 2018, the Districts withdrew their request for a trial-type hearing and the two alternative 4(e) conditions.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

U.S. Department of the Interior, Fish and Wildlife Service (FWS) timely filed, on January 29, 2018, recommendations under section 10(j) for both projects. FWS filed revised 10(j) recommendations 2, 3 and 4 for the Don Pedro Project, withdrew recommendation 7 for the Don Pedro Project, and withdrew recommendations 2, 3, 4 and 7 for the La Grange Project on October 2, 2018. The revised recommendations are summarized in tables 5.3.1-1 (for the Don Pedro Project) and 5.3.1-2 (for the La Grange Project), in section 5.3.1, *Fish and Wildlife Agency Recommendations*. In section 5.3.1, we also discuss how we address the agency recommendations and comply with section 10(j). California Department of Fish and Wildlife (California DFW) and NMFS also filed recommendations on January 29, 2018, but did not specifically identify which terms and conditions were filed pursuant to FPA section 10(j); therefore, we have analyzed these recommendations in the specific resource sections of this document pursuant to FPA section 10(a).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), the Commission may not issue a license for a hydroelectric project unless the license applicant obtains certification from the appropriate state pollution control agency verifying compliance with the CWA, or the state agency waives certification by failing to act within a reasonable time, not to exceed 1 year. On January 26, 2018, the Districts applied to the State Water Resources Control Board (Water Board) for 401 water quality certification (certification) for the Don Pedro

and La Grange Projects. The Water Board received this request on January 26, 2018. The Water Board denied the Districts' application without prejudice on January 24, 2019, and as of February 11, 2019, the Districts have not reapplied for certification.

On January 29, 2018, the Water Board filed preliminary certification conditions for the Don Pedro and La Grange Projects (appendix E) in response to the ready for analysis notice. These preliminary conditions would be mandatory if included in a final, valid certification and are described in section 2.2.5, *Modifications to Applicants' Proposal—Mandatory Conditions*.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Ten federally listed species, subspecies, or distinct populations may occur in the Don Pedro and La Grange Project vicinity—Central Valley spring-run Chinook salmon (*O. tshawytscha*), the California Central Valley Distinct Population Segment (DPS) of steelhead trout (*Oncorhynchus mykiss irideus*), the Southern DPS of North American green sturgeon *(Acipenser medirostris*), San Joaquin kit fox (*Vulpes macrotis mutica*), California red-legged frog (*Rana draytonii*), the Central Valley DPS of the California tiger salamander (*Ambystoma californiense*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), vernal pool fairy shrimp (*Branchinecta lynchi*), Layne's butterweed (*Packera layneae*), and Red Hills vervain (*Verbena californica*).[24] Our analyses of project effects on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are presented in section 5.1, *Comprehensive Development and Recommended Alternative*.

We conclude that relicensing the Don Pedro Project and licensing the La Grange Project, as proposed with staff-recommended measures, would have "no effect" on the Central Valley spring-run Chinook salmon, the Southern DPS of North American green sturgeon, and California red-legged frog, and vernal pool fairy shrimp; the projects "may affect, but are not likely to adversely affect" San Joaquin kit fox, the Central Valley DPS of California tiger salamander, valley elderberry longhorn beetle, Layne's butterweed,

[24] The updated species lists (letters from FWS, Sacramento Fish and Wildlife Office, filed October 19, 2018) identified 11 threatened, endangered, or candidate species that may be present within the Don Pedro Project and 8 threatened, endangered, or candidate species within the La Grange Project. Ten of those species are addressed in this EIS; however, the Delta smelt, conservancy fairy shrimp, vernal pool fairy shrimp, Chinese camp Brodiaea, and Hartweg's golden sunburst have not been identified within the project boundaries and are not considered further.

and Red Hills vervain. Considering the potential for incidental take of individuals associated with the proposed action,[25] we conclude that the proposed action is "likely to adversely affect" the California Central Valley steelhead trout, and "may affect, but is not likely to adversely affect" the designated critical habitat for this species.

We will request concurrence from FWS with our finding on the San Joaquin kit fox, Central Valley DPS of California tiger salamander, valley elderberry longhorn beetle, Layne's butterweed, and Red Hills vervain, and will request concurrence from NMFS with our finding on the California Central Valley steelhead and its critical habitat.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act, 16 United States Code (U.S.C.) § 1456(3)(A), the Commission may not issue a license for a project within or affecting a state's coastal zone unless the state Coastal Zone Management Act agency concurs with a license applicant's certification of consistency with the state's Coastal Zone Management Act program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Don Pedro and La Grange Projects are not located within the state-designated Coastal Management Zone, which extends inland to the crest of the Coast Mountain Range. The projects, which are located east of the Coast Mountain Range, would not affect California's coastal resources. Therefore, the projects are not subject to California coastal zone program review, and no consistency certification is needed for the action. By email dated May 29, 2018,[26] the California Coastal Commission concurred.[27]

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties, and provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on the undertaking. Historic properties are districts, sites, buildings, structures, traditional cultural properties (TCPs), and objects significant

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[25] If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made (FWS and NMFS, 1998).

[26] Filed on June 21, 2018.

[27] The email from the Coastal Commission stated that San Francisco Bay Conservation and Development Commission (BCDC) is the downstream coastal program decision maker for rivers that flow into the San Francisco Bay. The Districts consulted with BCDC, and filed documentation on October 9, 2018, that BCDC only regulates activities in the San Francisco Bay or within 100 feet of the shoreline, and that the Don Pedro and La Grange Projects are not under BCDC's jurisdiction.

in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute separate Programmatic Agreements (PAs) for the protection of historic properties from the effects of the operation of the Don Pedro and La Grange Projects. The terms of the PAs would ensure that the Districts address and treat all historic properties identified within each project area of potential effects (APE) through the implementation of final Historic Properties Management Plans (HPMPs) for each project.

1.3.6 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to determine whether the operation of a project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. Public Law 98-425 (September 28, 1984) designated the Tuolumne River as a Wild and Scenic River, from its source to Don Pedro Reservoir for a distance of 83 miles. BLM, the National Park Service (Park Service), and the U.S. Department of Agriculture, Forest Service (Forest Service) manage three Wild and Scenic River segments of the Tuolumne River located on land within their respective jurisdictions to protect and enhance the free-flowing condition, water quality, and outstanding remarkable values for which the river was designated, while providing for public recreation and resource uses that do not adversely affect or degrade those values.

The Forest Service manages the downstream segment of the designated Wild and Scenic River that terminates at Don Pedro Reservoir. In 1988, the Forest Service approved the Tuolumne Wild and Scenic River Management Plan, which established a 0.25-mile management corridor on each side of the designated river segment (Forest Service, 1988). The aliquot[28] parcel description of the corridor overlaps the Don Pedro Project lands at the upstream end of Don Pedro Reservoir.[29] Although the Don Pedro Project boundary includes land within the management corridor, Public Law 98-45 specifies that the Wild and Scenic River designation would not affect previously granted rights, obligations, privileges, or benefits. Because the Don Pedro Project pre-dates the Wild and Scenic River designation, and no designated river segments are downstream of

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[28] A location descriptor used in the public land survey system in which the townships and sections are indexed based on: (1) the township's position relative to the initial point, (2) the section's location within the designated township, and (3) the principal meridian reference.

[29] The corridor description in the Tuolumne Wild and Scenic River Management Plan includes land within T.1N, R.16E, S1/2N1/2, and N1/2S1/2. Project land overlapping the management corridor is within T.1N, R.16E, S1/2NW1/4, and N1/2SW1/4.0.

the Don Pedro Project, neither the Don Pedro Project nor the La Grange Project would affect any designated wild and scenic river segments.

1.3.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the NMFS on all actions that may adversely affect Essential Fish Habitat (EFH). In the case of the Don Pedro and La Grange Projects, EFH consultation is required for Central Valley fall/late fall-run Chinook salmon because the EFH for this species is present in the Tuolumne River from the La Grange Diversion Dam downstream to the confluence with the San Joaquin River.

Based on the above analyses and on our analyses in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the staff alternative would have only minor and, in most cases, beneficial effects on Chinook salmon EFH. In addition, the staff-recommended measures would likely improve EFH over the long term. By way of this draft EIS, we are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) for the Don Pedro Project was distributed to interested agencies and others on April 8, 2011. It was noticed in the *Federal Register* (FR) on April 14, 2011 (72 FR 20,791). Two scoping meetings, both advertised in local newspapers, were held on May 11, 2011, where oral comments on the project were sought. The daytime meeting was held in Turlock, California, and the evening meeting was held in Modesto, California. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. We also conducted an environmental site review of the project on May 10, 2011. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Gordon Hollingsworth	May 12, 2011
Mrs. Dooley	May 24, 2011
Stanislaus County Board of Supervisors	May 31, 2011
City of Turlock (Municipal Services Department)	June 6, 2011
Foster Poultry Farms	June 6, 2011
Town of La Grange, California	June 6, 2011
Friends of the Tuolumne	June 7, 2011
Bob Hackamack	June 8, 2011
California Department of Fish and Game	June 8, 2011
City of Modesto	June 8, 2011
Deanna Lynn Wulff	June 8, 2011
Kristin Olsen of California State Assembly	June 8, 2011
Tuolumne River Relicensing Work Group	June 8, 2011
Robert Shipley	June 9, 2011
California State Water Resources Control Board	June 9, 2011
Thomas H. Terpstra, A Professional Corporation	June 9, 2011
Turlock Chamber of Commerce	June 9, 2011
Acterra: Action for a Healthy Planet	June 10, 2011
Alfred M. Pirrone	June 10, 2011
Bay Area Water Supply and Conservation Agency	June 10, 2011
Bureau of Land Management	June 10, 2011
Bureau of Reclamation, Mid-Pacific Region	June 10, 2011
California Department of Fish and Game	June 10, 2011
City and County of San Francisco, Public Utilities Commission	June 10, 2011
Elaine Gorman	June 10, 2011
Griffin Derryberry	June 10, 2011
Jennifer Clary	June 10, 2011
Jerry Cadagan	June 10, 2011
Karen Gardner	June 10, 2011

Commenting Entity	Date Filed
Lawrence Beard	June 10, 2011
Martin Blake	June 10, 2011
Maryann Moise Derwin	June 10, 2011
NMFS	June 10, 2011
National Park Service	June 10, 2011
Paul J Van Konynenburg	June 10, 2011
Ray Ratto Jr.	June 10, 2011
Restore Hetch Hetchy	June 10, 2011
Rose Beam	June 10, 2011
Ross Mirkarimi	June 10, 2011
Stanislaus County Farm Bureau	June 10, 2011
American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Flyfishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Associations, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust	June 10, 2011
Turlock Irrigation District and Modesto Irrigation District	June 10, 2011
U.S. Fish and Wildlife Service	June 10, 2011
Yosemite Farm Credit, ACA	June 10, 2011
Charlotte Allen	June 13, 2011
John Rosapepe	June 13, 2011
Landowners, Farmers, and Interested Parties	June 13, 2011
Ty McCartney	June 13, 2011
William J and E Mape Lyons	June 13, 2011
California State Water Resources Control Board	June 14, 2011
Stanislaus County Farm Bureau	June 14, 2011
Tom Berryhill California Legislature	June 14, 2011
Bill Berryhill California Legislature	June 16, 2011

Commenting Entity	Date Filed
Mayor Jim Ridenour City of Modesto	June 17, 2011
City and County of San Francisco, Public Utilities Commission	July 13, 2011

A revised scoping document (SD2), addressing these comments, was issued on July 25, 2011.

An SD1 for the La Grange Project was distributed to interested agencies and others on May 23, 2014, and an errata was issued on June 11, 2014. It was noticed in the FR on June 2, 2014 (79 FR 31,318). Two scoping meetings, both advertised in local newspapers, were held on June 18, 2014, where oral comments on the project were sought. The daytime meeting was held in Turlock, California, and the evening meeting was held in Modesto, California. A court reporter recorded all comments and statements made at the scoping meetings, and these comments are part of the Commission's public record for the project. We also conducted an environmental site review of the project on June 19, 2014. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
California State Water Resources Control Board	July 22, 2014
American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Central Sierra Environmental Resource Center, Friends of the River, Golden West Women Flyfishers, Merced Fly Fishing Club, Northern California Federation of Flyfishers, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited, and the Tuolumne River Trust	July 22, 2014
NMFS	July 22, 2014
U.S. Fish and Wildlife Service	July 22, 2014
Bay Area Water Supply and Conservation Agency	July 22, 2014
Winston & Strawn	August 21, 2014

A revised SD2, addressing these comments, was issued on September 5, 2014.

1.4.2 Interventions

On November 30, 2017, the Commission issued notices that the Districts' application to relicense the Don Pedro Project and application for an original license for the La Grange Project were accepted. The notices set January 29, 2018, as the deadline for filing protests and motions to intervene. In response to the notice for the Don Pedro Project, the following entities filed motions to intervene:

Intervenor	Date Filed
Tuolumne River Conservancy	December 27, 2017
U.S. Department of the Interior	January 19, 2018
ARTA Rafting	January 22, 2018
NMFS	January 22, 2018
Sierra Mac River Trips, Inc.	January 22, 2018
California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, and Central Sierra Environmental Resource Center	January 23, 2018
California DFW	January 24, 2018
O.A.R.S. West, Inc.	January 24, 2018
All Outdoors Inc.[30]	January 26, 2018
County of Tuolumne	January 26, 2018
City and County of San Francisco	January 29, 2018
Merced Irrigation District	January 29, 2018
The Bay Institute	January 29, 2018

On January 30, 2018, The Bay Area Water Supply and Conservation Agency (BAWSCA) filed a petition for late intervention. No action has been taken on that petition.

In response to the notice for the La Grange Project, the following entities filed motions to intervene:

Intervenor	Date Filed
Tuolumne River Conservancy	December 26, 2017
U.S. Department of the Interior	January 19, 2018
ARTA Rafting	January 22, 2018
NMFS	January 22, 2018
Sierra Mac River Trips, Inc.	January 22, 2018

[30] Also referred to as All Outdoors or All Outdoors Whitewater Rafting.

Intervenor	Date Filed
California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, and Central Sierra Environmental Resource Center	January 23, 2018
California DFW	January 24, 2018
O.A.R.S. West, Inc.	January 24, 2018
All Outdoors Inc.	January 26, 2018
City and County of San Francisco	January 29, 2018
Merced Irrigation District	January 29, 2018
The Bay Institute	January 29, 2018

On January 30, 2018, BAWSCA filed a petition for late intervention. No action has been taken on that petition.

1.4.3 Comments on the Application

The November 30, 2017, notices also stated that the applications were ready for environmental analysis and solicited comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions. The following entities commented regarding the Don Pedro Project:

Commenting Agency and Other Entity	Date Filed
County of Tuolumne	January 17, 2018
Tuolumne River Conservancy	January 19, 2018
Stanislaus Regional Water Authority	January 22, 2018
All Outdoors Inc.	January 25, 2018
O.A.R.S. West Inc.	January 25, 2018
Sierra Mac River Trips, Inc.	January 25, 2018
Stanislaus and Tuolumne Rivers Groundwater Basin Association	January 26, 2018
State Senator Anthony Cannella	January 26, 2018
12th Assembly District of California	January 26, 2018
21st Assembly District of California	January 26, 2018
City of Ceres	January 26, 2018

Commenting Agency and Other Entity	Date Filed
Hughson City Council	January 26, 2018
City of Turlock	January 26, 2018
Manufacturers Council of the Central Valley	January 26, 2018
Stanislaus County Board of Supervisors	January 26, 2018
American River Touring Association	January 26, 2018
West Turlock Subbasin Groundwater Sustainability Agency	January 29, 2018
Forest Service	January 29, 2018
ECHO: The Wilderness Company	January 29, 2018
Congressman Jeff Denham	January 29, 2018
Congressman Jim Costa	January 29, 2018
Congressman Tom McClintock	January 29, 2018
Conservation Groups[31]	January 29, 2018
NMFS	January 29, 2018
Bay Institute	January 29, 2018
U.S. Department of the Interior, FWS	January 29, 2018 October 2, 2018[32]
California DFW	January 29, 2018
Water Board	January 29, 2018

The applicants filed reply comments on March 15, 2018, in response to the January 2018 comments, and on October 17, 2018, in response to the FWS comments filed on October 2, 2018.

[31] California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center and Tuolumne River Conservancy.

[32] On October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its Don Pedro 10(j) conditions 2, 3, 4, and 7, and replacing them with revised 10(j) conditions 2, 3, and 4.

The following entities commented regarding the La Grange Project:

Commenting Agency and Other Entity	Date Filed
Stanislaus and Tuolumne Rivers Groundwater Basin Association	January 26, 2018
West Turlock Subbasin Groundwater Sustainability Agency	January 29, 2018
Conservation Groups[20]	January 29, 2018
NMFS	January 29, 2018
California DFW	January 29, 2018
Water Board	January 29, 2018
U.S. Department of the Interior	January 29, 2018
	October 2, 2018[33]

The applicants filed reply comments on March 15, 2018, in response to the January 2018 comments, and on October 17, 2018, in response to the FWS comments filed on October 1, 2018.

In addition to the commenting entities listed above for the Don Pedro and La Grange Projects, 198 comment letters were filed by individuals with no agency or non-governmental organization (NGO) affiliation. Of these, 96 expressed interest in improving safety and access at the Ward's Ferry whitewater take-out, 43 expressed support for increased flows for fish and wildlife as well as improved access and safety measures at Ward's Ferry for whitewater boaters, 39 expressed interest and concern for maintaining sufficient instream flow downstream of the projects for restoration of fish, wildlife, vegetation, and recreational resources, 17 expressed concern for adequate instream flows for salmon and their spawning habitat, 2 expressed concern for the preservation of water for agricultural interests, and 1 expressed concern for invasive species and predation of salmon smolts in the lower Tuolumne River.

[33] On October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its La Grange 10(j) conditions 2, 3, 4, and 7.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed in the environmental document. Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license and the current flow regime, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative as the baseline environmental condition for comparison with other alternatives.

For the currently unlicensed but operating La Grange Project, the no-action alternative would be continuation of current operation. Thus, the no-action alternative would include the existing facilities and current project operation.

2.1.1 Existing Project Facilities

The primary features of the projects are on figures 2.1.1-1 and 2.1.1-2, and the following sections provide more details about these facilities.

2.1.1.1 Don Pedro Project

The Don Pedro Project consists of the following existing facilities: (1) a 580-foot-high, 1,900-foot-long, earth and rockfill dam; (2) a reservoir with a gross storage capacity of 2,030,000 acre-feet and a usable storage capacity of 1,721,000 acre-feet; (3) a 30-foot-high, 45-foot-wide, 135-foot-long, gated spillway including three 45-foot-wide by 30-foot-high radial gates; (4) a 995-foot-long, ungated ogee emergency spillway with a crest elevation of 830 feet National Geodetic Vertical Datum of 1929[34]; (5) a set of outlet works, which are located at the left abutment of the dam and consist of three individual gate housings in the diversion tunnel, each containing two 4-foot-by-5-foot slide gates; (6) a 3,500-foot-long, concrete-lined diversion tunnel with a total hydraulic capacity of 7,500 cubic feet per second (cfs); (7) a 2,960-foot-long power tunnel located in the left abutment of the dam that transitions from an 18-foot-diameter, concrete-lined section to a 16-foot-diameter, steel-lined section; (8) a 21-foot-high, 12-foot-wide, emergency closure fixed-wheel gate; (9) a powerhouse located immediately downstream of the dam containing a 72-inch hollow jet valve and four Francis turbine-generator units with a total nameplate capacity of 168,015 kilowatts and a maximum hydraulic capacity of 5,500 cfs; (10) a switchyard located on top of the powerhouse; (11) a 75-foot-high, earth and rockfill dike (Gasburg Creek Dike) with a slide-gate controlled 18-inch-diameter conduit located near the downstream end of the spillway; (12) three small embankment dikes—dike A located between the main dam and spillway and dikes B and C located east of

[34] All elevation data in this draft EIS are given in National Geodetic Vertical Datum of 1929.

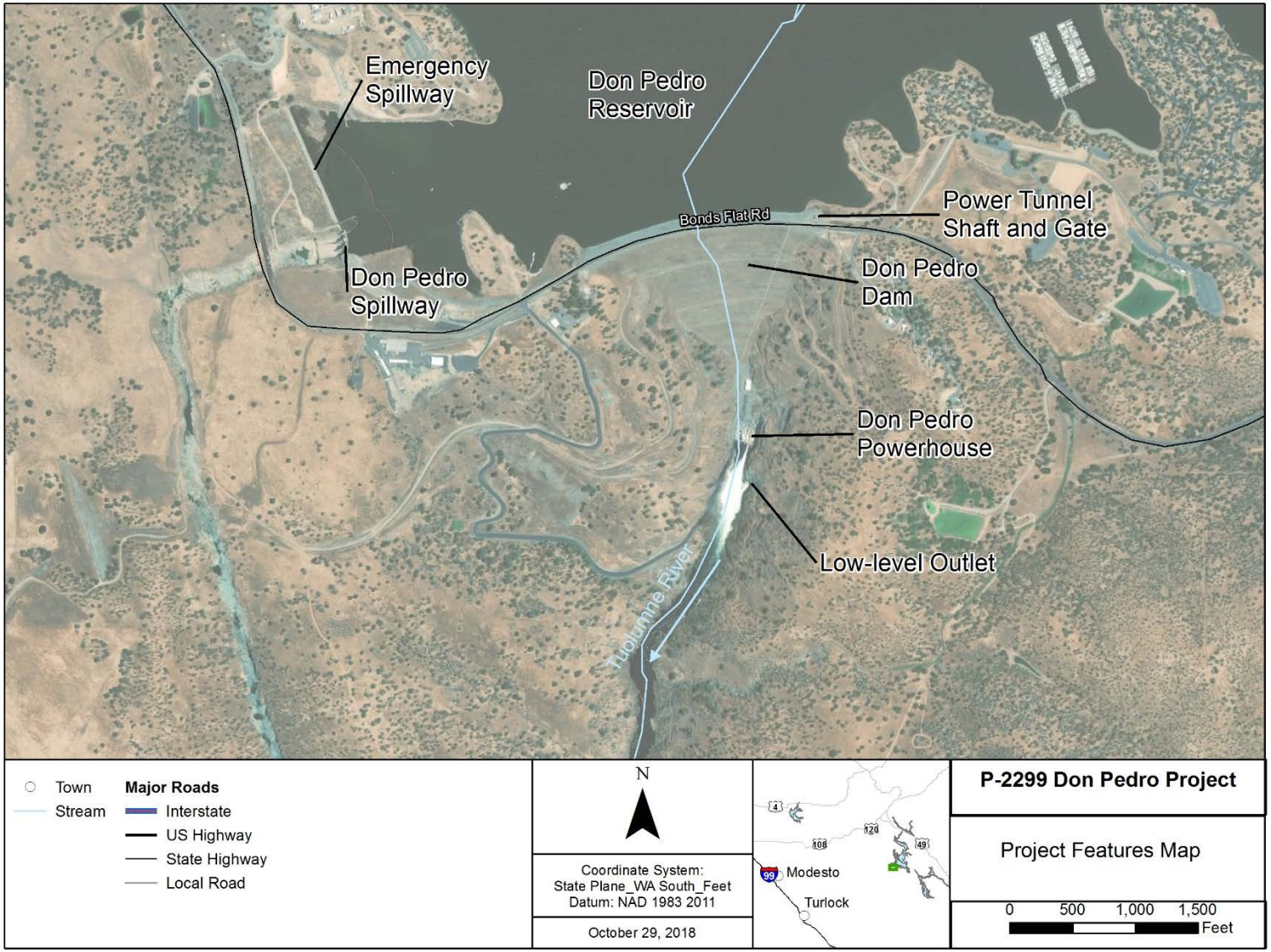

Figure 2.1.1-1. Location of major facilities for the Don Pedro Project (Source: staff).

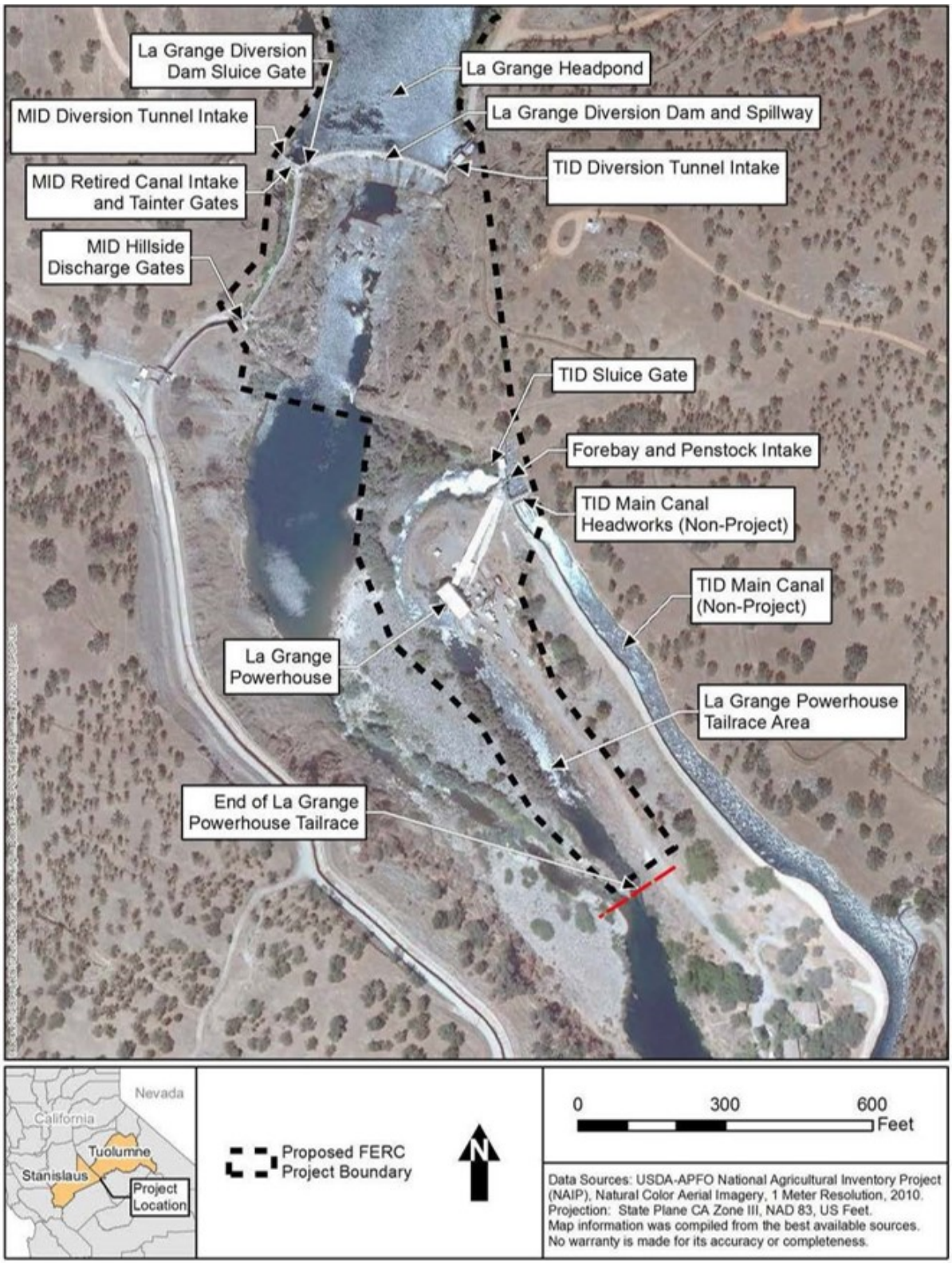

Figure 2.1.1-2. Location of major facilities and proposed project boundary for the La Grange Project (proposed boundary also includes the La Grange Reservoir) (Source: Districts, 2017b, as modified by staff).

the main dam; (13) recreational facilities on Don Pedro Reservoir, including Fleming Meadows, Blue Oaks, and Moccasin Point; and (14) appurtenant facilities and features including access roads.

2.1.1.2 La Grange Project

The La Grange Project consists of the following existing facilities: (1) a 310-foot-long, 131-foot-high, masonry arch diversion dam (La Grange Diversion Dam; (2) a reservoir with a total storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet; (3) the MID canal headworks, first 400 feet of the MID canal and "hillside" discharge gates (two 42-inch-diameter and one 60-by-60-inch) that are part of MID's retired irrigation canal facilities and are currently used to provide flows to the plunge pool downstream of the dam; (4) the TID irrigation intake and tunnel, which provides flow to the penstock intake structure and the headworks of the TID upper main canal; (5) a penstock intake structure containing a trashrack and three 7.5-foot-wide by 14-foot-tall concrete intake bays with manually operated gates and two automated 5-foot-high by 4-foot-wide sluice gates that can be used to discharge flow to the river via a sluice channel; (6) two penstocks leading to a powerhouse with two Francis turbine-generator units with a maximum combined generating capacity of 4.7 MW and a maximum combined hydraulic capacity of approximately 580 cfs; (7) a 700-foot-long excavated tailrace; and (8) a substation.

Because of maintenance and repair issues along the MID upper main canal, MID abandoned the upper portion of the canal on the west side of the dam and constructed a new intake and diversion tunnel to bypass this upper section. The new intake is located in the face of a cliff on the west bank, about 100 feet upstream of La Grange Diversion Dam. The intake and tunnel are not part of the La Grange Project. The first 400 feet of the MID canal is currently used to provide minimum flows to the bypass reach.

2.1.2 Existing Project Boundary

2.1.2.1 Don Pedro Project

The existing project boundary for the Don Pedro Project encompasses all of the project features and all lands necessary for the safe operation and maintenance of the project, and other project purposes, such as recreation, shoreline control, and protection of environmental resources. The existing project boundary slightly overlaps the proposed project boundary for the La Grange Project, and the Districts are proposing to correct that overlap (see section 2.2.2.1, *Proposed Project Boundary, Don Pedro Project*).

2.1.2.2 La Grange Project

The La Grange Project is currently unlicensed, and its project boundary will be established in any license that is issued for the project.

2.1.3 Project Safety

2.1.3.1 Don Pedro Project

The Don Pedro Project has been operating for more than 46 years under the existing license,[35] and during this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, the Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.3.2 La Grange Project

As part of the licensing process for the previously unlicensed La Grange Project, the Commission would prepare a Safety and Design Assessment covering the adequacy of the project facilities. Special articles would be included in any license issued, as appropriate. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.1.4 Existing Project Operation

2.1.4.1 Don Pedro Project

Inflows to the Don Pedro Reservoir originate in 22 tributary rivers and creeks. Fourteen of the tributaries enter the Tuolumne River upstream of the project boundary and reservoir and eight flow directly into the reservoir within the project boundary.

The Don Pedro Reservoir provides 2,030,000 acre-feet of total water storage. The project uses that water storage to serve the following primary purposes and functions: irrigation, municipal and industrial water supply, and flood control. These uses are critical functions of the project. Other uses supported by the water storage and water

[35] The project was licensed in 1964 and commercial operation began in 1971.

supply of the project are: recreation; power generation; and protection of the downstream anadromous fishery.

The following sections provide more detail regarding the irrigation, municipal and industrial water supply, flood control functions, and fishery protection flows.

Irrigation

The project provides water for irrigation of over 200,000 acres of farmland in California's Central Valley served by the Districts. Combined, the Districts supply, on average, more than 900,000 acre-feet of irrigation water per year to their customers.

Municipal and Industrial Water Supply

MID provides treated water to the City of Modesto (population 210,000), and TID and MID jointly provide treated water to the community of La Grange. The Districts provide up to a maximum of 67,500 acre-feet of water per year for municipal and industrial use.

The Don Pedro Project receives inflow from CCSF's upstream Hetch Hetchy Water and Power System (Hetch Hetchy System), a series of reservoirs, diversion conduits, and powerhouses located on the upper Tuolumne River.[36] Consistent with the requirements of the Raker Act[37] and agreements between the Districts and CCSF, the project provides a "water bank" of up to 570,000 acre-feet of storage. The water bank allows CCSF to meet its need to satisfy the Districts' senior water rights by using the Don Pedro Reservoir to store water released from its upstream facilities. By using the allotted reservoir storage, CCSF can then divert water at times releases would have been required to satisfy the District' water rights. CCSF's "water bank" within Don Pedro Reservoir provides water for its 2.4 million customers in the Bay Area.

Flood Control

The project provides storage for flood management on the Tuolumne and San Joaquin rivers. Following U.S. Army Corps of Engineers (Corps) guidelines, the Don Pedro Project provides up to 340,000 acre-feet of storage for flood control and adheres to

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[36] The Hetch Hetchy System, which is not a part of the licensed project, is owned and operated by CCSF pursuant to authority conferred in the Raker Act (38 Stat. 242 (1913)) and provides hydroelectric power and water supply. The Raker Act requires the Hetch Hetchy system to release a specified amount of water to the Districts. Section 29 of the FPA (16 U.S.C. § 823 (2006)) prohibits the Commission from modifying or repealing any provisions of the Raker Act.

[37] The Raker Act, passed by Congress in 1913, authorizes CCSF to build certain water and power facilities on federal lands and addresses the allocation of the waters of the Tuolumne River between the Districts and CCSF.

a flood control operations guideline in the Tuolumne River at Modesto of not exceeding 9,000 cfs. The most recent agreement with the CCSF for the storage of water in Don Pedro Reservoir, known as the Fourth Agreement, allows allocation of a portion of the 340,000 acre-foot flood control storage volume not reserved for flood control at any time to be available for conservation storage, split equally between the Districts and the CCSF.

Fishery Protection Downstream of Don Pedro Dam

In 1995, the Districts entered into a settlement agreement with the California DFW, FWS, CCSF, and four NGOs that provided for increasing releases from the Don Pedro Dam to improve conditions in the lower Tuolumne River for fall-run Chinook salmon. The Commission incorporated in the flow provisions of the agreement into the Don Pedro Project license by order dated July 31, 1996. The Districts agreed that certain flows released at the Don Pedro Dam would not be diverted at the La Grange Diversion Dam into the Districts' water supply conveyances, therefore allowing those flows to pass downstream of the La Grange Diversion Dam into the lower Tuolumne River.

Powerhouse Operations

Flow releases from the project are scheduled based on requirements for: (1) flood flow management, including pre-releases in advance of anticipated high flows during wet years, (2) the Districts' irrigation and municipal and industrial demands, (3) storage of up to 570,000 acre-feet of water to manage flow releases from the Hetch Hetchy System in compliance with agreements with the CCSF, and (4) protection of aquatic resources in the lower Tuolumne River in accordance with the terms of the FERC license. Scheduled flow releases are generally provided first through the four turbine-generator units (up to 5,500 cfs) located in the Don Pedro Powerhouse. Flows are delivered to the powerhouse via the power tunnel, which has an inlet centerline elevation of 534.3 feet and connects to a manifold that feeds each unit. A bifurcation in the manifold passes flow to Unit 4 and/or to a hollow jet discharge valve. The valve discharge is limited to 800 cfs when Unit 4 is operating, but the valve can release up to 3,000 cfs when Unit 4 is not operating. Units 1, 2, and 3 discharge to the Tuolumne River directly from the powerhouse. Unit 4 discharges through a 190-foot-long, 13-foot horseshoe-shaped tunnel to the diversion tunnel, which discharges downstream of the powerhouse. An additional 7,500 cfs can be passed through the low level outlet works tunnel that discharges downstream of the powerhouse. The gated spillway can release up to 172,500 cfs if reservoir water levels approach elevation 830 feet. If the reservoir water elevation exceeds 830 feet, up to 300,000 cfs can pass over the crest of the emergency ungated spillway (based on maximum elevation 850 feet).

When electrical demand is high, flow releases at the project may be increased to generate more electricity, subject to meeting the flow schedule requirements. These flow releases are limited by the small amount of usable storage available in the La Grange Reservoir, which is not sufficient to allow it to re-regulate high variations in hourly outflows, and also by the capacity of the TID main canal. Outflows from the Don Pedro

Powerhouse may vary by about 1,200 cfs between on-peak and off-peak periods, which can result in daily water fluctuations of about 1.8 inches in Don Pedro Reservoir.

During the winter, inflows are stored for water supply and only limited hydropower generation occurs. The releases during this period consist of releases to satisfy minimum flows to the lower Tuolumne River, provide water to fill downstream irrigation storage reservoirs, or to manage flood storage.

2.1.4.2 La Grange Project

The La Grange Project operates at times to pass flows as received but also provides some re-regulation of flow releases from Don Pedro Reservoir within the ability of the small reservoir to store water. Water released from Don Pedro Reservoir flows into La Grange Reservoir and is diverted into the TID and MID intakes and tunnels or passes over the spillway. Part of the flow that passes into the TID tunnel intake is diverted at the forebay through the penstocks, leading to the powerhouse, which has an operating range of 100 to 580 cfs. The sluice gates adjacent to the penstock intakes can also be used to release flow into the tailrace. The rest of the flow to the forebay passes through the TID main canal intake structure at the forebay and flows through the canal. The Districts normally release a flow of about 5 to 10 cfs about 400 feet downstream of the La Grange Diversion Dam via gates at the end of the retired MID intake canal.

2.1.5 Existing Environmental Measures

In 1995, the Districts entered into a Settlement Agreement with the California DFW, FWS, CCSF, and four NGOs that increased flow releases from the Don Pedro Project to the lower Tuolumne River to improve conditions for fall-run Chinook salmon. The Commission issued an order on July 31, 1996, amending the Don Pedro Project license to incorporate the lower Tuolumne River minimum flow provisions contained in the Settlement Agreement. The revised summertime minimum flows range from 50 cfs to 250 cfs, a substantial increase over the prior summertime minimum flow of 3 cfs, and fall through winter minimum flows vary from 150 cfs to 300 cfs, depending on water year type. The 10 water year type classifications are re-calculated each year to maintain approximately the same frequency distribution of water year types. The Settlement Agreement and license order also provide for the release of pulse flows, the volume of which also varies with water year type. The flow schedule provided for by the Settlement Agreement and subsequent license amendment is shown in table 2.1.5-1, and the volume of pulse flows provided by year are shown in table 2.1.5-2.

Table 2.1.5-1. Schedule of flow releases to the lower Tuolumne River by water year type contained in the Commission's 1996 order (Source: Districts, 2017a).

Schedule	Units	Critical and Below	Median Critically Dry	Interm. Critically Dry	Median Dry	Interm. Dry-BN	Median below Normal	Interm. BN-AN[a]	Median above Normal	Interm. AN-Wet	Median Wet/Max.
Occurrence	%	6.4%	8.0%	6.1%	10.8%	9.1%	10.3%	15.5%	5.1%	15.4%	13.3%
October 1–15	cfs	100	100	150	150	180	200	300	300	300	300
	acre-feet	2,975	2,975	4,463	4,463	5,355	5,950	8,926	8,926	8,926	8,926
Attraction pulse	acre-feet	None	None	None	None	1,676	1,736	5,950	5,950	5,950	5,950
October 16–May 31	cfs	150	150	150	150	180	175	300	300	300	300
	acre-feet	67,835	67,835	67,835	67,835	81,402	79,140	135,669	135,669	135,669	135,669
Out-migration pulse flow	acre-feet	11,091	20,091	32,619	37,060	35,920	60,027	89,882	89,882	89,882	89,882
June 1–September 30	cfs	50	50	50	75	75	75	250	250	250	250
	acre-feet	12,099	12,099	12,099	18,149	18,149	18,149	60,496	60,496	60,496	60,496
Volume (total)	acre-feet	94,000	103,000	117,016	127,507	142,502	165,003	300,923	300,923	300,923	300,923

Note: BN – below normal, AN – above normal

[a] Between a median critical water year and an intermediate below normal-above normal water year, the precise volume of flow to be released by the Districts each fish flow year is to be determined using accepted methods of interpolation between index values.

Table 2.1.5-2. Spring and fall pulse flow releases (1996–2017) (Source: staff).

	Spring Pulse Flow		Fall Pulse Flow	
Year	**Acre-feet**	**Peak Flow (cfs)**	**Acre-feet**	**Peak Flow (cfs)**
1996	48,590	2,403	5,949	800
1997	89,882	1,511	5,950	600
1998	89,907	1,511	5,949	228
1999	84,928	4,500	6,302	226
2000	89,891	2,000	5,950	600
2001	36,367	1,085	2,331	200
2002	42,684	1,300	2,225	140
2003	32,619	420	1,736	235
2004	35,514	2,800	0	N/A
2005	43,225	1,417	5,950	200
2006	74,175	1,417	5,950	200
2007	14,365	392	0	N/A
2008	52,340	1,300	0	N/A
2009	39,887	930	9,352	700
2010	53,653	1,400	5,950	500
2011	48,887	1,417	5,950	800
2012	39,722	2,050	3,228	557
2013	20,091	1,150	5,482	600
2014	11,091	1,022	0	N/A
2015	11,091	1,372	0	N/A
2016	35,920	2,438	1,676	106
2017	89,882	2,993	5,950	600

The Districts have actively participated in studying, monitoring, protecting, and enhancing the fall-run Chinook salmon in the lower Tuolumne River. In accordance with the 1995 Settlement Agreement, the Districts have continued to monitor the fall-run Chinook salmon population and provided annual reports to all parties. The Tuolumne River Technical Advisory Committee (TRTAC)—consisting of the Districts, CCSF, environmental groups, California DFW, and FWS—was designated under the terms of the 1995 Settlement Agreement to be responsible for coordinating portions of the Settlement Agreement, reviewing annual studies on the fall-run Chinook salmon and *O. mykiss*[38] fisheries, and advising the Districts on adjustments to fisheries studies. TRTAC meetings are open to the public, allowing any interested party to participate. Numerous additional aquatic resource monitoring and evaluation studies have been undertaken from 1996 to the present time. In March 2005, the Districts prepared and filed a ten-year summary report covering the environmental studies conducted from 1995 to 2004 (Districts, 2005). Annual studies and reports have been filed each year since that time.

2.2 APPLICANTS' PROPOSAL

2.2.1 Proposed Project Facilities

2.2.1.1 Don Pedro Project

The Districts propose to install and operate two in-river infiltration galleries (IG-1 and IG-2)[39] at approximately RM 25.9[40] just downstream of Fox Grove Park on the lower Tuolumne River. TID installed IG-1 in 2001 during the restoration of special-run pool-9 at RM 25.8 located below the Geer Road Bridge. IG-2 would be installed just upstream of IG-1. IG1 has a design capacity of approximately 100 cfs, and IG2 would have a capacity of 100 to 125 cfs. Water withdrawn at the infiltration galleries would be pumped to the TID water supply system via TID's Ceres Canal or other non-project facilities, reducing the amount that needs to be diverted at the La Grange Diversion Dam and allowing the Districts to provide additional summer flows to the 26-mile-long reach

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[38] The term *O. mykiss* is used to represent both resident and anadromous (steelhead) history forms of the species *Oncorhynchus mykiss*.

[39] We do not consider the infiltration galleries to be project facilities because their primary purpose is to provide water for consumptive use, and they are not necessary to maintain or operate the project.

[40] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

between the La Grange Powerhouse and the infiltration galleries (which provides important habitat for salmonids) without reducing water supplies.

2.2.1.2 La Grange Project

The Districts do not propose to construct any new project facilities at the La Grange Project other than those proposed as environmental measures, described below.

2.2.2 Proposed Project Boundary

2.2.2.1 Don Pedro Project

The Districts propose to revise the project boundary to include some additional land associated with proposed structures and to remove other lands that are not needed for project purposes. On November 27, 2017, the Districts filed a modified Exhibit G-1 map to remove lands from the Don Pedro Project boundary that overlap with the proposed La Grange Project boundary. The Districts noted that the removed lands are not needed for project purposes of the Don Pedro Project.

2.2.2.2 La Grange Project

The Districts propose a project boundary that encompasses all of the project features and all lands necessary for the safe operation and maintenance of the project, and other project purposes, such as recreation, shoreline control, and protection of environmental resources.

2.2.3 Proposed Project Operation

2.2.3.1 Don Pedro Project

Proposed operation of the Don Pedro Project would be generally consistent with existing operations, although the Districts are proposing some flow-related measures to enhance aquatic and recreational resources. IG-1 has a design capacity of approximately 100 cfs. Proposed IG-2 would have a flow capacity of 100 to 125 cfs. The infiltration galleries would be operational starting June 1, except in years with high flows, and extend through October 15. The infiltration galleries would be turned off during certain summer weekends and holidays to provide greater recreational boating opportunities.

2.2.3.2 La Grange Project

Other than the minimum flow release of 5 to 10 cfs to the plunge pool downstream of the La Grange Diversion Dam described below, the Districts do not propose to make substantive changes to the operation of the La Grange Project.

2.2.4 Proposed Environmental Measures

2.2.4.1 Don Pedro Project

The Districts propose the following environmental measures:

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 feet to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions
- Implement the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application).
- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating.

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7 (La Grange Gage)**	**RM 25.9**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100	150
July 1 through October 15	350	150	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)	RM 25.9	RM 51.7 (La Grange Gage)
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

- Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7 with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.
- Provide spring pulse flows in the following amounts to facilitate outmigration of juvenile fall Chinook salmon from the lower Tuolumne River. The timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application.

Wet and above normal water years:	150,000 acre-feet
Below normal water years:	100,000 acre-feet
Dry water years:	75,000 acre-feet
Sequential dry water years:	45,000 acre-feet
First critical water year:	35,000 acre-feet
Sequential critical water years:	11,000 acre-feet

- Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5[41] to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat.

[41] The location of this facility is also provided as RM 25.7 at some places in the Don Pedro amended final license application.

- Implement a predator control and suppression program that includes sponsoring fishing derbies and removal and/or isolation of predatory fish via electrofishing, seining, fyke netting, and other collection methods to control and suppress striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir.
- Conduct coarse sediment augmentation in the lower Tuolumne River between RM 39 and RM 52 over a 10-year period, annual surveys of fall-run Chinook salmon and *O. mykiss* spawning use of new gravel patches for 5 years following completion of gravel augmentation, and a spawning gravel evaluation in year 12 to improve spawning conditions for fall-run Chinook salmon and *O. mykiss*.
- Provide gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam during years when sufficient spill is projected to occur to improve salmonid spawning habitat.
- Implement a fall-run Chinook spawning superimposition[42] reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used suitable habitat.
- Conduct a 5-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).
- Develop a plan to implement the Lower Tuolumne River Habitat Improvement Program and associated $38 million capital fund and annual funding accounts. The plan would address establishment of the fund account, management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to the operation, maintenance, monitoring, and reporting associated with enhancement projects.
- Create a TPAC to provide recommendations on development and implementation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program. The committee would consist of the Districts,

[42] Redd superimposition occurs when later arriving female salmonids dig redds on top of existing redds, which can result in mortality to incubating eggs.

FWS, and CCSF. Other parties, including NMFS and California DFW would be encouraged to participate in the committee as full members.

- Implement the Aquatic Invasive Species Management Plan (filed as appendix E-4 of the Don Pedro amended final license application) that includes measures to prevent the introduction and spread of aquatic invasive species.
- Shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years.
- Implement the Terrestrial Resources Management Plan (TRMP) (filed as appendix E-6 of the Don Pedro amended final license application) that includes measures for controlling non-native plant species, protecting special-status species, revegetating disturbed areas, protecting bald eagles from disturbance, excluding bats from project facilities, and recording and reporting incidental observations of western pond turtles.
- Implement the Recreation Resource Management Plan (filed as appendix E-7 of the Don Pedro amended final license application) that includes measures to address existing and future recreational resource needs within the project boundary.
- Construct a new boat launch facility to provide boating access upstream of old Don Pedro Dam when reservoir levels are low.[43]
- Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) that includes measures for the collection, storage, and disposal of woody material to minimize hazards to boating and other recreational uses in Don Pedro Reservoir.

Provide the following flows to enhance conditions for non-motorized, recreational river boating on the lower Tuolumne River:

- From April 1–May 31 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. During this time period, the infiltration galleries would either be shut off, or additional flows to be withdrawn for water supply purposes would be released to the La Grange gage.
- From June 1–June 30 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-

[43] The final license application does not identify the proposed location; however, the boat launch likely would be located on the northeast shoreline near the location of old Don Pedro Dam, as shown in figure 1.1.1-1. Old Don Pedro Dam, which was inundated when the new Don Pedro Dam was constructed, is located 1.6 miles upstream of new Don Pedro Dam.

scheduled weekend in June to provide additional flow to the river downstream of RM 25.9.

- From July 1–October 15, a flow of at least 350 cfs in wet, above normal, and below normal water years and at least 300 cfs in dry and critical water years as measured at the La Grange gage. In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the 3-day July 4 holiday, the 3-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August. Park Service 10(a) recommendation 3 for the Don Pedro Project is a refinement of the Districts' proposed measure, which recommends scheduling the proposed 200-cfs boatable flow for the July 4 on the 3-day weekend that occurs closest to the actual holiday.[44]
- Provide a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting/barrier weir.
- Install a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.
- Annually notify BLM about the location and type of any road maintenance projects on BLM lands and convene a meeting to confer on project details if requested by BLM.
- Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.
- Implement the HPMP (filed as appendix E-8 of the Don Pedro amended final license application) that includes specific actions and processes to manage historical properties.

2.2.4.2 La Grange Project

The Districts propose the following environmental measures:

- Conduct dissolved oxygen (DO) monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel from September 1 to November 30 each year for the first 2 years of a new operating license. If results indicate that a specific cause for low DO exists, the Districts would develop and file an action plan in year 3 of the license.

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[44] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

- Provide a minimum flow of approximately 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times to ensure consistent and adequate flow to support aquatic resources.
- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.
- Construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes).
- Develop an HPMP in consultation with tribes, BLM, and State Historical Preservation Office to manage potential effects on historic properties.

2.2.5 Modifications to Applicants' Proposal—Mandatory Conditions

In this draft EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project.

Section 4(e) Land Management Conditions

Don Pedro Project

The following revised mandatory conditions have been provided by BLM under section 4(e) and are included in appendix C. We consider conditions 1, 5, 10, 12, 19 through 31, 33, 34, 36 through 42, and 44 to be administrative, and BLM withdrew preliminary condition 12 on August 23, 2018; therefore, these conditions are not analyzed in this EIS. The remaining conditions are resource-specific and are analyzed in this EIS.

- Condition 2: Annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants,[45] and sensitive areas known to occur within or adjacent to the project boundary.
- Condition 3: Develop a BLM-approved soil erosion and sediment control plan for actions affecting BLM-managed land within or adjacent to the project boundary.

[45] The term non-native invasive plants is synonymous with noxious weeds, which is the term we use globally in this EIS.

- Condition 4: Develop a BLM-approved burn plan for any large woody material (LWM) stored and burned on BLM-administered lands, and make all reasonable efforts to prevent LWM from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry.
- Condition 6: Implement a BLM-approved Aquatic Invasive Species Management Plan.
- Condition 7: Implement a BLM-approved TRMP.
- Condition 8: Implement a BLM-approved Bald Eagle Management Plan.
- Condition 9: Annually consult with BLM to review lists of special-status plant and wildlife species.
- Condition 11: Coordinate an annual recreation meeting with interested resource groups to discuss the management, public safety, protection, and use of project recreational facilities and resources.
- Condition 13: Develop a BLM-approved Ward's Ferry/Tuolumne River Take-Out Management Plan.
- Condition 14: Implement a BLM-approved Recreation Resource Management Plan.
- Condition 15: Upon Commission approval, implement the final HPMP.[46]
- Condition 16: Develop a BLM-approved transportation system management plan for BLM-managed land within the project boundary.
- Condition 17: Develop a BLM-approved Fire Prevention and Response Management Plan.
- Condition 18: Develop a BLM-approved visual resources management plan for BLM-managed land within the project boundary.
- Condition 32: Implement pesticide use restrictions on BLM land.
- Condition 35: Consult with BLM if ground-disturbing activities on or directly affecting BLM land are proposed if such activities are not covered in this National Environmental Policy Act (NEPA) document.
- Condition 43: Develop a BLM-approved hazardous substances plan.

[46] BLM condition refers to the "Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC." A final HPMP is to be filed by July 31, 2019.

La Grange Project

The following preliminary mandatory conditions have been provided by BLM under section 4(e) and are included in appendix D. We consider conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 2: Annually perform employee awareness training to familiarize the Districts' Don Pedro Recreation Agency and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary.
- Condition 3: Develop a BLM-approved soil erosion and sediment control plan for actions affecting BLM-managed land within or adjacent to the project boundary.
- Condition 5: Implement a BLM-approved TRMP.
- Condition 6: Annually consult with BLM to review lists of special-status plant and wildlife species.
- Condition 7: Upon Commission approval, implement the final amended HPMP that was included in the Districts' letter filed on July 10, 2018.[47]
- Condition 8: Construct and maintain the following recreational facilities on BLM land: (1) trail from parking area of La Grange Headquarters to the Tuolumne River; (2) kiosk near beginning of trail; and (3) two picnic tables located above floodplain near shore of the river.
- Condition 9: Develop a BLM-approved Bald Eagle Management Plan.
- Condition 23: Implement pesticide use restrictions on BLM land.
- Condition 26: Consult with BLM if ground-disturbing activities on or directly affecting BLM land are proposed if such activities are not covered in this NEPA document.
- Condition 34: Develop a BLM-approved hazardous substances plan.

Water Quality Certification Conditions

The following preliminary mandatory certification conditions have been provided by the Water Board and are included in appendix E. We consider preliminary condition

[47] BLM condition refers to the "Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC." A revised HPMP was filed on July 10, 2018.

11 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 1: The Water Board reserves the right to condition the project with minimum instream flows in light of the whole record.
- Condition 2: The Water Board reserves the right to determine criteria to classify water year types for the projects-affected reaches. Water year type classification criteria for affected waters downstream of La Grange Diversion Dam will likely be based on the San Joaquin Valley 60-20-20 Index.
- Condition 3: Develop a streamflow and reservoir level compliance plan to document compliance with streamflow and reservoir level requirements.
- Condition 4: Develop a large woody material (LWM) management plan to increase the amount of LWM downstream of La Grange Diversion Dam.
- Condition 5: Develop a sediment management plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River to improve downstream habitat.
- Condition 6: Develop a water quality monitoring plan.
- Condition 7: Develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects.
- Condition 8: Develop an aquatic invasive species management plan to minimize the spread and impact of aquatic invasive species on native fauna and habitats.
- Condition 9: Develop a soil erosion and sediment control plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by projects' operation and maintenance.
- Condition 10: Develop a hazardous material plan for storage, use, transportation, and disposal of hazardous materials in the projects' area.

2.3 STAFF ALTERNATIVE

2.3.1 Don Pedro Project

Under the staff alternative, the project would include some of the Districts' proposed measures, with the exception of the following: the minimum flows proposed to be in effect after the infiltration galleries are operational, the permanent fish counting/barrier weir at RM 25.5, the predator control and suppression program, the 10-year coarse sediment augmentation program, the fall-run Chinook spawning superimposition reduction program, the 5-year program of gravel cleaning and monitoring, the Lower Tuolumne River Habitat Improvement Program, the TPAC, the new boat launch facility to provide boating access upstream of old Don Pedro Dam, the

improved boat take-out facility upstream of the Ward's Ferry Bridge, and the new boat take-out/put-in at the fish counting/barrier weir.

Instead of the minimum flows that are proposed to be in effect after the infiltration galleries are operational, we recommend that the proposed interim flows, which would be monitored at the existing U.S. Department of the Interior, Geological Survey (USGS) gage downstream of La Grange Diversion Dam, remain in effect for the duration of any new license issued for the project. As noted previously, we do not consider the infiltration galleries to be project facilities because their primary purpose is to provide water for consumptive use, and they are not necessary to maintain or operate the project. However, our recommendation does not preclude the Districts from constructing and operating the infiltration galleries or the proposed infiltration gallery pipeline gage, or from implementing their proposed "with infiltration galleries" flow regime.

We do not recommend construction of a permanent barrier/counting weir or implementing a predator control and suppression plan because they would not likely be effective and could have adverse effects on federally listed steelhead. Similar predator removal efforts by the California Department of Water Resources did not noticeably reduce salmon mortality, and the permanent barrier/counting weir could act as a migration barrier to salmonids. The Districts' implementation of other habitat-related measures recommended by the resource agencies and staff (i.e., flow and gravel augmentation measures), however, would decrease the amount of available predator habitat (by proving flows above the suitable range for predatory species) and increase the quality and quantity of available salmonid spawning habitat.

Instead of the 10-year coarse sediment augmentation program proposed by the Districts, we recommend that the Districts develop a plan to augment gravel annually for the term of any new license, because Don Pedro Reservoir would continue to capture gravel for the duration of the license.

We do not recommend the implementation of a fall-run Chinook spawning superimposition reduction program because this measure could result in the "take" of federally listed steelhead due to potential injury from the temporary barrier that the Districts would install annually, and because other measures recommended by staff, including flow and gravel augmentation measures, would likely provide a greater benefit to Chinook salmon populations than this proposed measure. We also do not recommend that the licensee develop a 5-year program of gravel cleaning and monitoring. Continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality that is caused by the interruption of gravel transport by Don Pedro Reservoir.

We do not recommend developing a plan to implement the Lower Tuolumne River Habitat Improvement Program because it is unclear: (1) precisely what habitat restoration projects would be funded, (2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights needed to access a property for

restoration and maintenance activities for each proposed improvement site, (4) how compliance with the ESA and NHPA would be obtained at each site, and (5) the details on the project design and scope of operation and maintenance activities that would occur at each habitat improvement site so that the Commission can determine whether the site should be included within the project boundary.

We do not recommend requiring the Districts to create a TPAC to guide implementation of the proposed spill management plan and Lower Tuolumne River Habitat Improvement Program because the Commission has no authority to require other agencies to participate in such a committee. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program, if that program is implemented in the future.

We do not recommend the installation of a whitewater boat take-out facility upstream of Ward's Ferry as a license requirement because the measure has no nexus to the continued operation of the project. The Don Pedro Project does not affect the timing or quantity of flow in the whitewater boating reach. Instead, whitewater boating use and the resulting congestion and other associated problems at Ward's Ferry Bridge are related to Forest Service whitewater boating permitting decisions, flows provided by power generation from CCSF's Holm Powerhouse (non-project), and Tuolumne County road management. We also do not recommend construction of a new boat launch at Don Pedro Reservoir upstream of old Don Pedro Dam. The existing boat launches provide adequate boating access to Don Pedro Reservoir unless hydrologic conditions drier than those that occurred during the 42-year period of record occur in the future, which would likely be infrequent. We also do not recommend that the Districts provide a new boat take-out/put-in to facilitate boat passage past the proposed fish counting/barrier weir, because we do not recommend construction of the weir.

The staff alternative also includes the following recommended modifications of the Districts' proposal and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of best management practices (BMPs) for erosion control; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of surface water quality monitoring would occur during and after ground-disturbing activities.

Aquatic Resources

- Modify the proposed Spill Prevention Control and Countermeasure Management Plan to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed; (2) a description of equipment and procedures to be used to address hazardous substance spills; (3) a provision to notify the Water Board, California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days after a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.
- Develop a drought management plan to include: (1) definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) which license requirements would be temporarily modified during drought conditions; and (3) how the project would be operated when drought conditions occur.
- Develop a plan to monitor water temperatures in Don Pedro Reservoir near the dam and in the lower river at the gage below La Grange (RM 51.7), Basso Bridge (RM 47.5), Roberts Ferry (RM 39.5), and above the proposed infiltration galleries (upstream of RM 25.9) whenever reservoir elevations are lower than 600 feet; including provisions for reporting monitoring results and identifying any actions proposed to address water temperatures that exceed the suitable range for survival of Tuolumne River salmonids.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in the license.
- Develop a LWM management plan to increase the amount of LWM downstream of the La Grange Diversion Dam to include a description of methods to guide the placement of LWM, monitoring of enhanced sites, and revision of the plan based on monitoring data.
- Develop a coarse sediment management plan that includes gravel augmentation in the lower Tuolumne River between RM 39 and RM 52.
- Modify the proposed Aquatic Invasive Species Management Plan to include: (1) educating recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program; (3) implementing BMPs, such as identifying aquatic invasive species that may be introduced by a given activity, identifying critical control points (locations

and times), and implementing measures to prevent the spread of aquatic invasive species during routine operation and maintenance; (4) implementing public boating access restrictions and consultation with BLM, FWS, and California DFW regarding control measures if aquatic invasive species are discovered; (5) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, and California DFW within 24 hours, and to the Commission within 10 days; and (6) reassessing the vulnerability of Don Pedro Reservoir for the introduction of invasive species if dreissenid mussel species are identified in Tuolumne River or if calcium concentration of 13 mg/L or higher are documented in Don Pedro Reservoir.

Terrestrial Resources

- Modify the TRMP to include:
  - Conducting pre-construction surveys for special-status or threatened and endangered plants or animals before the start of any project-related ground disturbance involving heavy machinery, where suitable habitat exists, and establishing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.
  - Focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources; and implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.
  - Surveys for special-status plants within the Red Hills Area of Critical Environmental Concern (ACEC) every 5 years and every 10 years elsewhere within the project boundary, and the installation of interpretive signs about the unique plant communities of the Red Hills ACEC requesting that recreationists stay on trails.
  - Recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.
  - A bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31); resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.

- A description of specific locations where ground squirrel activity is problematic and where the Districts' rodent control activities could occur; conducting surveys of ground squirrel burrows for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox and California tiger salamander during other biological surveys.
- Decontaminating equipment during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.
- BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installation of signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed, and (6) consultation with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Recreation Resources

- Modify the proposed Recreation Resource Management Plan to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) an annual coordination meeting with BLM and other interested parties to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) a description of the BLM guidance for design and

construction of project recreation facilities that would be located on BLM-managed land to develop facilities consistent with agency requirements; (6) consultation with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands; (7) the visitor center near Fleming Meadows as a project facility where visitors can learn about the project and obtain information about project recreation facilities and points of public recreation access; (8) a description of the operation and maintenance of Fleming Meadows visitor center; (9) identification of land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, which includes proposed accessibility upgrades and allows adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities; (11) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (12) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user-created trails; and (13) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir.

- Modify the proposed Woody Debris Management Plan to include designated disposal site maps, treatment descriptions, and description of the coordination necessary for managing other resources.
- Modify the proposed boatable flows to require that the proposed 3-day July 4 holiday boating flow be scheduled to occur on the 3-day weekend that occurs closest to the actual holiday. If July 4 falls on a Wednesday, the Districts would provide this 3-day boating flow either the weekend before or the weekend after the holiday.

Land Use and Aesthetics

- Implement a BLM-approved Fire Prevention and Response Management Plan to ensure that project operation and maintenance activities are conducted in a manner that would not contribute to the ignition and spread of wildfires.
- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.

- Develop a visual resources management plan that addresses effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

Cultural Resources

- Modify the proposed HPMP to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the dispute resolution stipulation of the anticipated PA, and to include additional information that addresses all of the California State Historic Preservation Officer's (SHPO's) specific comments in previous correspondence and in any correspondence received subsequent to the date of this EIS. Appendices should identify each comment and the extent to which they were addressed in the final HPMP.

2.3.2 La Grange Project

Under the staff alternative, the project would include all of the Districts' proposed measures, with the exception of constructing a recreational foot trail to the La Grange Reservoir as a license condition for the La Grange Project. We recommend this measure as a license condition for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway.

Under the staff alternative, the project would include the following revisions to the proposed project and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of BMPs for erosion control; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of surface water quality monitoring would occur during and after ground-disturbing activities.

Water Quality

- Develop a plan to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.
- Develop a spill prevention control and countermeasure management plan to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed; (2) a description of equipment and procedures to

be used to address hazardous substance spills; (3) a provision to notify the Water Board, California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange USGS gage.
- Develop a stream flow and reservoir level compliance plan.
- Develop an aquatic invasive species management plan to include: (1) educating recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program; (3) implementing BMPs for minimizing the spread of invasive species during project operation and maintenance; (4) consulting with California DFW and BLM if aquatic invasive species are discovered; and (5) recording and communicating incidental observation of aquatic invasive species to BLM, FWS, and California DFW within 24 hours, and to the Commission within 10 days.

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operations and maintenance activities within the La Grange Project, to include:
  - A noxious weed survey of the La Grange Project in the first year of license issuance and every 5 years, with future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control measures, where feasible (instead of herbicides), in areas with sensitive resources.
  - A survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; and implementing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities.

- Recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.
- A bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31; resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.
- Protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species.
- BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS, and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installation of signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a fire prevention and response management plan for the La Grange Project.

Cultural Resources

- Modify the proposed HPMP to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the anticipated PA.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

In this draft EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis notice. We recognize that the Commission is required to include valid section 4(e) conditions in any license issued for the project.

2.4.1 Don Pedro Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary (BLM Don Pedro revised 4(e) condition 2); (2) annually consult with BLM to review lists of special-status plant and wildlife species (BLM Don Pedro revised 4(e) condition 9); (3) develop a Ward's Ferry day-use facility engineered plan (BLM Don Pedro revised 4(e) condition 13); (4) implement pesticide use restrictions on BLM land (BLM Don Pedro revised 4(e) condition 32); (5) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM Don Pedro revised 4(e) condition 35); (6) provide minimum instream flows to be specified by the Water Board (Water Board preliminary 401 conditions 1 and 2); (7) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (8) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (9) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the project (Water Board preliminary 401 condition 9).

Incorporation of these mandatory conditions into a new license would cause us to eliminate the following environmental measures that we include in the staff alternative: (1) implement the Districts' proposed interim minimum flows, spring pulse flows, flushing flows, and boating flows for the duration of any license; and (2) construct and maintain shoreline access trails on each side of Ward's Ferry Bridge.

2.4.2 La Grange Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) provide for annual environmental training of employees and contractors, rather than bi-annual as proposed (BLM La Grange preliminary 4(e) condition 2); (2) annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project

area (BLM La Grange preliminary 4(e) condition 6); (3) implement pesticide use restrictions on BLM land (BLM La Grange preliminary 4(e) condition 23); (4) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM La Grange preliminary 4(e) condition 26); (5) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (6) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (7) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the project's operation and maintenance (Water Board preliminary 401 condition 9).

Incorporation of these mandatory conditions into a new license would cause us to eliminate the following environmental measure that we include in the staff alternative: develop a plan in consultation with the Water Board, California DFW, FWS, and NMFS to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to the applicants' proposals to relicense the Don Pedro Project and to issue an original license for the La Grange Project, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license; (2) federal government takeover of the projects; and (3) retiring the projects.

2.5.1 Issuing a Non-Power License

A non-power license is a temporary license that the Commission will terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license for either project, and we have no basis for concluding that the projects should no longer be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to licensing either project in this circumstance.

2.5.2 Federal Government Takeover of the Projects

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the Don Pedro and La Grange Projects would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be

recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the projects.

2.5.3 Retiring the Projects

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense and original license applications and surrender or termination of the existing license for the Don Pedro Project with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. Don Pedro Dam and the La Grange Diversion Dam and associated reservoirs serve other important purposes including recreation, consumptive water supply, and flood control, regardless of whether power is produced. Thus, dam removal is not a reasonable alternative to licensing the projects with appropriate protection, mitigation, and enhancement measures.

The second project retirement alternative would involve retaining the dams and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the power supplied by the projects is needed, a source of replacement power would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historical and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[48]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Tuolumne River originates in the Sierra Nevada Mountains in Yosemite National Park and after nearly 8,600 feet of elevation drop converges with the San Joaquin River 150-miles downstream (see figure 3.1-1). The Tuolumne River Watershed covers 1,960 square miles and encompasses a range of climates and hydrologic conditions. Precipitation within the watershed varies from greater than 60 inches at the higher elevations to 12 inches in the lower valley. Within the Don Pedro Project boundary, annual precipitation ranges from 25 to 40 inches and the summer months are hot and dry.

Runoff from the upper basin into Don Pedro Reservoir occurs from April to July with an annual mean of 1.9 million acre-feet minus the out-of-basin diversions by CCSF for municipal and industrial purposes. The watershed's runoff experiences considerable variability and has varied from 382,000 acre-feet in water year 1977 to 4.6 million acre-feet in water year 1983.

[48] Unless otherwise indicated, our information is taken from the amended application for the Don Pedro Project and the final license application for the La Grange Project (Districts, 2017a,b) and additional information filed by the Districts (Districts, 2017g,e, 2018a,b).

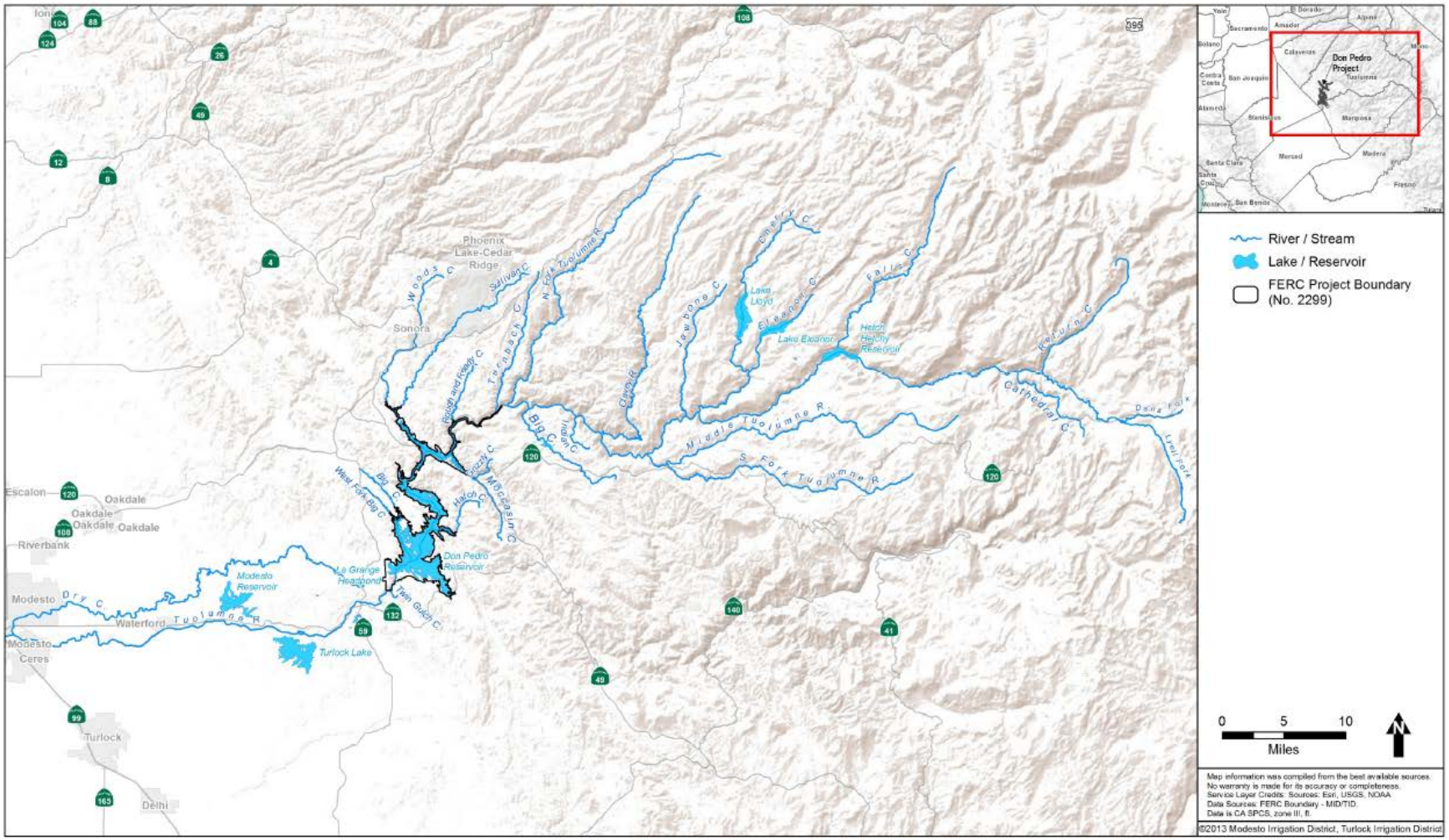

Figure 3.1-1. Tuolumne River Basin (Source: Districts, 2017a).

The Tuolumne River has three major water diversions—O'Shaughnessy Dam (RM 118) and Early Intake Diversion Dam (RM 105), which are associated with the CCSF's Hetch Hetchy System, which generates 1,700,000 MWh of electricity and provides 85 percent of its municipal and industrial water supply annually, and La Grange Diversion Dam (RM 52.2), which is owned by the Districts and diverts water flows downstream of Don Pedro Dam for irrigation, power, and municipal and industrial purposes.

Lands within the Tuolumne River Basin vary by use and ownership. Above the Don Pedro Project, lands are primarily federally managed by the Park Service, Forest Service, and BLM with small communities and dispersed individual residences with non-irrigated farmland composing the private lands. Lands within and adjacent to the project boundary are primarily District owned, while the balance falls within the BLM's Sierra Resource Management Area. Downstream of the Don Pedro Project to the Central Valley, lands are primarily private and used for agriculture, grazing, and residential purposes.

Within Tuolumne County, where the Don Pedro Project is located, the economy is driven by social services, recreation and tourism, retail trade, and construction. The main employers in the county are the Department of Corrections, Sonora Regional Convalescent Home, and Sonora Regional Hospital.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR § 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we identified geomorphology (including coarse sediment supply, substrate composition, and channel shape), water quantity, water quality, aquatic resources (including anadromous fish and EFH), recreation, and socioeconomics as having the potential to be cumulatively affected by the proposed projects in combination with other past, present, and foreseeable future activities.

The following past, current, and foreseeable actions or activities in the San Joaquin Basin may contribute to cumulative effects in the basin:

- historical gold mining and more recent aggregate mining activities in many tributaries, including the Tuolumne River and its tributaries;
- construction of dams and diversions to provide water for consumptive use, retention of sediment, and hydropower production;

- downstream diversions of water for consumptive use, including large-scale diversions in the Sacramento-San Joaquin River Delta;
- agricultural production;
- planned facility improvements and actions of the State Water Project (SWP) and federal Central Valley Project that would affect environmental resources in the Bay Delta that is expected to commence in late 2018 and be completed in 2031[49]; and
- proposed amendments to the 2006 Water Quality Control Plan for the Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), which would establish San Joaquin River flow objectives to protect fish and wildlife and Southern Delta salinity objectives for the protection of agriculture.[50]

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources defines the physical limits or boundaries of the effects of the proposed action on the resources. Our geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effect on the resources, and (2) contributing effects from other hydropower and non-hydropower activities within the San Joaquin Basin including storage and diversion of water to CCSF at the upstream Hetch Hetchy Dam and reservoir and flow diversions in the Sacramento-San Joaquin River Delta. Because the proposed action can affect resources differently, the geographic scope for each resource may vary.

For water quantity, water quality, aquatic resources, and socioeconomics we define the geographic scope as extending from the upstream Hetch Hetchy Dam on the Tuolumne River downstream to San Francisco Bay. For geomorphology, we define the geographic scope as extending from the upstream Hetch Hetchy Dam on the Tuolumne River downstream to the confluence of the Tuolumne and San Joaquin Rivers. For recreational resources, we define the geographic scope as extending from the upper

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[49] On July 21, 2017, California DWR approved the proposed California WaterFix evaluated in the *Bay Delta Conservation Plan/California WaterFix Final EIR/EIS* (California DWR and Reclamation, 2016).

[50] The Water Board released a final proposal to amend the Bay-Delta Plan and released a final substitute environmental document on July 6, 2018, received oral public comments on the topic on August 21 and 22, 2018, and state that its final action will be continued to a future Water Board meeting. These documents are available on the Water Board web page, available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2018_sed/.

extent of Don Pedro Reservoir downstream to the confluence of the Tuolumne and San Joaquin Rivers.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on geomorphology, water quantity, water quality, aquatic resources, recreation, and socioeconomics. Based on the potential term of a license, the temporal scope looked 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information for each resource. We identified the present resource conditions based on the license application, agency comments on the draft license application, comprehensive plans, and other publically available information.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific site-specific and cumulative environmental issues. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

Geologic and Physiographic Setting

The Don Pedro and La Grange Projects are located near the western margin of the Sierra Nevada Mountains, a major mountain chain that is 400 miles long and runs south-southeast to north-northwest in eastern California. The Sierra Nevada crest forms the eastern limit of the Tuolumne River Basin. The projects are located in the Western Sierra Nevada Metamorphic Belt within the Sierra Nevada Block, a 400-mile-long, 40- to 80-mile-wide, tilted fault block, trending north-northwest. The block includes the broad region of foothills along the western slope of the Sierra Nevada Mountains.

The Western Sierra Nevada Metamorphic Belt is divided into three bedrock subunits—the Western, Central, and Eastern belts. The Don Pedro and La Grange Projects overlie the Central Belt. The Central Belt is characterized by ultramafic[51] igneous rocks and metamorphosed volcanic and sedimentary sequences of the Paleozoic

[51] Rocks with a low silica content and rich in minerals such as hypersthene, augite, and olivine.

and Mesozoic eras. Surficial deposits overlie the bedrock units; they consist primarily of colluvial soils and local alluvium in the drainage areas.

Regional uplift and tilting of the Sierra Nevada Block reorganized the drainage networks of the western Sierra Nevada Mountains and initiated a period of sustained channel incision. The Tuolumne River Basin is characterized by high steep-sided ridges and a parallel drainage network consisting of narrow valleys and small tributaries with low sediment loads. The modern Tuolumne River began incising 5 million years ago with existing foothill channels striking perpendicular to ancient channels, leaving the deposits of ancient channels as upland gravels.

Faulting and Seismicity

The western margin of the Sierra Nevada Mountains contains the Foothills Fault System, a dominant structural feature that developed during the Jurassic and Cretaceous periods. The Foothills Fault System is a braided complex of north-northwest-striking fault segments with mineralized zones. Nearby fault segments were reactivated during the Cenozoic era; some were reactivated as recently as during the Quaternary period (1.8 million years ago to the present). The Cleveland Hill Fault, located about 134 miles northwest of the projects, was a previously unmapped fault zone that ruptured during the Oroville earthquake on August 1, 1975. The previously unmapped Cleveland Hill Fault is an extension of the Foothills Fault System (Corps, 1977).

Several faults and shear zones are present within the Foothills Fault System. These faults transect the vicinity of the projects and include, from southwest to northeast, the Bear Mountains Fault, the Bowie Flat fault, and the Melones Fault. All of these faults are classified by the California Divisions of Safety of Dams as *conditionally active*. Both the California Division of Mines and Geology and the California Geological Survey do not classify these faults as active because they have not displayed movement within Holocene time (i.e., 11,400 years). Several unnamed faults that are part of the Bear Mountains Fault Zone cross the Tuolumne River within the La Grange Project. The minor Bowie Flat Fault crosses the Don Pedro Reservoir.

A seismicity and ground motion study performed for Don Pedro Dam in November 1992 finds that earthquakes from faults less than 6 miles from the dam control the maximum ground motion observed, rather than more distant (more than 50 miles from the dam) active regional faults such as the San Andreas and Sierra Nevada frontal faults (Bechtel Corporation, 1992). HDR and Geomatrix (2000) agree with that assessment but recommend that a maximum earthquake of magnitude 6.5 (compared to magnitude 6.25 in the 1992 Bechtel Corporation report) be assigned to the fault traces in the Foothills Fault System. This report classifies all the faults in the system as *conditionally active* and considered the Gillman Gulch Fault, located within the Bear Mountains Fault Zone, as being the controlling fault source. Earthquake ground motions were estimated assuming a maximum earthquake of magnitude 6.5; median bedrock peak ground accelerations were estimated using two available ground motion attenuation

models (Sadigh et al., 1997; Abrahamson and Silva, 1997). Using those models, the reported peak ground accelerations for the Don Pedro Project ranges from 0.50 g to 0.60 g.

The largest earthquake that has occurred along a segment of the Foothills Fault System was the August 1, 1975, Oroville earthquake (Richter magnitude of 5.7), 136 miles northwest of the La Grange Diversion Dam. No major earthquakes have occurred within 60 miles of the projects in recorded history.

Mineral Resources

Gold mining started in the mid-1800s and was the dominant mineral resource activity near the projects. After more accessible gold deposits in river beds and alluvial gravels were depleted, extensive hydraulic and dredge mining operations were introduced. The use of high-pressure jets to extract gold bearing deposits transported sediment into river channels affecting their morphology and resulting in extensive deposits along the river banks. Gold mining declined sharply in the late 1940s. Many abandoned and active mines are scattered throughout the Tuolumne River Basin. Mercury, which was used for gold extraction at the time, remains sequestered in sediments within the region and continues to be a potential source of pollution to the Tuolumne River.

In addition to gold, marble and limestone products were also extensively mined in the vicinity of the projects. The Columbia marble beds northwest of the projects have had a long history of production prior to 1941; two operations are currently processing stone from these deposits. The area also contains deposits of copper, soapstone, scheelite, platinum, silver, sulfur, decorative stone, slate, sand, and gravel.

Large-scale, in-channel aggregate mining began in the Tuolumne River corridor in the 1940s, when aggregate mines extracted sand and gravel directly from large pits located within the active river channel. Legacy pits from these in-channel mining practices remain today. More recent aggregate mining operations have excavated sand and gravel from floodplains and terraces immediately adjacent to the main river channel. Floodplain and terrace pits are typically separated from the main river channel by berms. The Gravel Mining Reach of the lower Tuolumne River (RM 40.3 to 34.2) is currently the focus of development by commercial aggregate producers.

Soils

Soils near the projects are shallow and excessively to well drained. The dominant soil associations are the Whiterock-rock outcrop-Auburn association (71 percent), the Rock outcrop-Henneke-Delpiedra association (18 percent), and the Sierra-rock outcrop-Auberry-Ahwahnee association (8 percent). The Whiterock-rock outcrop-Auburn association is one of the more extensive associations in the foothills of the Sierra Nevada Mountains; it typically develops in tilted slate, amphibolite schist, and partially metamorphosed sandstone formations.

Erosion hazards within the project boundary of the Don Pedro and La Grange Projects are low. Most of the slopes adjacent to the Don Pedro Reservoir and the downstream areas of the Tuolumne River above La Grange Diversion Dam are characterized by intact rock, rubble, or boulder that are not prone to erosion. The land surrounding the La Grange Reservoir is mostly undeveloped. The reservoir is contained within a canyon reach of the Tuolumne River with heavily armored or rock-outcrop shorelines.

Erosion from overland flow in the project vicinities typically occurs on steep soil slopes in excess of 30 degrees. The highest erosion hazards near the projects are associated with the large drainages upstream of the Don Pedro Reservoir (e.g., Hatch Creek and Big Creek). High seasonal flows (i.e., floods) can result in bank erosion along streambanks. Upstream of Don Pedro Reservoir, a large flood in 1997[52] resulted in substantial accumulation of sediment (30 feet deep) near Ward's Ferry Bridge (RM 78) in the upper end of the reservoir.

Stream Geomorphology

Coarse sediment supply and bedload transport capacity govern morphological responses in river channels, including sediment storage, channel form, and bed surface texture. The Tuolumne River channel upstream, within, and downstream of the Don Pedro and La Grange Projects has been substantially altered from its historical state by dredging associated with gold and aggregate mining, dam and reservoir construction, and reduction in peak river flows. Prior to these actions, the Tuolumne River in the project area was a complex river system consisting of single-thread and spilt channels that migrated and avulsed. Over time, these channels became simplified as sediment excavated from the river was placed alongside the river channel, raising the floodplain and depleting the channels of sediment. A large amount of aggregate mining, primarily of sand and gravel, has occurred within the active river channel, creating large in-channel pits, commonly referred to as special run pools (SRPs). These SRPs can be as much as 400 feet wide and 35 feet deep. Agricultural and urban encroachment, in combination with a reduction in coarse sediment supply and high flows, has resulted in a relatively static river channel downstream of the projects.

Upstream of Don Pedro Reservoir, CCSF's reservoirs in the Hetch Hetchy System trap a large volume of sediment, leading to downstream bed coarsening, narrowing, and straightening. Most of the Tuolumne River channel upstream of Don Pedro Reservoir is

[52] Peak outflow of the 1997 event was about 59,400 cfs (recurrence interval of 319 years).

transport-dominated.[53] The river's gradient is steep, and it generally flows through resistant parent material with lateral and vertical control provided by bedrock.

Downstream of La Grange Diversion Dam, the Tuolumne River leaves the steep and confined bedrock valley and enters the eastern Central Valley, where hillslope gradients near the river corridor are typically less than 5 percent. From the La Grange Diversion Dam to the San Joaquin River, the Tuolumne River is divided into two broad geomorphic reaches defined by channel slope and bed composition—a gravel-bedded reach that extends from La Grange Diversion Dam (RM 52.2) to Greer Road Bridge (RM 24) and a sand-bedded reach that extends from Greer Road Bridge to the Tuolumne River's confluence with the San Joaquin River west of Modesto, California.

Channel surveys downstream of La Grange Diversion Dam indicate channel downcutting, widening, armoring, and localized depletion of sediment storage features (e.g., lateral bars and riffles). Bedload impedance reaches[54] were identified from La Grange Diversion Dam to the confluence of the San Joaquin River. These reaches are primarily associated with former instream aggregate extraction areas (e.g., SRPs) and gold dredger pits.

Sediment Processes in the Tuolumne River upstream of La Grange Diversion Dam

The natural sources of fine and coarse sediment to the Tuolumne River are primarily erosion and hillslope processes in the upper watershed in the Sierra Nevada Mountains. Together, the project dams—Don Pedro Dam and La Grange Diversion Dam—on the Tuolumne River trap all coarse sediment larger than 0.08 inch [2 millimeters (mm)] in diameter (gravels, cobbles, and boulders), and most finer bed material (fine gravels, sand, silt, and clay).

An estimated 33 million tons (25 million cubic yards) of total sediment accumulated in Don Pedro Reservoir during the 88-year period from 1923 to 2011, which translates to an average total sediment deposition rate of approximately 375,000 tons per year (289,000 cubic yards per year). McBain & Trush (2004) estimated that the sediment contains on average approximately 10 to 15 percent coarse-grained material (i.e., bedload), which implies a coarse-grained sediment deposition rate of 38,000 to 57,000 tons per year (29,000 to 43,000 cubic yards per year). Since the closure of old Don Pedro Dam in 1971, an estimated 15,700 acre-feet of storage has been lost because

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[53] Transport-dominated channels refer to reaches in a stream where the gradient is usually high enough to supply the energy to transport sediment and where the transport capacity is greater than the sediment supply. As a result, sediment does not accumulate in such reaches, but is transported through them over time.

[54] Locations where current hydraulic conditions are insufficient to transport coarse bed material (typically material with a diameter greater than 4 mm).

of sedimentation, which represents less than 1 percent of the original maximum storage volume of 2,030,000 acre-feet.

Sources for sediment entering La Grange Reservoir are bank erosion, surface erosion, debris flows, side channel development, and in-channel erosion during flood events in the watershed downstream of Don Pedro Dam. These sediment sources create gravel bars and floodplain features in the 2.6-mile river reach.

The largest erosion event after the construction of the new Don Pedro Dam occurred during the January 1997 flood. The Districts estimate that 650,000 tons (500,000 cubic yards) of sediment were eroded from the spillway of Don Pedro Dam to La Grange Reservoir. The spillway was eroded to bedrock, implying that the volume of sediment eroded from the spillway during future floods of similar magnitude will be substantially smaller.

The usable storage capacity of La Grange Reservoir is less than 100 acre-feet, and the current amount of sediment trapped by the dam is not well documented. During the January 1997 flood, it is estimated that the majority of eroded sediment passed through La Grange Reservoir and over the dam, ultimately depositing in downstream reaches of the Tuolumne River.

Sediment Processes in Tuolumne River downstream of La Grange Diversion Dam

Sediment transport flux in the lower Tuolumne River is a function of particle size and the magnitude and duration of peak flows downstream of La Grange Diversion Dam. High flows tend to scour the channel bed. As flows decrease, suspended and bedload sediments settle on the channel bed and in depositional features such as gravel and cobble point bars.

Fine-grained sediment is primarily supplied to the lower Tuolumne River by three tributaries downstream of La Grange Diversion Dam—Gasburg Creek (RM 50.3), Dominici Creek (RM 47.8), and Peaslee Creek (RM 45.5). Gasburg Creek alone supplies an estimated 1,600 tons (1,200 cubic yards) of fine sediment annually to the lower Tuolumne River. In the Tuolumne River reach immediately downstream of La Grange Diversion Dam, fine sediment deposits are most common from Basso Bridge (RM 47.5) to Roberts Ferry Bridge (RM 39.5).

Coarse sediment in the lower Tuolumne River ranges in diameter between 2 mm (fine gravel) to 4 meters (large boulders). Several indicators suggest a deficit in coarse sediment supply downstream of La Grange Diversion Dam. Specifically, the lower Tuolumne River channel lacks bankfull channel confinement and displays cross-sectional dimensions that are not adjusted to the contemporary flow regime. In addition, bedforms such as lateral bars and riffles lack coarse sediment, and riffles throughout the gravel-bedded zone have progressively diminished in size. In addition, SRPs, which occupy 32 percent of the entire gravel-bedded reach between RM 52.2 and RM 24, trap coarse sediment and further deprive downstream reaches of gravel and cobbles.

The Tuolumne River channel in the first 12 miles downstream of La Grange Diversion Dam is slowly downcutting in response to a reduction in coarse sediment supply caused by upstream dams. Erosion occurs primarily during high flow events. Between 2005 and 2012, an estimated 6,000 to 8,700 tons (7,800 to 11,300 cubic yards) of coarse bed material was eroded from the lower Tuolumne River channel between RM 52.2 and RM 45.8. McBain & Trush (2004) estimated a flow above 5,500 cfs is required to mobilize sediment particles in the size range of 2 to 8 mm in the lower Tuolumne River, flows above 7,000 cfs are needed to mobilize sediment particles in the size range of 8 to 128 mm, and flows above 8,200 cfs are required to mobilize sediment particles in the size range of 128 to 160 mm. Figure 3.3.1-1 shows the exceedance probability of peak flow events in the lower Tuolumne River at the USGS gage downstream of La Grange Diversion Dam from 1971 through 2017. A flow of 5,500 cfs has a recurrence interval of 3.2 years, a flow of 7,000 cfs has a recurrence interval of 4.4 years, and a flow of 8,200 cfs has a recurrence interval of 5.4 years. McBain & Trush (2004) estimated that for the lower Tuolumne River, sediment particles for optimal aquatic habitat substrate range in diameter from 8 to 128 mm (i.e., medium gravel to large cobbles).

Since 1999, the Districts, in coordination with California DFW, have mitigated some of the coarse material loss in the lower Tuolumne River by implementing gravel augmentation projects. As part of the 1995 Settlement Agreement, TRTAC developed 10 priority habitat restoration projects separated into three classes based on the project goals and type of restoration activity: (1) channel and riparian restoration, (2) predator isolation, and (3) sediment management. Augmentation projects implemented through 2011 have placed an estimated 58,175 tons of gravel (44,750 cubic yards) in the lower Tuolumne River channel between RM 50 to RM 43.

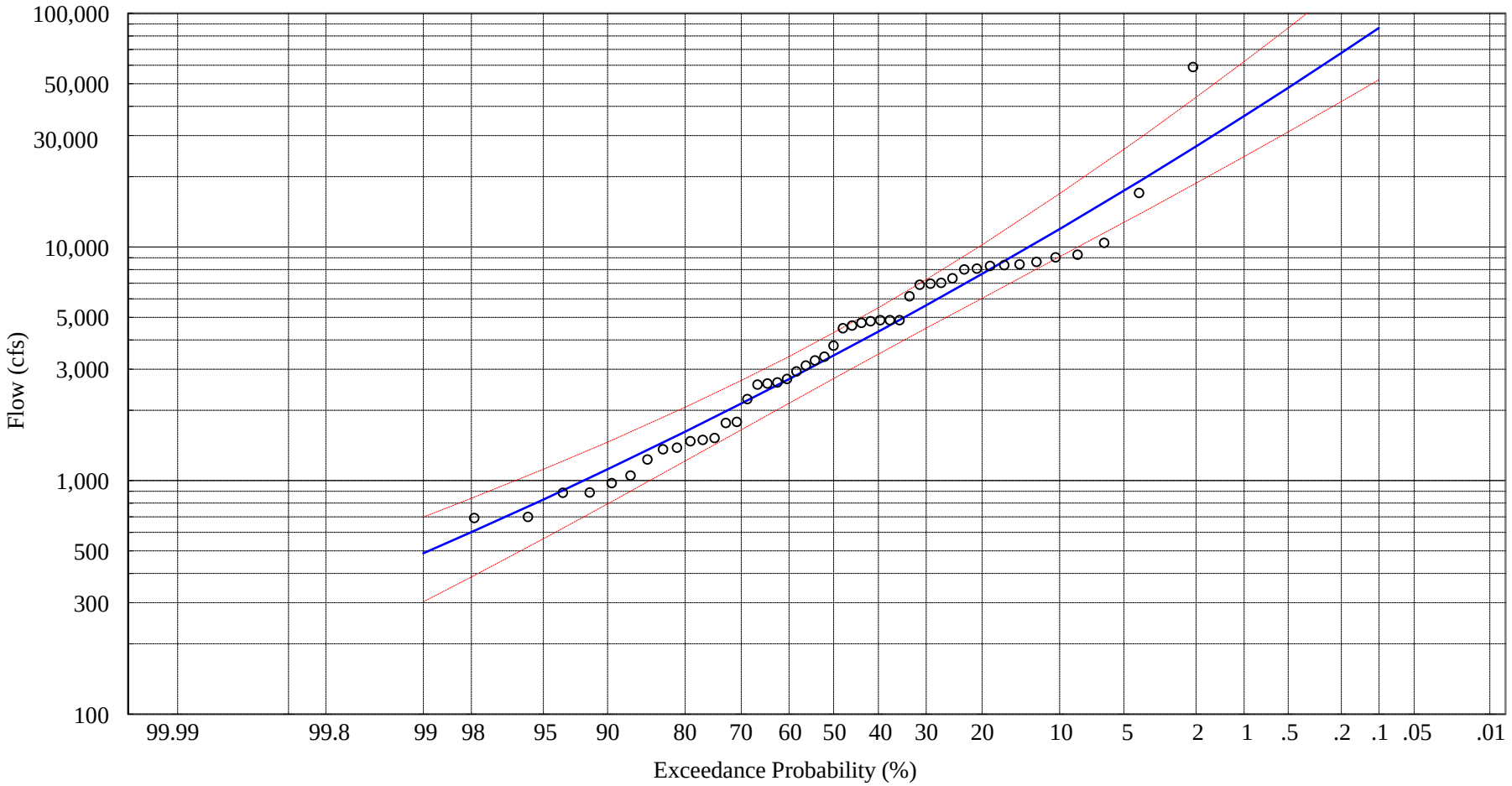

Figure 3.3.1-1 Flood frequency curve for USGS gage below La Grange Diversion Dam (1971–2017) (Source: USGS, 2018a).

3.3.1.2 Environmental Effects

Construction of new recreational facilities, modification of existing recreational facilities, or other ground-disturbing activities could increase soil erosion and fine sediment delivery to project waterways. Fine sediment can adversely affect water quality and associated aquatic habitat by increasing turbidity and total suspended solids. Accumulation of fine sediment in aquatic substrate can adversely affect fish spawning success and limit habitat suitability for many aquatic invertebrates.

Specifically, the Districts propose the following construction activities with the potential to contribute to erosion within the Don Pedro and La Grange Projects: (1) extending the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet, (2) constructing a fish counting/barrier weir in the lower Tuolumne River at RM 25.5, (3) constructing a new boat launch facility located just upstream of old Don Pedro Dam, (4) creating a foot path trail along the river-right shoreline of the La Grange Reservoir, and (5) enhancing existing recreational facilities.[55] The Districts also propose to lower the minimum operating pool of Don Pedro Reservoir from the current elevation of 600 feet to an elevation of 550 feet.

The only erosion control measure the Districts propose is to extend the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet to an elevation of 535 feet. The purpose of this proposal is to limit the potential for erosion if the reservoir is drawn down lower than the current minimum elevation of 600 feet. Areas potentially affected by riprap placement, including staging areas, would be surveyed prior to ground-disturbing activities to assess the need for erosion control measures.

BLM Don Pedro revised 4(e) condition 3 and La Grange preliminary 4(e) condition 3 specify that within 1 year of license issuance, the Districts develop an soil erosion and sediment control plan for ground-disturbing activities on or affecting BLM lands that are within or adjacent to the project boundaries. BLM approval would be required before submitting the final plan to the Commission. BLM states that an effective plan should include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting installed erosion control measures; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and

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[55] The Districts also propose improvements to the existing whitewater boating take-out at the Ward's Ferry Bridge and completing construction of an infiltration gallery at RM 25.9 and new construction of a second infiltration gallery in the same general location. However, as previously noted, neither of these facilities would be appropriate to include as project facilities.

(5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Additionally, BLM's Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts work with BLM to address any ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in this EIS. The Districts, in consultation with BLM, would determine the scope of work and potential for project-related effects and whether additional information is required to proceed with the planned activity. Upon BLM request, the Districts would enter into an agreement with BLM under which the Districts would fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

The Water Board's preliminary 401 condition 9 for the projects specifies that the Districts develop a soil erosion and sediment control plan in consultation with the relevant resource agencies to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the projects' operations and maintenance. The Water Board specifies that this plan should also contain erosion and sediment reduction protocols for ground-disturbing activities that could result in erosion or sediment discharges to surface waters including, but not limited to, any new construction and recreational improvements.

In their reply comments, the Districts propose to work in consultation with BLM to identify BMPs for any ground-disturbing activities on or affecting BLM land that is within the Don Pedro and La Grange Project boundaries. The Districts also propose to consult with the Water Board regarding details of proposed erosion and sedimentation control requirements.

The Districts indicate that they do not expect future project operations to have a measureable adverse impact on the shoreline resources of Don Pedro Reservoir or the La Grange Reservoir. The Districts note that erosion hazards within the project boundaries are low. Most of the shoreline adjacent to the Don Pedro Reservoir is characterized by intact rock, rubble, or boulder that is not prone to erosion, and the land surrounding Don Pedro Reservoir and the La Grange Reservoir is mostly undeveloped. The La Grange Reservoir is contained within a canyon reach of the Tuolumne River with mostly rocky shorelines. To prevent erosion of soil material into La Grange Reservoir during flood events, the Districts would continue the existing practice of removing the portion of road crossing the Don Pedro spillway when extreme high flow conditions necessitate the use of the spillway, which has only happened twice since the project was constructed.

Our Analysis

The Districts propose to rehabilitate existing recreational facilities, construct new recreational facilities, and construct additional project features (i.e., fish counting/barrier weir) at the projects. Construction of any type would likely result in ground-disturbing activities that could cause localized erosion and associated water quality and habitat

degradation in Don Pedro Reservoir, La Grange Reservoir, and in the Tuolumne River downstream of the proposed project facilities. The Districts' proposal to establish BMPs for erosion control for any ground-disturbing activity on BLM-administered lands within the Don Pedro and La Grange Project boundaries could serve as an effective tool to minimize potential erosion and sedimentation; however, the Districts provide few details about their proposed BMPs and the Districts' proposal and BLM's Don Pedro revised 4(e) condition 3 and La Grange preliminary 4(e) condition 3 are limited to ground-disturbing activities on BLM-managed land. Any ground-disturbing activity, including non-routine maintenance, has the potential to result in erosion and sedimentation. Consequently, developing soil erosion and sediment control plans would be appropriate for project construction activities authorized by the licenses of both projects.

An effective site-specific soil erosion and sediment control plan would include, at a minimum, the five provisions described above for the BLM recommendation and procedures for submitting each plan to appropriate agencies (e.g., BLM, the Water Board, California DFW, NMFS, and FWS) and the Commission for review at least 90 days in advance of initiating ground-disturbing activities to ensure that all appropriate erosion control measures are included.

Developing a soil erosion and sediment control plan that identifies the BMPs for specific construction activities, inspection protocols, techniques that would be used to stabilize sites once construction is completed, and monitoring protocols for potentially affected surface waters would minimize the potential for degradation of water quality from erosion during construction.

During project operation, erosion of soil may occur during stormwater runoff from exposed surfaces such as dirt roads, trails, and other unpaved areas. Project operation may also result in some shoreline erosion along the Don Pedro Reservoir. However, effects of project operation on shoreline erosion rates would be small because much of the shoreline consists of rock outcrop and shallow soil. Erosion from waves on the reservoir is also limited because the irregular shaped reservoir keeps the fetch[56] relatively short and therefore limits wave heights.

During daily operations and maintenance, erosion related to the use of the Don Pedro and La Grange Project spillways and dam outlet facilities is minimal and not likely to result in adverse effects on the lower Tuolumne River. The Don Pedro spillway, founded on rock, discharges directly to a bedrock-confined channel (Twin Gulch), and the outlet works tunnel discharges into a bedrock-lined portion of the Tuolumne River downstream of the Don Pedro Powerhouse. The spillway channel and Twin Gulch are kept dry, except occasionally during seasonal rainy periods. Since the completion of the

[56] The term *fetch* is the straight-line distance across a waterbody that is subject to the forces of wind. The *fetch* is a factor used in determining wave heights in a reservoir.

new Don Pedro Dam in 1971, the Don Pedro Project spillway has been used only twice (1997 and 2017) to discharge flood flows to the lower Tuolumne River.

Although normal project operation and maintenance (i.e., non-flood conditions) would not substantially contribute to erosion downstream of Don Pedro Reservoir, large flood events can result in substantial sediment movement into the La Grange Reservoir and the lower Tuolumne River. During the 1997 flood, peak inflow to Don Pedro Reservoir was estimated to be 121,000 cfs and peak outflow was estimated to be about 59,400 cfs (recurrence interval of 319 years), as measured at the USGS La Grange gage. The 1997 flood eroded 500,000 cubic yards of sediment from the Twin Gulch channel, resulting in the deposition of sediment at the confluence of the Twin Gulch channel with the Tuolumne River above the La Grange Reservoir, within the La Grange Reservoir, and in the lower Tuolumne River. On February 20, 2017, the Don Pedro Reservoir spilled for the second time, and the maximum release was 19,100 cfs (recurrence interval of 24 years).

Based on current conditions, flood events smaller than the 1997 flood event are not expected to result in significant erosion in the Twin Gulch channel and significant sediment movement into the La Grange Reservoir and lower Tuolumne River. A review of Google Earth aerial imagery from 1998 to 2017 shows that following the 1997 flood event, the Twin Gulch channel below the Don Pedro Project spillway accumulated minimal erodible sediment and maintained a bedrock substrate. As such, the volume of sediment moved during the 2017 is not known, but it was probably much lower than the amount of sediment eroded during the 1997 flood event. However, in both flood events, high flood waters would have completely eroded Bonds Flat Road, which crosses the Twin Gulch channel just downstream of the spillway release, resulting in the deposition of sediment in the La Grange Reservoir and lower Tuolumne River. Any future flood events requiring the use of the emergency spillway would likely have the same effect on Bonds Flat Road if it is constructed in the same location. However, the Districts' existing practice to remove the portion of Bonds Flat Road that crosses the Don Pedro Project spillway during extreme flood conditions when use of the spillway is anticipated prevents this material from flowing into the Tuolumne River and the La Grange Reservoir.[57]

3.3.1.3 Cumulative Effects

The geomorphology of the lower Tuolumne River has been affected by past gold mining practices, aggregate mining, and trapping of sediments in reservoirs within and upstream of the projects. Don Pedro Dam and La Grange Diversion Dam would continue to trap coarse sediment, and O'Shaughnessy Dam, located about 40 miles upstream of Don Pedro Reservoir, also traps sediment bedload transported by the Tuolumne River into the Hetch Hetchy System during high-flow events. In addition, aggregate mining

[57] The Districts' practice to remove Bonds Flat Road is referenced in the County of Tuolumne REA response letter filed with the Commission on January 17, 2018.

has removed large volumes of coarse sediment from the lower Tuolumne River downstream of La Grange Diversion Dam, reducing the amount of gravel suitable for salmon spawning and creating deep pool (SRPs), which provide favorable habitats for predatory fish. The Districts' proposed gravel augmentation program (discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Spawning Habitat Improvement*) would help to restore the quantity of gravel suitable for salmon spawning in the reach downstream of La Grange Diversion Dam (RM 52.2) and RM 39 and would begin to fill a small proportion of the SRP areas.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

*Water Storag*e

Don Pedro Reservoir is located on the Tuolumne River between RM 80.8 and Don Pedro Dam at RM 54.8. Water released from the Don Pedro Project enters the La Grange Reservoir created by the La Grange Diversion Dam located on the Tuolumne River at RM 52.2. The Districts divert and convey water from the river at the La Grange Project for irrigation and municipal and industrial water supply. Water released from the Don Pedro Project, and not diverted by the Districts at the La Grange Project, passes through the La Grange Reservoir to the lower Tuolumne River.

The Don Pedro Project attenuates high flows in the Tuolumne River from winter storms and spring runoff and stores the water in Don Pedro Reservoir. At the normal maximum water surface elevation of 830 feet, Don Pedro Reservoir has a surface area of 12,960 acres, a gross storage capacity of 2,030,000 acre-feet, and a usable storage capacity of 1,721,000 acre-feet. The current minimum operating water surface elevation of Don Pedro Reservoir is 600 feet. The Don Pedro Project typically reaches its usable storage capacity of at the end of the spring runoff season in June and is gradually drawn down through the irrigation season, which typically extends through September. The drainage area upstream of Don Pedro Dam is about 1,533 square miles.

In accordance with Corps regulations, the Districts reserve 340,000 acre-feet of usable capacity in Don Pedro Reservoir for flood storage from October through April for conditional flood space thereafter, depending on the anticipated snowmelt runoff during April, May, and June. Consistent with agreements between the Districts and CCSF, the Don Pedro Project also provides a water bank of 570,000 acre-feet of storage that CCSF uses to help manage the water supply of its Hetch Hetchy System while meeting the senior water rights of the Districts. Figure 3.3.2-1 shows the operational rule curves for the Don Pedro Project in representative wet, normal, and dry water years. The flood storage curve is defined by the Corps for flood management operations and the storage curves represent average monthly storage levels for each water year.

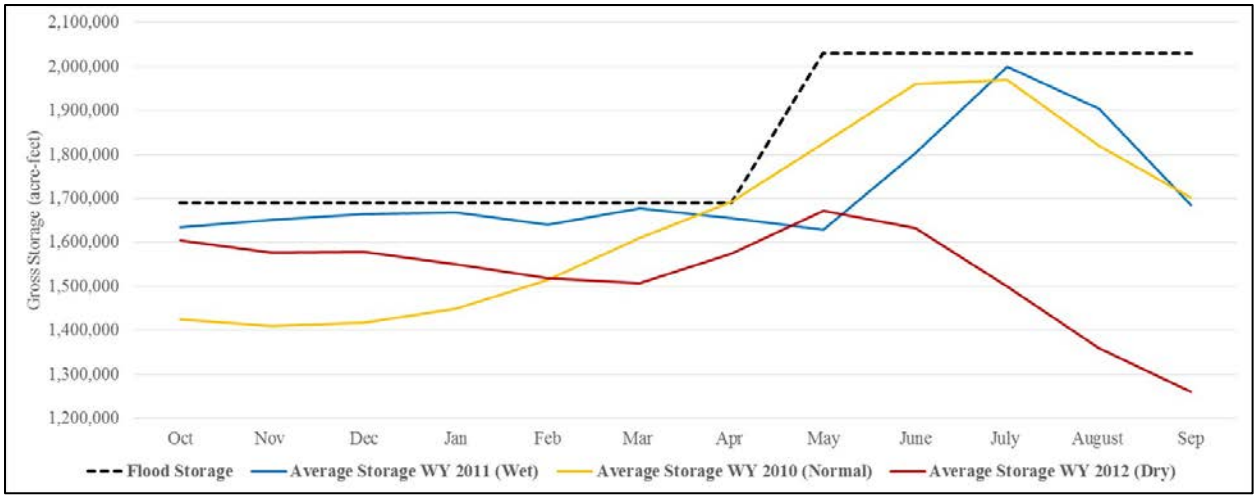

Figure 3.3.2-1. Don Pedro Reservoir storage curves for water years 2010–2012 (Source: USGS, 2018b).

Under non-spill conditions, La Grange Reservoir has a surface area of 35 acres, a gross storage capacity of 400 acre-feet, and a usable storage capacity of about 100 acre-feet. The surface elevation of the La Grange Reservoir varies between about 294 feet and 296 feet about 90 percent of the time. The drainage area upstream of the La Grange Diversion Dam is about 1,535 square miles.

Project-affected Stream Reaches

Project operation affects streamflows in the Tuolumne River downstream of Don Pedro Dam and in the lower Tuolumne River below La Grange Diversion Dam. Table 3.3.2-1 shows average annual and monthly flow statistics for these stream reaches, and table 3.3.2-2 presents the 10, 50, and 90-percent flow exceedances for each stream reach.

Tuolumne River above Don Pedro Reservoir—The Tuolumne River originates in Tuolumne Meadows in Yosemite National Park and flows westward for about 71 miles before it enters Don Pedro Reservoir at RM 80.8. Upstream of the Don Pedro Project, non-project inter-basin water transfers from the Tuolumne River to the San Francisco Bay Area reduce the volume of water that enters Don Pedro Reservoir. The largest inter-basin water diversions occur from CCSF's O'Shaughnessy Dam, which impounds the 360,400 acre-foot Hetch Hetchy Reservoir. The Hetch Hetchy System delivers an average of 265,000 acre-feet of water each year, providing 85 percent of CCSF's Bay Area municipal and industrial water supply. CCSF also owns and operates Early Intake Diversion Dam, which is used to divert water supplied by CCSF's Cherry Creek facilities during emergency and extreme drought conditions.

Table 3.3.2-1. Mean annual and monthly flow (cfs) of project-affected stream reaches for the period of record (water years 1971–2017) (Source: USGS, 2018c–2018j).

USGS Gage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Streamflow Gages Upstream of Don Pedro Reservoir													
11276900 Tuolumne River below Early Intake near Mather, California (RM 104.4) (USGS, 2018c)	280	339	430	594	1,570	2,050	923	212	111	76	93	163	570
11278400 Cherry Creek below Dion R. Holm Powerhouse near Mather, California (RM 0.2) (USGS, 2018d)	663	705	820	1,000	1,280	1,190	757	481	392	351	366	491	708
11281000 South Fork Tuolumne River near Oakland Recreation Camp, California[a] (USGS, 2018e)	95	154	199	216	246	137	41	14	11	14	32	53	101
11282000 Middle Fork Tuolumne River at Oakland Recreation Camp, California[a] (USGS, 2018f)	50	82	110	164	289	199	52	9	5	7	18	28	84

USGS Gage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Streamflow Gages Downstream of Don Pedro Reservoir													
11289000 Modesto Canal near La Grange, California (RM 53.2) (USGS, 2018g)	63	62	274	527	652	772	859	764	494	283	161	105	418
11289500 Turlock Canal near La Grange, California (RM 53.2) (USGS, 2018h)	131	168	583	1,030	1,190	1,460	1,760	1,530	793	391	169	182	782
11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (RM 51.7) (USGS, 2018i)	1,440	1,770	1,850	1,860	1,640	959	521	336	441	555	330	790	1,041
11290000 Tuolumne River at Modesto, California (RM 16.3) (USGS, 2018j)	1,760	2,080	2,170	2,070	1,830	1,130	690	494	625	762	594	1,030	1,270

[a] Period of record (water years 1971–2002)

Table 3.3.2-2. 10, 50, and 90-percent flow exceedances of project-affected stream reaches for the period of record (water years 1971–2017) (Source: USGS, 2018c–2018j).

	Percent Exceedance (cfs)		
USGS Gage	**10**	**50**	**90**
Streamflow Gages Upstream of Don Pedro Reservoir			
11276900 Tuolumne River below Early Intake near Mather, California (RM 104.4)	1,400	122	48
11278400 Cherry Creek below Dion R. Holm Powerhouse near Mather, California (RM 0.2)	1,390	575	53
11281000 South Fork Tuolumne River near Oakland Recreation Camp, California	277	31	5
11282000 Middle Fork Tuolumne River at Oakland Recreation Camp, California	247	21	2
Streamflow Gages Downstream of Don Pedro Reservoir			
11289000 Modesto Canal near La Grange, California (RM 53.2)	960	367	0
11289500 Turlock Canal near La Grange, California (RM 53.2)	1,850	643	1
11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (RM 51.7)	3,420	231	18
11290000 Tuolumne River at Modesto, California (RM 16.3)	3,970	416	157

Tuolumne River below Don Pedro Reservoir and above La Grange Diversion Dam—From Don Pedro Dam, the Tuolumne River flows southwest about 1.6 miles to where it enters the La Grange Reservoir near RM 53. Outflows from Don Pedro Reservoir reflect real-time operations by the Districts to manage flows in accordance with storage requirements, Corps flood control guidelines, and diversions for downstream irrigation and municipal and industrial uses. Water releases are also provided to benefit fish and aquatic resources in the lower Tuolumne River. Flow in the Tuolumne River above La Grange Diversion Dam (i.e., total outflow from Don Pedro Reservoir) is represented by the sum of flows measured at three USGS gages: (1) gage 112896050 (Tuolumne River below La Grange Diversion Dam near La Grange, California), (2) gage 11289000 (Modesto Canal near La Grange, California), and (3) gage 11289500 (Turlock Canal near La Grange, California).

Tuolumne River below La Grange Diversion Dam—The lower Tuolumne River extends 52.2 miles from La Grange Diversion Dam to the river's confluence with the San Joaquin River just west of Modesto, California. USGS gage 11289650 (Tuolumne River below La Grange Diversion Dam near La Grange, California) is located 0.5 mile downstream of La Grange Diversion Dam and captures a drainage area of 1,538 square miles.

Throughout this portion of the Tuolumne River, diversions for other non-project water uses (i.e., irrigation) are common. California Department of Water Resources (California DWR) lists 26 points of diversion along the lower Tuolumne River between La Grange Diversion Dam and the San Joaquin River. The diversions have an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Runoff from Dry Creek, agricultural return flows, groundwater seepage, and operational spills from irrigation canals all enter the lower portion of the Tuolumne River. Average monthly accretion flows in the lower Tuolumne River range from 40 cfs to 200 cfs with an estimated annual average accretion flow rate of 152 cfs (water years 1970–2010). Beginning on October 1 of each year, flows provided by the Don Pedro Project to the lower Tuolumne River, as measured at the USGS streamflow gage at La Grange, are adjusted to meet license requirements to benefit upmigrating adult fall-run Chinook salmon; these flows include a pulse flow, the amount of which varies depending on the water year type. In addition, flows provided by the Don Pedro Project are adjusted on October 16 of each year and maintained through May 31 of the following year to protect egg incubation, emergence, fry and juvenile rearing, and smolt outmigration of fall-run Chinook salmon; these flows include a spring pulse flow, the amount of which varies depending on the water year type. The peak flows and volume of water that have been allocated to provide pulse flows during the spring and fall each year since 1995 are shown in table 2.1.5-2.

USGS gage 11290000 (Tuolumne River at Modesto, California), which captures a drainage area of 1,884 square miles, measures flow in the Tuolumne River downstream from all project facilities and Dry Creek. The USGS streamflow gage at Modesto is the compliance point for the Corps flood control operations guideline of 9,000 cfs.

Water Rights and Water Supply Deliveries

The Raker Act, passed by Congress in 1913, authorized CCSF to build certain water and power facilities on federal lands and addressed the allocation of the waters of the Tuolumne River between the Districts and CCSF. Following the passage of the Raker Act, the Districts and CCSF entered into a series of agreements, culminating in the Fourth Agreement, which defines the allocation of the waters of the river between CCSF and the Districts and the associated water bank accounting. The water bank provision allows CCSF to pre-release water from its upstream facilities into a water bank in Don Pedro Reservoir, so at other times (e.g., during low water years), CCSF can hold back an equivalent amount of water that otherwise would have had to be released to satisfy the Districts' senior water rights.

The Districts have several individual water rights on the Tuolumne River, including certain appropriative water rights acquired in 1855, riparian water rights, additional pre-1914 appropriative water rights, and post-1914 appropriative water right licenses (license numbers 11057 and 11058) issued by the Water Board. The water rights recognized under license numbers 11057 and 11058 permit the use of water for irrigation, power generation, and recreation. The licenses also allow the storage, withdrawal from storage, diversion, and re-diversion of Tuolumne River water. Specifically, licenses 11057 and 11058 permit the Districts to annually: (1) store 1,046,800 acre-feet of water, (2) divert and re-divert 1,371,800 acre-feet of water, and (3) withdraw 951,100 acre-feet of water for consumptive water needs (i.e., irrigation and municipal and industrial water supply).

Total demand for Tuolumne River water during normal water years is about 1.5 million acre-feet. The Districts annually supply about 850,000 acre-feet of irrigation water and 67,500 acre-feet of municipal and industrial water to meet consumptive water demands. Irrigation deliveries typically begin in early March, normally reach their peak in July and August, and end in late October/early November. Municipal and industrial water supplies are delivered year-round.

Water Quality

The *Water Quality Control Plan for the Sacramento and San Joaquin Basins* (Basin Plan) designates existing and potential beneficial uses and water quality objectives for the Tuolumne River (CVRWQCB, 2016). Table 3.3.2-3 presents the existing and proposed designated beneficial uses for three sections of the Tuolumne River: (1) upstream of the Don Pedro Reservoir, (2) Don Pedro Reservoir, and (3) the river downstream of Don Pedro Dam. Designated beneficial uses for the reaches upstream and downstream of Don Pedro Reservoir are similar with the exceptions that the lower reach includes anadromous fish migration and spawning and does not include hydropower. Hydropower is not currently a designated beneficial use of the Tuolumne River downstream of Don Pedro Dam, even though the existing La Grange Project is located in the reach. Table 3.3.2-4 presents the Basin Plan water quality objectives to support these designated beneficial uses, and table 3.3.2-5 provides mercury water quality objectives approved by the U.S. Environmental Protection Agency (EPA) on July 14, 2017.

Table 3.3.2-3. Existing and proposed designated beneficial uses of the Tuolumne River Basin (Source: CVRWQCB, 2016).

Designated Beneficial Uses[a]	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
Municipal and domestic supply	Existing	Proposed	Proposed
Irrigation	Existing	NA	Existing
Stock watering	Existing	NA	Existing
Hydropower	Existing	Existing	NA
Contact recreation	Existing	Existing	Existing
Canoeing and rafting[b]	Existing	NA	Existing
Other noncontact recreation	Existing	Existing	Existing
Warm freshwater habitat[c,d]	Existing	Existing	Existing
Cold freshwater habitat[c]	Existing	Existing	Existing
Salmon and steelhead migration	NA	NA	Existing
Salmon and steelhead spawning	NA	NA	Existing
Striped bass, sturgeon, and shad spawning	NA	NA	Existing
Wildlife habitat	Existing	Existing	Existing

Notes: The designated beneficial uses are to be protected for all waters except in specific cases where evidence indicates the appropriateness of additional or alternative beneficial use designations.
NA – not applicable.

[a] Although the current Basin Plan defines the beneficial uses of groundwater recharge, freshwater replenishment, and preservation of rare and endangered species, the plan states that the surface waters falling within these beneficial uses will be identified in the future.

[b] Implies certain flows are required for this beneficial use.

[c] For resident, not anadromous, species.

[d] Where both warm and cold freshwater habitat are designated, the more conservative coldwater quality objectives take precedence.

Table 3.3.2-4. Water quality objectives to support designated beneficial uses in the Tuolumne River Basin (Source: CVRWQCB, 2016).

Water Quality Objective	Description
Temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in water temperature does not adversely affect beneficial uses. At no time or place, shall the temperature of cold or warm freshwater habitat be increased more than 5.0°F above natural receiving-water temperature.
Bacteria	In waters designated for contact recreation, fecal coliform concentration must be: (1) less than a geometric mean of 200 per 100 milliliters water based on a minimum of five samples collected in any 30-day period, and (2) less than 400 per 100 milliliters of water in at least 90 percent of all samples taken in a 30-day period.
Biostimulatory substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.
Chemical constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, waters designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in Title 22 of the California Code of Regulations.
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
DO	The DO concentrations shall not be reduced below the following minimum levels at any time. • Waters designated as warm freshwater habitat: 5.0 mg/L • Waters designated as cold freshwater habitat: 7.0 mg/L • Waters designated as spawning habitat: 7.0 mg/L In the Tuolumne River from Waterford to La Grange, DO concentrations shall not be reduced below 8.0 mg/L between October 15 and June 15.[a] The monthly median of the mean daily DO concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation.

Water Quality Objective	Description
Floating material	Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.
Oil and grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
Pesticides	Waters shall not contain individual pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses.[b] Waters designated for use as domestic or municipal supply shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Code of Regulations, Title 22, Division 4, Chapter 15 or contain concentrations of thiobencarb in excess of 1.0 microgram per liter.[c]
pH	The pH of surface shall neither be depressed below 6.5 nor raised above 8.5.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses.
Settleable material	Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.
Suspended material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Taste and odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies, fish flesh, or other edible products of aquatic origin; or that cause nuisance; or otherwise adversely affect beneficial uses.[d]
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analysis of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the Regional Water Quality Control Board.

Water Quality Objective	Description
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: • where natural turbidity is less than 1 NTU, turbidity shall not cause downstream turbidity to exceed 2 NTU; • where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU; • where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent; • where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTU; • where natural turbidity is greater than 100 NTU, increases shall not exceed 10 percent

Notes: DO—dissolved oxygen, °F—degrees Fahrenheit, mg/L—milligrams per liter, NTU—nephelometric turbidity unit

[a] Because the Basin Plan does not specify river miles for this reach, we used available information to identify the river miles as approximately RM 31.5 to RM 52.2.

[b] The Basin Plan defines pesticide as: "(1) any substance, or mixture of substances, which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant, or (3) any breakdown products of these materials that threaten beneficial uses."

[c] Thiobencarb, also referred to as benthiocarb, is an active ingredient of rice herbicides including Bolero® and Abolish®.

[d] Taste and odor limits for drinking water are provided as secondary maximum contaminant levels in Title 22 of the California Code of Regulations.

Table 3.3.2-5. Methylmercury water quality objectives to support designated beneficial uses in the Tuolumne River Basin.[a]

Water Quality Objective	Description
Sport Fish (human health and wildlife)[b]	Wet weight concentration in skinless fillet of highest trophic level fish shall not exceed 0.2 mg/kg within a calendar year. This objective applies to trophic level 3 fish of 150–500 mm total length and trophic level 4 fish of 200–500 mm total length.
Prey Fish (wildlife)	Wet weight concentration in whole fish 50 to 150 mm total length shall not exceed 0.05 mg/kg between February 1 and July 31.

Notes: mg/kg – milligrams per kilogram wet weight, mm – millimeters.

[a] Source: Letter from Tomás Torres, Director, Water Division, EPA, San Francisco, California, to Felicia Marcus, Chair, Water Board, Sacramento, California, regarding Water Quality Control Plan for inland surface waters, enclosed bays, and estuaries of California—Tribal and subsistence fishing beneficial uses and mercury provisions, dated July 14, 2017. Available at: https://www.epa.gov/sites/production/files/2017-07/documents/ca_hg_approval_letter_with_enclosures_signed_071417.pdf. Accessed September 25, 2018.

[b] Trophic level 3 are secondary consumers and tropic level 4 fish are piscivorous fish.

The latest (2012) EPA-approved list of California's water-quality limited waterbodies under section 303(d) of the CWA includes several waterbodies within the Tuolumne River Basin (Water Board, 2015). The listed waterbodies and the parameter(s) for which they are included are as follows[58]:

- Hetch Hetchy Reservoir—mercury
- Sullivan Creek from Phoenix Reservoir to Don Pedro Reservoir—*Escherichia coli* (*E. coli*)
- Woods Creek[59]—*E. coli*
- Don Pedro Reservoir—mercury

[58] Listed from upstream to downstream.

[59] Tributary to Don Pedro Reservoir.

- Lower Tuolumne River—water temperature, mercury, chlorpyrifos, diazinon, Group A pesticides,[60] and unknown toxicity
- Modesto Lake—mercury
- Turlock Lake—mercury
- Dry Creek—*E. coli*, chlorpyrifos, diazinon, and unknown toxicity

Potential sources were not identified for any of these 2012 303(d) listings (Water Board, 2015), although the 2010 303(d) list identified potential sources as agriculture for all the basin's listings of chlorpyrifos, diazinon, and Group A pesticides; resource extraction for mercury in Don Pedro Reservoir and the lower Tuolumne River; and unknown for other listings (Water Board, 2011). Total Maximum Daily Loads are expected to be completed for all of these 303(d) listings by 2021 (Water Board, 2015).

Although the 303(d) list includes mercury for Don Pedro Reservoir, the lower Tuolumne River, and other waterbodies in the basin, Don Pedro Reservoir is the only waterbody in the basin with a California Office of Environmental Health Hazard Assessment of a site-specific advisory warning for eating fish (OEHHA, 2018a). This advisory provides recommended guidelines for eating black bass species including largemouth bass, suckers, sunfish species, channel catfish, and common carp (OEHHA, 2018b). In addition, a statewide advisory for eating fish from lakes and reservoirs applies to other lakes and reservoirs in the basin (OEHHA, 2013a,b). California's statewide mercury control program for reservoirs is addressing mercury control for 132 reservoirs, including Hetch Hetchy Reservoir, Don Pedro Reservoir, Modesto Lake, and Turlock Lake (Water Board, 2017; Water Board and California EPA, 2017).

Site-specific Water Quality Data

Based on the Districts' water temperature and DO vertical profile data, Don Pedro Reservoir typically stratifies throughout the year, although stratification is weakly defined in the winter (figures 3.3.2-2 and 3.3.2-3). As is typical, the depth and strength of the thermocline varies seasonally and depends on general runoff patterns for the year. Reservoir temperatures are coolest in January and typically range from 9 to 15 degrees Celsius (°C) in winter with stratification strengthening as spring nears. During spring and early summer, near surface temperature warms to a maximum that occurs in July or August and thermal stratification further strengthens followed by seasonal cooling of air temperature and reservoir near surface temperatures.

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[60] Chlorpyrifos and diazinon are pesticides, and Group A pesticides include one or more of the following compounds: dieldrin, endrin, alpha-chlordane, gamma-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane, heptachlor, and heptachlor epoxide (CVRWQCB, 2009).

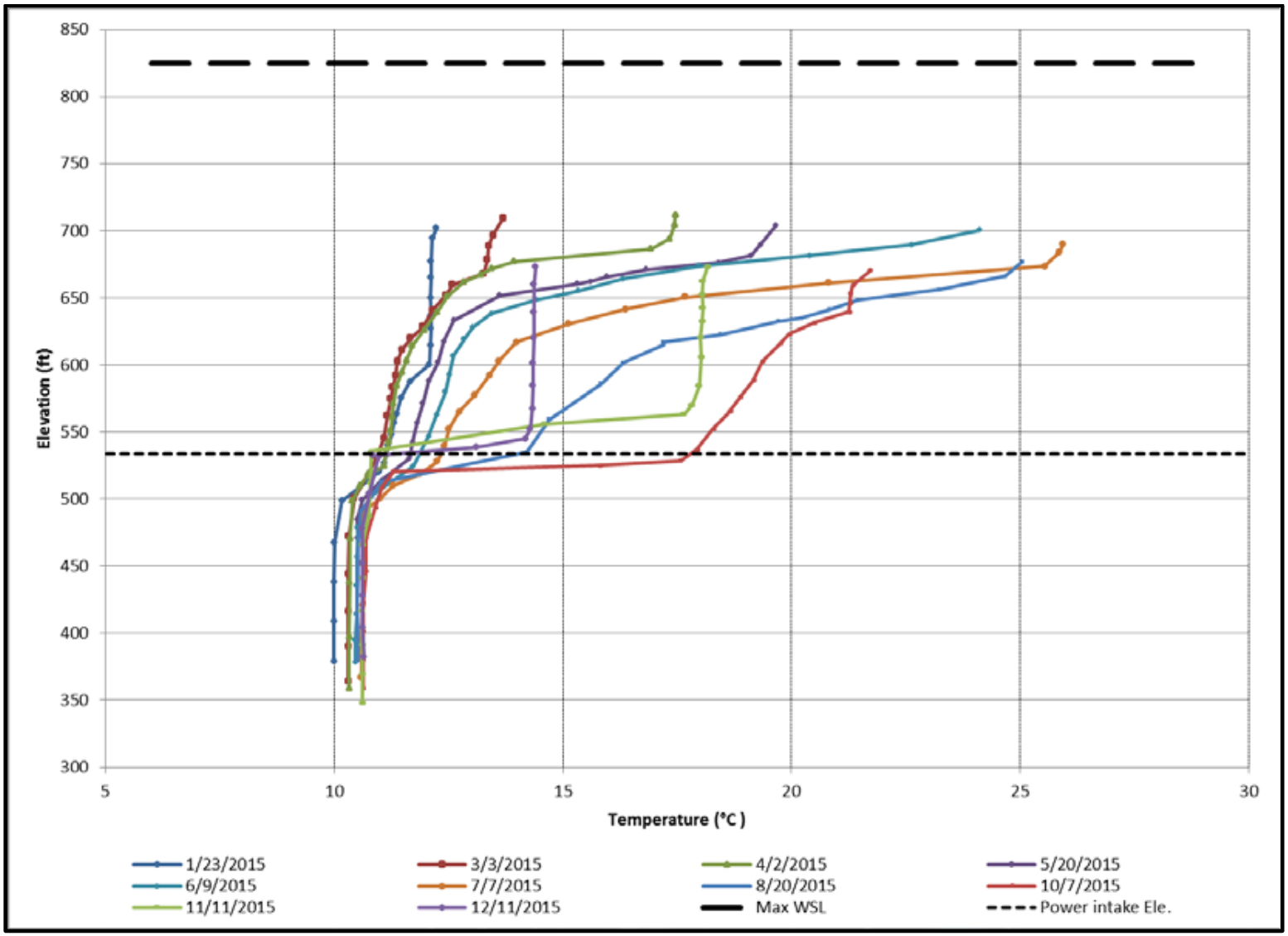

Figure 3.3.2-2. Water temperature profiles recoded in Don Pedro Forebay in 2015 (Source: Districts, 2017a).

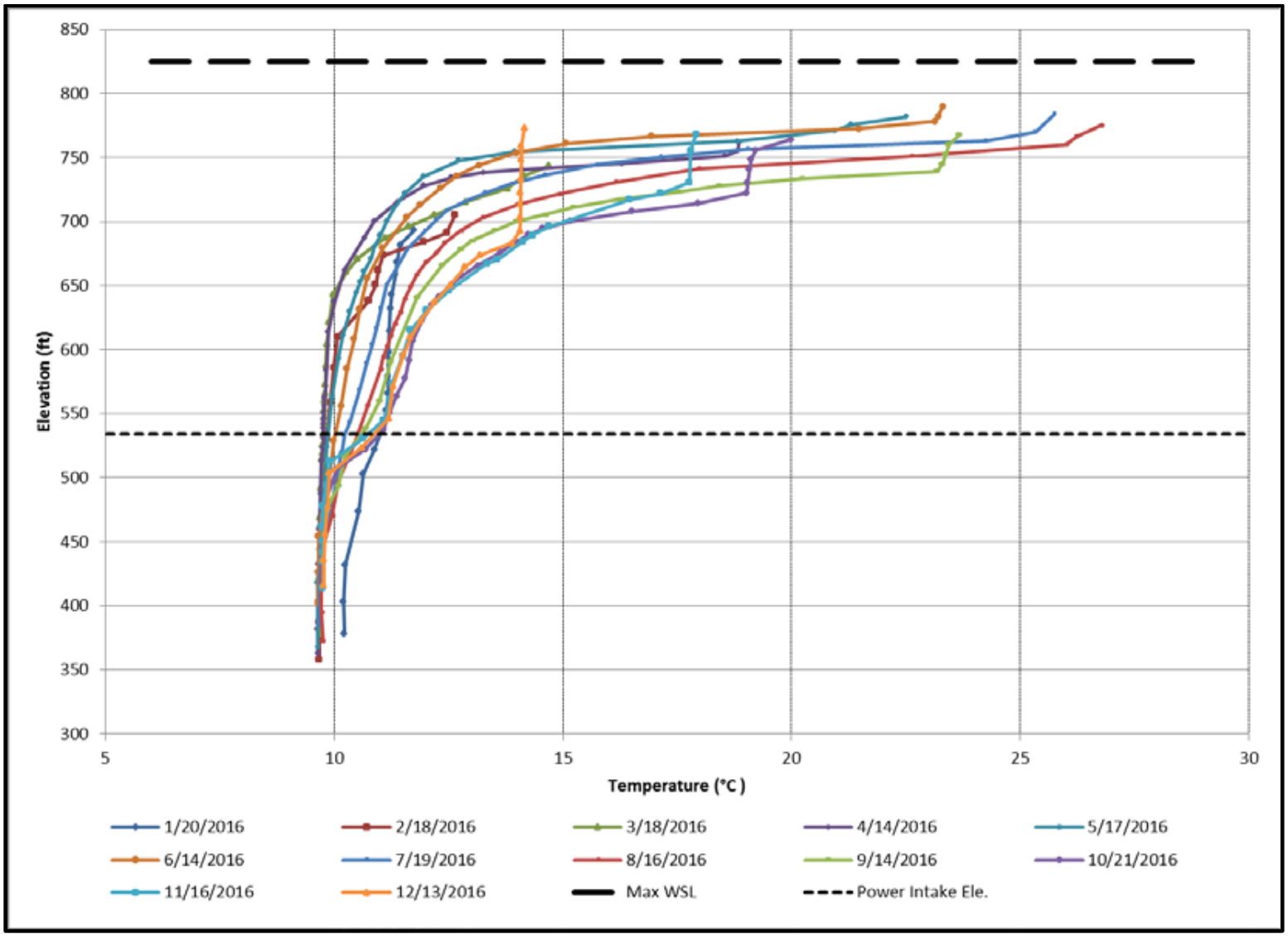

Figure 3.3.2-3. Water temperature profiles recoded in Don Pedro Forebay in 2016 (Source: Districts, 2017a).

The timing and depth to which this seasonal pattern occurs is highly dependent on the volume of water in the reservoir, the magnitude of inflows and weather. For example, the warm upper layer in November was less than 50 feet deep in 2016 when the reservoir's water level was about 770 feet, but 100 feet deep in 2015 when the reservoir's water level was drawn down to an elevation of about 670 feet. From June through September (and sometimes in May and October), surface water temperatures exceed 20.0°C and extend to depths that are dependent on season. Figures 3.3.2-2 and 3.3.2-3 show that water temperature at the depth of the powerhouse intake is generally 9.5 to 12°C but can reach about 18°C in some periods with the reservoir drafted to a water level of about 670 feet.

Mean monthly temperatures in Don Pedro Reservoir hypolimnion near the powerhouse intake, Don Pedro Project outflows, and above La Grange Diversion Dam are relatively stable at about 10 to 12°C throughout the year (table 3.3.2-6). Mean monthly temperatures are a little cooler in Don Pedro Project's outflow than near the dam at the powerhouse intake depth likely because some of the withdrawal is drafted from below the intake elevation. Little thermal stratification or warming occurs in the La Grange Reservoir because of the reservoir's minimal storage and run-of-river operation. Review of USGS water temperature data for gage 11289650 below La Grange Diversion Dam shows that since implementation of the 1995 settlement agreement, water temperatures have usually ranged between 9 and 13°C but was as high as 18.7°C in October 2015, coinciding with Don Pedro Reservoir water level being drawn down to about 670 feet (USGS, 2018i).

Table 3.3.2-6. Comparison of mean monthly water temperature in the Don Pedro forebay hypolimnion, Don Pedro Project outflow, and La Grange forebay (Source: Districts, 2017a, as modified by staff).[a]

Month	Don Pedro Reservoir Hypolimnion near Dam (RM 55.1)	Don Pedro Project Outflow (RM 54.3)	Above La Grange Diversion Dam (RM 52.2)	Don Pedro Outflow vs. Hypolimnion	Above La Grange Diversion Dam vs. Don Pedro Outflow
Jan	10.8	10.5	11.3	-0.3	0.8
Feb	10.1	9.7	10.8	-0.4	1.1
Mar	10.1	9.3	10.8	-0.8	1.5
Apr	10.2	9.4	10.9	-0.8	1.5
May	10.4	9.8	11.0	-0.6	1.2
Jun	10.7	10.2	11.2	-0.5	1.0
Jul	11.0	10.6	11.5	-0.4	0.9

Month	Don Pedro Reservoir Hypolimnion near Dam (RM 55.1)	Don Pedro Project Outflow (RM 54.3)	Above La Grange Diversion Dam (RM 52.2)	Don Pedro Outflow vs. Hypolimnion	Above La Grange Diversion Dam vs. Don Pedro Outflow
Aug	11.3	10.9	11.8	-0.4	0.9
Sep	11.4	11.1	12.0	-0.3	0.9
Oct	11.5	11.3	12.1	-0.2	0.8
Nov	11.4	11.3	11.2	-0.1	-0.1
Dec	11.5	11.2	11.2	-0.3	0.0

[a] Period of record varies by station: August 2004–November 2012 with most of 2009 missing for RM 55.1; January 1987–September 1988 and May 2010–February 2013 for RM 54.3; and August 2011–December 2012 for RM 52.2.

Figures 3.3.2-4 through 3.3.2-7 show Tuolumne River daily mean temperatures between the USGS gage below La Grange Diversion Dam (RM 51.7) and Shiloh (RM 3.4) for water years 2015 and 2016, respectively. These figures show relatively small temperature increases between RM 51.8 and RM 49.0, and much larger temperature increases downstream of RM 49.0.

The Districts' summary of the range of DO concentrations measured near Don Pedro Reservoir's upstream and downstream ends (table 3.3.2-7) shows that DO concentrations of less than the 7.0-mg/L objective occur throughout most of the year. DO vertical profiles for the reservoir follow the common pattern of many deep lakes and reservoirs with high DO near the surface and in the metalimnion (figure 3.3.2-8), likely the result of photosynthetic activity by phytoplankton during daylight hours. The lowest DO concentrations are typically in water between the reservoir bottom and the elevation of the powerhouse intake. Hourly DO data collected from the Tuolumne River just downstream of the Don Pedro Dam and Powerhouse in 2012 ranged from 5.8 to 12.4 mg/L (table 3.3.2-8). Although 17 days in October and November of 2012 have at least one hourly DO measurement less than 7.0 mg/L, the Districts report that all average daily values meet the 7.0-mg/L objective.

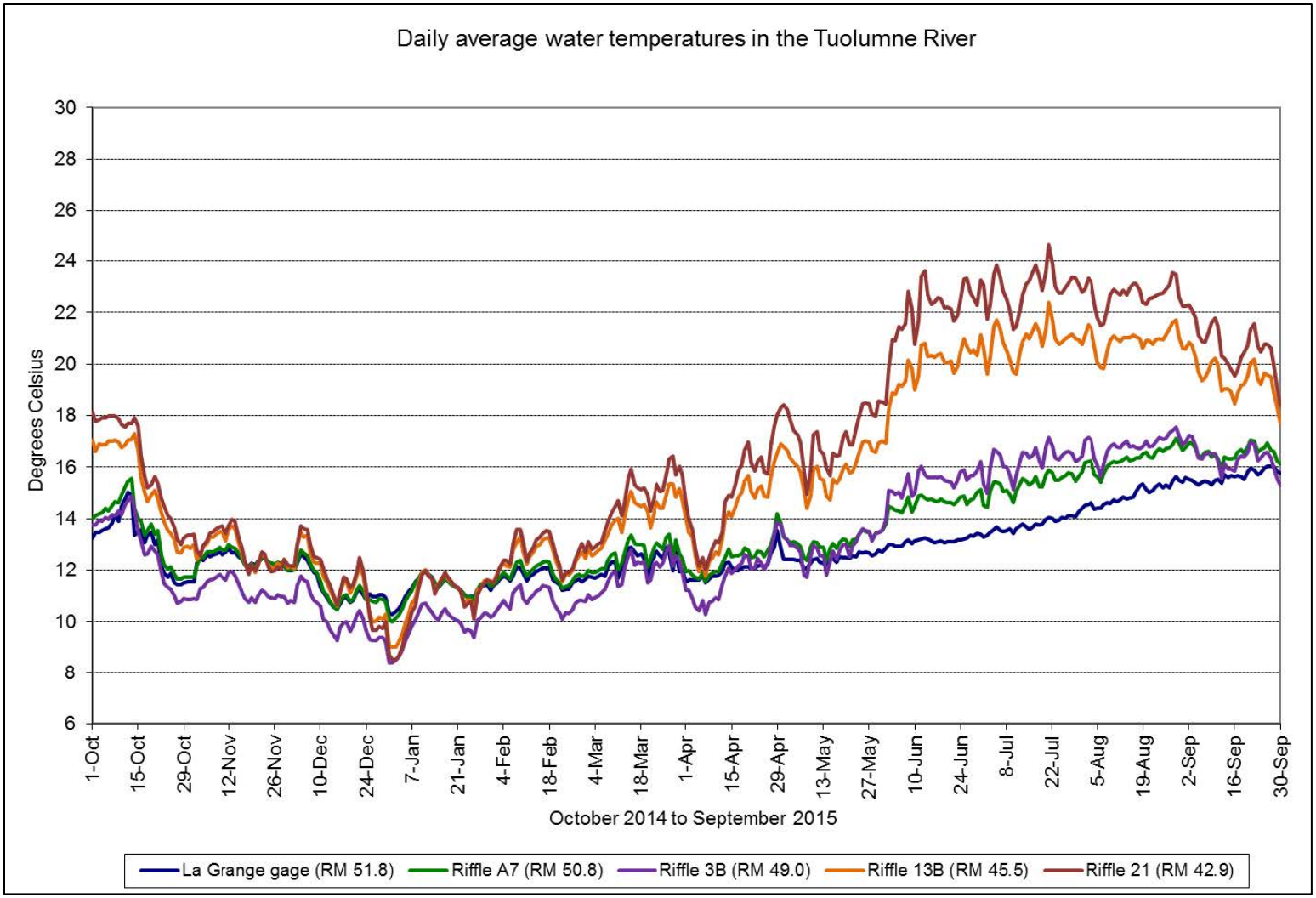

Figure 3.3.2-4. Tuolumne River daily mean temperature between RM 51.8 and RM 42.9, water year 2015 (Source: Districts, 2016).

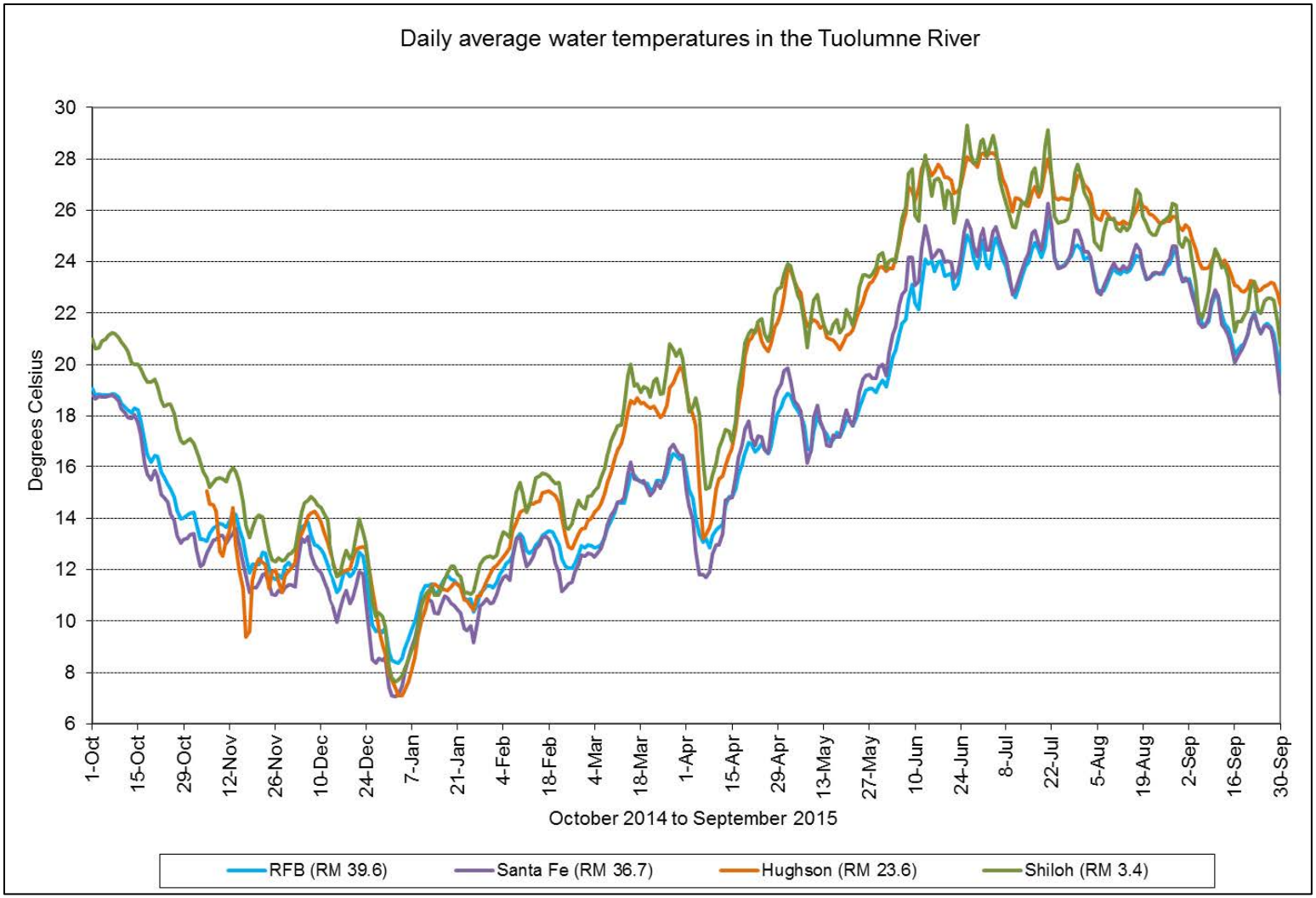

Figure 3.3.2-5. Tuolumne River daily mean temperature between RM 39.6 and RM 3.4, water year 2015 (Source: Districts, 2016).

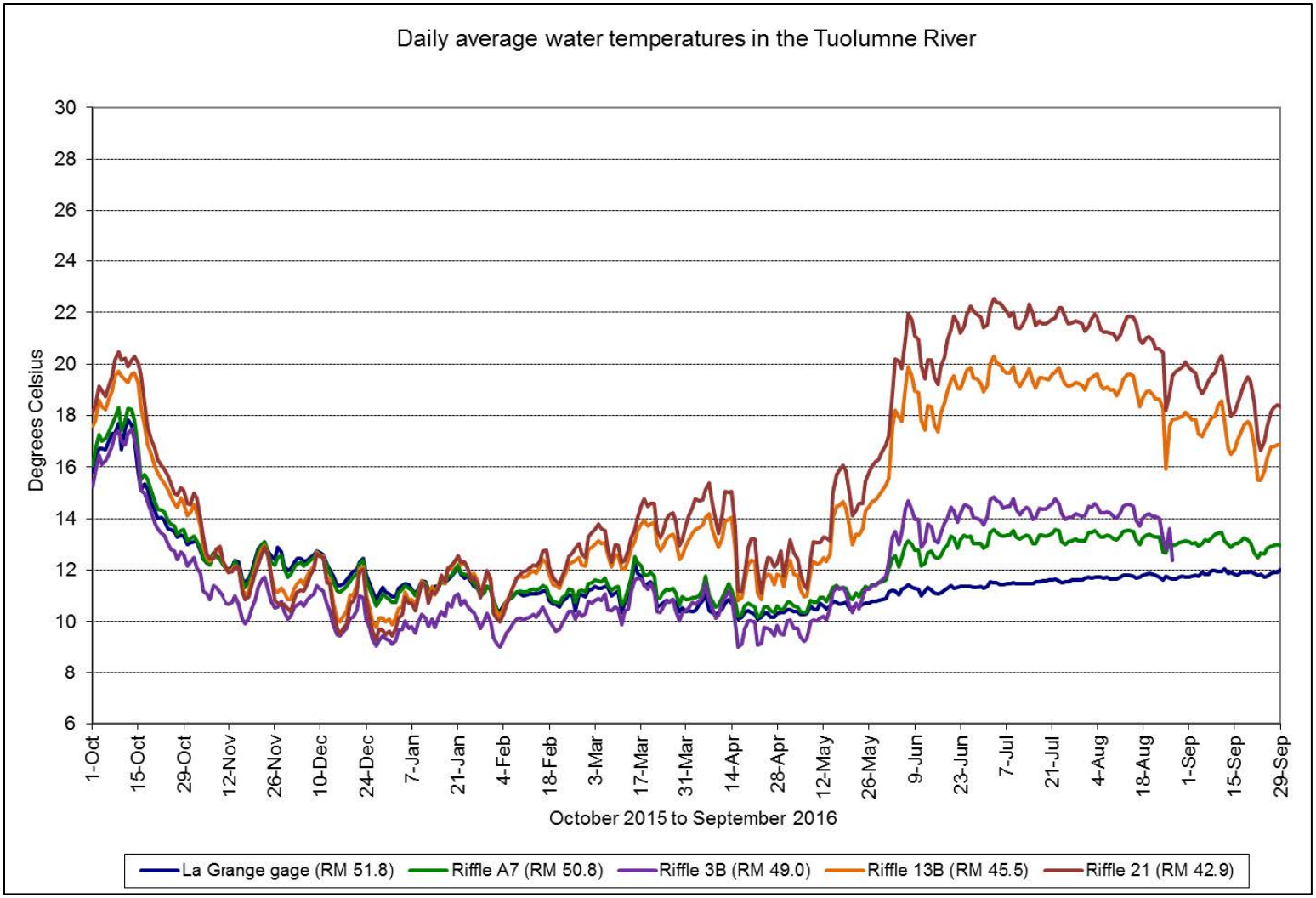

Figure 3.3.2-6. Tuolumne River daily mean temperature between RM 51.8 and RM 42.9, water year 2016 (Source: Districts, 2017c).

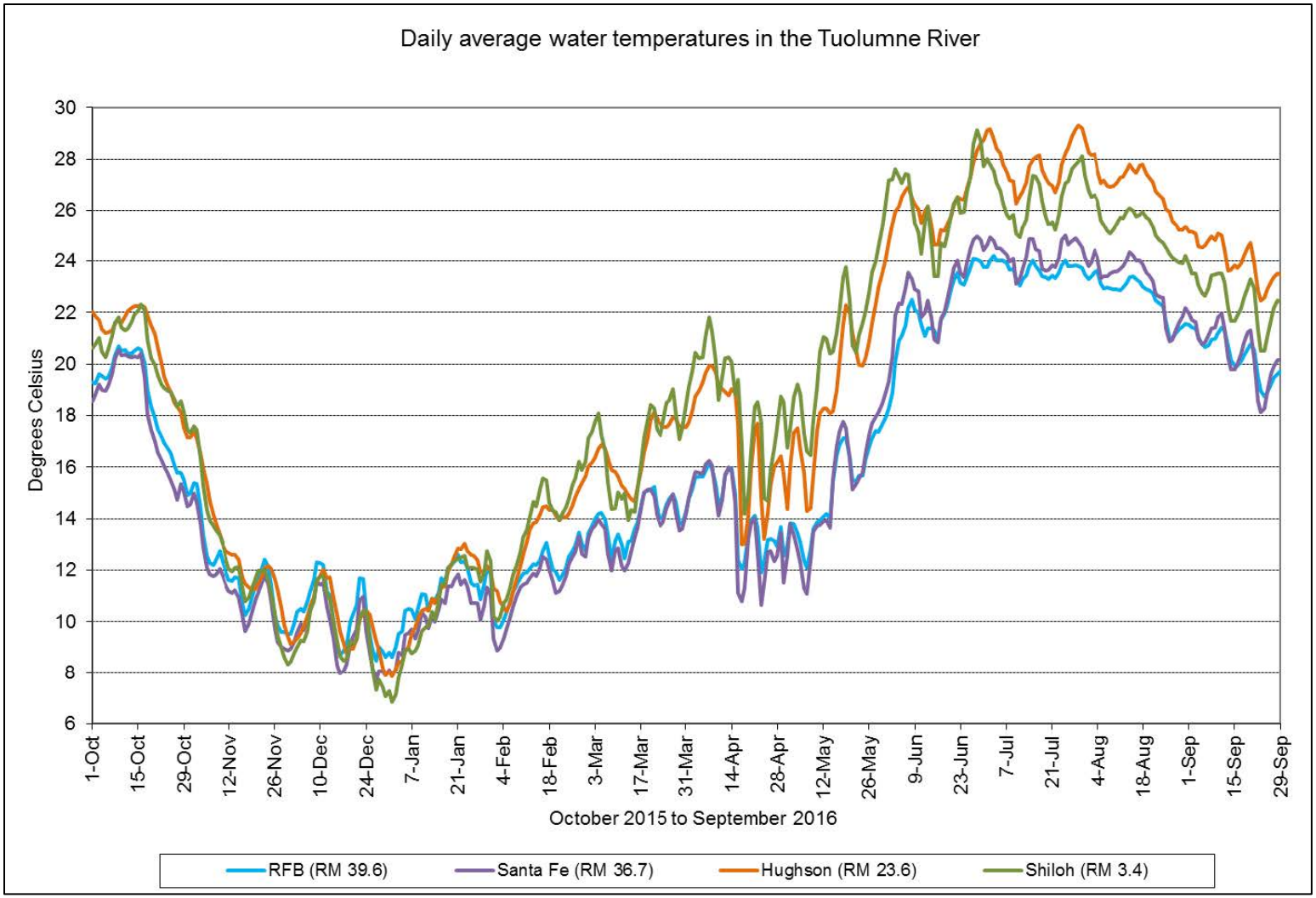

Figure 3.3.2-7. Tuolumne River daily mean temperature between RM 39.6 and RM 3.4, water year 2016 (Source: Districts, 2017c).

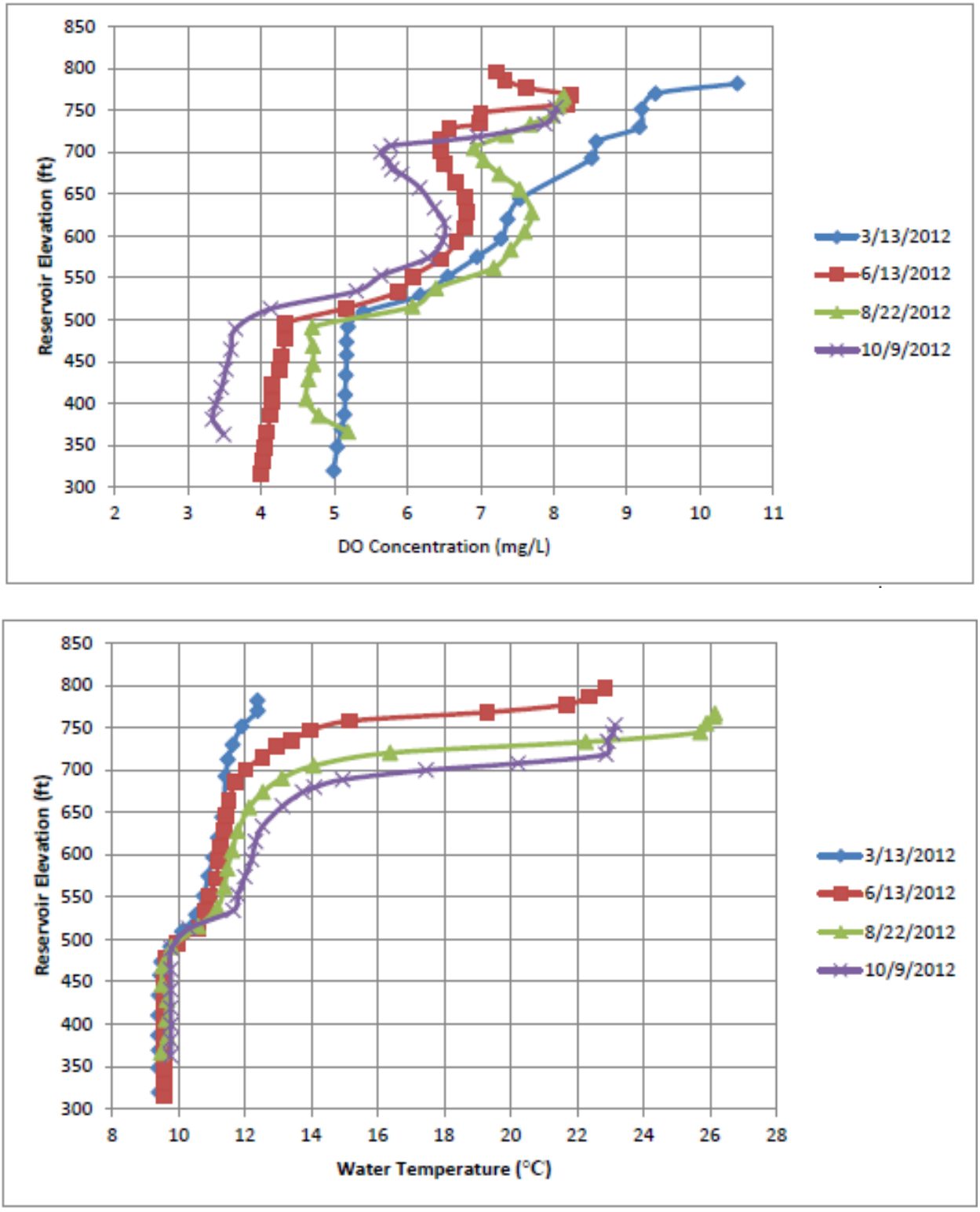

Figure 3.3.2-8. DO concentration and water temperature vertical profiles recorded in Don Pedro Reservoir near the dam in 2012 (Source: Districts, 2017a).

Table 3.3.2-7. Monthly ranges of DO concentrations in the Don Pedro Reservoir and its outflow (Source: Districts, 2017a, as modified by staff).

Month	Don Pedro Reservoir near Highway 49 Bridge[a]	Don Pedro Reservoir near Dam[b]	River Just Downstream of Don Pedro Dam and Powerhouse[c]
January	NR	NR	8.6–11.4
February	7.5–8.7	2.6–7.5	8.2–12.4
March	6.9–9.9	0.7–10.5	8.4–12.1
April	6.6–7.6	3.7–11	8.4–10.9
May	6.6–9.5	4.1–9.6	8.8–10.6
June	5.7–10.6	4.0–9.3	8.6–10.7
July	4.5–9.4	4.2–9.8	8.3–10.3
August	0.8–8.4	4.6–8.4	8.2–10.4
September	0.6–8.4	3.3–8.5	7.4–10.3
October	0.8–8.1	3.3–8.4	6.8–10.7
November	0.0–8.3	3.4–8.2	5.8–11.0
December	NR	NR	8.6–9.1

Note: NR—no measurements reported

[a] Period of record consists of vertical profiles conducted in June through November of 2011; March, May, June, July, September and November of 2012; and February through July and September of 2013.

[b] Period of record consists of vertical profiles conducted in June through November of 2011; March through November of 2012; and February through July and September of 2013.

[c] Period of record consists of hourly data recorded throughout 2012.

Table 3.3.2-8. Range of DO concentrations measured in the lower Tuolumne River, 2012–2017 (Source: Districts, 2013, 2014, 2015, 2016, 2017e, 2018d; as modified by staff).

Period, Study	RMs	2012	2013	2014	2015	2016	2017
Between La Grange Diversion Dam and Waterford: Basin Plan objective is ≥ 8.0 mg/L between October 15 and June 15 and ≥ 7.0 mg/L the rest of the year							
January–June, Seine Study[a]	31.6–50.5	7.7–11.9[d]	8.5–13.8	8.6–12.8	8.3–10.8	8.5–12.2	8.6–13.4
July, Snorkel Surveys[b]	31.5–50.7	8.4–11.0	8.4–11.8	7.0–10.4	7.0–11.0	7.6–10.4	8.3–10.4
Below Waterford: Basin Plan Objective is ≥ 7.0 mg/L throughout the Year							
January–June, Seine Study[a]	3.4–24.9	8.3–11.8	8.2–13.3	8.3–11.0	7.4–10.9	8.2–10.9	8.6–13.2
January–May, adult fall-run migration[c]	24.5	NR	7.3–12.8	8.5–12.7	8.6–12.0	8.2–13.1	NR
September–December, adult fall-run migration[c]	24.5	7.8–13.6	8.5–13.6	7.7–11.4	7.1–11.8	8.4–12.3	8.9–11.8

Notes: NR—no measurements reported

[a] Seine study reports provide instantaneous DO concentrations measured at about 14-day intervals. The 2012–2016 monitoring sites are the Old La Grange Bridge at RM 50.5, Riffle 5 at RM 48.0, Tuolumne River Resort at RM 42.4, Hickman Bridge at RM 31.6, Charles Road at RM 24.9, Legion Park at RM 17.2, Service Road at RM 7.4, and Shiloh Road at RM 3.4. In 2017, three additional sites are added for Roberts Ferry at RM 39.5, Fox Grove at RM 27.8, and Riverdale at RM 12.5. In 2015, DO was not measured in June.

[b] Snorkel surveys provide instantaneous DO concentrations measured in riffles at RMs 50.7, 49.9, 49.1, 47.9, 46.9, 45.5, 42.9, 42.3, 38.0, 37.1, 35.3, and 31.5. The 2014 DO values are limited to sites from RM 50.7 to RM 45.5, because the meter malfunctioned.

[c] Adult fall-run Chinook salmon migration reports provide instantaneous DO concentrations measured at the existing seasonal fish counting weir at RM 24.5 for the adult fall-run Chinook salmon study, which is typically from late September to early May. In 2015, DO values were not reported for May. We interpreted a reported DO reading of 1.7 mg/L in 2016 as a typographical error because the next lowest reported DO reading was 8.2 mg/L.

[d] The 7.7 mg/L value recorded at RM 31.6 on June 5, 2012, is the only value less than the Basin Plan DO objective of 8.0 mg/L for the period from October 15 to June 15.

The Districts conducted instantaneous DO measurements as part of the La Grange Project Fish Barrier Assessment (FISHBIO, 2017a). In the Tuolumne River's main channel across from the La Grange Powerhouse (refer to figure 3.3.2-9), morning instantaneous DO measurements were 9.0 mg/L to 14.2 mg/L in the September to April monitoring season of 2015–2016, and 10.2 mg/L to 11.6 mg/L in 2016–2017 monitoring season.[61] However, morning instantaneous DO measurements for the La Grange Powerhouse tailrace channel were lower, ranging from 4.0 mg/L to 13.9 mg/L in the 2015–2016 study period and 7.1 mg/L to 10.9 mg/L in the 2016–2017 study period.[62] In the amended application for the La Grange Project, the Districts report that the DO measurements of less than 8.0 mg/L occur at the powerhouse tailrace channel weir from late September through October of 2015, when DO measurements at the main channel weir remain above 8.0 mg/L.

Table 3.3.2-8 summarizes the Districts' instantaneous DO measurements taken at several locations in the lower Tuolumne River to satisfy Don Pedro Project license requirements in 2012–2017. During this 6-year period, only one measurement was less than the 8.0-mg/L Basin Plan DO objective applicable for Waterford to La Grange between October 15 and June 15. All DO measurements in 2012–2017 met the 7.0-mg/L DO objective that applies to the remainder of the year from Waterford to La Grange and all year downstream of Waterford.

Instantaneous turbidity measurements conducted at rotary screw traps (RSTs) in January to May of 2015–2017 range from 0 to 24 nephelometric turbidity units (NTUs) at RM 29.8 (downstream of Waterford) and from 2.3 to 55 NTUs at Grayson (RM 5.2) (Districts, 2016, 2017c, 2018d). Baseline turbidity levels are generally less than 5 NTUs, but turbidity occasionally exceeds 15 NTUs during this period. As expected, the out-migration of Chinook salmon fry and smolt peak at Waterford and Grayson for brief periods during rain events or scheduled releases from Don Pedro Reservoir when turbidity is slightly elevated above background levels (Districts, 2016, 2017c, 2018d). Instantaneous turbidity monitoring conducted for annual adult fall-run Chinook salmon migration studies document turbidity ranges at the existing seasonal fish counting weir at RM 24.5 of 0.4 to 27 NTUs for September to May of 2015–2017, and 0.5 to 6.1 NTUs for January to May of 2015 and 2016 (Districts, 2016, 2017c, 2018d).

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[61] The main channel and powerhouse tailrace channel are separated by a large gravel bar, which includes riparian vegetation, and extends about 150 feet across the river's floodplain.

[62] The Districts report that instantaneous DO measurements were less than 8.0 mg/L 35 times during the 42-day period of September 23 to November 3 of 2015 (see the Districts' response to comments on the draft license application included as Attachment B to their amended license application) but do not provide the frequency or dates DO was less than 8.0 mg/L in the 2016–2017 study period.

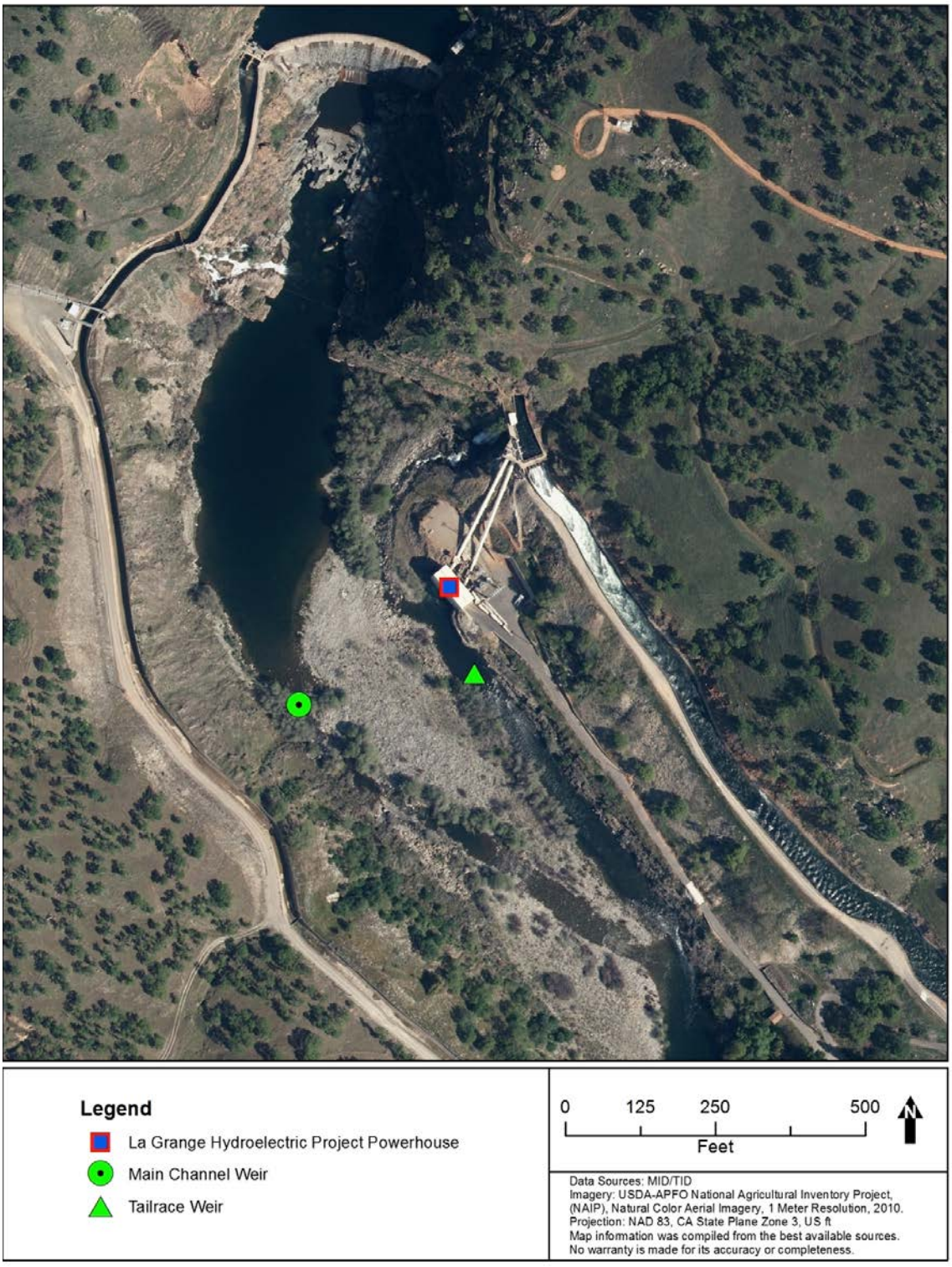

Figure 3.3.2-9. Location of La Grange main channel weir and powerhouse tailrace channel weir (Source: FISHBIO, 2017a).

The Districts' water quality study conducted in 2012 provides insight into water quality conditions of summer low inflow to Don Pedro Reservoir, water near the surface and bottom of the reservoir, and water downstream of the reservoir (HDR, 2013a). This study consisted of sampling physical and chemical characteristics in August, and a recreational water quality element surrounding the Independence Day holiday high-use recreation period. The study involved collecting surface water samples from three Tuolumne River sites and within 1 to 2 meters of the surface and bottom from two Don Pedro Reservoir sites[63] for five *in situ*, 17 basic water quality, 18 metal, and 15 pesticide constituents.[64] August 2012 data indicate water quality is generally good upstream, within, and downstream of the Don Pedro Reservoir. Alkalinity is low (<16 mg/L as $CaCO_3$ in all samples), and pH is nearly neutral (6.4 to 8.0 standard units and did not meet the Basin Plan objective values of 6.4 to 8.5 only near the bottom of the reservoir). No algae blooms were observed and nutrient concentrations were generally low with measured concentrations of nitrate, nitrite, ammonia, total Kjeldahl nitrogen, ortho-phosphorus, and total phosphorus at or near the analytical method reporting limits. Turbidity is relatively low (i.e., <10 NTUs) at all sites other than the near surface in the reservoir between the upper and middle bays, which had a turbidity of 283 NTUs, possibly because of accumulation of plankton. All 12 of the recreational sites have fecal coliform counts that meet the Basin Plan water quality objectives, and *E. coli* counts meet the EPA-recommended criteria for primary-contact recreational uses (EPA, 2012). Most other analytes were reported as non-detectable to just above analytical reporting limit concentrations. None of the agricultural pesticides on the 303(d) list—chlorpyrifos, diazinon and Group A pesticides—were detected at commercially available reporting limits. Both samples collected near the bottom of Don Pedro Reservoir exhibit a dissolved copper concentration that exceeds the corresponding California Toxics Rule

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[63] Sampling sites were (1) the Tuolumne River upstream of Don Pedro Reservoir, downstream of Don Pedro Dam, and downstream of La Grange Diversion Dam and (2) in Don Pedro Reservoir near the dam and at a location about one-third of the way from the dam to Ward's Ferry Bridge.

[64] *In situ* constituents are temperature, DO, specific conductance, pH, and turbidity. Basic water quality constituents are total alkalinity, total hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total phosphorus, ortho-phosphorus, total organic carbon, dissolved organic carbon, calcium, chloride, magnesium, potassium, sodium, total suspended solids, and total dissolved solids. Metal constituents are total and dissolved arsenic, cadmium, copper, iron, lead, methyl-mercury, silver and zinc; and dissolved mercury and selenium. Pesticide constituents are aldrin, alpha-BHC, beta-BHC, chlordane, chlorpyrifos, delta-BHC, diazinon, dieldrin, endosulfan I, endosulfan II, endrin, gamma-BHC, heptachlor, heptachlor epoxide, and toxaphene.

(hardness-dependent) concentration of 1.8 microgram per liter.[65] The remaining six samples exhibited dissolved copper concentrations ranging from 0.4 microgram per liter to 0.96 microgram per liter (HDR, 2013a). Except for total iron in the Tuolumne River upstream of Don Pedro Reservoir, all the samples met the California Toxics Rule criteria.

The Districts report that mercury concentrations in fish tissue sampled in 2008 and 2009 exceeded the EPA 0.3-milligram-per-kilogram criterion (EPA, 2001) for all sites sampled within Don Pedro Reservoir and in the lower Tuolumne River. The highest fish tissue mercury concentrations (0.29 to 0.99 milligram per kilogram) occurred in largemouth bass sampled from the shallow Moccasin Creek and Woods Creek arms of Don Pedro Reservoir.

Fishery Resources

Aquatic Habitat

The upper Tuolumne River originates from tributary streams located on Mount Lyell and Mount Dana in the Sierra Nevada. These tributaries join at Tuolumne Meadows (elevation 8,600 feet), and from this point the upper Tuolumne River descends rapidly through a deep canyon in wilderness areas of Yosemite National Park to Hetch Hetchy Reservoir (at an elevation of about 3,800 feet). Except for a short reach at Early Intake Reservoir about 13 miles downstream from O'Shaughnessy Dam (which impounds Hetch Hetchy Reservoir), the river flows unimpeded through a deep canyon for approximately 40 miles, from O'Shaughnessy Dam to the upstream end of Don Pedro Reservoir, which has a normal maximum water surface elevation of 830 feet.

The mainstem Tuolumne River is joined by several tributaries including Cherry Creek, the South Fork Tuolumne River, the Clavey River, and the North Fork of the Tuolumne River, before entering Don Pedro Reservoir. Within the Don Pedro Project vicinity, a number of tributaries flow into Don Pedro Reservoir. Because of their relatively low elevation, most of the streams contributing flow to the reservoir are ephemeral and rain-driven, and thus contribute comparatively little water when compared to the mainstem Tuolumne River.

Downstream of Don Pedro Reservoir, the rolling hills of the eastern Central Valley gradually flatten to become a terraced floodplain. Two small, intermittent drainageways—Big Creek and Twin Gulch—enter the La Grange Reservoir between Don Pedro Dam and La Grange Diversion Dam. As part of its fish population assessment, the Districts characterized the aquatic habitat between Don Pedro Dam and La Grange Diversion Dam in 2012 (HDR, 2013b). The reach between Don Pedro Dam and Twin

[65] The near-bottom dissolved copper concentrations are 8.16 micrograms per liter for the site near the dam and 6.25 micrograms per liter for the site between the upper and middle bays.

Gulch was characterized as riverine habitat with currents, large substrate dominated by boulders, and a lack of rooted macrophyte beds. Very little habitat complexity is present because bedrock cliffs are the dominant shoreline habitat type with sparse overhanging vegetation. Flow velocities in this reach can range from 5 feet per second during high outflows (approximately 4,000 cfs) to 3 feet per second during lower outflows (1,000 cfs) just downstream of Don Pedro Powerhouse, and from 2.5 feet per second to 1 foot per second in the deeper pool section just upstream of Twin Gulch. The change in stage between high and low outflows in this reach is approximately 1.5 feet. The reach downstream of Twin Gulch is characterized as lacustrine with a lack of currents and rooted macrophyte beds. In addition to numerous boulders, smaller substrate, including cobble and gravel are more common than upstream of Twin Gulch. Habitat complexity, however, was similar to the reach upstream of Twin Gulch. Flow velocities in this reach can range from 0.8 foot per second during high outflows to 0.3 foot per second during low outflows. The change in stage between high and low outflows in this reach is approximately 0.2 foot.

Downstream of the La Grange Diversion Dam, the Tuolumne River flows to its confluence with the San Joaquin River. Dry Creek, which joins the lower Tuolumne River at RM 16, is the only significant tributary (drainage area of about 204 square miles) downstream of the La Grange Diversion Dam. The Tuolumne River downstream of the La Grange Diversion Dam to RM 24 is gravel-bedded with moderate slope (0.10 to 0.15 percent), whereas the lower zone (RM 0 to RM 24) is sand-bedded with a slope generally less than 0.03 percent (McBain & Trush, 2000).

From June 12 to June 14, 2012, the Districts surveyed instream habitat at six locations along the lower Tuolumne River from La Grange Diversion Dam (RM 52.2) to Roberts Ferry Bridge (RM 39.5). Table 3.3.2-9 summarizes the combined instream habitat types and physical attributes, and table 3.3.2-10 summarizes the dominant substrates within each of the instream habitat types surveyed by the Districts.

The Districts also surveyed LWM in Don Pedro Reservoir near Ward's Ferry Bridge, and at 10 locations along the lower Tuolumne River from about RM 52 to RM 24 from June 12 to June 15, 2012. The Districts surveyed 305 pieces of LWM from Don Pedro Reservoir and 200 pieces from the lower Tuolumne River (table 3.3.2-11). Most surveyed LWM was less than 8 inches in diameter and less than 13 feet long. The Districts did not see any LWM larger than 31 inches in diameter and 52 feet long in 2012. Using data about wood raft and burn pile volumes provided by Don Pedro Recreation Agency (DPRA), the Districts estimated that Don Pedro Reservoir captured an average volume of LWM of 70,761 cubic feet annually between 2005 and 2013.

Table 3.3.2-9. Habitat types and physical attributes surveyed in the lower Tuolumne River between RM 51.8 and RM 39.5 (Source: Stillwater Sciences, 2017a).

Habitat Type	Number of Habitat Units	Total Habitat Length (feet)	Percent of Total Length	Average Habitat Unit Length (feet)	Average Habitat Unit Width (feet)	Average Habitat Unit Depth (feet)	Average Maximum Habitat Unit Depth (feet)	Average Habitat Unit Area (square feet)
Riffle	10	2,384	14	238	112	0.7	1.3	26,725
Flatwater	12	9,244	55	770	130	2.3	4.4	99,822
Main channel pool	5	2,845	17	569	128	7.2	14.5	72,604
Scour pool	3	1,335	8	445	102	7.7	17.5	45,538
Side channel flatwater	3	1,098	6	366	49	1.5	2.9	18,056
Overall	**33**	**16,906**	**100**	**512**	**114**	**3**	**6.0**	**61,179**

Table 3.3.2-10. Dominant substrate by habitat type in the lower Tuolumne River between RM 51.8 and RM 39.5 (Source: Stillwater Sciences, 2017a).

Habitat Type	Substrate Type	Percent within Habitat Type	Percent within Total Reach Length
Riffle	Gravel	40	6
	Small cobble	60	8
Flatwater	Gravel	17	11
	Small cobble	45	27
	Large cobble	34	21
	Bedrock	4	2
Main channel pool	Large cobble	65	11
	Boulders	22	4
	Bedrock	13	2
Scour pool	Large cobble	41	3
	Boulders	59	5

Table 3.3.2-11. Summary of large woody debris surveyed in Don Pedro Reservoir and the lower Tuolumne River (Source: Stillwater Sciences, 2017a).

Diameter (inches)	Length (feet)	Instream Count	Percentage of Instream Total	Reservoir Count	Percentage of Reservoir Total
4–8	3.0–6.5	30	15.0	84	27.5
	6.6–13.0	62	31.0	42	13.8
	13.1–26.0	26	13.0	28	9.2
	26.1–52.0	1	0.5	1	0.3
8.1–16	3.0–6.5	8	4.0	23	7.5
	6.6–13.0	28	14.0	27	8.9
	13.1–26.0	21	10.5	25	8.2
	26.1–52.0	5	2.5	2	0.7
16.1–31	3.0–6.5	0	0.0	12	3.9
	6.6–13.0	4	2.0	19	6.2
	13.1–26.0	11	5.5	24	7.9
	26.1–52.0	4	2.0	18	5.9
Total	**--**	**200**	**100**	**305**	**100**

Reservoir Fish Populations

California DFW manages Don Pedro Reservoir as a put-and-take fishery for coldwater species and as a year-round fishery for black bass. Table 3.3.2-12 shows the numbers and species stocked by California DFW in Don Pedro Reservoir from 2000 through 2012. DPRA has annually stocked black bass in the reservoir since the early 1980s.

In 2012, the Districts collected 14 fish species in Don Pedro Reservoir by electrofishing and gillnet sampling (table 3.3.2-13). Additional species not collected during the 2012 study, but known to occur in Don Pedro Reservoir, include brown trout, brook trout, Eagle Lake trout,[66] Chinook salmon, coho salmon, black bullhead, Sacramento pikeminnow, and whitefish (HDR, 2013c). District biologists collected

[66] Eagle Lake trout are a subspecies of rainbow trout endemic to Eagle Lake, in Lassen County, California.

scales of black bass species[67] for age class analysis and observed multiple age classes including young of the year. District biologists additionally observed 14 bass nests at depths ranging from 2.2 feet to 8 feet with nest diameter between 0.6 foot and 6.5 feet and mostly within 30 feet of shore. These observations indicate that black bass successfully reproduce within Don Pedro Reservoir.

Stream Fish Populations

No known fish stocking has occurred in the reach of the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam, and no hatchery supplementation occurs in the reach downstream of the La Grange Diversion Dam. The Districts collected *O. mykiss* and prickly sculpin in 2012 throughout the reach between Don Pedro Dam and La Grange Diversion Dam, and both species exhibited multiple age classes, indicating successful reproduction in this reach.

Table 3.3.2-12. Fish stocking record for species planted in Don Pedro Reservoir by California DFW (2000–2012) (Source: HDR, 2013c).

Year	Kokanee	Chinook Salmon	Brook Trout	Brown Trout	Rainbow Trout	Eagle Lake Trout	Black Bass
2000	45,982	0	2,000	20,070	59,100	0	1,980
2001	50,103	0	3,520	19,800	65,600	0	2,758
2002	10,080	0	0	14,600	52,450	0	1,719
2003	10,043	0	0	0	71,675	0	1,825
2004	9,984	0	0	26,400	179,263	0	3,621
2005	10,143	100,440	118,400	73,687	262,585	3,600	2,000
2006	4,061	70,015	0	22,100	388,720	405	1,062
2007	6,517	91,000	0	15,860	41,720	72,680	1,667
2008	10,080	93,885	18,222	10,050	37,617	31,600	1,680
2009	10,050	100,006	5,610	31,320	329,495	93,790	1,367
2010	10,032	100,000	0	0	4,800	52,300	1,755
2011	10,260	129,980	0	16,000	44,300	55,300	0
2012	10,000	99,997	0	15,400	52,300	37,900	2,000

[67] The term *black bass* is used to refer to any bass species in the genus *Micropterus*, and includes, but not limited to, largemouth, smallmouth, and spotted bass.

Table 3.3.2-13. Fish species collected by the Districts in Don Pedro Reservoir in October 2012 (Source: Districts, 2017a).

Species	Native Species (N)	Composition		Length (mm)			Weight (g)			Mean Condition Factor (Kn)[a]
		N	%	Min	Max	Mean	Min	Max	Mean	
Threadfin shad	--	135	20.8	58	111	76.3	1.0	18.7	6.0	0.99
Common carp	--	8	1.2	450	686	578.0	1,420	4,678	2,910	--
Golden shiner	--	5	0.8	53	90	70.6	2.6	11.5	6.0	--
Sacramento sucker	N	9	1.4	322	495	406.9	322.0	1310	785.0	--
White catfish	--	1	0.2	295	295	295	368.5	368.5	368.5	--
Channel catfish	--	30	4.6	60	575	326.1	3.3	2,350	760.8	0.99
Kokanee	--	18	2.8	308	412	332.3	172.0	965.0	380.6	0.92
Rainbow trout	N	1	0.2	422	422	422.0	683.0	683.0	683.0	--
Black bass[b]	--	76	11.7	52	98	68.8	1.2	11.2	4.1	--
Largemouth bass	--	116	17.8	45	465	252.3	1.1	1,723	361.2	1.06
Smallmouth bass	--	20	3.1	54	410	201.7	2.1	1,107	285.3	1.04
Spotted bass	--	57	8.8	100	403	276.8	11.9	992.2	377.1	0.95
Green sunfish	--	95	14.6	32	102	67.1	0.5	19.0	5.2	1.04
Bluegill sunfish	--	78	12.0	37	138	80.7	1.0	60.0	12.8	1.00
Crappie	--	1	0.2	57	57	57.0	2.2	2.2	2.2	--

[a] Species with 10 or fewer individuals or poorly fit regressions did not have a reportable condition factor.

[b] Small-sized black bass were not identified to species.

The Tuolumne River downstream of the La Grange Diversion Dam to the confluence with the San Joaquin River contains a fish community mixed with native and introduced species and resident and migratory species. Water temperature and velocity, which vary by location and season and in response to flow, influence the distributions of native and non-native fishes. Most native resident fish species are riffle-spawners and are generally more abundant in the gravel-bedded reach (RM 24-52). The Sacramento sucker is the most abundant and widespread native fish species in the river downstream of the La Grange Diversion Dam. Non-native fishes are present throughout the lower river but are typically most abundant in the sand-bedded reach (RM 0-24) and in the lower 6 to 7 miles of the gravel-bedded reach (RM 24 to RM 31), where water

temperatures are warmer and SRPs[68] provide habitat (Ford and Brown, 2001). Sunfishes are the most abundant and widespread non-native fish in the lower river. The non-native predator fish community in the lower river includes largemouth, smallmouth, and striped bass. Migratory species in the Tuolumne River downstream of the La Grange Division Dam include Pacific lamprey, Sacramento splittail, fall-run Chinook salmon, steelhead,[69] and striped bass.

Fall-run Chinook salmon spawn in the Tuolumne River between RM 24 and RM 52 from late October through December, egg incubation and fry emergence occurs from November through January, and rearing primarily occurs between January and April (Stillwater Sciences, 2013a). Early estimates of Chinook run sizes have ranged from 130,000 spawners in 1944 to 100 in 1963. Since the completion of Don Pedro Dam in 1971, spawner estimates from 1971 to 2015 have ranged from 40,300 in 1985 to 77 in 1991 (table 3.3.2-14). From 1971 to 2009, the date of the peak weekly live spawner count has ranged from October 31 (1996) to November 27 (1972) with a median date of November 12. Since fall 2009, escapement monitoring has been conducted at the seasonal fish counting weir established at RM 24.5, just downstream of the downstream boundary of the gravel-bedded reach.

Table 3.3.2-14. Tuolumne River fall-run Chinook salmon estimates (Source: Districts, 2013, 2014, 2015, and 2016a; Stillwater Sciences, 2013a).

Year	Estimated Run Size	Year	Estimated Run Size	Year	Estimated Run Size
1971	21,885	1986	7,288	2001	9,222
1972	5,100	1987	14,751	2002	7,125
1973	1,989	1988	6,349	2003	2,961
1974	1,150	1989	1,274	2004	1,700
1975	1,600	1990	96	2005	719
1976	1,700	1991	77	2006	625
1977	450	1992	132	2007	211

[68] SRPs are large, in-channel pits (up to 400 feet wide and 35 feet deep) created by historical aggregate mining.

[69] The question of whether the *O. mykiss* population in the Tuolumne River includes a migratory component that represents a population of steelhead has been a subject of contention in the record for the Don Pedro Project. Ultimately, in an order issued on July 16, 2009, the Commission concluded that the information filed by FWS, NMFS, and other stakeholders was sufficient to support the conclusion that steelhead are present in the Tuolumne River.

Year	Estimated Run Size	Year	Estimated Run Size	Year	Estimated Run Size
1978	1,300	1993	431	2008	372
1979	1,184	1994	513	2009	300
1980	559	1995	928	2010	766
1981	14,253	1996	4,362	2011	2,847
1982	7,126	1997	7,548	2012	2,120
1983	14,836	1998	8,967	2013	3,738
1984	13,689	1999	7,730	2014	638
1985	40,322	2000	17,873	2015	421

NMFS considers the lower Tuolumne River steelhead/rainbow trout population to be part of the California Central Valley steelhead DPS. California Central Valley steelhead return from the ocean to enter fresh water beginning in August and spawning occurs from December through April. After spawning, adults may survive and migrate back to the ocean. Steelhead offspring rear for 1 to 3 years in fresh water before they migrate to the ocean as smolts, where most of their growth occurs. Steelhead are the anadromous form of rainbow trout, and both forms (anadromous and resident) are variants of the same species, *Oncorhynchus mykiss*. Table 3.3.2-15 presents the steelhead/rainbow trout population estimates based on snorkeling surveys from 2008 through 2011.

Table 3.3.2-15. Summary of *O. mykiss* population estimates in the Tuolumne River from 2008–2011, between RM 51.8 and RM 29 (Source: Stillwater Sciences, 2013b).

	***O. mykiss* <150 mm**			***O. mykiss* ≥150 mm**		
Survey Date	**Observed**	**Estimate**	**Standard Deviation**	**Observed**	**Estimate**	**Standard Deviation**
July 2008	128	2,472	616.9	41	643	217.7
March 2009	5	63	--	7	170	86.3
July 2009	641	3,475	1,290.5	105	963	254.4
March 2010	1	1	0.3	13	109	30
August 2010	313	2,405	908.1	324	2,139	720.6
September 2011	4,913	47,432	5,662.2	813	9,541	1,200.9

Special-status Fishes

Three special-status fish species—hardhead, Red Hills roach, and Sacramento-San Joaquin roach—occur in tributaries to Don Pedro Reservoir or in the mainstem Tuolumne River upstream and downstream of the reservoir. However, these species have not been found within the project boundary. The hardhead is a California species of special concern and historically was widely distributed and locally abundant in the Central Valley. Widespread alteration of lower elevation riverine habitats and predation by bass species have resulted in population declines and isolation of populations (Moyle, 2002). The Red Hills roach is a California endangered species and is part of the California roach fish community. Individuals in the California roach fish community are abundant in several permanent pools in tributaries to Don Pedro Reservoir. The Red Hills roach is specifically found in areas characterized by serpentine soils and stunted vegetation (Moyle, 2002). The Sacramento-San Joaquin roach is a California species of special concern and also part of the California roach fish community. The Sacramento-San Joaquin roach is generally found in small, warm, intermittent streams and is most abundant in mid-elevation streams in the Sierra foothills and in the lower reaches of some coastal streams (Moyle, 2002). The adult Sacramento-San Joaquin roach has been observed and documented in the general vicinity of the Don Pedro Project, (i.e., in Hatch and Second Creeks and Rough and Ready Creek, but not in the Tuolumne River mainstem).

Benthic Macroinvertebrates

Benthic macroinvertebrates (BMI) are a diverse and typically abundant group of organisms with specific habitat preferences. Many species are sensitive to environmental conditions and stresses and intolerant of specific pollution sources. Therefore, benthic communities are excellent indicators of both water quality and biological integrity. Based on community structure metrics, indices can be developed where higher scores on an index indicate better water quality and higher biological integrity.

The Districts have conducted BMI monitoring in the lower Tuolumne River since 1987. Table 3.3.2-16 presents a comparison of Hess samples collected at riffles 4A (RM 48.4) and 23C (RM 42.3). The EPT (Ephemoptera [mayflies], Plectoptera [stoneflies], and Trichoptera [caddisflies]) Index is the percentage of all organisms in the taxonomic orders of Ephemoptera (mayflies), Plectoptera (stoneflies), and Trichoptera (caddisflies) and will generally decrease with biological impairment. The percent of Chironomidae, or percent of midge larvae, will generally increase with biological impairment. The EPT/Chironomid ratio, or ratio of EPT larvae to midge larvae, will generally decrease with biological impairment, as will the Shannon Diversity index metric. Although overall invertebrate abundances in Riffle 4A samples declined slightly from 1996 to the present, community composition shifted away from pollution-tolerant organisms and toward those with higher food value for juvenile salmonids and other fish.

Table 3.3.2-16. BMI community metrics for long-term Hess sampling sites at riffles R4A (RM 48.8) and R23C (RM 42.3) in the lower Tuolumne River (Source: Districts 2017a, as modified by staff).

Year	Sampling Location	EPT Index (%)	EPT / Chironomid Ratio	Shannon Diversity	Percent Chironomidae	Density (no. per square meter)
1992	R4A	14	0.28	2.13	60	23,272
1993	R4A	15	0.38	1.77	44	24,813
1994	R4A	22	1.73	2.62	17	3,897
1996	R4A	84	11.09	1.59	8	22,987
1997	R4A	28	0.45	1.31	63	20,780
2000	R4A	52	2.57	2.13	25	28,832
2001	R4A	44	1.44	2.7	30	17,037
	R23C	48	2.17	2.43	22	15,528
2002	R4A	49	1.52	2.0	34	24,798
	R23C	11	0.38	2.26	32	11,649
2003	R4A	41	0.85	2.32	48	23,547
	R23C	51	8.16	2.37	8	11,767
2004	R4A	68	3.18	1.92	21	28,994
	R23C	79	26.86	1.79	3	19,120
2005	R4A	76	7.52	1.56	10	27,440
	R23C	85	15.34	1.42	3	6,710
2007	R4A	58	1.91	2.73	30	10,040
	R23C	80	15.95	1.84	5	4,143

Year	Sampling Location	EPT Index (%)	EPT / Chironomid Ratio	Shannon Diversity	Percent Chironomidae	Density (no. per square meter)
2008	R4A	61	0.88	2.58	18	4,733
	R23C	68	23.28	2.12	3	2,762
2009	R4A	50	1.82	2.79	28	28,516
	R23C	49	12.99	2.33	4	23,917

Aquatic Invasive Species

The aquatic invasive species of concern in the Central Valley include the quagga mussel, zebra mussel, New Zealand mudsnail, and water hyacinth. With the exception of water hyacinth, none of these species have been documented in Don Pedro Reservoir or the Tuolumne River Watershed (Districts, 2017a, exhibit E, appendix E-4). The zebra mussel was found for the first time in California in January 2008 at the San Justo Reservoir in San Benito County. The New Zealand mudsnail is more prevalent in California than either mussel species and has been documented in the Merced and Stanislaus Rivers (USGS, 2018k). If the New Zealand mudsnail were to become established in the Tuolumne River Watershed, it would pose similar threats as other aquatic invasive species in other areas, including clogging facility pipes and out-competing other aquatic macroinvertebrates for food, thereby disrupting ecosystem balances across the food web.

The water hyacinth is a non-native invasive plant from the Amazon River Basin and is considered one of the world's most invasive aquatic weeds. In California, the water hyacinth is usually found at elevations of 650 feet or lower in the San Francisco Bay area, along the South Coast, and in the Central Valley, including the lower Tuolumne River. The water hyacinth is prevalent in the lower Tuolumne at flows less than 200 cfs, resulting from diminished water quality and low flows causing stagnant water. It has been documented as occurring in dense mats covering the lower Tuolumne River from bank to bank, particularly in the reach between Riverdale Park (RM 12.3) and Shiloh Bridge (RM 4.0).

3.3.2.2 Environmental Effects

The Districts, in consultation with Don Pedro Project stakeholders, developed a suite of models to evaluate the effects of alternative operations on Don Pedro Project economics; water supply; Don Pedro Reservoir pool storage and elevation; and lower Tuolumne River flow, water temperature, and populations of Chinook salmon and *O. mykiss*.[70] The resulting models are:

- Operations Model, a model built on a spreadsheet platform to simulate current and potential future operations of the project encompasses the area from the

[70] The Districts' consultation with relicensing participants includes workshops held between March 20, 2012, and May 18, 2017, training sessions for operation of the models, and provision for the participants to directly run the models.

CSF's Hetch Hetchy System to the Tuolumne River confluence with the San Joaquin River.[71]

- Don Pedro Reservoir Temperature Model, a 3-dimensional model developed on the Danish Hydraulic Institute's MIKE3-FM platform, which incorporates the old Don Pedro Dam structure, to simulate the dynamics of the water temperature regime in Don Pedro Reservoir and characterize the existing seasonal coldwater storage volume.[72]
- Lower Tuolumne River Temperature Model, a 1-dimensional model developed on the Corps' HEC-RAS platform for the Tuolumne River from Don Pedro Dam (RM 54.8) to the confluence with the San Joaquin River.[73]
- Lower Tuolumne River Floodplain Hydraulic and Habitat Model developed using the TUFLOW model platform that simulates the interaction between flow within the Tuolumne River main channel and the floodplain downstream of the La Grange Diversion Dam (RM 52.2) to the confluence with the San Joaquin River (RM 0) to estimate floodplain juvenile salmonid rearing habitat.[74]
- Lower Tuolumne River Chinook Population Model, referred to as TRCh, a multi-stage stock production model using the publically available "R" statistical package and documented in Stillwater Sciences (2017a).[75]

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[71] The operations model developed under the W&AR-2 study is documented in the Project Operations Water Balance Model Amended Study Report (Steiner, 2017); it provides the needed flow and reservoir water elevations to the other models.

[72] The reservoir temperature model is documented in the W&AR-3 Study Report (HDR, 2017a); it provides Don Pedro Reservoir outflow temperatures to the lower Tuolumne River temperature model.

[73] The lower river temperature model is documented in the W&AR-16 study report (HDR, 2017b); it provides simulated lower Tuolumne River temperatures to the Chinook salmon and *O. mykiss* population models.

[74] The floodplain model is documented in the W&AR-21 Study Report (HDR and Stillwater Sciences, 2017); the results of this model are incorporated into the Chinook salmon and *O. mykiss* population models.

[75] The Chinook salmon population model is documented in the W&AR-06 study report (Stillwater Sciences, 2017b).

- Lower Tuolumne River *O. mykiss* Population Model, referred to as TROm, a multi-stage stock production model using the publically available "R" statistical package and documented in Stillwater Sciences (2017b).[76]

As described in the Districts' May 14, 2018, filing of modeling results,[77] the models were revised to (1) correct the operations model's representation of the Districts' proposed "dry year relief" of reducing spring pulse flows in sequential dry water years[78] and (2) update the reservoir temperature model's representation of old Don Pedro Dam with information discovered after the Districts filed the amended final license application.[79]

The Districts used the resulting models to simulate the proposed and recommended operation scenarios and filed their response to the Commission's additional information requests (AIRs) on May 14, June 19, July 11, and July 30, 2018.[80] The general approach for this modeling is to represent the no-action scenario (base case) and proposed and recommended operations within the limits of the models. All these scenarios use the Fourth Agreement's shared responsibility of the CCSF Hetch Hetchy System operations contributing 51.7 percent of the required releases greater than the current FERC license flows.[81] No attempt to alter recommended operations to meet water temperature objectives or account for accretion/depletion between the La Grange gage and locations downstream of the two proposed infiltration galleries are included in these scenarios. The base case and four other scenarios do not include operation of the infiltration galleries.

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[76] The *O. mykiss* salmon population model is documented in the W&AR-10 study report (Stillwater Sciences, 2017a).

[77] Districts, 2018a.

[78] Prior to this revision, input to the operations model incorrectly applied 35 thousand acre-feet, instead of the proposed 45 thousand acre-feet, for spring pulse flows in sequential dry water years. The Districts (2018a) report that this only affected simulated flows in 2002.

[79] Newly discovered design drawings indicate the original side-channel spillway of the old dam, which is located at about RM 56.4 about 1.5 miles up-reservoir of the current dam, had a concrete crest at elevation 596.5 feet and was about 570 feet long. The Districts' also revised the model's bathymetry to be consistent with removal of the original spill gates that were on top of the spillway prior to filling of new Don Pedro Reservoir.

[80] Districts, 2018a, 2018c, 2018e, and 2018b, respectively.

[81] The percentage of shared responsibility may change during any license period.

On May 14, 2018, the Districts filed model simulations to provide model results for nine scenarios of project operations in response to the Commission's AIR issued February 16, 2018.[82] Commission staff's review of this filing revealed an lack of information about (1) Tuolumne River flows just downstream of the Districts' proposed infiltration galleries, (2) modeling of the Districts' proposed interim flows, which would be in effect until the infiltration galleries are operational, and (3) misrepresentations of recommendations made by The Bay Institute and ECHO. Therefore, the Commission requested additional information to fill these data gaps, and the Districts filed the requested additional information on June 19[83] and July 30, 2018.[84] Table 3.3.2-17 summarizes the 10 model scenarios used in this EIS.

Streamflows and Reservoir Levels

The Districts have historically operated the Don Pedro Project for flood control, water supply, recreation, hydropower, and environmental benefits. The project attenuates high flows in the Tuolumne River from winter storms and spring runoff by storing water in Don Pedro Reservoir. Irrigation deliveries normally reach their peak in July and August, while municipal and industrial deliveries occur year-round. Don Pedro Reservoir is operated to provide water storage sufficient to satisfy annual flow requirements, while considering the need for carry-over storage that may be needed to meet water needs over successive dry years. The minimum annual reservoir water level generally occurs from October to November, and the maximum water level generally occurs from May to June. Reservoir storage changes over a water year can be as small as 100,000 acre-feet to as great as 1,000,000 acre-feet or more. Don Pedro Reservoir typically operates between elevation 690 feet and 830 feet.

The Districts propose to lower the required minimum operating pool level of Don Pedro Reservoir from the current elevation of 600 feet to 550 feet. During the relicensing process, the Districts conducted preliminary studies that indicate a single turbine-generator unit would be able to operate at reduced loads down to water levels of about 570 feet, and the hollow jet valve in the powerhouse can operate to water levels of 550 feet or lower. The 150,000 acre-feet of additional storage that would be made available by this change would be used to reduce the stress on the Districts' surface water supplies and other water supplies (i.e., groundwater) during times of extended drought.

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[82] Districts (2018a), which includes information for the base case, DPP-1r, FWSREA, NMFSREA, DFWREA, SWBREA, CGREA10% and two scenarios that are not used in this EIS.

[83] Districts (2018c), which includes Tuolumne River flows at RM 25.5 for the scenarios filed on May 14, 2018.

[84] Districts (2018e), which includes information for the DPP-1r-NoIG, TBIREA-NoIG, and ECHOREA-NoIG scenarios.

Table 3.3.2-17. Description of model scenarios (Source: Districts, 2018a,b, as modified by staff).

Scenario Name	Represents	Minimum Don Pedro Reservoir Pool	Minimum Instream Flows[a]	Pulse Flows	Ramping Rates/ Recession Flows	Operation of IGs
Base case	Environmental Baseline[b]	375 TAF, ≈610 feet	At La Grange gage	Spring pulse flows	No	No
DPP-1r-NoIG	Districts' proposed interim flows (without IGs operational)	375 TAF, ≈610 feet[c]	At La Grange gage[d]	Fall and spring pulse flows	No	No
DPP1r	Districts' proposed flows with IGs operational	375 TAF, ≈610 feet[c]	At La Grange gage and below the IGs supplemented with boatable flows[d]	Fall and spring pulse flows	No	Yes[e]
FWSREA[f]	FWS 10(j) recommendation 2 filed on January 29, 2018 (accession no. 20180129-5298)	---	At La Grange Gage and below the IGs	Fall and spring pulse flows	Recession flow rates	Yes, 100 cfs July–September
NMFSREA[g]	NMFS 10(a) recommendation 1 filed on January 29, 2018 (accession no. 20180129-5258)	---	At La Grange gage and below the IGs	Fall and spring pulse flows	Pulse flow recession rates, minimum instream flows up and down ramping rates	Yes, none in extra critical dry years
DFWREA[h]	California DFW 10(a) recommendation M1 filed on January 29, 2018 (accession no. 20180129-5315)	500 TAF, ≈647 feet	At La Grange gage and below the IGs	Fall and spring pulse flows, geomorphic flood pulses	Spring recession rates, ramping rates	Yes

Scenario Name	Represents	Minimum Don Pedro Reservoir Pool	Minimum Instream Flows[a]	Pulse Flows	Ramping Rates/ Recession Flows	Operation of IGs
SWBREA[i]	The Water Board filed on January 29, 2018 (accession no. 20180129-5393)	800 TAF, ≈700 feet, on Sep 30 unless needed to meet 363 TAF minimum annual diversion	Feb-Jun 40% of unimpaired with up to 10% of the unimpaired flow shifted to the fall in wet years, and current FERC requirement rest of year[j]	No	No	No
CGREA10%[k]	Conservation Groups filed January 29, 2018 (accession no. 20180129-5200)	---	At La Grange gage and below the IGs	Fall and spring pulse flows	Recession flow rates	Yes, 100 cfs July–September
TBIREA-NoIG[l]	The Bay Institute filed January 29, 2018 (accession no. 20180129-5262)	---	At La Grange gage	Fall pulse flows	Recession rates	No
ECHOREA-NoIG	ECHO filed January 29, 2018 (accession no. 20180129-5047)	---	February–June 60% unimpaired inflow to Don Pedro Reservoir; other periods same as base case	---	---	No

Notes: The May 14, 2018, filing (Districts, 2018a, provides the base case, DPP-1r, FWSREA, NMFSREA, DFWREA, SWBREA, and CGREA10% scenarios; the July 30, 2018, filing (Districts, 2018b, provides the DPP-1r-NoIG, TBIREA-NoIG, and ECHOREA-NoIG scenarios.

SJI – San Joaquin River Index, TAF – thousand acre-feet

[a] No flow changes (accretion or depletion) are considered between La Grange and the infiltration galleries.

[b] Environmental baseline conditions in accordance with the current license, Corps flood management guidelines, the Districts' irrigation and municipal and industrial water management practices, and changes in CCSF's operations resulting from construction of capital improvement projects permitted under CEQA, approved by CCSF, and funded but not fully implemented at the time of model development (i.e., in 2013). The Districts provide additional details for this scenario in the Water Balance Model Amended Study Report filed in the Don Pedro Project amended application (Steiner, 2017).

[c] Although the Districts propose lowering the minimum elevation of Don Pedro Reservoir from 600 feet to 550 feet, they apply the same minimum pool level as baseline conditions without providing their rationale.

[d] Proposed minimum flows are provided in exhibit E, table 5.6-2.

[e] This scenario simulates infiltration galleries operations between June 1 and October 15, depending on water year type and a reduction of infiltration galleries withdrawals to provide boatable flows.

[f] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

[g] Water year types for Bulletin 120 values less than 830 thousand acre-feet are categorized as extra critical dry and simulated with the same minimum instream flows as dry years without pulsing or infiltration galleries operation. In other July 1-October 15 periods, the infiltration galleries' operation is simulated as 200 cfs for wet, above normal, and below normal years or 225 cfs for dry and critically dry years.

[h] Simulated ramping rate limits are 500 cfs per day for downramps and unrestricted for upramps. Although the Districts state that simulated minimum instream flows for below the infiltration galleries are set equal to the La Grange gage for periods with higher minimum instream flows at the downstream site (Districts, 2018a), the simulated daily average flows below the infiltration galleries (Districts, 2018c) suggest early October minimum instream flows for this site may be set at 280 cfs, instead of 200 cfs, for critical years and 360 cfs, instead of 280 cfs, for below normal years.

[i] Although the Water Board's substitute environmental document's compliance point for target flows is at Modesto, simulations applied them to at La Grange (i.e., Dry Creek inflows and accretion/depletion below La Grange are not considered) to be conservative. Don Pedro Reservoir's minimum storage on September 30 is maintained at 800 thousand acre-feet (pool elevation of about 700 feet) unless it is needed to supply 363 thousand acre-feet minimum diversion. This scenario does not include operation of the infiltration galleries.

[j] Also incorporated pro-rated increase to meet 1,000 cfs in the San Joaquin River at Vernalis.

[k] Simulations do not include the Conservation Groups' recommended groundwater water bank recharging and accounting.

[l] Modeled with "TuolumneProposalTBI2018-01-26.dss" filed with The Bay Institute (letter from Gary Bobker, Program Director, The Bay Institute, San Francisco, California, to Kimberly Bose, Secretary, Federal Energy Regulatory Commission, Washington, D.C. Re: Don Pedro Hydroelectric Project, FERC Project No. 2299-082, January 29, 2018 [accession no. 20180129-5262]).

Under non-spill conditions, La Grange Reservoir is operated to maintain a storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet. The surface elevation of La Grange Reservoir varies between about 294 feet and 296 feet about 90 percent of the time.

The Districts calculate the water supply index for the project based on unregulated inflow to Don Pedro Reservoir, using the same methods currently used for the San Joaquin Valley Water Year Hydrologic Classification[85] (i.e., San Joaquin Valley 60-20-20 Index), which was developed by the Water Board for the San Joaquin River Basin as part of its Bay-Delta regulatory activities (Water Board, 2006). The five water year classifications—wet, above normal, below normal, dry, and critically dry—are calculated as 60 percent of the current year's April through July inflow to Don Pedro Reservoir, plus 20 percent of the current year's October through March inflow to Don Pedro Reservoir, plus 20 percent of the previous year's index (i.e., 20 percent of the total unregulated inflow to Don Pedro Reservoir). The Districts currently determine water year type by early April and issue the schedule of releases for the subsequent April 15 to April 14 of the next calendar year. The Districts propose to continue to use the existing hydrologic index and associated water year types, to determine minimum required flows in the Tuolumne River downstream of the La Grange Diversion Dam. Table 3.3.2-18 presents the San Joaquin River Index thresholds and associated water year types.

Table 3.3.2-18. San Joaquin 60-20-20 Index water year types and associated thresholds (Source: Districts, 2017a).

Water Year Type	San Joaquin Valley 60-20-20 Index Classification (thousand acre-feet)
Wet	Greater than 3,800
Above normal	3,101 to 3,800
Below normal	2,501 to 3,100
Dry	2,101 to 2,500
Critically dry	Less than 2,100

[85] Water year classification for the San Joaquin Valley 60-20-20 Index is based on the sum of unregulated (i.e., unimpaired) flow at Stanislaus River below Goodwin Reservoir (i.e., inflow to New Melones Reservoir), Tuolumne River below La Grange (i.e., inflow to Don Pedro Reservoir), Merced River below Merced Falls (i.e., inflow to Lake McClure), and San Joaquin River inflow to Millerton Lake.

Table 3.3.2-19 shows the minimum streamflow schedules, based on the applicable water year type, the Districts currently maintain in the Tuolumne River downstream of the La Grange Diversion Dam.

Table 3.3.2-19. Existing project flow requirements (cfs and acre-feet) for the lower Tuolumne River downstream of the La Grange Diversion Dam (Source: Districts, 2017a).

Month	Wet	Above Normal	Below Normal	Dry Water	Critically Dry
October 1–15 (cfs)	300	300	200	150	100
October 16–May 31 (cfs)	300	300	175	150	150
June 1–September 30 (cfs)	250	250	75	75	50
Attraction pulse flow[a] (acre-feet)	5,950	5,950	1,736	None	None
Out-migration pulse flow[b] (acre-feet)	89,882	89,882	60,027	37,060	11,091
Total Volume (minimum flows +flow pulses) (acre-feet)	300,923	300,923	165,002	127,507	94,000

[a] Flow used to attract upstream-migrating adult fall-run Chinook salmon.

[b] Flows for fall-run Chinook salmon smolt outmigration.

To benefit Tuolumne River coldwater fisheries and protect their water supplies, the Districts propose to install and operate two in-stream infiltration galleries—IG-1 and IG-2. The Districts intend to complete construction of IG-1 and undertake construction of IG-2, both of which would be located at approximately RM 25.9. IG-1 has a design capacity of 100 cfs, and IG-2 would have a capacity of 100 to 125 cfs. Water withdrawn from the river through the infiltration galleries would be delivered to TID's Ceres Canal for consumptive use. The infiltration galleries would be in operation from June 1 through October 15 each year.

The Districts' proposal includes new project flow requirements for the Tuolumne River downstream of the La Grange Diversion Dam. The proposed minimum flows would be determined by the applicable San Joaquin 60-20-20 Index water year type. Table 3.3.2-20 presents the proposed minimum flow requirements by water year type, as

measured at the USGS gage below La Grange Diversion Dam (RM 51.7) and below the existing IG1 and proposed IG2 infiltration galleries (RM 25.9). The table also shows interim flows that would be provided until the infiltration galleries are operational.

Table 3.3.2-20. Proposed minimum flow requirements (in cfs) with and without infiltration galleries for the Tuolumne River downstream of the La Grange Diversion Dam by San Joaquin 60-20-20 Index water year type as measured at the USGS gage below La Grange Diversion Dam (RM 51.7) and RM 25.9 (Source: Districts, 2017a).

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7 (La Grange Gage)**	**RM 25.9**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100	150
July 1 through October 15	350	150	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)	RM 25.9	RM 51.7 (La Grange Gage)
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

Any infiltration gallery outage preventing the planned amount of water to be withdrawn and lasting for more than 3 consecutive days would result in the Districts' proposed minimum instream flows required at the USGS La Grange gage to be reduced by two-thirds of the amount that would have been withdrawn. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration galleries pipeline gage) and to monitor compliance with the flows downstream of the infiltration galleries (RM 25.9) by subtracting the flow volume measured at the infiltration galleries pipeline gage from the flow measured at the La Grange gage.

In addition to the flows presented in table 3.3.2-20, the Districts would provide a flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7 to accumulated algae and fines from gravels prior to peak Chinook salmon spawning with the proposed infiltration galleries shut off. These flows would be provided in wet, above normal, and below normal water years only.

The Districts would also provide spring pulse flows in the following amounts to facilitate outmigration of juvenile fall Chinook salmon (these flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application):

- Wet and above normal water years—150,000 acre-feet
- Below normal water years—100,000 acre-feet

- Dry water years—75,000 acre-feet
- Sequential dry water years—45,000 acre-feet
- First critical water year—35,000 acre-feet
- Sequential critical water year—11,000 acre-feet

To enhance downstream spawning conditions, the Districts would conduct coarse sediment augmentation from RM 52 to RM 39 over a 10-year period following issuance of any license issued. To promote sediment mobilization downstream of the La Grange Diversion Dam, the Districts would release flows ranging from 6,000 to 7,000 cfs, measured at the USGS La Grange gage, for at least 2 days during years when sufficient spill is projected to occur. The Districts estimate that sufficient flow would be released to provide the gravel mobilization flows at an estimated average frequency of once every 3 to 4 years. In years when the spring (March through June) spill at the La Grange Project is anticipated to exceed 10,000 acre-feet, the Districts would plan to release a flow of 6,500 cfs for 2 days during the spill period, and down-ramping would not exceed 300 cfs per hour.

To enhance conditions for recreational boating on the Tuolumne River downstream of the La Grange Diversion Dam, the Districts propose to provide a flow of 200 cfs or greater from April 1 through May 31 in all water years at the La Grange gage. During this period, the Districts would either shut off the infiltration galleries or release additional flows downstream of the La Grange Diversion Dam. From June 1 through June 30, a flow of 200 cfs would be provided at the La Grange gage in all water years. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional boating flows to the river downstream of RM 25.9. From July 1 through October 15, the Districts would provide a flow of 350 cfs in wet, above normal, and below normal water years and 300 cfs in dry and critical water years at the La Grange gage. In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the 3-day July 4 holiday, 3-day Labor Day holiday, and 2 pre-scheduled additional weekends in either July or August, representing an incremental increase of 50 cfs downstream of RM 25.9 (over the background of 150 cfs) in wet, above normal, and below normal water years, and an incremental increase of 125 cfs (over the background of 75 cfs) in dry water years, as measured at the La Grange gage.

In spill years, the Districts would make an effort to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions.

Our Analysis

The Districts developed a water balance/operations model (Tuolumne River Operations Model) to simulate: (1) Don Pedro Project operations and Hetch Hetchy System water supply operations for a period of analysis that covers a range of historical hydrologic conditions; and (2) the alternative operating scenarios and their effects on

hydropower generation, downstream flows, and water supplies to the Districts and CCSF's Bay Area customers. For modeling purposes, the Districts defined the no-action (i.e., base case) scenario as current operations, including required minimum flows and reservoir operations that have been historically implemented over the period of record. The Districts' proposed project scenario would increase the amount of water that would be released annually into the lower Tuolumne River compared to its current license requirements. CCSF's Hetch Hetchy System operation would contribute 51.7 percent of the additional water that would be needed to meet the releases in the proposed flow regime.

Figures 3.3.2-10 through 3.3.2-13 present simulated hourly flows for the Tuolumne River downstream of the La Grange Diversion Dam for the Districts' no-action and proposed project scenario for representative wet, dry, and normal water years. Figures 3.3.2-14 through 3.3.2-16 present simulated daily Don Pedro Reservoir water surface elevations for the Districts' no-action and proposed project scenario for representative wet, dry, and normal water years. Figures 3.3.2-17 through 3.3.2-19 present simulated daily Don Pedro Reservoir water surface elevations for the Districts' no-action and proposed project scenario for representative sequential dry/critical water years. Effects of these changes in project flows and reservoir water levels on specific resources are addressed in following sections.

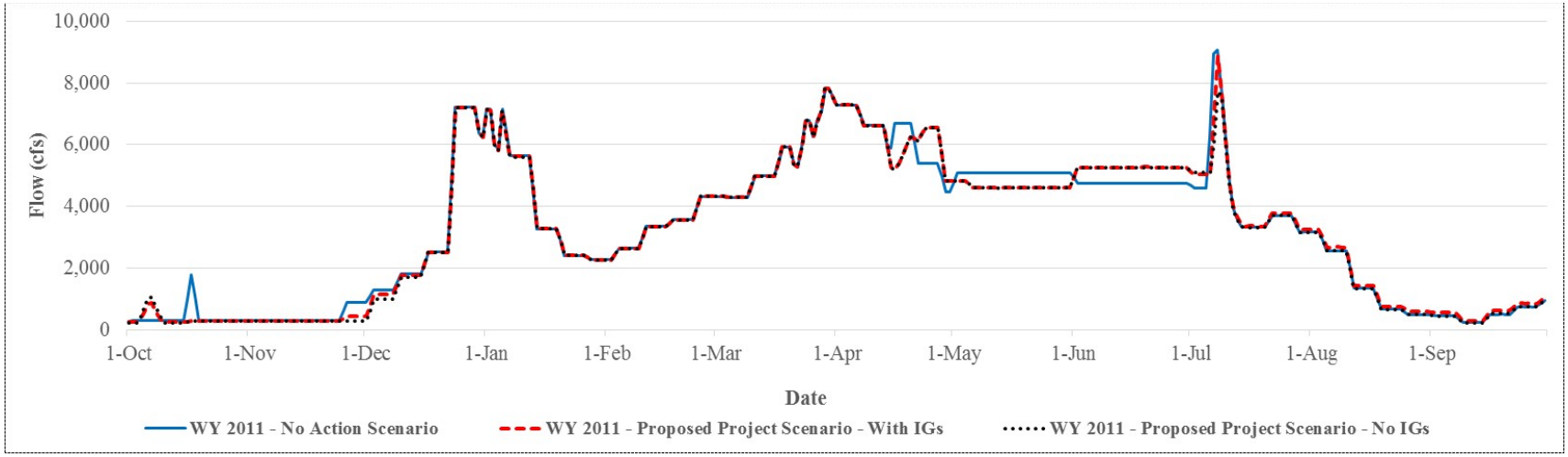

Figure 3.3.2-10. Simulated Tuolumne River flow downstream of the La Grange Diversion Dam for the Districts no-action and proposed project scenario for representative wet (2011) water year (Source: Districts, 2018a,b).

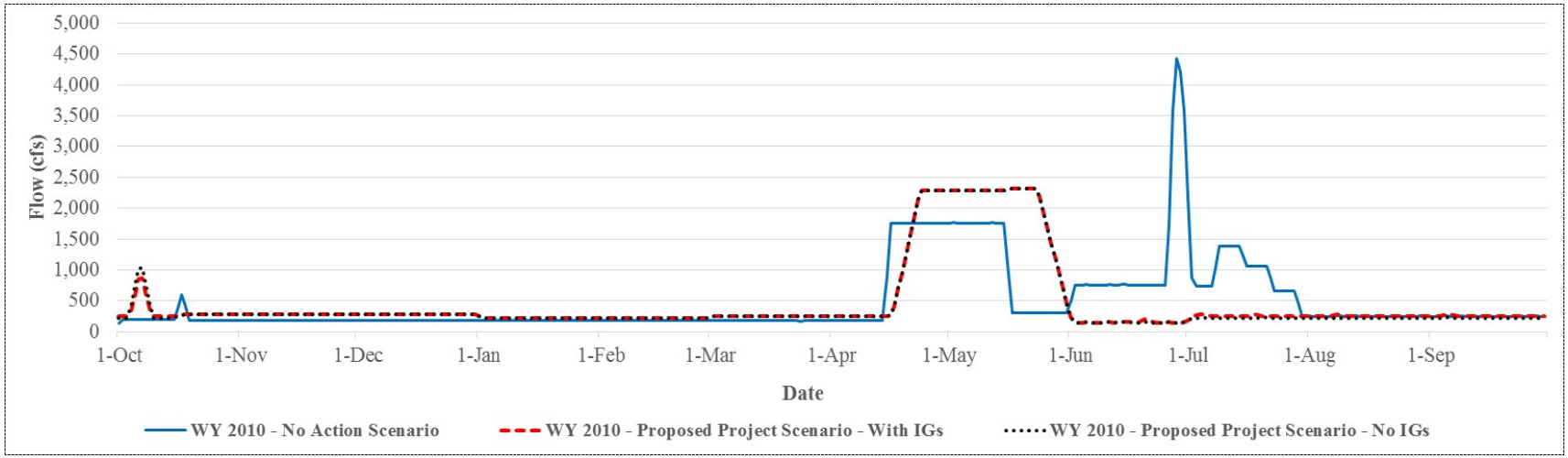

Figure 3.3.2-11. Simulated Tuolumne River flow downstream of the La Grange Diversion Dam for the Districts' no-action and proposed project scenario for representative normal (2010) water year (Source: Districts, 2018a,b).

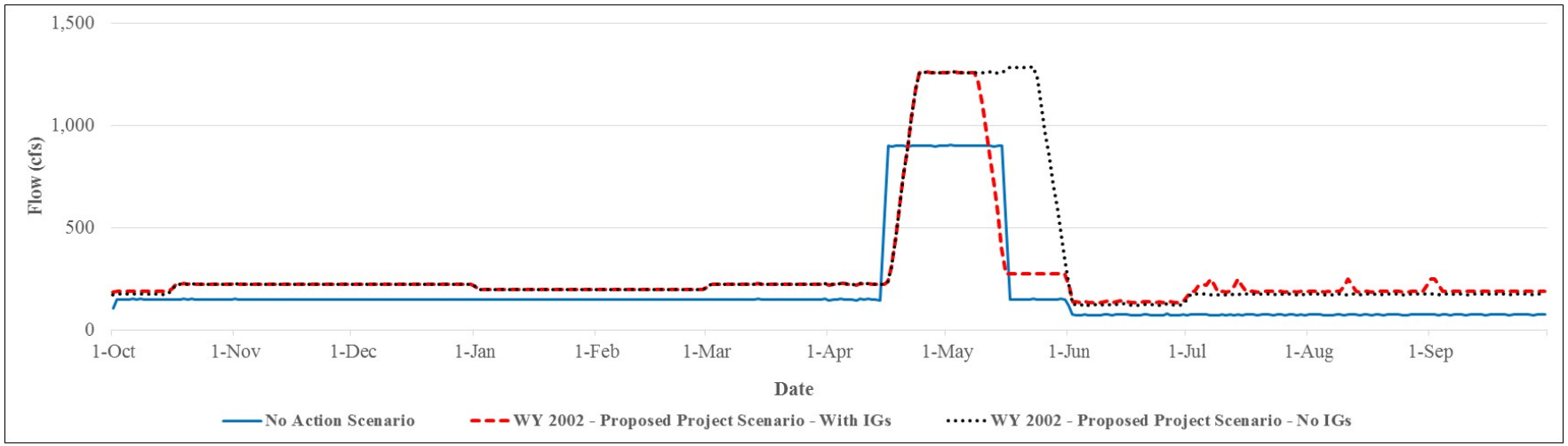

Figure 3.3.2-12. Simulated Tuolumne River flow downstream of La Grange Diversion Dam for the Districts' no-action and proposed project scenario for representative dry (2002) water year (Source: Districts, 2018a,b).

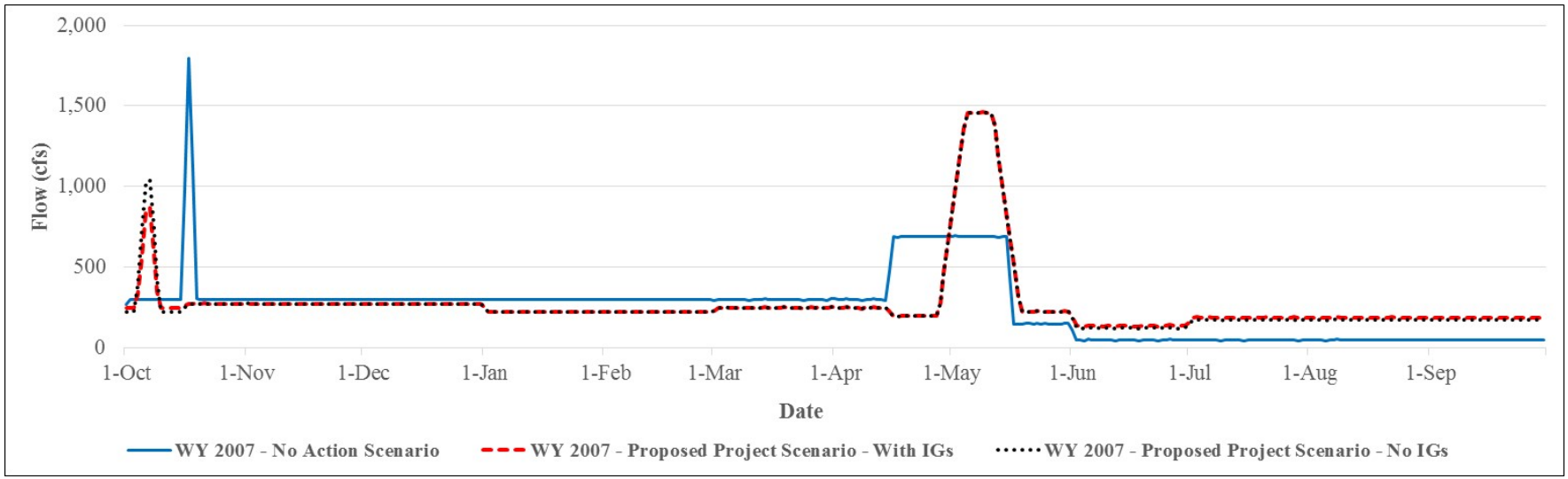

Figure 3.3.2-13. Simulated Tuolumne River flow downstream of La Grange Diversion Dam for the Districts' no-action and proposed project scenario for representative critical (2007) water year (Source: Districts, 2018a,b).

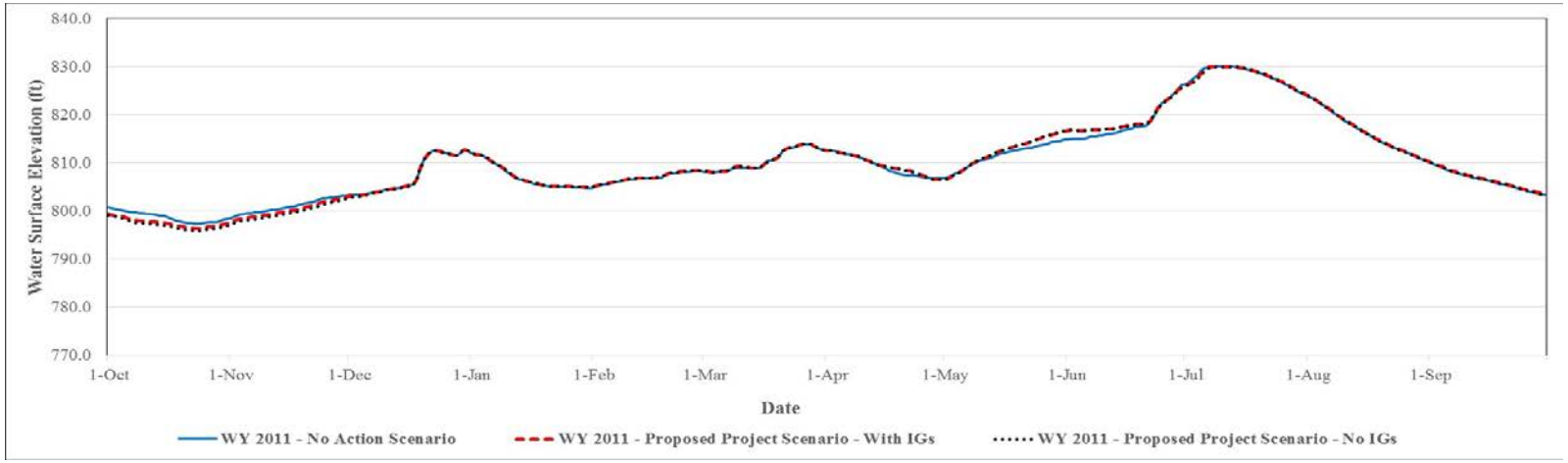

Figure 3.3.2-14. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative wet (2011) water year (Source: Districts, 2018a,b).

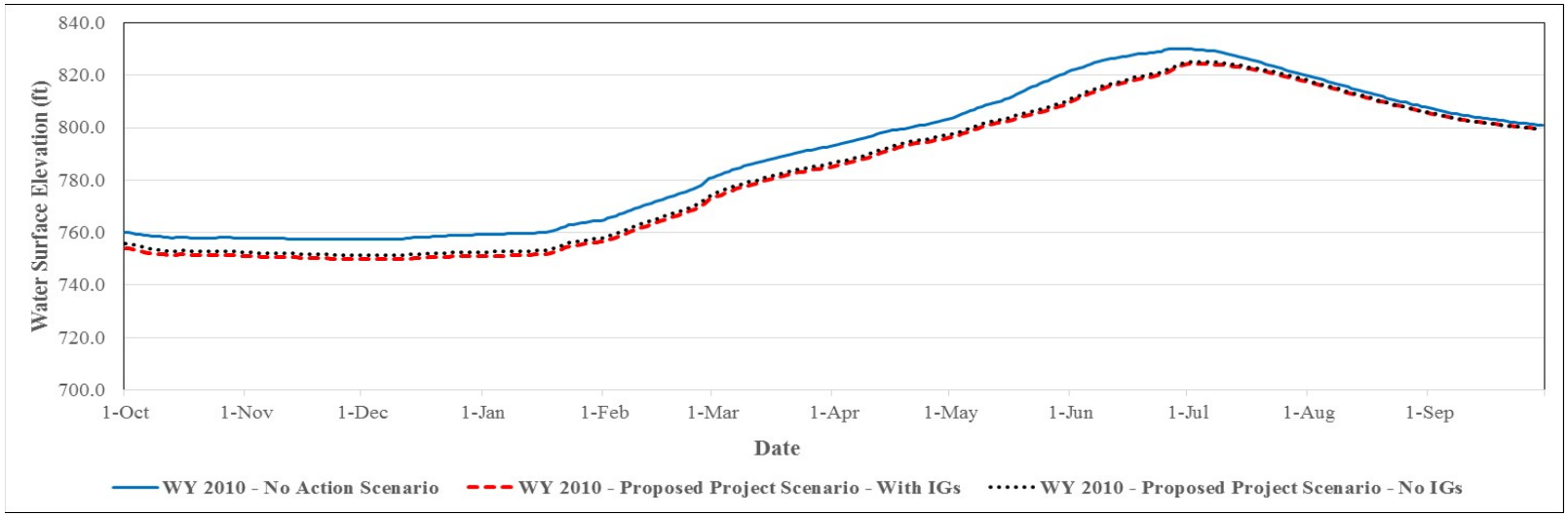

Figure 3.3.2-15. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative normal (2010) water year (Source: Districts, 2018a,b).

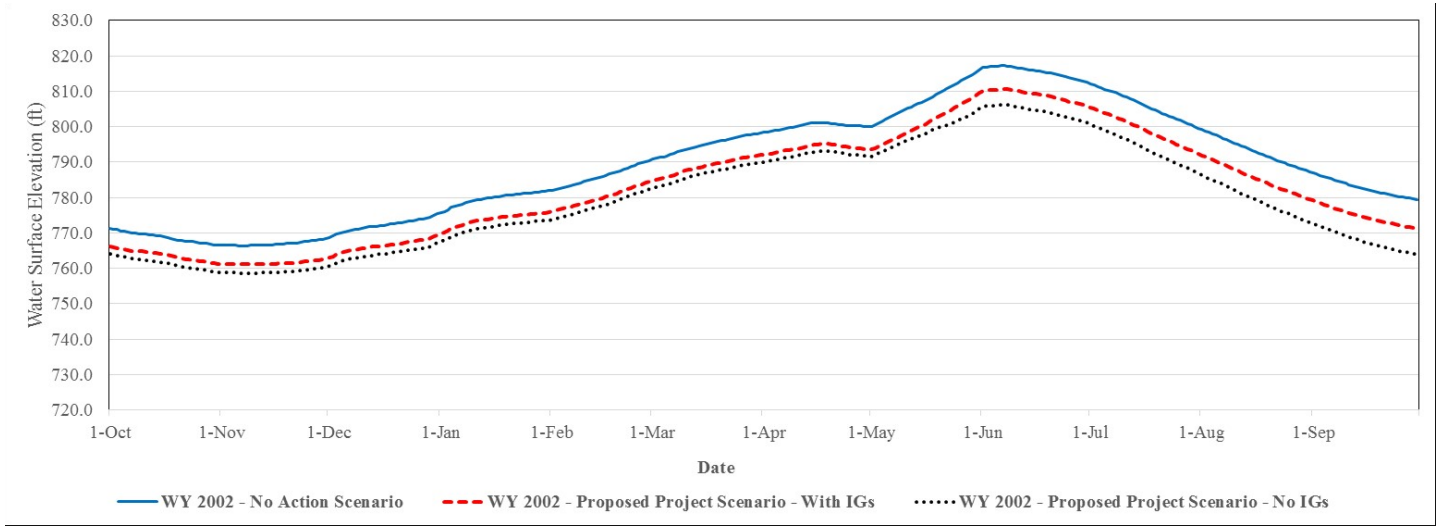

Figure 3.3.2-16. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative dry (2002) water year (Source: Districts, 2018a,b).

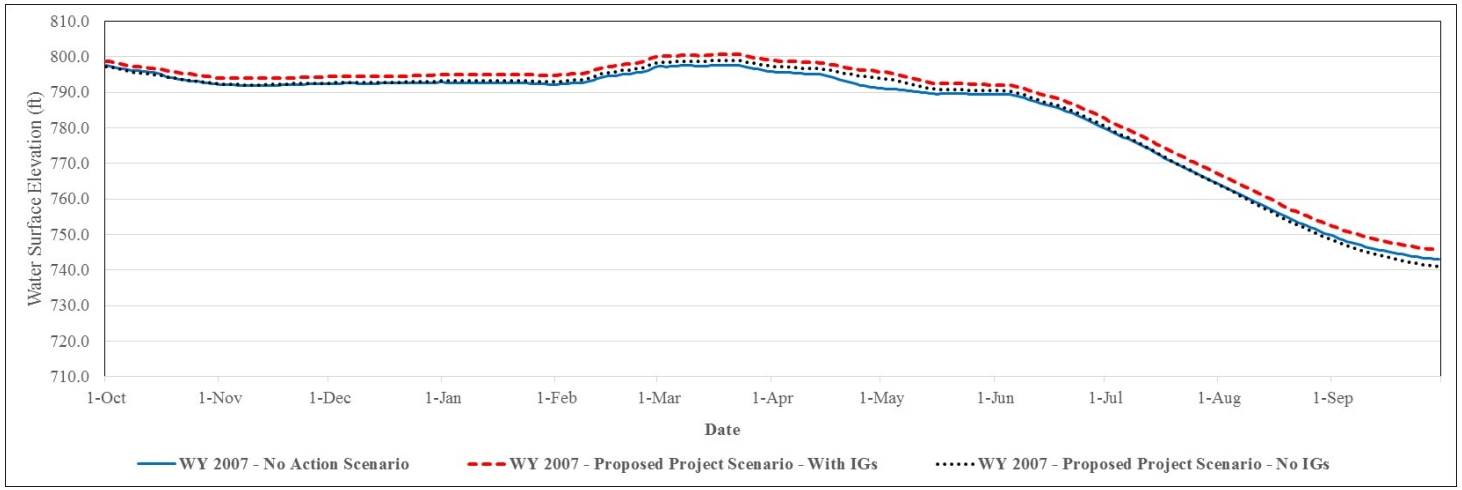

Figure 3.3.2-17. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative critical (2007) water year (Source: Districts, 2018a,b).

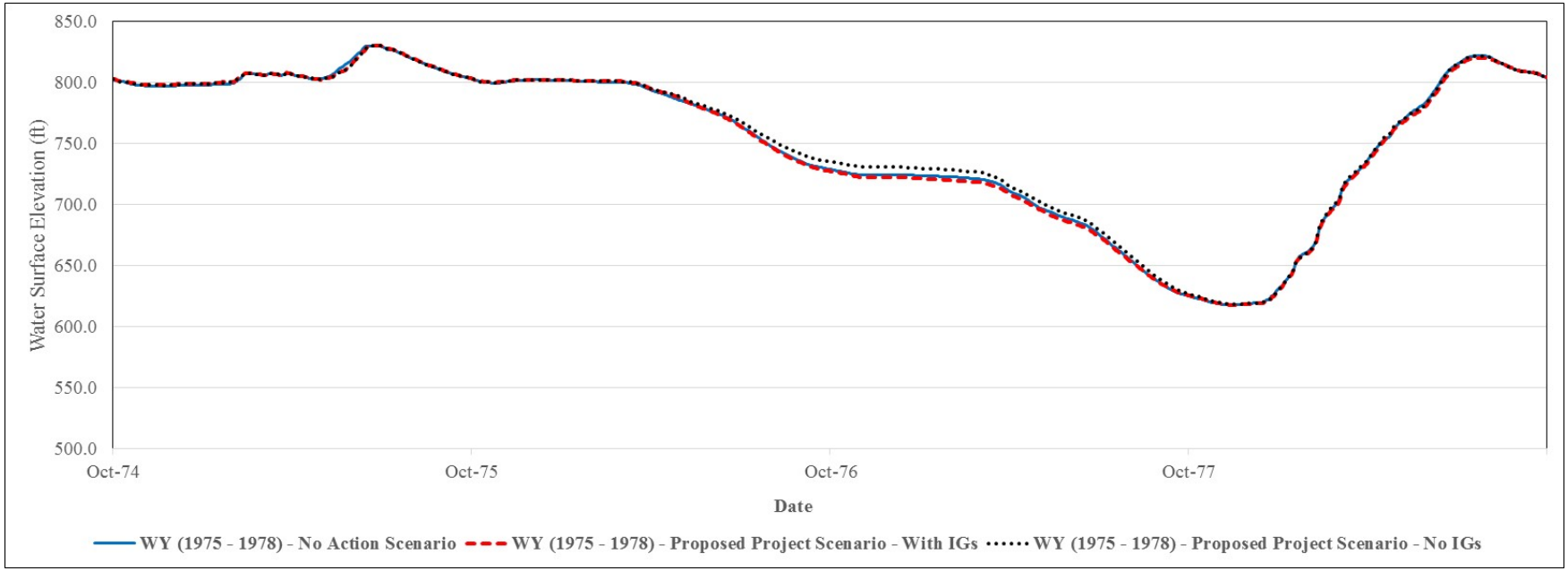

Figure 3.3.2-18. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative sequential dry/critical (1976 through 1977) water years (Source: Districts, 2018a,b).

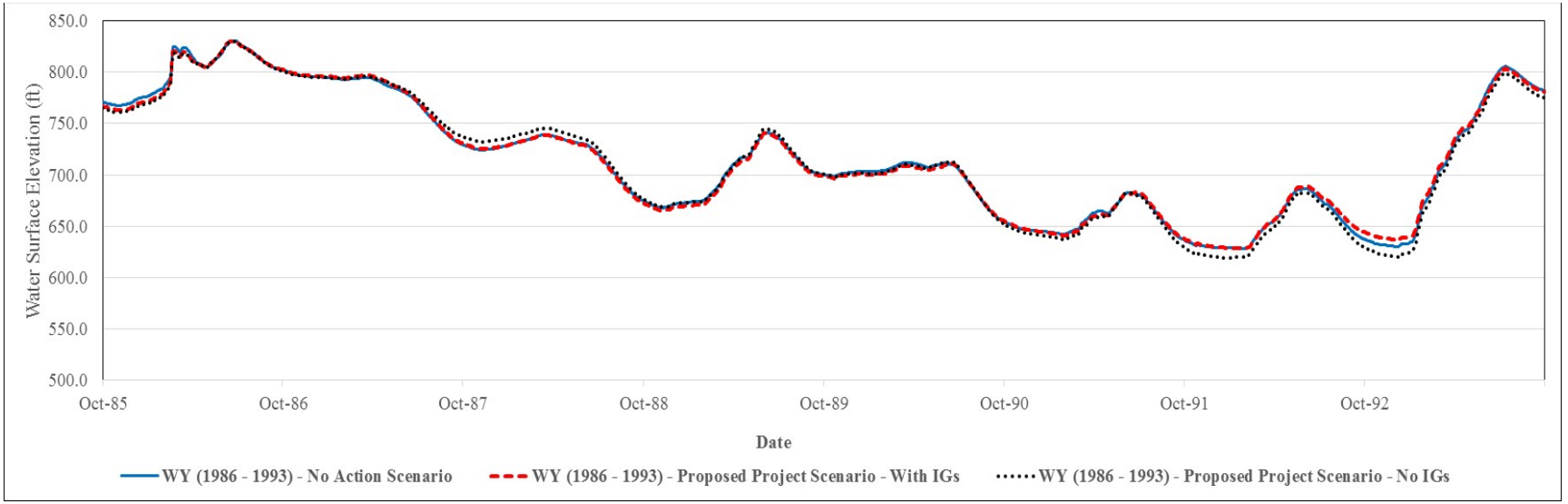

Figure 3.3.2-19. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenario for representative sequential dry/critical (1987 through 1992) water years (Source: Districts, 2018a,b).

Drought Management

Drought management often requires temporary reapportionment of water to continue all water uses. The Districts' proposal includes several flow-related measures that specify how flow releases into the lower Tuolumne River and storage requirements would be adjusted during years when water availability is limited. These adjustments include lower minimum flows for dry and critically dry water years, a reduction in spring pulse flows during sequential-year droughts, and a lower minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet. The reduced minimum operating elevation would make an additional 150,000 acre-feet of storage available to meet instream flow and water supply needs. The Districts do not propose any specific mechanism to allow deviation from license requirements during prolonged drought conditions.

The Districts also participate in CCSF's Water System Improvement Program, a comprehensive program designed to improve CCSF's Regional Water System (RWS) with respect to water supply and water delivery needs. The Water System Improvement Program includes a multi-stage drought response program with several key program elements related to the Districts' role in providing effective drought management: (1) the development of 20 million gallons per day (mgd) of conservation, recycled water, and groundwater within the San Francisco Public Utilities Commission (SFPUC) service area; and (2) a dry-year transfer from the Districts of about 2 mgd coupled with the drought year goal of limiting rationing to no more than 20 percent on a system-wide basis.

NMFS 10(a) recommendation 1.6 recommends a drought plan that in the event that three or more, consecutive, dry and/or critically dry water years occur, the Districts would modify operation of the Don Pedro and La Grange Projects. Specifically, by March 10 of the second or subsequent dry and/or critically dry water year, NMFS recommends that the Districts notify the appropriate resource agencies (e.g., NMFS, California DFW, FWS, and the Water Board) of their concerns in meeting one or more license conditions. By May 1 of the same year, the Districts would consult with the appropriate agencies to discuss the projects operational plans to manage the drought conditions. If the Districts and appropriate agencies agree on a revised operational plan (i.e., drought plan), the Districts may begin implementing the new drought plan as soon as it files documentation of the agreement with the Commission. If unanimous agreement between the Districts and appropriate agencies is not reached, the Districts would submit a revised drought plan, including as many of the commenting agencies' issues as possible and any assenting and dissenting comments, to the Commission and would implement the proposed drought plan upon Commission approval.

In their reply comments, the Districts state that NMFS's recommendation lacks clarity on regarding what circumstances would trigger the proposed measures, what action would be required, and the time frames for submittals, responses, and approvals.

Our Analysis

The operational guidelines of the existing license determine the water levels and streamflows in the Tuolumne River downstream of the La Grange Diversion Dam. During drought conditions, water storage in Don Pedro Reservoir provides a buffer to downstream areas and could lessen the effects of a drought on aquatic habitat (i.e., more water is available to provide a minimum instream flow). However, during multiple critically dry years, compounded drought conditions could make it difficult for the Districts to supply all water uses, such as minimum flows for aquatic resources and irrigation and municipal and industrial deliveries.

The Districts' proposed flow-related measures incorporate dry-year relief mechanisms (e.g., lower minimum flows for dry and critically dry water year types, reduction of spring pulse flows during sequential-year droughts, and lowering the minimum operating elevation of Don Pedro Reservoir from 600 feet to 550 feet). The Districts used six models[86] to evaluate the effects of their proposed flows on water supply and environmental resources to seek an appropriate balance between competing needs in all types of water years, including prolonged droughts. It is unclear how NMFS's recommendation to trigger the development of a drought plan when three or more consecutive dry and/or critically dry water years occur would result in a better balance among competing needs compared to the flows developed by the Districts, based on model results.

However, because of the highly variable nature of hydrologic conditions and the increasing water demand in the region, it is possible that an extreme or prolonged drought may occur that would require a variance from license conditions. Developing a drought plan that defines the process the Districts would follow to request a variance from license conditions would help to ensure that the available water is allocated in the most beneficial manner. Such a plan should include a definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); which license requirements would be temporarily modified during drought conditions; and how the project would be operated when drought conditions occur. Developing a drought plan in consultation with California DFW, NMFS, the Water Board, BLM, and FWS would help guide the implementation of this measure and ensure that the resource agencies have an opportunity to provide input on the plan.

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[86] Tuolumne River Operations Model, which includes the Districts' water supply and hydropower operations and the water supply operations of CCSF; Don Pedro Reservoir Temperature Model; Lower Tuolumne River Temperature Model; Lower Tuolumne River Fall-run Chinook Population Model; Lower Tuolumne River *O. mykiss* Population Model; and Lower Tuolumne River Floodplain Hydraulic and Habitat Model.

Coordination of Project Operations

The Districts currently operate the Don Pedro and La Grange Projects in coordination with CCSF and the Corps to manage and provide a reliable water supply for consumptive use and flood flow management. The Districts propose to continue to operate the Don Pedro and La Grange Projects in coordination with CCSF and the Corps, while also implementing a number of environmental measures related to instream flows, flow management, habitat improvement, aquatic organism health, and recreation.

California DFW (10(a) recommendation M3-2) recommends that the Districts develop a coordinated operations plan to provide for coordination of environmental requirements and actions (i.e., flood control, water storage, and water diversion) with the Districts and other hydroelectric facilities of the San Joaquin River Basin. The coordinated operations plan would include: (1) a listing of other participating projects and operators, (2) the roles and responsibilities of participating projects and operators, (3) a list of coordination goals and objectives, (4) a description of the extent of ability to cooperate and coordinate flood control, water storage, water diversion with other hydroelectric facilities of the San Joaquin River Basin, (5) the roles and responsibilities related to the Stanislaus, Tuolumne and Merced Work Group (STM Work Group organized by the Water Board), and (6) a list of voluntary actions aimed at increasing effectiveness of actions, monitoring, and data synthesis. Once a draft coordinated operations plan is completed, the appropriate resource agencies would have 30 days to review and comment. Following the comment period, the Districts would incorporate any comments received and following final agency approval, file the plan with the Commission for approval.

The resource agencies also recommend the Districts coordinate with other stakeholders within the San Joaquin watershed to meet desired goals and objectives for environmental protection and mitigation at the projects. FWS 10(j) recommendation 12 for the Don Pedro Project and 11 for the La Grange Project, California DFW 10(a) recommendation M3-1, and Conservation Groups recommendation 3 recommend the formation or reestablishment of a Tuolumne River Ecological Group (TREG) that would meet annually for consultation and coordination. FWS and California DFW provided a recommended agenda and topics to be discussed would include license conditions, monitoring, and annual river operations.

In their reply comments, the Districts note that many of the coordination activities (e.g., providing a water bank in Don Pedro Reservoir to CCSF for its water supply requirements) with the Districts and non-licensees are not under the jurisdiction of the Commission. The Districts state that they would participate in a coordinated operations organization composed of federal and state agency leadership as long as its jurisdiction and authorities were clear.

Our Analysis

CCSF's Cherry Creek facilities and the Hetch Hetchy System are located on the Tuolumne River about 38 miles upstream of Don Pedro Reservoir, and no other hydroelectric facilities occur downstream of the La Grange Diversion Dam on the lower Tuolumne River. Although the Districts operate the Don Pedro and La Grange Projects in close coordination with CCSF's facilities, developing a coordinated operations plan is not necessary to ensure implementation of the project license conditions. The Districts have contracts with the Corps concerning flood control that regulate storage in Don Pedro Reservoir and streamflows in the lower Tuolumne River near Modesto, California. The Districts would continue to be required to meet the terms of its contract with the Corps and the terms of any new license. Additional agreements with CCSF would also have to incorporate the terms of any new license.

The formation of the TREG would facilitate communication among the Districts, the resource agencies, and other stakeholders in the Tuolumne River Watershed and provide interested stakeholders with an opportunity to discuss license implementation. While the formation of such a group may provide an efficient method of consultation, the Commission, however, does not have the authority to require any agencies or other stakeholders to join or participate in the group.

California DFW 10(a) recommendation M3-2 would put the responsibility on the Districts to develop a plan to facilitate coordination of operations among multiple projects and entities in a very large river basin and cover a wide range of project purposes, many of which are outside of the Commission's jurisdiction. As noted by the California DFW, the Water Board is considering the establishment of the STM Work Group as part of the update to the 2006 Water Quality Control Plan for the San Francisco Bay Sacramento-San Joaquin Delta Estuary. The Districts' voluntary participation in this type of regional planning effort would be better suited to address basin-wide coordination associated with the range of project purposes identified by California DFW in its recommendation.

Streamflow and Reservoir Level Compliance Monitoring

The Districts have historically operated the Don Pedro and La Grange Projects on an annual cycle consistent with managing for and providing a reliable water supply for consumptive use purposes, providing flood flow management, and ensuring delivery of downstream flows (i.e., minimum flows) to protect aquatic resources. The Districts currently monitor requirements of the existing license using the following streamflow gages: (1) USGS gage 112875000 Don Pedro Reservoir near La Grange, California (Don Pedro Reservoir elevation and Corps flood storage requirements); (2) USGS gage 11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (project minimum flows); and (3) USGS gage 11290000 Tuolumne River at Modesto, California (Corps flood regulation).

The Districts propose to use two gages to monitor compliance with the proposed license conditions: (1) the existing USGS Tuolumne River at La Grange gage and (2) a new USGS gage that would measure flow in pipeline that conveys water from the infiltration galleries to the Districts' water supply system. The USGS La Grange gage would be used to monitor compliance for flows to be released from La Grange Diversion Dam. For flows required downstream of the infiltration galleries (RM 25.9), the Districts would subtract the flow measured at the proposed infiltration gallery pipeline gage from the flow measured at the La Grange gage to yield the instream flow downstream of the infiltration galleries. Compliance would be deemed met if flows equaled or exceeded the Districts' proposed minimum flows over monthly time frames, with no deficits of more than 10 percent below the minimum for more than 60 minutes, and no instantaneous deficits of more than 20 percent below the proposed minimum flows.

The Districts also propose to formalize the current project practice of releasing a minimum flow of 5 to 10 cfs through the MID Tainter gates and Hillside gates to the plunge pool downstream of the La Grange Project at all times.

The Water Board includes preliminary 401 condition 3 pertaining to the documentation and compliance with streamflow and reservoir level requirements in its preliminary 401 conditions for the Don Pedro and La Grange Projects:

In consultation with the Water Board, develop a streamflow and reservoir level compliance plan to document compliance with streamflow and reservoir level requirements in the new project license. At a minimum, this plan should include: (1) locations where the Districts monitor streamflow and reservoir levels, (2) equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of this certification, (3) a description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of this certification is deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained, (4) a description of how the data will be retrieved from the equipment used by the Districts to monitor compliance with the requirements in the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage, and (5) a description of how streamflow and reservoir level data are provided to the Water Board.

California DFW 10(a) recommendation M1-1 and FWS 10(j) recommendation 1 recommend the Districts develop a streamflow and reservoir level compliance monitoring plan to monitor compliance with flow and water level requirements specified in a new license. The plan would be developed in consultation with California DFW, FWS, NMFS, and the Water Board. The plan would include descriptions of: (1) locations where the Districts monitor compliance to the requirements in the license related to streamflows and reservoir levels, (2) equipment used by the Districts to monitor compliance to the requirements in the license related to streamflows and reservoir levels, (3) how the equipment used by the Districts to monitor compliance to the requirements in the license is deployed, (4) how data are retrieved from the equipment used by the

Districts, including frequency of data downloads, quality assurance/quality control procedures, and data storage, (5) how the Districts make streamflow and reservoir level data available to the Commission, agencies, and the public, and (6) how the Districts will report streamflow and reservoir data to the Commission, and update the proposed plan as needed in the future.

Both California DFW and FWS also recommend that the Districts add an additional minimum instream streamflow compliance gage in the lower Tuolumne River. The new compliance gage would be located in the river up to 1,500 feet downstream of the Districts' existing and proposed infiltration galleries (RM 25.9). NMFS (10(a) recommendation 1.4) recommends the Districts establish a new streamflow gage, rated to USGS gaging standards and criteria, near RM 25, downstream of the proposed infiltration galleries. The new gage would be capable of recording up to 8,000 cfs.

In their reply comments, the Districts state that they are opposed to the requirement to establish an additional USGS-type streamflow gage downstream of the existing and proposed infiltration galleries. The Districts state that (1) the Districts' proposed infiltration gallery gage would be more accurate than an open channel streamflow gage, and (2) establishing a stream flow gage below the infiltration galleries would make the Districts responsible for non-project diversions and accretions associated with multiple irrigation diversions that exist between La Grange gage and the proposed gage location, and over which they have no control.

Our Analysis

We provide our analysis of the proposed and recommended minimum flows and ramping rates for the Tuolumne River downstream of the project under *Effects of Minimum Flows and Pulse Flows* and *Ramping Rates and Fish Stranding*, later in this section. Our discussion herein focuses on the flow gaging and monitoring that would be required to determine whether the project is operating in compliance with any flow requirements of any license issued.

The Districts propose to modify and provide new minimum flows downstream of the project facilities. However, the Districts provide few details regarding a plan to monitor compliance with flow and water level requirements specified in a new license. An effective streamflow and reservoir compliance plan would include, at a minimum, the five elements identified by the Water Board, and should be submitted to the Water Board, California DFW, and FWS for review before it is filed with the recommendations, as well as procedures for submitting to the Commission for approval. Such a plan would specify how compliance with the operational requirements of any license issued would be measured, documented, and reported, which would minimize misunderstandings about operational compliance.

However, California DFW, FWS, and NMFS's recommendations to measure flow compliance using a new gage installed downstream of the infiltration galleries would make compliance difficult due to the effects of non-project water diversions. As noted in

section 3.3.2.1, *Aquatic Resources, Affected Environment,* in the subsection *Water Quantity,* California DWR lists 26 non-project points of diversion along the lower Tuolumne River between the La Grange Diversion Dam and the San Joaquin River, with an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Of the 26 points of diversion listed by California DWR, 12 exist between the La Grange streamflow gage (RM 51.7) and the agency recommended gage location (i.e., near RM 25) and account for over half (43 cfs) of the estimated total combined withdrawal capacity on the lower Tuolumne River (Water Board, 2018a). Variations in withdrawal rates at these diversions, which are not controlled by the Districts, would make it difficult for the Districts to ensure compliance with flow requirements tied to a gage downstream of the infiltration galleries.

Spill Prevention, Control, and Countermeasures

Construction of any new project facilities, modification of existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways.

At the Don Pedro Project, the Districts propose to implement a Spill Prevention Control and Countermeasure Management Plan to guide the handling of hazardous substances and protect water quality and aquatic biota during project construction and operation. The Districts' Spill Prevention Control and Countermeasure Management Plan (Districts, 2017d) identifies relevant federal, state, and local regulations and consists of two components: (1) DPRA Spill Prevention, Control, and Countermeasure Plan, and (2) DPRA HAZMAT Plan.[87]

BLM (Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34) specifies that, within 1 year of issuance of any new license or prior to undertaking activities on BLM lands, the Districts would file with the Commission a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. BLM also specifies that during planning and prior to any new construction or maintenance not addressed in an existing plan, the Districts would be required to consult with BLM, to determine whether a new oil and hazardous substances storage and spill prevention and cleanup is needed. The plan would need to be approved by BLM before it is filed with the Commission.

BLM specifies that at a minimum, a plan must require the Districts to: (1) maintain in the project area, a cache of spill cleanup equipment suitable to contain any spill from the project; (2) to periodically inform BLM of the location of the spill cleanup

[87] Although the Districts state that their plan incorporated a third component (the Don Pedro Hydroelectric Project Spill, Prevention, Control, and Countermeasure Plan); this component was not included in the version that was filed on October 11, 2017.

equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (3) to inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. BLM would require that the plan include a monitoring plan that details corrective measures that would be taken if spills occur. The plan would include a requirement for a weekly written report during construction, documenting the results of the monitoring.

The Water Board (preliminary 401 condition 10) states they will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan for the storage, use, transportation, and disposal of hazardous materials in the projects' area. The Water Board specifies that the plan discuss appropriate measures and equipment required to prevent or limit the extent of any hazardous material spill. This plan would also include protocols to prevent adverse impacts to beneficial uses in the event that hazardous materials are spilled. The Water Board specifies that on-site containment for hazardous-chemical storage be placed away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320. Protocols and methods in this plan would abide by federal, state and local laws and policies.

Our Analysis

Developing project-specific plans for hazardous substance control would help to ensure that proper procedures are in place to prevent accidental spills and address any discharges of hazardous substances to project lands and waters. These project-specific plans would address the prevention of hazardous substance spills, ensure protocols and equipment are in place to contain and cleanup any spills, and ensure appropriate notification procedures are followed.

The Districts' proposed measures would focus on managing risks associated with the DPRA warehouse and fuel island located at 10181 Bonds Flat Road by defining locations for storage of hazardous materials used for the project, specifying primary and secondary containment of hazardous materials, identifying mitigation measures to prevent any hazardous material spill from spreading, ensuring that the Districts' staff receive training for managing hazardous materials, and cleaning up any hazardous material spills. However, the Districts' proposed plan does not address management of oil or other hazardous materials associated with the Don Pedro or La Grange hydroelectric facilities. Development of separate plans to manage oil or other hazardous materials associated with the Don Pedro and La Grange hydroelectric facilities would provide assurance that the frequency and magnitude of spills would be minimized and appropriate cleanup procedures would be conducted in the event of a spill.

Development of project-specific spill prevention control and countermeasure management plans through consultation with the Water Board, California DFW, BLM, FWS, and NMFS would facilitate addressing their concerns. Appropriate plans would focus on management of oil, fuels, lubricant products, and other hazardous liquid

substances and include: (1) description of how they would be transported, stored, handled, and disposed of in a safe and environmentally acceptable manner; (2) a description of the equipment and procedures used to ensure containment and cleanup of any hazardous substances; (3) a provision to notify the Water Board, California DFW, BLM, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future. If the Districts are required to document all spill and cleanup activities as described above, BLM's specified weekly reporting during construction would not be warranted.

Overall, the proposed plan and the separate plans discussed above would minimize any negative effects on water quality and aquatic resources within the Don Pedro and La Grange Projects that may result from accidental hazardous substance spills.

Water Quality Management and Compliance

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment,* existing water quality data document that:

- DO is less than the 7.0-mg/L Basin Plan objective[88] in the hypolimnion of Don Pedro Reservoir; and for brief periods just below Don Pedro Dam and Powerhouse. However, the average daily concentrations below Don Pedro Dam and Powerhouse remain above 7.0 mg/L.
- DO of less than the 8.0-mg/L Basin Plan objective for the Waterford-La Grange reach occurs in September and October of some years in the La Grange Powerhouse tailrace channel, while DO in the mainstem channel remains at 9.0 mg/L or higher.
- Dissolved copper in Don Pedro Reservoir's hypolimnion exceeds the corresponding California Toxics Rule's allowable level, although all other sites and metals meet the California Toxics Rule limit.
- Bioaccumulation of mercury in Don Pedro Reservoir and lower Tuolumne River fishes exceeds limits considered safe for human consumption (OEHHA, 2018b; Districts, 2017a).

Changing the operations for either project has the potential to alter water quality from existing conditions. Even if water quality conditions are not changed, continuation

[88] The Basin Plan objectives for DO are to maintain at least 7.0 mg/L for cold freshwater habitat and spawning, and at least 8.0 mg/L from Waterford to La Grange between October 15 and June 15.

of negative water quality effects has the potential to adversely affect beneficial uses. To address low DO observed in the La Grange Powerhouse tailrace,[89] the Districts propose to monitor DO from September 1 to November 30 in the first 2 years of a new La Grange Project operating license, and to submit an action plan if low DO levels are found. This proposal includes collecting DO information at 15-minute intervals at three locations: (1) the La Grange Project forebay, (2) immediately below the La Grange Powerhouse, and (3) at the lower end of the La Grange Powerhouse tailrace channel. At the end of each year's monitoring period, that year's DO data would be compiled, analyzed, and submitted as an annual report to FERC. The Districts state that in the event the monitoring indicates a specific cause for low DO, the Districts would develop and submit an action plan to FERC in year 3 of the license.

The Water Board (preliminary 401 condition 6) states they will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to monitor water quality. The Water Board specifies that the plan address: (1) monitoring locations, (2) monitoring periods, (3) monitoring parameters, and (4) reporting. The Water Board specifies that monitoring locations include an adequate number and spatial distribution of monitoring sites in the projects' reservoirs and throughout project-affected river reaches to provide data that measures potential water-quality impacts from operation of the projects. Water quality monitoring would occur at intervals during the license term to document trends in time and changes in water quality related to operational changes that may impact water quality or designated beneficial uses of water. The Water Board specifies that the plan consider in-situ, DO, recreation-related water quality, and bioaccumulation monitoring components. The Water Board specifies that if at any point monitoring suggests water quality conditions are in exceedance of Basin Plan water quality objectives, the Districts would immediately notify the Water Board and Central Valley Regional Water Quality Control Board.

Our Analysis

Although the Districts propose to reduce the minimum pool level in Don Pedro Reservoir from 600 feet to 550 feet, use of the water below the current 600 feet elevation would most likely occur during successive dry years, so frequency of use would be low. In general, the Districts' operation model results filed on May 14 and July 30, 2018, suggest that Don Pedro Reservoir water levels would remain similar to existing conditions under proposed operation (table 3.3.2-21). Simulated daily reservoir water levels are within 10 feet of the base case levels 94 percent of the time for the Districts' proposed interim flows and 99 percent of the time for the Districts' proposed operation with infiltration galleries throughout the 42-year period of water years 1971−2012.

[89] Instantaneous measurements of DO are as low as 4.0 mg/L in the La Grange Powerhouse tailrace channel.

Because proposed project operation would not substantially change the flow of water through the project reservoirs, water quality in the reservoirs or in project releases would similarly not change. Low DO near the bottom of Don Pedro Reservoir would likely continue and may contribute to the release of mercury from sediments and subsequently lead to bioaccumulation in aquatic organisms, some of which may be consumed by humans. However, this effect is a typical result of reservoir stratification, and overall effects of the proposed project operation are expected to result in water quality that is at least as good as under existing conditions.

Table 3.3.2-21 shows that simulated monthly median Don Pedro Reservoir elevations are more than 10 feet lower than existing conditions for nearly all months at the scenarios recommended by other stakeholders, and monthly 90 percent exceedance pool levels would often be more than 10 feet higher or 10 feet lower than existing conditions at the alternative scenarios. These large differences in pool levels suggest that water quality could be affected by all of the alternative recommended operations compared to either of the Districts' proposals. Although effects of reservoir elevations lower than 600 feet on water quality were not modeled, the lower pool elevations could affect the depths of the mixing zones in the reservoir, potentially affecting reservoir stratification and the resulting DO levels both in the reservoir and in reservoir releases.

Under the Districts' proposed operations, the Basin Plan DO objectives would be mostly met immediately below the Don Pedro Powerhouse and in the lower Tuolumne River, with the exception of the La Grange Powerhouse tailrace channel. Low DO concentrations, as discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment,* in the subsection *Water Quality*, are expected to continue to occur in the La Grange Powerhouse tailrace in September, October, and November unless the cause is mitigated.

In response to comments on the draft license application, the Districts state these low DO concentrations appear to be a localized phenomenon associated with high levels of aquatic vegetation in the La Grange Powerhouse forebay and near the penstock intake.[90] To further evaluate potential causes of the low DO, the Districts propose DO monitoring from September 1 to November 30 in the first 2 years of the license. This would enable determination of: (1) the diel pattern of DO concentrations and when DO is lower than the Basin Plan objective, (2) whether low DO concentrations coincide at multiple sites, and (3) whether low DO in the powerhouse tailrace is consistently reaerated to at least the Basin Plan objective by the lower end of the powerhouse tailrace

[90] While aquatic vegetation may enhance DO levels during daylight hours via photosynthesis, during nighttime hours this vegetation uses oxygen via respiration, and may result in depression of DO levels. Oxygen is also consumed as vegetation decays.

Table 3.3.2-21. Monthly simulated 10, 50, and 90 percent exceedance values for Don Pedro Reservoir elevations (feet), water years 1971–2012. See table 3.3.2-1 for a description of each model scenario (Source: Districts, 2018a,b, as modified by staff).

Month	Base Case	Districts Interim	Districts with-IGs	FWS[a]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
10% Exceedance										
January	805.8	805.9	805.9	802.3	803.8	805.4	805.2	802.3	803.9	804.7
February	810.9	811.1	811.2	805.2	806.3	808.9	806.4	805.3	807.0	805.9
March	811.1	811.0	811.0	804.8	807.0	809.2	807.3	805.0	806.9	806.1
April	809.5	809.4	809.4	804.8	803.5	808.1	807.2	804.9	805.4	804.4
May	819.4	818.0	818.0	811.4	811.3	817.4	817.2	810.9	812.9	809.0
June	830.0	829.5	829.6	820.1	824.1	828.5	830.0	820.3	824.2	813.8
July	828.4	828.0	828.1	826.1	828.1	829.1	829.2	826.9	826.0	818.2
August	817.4	817.2	817.4	815.0	816.1	817.3	816.7	815.1	814.6	812.8
September	807.1	807.1	807.4	806.2	805.7	807.0	805.7	806.2	805.4	804.6
October	800.9	800.8	801.1	800.1	799.8	800.8	798.2	800.1	799.3	799.1
November	799.1	799.0	799.6	795.9	794.8	795.7	793.6	796.0	795.5	797.3
December	802.8	803.2	803.4	799.4	797.6	799.5	795.3	799.8	797.7	798.2
50% Exceedance (Median)										
January	793.2	792.8	794.5	756.2	759.6	780.1	772.1	757.1	776.4	774.4
February	798.9	795.6	798.1	768.6	771.0	788.9	779.3	770.1	783.7	781.3
March	803.0	802.3	802.9	775.0	779.5	793.9	784.2	776.7	786.5	787.5
April	802.3	802.2	802.2	770.5	780.3	793.1	784.0	775.3	784.5	785.3
May	805.4	803.5	803.7	775.8	780.9	798.2	785.2	780.6	782.6	782.3
June	813.6	808.5	810.1	775.9	784.8	798.3	789.3	780.5	785.1	776.9
July	814.6	810.1	812.9	767.2	778.7	797.6	782.9	772.3	777.3	768.1

Month	Base Case	Districts Interim	Districts with-IGs	FWS[a]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
August	804.9	797.4	801.5	756.8	763.1	787.8	776.0	757.7	766.6	759.8
September	795.5	787.0	792.4	745.7	750.0	777.3	770.6	744.5	758.3	754.0
October	793.6	786.9	791.5	738.5	745.2	775.5	769.0	738.8	763.3	751.4
November	792.2	784.5	788.6	737.8	744.8	771.3	765.6	734.4	767.0	753.2
December	793.1	788.6	791.6	742.4	748.3	776.4	768.0	739.0	770.3	762.6
90% Exceedance										
January	673.8	673.5	670.6	653.1	670.8	682.6	**701.8**	653.2	661.2	663.8
February	690.4	688.3	691.9	675.2	688.7	**707.2**	**708.2**	669.8	681.7	678.7
March	711.9	709.9	708.9	695.6	700.7	714.8	719.3	694.7	698.8	686.6
April	712.7	713.8	709.1	697.7	708.9	717.4	722.6	700.4	693.0	684.2
May	722.1	724.6	721.1	700.0	712.2	**732.5**	**733.4**	703.5	694.3	689.1
June	723.4	728.4	722.0	703.0	717.2	728.8	**735.3**	703.4	689.1	686.4
July	706.6	710.8	705.6	692.3	705.5	**719.6**	**727.1**	689.7	675.5	683.2
August	688.7	691.8	686.9	675.2	687.9	**704.3**	**712.7**	672.2	660.7	669.7
September	676.2	678.1	674.1	660.1	671.8	**691.0**	**703.3**	657.1	648.5	660.9
October	669.4	670.3	667.1	651.6	663.2	**682.4**	**698.3**	646.0	644.2	657.0
November	668.1	668.8	665.6	647.0	659.5	**678.6**	**695.7**	640.8	639.5	654.8
December	672.1	672.2	669.1	650.3	665.3	679.6	**696.5**	637.2	641.7	653.6

[a] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

Note: Elevations shown in bold are at least 10 feet higher than the base case, and shaded values are at least 10 feet lower than the base case.

channel. Adding a monitoring location in the upstream end of the La Grange Reservoir would provide baseline DO levels for the inflow to the forebay and could be used to determine whether low DO in the forebay is caused by low-DO inflows from upstream or local conditions. Because of the linkage of DO with water temperature and aquatic vegetation, it would also be beneficial to collect coinciding water temperature data at each location DO concentrations are monitored and record weekly observations of aquatic vegetation and algae growth and senescence in the La Grange Powerhouse forebay and near the penstock intake throughout the monitoring period. Preparation of an annual report following the end of each monitoring season would provide locations and times when the Basin Plan DO objectives are not met, and an evaluation of whether the La Grange Project operation is a factor causing low DO. If the project is found to be a factor in causing DO not to be consistent with Basin Plan DO objectives, this could be addressed by the Districts developing an approach to mitigate the project's effect and implementing it in the year following the determination of a project effect. Monitoring DO, temperature, and aquatic vegetation in the first 3 years of a license would document whether the project is contributing to low DO in the La Grange Powerhouse tailrace channel, and whether any mitigation actions implemented in years immediately following the initial detection of the cause of low DO are effective at addressing project effects. Conducting this monitoring for the greater of 3 years or until documentation of effective mitigation for any contribution of the project to low DO levels would provide reasonable assurance that any effects of the project on DO levels are appropriately addressed.

Flows and reservoir levels proposed by the Districts and recommended by the agencies and other stakeholders would not measurably influence recreation-related water quality (i.e., the concentration of coliform bacteria, oils, or grease). As discussed in section 3.3.5.2, *Recreation, Environmental Effects*, the Districts would periodically assess each project's recreational use and any need for recreational facility upgrade to maintain a safe environment for recreational use during any license term. Any recreational needs identified for the Don Pedro Project would be addressed through a Recreation Resource Management Plan.

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, EPA has issued a human health advisory for the consumption of largemouth bass, suckers, sunfish species, channel catfish, and common carp from Don Pedro Reservoir (OEHHA, 2018b), and fish in the lower Tuolumne River have mercury concentrations exceeding the 0.3-milligram-per-kilogram criterion for safe human consumption of fish (EPA, 2001). Although concentrations of mercury and other metals sometimes increase in newly constructed reservoirs and cause increases in bioaccumulation of mercury in fish, this is less likely to occur in project reservoirs that have been in place for decades (Willacker et al., 2016; Bilodeau et al., 2017). It is unclear how additional bioaccumulation data collected under Water Board preliminary 401 condition 6 would be used to guide project operation. Based on the above, there appears to be little basis for requiring the Districts to monitor recreation-related water quality or bioaccumulation in aquatic organisms.

Water Temperature Compliance

The water quality objective for temperature in the Basin Plan specifies, "At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5 degrees Fahrenheit (°F) [(2.8°C)] above natural receiving water temperature." As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment,* in the subsection *Water Quality*, water temperatures at USGS station 11289650 below La Grange typically range from about 8.0 to 16.0°C annually and occasionally reach a maximum of nearly 19°C. The lower Tuolumne River is listed under CWA section 303(d) as impaired for temperature, based on life-stage specific 7-day average daily maximum (7DADM) values (EPA, 2011). Under current conditions, warmwater temperatures reduce habitat suitability for Chinook salmon and *O. mykiss* downstream of the La Grange Diversion Dam, particularly for spawning and egg incubation.

Based on the Districts' modeling studies, the Don Pedro Project affects water temperatures in the main channel of the lower Tuolumne River downstream of Don Pedro Dam (RM 54.8). During the irrigation season, the project and other disturbances to the channel (e.g., diversions and agricultural returns) contribute to cumulative increases in water temperature. The Districts do not propose to monitor water temperature at the projects.

Water Board preliminary 401 condition 7 for the Don Pedro and La Grange Projects specifies that the Districts develop, in consultation with relevant resource agencies, a plan to monitor potential effects on water temperature from the projects by monitoring water temperature in Don Pedro Reservoir, La Grange Reservoir, and the lower Tuolumne River. The Water Board specifies water temperature monitoring at "an adequate number of sites to track the changes in water temperature stored in reservoirs and released below impoundments," and states that water temperature data would be used to help determine the effects of the projects' operations on thermal conditions. The Water Board specifies that the Districts monitor reservoir water temperature and thermocline depth by profile sampling near the dam to determine reservoir stratification depths, and flowing-water temperatures by installation and anchoring of appropriate devices to continuously record water temperature seasonally or throughout the year.

FWS 10(j) recommendation 6 for both projects and California DFW 10(a) recommendation M2-1 for both projects recommend that the Districts develop a water temperature monitoring plan that includes the project reservoirs and project-affected reaches of the lower Tuolumne River. The plan would be developed in consultation with FWS, NMFS, California DFW, and the Water Board and would include descriptions of: (1) methods to monitor and analyze water temperature, (2) locations and frequency of water temperature monitoring, and (3) how the Districts would report water temperature data to FERC and update the plan, as needed.

California DFW 10(a) recommendation M2-1 recommends that the plan include location-specific temperature-performance measures that are consistent with CWA section 303(d) water temperature objectives for the lower Tuolumne River, a reporting

schedule for annual reports detailing temperature gage and flow data, and summary reports every 5 years that provide: (1) a summary of the annual reports, and information and analysis of the operation of the projects in relation to meeting location-specific temperature performance measures; (2) recommendations for improvement, if needed, in meeting performance measures; and (3) recommendations of changes to performance measures and rationale for those recommendations, if information has been developed in this system or with outside studies that indicate changes should be made.

California DFW 10(a) recommendation M2-3 recommends a schedule for each report that includes providing the reports to the TREG including California DFW, the Water Board, FWS, and NMFS. For annual reports, California DFW's recommended schedule includes a 30-day comment period, the Districts' incorporation of comments into the report, and filing the final report with FERC. For summary reports, California DFW's recommended schedule includes a 60-day comment period; the Districts' incorporation of comments into a draft final report; a 30-day period for the agencies to approve the draft final report or provide additional comments; and filing of a final report, which includes an appendix documenting the consultation process with the TREG and the agencies, with FERC.

California DFW 10(a) recommendation M2-3 states that the Districts would be financially responsible for implementation of the Water Temperature Monitoring Plan and Compliance Plan, but includes a provision allowing any organization of the TREG to be assigned the lead in implementing portions of the plan.

California DFW 10(a) recommendation M2-1 and FWS 10(j) recommendation 6 recommend that the plan include monitoring in the flowing reaches, at a minimum:

1. Between RM 52.2 and 47.5 (La Grange Diversion Dam to Basso Bridge);
2. Between RM 47.5 and 39.5 (Basso Bridge to Roberts Ferry);
3. Between RM 39.5 and just upstream of the infiltration gallery[91];
4. Downstream of the infiltration galleries to the confluence with the San Joaquin River.

NMFS 10(a) recommendation 1.4 for the La Grange Project recommends establishing temperature gages near RM 25 and near the Robert's Ferry Bridge crossing at RM 39.5.[92] NMFS recommends that these new temperature gages record temperature at 1-hour or shorter intervals and the data be made publicly available in real-time.

NMFS 10(a) recommendation 1.5 for the La Grange Project recommends that the Districts prepare a report and provide it to FERC and the resource agencies before

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[91] The location of the existing and proposed infiltration galleries is about RM 26.

[92] NMFS recommends co-locating the temperature gage near RM 25 with a new flow gage at the same site.

January 1 annually. NMFS recommends that the report use empirical temperature data from the lower Tuolumne River to describe the timing, magnitude, and duration of the temperature criteria exceedance events; and include analysis of operational changes needed to prevent similar exceedance events in the future.

California DFW, NMFS, FWS, and others recommend project operations to maintain specific water temperature criteria in project-affected waters.[93] Table 3.3.2-22 provides California DFW 10(a) recommendation M2-2 and NMFS 10(a) recommendation 1.5 recommend water temperature criteria and compliance points. Temperature criteria recommended by NMFS are set as 7DADMs; whereas, California DFW values are set as maximums for a short period that has not been specifically defined.[94] California DFW specifically recommends that the Districts meet the designated maximum temperatures under the following conditions[95]:

- The outflow water temperatures of Don Pedro Reservoir and La Grange Diversion Dam are equal to or lower than the required temperatures;
- River accretions (inflows) below La Grange Diversion Dam are of large enough quantity and high enough temperatures to preclude meeting the required temperatures at the appropriate location; or
- Some other reasonably uncontrollable condition exists that precludes the Districts from meeting the requirements.

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[93]California DFW recommends that the Districts meet its recommended water temperature objectives, NMFS recommends that the Districts "make a good faith effort to meet [its] recommended temperature objectives," and FWS does not recommend specific water temperature objectives.

[94] California DFW states: "The objective temperature requirement is a maximum temperature, to be determined over a short duration such as hourly or daily, as set by the water temperature monitoring plan and compliance plan developed as part of Measure M2-1."

[95] California DFW's recommendation as repeated herein is unclear. We interpret condition "a" to be the general requirement that the outflow from Don Pedro Reservoir and La Grange Diversion Dam should be equal to or lower than the required maximum temperatures, while conditions "b" and "c" would be scenarios that would allow an exceedance of the location-specific designated temperature maximum without assigning responsibility to the Don Pedro or La Grange Project.

Table 3.3.2-22. California DFW and NMFS recommended water temperature criteria (Source: California DFW 10(a) recommendation M2-2; NMFS 10(a) recommendation 1.5, as modified by staff).

	California DFW		NMFS	
Water Year Type(s) [a]	**Temperature [b]**	**Compliance Point [c]**	**Temperature**	**Compliance Point [c]**
Salmon Spawning, Egg Incubation, and Fry Emergence, October 16–December 31				
Wet, above normal, and below normal	13°C maximum	RM 42.8	13°C 7DADM	RM 39.5
Dry and critical	Same	RM 47.4	Same	RM 47.4
Steelhead Smoltification, January 1–May 31				
Wet	13°C maximum	RM 31.8	14°C 7DADM	RM 31.8
Above normal	Same	RM 35 Riffle	Same	RM 31.8
Below normal	Same	RM 40 Riffle	Same	RM 31.8
Dry	Same	RM 40 Riffle	Same	RM 39.5
Critical	Same	RM 42.8	Same	RM 39.5
Steelhead Juvenile Rearing, June 1–October 15				
Wet, above normal, and below normal	18°C maximum	RM 42.8	18°C 7DADM	RM 39.5
Dry and critical	Same	RM 42.8	Same	RM 42.8

[a] Water year types are based on estimated annual unimpaired flow of the Tuolumne River at the La Grange gage.

[b] California DFW recommends that the Districts meet water temperature maximum criteria, determined over a short duration (e.g., hourly or daily), after the first 5 years of implementing the Water Temperature Monitoring and Compliance Plan.

[c] Compliance point descriptions provided by California DFW and NMFS are: RM 31.8 Modesto Gage, RM 39.5 Robert's Ferry Bridge, RM 42.8 Turlock State Park, and RM 47.4 Basso Bridge. Although it lists RM 31.8 as the Modesto Gage, that gage is located at about RM 16.5, and RM 31.8 is actually located near Waterford. We interpret the intent as RM 31.8, not the Modesto Gage (USGS No. 11290000).

The Bay Institute does not recommend water temperature targets or criteria, although in its January 29, 2018, filing with the Commission, it recommends a flow regime for the Don Pedro and La Grange Projects that is partially based on water temperature objectives. Temperature objectives incorporated into its recommended flow regime consist of 12.5ºC for spawning, 12.5ºC and 13.0ºC for incubation, 14.5ºC for

holding, 15.5ºC for migration, 16.0ºC for rearing, and 16.0 ºC for "suitable release."[96] In addition, The Bay Institute states that it will revise its flow recommendation as more temperature modeling and other information becomes available. Although the Districts filed new temperature modeling results on May 14, June 19, and July 30, 2018 (Districts, 2018a,b,c), The Bay Institute had not filed a revised flow recommendation as of January 30, 2019.

In their reply comments, the Districts state that they should not need to comply with temperature regimes at points located 10 miles or more downstream of the project and likely affected by non-project local conditions, groundwater inflows/outflows, and riparian withdrawals. The Districts also state that the existing cumulative efforts of California DFW, USGS, and the Districts result in a network of more than 10 temperature monitoring stations in the lower Tuolumne River that provides adequate coverage of the lower river's temperature regime.[97] The Districts agree to relocate existing station(s), as California DFW prefers, because the existing locations may not be optimal.

Our Analysis

The lower Tuolumne River is currently on the 303(d) list for water temperature, and the temperature total maximum daily load is scheduled to be completed in 2021 (Water Board, 2015). This listing is specifically based on EPA's evaluation of 1998 through 2006 7DADM temperatures compared to criteria of: 18ºC in June 15–September 15 for steelhead trout summer rearing, 18ºC in September 1–October 31 for Chinook salmon adult migration, 16ºC in March 15–June 15 for Chinook salmon smoltification and juvenile rearing, and 13ºC in October 1–December 15 for Chinook salmon spawning (EPA, 2011).[98] By letter (D.L. Forsgren, Deputy Assistant Administrator, EPA, Washington, D.C., to C. Hashimoto, General Manager, TID, Turlock, California, June 27,

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[96] The Bay Institute does not indicate which species its temperature recommendations are intended to protect, define their temperature objectives (e.g., mean daily, maximum daily, or 7DADM), or provide the goal for its "suitable release temperatures (60.8ºF at La Grange)" objective in July, August, and September.

[97] The Districts do not provide insight into which stations are monitored by whom. Our review of USGS gages (USGS, 2018l, indicates USGS currently monitors water temperature at two gages in the lower Tuolumne River (11289650 below La Grange Diversion Dam and 11290000 at Modesto). Review of California Data Exchange Center's database (California DWR, 2018) provides no active California DFW temperature stations in the lower Tuolumne River and suggests it discontinued temperature monitoring at six lower Tuolumne River stations in May 2018.

[98] The 7DADM values used for the lower Tuolumne River 303(d) listing are consistent with temperature guidance values for the Pacific Northwest (EPA, 2003).

2018), EPA states that it is aware of research with salmonid species from California rivers that suggests populations at the southern limit of their distribution may be locally adjusted to warmer temperatures relative to more northern populations, and that these findings challenge the use of a single thermal criterion for their entire range. EPA concludes the issue of whether salmonid populations are adaptable to warmer conditions in California is an open and legitimate scientific question and encourages use of the most up-to-date research to evaluate the impact on fish populations.

Several peer-reviewed studies conducted since the EPA's temperature guidance (EPA, 2003) was issued support the ability of salmonid, including *O. mykiss*, populations to adapt to warm conditions (Chen et al., 2015; Narum et al., 2010, 2013; Rodnick et al., 2004). Evaluation of the thermal performance of juvenile *O. mykiss* captured in the lower Tuolumne River between RM 49.1 and 51.5, and tested in a swim tunnel respirometer at temperatures between 13ºC and 25ºC concludes that 95 percent of peak aerobic capacity is at 17.8°C to 24.6°C (Farrell et al., 2017; Verhille et al., 2016).[99] As a result of the study, the Districts propose use of a 22°C, instead of 18°C, 7DADM as a conservative upper performance limit for juvenile *O. mykiss*. In a January 29, 2018, filing with the Commission, California DFW (10(a) recommendation M1) states that the 18°C temperature "criteria" should not be changed based on a single study,[100] and notes that other life stages of *O. mykiss* are present in the lower Tuolumne River. NMFS recommends use of the 18ºC 7DADM temperature objective for steelhead juvenile rearing in the lower Tuolumne River (NMFS 10(a) recommendation 1.5). However, NMFS's estimates of the upper Tuolumne River's capacity for steelhead and Chinook salmon (Boughton et al., 2018) incorporate increased temperature tolerance based on results of the lower Tuolumne River swim tests (Verhille et al., 2016), and observations of temperatures experienced by holding Chinook salmon in Big Chico Creek (Cresswell, 2004). Based on the above information, we conclude that some fish populations have adapted to local/regional thermal regimes, and it appears that *O. mykiss* in the lower Tuolumne River have likely adapted to the river's thermal regime (Farrell et al., 2017). However, we note that juvenile *O. mykiss* tested in the swim tunnel respirometer may not represent the entire population of younger life stages, some of which may not have survived warmer water temperatures. Use of 7DADM water temperature targets is a commonly accepted approach to evaluate the temperature suitability for salmonid species and this index is supported by a large body of information; whereas, this is not likely to

[99] The fish for this study were captured in the Tuolumne River and determined to have fed well prior to the test, based on their condition factors, feces found in the swim tunnel, and regurgitation of large meals by two fish. The study's limiting of the upper temperature tested to the permit requirement of 25ºC appears to bias the results to be more conservative than actual conditions.

[100] We note that the EPA (2003) 7DADMs are temperature guidance, not specifically criteria as stated by California DFW.

be the case for if a new temperature metric were to be developed, as California DFW recommends. Therefore, to be conservative, we evaluate the thermal regimes resulting from baseline, proposed, and recommended project operations using the selected 7DADMs for the life cycle of Chinook salmon and steelhead, and lower Tuolumne River juvenile *O. mykiss* presented in table 3.3.2-23.

The Don Pedro Project directly affects flows and temperatures in the lower Tuolumne River downstream of Don Pedro Dam, but the La Grange Project has negligible effect on temperatures in the lower Tuolumne River because of the short retention time in the La Grange Reservoir and forebay. Although the Don Pedro Project influences temperatures in the lower Tuolumne River, its ability to reduce water temperatures is limited by non-hydroelectric project withdrawals[101] and irrigation returns; and past disturbance to the channel, floodplain, and riparian habitat. During the non-irrigation season, little to no water is diverted into the Districts' water supply canals, and the magnitude and duration of releases from Don Pedro Dam directly affect flows and water temperature in the lower Tuolumne River. Increasing flows to reduce water temperatures in the spring and early summer would reduce storage for releases in the summer and fall from Don Pedro Reservoir. This relationship is a major factor when attempting to balance flow releases to meet temperature targets for protecting coldwater species such as *O. mykiss* and Chinook salmon.

Another factor that would highly influence lower Tuolumne River water temperatures is operation of the infiltration galleries. Following completion of infiltration gallery 1 and construction of infiltration gallery 2, a total of up to 225 cfs could be withdrawn from the river through them instead of being diverted into TID's canal at the La Grange Powerhouse forebay. This would enable a subsequent increase in flows released into the Tuolumne River from the La Grange Diversion Dam and powerhouse and thereby lower Tuolumne River temperatures downstream to about RM 26. Although the Districts propose operation of the infiltration galleries as part of the Don Pedro Project, these facilities are not needed to operate the hydroelectric project and

[101] For example, average annual diversions from the Tuolumne River are 244,000 acre-feet from Hetch Hetchy Reservoir and 867,000 acre-feet at La Grange Diversion Dam leaving about 40 percent of the unimpaired flow to be released into the lower Tuolumne River (CCSF, 2005).

Table 3.3.2-23. 7DADM water temperature targets and periodicity for fall-run Chinook salmon, Central Valley steelhead, and juvenile Tuolumne River *O. mykiss* life stages (Source: EPA, 2003; Farrell et al., 2017, as modified by staff).

Life Stage	7DADM[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall-Run Chinook Salmon													
Spawning and egg incubation[b]	13ºC	■								■	■	■	■
Juvenile rearing and emigration[b]	16ºC	■	■	■	■	■	■						
Adult upstream migration[b]	18ºC								■	■	■	■	■
Central Valley Steelhead													
Spawning and egg incubation	13ºC	■	■	■	■	■							■
Smoltification	14ºC	■	■	■	■	■	■						
Juvenile rearing and emigration (core)[c]	16ºC	■	■	■	■	■	■	■	■	■	■	■	■
Juvenile over-summer rearing[b]	18ºC						■	■	■	■			
Adult upstream migration	18ºC	■	■	■				■	■	■	■	■	■
Juvenile rearing and emigration (non-core)[d]	18ºC	■	■	■	■	■	■	■	■	■	■	■	■
Adult rearing	18ºC	■	■	■	■	■	■	■	■	■	■	■	■
Tuolumne River *O. mykiss*													
Juvenile rearing and emigration (non-core)[d]	22ºC	■	■	■	■	■	■	■	■	■	■	■	■

[a] Fall-run Chinook salmon and Central Valley steelhead 7DADMs are from EPA's temperature guidance for the Pacific Northwest (EPA, 2003), and Tuolumne River *O. mykiss* 7DADM is based on lower Tuolumne River swim tunnel tests (Farrell et al., 2017).

[b] Species-life stage included in EPA's methodology for lower Tuolumne River 303(d) listings (EPA, 2011), although time period has been refined based on available information (Stillwater Sciences, 2013a).

[c] EPA considers waters that currently have low-density populations as a reasonable approximation of waters that could support moderate to high density use if the temperature were reduced.

[d] EPA recognizes the fact that salmon and trout juveniles will use waters that have a higher temperature than their optimal thermal range.

therefore are not appropriate to include as a project facility. However, TID could still operate them for municipal and industrial deliveries, and the Districts could compensate for this by increased instream flow releases from the La Grange Project.[102] Therefore, our evaluation of the Districts' proposed flow regime on water temperature includes operation of the infiltration galleries.

Increasing instream flow releases from La Grange Powerhouse, as proposed by the Districts and recommended by agencies and other stakeholders would maintain lower water temperatures in the lower Tuolumne River, especially in the reach between the La Grange Diversion Dam and the infiltration galleries. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the Districts developed a suite of models to evaluate effects of alternative project operations on several resources, including water temperature. Models pertinent to water temperature include the operations model and separate water temperature models for Don Pedro Reservoir and the lower Tuolumne River.

The Districts used these models to simulate the proposed and recommended operation scenarios to provide the additional information requested by Commission staff, and filed the results for water temperature on May 14 and July 30, 2018 (Districts, 2018a,b). The general approach for this modeling was to represent the no-action scenario (base case), and proposed and recommended operations within the limits of the models. No attempt to alter recommended operations to meet water temperature objectives or account for accretion/depletion between the La Grange gage and locations below the proposed two infiltration galleries were included in these scenarios. The baseline and four other scenarios do not include operation of the infiltration galleries; however, the Districts state that the other five scenarios include operation of the infiltration galleries. Each model scenario is described in detail in the Districts' May 14 and July 30, 2018, filings (Districts, 2018a,b).

Table 3.3.2-24 compares 7DADM water temperature target exceedances under baseline (base case) conditions and the proposed and recommended project operation regimes for all life stages of fall-run Chinook salmon, steelhead, and juvenile Tuolumne River *O. mykiss*. This table provides exceedance values for each specified life stage-specific 7DADM temperature target at eight locations from RM 51.5 below the La Grange Powerhouse to RM 3 near the confluence with the San Joaquin River. The table shows that generally, simulated temperature regimes in the lower Tuolumne River for the Districts' two proposed scenarios (interim flows that would be provided until the

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As of August 3, 2017, the Regional Surface Water Supply Project, of which the infiltration galleries are a component, is scheduled to become operational in 2022 (West Yost Associates, 2017). This project would enable integrated use of groundwater and surface water to supply municipal and industrial uses in the cities of Ceres and Turlock.

infiltration galleries are operational, and "with-infiltration gallery" flows that would be in effect after the infiltration galleries are operational) are similar to the environmental baseline, and that flow scenarios recommended by other stakeholders also continue to exceed 7DADM water temperature targets.

To systematically compare the simulated temperature regimes of each proposed and recommended scenario, we computed the difference in 7DADM exceedances from the base case scenario; then categorized the relative magnitude of these differences based on their absolute value, and finally determined the percent of values in each category. The categorization considers differences as negligible if they were less than 2 percent, minor for 2 to 5 percent, moderate for more than 5 to 10 percent, and major for more than 10 percent. Table 3.3.2-25 shows simulations for all of the proposed and recommended scenarios generally improve the temperature regime. The scenarios representing the Districts' proposals showed improvement in 29 percent of the exceedance values for interim flows and 38 percent of the exceedance values for the flows that would be released after the infiltration galleries are operational.[103] All of the scenarios recommended by other stakeholders show greater relative improvements (reduced exceedances) than the Districts' proposals for some life stages and locations, although they also show more deterioration (increased exceedances) than the Districts' proposals for other life stages and locations.[104] For example, all the flow scenarios recommended by other stakeholders have more frequent exceedances of the fall Chinook spawning and egg incubation 13ºC 7DADM, but less frequent exceedances of the Chinook juvenile rearing and emigration 16ºC 7DADM (table 3.3.2-24). We note that this evaluation of relative change places equal weighting on all 7DADM against one another and throughout the entire lower Tuolumne River. The effects of different flow regimes on specific species and life stages are further discussed below in subsection *Minimum Flows and Pulse Flows*.

[103] Improvement means that simulated temperatures exceeded the 7DADM water temperature targets less of the time, indicating cooler water temperatures.

[104] Deterioration means that simulated temperatures exceeded the 7DADM water temperature targets more of the time, indicating warmer water temperatures.

Table 3.3.2-24. Comparison of 7DADM simulated water temperature target exceedance between the environmental baseline conditions and proposed and recommended flow regimes for all life stages of fall-run Chinook salmon and Central Valley steelhead, and juvenile Tuolumne River *O. mykiss* in the lower Tuolumne River between RM 51.5 and RM 3 (Source: Districts, 2018a,b, as modified by staff).

7DADM, Time Period	Location[a]	Percent of Time 7DADM is Exceeded									
		Base Case	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
Fall-Run Chinook Salmon, Spawning and Egg Incubation[b]											
13ºC, Sep–Jan	RM 51.5	32%	29%	29%	37%	37%	30%	38%	44%	39%	39%
	RM 50	41%	41%	40%	47%	47%	41%	42%	52%	48%	51%
	RM 46	56%	57%	57%	62%	64%	59%	60%	65%	62%	61%
	RM 43	54%	55%	55%	60%	62%	57%	57%	62%	61%	58%
	RM 39	50%	51%	51%	54%	56%	53%	52%	57%	56%	52%
	RM 26	44%	45%	45%	46%	45%	44%	44%	46%	46%	46%
	RM 16	47%	47%	47%	48%	48%	48%	47%	48%	48%	48%
	RM 3	47%	48%	48%	48%	49%	48%	47%	49%	48%	48%
Fall-Run Chinook Salmon, Juvenile Rearing and Emigration[c]											
16ºC, Jan–Jun	RM 51.5	4%	1%	1%	0%	0%	0%	0%	0%	0%	0%
	RM 50	8%	5%	5%	1%	1%	0%	1%	1%	0%	0%
	RM 46	21%	20%	20%	15%	16%	9%	6%	15%	6%	6%
	RM 43	25%	24%	24%	18%	19%	16%	12%	18%	9%	10%
	RM 39	27%	26%	26%	21%	24%	24%	17%	21%	15%	14%
	RM 26	26%	24%	24%	19%	21%	16%	11%	18%	9%	10%
	RM 16	34%	33%	32%	23%	26%	29%	22%	24%	18%	16%
	RM 3	36%	36%	36%	29%	31%	32%	28%	29%	25%	23%

7DADM, Time Period	Location[a]	Percent of Time 7DADM is Exceeded									
		Base Case	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
Fall-Run Chinook Salmon, Adult Upstream Migration[b]											
18ºC, Aug–Dec	RM 51.5	6%	3%	3%	2%	2%	1%	4%	4%	5%	5%
	RM 50	8%	6%	5%	3%	3%	2%	6%	6%	7%	11%
	RM 46	27%	24%	22%	20%	17%	15%	26%	27%	26%	32%
	RM 43	31%	30%	28%	29%	22%	24%	28%	34%	32%	36%
	RM 39	32%	31%	30%	31%	26%	28%	28%	35%	33%	36%
	RM 26	38%	38%	37%	37%	31%	35%	32%	39%	38%	41%
	RM 16	44%	43%	43%	44%	43%	43%	40%	45%	43%	46%
	RM 3	47%	46%	46%	46%	47%	46%	43%	47%	47%	48%
Central Valley Steelhead, Spawning, and Egg Incubation											
13ºC, Dec–May	RM 51.5	14%	11%	12%	13%	13%	7%	10%	13%	9%	9%
	RM 50	22%	19%	19%	19%	19%	12%	14%	18%	11%	13%
	RM 46	38%	38%	38%	39%	40%	39%	35%	37%	36%	35%
	RM 43	40%	40%	40%	43%	43%	42%	41%	40%	42%	37%
	RM 39	40%	40%	41%	44%	43%	43%	42%	42%	44%	40%
	RM 26	34%	34%	34%	33%	32%	33%	32%	30%	30%	30%
	RM 16	38%	38%	38%	39%	36%	39%	39%	36%	37%	35%
	RM 3	42%	42%	42%	43%	41%	43%	43%	41%	41%	40%
Central Valley Steelhead, Smoltification											
14ºC, Jan–Jun	RM 51.5	12%	9%	9%	4%	4%	1%	2%	3%	2%	2%
	RM 50	16%	16%	17%	11%	11%	6%	4%	10%	3%	6%
	RM 46	37%	36%	36%	29%	33%	33%	27%	30%	23%	23%

7DADM, Time Period	Location[a]	Percent of Time 7DADM is Exceeded									
		Base Case	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
	RM 43	42%	41%	41%	35%	39%	39%	35%	35%	32%	32%
	RM 39	44%	44%	44%	42%	43%	44%	42%	40%	39%	38%
	RM 26	39%	39%	38%	35%	35%	36%	33%	34%	31%	31%
	RM 16	47%	46%	46%	42%	42%	45%	44%	40%	40%	37%
	RM 3	51%	51%	51%	50%	48%	51%	50%	47%	48%	46%
Central Valley Steelhead, Juvenile Rearing and Emigration (core)											
16ºC, Year-round	RM 51.5	11%	5%	5%	3%	4%	3%	11%	6%	6%	6%
	RM 50	17%	9%	8%	5%	6%	4%	14%	8%	9%	14%
	RM 46	35%	35%	34%	33%	30%	28%	24%	34%	27%	31%
	RM 43	39%	38%	38%	36%	37%	33%	30%	37%	31%	34%
	RM 39	40%	39%	39%	38%	39%	38%	35%	39%	36%	36%
	RM 26	40%	39%	39%	36%	37%	35%	30%	37%	31%	34%
	RM 16	46%	46%	46%	41%	42%	43%	39%	42%	39%	39%
	RM 3	49%	49%	49%	45%	46%	46%	44%	46%	44%	43%
Central Valley Steelhead, Juvenile Over-summer Rearing[b]											
18ºC, Jun–Sep	RM 51.5	9%	3%	3%	1%	1%	1%	5%	3%	4%	4%
	RM 50	15%	7%	7%	3%	3%	3%	10%	7%	9%	15%
	RM 46	59%	60%	56%	45%	36%	35%	47%	54%	40%	57%
	RM 43	69%	70%	67%	62%	46%	54%	51%	67%	52%	66%
	RM 39	72%	73%	72%	68%	59%	65%	56%	72%	61%	70%
	RM 26	79%	81%	80%	75%	68%	73%	58%	77%	67%	73%
	RM 16	85%	86%	86%	83%	85%	85%	72%	83%	78%	80%

7DADM, Time Period	Location[a]	Percent of Time 7DADM is Exceeded									
		Base Case	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
	RM 3	87%	88%	88%	85%	88%	88%	78%	85%	81%	83%
Central Valley Steelhead, Adult Upstream Migration											
18ºC, Jul–Mar	RM 51.5	4%	2%	2%	1%	1%	1%	3%	2%	3%	3%
	RM 50	6%	4%	4%	2%	2%	2%	5%	4%	5%	9%
	RM 46	22%	21%	20%	18%	14%	14%	22%	23%	19%	27%
	RM 43	26%	25%	24%	25%	18%	21%	23%	28%	24%	30%
	RM 39	27%	26%	26%	27%	23%	25%	23%	29%	26%	30%
	RM 26	30%	30%	30%	30%	27%	28%	26%	31%	29%	33%
	RM 16	35%	34%	34%	35%	34%	33%	31%	35%	34%	36%
	RM 3	37%	36%	36%	36%	36%	36%	33%	37%	36%	37%
Central Valley Steelhead, Juvenile Rearing and Emigration (non-core) and Central Valley Steelhead, Adult Rearing											
18ºC, Year-round	RM 51.5	4%	1%	1%	1%	1%	0%	2%	2%	2%	2%
	RM 50	6%	3%	3%	1%	1%	1%	4%	3%	4%	6%
	RM 46	23%	22%	21%	17%	14%	13%	17%	21%	15%	21%
	RM 43	27%	27%	26%	24%	19%	19%	19%	26%	19%	24%
	RM 39	28%	28%	27%	27%	24%	23%	20%	28%	22%	25%
	RM 26	32%	31%	31%	29%	27%	25%	21%	30%	24%	26%
	RM 16	38%	36%	36%	35%	35%	32%	28%	35%	29%	31%
	RM 3	40%	39%	39%	37%	37%	35%	31%	37%	32%	33%
Tuolumne River *O. mykiss*, Juvenile Rearing and Emigration (non-core)											
	RM 51.5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	RM 50	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

7DADM, Time Period	Location[a]	Percent of Time 7DADM is Exceeded									
		Base Case	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
22ºC, Year-round	RM 46	11%	2%	2%	0%	0%	0%	8%	1%	2%	8%
	RM 43	11%	2%	2%	0%	0%	0%	8%	1%	2%	8%
	RM 39	12%	4%	3%	1%	1%	1%	9%	2%	3%	9%
	RM 26	20%	18%	17%	9%	6%	8%	13%	13%	10%	16%
	RM 16	26%	25%	26%	22%	18%	19%	17%	23%	17%	22%
	RM 3	28%	27%	27%	25%	24%	23%	18%	25%	20%	23%

[a] Location descriptions are: RM 51.5 below La Grange Powerhouse, RM 50 La Grange Bridge, RM 46 about 1.5 mile downstream of Basso Bridge, RM 43 near Turlock State Park, RM 39 about 0.5 mile downstream of Robert's Ferry Bridge, RM 26 Geer Road Bridge upstream of Districts' proposed infiltration galleries, RM 16 about 0.2 mile downstream of Dennett Dam, and RM 3 near Shiloh Bridge.

[b] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

[c] Species-life stage included in EPA's methodology for lower Tuolumne River 303(d) listings (EPA, 2011), although time period has been refined based on available information (Stillwater Sciences, 2013a).

Table 3.3.2-25. Relative difference between 7DADM simulated water temperature target exceedances from base case scenario for all species and life stages (Source: Districts, 2018a,b, as modified by staff).

Relative Change[a]	Districts Interim	Districts With-IGs	FWS[b]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
Major improvement	0%	0%	10%	13%	14%	15%	0%	16%	9%
Moderate improvement	9%	9%	18%	19%	25%	26%	24%	31%	19%
Minor improvement	20%	29%	38%	40%	34%	34%	35%	18%	36%
Negligible	70%	63%	25%	18%	21%	19%	26%	25%	15%
Minor deterioration	1%	0%	6%	6%	6%	5%	9%	4%	19%
Moderate deterioration	0%	0%	4%	5%	0%	1%	4%	6%	3%
Major deterioration	0%	0%	0%	0%	0%	0%	3%	0%	0%

[a] Relative change was categorized based on the difference in percent exceedance: negligible if less than 2, minor for 2 to 5, moderate for more than 5 to 10, and major for more than 10.

[b] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

The Districts' modeling of each scenario to represent corresponding proposed and recommended project operations captures the issues that would influence temperature in the lower Tuolumne River with the exception of not adequately representing conditions that could occur in sequential low-flow years. Flow and water temperature conditions in sequential low-flow years vary depending on specific timing and magnitude of conditions leading up to worst-case conditions, and the model results provide limited value in directing operations that would occur in these situations. As discussed above in *Drought Management*, sequential low-flow years present unique challenges for balancing water use throughout the region. This reason is why the Districts propose lowering the existing minimum Don Pedro Reservoir pool elevation from 600 feet to 550 feet, which increases the usable storage by 150,000 acre-feet. Simulations of the Districts' two proposals suggest that the period of record analyzed did not include any series of low flow years that were severe enough to require the use any of this additional storage.

Water temperature monitoring during extended drought conditions would aid in understanding the effects of low reservoir levels on water temperatures, which would allow operations to be adjusted in the future if needed to prevent or limit adverse effects on aquatic resources. Insight into the volume of available coldwater storage in Don Pedro Reservoir could be tracked through time by monitoring vertical temperature profiles in Don Pedro Reservoir near the dam. Conducting monthly measurements would update the status of available cold water. However, deploying a series of temperature loggers arranged vertically in the water column and downloading them monthly would provide much more information on the rate of change, and, depending on its feasibility, may have little additional costs. Monitoring lower Tuolumne River temperatures at the gage below La Grange (RM 51.7), Basso Bridge (RM 47.5), Roberts Ferry (RM 39.5), and just above the infiltration galleries (RM 26) would enable evaluation of the effects of project operations and could help guide decisions about balancing temperatures in the lower Tuolumne River with maintaining cool water storage availability for the future.

There would be little value in monitoring temperature between Don Pedro Dam and the La Grange Diversion Dam because the short retention time and geomorphic characteristics limit warming in this reach, and the La Grange Project has virtually no influence on lower Tuolumne River flows. Temperature effects of the Don Pedro Project diminish as water flows downstream where non-project diversions, irrigation returns, and tributaries have increasing influence on the river's temperature; therefore, any temperature monitoring below the infiltration galleries, as recommended by California DFW and FWS, would not directly link to project operations.

Based on the above information, we conclude that conducting water temperature monitoring when Don Pedro Reservoir elevations drop to levels lower than 600 feet would provide information that could be used with forecasts of flow and water demand to determine whether to reduce minimum instream flows and/or pulse flows to reserve available coldwater storage in Don Pedro Reservoir.

Minimum Flows and Pulse Flows

Operation of the projects affects the seasonal flow pattern of the lower Tuolumne River between Don Pedro Dam (RM 54.8) and its confluence with the San Joaquin River. These altered flow conditions affect the river's capacity to support spawning, rearing, and other life stages of resident and anadromous fish and may also affect additional physical processes including sediment transport, floodplain connectivity, water temperature, and the maintenance of riparian vegetation. Changes in the annual hydrograph can also affect locally adapted anadromous species and their habitats by altering the timing of immigration and emigration and ability to ascend natural and artificial barriers. The annual hydrograph in the lower Tuolumne River is most altered during the spring months when snowmelt runoff (April through June) is stored in Don Pedro Reservoir, with effects varying in magnitude across water years.

In regulated river reaches that contain productive aquatic habitat, resource managers often establish instream flow regimes to maintain ecological functions and processes that are important for sustaining aquatic and riparian biota. However, balancing the different resource values associated with a given flow regime often involves a complex series of tradeoffs that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation.

The Districts propose to implement base flows designed for specific salmonid life stages in the Tuolumne River, flushing flows to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. For all flow-related measures, the flow schedules are based on five water-year types determined using the 60-20-20 San Joaquin River Index (see section 3.3.2.2, *Aquatic Resources, Streamflow and Reservoir Level Compliance Monitoring*). The five types are wet, above normal, below normal, dry, and critical.

The Districts propose two sets of base flows: interim base flows that would be implemented until the infiltration galleries are operational and a second set of flows that would be implemented after the infiltration galleries are operational (table 3.3.2-26). Once the infiltration galleries are operational, the proposed with-infiltration galleries flows would provide additional flow in the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration gallery pipeline gage), and to monitor compliance with the flows downstream of the infiltration galleries (RM 25.9) by subtracting the flow volume measured at the infiltration gallery pipeline gage from the flow measured at the La Grange gage. Although the Districts propose that the infiltration galleries be incorporated into the license as project facilities, this is not appropriate because their primary purpose is to provide municipal and industrial water for consumptive use, and they are not necessary to maintain or operate the project.

Table 3.3.2-26. Proposed lower Tuolumne River flows to benefit aquatic resources and accommodate recreational boating (Source: Districts, 2017a).

	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
Water Year/Period	**RM 51.7 (La Grange Gage)**	**RM 25.9**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100	150
July 1 through October 15	350	150	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150
October 16 through December 31	200	200	200

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)	RM 25.9	RM 51.7 (La Grange Gage)
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

Also, in order to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, the Districts propose to release a flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7 and the infiltration galleries shut off. These flows would be provided in wet, above normal, and below normal water years only.

In addition, to facilitate the outmigration of juvenile fall Chinook salmon, the Districts propose to provide spring pulse flows in the amounts as follows (the timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application):

- Wet and above normal water years—150,000 acre-feet,
- Below normal water years—100,000 acre-feet,
- Dry water years—75,000 acre-feet,
- Sequential dry water years—45,000 acre-feet,
- First critical water year—35,000 acre-feet, and
- Sequential critical water years—11,000 acre-feet.

At the La Grange Project, the Districts propose to formalize the practice of releasing a minimum flow of 5 to 10 cfs to the plunge pool below the La Grange Diversion Dam.

NMFS (10(a) recommendation 1) recommends that the Districts provide minimum instream flows and pulse flows, by dates and water years, in accordance with the schedule shown in table 3.3.2-27 as measured at the gage below La Grange Diversion Dam (USGS 11289650). Water year types would be determined using the estimated median value for annual unimpaired flow at La Grange.

Table 3.3.2-27. NMFS recommended minimum instream flows in cfs below La Grange Diversion Dam (Source: NMFS, 2018a, table 2, as modified by staff).

Dates	Wet	Above Normal	Below Normal	Dry	Critical
October 1	500	400	300	300	300
October 16	500	400	400	300	300
November 1	500	400	400	300	300
November 16	500	400	400	300	300
December 1	500	400	400	300	300
December 16	500	400	400	300	300
January 1	500	400	400	300	300
January 16	500	400	400	300	300
February 1	3,000	400	400	300	300
February 15	3,000	400	400	300	300
March 1	3,000	2,000	2,000	1,500	300
March 16	3,000	2,000	2,000	1,500	1,000
April 1	4,000	3,500	2,000	1,500	300
April 16	4,000	3,500	2,000	2,000	300
May 1	4,000	3,500	3,500	350	300
May 16	4,000	3,500	3,500	350	300
June 1	700	600	500	350	300
June 16	700	600	500	350	300
July 1	700	600	500	350	300
July 16	700	600	500	350	300
August 1	700	600	500	350	300
August 16	700	600	500	350	300
September 1	600	500	400	300	300
September 16	500	400	300	300	300

In addition to the flows listed in table 3.3.2-27, NMFS recommends the Districts also maintain a flow of no less than 300 cfs in all years as measured at a new flow gage to be installed near RM 25, downstream of the proposed infiltration galleries.

NMFS's recommended minimum instream flows are the mean daily instream flows in cfs. NMFS further recommends that instantaneous instream flows may deviate below the recommended minimum instream flows by up to 10 percent or 5 cfs, whichever is less. However, NMFS recommends the Districts make a good faith effort to meet the specified minimum instream flows at all times. Temporary deviations would be allowed in the case of equipment malfunction or as directed by law enforcement authorities, or in emergencies.

NMFS also recommends the Districts implement fall pulse flows, as shown below in table 3.3.2-28, given as the volume of water to be released in addition to the minimum instream flows listed in table 3.3.2-27. TRTAC would recommend the timing, magnitude, and duration of the fall pulse flows. TRTAC would also have the option to reshape the spring hydrograph during the February–June period. If TRTAC exercises this option, the minimum flow volumes used for reshaping and absolute minimum flows shown in table 3.3.2-28 would be used.

Table 3.3.2-28. NMFS's recommended volume of water (acre-feet) allocated for fall and spring pulse flows, and absolute minimum flows, by water year in the lower Tuolumne River (Source: NMFS, 2018a, tables 3 and 4, as modified by staff).

	Wet	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Fall Pulse Flows (acre-feet) (determined by TRTAC)	25,000	25,000	25,000	15,000	10,000
Spring Pulse Flows (acre-feet) (February–June)	876,181	596,042	500,675	253,318	110,268
February–June minimum instream flows (cfs)	500	400	400	300	300

FWS does not recommend an instream flow regime for the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 2) preparation of a Spill Management Plan that would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing by identifying the preferred timing of releases, minimum durations, and preferred flow rates. Additional discussion of the Spill Management Plan is included below in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Spill Management Plan.*

In its 10(a) recommendation M1-2, California DFW recommends the Districts establish year-round minimum base flow of 300 cfs at La Grange gage and 200 cfs in July, August and September of each year, and 300 cfs in all other months at a gage located downstream of Geer Road infiltration gallery (tables 3.3.2-29 and 3.3.2-30). The water year types should be based on the California DWR Bulletin 120, 50 percent exceedance estimated annual unimpaired flow of the Tuolumne River at the La Grange gage. California DFW also recommends the Districts release spring floodplain activation flows at rates and timing (after February 16th and before May 1st) according to recommendations by the TREG and approved by California DFW, FWS and NMFS (tables 3.3.2-29 and 3.3.2-30). In addition, California DFW recommends the Districts implement spring recession flows and adult Chinook salmon fall attraction pulse flows as recommended by the TREG and approved by California DFW, FWS, using the timing windows and volumes presented in tables 3.3.2-29 through 3.3.2-32.

In its preliminary terms and conditions, the Water Board (preliminary 401 condition 2) indicates that it will likely condition minimum instream flows in light of the whole record. The whole record includes, but is not limited to, the FERC record (including recommendations by resource agencies), the final NEPA document, the final CEQA document, the updated Bay-Delta Plan, and the Basin Plan. The Water Board also indicates that it will likely determine the criteria to classify water year types for the project-affected reaches based on the San Joaquin Valley 60-20-20 Index (preliminary 401 condition 1).

The Conservation Groups recommend the Districts provide the minimum instream flows described in table 3.3.2-33 (based on the California DWR Bulletin 120, 50 percent exceedance estimated annual unimpaired flow of the Tuolumne River at the La Grange gage).

Table 3.3.2-29. California DFW recommended base instream flows for the Tuolumne River at La Grange Diversion Dam Gage (Source: California DFW, 2018a, table M1-2, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
January 1	200	280	280	420	420	
January 16	200	280	280	440	440	
February 1	370	370	370	420	420	
February 16	380	380	380	430	430	**Floodplain activation pulse flow window**[a] Volume of pulse flow would be 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years with rates and timing to be recommended by TREG
March 1	410	460	460	640	640	
March 16	490	650	650	750	750	
April 1	710	810	810	1,070	1,070	
April 16	830	1,000	1,000	1,690	1,690	
May 1	1,170	1,420	1,420	2,240	2,240	
May 16	1,410	2,110	2,110	3,570	3,570	
May 31	1,410	2,110	2,110	3,570	3,570	**Spring recession** Reduction in flow and length of recession varies with highest flow requirement
			Recession Rates begin (see table 3.3.2-31)			
July 1	300	300	300	350	350	
July 16	300	300	300	350	350	
August 1	300	300	300	350	350	

Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
August 16	300	300	300	350	350	
September 1	300	300	300	350	350	
September 16	300	300	300	350	350	
October 1	200	280	280	350	350	**Fall pulse flows window**[b] Volume of fall pulse flow would be 10,000 acre-feet in critical years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years, with rates and timing to be recommended by TREG
October 16	440	440	470	470	470	
November 1	430	430	470	470	470	
November 16	350	350	420	420	420	
December 1	330	330	390	390	390	
December 16	240	275	350	350	350	
December 31	240	275	350	350	350	

[a] The primary purpose of the pulse flows is to encourage returning adults to migrate towards spawning habitat once water temperatures begin to trend towards acceptable levels.

[b] These pulse flows are meant to attract upstream salmon migrants.

Table 3.3.2-30. California DFW recommended base instream flow recommendations for the Tuolumne River below Gear (gage below infiltration galleries) (Source: California DFW, 2018a, table M1-3, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
January 1	200	280	280	420	420	
January 16	200	280	280	440	440	
February 1	370	370	370	420	420	
February 16	380	380	380	430	430	**Floodplain Activation Pulse Flow Window** Volume of pulse flow would be 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years with rates and timing to be recommended by TREG
March 1	410	460	460	640	640	
March 16	490	650	650	750	750	
April 1	710	810	810	1,070	1,070	
April 16	830	1,000	1,000	1,690	1,690	
May 1	1170	1,420	1,420	2,240	2,240	
May 16	1,410	2,110	2,110	3,570	3,570	
May 31	1,410	2,110	2,110	3,570	3,570	**Spring recession** Reduction in flow and length of recession varies with highest flow requirement
			Recession rates begin (see table 3.3.2-31)			
July 1	250	250	300	300	300	
July 16	250	250	300	300	300	
August 1	250	250	300	300	300	
August 16	250	250	300	300	300	

Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
September 1	250	250	300	300	300	
September 16	250	250	300	300	300	
October 1	250	250	300	350	350	**Fall pulse flows window** Volume of fall pulse flow would be 10,000 acre-feet in critical years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years, with rates and timing to be recommended by TREG
October 16	440	440	470	470	470	
November 1	430	430	470	470	470	
November 16	350	350	420	420	420	
December 1	330	330	390	390	390	
December 16	240	275	350	350	350	
December 31	240	275	350	350	350	

Table 3.3.2-31. California DFW recommended spring recession flows for the Tuolumne River at La Grange Diversion Dam gage (Source: California DFW, 2018a, table M1-4, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet
May 31	1,410	2,110	1,715	3,570	3,570
June 1	1,157	1,484	1,484	2,918	2,918
June 2	1,009	1,320	1,320	2,537	2,537
June 3	904	1,193	1,193	2,267	2,267
June 4	823	1,089	1,089	2,057	2,057
June 5	756	1,001	1,001	1,886	1,886
June 6	700	925	925	1,741	1,741
June 7	651	858	858	1,615	1,615
June 8	608	798	798	1,505	1,505
June 9	570	743	743	1,406	1,406
June 10	535	694	694	1,316	1,316
June 11	503	648	648	1,234	1,234
June 12	474	606	606	1,159	1,159
June 13	447	566	566	1,089	1,089
June 14	422	530	530	1,024	1,024
June 15	398	495	495	964	964
June 16	376	462	462	907	907
June 17	355	432	432	853	853
June 18	335	402	402	802	802
June 19	300	375	375	754	754
June 20	300	348	348	708	708
June 21	300	323	323	664	664
June 22	300	300	300	623	623
June 23	300	300	300	583	583
June 24	300	300	300	544	544
June 25	300	300	300	507	507

Date	Critical	Dry	Below Normal	Above Normal	Wet
June 26	300	300	300	472	472
June 27	300	300	300	438	438
June 28	300	300	300	405	405
June 29	300	300	300	373	373
June 30	300	300	300	350	350

Table 3.3.2-32. California DFW recommended recession flows for the Tuolumne River downstream of the Gear Road Infiltration Galleries (Source: California DFW, 2018a, table M1-5, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet
May 31	1,410	2,110	1,715	3,570	3,570
June 1	1,157	1,484	1,484	2,918	2,918
June 2	1,009	1,320	1,320	2,537	2,537
June 3	904	1,193	1,193	2,267	2,267
June 4	823	1,089	1,089	2,057	2,057
June 5	756	1,001	1,001	1,886	1,886
June 6	700	925	925	1,741	1,741
June 7	651	858	858	1,615	1,615
June 8	608	798	798	1,505	1,505
June 9	570	743	743	1,406	1,406
June 10	535	694	694	1,316	1,316
June 11	503	648	648	1,234	1,234
June 12	474	606	606	1,159	1,159
June 13	447	566	566	1,089	1,089
June 14	422	530	530	1,024	1,024
June 15	398	495	495	964	964
June 16	376	462	462	907	907
June 17	355	432	432	853	853

Date	Critical	Dry	Below Normal	Above Normal	Wet
June 18	335	402	402	802	802
June 19	300	375	375	754	754
June 20	250	348	348	708	708
June 21	250	323	323	664	664
June 22	250	300	300	623	623
June 23	250	250	300	583	583
June 24	250	250	300	544	544
June 25	250	250	300	507	507
June 26	250	250	300	472	472
June 27	250	250	300	438	438
June 28	250	250	300	405	405
June 29	250	250	300	373	373
June 30	250	250	300	350	350
July 1	250	250	300	300	300

Table 3.3.2-33. The Conservation Groups recommended instream flows by water year type[105] for the Tuolumne River at La Grange Diversion Dam gage (Source: Conservation Groups, 2018).

Date	Super Critically Dry	Critical	Dry	Below Normal	Above Normal	Wet
Feb–Jun	1. February–June required flow is 300 cfs at the La Grange gage. 2. Provide an additional 12,500 acre-feet of water for pulse flows in the March 15 through April 15 period, with release specifics to be determined by an implementation committee. 3. Irrigation deliveries in a super critically dry year are 70% of demand.	1. February–June required flow is 300 cfs at the La Grange gage. 2. Provide an additional 35,000 acre-feet of water for pulse flows in the March 15 through April 15 period, with release specifics to be determined by an implementation committee. 3. Allowed irrigation deliveries in a critically dry year are 75% of demand.	1. Minimum instream flow in February is 300 cfs at the La Grange gage. 2. Meet 50% of March–April unimpaired flow at the La Grange gage. 3. 300 cfs at the La Grange gage is a March–April default floor value if 50% of unimpaired drops below 300 cfs in March–April in a dry year. 4. Allowed irrigation deliveries in a dry year are 80% of demand. 5. Apply a managed flow recession in dry	1. Meet 50% of February–May unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–May default floor value if 50% of unimpaired drops below 300 cfs in a below normal year. 3. Allowed irrigation deliveries in a below normal year are 80% of demand. 4. Apply a managed flow recession in below normal years according to a set ramp-down schedule beginning on the final day of any water year	1. Meet 50% of February–May unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–May default floor value if 50% of unimpaired drops below 300 cfs in February–May in an above normal year. 3. Allowed irrigation deliveries in an above normal year are 90% of demand, 90,000 acre-feet of which shall be managed recharge deliveries to the groundwater water bank if July 1 Don Pedro storage is greater	1. Meet 50% of February–June unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–June default floor value if 50% of unimpaired drops below 300 cfs in February–June in a wet year. 3. Allowed irrigation deliveries in a Wet year are 100% of demand, 90,000 acre-feet of which shall be managed recharge

[105] The Conservation Groups define water year types as follows: wet - equal to or greater than 2,725; above normal - equal to or greater than 2,000 and less than 2,725; below normal - equal to or greater than 1,400 and less than 2,000; dry - equal to or greater than 1,075 and less than 1,400; critically dry - equal to or greater than 830 and less than 1,075; super critically dry - less than 830 TAF.

Date	Super Critically Dry	Critical	Dry	Below Normal	Above Normal	Wet
			years according to a set ramp-down schedule beginning on the final day of any water year on which minimum flows are determined by a percent of unimpaired flow (approximately May 13). 6. If recession flow drops to 300 cfs during May or June, the minimum instream flow for the remainder of May and/or June is 300 cfs at the La Grange gage. 7. Dry years immediately preceded by 2 critical years will be considered to be critical years.	on which minimum flows are determined by a percent of unimpaired flow (approximately June 13). 5. If recession flow drops to 300 cfs prior to the end of June, the minimum instream flow for the remainder of June is 300 cfs at the La Grange gage.	than 1.6 MAD, as described infra. 4. Apply a managed flow recession in above normal years according to a set rampdown schedule beginning on the final day of any water year on which minimum flows are determined by a percent of unimpaired flow (approximately June 13). 5. If recession flow drops to 300 cfs prior to the end of June, the minimum instream flow for the remainder of June is 300 cfs at the La Grange gage.	deliveries to the groundwater water bank, as described infra.
Jul–Sept	1. July–September required flow in all water year types is 300 cfs at the La Grange gage. 2. July–September required flow in all water year types is 200 cfs at a gage 1 mile or less downstream of the Geer Road infiltration gallery ("Downstream gage").					
Oct–Jan	1. October–January required flow in all water year types is 300 cfs at the La Grange gage.					

In addition to the flow schedule presented in table 3.3.2-33, the Conservation Groups recommend the Districts release fall pulse flows to attract salmon, with release specifics to be determined by an implementation committee. Flow volumes of pulse flows in addition to October baseflow volume shall be 20,000 acre-feet in wet and above normal years, 15,000 acre-feet in below normal and dry years, 10,000 acre-feet in critical years, and 7,500 in super critically dry years.

The Conservation Groups also recommend the Districts provide recession flows only in above normal, below normal and dry years. These recession flows provide a multi-day rampdown to base flow from the flow value on the final day of any water year ("Recession Initiation Flow Value") on which minimum flows are determined by a percent of unimpaired flow. The recommended recession rate is 180 cfs/day when the Recession Initiation Flow Value is greater than or equal to 1,400 cfs, and they would remain at that rate until the daily flow value is equal to or less than 1,400 cfs. Recession rate for flows equal to or less than 1,400 cfs is meant to require a drop in stage height of 9 cm per day (3.5 inches per day) for the first 6 days, and 3 cm per day (1.2 inches per day) thereafter, until base flow is reached.

If the Recession Initiation Flow Value is equal to or less than 1,400 cfs, or otherwise once the flow value becomes equal to or less than 1,400 cfs in the course of the implementation of the 180 cfs/day recession, the Conservation Groups recommend the Districts ramp down according to the values in table 3.3.2-34. If the Recession Initiation Flow Value is less than or equal to 1,254 cfs, then the Districts should initiate the rampdown at the smallest value greater than the Recession Initiation Flow Value, and ramp down each day according to the descending values on the table.

Table 3.3.2-34. The Conservation Groups recommended recession values for flows equal to or less than 1,400 cfs (Source: Conservation Groups, 2018).

Day	Flow	Day	Flow
1	1,400	14	612
2	1,254	15	584
3	1,157	16	556
4	1,068	17	527
5	979	18	499
6	890	19	499
7	801	20	471
8	771	21	443
9	742	22	414
10	720	23	386

Day	Flow	Day	Flow
11	697	24	358
12	669	25	330
13	640	26	301

If flood releases occur on the day that the recession is to be initiated or Districts must make flood releases in excess of the prescribed value for any given day in the flow recession sequence, the Conservation Groups recommend the Districts should reinitiate the flow recession once flood control requirements allow the Districts to resume the recession. In such case, the Districts should resume the flow recession using the highest flow at which the Districts can maintain system control as the new Recession Initiation Flow Value.

Furthermore, the Conservation Groups recommend a suite of measures, including development of a groundwater water bank to keep the existing water bank from going negative and help to preserve CCSF's total system storage at a level where CCSF can limit the frequency of water rationing. The Districts would adjust the water-year types based on the 50 percent exceedance estimated unimpaired inflow to La Grange as given in the February, March, April, and May California DWR Bulletins 120 (with adjustment of the water-year type on a monthly basis). More detailed information describing the Conservation Groups' recommended groundwater water bank and modeling notes are provided in Conservation Groups (2018).

The Bay Institute recommends that the Districts provide the flows presented in table 3.3.2-35 below La Grange Diversion Dam and remain instream at least as far as the Delta so that they can contribute to ecologically necessary increases in Delta inflow and outflow.

ECHO recommends the Districts provide 60 percent unimpaired flow from February to June to protect salmon.

Table 3.3.2-35. The Bay Institute's recommended instream flows below La Grange Diversion Dam.[a]

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
October 1–15	200			350 plus 700 for 2 days	400 plus 1,000 for 2 days	400 plus 1,500 for 2 days
October 16–31	200		350 plus 700 for 2 days	350	400	
November 1–15	350	350 plus 700 for 2 days	350 plus 1,000 for 2 days		400 plus 1,500 for 2 days	400 plus 2,000 for 2 days
November 16–30	350 plus 500 for 2 days	350			400	
December	350				400	
January	350				400	
February	550		500 or 50% of unimpaired flow		400 or 50% of unimpaired flow	
March	550 or 40% of unimpaired flow			500 or 50% of unimpaired flow	400 or 50% of unimpaired flow	400 or 40% of unimpaired flow
April	550 or 40% of unimpaired flow		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 or 40% of unimpaired flow
May 1–15	550 cfs or 40% of unimpaired flow. Up to 0.33 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
	the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives					inundation in lower river. Water for this can be shifted from June water budget.
May 16–31	550 or 40% of unimpaired flow		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 cfs or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day inundation in lower river. Water for this can be shifted from June water budget.
June 1–15	550 riparian recession		500 cfs or 50% of unimpaired flow. Up to 1/3 in dry water years and 1/2 in below average years of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall		350 cfs or 50% of unimpaired flow	400 cfs or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day inundation in lower river.

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
			if temperature benefit of carryover would allow attainment of summer or fall objectives.			Water for this can be shifted from June water budget.
June 16–30[b]	550 riparian recession		500 cfs or 50% of unimpaired flow. Up to 1/2 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.		350 cfs or 50% of unimpaired flow. Up to 1/2 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.	400 cfs or 40% of unimpaired flow. Up to 1/2 of any excess flow beyond that needed to attain salmonid objectives may be carried over for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.
July	100		200 riparian recession		250 riparian recession	300 riparian recession

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
August	100		200		250 riparian recession	300 riparian recession
September 1–15	100			200	250	300 riparian recession
September 16–30	100			200	250	300 riparian recession

[a] Source: Letter from Gary Bobker, Program Director, The Bay Institute, San Francisco, California, to Kimberly Bose, Secretary, Federal Energy Regulatory Commission, Washington, D.C. Re: Don Pedro Hydroelectric Project, FERC Project No. 2299-082. January 29, 2018 (accession no. 20180129-5262).

[b] In extremely wet years 400 cfs or 40% of unimpaired flow.

Our Analysis

Balancing different resource values associated with instream flow releases often involves a complex series of tradeoffs among multiple resource demands, as the timing, magnitude and duration of instream flows can have a substantial effect on water temperature, physical habitat availability for specific fish species and life-stages, the outmigration timing and survival of juvenile and adult anadromous salmonid, recreation, irrigation, domestic water supply, and other beneficial uses.

As described above, the Districts' proposed instream flows include base flows designed for specific salmonid life stages in the Tuolumne River, flushing flows to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. These flows are generally greater than what was mandated in the 1995 settlement agreement. Flow recommendations by NMFS, California DFW, the Conservation Groups, ECHO, and The Bay Institute are considerably higher than those proposed by the Districts, with variable patterns based on a percentage of unregulated flow or on a percentage of overall water demand.

During the ILP process, the Districts conducted a series of instream flow studies and modelling exercises to help develop their proposed seasonal instream flow releases for the lower Tuolumne River. These studies included a one-dimensional (1-D) physical habitat simulation (PHABSIM) model (Stillwater Sciences, 2013a), conducted per a July 16, 2009, FERC Order (128 FERC 61,035). The Districts also conducted the *Lower Tuolumne River Instream Flow Study–Evaluation of Effective Usable Habitat Area for Over-Summering O. mykiss* (Stillwater Sciences, 2017c) to estimate the "effective" weighted usable area (eWUA) of select lower Tuolumne River habitat reaches for various life history-stages of *O. mykiss* during June–September). Unlike the traditional weighted usable area (WUA) computed for stream habitat analysis, which is based on the relationship between physical parameters (i.e., depth, velocity, and/or substrate and cover) and flow (Bovee, 1982), the eWUA evaluation also accounts for temperature. Furthermore, as a supplement to their PHABSIM study (Stillwater Sciences, 2013c), the Districts developed WUA versus flow analyses for Sacramento splittail and Pacific lamprey, using existing habitat suitability criteria (Stillwater Sciences, 2014).

In addition to the above studies, the Districts conducted a *Lower Tuolumne River Instream Flow Study–Non-Native Predatory Bass 1-D PHABSIM Habitat Assessment* (Stillwater Sciences, 2017d) in response to the Commission's April 29, 2014, determination on requests for study modifications (FERC, 2014), which required an assessment of the relationship between flow and bass habitat in the lower river (see section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Fish Enumeration and Predator Control*). The study was conducted using existing habitat suitability criteria for smallmouth, largemouth, and striped bass.

As described below under *The Districts' Modeling Results*, the Districts also developed a project operations model, a reservoir water temperature model, a Chinook salmon and *O. mykiss* population model, a socioeconomic model, and a floodplain hydraulic model, as needed to evaluate the effects of various project alternatives on fish productivity, water supply, recreation, socioeconomics, and project economics.

Results of the Districts' PHABSIM analysis of WUA versus flow relationships for each species and life stage are presented in Figures 3.3.2-20 through 3.3.2-23. To facilitate comparison and analyses, the flow verses habitat relationships are shown with a normalized y-axis scale representing "percent of maximum" WUA. Results for *O. mykiss* fry show peak WUA values (e.g., ≥95% of maximum) below approximately 75 cfs, with relatively high WUA values (e.g., ≥80% of maximum) at flows ≤125 cfs (figure 3.3.2-20). *O. mykiss* juveniles show peak WUA values at approximately 75–275 cfs, with relatively high WUA values at flows ≤500 cfs, and results for *O. mykiss* adults show peak WUA values at flows ≥350 cfs, with relatively high WUA values at flows ≥200 cfs. Findings for *O. mykiss* spawning show peak WUA values at ≥375 cfs, with relatively high WUA values at flows ≥225 cfs. This WUA versus flow relationship was not appreciably altered by spawning gravel availability.

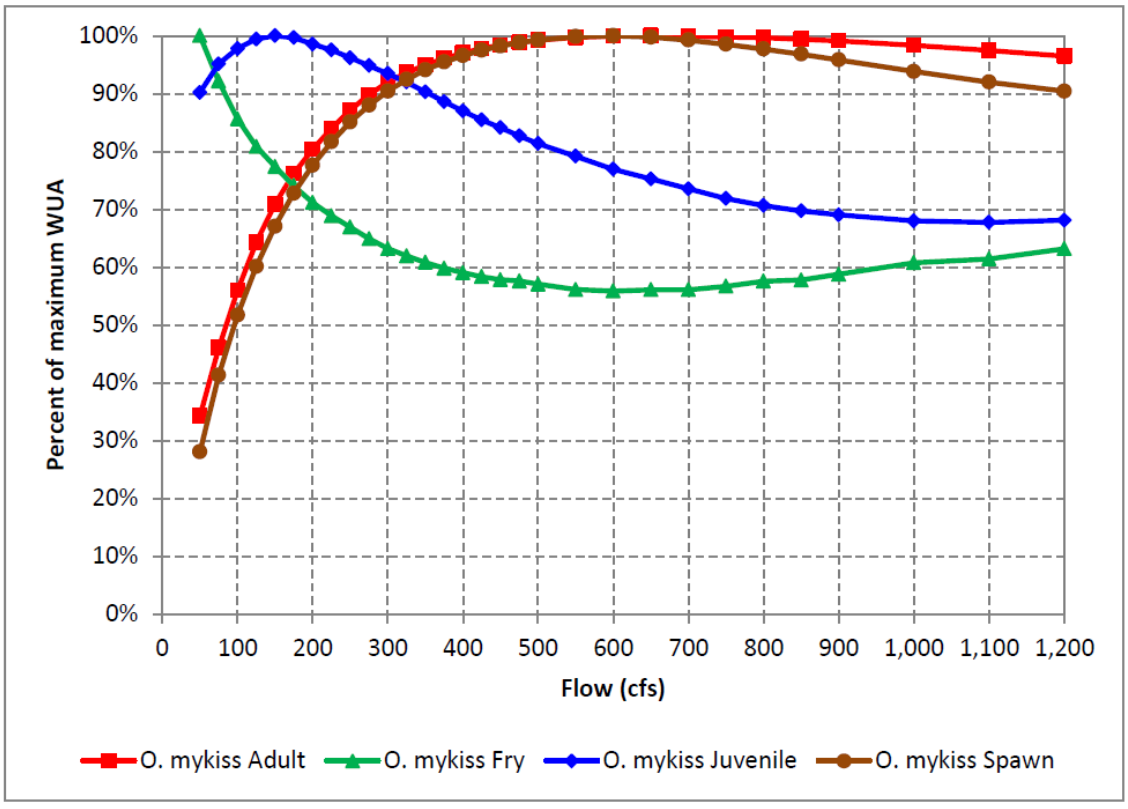

Figure 3.3.2-20. *O. mykiss* WUA results for the lower Tuolumne River (Source: Stillwater Sciences, 2013c).

Results for Chinook salmon fry show peak WUA values at approximately 50 to 100 cfs, with relatively high WUA values below 125 cfs (figure 3.3.2-21). Chinook salmon juveniles show peak WUA values at approximately 75 to 225 cfs, with relatively high WUA values below 400 cfs, and salmon spawning show peak WUA values at approximately 250 to 350 cfs, with relatively high WUA values from 175 to 475 cfs.

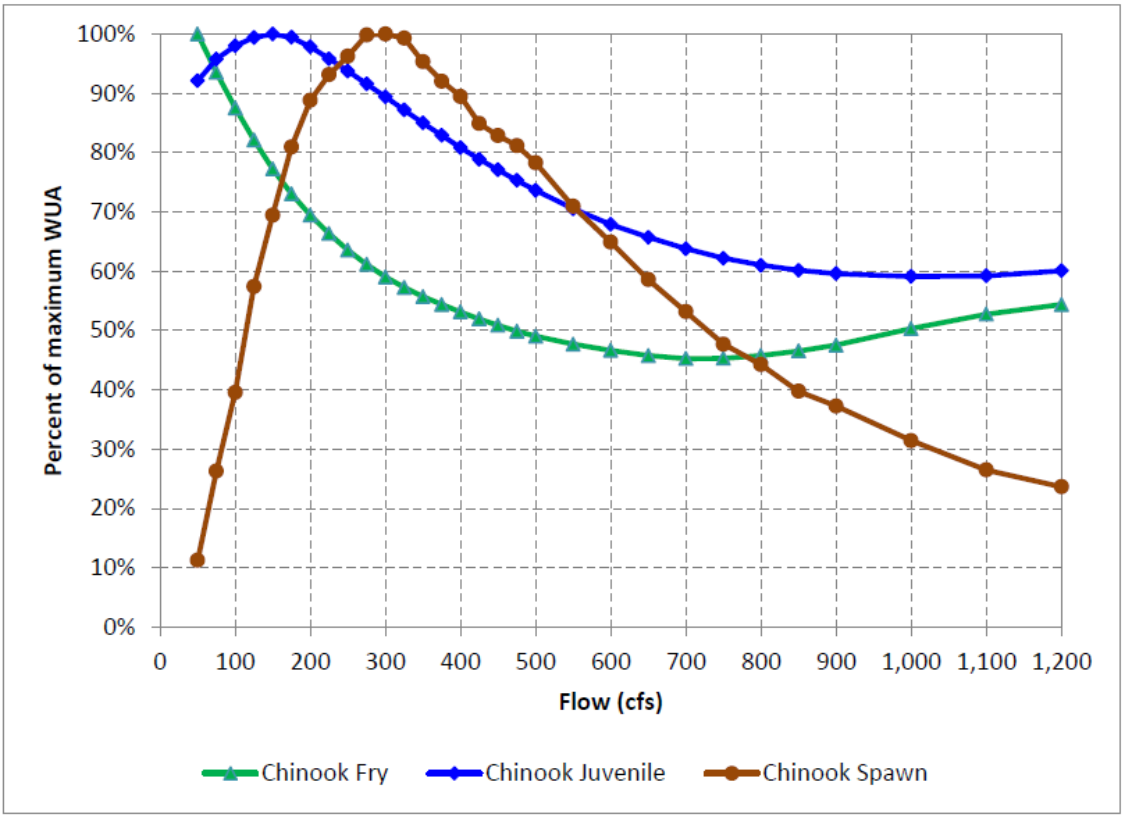

Figure 3.3.2-21. Chinook Salmon WUA results for the lower Tuolumne River (Source: Stillwater Sciences, 2013c).

Sacramento splittail juveniles show peak WUA values at approximately 50 to 175 cfs, with relatively high WUA values below 300 cfs (figures 3.3.2-22). Results for Sacramento splittail spawning show high WUA at about 300 to 400 cfs, with relatively small increases in WUA over the remaining simulation range.

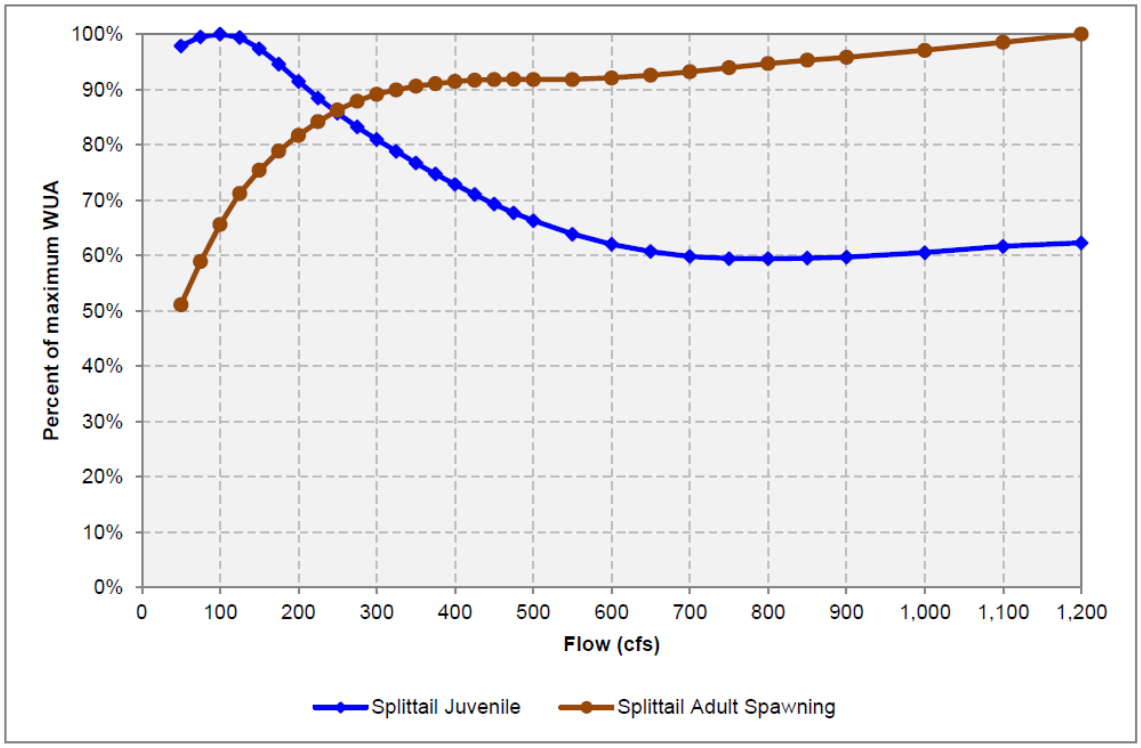

Figure 3.3.2-22. Sacramento splittail WUA results (percent of maximum) for the lower Tuolumne River (Source: Stillwater Sciences, 2014).

Results for Pacific lamprey ammocoetes show that potential habitat is maximized at low flows, with peak WUA at flows less than about 150 cfs, followed by a slight decline, but still relatively high WUA over the remaining range of simulated flows (figure 3.3.2-23) (Stillwater Sciences, 2014). Pacific lamprey spawning show peak WUA values at 75 to 150 cfs, with a steady decline in WUA values (but still relatively high) up to about 250 cfs, followed by a more gradual decline over the remaining range of simulated flows (figure 3.3.2-23).

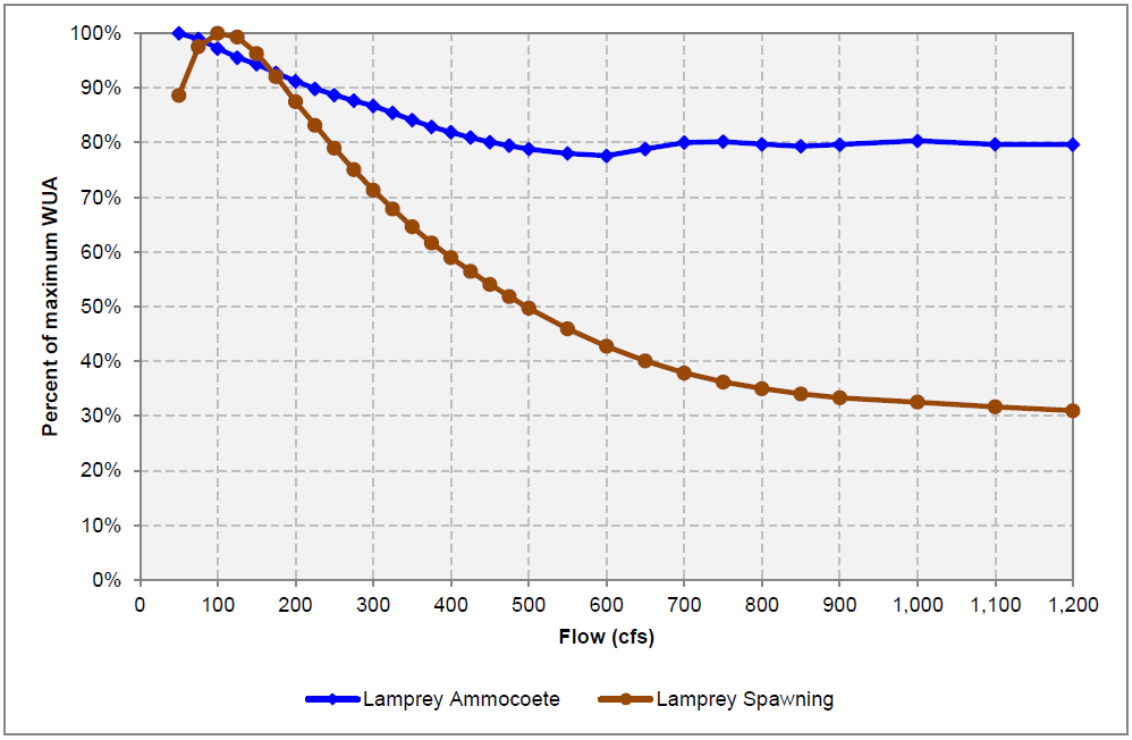

Figure 3.3.2-23. Pacific lamprey WUA results (percent of maximum) for the lower Tuolumne River (Source: Stillwater Sciences, 2014).

Habitat time series[106] conclusions for each of five water year types (using the San Joaquin River 60-20-20 Index) for *O. mykiss* and Chinook life stage combinations are presented in Stillwater Sciences (2013c) and are summarized in figures 3.3.2-24 and 3.3.2-25. The time periods used in the habitat time series analysis were when individual life-stages are most typically observed, or expected to be present, within the study reach. Figure 3.3.2-24 documents that *O. mykiss* WUA exhibits a similar pattern of annual fluctuation across all water year types, although juvenile and fry WUA tends to be lower in both above normal and wet water years. Adult *O. mykiss* WUA is typically higher and more stable in above normal and wet water years. Figure 3.3.2-25 shows that Chinook salmon WUA exhibits a similar trend as *O. mykiss*, except for juvenile and fry habitat that declines in wet years.

[106] Habitat time series illustrate the dynamics of the temporal habitat change for a particular species and life stage during each season or critical time period under evaluation.

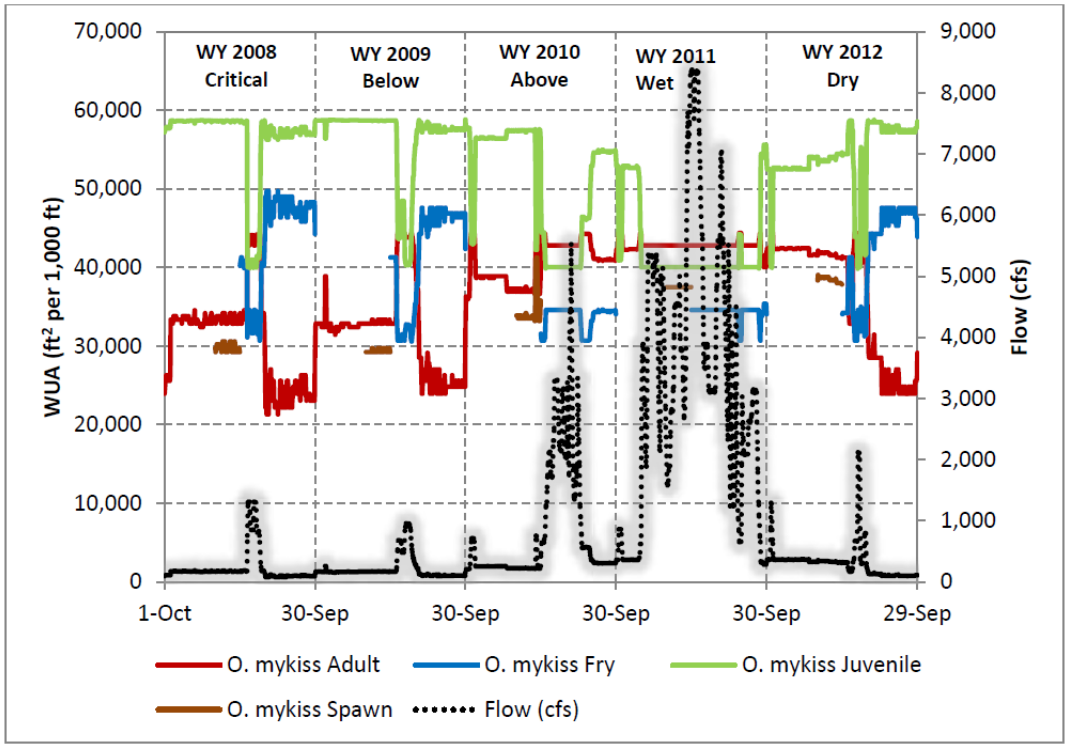

Figure 3.3.2-24. Habitat Time series results for lower Tuolumne River *O. mykiss* across all water year types (Source: Stillwater Sciences, 2013c).

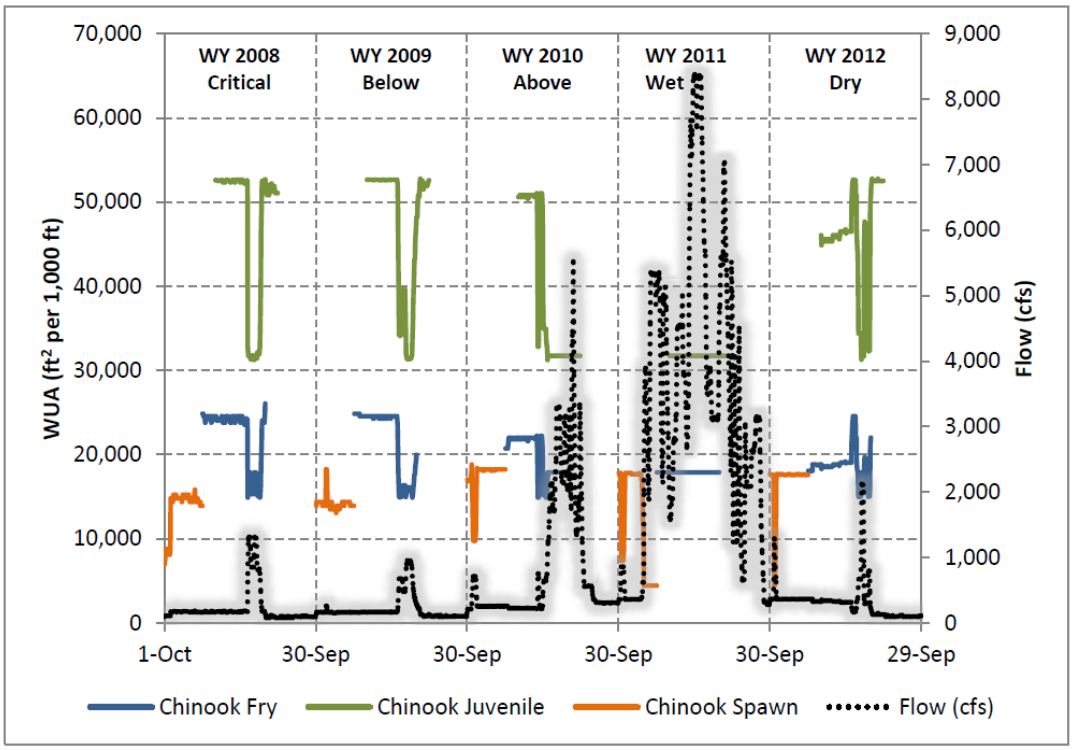

Figure 3.3.2-25. Habitat time series results for lower Tuolumne River Chinook salmon across all water year types (Source: Stillwater Sciences, 2013c).

The Districts' Sacramento splittail habitat time series analyses show that under critical, dry, and below normal water year scenarios, juvenile WUA is maximized during periods of low flow and quickly drops when flow increases (Stillwater Sciences, 2014). In contrast, Sacramento splittail spawning WUA is minimized at lower flows and increases as flows increase above 1,000 cfs. Under above normal and wet water year scenarios, Sacramento splittail juvenile WUA is minimized when flow increases above approximately 600 cfs, and spawning WUA is maximized as flow increases up to 1,200 cfs. The Districts' Pacific lamprey habitat time series analyses for critical, dry, and below normal water year scenarios show that Pacific lamprey ammocoete WUA remains relatively stable, but spawning WUA fluctuates with flow until flow nears 1,200 cfs, where WUA is minimized (Stillwater Sciences, 2014).

The Districts' proposed early summer base flows (June 1 through June 30) are intended to enhance rearing habitat conditions for *O. mykiss* fry, as most juvenile fall-run Chinook salmon have left the Tuolumne River by the end of May (Stillwater Sciences, 2013a, W&AR-05). These flows would be 200 cfs at the La Grange gage from June 1 through June 30 of all water-year types (table 3.3.2-26). Downstream of RM 25.9 (i.e., downstream of the infiltration galleries), the Districts' proposed flows would be 100 cfs during wet, above normal, and below normal water years and 75 cfs in dry and critical years.[107] The Districts developed these proposed flows based on years of monitoring studies that show that *O. mykiss* are predominantly found upstream of RM 42, with peak fry densities occurring into June. The Districts also indicate that flows higher than those described above would tend to displace weaker-swimming *O. mykiss* fry to downstream areas with lower quality physical habitat, higher water temperatures, and greater predator densities.

The Districts' IFIM study results (Stillwater Sciences, 2013c) indicate that at 100 cfs, *O. mykiss* fry WUA would be 85 percent of maximum, at 150 cfs it would be 78 percent of maximum, and at 200 cfs it would be 71 percent of maximum (figure 3.3.2-20). *O. mykiss* adult WUA would be 78 percent of maximum WUA at 200 cfs. Water temperature modeling shows that at RM 47, a flow of 200 cfs would maintain average daily water temperatures at less than 18°C, and at RM 43, a flow of 200 cfs would maintain average daily water temperatures at less than 20°C, except when maximum daily ambient air temperatures exceed 38°C (100°F), which on average occurs only one day in June. At 150 cfs, average daily water temperatures at RM 43 would be

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[107] The infiltration galleries would be operated from June through mid-October to enable the release of increased flows to preferred *O. mykiss* habitats located upstream of RM 42, while continuing the Districts' use of a portion of this instream flow for water supply purposes by withdrawing flows through the infiltration galleries. Lower flows in the sand-bedded reach located downstream of the infiltration galleries would accommodate the warmwater species that inhabit and may improve fishing success for non-native predator species inhabiting these reaches.

less than 20°C until maximum daily air temperature exceeds 95°F, which occurs on average three days in June.

By July, *O. mykiss* in the lower Tuolumne River consist predominantly of adult and juvenile life-stages, which are known to be stronger swimmers than fry and can maintain their positions in the river at higher flows. Consequently, the Districts developed their proposed July 1 through October 15 base flows to maintain suitable water temperatures from just downstream of the La Grange Project to approximately RM 42. Based on this rationale, the Districts' proposed late-summer base flows (July 1 through October 15) would be 350 cfs at the La Grange gage in wet, above normal, and below normal water years and 300 cfs in dry and critical water years. Downstream of RM 25.95 the Districts' proposed instream flows would be 150 cfs during wet, above normal, and below normal water years and 75 cfs in dry and critical years. In wet, above normal, and below normal water years, the Districts would also provide a 1,000 cfs flushing flows (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with appropriate up and down ramps to clean gravels of accumulated algae and fines. In dry and critical years, the flows at La Grange would continue to be 300 cfs, with withdrawals of 225 cfs at the infiltration galleries, leaving 75 cfs in the river below RM 25.9.

At a flow of 350 cfs, adult WUA for *O. mykiss* in the lower Tuolumne River would be 95 percent of maximum and juvenile WUA would be 90 percent of maximum (figure 3.3.2-20). During dry and critical years, flow at the La Grange gage would be reduced to 300 cfs, at which both juvenile and adult *O. mykiss* WUA would be 91 percent of maximum. In addition, a flow of 350 cfs would maintain average daily water temperatures below 18°C at RM 43 until daily maximum air temperatures exceed 105°F (40.6°C). These flow/temperature effects would have little or no effect on Chinook salmon as most juvenile fall-run Chinook salmon have left the Tuolumne River by the end of May, and maximum air and water temperatures occur during the summer.

The Districts' proposed October 16–December 31 instream flows would be 275 cfs (below normal, above normal, and wet water years), 225 cfs (dry water years), and 200 cfs (critical water years). According to the Districts, these flows are designed to provide spawning habitat for fall-run Chinook salmon. To provide habitat for fall-run Chinook fry rearing, the Districts would provide the following minimum instream flows from January 1–February 28/29: (1) 225 cfs (below normal, above normal, and wet water years), (2) 200 cfs (dry water years), and (3) 175 cfs (critical water years). To provide habitat for Chinook juvenile rearing, the Districts would provide the following minimum instream flows from March 1–April 15: (1) 250 cfs (below, above normal, and wet water years), (2) 225 cfs (dry water years), and (3) 200 cfs (critical water years).

At a flow of 275 cfs, Chinook spawning WUA is 100 percent of maximum; at 225 cfs Chinook spawning WUA is 93 percent of maximum; and at 200 cfs Chinook spawning WUA is 89 percent of maximum.

At a flow of 275 cfs, adult *O. mykiss* WUA is 90 percent of maximum, and juvenile WUA is 95 percent of maximum (figure 3.3.2-20). At a flow of 225 cfs, adult

O. mykiss WUA is 84 percent of maximum, and juvenile WUA is 98 percent of maximum, and at a flow of 200 cfs, adult *O. mykiss* WUA is 80 percent of maximum, and juvenile WUA is 99 percent of maximum.

During October 16–December 31, at 275 cfs, average daily water temperatures at RM 43 would be less than 14.5°C until daily maximum air temperatures exceed 75°F, which is estimated to occur about one day in November on average. Average daily water temperatures would generally remain below 14°C in December throughout the entire gravel-bedded reach of the lower Tuolumne River. In addition to the above base flows, the Districts would provide the following outmigration base flows for the period of April 16–May 15: (1) 275 cfs (below normal, above normal, and wet water years), (2) 250 cfs (dry water years), and (3) 200 cfs (critical water years). Increasing base flows in the March 1–April 15 period would maintain suitable water temperatures during the mid-April through mid-May period, which is expected to benefit salmonids. These base flows could be augmented by outmigration pulse flows (see below), depending on the timing of the pulse flows, which would further reduce water temperatures at a given location and extend the plume of colder water farther downstream.

Furthermore, the Districts are proposing to allocate the following volumes of water for spring pulse flow releases: 150,000 acre-feet (above normal and wet water years), 100,000 acre-feet (below normal water years), 75,000 acre-feet (dry water years), 45,000 acre-feet (sequential dry water years), 35,000 acre-feet (initial critical water year), and 11,000 acre-feet (sequential critical water years). These pulse flows are designed to encourage fall-run Chinook smolt outmigration and increase survival. Consequently, these pulse flows would be provided to coincide with periods when large numbers of parr- or smolt-size fish are occurring in the river. The available pulse flow volumes would be substantially increased over baseline levels, except in the second (and subsequent to the second) critical water year. Consequently, providing these spring pulse flows in the lower Tuolumne River could facilitate outmigration and increase the survival of juvenile salmon and steelhead, particularly during periods of high turbidity associated with spill events. Structuring these pulse flow events to mimic the natural hydrograph would ensure that they provide the maximum environmental benefit. In addition, spring pulse flows would mobilize and redistribute sediments that provide potential germination sites for riparian tree species if these flows do not recede too quickly.

Finally, in spill years, the Districts state that they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions. Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs. Based on flows in the 1971 to 2012 period of record, flows at the La Grange gage greater than 1,500 cfs would occur from February through July in 28 years (or more than 60 percent of the years). Flows exceeding 2,500 cfs would occur in 45 percent of the years in that period.

NMFS states that it developed its recommended instream flows to better mimic the components of a natural hydrograph that benefit salmonids and riparian ecosystem

function. The five components of a natural hydrograph in the eastern Central Valley are: (1) fall or winter freshets (first inundation flows of the wet season), (2) winter storm/peak flows, (3) spring snowmelt flows, (4) snowmelt recession flows, and (5) summer base flows. NMFS believes that the Districts' proposed flows do not provide the components of the natural hydrograph that would provide timely migration cues and foraging habitat for juvenile salmonids in the floodplain and other areas outside of the main channel, or adequately mitigate for the fish passage impacts of the projects. NMFS also states that the Districts' summer base flows (June 1–October 15) would only provide suitable *O. mykiss* habitat in the uppermost approximately 5 miles of the lower Tuolumne River (from RM 46.9 upstream to RM 51.6), while NMFS believes its recommended flows would create habitat for juvenile salmonid rearing for approximately 12 miles in the lower Tuolumne during wet, above normal, and below normal water years. During dry and critically dry years, rearing could extend downstream for approximately 5 miles, depending on meteorological conditions. NMFS notes that its recommended flows during dry and critically dry years are lower due to concerns regarding water availability, but still provide protection for salmonid rearing below La Grange Diversion Dam.

The NMFS recommended fall/winter flows for salmonid immigration, spawning, and incubation (October 15–February 15) are meant to mimic natural hydrologic processes for habitat creation and maintenance and to facilitate fish migration and spawning. The NMFS recommended springtime flows for salmonid migration, floodplain inundation, and rearing (February 15–May 31) are designed to annually inundate floodplain habitat for between 30 and 90 days to allow for primary productivity of the BMI food web, which NMFS states would benefit salmonids throughout most of the lower Tuolumne and San Joaquin Rivers. In addition to providing critical rearing habitat, NMFS indicates its recommended elevated flows in springtime would decrease energetic expenditure for emigrating salmonids and reduce the risk of predation, thereby improving outmigration success in the Tuolumne River, San Joaquin River, and Delta. The NMFS recommended recession rates are intended to mimic a natural decrease in flow from springtime snowmelt to summertime base flow, which would extend the in-river salmonid rearing period through June in normal to wet years.

As is the case for NMFS, California DFW believes that the Districts' proposed instream flows do not adequately address components of a natural hydrograph that benefit salmonids and riparian ecosystem function, and are not sufficient to support salmonid holding, spawning, and rearing in the lower Tuolumne River. Accordingly, California DFW's recommended instream flows for the lower Tuolumne River are designed to: (a) simulate the shape of the natural hydrograph in duration, magnitude, timing, rate of change, and frequency to the extent necessary to restore or protect applicable ecological functions; (b) provide fall attraction pulse flows; (c) maximize riparian floodplain inundation to increase prey availability; (d) mimic a snowmelt recession; (e) provide recession rates necessary for conservation of riparian ecosystem function, including regeneration of riparian plant species; and (f) provide boatable flows on the Tuolumne River.

Rather than requiring a minimum flow based on unimpaired flows during February through June in all water year types, California DFW first developed a set of flows that would inundate springtime salmonid habitats relying on results of PHABSIM studies conducted on the Tuolumne River (Stillwater Sciences, 2012). After developing flows informed by WUA, California DFW used the HEC-5Q, Project Operations and Water Temperature Models to develop base flows that would meet the EPA temperature requirements a majority of the time. California DFW then added additional recommended flows to activate the floodplains in the early spring so that when later high flows spill onto the floodplains, the floodplain ecosystem has already began its spring growth. California DFW also recommends a spring snow-melt recession rate, so that floodplain use by juvenile salmonids is maximized and so that floodplain plants, including riparian trees and shrubs, can continue to grow their root system as the water level recedes gradually. Lastly, California DFW recommends a fall pulse flow to attract adult fall-run Chinook into the system. California DFW's rationale for these flows is similar to that provided by NMFS.

According to the Conservation Groups, their recommended February through June percent-of-unimpaired requirement in above normal, below normal, and dry years considers: (1) the life-stages of salmon and *O. mykiss* that benefit from flow in each month; (2) the relative biological benefit that derives from the hydrology under the percent-of-unimpaired requirement in each month; and (3) downstream conditions in each month. It selected 50 percent of unimpaired value as a compromise based on analyses of the hydrology of the Tuolumne River and the competing uses.[108] In addition, it suggests that eliminating its recommended percent-of-unimpaired requirement in June for above normal and below normal years would do more to balance water supply towards water for storage and irrigation. The Conservation Groups also eliminated February and May from a percent-of-unimpaired requirement in dry years.

In above normal, below normal, and dry years, the Conservation Groups' flow recommendation is also designed to extend the benefit of the percent-of-unimpaired flow requirement by immediately following its flow recommendation with a managed down-ramp that mimics the snowmelt recession (to improve riparian recruitment). In critically dry and super critically dry years, the Conservation Groups' recommended spring block flows are designed to at least facilitate successful outmigration of salmonids that are able to survive flatline baseflow conditions. In addition, the Conservation Groups recommend releases of fall pulse flows to attract salmon upstream because a strong correlation exists between flow pulses and upstream migration, as documented in the Mokelumne River on the declining limb of the pulse.

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[108] The Water Board's 2010 Delta Flow Criteria Report established that 60 percent of February–June unimpaired flow is what fish need as in-river flow in each of the three major San Joaquin tributaries and as outflow from the San Joaquin River.

The Bay Institute's recommended instream flows below La Grange are designed to contribute to ecologically important increases in Delta inflow and outflow and restore/maximize Tuolumne River cottonwood and willow recruitment, and ECHO recommends the Districts provide 60 percent of the unimpaired flow in the Tuolumne River from February to June to protect salmon.

The Districts' Modeling Results

In response to the Commissions February 16, 2018 AIR, the Districts prepared an analysis of each of the above instream flow proposals/recommendations consisting of (a) running each recommended/proposed flow regime through the suite of models developed during the ILP study process, including the project operations model, the reservoir temperature model, the Chinook salmon and *O. mykiss* population models, the socioeconomic model, and the floodplain hydraulic model; (b) evaluating non-flow measures[109] proposed by the Districts and recommended by stakeholders that may need to be included in runs through the project operations and fish population models; and (c) analyzing the results of the model runs to inform potential benefits, impacts, and costs of the proposed flow and non-flow measures. As requested by this same AIR, the Districts also compared and contrasted the costs associated with each flow recommendation (including minimum flows, pulse flows, recession flows, ramping rate restrictions, and minimum water storage). The base case under the Commission's procedures and protocols represents the scenario of future project operations under the current license conditions. Specific to the Tuolumne River Operations Model, the base case depicts the operation of the Don Pedro Project in accordance with the current license, Corps flood management guidelines, and the Districts' irrigation and municipal and industrial water management practices.

As shown in figures 3.3.2-26 through 3.3.2-40, the Districts' proposed minimum instream flows (and non-flow measures) would likely increase the in-river abundance of juvenile and adult fall-run Chinook salmon and steelhead compared to the base case and to what would be realized under the agencies and NGO's flow recommendations.[110] The Districts and agencies/NGOs minimum flows would result in similar adult replacement rates for these same species, but the Districts' minimum flow proposal would have far less of a negative effect on water supply and generation (see section 3.3.8, *Socioeconomics*) and section 4.0, *Developmental Analysis*). In addition, based on the Districts' and CCSF's review of the historical flow record, each of the alternative minimum flow recommendations (agencies and NGOs) would cause significant water

[109] These would include the coarse sediment management program, gravel mobilization flows, gravel cleaning, instream habitat improvement, and predator control.

[110] The Districts indicate that these model results are not intended to be precise predictions of absolute values, but should be interpreted as a relative comparison of salmonid productivity when comparing alternatives.

shortages to the BAWSCA service area, including a much higher level of rationing and much higher frequency of rationing, over the period of hydrologic record (see section 3.3.8, *Socioeconomics*). Rationing would be even more severe to BAWSCA agencies when water demands in the BAWSCA service area are higher.

It is important to note that the modelling results shown for the Districts' proposal include the combined benefits of both their proposed flow regime as well as their non-flow measures, while the modelling results shown for the other stakeholders' recommendations do not include any of the stakeholders' recommended non-flow measures. In section 4.0 of the Districts' response to the Commission's February 16, 2018, AIR, the Districts address this deficiency by analyzing the effects of the various non-flow measures recommended by the relicensing stakeholders. While there was considerable variability in the degree of specificity for each of the stakeholder's measures and in the proposed measures themselves, most of the recommendations did include each of the following non-flow measures to be implemented in the lower Tuolumne River:

- coarse sediment augmentation;
- floodplain modifications;
- LWM augmentation; and
- riparian resources augmentation.

Consequently, the Districts modeled each of the non-flow proposals by individual measure instead of by entity because of the general similarity of the recommended measures. Potential benefits to fish populations were modeled if the measure was sufficiently detailed to allow modelling. With these measures incorporated into the salmonid population models, the proposed non-flow measures were combined with the base case instream flows, FWS's original[111] recommended instream flows, California DFW's instream flows, and the Districts' proposed instream flows. The results of this modeling effort are presented in figures 3.3.2-26 through 3.3.2-40. The various assumptions that went into these model runs are available in the Districts' February 16, 2018, AIR response.

Incorporating the stakeholders' non-flow measures into the Districts' models, Chinook smolt productivity values range from 8.16 and 3.79 smolts per female (base case) to 10.68 and 5.21 smolts per female[112] for FWS's original recommendation, which would increase the required discharge from 216,000 to 748,000 acre-feet

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[111] On October 2, 2018, FWS withdrew its minimum flow recommendation and replaced it with its recommended spill management plan.

[112] The range of smolts per female is for theoretical populations of 2,000 female spawners and 10,000 female spawners, respectively.

(figure 3.3.2-26). Similarly, California DFW's recommended flows resulted in Chinook smolt productivity values ranging from 9.43 to 4.66 smolts per female, but would require 487,000 acre-feet. Estimated *O. mykiss* young-of-year production values are fairly similar among each proposal/recommendation; however, the Districts' minimum flow proposal[113] would have far less of a negative effect on water supply (figure 3.3.2-27). Estimated effects on Tuolumne River *O. mykiss* adult replacement rate are also similar among each proposal/recommendation, but the Districts' proposal would again have far less of an effect on water supply (figure 3.3.2-28).

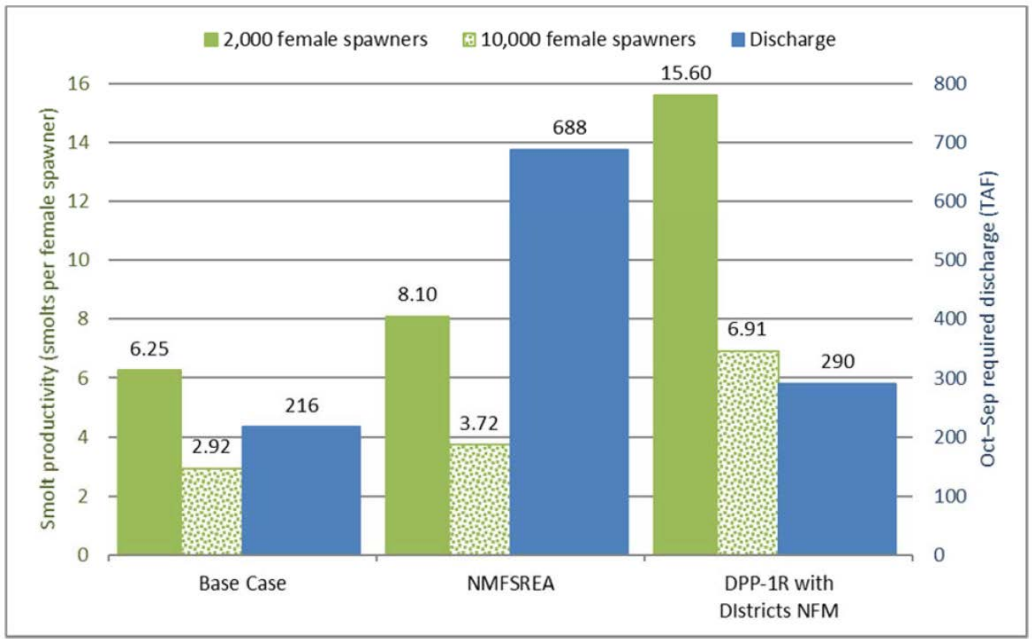

Figure 3.3.2-26. Average annual fall-run Chinook smolt production and required instream flows under base case, NMFS's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

[113] The DPP-1R model scenario shown in these figures represents the Districts' proposed flows that would be in effect after the irrigation galleries are operational.

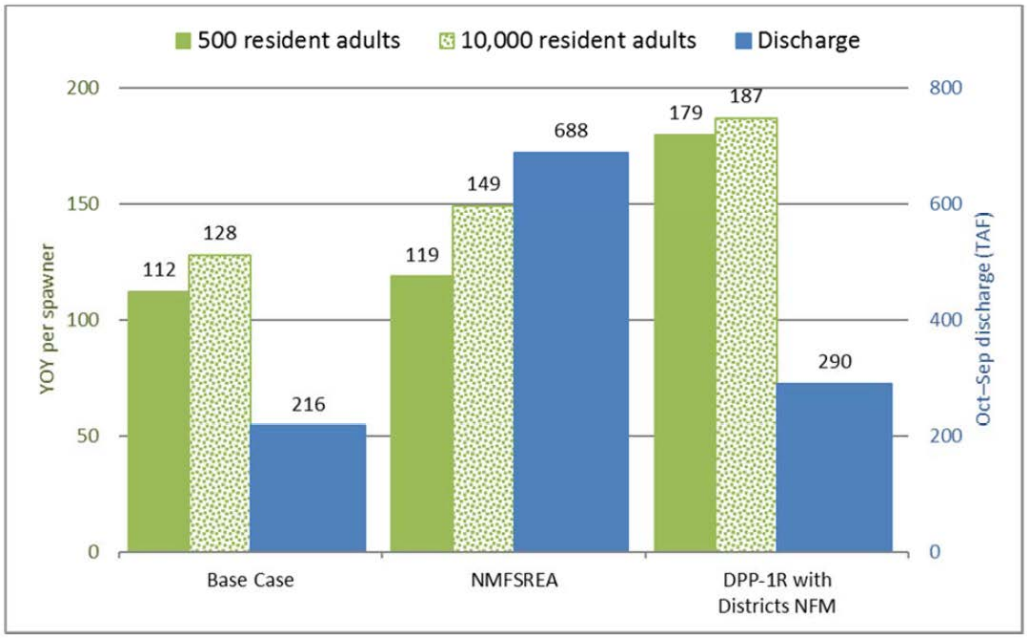

Figure 3.3.2-27. Annual average *O. mykiss* young-of-year production and required instream flows under the base case, NMFS's flow recommendation, and the Districts' proposal (including the Districts non-flow measures) (Source: Districts, 2018a).

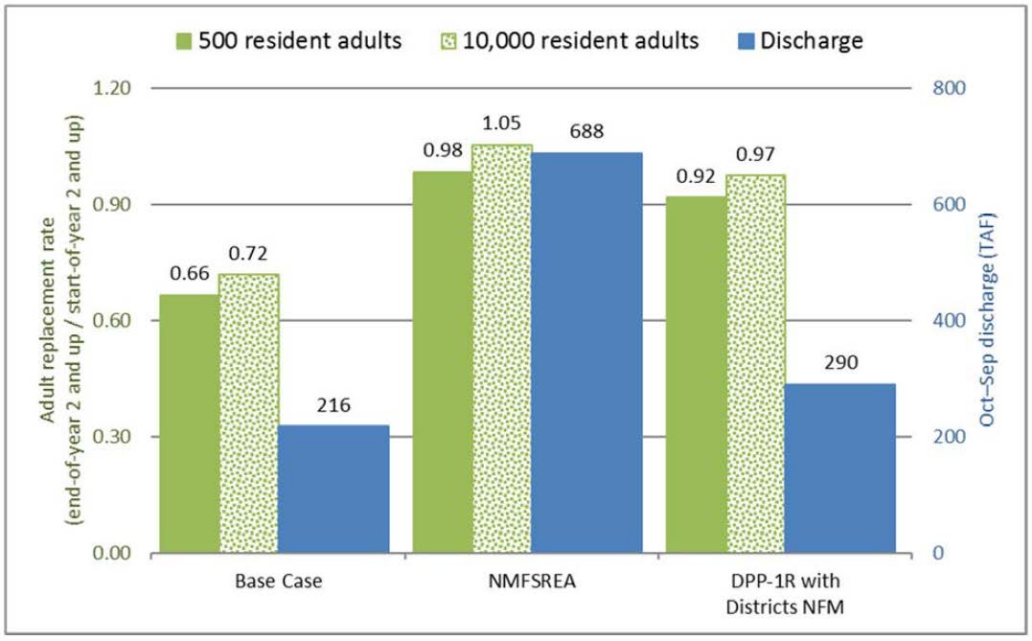

Figure 3.3.2-28. Average annual *O. mykiss* adult replacement rate for the base case, NMFS's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

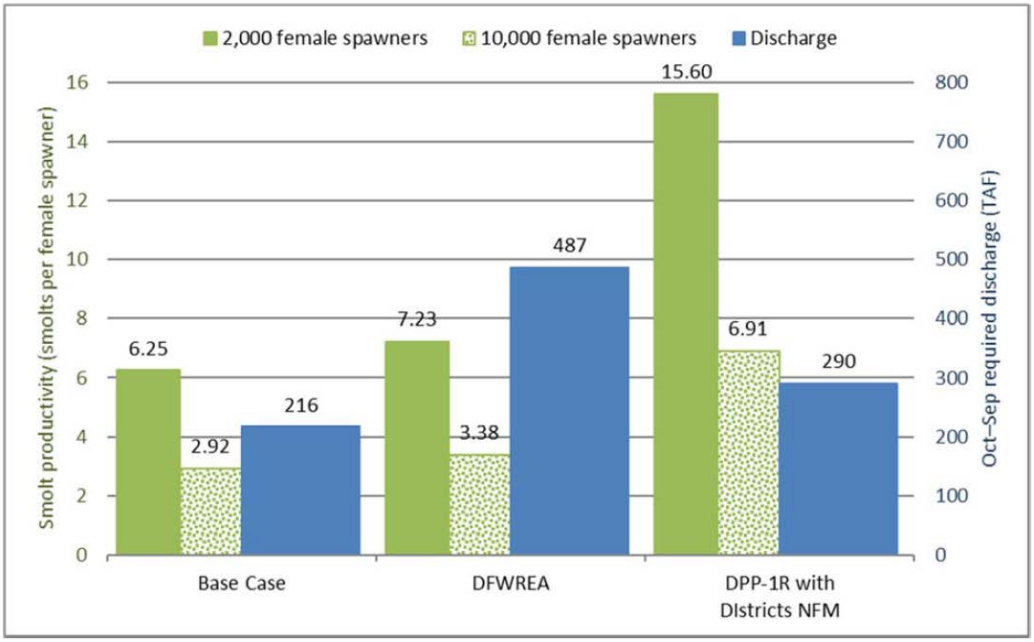

Figure 3.3.2-29. Average annual fall-run Chinook smolt production and required instream flows under the base case, CDFW's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

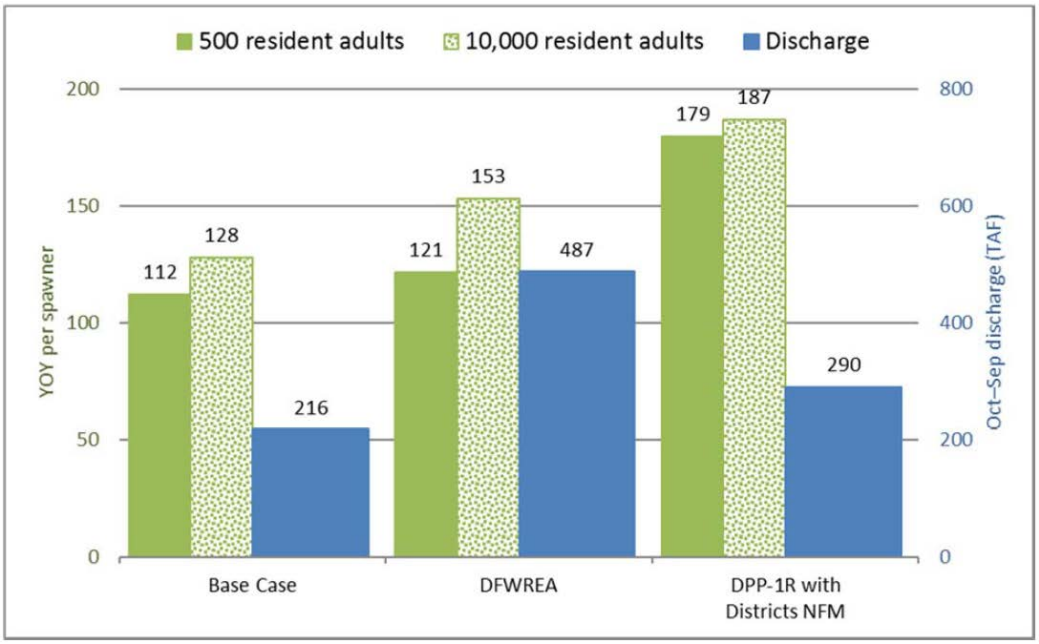

Figure 3.3.2-30. Annual average *O. mykiss* young-of-year production and required instream flows under the base case, CDFW's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

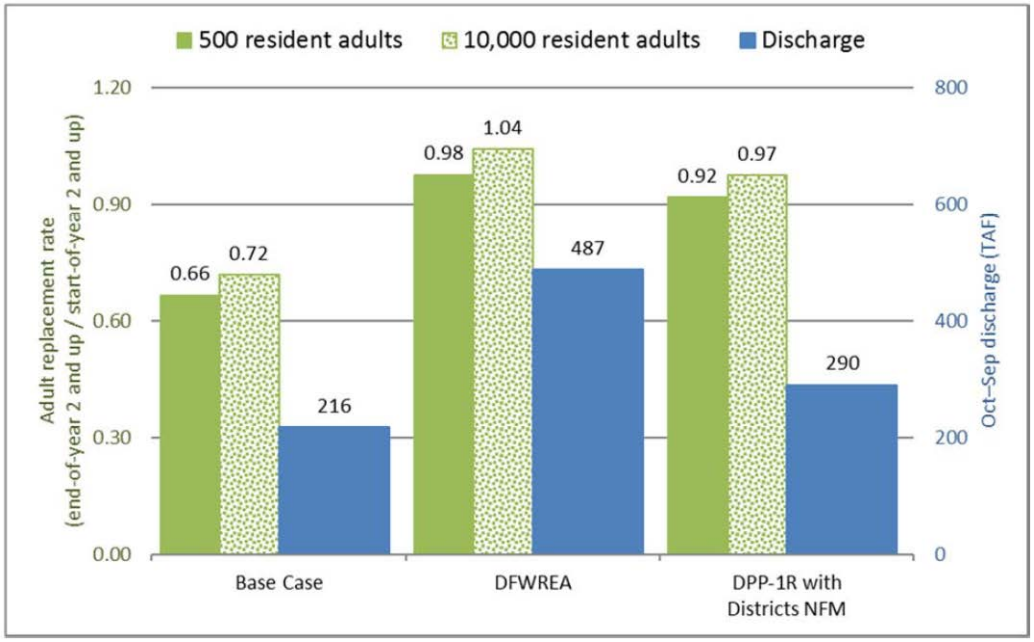

Figure 3.3.2-31. Average annual *O. mykiss* adult replacement rate for the base case, CDFW's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

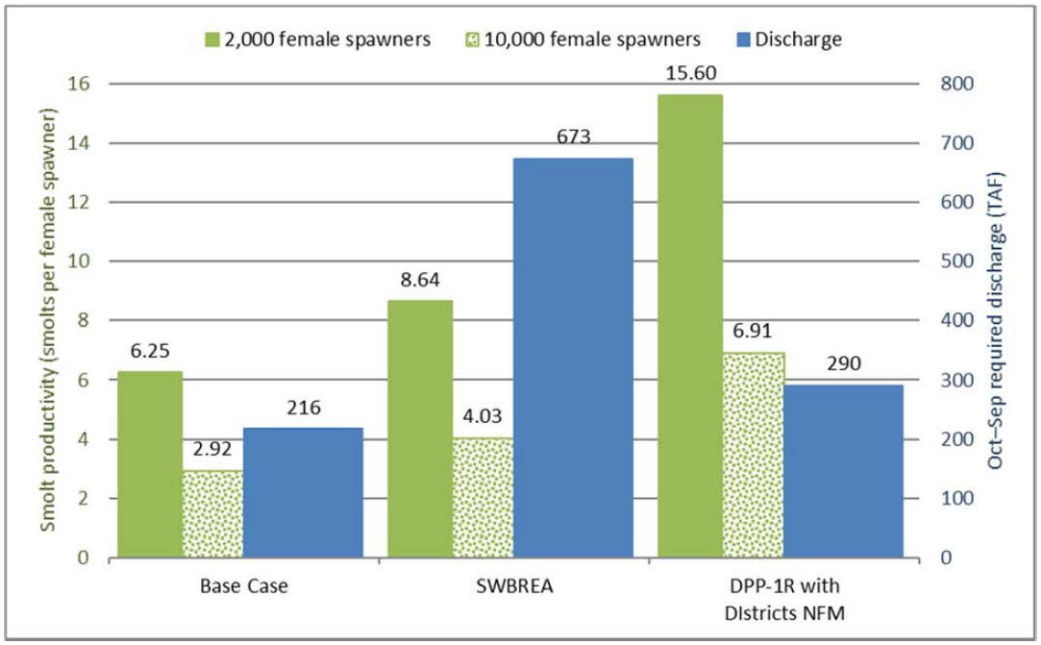

Figure 3.3.2-32. Average annual fall-run Chinook smolt production and required instream flows under the base case, the Water Board's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

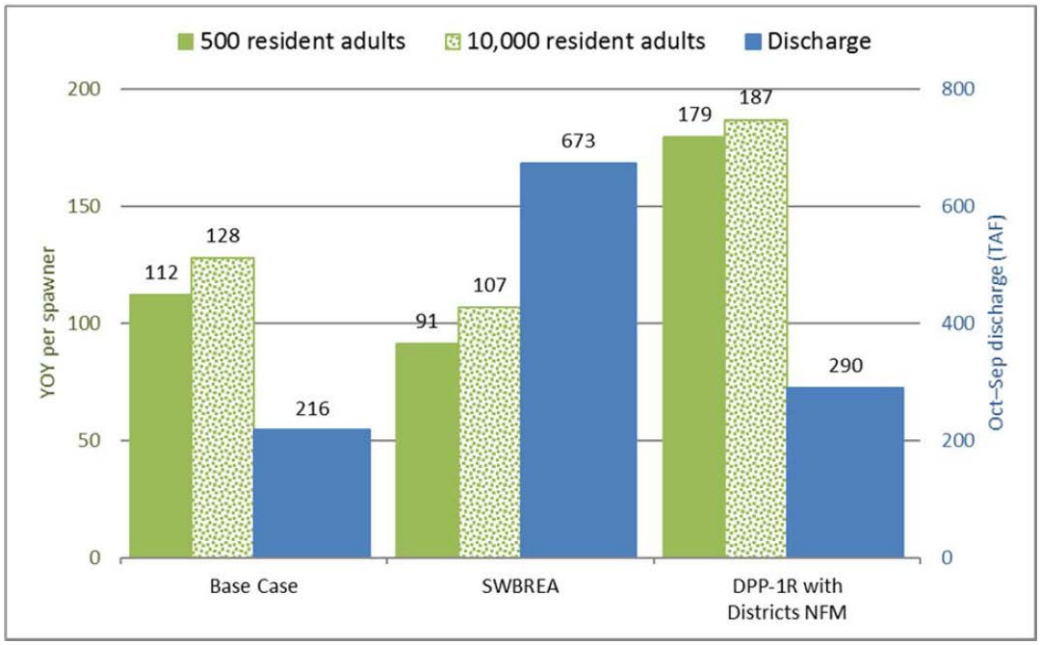

Figure 3.3.2-33. Annual average *O. mykiss* young-of-year production and required instream flows under the base case, the Water Board's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

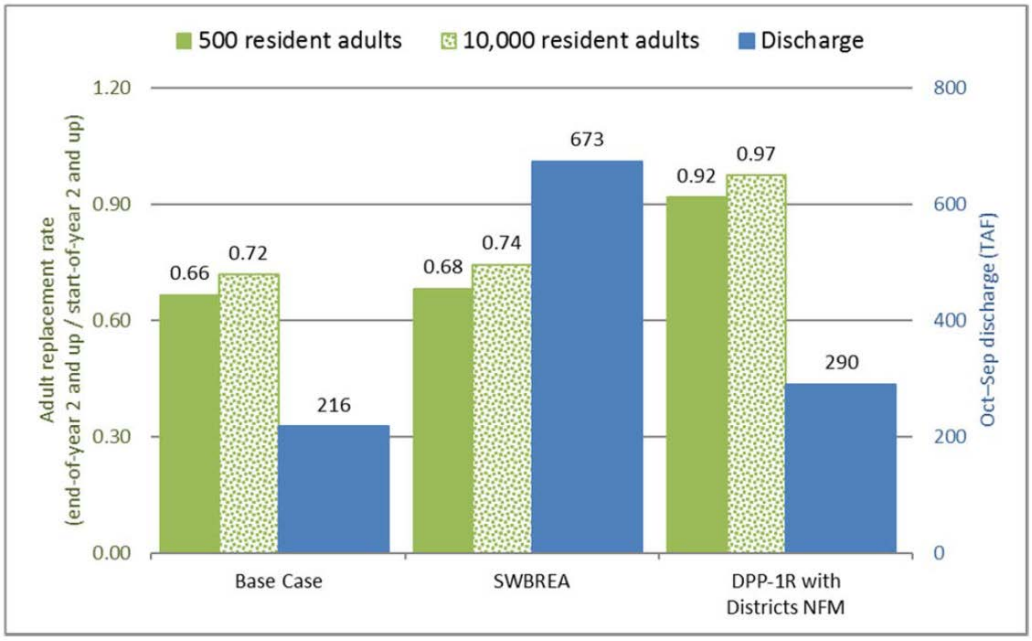

Figure 3.3.2-34. Average annual *O. mykiss* adult replacement rate for the base case, the Water Board's flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

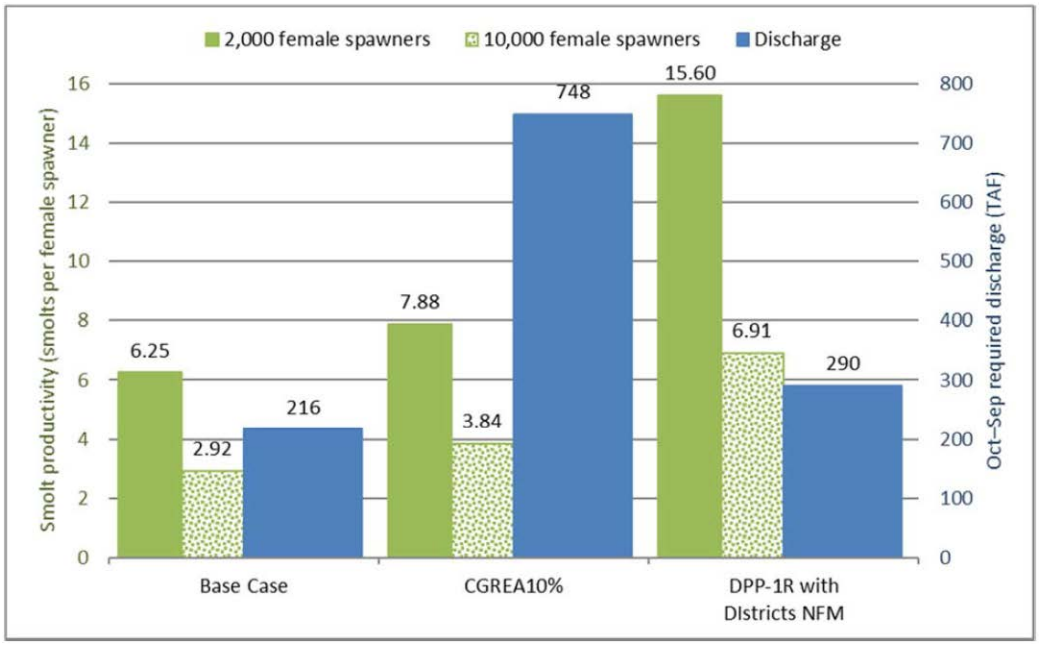

Figure 3.3.2-35. Average annual fall-run Chinook smolt production and required instream flows under the base case, the Conservation Groups' flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

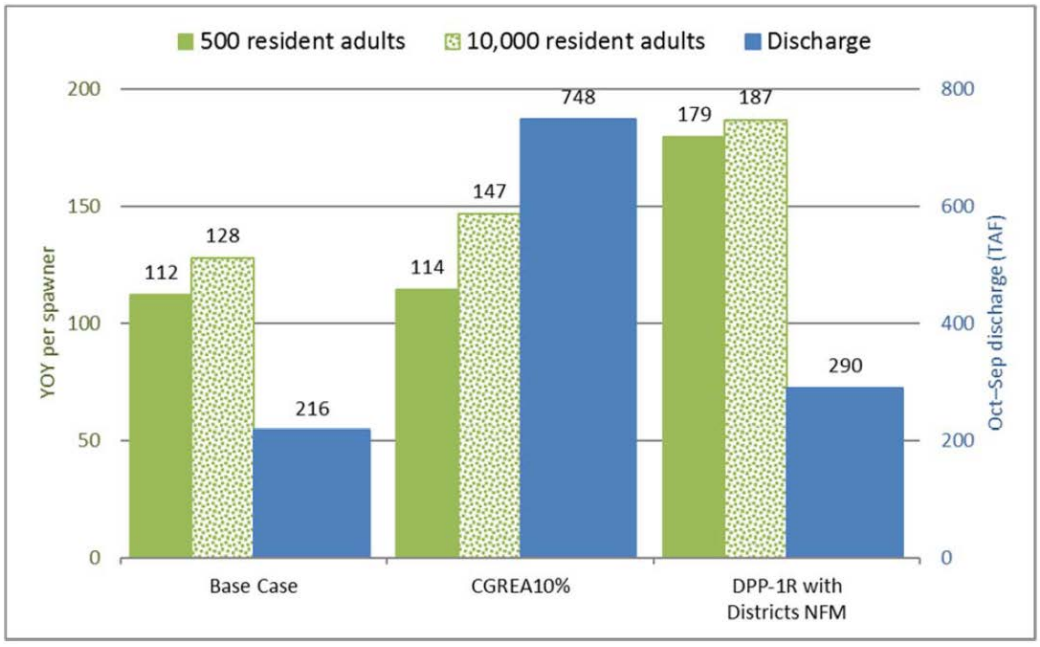

Figure 3.3.2-36. Annual average *O. mykiss* young-of-year production and required instream flows under the base case, the Conservation Groups' flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

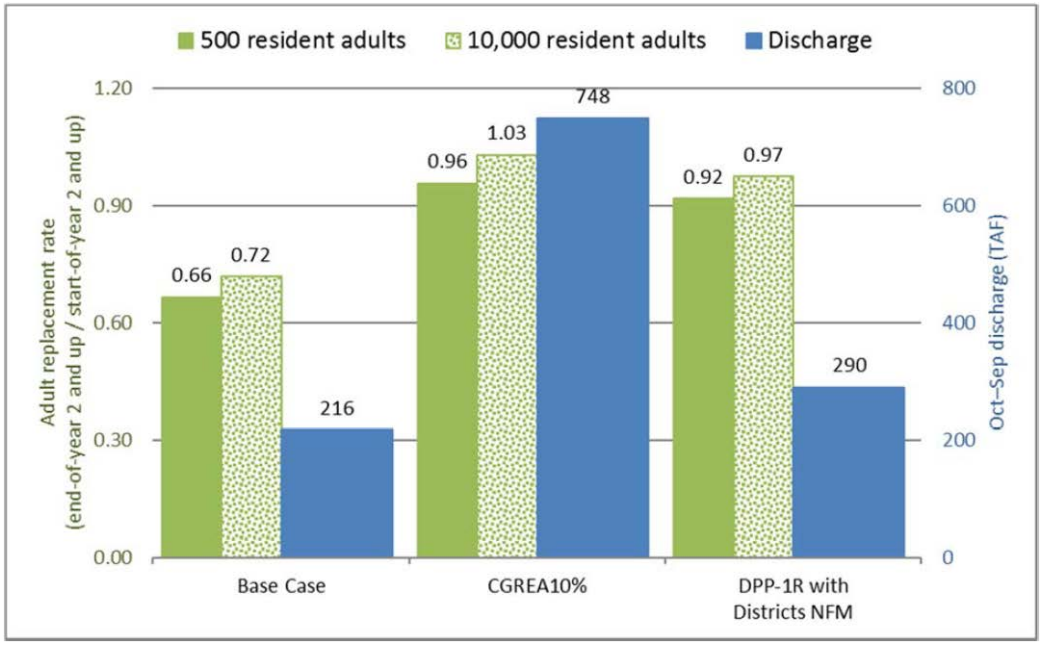

Figure 3.3.2-37. Average annual *O. mykiss* adult replacement rate for base case, the Conservation Groups' flow recommendation, and the Districts' proposal (including the Districts' non-flow measures) (Source: Districts, 2018a).

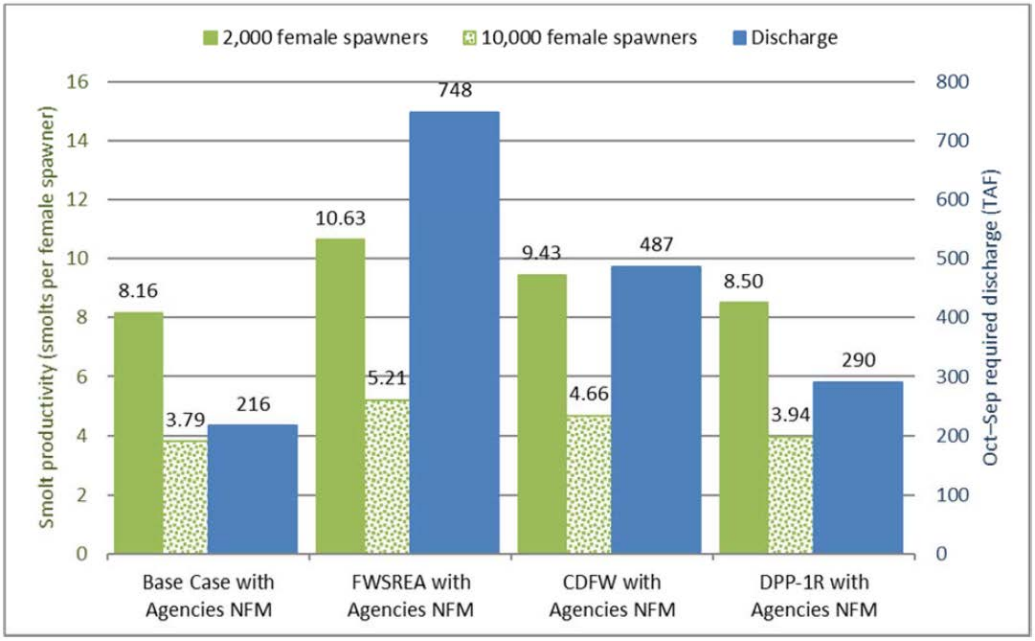

Figure 3.3.2-38. Estimated effects on Tuolumne River fall-run Chinook smolt production using base case instream flows, FWS's recommended instream flows, California DFW's instream flows, and the Districts' proposed instream flows when combined with agency/ Conservation Groups' non-flow measures of coarse sediment augmentation, floodplain lowering, and LWM augmentation (Source: Districts, 2018a).

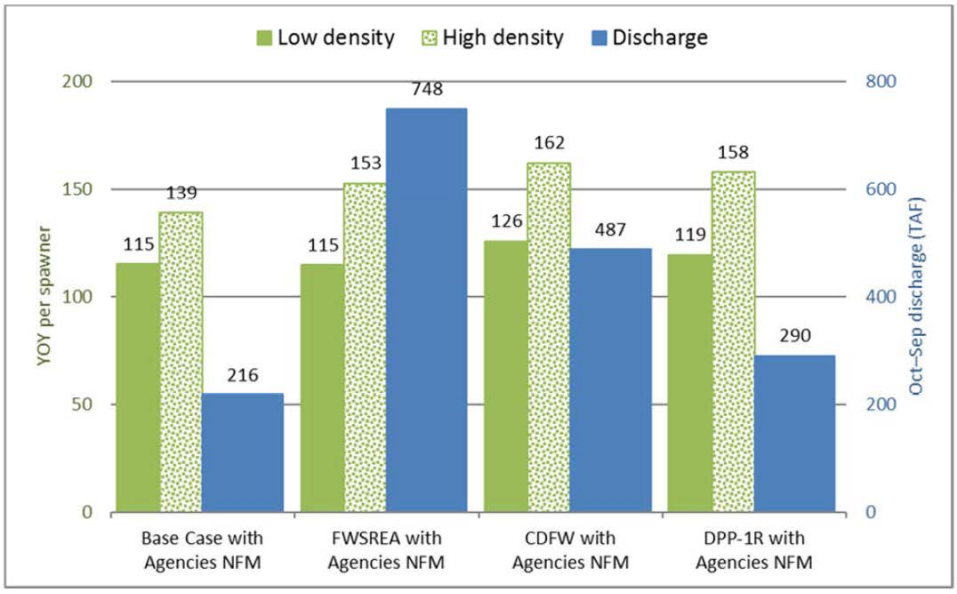

Figure 3.3.2-39. Estimated effects on Tuolumne River *O. mykiss* young-of-year production using base case instream flows, FWS's instream flows, California DFW's instream flows, and the Districts' instream flows when combined with agency/Conservation Groups' non-flow measures of coarse sediment augmentation, floodplain lowering, and LWM augmentation (Source: Districts, 2018a).

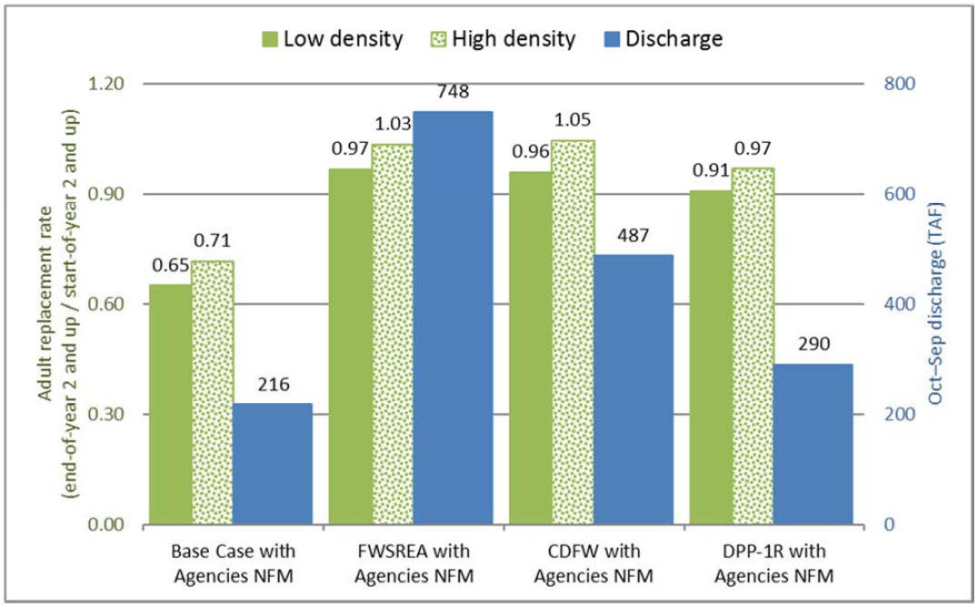

Figure 3.3.2-40. Estimated effects on Tuolumne River *O. mykiss* adult replacement rate using base case instream flows, FWS's instream flows, and the Districts' instream flows when combined with agency/ Conservation Groups' non-flow measures of coarse sediment augmentation, floodplain lowering, and LWM augmentation (Source: Districts, 2018a).

According to the Districts, modeling The Bay Institute's recommended instream flows (as presented) would result in a 90 percent water shortage for the 2.6 million Bay Area customers of CCSF in each year of the 1988 to 1992 period. Many other years of greater than a 50 percent water shortage would also occur. Water shortages under CCSF's Year 2040 demand would even be greater than 90 percent using the 1988 to 1992 hydrology. The Districts note that these shortages would crash the Hetch Hetchy System portion of the model, and prevent reasonable modeling.

ECHO's flow recommendation triples the Districts' water shortages during the 1987 to 1992 period, increasing from an average of 12 percent under base case conditions to 36 percent on average over the 6-year period. The Districts' water shortages would exceed 30 percent in 32 of 42 years used to populate the model. CCSF's water shortages would increase from 10 percent each year in the 1988 to 1992 period under base case conditions to 90 percent water shortages each year in the 1988 to 1992 period. The Districts note that these levels of water shortages make further modeling uninformative.

Based on the above analyses, it is apparent that the resource agencies/stakeholders recommended streamflow regimes would more closely mimic the natural (pre-project) hydrograph in the Tuolumne River downstream of the La Grange Diversion Dam. It is also evident that mimicking the natural hydrographs would likely create more normative ecological processes that would benefit native resident and anadromous fish populations and their habitat, although modeling did not indicate a major increase in fish production over the Districts' proposed flows. The resource agencies and stakeholders recommended flow regimes would have a substantial negative effect on the water supplies of the Districts and CCSF, and any incremental ecological benefits of these flow regimes over those proposed by the Districts should be weighed against the cost of water used. The primary purpose of the Don Pedro Project is to provide adequate water supplies through extended dry periods, which have occurred historically with some frequency. This is also the case with CCSF's water supplies to the Bay Area; the primary purpose of the Hetch Hetchy System is to provide adequate municipal and domestic water supplies to its RWS service area.

Operating within these constraints, we agree that implementing spring recession flows would likely benefit juvenile salmonids through the reestablishment of riparian vegetation and its associated increase in prey availability. Regarding the needed for fall pulse flows, the literature cited by the resource agencies discusses natural freshets and upstream salmon movements. There is limited evidence that managed pulse flows attract salmon. On the Stanislaus River, Peterson et al. (2016) found that pulse flows resulted in immediate increases in passage, but the response was brief and represented a small portion of the total run. This study recommended additional experimental analysis of pulse flow timing and "control" or no-pulse years. No substantial differences in migration rates in the Klamath and Trinity Rivers were observed between years with managed pulse flows and years without pulse flows (Strange, 2007). In addition, no evidence exists that low flows in the San Joaquin River impede migration (Mesick, 2001). Finally, pre-spawn mortality on the Tuolumne River is low under existing

conditions, and it is not apparent how a fall pulse flow would substantially improve migration or spawning conditions for fall-run Chinook salmon.

Summary of Modeling Results

As noted above, water resource management in the Central Valley often involves a complex balance of water allocations for fishery resources, irrigation, recreation, and domestic uses. While returning the flow regime in the lower Tuolumne River to a condition that more closely mimics the magnitude, duration, and timing of the unimpaired hydrograph would be expected to provide multiple benefits to aquatic resources, the Districts' proposed flow regime would also improve aquatic habitat conditions downstream of the La Grange Diversion Dam compared to the base case, and would continue to meet existing and projected water demands in the region. The Districts' proposed base flows would provide from 71 to 95 percent of maximum WUA for all life stages of *O. mykiss* (depending on life stage and water year type), from 66 to 73 of percent of maximum WUA for Chinook fry, and from 94 to 98 percent of maximum for Chinook juveniles. Chinook spawning WUA would range from 89 to 100 percent of maximum depending on water year type. These base flows would also maintain water temperatures well within the suitable range for these species upstream of RM 43. In wet, above normal, and below normal water years, the Districts' 1,000-cfs flushing flows on October 5, 6, and 7, would clean gravels of accumulated algae and fines prior to the onset of substantial spawning and would not be expected to have significant effects on water quality.

Under the resource agencies/stakeholders' recommendations, aquatic habitat conditions would be similar to those under the Districts' proposal; however, the Districts' proposal would continue to meet both the Districts' irrigation demands and CCSF's domestic water supply needs. Within these constraints, implementing the Districts' proposal would likely further benefit juvenile salmonids through the reestablishment of riparian vegetation and its associated increase in prey availability, which appears to be a major limiting factor in the lower Tuolumne River. Conversely, implementing any of the resource agency's base flow recommendations would result in extreme water supply reductions. Therefore, the Districts' proposed flow regime represents an equitable compromise between these competing beneficial uses, and would best meet FERC's mandate to balance both developmental and non-developmental resources.

Spill Management Plan

On October 2, 2018, FWS filed revised 10(j) recommendation 2 for the Don Pedro Project,[114] which calls for the development of a spill management plan, which would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would offer a means for the agencies to provide recommendations on how to control the magnitude, timing, and duration of spill events into the Lower Tuolumne River to improve fall-run Chinook salmon floodplain rearing habitat. The Districts would retain ultimate control over actual spill amounts, timing and management, but would make all reasonable efforts to implement recommendations of the TPAC as to spill management whenever possible.

In its revised Don Pedro 10(j) recommendation 2, FWS defines *spills* as flows released into the Tuolumne River in excess of the Districts' proposed minimum flows. The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates. FWS states in supporting documentation that the target months for management of available flow volumes in the spill management plan should be March and April, and at a duration of at least 15 days. FWS further states that the Districts should target a managed spill release of no less than 1,750 cfs to maximize benefits and to try to limit occurrences of spill releases between 500 cfs and 1,700 cfs at the La Grange gage except during recession flows. The Districts would seek recommendations on implementation of the spill management plan from the TPAC. The TPAC, which would be created pursuant to FWS's revised Don Pedro 10(j) recommendation 4, would consist of at least the Districts, FWS, and the CCSF and would meet monthly or more frequently starting in the first January after any license issuance on or about the 10th of each month to review the Districts' projections of potential spills, and discuss use of any identified spill volumes.

For spring pulse flows, FWS states that if the spill volume estimated by the Districts in March is less than 55,000 acre-feet, the managed spill volume may be added to the spring pulse flow proposed by the Districts. However, FWS also states that based on recommendations of the TPAC, any spill volume less than 55,000 acre-feet may be used to improve in-channel rearing, riparian recruitment, and survival or temperature management consistent with the spill volume mentioned above.

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[114] In the same filing, FWS also filed revised 10(j) recommendations 3 (Lower Tuolumne River Habitat Improvement Program) and 4 (Creation of Tuolumne Partnership Advisory Committee) for the Don Pedro Project, and withdrew its original 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects. FWS states that this filing resulted from meaningful discussions between FWS and the Districts subsequent to the January 29, 2018, FWS filing of comments in response to the REA notice.

For fall pulse flows, FWS states that if there is excess water available on September 1 of any year, the TPAC may recommend release of such water, subject to the following: (1) on September 1, if the Don Pedro Reservoir water surface elevation is above 801.9 feet, the TPAC will meet and confer on the use of the unused portion of the spill volume; (2) any such water will be used before October 7; and (3) use of the water will not, by itself, result in the Don Pedro Reservoir water surface elevation being less than 801.9 feet as of October 7.

FWS (revised Don Pedro 10(j) recommendation 2) also recommends that within six months of the 12th anniversary of any license issuance, the Districts would initiate the necessary studies to develop a revised rearing habitat vs. flow relationship on the lower Tuolumne River, which would reflect and document the changes that have occurred since license issuance using the results of the Districts' Spawning Gravel in the Lower Tuolumne River Study (Stillwater Sciences, 2013d) as baseline habitat conditions.

In response to FWS's revised 10(j) recommendations filed on October 2, 2018, the Districts support the withdrawal of 10(j) recommendations 2, 3, 4 and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal. The Districts also acknowledge in their letter filed October 17, 2018, that in many years, sufficient flexibility exists to also manage releases from Don Pedro Reservoir that exceed the minimum flow requirements, in order to benefit native fish species downstream of the reservoir, while continuing to meet the Districts' primary obligations and responsibilities related to water supply, instream flow requirements, flood control, and project safety. The Districts note that the spill management plan is intended as a discretionary plan, subjected to the primary project obligations and responsibilities.

Our Analysis

To assess how often a spill flow of at least 1,750 cfs could be maintained for the entire March through April period, we reviewed the storage and flow record for the project, and prepared an assessment based on water year types. Table 3.3.2-36 shows that a flow of at least 1,750 cfs could be maintained for the entire March through April period during wet and above normal water year types, and for an average of 13 days during below normal water year types. However, in dry or critical water years, essentially no spill flow of at least 1,750 cfs would be available. Table 3.3.2-36 also shows the average total annual volume of water passing La Grange Dam in excess of the Districts' proposed minimum flows by water year type. This excess water could be used to provide either additional pulse flows to benefit outmigrating smolts or potentially optimize juvenile floodplain rearing habitat. The spill management plan would allow key water-supply-entities (the Districts and the CCSF) to work collaboratively with wildlife resource agencies (FWS and potentially NMFS and California DFW) to develop management strategies to make the best use of this excess water.

Table 3.3.2-36. Water volumes available for management[a] under the Districts' proposed minimum flows by water year type and number of days that flows of at least 1,750 cfs could be maintained in March and April via spill management (Source: staff).

Water Year Type	Average Total Annual Water Volume Passing La Grange Dam in Excess of the Districts' Proposed Minimum Flows (acre-feet)	Number of Days that Flows of at Least 1,750 cfs can be Maintained in March and April via Spill Management[b]
Wet	1,446,482	61
Above Normal	617,908	61
Below Normal	38,290	13
Dry	1,034	<1
Critical	0	0

[a] Assumes that all flows in excess of the Districts' proposed minimum flows can be stored for later usage.

[b] Note that the Districts' interim flows are the same as the proposed "with infiltration galleries" flows for this time period (250 cfs from March 1 to April 15 and 275 cfs from April 16 to April 30). The number of days shown were calculated using a minimum flow of 250 cfs.

FWS revised 10(j) recommendation 2 also recommends that the Districts seek recommendations on implementation of the spill management plan from the TPAC (FWS's revised Don Pedro 10(j) recommendation 4). While we agree that the formation of the TPAC could provide valuable guidance on the best use of excess water, we note that the Commission does not have the authority to require any agency or other stakeholder to join or participate in the group. An alternative approach would be for the Districts to consult with FWS, NMFS, and California DFW during development of the plan to get their recommendations on how to best manage and allocate spill flows in years when spill flows are projected to occur.

Ramping Rates and Fish Stranding

Rapid changes in streamflow associated with hydroelectric project operations have the potential to adversely affect aquatic resources by stranding fish in shallow, low gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). Fry and juvenile fish less than 2 inches long are normally the most vulnerable to stranding because of their weak swimming ability; preference for shallow, low-velocity habitat such as edge-water and side channels; and a tendency to burrow into the substrate to hide. Rapid changes in stream flows also can affect fish behavior and reduce spawning

success. Limits governing the rate and timing of project-induced stage changes (ramping rate restrictions) are often established at hydroelectric projects to protect aquatic organisms (Hunter, 1992; CH2M Hill, 1990). However, stranding is also a natural and complex occurrence on unregulated streams in association with flow changes resulting from runoff events. Although stranding may affect only a small percentage of the fish population at a time, and may occur naturally, repeated flow fluctuations such as hydropower-related pulsed flows can cause cumulative mortalities that can result in a significant fish loss.

In the Tuolumne River, unit outage at the La Grange Powerhouse can result in a disruption of otherwise continuous flows downstream of the powerhouse. During such outages, one or both of the TID sluice gates open and water is released into the sluice gate channel. Once powerhouse generation can be resumed, the sluice gates are closed and the flow is reduced to the 5 to 10 cfs minimum flow. However, the alternating flow releases can attract migratory fishes into the sluice gate channel, where they are vulnerable to being stranded when flow resumes through the La Grange Powerhouse. Salmon redds are also vulnerable to being dewatered during these changes in flow releases, and these are located primarily between RM 51 and 47, or 1.2 to 5.2 miles downstream of the La Grange Diversion Dam (FISHBIO, 2013a).

The Districts do not propose any measures to limit ramping rates downstream of the La Grange Diversion Dam; however, they do propose to install a fish exclusion barrier at the entrance to the sluice gate channel. The fish exclusion barrier would prevent fish from entering the sluice gate channel during an outage, where dewatering or stranding could occur once hydropower generation is restored. The barrier would be designed to function during flows of up to 7,000 cfs.

California DFW recommends (10(a) recommendation M1-6) that the Districts follow the spring recession rates shown in tables 3.3.2-31 and 3.3.2-32 for the Tuolumne River at the La Grange Diversion Dam gage and downstream of the infiltration galleries, respectively. California DFW further recommends (10(a) recommendation M1-8) that for all controllable flow rate changes above 200 cfs, and not already managed by the recession rates in tables 3.3.2-31 and 3.3.2-32, that flow increases should be less than or equal to double the amount of release during any 1-hour period, and decreases in flow should be no more than 2 inches per hour, and less than or equal to 500 cfs in any single 24-hour period.

NMFS recommends (10(a) recommendation 1.7) for both projects that incremental upramping should occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period, in all water years. Compliance would be measured at La Grange Diversion Dam gage (USGS gage 11289650) and a new gage located near RM 25. For downramping, when flows downstream of the La Grange Diversion Dam are less than 4,000 cfs from April 1 through July 31 in wet, above normal, and below normal water years, NMFS recommends the Districts not reduce flows by more than 7 percent of the previous 24-hour average flow, unless required due to flood control operations or

emergencies. When flows downstream of the La Grange Diversion Dam are less than 2,000 cfs from April 1 through July 31 in dry water years, NMFS recommends the Districts not reduce flows by more than 10 percent of the previous 24-hour average flow, unless required due to flood control operations or emergency. When the above two downramping scenarios are not in effect, downramping should occur evenly over a 24-hour period, and the Districts should not reduce flows by more than 500 cfs in any single 24-hour period. Compliance would be measured at La Grange gage (USGS gage 11289650) and a new gage located near RM 25.

In their reply comments dated March 15, 2018, the Districts state California DFW fails to present evidence of either juvenile stranding or redd dewatering under existing operations, or potentially associated with proposed project operations. The Districts also state that NMFS's recommended ramping rates are specific, and NMFS does not provide evidence showing the need for these rates, what species they are expected to protect, or demonstrate an ongoing effect. The Districts further state that in the absence of evidence of an existing effect resulting from current operations or specific benefits to fish populations expected to be attained, there is no basis for the California DFW and NMFS's recommendations, and the benefits cannot be evaluated.

Our Analysis

The susceptibility of fish to stranding is a function of their behavioral response to changing flows, which depends on the species, body size, water temperature, time of year, and time of day. In general, there appears to be a consensus that reduced water flow, gently sloped shorelines, heavily structured littoral zones, cooler water temperatures, abrupt water level changes and poor water quality are conditions that increase the likelihood of fish stranding events (Nagrodski et al., 2012). Downstream of hydroelectric projects, a common finding has been that more rapid flow fluctuations have a greater potential to strand fishes; however, salmonid fry stranding studies on the Skagit and Sultan rivers in Washington have shown that fry stranding in side channels and potholes was more related to ramping range than to down-ramping rate (Pflug and Mobrand, 1989; Olson, 1990; and Woodin, 1984). Numerous studies in California have shown that ramping rates in the 1 to 6 inches per hour range minimize any adverse effects on aquatic biota. For example, in 2004, PacifiCorp completed a literature-based assessment of the potential effects associated with ramping regimes in river reaches affected by the Klamath Hydroelectric Project. The study found that ramping rates ranging from 0.1 to 0.6 foot per hour resulted in minimal stranding and were well within the natural range of those found in unregulated river systems (PacifiCorp, 2004), and recommendations described in Hunter (1992) suggest that reductions in river stage of 1 to 2 inches per hour are generally protective of juvenile anadromous salmonids.

In 2001, the Districts filed a comprehensive report to FERC that reviewed the results of long-term stranding assessments conducted in the lower Tuolumne River between 1986 and 2000; evaluated the effectiveness of the 1995 Settlement Agreement's ramping rates; documented conditions under which stranding may occur; and identified

potential areas for floodplain improvements. The review indicated that several factors contribute to the magnitude of juvenile stranding, including: (1) salmon density, (2) extent of flow reduction and the minimum flow in the fluctuation cycle (which determines the amount of potential stranding area exposed), (3) ramping rate, and (4) physical characteristics of sites in terms of slope and substrate. It also indicated the highest potential for stranding occurred between 1,100 and 3,100 cfs, which corresponds to a broad floodplain inundation zone in several areas of the spawning reach. In years of high juvenile salmon density, stranded salmonids were generally found on gently sloping stream banks and gravel bars on a wide range of substrates in the primary spawning reach (RM 36.5–50.7). The Districts noted that little salmonid stranding has been documented following implementation of the 1995 Settlement Agreement because the project no longer operates in a peaking mode in response to immediate system load demands.

To evaluate the Districts' proposed and the resource agencies' recommended recession/ramping rates, we compared the hourly changes in modeled stage heights predicted at the La Grange gage during April through July across the period of record (1971–2012). We then calculated the percentage of time with modeled hourly stage decreases of less than or equal to 2.5 cm (1 inch) (table 3.3.2-37). Based on our analysis, the proposed and recommended flow regimes for the Don Pedro Project are compatible with maintaining an hourly stage change downstream of La Grange of 1-inch per hour, or less, from 97 to 100 percent of the time. However, more rapid changes in stage could occur, with an associated increase in the risk of fish stranding, if the rate at which flows are diverted into TID or MID canals at the La Grange Project were to change rapidly.

Given these findings, it is likely that implementing a year-round downramping rate not to exceed 2 inches per hour would continue to protect juvenile salmonids in the lower Tuolumne River. Furthermore, decreasing flows at night (when possible), when Chinook salmon are less vulnerable to stranding (Connor and Pflug, 2004; Hunter, 1992; Olson and Metzgar, 1987; and Woodin, 1984), would further reduce the possibility of fish being isolated and/or dewatered along the channel margins and gravel bars. While it is possible that limiting upramping rates as recommended by California DFW could reduce disturbance during spawning and the downstream displacement of juvenile salmonids, there is not sufficient information describing the effects of rapid increases in flow on salmonids to allow the potential benefits of limiting upramping rates to be quantified.

Table 3.3.2-37. Frequency that simulated hourly stage changes downstream of La Grange Powerhouse tailrace meet a ramping rate of 1-inch per hour or less, for all proposed and recommended flow regimes, water years 1971-2012 (Source: Districts, 2018a,b).

Month	Base Case	Districts Interim	Districts With-IGs	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
January	99%	99%	99%	99%	99%	99%	99%	99%	99%
February	100%	100%	100%	100%	100%	100%	100%	100%	100%
March	100%	100%	100%	100%	100%	100%	100%	100%	100%
April	99%	99%	99%	99%	99%	99%	99%	99%	99%
May	98%	98%	98%	98%	98%	98%	98%	98%	98%
June	100%	100%	100%	100%	100%	100%	100%	100%	100%
July	99%	99%	99%	99%	99%	99%	99%	99%	99%
August	99%	99%	99%	99%	99%	99%	99%	99%	99%
September	100%	100%	100%	100%	100%	100%	100%	100%	100%
October	97%	97%	97%	97%	97%	97%	97%	97%	97%
November	100%	100%	100%	100%	100%	100%	100%	100%	100%
December	100%	100%	100%	100%	100%	100%	100%	100%	100%
All	99%	99%	99%	99%	99%	99%	99%	99%	99%
April–July	99%	99%	99%	99%	99%	99%	99%	99%	99%

Under existing conditions, salmonid stranding may occur in the sluice gate channel adjacent to the La Grange Powerhouse. The Districts' 2017 Fish Presence and Stranding Assessment (FISHBIO, 2017b) documented four fall-run Chinook salmon carcasses in the sluice gate channel during the September 2015 to April 2016 and September 2016 to January 2017 monitoring periods. Three male carcasses recovered in the sluice gate channel were post-spawn individuals. In addition to the four carcasses documented, four other fall-run Chinook salmon were observed in the sluice gate channel during outages in the 2015–2016 monitoring, and 42 other fall-run Chinook salmon were observed in the sluice gate channel during outages in the 2016–2017 monitoring (table 3.3.2-38). Based on the documented occurrence of salmonids in the sluice gate channel and observations of salmonid mortality due to stranding, installing a fish exclusion barrier at the sluice gate channel entrance, as proposed by the Districts, would minimize the potential for additional salmonid stranding and mortality.

Reservoir Fish Stranding

Instream and pulse flows proposed by the Districts and those recommended by FWS, NMFS, California DFW, the Water Board, Conservation Groups, The Bay Institute, and ECHO could cause the Don Pedro Reservoir water surface elevations to fluctuate differently than under existing conditions, and in turn, could lead to fish stranding and nest dewatering. As described previously in the section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Streamflow and Reservoir Level Compliance Monitoring*, the Districts have historically operated the project for flood control, water supply, recreation, hydropower, and environmental benefits. Project operations can result in annual and multi-year changes in Don Pedro Reservoir water levels. The minimum annual reservoir water level generally occurs from October to November, and the maximum water level generally occurs from May to June. Don Pedro Reservoir typically operates between elevation 690 feet and 830 feet. During the spring spawning season (March through June) reservoir elevations typically vary between 750 feet and 830 feet.

The Districts propose to lower the required minimum pool of Don Pedro Reservoir from the current elevation of 600 feet to 550 feet, but are not proposing any other changes in the elevation of the reservoir. Stakeholders did not make recommendations regarding the Don Pedro Reservoir levels; however, their various instream flow recommendations (see *Effects of the Project Operation on Streamflows and Reservoir Levels*, and *Minimum Flows and Pulse Flows*) could affect the reservoir levels, with higher minimum flows resulting in greater drawdowns.

Table 3.3.2-38. Fish observations during sluice gate channel stranding surveys during the 2015–2016 and 2016–2017 monitoring seasons (Source: FISHBIO, 2017b).

Date	Number of Fish	Estimated Length (mm)	Fish Condition	Comments
11/30/15	1	700	Good	Relocated to the pool directly below powerhouse
12/15/15	1	600	Good	Relocated to the pool directly below powerhouse
12/15/15	1	800	Good	Relocated to the pool directly below powerhouse
12/15/15	1	700	Good	Swam volitionally to tailrace channel
12/25/15	1	780	Mortality	Unspawned female
10/20/16	2	600	Good	Low risk of stranding
10/29/16	4	600	Good	Low risk of stranding
11/3/16	20	600-800	Good	Low risk of stranding
11/11/16	8	600-800	Good	Low risk of stranding
11/14/16	6	600-800	Good	Low risk of stranding
11/23/16	2	600-800	Good	Low risk of stranding
11/24/16	1	845	Mortality	Spawned male
11/24/16	1	710	Mortality	Spawned male
11/25/16	1	805	Mortality	Spawned male

Our Analysis

Don Pedro Reservoir offers anglers year-round fishing for cold- and warmwater species and hosts multiple fishing tournaments annually. However, routine project operations and maintenance can result in reservoir stage reductions during the black bass spawning period (March through June). The Districts evaluated the potential operational effects of the Don Pedro Project on bass nest survival (HDR, 2013c).

Under existing Don Pedro operations, black bass nest survival has equaled or exceeded a 20-percent survival rate at least 96 percent of the March through June spawning period from 1984 to 2010 (table 3.3.2-39). The Districts selected a spawning nest survival rate of at least 20 percent as necessary to maintain long-term population levels of highly fecund, warmwater fishes, such as black bass, based on Lee (1999).

These data indicate that current operations of the reservoir are not adversely affecting black bass spawning.

Table 3.3.2-39. Percent of time that black bass estimated spawning nest survival has exceeded 20 percent in Don Pedro Reservoir for March through June, 1984–2010 (Source: HDR, 2013c).

Month	Largemouth Bass	Smallmouth Bass	Spotted Bass
March	100%	100%	100%
April	96.2%	96.2%	100%
May	100%	100%	100%
June	96.2%	96.2%	100%

Alternative instream flows could affect reservoir elevations differently; however, table 3.3.2-40 shows that the instream flows proposed by the Districts and those recommended by stakeholders generally would not result in daily changes in reservoir water surface elevation substantially different than under current Don Pedro Project operations. The various instream flow scenarios showed variable increases or decreases in reservoir levels; however, these differences were less than 6 inches. Therefore, regardless of which instream flows are required by any license issued for the Don Pedro Project, the potential for instream flows to dewater black bass nests or other aquatic habitat important to reservoir fishes would not change substantially from current conditions.

Table 3.3.2-40. Simulated minimum, 90 percent exceedance, and median 1-day change in Don Pedro Reservoir pool elevation (feet) in all months, water years 1971–2012 (Source: Districts, 2018a,b).

Month	Base Case	Districts Interim	Districts With-IGs	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
January	-0.9	-0.9	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
February	-0.9	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
March	-0.8	-0.8	-0.8	-0.8	-0.8	**-0.7**	-0.9	-0.8	-0.9
April	-0.8	**-0.7**	**-0.7**	**-0.7**	**-0.7**	**-0.7**	-0.8	**-0.7**	-1.0
May	-0.7	**-0.6**	**-0.6**	**-0.4**	**-0.6**	**-0.6**	-0.7	**-0.6**	-0.8
June	-0.7	-0.7	**-0.6**	-0.7	**-0.6**	-0.7	-0.9	-0.9	-1.1
July	-1.0	-1.0	-1.0	**-0.8**	**-0.7**	**-0.8**	-1.4	**-0.7**	**-0.7**
August	-0.8	-0.8	-0.8	-0.8	-0.8	**-0.7**	-0.8	**-0.7**	-0.8
September	-0.6	-0.7	-0.6	-0.7	**-0.5**	-0.6	-0.7	-0.6	**-0.5**
October	-0.5	-0.5	-0.5	-1.0	-0.9	-0.5	-1.3	-0.6	-0.7
November	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.5	-0.3
December	-0.5	-0.5	-0.5	-0.5	-0.5	**-0.4**	-0.5	-0.5	-0.5
January	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
February	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
March	-0.3	-0.3	-0.3	-0.3	**-0.2**	**-0.2**	**-0.2**	**-0.2**	-0.3
April	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4
May	-0.1	-0.2	-0.2	**0.0**	-0.1	-0.2	-0.1	-0.2	-0.4
June	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	**-0.3**	-0.5	-0.6
July	-0.6	-0.6	-0.6	-0.6	**-0.5**	-0.6	-0.7	**-0.5**	**-0.4**
August	-0.6	-0.6	-0.6	-0.6	**-0.5**	**-0.5**	-0.6	**-0.5**	**-0.5**
September	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	**-0.3**	**-0.3**

Month	Base Case	Districts Interim	Districts With-IGs	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
October	-0.3	-0.3	-0.3	-0.5	-0.5	-0.3	-0.5	-0.3	**-0.2**
November	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1
December	0.0	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	0.0
January	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1
February	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2
March	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0
April	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	**0.0**	-0.1	-0.1
May	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.1
June	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.1	-0.2
July	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	-0.4	**-0.3**
August	-0.4	-0.4	-0.4	-0.5	-0.4	-0.4	-0.5	-0.4	**-0.3**
September	-0.2	-0.3	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2
October	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	**-0.1**
November	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
December	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1

Note: Bold values indicate less drawdown than base case conditions, and shaded values indicate a greater drawdown than base case conditions.

Fish Entrainment

Some fish entrainment likely occurs at powerhouse intakes in Don Pedro and La Grange Reservoirs. Fish entrained through powerhouses may be subject to injury or mortality during turbine passage, or may be redistributed into canal systems, and this entrainment may cumulatively affect the species composition and recruitment of fish to the reaches downstream of the diversion facilities.

The Districts do not propose any measures to reduce the entrainment potential of their facilities. California DFW recommends (10(a) recommendation M8-1) that the Districts develop a facilities salmonid protection and monitoring plan for both projects, that includes provisions for: (1) assessments of all diversions from the Tuolumne River and of all gates where the Districts' canal systems enter the San Joaquin, Merced, Tuolumne, and Stanislaus River for potential access by salmonids; (2) proposed solutions to prevent salmonids from accessing the diversions and canal systems; (3) a monitoring program to determine entrainment rates at the diversions and canal systems at locations where return flow is spilled; (4) a reporting plan for annual and incidental notification requirements; and (5) a financial assurance plan to provide for the implementation of the facilities salmonid protection and monitoring plan.

FWS recommends (La Grange 10(j) recommendation 12) the Districts develop a fish rescue plan for the La Grange Project that would include provisions for rescuing fish that are entrained into the MID Diversion Tunnel from April 1 through June 15, and tagging and releasing rescued fish into the Tuolumne River downstream of La Grange Diversion Dam. The measure would also require the Districts to perform rescues weekly until 10 or more rescues are made during a rescue attempt, after which, rescue attempts would be performed daily. Rescue attempts could return to a weekly frequency when 10 or fewer rescues per day are performed, and could cease entirely for the remainder of that year, if by May 16 less than 2 fish per day are rescued, for 3 consecutive sampling dates.

In their reply comments, the Districts state the MID tunnel diverts water for irrigation and domestic use and the MID/TID canals are not project facilities and not subject to FERC's jurisdiction. The Districts also state that FWS's La Grange 10(j) recommendation 12 would require frequent dewatering and have significant potential effects on irrigation deliveries and costs to MID. Additionally, the Districts note that fish surveys performed in the La Grange Reservoir documented a robust trout population that included multiple life stages. However, the Districts state that they are willing to develop protective measures jointly with California DFW dealing with straying salmon entering the canal system.

Our Analysis

Don Pedro Project—We assessed the potential for fish entrainment at the project by determining the elevation of the outlets from Don Pedro Reservoir and comparing that to the typical fish distribution in the reservoir. The Don Pedro power tunnel intake is located at elevation 534 feet, or about 296 feet to 156 feet below the water surface, given

the typical operational elevation range of 830 feet to 690 feet for Don Pedro Reservoir. The inlet structure for the low-level outlet, which is used to pass up to 7,500 cfs when flows exceed the turbine capacity, is located at elevation 342 feet, or about 488 feet to 348 feet below the water surface. In 2012, the Districts surveyed reservoir fishes via gillnetting conducted at variable depths ranging as deep as 140 to 200 feet. From this sampling, 7.2 percent of the total adult gillnet catch was collected in the deep-water net sets, at a catch rate of 0.17 fish/hour, compared to a rate of 2.91 fish/hour in shoreline adult gillnet sets. Kokanee and Sacramento sucker were the two species captured in the deep-water gillnets, with kokanee accounting for 92 percent of the deep-water catch. Two of the gillnet sets were located near Don Pedro Dam a depth of 100 feet. Only three fish were captured at these sites in 18.6 hours of fishing midwater and deep-water gillnets. Don Pedro Reservoir also contains several warmwater species (i.e., centrarchids) that were absent from deep-water gillnet samples, likely due to cooler water temperatures. Stocked coldwater species, however, occupy cooler, deeper water during the warmer periods of the year. The Districts' surveys, which sampled close to the depths for the zone of withdrawal for the power tunnel intake, indicate that few fish would be present in those deeper waters and be susceptible to entrainment. Because of the deeper depth and limited operation of the low-level outlet, fish entrainment through that outlet would be negligible.

Fish entrained in the power tunnel would enter the Don Pedro Powerhouse, which has four vertical Francis turbines that generally have higher survival rates for any entrained fish compared to other turbine types used in high-head projects (i.e., Pelton turbines; Cada, 2001). Typical survival rates of 75 to 88 percent, given the small number of fish likely to be entrained, should ensure that any entrainment mortality would not cause major adverse effects on fish populations in Don Pedro Reservoir and in the Tuolumne River. California DFW states that the objective of its 10(a) recommendation M8-1 is to create the conditions necessary for healthy resident trout and anadromous salmonid populations throughout the Tuolumne River to achieve self-sustaining, viable populations. There are no anadromous species upstream of La Grange Diversion Dam, so anadromous species would not be exposed to entrainment at Don Pedro Dam. While resident trout and other species in Don Pedro Reservoir may be entrained through the power tunnel, considering the low number of fish occurring in deep water and the relatively high survival rate through the Don Pedro Powerhouse, operating the Don Pedro Powerhouse would not adversely affect resident trout and other reservoir fish populations. Therefore, there appears to be little need for a facilities salmonid protection and monitoring plan.

La Grange Project—California DFW's recommendation for assessments of all diversions and of all gates where the Districts' canal systems enter the San Joaquin, Merced, Tuolumne, and Stanislaus River for potential access by salmonids and for solutions to prevent salmonids from accessing the diversions and canal systems is largely outside the jurisdiction of any license that may be issued for the La Grange Project. As

mentioned previously, the headworks and sluice gates associated with the MID canal are part of the La Grange Project.

Fish species collected by the Districts in the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam exhibited multiple age classes, indicating successful reproduction and population sustainability in this reach. In its letter providing comments, terms and conditions, California DFW states that on November 8, 2016, California DFW staff rescued and relocated 36 salmon from the TID canal system to the Merced River following the observation of salmon in the canal east of Turlock, California, and on November 18, 2017, staff rescued and relocated 38 salmon from the MID canal to the Stanislaus River. Lower Tuolumne River salmon do not ascend past the La Grange Dam so there is no possibility that these fish entered the canal via the TID/MID intakes at the La Grange Diversion Dam. Salmon can, however, enter the MID and TID canal systems through the many diversions along the river. However, the MID and TID canal systems are used for water supply, are non-project facilities not associated with hydropower generation, and extend well beyond the La Grange Project boundary. Furthermore, the MID canal system is also connected to the Stanislaus River which can allow salmonids access to the canal completely independent of La Grange Project operations or conditions in the Tuolumne River. Additionally, 26 diversions, owned by a variety of entities, are located downstream of the La Grange Diversion Dam to the Tuolumne River's confluence with the San Joaquin River.

FWS states that the MID irrigation diversion is an unscreened diversion from the La Grange Reservoir and a fish rescue event in 2017 indicated a high level of *O. mykiss* entrainment, which are a valuable genetic strain and may be needed for ESA-related conservation of *O. mykiss* (FWS, 2018a). The Districts note in their reply comments that the 2017 rescue event mentioned by FWS occurred during a scheduled and infrequent dewatering event and that the MID canal is not a La Grange Project facility. However, the headworks and sluice gates associated with the MID canal, and the slide gate in the face of La Grange Diversion Dam are part of the La Grange Project as they can discharge water to the Tuolumne River downstream of the La Grange Diversion Dam. The TID diversion tunnel intake is located on the east side of the reservoir, or left descending bank when looking downstream, approximately 93 feet below the normal La Grange Reservoir water surface elevation. The intake for the La Grange Powerhouse, which contains two Francis turbine-generator units, is located on the TID canal just upstream of the TID main canal headworks, so fish entering the TID diversion tunnel could be exposed to entrainment through the La Grange Powerhouse. As previously mentioned in section 3.3.2.1, *Aquatic Resources, Affected Environment, Fishery Resources*, no known fish stocking has occurred in the reach of the Tuolumne River between the Don Pedro Dam and La Grange Diversion Dam, and species collected throughout this reach exhibited multiple age classes, indicating successful reproduction and population sustainability. Considering that the reservoir fish population appears to be self-sustaining, and any fish entrained through the powerhouse would have high survival rates of 75 to 88 percent through the Francis turbines, entrainment-related effects associated with the proposed

operation of the La Grange Powerhouse would be minimal, and there appears to be little need for measures to mitigate the entrainment potential.

FWS's recommended fish rescue plan would include provisions for rescuing fish that are entrained into the MID Diversion Tunnel from April 1 through June 15. As mentioned in section 3.3.2.1, *Aquatic Resources, Affected Environment,* in the subsection *Water Quantity*, irrigation deliveries typically begin in early March, normally reach their peak in July and August, and end in late October/early November. Weekly and potentially daily drawdowns of the MID canal system for fish rescue from April 1 through June 15 would reduce the Districts' ability to meet their water supply contribution towards the 1.5 million acre-feet total demand for Tuolumne River water during normal water years. In addition, the current healthy, self-sustaining reservoir fish population appears to be minimally affected by current operations associated with non-project irrigation deliveries. There is little basis for requiring a fish rescue plan as a requirement of any license issued.

Regarding the genetic value of *O. mykiss* occurring upstream of La Grange Diversion Dam for ESA-related conservation of anadromous O. mykiss, the Districts evaluated the genetic characteristics of *O. mykiss* residing within about 1 mile of the Tuolumne River downstream of La Grange Diversion Dam compared to *O. mykiss* present upstream of Don Pedro Reservoir, to determine whether evidence of one or more populations present within an *O. mykiss* collection, and whether *O. mykiss* from the upper and lower Tuolumne River are genetically differentiated (Cramer Fish Sciences, 2018). The report concluded that: (1) neither *O. mykiss* collections upstream of Don Pedro Reservoir or just downstream of La Grange Diversion Dam reflected a genetically similar and isolated sub-population that would benefit from a passage prescription; and (2) the *O. mykiss* collected from upstream of Don Pedro Reservoir and downstream of La Grange Diversion Dam are differentiated genetically from each other and should not be considered drawn from the same underlying population.

Anadromous Fish Passage/Reintroduction

Barriers to upstream fish passage can be natural or human-caused and often delay migrations and movements, fragment populations, or prevent access to critical habitat necessary to sustain populations. Natural barriers can include waterfalls and debris obstructions (e.g., beaver dams); artificial barriers to fish passage mainly include dams and road-stream crossings. Under existing conditions, both La Grange and Don Pedro Dams completely block upstream fish migration and impede downstream fish passage. Historic accounts indicate salmon were present in the upper Tuolumne River, perhaps as far upstream as Preston Falls, and also in the lower Clavey River.

Although the Districts do not propose to evaluate or provide fish passage facilities at the La Grange Diversion Dam or Don Pedro Dam, the Districts did implement a series of workshops and technical studies during the Integrated Licensing Process to evaluate the feasibility of reintroducing spring-run Chinook salmon and steelhead to the upper

Tuolumne River. The Reintroduction/Fish Passage Assessment Framework processes (Assessment Framework) used in this evaluation were consistent with guidelines suggested by Anderson et al. (2014), which identify the need for a comprehensive approach to assess reintroduction feasibility with the goal of recovery of federally listed fish species. The Assessment Framework was intended to broaden the scope from only evaluating fish passage concepts and feasibility to evaluating the biological, regulatory and socioeconomic aspects as well.

In its preliminary Section 18 fishway prescription, NMFS reserves its authority to prescribe the construction, operation, and maintenance of fishways at the projects, including measures to determine, ensure, or improve the effectiveness of such prescribed fishways, pursuant to section 18 of the FPA, as amended, until December 31, 2025.[115]

In its section 10(a) recommendation 5, Fish Passage Program Plan, NMFS also recommends the Districts develop a fish passage program plan for providing safe, timely, and effective passage of juvenile and adult fish at the projects, to be developed with NMFS and the resource agencies. After approval by NMFS, the plan would be submitted to FERC for its approval and subsequent implementation by the Districts. To ensure that fishway design and operations can best accomplish safe, timely and effective fish passage, NMFS recommends the development of fishways include a phased Fish Passage Program Plan that assesses the feasibility and design of fishways and procedures for effective upstream and downstream passage. The Fish Passage Program Plan would include several fish passage actions (actions) that are intended to proceed in phases and use an adaptive management approach. The ultimate goal is to create facilities and operations that provide successful fish passage. The main phase consists of short-term actions within 7 years from the issuance of licenses. Within the short-term phase, actions could occur concurrently as new information is gained, evaluated, and adaptively managed. These short-term actions are outlined in table 3.3.2-41. A more detailed description of these short-term actions is available in NMFS (2018a).

[115] According to the San Joaquin River Restoration Settlement Act (SJRRSA, 2009), NMFS shall exercise its FPA section 18 authority to prescribe fish passage for Central Valley spring-run Chinook salmon reintroduced pursuant to the San Joaquin Settlement by reserving that authority until after the expiration of the term of the San Joaquin Settlement, December 31, 2025, or the expiration of the designation made pursuant to the reintroduction, whichever ends first. The SJRRSA (2009) does not provide similar FPA section 18 limitations for other anadromous fish species like California Central Valley steelhead.

Table 3.3.2-41. Short-term fish passage actions recommended by NMFS in its section 10(a) recommendation 5, Fish Passage Program Plan (Source: NMFS, 2018a).

Short-Term (ST) Fish Passage Actions	Years from Issuance of Licenses
ST-1. Form a Fish Passage Committee.	0.5
ST-2. Evaluate Salmonid Habitats Upstream of Don Pedro Reservoir.	1-4
ST-3. Develop a Stock Selection and Management Plan.	2-4
ST-4. Develop a 2-Year Pilot Fish Passage Program (Pilot Program).	2-5
ST-5. Implement the 2-Year Pilot Program.	5-7
ST-5.1. Design Adult Fish Collection and Handling Facilities.	7
ST-5.2. Evaluate Adult Fish Release Sites Above Don Pedro Reservoir and Juvenile Fish Release Sites Below La Grange Diversion Dam.	5-7
ST-5.3. Conduct Adult Collection and Transport Experiments.	7
ST-5.4. Conduct Downstream Juvenile Fish Passage Studies.	5-7
ST-5.5. Design Juvenile Fish Downstream Collection Prototype.	7
ST-5.6. Monitor and Evaluate the Pilot Program's Progress.	7
ST-5.6.1. Produce a Comprehensive Pilot Program 7-Year Report.	7

In their recommendation 2, the Conservation Groups advocate that NMFS should reserve its FPA Section 18 authority to require fish passage for spring-run Chinook salmon and possibly steelhead to the upper Tuolumne River after 2025.

In their reply comments dated March 15, 2018, the Districts state that their completed Fish Passage Alternatives Assessment determined that reintroduction under the current conditions in the watershed is not feasible to support species recovery. This assessment included additional analyses of numerous factors relevant to available habitat in the upper Tuolumne River and comprises a comprehensive evaluation of reintroduction. The Districts also state that to the extent that additional studies are needed by NMFS to support its Section 18 fishway prescription, these studies should have been performed by NMFS during the multi-year licensing process.

Our Analysis

Under existing conditions, both La Grange and Don Pedro Dams completely block upstream access to as much as 18.17 miles of accessible and 31.26 miles of potentially accessible[116] anadromous fish habitat in the upper Tuolumne River Basin, and also prevent or impede downstream fish passage (table 3.3.2-42). While a variety of fishways have been built at dams in California, Oregon, and Washington and have successfully transported salmon and steelhead past dams for many years, fish passage has not been provided in the Tuolumne River. However, NMFS is currently considering a requirement to provide fish passage at the La Grange and Don Pedro Projects for its potential to support the recovery of federally listed anadromous fish.

Table 3.3.2-42. Summary of upper Tuolumne River reaches accessible by anadromous salmonids, if fish passage is provided at La Grange and Don Pedro Dams (Source: HDR, 2017c, as modified by staff).

River/Tributary	Accessible	Potentially Accessible
Mainstem Tuolumne River	17	24
North Fork Tuolumne River	0.52	1.69
Clavey River	0.2	2.05
South Fork Tuolumne River	0.45	1.9
Middle Fork Tuolumne River	0	0
Cherry Creek	0	1.62
Total	**18.17**	**31.26**

In 2015, during implementation of their Fish Passage Facilities Alternatives Assessment (described below), the Districts identified significant biological and engineering data gaps that needed to be addressed to inform the development of fish passage alternatives at La Grange and Don Pedro Dams (Districts, 2015). In an effort to address these data gaps, the Districts, in consultation with the licensing participants, broadened the scope of their alternatives assessment to implement an Assessment Framework process for the upper Tuolumne River. This process, as approved by the licensing participants, was structured in a manner that was consistent with procedures

[116] A potential barrier is a feature identified by the study team that may exhibit conditions that create an impediment to upstream fish passage of adult spring-run Chinook or steelhead on a partial or temporal basis, but where conclusions have not yet been developed to establish the duration, range of flows, or conditions when or if the feature is passable.

described by Anderson et al. (2014), "Planning Pacific Salmon and Steelhead Reintroductions Aimed at Long-Term Viability and Recovery." Key elements incorporated into the Assessment Framework included ecological feasibility; biological constraints; and economic, regulatory, and other key considerations.

The Districts held their first two Assessment Framework Plenary Group workshops in early 2016, and meetings were attended by federal and state resource agencies, NGOs, and the public. Workshops identified important information gaps, outlined voluntary studies to be conducted by the Districts to address information gaps, identified information to be provided by NMFS, and established a series of technical subcommittees. The technical subcommittees were formed to help develop study plans, determine reintroduction goals and objectives, and identify appropriate water temperature criteria and target species/life stages to be used in the reintroduction assessment.

On May 18, 2017, the Reintroduction Goals and Water Temperature technical subcommittees presented results of their tasks to Plenary Group members for review and approval. The final Tuolumne River reintroduction program goal statement is to "Contribute to the recovery of ESA-listed salmonids in the Central Valley by establishing viable populations in the Tuolumne River at fair and reasonable cost." Table 3.3.2-43 presents temperature guidelines for assessing reintroduction regarding thermal suitability.

As a component of the Assessment Framework, the Districts also conducted a Fish Passage Facilities Alternatives Assessment (HDR, 2017d). The goal of this assessment was to investigate the feasibility of providing upstream and downstream passage of spring-run Chinook salmon and steelhead at the La Grange and Don Pedro Dams.

During preparation of its preliminary fish passage alternatives, the Districts identified factors that influence both upstream and downstream fish passage and included information on species life history information and migration timing; access to collection and release locations; and operations, flows, water temperatures, and water surface fluctuations (reservoir and tailwater) above and below both La Grange and Don Pedro Dams. Together, these data played a key role in the preparation of fish passage facility alternatives that would comply with agency technical design criteria and guidelines.

Table 3.3.2-43. La Grange Reintroduction Assessment Framework – Upper Tuolumne River Temperature and Timing (Source: Watercourse Engineering and HDR, 2017).

	UOWTI (MWAT)	UTWTI (MWAT)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spring-run Chinook Salmon[a,b]														
Adult upstream migration	64	68												
Adult holding	61	65												
Adult spawning	56	58												
Embryo incubation and emergence	56	58												
Fry rearing	65	68												
Juvenile rearing and downstream movement	65	68												
Smolt outmigration	63	68												
Steelhead[a,b]														
Adult upstream migration	64	68												
Holding	61	65												
Adult spawning	54	57												
Embryo incubation and emergence	54	57												
Fry rearing	68	72												
Juvenile rearing and downstream movement	68	72												
Smolt outmigration	55	57												

Note: UOWTI—Upper Optimum Water Temperature Index; UTWTI—Upper Tolerable Water Temperature Index; MWAT—Maximum Weekly Average Temperature.

[a] Dark shaded areas represent known peak periods for the specified life stage, whereas light shaded areas represent presence.

[b] The absence of dark shaded areas for any life stage indicates that the Technical Committee did not identify any particular peak period based on the available date.

Using the results of this collaborative process, the Districts developed five potential upstream fish passage alternatives representing four upstream technologies to a conceptual level of design and evaluated these as part of the fish passage study. These alternatives included:

- Alternative U1A: Technical Fish Ladder – Bypass[117]
- Alternative U1B: Two Separate Technical Fish Ladders
- Alternative U2: Fish Lift with Technical Ladder at La Grange
- Alternative U3: Collection, Handling, Transport and Release (CHTR) Facility
- Alternative U4: Whooshh Fish Transport Tube

Following an assessment of major functional elements, advantages, disadvantages, and assessment of technical feasibility based upon the evaluation factors defined above, the Districts determined that only Alternative U3: CHTR Facility was technically feasible. The remaining four alternatives were determined to not be technically feasible based upon the evaluation factors. Of the alternative concepts developed, none of the alternatives investigated that were volitional in nature could be considered likely to meet performance standards given the 213 feet of total reservoir fluctuation that can occur at Don Pedro Reservoir during the anticipated period of migration. Both the fish ladder and fish lift alternatives would require the integration of an experimental fish return flume or fish transport tube system at the fish passageway exit that would accommodate release of upstream migrating fish into Don Pedro Reservoir. Alternatives U1A, U1B, U2, and U4 also rely on adult upstream migration through Don Pedro Reservoir, which is likely to significantly reduce their overall adult passage efficiency (Districts, 2017e).

CHTR represents a relatively proven technology with numerous similar facilities in operation that, in general, exhibit high overall fish passage performance characteristics meeting resource agency performance criteria. When sited and designed to accommodate the unique site-specific conditions exhibited at La Grange Diversion Dam, this alternative is expected to meet performance criteria. Numerous examples of CHTR facilities exist in the Pacific Northwest that collect and transport adult spring-run Chinook and steelhead with high levels of performance and low levels of injury or direct mortality.

The Districts also developed and evaluated the following four potential downstream fish passage facility alternatives to a conceptual level:

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[117] Two potential fish ladder alternatives are considered in this study for the purposes of providing upstream fish passage. Alternative U1A includes a single continuous navigational pathway that bypasses both La Grange and Don Pedro Dams. Alternative U1B includes two separate technical fish ladders: one that bypasses La Grange Diversion Dam; and a second that bypasses Don Pedro Dam.

- Alternative D1: Fixed Multi-Port Collector with Helical Bypass near Don Pedro Dam
- Alternative D2A: Floating Surface Collector near Don Pedro Dam
- Alternative D2B: Floating Surface Collector near Head of Reservoir
- Alternative D3: Fixed In-River Collector

None of the downstream alternatives were determined to be technically feasible based upon the evaluation factors defined above. Of the technologies evaluated only one alternative has examples of facilities that are currently in operation: Alternative D2A.[118] The remaining alternatives represent types of downstream fish passage technologies that are yet to be applied in practice at a full scale, and it cannot be known how or whether such a facility will work. For all alternatives, the anticipated reservoir passage efficiency and collection efficiency standards are not likely to meet the performance standards required at other high dam facilities in operation.

Operation of a floating surface collector near Don Pedro Dam is highly unlikely to provide safe, timely or effective downstream fish passage for out-migrating anadromous salmonids. The high head nature of the dam combined with the dramatic (i.e., up to 213 feet) fluctuations in reservoir surface elevation in Don Pedro Reservoir and associated seasonal changes in temperature and velocity create challenging conditions for fish collection. No existing collection facilities currently operate under such dynamic conditions, and operation of a juvenile downstream collection facility at the head of reservoir would be experimental in nature (Districts, 2017e).

Based on the above information, it is apparent that the mainstem Tuolumne River and its tributaries upstream of Don Pedro Reservoir contain anywhere from 18 and 31 miles of potentially accessible anadromous fish habitat of varying quality and that upstream passage is feasible at La Grange Diversion Dam via Alternative U3.

If adult anadromous fish should successfully spawn and rear in the upper Tuolumne River Basin, out-migrating juveniles would also require safe, timely and effective downstream passage at Don Pedro and La Grange Dams. However, existing reservoir conditions (extreme drawdowns, low water velocities, high water temperatures, and risk of predation) would likely preclude or severely limit the efficacy of any reservoir or dam-based downstream fish collection facility. In addition, inflows ranging from approximately 90 to 10,600 cfs during the outmigration period, unstable channel conditions, and an existing Wild and Scenic River designation would likely prohibit the construction and operation of a permanent in-river collector upstream of Don Pedro Reservoir. Given these constraints, a temporary/portable in-river collection device or

[118] PacifiCorp's Lewis River Hydroelectric Projects, WA operates a floating surface collected near Swift Dam in Swift Reservoir, which is moderately successful at collecting downstream migrants.

series of these devices at the upstream end of Don Pedro Reservoir may be the only biologically viable option for downstream passage, and even then, the use of these devices may be restricted pursuant to the Wild and Scenic River designation.

As is the case for numerous hydroelectric projects in California, NMFS's request for reservation of authority to prescribe fishways under Section 18 of the FPA would help maintain the flexibility necessary to respond to new information during the license term (e.g., fish passage needs, project modifications, management goals, environmental conditions, and technological innovations), and allow for potential future installation of fishways, if feasible and needed. However, we find that certain elements of NMFS's preliminary section 10(j) and 10(a) recommendations (table 3.3.2-41) are not justified, based on the Districts' analysis of the feasibility of establishing viable populations of federally listed salmonids in the upper Tuolumne River Basin. In addition, NMFS has not shown that fish passage above the La Grange Diversion Dam would be reasonably certain to occur in the near future.

However, with the NMFS reservation of authority under section 18, and with the standard fish and wildlife reopener article, fish passage could be provided in the future if an appropriate administrative record were developed and provided to the Commission supporting the need for upstream or downstream anadromous fish passage at the La Grange or Don Pedro Dams, after notice and opportunity for hearing.

Fish Enumeration and Predator Control

There are no fish passage facilities at the La Grange and Don Pedro Projects; however, the Districts recently began operating temporary fish counting weirs in the Tuolumne River downstream of the La Grange Diversion Dam. One weir was located approximately 1,000 feet downstream of the dam in the main channel, and the other was approximately 140 feet downstream of the La Grange Powerhouse in the tailrace channel. The Districts operated these weirs from September 23, 2015, through April 14, 2016, and from September 20, 2016, through January 2, 2017. The Districts have been operating an additional seasonal fish counting weir at RM 24.5 since 2009, about 27.7 miles downstream of the La Grange Diversion Dam.

The Districts do not propose to construct or operate any fish passage facilities at La Grange Diversion Dam or Don Pedro Dam. However, the Districts do propose to construct and operate a small permanent fish counting/barrier weir (less than 5 feet of head at normal flows) at approximately RM 25.5 (about 26.7 miles downstream of the La Grange Diversion Dam), to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitats. The weir would be a reinforced concrete structure consisting of the following components: (1) a right concrete abutment merging with natural grade, (2) a Denil-type fishway and counting structure with a viewing window and fish sorting capabilities, (3) a bottom drop gate with a maximum hydraulic capacity of 75 cfs providing attraction flow to the fishway entrance, (4) a spillway section, (5) middle

abutment, (6) a non-motorized craft (kayak/canoe/raft) bypass structure with flap-gate control and concrete chute; and (7) left concrete abutment merging with natural grade.

To further reduce predation on Chinook salmon by striped and black bass, the Districts also propose to implement a predator control and suppression program that would include active control and suppression of striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir. Control and suppression measures would include, but would not be limited to, sponsoring and promoting black bass and striped bass derbies and reward-based angling in locations both above and below the fish counting/barrier weir, and removal and/or isolation via electrofishing, seining, fyke netting, and other collection methods. To ensure compliance with this measure, the Districts propose to file an annual report on black bass and striped bass reduction efforts undertaken during the prior calendar year. The Districts would conduct a survey every 5 years to identify the number of fish to be targeted in order to reduce the bass population by 10 percent in succeeding years. Additionally, the Districts would seek and advocate for changes to current fishing regulations for the lower Tuolumne River (e.g., length of season, bag limit, catchable size, requested removal of black bass/striped bass caught, allowing a bounty program) to reduce black and striped bass numbers. The Districts propose to establish a fund to carry out the activities above and to educate the public on the adverse effects of introduced predatory species on fall-run Chinook salmon in the Tuolumne River,[119] to encourage participation in the removal program and advocacy of changes to fishing regulations that facilitate such removal. To monitor compliance with this measure, the Districts propose to file an annual report describing the specific educational and advocacy measures undertaken during that year.

In its letter filed January 29, 2018, NMFS states that the Districts' proposed predator control suppression plan is not beneficial to salmonids and does not address the problem that juvenile salmonids have very little floodplain refugia in the lower Tuolumne River and that predator fields (mining pits) are maintained by the projects' flows and sediment retention. Furthermore, the proposed fish counting/barrier weir at RM 25.5 can also act as a partial migration barrier to Chinook salmon and steelhead trout and is likely to result in a predator field becoming established on the downstream side. NMFS also comments that many of the measures in the Districts' proposed predator control and suppression plan range from having the potential to measurably adversely affect salmonids, like electrofishing during outmigration, to having little to no potential for a measurable benefit to salmonids, like a public sport-fishing derby.

California DFW recommends (10(a) recommendation M6) the Districts revise its proposed predator control and suppression plan to include: (1) recommendations for

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[119] The Districts suggest that activities could include, but would not be limited to, developing educational materials about the effects of predatory fish, community outreach, or kiosks.

shaping spring pulse flows, recession flows, and how to best meet temperature requirements consistent with requirements of CWA § 303(d) that favor native fish and dissuade non-native predatory fish, (2) recommendations, priorities, and conceptual designs that would be used to conduct the annual placement of sediment and LWM (California DFW 10(a) recommendation M4) to minimize predator habitat and to favor cover habitat for salmonids, (3) monitoring activities that can be readily incorporated in other required monitoring activities conducted by the Districts and members of the TREG, and (4) performance measures and monitoring actions to evaluate the outcomes of any recommendations from the revised predator control and suppression plan that are incorporated into ongoing FERC required measures. California DFW further recommends (10(a) recommendation M6) that the Districts should prepare annual predation monitoring reports as well as a predation monitoring synthesis report every 5 years that would report on the synthesis of all required predation monitoring activities for the last 5 years, including analysis of trends and results of meeting performance measures that are part of the predator monitoring plan. California DFW also recommends that the Districts revise their proposed predator control and suppression plan to include monitoring activities that may be conducted by any member of the TREG.

The Conservation Groups state that they strongly oppose the installation of a permanent fish counting/barrier weir at RM 25.5, but support installation of a temporary seasonal fish counting weir and a temporary weir to capture striped bass and black bass in critically dry and super critically dry water years only. The Conservation Groups (recommendation 7) recommend the Districts: (1) annually install a fish counting weir at or near RM 24, from September 15 through at least December 31, with the same basic configuration as the facility that the Districts have deployed since 2009, (2) install a temporary weir in critically dry and super critically dry years, from no later than April 15 to September 1, between RM 25.9 and RM 25 for the purpose of capturing and removing striped bass, black bass, and other non-salmonid piscivorous fish, with no permanent infrastructure related to the weir, and (3) relocate striped bass captured at the temporary weir to San Francisco Bay, and black bass and other warmwater piscivorous fish to reservoirs where salmonids are not present and are isolated from the Tuolumne River or other salmonid-bearing waters. The Conservation Groups (recommendation 7) also recommend the Districts conduct two snorkel surveys between April 20 and June 30 in any year that the weir is installed, both 300 feet upstream and downstream of the temporary weir and monitor the numbers, species and size of fish captured at the weir. The Districts would report the initial results of the snorkeling surveys to TRTAC as soon as data are compiled, with a written report on fish captured at the weir and the results of the snorkel surveys provided to TRTAC within 6 months of the removal of the weir.

Regarding California DFW's recommendation for the Districts to revise their proposed predator control and suppression plan to include monitoring conducted by any member of the TREG, the Districts state in their reply comments that no basis exists for it to be held financially liable for activities by others for a watershed-wide problem not of the Districts' making. They also state that Conservations Groups' statement that

installing a temporary weir can be effective at capturing predators during periods of very low flows is not supported by any data, but has nevertheless been noted for consideration. The Districts also state that Conservations Groups' recommendation to relocate striped bass to San Francisco Bay should not be adopted because the Bay would still be in the migration corridor of Tuolumne River Chinook juveniles, and instead, any successful predator removal should require relocation to non-anadromous waters.

Our Analysis

The lower Tuolumne River supports large numbers of non-native largemouth, smallmouth, and striped bass. While these species support a popular recreational fishery, they are highly piscivorous and are known to consume large numbers of juvenile salmonids (FISHBIO, 2013b). Predation of juvenile salmonids by introduced species may be a major source of their mortality under low-flow conditions in the Tuolumne River and SRPs appear to provide ideal habitat for predators.

During the spring of 2012, the Districts conducted a series of investigations to quantify the effects of predation on juvenile Chinook rearing in the lower river (FISHBIO, 2013b). Specifically, these studies estimated the abundance of predatory fish species, assessed predation rates on juvenile Chinook salmon, and tracked the movements of predatory fish in relation to juvenile Chinook salmon.

Between March 1 and May 31, 2012, the estimated number of smallmouth bass (>150 mm fork length) observed in the lower Tuolumne River (from RM 0 to RM 39.4) was 9,092 and 6,764, based on area and shoreline length, respectively. The estimated number of largemouth bass (>150 mm fork length) was 3,796 and 5,843, and the estimated number of striped bass (>150 mm fork length) was 588 and 692, based on similar methodology. Largemouth bass were captured downstream of RM 34.8, smallmouth bass were captured throughout the study reach (RM 3.7 to RM 38.4), and striped bass found from RM 3.7 to RM 35.0.

The estimated number of juvenile Chinook salmon potentially consumed annually by these predators was 15,495 for largemouth bass, 20,501 for smallmouth bass, and 6,193 for striped bass. Using the estimated losses of juvenile Chinook salmon observed by RSTs in the Tuolumne River from 2007 through 2011, the Districts estimated the number of juvenile Chinook salmon lost ranged from 47,000 to 270,000.[120] Based on these findings, the authors hypothesized that the majority of juvenile Chinook salmon mortality in the Tuolumne River during most years may be due to predation (FISHBIO, 2013b).

[120] It is not clear what proportion of juvenile mortality can be directly attributed to fish predation.

As proposed by the Districts, its permanent upstream migrant fish counting/barrier weir located at RM 25.5 would include a Denil-type fishway and counting window to facilitate fish counts, fish species separation, and broodstock collection. It would also provide a barrier to exclude striped bass from upstream habitats used for rearing by juvenile fall-run Chinook salmon, and prevent black bass movement into sections of river upstream of RM 25.5. Furthermore, the proposed fish counting/barrier weir would be capable of being operated year-round and in river flows up to at least 3,000 cfs.[121] The annual operation of this weir, in combination with the Districts' proposed predator control and suppression program would also facilitate the removal of bass and other predatory fish in the lower river.

While the above measures would likely reduce predator abundance in the lower Tuolumne River, and theoretically decrease the amount of predation on juvenile Chinook salmon, it is not known if they would have a measurable benefit to Chinook salmon or *O. mykiss*. As described in NMFS (2018a), predator removal efforts on a much larger scale than those proposed in this plan have been shown to have no reduction in striped bass predation on Chinook salmon (California DWR, 2017). When California DWR removed 6,151 predatory fish weighing approximately 7,200 pounds (3.26 metric tons) from Clifton Court Forebay,[122] they did not detect any reductions in salmon mortality (California DWR, 2017). In the first 2 years of predator removal, California DWR did not find a statistically significant difference in Chinook salmon losses from predators (California DWR, 2016, 2017). The construction of the fish counting/barrier weir would also add an additional impediment to salmonid migration in the Tuolumne River. In addition, striped bass are likely to congregate near the weir and consume juvenile salmonids migrating downstream. This is of particular concern in both dry and critically dry water years, allowing for concentrated predation. Construction of a fish counting/barrier weir may not achieve its desired objective of predator exclusion, while at the same time result in additional adverse effects on anadromous salmonids.

Removal of predator habitat by filling in the SRPs to reduce predator hot spots could reduce predator abundance in the Tuolumne River (as these represent preferred habitat for these species) and would not require direct removal of fish. Providing floodplain rearing habitat also has the potential to further reduce juvenile salmonid mortality by reducing predation. However, as described previously, existing SRPs and degraded floodplain habitat are not a project effect, and it is not the Districts' responsibility to mitigate these impacts on aquatic habitat in the lower river. Although

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[121] The existing temporary seasonally-operated Alaska-type counting weir located at RM 24.5 must be removed when flows reach 1,500 cfs.

[122] The Clifton Court Forebay is a key part of the SWP and is the starting point of the California Aqueduct (which delivers water to Southern California). Clifton Court also recharges water in the San Joaquin Valley via the Delta-Mendota Canal.

the amount of existing floodplain habitat does not appear to currently limit Chinook salmon productivity in the Tuolumne River (Stillwater Sciences, 2017a), sediment harvest downstream of La Grange Diversion Dam, associated with the Districts' coarse sediment augmentation program, would be completed in a manner that creates new floodplain areas. In-channel gravel placement would be completed to help increase local floodplain inundation (e.g., raise the channel bed), and improve salmon habitat in the lower river.

Spawning Habitat Improvement

The availability and composition of river gravels influences suitability of spawning habitat for anadromous and resident fish. Coarse gravel also provides substrate for growth of algae and invertebrates, both of which are important components of the aquatic food web. Mitigating any adverse effects associated with operation of the project through the implementation of gravel augmentation projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Tuolumne River. However, any recommended or proposed mitigation measures must demonstrate a clear nexus to the project and consider the Districts' ongoing role in providing water supply, flood control, hydroelectric generation, and recreation.

To improve spawning conditions for fall-run Chinook and *O. mykiss*, the Districts propose (RPM-1) to conduct coarse (0.125 to 5.0 inches in diameter) sediment augmentation from RM 52 to RM 39 over a 10-year period following issuance of a new license. Monitoring associated with this measure would include (1) a spawning gravel evaluation in year 12 of the augmentation program using methods comparable to those employed for the "Spawning Gravel in the Lower Tuolumne River Study" (Stillwater Sciences, 2013d), and (2) annual surveys of fall-run Chinook and *O. mykiss* spawning use of new gravel patches for 5 years following completion of gravel augmentation. The estimated amount of coarse sediment to be augmented would be approximately 75,000 tons, or almost 10 times the amount of coarse sediment lost over the 8-year period as estimated in the Spawning Gravel Study. Because spawning preferences are more heavily weighted towards upstream habitats, the highest priority for gravel augmentation is upstream of Old La Grange Bridge (RM 50.5).

In addition, the Districts propose (RPM-2) to provide flows of 6,000 to 7,000 cfs (measured at the La Grange gage) to mobilize gravel and fines. Flows would be provided for at least two days at an estimated average frequency of once every 3 to 4 years, i.e., during years when sufficient spill is projected to occur. In years when the La Grange gage spring (March through June) spill is projected to exceed 100,000 acre-feet, the Districts would plan to release a flow of 6,500 cfs for two days within the spill period, with downramping not to exceed 300 cfs/hour. Monitoring associated with this measure would consist of conducting substrate surveys at designated test sites located upstream of RM 43 prior to a high-flow event and then examining the same test sites following the flow event to evaluate whether corresponding changes occur in channel morphology or

improvements to the quality of spawning gravel via a reduction in interstitial fines. Flow magnitude and/or duration may be adjusted based on these observations.

The Districts also propose (RPM-4) a 5-year experimental gravel cleaning program. Each year of the program would consist of two to three weeks of cleaning select gravel patches using a gravel ripper and pressure wash operated from a backhoe, or equivalent methodology. The Districts would conduct *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning prior to commencing any gravel cleaning. Subject to the findings of these surveys, the gravel cleaning might coincide with May pulse flows to benefit Chinook salmon smolt outmigration by providing increased turbidity to reduce predator sight feeding effectiveness. Monitoring associated with this measure would consist of substrate surveys at designated test sites. Monitoring would be implemented prior to and following gravel cleaning to evaluate changes in substrate composition, particularly reductions in interstitial fines.

To reduce fall-run Chinook salmon redd superimposition, the Districts also propose to develop and install a temporary barrier to encourage spawning on less used, but still suitable, high-quality riffles (RPM-8). The temporary barrier would be installed each year below the new La Grange Bridge (RM 49.9) after November 15 once the number of Chinook salmon passing the proposed RM 25.5 fish counting/barrier weir exceeds 4,000 total spawners. The temporary barrier would be similar to the Alaska-type counting weir currently used on the Tuolumne River at RM 24.5 or a picket-weir type. Final design and configuration of the temporary barrier would be based on consultation with state and federal resource agencies

NMFS and California DFW each recommend the Districts develop a gravel augmentation program in the lower Tuolumne River. Specifically, NMFS (10(a) recommendation 2) recommends that for both projects, over the duration of any new licenses issued for the projects, the Districts should add a total volume of 752,000 cubic yards of coarse gravel (spawning and non-spawning) within four reaches of the lower Tuolumne River, at a rate of 18,800 cubic yards per year, in consultation with TRTAC, to mitigate for the 18,800 cubic yards per year of sediment/gravels trapped annually by the projects. Under the NMFS measure, the Districts would enhance the following reaches of the lower Tuolumne River:

- Spawning Reach (RM 52.2–RM 47.5) La Grange Diversion Dam to Basso Bridge
- Dredger Reach (RM 47.5–RM 39.5) Basso Bridge to Roberts Ferry
- Mining Reach (RM 39.5–RM 36.3) Roberts Ferry to Santa Fe Bridge
- Lower Tuolumne River (RM 36.3–RM 0.0)

Within the first 15 years of any license issuances, NMFS recommends the Districts place 564,000 cubic yards of the total volume noted above to fill in the bedload traps/special pools and follow the priorities for short and long-term gravel augmentation

as found in the Tuolumne River Coarse Sediment Plan (McBain & Trush, 2004). Additionally, sediment harvest downstream of La Grange Diversion Dam would be completed in a manner that creates new floodplain areas, and in-channel placement would be completed in a manner that increases local floodplain inundation (e.g., raises the channel bed). The Districts would annually use 13,400 cubic yards of coarse gravels to fill in the SRPs (total volume is 564,000 cubic yards). The Districts would annually use 5,400 cubic yards of cleaned spawning sized gravel to create or restore spawning riffles and restore fluvial geomorphic processes (total volume 188,000 cubic yards). Under the NMFS recommendation, the placement of gravel by the Districts into the respective reaches, configurations (piles or beds), and depth of sediments, cobble/fill material, and its integration with other substrates (LWM and boulders) would be determined based on an assessment of each placement site, guided by the Tuolumne River Coarse Sediment Plan (McBain & Trush, 2004), in consultation with TRTAC. Goals useful for monitoring the effectiveness of sediment management in the lower Tuolumne River reaches would include: (1) increase the amount of California Central Valley steelhead and Central Valley Chinook salmon spawning habitats; and (2) increase the number and longitudinal distribution of California Central Valley steelhead and Central Valley Chinook salmon redds, decrease superimposition, and decrease female egg retention levels. Specific metrics useful for monitoring the effectiveness of sediment management in the lower Tuolumne River reaches would include: (a) the maximum size of substrate movable by salmonids would be approximately 10 percent of fish length; (b) the number of redds per square meter indicates whether salmonids find the gravel appropriate for spawning (0.05 redds per square meter is a standard guideline); (c) the level of egg retention in females indicates whether a sufficient number of suitable sites are available for spawning (less than 10 percent retention is a standard guideline); (d) the percentage of salmonids using emplaced gravel indicates whether the action is providing habitat that is suitable (10 percent use is a standard guideline); (e) redd density in the Tuolumne River can be approximated to estimate capacity because spawnable area includes 4 times the redd area to account for defensible space (however, defensible space need not necessarily be comprised of just spawning gravel, other habitat types are acceptable); and (f) increase annual average of egg-to-emergence survival for Central Valley Chinook salmon and California Central Valley steelhead by 24 percent.

FWS does not recommend a gravel augmentation program in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of a Lower Tuolumne River Habitat Improvement Program that would provide funding for planning, designing, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. This would include spawning habitat improvements. Additional discussion of the Lower Tuolumne River Habitat Improvement Program is included below in the section *Lower Tuolumne River Habitat Improvement Program*.

California DFW recommends (10(a) recommendation M4) that the Districts update the coarse sediment management plan (McBain & Trush, 2004) for both projects and develop project designs working with the TREG within 2 years of license issuances. The updated plan should include the following: (1) description of potential locations of gravel collection for placement into the reaches of the Tuolumne River between La Grange Diversion Dam (RM 52.2) and Geer Road Bridge (RM 24.0); (2) description of any other potential options for providing and placing gravel in the La Grange Diversion Dam to Geer Road Bridge reaches; (3) consultation with the TREG regarding annual gravel augmentation with respect to geomorphic and hydrologic annual variations; (4) plans for annual gravel augmentation with respect to geomorphic and hydrologic factors, access, and suitability for gravel addition; (5) an implementation timeline; (6) report and evaluate any legal constraints on gravel placement, and any federal, state, or local permits that may be needed; and (7) approval by California DFW, NMFS, and FWS. As part of the updated plan, conceptual designs would be developed for the modifications of SRPs and other reaches that the TREG identifies as desirable restoration sites. These designs would be approved by California DFW, FWS, and NMFS before finalization and used by the Districts to minimize predation habitat via sediment placement. Project designs should focus on: (1) enhancing Chinook salmon and *O. mykiss* spawning habitat; (2) reducing predator holding and spawning habitat; (3) maintaining or enhancing *O. mykiss* holding habitat above RM 42; and (4) creating floodplain habitat of medium to high quality for juvenile salmon rearing. The updated plan would be used as the guiding document for annual gravel augmentation in the lower Tuolumne River with the goal of mitigating the loss of gravel and sediment (both spawning-sized gravel and fine sediment) due to direct effects of project operations, as well as, mitigating for the abundance of predator habitat created by direct project effects and/or by the loss of proper river functions due to past and current project operations. Starting upon completion of the updated plan, the Districts would place at least 200,000 cubic yards of sediment annually for 10 years to mitigate for project impacts until at least 1,950,824 cubic yards of additional sediment has been placed in the river to fill SRPs. California DFW further recommends that the Districts should apply the bedload transport rating curve developed for the coarse sediment management plan (McBain & Trush, 2004) to any new flow schedule required by the Commission or the Water Board for the Don Pedro or La Grange Projects, to calculate average annual bedload transport rates for sediment > 8 mm. The Districts would annually add this amount of gravel to the lower Tuolumne River to ensure no net loss of spawning habitat occurs. At a minimum, the Districts should annually add 2,500 cubic yards of cleaned spawning sized gravel. The size of gravel added under this provision would be identified in consultation with the TREG and agreed to by California DFW, FWS and NMFS. California DFW recommends the Districts comply with California DFW Fish and Game Code § 1602, which requires any person, state or local governmental agency, or public utility to notify California DFW before beginning any activity that will substantially modify a river, stream or lake.

California DFW further recommends monitoring and reporting within 60 days of full implementation of gravel placement and augmentation actions. The report should include: (1) the quantity and quality of placed gravel; and (2) the results of monitoring of the placement/augmentation of gravels, and subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change) and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach. California DFW recommends this report be submitted to the TREG by March 1 each year, and a final report submitted to the Commission each year, following approval by California DFW, BLM, FWS, and NMFS. California DFW's recommendation additionally contains a provision for effectiveness monitoring that would include assessments of floodplain inundation and geomorphic processes at the sites of gravel placement and gravel augmentation. The effectiveness monitoring would begin 1 year after gravel placement and augmentation and for a period of 3 years. The Districts would present the results of effectiveness monitoring to the agencies mentioned previously at the annual TREG meeting and provide a summary of effectiveness monitoring in a report provided to the agencies for review and comment within 60 days following completion of monitoring. California DFW also recommends a separate annual report be submitted to the Commission and California DFW, BLM, FWS, NMFS, and the Water Board by March 15, which describes both implementation and effectiveness monitoring.

The Conservation Groups commented that the Districts' coarse sediment augmentation proposal (RPM-1) is inadequate, and they propose a more extensive and robust gravel augmentation program which, in combination with other Conservation Groups restoration measures, would mitigate project effects and achieve the Anadromous Fish Restoration Program's Doubling Goal. Conservation Groups (recommendation 6) recommended gravel augmentation and restoration and predatory habitat reduction provisions, for both projects, are identical to California DFW's 10(a) recommendation 4. The Conservation Groups further recommend identifying the size of gravel added under this provision in consultation with the TRTAC described in Conservation Groups' recommendation 3. The Conservation Groups also state they oppose the Districts' proposed measure RPM-4 (gravel cleaning) and that the Conservation Groups' flow proposal would achieve gravel-cleaning objectives more effectively and in a less damaging manner than the Districts' proposal.

The Water Board (preliminary 401 condition 5) specifies that it will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River. The goal of this plan is to replace sediment lost downstream of La Grange Diversion Dam in order to improve downstream habitat. The Districts may also be required to monitor implementation and effectiveness of the sediment augmentation and submit associated reports to the Water Board's Deputy Director. BMPs would be developed to minimize the impact to beneficial uses (e.g., turbidity and wildlife) from initial sediment placement.

In response to NMFS's (10(a) recommendation 2) recommendation, the Districts state in their reply comments filed on March 15, 2018, that mining pits are unrelated to the Don Pedro Project and its operations. The Districts also note that their lower Tuolumne River spawning gravel study (Stillwater Sciences, 2013d) concluded the coarse sediment budget for RM 52.2 to RM 45.5, encompassing the primary salmon spawning reach immediately downstream of La Grange Diversion Dam, indicates that approximately 4,549–6,707 cubic yards (5,913–8,720 tons) of coarse bed material was lost from storage between 2005 and 2012, and the total estimated volume lost from storage in the reach is comparable in magnitude to the quantity of coarse sediment added during any one of the augmentation projects that occurred since 2002 (approximately 7,000–14,000 tons). The Districts additionally comment that NMFS's citing an estimated 18,800 cubic yards of coarse sediment annually captured by the Don Pedro Project from McBain & Trush (2004) is incorrect; in fact, the estimate of coarse sediment supply used by McBain & Trush (2004) was taken from a separate study (Brown and Thorp, 1947[123]) and is specifically stated to be the estimated "*unimpaired* coarse sediment supply from the *watershed*." NMFS does not account for the capture of sediment by CCSF's Hetch Hetchy System of dams (O'Shaughnessy, Cherry, Eleanor, and Early Intake) all located upstream of Don Pedro Reservoir.

In response to Conservation Groups' recommendation 6 to develop a coarse sediment and gravel replacement and restoration plan, the Districts state that mining pits are unrelated to the Don Pedro Project and its operations and mitigating the impacts of bedload traps created by SRPs in the mining reaches from RM 46.6 to RM 24 is outside the scope of relicensing. They further note that the Districts' proposed coarse gravel augmentation from RM 52 to RM 39 over a 10-year period following issuance of a new license is consistent with coarse sediment augmentation priorities identified in McBain & Trush (2004) and in their lower Tuolumne River spawning gravel study.

In response to California DFW's recommendation for annual sediment placement to minimize predation habitat hotspots, the Districts state that predation is not a project effect; in fact non-native predators were introduced into the San Joaquin watershed by California DFW to advance its interest in recreational fishing. It is unreasonable for the agency to now recommend that the Districts use their water supply and spend their customers' money to address an impact caused by California DFW. In response to California DFW's recommended annual gravel augmentation, the Districts state that their proposed gravel augmentation plan (RPM-1), which was developed based on the results of their lower Tuolumne River spawning gravel study and specifically examined the effects of the Don Pedro Project operation on gravel availability, condition, and transport,

[123] In their reply comments, the Districts erroneously cited this reference as Thorp (1947).

would include a study in year 12 to again update the condition of coarse sediment in the lower Tuolumne River.

Our Analysis

Prior to widespread European settlement, the channel form in the lower Tuolumne River was a combination of single-thread and split channels that migrated and avulsed (McBain & Trush, 2004). Beginning in the mid-1800s stored riverbed material was excavated for gold and aggregate, which eliminated active floodplains and terraces and created large in-channel and off-channel pits. By the end of the gold mining era, 12.5 miles of river channel and floodplain from RM 50.5 to RM 38 were dredged and converted to tailings piles, and much of the gravel-bedded zone of the river was converted to long, deep pools, now referred to as SRPs. These SRPs are as much as 400 feet wide and 35 feet deep, occupying 32 percent of the channel length in the gravel-bedded reach. Agricultural and urban encroachment, in combination with a reduction in coarse sediment supply and high flows, have also resulted in a relatively static channel within a floodway confined by dikes and agricultural uses.

Under existing conditions, La Grange Diversion Dam (constructed in 1893), old Don Pedro Dam (completed in 1923), and new Don Pedro Dam (completed in 1971) trap all coarse sediment (>2 mm) and most fine sediment (<2 mm) originating from unregulated portions of the upper watershed. These projects also alter the frequency, magnitude, and duration of bed-mobilizing flows that influence bedload transport capacity in the lower Tuolumne River.

McBain & Trush (2004) estimated the "unimpaired" annual bedload sediment delivery in the lower Tuolumne River to be an average of 18,800 cubic yards per year, and the rate of bedload transport to be 5,400 cubic yards per year (McBain & Trush, 2004). McBain & Trush (2004) also mapped the SRPs in the lower Tuolumne River that resulted from in-channel mining and determined that they trap the majority of sediment input from upstream reaches. As a result, the SRPs have the potential to minimize any benefits associated with spawning gravel augmentations. Based on these findings, NMFS recommends that the bedload traps (564,000 cubic yards total volume) be filled in with coarse gravels and then overlain with suitable spawning gravels (188,000 cubic yards total volume) to provide adequate spawning habitat for resident and anadromous salmonids. California DFW recommends the Districts place at least 1,950,824 cubic yards of sediment in the river to fill the SRPs.

In their study of spawning gravel in the lower Tuolumne River, the Districts describe indicators that suggest a deficit in coarse sediment supply relative to bedload transport in the Tuolumne downstream of La Grange Diversion Dam, a condition affecting both the capacity and productivity of salmonid spawning habitat (California DWR, 1994; McBain & Trush, 2004):

- Channel cross section surveys indicate that in many reaches the channel is wider than would have occurred prior to large-scale anthropogenic disturbance,

lacks bankfull channel confinement, and has cross sectional dimensions that are not adjusted to the contemporary flow regime.

- Field surveys indicate that sediment storage features (e.g., lateral bars and riffles) are depleted of coarse sediment, and riffles throughout the gravel-bedded zone have progressively diminished in size.
- SRPs deprive downstream reaches of sediment by trapping all particles larger than coarse sand (4 mm), provide little or no high-quality salmonid habitat, and provide suitable habitat for non-native piscivores that prey on juvenile salmonids (McBain & Trush, 2000).

The Districts also determined that:

- The average annual total and coarse (>2 mm) sediment yields to Don Pedro Reservoir, calculated over the 1923–2011 period, were approximately 373,966 tons (287,657 cubic yards) per year and 37,397 tons (28,766 cubic yards) per year, respectively.
- The channel in the first 12.4 miles downstream of La Grange Diversion Dam is slowly degrading in response to a reduction in coarse sediment supply by new Don Pedro Dam, but past gravel augmentation has helped increase coarse sediment storage in the reach.
- Augmentation material is being mobilized short distances during infrequent high flow events (e.g., during water year 2006 and water year 2011), but that routing is slow due to low bedload transport capacity.
- The total volume of discrete fine bed material deposits in the reach from La Grange Diversion Dam (RM 52.2) to Roberts Ferry Bridge (RM 39.5) decreased by 48 percent from 2001 to 2012.
- A total of 3,527,200 square feet of riffle mesohabitat was mapped from RM 52.2 to RM 23 in 2012, of which 2,967,500 square feet (84 percent) was occupied by spawning gravel.
- Comparing the results of riffle surveys conducted in 1988 and 2012 suggests riffle area increased by 606,200 square feet (21 percent).

Based on the above findings, it is apparent that the projects have reduced the amount of coarse sediment entering the lower Tuolumne River, and that without some form of ongoing gravel augmentation over the term of the licenses, the river channel would slowly degrade, and eventually become gravel limited. It is also evident that gravel augmentation efforts associated with the projects' 1995 Settlement Agreement have helped increase coarse sediment storage in the reach, and that most of this coarse sediment has been retained, increasing the amount of available salmonid spawning habitat.

Because the projects intercept gravel that would otherwise be available as spawning habitat in the lower Tuolumne River, it would be appropriate for the Districts to develop a coarse sediment management plan, in consultation with the NMFS, FWS, California DFW, and Water Board, that includes a gravel augmentation program that would extend throughout the term of any new licenses issued for the projects. However, river channel impacts associated with gold and aggregate mining are not related to the projects and would not be required to fill the bedload traps/SRPs, as these impacts have no direct nexus to project operations. Rather, the coarse sediment management plan would focus on providing high quality spawning habitat for anadromous salmonids in those reaches that have the greatest potential to increase salmon and steelhead production (i.e., the first 12.4 miles downstream of the La Grange Diversion Dam). Periodically monitoring and mapping augmented spawning gravels (i.e., once every 10 years over the term of the licenses), as recommended by NMFS, FWS, California DFW, and the Conservation Groups, would also provide an indication of the performance of the augmentations and inform the need for future augmentation. The Districts are proposing the Lower Tuolumne River Habitat Improvement Program, which may include in-channel habitat improvements such as gravel placement, and if the Lower Tuolumne River Habitat Improvement Program is implemented, the coarse sediment management plan could be included under the umbrella of the Lower Tuolumne River Habitat Improvement Program.

According to *Spawning Gravel in the Lower Tuolumne River* (Stillwater Sciences, 2013d), actions implemented under the projects' 1995 Settlement Agreement from 2002 through 2012 have already resulted in the addition of approximately 44,750 cubic yards of gravel to the river. This program, combined with the Districts' proposed gravel augmentation program (approximately 54,000 cubic yards over a 10-year period), would result in the augmentation of approximately 98,750 cubic yards of gravel. Assuming a 30-year license term (with a new license issued in 2019), these measures would add an average of approximately 2,100 cubic yards of coarse sediment to the river per year. Over a 50-year license term, these combined actions would add an average of approximately 1,500 cubic yards of coarse sediment per year.

According to McBain & Trush (2004), approximately 1,000 to 2,500 cubic yards of gravel per year would be needed for long-term coarse sediment maintenance in the lower Tuolumne River. Although the 1,000 to 2,500 cubic yards per year estimate is well below the "unimpaired" annual bedload sediment delivery value described in McBain & Trush (2004) (approximately 18,800 cubic yards/year), the coarse sediment budget for RM 52.2 to RM 45.5 (Stillwater Sciences, 2013d), encompassing the primary salmon spawning reach immediately downstream of La Grange Diversion Dam, indicates that approximately 4,549–6,707 cubic yards (5,913–8,720 tons) of coarse bed material was lost from storage between 2005 and 2012, and the total estimated volume lost from storage in the reach is comparable in magnitude to the quantity of coarse sediment added during any one of the augmentation projects that occurred since 2002 (approximately 7,000–14,000 tons). It is reasonable to conclude that the Districts' ongoing gravel

augmentation program is maintaining an adequate amount of spawning habitat in the lower Tuolumne River, as there is no evidence that gravel availability is limiting *O. mykiss* or fall-run Chinook salmon productivity downstream of La Grange Diversion Dam. However, the Districts' proposed gravel augmentation program would be limited to only 10 years (following license issuance). Under any new licenses for the projects (which may be issued for a term of up to 50 years), Don Pedro Reservoir would continue to capture gravel that would eventually result the net loss of gravel supply to the lower Tuolumne River, Consequently, developing a coarse sediment management plan that addresses the need for gravel augmentation throughout the term of any new licenses, potentially as part of a future Lower Tuolumne River Habitat Improvement Program, in consultation with the resource agencies, is needed to mitigate the impacts of the projects on aquatic habitat downstream of La Grange Diversion Dam. It is also apparent that the annual volume of gravel added to the river should be commensurate with the project's ongoing level of impact, as described in Stillwater Sciences (2013d).

Obtaining the gravel to be placed in the lower reaches from the existing dredger-tailings piles along the river, as recommended by NMFS, California DFW, and the Conservation Groups, could make implementation relatively efficient, as opposed to importing gravels from outside the projects, which could result in off-site environmental effects at the harvest site. Harvesting gravels here would also serve to create a more natural floodplain. The Districts' proposed 5-year experimental gravel cleaning program, with associated redd and substrate surveys, would also act to improve spawning substrates in the lower river.

While implementation of the Districts' proposed spawning surveys would provide data on the annual distribution and abundance fall-run Chinook and *O. mykiss* entering the Tuolumne River for 5 years, it is unclear how these data would be used to inform future gravel augmentation measures. It is well known that the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the operation of other dams and diversions in the watershed. All these factors are outside the Districts' control.

The Districts, agencies, and other stakeholders have focused on the effects of gravel retention by the projects on the spawning habitat in the lower river, but BMI may also be affected by gravel retention, where substrates may become less suitable for some species and orders. However, the Districts have conducted BMI monitoring in the lower Tuolumne River since 1987, and this sampling has indicated that although overall invertebrate abundances in riffle samples have declined slightly from 1996 to the present, community composition shifted away from pollution-tolerant organisms and toward those with higher food value for juvenile salmonids and other fish. This indicates a gradual improvement in habitat conditions for BMI under current project operations.

Regarding the Districts' proposed fall-run Chinook spawning superimposition reduction program, this program would not fully address the lack of suitable spawning

habitat in the lower Tuolumne River and could also result in the "take" of federally listed steelhead through potential injury from the temporary barrier. Furthermore, implementation of a coarse sediment management plan, as mentioned above potentially as part of a future Lower Tuolumne River Habitat Improvement Program, would address the lack of suitable spawning habitat more fully than the proposed superimposition reduction program and without the potential "take" of federally listed species.

Instream Habitat Improvement (LWM)

LWM provides habitat structure in rivers and streams and can influence sediment storage and channel morphology through its effects on flow, water velocity, and sediment transport. These in-channel features also provide cover and holding habitat for fish, serve as substrate for the growth of algae and invertebrates (which are important components of the aquatic food web), and affect patterns of sediment deposition and scouring. A reduction in the amount of LWM can result in reduced complexity of aquatic habitat and reduced carrying capacity for aquatic biota. Mitigating any adverse effects of the projects on instream habitat through the implementation of habitat restoration projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Tuolumne River. However, any recommended or proposed mitigation measures must demonstrate a clear nexus to the project.

The Districts propose to implement their Woody Debris Management Plan filed on October 11, 2017, for the Don Pedro Project. To limit the hazards to recreational users of Don Pedro Reservoir, woody debris is collected in boom rafts, anchored along the reservoir's edge, and burned during fall and winter when reservoir levels are low. During the term of any new license issued for the Don Pedro Project, the Districts would continue to manage woody debris as described above. The Districts would obtain a burn permit from California Department of Forestry and Fire Protection and an air quality permit from the Tuolumne County Air Pollution Control District before any woody debris is burned. The Districts would also file a fire management plan with the BLM before woody debris is burned on lands managed by BLM. No staging or burning of wood would occur within 0.5 mile of active bald eagle nests or in areas known to support special-status species.

NMFS recommends (10(a) recommendation 3) LWM enhancement and management for both projects, that includes provisions for counting and acquiring LWM from the projects' reservoirs and roads as well as during sediment harvesting from nearby dredger tailings, for collecting, storing, and prioritizing LWM for enhancement projects, for placement in the lower Tuolumne River, and for monitoring and reporting on the overall LWM enhancement and management effort. Under the NMFS recommendation, LWM is defined as structurally sound logs, with or without rootwads that are at least 3 feet long and at least 8-inches in diameter at 4 feet from the large end, while key pieces of LWM are logs greater than 25 feet long, with rood wad attached, and 24 inches or greater in diameter (measured 4 feet from the rootwad). Under NMFS's 10(a) recommendation 3 the Districts would survey the upper reaches of Don Pedro Reservoir

following any peak flow equal to or greater than a 1.5-year return interval flow and secure all LWM floating in the reservoir or perched on the reservoir margin so that it can be retrieved for removal later that season. The Districts would also annually remove LWM from the projects' reservoirs and store the material at locations that minimize transport time to the restoration reaches and are secure from illegal firewood cutting and other non-designated consumptive uses. The Districts would enhance the following reaches of the lower Tuolumne River with an initial placement of 80 to 100 pieces of LWM each year:

- Spawning Reach (RM 52.2–RM 47.5), La Grange Diversion Dam to Basso Bridge
- Dredger Reach (RM 47.5–RM 39.5), Basso Bridge to Roberts Ferry
- Mining Reach (RM 39.5–RM 36.3), Roberts Ferry to Santa Fe
- Lower Tuolumne River (RM 36.3–RM 0.0)

Under the NMFS recommendation, the annual wood augmentation would continue until a frequency of 100 LWM pieces per mile of stream channel is reached (about 6 pieces per 100 meters of channel length) on average throughout the four restoration reaches. Wood frequencies within a given reach may be higher or lower than the target average frequency, but a minimum frequency of 70 pieces per mile would need to be met in each of the reaches. Once an average frequency of 100 pieces per mile is met, monitoring (frequency dependent on peak flow occurrence) would determine whether the target frequencies are being maintained throughout the reaches (minimum of 70 pieces per mile within a reach and an average of 100 pieces per mile over the entire length of the 52-RM reach). Additional LWM augmentation would be necessary if LWM frequencies fall below the targets. LWM would be placed within the active channel, side channels, and on floodplain benches. Specifically, at least 50 percent of LWM would be placed in the active channel, as single pieces, clusters, and jams. Placement of the key pieces would be as follows: (1) 50 percent of the root-wad-free end of the log would be buried in the riverbank (not the stream bed); (2) the rootwad end of the log would be placed in the river at a depth so that 50 percent of the rootwad is inundated at low flows; and (3) placement of the log would be angled so that the rootwad end is at a 45 degree angle directed downstream. NMFS recommends that the composition of LWM augmentation pieces should adhere to the following guidelines: (1) at least 50 percent of all augmentation pieces should be longer than 10 feet long and have diameters greater than 12 inches and 20 percent should be longer than 18 feet long and have diameters greater than 24 inches, and (2) at least 20 percent of all LWM augmentation pieces should have rootwads attached. NMFS further recommends (10(a) recommendation 3) that the Districts map the LWM in the lower Tuolumne River to inventory all LWM in the four lower Tuolumne restoration reaches. The mapping effort would begin with an initial inventory of existing wood to prioritize the initial LWM augmentation efforts and updated as LWM is augmented each year. The augmented reaches would be remapped to verify existing wood locations during water years when a high flow occurs sufficient to

mobilize and transport LWM. The Districts would also prepare an annual report to the Commission on the status of the LWM management program and monitoring, including the amount and types (e.g., size ranges) of LWM collected during the year, amount and location of material transported, and any noted biological use of LWM.

FWS does not recommend LWM augmentation in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of a Lower Tuolumne River Habitat Improvement Program that would provide funding for planning, design, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. This would include holding and rearing habitat improvements. Additional discussion of the Lower Tuolumne River Habitat Improvement Program is included below in the section entitled *Lower Tuolumne River Habitat Improvement Program*.

California DFW (10(a) recommendation M4-4) and FWS (FWS Don Pedro 10(j) recommendation 9) recommend that the Districts revise the Woody Debris Management Plan filed October 11, 2017, to address safe and expeditious wood removal in Don Pedro Reservoir when the volume exceeds 5,000 cubic yards of woody debris entering Don Pedro Reservoir in any one year. Specifically, the agencies recommend that the revised plan include the following: (1) wood would be removed from Don Pedro Reservoir using an excavator placed on dry land and loading the wood from the water onto trucks; (2) the wood would be hauled off-site promptly and transported to a lumber yard, chipping facility, or storage area for wood to be used in lower Tuolumne River salmonid habitat restoration; and (3) whenever the volume of LWM in Don Pedro Reservoir exceeds 5,000 cubic yards, and during or immediately following rapid LWM removal, the Districts would make 200 key pieces of LWM available to entities conducting salmonid restoration actions in the lower Tuolumne River; this would be material that the Districts would not be using to meet other requirements of the any license issued for the project. If fewer than 200 key pieces of LWM were available in years when LWM and woody debris exceeds 5,000 cubic yards of material, the Districts would provide the balance of the LWM in pieces of wood that could be used to construct engineered log jams in the lower Tuolumne River, selecting pieces of LWM that are longer than 18 feet. The Districts would consult annually with FWS on timing and amounts of key LWM pieces available. Key pieces for engineered log jams are logs greater than 18 inches in diameter and longer than 16 feet, and key pieces for toed-in or embedded LWM are logs greater than 24 inches in diameter and longer than 18 feet (from trunk base to log end), with a rootwad or crown attached. All key pieces of LWM with rootwads still attached would be preferentially selected to be made available for lower Tuolumne River salmonid habitat restoration. Entities receiving the LWM for the purpose of salmonid habitat restoration would be charged no more than the hauling cost to transport the LWM to restoration areas or storage areas in the lower Tuolumne River. The Districts would provide the parties receiving the wood a minimum of 60 days to collect the key pieces of LWM.

As part of the revised plan, California DFW recommends the Districts place a total of 1,600 pieces of LWM from La Grange Diversion Dam down to the confluence with the San Joaquin River. They further recommend that the LWM be placed at an appropriate distribution, density, and configuration as recommended by a restoration ecologist and in consultation with appropriate agencies; that LWM pieces be placed within or adjacent to floodplain lowering and planting sites where feasible; that a minimum of 160 LWM pieces be secured or embedded in the bank to provide at least partial inundation at 300 cfs upstream of the Districts existing infiltration galleries and 200 cfs in areas downstream of the infiltration galleries; and that all pieces of LWM be a minimum of 24 inches in diameter and 18 feet in length with a minimum of 50 percent having a crown or rootwad attached.

California DFW further recommends that annual implementation reports be prepared to include: (1) the quantity and quality of placed gravel and LWM; (2) the locations and duration of placed LWM, if dislodged, and placement/augmentation; (3) the results of monitoring of the placement/augmentation of gravels, and subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change), and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach; and (4) the quantity, timing, and disposal method of LWM removed from Don Pedro Reservoir and La Grange Reservoir.

Additionally, a census would be conducted 3 and 10 years following license issuance and every 10 years thereafter. The census would include procedures for documenting all unrooted wood meeting minimum size requirements of greater than 3 feet in length and 4 inches in diameter that are located within the channel bed up to areas that would be inundated at 5,000 cfs and a map, including a geographic information system (GIS) database, developed after each census with an associated report.

Conservation Groups (recommendation 5) recommend that, within six months of any new licenses issued for the projects, the Districts develop a large woody debris placement and management plan in consultation with the TRTAC. The Conservation Groups recommend that the plan include the following: (1) description of potential collection locations of LWM in Don Pedro Reservoir or other locations in the Tuolumne River Watershed; (2) description of potential options for moving LWM from Don Pedro Reservoir to the Tuolumne River downstream of La Grange Diversion Dam; (3) identification of suitable LWM placement locations in the active channel of the Tuolumne River downstream of La Grange Diversion Dam to the confluence with the San Joaquin River; (4) consultation with state and federal agencies regarding effects of LWM on safety or maintenance of bridges; (5) consultation with qualified recreational boating groups to ensure safety with regard to placement of LWM in the context of channel design; (6) evaluation of the efficacy, costs, and permitting requirements of providing permanent anchorage to the placed LWM; (7) a long-term LWM management plan to re-install LWM annually to ensure no net loss of LWM; (8) a regular LWM effectiveness monitoring and reporting process; and (9) description of necessary permits and a permitting timeline.

The Water Board (preliminary 401 condition 4) specifies that it will likely require the Districts, in consultation with relevant resource agencies, to develop a plan to address the reduction of LWM downstream of La Grange Diversion Dam. The goal of this plan would be to increase the amount of LWM below La Grange Diversion Dam in order to improve downstream aquatic habitat. The Districts would consult with representatives from the boating community (e.g., American Whitewater) to ensure LWM placement in the river is not hazardous to boaters. The Districts may also be required to monitor the implementation and effectiveness of LWM augmentation and to submit associated reports to the Water Board's Deputy Director. BMPs would be developed to minimize the effect on beneficial uses (e.g., turbidity and wildlife) from LWM placement and installation.

In their reply comments, the Districts state it is unlikely the Don Pedro Project affects LWM content in the lower Tuolumne River because the captured wood is too small to be maintained in the lower river for any length of time. In two surveys of the size of wood deposited in the reservoir, an average of only 6.5 percent of the measured logs were >16 inches in diameter and >13 feet long (Stillwater Sciences, 2017b). These surveys occurred in the third and fifth highest wood loading years of the 12-year study of wood raft volume in Don Pedro Reservoir. Moreover, because even logs 18 feet long and 24 inches in diameter are unlikely to be stable in the 120-foot-wide alluvial lower Tuolumne River, wood is likely to be highly mobile and is unlikely to provide extensive habitat. Nearly every study of wood mobility emphasizes that wood less than half a channel width is unlikely to be stable, particularly if the diameter is less than the mean depth during floods. Ten-foot-long logs are even less likely to be stable and would be very difficult to anchor. These logs would likely need to be replaced after even modest flows, particularly given the lack of key pieces (>60 feet long) in the reservoir and riparian zone.

In response to California DFW's recommendation, the Districts state that insufficient large wood from upstream is delivered to Don Pedro Reservoir to justify California DFW's recommendation, and that California DFW offers no justification for the program it recommends as applied to the lower Tuolumne River, nor any assessment of the expected benefits other than hypothesized general habitat improvements. The wood trapped in Don Pedro Reservoir is typically small, with few large logs.

Our Analysis

Under existing conditions, Don Pedro and La Grange Dams intercept most LWM moving downstream from the upper Tuolumne River Basin. The projects also reduce the frequency and magnitude of high flows in the lower river, which limits LWM transport and reduces geomorphic processes that often deliver local sources of wood to the channel. Furthermore, flow regulation during the spring and summer is known to suppress the growth of riparian vegetation, limiting the production and availability of LWM in some river systems. While other historic and ongoing activities (e.g., mining, timber harvest, development, and agriculture) have undeniably reduced LWM recruitment in the lower Tuolumne River, the projects remain a major impediment to the

lower Tuolumne River developing properly functioning habitat related to LWM. When comparing the lower Tuolumne River with 19 other California salmonid-bearing streams, Albertson et al. (2013) found that the lower Tuolumne River is limited in salmonid rearing habitat attributes, little to no LWM, no undercut banks, and only a thin riparian edge.

As a component of its existing FERC license, the Districts are required to collect and remove floating debris at Don Pedro Dam, in the upper Tuolumne River portion of the reservoir, and in other dispersed areas of the reservoir, as needed, to limit the public safety hazard to recreational users of Don Pedro Reservoir. Debris is collected in boom rafts, anchored along the reservoir edge, and burned during fall and winter under low reservoir levels. As described in study report W&AR-12, the Districts estimated an average 169,039 cubic feet of LWM are captured by Don Pedro Reservoir each year. Don Pedro Reservoir captured an estimated 952,000 cubic feet of LWM in 2006 and in 2017, and Don Pedro Recreation Area staff observed approximately 40 acres of LWM in the reservoir (McCarthy, 2017) (figure 3.3.2-41).

Figure 3.3.2-41. LWM on Don Pedro Reservoir in 2017, near Ward's Ferry Bridge (Source: FWS, 2018a).

Implementation of a comprehensive LWM management plan (as recommended by the resource agencies) would promote the accumulation of spawning gravels, provide hydraulic refugia for juvenile fish rearing and adult fish holding (Roni and Quinn, 2001; Bisson et al., 1987), create pools by forcing flows to scour channel beds and banks, and afford structural partitioning that provides protection from predation, and visual isolation that lowers interspecies competition (Dolloff, 1983). The LWM would also supply nutrients and substrate for aquatic organisms (Anderson et al., 1978) and aid in the retention of salmonid carcasses, which provide important marine-derived nitrogen to

terrestrial ecosystems and organic nutrients to salmon juveniles, macroinvertebrates, terrestrial animals, and birds (Naiman et al., 2002; Merz and Moyle, 2006).

Based on these findings, collecting and transporting LWM from Don Pedro Reservoir and placing it in the lower Tuolumne River, as recommended by the resource agencies, would undoubtedly enhance existing aquatic habitat downstream of La Grange Diversion Dam (compared to existing conditions). If done properly, LWM augmentation would be expected to increase aquatic habitat diversity and provide most, if not all, of the benefits described above. However, we question the applicability of the resource agencies recommended size-based guidelines. For example, it is unlikely that LWM measuring less than 16 inches in diameter (at 4 feet from the large end) and less than 20 feet in length would provide the structural benefits that are currently lacking in the lower Tuolumne River (given its existing bankfull width) and even then, pieces of this size may need to be aggregated into log jams to provide the desired benefits. It is also unlikely that NMFS's recommendation to annually remove wood as small as 3 feet long and 8 inches in diameter from all project reservoirs and place it at locations proximal to the lower river enhancement projects would result in any long-term benefits to aquatic habitat. Furthermore, the availability of larger pieces of LWM in Don Pedro Reservoir appears to be somewhat limited.

While the resource agencies also identified placement targets for the lower Tuolumne River, the NMFS target (an average frequency of 100 pieces per mile) was derived using densities found in other California streams supporting Chinook salmon and in the lower Mokelumne River. Rather than rely on these target densities, which are likely influenced by a variety of factors that may not be applicable to the Tuolumne River, it would be more appropriate to focus the LWM management plan on mitigating only the existing effects of the projects on wood recruitment. Consequently, LWM (meeting an agreed upon size criteria) should only be collected from Don Pedro Reservoir when it becomes available. It would not be appropriate for the Districts to either purchase or harvest LWM from other sources.

Developing a comprehensive LWM management plan for the project, in consultation with the resource agencies, would ensure that the plan is well developed, scientifically sound, and capable of meeting its stated enhancement objectives. The plan could identify the frequency at which LWM is collected from Don Pedro Reservoir for downstream placement, develop viable options for storing and transporting collected LWM, and identify suitable LWM size classes, locations for placement, and placement methods (i.e., anchoring) in the lower Tuolumne River. The plan could also incorporate key elements of the Districts' Woody Debris Management Plan to ensure the continued public safety benefit of the Districts' woody debris management efforts, while limiting the potential for these efforts to result in detrimental effects on local resources.

Monitoring and mapping the location of LWM over time could also provide an indication of their stability and inform the need for future placement activities. Revisiting the LWM management plan goals and the timing and frequency of placement

events once within the first 3 years of license issuance, and then in license year 10 and every 10 years thereafter (i.e., license years 20 and 30), could also facilitate adaptive revisions to the plan as conditions improve in the lower river.

Floodplain Habitat Restoration

The storage and diversion of water associated with operation of the projects and irrigation diversions in the lower Tuolumne River restricts fish passage; blocks the downstream movement of LWM and coarse sediment; alters the timing, magnitude and duration of river flows; and modifies the natural thermal regime in the lower Tuolumne River. Mitigating any adverse effects associated with operation of the projects through the implementation of habitat restoration and enhancement projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Tuolumne River. However, any recommended or proposed mitigation measures must demonstrate a clear nexus to the project and consider the Districts' ongoing role in providing water supply, flood control, hydroelectric generation, and recreation. The Districts do not propose any measures specifically relating to floodplain habitat restoration along the lower Tuolumne River.

In order to restore and create additional salmon fry and juvenile rearing habitat in conjunction with instream flows to support the Anadromous Fish Restoration Program doubling goal,[124] California DFW (10(a) recommendation M5) recommends the Districts develop a floodplain rearing habitat restoration plan in consultation with TREG within 2 years of any new licenses issued for the projects. The plan would identify the river reaches with the greatest need for rearing habitat, the target amount of rearing habitat to be developed for each reach, potential locations for rearing habitat, a floodplain inundation analysis to identify elevations for flooding at flows of 1,500 to 3,000 cfs, a revegetation plan, and other relevant details. Under the plan, the Districts would restore and create sufficient acreage of salmon fry and juvenile rearing habitat by either: (1) lowering historic floodplain surfaces that currently inundate at flows greater than 5,000 cfs to attain 77,640 acre-days of inundation at flows >1,000 cfs between February 1 and June 15; or (2) creating 810 acres of 100 percent suitable floodplain habitat. Fry and juvenile rearing habitat would be created at no less than six restoration sites along the lower Tuolumne River, with one restoration site being the area known as Buck Flat. The Districts would also be responsible for planting floodplain surfaces with native riparian

[124] Section 3406(b)(1) of the Central Valley Project Improvement Act directs the Secretary of the Interior to develop within 3 years of enactment and implement a program that makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during 1967–1991. This directive is commonly referred to as the Anadromous Fish Restoration Program doubling goal.

trees, shrubs, forbs, and grasses. All restoration designs should emphasize floodplain terraces, benches, and swales with through-flow and include performance metrics. California DFW (10(a) recommendation M5) further recommends that the Districts develop a monitoring plan for all restoration sites that includes the following parameters for immediate implementation following the completion of any individual project: (1) monitor pre- and post-project floodplain inundation frequency, duration, depth, timing, velocity, and temperature, (2) monitor the pre- and post-project utilization of the restored project sites by fish, particularly juvenile salmonids, and (3) monitor survival of planted riparian species at newly constructed restoration sites.

FWS does not recommend specific measures for floodplain habitat restoration in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of a Lower Tuolumne River Habitat Improvement Program that would provide funding for planning, design, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. This would include floodplain habitat improvements. The Districts have indicated support for revised Don Pedro 10(j) recommendation 3. Additional discussion of the Lower Tuolumne River Habitat Improvement Program is included below in the section *Lower Tuolumne River Habitat Improvement Program.*

The Tuolumne River Conservancy recommends that the Districts fund the final cleanup and restore the spawning riffle of a 57-acre area on the north bank of the Tuolumne River on the northwest corner of the New La Grange Bridge known as Buck Flat and an additional area approximately 3 miles downstream. The Tuolumne River Conservancy further comments that both areas contain damage and construction material left behind from the construction of Don Pedro Dam and are within salmonid spawning and rearing sections of the Tuolumne River.

Conservation Groups' recommendation 4 is largely the same as California DFW's 10(a) recommendation M5 described previously, except that Conservation Groups' recommendation: (1) does not include Buck Flat as one of the six minimum restoration sites; (2) provides numbers of acre-days of inundation for (a) above normal water years (a median of at least 100,000 acre-days), (b) below normal water years (a median of at least 65,000 acre-days), and (c) dry water years (a median of at least 36,000 acre-days); (3) recommends inundation amounts for the 810 acres of 100 percent suitable floodplain habitat (i.e., 25 percent must inundate at 1,500 cfs or lower flow; 50 percent must inundate at 3,000 cfs or lower flow; 75 percent must inundate at 4,000 cfs or lower flow; and 100 percent must inundate at 5,000 cfs or lower flow); and (4) does not include an effectiveness monitoring component.

In their reply comments, the Districts question California DFW's recommendation for development of a floodplain rearing habitat restoration plan, stating that existing access to instream and floodplain rearing habitat does not currently limit Chinook salmon productivity in the Tuolumne River based on relicensing studies filed October 11, 2017,

as appendices to the Districts' amended final license application for the Don Pedro Project (Stillwater Sciences, 2017a; HDR and Stillwater Sciences, 2017). Additionally, the apparent lack of sufficient floodplain rearing habitat and potential benefits of new habitat created as a result of California DFW's recommended plan are both hypotheses and have not yet been demonstrated on the lower Tuolumne River. The Districts further state their lower Tuolumne River floodplain hydraulic assessment study report (HDR and Stillwater Sciences, 2017) demonstrates that current floodplain morphology is associated with an expansion of annually available floodplain habitat inundated (for at least 14 days) by a factor of 4 every 2 years and by a factor of 10 every 4 years. This corresponds to an expansion of suitable fry habitat by a factor of 2-to-5 over these same return periods. Because these return periods are within typical cohort returns of Chinook salmon, the Districts conclude that the amounts and frequency of floodplain access currently provide areas supportive of salmon populations.

The Districts state that based upon Newman and Hankin (2004) showing unquantifiable bias in baseline population data used for the Anadromous Fish Restoration Program doubling goal, as well as concerns over FWS's misapplication of survival vs. inundation regressions as submitted in its 2015 comments on the Districts' draft lower Tuolumne River hydraulic assessment report, the floodplain duration (acre-day) goals recommended by California DFW and the Conservation Groups are inappropriate. Furthermore, because the duration of potential floodplain residency during paired-release coded-wiretagged survival studies (Stillwater Sciences, 2005), as well as more recent examination of relative RST passage (Stillwater Sciences, 2017a) being relatively short, it is unreasonable to attribute observed survival increases to increased acre-days of potential floodplain residency, rather than simple increases of in-channel flows such as those occurring during FERC-required spring pulse flows.

Our Analysis

The Tuolumne River historically supported large numbers of anadromous spring-run Chinook salmon, fall-run Chinook salmon, *O. mykiss*, and unknown numbers of other native fish species. However, beginning in the mid-1800s, a combination of gold mining, gravel mining, grazing, and agriculture severely impacted floodplain habitat availability for juvenile salmonids. Dredge mine tailings located along the lower Tuolumne River are primarily the result of gold mining abandoned in the early 20th century; however, gravel and aggregate mining still continues for a number of miles along the river, particularly upstream of RM 34. Excavation of riverbed material for gold and aggregate to depths well below the river thalweg also formed large in-channel SRPs as well as off-channel ponds. During the construction of Don Pedro Dam, aggregate was reclaimed from floodplain areas formerly occupied by dredger tailings between RM 51.5 and RM 40.3 (McBain & Trush, 2000). These floodplain areas are characterized by floodplains two to three times wider than floodplains in other portions of the lower Tuolumne River corridor. Along the lower Tuolumne River, agricultural and urban encroachment in combination with in-channel excavation has resulted in a river channel contained within a

narrow floodway confined by dikes and agricultural fields. Levees and bank revetment extend along portions of the river bank from near Modesto (RM 16) downstream to the San Joaquin River, limiting potential floodplain access for rearing juvenile salmonids.

In addition to these channel modifications, altered flows in the Tuolumne River associated with project operations have reduced the magnitude and frequency of high flow events that are part of the natural flow regime, thereby affecting habitat diversity and complexity in the lower river. Attenuation of peak flows reduces the frequency of river connection to the floodplain and its inundation, which is important for juvenile salmonid rearing. However, previous studies estimate that flows as low as 1,000 cfs may reach bankfull within portions of the lower Tuolumne River (HDR and Stillwater Sciences, 2017). The flow frequency curve for the lower Tuolumne River at Modesto for the study period indicates that mean daily flows exceed 1,000 cfs approximately 28 percent of the time throughout the year.

As part of its pre-application studies, the Districts developed a hydraulic model (TUFLOW) for the lower Tuolumne River that simulates the interaction between flow within the main channel and the floodplain downstream of the La Grange Diversion Dam to the confluence with the San Joaquin River and applied the model results to estimate floodplain juvenile salmonid rearing habitat (HDR and Stillwater Sciences, 2017). The TUFLOW model expands the flow range and number of flow regimes evaluated in the 2013 Pulse Flow Study (Stillwater Sciences, 2012) and uses recent data on floodplain topography and in-channel hydraulic controls that were not included in either the 2012 Pulse Flow Study or floodplain GIS analysis conducted by FWS (2008). The following objectives applied to this study:

- reproduce observed water surface elevations, within reasonable calibration standards, over the sampled range of hydrologic conditions;
- determine floodplain inundation extents for flows at 250 cfs intervals between 1,000 and 3,000 cfs and 500 cfs intervals between 3,000 cfs and 9,000 cfs;
- estimate the area, frequency and duration of inundation over a range of flows for the base case (water years 1971–2012) hydrology; and
- apply modeled water depths and velocities to quantify the amount of suitable salmonid rearing habitat for juvenile Chinook salmon and *O. mykiss* at the designated flow increments.

The Districts ran TUFLOW model simulations for 21 flows identified in the study plan, ranging from 1,000 cfs to 9,000 cfs, and the model results were used to estimate total wetted area within in-channel and floodplain habitats for juvenile life stages of Chinook salmon and *O. mykiss* as a function of flow. Inundated floodplain areas for each of the three TUFLOW model reaches are shown in figure 3.3.2-42 as a function of discharge.

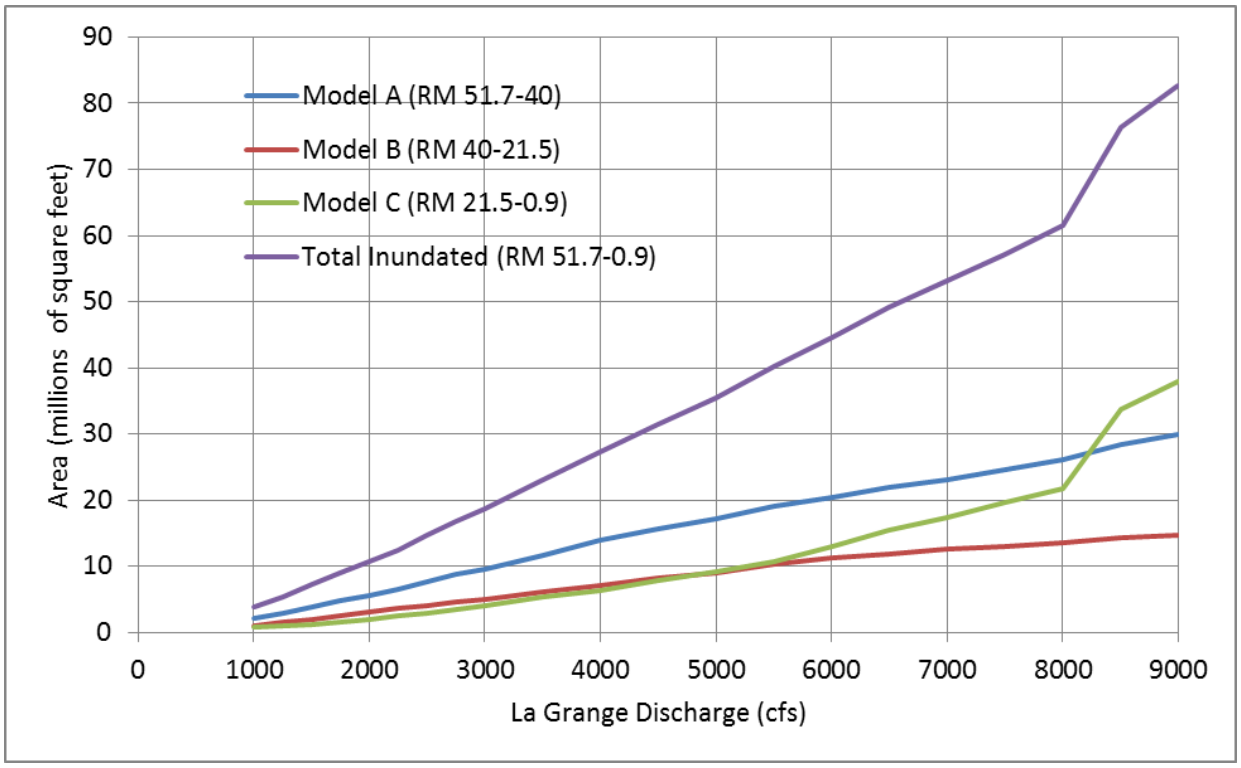

Figure 3.3.2-42. Total inundated floodplain area as a function of discharge within three modeled reaches of the lower Tuolumne River (Source: HDR and Stillwater Sciences, 2017).

The Districts then used fry and juvenile Chinook salmon habitat suitability criteria developed for the 2013 IFIM Study (Stillwater Sciences, 2013c) in combination with depth and velocity predictions to estimate total usable habitat as a function of flow (table 3.3.2-44).

Table 3.3.2-44. Hydraulic modeling results of total inundated and usable floodplain habitat area (square feet) for salmonid juveniles at selected flows in the lower Tuolumne River (RM 51.7 to RM 0.9) (Source: HDR and Stillwater Sciences, 2017).

Modeled Flow	**1,000 cfs**	**2,000 cfs**	**3,000 cfs**	**5,000 cfs**	**7,000 cfs**	**9,000 cfs**
Inundated Area	3,872,250	10,705,050	18,673,425	35,468,54	53,080,650	82,573,200
Chinook salmon fry habitat area	2,278,630	5,871,189	8,839,073	12,776,487	16,503,594	24,091,422
O. mykiss fry habitat area	3,243,756	8,048,116	12,391,338	18,147,111	23,283,027	35,364,719
Chinook salmon juvenile habitat area	1,392,718	5,639,850	10,584,427	18,941,945	26,481,740	39,302,723
O. mykiss juvenile habitat area	1,503,247	5,924,034	11,143,474	20,268,776	28,910,727	41,868,679

Assuming a maximum density of 1.44 Chinook fry/ft^2 as described in Grant and Kramer (1990), the Districts calculated a river-wide carrying capacity of 3.3 million Chinook fry at 1,000 cfs (i.e., 1.44 fry/ft^2 x 2.28 million ft^2 = 3.3 million fry), 8.5 million fry at 2,000 cfs, 12.7 million fry at 3,000 cfs, and 18.4 million fry at 5,000 cfs. Assuming a maximum density of 0.465 Chinook juveniles/ft^2 (FWS, 1991), the Districts calculated a river-wide carrying capacity of 0.6 million Chinook juveniles at 1,000 cfs, 2.6 million juveniles at 2,000 cfs, 4.9 million juveniles at 3,000 cfs, and 8.8 million juveniles at 5,000 cfs. Although the Districts developed corresponding estimates of usable habitat for juvenile *O. mykiss* as a basis of comparison, they did not provide a carrying capacity estimate for this species, as juvenile *O. mykiss* have not been observed using floodplain habitat in the lower Tuolumne River.

In their analyses, the Districts also determined that approximately 60 to 80 percent of the total inundated floodplain area under Model A (RM 51.7 to RM 40) is usable by Chinook salmon and *O. mykiss* fry at the lowest modeled flow (1,000 cfs). However, as flows increase, increased depths and velocities in the floodplain areas reduce suitability for fry life stages such that usable habitat falls to 25 to 40 percent of total inundated habitat at 9,000 cfs (figure 3.3.2-43). This decrease in the percentage of floodplain habitat availability as flows increase is also evident under Models B (RM 40 to RM 21.5) and C (RM 21.5 to RM 0.9) (figures 3.3.2-44 and 3.3.2-45).

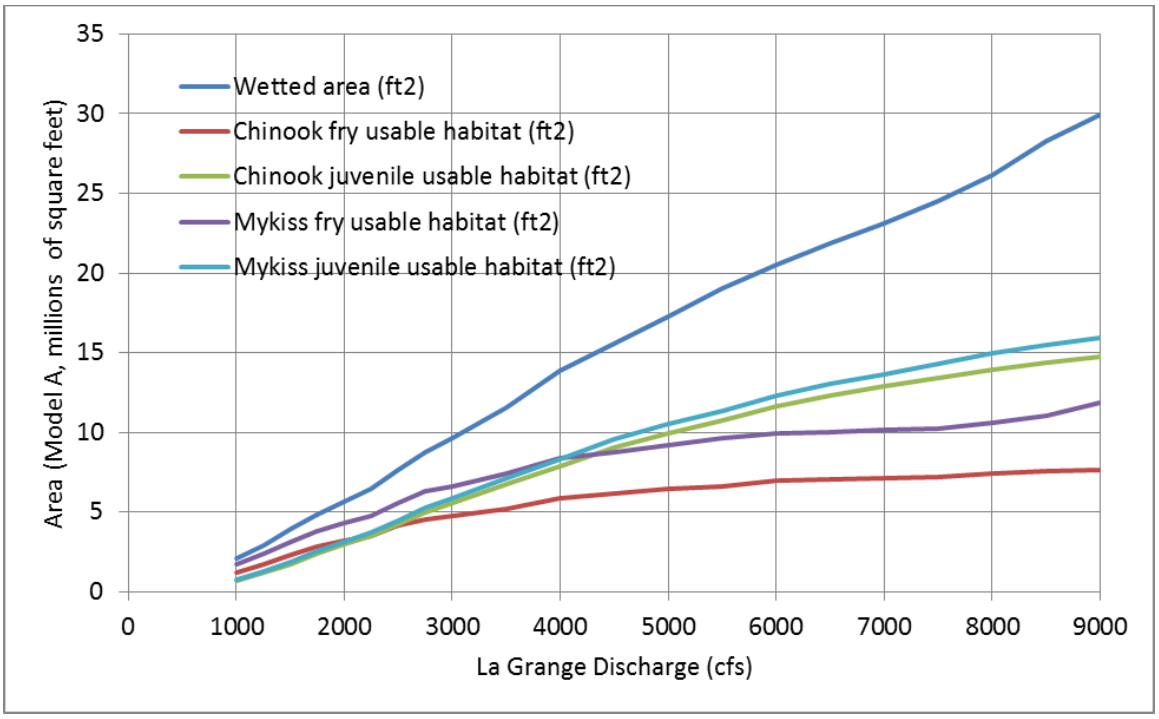

Figure 3.3.2-43. Model A results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 51.7–RM 40) (Source: HDR and Stillwater Sciences, 2017).

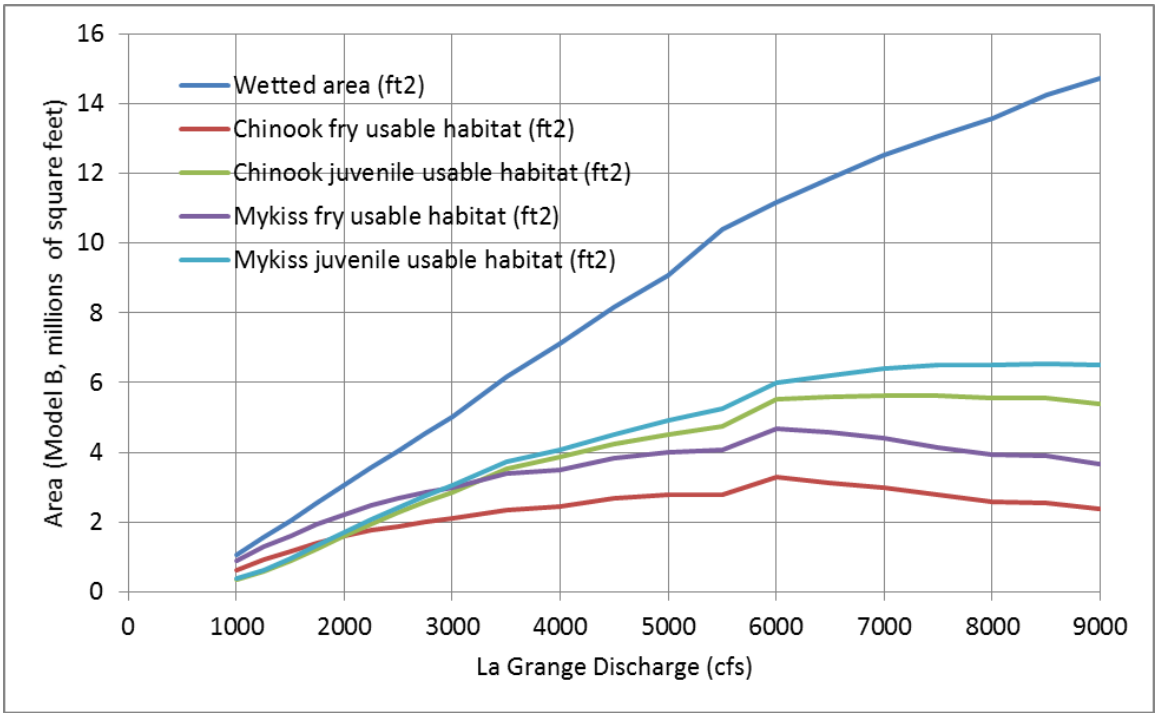

Figure 3.3.2-44. Model B results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 40–RM 21.5) (Source: HDR and Stillwater Sciences, 2017).

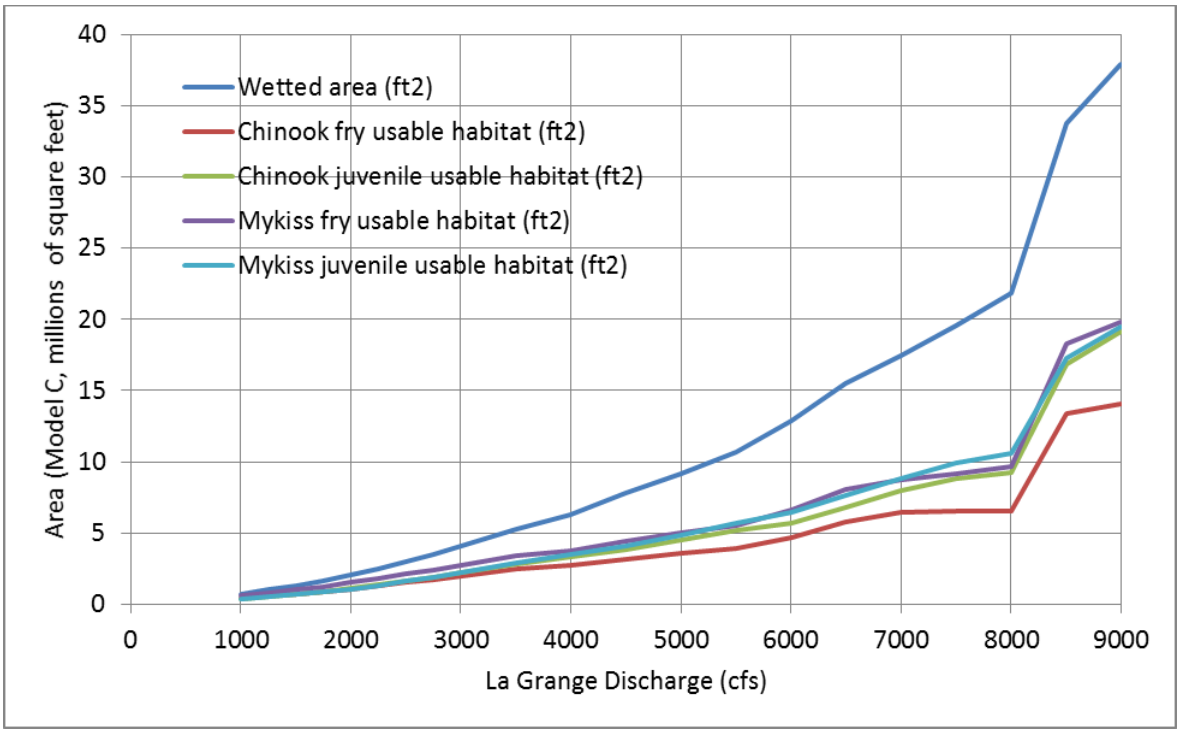

Figure 3.3.2-45. Model C results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 21.5–RM 0.9) (Source: HDR and Stillwater Sciences, 2017).

Based on the above information, flows above bankfull discharge are associated with increases in habitat area for fry and juvenile life stages of lower Tuolumne River salmonids. Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs. Based on flows in the 1971 to 2012 period of record, flows at the La Grange gage greater than 1,500 cfs would occur from February through July in 28 years (or more than 60 percent of the years) under the District's proposed flow regime. Flows exceeding 2,500 cfs would occur in 45 percent of the years in that period. Extended periods of springtime floodplain inundation (e.g., 14 to 21 days) regularly occurs at a 2- to 4-year recurrence interval in the lower Tuolumne River under the base case (water years 1971–2012) hydrology. In addition, in spill years, as part of their agreement with FWS revised 10(j) recommendation 2 (the spill management plan), the Districts state that they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions and benefit salmonid floodplain rearing.

Lower Tuolumne River Habitat Improvement Program

On October 1, 2018, FWS filed revised Don Pedro 10(j) recommendation 3,[125] which calls for the development of a Lower Tuolumne River Habitat Improvement Program that would provide funding for planning, designing, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. The Lower Tuolumne River Habitat Improvement Program would be developed by the Districts in coordination with FWS, NMFS, California DFW, and CCSF, and filed with the Commission for approval. The Lower Tuolumne River Habitat Improvement Program would have a total capital fund of $38 million to be funded with four equal distributions of $9.5 million beginning within 6 months of the Commission's approval of the Lower Tuolumne River Habitat Improvement Program implementation plan and being fully funded by the 12th anniversary of license issuance. After the first contribution, additional contributions of $9.5 million would be made by the Districts within 6 months of the 6th, 9th, and 12th anniversaries of license issuance. This recommendation would replace FWS's original Don Pedro 10(j) recommendation 3 (Restore and Enhance Juvenile Salmonid Rearing Habitat in the Lower Tuolumne River) and 10(j) recommendation 4 (Coarse Sediment and Gravel Replacement and Restoration Plan). FWS also states that establishment of the Lower Tuolumne River Habitat Improvement Program would be in lieu of the Districts' proposed hatchery, boulder placement, and hyacinth funding enhancement measures.

On October 17, 2018, the Districts filed a response to the FWS's October 1, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal, and their proposed restoration hatchery, boulder placement, and donations to California Boating and Waterways to aid in hyacinth control are considered withdrawn from their proposal.

[125] In the same filing, FWS also filed revised 10(j) recommendations 2 (Spill Management Plan) and 4 (Creation of Tuolumne Partnership Advisory Committee) for the Don Pedro Project, and withdrew its original 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects. FWS states that this filing resulted from meaningful discussions between FWS and the Districts subsequent to the January 29, 2018, FWS filing of comments in response to the REA notice.

Our Analysis

The purpose of the Lower Tuolumne River Habitat Improvement Program is the development of a long-term habitat restoration strategy to be implemented via an associated capital fund ($38 million) and annual funding ($1 million for operation and maintenance, monitoring, and reporting), for actions that protect and enhance salmonid populations and aquatic habitat in the lower Tuolumne River. The associated fund would support non-flow resource measures that enhance habitat for native salmonid species. The Districts would be responsible for dispersing monies from the Lower Tuolumne River Habitat Improvement Program account, as recommended by TPAC,[126] and would be responsible for executing and implementing contracts for design, permitting, construction, monitoring, and reporting related to the improvement projects.

Types of enhancement projects may include spawning habitat improvements, floodplain habitat improvements, riparian restoration, improved connectivity between the river channel and adjacent floodplains, slough development, improvements to in-channel structural complexity, and LWM installation and replacement. Habitat improvement projects would be prioritized and recommended by TPAC, with the primary beneficiaries of the projects being native salmonid species. The project selection process would follow the Spawning Habitat Integrated Rehabilitation Approach (SHIRA), or another technically rigorous approach approved by TPAC. According to FWS, SHIRA focuses on traditional approaches for improving salmonid spawning and rearing habitat to decrease differences between existing riverbed elevations and adjacent floodplain habitats. Through time, this allows for improvements to instream habitat for salmonids, more frequent activation of existing floodplain habitats at lower flow levels, and potential additional active floodplain reconnection at a much lower cost and with less overall effects on riverine habitats to achieve successful results. SHIRA has been successfully used on several Central Valley watersheds where overall water availability was limiting. Typically, initial work using SHIRA is focused on instream additions of gravel and contouring of existing gravels. Gravel cleaning, as proposed by the Districts, could be a complementary component of efforts to contour and improve existing gravel.

FWS identifies recently implemented restoration projects on the Mokelumne, Merced, Stanislaus, and Yuba Rivers that used the general approach for floodplain reconnection/restoration that could be used on the Tuolumne River. FWS also lists areas adjacent to the lower Tuolumne River that may be suitable for restoration efforts, based on GIS databases, totaling approximately 27 miles of shoreline on the lower Tuolumne

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[126] The TPAC, which would be established pursuant to 10(j) recommendation 4, would guide the implementation of measures provided under 10(j) recommendations 2 (Spill Management Plan) and 3 (the Lower Tuolumne River Habitat Improvement Program). The TPAC would, at a minimum, include the Districts, FWS, and CCSF, but other agencies such as NMFS and California DFW would be invited to participate.

River that are publically owned, are designated as open space, and/or have existing conservation easements.

Overall, the recommended Lower Tuolumne River Habitat Improvement Program overseen by the TPAC appears to be a program that could improve salmonid habitat in the lower Tuolumne River, potentially benefiting anadromous fish populations in the lower river. However, although FWS identifies a range of habitat enhancement projects that could be implemented using the $38 million capital fund and lists potential enhancement sites in the lower 52.5 miles of the river, few specifics are provided as to how the $38 million would be spent, and whether this would mitigate project effects or serve as enhancement. FWS states that the fund could be used for in-channel habitat improvements such as spawning gravel enhancement or addition of LWM, but the focus appears to be on floodplain habitat improvements (see Attachment 1, tables 1 and 2, of the FWS October 1, 2018, filing).

In the previous section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Floodplain Habitat Restoration*, we conclude that additional measures for floodplain habitat restoration are not needed because existing project operations include periods of high flows on a regular basis (2- to 4-year recurrence interval in the 1971 to 2012 period of record) that would sufficiently inundate the floodplain and provide substantial habitat for Chinook salmon and *O. mykiss* fry and juveniles, the two life stages that would benefit the most from additional floodplain habitat. However, in some lower flow years when Don Pedro Reservoir is storing the spring runoff, that operation would reduce downstream flows and the extent of floodplain inundation, adversely affecting salmonid rearing habitat.

To estimate the effect of Don Pedro Reservoir storage during spring runoff under proposed operations,[127] using the output from the Districts' operations model, we estimated the amount of storage (in acre-feet) retained in the months of March and April[128] by subtracting the storage value at the beginning of each month from the storage value at the end of each month. We then estimated the volume of river flow retained, based on the amount of storage retained, and using the relationship of flow versus floodplain inundation in HDR and Stillwater Sciences (2017), estimated the average amount of inundation area that is lost due to reservoir storage. We ran this analysis for five water year types for the period of record, and this analysis is summarized in table 3.3.2-45.

[127] Note that this only estimates the effect of reservoir storage and not for any other consumptive uses.

[128] March and April are important months for fall Chinook rearing and are the months when floodplain inundation typically occurs.

Table 3.3.2-45. Analysis of the effect of Don Pedro Reservoir storage on floodplain inundation in the lower Tuolumne River (Source: staff).

Water Year Type	Average difference in storage (ac-ft)		Average flow retained per day (cfs)		Lost inundation area due to storage (ac) – Total River		Lost inundation area due to storage (ac) – Gravel Reach (RM 51.7 – 40)	
	March	April	March	April	March	April	March	April
Wet	34,096	-5,032	555	0	51	0	26	0
Above Normal	18,799	-6,147	306	0	28	0	14	0
Below Normal	79,358	2,071	1,291	35	148	3	74	1.5
Dry	31,208	-18,733	508	0	47	0	23	0
Critical	14,711	-13,092	239	0	22	0	11	0
Combined (All Water Years)	29,586	-9,078	481	0	44	0	22	0

Our analysis indicates that the greatest effect of reservoir storage occurs in the month of March, when reservoir storage may result in the loss of from 22 acres to 148 acres of floodplain inundation, depending on water year type, with an overall loss of 44 acres for all water year types for the total lower river. The loss of inundated area in the more upstream gravel-bedded reach is about half of the total river loss, which indicates that the overall effect of reservoir storage on potential floodplain rearing habitat in the lower river is not substantial. The overall loss of 44 acres equals 1,916,640 square feet. In table 3.3.2-45, we provide the estimated amount of floodplain inundation and habitat inundation at a range of river flows, with floodplain inundation ranging from 3,872,250 square feet to 82,573,200 square feet at flows of 1,000 cfs and 9,000 cfs, respectively. In comparison, a loss of 1,916,640 square feet (44 acres) would represent about 49 percent of the total inundation at 1,000 cfs and about 2 percent of the total inundation at 9,000 cfs.

Another perspective is that, at an average cost of $146,836 per acre for floodplain reconnection/restoration projects (from FWS October 1, 2018, filing, Attachment 1, table 1), restoring 44 acres of floodplain habitat would cost about $6.5 million, compared to the total Lower Tuolumne River Habitat Improvement Program capital fund of $38 million. The Lower Tuolumne River Habitat Improvement Program capital fund would greatly exceed the cost for restoring our overall estimate of 44 acres of floodplain habitat lost due to reservoir storage, although we understand that the Lower Tuolumne River Habitat Improvement Program may be used for other habitat restoration projects. It is unclear at this time: (1) precisely what habitat restoration projects would be funded,

(2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights to access a property for restoration and maintenance activities for each proposed improvement site, (4) how compliance with the ESA and NHPA would be obtained at each site, and (5) the details on project design and the scope of operation and maintenance activities that would occur at each habitat improvement site to allow the Commission to determine whether the site should be included in the project boundary. Therefore, additional details would need to be provided for the Lower Tuolumne River Habitat Improvement Program to be become a requirement of any license that may be issued.

Fish Stocking

Don Pedro Reservoir offers anglers year-round fishing for cold- and warmwater species and hosts multiple fishing tournaments annually. California DFW stocks trout in Don Pedro Reservoir, while DPRA stocks largemouth bass. Additionally, the Districts estimated recreational use to increase by approximately 67 and 12 percent for Stanislaus and Tuolumne Counties respectively, by 2050 (HDR, 2013d). No known fish stocking has occurred in the reach of the Tuolumne River between the Don Pedro Dam and La Grange Diversion Dam, and no local hatchery supplementation occurs in the reach of river downstream of the La Grange Diversion Dam.

Hatchery-raised fall-run Chinook salmon from other San Joaquin tributary rivers often stray into the Tuolumne River and crossbreed with native Tuolumne River fall-run Chinook salmon. The rate of hatchery-raised fall-run Chinook salmon straying into the Tuolumne River has ranged from 39 to 100 percent in some years, based on otolith samples provided to the Districts by California DFW (Stillwater Sciences, 2016).

To genetically manage the Tuolumne River fisheries, California DFW recommends (10(a) recommendation M7-1) the Districts develop a fisheries genetic management plan for both projects, in consultation with TREG. The plans should include at a minimum: (1) genetic goals and objectives for Chinook salmon, steelhead/rainbow trout, species that would be part of reservoir fish stockings, and other natives fishes of the Tuolumne River including, but not limited to, white sturgeon, Red Hills roach, and Pacific lamprey, and (2) recreation fish stocking plans for project facilities. California DFW further recommends (10(a) recommendation M7-1) that if required by California DFW's 10(a) recommendation M8 (provide for fish protection at project facilities and Section 18 authority for fish passage) or by TREG during development of the recommended fisheries genetic management plan, the Districts should develop a conservation hatchery plan to accompany the fisheries genetic management plan. California DFW's recommended conservation hatchery plan would address: (1) native fish restoration, especially Chinook salmon and steelhead/rainbow trout, (2) genetic and ecological criteria, (3) maximizing genetic and phenotypic (e.g., behavioral life history) diversity, (4) enhancement of natural life history strategies, and (5) minimizing negative impacts to the existing native Tuolumne River salmonid

population. The plan would be intended as a basis for an adaptive management program and any implementation would be based on an adaptive management framework.

California DFW recommends (10(a) recommendation M7-2) that in order to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities, that the Districts assume full responsibility for providing reservoir-based recreation, including angling opportunities, at all project reservoirs that are currently or have historically been stocked by California DFW. Under this recommendation, the Districts would stock at least 35,000 pounds of hatchery salmonids in the project reservoirs for the first 2 years of any new licenses issued for the projects, or until the fisheries genetic management plan is developed and implemented. After which, the Districts would annually fund fish stocking in Don Pedro Reservoir and annually consult with California DFW to establish stocking targets, species compositions, discuss acquisition, and verify completion of the previous year's stocking commitment. The Districts may acquire fish directly from a California DFW-approved hatchery, or reimburse the California DFW, to the extent the department has fish available, for the cost of the stocking.

In their reply comments the Districts state that expanding the goals and objectives of a genetic management plan to other species (i.e., steelhead/rainbow trout, white sturgeon, Red Hills roach, and Pacific lamprey) other than just fall-run Chinook, as recommended by California DFW, is not supported by available information that indicates the reintroduction of spring-run Chinook and steelhead into the upper Tuolumne River above the Don Pedro Project is not feasible.

Our Analysis

Don Pedro Project—California DFW and DPRA have stocked hatchery fish into Don Pedro Reservoir since 1953 and manage the reservoir as a put-and-take fishery for coldwater species and as a year-round fishery for black bass. DPRA has been stocking black bass in the reservoir on an annual basis since the early 1980s, and the reservoir is home to frequent bass fishing tournaments. Specifically, in 2010, 30 different organizations held 45 tournaments in Don Pedro Reservoir. According to DPRA's website, 31 fishing tournaments are scheduled for 2018 in Don Pedro Reservoir, and black bass weighing up to 18.5 pounds have been caught in the reservoir in recent years (DPRA, 2018). California DFW's (10(a) recommendation M7-2) recommendation is intended to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities. However, the fishery in Don Pedro Reservoir offers substantial recreation opportunities, and a need to improve it is unclear, or why the Districts should become responsible for stocking the reservoir.

California DFW's recommended fisheries genetic management plan and conservation hatchery plan does not contain specific details regarding the contents of the plans and its nexus to the Don Pedro Project. Instead, these details would be developed in consultation with resource agencies, after issuance of any license. Consequently, we

cannot evaluate how California DFW's recommendations would specifically address impacts of the Don Pedro Project. As written, California DFW's recommendations appear to be a general research project for the fisheries of the Tuolumne River Basin. Our analysis must focus on potential project-related measures that could benefit Central Valley fall-run Chinook salmon populations and other species by enhancing natural in-river production, such as an improved flow regime, reduced water temperatures to the extent controllable by the project, and spawning habitat enhancements.

La Grange Project—California DFW states that goal of its 10(a) recommendation M7 is to identify and maintain a diverse and locally adapted fish population in the Tuolumne River, Don Pedro Reservoir and La Grange Reservoir, while the objective of its recommended fisheries genetic management plan is to identify genetic goals for fishes stocked in the Tuolumne River, Don Pedro Reservoir and La Grange Reservoir to ensure that the genetic portfolio of each species is not detrimentally altered by any river or reservoir stocking program. As with the Don Pedro Project, because of the lack of specific details, there appears to be little nexus to the La Grange Project.

Salmonid Monitoring

Any new license for the project would likely include several measures that would alter aquatic and riparian habitat conditions in the Tuolumne River downstream of La Grange Diversion Dam. These altered habitat conditions could affect the distribution and abundance of resident and anadromous salmonids and other aquatic organisms in the Tuolumne River.

NMFS recommends (10(a) recommendation 4) the Districts develop a salmonid monitoring plan within the first year of any new licenses issued for the projects. The plan would cover resident and anadromous salmonids with the option to add green sturgeon to the plan once NMFS has determined their presence in the lower Tuolumne River. Under NMFS's plan, monitoring would include: (1) annual snorkeling, pre-spawning mortality, and carcass surveys in the following reaches (a) downstream of La Grange Diversion Dam to Basso Bridge (RMs 52.0 to 47.5), (b) from Basso Bridge downstream to Roberts Ferry (RMs 47.5 to 39.5), (c) from Roberts Ferry downstream to Santa Fe Bridge (RMs 39.5 to 36.3), and (d) from Santa Fe Bridge to the Tuolumne River's confluence with the San Joaquin River (RMs 36.3 to 0); (2) annual juvenile emergence and outmigration monitoring from at least mid-January through the end of May, using a paired RST at RM 5.3 (Grayson RST) and one at RM 29.8 (Waterford RST); (3) seasonal counting weir at RM 24.5 to estimate Central Valley Chinook salmon and California Central Valley steelhead escapement and provide data on the percentage of females and migration timing; (4) annual otolith analysis to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population; and (5) supervision of all work by California DFW and NMFS field staff in consultation with TRTAC.

FWS recommends (Don Pedro 10(j) recommendation 5) the Districts develop a salmonid monitoring plan in consultation with FWS, NMFS, California DFW, and the

Water Board, within the first 3 years of any new licenses issued for the projects. Under FWS's plan, salmonid monitoring would include at a minimum: (1) measurement of fall-run Chinook salmon escapement by conducting annual carcass surveys, from October 1 through December 31; (2) morphometric measurements of 100 percent of the Chinook salmon carcasses downstream of the existing seasonal fish counting weir at RM 24.5; (3) morphometric measurements of the first 500 Chinook salmon carcasses found upstream of the fish counting weir, plus morphometric measurements of 5 percent of the next 500 to 1,000 Chinook salmon carcasses found upstream of the fish counting weir; (4) annual paired RST surveys from February 1 through June 15 at RM 5.3 (Grayson RST) and at RM 29.8 (Waterford RST); (5) the operation and maintenance of the existing seasonal counting weir at RM 24.5; (6) snorkel surveys prior to each LWM placement action, within the area of the LWM placement and 10 meters upstream and downstream of the placement; two snorkel surveys should occur in the placement area following LWM placement (the first during the second week following placement and the second prior to spring flows returning to minimum instream flows in the calendar year following LWM placement); and (7) annual reporting of the results of salmonid monitoring to FWS, NMFS, and California DFW.

California DFW recommends (10(a) recommendation M11) a similar plan as FWS however, with the provision that if STM Work Group is established by the Water Board, as part of the update to the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, then TREG would work with the STM Work Group, to further the goals and objectives of the California DFW's recommended salmonid monitoring plan.

In their reply comments, the Districts state that they already perform many aspects of the NMFS's recommended program (including snorkeling surveys, RST monitoring, and weir monitoring), propose to continue these measures, and each monitoring measure in the Districts' program has a specific purpose and use for the data obtained, while NMFS does not explain what is to be done with the large amount of data collected and what purpose each measure serves. The Districts also state that NMFS and FWS's recommended annual carcass surveys to estimate spawning and escapement should not be adopted because of the high level of uncertainty in abundance estimates.[129] Regarding NMFS's recommendation for annual pre-spawning mortality surveys, the Districts state that based on California DFW carcass survey data, pre-spawn mortality has not been an issue of concern on the Tuolumne River; however, evaluation of pre-spawn mortality could be incorporated into reduced carcass surveys and should be focused on expanded collection of scales, otoliths, and coded-wire-tags. In response to FWS's Don Pedro 10(j)

[129] The Districts state that comparison of weir counts with Jolly-Seber escapement estimates showed that California DFW underestimated annual abundance by 47 to 69 percent; however, they did not provide a reference to support their statement.

recommendation 5, the Districts state that continued operation of the Tuolumne River weir would provide morphometric measurements of all Chinook salmon passages.

Our Analysis

Fish population monitoring, if conducted, is typically based on the presence, absence, and relative abundance of target species, or on community parameters (such as productivity, density, and diversity), and is usually conducted over multiple years. Once analyzed, monitoring data can be used to verify compliance with specific license requirements or to evaluate ongoing project effects on a resource. However, these data must be robust enough to separate any project effects from non-project effects on the monitored resource.

While the agency-recommended salmonid monitoring measures would provide valuable information on annual anadromous salmonid escapement, pre-spawning mortality, spawning success, juvenile outmigration and abundance, and other parameters, we do not see how this information would specifically relate to project operations or how these data could be used to inform any future changes in these operations. In addition, the resource agencies do not explain what would be done with these data or how it would be used to better manage the resource. Resource management, however, is an agency responsibility and not the Districts.

It is well known that the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the operation of other dams and diversions in the watershed. All of these factors are outside of the Districts control and they should not be held responsible for any impacts to the fishery that may occur outside of the Tuolumne River. Furthermore, the Districts already perform snorkeling surveys, RST monitoring, and weir monitoring (as a component of the 1995 Settlement Agreement), and propose to continue these measures under any new licenses issued for the projects.

Aquatic Invasive Species Management

New Zealand mudsnails, quagga mussels, and zebra mussels are invasive aquatic mollusk species that compete for habitat and food resources and have the potential to affect aquatic communities. While these species have not been reported in the Don Pedro Reservoir or the Tuolumne River by the Districts or resource agencies, the New Zealand mudsnail has been documented in the lower Merced River between Crocker-Huffman Diversion Dam (RM 52.0) and the Highway 59 Bridge (RM 42.0). If New Zealand mudsnails became established in the Tuolumne River Watershed, they would pose similar threats as other aquatic invasive species in other areas, including clogging facility pipes and out competing other aquatic macroinvertebrates for food, thereby disrupting ecosystem balances across the food web.

Water hyacinth is an invasive aquatic plant species that spreads rapidly and can displace native aquatic plants. During relicensing studies, the Districts documented water hyacinth throughout the lower Tuolumne River between RM 24.5 and the confluence with the San Joaquin River. Through rapid proliferation, water hyacinths can obstruct navigable waterways, impede drainage, foul hydroelectric generators and pumps, block irrigation canals and impair water quality (California Invasive Plant Council, 2018).

The Districts propose to implement their Aquatic Invasive Species Management Plan (filed on October 11, 2017) that includes: (1) providing information to recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program for invasive mollusks; and (3) routine operation and management activities, including the following BMPs: (a) identifying aquatic invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs.

In its letter filed January 29, 2018, the Water Board (preliminary 401 condition 8) specifies the Districts develop, in consultation with resource agencies, a plan to manage aquatic invasive species, through establishing a framework with specific activities to minimize the spread and impact of aquatic invasive species on native fauna and habitats, and identifying and describing aquatic invasive species currently established within the projects' area, and aquatic invasive species with high potential to become established within the projects' area. The plan specified by the Water Board could include, but is not limited to, the following measures: (1) implement actions to minimize and prevent the introduction and spread of aquatic invasive species into and throughout projects' affected waters, (2) provide education and outreach to ensure public awareness of aquatic invasive species effects and management throughout the projects' affected waters, (3) implement monitoring programs for early detection of aquatic invasive species, (4) ensure all the projects' aquatic invasive species management activities comply with federal and State of California laws, regulations, policies, and management plans, and with Forest Service directives and orders regarding aquatic invasive species, and (5) monitor and minimize the spread of established aquatic invasive species.

California DFW recommends (10(a) recommendation M10) the Districts implement the revised Aquatic Invasive Species Management Plan filed with their recommendation. California DFW's revised plan would address the same species as the Districts' plan, but would also address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. Many of California DFW's recommended provisions are either similar to or slightly modified from provisions in the Districts' plan, and include: (1) educating the public with respect to aquatic invasive species with the potential to invade project waters, (2) meeting or exceeding the requirements of the

California Fish and Game Code § 2302[130] with respect to dreissenid mussels, (3) incorporating aquatic invasive species prevention in all project activities, (4) continuing to collaborate with other regional and state-wide efforts, (5) reporting incidental observations, (6) implementing the North Central Valley Consortium's Quagga and Zebra Mussel Prevention Plan, and (7) developing BMPs for individual project activities that have the potential to introduce aquatic invasive species into a project reservoir. California DFW's revised plan also includes provisions for annual consultation between the Districts, California DFW, and BLM to ensure that the goals and objectives of the plan are met, the proposed measures are implemented, and for review, update, and/or revisions to the plan as needed, when changes to the existing conditions regarding aquatic invasive species have occurred.

BLM Don Pedro revised 4(e) condition 6 specifies that, following consultation with BLM, the Districts should file a BLM-approved aquatic invasive species management plan within 1 year of any new license issued for the project. BLM provided an approved plan with its preliminary condition. The plan provided by BLM contains the same provision as listed previously in California DFW's plan, and addresses the same invasive species. However, in BLM's plan, all invasive plant species would be addressed in the TRMP specified by BLM's Don Pedro revised 4(e) condition 7. Park Service 10(a) recommendation 3 recommends conducting any measures to remove water hyacinth that would render the river non-navigable well before the summer recreational flow season. In their reply comments, the Districts state that in response to California DFW's recommendation to educate the public with respect to aquatic invasive species, they agree to draft a modified Aquatic Invasive Species Plan to include information provided by California DFW.

Our Analysis

Don Pedro Project—Don Pedro Reservoir provides many angling opportunities (40 to 80 fishing derbies annually), and consequently, provides frequent opportunities for boats and trailers to transfer aquatic invasive species into the reservoir. Educating the public on ways to reduce the spread of invasive species, by providing signage and

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[130] Section 2302 of the California Fish and Game Code requires any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir, as defined in section 6004.5 of the Water Code, where recreational, boating, or fishing activities are permitted, except a privately owned reservoir that is not open to the public, to assess the vulnerability of the reservoir for the introduction of non-native dreissenid mussel species and develop and implement a program designed to prevent the introduction of non-native dreissenid mussel species. If recreational, boating, or fishing activities are not permitted, the managing entity shall, based on its available resources and staffing, include visual monitoring for the presence of mussels as part of its routine field activities.

information pamphlets at boat launches around Don Pedro Reservoir and at canoe take-outs and put-ins along the Tuolumne River as well as relevant information and boater self-inspection forms on project recreational facility websites, as proposed by the Districts and recommended by the Water Board, BLM, and California DFW would help minimize the risk of transporting invasive species from infected waterbodies.

The Districts propose and resource agencies recommend similar BMPs for individual project activities, including maintenance activities performed by the Districts or its contractors. Both California DFW's and BLM's recommended plans, however, state that if aquatic invasive species are found within Don Pedro Reservoir, the default action to be taken by the Districts should be to implement access restrictions and consult with the appropriate agencies. California DFW also recommends annual employee training. The BMPs proposed by the Districts and recommended by the resource agencies would help minimize the introduction and potential spread of invasive species, particularly during project activities at the Don Pedro Project where aquatic invasive species management may not be the primary objective. Additionally, including access restrictions and consultations with the appropriate agencies as a default action to be taken if aquatic invasive species are discovered, as recommended by California DFW and specified by BLM, would minimize the potential spread of any discovered species compared to not having a default action. Including annual employee training to identify aquatic invasive species would increase the potential for incidental observations of non-native species.

Early detection is a critical component in effectively managing the spread of invasive species and routine monitoring as recommended by California DFW and specified by the Water Board and BLM, would provide a means for early detection. As mentioned previously, invasive mollusks have not been reported by the Districts or resource agencies in Don Pedro or La Grange Reservoirs or the Tuolumne River, and the nearest occurrence of invasive mollusks are New Zealand mudsnails documented in the lower Merced River. Recording incidental observations of non-native species during project activities in Don Pedro Reservoir and in stream reaches regulated by the Don Pedro Project, and immediately (within 24 hours) reporting any observations to California DFW, and if observed on federal lands, to BLM, would help to provide a means for effectively managing invasive mollusks.

The Districts consider the overall vulnerability of Don Pedro Reservoir to the introduction of dreissenid mussels to be low, based on Cohen's (2008) ranking of sites on the Tuolumne River upstream of Don Pedro Dam and downstream of La Grange Diversion Dam as "not vulnerable to colonization" by zebra mussel and quagga mussel due to low calcium concentrations. The Districts' proposed plan includes a provision to reassess the vulnerability of Don Pedro Reservoir and to develop appropriate additional program modifications, if significant new information becomes available that changes current understandings on the water chemistry thresholds that support non-native dreissenid mussel species. Because calcium samples analyzed in Cohen (2008) from the Tuolumne River at Modesto were within the lower tolerable range for zebra mussels

(13 mg/L), the Districts' provision would allow the Districts to maintain an accurate understanding of the vulnerability of the Don Pedro Reservoir to dreissenid mussel establishment. Both California DFW's and BLM's recommended plans are intended to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil, in addition to the dreissenid mussels and New Zealand mudsnail addressed by the Districts' proposed plan. Asian clam, like the New Zealand mudsnail have not been documented in the Tuolumne River, but have been observed in the lower Merced River. Re-assessing project waters vulnerability, early detection, applying BMPs, and public educational information on Asian clams would provide appropriate management of aquatic invasive species for the Don Pedro Project.

La Grange Project—No existing recreational facilities are located along the reach of the Tuolumne River between Don Pedro Dam and the La Grange Diversion Dam that would act to draw recreationists that could spread invasive species, but the Districts propose to construct a footpath to improve access to La Grange Reservoir. Boating above La Grange Diversion Dam is made difficult by the lack of access sites, infeasibility of portage at the spillway because the dam's abutments are vertical canyon walls, and the design of the spillway spanning directly between the two Districts' canal intakes, which creates hazardous conditions for boating. However, multiple recreational boating and kayaking opportunities are available downstream of La Grange Diversion Dam. Similar to managing aquatic invasive species at the Don Pedro Project, educating the public on ways to reduce the spread of invasive species, by providing signage and information pamphlets at canoe take-outs and put-ins along the Tuolumne River, as well as relevant information and boater self-inspection forms on project recreational facility websites, as proposed by the Districts for the Don Pedro Project, and as specified by the Water Board and recommended by California DFW for the La Grange Project, would help minimize the risk of transporting invasive species from infected waterbodies.

Applying similar BMPs as discussed previously for the Don Pedro Project, to individual La Grange Project activities, including access restrictions and consultation with the appropriate agencies as a default action to be taken if aquatic invasive species are discovered, as recommended by California DFW, would minimize the potential spread of any discovered species. Including annual employee training to identify aquatic invasive species would increase the potential for incidental observations of non-native species. Similar to the Don Pedro Project, recording incidental observations of non-native species during La Grange Project activities and immediately (within 24 hours) reporting any observations to California DFW, and if observed on federal lands, to BLM, would help to provide a means for effectively managing invasive mollusks. California DFW's recommended plan is intended to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil, in addition to the dreissenid mussels and New Zealand mudsnail. Asian clam, like the New Zealand mudsnail have not been documented in the Tuolumne River, but have been observed in the lower Merced River. Early detection, applying BMPs, and public educational information on Asian clams would provide appropriate management of aquatic invasive species for the La Grange Project.

3.3.2.3 Cumulative Effects

Water Quantity

Hydroelectric project operation and diversions for consumptive uses have historically affected streamflows and water levels in the Tuolumne River Basin. Upstream of the Don Pedro Project, non-project inter-basin water transfers from the Tuolumne River to the San Francisco Bay Area reduce the volume of water that enters Don Pedro Reservoir and is subsequently available for release to the portions of the Tuolumne River below the Don Pedro Project. The largest inter-basin water diversions occur from CCSF's O'Shaughnessy Dam which impounds the 360,400 acre-foot Hetch Hetchy Reservoir. The Hetch Hetchy System delivers an average of 265,000 acre-feet of water each year, providing 85 percent of CCSF's Bay Area municipal and industrial water supply. CCSF also owns and operates Early Intake Diversion Dam, which is used to divert water supplied by CCSF's Cherry Creek facilities during emergency and extreme drought conditions.

The Districts divert flows from the Tuolumne River, at the La Grange Project, for irrigation and municipal and industrial water supply purposes. The Districts' proposed changes in minimum flows and the continued intrabasin water transfers from the Tuolumne River associated with project operation would influence the timing and volume of the water that enters the La Grange Reservoir and is subsequently available for release to the lower Tuolumne River downstream of La Grange Diversion Dam. The Corps also affects the timing of flow releases from the Don Pedro Project through its flood control regulations. Storage provided by project and non-project storage reservoirs buffers the flow regime in the Tuolumne River by storing runoff during high flow periods and releasing the stored water over longer periods.

One of the Districts' primary purposes is to provide a reliable water supply to its members. During the irrigation season, which typically extends from March through October, diversions from the Tuolumne River into water supply canals typically average 920,000 acre-feet per year. The Districts' proposal to shift the supply of up to 225 cfs to the infiltration galleries between June 1 and October 15 would result in higher flows in the 26-mile-long reach from between the La Grange Powerhouse and the infiltration galleries. Although environmental flow measures and power operations are likely to remain similar over the duration of the project license, non-project consumptive water demand (agriculture, municipal, and industrial) is projected to increase during this same period. Increases in water demand and the exercise of water rights to meet that demand could contribute to lower minimum flows being implemented when the proposed drought management plan is triggered, particularly sequential during warm, dry water years.

The magnitude and timing of flows in the southern delta are determined by the factors discussed above; withdrawals and storage of water from the San Joaquin River and its tributaries; and operation of the State Water Project (SWP) and the federal Central Valley Project. Historically and currently, these facilities withdraw up to about

15,000 cfs from the south delta near Tracy, which results in water flowing upstream, referred to as reverse flows, in the south delta.[131] The WaterFix Project, which was approved by California DWR on July 21, 2017, includes installing three intakes to withdraw up to a total of 9,000 cfs from the Sacramento River between Clarksburg and Courtland instead of obtaining the entire water supply solely from the south delta pumps. Specific operation protocols for the use of these new northern intakes and the south delta pumps will be based on a decision-tree process developed to protect Bay Delta Conservation Plan-covered fish species (California DWR and Reclamation, 2016).[132] Shifting water supply from the south delta pumps to the new intakes on the Sacramento River will reduce reverse flows in the south delta.

Water Quality

Results of the Districts' water temperature modeling indicate that CCSF's operation of the Hetch Hetchy Project reduces Tuolumne River average 7DADM temperature in the summer by as much as 7ºC resulting in less frequent exceedance of 20ºC, and increases average 7DADMs by up to about 3ºC in mid-fall to early summer (Districts, 2017a).[133] In addition, CCSF's peaking operation of the Dion Holm Powerhouse located at RM 0.6 on Cherry Creek results in daily temperature fluctuations of up to about 10ºC in lower Cherry Creek and the Tuolumne River just below the confluence with Cherry Creek at about RM 103.7 (Watercourse Engineering, 2017). These fluctuations become smaller as water flows down to Don Pedro Reservoir. These effects in combination with the Districts' operation of the projects generally reduces 7DADMs just below Don Pedro Dam by more than 5ºC in mid-June through late October, increases 7DADMs just below Don Pedro Dam by about 5ºC in early January, and shifts the timing of maximum 7DADMs between RM 46 and the confluence with the San Joaquin River from early September to mid-July (Districts, 2017a). These cooling and warming effects diminish with distance downstream of the projects primarily because

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[131] The Central Valley Project's Jones Pumping Plant includes 6 pumps with a total capacity of 4,600 cfs, and the SWP's Banks Pumping Plant includes 11 pumps with a total nominal capacity of 10,300 cfs.

[132] Bay Delta Conservation Plan-covered fish species consist of delta smelt, longfin smelt, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley fall and late fall-run Chinook salmon, Central Valley steelhead, Sacramento splittail, green sturgeon, white sturgeon, Pacific lamprey, and river lamprey.

[133] For example, simulated average 7DADMs below Indian Creek (at about RM 88) without CCSF's dams exceed 20ºC from early July through September and reach a high of about 25ºC, but with the dams only exceed 20ºC for a total of about one month in the summer and reach a high of about 21ºC (Districts, 2017a).

of the non-project effects, including ambient meteorology, non-project diversions, and inflows from agricultural returns, Dry Creek, and groundwater. Regardless of which of the proposed or recommended operations occur, these general patterns would continue to occur in the lower Tuolumne River because thermal stratification of Don Pedro Reservoir would remain nearly the same. Temperature in the lower San Joaquin River and south delta is primarily determined by the magnitude and temperature of inflows from the upper San Joaquin River and its primary tributaries and flow patterns in the south delta. The higher flows that the Water Board is currently considering for the lower San Joaquin River's primary tributaries, including the Tuolumne River, would result in cooler spring temperatures that would benefit Chinook salmon, steelhead, and other native fish species (Water Board, 2018b).

The projects do not measurably contribute to the salinity in the Tuolumne River, but agricultural returns and groundwater inflows increase salinity as water flows downstream, particularly during low instream flows (Water Board, 2018b).[134] Nonetheless, Tuolumne River near the confluence with the San Joaquin River generally has lower salinity than the upper San Joaquin River. Therefore, inflow from the Tuolumne River, as well as inflow from the Merced and Stanislaus Rivers, tends to lower salinity in the San Joaquin River. When flows in the San Joaquin River at Vernalis are lower than the 1995 Bay-Delta Plan requires, the Bureau of Reclamation supplements flows up to the minimum with releases from New Melones Reservoir on the Stanislaus River, which further reduces salinity. However, high-salinity inflows from agricultural returns, groundwater, and wastewater increase salinity. Tides also influence salinity in the delta. The Water Board is currently considering changing the required approach to meeting required minimum flows at Vernalis and reducing salinity in the south delta by requiring that hydroelectric projects on the Tuolumne, Merced, and Stanislaus Rivers provide February–June instream flows based on unaltered flows (Water Board, 2018b). Any increase in inflows from the Tuolumne, Merced, and Stanislaus Rivers would result in lower salinity in the San Joaquin River. Evaluation of all model scenarios considered in this EIS indicates that the change in February–June average flows in the Tuolumne River at RM 25.5 would range from virtually unchanged for the Districts' two proposals to an increase of 60 percent for ECHO's recommended operations (based on District model simulations in Districts, 2018b,c). Therefore, the Districts' proposed operations would not measurably affect salinity at Vernalis, and ECHO's recommended operations would reduce salinity the most of any of the simulated operations. In addition, the WaterFix Project would reduce salinity in the south delta by reducing reverse flows, as discussed above.

[134] This discussion is primarily based on using electrical conductivity as a surrogate for salinity.

Fisheries Resources

Tuolumne River Basin

Mining-related effects on aquatic habitat in and along the mainstem of the Tuolumne River began with the California Gold Rush in 1848. The major mining camps of Sonora, Columbia, and Jacksonville were founded in 1848 and 1849. A historical timeline of mining activities in the San Joaquin River's tributaries, including the Tuolumne River, includes placer mining (1848–1880), hydraulic mining in the La Grange vicinity (1871 to about 1900), dredge mining (1908–1942 and 1945–1951), and gravel and aggregate mining (1940s to present). Decades of dredge mining in the main channel of the Tuolumne River resulted in the excavation of channel and floodplain sediments, which has left a legacy of significant Tuolumne River channel modifications and shoreline dredger tailing deposits between RM 50.5 and 38.0.

After the Gold Rush, crop production and ranching substantially increased in the Central Valley. During this period, woody vegetation along the Tuolumne River was cleared to allow for crop production in the alluvial soils of the bottomlands. Engineers constructed levees to protect the new farmlands from flooding in spring and built irrigation canals to provide water during the growing season. Of the estimated 4 million acres of wetland that occurred historically in the Central Valley, only about 300,000 acres remained in 1990. The conversion of wetlands to agricultural uses accounts for much of the reduction in wetland area. Primary existing agricultural land uses along the gravel-bedded reach include orchards, row crops, and livestock grazing.

Timber harvest operations existed throughout the Sierra Nevada since the mid-1800s. However, the subsequent Gold Rush of 1849 fueled a human migration into California that resulted in dramatic increases in the demand for timber. The indirect effects of gold mining included steamship transportation along the major rivers of the Central Valley, fueled by cordwood harvested from adjacent lands, and likely resulted in the first wave of riparian forest clearing in some areas of the Tuolumne River Basin. More recently, timber harvest in the Tuolumne River Watershed has typically been limited to lands in the upper basin. Large forest fires in 1987 and 2013 also consumed a substantial amount of timber in the upper Tuolumne River Basin.

Privately owned land in the lower Tuolumne River Watershed is also used for rural residential purposes or for denser residential, municipal, and industrial purposes in communities such as Waterford and Modesto. Many miles of river bank have been leveed and stabilized with riprap by agencies or landowners. Levees and bank revetment extend along portions of the river bank from near Modesto (RM 16) downstream to the San Joaquin River. Following the 1997 flood, some subdivisions that had been inundated in the Modesto area were found to have been constructed within the Federal Emergency Management Agency floodplain area designated prior to 1997.

The first dam built on the Tuolumne River—Wheaton Dam—was constructed in 1871 near the current location of La Grange Diversion Dam at approximately RM 52.2.

Since the late-1800s, several additional dams have been constructed on the main stem of the Tuolumne River and its tributaries; some of them are used for water storage and others are primarily diversion dams.

Completed in 1893, the La Grange Project receives flow from the Tuolumne River and regulates flows to the lower Tuolumne River downstream of La Grange Diversion Dam. The Districts divert flows from the Tuolumne River at the La Grange Project for irrigation and municipal and industrial water supply purposes.

In 1923, Turlock and Modesto Irrigation Districts joined forces to build the first Don Pedro Dam. The dam held just enough water to accommodate growers' irrigation needs for a single growing season. To get through consecutive dry years, which happens often in TID territory, the Districts needed a dam large enough to store enough water for the demands of multiple irrigation seasons. When the original Don Pedro Dam was finished, the 284-foot-high arched dam was the highest in the world and had a maximum storage of 289,000 acre-feet, which expanded the Districts' irrigation season beyond just the spring runoff season.

Construction of the new Don Pedro Dam began in 1967 and was completed in 1971. By constructing the new Don Pedro Dam, power plant, and related facilities, the Districts firmed up water supplies for their districts, increased capacity to generate hydroelectric power, and provided recreation opportunities and flood control in the Tuolumne River Basin.

CCSF's Hetch Hetchy Water and Power Division maintains and operates several reservoirs in the middle-elevation band of the Tuolumne River Watershed upstream of the Don Pedro Project, including CCSF's Cherry Lake (elevation 4,700 feet), Lake Eleanor (elevation 4,660 feet), and Hetch Hetchy Reservoir (elevation 3,800 feet). These projects provide storage for water supply and also generate hydroelectric energy. CCSF stores and diverts water from the upper Tuolumne River for use outside the Tuolumne River Basin. The Don Pedro Project also contributes substantially to the water supplies of the City of Modesto (population: 210,000) and 2.6 million people in the San Francisco Bay Area. The CCSF contributed financially to the construction of the Don Pedro Project in exchange for water banking privileges that benefit CCSF's Bay Area water customers. The Hetch Hetchy System includes the San Joaquin Pipeline, which transports about 85 percent of CCSF's total water supply.

In addition to these dams and diversions, four wastewater treatment plants contribute a little over 19 percent of the total phosphorus to the Don Pedro Reservoir. Urban runoff to the lower Tuolumne River from the Modesto area has been shown to contain pesticides.

Fish hatchery practices and non-native fish introductions have altered the fish assemblage in the Tuolumne River Basin. Currently, California DFW manages the Don Pedro Reservoir salmonid fishery as a put-and-grow resource with substantial stocking of kokanee and rainbow trout. Don Pedro Reservoir is also managed as a year-round fishery

for black bass. Starting in 2014, triploid (sterile) Chinook salmon from the Iron Gate Hatchery/Silverado Fisheries Base have been stocked in Don Pedro Reservoir. The reaches of the main stem of the Tuolumne River below Yosemite National Park are stocked by California DFW with triploid (sterile) rainbow trout and triploid brown trout raised at the Moccasin Creek Hatchery. California DFW stocks rainbow trout and Eagle Lake trout in the North Fork, Middle Fork, and South Fork of the Tuolumne River. Largemouth, smallmouth, and spotted bass were all introduced into California waters by California DFW and are now actively managed by California DFW in many locations. All three species of bass can be highly piscivorous and prey heavily on salmonids and other fish species.

San Joaquin River and Sacramento-San Joaquin Delta

Downstream of the Tuolumne River Basin, the San Joaquin River flows northward and enters the legally defined Delta near the USGS Vernalis gaging station (RM 73). The three main tributaries to the San Joaquin River upstream from the USGS Vernalis gaging station are the Merced, Tuolumne, and Stanislaus Rivers. Under historical conditions, the south Delta and lower San Joaquin River were composed of tidal wetlands merging southward into floodplain wetlands interspersed with complex side-channel habitats, lakes, and ponds with seasonal wetlands bordering upland habitats.

Beginning in the 1850s, the construction of levees around the San Joaquin River and Delta facilitated the conversion of lands to agricultural and other human uses. Combined with the straightening, widening, and dredging of channels, levee construction increased shipping access to the Central Valley and increased the ability to control water conveyance and prevent flooding. Currently, the Delta is a highly engineered environment, composed of 57 leveed island tracts and 700 miles of sloughs and winding channels. More than 1,100 miles of levees protect 738,000 acres of Delta islands, tracts, and population centers from flooding and safeguard a large portion of California's water supply.

Agriculture is the primary land use along the lower San Joaquin River from its confluence with the Tuolumne River to the USGS Vernalis gaging station; uses include fruit and nut orchards, field crops, crops of vegetables, seed and other row crops, vineyards, and pastures. The Delta's combination of highly productive soils, a climate conducive to agriculture, and readily available high-quality irrigation water support a broad range of agriculture, including high-value crops. Delta agricultural production relies heavily on irrigation because low rainfall occurs during most of the growing season. Generally, irrigation water is diverted directly from Delta waterways and transported to agricultural lands via canals. In some cases, water is pumped directly into field furrows. Irrigation and drainage canals are operated and maintained in the Delta by reclamation districts, irrigation districts, and water agencies. Some of the agricultural surface water diversions are screened to protect fish, but many are not.

No incorporated cities are located along the lower San Joaquin River from its confluence with the Merced River to Vernalis. Rural residential use is typically the only type of development, and much of the population resides in surrounding cities. There is little infrastructure along the lower San Joaquin River aside from that which supports agriculture and rural residential development. The Delta, on the other hand, contains much infrastructure of statewide importance, including transportation and power transmission facilities.

Currently, more than 80 dams are located on the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers, and these dams have a total storage capacity of greater than 7.7 million acre-feet. Combined, these facilities have the capacity to capture and control the entire average annual yield of the rivers they dam for the primary purposes of water supply, flood control, and hydroelectric power generation. The relatively large flows from the eastside tributaries (i.e., the Merced, Tuolumne, and Stanislaus Rivers), emanating from the Sierra Nevada Mountains, strongly influence flow and water quality in the mainstem San Joaquin River. The low-elevation west side tributaries are ephemeral, so water entering the San Joaquin River from the west side of the basin consists largely of agricultural return flows, which strongly influences the quality of water in the river.

The Central Valley Project, a complex, multi-purpose network of dams, reservoirs, canals, hydroelectric power plants and other facilities, is the largest water supply project in the United States. It includes 18 reservoirs with a combined storage capacity of more than 11 million acre-feet, 11 hydroelectric power plants, and more than 500 miles of major canals and aqueducts. Five Central Valley Project divisions/units are located south of the Delta in the San Joaquin River Basin—the Friant Division, the Hidden and Buchanan Units, the New Melones Unit, the San Luis Unit, and the San Felipe Division. Section 4.1.3.2 of the Districts' amended final license application for the Don Pedro Project describes these divisions/units and their effects on water resources in detail.

The State Water Project is a complex system composed of pumping plants, hydroelectric power plants, water storage facilities with a combined capacity of approximately 5.8 million acre-feet, and approximately 700 miles of pipelines and canals. It is the largest state-built water storage and conveyance project in the United States. California DWR operates and maintains the State Water Project, which delivers water to 29 agricultural and municipal and industrial contractors in northern California, the San Joaquin Valley, the Bay Area, the Central Coast, and southern California. The State Water Project facilities south of the Delta in the San Joaquin River Basin include the following: (1) the San Luis Area, which includes the Gianelli Pumping-Generating Plant and the Dos Amigos Pumping Plant; (2) the Coastal Branch Area, which consists of the Devil's Den, Bluestone, and Polonio Pass pumping plants and the Las Perillas and Badger Hill pumping plants; (3) the South San Joaquin Area, which includes the Buena Vista, Teerink and Chrisman, and Edmonston pumping plants; (4) the West Branch Area, which includes the Oso and Alamo pumping plants and the Warne and Castaic power plants; and (5) the East Branch Area, which includes Lake Perris, the Pearblossom

Pumping Plants, and the Mojave and Devil Canyon power plants. Section 4.1.3.2 of the Districts' amended final license application for the Don Pedro Project presents a detailed description of these facilities.

Near the city of Stockton, the lower San Joaquin River flows into the Delta's 78-mile-long Deep Water Ship Channel. The Deep Water Ship Channel, which was first dredged in the 1930s, terminates at the Deep Water Turning Basin adjacent to the Stockton Port. The channel serves as a shipping corridor for cargo ships traveling from San Francisco Bay to the Stockton Port. Periods of low DO concentrations have historically been observed in the Deep Water Ship Channel; the majority of these low DO periods have occurred during summer and fall upstream of Turner Cut. In January 1998, the Water Board adopted the CWA Section 303(d) list that identified this DO impairment, and the Central Valley Regional Water Quality Control Board initiated development of a TMDL to identify factors contributing to the DO impairment and assign responsibility for correcting the low DO problem. Since the approval of the San Joaquin River DO TMDL Basin Plan Amendment in 2005, two actions have been implemented to alleviate low DO conditions in the Deep Water Ship Channel: (1) the City of Stockton added engineered wetlands and two nitrifying bio-towers to the Stockton Regional Wastewater Control Facility to reduce ammonia discharges to the San Joaquin River, and (2) the California DWR constructed the Demonstration Dissolved Oxygen Aeration Facility (Aeration Facility) at Rough and Ready Island to evaluate its applicability for improving DO conditions in the Deep Water Ship Channel.

Recreational use is a critical asset to the San Joaquin River Watershed and Delta region. Along the San Joaquin River and Delta waterways and on Delta islands, activities include picnicking, swimming, fishing, boating, waterskiing, nature study, sightseeing, horseback riding, tent and RV camping, biking, hunting, and hiking. The 7,000-acre San Joaquin River National Wildlife Refuge supports a mix of habitats that provide excellent conditions for wildlife and plant diversity. Visitor activities at the refuge include wildlife viewing, interpretation and environmental education, and photography. Formal fishing access and hunting opportunities are generally available in publicly owned parks or wildlife areas. Along some waterways, particularly along the Deep Water Ship Channel, there are sandy beaches that are heavily used by boaters.

During the twentieth century, fish hatcheries were constructed throughout California to supplement declining native anadromous fish populations. Fish are reared and released for recreational fishing, commercial harvest, conservation and restoration of native fish species, mitigation for habitat losses caused by development, and mitigation for fish lost at pumping facilities in the Delta. Annual production of salmon and steelhead in California hatcheries approaches 50 million juveniles. During most years, over 32 million fall-run Chinook salmon are produced at five hatcheries in the Central Valley, and nearly 9 million are produced at two hatcheries in the Klamath-Trinity River basin. California DFW currently stocks trout in high mountain lakes, low elevation reservoirs, and various streams and creeks. Salmon and steelhead have been stocked primarily in rivers, including direct tributaries to the Pacific Ocean. California DFW

operates four hatcheries in the San Joaquin River basin: (1) the San Joaquin Hatchery in the town of Friant, (2) the Merced River Hatchery in the town of Snelling, (3) the Mokelumne River Hatchery in the town of Clements, and (4) the Moccasin Creek Hatchery on Moccasin Creek. Currently, only steelhead and Chinook salmon are released by California DFW into the lower San Joaquin, lower Merced, lower Mokelumne, and lower Tuolumne Rivers. The San Joaquin River Restoration Program released juvenile Central Valley spring-run Chinook salmon into the San Joaquin River annually during 2014–2016.

Introduction of non-native species has resulted in large changes in the fish community structure of the Central Valley. Current fish communities in the lower reaches of the San Joaquin River tributaries and Delta are dominated by non-native taxa. Over 200 non-native species have been introduced in the Delta and become naturalized, including many fish (e.g., smallmouth bass, largemouth bass, and striped bass) that prey on juvenile salmonids. According to Grossman et al. (2013), juvenile salmon are clearly consumed by fish predators in the San Joaquin River system and several studies indicate that the population of predators is large enough to effectively consume all juvenile salmon production. However, given extensive flow modification, altered habitat conditions, native and non-native fish and avian predators, temperature and DO limitations, and overall reduction in historical salmon population size, it is not clear what proportion of juvenile mortality can be directly attributed to fish predation. Fish predation may serve as the proximate mechanism of mortality in a large proportion of the population but the ultimate causes of mortality and declines in productivity are less clear. California DFW continues to manage some non-native fish species for recreational angling, such as black bass, striped bass, sunfish and crappie, and catfish and bullhead.

Aquatic Resources Management and Recovery Activities in the Central Valley

There are numerous programs and efforts in the San Joaquin River Basin and Delta that have been completed, are currently underway, or are planned for the foreseeable future. These programs are likely to result in the establishment of new environmental mandates such as streamflow requirements, aquatic habitat restoration measures, and fish protection and recovery objectives. Cumulatively, these requirements could have effects on aquatic resources and threatened and endangered species in the Tuolumne River, lower San Joaquin River, and the Delta.

Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead—In 2014, NMFS issued a final Recovery Plan for the endangered Sacramento River winter-run Chinook salmon Evolutionarily Significant Unit (ESU), threatened Central Valley spring-run Chinook salmon ESU, and threatened Central Valley steelhead DPS. Implementation of the recovery plan is intended to improve the viability of these species so they can be removed from federal protection under the ESA. The recovery plan describes the steps, strategies, and actions projected to return the three species to viable status in the Central Valley,

thereby ensuring their long-term (i.e., greater than 100 years) persistence and evolutionary potential. Watershed-specific actions address threats occurring in each of the rivers or creeks that support spawning populations of the ESUs and/or DPS.

San Joaquin River Restoration Program—The San Joaquin River Restoration Program is a direct result of a settlement reached in September 2006 to provide sufficient fish habitat in the San Joaquin River below Friant Dam. Parties to the Settlement include the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority. Federal legislation was passed in March 2009 authorizing Federal agencies to implement the settlement.

The settlement is based on two goals: (1) to restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish, and (2) to reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that could result from the interim flows and restoration flows provided for in the settlement. The San Joaquin River Restoration Program outlines a comprehensive long-term effort to provide flows in the San Joaquin River from Friant Dam to the confluence of the Merced River to restore a self-sustaining spring-run Chinook salmon fishery while reducing or avoiding adverse water supply impacts.

Delta Water Quality Control Planning—On August 16, 1978, the Water Board adopted the 1978 Delta Plan and Decision 1485 (D-1485). The 1978 Delta Plan included water quality objectives intended to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses in the Delta, and fish and wildlife beneficial uses in Suisun Marsh. The 1978 Delta Plan and D-1485 standards were based on the principle that Delta water quality should be at least as good as it would have been had the state and federal water projects not been constructed. The fish and wildlife standards in the 1978 Delta Plan and D-1485 were based on an agreement developed by California DWR, California DFW (then California DFG), the U.S. Bureau of Reclamation, and FWS. It was acknowledged that these standards did not afford a "without-project" level of protection for salmon, but the level of protection was believed to be reasonable until determinations regarding Delta mitigation measures were finalized.

In 1985, some D-1485 standards were amended to modify or omit some monitoring stations in Suisun Marsh and to revise the schedule for implementation of salinity objectives. In May 1991, the Water Board adopted the 1991 Bay-Delta Plan, which superseded water quality objectives in the 1978 Delta Plan and the San Francisco Bay and the Sacramento-San Joaquin Delta regional water quality control plans in instances where the existing plans conflicted with the 1991 Bay-Delta Plan. The 1991 Bay-Delta Plan contained a range of water quality objectives aimed at protecting beneficial uses. These objectives addressed: (1) salinity levels for municipal and industrial intakes, Delta agriculture, water export agriculture, and estuarine fish and wildlife resources, (2) an expanded period of protection for striped bass spawning, and

(3) temperature and DO levels for Delta fisheries. The 1991 Bay-Delta Plan did not include Delta outflow objectives and operational constraints.

In May 1995, the Water Board adopted the 1995 Bay-Delta Plan, which was superseded by the 2006 Bay-Delta Plan, in instances where the 1995 plan conflicted with the 2006 plan. The 2006 Bay-Delta Plan included updates to address what it noted were emerging issues that, because of changing circumstances or increases in scientific understanding, it determined were either unregulated or not fully regulated by preceding plans. The issues noted by the plan included pelagic organism decline (pelagic fishes in the Delta Estuary and Suisun Bay), climate change, Delta and Central Valley salinity, and San Joaquin River flows. The 2006 Bay-Delta Plan included specific objectives related to the following variables: Delta outflow, flows in the Sacramento River at Rio Vista, flows in the San Joaquin River at Vernalis, export limits, Delta cross channel gates operation, and salinity. The plan also identified what it determined to be beneficial uses of the Bay-Delta, water quality objectives for the reasonable protection of those beneficial uses, and a program of implementation for achieving the water quality objectives.

The Water Board released a final proposal to amend the Bay-Delta Plan and released a final substitute environmental document on July 6, 2018, received oral public comments on the topic on August 21 and 22, 2018, and states that its final action will be continued to a future Water Board meeting.[135]

San Joaquin River TMDL Plans—Adoption of TMDLs required under the CWA § 303(d) has the potential to affect stream flows in the San Joaquin River basin. The Water Board has initiated a comprehensive effort to address salinity and nitrate problems in the Central Valley and to adopt long-term solutions that will lead to enhanced water quality and economic sustainability. The Central Valley Salinity Alternatives for Long-Term Sustainability effort is a collaborative basin planning effort aimed at developing a comprehensive salinity and nitrate management program. Additional San Joaquin River flows are being targeted to help dilute saline agricultural return waters and naturally occurring saline waters, pesticides, and other potentially toxic compounds and to reduce temperatures throughout the watershed.

Bay-Delta Conservation Plan—The Bay-Delta Conservation Plan was developed to provide for water supply reliability and recovery of listed species through a Habitat Conservation Plan under federal law, and a Natural Community Conservation Plan under state law. The Bay-Delta Conservation Plan included a wide range of actions related to habitat restoration, protection, and enhancement; water conveyance facilities; water

[135] These documents are available on the Water Board web page, available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2018_sed/.

operations and management; monitoring, assessment, and adaptive management; costs and funding; and governance structure and decision-making.

The Bay-Delta Conservation Plan was developed to address ecological needs of at-risk Delta species, primarily fish, while improving and securing a reliable water supply. The Bay-Delta Conservation Plan was structured to be a comprehensive restoration program, consisting of conservation measures designed to improve the state of natural communities and in so doing improve the overall health of the Delta ecosystem. The Bay-Delta Conservation Plan attempted to balance species conservation with a variety of other important uses in the Delta. A draft of the Bay-Delta Conservation Plan was issued in December, 2013, but was withdrawn and replaced by the California WaterFix and EcoRestore programs (see below).

Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project—On June 4, 2009, NMFS released the Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project. The opinion included a series of alternatives to avoid jeopardy of the continued existence of Central Valley steelhead, among other species, and adverse modification of its designated critical habitat. Among the alternatives identified are significantly higher instream flows in the Stanislaus River, San Joaquin River minimum flow requirements at Vernalis, and Delta export limitations to protect out-migrating anadromous salmonids.

Although the opinion addressed only the combined Central Valley Project and State Water Project operations, it concluded that "the long-term viability of this diversity group [steelhead] will depend not only on implementation of this reasonable and prudent alternative, but also on actions outside this consultation, most significantly increasing flows in the Tuolumne and Merced Rivers."

The California WaterFix—The California WaterFix is a proposal to improve the State Water Project and Central Valley Project freshwater storage and delivery systems, and involves the following primary elements: (1) construction and operation of new water conveyance facilities in the Delta, including three intakes, two tunnels, appurtenant structures, a permanent head of Old River gate, and expansion of the Clifton Court Forebay, (2) coordinated operation and maintenance of existing and new State Water Project and Central Valley Project Delta facilities, (3) resource conservation measures, and (4) a monitoring and adaptive management program. These improvements are being undertaken to help protect California's water supply from the effects of earthquakes, flooding, and rising sea levels; reduce waste of fresh water; and improve habitat for fish and wildlife. On July 21, 2017, California DWR approved the proposed California WaterFix evaluated in the Bay Delta Conservation Plan/California WaterFix Final EIR/EIS.

California EcoRestore—The California Natural Resources Agency is implementing EcoRestore in coordination with other state and federal agencies to contribute to the restoration of at least 30,000 acres of Delta habitat by 2020. The

science-driven objectives will be guided by an adaptive management program to pursue habitat restoration projects with well-defined goals and objectives and the financing needed to successfully implement the projects. Habitat types identified for restoration include tidal wetlands, floodplains, riparian areas, and uplands. Fish passage improvements and other projects are also elements of the program.

Water Board Revised Draft Substitute Environmental Document—The Water Board protects beneficial uses of water in the Bay-Delta via the Bay-Delta Plan. The Water Board is proposing to amend two elements of the Bay-Delta Plan: (1) San Joaquin River flow objectives to protect fish and wildlife, and (2) Southern Delta salinity objectives for the protection of agriculture. On September 15, 2016, the Water Board released for public comment the revised draft substitute environmental document, which provides a description of these proposed amendments and the Water Board's analysis of their potential effects. The flow element of the proposed amendments would, if adopted, require that increased flows remain in the San Joaquin River and its three major tributaries–the Stanislaus, Tuolumne, and Merced Rivers–and would establish flow-related compliance locations on each of these major tributaries, in addition to the current flow compliance point located on the San Joaquin River at Vernalis.

California DFW's Ecosystem Restoration Program—California DFW's Ecosystem Restoration Program is designed to improve the ecological health of the Bay-Delta Watershed through restoring and protecting habitats, ecosystem functions, and native species. The Watershed Program Element specifically works in tandem with the Ecosystem Restoration Program Element to ensure that the ecological health of the Delta is restored and that water management is improved by working with communities at the watershed level.

California Advisory Committee on Salmon and Steelhead Trout—The California Advisory Committee on Salmon and Steelhead Trout was established by California legislation in 1983 to develop a strategy for the conservation and restoration of salmon and steelhead in California. The Central Valley Salmon and Steelhead Restoration and Enhancement Plan was intended to outline California DFW's restoration and enhancement goals for salmon and steelhead resources of the Sacramento River and San Joaquin River systems and to provide direction for various California DFW programs and activities.

The Restoring Central Valley Streams Plan identifies the following goals to benefit anadromous fish: restore and protect California's aquatic ecosystems that support fish and wildlife, protect threatened and endangered species, and incorporate the state legislature's mandate and policy to double the size of populations of anadromous fish in California. The plan encompasses only Central Valley waters accessible to anadromous fish, excluding the Sacramento-San Joaquin Delta. The Steelhead Restoration and Management Plan for California focuses on restoration of native and naturally produced (wild) fish stocks because they have the greatest value for maintaining genetic and biological diversity. Goals for steelhead restoration and management are: (1) increase

natural production, as mandated by The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988, so that steelhead populations are self-sustaining and maintained in good condition, and (2) enhance angling opportunities and non-consumptive uses.

Final Restoration Plan for Anadromous Fish Restoration Program—In addition, the Final Restoration Plan for Anadromous Fish Restoration Program (Yoshiyama et al., 2001) identifies restoration actions that may increase natural production of anadromous fish in the Central Valley of California. This plan is divided to address different watersheds within the Central Valley, and restoration actions are identified for each watershed. It also includes the involved parties, tools, priority rating, and evaluation of each restoration action. The plan addresses only Central Valley waters accessible to anadromous fish.

Tuolumne Wild and Scenic River Management Plan—The Forest Service Tuolumne Wild and Scenic River Management Plan, which was approved in 1986 and revised in 1988, provides "direction for managing the federal lands within the boundaries of the designated corridor." The plan addresses portions of the Tuolumne Wild and Scenic River (29 miles) outside of Yosemite National Park. As directed under the 1995 Settlement Agreement, TRTAC developed a suite of priority habitat restoration projects aimed at improving geomorphic and biological elements of the lower Tuolumne River corridor. These include channel and riparian restoration projects (RM 34.3–RM 40.3), predator isolation projects (RM 25.5–RM 25.9), and sediment management projects (RM 47.5–RM 51.8).

Fish and Aquatic Resources Cumulative Effects Assessment

As described above, the fish and aquatic resources of the Tuolumne River and San Joaquin River downstream to the San Francisco Bay Area are affected by numerous past, present, and potential future anthropogenic actions and background environmental conditions, both within and outside the San Joaquin River Watershed. For example, prior to widespread European settlement, the channel form of the lower Tuolumne River consisted of a combination of single-thread and split channels that migrated and avulsed. The riparian corridor was miles wide in places where the river lacked confinement. More than a century of cumulative impacts have transformed the lower Tuolumne River from a dynamic, alluvial system capable of forming its own bed and bank morphology to a river highly constrained between either man-made dikes or agricultural fields, or constrained by riparian vegetation that has encroached into the low water channel.

Over the past 120 years, dams and diversions have also modified the lower Tuolumne River's flow regime. Analyses of streamflow records from the USGS gaging station at La Grange reveal the following alterations of hydrologic conditions: (1) the magnitude and variability of summer and winter base flows, fall and winter storms, and spring snowmelt runoff have been reduced, and (2) the magnitude, duration, and frequency of winter floods have been reduced. Following completion of the new Don

Pedro Dam in 1971, compliance with Corps flood control and other flow requirements reduced the estimated average annual flood from 18,400 cfs to 6,400 cfs.

Gravel and gold mining, as well as other land uses, adversely affected aquatic habitat prior to the construction of dams on the Tuolumne River. The presence of dams, aggregate extraction, agricultural and urban encroachment, and other land uses, including hydraulic mining practices near La Grange, have resulted in imbalances of sediment supply and transport in the lower Tuolumne River channel. Don Pedro Dam and La Grange Diversion Dam, combined with other dams upstream of the project boundary, trap all coarse sediment and LWM that would otherwise pass downstream. In the lower river, in-channel excavation of bed material to depths well below the river thalweg for gold and aggregate has significantly reduced available spawning habitat, eliminated active floodplains and terraces, and created large in- and off-channel pits that provide favorable habitat for non-native predator species.

Historical clearing of riparian forests in the Tuolumne River Basin modified vegetation and associated habitat, halting many attendant ecosystem processes. Urban and agricultural encroachment and mining have resulted in the direct removal of large tracts of riparian vegetation in the lower Tuolumne River corridor. Livestock selectively graze younger vegetation, which limits the establishment of riparian plants. Clearing woody plant cover has also created openings in the riparian corridor where non-native plant species have become established and proliferated. Flow regulation and sediment trapping associated with upstream dams have also indirectly affected riparian vegetation by modifying the hydrologic and fluvial processes that influence survival and mortality of riparian vegetation.

Furthermore, anadromous fish abundance in the Tuolumne River has been reduced by habitat degradation and extensive instream and floodplain mining beginning in the mid-1800s. Dams and water diversions associated with mining have affected fish migration as early as 1852. Access to historic spawning and rearing habitat was significantly restricted beginning in the 1870s, when a number of dams and irrigation diversion projects were constructed. Wheaton Dam, built in 1871 near the site of the present-day La Grange Diversion Dam, was a barrier to salmon migration. In 1884, 3 years before either District was created, the California Fish and Game Commission reported that the Tuolumne River was “dammed in such a way to prevent the fish from ascending.”

During their upstream migration, Tuolumne River flows may affect homing of Tuolumne River origin Chinook salmon, and could also affect straying of salmonids from other rivers into the Tuolumne River. A lack of spawning gravel and curtailed sediment recruitment, due to in-river and floodplain mining, trapping by upstream dams, and other land uses, also results in density-dependent competition and exclusion from suitable spawning sites.

In addition, because of higher channel gradient, overbank habitats in this reach do not provide the same relative benefits as other river floodplain habitats studied in lowland

portions of the Central Valley. Remnant dredger pits and multiple connected backwaters along the lower Tuolumne River have been identified as areas of potential juvenile Chinook stranding and may actually create favorable habitat for predator species. Because current Don Pedro Project operations do not include power peaking, potential risk of juvenile Chinook salmon and *O. mykiss* stranding and entrapment are low.

Although returning the flow regime in the lower Tuolumne River to a condition that more closely mimics the magnitude, duration, and timing of the unimpaired hydrograph (as recommended by the resource agencies) would provide multiple benefits to aquatic resources, the Districts' proposed flow regime would also improve aquatic habitat conditions downstream of La Grange Diversion Dam compared to existing conditions and continue to meet existing and projected water demands in the region. The Districts' base flows would slightly improve the frequency of meeting suitable water temperatures for Chinook salmon and *O. mykiss*. In wet, above normal, and below normal water years, the Districts' 1,000-cfs flushing flows on October 5, 6, and 7 would clean gravels of accumulated algae and fines prior to the onset of substantial salmon spawning and would not be expected to have significant effects on water quality. Implementing the recommended spring recession flows would further benefit juvenile salmonids through the reestablishment of riparian vegetation and its associated increase in prey availability, which appears to be a major limiting factor in the lower Tuolumne River. Furthermore, providing a minimum flows of at least 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times would ensure consistent and adequate flow to support aquatic resources.

In addition to these flow-related measures, implementing a year-round downramping rate not to exceed 2 inches per hour would protect juvenile of salmonids in the lower Tuolumne River. Decreasing flows at night (when possible), when Chinook salmon are less vulnerable to stranding, would likewise reduce the possibility of fish being isolated and/or dewatered along the channel margins and gravel bars.

Conducting coarse sediment augmentation in the lower Tuolumne River between RM 39 and RM 52 through development and implementation of a coarse sediment management plan would enhance the quality and quantity of fall-run Chinook and *O. mykiss* spawning habitat in this reach of the lower Tuolumne River. Adding coarse sediment to the river channel would also be expected to increase the salmonid egg-to-emergence survival ratio, reduce superimposition of salmonid redds, increase BMI production, and potentially improve hyporheic flow and coldwater habitat downstream of La Grange Diversion Dam.

NMFS's request for reservation of authority to prescribe fishways under Section 18 of the FPA would help maintain the flexibility necessary to respond to new information during the license term (e.g., fish passage needs, project modifications, management goals, environmental conditions, and technological innovations), and allow for potential future installation of fishways, if feasible and needed. Installing a fish

exclusion barrier near the TID sluice gate would also prevent fish from entering the sluice channel during powerhouse outages.

Finally, implementation of the recommended revised Aquatic Invasive Species Management Plan would help minimize the introduction and potential spread of invasive species, particularly during project activities at the projects.

Although all of the above measures that would be implemented as part of any licenses that may be issued, in combination with the all of the aquatic resources management and recovery programs described above, would likely benefit aquatic species in the Tuolumne River and to a lesser degree in the San Joaquin River downstream to the San Francisco Bay Area, we do not recommend implementation of the Districts' proposed permanent fish counting/barrier weir at RM 25.5, predator control and suppression program, fall-run Chinook spawning superimposition reduction program, and gravel cleaning program.

The Districts' proposed permanent fish counting/barrier weir and predator control and suppression program is not supported by the resource agencies and it is not known if it would provide a measurable benefit to Chinook salmon or *O. mykiss*. The fish counting/barrier weir could also add an additional impediment to salmonid migration in the Tuolumne River and could serve to increase predation. Regarding the Districts' proposed fall-run Chinook spawning superimposition reduction program, this program would not fully address the lack of suitable spawning habitat in the lower Tuolumne River and could additionally result in the "take" of ESA listed species through potential injury from the temporary barrier.

Implementation of a coarse sediment management plan, as mentioned above, would address the lack of suitable spawning habitat more fully than the proposed superimposition reduction program and without the potential "take" of federally listed species. Implementation of a comprehensive LWM management plan (as recommended by the resource agencies and staff) would provide much more complex habitat over a longer period of time. In addition, we anticipate that the Districts' flow proposal will achieve gravel cleaning objectives more effectively and in a less damaging manner than their proposed experimental program.

Overall, implementation of the Districts' proposed aquatic resources measures, as modified by staff, are expected to help maintain the existing aquatic habitat diversity and more closely mimic the natural hydrograph of the lower Tuolumne River over the duration of any licenses issued for the projects. Therefore, operation of the Don Pedro and La Grange Projects would help mitigate cumulative effects on fishery resources in the lower Tuolumne River. Other cumulative non-project effects would still need to be addressed by other entities for the available spawning and rearing habitat to reach its full potential, given the competing demands for available water.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

General Vegetation

The Don Pedro Project is located in the foothills of the west slope of California's Sierra Nevada. The project boundary encompasses over 7,600 acres and is dominated by blue oak woodlands (44 percent), annual grasslands (30 percent), and substantial components of shrub-dominated chaparral (11 percent), gray pine woodlands (6 percent).

Blue oak woodlands occur on well-drained, gentle slopes and sometimes include other hardwood species such as interior live oak, valley oak and/or California buckeye. Shrubs such as wedgeleaf ceanothus, manzanita, coffeeberry, birchleaf mountain mahogany, and poison oak can occur in the understory. Annual grasslands are composed of grasses such as ripgut brome, Italian ryegrass, soft chess, wild oats, cheatgrass, and silver hairgrass. Chaparral communities consist of shrubs such as whiteleaf manzanita, wedgeleaf ceanothus, chamise, birchleaf mountain mahogany and other drought-tolerant species.

Vegetation within the La Grange Project is similar to that described above for the Don Pedro Project, dominated by blue oak (33 percent) and annual grasslands (63 percent), with scattered patches of chaparral plant communities (2 percent).

Wetlands and Riparian Areas

The Districts reviewed FWS's National Wetlands Inventory maps to identify a total of 82.4 acres of potential riparian and wetlands areas within the Don Pedro Project boundary, excluding the Don Pedro Reservoir. Most identified wetlands occurred along the narrow margins of steep ephemeral streams that drain into Don Pedro Reservoir.

For its study of wetland habitats in 2012 (HDR, 2013e), the Districts examined 10 drainages in the field for the presence of wetlands. Nine of the ten drainages supported wetlands, which consisted of mostly patches of riparian vegetation alongside tributary creeks. Wetland conditions typically began at or above the Don Pedro Reservoir's normal maximum surface elevation and extended upstream, usually beyond the project boundary. Most wetlands were dominated by bedrock or cobble and boulder substrates, which do not support hydric soils but provide for hydrophytic vegetation. In addition, other indicators of ground saturation during the growing season, such as watermarks, were often evident. One drainage, Big Creek, is not hydrologically associated with Don Pedro Reservoir; instead, it is supported by subsurface drainage from the swimming lagoon located upslope at Fleming Meadows Recreation Area. Big Creek had no defined channel but supported hydrophytic vegetation and had hydric soils throughout. The drainage not supporting any wetlands was Three Springs Gulch.

Don Pedro Reservoir is characterized by perennial, deep, slow-moving, open water and steep poorly vegetated banks. Its steep shoreline supports upland plant

communities adjacent to the reservoir margin. Areas below the normal maximum surface elevation, which are periodically exposed during low water, are sparsely vegetated or bare. Wetland and riparian habitats are uncommon along its shoreline and shallow areas or areas with emergent vegetation are primarily associated with tributary mouths.

Wetlands at the La Grange Project are primarily confined to narrow bands or small isolated wetlands adjacent to the Tuolumne River. The Districts evaluated wetlands within the La Grange Project by reviewing FWS's National Wetlands Inventory maps to identify potential wetlands within a 1-mile buffer around the project boundary. Excluding the La Grange Reservoir, there were only 0.09 acre of palustrine wetlands within the La Grange Project boundary.

Riparian areas on the Tuolumne River below Don Pedro Dam and La Grange Diversion Dam have been reduced due to a confined channel and a restricted floodplain. Although the project has contributed to this situation, several contributing factors include riparian forest cutting and hydraulic mining during the Gold Rush era, historic levee construction, floodplain encroachment for agriculture and developed land uses, and channelization for flood control. The participants to the 1995 Settlement Agreement agreed that improving the downstream riparian habitat would not only benefit the federally listed Chinook salmon, but also the multipurpose uses of the Tuolumne River. FWS, in its 10(j) comments, states that the lower Tuolumne River is notably lacking in both riparian floodplain and riparian overstory.

The Districts evaluated the extent of riparian vegetation in its Lower Tuolumne River Riparian Information and Synthesis Study (Stillwater Sciences, 2013e), finding that native riparian vegetation occupies approximately 2,700 acres as a nearly continuous but variable-width corridor along the lower Tuolumne River. Native cottonwood forest comprises 21 percent of the riparian plant communities, or 580 acres. The most common woody riparian plants are valley oak, narrow-leaf willow, Fremont cottonwood, and Goodding's black willow. Several riparian restoration projects have been implemented along the lower river during the past decade, and the overall extent of riparian vegetation has increased by approximately 400 acres since a previous riparian vegetation mapping in 1996, over half of which occurs in the lowermost 10 miles near the San Joaquin Wildlife Refuge. Only one 6-mile stretch of the Tuolumne River (Dredger Tailing Reach 6) has multiple age classes of Fremont cottonwood trees, suggesting that natural recruitment of cottonwood is not occurring along the remaining length of the lower Tuolumne River (McBain & Trush, 2000).

Noxious Weeds

To document the current distribution of noxious weeds[136] within the Don Pedro and La Grange Project boundaries, the Districts prepared a Noxious Weeds Study Report that summarized historical occurrences and field surveys (HDR, 2013f). The Districts identified 27 noxious weeds that have a reasonable potential to occur within the project vicinity. The Districts performed noxious weed surveys within the Don Pedro Project boundary in 2012, including all project facilities, recreational areas, and high-use dispersed recreational areas, as identified during study plan consultation. The survey area extended out to 300 feet beyond the project boundary within high-use recreational areas and the BLM's Red Hills ACEC. The Districts identified and mapped the distribution of 12 noxious weeds, divided among 623 geographically distinct occurrences. Table 3.3.3-1 lists the species encountered and their classification and occurrence by land ownership type. One species, Italian thistle, was considered ubiquitous and individual occurrences were not mapped. No California Department of Food and Agriculture (California DFA) A-listed noxious weeds, which are of greatest concern, were documented at the Don Pedro Project. Of the 22 occurrences of California DFA B-listed weeds, 11 of them occurred on BLM lands and 11 were on the District lands. The most widespread noxious weed identified was Italian thistle, which was ubiquitous throughout the Don Pedro Project. Bermudagrass was also common, occurring in a band around Don Pedro Reservoir, just below high-water mark, plus an additional 76 occurrences. Other common noxious weeds included medusahead grass with 317 occurrences, and klamathweed with 158 occurrences (HDR, 2013f).

The Districts did not perform field surveys for noxious weeds within the La Grange Project. Four of the 12 noxious weed species that the Districts observed and mapped within the Don Pedro Project occurred downstream of the dam, extending into the La Grange Project boundary, including: (1) a giant reed population on BLM land, at a turn along the Don Pedro Powerhouse access road, where there were more than 500 plants growing in an area of approximately 0.1 acre; (2) three small infestations of tree-of-heaven, on BLM land just downstream of the Don Pedro Dam spillway; (3) several patches of bermudagrass along the Tuolumne River near the La Grange Project at the Twin Gulch channel; and (4) numerous large, diffuse patches of medusahead within annual grasslands below the Don Pedro Dam.

[136] The Districts defined noxious weeds as those species meeting one or more of the following criteria: (1) listed as "noxious" under the Federal Plant Protection Act; (2) listed as "noxious" and with a rating of A, B, or C by the California Department of Food and Agriculture; or (3) listed as a target species in the Districts' Noxious Weed Survey study plan.

Table 3.3.3-1. Noxious weeds observed within 300 feet of the Don Pedro Project boundary (Source: HDR, 2013f).

Common Name	Scientific Name	California DFA Rating[a]	Number of Occurrences on BLM Land	Number of Occurrences on MID and TID Land
Barbed goat grass	*Aegilops triuncialis*	B	4	1
Tree of heaven	*Ailanthus altissima*	C	3	4
Giant reed	*Arundo donax*	B	1	--
Italian thistle	*Carduus pycnocephalus*	C	n/a	n/a
Smooth distaff thistle	*Carthamus creticus*	B	6	9
Yellow star-thistle	*Centaurea solstitialis*	C	17	21
Bermudagrass	*Cynodon dactylon*	C	19	57
Medusahead grass	*Elymus caput-medusae*	C	24	293
Klamathweed	*Hypericum perforatum*	C	11	147
Russian thistle	*Salsola tragus*	C	--	2
Tamarisk	*Tamarix sp.*	B	--	1
Puncturevine	*Tribulus terrestris*	C	--	3
Total Occurrences			**85**	**538**

[a] California DFA Rating: A—Eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state; B—Eradication, containment, control, or other holding action at the discretion of the commissioner. State endorsed holding action and eradication only when found in a nursery; C—Action to retard spread outside nurseries at the discretion of the commissioner; reject only when found in a crop seed for planting or at the discretion of the commissioner

Special-status Plants

Plant species considered special-status are those meeting one or more of the following criteria: (1) listed by BLM as Sensitive; (2) listed under California Endangered Species Act (CESA), including species proposed for listing; (3) listed on the California DFW list of California Rare species under the Native Species Plant Protection Act of 1977; or (4) listed on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2, or 3 plants (CNPS 1, CNPS 2, CNPS 3).

Plants listed under the federal ESA are considered separately, in section 3.3.4, *Threatened and Endangered Species*. The Districts identified 31 special-status plant species that could potentially occur at the Don Pedro Project by reviewing the CNPS database and California DFW's California Natural Diversity Database (CNDDB).

In 2012, the Districts performed botanical surveys within the Don Pedro Project boundary, targeting special-status plants that are subject to project operation and maintenance, or recreational activities (HDR, 2013g). The Districts surveyed portions of the Don Pedro Project with potential for project effects, including all project facilities, recreational areas, and high-use dispersed recreational areas as identified during study plan consultation. The study area extended out to 300 feet beyond the project boundary within high-use recreational areas and the BLM's Red Hills ACEC. The Districts documented the full extent of each special-status plant occurrence up to 0.25 mile outside the project boundary. The Districts' study identified 8 special-status plants with 86 occurrences (table 3.3.3-2), with 58 on public land administered by BLM and 28 on private land owned by the Districts. The most abundant special-status plants were Mariposa clarkia (25 occurrences), Red Hills soaproot (20 occurrences), and Mariposa cryptantha (10 occurrences). Most sensitive species are found on serpentine soils within the Red Hills ACEC, which occurs on both sides of Don Pedro Reservoir.

The Commission's SD2 for the La Grange Project identified the potential for occurrence of seven special-status plants, which included spiny-sepaled button celery, Hoover's calycadenia, Hartweg's golden sunburst, Mariposa cryptantha, dwarf downingia, Merced monardella, and knotted rush. The Districts did not perform project-specific studies of special-status plants within the La Grange Project boundary, but reviewed existing information that revealed no known occurrences. The survey area for the Don Pedro Project study extended 1 mile downstream of Don Pedro Dam and included habitats that are similar to the Don Pedro Project. The Districts did not document any special-status plants along this reach of the Tuolumne River below Don Pedro Dam. There were no additional records of special-status plants within the La Grange Project boundary. During the scoping and study development process for the La Grange Project, no additional special-status plant surveys were requested by FWS, California DFW, or other entities.

Table 3.3.3-2. Special-status plants observed within 300 feet of the Don Pedro Project boundary (Source: Districts, 2017a, as modified by staff).

Common Name	Scientific Name	Status	Number of Occurrences by Land Ownership	Occurrence Locations/Habitat
Red Hills onion	*Allium tuolumnense*	BLM-S, CNPS 1B	BLM–10 Districts–0	Prefers south-facing slopes with shallow, serpentine soils in the Red Hills ACEC. Six occurrences were documented at Sixbit Gulch, two at Kanaka Point, one near Moccasin Point Recreation Area and one at Poor Man's Gulch for a total of over 700 individuals over a combined area of approximately 0.3 acre. Known from approximately 20 occurrences.
Red Hills soaproot	*Chlorogalum grandiflorum*	BLM-S, CNPS 1B	BLM–20 Districts–0	Occurs on rocky, serpentine soils within open areas in chaparral plant communities, mostly in the Red Hills ACEC and several other locations. Twelve occurrences were at Sixbit Gulch and eight at Poor Man's Gulch for a total of over 1,600 individuals combined over 0.4 acre.
Mariposa clarkia	*Clarkia biloba ssp. australis*	BLM-S, CNPS 1B	BLM–2 Districts–23	Most often found on north-, northeast-, and northwest-facing, disturbed sites. Many populations are large (> 0.1 acre). Occurrences were found at the Moccasin Point Recreation Area, at Rogers Creek Arm, near the Moccasin transmission line, and along Shawmut Road for a total of over 35,000 individuals. Additionally, one occurrence was in an area associated with a burn pile from debris removal activities, and some occurrences extended below the Don Pedro Reservoir normal maximum surface elevation.

Common Name	Scientific Name	Status	Number of Occurrences by Land Ownership	Occurrence Locations/Habitat
Mariposa cryptantha	*Cryptantha mariposae*	BLM-S, CNPS 1B	BLM–9 Districts–1	Occurs on serpentine soils in the understory of chaparral communities. Many populations are large (> 0.1 acre). Ten occurrences were found in proximity to Kanaka Point, at Moccasin Point Recreation Area, Railroad Canyon, and Sixbit Gulch for about 2,300 individuals over a combined area of approximately 1.24 acres.
Tripod buckwheat	*Eriogonum tripodum*	BLM-S	BLM–4 Districts–0	Occurs on serpentine soils. Four occurrences were documented, at Sixbit Gulch. Approximately 277 individuals were observed over a combined area of approximately 0.07 acre.
Congdon's lomatium	*Lomatium congdonii*	BLM-S, CNPS 1B	BLM–7 Districts–0	Occurs on serpentine soils. Seven occurrences were documented. Five occurrences were at Sixbit Gulch and two at Poor Man's Gulch.
Shaggyhair lupine	*Lupinus spectabilis*	BLM-S, CNPS 1B	BLM–4 Districts–3	Occurs on serpentine soils. Seven occurrences were documented. Two were at Poor Man's Gulch and five at Railroad Canyon. Occurrences ranged from one to 2,000 plants, totaling approximately 0.25 acre.
Red Hills ragwort	*Packera clevelandii*	BLM-S, CNPS 1B	BLM–1 Districts–1	Occurs on serpentine soils. Two occurrences were documented, one on BLM land and another on the Districts' land at Recreation Bay and Sixbit Gulch. A total number of 268 individuals were observed over a combined area of approximately 0.02 acre.

Notes: BLM-S—Bureau of Land Management Sensitive Species; CNPS 1B—California Native Plant Society listed as rare or endangered in California and elsewhere.

General Wildlife

The Districts evaluated wildlife for both Don Pedro and La Grange Projects by compiling historic records and performing field surveys for rare and protected species within the Don Pedro Project boundary. The Districts' analysis of the California Wildlife Habitat Relationship System identified a total of 339 terrestrial vertebrate wildlife species that are predicted to occur in the Don Pedro Project. The Districts provided a partial list of wildlife potentially occurring in the La Grange Project vicinity, which included 35 mammals, and 120 birds. Common mammals at the Don Pedro and La Grange Projects are mule deer, raccoon, and coyote. Birds likely to occur within both project boundaries are species that prefer oak woodland, oak-pine woodland, chaparral, and grassland habitats. Common birds in oak woodlands include the acorn woodpecker, oak titmouse, house wren, European starling, bushtit, and lesser and American goldfinches (Garrison, 2005). In annual grasslands, the western meadowlark, lark sparrow, western bluebird, and dark-eyed (Oregon) junco are most common, in addition to several dozen other species (PRBO Conservation Science, 2008). Water birds likely to occur at the projects include wading birds and waterfowl, such as great blue herons, common mergansers, and mallard ducks, as well as fish-eating raptors such as bald eagles and osprey. Common amphibians and reptiles at the projects could include California toad, American bullfrog, western yellow-bellied racer, Pacific gopher snake, and valley gartersnake.

The CNDDB revealed records of occurrence for five special-status vertebrates within the USGS 7.5-minute quadrangle maps corresponding to the Don Pedro Project boundary: (1) bald eagle; (2) foothill yellow-legged frog; (3) western pond turtle; (4) Sierra Nevada yellow-legged frog; and (5) coast horned lizard (i.e., Blainville's horned lizard). These and other special-status species likely to occur in the projects are discussed further below. Sierra Nevada yellow-legged frog is not considered further because it is restricted to elevations above 6,000 feet, well above the project elevations.

Special-status Wildlife

Special-status wildlife include those species that are listed as: (1) bird of conservation concern by FWS; (2) sensitive species by BLM; (3) protected under the Bald and Golden Eagle Protection Act; (4) threatened, endangered, or candidate species under CESA; (5) fully protected under California Fish and Game Code; or (6) nesting birds and birds-of-prey protected under California Fish and Game Code, Sections 3503 and 3503.5. In its SD2 for the Don Pedro Project, the Commission indicated that its environmental review would evaluate the effects on special-status wildlife that include the following species: western pond turtle, foothill yellow-legged frog, Swainson's hawk, bald eagle, and osprey. For the La Grange Project, SD2 identified 10 additional special-status wildlife species for which project effects should be evaluated, excluding federally listed species (see section 3.3.4, *Threatened and Endangered Species*, in the subsection *Terrestrial Species*). In addition to the bald eagle, this included one mammal (American badger) and two birds (tricolored blackbird and golden eagle).

The Districts reviewed existing information on wildlife resources to determine the presence and distribution of special-status wildlife. The review included a query of federal and state databases; past District surveys; and consultation with FWS, BLM, and California DFW staff. The Districts reported five special-status vertebrates with historic records within the Don Pedro Project boundary, including the western pond turtle, foothill yellow-legged frog, bald eagle, Sierra Nevada yellow-legged frog, and coast horned lizard. Based on the SD2, the Districts performed studies to understand potential project effects to 3 of these species (western pond turtle, foothill yellow-legged frog, and bald eagle), as well as 1 additional bird (osprey) and 9 special-status bats, totaling 13 species. The Districts conducted a study of bats at the Don Pedro Project in 2012 because the project potentially supports nine special-status bat species (HDR, 2013h). The Districts studied bald eagles and osprey on Don Pedro Reservoir in 2012 and 2013 (HDR, 2013i). In 2013, the Districts conducted studies for the western pond turtle and foothill yellow-legged frog—two semi-aquatic special-status species that are under review for ESA listing and potentially found in the projects (HDR, 2013j). Further detail on these surveys is provided below.

Because agency comments addressed potential project effects to other special-status species (i.e., western burrowing owl and golden eagle), we developed an updated list of 35 special-status wildlife species that have suitable habitat or the potential to occur within the Don Pedro Project, including 11 mammals, 21 birds, 1 amphibian, and 2 reptiles. Table 3.3.3-3 lists these species, along with their status and known occurrences within the projects.

The Districts did not perform any project-specific studies of special-status wildlife within the La Grange Project boundary because they had conducted surveys for special-status wildlife in 2012 for the Don Pedro Project. These studies extended 1 mile below the Don Pedro Dam and included habitats that are similar to the Don Pedro Project. There were no additional records of special-status species within the La Grange Project boundary. Due to similar habitat, the special-status terrestrial wildlife species listed in table 3.3.3-3 could also occur within the La Grange Project.

Bats

The Districts reviewed the CNDDB for historical occurrences of bat species in the Don Pedro Project vicinity. They performed focused surveys using mist nets and acoustic monitoring at four sites (Fleming Meadows Recreation Area, Don Pedro Dam spillway, Blue Oaks Recreation Area, and Moccasin Point Recreation Area). In addition, the Districts surveyed two long-term acoustic monitoring sites for 8 months at the Don Pedro Dam and its spillway. During field surveys, the Districts inspected all project facilities (e.g., powerhouses, storage buildings, public restrooms at campgrounds and boat launches, kiosks, etc.) for active bat roosts and/or signs of past use, including guano and urine staining (HDR, 2013h).

Table 3.3.3-3. Special-status wildlife species with potential to occur within the Don Pedro and La Grange Projects (Source: Districts, 2017a,b as modified by staff; Audubon, 2018; California DFW, 2018b).

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Mammals				
Pacific fisher	*Pekania pennanti*	BLM-S, SSC, ST	Occurs in late succession forest near streams and meadows.	Not detected by surveys. Very low potential for occurrence due to lack of suitable habitat.
American badger	*Taxidea taxus*	SSC	Prefers open areas and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	Not detected by surveys. Potentially occurs within suitable habitat.
Western red bat	*Lasiurus blossevillii*	SSC	Ranges from sea level up through high-elevation mixed conifer forests; roosts in foliage, forages in open areas.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Fleming Meadows Recreation Area, Don Pedro Dam, and at its spillway.
Spotted bat	*Euderma maculatum*	BLM-S, SSC	Ranges from sea level up to 9,800 feet in arid deserts, grasslands and mixed conifer forests.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Don Pedro Dam.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM-S, SSC	Ranges from sea level up to 10,300 feet; roosts in buildings, mines, tunnels, and caves; feeds along habitat edges.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Don Pedro Dam and at its spillway.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Pallid bat	*Antrozous pallidus*	BLM-S, SSC	Ranges from sea level up to 8,000 feet; roosts in caves, crevices and buildings, and forages in a variety of open habitats.	Five CNDDB occurrences in project vicinity. Five individuals captured in mist nets during focused surveys at Blue Oaks Recreation Area (campground). Also detected by acoustic monitoring at Fleming Meadows Recreation Area, and the vicinity of Don Pedro Powerhouse and spillway.
Fringed myotis	*Myotis thysanodes*	BLM-S	Occur primarily at middle elevations in desert, riparian, grassland, and woodland habitats. Roosts in caves, mines, cliff faces, rock crevices, old buildings, bridges, snags, and other sheltered sites. Foraging often occurs close to vegetative canopy.	No CDDNB occurrences in project vicinity. Not detected by surveys. Potentially occurs within suitable habitat.
Western mastiff bat	*Eumops perotis*	BLM-S, SSC	Ranges from sea level up to 8,700 feet; roosts in rock crevices, outcroppings and buildings.	Six CNDDB occurrences in project vicinity. Detected by acoustic monitoring at Don Pedro Dam, and its spillway.
Long-eared myotis	*Myotis evotis*	BLM-S	Roosts in buildings, crevices, and snags; feeds along habitat edges, in open habitats, and over water (0 to 8,800 feet at least).	No CNDDB occurrences within the projects. Detected by acoustic monitoring at Moccasin Creek Recreation Area, Don Pedro Dam, and its spillway.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Yuma myotis	*Myotis yumanensis*	BLM-S	Roosts in buildings, mines, caves, and crevices; feeds over water (0 to 10,800 feet), but uncommon to rare above 8,400 feet.	Two CNDDB occurrences in project vicinity. One individual captured during mist nest sampling at the Don Pedro Dam spillway. Also detected by acoustic monitoring at the Don Pedro Dam spillway.
Western small-footed myotis	*Myotis ciliolabrum*	BLM-S	Roosts in caves, buildings, mines, crevices, and under bridges; feeds over streams, ponds, and springs (0 to 8,800 feet).	No CNDDB occurrences within the projects. Possibly detected by acoustic monitoring at Don Pedro Dam and at its spillway, but not certain because of similarities in call structure to several other myotis species.
Birds				
Bald eagle	*Haliaeetus leucocephalus*	CE, CFP, BLM-S, BCC, BGEPA	See text.	See text.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Golden eagle	*Aquila chrysaetos*	CFP, BCC, BGEPA	Generally inhabit open and semi-open country such as prairies, sagebrush, savannah or sparse woodland, and barren areas, especially in hilly or mountainous regions, in areas with sufficient mammalian prey base and near suitable nesting sites. Nests are most often on rock ledges of cliffs but sometimes in large trees.	Only one observation of an adult perched on a pine tree near the top of southwest rim of Railroad Canyon. Previous observations during the BLM and Central Sierra Audubon Society mid-winter eagle surveys on Don Pedro Reservoir in 1997 and each year between 1999 and 2009.
Osprey	*Pandion haliaetus*	FGC	Occur primarily along rivers, lakes, reservoirs, and seacoasts. They often cross land between bodies of water. They typically build large stick nests on living or dead trees and man-made structures. Forage almost exclusively on fish.	Frequently observed on Don Pedro Reservoir, where there are 8 documented nests, with concentrations in the areas of the Upper and Middle Bays (three nests and two nests, respectively). Additionally, one nest was recorded near the Highway 49 bridge, one nest in the West Bay area, and one adjacent to Jacksonville Road close to Jacksonville Road Bridge.
Swainson's hawk	*Buteo swainsoni*	ST, BLM-S	In California, occurs in open blue oak savannahs, annual grasslands, gray pine-oak woodlands, and riparian areas. Foraging typically occurs in native grassland communities.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Rufous Hummingbird	*Selasphorus rufus*	BCC	Migrate through California, but don't nest. Uses a variety of habitats that provide nectar-producing flowers, such as forest edges, streamsides, and mountain meadows.	Unknown. Potentially occurs within suitable habitat.
Oak titmouse	*Baeolophus inornatus*	BCC	Prefers relatively open woodlands of oak and pine and oak trees, and can also be found in forests as long as adequate oak trees are present, as well as woody riparian habitats.	Unknown. Potentially occurs within suitable habitat.
Tricolored blackbird	*Agelaius tricolor*	CC, SSC, BLM-S, BCC	Occurs in fresh-water marshes with herbaceous cover such as cattails and bulrushes. Nests in vegetation of marshes or thickets, sometimes nests on the ground. Historically strongly tied to emergent marshes; in recent decades much nesting has shifted to non-native vegetation.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Long-billed Curlew	*Numenius americanus*	BCC	Prefers open habitats of upland shortgrass prairies, wet meadows, grasslands, and, in winter, agricultural fields, saltwater marshes with tidal channels, intertidal mudflats, and coastal estuaries. Breeding habitat is mostly dry grassland and shrublands prairie, often with wetland areas nearby to provide better feeding area for the young.	Unknown. Potentially occurs within suitable habitat.
California thrasher	*Toxostoma redivivum*	BCC	Most common in chaparral, but also in dense oak woodlands, streamside thickets, and in suburban neighborhoods that have enough vegetation.	Unknown. Potentially occurs within suitable habitat.
Lewis woodpecker	*Melanerpes lewis*	BCC	Uncommon, local winter resident occurring in open oak savannahs, broken deciduous, and coniferous forests.	Unknown. Potentially occurs within suitable habitat.
Nuttall's Woodpecker	*Picoides nuttallii*	BCC	Resident of oak and pine-oak woodlands.	Unknown. Potentially occurs within suitable habitat.
Clark’s grebe	*Aechmophorus clarkii*	BCC	Colonial-nesting waterbirds that uses freshwater lakes or marshes with extensive open water, where they feed primarily on fish.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Yellow-billed magpie	*Pica nuttalli*	BCC	Resident of open oak woodlands, riparian areas, and other open and semi-open habitats.	Unknown. Potentially occurs within suitable habitat.
Wrentit	*Chamaea fasciata*	BCC	Inhabits dense shrub thickets within chaparral, oak woodlands, mixed evergreen forests, and other shrubby areas.	Unknown. Potentially occurs within suitable habitat.
White-headed woodpecker	*Picoides albolarvatus*	BCC	Resident of mountain pine forests, preferring stands with large cones or prolific seed production, such as Coulter, ponderosa, Jeffrey, and sugar pines.	Unknown. Potentially occurs within suitable habitat.
Black swift	*Spizella atrogularis*	SSC, BCC	Nests in moist crevices or caves or on cliffs near waterfalls in deep canyons. Forages widely over many habitats.	Unknown. Potentially occurs within suitable habitat.
Black-chinned sparrow	*Chlidonias niger*	BCC	Occurs in marshes, along sloughs, rivers, lakeshores, and reservoirs, or in wet meadows.	Unknown. Potentially occurs within suitable habitat.
Burrowing owl	*Athene cunicularia hypugaea*	SSC, BLM-S, BCC	See text.	See text.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Spotted towhee	*Pipilo maculatus clementae*	BCC	Found in chaparral, oak woodlands, or other shrub habitats and in open stands of riparian and forested habitats. Prefers relatively tall, dense stands of shrubs and riparian thickets.	Unknown. Potentially occurs within suitable habitat.
Song sparrow	*Melospiza melodia*	BCC	Found in a wide variety of habitats, including brushy fields, woody riparian habitats, shrubby marsh edges, woodland and forest edges, agricultural fields, and even suburban areas.	Unknown. Potentially occurs within suitable habitat.
Lawrence's goldfinch	*Carduelis lawrencei*	BCC	Uses a variety of habitats including riparian forest, oak woodland, open pine woodland, pinyon-juniper woods, and chaparral. Restricted nesting habitat is limited to California, in open oak woodlands or other arid woodland and chaparral, near water sources.	Unknown. Potentially occurs within suitable habitat.
Amphibians				
Foothill yellow-legged frog	*Rana boylii*	FSS, SSC, SC	See text.	See text.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Reptiles				
Blainville's horned lizard	*Phrynosoma blainvillii*	FSS, SSC	Occurs in a variety of habitats, including shrubland, grassland, coniferous woods, and broadleaf woodlands.	Unknown. Potentially occurs within suitable habitat.
Western pond turtle	*Actinemys marmorata*	FSS, SSC	See text.	See text.

[a] BCC—Federal bird of conservation concern; BGEPA—protected by the Bald and Golden Eagle Protection Act; BLM-S—BLM Sensitive Species; FSS—Forest Service sensitive species; CE—CESA-listed as endangered; ST—CESA-listed as threatened; SC—CESA candidate species; CFP—California fully protected; SSC—California species of special concern; FGC—protected by California Fish and Game Code sections 3503 and 3503.5.

Focused surveys and acoustic recordings documented the presence of nine special-status bats species at the Don Pedro Project, which included the pallid bat, Townsend's big-eared bat, spotted bat, western mastiff bat, western red bat, western small-footed myotis, long-eared myotis, fringed myotis, and Yuma myotis. Western red bat and canyon bat were the most often recorded species at all monitoring sites. Pallid bat and Townsend's big-eared bat were the second most often recorded species at both sites, and were absent only during the month of March. Of the nine identified species, seven are considered special-status by BLM or California DFW (table 3.3.3-3).

The Districts' study reported evidence of bat use at several project facilities, including the Don Pedro Powerhouse; the visitor center building; and the Fleming Meadows, Moccasin Point, and Blue Oaks Recreation Areas. These observations indicated that project facilities were mostly used by bats as night roosts, where human presence is generally infrequent and intermittent at night, and associated with recreation use rather than project operation and maintenance. However, at Don Pedro Dam, two bats (*Myotis* spp.) were observed day roosting in the fixed wheel gate building, which provides emergency closure for the power tunnel but is not otherwise used (HDR, 2013h).

The Districts have not performed bat surveys within the La Grange Project boundary.

Bald Eagle

The Don Pedro and La Grange Projects provide year-round habitat for bald eagles. Bald eagle breeding habitat most commonly includes areas close to rivers, lakes, reservoirs, or other bodies of water that provide their primary food sources of fish and waterfowl. Wintering areas are commonly associated with ice-free water and bald eagles communally roost in conifers or other sheltered sites in winter. In California, bald eagle courtship and nest building begins in January, egg laying occurs in February through March, incubation is from late February through May, eggs hatch from March through May, the nestling period occurs from late March through late July, eaglets fledge from early June through late July, the post-fledging period when juvenile eagles learn to hunt and fly extends from early June through August, and migration occurs in mid-July through August.

The study area for the Districts' 2012 and 2013 bald eagle surveys encompassed a 1,000-foot buffer around Don Pedro Reservoir and project facilities. The Districts also documented observations of osprey and other raptors. A review of historical records from BLM and occurrence records in the CNDDB revealed seven previously documented bald eagle nests on Don Pedro Reservoir. Field surveys located nine bald eagle nests, of which five had been previously documented by BLM, and four are considered to be new or previously undocumented by BLM. Three of the nine nests were active during 2012. Two nests successfully hatched one eaglet, located near the upper reach of the Woods Creek Arm and on the northeast corner of Mine Island, but subsequent surveys were not

performed to determine if the eaglets later fledged from either nest. The third active nest that failed was located on the northern flank of Blank Peak, near the entrance to the Rodgers Creek Arm. During May 2013, the Districts observed two occupied and eight unoccupied bald eagle nests. The occupied nests were the same two that hatched eaglets in 2012, located in the Woods Creek Arm and on Mine Island. Some of the unoccupied nests may serve as alternate nests to the three occupied nests located in 2012, although data is insufficient to make that determination. The Districts did not report any historic or recent bald eagle nests within the La Grange Project boundary (HDR, 2013i).

No bald eagle winter surveys were performed by the Districts, although incidental sightings of bald eagles have been recorded on Don Pedro Reservoir during winter. BLM, in coordination with Central Sierra Audubon, have conducted annual wintering counts from 1994-2012 during one day each year in mid-January. The number of eagles per year has varied from 5 to 34 with an average of 20 bald eagles per year (BLM, 2018). No bald eagle winter surveys have been conducted on the La Grange Reservoir.

Burrowing Owl

The western burrowing owl has been included on the list of California species of special concern since 1978 (Gervais et al., 2008) and is listed as a BLM sensitive species. Nest sites of western burrowing owls are protected in California under Fish and Game Code Section 3503.5. In 2003, a petition to list the burrowing owl as threatened or endangered under the CESA was rejected (California Fish and Game Commission, 2004). Another petition could be submitted, however, that could potentially change the burrowing owl's status under the ESA or CESA during the duration of any project license.

The range of western burrowing owl extends throughout the lowlands of the Central and Imperial Valleys, and other open, relatively flat regions of California. Its distribution and abundance varies considerably throughout its range (DeSante et al., 2007). Throughout their range, the western burrowing owl requires habitats with three basic attributes: open, well-drained terrain; short, sparse vegetation generally lacking trees; and underground burrows or burrow-like structures (e.g., culverts). These habitats include grasslands, deserts, shrublands, agricultural areas, and a variety of other open habitat types such as the margins of airports, golf courses, residential developments, and roads (Gervais et al., 2008).

Available information on the status of the western burrowing owl in California suggests that the subspecies has been extirpated in many areas by increasing development and that the distribution of remaining populations reflects the degree to which land conversion and development has reduced available habitat, offset by the bird's ability to adapt to agricultural landscapes. The subspecies has disappeared or greatly declined as a breeding bird in many areas that were once occupied. The population trend for the subspecies in California is reportedly declining, and surveys from 1986 and 1991 show breeding population decreases of 23 to 52 percent. Nearly 60 percent of 22 western

burrowing owl colonies that existed in the 1980s reportedly disappeared by the early 1990s (DeSante and Ruhlen, 1995). In its determination that the subspecies was not warranted for listing under the CESA, the California Fish and Game Commission (2004) found that that expansion of western burrowing owl numbers in some areas, particularly arid lands that are now used for irrigated agriculture, may be offsetting declines elsewhere. It found insufficient evidence to establish an overall statewide increase or decline in western burrowing owl abundance.

Populations of western burrowing owls in California are threatened by the loss of farmland, changes in agricultural practices, eradication of ground squirrels, pesticide use, traffic and wind turbine-related mortality, and possibly West Nile virus. Other hazards of agricultural areas in California include automobiles, barbed-wire fences, and electric fences (Gervais et al., 2008). During the non-breeding season, burrowing owls remain closely associated with burrows, as they continue to use them as refuge from predators, shelter from weather and roost sites (California DFW, 2012). Thus, the decline of burrowing rodents such as California ground squirrels is of considerable concern the subspecies' conservation (DeSante et al., 2007; California DFW, 2008). Conserving and restoring populations of ground squirrels and other host burrowers by reducing or prohibiting lethal rodent control measures is a priority conservation measure for burrowing owls (California DFW, 2012).

The Districts have not conducted surveys for western burrowing owls within either of the project boundaries.

Foothill Yellow-legged Frog

The foothill yellow-legged frog is a candidate for listing under the CESA. It occurs in small to large streams and rivers with pools and low-gradient riffles (small streams are probably nonbreeding habitat). Breeding sites are usually in shallow, slow-flowing areas near the shore with coarse substrates (cobbles and boulders). Foothill yellow-legged frogs are infrequent in habitats where introduced fish and American bullfrogs are present.

Two historic occurrences of foothill yellow-legged frogs are reported to occur within tributary creeks to Don Pedro Reservoir. Additionally, the species is known to occur well upstream of the Don Pedro Project in Moccasin Creek and Mountain Pass Creek, and was observed in Hatch Creek, about four miles upstream of Don Pedro Reservoir, in 1970. The Districts performed a desktop evaluation of foothill yellow-legged frog habitat at 20 locations along perennial streams within 0.5 miles of the Don Pedro Reservoir, including the Tuolumne River up to RM 79, and tributaries up to 1 mile upstream of the reservoir. Based on potential habitat identified during the desktop evaluation and property access, the Districts assessed 17 locations in the field for evidence of foothill yellow-legged frog habitat suitability. They also performed visual encounter surveys along five tributaries to Don Pedro Reservoir: Six-Bit Gulch, Poor Man's Gulch, Woods Creek, Moccasin Creek, and Drainage #8 (an unnamed tributary of

Don Pedro Reservoir at Gardiner Falls). No foothill yellow-legged frogs were observed at any sites during surveys, or incidentally observed during the course of other relicensing studies. Suitable foothill yellow-legged frog breeding habitat was reportedly scarce. In addition, invasive predatory American bullfrogs were observed throughout the Don Pedro Project vicinity, including at three of the visual encounter survey sites (Six-Bit Gulch, Poor Man's Gulch, and Woods Creek). Crayfish were also found throughout the vicinity and predatory fish species are known to occur in the tributaries surveyed (HDR, 2013j).

The Districts did not conduct surveys for foothill yellow-legged frogs within the La Grange Project boundary.

Western Pond Turtle

The western pond turtle is a Forest Service sensitive species and California species of special concern. It is California's only native aquatic turtle, occurring in permanent ponds, lakes, channels, backwaters, and pools of streams. Western pond turtles require habitats with sufficient cover, such as emergent vegetation, to protect hatchlings, and basking substrates such as rocks, logs, banks, and root masses. In river environments, western pond turtles prefer slow flowing areas and backwater environments with basking sites and underwater refuges. They use rivers primarily in the summertime and avoid high flow periods. Western pond turtles spend considerable amounts of time in upland areas surrounding aquatic habitats and may use uplands during any month of the year, particularly for nesting, aestivating, dispersal and overwintering. Females travel into upland environments to nest in mid-summer and may produce more than one clutch of approx. 4-8 eggs each. Nesting usually occurs within 328 feet of water at sites with southern exposure, short vegetation with little or no tree or shrub overstory, and well-drained compact soils with significant clay/silt content (Hallock et al., 2017). The relatively low reproductive effort and longevity of western pond turtles (~ 40 years) means that this species' population recovery time (after disturbances or local extinctions) is relatively slow compared to other species.

Fourteen live western pond turtles were observed by the Districts during its 2012 study (HDR, 2013j). Six individuals were detected at 5 basking survey sites and 10 individuals (8 live, 2 dead) were observed incidentally at 10 locations. Of the 10 incidentally observed turtles, 5 were within Don Pedro Reservoir, 1 was seen in the Don Pedro spillway channel, and 2 were in Woods Creek upstream of the project (one of these western pond turtles was a juvenile). Two incidental observations of dead western pond turtles occurred, one on the banks of the reservoir, and one in Woods Creek, upstream of Don Pedro Reservoir. Some observations could represent repeat observations of the same individuals. These findings suggest that western pond turtles occurs in relatively small numbers concentrated in backwater inlets, particularly those associated with seasonal or perennial tributary streams (HDR, 2013j).

The Districts did not conduct surveys for western pond turtles within the La Grange Project boundary.

3.3.3.2 Environmental Effects

To minimize potential adverse effects on terrestrial resources at the Don Pedro Project, the Districts propose to implement their TRMP for the duration of a new license. The Districts did not propose a management plan for terrestrial resources with their La Grange Project application. The Don Pedro plan covers the following components: (1) special-status plant species protection and monitoring; (2) noxious weed prevention and management measures; (3) valley elderberry longhorn beetle host plant guidelines; (4) descriptions of bi-annual employee and contractor training; and (5) procedures for revegetation following ground-disturbing activities. The plan includes specific guidelines for protecting and managing special-status bats, bald eagles, western pond turtles, and the federally threatened valley elderberry longhorn beetle.

BLM, FWS, and California DFW comment that the Districts' proposed Don Pedro TRMP would not provide adequate protections for several special-status plants and animals, and species listed under the ESA or CESA. Their suggested modifications are included in several of BLM's revised 4(e) conditions, FWS's 10(j) recommendations, and California DFW's 10(a) recommendations. The resource agencies also recommend a similar plan for guiding the management of terrestrial resources at the La Grange Project. Specifically, FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 suggest that the Districts include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, and California tiger salamander. FWS also included Layne's butterweed and Red Hills vervain in this recommendation for the Don Pedro Project and included the western pond turtle in its recommendation for the La Grange Project. For guidance, BLM and FWS provided the Districts with a revised Don Pedro TRMP and a template version for of a La Grange TRMP, the latter being an edited version of the Districts' Don Pedro plan. Also, BLM specifies and FWS recommends that the bald eagle section of the Don Pedro TRMP be revised as a stand-alone bald eagle management plan, and they provided the Districts with recommended stand-alone drafts for both projects. The Districts replied that they would draft revised plans, if necessary, and would review the plans submitted by BLM.

Our Analysis

Our analysis supports the benefits of revising the Don Pedro TRMP to address potential effects that would not be covered by the Districts' proposed plan. The Districts' development of a new, similar TRMP for the La Grange Project would also be beneficial. The specific project effects or resources that would benefit from being addressed by the plans for both projects include: (1) vegetation management; (2) ground disturbance related to new project construction; (3) wetlands and riparian areas; (4) noxious weeds; (5) special-status plants; (6) burrowing owls; (7) other special-status birds; (8) special-status bats; (9) special-status amphibians and reptiles; (10) San Joaquin kit fox; (11) California red-legged frog; (12) California tiger salamander; and (13) valley elderberry longhorn beetle. We discuss these elements in subsequent sections, although

items 10, 11, 12 and 13 are addressed in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*. Developing plans for both projects would guide the Districts' management of terrestrial resources for the duration of the project licenses. Therefore, the TRMPs are the appropriate documents within which the Districts could specify additional environmental measures for the protection and enhancement of terrestrial resources. The only terrestrial wildlife for which a separate stand-alone management plan seems warranted is the bald eagle, as recommended by both FWS and BLM, and supported by California DFW.

Vegetation Management

Under a new license, the Districts could disturb vegetation resources through excavation, grading, topsoil stripping, or vegetation management during the operation and maintenance of the Don Pedro Dam and La Grange Diversion Dam, project facility maintenance, and road maintenance (e.g., grading). Vegetation would also be affected during improvements to recreational resources (e.g., trail maintenance) and treatment of noxious weeds.

The Districts maintain project facilities and associated roads, including three developed recreational areas at Don Pedro Reservoir, using a combination of mowing and periodic use of pre-emergent herbicides, applied by licensed applicators, to manage vegetation growth. The Districts typically manage these areas in proportion to their use, in order to minimize the spread of unwanted vegetation (e.g., noxious weeds) and the risk of fire. High-use sections of each recreational area are mowed, and shrubs and trees are trimmed on a frequent basis around structures and buildings to remove ladder fuels that could increase fire risk, and to eliminate low branches that could injure passing humans. The Districts use herbicides to maintain bare ground around project powerhouses and switchyards, and on Don Pedro Dam. They also spray herbicides on an annual basis in parking areas, campsite pads, road edges, paths along irrigation canals, firebreaks, and the immediate area around restrooms and other recreational facilities.

The Districts propose BMPs for minimizing noxious weeds and ground disturbance during routine operations and maintenance activities in the Don Pedro TRMP, discussed further below under *Noxious Weeds*. The Districts' Don Pedro TRMP also includes provisions to protect special-status plants, discussed below under *Special-status Plants.*

As detailed in section 3.3.1, *Geologic and Soil Resources,* BLM 4(e) condition 3 for both projects specifies that the Districts develop a soil erosion and sediment control plan for erosion and/or restoration actions on or affecting BLM lands that are within or adjacent to the project. The Water Board provides support with its preliminary 401 condition 9, which specifies that the Districts develop a plan to minimize undesirable erosion or reduce sediment for ground-disturbing activities that include, but are not limited to, routine operation, maintenance, any new construction, and recreational improvement. Such a plan would specify the techniques that would be used to stabilize

sites once ground-disturbing activities are completed, in order to support subsequent reclamation or vegetation restoration. According to BLM, an effective soil erosion and sediment control plan would include the following: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Also, BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts consult with BLM regarding any additional ground-disturbing activities that are not specifically addressed in this license application. The Districts responded that they would work with BLM to identify any necessary site-specific BMPs for ground-disturbing activities on BLM land within both projects.

Our Analysis

The Districts' proposed Don Pedro TRMP does not provide a comprehensive list of BMPs that would be implemented to avoid adverse impacts to plant communities and wildlife habitat from ground-disturbing activities. BLM's 4(e) condition 3 for both projects to develop a soil erosion and sediment control plan, in consultation with the other resource agencies, would serve to limit potential effects on plant communities. Our analysis of the recommended soil erosion and sediment control plan is provided above in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*. Such a plan would provide overarching guidance for project construction, ensuring that affected lands would be revegetated, that noxious weeds would be prevented from establishment, and that erosion would not adversely affect adjacent plant communities. Expanding the plan to apply to all construction activities authorized by the license, rather than on BLM lands, would provide additional protection during the Districts' ground-disturbing activities.

New Project Construction

The Districts propose several capital improvement projects that could have both short-term and long-term, direct and indirect effects on vegetation (i.e., habitat) and wildlife. Future construction of new project facilities would produce various levels of ground disturbance that would directly affect plant community composition and/or structure, or increase the potential for invasive weed colonization. These effects would influence wildlife habitat quality. The Districts propose the following measures that involve new construction: (1) extending the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet; (2) construction of a fish counting/barrier weir in the lower Tuolumne River at RM 25.5; (3) construction of a new boat launch facility located just upstream of old Don Pedro Dam; (4) construction of a foot path trail along the river-right shoreline of the La Grange

Reservoir; and (5) enhancements at existing recreation facilities.[137] The affected areas for these projects would also include haul roads and staging areas.

California DFW 10(a) recommendation M9 requests that the Districts consider the potential effects on terrestrial species from operating and maintaining the infiltration galleries downstream of the Geer Road Bridge, at approximately RM 25.9. FWS made the same comment about the Districts' proposed Don Pedro TRMP, but did not include it as a 10(j) recommendation. The Districts replied that if additional lands are added to the project boundary under the new license, they will be incorporated into the plan.

Our Analysis

The construction of several projects proposed by the Districts would require ground disturbance or the use of equipment to excavate portions of the Tuolumne River channel and bank areas. This disturbance could affect plants and animals through mortality, injury, or displacement as a result of habitat destruction, modification, or fragmentation. Indirect effects could result from changes to wildlife habitat use, reduced animal fitness, and altered natural food webs, or changes to predator-prey abundance. These effects would occur during the duration of construction activities but would mostly cease following the completion of the construction.

The resource agencies did not have specific recommendations to minimize or mitigate effects on terrestrial resources for each potential construction project that the Districts could undertake during the duration of new licenses for the Don Pedro and La Grange Projects. Also, BLM's 4(e) condition 3 for both projects specifies that the Districts would develop a soil erosion and sediment control plan with BLM approval for actions affecting BLM lands. Such a plan would prescribe site-specific erosion control measures, which would serve to avoid the spread of noxious weeds and protect and restore wildlife habitat after ground-disturbing activities are completed. BMPs could include actions to avoid habitat loss or compensate for any temporary or permanent loss of habitat due to construction activities. Conducting pre-construction surveys by a qualified biologist for special-status or threatened and endangered species prior to any ground disturbance involving heavy machinery, where suitable habitat exists, would provide further assurances that project effects would be minimized.

[137] The Districts also propose improvements to the existing whitewater boating take-out at the Ward's Ferry Bridge and completing construction of an infiltration gallery at RM 25.9 and new construction of a second infiltration gallery at the same general location. However, neither of these facilities would be included in the project. The Ward's Ferry Bridge improvements have no nexus to the project and the primary function of the infiltration galleries would be to withdraw water for consumptive use.

Wetlands and Riparian Areas

Continued operation and maintenance of the Don Pedro Project could affect the distribution, extent, composition, and structure of riparian vegetation along the lower Tuolumne River because the Don Pedro and La Grange Projects control flows and trap sediment. Under pre-dam hydrology, spring flows would have deposited sediment and created sandbars at elevations above the normal low-flow elevation. Conditions for cottonwood and willow recruitment on these sediments would have been provided by the slow recession of snow-melt flows. Controlled flows below both project dams reduce spring pulse flows and impede sediment transport, which disrupts the regeneration of riparian forest because dominant woody species like cottonwood and willow require freshly deposited and wetted mineral soils for germination. Altered spring recession flows can decrease the duration of floodplain inundation and affect the establishment, growth, and survival of riparian vegetation. Along the lower Tuolumne River, limited natural recruitment of Fremont cottonwood, Goodding's black willow, and other willow species (excluding narrow-leaf, red, and shining willow) outside of actively replanted restoration areas is demonstrated by lack of young cohorts of these species during both field surveys in 1996 and 2012 (Stillwater Sciences, 2013e). Cottonwoods and willows provide important ecological structure and function to riparian ecosystems by stabilizing stream banks, fixing carbon, generating LWM, and providing critical wildlife habitat.

The Districts propose to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph of the Tuolumne River, which would promote seed dispersal and germination of cottonwoods and willows. The Districts propose a significant increase in spring pulse flows over the current flows during high-flow, which they modeled as occurring in 60 percent of all years (i.e., spill years, in which flows at La Grange gage exceed 1,500 cfs in the February through July period). The Districts developed a draft plan to systematically optimize the benefit of the higher pulse flows, although it is specifically intended to benefit fall-run Chinook salmon outmigration. They did not identify specific recession rates, but if spill conditions allow, they would manage recession rates during the cottonwood seed dispersal period to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. The Districts contend that their flow hydrograph shaping is consistent with the intent of the agency and the Conservation Groups' flow proposals (i.e., spring pulse and recession rates) to support riparian vegetation maintenance in the lower Tuolumne River.

A stated goal of FWS is the restoration of riparian forest and floodplain along the Tuolumne River to support juvenile salmonid rearing, which would have substantial positive benefit to a wide diversity of native terrestrial biota. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Floodplain Habitat Restoration,* FWS does not recommend specific measures for habitat restoration within floodplains affected by the Don Pedro and La Grange Projects. Instead, FWS recommends (revised 10(j) recommendation 3 for the Don Pedro Project) implementing the Lower Tuolumne River Habitat Improvement Program, which would provide funding for planning, design, and constructing specific in-channel, riparian and floodplain

improvements in the lower Tuolumne River. Additional discussion of the Lower Tuolumne River Habitat Improvement Program is included above in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Lower Tuolumne River Habitat Improvement Program*. California DFW recommends (10(a) recommendation M5-1) the Districts prepare a spawning and floodplain habitat restoration plan for the lower Tuolumne River that would include no fewer than six project sites along the lower river, below the La Grange Diversion Dam, for the purpose of restoring native riparian vegetation. For the specific details of both FWS and California DFW recommendations, see section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Floodplain Habitat Restoration*. NMFS recommends (10(a) recommendation 2) the Districts recreate floodplains and side channels by recontouring piles of dredger tailings, including lowering the higher mounds of tailings piles, creating side channels, and raising the existing riverbed level, and that any in-channel placement of cobble/fill material be performed in a manner that increases local floodplain inundation. The Conservation Groups also recommend (recommendation 4) that the Districts design and implement the lowering of sufficient floodplain surfaces to achieve inundation for the same number of acre-days, as specified above during flow levels greater than 5,000 cfs, between February 1 and June 15. The Districts do not propose any measures specifically relating to floodplain habitat restoration along the lower Tuolumne River.

To further promote restoration of woody riparian vegetation in the lower Tuolumne River floodplain, NMFS recommends (10(a) recommendation 1.7) that the Districts base daily flow recession rates, between April 1 and July 31, on the percentage of the previous 24-hour average flow, depending on water year. During wet, above normal, and below normal water years, flows would not be reduced by more than 7 percent of the previous 24-hour average flow. During dry years, daily flow recession rates would not exceed 10 percent of the previous 24-hour average flow. Further details about this recommendation and the Districts' response to agency recommendations about recession rates are discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Ramping Rates and Fish Stranding.* California DFW recommends (10(a) recommendation M1-6) that the Districts follow the spring recession rates, presented above in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the *Minimum Flows and Pulse Flows* subsection, and shown in tables 3.3.2-31 and 3.3.2-32 for the Tuolumne River at the La Grange Diversion Dam gage and downstream of the infiltration galleries, respectively. The Conservation Groups recommend specific recession flows that would apply in above normal, below normal, and dry years, which are also presented above in the same *Minimum Flows and Pulse Flows* subsection.

Our Analysis

Wetlands and riparian areas support the greatest biodiversity of any ecosystem within the Don Pedro and La Grange Projects and are critically important to numerous rare and protected species. Nine of the ten drainages that the Districts evaluated within the Don Pedro Project were found to support wetlands and were assessed using the

California Rapid Assessment Methodology.[138] Most wetlands evaluated had scores between 70 and 100, indicating that they experience few stressors and provide a multitude of wetland services, but two wetlands had lower scores, suggesting that their function was reduced due to stressors. These systems are influenced primarily by the channel gradient, substrate, and flow duration, rather than project operation and maintenance activities. Adverse effects from cattle grazing was apparent at many wetlands evaluated, as evident by hoof action, grazed vegetation, cow manure, or direct observation of cattle. However, the wetlands examined supported few noxious weed infestations. Those that were present were generally upland species adjacent to wetlands. No project facilities, access roads, recreational use, or other operation and maintenance activities occur in any wetlands surveyed; therefore, there is little to no project effects on wetland habitat conditions.

The bulk of Don Pedro Reservoir is steep-sided, with upland grass or shrub habitats directly adjacent to the reservoir margin. Periodically, exposed areas below the normal maximum surface elevation are sparsely vegetated or bare. No wetland conditions below the reservoir's normal maximum surface elevation were observed during study efforts, and no water backs up into wetlands as a result of the Don Pedro Project operation. As a result, water level fluctuations do not affect wetland systems in proximity to the reservoir.

The Districts' study of riparian vegetation along lower Tuolumne River demonstrated that riparian areas are recovering from historical disturbances, based on the vigor and variety of age classes of the plants present. Cottonwood is one of the most abundant riparian trees in the river floodplain, second only to willows, and has increased from approximately 465 to 580 acres from 1996 to 2012. Overall, there has been a 419-acre increase in the extent of native riparian vegetation along the lower Tuolumne River over this time period (Stillwater Sciences, 2013e). This increase in native vegetation is largely associated with active restoration projects. Several restoration projects recommended for the Districts to undertake do not have a nexus to the Don Pedro and La Grange Projects. For example, recontouring the Tuolumne River floodplain in places affected by historical mining and dredger tailings has no relationship to the effects of the projects. The Districts' study of the lower Tuolumne River floodplain demonstrates that several historical and existing human activities have contributed to the current degraded condition of riparian vegetation, including gold dredging, floodplain gravel mining, levee construction, channelization, grazing, row crops, and urban development. Any potential floodplain restoration efforts along the banks of the Tuolumne River would require work under challenging conditions and

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[138] This standardized approach evaluates riparian wetlands in California with a standardized methodology. The highest score possible for an overall AA attribute score is 100, indicating that every possible wetland service is provided, and the wetland has reached its maximum potential for riparian wetlands.

require solutions to working with private landowners, getting access (temporary and/or permanent) through active mining operations or agricultural land, acquisition of aggregate or mineral rights, and reclamation of tailings ponds. The cost of such efforts could likely be very high. However, our analysis reveals that some ecological functions could be restored to reaches that have been degraded by historical floodplain alteration, mining and dredger tailing deposits.

Since 1996, FWS and other stakeholders have successfully increased the amount riparian vegetation by greater than 1,300 acres along the lower Tuolumne River through active restoration activities. These effort have also increased the distribution and quality of riparian habitat (Stillwater Sciences, 2013e). Large-scale river restoration projects are increasingly common in the lower San Joaquin Basin, and numerous studies have been conducted to understand the key physical and ecological processes needed to restore riparian cottonwood and willow ecosystems on large western rivers. With the application of this knowledge to future riparian restoration projects on the Lower Tuolumne River, floodplain restoration projects would likely be successful and cost-effective. As described in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Lower Tuolumne River Habitat Improvement Program*, the Lower Tuolumne River Habitat Improvement Program would provide a sustained funding source to perform active floodplain restoration, which would provide substantial, long-term benefits to the majority of terrestrial wildlife species in the region.

A major effect of the Don Pedro and La Grange Projects is the reduced magnitude, duration, and frequency of spring floods in the lower Tuolumne River. The resource agencies and Conservation Groups have presented evidence demonstrating the benefits of high spring flows and resulting floodplain inundation (e.g., Cienciala and Pasternack, 2017; Oppermann et al., 2010; Poff and Zimmerman, 2010; Richter and Richter, 2000; Rood et al., 2003). Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs. The Districts' proposed flow regime would increase spring pulse flows downstream of La Grange Diversion Dam, achieving floodplain inundation. For further detail regarding the association between floodplain inundation and fisheries, please see section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the *Floodplain Habitat Restoration* subsection.

The Districts designed their flow proposal to provide spring flows to benefit the recruitment and growth of native riparian vegetation that depends on seed deposition during high-flow periods (e.g., cottonwoods). Based on historic hydrologic conditions, the Districts state that their proposed schedule for water releases would provide for spring flows exceeding 1,500 cfs in February through July during 60 percent of years, and flows exceeding 2,500 cfs during 45 percent of the years. This metric is not very useful because it does not quantify the duration of spring flood flows. We evaluated the Districts' flow proposal against other stakeholders' flow recommendations for providing simulated average daily flows greater than 1,100 cfs from April 1 to July 15 below the La Grange Diversion Dam, which is the rate at which floodplain inundation is initiated.

Table 3.3.3-4 summarizes the percentage of days when the simulated average daily flows below La Grange Diversion Dam would provide floodplain inundation under the flow proposals by the Districts and other stakeholders. Across all water years, each simulated flow proposal would provide an improvement over existing conditions (i.e., base case), which on average provides flows exceeding 1,100 cfs during approximately 40 percent of the days. The Districts' proposed flow regime would increase the frequency of floodplain-inundating flows to approximately 55 percent and 70 percent of the days during April and May, respectively, but such high flows would occur less frequently during June and early July (<30 percent of days). On average, the FWS, NMFS, California DFW, and the Conservation Groups' flow scenarios would provide around an additional 5 percent more days with high spring flows in comparison to the Districts' proposal, with greater frequency during either April or May and with flows similarly declining towards baseflow levels into late June and early July. The flow regimes prescribed by the Water Board and recommended by ECHO and The Bay Institute provided the greatest number of days with flows exceeding 1,100 cfs, or between 68 percent and 73 percent of all simulated days. Overall, The Bay Institute flow proposal would maximize the number of simulated days at which floodplain inundation would occur on the lower Tuolumne River.

In unregulated rivers in the Sierra Nevada, native riparian tree species are adapted to recession flows following spring snowmelt. The timing of seed production and environmental cues for seed germination are correlated with high spring flood flows and flood recession. Cottonwood trees, for example, release their seeds after high spring flows have deposited sand and silt along river margins, creating conditions suitable for seed germination. Gradual recession of spring flows allows for riparian tree establishment by providing soil moisture conditions that allow seeds to take up water, germinate, and form roots. Changes in the timing and magnitude of receding spring flows can limit establishment of cottonwood and willow seedlings. The Don Pedro and La Grange Projects have historically operated without a flow recession that would allow riparian forests to regenerate, resulting in a degraded riparian system that is dominated by older trees and shrubs. In order to mimic a natural decrease in flow from springtime snowmelt to summertime base flow, if water supply allows, the Districts' proposed flow regime would manage spring flow recession rates during the cottonwood seed dispersal and seedling establishment periods. However, the Districts did not evaluate their model's performance at providing recession flows. In general, an ideal recession rate for seedling germination would be 2.5 cm per day drop in stage from April 1 to July 15 (Stillwater Sciences, 2006). Multiple studies suggest that a recession rate greater than 2.5 cm per day would prevent Fremont cottonwood seedling recruitment, and recession rates as slow as 1.5 cm per day could limit seedling recruitment (Mahoney and Rood, 1998; Rood et al., 2005; Stella et al., 2010).

Table 3.3.3-4. Percentage of days with potential floodplain inundation under flow proposals by the Districts and other stakeholders, quantified as the percentage of days with simulated average daily flows ≥ 1,100 cfs below the La Grange Diversion Dam (Source: Districts, 2018a,b, as modified by staff).

	Base Case	Districts Interim	Districts with IGs	FWS	NMFS	Cal. DFW	Water Board	Conserv. Groups	The Bay Institute	ECHO
April 01–April 30	54.5%	56.0%	56.3%	69.7%	74.4%	45.2%	80.9%	70.0%	86.4%	86.5%
May 01–May 31	41.5%	69.9%	68.5%	65.8%	63.8%	99.2%	93.2%	66.0%	94.9%	98.1%
June 01–June 30	34.8%	28.6%	28.7%	51.0%	39.2%	34.4%	71.8%	51.0%	75.9%	81.7%
July 01–July 15	24.8%	21.4%	20.8%	11.4%	13.7%	18.3%	29.0%	12.2%	35.2%	6.8%
Average	38.9%	44.0%	43.6%	49.5%	47.8%	49.3%	68.7%	49.8%	73.1%	68.3%

Note: The term *IGs* refers to the Districts' proposal to install and operate two in-river infiltration galleries at approximately RM 25.9 on the lower Tuolumne River. The infiltration galleries would be used to withdraw some of the water required to meet consumptive use needs and reduce the amount of water withdrawn at the La Grange Diversion Dam.

To evaluate the recession rates of the Districts' proposed flow regime against other stakeholder's flow recommendations, we compared the frequency of days with potentially suitable recession rates. We calculated the number of days during April 1 to July 15 when the daily change in simulated stage height below the La Grange Diversion Dam fell by 1.5 to 3.5 centimeters per day when the prior day's simulated flow was at least 1,100 cfs, during above normal, below normal, and dry water years. Table 3.3.3-5 provides a summary of the percentage of days when the simulated 24-hour river stage fell within that range.

In general, the modeled flow scenarios would not provide much opportunity for cottonwood recruitment in spite of the fact that FWS, NMFS, California DFW, Conservation Groups, and The Bay Institute's flow recommendations included parameters for achieving desirable recession rates. The Water Board's flow proposal performed better than all other flow proposals, and the simulated existing flow schedule (i.e., base case) generally achieved the target recession rates just as often as NMFS and California DFW's flow schedules. The Water Board's flow proposal did not contain specific recommendations for recession rates, but performed better than flow proposals that included explicit recession rates. We suspect that the poor performance of the recommended flow proposals for achieving recommended recession rates is due to the model's need to balance water supply and environmental resources among competing needs. For example, during years when water supply is adequate to achieve floodplain inundation, the operations models may be constrained by the need to maintain water in Don Pedro Reservoir for future water releases for irrigation, municipal and industrial purposes, and other environmental benefits in the lower Tuolumne River.

Despite the poor performance of the Districts' proposed flow regime to achieve target recession rates for enhancing woody riparian vegetation, as modeled, we do not discount that the Districts' proposed operations schedule would benefit riparian areas in the lower Tuolumne River. However, the Districts' flow regime could be more effective at restoring riparian ecosystems by specifying down-ramping rates of specified volume or at a volume that would achieve a drop in stage height of around 2.5 centimeters per day until the summer base flow is reached, depending on a recession flow initiation value and during above normal, below normal, and wet water years. In combination with other floodplain restoration projects by various stakeholders, including state and federal resource agencies, public utilities, and private organizations, the Districts' proposed spring pulse flows would provide for an increased distribution and diversity of riparian vegetation along the lower Tuolumne River. Given the relatively frequent (2−10 year) recurrence of inundation events lasting at least 30 days (HDR and Stillwater Sciences, 2017), and the Districts' commitment during spill years (60 percent of years during the 1971−2012 modeling period of record) to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions, the Districts' proposed flow regime would benefit riparian resources.

Table 3.3.3-5. Percentage of days with potentially suitable recession rates under flow proposals by the Districts and other stakeholders, quantified as the percentage of days where simulated average stage heights decrease between 1.5 and 3.5 cm on days following simulated flow of at least 1,100 cfs, below the La Grange Diversion Dam from April 1 to July 15 (Source: Districts, 2018a,b, as modified by staff).

	Base Case	Districts Interim	Districts With-IGs	FWS	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute	ECHO
April 01–April 30	0.44%	0.85%	0.85%	11.16%	0.64%	2.11%	9.62%	11.45%	10.74%	11.56%
May 01–May 31	0.74%	0.22%	0.34%	5.83%	0.24%	0.15%	6.51%	5.82%	6.31%	6.03%
June 01–June 30	2.51%	1.67%	0.56%	3.12%	0.00%	0.92%	9.39%	3.12%	8.89%	7.68%
July 01–July 15	7.05%	8.15%	1.53%	1.39%	5.81%	5.22%	5.46%	2.60%	1.80%	0.00%
Average	2.7%	2.7%	0.8%	5.4%	1.7%	2.1%	7.7%	5.7%	6.9%	6.3%

Note: The term *IGs* refers to the Districts' proposal to install and operate two in-river infiltration galleries at approximately RM 25.9 on the lower Tuolumne River. The infiltration galleries would be used to withdraw some of the water required to meet consumptive use needs and reduce the amount of water withdrawn at the La Grange Diversion Dam.

It is unclear why the recession rates recommended by the Conservation Groups would apply during dry water years, but not wet years. As recommended in Stillwater Sciences (2006), riparian recruitment flows are not normally targeted for normal, dry, or critically dry water years because reservoir volumes would not likely be sufficient to meet riparian recruitment flow needs. In these years, we conclude that the most appropriate strategy is to conserve the limited water supply to meet human needs and to provide stable base flows for recharging water tables during late summer, when existing cottonwood and willow trees would be most vulnerable to drought mortality. Furthermore, recruitment of these species is naturally sporadic, with cohorts becoming established and surviving not every year, but primarily in high flow years. Stillwater Sciences (2006) also suggests that riparian recruitment flows should be targeted from mid-April to late May to improve cottonwood recruitment, and mid-May to late June to benefit Goodding's black willow. Thus, California DFW's recommendation for only providing recession flows during June may be inadequate. Thus, an adaptive management approach to pulse-flow timing and duration, and recession rate management by the Districts, based on real-time knowledge of the project operation, would provide necessary flexibility for balancing resource needs and satisfying riparian restoration objectives.

Noxious Weeds

Ground disturbance due to vegetation management, human activity (e.g., recreation), reservoir water level fluctuations, and the presence and use of project roads have the potential to alter the composition of existing vegetation communities by increasing the potential introduction and spread of noxious weeds.

The Districts propose to manage noxious weeds according to the degree of threat posed to other resources (e.g., special-status plants) and California DFW's listing status and feasibility of control. The Districts' proposed Don Pedro TRMP includes three main components to manage noxious weeds: (1) using BMPs to prevent their introduction, establishment, and further spread; (2) surveying for noxious weeds beginning in the second year following license issuance, and every fifth year thereafter over the term of a new license; and (3) providing management guidelines to contain (and/or eradicate) existing and newly established infestations. BMPs in the plan for minimizing the potential introduction or spread of noxious weeds include: cleaning heavy construction equipment and vehicles that have been used off-road, minimizing ground disturbance during routine operation and maintenance activities, conducting revegetation in accordance with BLM guidelines for ground disturbance larger than 0.25 acre, using weed-free straw and native plants, and restricting travel to established roads.

To monitor the distribution of noxious weeds within the Don Pedro Project, the proposed TRMP also calls for conducting surveys on BLM-administered lands within the Red Hills ACEC and other lands within the project boundary that are subject to operation and maintenance activities. These noxious weed surveys would cover the Districts' developed recreational areas and would focus on recreational areas, along project roads,

adjacent to facilities, and similar areas that are most likely to be prone to noxious weed infestations. The Districts would document species composition, location, and relative abundance of each noxious weed occurrence. To manage noxious weed infestations, the Districts' proposed TRMP would include using herbicides to control California DFA A- and B-listed plants and some localized infestations of C-listed noxious weeds. The Districts propose to treat multiple occurrences of three California DFA B-listed plants: barbed goatgrass (n = 6), smooth distaff thistle (n = 15), and tamarisk (n = 1) but would use manual control methods in areas within 50 feet of ESA/CESA-listed plant occurrences. According to their proposed plan, the Districts would annually consult with the BLM about noxious weed management, including the current distribution and location of noxious weeds, proposed management plans and desired future conditions, and post-treatment monitoring methods and schedule.

The Districts did not submit a plan for managing noxious weeds at the La Grange Project, although due to its smaller size, overall project effects would be less than the Don Pedro Project. Furthermore, the potential for the spread of noxious weeds at the La Grange Project is limited by the lack of public access roads and facilities, or public access points.

To provide for early detection of new populations of noxious weeds, the Don Pedro TRMP includes protocols for environmental training of project staff and contractors once every 2 years for the term of any license. This biennial training would include information about the recognition of high-priority noxious weed species, emphasizing the Districts' noxious weed prevention guidelines and reporting procedures to document any infestations.

The Districts propose to consult annually with BLM about its noxious weed management activities, including the following information: (1) the current distribution and location of target noxious weed occurrence(s); (2) the proposed management method, duration, schedule, and specific application plans; (3) the desired future condition and criteria for success; and (4) the methods and schedule for follow-up monitoring of treated areas.

California DFW (10(a) recommendation M9-4.1), as well as FWS (in its comments on the Don Pedro TRMP) recommend that the Districts revise the plan to include the following BMPs that address noxious weeds:

1. Monitoring for new weed occurrences in special-status plant areas, such as Kanaka Point, where smooth distaff thistle is growing along the footpath that leads to Layne's butterweed occurrences.
2. Emphasis on manual control activities (such as hand trimming or weed whacking), when noxious weeds are in special-status plant areas, such as at Kanaka Point, where there is yellow starthistle in close proximity to Layne's butterweed.

Because the Districts did not conduct a noxious weed survey at the La Grange Project, BLM and FWS provided a draft TRMP that provides for a noxious weed survey of the La Grange Project during the first year following license issuance, and every fifth year thereafter.

Our Analysis

Noxious weeds pose a significant threat to native plant communities and wildlife habitat, especially the four California DFA B-listed species that were found at the Don Pedro Project (see table 3.3.3-1). Project operation and maintenance activities could potentially contribute to the spread of some noxious weeds, with the main potential contributors being roads and ground disturbances around project facilities (e.g., grading, mowing and spraying), recreational use (e.g., camping and hiking), and livestock grazing. Disturbed areas are more susceptible to colonization by noxious weeds than undisturbed areas. Noxious weeds have the potential to outcompete and displace native species, which alters native plant community composition and function. Noxious weeds may negatively affect wildlife habitat and biodiversity, increase wildfire risk, reduce agricultural water-use efficiency, and diminish recreational values.

The Districts identified 10 noxious weed occurrences in areas with grading activities, 5 occurrences in waste or storage areas, and 19 occurrences in mowed areas. In these areas, ground-disturbance by vehicles, heavy equipment, or human traffic could expose soil to the establishment of noxious weeds. Routine project operation and maintenance activities could affect the presence and spread of noxious weeds in proximity to project facilities, as well as the Districts' three recreational areas. Project operations that affect water levels in Don Pedro Reservoir also influence the spread of several noxious weeds, such as bermudagrass, a California DFA C-listed noxious weed, which occurs as a discontinuous band around Don Pedro Reservoir just below the normal maximum surface elevation. Bermudagrass and medusahead grass, also California DFA C-listed, are also known to occur near the eastern edge of the La Grange Reservoir. Once established, these non-native plant populations could expand quickly and would alter native plant communities.

In their Don Pedro TRMP, the Districts propose to conduct surveys for noxious weeds on BLM lands in the Red Hills ACEC and other lands subject to operations and maintenance activities. We agree that the surveys, as proposed, are warranted and necessary due to documented project effects on the occurrence of noxious weeds. These surveys would help ensure that noxious weeds do not increase. It would be most effective for the Districts to focus on areas where noxious weeds are most likely to occur or be introduced, which include the Don Pedro Reservoir shoreline, along busy roads and trails of Don Pedro Project recreational areas, in heavily grazed areas, and around project facilities.

We are unable to determine the extent of noxious weeds at the La Grange Project because the Districts have not performed a noxious weed survey of the project.

Operation and maintenance activities could contribute to the spread of noxious weeds at the La Grange Project, particularly in proximity to roads, canals, and facilities. Also, the Districts' proposed trail to the La Grange Reservoir could increase the likelihood of noxious weeds being introduced by recreational users. FWS commented that considerably more attention should be given to the potential adverse effects of recreation on sensitive wildlife and plant resources at the La Grange Project. In their reply comments, the Districts stated that there is limited recreation occurring within the La Grange Project and that they would conduct appropriate surveys prior to construction of the proposed trail to the La Grange Reservoir. We assume that this would include surveys for noxious weeds. However, to minimize the potential for project effects contributing to the spread of noxious weeds in the La Grange Project, conducting surveys for noxious weeds within the project boundary would be beneficial, as recommended by BLM. It would be sensible to perform a noxious weed survey of the La Grange Project during the first year of license issuance and with the same schedule as the Districts have proposed for the Don Pedro Project (every 5 years).

As discussed below under *Special-status Plants*, noxious weeds could become established and outcompete populations of special-status plants, as over half of the known special-status plant occurrences at the Don Pedro Project had noxious weeds growing in their proximity. Revising the Don Pedro TRMP to include additional provisions for future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants would reduce potential for this adverse effect. By focusing noxious weed surveys on these areas, the Districts would document any further encroachment of noxious weeds on sensitive plants, especially in areas such as Kanaka Point where the Districts documented recreational activities as potentially increasing noxious weeds in proximity to special-status plants. For the Don Pedro Project, the Districts have proposed to conduct surveys for special-status plants with the same frequency, so these surveys could occur simultaneously. Also, the Districts could control some small noxious weed populations during the surveys, as they reportedly did for multiple occurrences (n = 8) during their 2012 surveys. It would also be beneficial to include these same protective measures in a La Grange TRMP.

The Districts' proposal to treat noxious weed infestations with herbicides could adversely affect adjacent special-status plants if precautions are not taken. Six of the smooth distaff thistle populations that the Districts propose to treat with herbicide are in the vicinity of three occurrences of the federally threatened Layne's butterweed (within 250 feet of one occurrence), located on Kanaka Point. The Districts' Don Pedro TRMP calls for a 50-foot buffer around ESA/CESA-listed plant occurrences where no herbicide application would occur for documented California DFA B-listed occurrences within the project boundary. However, the resource agencies recommended an emphasis on manual control of noxious weeds in all areas where special-status plants are likely to occur, including future infestations. Modifying the Districts' Don Pedro TRMP to emphasize the use of manual control methods of noxious weeds in areas with special-status or threatened and endangered species, where feasible, would be a simple modification to

protect all special-status plants in addition to ESA/CESA-listed species. The use of manual control methods in areas with special-status or threatened and endangered species would also be appropriate at the La Grange Project. This treatment strategy would also avoid any adverse effects of herbicide include special-status plants, burrowing animals, wetlands and riparian areas, amphibians, reptiles, bats, and nesting birds. This would ensure that the treatment of smooth distaff thistle and other noxious weeds does not adversely affect Layne's butterweed, or other special-status plants. We discuss the benefits of flagging or fencing around special-status plants prior to any vegetation management activities, including noxious weed treatments, under *Special-status Plants*.

The Districts documented one occurrence of giant reed, a California DFA B-listed noxious weed, at the Don Pedro Project that was not proposed for management by the Districts in their Don Pedro TRMP. This population includes approximately 500 plants within an area of about 0.1 acre at a turn along the Don Pedro Powerhouse access road. Controlling this population of giant reed would reduce its potential spread to other areas of either project. Revising the Don Pedro TRMP accordingly would address the treatment of all known occurrences of California DFA A- and B-listed noxious weeds that the Districts identified. Future surveys at the La Grange Project would also document if there are any A- or B-listed noxious weeds in the La Grange Project.

Lastly, the recreational trail that the Districts propose to construct from the Don Pedro Visitor Center parking lot to the La Grange Reservoir would require ground-disturbing activities during construction, which could spread noxious weeds into adjacent plant communities. The Districts have documented numerous existing populations of medusahead grass and klamathweed in the general area of the proposed trail. Due to this lack of information, conducting pre-construction surveys prior to ground disturbance involving heavy machinery and monitoring noxious weed occurrences would determine if additional mitigation measures are needed to prevent their spread during trail construction.

Special-status Plants

The Districts reported four instances of project operation and maintenance activities that could affect special-status plants, including (1) road and campground maintenance, where one occurrence of Red Hills onion and six occurrences of Mariposa clarkia could be affected; (2) the use of a storage area, where one occurrence of Mariposa cryptantha is growing among stored equipment; (3) the removal and disposal of stockpiled wood, where one occurrence of Mariposa clarkia was growing among the debris pile; and (4) the management of Don Pedro Reservoir water levels, as portions of seven special-status plant occurrences of five species are located near or below the reservoir maximum inundation line.

Recreational activities, especially in the Red Hills ACEC, could affect several special-status plants that occur in that area. The Red Hills ACEC is important for special-status plants because of its serpentine soils and was designated to protect its rare

plant species. The primary stressors on the majority of special-status plant occurrences within the Don Pedro Project were noxious weeds and private cattle grazing activities (HDR, 2013g). In addition, portions of seven special-status plant occurrences of five species are located near or below the reservoir maximum inundation line, although the Districts reported them to not be adversely affected by current project operations. The Districts do not propose any changes to Don Pedro Reservoir water levels that could affect the duration or timing of these occurrences' inundation. Lastly, project activities that promote the establishment and spread of noxious weeds may have indirect effects on special-status plants, as over half of the observed occurrences of special-status plants were co-located with noxious weed occurrences (see *Noxious Weeds* above).

The Districts' proposed Don Pedro TRMP addresses project effects on special-status plants. The proposed plan includes protective measures for special-status plants on BLM lands and lands under the Districts' ownership, which include consultation with BLM, and conducting surveys prior to ground-disturbing activities. The Districts would develop specific-use plans for areas surrounding known occurrences of special-status plants that would be potentially affected by proposed project activities. Until such plans are developed, the Districts would exclude known special-status plant occurrences from routine Don Pedro Project activities. Also, prior to any new ground-disturbing activities affecting more than 0.5 acre, the Districts would conduct site-specific surveys for special-status plants, if warranted, during pre-activity review and consultation with BLM.

The Districts propose to monitor known occurrences of special-status plants within the Don Pedro Project beginning in the second year of license issuance, and every fifth year thereafter. They would consider additional monitoring or site-specific management efforts if data indicate substantial species decline, specific potential for project effects on special-status plants, or a need to evaluate individual activities.

California DFW recommends (10(a) recommendation M9-4.1) that the Districts revise the TRMP to include six BMPs to conserve special-status species. Two of those BMPs are also related to noxious weeds and were discussed previously under *Noxious Weeds*. The remaining four BMPs include:

1. Annual employee training for staff (employees and contractors), which would include information on recognition of special-status species, the location of existing occurrences of sensitive resources and areas to be avoided.
2. Implementing buffers around sensitive areas.
3. Flagging or fencing of sensitive areas with a site- and resource-specific buffers prior to any vegetation management activities, including noxious weed treatments, and removing the flagging when the work is complete.
4. Posting signs telling recreationists to "Stay on the Trail to Preserve Rare Plants and Their Habitat" when trails created by hikers and horseback riders go through special-status plant habitat, especially within the Red Hills ACEC at

Kanaka Point where there is evidence of a walking trail near the occurrences of Layne's butterweed and in Poor Man's Gulch where equestrian trail riding occurs near several occurrences of Layne's butterweed and Red Hills vervain.

FWS made these same recommendations in its comments on the Don Pedro TRMP, although they were not included as 10(j) recommendations. The Districts replied that, if necessary under the new license, they would draft a revised plan with additional protective measures.

BLM Don Pedro revised 4(e) condition 7 specifies that the Districts would conduct surveys for special-status plants every 5 years in the Red Hills ACEC and every 10 years on BLM lands elsewhere in the project. California DFW 10(a) recommendation M9-4.2 recommends that the Districts change the threshold for increased monitoring so that any substantial decline in special-status plants triggers consultation with California DFW, FWS, and BLM. California DFW also recommends that the Districts conduct surveys for special-status plants, in addition to known occurrences, in the following areas:

1. The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation Areas and related facilities, including the 3.5-mile Don Pedro shoreline trail;
2. High-use dispersed recreational areas, as identified by the Districts' staff;
3. Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
4. Don Pedro spillway channel and related access roads;
5. Gasburg Creek diversion dike and related access roads;
6. Employee housing near Don Pedro Dam;
7. Don Pedro Recreation Agency Headquarters and Visitor Center;
8. Dikes A, B, and C near Don Pedro Dam; and
9. Ward's Ferry take-out.

The Districts did not conduct surveys for special-status plants in the La Grange Project. BLM La Grange preliminary 4(e) condition 5 specifies that the Districts would conduct special-status plant surveys of the project every 10 years. BLM and FWS provided a draft TRMP for the La Grange Project as an attachment to their preliminary 4(e) conditions and 10(j) recommendations, which provides for a special-status plant survey on BLM lands within the La Grange Project boundary in the first year of license issuance and every tenth year thereafter.

Our Analysis

The Districts' proposed Don Pedro TRMP includes a section on special-status plants that would serve to protect known occurrences by ensuring that protection and consultation be undertaken prior to ground-disturbing activities. These protections,

which include BMPs for the control of noxious weeds, bi-annual employee training, and surveys for known occurrences of special-status plants every 5 years, would help to protect known special-status plant populations from project operation and maintenance activities, as well as from the indirect effects from invasive weeds, water fluctuations, and recreational activities. Surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery, rather than the proposed 0.5-acre minimum threshold for surveys, would ensure that adverse effects on special-status plant species are minimized during project activities.

Substantial numbers of special-status plants exist within the Don Pedro Project, and we find the Districts' proposed management of special-status plants to be lacking because the proposed surveys would only focus on known occurrences of special-status plants. Undocumented populations of special-status plants (i.e., not found during surveys) likely exist at the Don Pedro Project, and new populations of special-status species could become established over the duration of a license period. Thus, monitoring only known populations would be insufficient to protect new occurrences from project effects. Revising the Don Pedro TRMP to include additional surveys for special-status plants within the Red Hills ACEC every 5 years and every 10 years elsewhere within the project boundary would thus be necessary to prevent project effects on these species. Because special-status plant surveys were not performed at the La Grange Project, including a survey of special-status plants and a summary report assessing the need for future surveys would be beneficial. These surveys would include additional lands that are within the Don Pedro and La Grange Project boundaries and are subject to operations and maintenance activities (i.e., recreational areas, roads, and trails, as described above under California DFW 10(a) recommendation M9-4). The resource agencies mentioned numerous such locations for focusing surveys, including Kanaka Point and other areas mentioned previously.

The proposed bi-annual employee and contractor training would familiarize project staff with the ecology and management of plant communities at the projects. The analysis supports the Districts' revision of the Don Pedro TRMP to include additional information in the training about special-status plants and their habitats within the Don Pedro Project. It would be beneficial for this training to focus on the Red Hills ACEC and its special-status species because of their high abundance in that area. Increasing the frequency of employee training to an annual occurrence would provide greater protection of plant communities. BLM 4(e) condition 2 for both projects specifies that, as part of its employee training, the Districts provide employees with a confidential map of special-status plant populations and invasive plant locations, including GPS coordinates, and pictures and other guides to assist staff in recognizing special-status species, emphasizing the Districts' policies, management practices, and prevention guidelines. This would help project staff monitor existing populations of special-status plants or potentially identify unknown occurrences of special-status plants at the Don Pedro Project.

In addition, we agree with the resource agencies that the conservation of special-status plants in both projects would be provided by Districts' implementation of buffers around special-status plant occurrences, marked them with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatments, and removing the flagging or fencing when the work is complete. The resource agencies did not provide a specific buffer distance in their recommendation. Consistent with the Districts' proposed buffer for herbicide use around threatened and endangered plants, implementing a 50-foot protective buffer around special-status plants would protect sensitive plants from ground-disturbing activities at both projects.

The Districts could avoid potential adverse effects on Mariposa clarkia resulting from woody debris removal from Don Pedro Reservoir if they follow the recommendations of FWS and California DFW to employ a different rapid wood removal and off-site storage strategy rather than stockpiling and burning the woody debris. The inclusion of buffers around special-status plants, as suggested above, would protect this population and avoid duplicative protective measures. We provide further discussion of the Districts' Woody Debris Management Plan under the potential project effects on California red-legged frog (see section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*).

Don Pedro Reservoir operations have the potential to affect seven special-status plant occurrences of five species (Red Hills onion, tripod buckwheat, Congdon's lomatium, shaggy-haired lupine, and Red Hills ragwort) located below the high-water mark of the reservoir. These seven occurrences could be adversely affected by changes in duration or timing of inundation due to water level fluctuations. Several additional occurrences of other special-status plants are located on the reservoir shoreline near the maximum inundation line, including populations of Mariposa clarkia, Mariposa cryptantha, and shaggy-haired lupine. However, the Districts state they do not propose any substantial changes to increase reservoir water levels under a new license issuance, so there would be no adverse effects. The Districts' proposal to monitor known occurrences of special-status plants every 5 years would provide for the tracking of any future adverse effects of inundation on special-status plants near the reservoir shoreline.

The Districts located six occurrences of special-status plants in areas likely affected by recreational activities near developed recreational areas (two Red Hills onion, two Mariposa clarkia, and two Mariposa cryptantha). Other occurrences of these three species, in addition to populations of shaggyhair lupine, Red Hills soaproot, Congdon's lomatium, and Red Hills ragwort, were documented in proximity to other project operation and maintenance activities or recreational areas, although only the potential for effects from non-recreational activities were noted. In their comments on the Don Pedro TRMP, FWS and BLM described several special-status plant occurrences that they suggest be added to the Districts' description of special-status plant occurrences with the potential to be affected based on their known proximity to project roads, day-use areas, footpaths, and equestrian trails. Potential threats presented by recreational activities

include trampling or soil disturbance, and the associated spread of noxious weeds. We agree that recreation is a valid threat to special-status plants at the Don Pedro Project, and the analysis suggests that public outreach or education could serve to further protect their habitat, specifically within the Red Hills ACEC. If the Districts consult with BLM and provide interpretive information about the unique plant communities of the Red Hills ACEC, such as posting signs telling recreationists to "Stay on the Trail to Conserve Rare Plants and Their Habitat," the Districts could reduce the potential for recreation to affect these species.

Vegetation Management

Under a new license, the Districts would disturb vegetation resources through excavation, grading, topsoil stripping, or vegetation management during project operations and maintenance, and road maintenance (e.g., grading). Vegetation would also be affected during improvements to recreational resources (e.g., trail maintenance) and treatment of noxious weeds.

The Districts maintain facilities and associated roads, including three developed recreational areas at Don Pedro Reservoir, with a combination of mowing and periodically using pre-emergent herbicides, applied by licensed applicators, to manage vegetation growth. The Districts typically manage these areas, in proportion to their use, to minimize the spread of unwanted vegetation (e.g., noxious weeds) and the risk of fire. High-use sections of each recreational area are mowed, and shrubs and trees are frequently trimmed around structures and buildings to remove ladder fuels that could increase fire risk and to eliminate low branches that could injure passing humans. The Districts use herbicides to maintain bare ground around project powerhouses and switchyards and on Don Pedro Dam. They also annually apply herbicides to parking areas, campsite pads, roadsides, paths along irrigation canals, firebreaks, and the immediate area around restrooms and other recreational facilities.

In the Don Pedro TRMP, the Districts propose BMPs to minimize noxious weeds and ground disturbance during routine operations and maintenance activities. For ground disturbances larger than 0.25 acre in size, the Districts would conduct revegetation in accordance with BLM guidelines.

As detailed in section 3.3.1, *Geologic and Soil Resources,* BLM 4(e) condition 3 for both projects specifies that the Districts develop a soil erosion and sediment control plan for erosion and/or restoration actions on or affecting BLM lands that are within or adjacent to the project. The Water Board provides support with its preliminary 401 condition 9, which specifies that the Districts develop and implement a plan to minimize undesirable erosion or reduce sediment for ground-disturbing activities that include, but are not limited to, routine operation, maintenance, any new construction, and recreation improvement. Such a plan would specify the techniques that would be used to stabilize sites once ground-disturbing activities are completed, in order to support subsequent reclamation or vegetation restoration. According to BLM, an effective soil erosion and

sediment control plan would include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Also, BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts consult with BLM regarding any additional ground-disturbing activities not specifically addressed in this license application. The Districts responded that they would work with BLM to identify any necessary site-specific BMPs for ground-disturbing activities on BLM land within both projects.

Our Analysis

The Districts' proposed Don Pedro TRMP does not provide a comprehensive list of BMPs that would be implemented to avoid adverse effects on plant communities and wildlife habitat from ground-disturbing activities. BLM's 4(e) condition to develop a soil erosion and sediment control plan, in consultation with the other resource agencies, would serve to limit potential effects on plant communities. The analysis of the recommended soil erosion and sediment control plan is provided above in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*. Such a plan would provide overarching guidance for project construction and routine maintenance activities that require ground disturbance, ensuring that affected lands would be revegetated, noxious weeds would be prevented from establishing, and erosion does not adversely affect adjacent plant communities. Expanding the plan to apply to all project-related activities that entail ground-disturbing activities on all lands within the project boundary, rather than on BLM lands or greater than the Districts' proposed 0.25-acre minimum size, would provide additional protection during the Districts' vegetation management activities.

Special-status Bats

Bats are sensitive to human activity and can be adversely affected by disturbances to roost sites and foraging habitat. The Districts' study of bats in 2012 demonstrated that project facilities provide suitable habitat for several species of special-status bats, by evidence of bat night roosting at campground buildings and other project facilities. Because these areas are mostly used during the daytime, disturbance to night roost would not generally affect bat use of those facilities. As such, recreational activities are unlikely to result in abandonment of roosts by bats, although human use of these facilities at night may occasionally disturb bats. The Districts concluded that project operation and maintenance is not likely to affect special-status bats because the areas where bats were observed, such as the Fixed Wheel Gate building or access tunnel adjacent to the Don Pedro Powerhouse, are used very infrequently. Furthermore, the Districts did not identify

any maternity colonies or winter hibernacula during surveys of facilities or recreational sites.

The Districts' proposed Don Pedro TRMP includes guidelines for managing bats at the Don Pedro Project facilities, which includes the use of humane exclusion devices in coordination with California DFW, and BLM (if the facility is located on BLM-administered land). The Districts would install exclusion devices at project facilities that have a routine staff presence (i.e., at least daily or weekly) and with documented bat use, or signs of roosting. Where feasible, in the calendar year following discovery of bat presence, the Districts would install humane exclusion devices during periods when bats are absent from the facility to prevent further occupation of the structure. Thus, installation of exclusion devices would occur between November 1 and February 28. Prior to their installation, the Districts would perform an inspection of the facility to ensure that overwintering bats would not be trapped. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 support these protective measures for special-status bats and recommend that roosting special-status bats be protected from project effects in a revised Don Pedro TRMP and a new La Grange TRMP. In its recommendation, FWS provided guidance for the placement of exclusion devices, recommending that they not be placed over bat roosts located on the exterior of project facilities or on project facilities where human presence is infrequent or non-existent. FWS also recommends foam sealant not be utilized as an exclusion device. They also support the Districts' proposal to conduct additional inspections of facilities prior to installation of exclusion devices to ensure that overwintering bats would not be trapped. If overwintering bats are present during the inspection, installation of humane exclusion measures would be delayed and the Districts would consult with California DFW and BLM to identify future dates that would be suitable for installation of humane exclusion devices. The Districts' Don Pedro TRMP specifies that bats would not be excluded from day or night roosts discovered on the exterior of project facilities, night roosts at recreational area restrooms, and other project facilities where staff presence is infrequent or non-existent (e.g., the Fixed Wheel Gate building or access tunnel). The Districts would inspect the installed devices after 6 months to confirm their effectiveness (i.e., no evidence of bat presence) and annually inspect them thereafter for the duration of a new license. They would re-evaluate facilities with exclusion devices for roosting bats every 2 years after the devices are installed to ensure that no new bat roosts or entry points have been established. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 also supports this inspection schedule for maintaining bat exclusion devices in properly functioning condition, and repairing or replacing them when necessary.

In their 2012 survey, the Districts identified two facilities that are likely used as bat day roosts: the Fixed Wheel Gate building and the tunnel adjacent to Don Pedro Powerhouse. Thirty-two night roosts were also identified, mostly at campground restrooms and other recreational facility buildings, which are likely subject to indirect disturbance related to recreational use. The Districts state that, in spite of human activity

in and around these facilities, disturbance to night roosts would be limited and would thus not likely result in abandonment by bats. At a small cinderblock structure near the A2 restroom in the Blue Oaks campground, a single instance of a pallid bats night roost showed evidence of human activity with potentially adverse effects. To prevent visitor activities from disrupting bat use of this building during the evening, the Districts propose in their Recreation Resource Management Plan to take measures to exclude humans from the building while still accommodating pallid bat use (e.g., partially boarding the doorway).

FWS expressed concern that the Districts' proposed Don Pedro TRMP does not provide for the protection of special-status bats within the project, especially concerning human disturbance from recreationists. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 recommend the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures for any maternity colonies, developed in collaboration with the resource agencies. These recommended measures include prohibiting pesticide usage within 500 feet of a bat maternity colony. FWS also recommends annual surveys that would entail: (1) performing one day of surveys, annually, for bats and/or signs of bats roosting at project facilities, consisting of a daytime visual assessment and a nighttime emergence survey at all project buildings (e.g., powerhouses, storage buildings and valve houses), recreational facilities, dams, or other structures. FWS recommends the surveys occur during the peak of the bat maternity season, which is July 1 through August 31; (2) providing the resource agencies with a brief report[139] summarizing the results of the surveys within 30 days of completion of surveys, including a list of project facilities in which exclusion devices are proposed. FWS states that a goal of the plan, where feasible, is to install bat exclusion devices in the same calendar year that bat surveys occur; and (3) reevaluating project facilities for roosting bats every 2 years after the initial exclusion devices are installed to insure that no new roosts or entry points have been established. FWS recommends that the Districts maintain a map that identifies the locations of all installed bat exclusion devices and screen.

In its comments on both the Don Pedro and La Grange Projects, FWS states that the Districts did not provide any information about whether maternity roosts or winter hibernacula are present. It argues that this information is necessary to evaluate potential effects on special-status bats within the projects because bats using winter hibernacula and maternity colonies are the most susceptible to adverse effects from disturbance. The

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[139] The report would include a table with the list of project facilities surveyed and identify the facilities at which bats and/or signs of bat roosting were found, a map showing the locations of the facilities, photographs of the facilities showing the bats and/or signs of bat roosting, and the bat exclusion materials (i.e., screens) proposed for each facility. The resource agencies would have 30 days to review the report and provide comments.

Districts replied that measures to protect bat hibernacula and maternity roosts in the Don Pedro Project are unnecessary due to uncertainty about their existence, that the approved study plan did not require a complete survey of non-project facilities, and that no hibernacula or maternity roosts were identified at project facilities. The Districts did not comment on the resource agencies recommendations for additional bat surveys.

The Districts did not perform any pre-licensing surveys for bats within the La Grange Project and did not discuss any environmental measures in their license application. FWS's recommended protective measures for bats within the La Grange Project, which are the same recommendations detailed above for the Don Pedro Project. FWS recommends the Districts incorporate these measures into a new La Grange TRMP.

California DFW recommends (10(a) recommendation M9-3.2) the Districts revise the Don Pedro TRMP to include a bat monitoring and management plan, developed in consultation with the resource agencies, within 6 months of license issuance. The items detailed in this plan would consist of: (1) survey protocols for bat monitoring; (2) protocols for monitoring white-nose syndrome (WNS); (3) BMPs to avoid or minimize project effects on bats; (4) protection guidelines and requirements to ensure that projects' operation and maintenance or construction activities minimize effects on bats and their roosting areas; (5) BMPs at project facilities to avoid and minimize impacts; and (6) public education actions about bats at the project. The Districts replied that that there is no reason to suspect that project operation and maintenance has any bearing on the occurrence of WNS. They did not reply to the resource agency's recommendation for additional surveys. Regarding the need for additional protective measures, the Districts replied that while project effects on bats are limited, they would update the bat management plan to include information and educational materials on detection of WNS during annual employee and contractor training, and procedures to document and report evidence of bats affected by WNS to California DFW (e.g., via an on-line form). We assume that the Districts intended to say "Terrestrial Resources Management Plan" because no bat management plan was included with the Districts' license application for either the Don Pedro or La Grange Projects.

Our Analysis

Bat signs were detected at a number of project buildings at Don Pedro recreational areas, as well as other project facilities. Don Pedro TRMP does not propose measures to exclude bats from using all facilities where project activities could disturb them. Potential effects from the project include not only maintenance at project facilities, but also human disturbance from recreationists. Installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting would ensure that project recreational uses do not adversely affect special-status bats.

To account for potential adverse effects on special-status bats, a stand-alone Bat Monitoring and Management Plan would not be necessary. Rather additional protective measures could be incorporated into a revision of the Don Pedro TRMP and a new

La Grange TRMP. This could include additional consultation with the resource agencies to more accurately determine which project facilities are likely affected by human disturbance, which would guide the Districts' installation of exclusion devices.

The Districts last conducted a bat survey over 5 years ago, in 2012. Because bat habitat use could change for reasons such as drought or wildfire, a reevaluation of bat use at Don Pedro Project facilities, where the potential exists for conflict with humans, would provide for more accurate decisions about the proposed protective measures (i.e., exclusion devices). Performing this survey during peak bat maternity season (July 1 through August 31) would help to inform if and where any maternity roosts exist within the project boundary. In addition, surveys for bats surrounding the La Grange Project facilities were not performed. A comprehensive survey of the La Grange Project, focused on all areas of the project with any potential for project effects on bats, would indicate whether bat exclusion measures are also needed at La Grange Project facilities. If necessary, special-status bats at the La Grange Project could be protected with the installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. Revising the TRMPs for both projects, and excluding bats from facilities where they would be affected by project activities, would afford special-status bats with adequate protections. Additionally, because bat roosting behavior and human activity at project facilities could change, periodic surveys would be necessary to ensure that project operations do not affect bats over the duration of any license. If the Districts resurvey all project facilities that have the potential for bat use every 5 years, rather than only resurveying those facilities where exclusion devices have been installed, bats would be afforded further protection. This could also be incorporated into a revised Don Pedro TRMP and a new La Grange TRMP.

WNS is caused by a fungus that infects bats while they hibernate for the winter. It covers their nose, wings and ears with a white fuzz that invades the bat's skin and causes them to wake from hibernation and burn essential fat reserves that often leads to starvation. The potential occurrence of WNS and its deadly impacts on bats is a real concern given its steady westward spread across North America since being detected on bats in New York in 2006. The disease reached southwest Washington in 2016, but has not yet been documented in California or elsewhere west of Nebraska (White-nose Syndrome Response Team, 2018). In spite of its impending threat, there is not a project nexus for the occurrence of WNS because project staff and recreationists do not regularly interact with bats at the projects. The exclusionary measures proposed for project facilities in the Don Pedro TRMP, combined with additional surveys to better understand bat usage around project facilities, would serve to avoid any potential for humans to spread the WNS fungus. A periodic evaluation of bat usage at project facilities, in combination with bat monitoring by California DFW and FWS, would provide adequate information for the Districts to evaluate whether WNS is adversely affecting special-status bats that roost within either the Don Pedro or La Grange Project boundaries.

Disturbance to bat roosts due to human activity at project facilities can be especially harmful to bats during sensitive life-history periods, especially the maternity

season and winter hibernating. Both types of roosts are typically used by successive generations of bats over many years. Disturbance to maternity colonies can cause bats to abandon young, and effects on maternity colonies can decrease fecundity of individuals and populations as well as subsequent generations of bats. If disturbed during hibernation, bats may awake prematurely, which can cause an elevation in body temperatures and promote the use of stored energy reserves, leaving insufficient energy to survive the rest of the winter. The presence of maternity roosts or winter hibernacula within the Don Pedro and La Grange Projects is uncertain because that was not a focus of the Commission-approved study plan. Another survey of all Don Pedro and La Grange Project facilities during the maternity season, and resurveys of potential roosting areas would provide data to help determine if the projects supports any maternal roosts or hibernacula.

Lastly, because the Districts did not name the specific facilities where vegetation is controlled with herbicides, it is possible that some structures used by bats (e.g., campground pads and housing areas near Don Pedro Dam) could have herbicides applied in their vicinity. Although the Districts did not locate any maternity roosts, sexually mature pallid bats were captured, which suggests that some of the identified bat day roosts could potentially be used as maternity roosts. Likewise, although no winter hibernacula were identified, bats were detected in winter months, indicating that winter hibernacula is likely present within the project boundaries. Based on these findings, prohibiting the use of pesticides[140] within 500 feet of any documented maternity roosts would limit negative effects on prey populations and reduce bat's potential intake of exposed insects and the adverse effects of accumulating pesticides that have genotoxic effects on bats (FWS, 1981; Schmidt et al., 2001; O'Shea and Clark, 2002). However, restricting pesticide use could potentially prevent YCWA from applying pesticides to dam faces and groins, including spillway areas, where they are essential to control pests (e.g., ground squirrels and invasive weeds and vegetation). Controlling vegetation around project facilities would also be necessary for the Districts to perform visual inspections and to minimize the risk of wildfire. Although it could be beneficial to stipulate that pesticides be avoided in proximity to bat maternity roosts, we expect that the Districts will responsibly follow California pesticide regulations to avoid contamination of the environment, as set forth in California Code of Regulations, Title 3, Division 6, Chapter 3. If special-status bat roosts or foraging occur in proximity to areas

[140] Pesticide refers to many kinds of chemicals intended to control, destroy, repel, or attract pests, including insecticides, herbicides, and rodenticides. The Districts use herbicides annually for vegetation management and rodenticides occasionally for ground squirrel management. The resource agency recommendations frequently reference "pesticides," which we interpret as meaning both herbicides and rodenticides. For the purposes of this EIS, the use of the term "pesticide" includes both herbicides and/or rodenticides.

where the Districts plan to use pesticides, mitigation to consider would include: (1) alternative herbicides; (2) reduced application rates; (3) no-herbicide buffers around bat roosts; (4) alternative forms of herbicides, such as the pelletized forms; or (5) alternative methods of herbicide application, such as spot spraying.

Bald Eagles

Don Pedro Reservoir supports multiple nesting bald eagles, and three active nests were observed during the Districts' 2012 nesting survey. Activities that could potentially disturb bald eagle foraging and nesting include project operation and maintenance, such as woody debris management, and recreational uses that include camping, hiking, motorized and non-motorized boating, and off-highway vehicle use. Bald eagles that roost during winter on Don Pedro Reservoir could also potentially be affected by these disturbing activities. Where human activity agitates or bothers roosting or foraging bald eagles to the degree that causes injury or substantially interferes with their breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or nest abandonment, the conduct of the activity constitutes a violation of the Bald and Golden Eagle Protection Act's prohibition against disturbing eagles (FWS, 2007a).

The Districts did not conduct surveys for bald eagles within the La Grange Project. However, because of the abundance of fish, the La Grange Reservoir likely supports bald eagles, at least occasionally. Human recreation, primarily fishing, would potentially affect bald eagle foraging in the La Grange Reservoir and further downstream on the lower Tuolumne River.

The Districts' Don Pedro TRMP includes a section on bald eagle management, which includes the following measures to protect bald eagles: (1) conducting periodic surveys, beginning the first full calendar year after license issuance, repeated in year 2 and year 4, and then once every 5 years after the fifth year; (2) protecting existing nests; and (3) restricting human access to prevent disturbance during bald eagle mating and rearing. Upon completion of the first nest survey (in March of the first full calendar year following license issuance) and for all active nests identified after the initial nest survey, the Districts would establish a 660-foot protective buffer around all occupied bald eagle nests. Buoys and signs would be used to delineate the buffer. The plan also includes ongoing consultation with the FWS regarding any planned rodenticide use, and awareness training for employees for avoidance around active nesting areas. Beginning January 1 through August 31 of each year thereafter, the Districts would institute a limited operating period around all known active bald eagle nests for operation and maintenance and recreational activities (e.g., boating, camping, and hiking) within the 660-foot buffer. The Districts could remove, adjust, or establish new nest buffers if subsequent nesting surveys demonstrate that a territory is no longer occupied or if new bald eagle nests are identified.

In its 10(j) comments, FWS claims that the Districts' proposed plan is inadequate to protect nesting bald eagles on Don Pedro Reservoir because the Districts only propose

to conduct nest surveys during 10 years out of a potential 40-year license term. It is unclear if this is the intent of the Districts' proposed schedule for bald eagle surveys, but during years when surveys are not performed, it would not be possible to impose protective buffers around active nests. Thus, FWS contends annual surveys are necessary to identify bald eagle nest locations.

BLM Don Pedro revised 4(e) condition 8 and La Grange preliminary 4(e) condition 9 specify, and FWS Don Pedro 10(j) recommendation 10, La Grange 10(j) recommendation 9, and California DFW 10(a) recommendation M9-1 recommend that the Districts develop a stand-alone bald eagle management plan that is consistent with bald eagle management on other reservoirs. FWS provided a draft plan for Districts to use, as an attachment to its 10(j) comments. FWS recommends and BLM stipulates that the plan include: (1) annually conducting bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 1 mile of the shorelines of Don Pedro Reservoir and La Grange Reservoir; (2) conducting surveys in accordance with the Bald Eagle Breeding Survey Instructions (California DFW, 2010) and the Protocol for Evaluating Bald Eagle Habitat and Populations in California (Jackman and Jenkins, 2004); (3) if any new nests or communal night roosts are located, coordinating with BLM, FWS, and California DFW to establish a protective buffer around each nest or night roost; (4) conducting annual employee awareness training; and (5) holding an annual consultation meeting and completing annual reporting. FWS also recommends conducting bald eagle nesting surveys also be conducted within suitable habitat on all lands within 1 mile of La Grange Reservoir shoreline for the first 3 years of a new license and continuing annually if any nesting activity is observed, or once every 3 years if no nesting activity is observed.

FWS, in its 10(j) comments and attached stand-alone bald eagle management plan, filed January 29, 2018, recommends that the buffer around bald eagle nests be changed to 0.25 mile because of a recently documented nest failure and because a 0.25-mile buffer has been adopted at other projects. California DFW 10(a) recommendation M9-1 recommends establishing a 0.25-mile buffer around both nests and communal night roosts. FWS states that if it has been established that a bald eagle nest is successful with the 660-foot-radius buffer, the Districts should consult with BLM (on BLM-administered lands) and FWS to establish a site-specific buffer reduction. California DFW 10(a) recommendation 9-4.1 additionally recommends that water barriers (e.g., buoys, signage) and land barriers (e.g., fencing signage) be installed around occupied bald eagle nests to delineate the buffers restricting recreational activities near nests, if determined appropriate by BLM, FWS, and California DFW

The Districts replied that although they disagree with many of the above components of the recommended plan, they are not opposed to preparing a stand-alone bald eagle management plan for the Don Pedro Project and a bald eagle management plan for the La Grange Project. No studies of bald eagle were requested or required for the La Grange Project, and the Districts contend that there is no evidence of bald eagle use of the project. The Districts replied that they would draft a stand-alone plan that is "suitable

to the scale of the La Grange Project." The Districts contend that its proposed 660-foot protective buffer around active nests is sufficient and is compatible with successful bald eagle foraging and nesting. They cite, for example, that the Mine Island nest is located in an area that experiences frequent and heavy recreational boat traffic during the spring and summer seasons. Similarly, the nest in the Woods Creek Arm is located in an area that not only receives regular use by boaters, but is located in a narrow portion of the canyon that exposes the nest to all passing boats. The Districts disagree with FWS's buffer assessment, stating that the bulk of the potential disturbance to bald eagle is from motorized watercraft on Don Pedro Reservoir. They cite the FWS National Bald Eagle Management Guidelines as recommending a 330 foot buffer during breeding to protect against disturbance by motorized watercraft.

California DFW 10(a) recommendation M9-1 recommends that the golden eagle be added to the FWS-recommended bald eagle management plan to provide similar protections for golden eagles. The Districts replied that California DFW does not provide any supporting information or evidence of the need for including golden eagles in the plan. They acknowledge that golden eagles may infrequently occur at the Don Pedro Project and would record any future opportunistic sightings of golden eagles.

Our Analysis

Bald eagle nest surveys in 2012 and 2013 on Don Pedro Reservoir identified nine bald eagle nests, three of which were occupied by nesting bald eagle pairs. Activities associated with project operation, maintenance, construction or recreation may adversely affect or disturb, resulting in take of bald eagles. The National Bald Eagle Management Guidelines (FWS, 2007a) report that recreational activities similar to those on Don Pedro Reservoir and La Grange Reservoir (e.g., boating, jet skis, hiking, camping, fishing, kayaking, and canoeing) have the potential to disturb nesting bald eagles. Also, routine maintenance, including vegetation management, and hazard tree removal activities have the potential to disturb bald eagles.

Recreational uses at the Don Pedro Project, such as motorized and non-motorized boating, highway vehicle use, and hiking, would potentially disturb bald eagles, especially nesting adults. Project operation and maintenance activities would be unlikely to adversely affect nesting bald eagles since no facilities or maintenance activities are located within 1.5 miles of a bald eagle nest. Under the Districts' proposed Woody Debris Management Plan, no staging or burning of woody debris in Don Pedro Reservoir would occur within 0.5 mile of an active bald eagle nest.

Adult eagles that are disturbed during the nesting season can become agitated to the extent that they abandon their nest before successfully raising chicks. It is uncertain if human disturbance at Don Pedro Reservoir has been responsible for any bald eagle nest failure, although the resource agencies suggested that it is likely the reason why a documented nest failed in 2012. Therefore, we agree that it would be prudent to increase the protective buffer around active bald eagle nests from 660 feet, as proposed, to

0.25 mile, and provide signs to inform recreationists of the temporary closure(s). This protective buffer distance has been adopted by the Commission for several other projects. If it has been established that a bald eagle nest has been successful with the 660-foot buffer, then the Districts could consult with BLM (on BLM administered land), California DFW, and FWS to establish a site-specific buffer reduction.

In order to determine if and where protection buffers are needed around bald eagle nests, regularly scheduled annual surveys are necessary. FWS expressed concern that the infrequent schedule of proposed bald eagle nest surveys, every 5 years after the fifth year of license issuance, would result in no protections for nesting bald eagles during 75 percent of the years of any potential license. The inclusion of annual nesting surveys in a revised, stand-alone bald eagle management plan would allow the Districts to protect active nests every year.

Golden eagles rarely occur at the Don Pedro or La Grange Projects, and no nests have been reported. Thus, we do not see any benefit to the species by including additional protective measures for golden eagle in the revised bald eagle management plan. However, including a provision for recording incidental sightings in the TRMPs for both projects would serve to protect golden eagle. This is discussed further in the next section, as it also pertains to several other special-status birds that may utilize both projects.

BLM and Central Sierra Audubon have conducted wintering counts for bald eagles near Don Pedro Reservoir during mid-January from 1994–2012. The number of bald eagles on Don Pedro Reservoir has varied from 5 to 34 per survey, with an average of 20 bald eagles per year (BLM, 2018). Project recreation and woody debris management on Don Pedro Reservoir could also affect wintering bald eagles on daytime hunting perches, while foraging in the reservoir, or at communal night roosts. The Districts could minimize potential adverse effects on wintering bald eagles by conducting annual winter population and night roost surveys as recommended by FWS in its revisions to the bald eagle management plan for the Don Pedro Project. They suggest the Districts annually monitor the size and distribution of wintering bald eagle populations along established survey routes around Don Pedro Reservoir. Wintering surveys are typically conducted during the 2-week, nationwide mid-winter bald eagle survey, typically scheduled during the first part of January every year (Jackman and Jenkins, 2004). FWS's recommended plan provides for protecting wintering bald eagles by restricting activities from November 15 through March 15 within 0.25-mile of the Don Pedro Reservoir, and within 0.25 miles of the Don Pedro Dam. The National Bald Eagle Management Guidelines (FWS, 2007a) recommendations for avoiding disturbance at foraging areas and communal roosts, such as wintering areas, include the avoidance of "important foraging areas", avoiding aircraft use within 1,000 feet vertical or horizontal distance from communal roost sites, and limiting explosives within 0.5 mile of communal roosts. Communal night roosting is one of the most important phenomena of wintering eagles. We are unable to evaluate the Districts' conformance with these guidelines

without knowing the locations of bald eagle communal night roosts or important foraging areas of wintering eagles.

Human recreation on Don Pedro Reservoir has been ongoing since the project was constructed but has increased and is expected to continue to increase. Two of the three occupied bald eagle nests observed during pre-licensing surveys were located in areas of high recreational use. Given the relatively high level of motorized recreation on Don Pedro Reservoir, we agree with the resources agencies that bald eagles would be better protected by the development of a stand-alone bald eagle and special-status bird management plan for both the Don Pedro and La Grange Projects, with any revisions developed in consultation with the resource agencies.

Burrowing Owls

Project operation and maintenance of the Don Pedro Project includes periodic gopher control (e.g., California ground squirrel and valley pocket gopher) in developed recreational areas. Beginning in 2016, the Districts ceased to control rodents with burrow blasting and pelleted rodent poison, and now use a Gopher X smoke and carbon monoxide system that poses less risk to other wildlife and leaves burrows intact following treatment. The Districts propose to continue using this system during the course of a new license term for the Don Pedro Project. The La Grange Project license application makes no mention of any gopher control activities, so we assume it does not occur. If the need to use rodenticides within the Don Pedro Project boundary arises, the Districts state that prior to application, they would consult with the California DFW, FWS, and BLM on the type and location of use.

The burrowing owl and Blainville's horned lizard are two special-status species that potentially occupy small mammal burrows within the Don Pedro Project. The burrowing owl depends on rodent burrows for nesting. The western subspecies of burrowing owl appears to have been overlooked during project scoping but was addressed by the resource agencies' recommendations and mandatory conditions. In absence of surveys, FWS and California DFW assume the species may be present.

FWS Don Pedro 10(j) recommendation 11 and FWS 10(j) La Grange recommendation 10 suggest that the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures that would apply to burrowing owls within the project boundaries.[141] Specifically, they recommend:

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[141] FWS 10(j) recommendations 11 for the Don Pedro Project and 10 for the La Grange Project are also intended to address potential effects on San Joaquin kit fox, California red-legged frog, and California tiger salamander. We discuss effects on these species in section 3.3.4, *Threatened and Endangered Species.*

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for western burrowing owl.
2. Provisions to minimize impacts from roads on western burrowing owl, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
3. Provisions to minimize impacts from transmission lines on the western burrowing owl, developed in collaboration with the resource agencies. This would include measures to discourage raptor use of transmission lines as perches within suitable habitat for burrowing owls.
4. Measures to avoid impacts to western burrowing owls from vegetation management and ground squirrel control. Vegetation management and burrow fumigation activities should avoid all occupied western burrowing owl dens in all months of the year. Protective buffers for occupied dens should be developed in collaboration with the resource agencies.
5. Development of species monitoring, in collaboration with the resource agencies, for western burrowing owl with surveys to be conducted every 3 years or as determined by the resource agencies.
6. Include actions in the plans, as appropriate for the project(s), provided in the Guidance for Burrowing Owl Conservation (California DFW, 2008).

The Districts replied that because they have documented no evidence of these species at the Don Pedro Project, there is no basis for developing a management plan with monitoring and protection measures for them. They argue that their relicensing studies, environmental analyses, and draft Biological Assessment (BA) for terrestrial species found that the projects are unlikely to adversely affect burrowing owl, and contend that FWS presents no data or studies to refute these findings. The Districts believe that their Don Pedro TRMP, as currently drafted, provides adequate protection for all terrestrial species.

Our Analysis

The potential effects of project operation and maintenance on special-status burrowing wildlife such as the burrowing owl include the Districts' use of pesticides and rodent control activities. We discuss the use of pesticides (i.e., herbicides) below, under section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the *Special-status Bats* and *Special-status Amphibians and Reptiles* subsections.

The Districts' use of a Gopher X extermination machine for rodent control in proximity to the three Don Pedro Project developed recreational areas could adversely affect burrowing owl if they were to occur within the project boundary. The Gopher X machine works by heating a mixture of castor oil and mineral oil to create a smoke and force it into rodent burrows. Although it is a preferable alternative to fumigation or rodenticide, the smoke and carbon monoxide would cause non-target burrowing wildlife

to also die from asphyxiation. The Districts did not propose any protective measures for burrowing animals, including burrowing owls, in the Don Pedro or La Grange Projects because they concluded that there would be no project effects. While the potential effects are less than fumigation or rodenticides, the Districts' rodent control activities would present some risks to other non-target wildlife. Furthermore, while their method leaves rodent burrows intact following treatment, burrows would likely collapse without maintenance by ground squirrels and the important habitat they provide to other species would be lost. Including BMPs to protect burrowing owl in the Don Pedro TRMP would avoid this potential effect. Such measures would include specific descriptions of where ground squirrel activity is problematic and where the Districts' rodent control would potentially occur, conducting surveys in accordance with California DFW protocols prior to any rodent control, and instituting avoidance measures for any occupied or potentially occupied burrows.

Other Special-status Birds

Project operation and maintenance, and recreational activities could disturb several birds of prey that potentially nest and forage at the Don Pedro Project, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Of these, the Districts have only documented occurrences of osprey and golden eagle within the project, although the Swainson's hawk has been documented within 4 miles of the Don Pedro Project boundary. Osprey are generally less sensitive to human disturbance than bald eagles, but would be susceptible to the same potential effects as described above for bald eagles.

California DFW recommends (10(a) recommendation M9-1.5) the Districts collect and maintain records of incidental observations of the above five special-status raptors, and other special-status species such as the least Bell's vireo. These observations would occur while conducting bald eagle surveys or while performing any project operation and maintenance activities. They request that Districts maintain a map of all special-status birds and their nests located while surveying or incidentally observed in the projects' vicinity. Furthermore, California DFW recommends that if any active nests of these species are observed, the Districts should protect the nest with a minimum 500-foot avoidance buffer until the breeding season has ended.

Our Analysis

It is difficult to develop species-specific avoidance and minimization measures due to the lack of known occurrences for several special-status birds that could potentially occur at the Don Pedro and La Grange Projects. For example, golden eagles and Swainson's hawks likely use lands within the project boundaries, but it is unknown if they ever occur in proximity to project operations and maintenance activities. We agree that special-status birds would benefit from the Districts' collection of incidental observations while performing other activities at both the Don Pedro and La Grange Projects. The bald eagle nesting surveys on Don Pedro Reservoir and La Grange

Reservoir would provide an opportune time to also document other special-status avian species. We suggested previously in the *Bald Eagles* section that these surveys would be more informative of project effects if they were to occur on an annual basis, rather than the Districts' proposed schedule on Don Pedro Reservoir. A more frequent survey interval would increase any potential incidental sightings of additional raptor species. Recording the locations of special-status bird observations would inform any future need for management actions to conserve special-status birds. Furthermore, implementing a protective buffer around active nests of these special-status birds would ensure the project would have "no effect" on them. The buffer distance would vary by species. For example, ospreys are generally less sensitive to disturbance than bald eagles, as demonstrated by documented nest success in areas of Don Pedro Reservoir that experience high levels of motorized boating. For other special-status birds, further consultation with FWS and California DFW would determine if protective buffers are needed around any discovered nests and what buffer distances are appropriate based on species sensitivity to disturbance.

Special-status Amphibians and Reptiles

Project operation and maintenance could affect one special-status amphibian, the foothills yellow-legged frog, and two special-status reptiles, the Blainville's horned lizard and western pond turtle. Effects on amphibians and reptiles could occur due to herbicide usage, rodent control activities, water level fluctuations of Don Pedro Reservoir and La Grange Reservoir, woody debris management, and the presence of American bullfrogs and predatory fish. The projects could affect two federally listed amphibians, the California red-legged frog and California tiger salamander, which are discussed below in section 3.3.4, *Threatened and Endangered Species.* Water level fluctuations in Don Pedro Reservoir and La Grange Reservoir, associated with project operation, could affect western pond turtle habitat by affecting water temperatures and the availability of both basking substrates and vegetated, shallow shoreline areas that are necessary for juvenile western pond turtles. Traffic associated with project operation and recreation may also affect the species.

The use of herbicides to control vegetation around project infrastructure and facilities has the potential to cause significant adverse effects on amphibians. The active and inert ingredients of pesticides and herbicides are known to have deleterious effects on amphibians (Cox and Surgan, 2007). For example, glyphosate (the active ingredient in a common herbicide) has been found to be poisonous to frogs and other amphibians and is extremely toxic to the tadpoles. To reduce potential adverse effects on amphibians, the nearby Stanislaus National Forest Service's guideline from its most recent Forest Plan is to avoid application of pesticides to areas within 500 feet of sites known to be occupied by sensitive amphibian species. BLM does not provide specific distance buffers, but its Don Pedro revised 4(e) condition 32 and La Grange preliminary 4(e) condition 23 specify that pesticides are not to be used in areas affecting BLM lands without the prior written approval of BLM. The Districts would need to submit to BLM an annual request for

approval of planned uses of pesticides for the upcoming year, which would include specific herbicides proposed for use, the specific locations, application rates, and safety risk and timeframes for application. Also, BLM requests that any pesticide use deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations of BLM special-status plant populations, be designed to avoid adverse effects. FWS 10(j) recommendation 8 for both projects suggests that the Districts initiate formal ESA consultation with FWS for future planned use of pesticides within the projects. FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend protective buffers for the use of pesticides, but do not state distances.

In their reply comments, the Districts state that they conducted a detailed assessment of habitat availability for federally listed amphibians, in accordance with the approved study plan for the Don Pedro Project, and that these studies found a very limited potential for project effects on these species. They argue that FWS provided no data or analyses to refute these findings.

In its REA comments, FWS notes that the projects' influence on water flow and temperature could affect western pond turtle habitat, behavior, reproduction, and survival. Water level fluctuations in Don Pedro Reservoir and its inlet creeks could affect western pond turtle habitat by changing the availability of both basking substrates and the vegetated, shallow-water areas that are necessary for juvenile western pond turtles. Changes in reservoir water temperatures may affect the species' life history, such as growth patterns, age at maturity, and size at maturity, which in turn could affect turtle survival and reproduction. FWS contends that the significant amount of time western pond turtles spend in upland environments (for nesting and overwintering) means that effects of roads and canals and extreme flow fluctuations during winter months, in both rivers and reservoirs, needs to be evaluated. FWS notes that canals can act as barriers to upland movements and potentially result in mortality if turtles fall in and cannot climb out. Road mortality effects on sex ratios (reduction in adult females) have been documented for many other species of turtles (Gibbs and Steen, 2005).

BLM Don Pedro revised 4(e) condition 7 specifies the Districts record incidental observations of western pond turtle during other monitoring efforts to gain a better understanding of its distribution and population status within the project, and the Districts propose this recording in their Don Pedro TRMP. California DFW 10(a) recommendation M9-2 suggests the Districts' plan includes provisions for avoiding potential disturbance to western pond turtles unless approved by California DFW, BLM, and FWS. The Districts responded that their study of special-status amphibians and reptiles found no project effects on western pond turtle, and that the Don Pedro TRMP provides for appropriate management measures to monitor occurrences of western pond turtles during the new license term. They argue that their plan provides for employee training on western pond turtle identification and that incidental observations by staff and contractors would be recorded, assembled, and made available to BLM and California DFW, allowing their input about any necessary future protective measures.

Our Analysis

The Districts' proposed use of herbicides for noxious weed control or other vegetation management could adversely affect amphibians. Using caution during these activities, and only using the minimum manufacturer-recommended amounts of chemicals would serve to protect special-status amphibians. As discussed in the analysis under *Noxious Weeds*, manual vegetation control methods would also avoid any potential adverse effects from herbicide use. Several of the 15 infestations of smooth distaff thistle, a California DFA B-listed species that the Districts propose to treat, occur near the Don Pedro lakeshore. Because such infestations could occur near western pond turtle habitat, manual control methods would also be beneficial. This recommendation and its benefits to amphibians is discussed further in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects,* in the subsection *California Red-legged Frog.* Furthermore, adverse effects from pesticide use within 500 feet of known locations of western pond turtles could be avoided or minimized on BLM land if the Districts design noxious weed treatments to avoid individuals and their habitats, consistent with BLM riparian conservation objectives. Additionally, compliance with California pesticide regulations would require the Districts to avoid any pesticide application where there is a reasonable possibility of damage to nontarget animals, which would apply to any pesticide use in proximity to suitable aquatic habitat for amphibians and reptiles.

We find no reason to suspect that the project is adversely affecting the Blainville horned lizard. The resource agencies did not express concern about any potential effects on the species. Any protective measures to reduce the projects' effects from herbicide use or rodent control would benefit this species, as well as other reptiles and amphibians that occur in both projects.

The Districts observed western pond turtles in Don Pedro Reservoir at Poor Man's Gulch, Sixbit Gulch, Hatch Creek Arm, Moccasin Creek, West Fork Big Creek, and Woods Creek Arm, including Slate Creek, suggesting that suitable habitat is common within backwater inlets or coves, associated with tributary streams. Also, the Districts observed adult western pond turtles in the Don Pedro Dam spillway channel and within the Don Pedro Dam emergency spillway. Although western pond turtle nesting was not documented, the Districts reported abundant suitable nesting habitat around Don Pedro Reservoir with some habitat concentrated near where adult and/or juvenile turtles were observed. It appears that an unquantified amount of suitable nesting habitat identified by the Districts is below the normal maximum surface water elevation of the reservoir. Thus, fluctuating reservoir water levels could cause western pond turtle nests to fail if eggs become inundated or too saturated (Feldman, 1982), although western pond turtles select nest sites with some vegetation (Holte, 1998) and would likely avoid areas subject to the most frequent inundation. Furthermore, because peak water surface elevation in the reservoir generally occurs in May or June, relatively little suitable nesting habitat below is likely to be exposed during most of the May to July egg-laying season or during the 90 to 120 day incubation period. Therefore, reservoir water level fluctuations during

the fall and winter would most likely affect small numbers of hatchlings that remain in their nests for approximately 1 year prior to emergence (Holte, 1998). Water level fluctuations in the reservoir could also affect the availability of western pond turtle basking substrates, and the extent of vegetated shallow water that is important for by juveniles. In most cases, we suspect that adult western pond turtles would adjust their use of habitat based on existing conditions, and project effects would be minimal. However, reduced recruitment of juveniles as a result of nest inundation and hatchling predation due to bullfrogs and predatory non-native fish could have population effects on western pond turtles.

The Districts' proposed flows below Don Pedro Dam in La Grange Reservoir would more closely resemble the natural hydrograph and would likely benefit western pond turtles below Don Pedro Dam. Because of these potential effects, the analysis suggests that rather than recording incidental observations, additional annual monitoring of known locations of western pond turtles in the Don Pedro and La Grange Projects would serve to better evaluate any suspected minor adverse effects, or beneficial effects, on western pond turtles. However, it is unclear how monitoring would isolate potential project effects from other sources of turtle mortality, or how the results of monitoring data would be used to modify project operations. As proposed, the Districts' Don Pedro TRMP would provide for an annual consultation memo submitted to the BLM and California DFW, allowing input about any future protective measures for western pond turtle, if necessary.

Interactions between recreational users of Don Pedro Reservoir and western pond turtle likely occur as a result of recreational boating and shoreline hiking and camping. Because the species is relatively sensitive to disturbance, these activities could affect the frequency and duration of basking or foraging behavior, which could ultimately affect reproduction and survival. Western pond turtles could also be affected by project infrastructure, including roads and canals, because they spend a significant amount of time in upland environments (for nesting and overwintering). In the Moccasin Creek Arm, in particular, observations of western pond turtles were in proximity to the Moccasin Point Recreation Area. The Districts did not observe any direct effects from recreational activities, roads, or other project infrastructure, although the two dead turtles reported during the Districts surveys are surprising given the high adult survivorship of western pond turtles (Vander Haeger et al., 2010). Recording incidental observations during other biological surveys in the Don Pedro Project would not provide data about adult survivorship, but over several years, would suggest population trends and indicate if turtle mortality is a concern within the project.

In its comments on the La Grange Project, FWS noted that no surveys have been conducted for western pond turtles within the La Grange Project and recommended that the Districts collaborate with CDFW, FWS, and BLM to determine measures to support and conserve the species. The lack of surveys for western pond turtles does not allow us to determine if the operation and maintenance of the La Grange Project would have any effect on the species. Recording incidental observations of western pond turtles and an

evaluation of habitat suitability for the species within the La Grange Project boundary would be necessary to conclude whether the species is present and if any protective measures are necessary. Consulting with FWS and California DFW to develop protective measures for the western pond turtles and providing for these measures in a La Grange TRMP would ensure that the La Grange Project does not adversely affect western pond turtles.

The woody debris that has accumulated as large rafts of floating wood in the upper reaches of Don Pedro Reservoir is very likely having adverse effects on native wildlife, especially special-status frogs and reptiles. The woody material can become a haven for non-native invasive American bullfrogs, which would adversely affect any potential occurrence of native frogs in the Don Pedro Reservoir. This issue is also discussed further in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects,* in the subsection *California Red-legged Frog.*

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Aquatic Species

Central Valley spring-run Chinook salmon, Central Valley steelhead, and North American green sturgeon are listed as threatened under the federal ESA and are under the jurisdiction of NMFS. NMFS also manages Chinook salmon EFH under the Magnuson-Stevens Fishery Conservation and Management Act.

La Grange Diversion Dam, located on the Tuolumne River about 52.2 river miles upstream of the Tuolumne River's confluence with the San Joaquin River, has no fish passage facilities. Upstream fish migration has been blocked at about RM 52.2 since the construction of the Wheaton Dam in 1871. In 1893, construction of the La Grange Diversion Dam replaced the Wheaton Dam and continued to provide a complete barrier to fish migration. Don Pedro Dam, about 2.6 river miles upstream of La Grange Diversion Dam is also a complete barrier to fish passage. Prior to the construction of dams in the basin, the Tuolumne River and its tributaries upstream of Don Pedro Reservoir are believed to have provided spawning and rearing habitat for spring-run Chinook salmon and steelhead (Lindley et al., 2006; Yoshiyama et al., 2001). In July 2014, NMFS published its Recovery Plan for Central Valley Chinook Salmon and Steelhead and identified the loss of most historic spawning habitat and degradation of the remaining habitat to be primary threats to the recovery of Central Valley spring-run Chinook salmon and steelhead (NMFS, 2014). NMFS is currently preparing a recovery plan for the Southern DPS of North American green sturgeon, but it cites the reduction of historic spawning area as the principal factor in decline of this species (NMFS, 2018b).

Central Valley Spring-run Chinook Salmon Evolutionary Significant Unit

NMFS listed the Central Valley ESU of spring-run Chinook salmon as threatened on September 16, 1999 (64 FR 50394). On June 14, 2004, following a 5-year species-status review, NMFS proposed that the Central Valley spring-run Chinook salmon remain listed as threatened based on the Biological Review Team's strong majority opinion that the Central Valley spring-run Chinook ESU is "likely to become endangered within the foreseeable future" because of the greatly reduced distribution of Central Valley spring-run Chinook salmon and hatchery influences on the natural population. This threatened status was reaffirmed on June 28, 2005, when the Feather River Fish Hatchery spring-run Chinook salmon population, a part of the Central Valley spring-run Chinook salmon ESU, was included in the listing (70 FR 37160).

Distribution and Abundance—Spring-run Chinook salmon once occupied all major river systems in California where there was access to cool-water reaches that would support over-summering adults. Historically, they were widely distributed in streams throughout the Central Valley. Prior to the construction of dams in the Sacramento and San Joaquin Basins, spring-run Chinook salmon migrated during spring snowmelt flows to access coldwater holding and spawning habitat higher up in the basins. For many decades, Central Valley spring-run Chinook salmon were considered extirpated from the Southern Sierra Nevada diversity group in the San Joaquin River Basin, despite their historical numerical dominance in the Basin (Fisher, 1994). However, more recently, there have been reports of adult Chinook salmon returning in February through June to San Joaquin River tributaries, including the Tuolumne River (Franks, 2014). These spring-running adults have been observed in several years and exhibit typical spring-run life history characteristics, such as returning to tributaries during the springtime, over-summering in deep pools, and spawning in early fall (Franks, 2014). Additionally, the San Joaquin River Restoration Program operates the Interim Salmon Conservation and Research Facility, located below Friant Dam on the San Joaquin River. The San Joaquin River Restoration Program released juvenile Central Valley spring-run Chinook salmon smolts into the San Joaquin River annually during 2014–2016.

After maturing in the ocean, adult spring-run Chinook salmon return between the ages of 2 to 5 years and enter the Delta beginning in January, reaching their natal spawning streams from March to July (Myers et al., 1998). Adults require large, deep pools with moderate flows for holding over the summer prior to spawning in the fall. Water temperatures for adult spring-run Chinook salmon holding and spawning are reportedly best when less than 60.8°F (16°C), but lethal when greater than 80.6°F (27°C) (Hinze, 1959; Boles et al., 1988). There is evidence that spring-run Chinook salmon in the San Joaquin River were exposed to high temperatures during migration and holding under historical conditions (Clark, 1943; Yoshiyama et al., 2001). It is possible that Central Valley spring-run Chinook salmon are adapted to tolerate warmer temperatures than other Chinook salmon stocks, but there is no experimental evidence to confirm this hypothesis, although short-term exposure to temperatures as high as 77 to 80.6°F (25 to

27°C) is known to be tolerated by adult Chinook salmon (Piper et al., 1982; Boles et al., 1988).

Egg incubation for spring-run Chinook salmon extends from August to March (Fisher, 1994; Ward and McReynolds, 2001). Egg incubation generally lasts between 40 and 90 days at water temperatures of 42.8 to 53.6°F (6 to 12°C) (Heming, 1982). Pre-emergent fry remain in the gravel for 2 to 3 weeks after hatching while absorbing their yolk sacs. Emergence from the gravel occurs from November to March (Fisher, 1994; Ward and McReynolds, 2001).

Fry and juvenile rearing takes place in the natal streams, the main stem of the Sacramento River, inundated floodplains, and the Delta. The rearing and outmigration patterns exhibited by spring-run Chinook salmon are highly variable, with fish rearing anywhere from 3 to 15 months before outmigrating to the ocean (Fisher, 1994). Some may disperse downstream soon after emergence as fry in March and April, with others smolting after several months of rearing, and still others remaining to oversummer and emigrate as yearlings (FWS, 1996).

Critical Habitat Designation—Critical habitat was designated for the Central Valley spring-run Chinook salmon ESU on September 2, 2005 (70 FR 52488), and includes stream reaches of the Feather and Yuba Rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear Creeks, the Sacramento River, and portions of its northern Delta.

Steelhead

On March 19, 1998, NMFS listed the Central Valley steelhead as threatened (63 FR 13347). NMFS concluded that the risks to Central Valley steelhead had diminished since the completion of the 1996 status review, based on a review of existing and recently implemented state conservation efforts and federal management programs (e.g., Central Valley Project Improvement Act Anadromous Fish Restoration Program, CALFED Bay-Delta Program) that address key factors for the decline of this species. Furthermore, NMFS noted that additional actions benefiting Central Valley steelhead included efforts to enhance fisheries monitoring and conservation actions to address artificial propagation (NMFS, 2014).

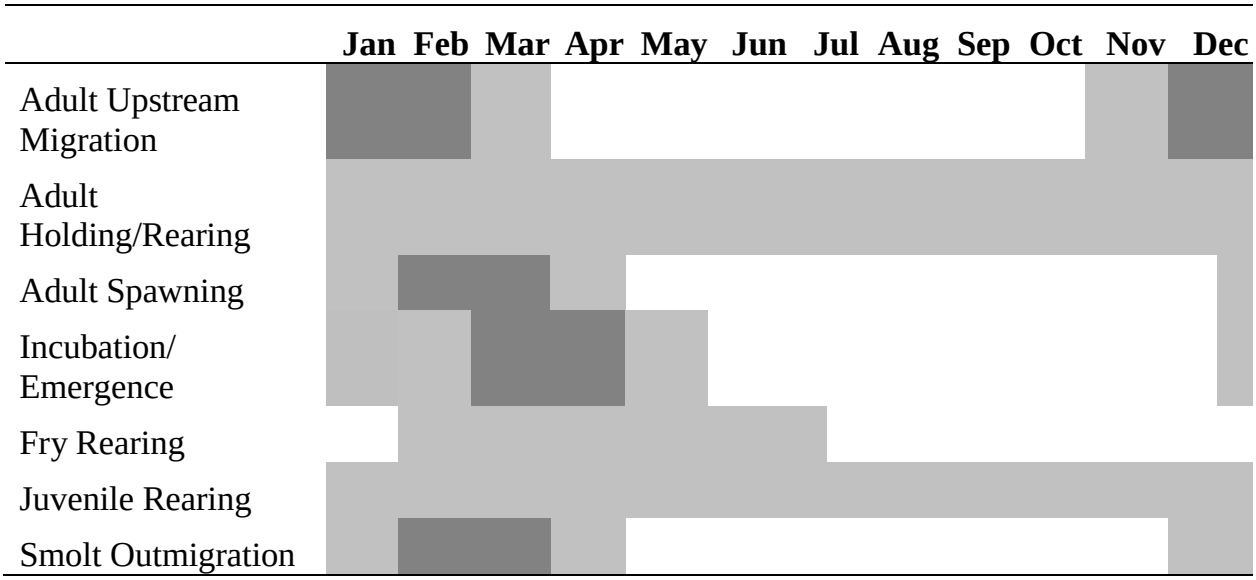
On September 8, 2000, pursuant to a July 10, 2000, rule issued by NMFS under section 4(d) of the ESA (16 U.S.C. § 1533(d)), the take restrictions that apply statutorily to endangered species began to apply with specific limitations to Central Valley steelhead (65 FR 42422). On January 5, 2006, NMFS reaffirmed the threatened status of the Central Valley steelhead and applied the DPS policy to the species because the resident and anadromous life forms of steelhead remain "markedly separated" as a consequence of physical, ecological, and behavioral factors, and may therefore warrant delineation as a separate DPS (71 FR 834). NMFS (1998) based its conclusion on conservation and protective efforts that, "mitigate the immediacy of extinction risk facing the Central Valley steelhead DPS" (NMFS, 2014).

On January 5, 2006, NMFS issued a final decision that defined Central Valley steelhead as a DPS rather than an ESU and retained the status of Central Valley steelhead as threatened (71 FR 834). The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and human-made impassable barriers in the Sacramento and San Joaquin Rivers and their tributaries, excluding steelhead from San Francisco and San Pablo Bays and their tributaries (63 FR 13347). Steelhead in two artificial propagation programs—the Coleman National Fish Hatchery and Feather River Fish Hatchery steelhead hatchery programs are considered to be part of the DPS. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the DPS (71 FR 834).

Distribution and Abundance—Adult steelhead typically migrate into Central Valley rivers from August through March (McEwan, 2001; NMFS, 2004), and migration peaks in January and February (Moyle, 2002). Optimal migration and holding temperatures have been reported to range from 8 to 11°C (46–52°F; NMFS, 2014). However, the *O. mykiss* (>400 mm or 16 inches) observed at the existing seasonal fish counting weir in the lower Tuolumne River (at RM 24.5) from 2011–2016 passed at temperatures ranging from 11.6°C to 20.5°C (53°F–69°F). Steelhead adults typically spawn in small streams and tributaries where cool, well-oxygenated water is available year-round. Spawning occurs from December through April, peaking from January through March. During egg incubation, steelhead require water temperatures less than 12.8°C to ensure successful embryonic development. After hatching, steelhead have a highly variable life history strategy. Juveniles may rear in fresh water for 2 to 3 years before emigrating to the ocean. Juvenile steelhead generally require water temperatures lower than 20°C to avoid physiological stress; however, some strains of *O. mykiss* have been shown to grow well at temperatures as high as 22°C and maintain weight at temperatures as high as 25°C. Information regarding the lifestages of steelhead observed in the lower Tuolumne River is presented in table 3.3.4-1. Since 2009, six steelhead greater than 16 inches has been detected at the Districts' seasonal fish counting weir located at RM 24.5. The number of steelhead entering the Tuolumne River is low and there does not appear to be any self-sustaining run or population of Central Valley steelhead in the Tuolumne River (Districts, 2013).

Critical Habitat Designation—On February 16, 2000 (65 FR 7764), NMFS published a final rule designating critical habitat for Central Valley steelhead. NMFS proposed new critical habitat for spring-run Chinook salmon and Central Valley steelhead on December 10, 2004 (69 FR 71880), and published a final rule designating critical habitat for these species on September 2, 2005 (70 FR 52488). This critical habitat includes the lower Tuolumne River from La Grange Diversion Dam downstream to the confluence with the San Joaquin River, and downstream to the Sacramento-San Joaquin Delta.

Table 3.3.4-1. Lifestage-specific periodicities for steelhead in the lower Tuolumne River (Source: Districts, 2017f).



Note: Dark shaded areas represent known peak periods; light shaded areas represent presence. The absence of dark shaded areas indicates that the Technical Committee did not identify any particular peak period based on the available data.

North American Green Sturgeon

The Southern DPS of North American green sturgeon was listed as federally threatened on April 7, 2006 (71 FR 17757), and includes the green sturgeon population spawning in the Sacramento River and using the Sacramento-San Joaquin River Delta, and San Francisco Estuary.

Distribution and Abundance—Although green sturgeon spend the majority of their life in marine and estuarine environments, they periodically migrate into freshwater streams to spawn, spending up to 6 months in freshwater during their spawning migration. Upstream migration generally begins in February and may last until late July (Adams et al., 2002). Spawning occurs between March and July, peaking between mid-April and mid-June (Emmett et al., 1991). Following emergence in early summer, larval green sturgeon begin migrating downstream, becoming more tolerant of increasing water temperatures and salinities. Several studies suggest that juvenile green sturgeon rear in freshwater for 1 to 4 years, acclimating gradually to brackish environments before migrating to the ocean (Beamesderfer and Webb, 2002; Nakamoto et al., 1995).

The only known historical or current spawning population of green sturgeon in the Central Valley occurs in the Sacramento River Basin (71 FR 17757; Adams et al., 2002). Numerous fisheries studies in the Tuolumne River since the 1980's have not documented green sturgeon (FISHBIO and HDR, 2013). However, six green sturgeon have been self-reported to California DFW by three anglers in the San Joaquin River during spring

2009 and 2010, including one captured upstream of Highway 140 Bridge and five between Stockton and Highway 140 Bridge, ranging in size from 0.6 to 0.8 meter (24 to 31 inches).

Critical Habitat Designation—On October 9, 2009, NMFS (74 FR 52300) designated critical habitat for the Southern DPS of North American green sturgeon. This designated critical habitat includes most of the DPS' occupied range, including (1) coastal marine waters from Monterey Bay to the Washington/Canada border; (2) coastal bays and estuaries in California, Oregon, and Washington; and (3) fresh water rivers in California's Central Valley. In the Central Valley, critical habitat for green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento-San Joaquin River Delta, and San Francisco Estuary. The San Joaquin River and its tributaries upstream of the Delta, including the Tuolumne River, are not designated as critical habitat.

Terrestrial Species

The Districts reviewed the status and distribution of federally listed threatened and endangered terrestrial species within the Don Pedro Project, revealing the potential occurrence of one mammal, two amphibians, one crustacean, one insect, and nine plants. Table 3.3.4-2 lists these species, along with their status and known occurrences within the project vicinity. No federally listed birds or reptiles with potential to occur within the Don Pedro Project were identified. In 2012, the Districts conducted field surveys for species that were determined as likely to occur within the project boundary. We discuss the results of these surveys in further detail below for those species.

For the La Grange Project, the Districts did not conduct any surveys for rare, threatened, endangered, protected, or special-status wildlife. The Districts relied on their studies of federally listed threatened and endangered species within the upstream Don Pedro Project. In some cases, those studies extended up to 0.25 mile downstream of Don Pedro Dam, towards the La Grange Project. They also consulted public agency databases (e.g., CNDDB [California DFW, 2018c], USDA PLANTS [USDA, 2018], and FWS IPaC [FWS, 2018b]) and provided a list of species potentially occurring within the La Grange Project boundary. The ESA/CESA-listed terrestrial species listed in table 3.3.4-2 could also occur within the La Grange Project.

Table 3.3.4-2. Federally and state-listed threatened and endangered terrestrial species with potential to occur within the Don Pedro and La Grange Projects (Source: Districts, 2017a,b, as modified by staff; California DFW, 2018d,e; FWS, 2018b).

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Mammals				
San Joaquin kit fox	*Pekania pennanti*	FE, ST	See Text	See Text
Amphibians				
California red-legged frog	*Rana boylii*	FT, SSC	See Text	See Text
California tiger salamander	*Ambystoma californiense*	FT, ST	See Text	See Text
Insects				
Valley elderberry longhorn beetle	*Phrynosoma blainvillii*	FT	See Text	See Text
Brachiopods				
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT	See Text	None
Plants				
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	FE, SE, CNPS-1B	Cismontane woodland, valley and foothill grassland	None
Chinese camp brodiaea	*Brodiaea pallida*	CT, SE, CNPS-1B	Grows in vernal depressions, within open areas along seeps and intermittent springs in volcanic and serpentine soils in the California Sierra foothill woodlands between	None

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
			984-1,312 feet in elevation.	
Layne's butterweed (or Layne's ragwort)	*Packera laynea* (or *Senecio layneae*)	FT, SR, CNPS-1B	See Text	See Text
Red Hills vervain (or California vervain)	*Verbena californica*	FT, ST, CNPS-1B	See Text	See Text
Succulent owl's clover	*Castilleja campestris* ssp. *succulenta*	FT, SE, CNPS-1B	Vernal pools	None
Hoover's spurge	*Chamaesyce hooveri*	FT, CNPS-1B	Vernal pools	None
Colusa grass	*Neostapfia colusana*	FT, SE, CNPS-1B	Vernal pools	None
Hairy orcutt grass	*Orcuttia pilosa*	FE, SE, CNPS-1B	Vernal pools	None
Greene's tuctoria	*Tuctoria greenei*	FE, SR, CNPS-1B	Vernal pools	None

[a] FE—ESA-listed as endangered; FT—ESA-listed as threatened; FC—ESA candidate species; SE—CESA-listed as endangered; ST—CESA-listed as threatened; SSC—California species of special concern; SR—California Rare Species; CNPS-1B—California Native Plant Society listed species considered rare or endangered in California and elsewhere.

In addition to the species in table 3.3.4-2, the Districts considered other federally listed species that were identified in the Commission's Scoping Document for the Don Pedro Project, which included: riparian brush rabbit (*Sylvilagus bachmani riparius*); riparian wood rat (*Neotoma fuscipes riparia*), least Bell's vireo (*Vireo bellii pusillus*), and Conservancy fairy shrimp (*Branchinecta conservatio*). These four species and their critical habitats have not been reported to occur within 5 miles of the Don Pedro Project,

nor within Tuolumne County, and no suitable habitat occurs within the project boundaries. The closest designated critical habitat for Conservancy fairy shrimp is over 10 miles from the projects, and no vernal pool habitats, which are required by the species, were found during field studies. The riparian woodrat and riparian brush rabbit inhabit forested river corridors on the eastern side of the San Joaquin Valley and are do not occur near either project. The least Bell's vireo also requires riparian shrub habitats and its current range is hundreds of miles to the south of the projects. These species were thus removed from further discussion.

San Joaquin Kit Fox

The San Joaquin kit fox was originally listed as endangered under the ESA in 1967 (32 FR 4001) and was listed as threatened by California 4 years later. The *Final Recovery Plan for Upland Species of the San Joaquin Valley*, which includes the San Joaquin kit fox, was issued in 1998 (FWS, 1998). A 5-year review was completed for the species in 2010 and no change to its listing status was recommended (FWS, 2010). Population declines are attributed to habitat loss and degradation caused by agriculture and urban land uses. To date, conservation efforts for the San Joaquin kit fox have not been successful at reversing their declining trend, and the conservation needs of kit foxes have not been met. Mortality from predation, shooting, habitat loss, and poisoning through the consumption of poisoned rodents also contributes to population declines (FWS, 1998). No critical habitat has been designated for San Joaquin kit fox.

The San Joaquin kit fox inhabits grasslands and agricultural lands in the San Joaquin Valley. They mate in winter and have between four and seven young in February or March. They use multiple underground dens throughout the year, sometimes using pipes or culverts as den sites in addition to other animal burrows greater than 5 inches in diameter. Their primary prey is usually the most abundant nocturnal rodent or lagomorph[142] in their area, although they also feed opportunistically on carrion, birds, reptiles, insects, and fruits.

The Districts reviewed the CNDDB and found a single record from 1972 of a San Joaquin kit fox within the general vicinity of the Don Pedro Project, approximately 2.1 miles southwest of the project boundary. No other occurrences of San Joaquin kit fox have been recorded within 5 miles of the project since 1973. During the Districts' surveys of the Don Pedro Project in 2012, no kit fox sightings or large burrows were documented, although suitable habitat for the species is reportedly common. The Districts did not evaluate the potential presence of San Joaquin kit fox in the La Grange

[142] Lagomorphs are the members of the taxonomic order Lagomorpha, of which there are two living families: the Leporidae (hares and rabbits) and the Ochotonidae (pikas).

Project, where suitable habitat also occurs. As a result, the presence of kit foxes cannot be ruled out.

California Red-legged Frog

The California red-legged frog was listed as threatened in 1996 (61 FR 25813); FWS published a Recovery Plan in 2002 (FWS, 2002a) and designated critical habitat for the species 2010 (71 FR 19244). The California red-legged frog is the largest native frog on the west coast. It is primarily associated with perennial ponds and low-gradient, slow-moving perennial or seasonal streams and rivers, including natural and manmade (e.g., stock) ponds. To support breeding populations, the waterbody must hold water continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and tadpoles to complete development). The minimum depth of breeding habitat is 20 inches; however, deep water pools, ponds, and lake areas are not suitable. Dense, shrubby riparian vegetation (e.g., willow, bullrush, and tule species) and bank overhangs are important features of California red-legged frog breeding habitat, although they sometimes use sites that lack these features. Locations with the highest densities of California red-legged frogs exhibit dense emergent or shoreline riparian vegetation closely associated with moderately deep (greater than 2.3 feet), still, or slow-moving water.

The current range of the California red-legged frog is greatly reduced, with most remaining populations found along the coast from Marin County to Ventura County. In the Sierra Nevada foothills, where the species was once widespread, there are only six known extant populations, most of which contain few adults. There are 5 known historical occurrences of California red-legged frog within 10 miles of the Don Pedro Project boundary, with the most recent approximately 5.5 miles to the northeast in 1984. Furthermore, the FWS's recovery plan for the species lists California red-legged frog as extirpated from the Tuolumne River Watershed. The species has declined in habitats with introduced fish or where non-native invasive American bullfrogs have become dominant.

The Districts conducted a study of California red-legged frog in the Don Pedro Project in 2012. They performed a desktop evaluation of 337 sites within 1 mile of the project boundary, including 73 within the project boundary. Based on potential habitat identified during desktop assessments and property access, the Districts assessed 85 sites in the field for evidence of California red-legged frog and habitat suitability for the species, including 66 within the project boundary. They identified 52 aquatic habitat locations with characteristics potentially suitable for California red-legged frog breeding based on the minimum criteria. Ten sites were assessed to be more favorable for breeding due to the presence of suitable vegetation and lack of predators. However, no California red-legged frog were observed during this or any other pre-licensing studies. Don Pedro Reservoir itself does not possess the essential components of California red-legged frog breeding habitat because of the absence of suitable vegetation. This reservoir is also stocked with a variety of introduced, predatory fish which diminish

suitability for California red-legged frog. The Districts did not perform surveys for California red-legged frog or prepare a draft BA for terrestrial species for the La Grange Project.

The projects are within the Sierra Nevada Foothills and Central Valley Recovery Unit, as defined by the Recovery Plan for the California Red-Legged Frog (FWS, 2002a). However, neither the Don Pedro Project, nor the La Grange Project contains designated critical habitat for California red-legged frog; they are also not within a Core Area as defined in the recovery plan. Core Areas are geographic units where recovery actions are focused, and are distributed throughout portions of the species' historic and current range. The Piney Creek Core Area encompasses an adjacent watershed; Piney Creek is a tributary to Lake McClure. Although California red-legged frogs are thought to be extirpated from this drainage, the task in the recovery plan is to "develop and implement a watershed management and protection plan for Core Area #7 (Piney Creek)." The conservation needs for the California red-legged frog in the Piney Creek Core Area are to control American bullfrogs and reestablish red-legged frog populations. Also, the Tuolumne River Core Area is located upstream of the projects, encompassing portions of the projects' contributing watershed within Stanislaus National Forest and Yosemite National Park. Conservation needs for the California red-legged frog in the Piney Creek Core Area, as specified for the Tuolumne River Core Area in the Recovery Plan, are to "control non-native fish and amphibians, reestablish populations (e.g., at Swamp Lake, Miguel Meadows)" (FWS, 2002a). The nearest extant occurrence is 29 miles northwest of the projects within Critical Habitat Unit CAL-1 in Calaveras County.

California Tiger Salamander

The Central Valley DPS of California tiger salamander was listed as threatened under ESA in 2004 (69 FR 47212) and is listed under the CESA. Critical habitat was designated in 2005 (70 FR 49380), including an area approximately 1 mile southwest of the Don Pedro Project boundary in Stanislaus County.

California tiger salamanders breed from December through February in shallow, seasonal (i.e., continuously flooded for a minimum of 10-12 consecutive weeks), or semi-permanent pools and ponds that fill during heavy winter rains, and occasionally in intermittent streams or in permanent ponds where predatory fish are absent. Adults spend little time at breeding sites before returning to upland habitats where they typically utilize small mammal burrows or other underground retreats throughout most of the year, located in grassland, savanna, or open woodland habitats. California tiger salamander populations generally do not persist where fish, American bullfrog, or predacious insects are well established. According to the California DFW's *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander*, the criteria for breeding habitat includes the presence of standing water for a period sufficient for larvae metamorphosis following breeding, which occurs from December through and February. Larvae may metamorphose in as little as 10-12 weeks, but typically not until May to July. Natural vernal pools, stock

ponds, drainage ditches, and pools in low-gradient streams are potential habitats. Juvenile salamanders migrate into uplands and settle into animal burrows, and like adults, they leave their burrows to feed on insects and worms during nights of high humidity, and return to the burrow before morning. Suitable upland habitats are thus equally important to the survival of adult California tiger salamanders (FWS, 2018c).

There are five known historical California tiger salamander occurrences within 5 miles of the Don Pedro Project boundary; the most recent was documented in 2007, approximately 0.4 mile from Don Pedro Reservoir. The Districts surveyed all suitable aquatic habitats within 1.24 miles of the project boundary in 2012, consistent with FWS requirements, and did not locate any occurrences of California tiger salamander. Potential California tiger salamander breeding habitat (standing water for at least 10 weeks during the breeding season) was documented at or near 247 habitat sites, which varied from large streams with substantial overhanging vegetation to manmade agricultural or water treatment ponds with no cover and limited vegetation. Small burrows were present in proximity to many sites surveyed. Field surveys revealed that the majority of these sites were perennial streams that were unsuitable because of high gradient or a lack of upland habitat suitable for dispersal. Within the project boundary, 38 field-assessed sites were characterized as potentially suitable for California tiger salamander breeding, 29 of which were would be more favorable to breeding due to the presence of small burrows and upland habitat suitable for dispersal.

The Districts reported one occurrence of the California tiger salamander within the La Grange Project boundary in the CNDDB records, but did not perform any field surveys for the species at the La Grange Project. Critical habitat for the California tiger salamander is located approximately 0.5 mile south of the La Grange Project boundary, designated as Unit 8 (La Grange Ridge Unit) of the Central Valley Region (70 FR 49379). This is beyond the average dispersal distance of the salamander (1,844 feet) but is within the maximum known dispersal distance (1.3 miles) for the species (FWS, 2018b).

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle was listed as threatened in 1980 (43 FR 35636) and FWS designated critical habitat for this species on the same year (45 FR 29373). It is associated with its host plant, elderberry (*Sambucus* spp.) shrubs, throughout the California Central Valley and foothills below 3,000 feet mean sea level. The project is outside the designated critical habitat zones, but portions of the project include potential habitat for the beetle. The valley elderberry longhorn beetle occurs within riparian vegetation communities where it feeds exclusively on elderberry shrubs in both adult and larval stages. Adult females lay eggs in crevices in the bark of the host elderberry plant. After hatching, larvae spend 1 to 2 years feeding inside the plant. Prior to pupating, valley elderberry longhorn beetle larvae chew an exit hole in the elderberry trunk for the emerging adult, leaving boreholes in the elderberry stems.

The Districts conducted surveys for elderberry plants at the Don Pedro Project (HDR, 2013k). Surveyors examined elderberry plants for evidence of valley elderberry longhorn beetle presence, encompassing the area surrounding all project facilities within the project boundary. The Districts located 73 occurrences elderberry plants, of which 14 had evidence of valley elderberry longhorn beetle presence. Of the 14 elderberry plants with exit holes, only two were found in riparian areas; the majority were in partially disturbed habitat near roads or developed recreational areas. These occurrences include: four at Moccasin Point Recreation Area; one below Don Pedro Dam; one near a sewage pond across from Blue Oaks Recreation Area; one along Hatch Creek; four along Jacksonville Road; one along the Moccasin transmission line; and two at Rogers Creek Arm of Don Pedro Reservoir. No surveys for the valley elderberry longhorn beetle or its host plants were performed within the La Grange Project boundary.

The most commonly observed potential stressors to elderberry plants at the Don Pedro Project included proximity to roads and trails (19 occurrences), cattle grazing (18 occurrences) and noxious weeds (15 occurrences). Also, two elderberry occurrences were located directly next to sewage treatment plants and would be subject to disturbance by project operation and maintenance. Direct signs of disturbance to elderberry occurrences included trash within the branches of two occurrences, fencing through plant branches at two occurrences, trampling of plants at three occurrences, and noxious weeds directly under plants at seven occurrences. Less common potential stressors included a fuel break located in the immediate vicinity of one occurrence, dumping of refuse at six occurrences, the proximity of transmission lines at two occurrences, and the proximity of housing at one occurrence. Two occurrences were located in non-riparian areas on the Rogers Creek Arm and could be affected by fluctuating water levels of the reservoir.

Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp was listed as threatened under the ESA in 1994 (59 FR 48136). Critical habitat for vernal pool fairy shrimp was designated in 2003 (68 FR 46684) and revised in 2006 (71 FR 7118). Of the 35 designated critical habitat units, unit 21 (Stanislaus Unit) is the closest to the project, at approximately 2.5 miles from the edge of the project boundary. FWS issued a Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon in 2005. A 5-year status review for vernal pool fairy shrimp was completed in 2007 and a second status review was initiated in 2011 (76 FR 30377).

Vernal pool fairy shrimp occur mostly in vernal pools, but may also occur in natural and artificial seasonal wetland habitats, such as alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools. Vernal pool fairy shrimp tend to occur primarily in smaller pools of less than 0.05 acre and with water temperatures between 4.5°C and about 23°C. Because vernal pools are mostly rain-fed, they usually have low nutrient levels and often have dramatic daily fluctuations in pH, DO, and carbon dioxide.

The CNDDB includes one occurrence of vernal pool fairy shrimp in the Don Pedro Project vicinity. The Districts performed terrestrial resource studies within in the Don Pedro Project boundary in 2012, during which no vernal pools or vernal pool plants that might indicate their presence were observed. The Districts also state that no vernal pools are located within 1 mile of the La Grange Project boundary. Because this crustacean does not occur within either project, and are not likely to colonize the projects, the Don Pedro and La Grange Projects would have "no effect" on the vernal pool fairy shrimp, and no further discussion is warranted.

Federally Listed Plants

The Districts completed a study of threatened and endangered plants in 2012 for the Don Pedro Project (HDR, 2013l). Prior to completing field surveys, the Districts reviewed the CNPS database and CNDDB for federally listed plant occurrences within a 1-mile buffer of the project boundary, which revealed five occurrences each of Layne's butterweed and Red Hills vervain. FWS listed Layne's butterweed and Red Hills vervain as threatened under the ESA in 1997 (62 FR 49398) and in 1998 (63 FR 49022), respectively.

The Districts identified an additional two federally listed species with documented occurrences within the USGS quadrangle (quad) maps that cover the Don Pedro Project boundary—Chinese Camp brodiaea (*Brodiaea pallida*) and Hartweg's golden sunburst (*Pseudobahia bahiifolia*). The Districts reported an additional six federally listed plants located within the adjacent nine USGS quads, including succulent owls-clover (*Castilleja campestris* ssp. *succulenta*), Hoover's spurge (*Chamaesyce hooveri*), delta button-celery (*Eryngium racemosum*), colusa grass (*Neostapfia colusana*), hairy orcutt grass (*Orcuttia pilosa*), and Greene's tuctoria (*Tuctoria greenei*).

The Districts performed botanical surveys that covered approximately 3,870 acres between March 5 and June 29, 2012. Surveys were floristic in nature and carried out by qualified botanists on foot and by boat, generally following California DFW (2018e) protocols. Surveys were conducted using a random meander technique with particular focus in high quality habitat or areas suitable for supporting the target plant species.

Two perennial herbs, Layne's butterweed and Red Hills vervain, were located within the Don Pedro Project boundary. Layne's butterweed is a perennial aster that flowers from April to August and occurs in chaparral and woodland habitats with gabbro, or serpentine, soils in the central Sierra Nevada foothills. The Districts documented 25 occurrences of Layne's butterweed on BLM lands within the Red Hills ACEC, in Sixbit Gulch and Poor Man's Gulch. Layne's butterweed populations ranged from five to 250 plants, totaling approximately 1,200 individuals with a total estimated area of 2.9 acres. Layne's butterweed occurrences near the projects face a number of potential stressors, including cattle grazing, recreation, noxious weeds (i.e., barbed goatgrass, smooth distaff thistle, and bermudagrass), and Don Pedro Reservoir operations. FWS further cites habitat loss and fragmentation as primary threats for this species, but other

threats also include herbicide spraying, change in fire frequency, off-road vehicle use, overgrazing, and competition from noxious weeds (FWS, 2017a). FWS has not designated critical habitat for this species, but issued a *Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada* (FWS, 2002b), which included Layne's butterweed, among other species.

Red Hills vervain is endemic to the Red Hills ACEC. It is only found along small or intermittent perennial streams that run through areas with serpentine soils, usually in woodland and grassland habitats. The Districts documented two occurrences of Red Hills vervain, one in Poor Man's Gulch containing over 200 individuals in an area of about 0.2 acre, and the other occurrence in Six Bit Gulch consisting of only two individuals in a 4-foot square patch. Both were located within riparian zones containing arroyo willow, sedges, white brodiaea, and Baltic rush. The Districts noted that potential stressors around the Red Hills vervain includes cattle grazing and recreation near one population. Also, the California DFA B-listed barbed goatgrass was observed near both occurrences. Other threats to Red Hills vervain include recreational activities such as gold mining, mountain biking, hiking, and hydrological fluctuations (FWS, 2017b). FWS has not designated critical habitat for Red Hills vervain but is currently developing a recovery plan.

The potential for other federally listed plants to occur in the Don Pedro and La Grange Project vicinity is low. Based on life history information gathered through the literature review and field observations during floristic surveys, the remaining seven federally listed plant species that either require vernal pools habitats or are not present in the projects, which includes Hoover's spurge, succulent owl's clover, colusa grass, Greene's tuctoria, Chinese camp brodiaea, Hartweg's golden sunburst, and hairy orcutt grass. Because these seven federally listed plant species do not occur within the area of project effects and are not likely to colonize the projects, the Don Pedro and La Grange Projects would have "no effect" on them, and no further discussion is warranted.

The Districts did not perform surveys for federally listed plants in the La Grange Project. Hartweg's golden sunburst is documented as occurring within the La Grange USGS quad.

3.3.4.2 Environmental Effects

Aquatic Species

During the ILP process, the Districts prepared a draft BA for aquatic species that summarized the status of California Central Valley steelhead and evaluated the effects of the Don Pedro Project (including the proposed environmental measures) on California Central Valley steelhead and its designated critical habitat. In the draft BA, the Districts determined that the continued hydroelectric power generation at the project was not likely to adversely affect California Central Valley steelhead or its designated critical habitat. The Districts also determined that several project actions would not likely adversely affect the Central Valley spring-run Chinook salmon but did not make an overall

determination of the projects' effect for the ESU. The Districts' draft BA for aquatic species did not evaluate project effects on the southern DPS of North American green sturgeon. However, in their amended final license application for the Don Pedro Project, the Districts state that, based on NMFS's determination that the Tuolumne River does not provide critical habitat for green sturgeon (NMFS, 2009), and 36 years of fisheries monitoring without encountering any sturgeon, the species is unlikely to occur within the Tuolumne River Basin.

In this section, we address the effects of relicensing the projects under the staff alternative (the recommended alternative) on California Central Valley steelhead, Central Valley spring-run Chinook salmon, and North American green sturgeon, and their designated critical habitat. The action area for ESA section 7 consultation extends from La Grange Diversion Dam to the Sacramento-San Joaquin Rivers Delta (Delta).

Some of the measures included in the staff alternative are specifically designed to benefit California Central Valley steelhead, while others are intended to benefit non-ESA listed fall-run Chinook salmon or the aquatic ecosystem in general. These measures are described in detail in section 2.3, *Staff Alternative*, and include:

- Maintain minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources;
- Provide spring pulse flows to facilitate outmigration of juvenile fall-run Chinook salmon;
- Develop a coarse sediment management plan in the lower Tuolumne River between RM 39 and RM 52;
- Develop an LWM management plan to increase the amount of LWM downstream of La Grange Diversion Dam;
- Provide gravel mobilization flows of 6,000 to 7,000 cfs to improve salmonid spawning habitat;
- Shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years;
- Develop a water quality monitoring plan in consultation with resource agencies;
- Develop a water temperature monitoring plan in consultation with resource agencies;
- Develop an erosion and sediment control plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs; and
- Develop a hazardous material plan for storage, use, transportation, and disposal of hazardous materials in the project areas, in consultation with resource agencies.

Our Analysis

California Central Valley Steelhead (Oncorhynchus mykiss)—Although the staff alternative does not involve any construction-related modifications to existing project facilities, actions including routine project maintenance, as well as non-routine ground-disturbing activities, have the potential to result in water quality-related impacts on *O. mykiss* downstream of La Grange Diversion Dam. For example, ground-disturbing activities could result in temporary increases in turbidity, loss of habitat, degradation of water quality, construction debris, and disturbance and noise. Heavy equipment also has the potential to release hydrocarbon-based contaminants that could enter the Tuolumne River. In section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects,* we analyze measures that the Districts propose to reduce any future construction-related effects, and measures specified under BLM 4(e) condition 3 and Water Board preliminary 401 condition 9, both of which apply to both projects. The Districts' implementation of these measures would minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by projects' operation and maintenance. In addition, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Spill Prevention, Control, and Countermeasures,* implementing the Districts' proposed Spill Prevention Control and Countermeasure Management Plan, BLM's Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34, and Water Board's preliminary 401 condition 10, would minimize the extent of any hazardous material spill and include protocols to prevent adverse impacts to beneficial uses in the event of a spill. Furthermore, in any construction and future maintenance of the project, the location and standards of roads and trails, and other land uses, including the location and condition of any future quarries, borrow pits, and spoil disposal areas, and sanitary facilities, would be subject to the approval of the department or agency of the United States having supervision over the lands involved, if located on federal lands, and would also be required to meet Water Board regulations.

The Districts' proposed and staff-recommended minimum flow regime (base flows) in the Tuolumne River would be expected to improve aquatic habitat conditions (increase WUA compared to existing conditions) for *O. mykiss* downstream of La Grange Diversion Dam. For example, the Districts' recommended base flows would provide from 71 to 95 percent of maximum WUA for *O. mykiss* (depending on life stage and water year type). In addition, these base flows would maintain suitable water temperatures for *O. mykiss* upstream of RM 43. Finally, our recommended ramping rate restrictions would reduce the risk of juvenile salmon and steelhead stranding and redd dewatering in the gravel-bedded reach of the lower river from about RM 52.2 to RM 24.

While designed to encourage fall-run Chinook smolt outmigration and increase survival, the staff-recommended pulse flows would augment outmigration base flows, which would further reduce water temperatures at a given location and extend the beneficial plume of colder water farther downstream relative to that provided by the base flows alone, which would also benefit *O. mykiss*. In wet, above normal, and below

normal water years, the Districts' 1,000 cfs flushing flows on October 5, 6, and 7, would also likely clean gravels of accumulated algae and fines prior to the onset of spawning in the spring and would not be expected to have significant effects on water quality.

Under the staff-recommended coarse sediment management plan, the Districts would place spawning gravel in the Tuolumne River downstream of La Grange Diversion Dam, which would maintain the availability of high quality *O. mykiss* spawning habitat. Placing the gravel following the *O. mykiss* fry rearing period also would minimize any risk of smothering *O. mykiss* fry within substrate interstices. Juvenile *O. mykiss* would also be able to more readily move away from the augmentation area during sediment placement, thereby minimizing effects on juveniles. Because gravel would be clean, release of fines would be minimized, and along with it, potential adverse effects on *O. mykiss*, such as gill abrasion resulting from pulses of suspended sediment.

Furthermore, the staff-recommended gravel mobilization flows of 6,000 to 7,000 cfs would likely reduced fine sediment storage in the river channel and in spawning gravels, which could increase *O. mykiss* egg-to-emergence survival and fry production, and BMI production; increase fine sediment storage on floodplains, which could improve regeneration of native riparian plant species during wetter water years, and increase lateral channel migration, bar formation, and large wood introduction, which together could create new floodplain habitat and complex hydraulic environments for improved adult *O. mykiss* holding, spawning, and juvenile rearing. While these mobilization flows could cause localized, short-duration pulses in turbidity, no significant associated effects on *O. mykiss* are anticipated. These flows would be released at a time when high-flows naturally occur (i.e., March–June of wet and above normal water years), and would have effects similar to what would take place in a natural system during a minor channel-forming event.

Shaping the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, is expected to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. Increasing natural recruitment of snowmelt-dependent hardwoods would likely increase the number of stands of trees that could contribute large wood to the channel over the long-term and provide cover and shade for aquatic species, which could have a beneficial cooling effect on water temperature in localized areas. Benefits to the overall ecosystem could translate into benefits for *O. mykiss* occupying the lower river.

Implementation of the staff recommend LWM management plan would be expected to provide favorable microhabitats for *O. mykiss* by increasing structural and hydraulic complexity in the channel, and would also improve spawning habitat for *O. mykiss* as localized scour displaces fines from gravel beds. In addition, LWM augmentation would create pools by forcing flows to scour channel beds and banks, and afford structural partitioning that provides protection from predation, and visual isolation that lowers interspecies competition (Dolloff, 1983). The LWM would also supply nutrients and substrate for aquatic organisms (Anderson et al., 1978) and aid in the

retention of salmonid carcasses, which provide important marine-derived nitrogen to terrestrial ecosystems and organic nutrients to salmon juveniles, macroinvertebrates, terrestrial animals, and birds (Naiman et al., 2002; Merz and Moyle, 2006). Short-duration disturbance of juvenile *O. mykiss* could occur during LWM placement, but no significant injury or mortality is anticipated. It is anticipated that LWM would be placed after July 15, i.e., following the fry rearing period, which would minimize the risk of disturbance of *O. mykiss* fry within substrate interstices.

Based on the above analysis, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to California Central Valley steelhead relative to the environmental baseline. However, it is likely that some individual *O. mykiss* could be injured or killed during the placement of gravel or LWM during implementation of the staff-recommended measures. Considering the potential for incidental take of individuals associated with the proposed action, we determine that issuing a new license for the Don Pedro Project and an original license for the La Grange Project as proposed with staff-recommended measures (the proposed action) is "likely to adversely affect" the California Central Valley steelhead, and "may affect, but is not likely adversely affect" the designated critical habitat for this species.

Central Valley Spring-run Chinook Salmon (O. tshawytscha)—Spring-run Chinook salmon may have historically occurred within the Don Pedro and La Grange Projects. However, they were extirpated from the San Joaquin River and its tributaries, as the watersheds became highly modified and access and other habitat conditions were degraded or completely destroyed. The modifications accompanied gold and gravel mining and associated dams and water diversions, agriculture, urbanization, levee construction, clearing of riparian vegetation for agriculture, introduction of exotic plant and fish species, and pollution from point sources like abandoned mines, among other factors. Agricultural and urban encroachment along the lower river has resulted in relatively static channels within floodways confined by dikes and agricultural uses. Many miles of river bank have been leveed and stabilized with riprap by agencies or landowners. These activities have collectively resulted in substantial changes in channel morphology, modified the flow and temperature regime, reduced riparian vegetation, increased siltation, induced armoring of the streambed, reduced gravel recruitment, and increased non-native predatory fish habitat.

The ESU for Central Valley spring-run Chinook salmon is defined as all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, including the Feather River Fish Hatchery population (70 FR 37160). The ESU and its critical habitat do not include the San Joaquin River or the Tuolumne River, even though attempts to introduce the species (as an experimental population) into the San Joaquin River and its tributaries were initiated in spring 2014 under the San Joaquin River Restoration Settlement Act. In addition, the San Joaquin River Restoration Settlement Act specifies that Central Valley spring-run Chinook salmon ESU introduction, if it were to occur, would be as a non-essential experimental population and

would not impose more than *de minimus* water supply reductions, additional storage releases or bypass flows on unwilling third parties due to such re-introduction.

The aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to Central Valley spring-run Chinook salmon ESU in the action area relative to the environmental baseline. Designated critical habitat occurs for this species within a small part of the Delta portion of the action area, and the staff alternative would not affect this portion of the Delta. Therefore, the staff alternative would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat.

North American Green Sturgeon (Acipenser medirostris)—Adult migration and spawning and early development and growth of green sturgeon in the Central Valley occurs primarily in the Sacramento River between Red Bluff Diversion Dam and Keswick Dam and in some tributaries, including the Feather River (NMFS, 2012). Subadults and adults also occur throughout the Delta to feed, grow, and prepare for their outmigration to the ocean (74 FR 52300, October 8, 2009). Designated critical habitat for the Southern DPS of North American green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento-San Joaquin River Delta, and San Francisco Estuary. However, North American green sturgeon are not known to occur in the Tuolumne River or San Joaquin River portions of the action area. The staff alternative would result in some slight increases in flow within the Delta during certain periods of the year. Considering that the Tuolumne River is part of a much larger San Joaquin River watershed and that the Sacramento River watershed also contributes to Delta inflow, the minor increase in flow contributed from the Tuolumne River would have no detectable effects on habitat conditions within portions of the Delta that are occupied by the Southern DPS of North American green sturgeon or its designated critical habitat. Consequently, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to North American green sturgeon relative to the environmental baseline. Therefore, the staff alternative would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Essential Fish Habitat—EFH for Pacific salmon refers to those waters and substrate necessary for salmon production needed to support a long-term, sustainable salmon fishery and salmon contributions to a healthy ecosystem. To achieve that level of production, EFH must include all those streams, lakes, ponds, wetlands, and other currently viable waterbodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho, and California (PFMC, 1999). In the estuarine and marine areas, Pacific salmon EFH extends from the near shore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (230.2 miles) offshore of Washington, Oregon, and California north of Point Conception (PFMC, 1999). The Pacific Coast Salmon Plan covers Chinook salmon, coho salmon, Puget Sound pink salmon (odd-numbered years only), and any

other federally listed salmonid species that is "measurably impacted" by Pacific Fishery Management Council fisheries (PFMC, 1999). The plan does not cover steelhead.

EFH guidelines published in the federal regulations identify Habitat Areas of Particular Concern as types or areas of habitat within EFH that are identified based on one or more of the following considerations:

- the importance of the ecological function provided by the habitat;
- the extent to which the habitat is sensitive to human-induced environmental degradation;
- whether, and to what extent, development activities are or would be stressing;
- the habitat type; and
- the rarity of the habitat type.

In the Tuolumne River (HU 18040009), EFH extends from La Grange Diversion Dam (RM 52.2) to the confluence with the San Joaquin River. As described in Scoping Document 2, the action area for this EFH Assessment includes all EFH in the Tuolumne River from La Grange Diversion Dam to the confluence with the San Joaquin River, and in the San Joaquin River from RM 84 (i.e., the confluence with the Tuolumne River) downstream through the Sacramento-San Joaquin Delta (Delta) to San Francisco Bay.

Based on the above analyses and on our analyses in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the staff alternative would have only minor and, in most cases, beneficial effects on Chinook salmon EFH. In addition, the staff-recommended measures would likely improve EFH over the long term. By way of this draft EIS, we are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations.

Terrestrial Species

The Districts prepared a draft BA for terrestrial species at the Don Pedro Project, which summarized the status of the Don Pedro Project's effects on five animals (San Joaquin kit fox, California red-legged frog, California tiger salamander, valley elderberry longhorn beetle, and vernal pool fairy shrimp) and two plants (Layne's ragwort [butterweed] and California [Red Hills] vervain). The Districts determined that the Don Pedro Project would have "no effect" on any terrestrial species. Because of this determination, the Districts' proposed few environmental measures for threatened and endangered species in the Don Pedro Project. In its 10(j) comments, FWS suggests that the effect determinations are incorrect and, at a minimum, should all be changed to "may affect". The Districts intent for both BAs is to serve as the basis for consultation between the Commission and FWS, pursuant to section 7 of the ESA. The Districts did not prepare a draft BA for terrestrial species at the La Grange Project. FWS 10(j) Don Pedro recommendation 11 and 10(j) La Grange recommendation 10 recommend the Districts

revise the draft Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures for federally listed terrestrial wildlife.

In general, FWS and California DFW contend that the Don Pedro amended final license application and draft BA for terrestrial species, and La Grange final application, do not contain adequate protective measures for federally listed terrestrial species. They cite project activities that could result in take of listed terrestrial species, including, but not limited to, burrow fumigation, wood stockpiling and burning, and pesticide use. FWS 10(j) recommendation 8 for both projects recommends that operation and maintenance activities not proceed within habitat for San Joaquin kit fox, California red-legged frog, California tiger salamander, or valley elderberry longhorn beetle until ESA consultation with FWS is concluded. FWS also included two federally listed plants, Layne's butterweed and Red Hills vervain, in this recommendation for the Don Pedro Project. It recommends that the Districts revise the BA to correct its deficiencies pertaining to consultation and species conservation, including (1) procedures to minimize adverse effects on listed species; (2) ensuring compliance with site management plans for special-status species; and (3) developing implementation and effectiveness monitoring of measures taken to reduce impacts to listed species. FWS 10(j) recommendation 8 for both projects recommends that that the Districts generate a new threatened and endangered species list for the projects every 120 days for the duration of the project licenses, and contact the FWS within 5 days if a new species becomes listed. Also, FWS recommends that the Districts to annually review the list of all special-status species that could occur at the projects. When a species is added, FWS and BLM, in consultation with Districts, would determine if the species or un-surveyed suitable habitat could occur in areas affected by Project activities. For any newly listed species, FWS 10(j) recommendation 8 recommends that the Districts develop and implement a study plan in consultation with FWS and BLM to assess project effects on the species, and prepare a draft BA. If any new species is listed or critical habitat is designated within the projects' boundaries, the Districts would initiate consultation with the FWS and develop measures to avoid project effects. Also, if any terrestrial listed species or critical habitat affected by the project is outside of the projects' boundaries, the Districts would also consult with the FWS about whether a section 7 nexus exists with another federal agency or if an ESA section 10 Habitat Conservation Plan and permit is needed.

Lastly, FWS 10(j) recommendation 8 requests that the Districts comply with the terms and conditions of any biological opinion issued by FWS on the Don Pedro and La Grange Projects, and allow for conservation actions for federally listed species to occur within the projects. Additionally, BLM Don Pedro revised 4(e) condition 28 and BLM La Grange preliminary 4(e) condition 19 specify that, before constructing new project features on BLM lands that were not addressed in this EIS, the Districts would submit a biological evaluation for BLM approval that evaluates the potential impact of the action on threatened and endangered species or BLM special-status species or their habitat. In coordination with the Commission, BLM could require mitigation measures for the protection of the affected species. We discuss the benefits of these and other

recommendations and conditions below as they pertain to the specific federally listed terrestrial animals that could occur within the projects' boundaries.

San Joaquin Kit Fox

Noise caused by project maintenance activities and recreation could affect San Joaquin kit fox in the project vicinity. As mentioned in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the *Burrowing Owls* subsection, the use of smoke and carbon monoxide to control rodents around recreational areas would adversely affect San Joaquin kit foxes if foxes are inhabiting burrows at the time of fumigation. The Districts do not engage in any other predator control that could affect San Joaquin kit fox, and no habitat conversion is proposed that would alter potential San Joaquin kit fox habitat within the projects. FWS also suggests that the projects are dispersal barriers to San Joaquin kit foxes, increasing their vulnerability to starvation and predation if adequate ground squirrel habitat is not present on both the north and south sides of the projects.

The Districts maintain that, due to a lack of evidence of San Joaquin kit fox at the Don Pedro Project, there is no potential for adverse effects on any kit foxes that could occupy potentially suitable habitat within the project boundary. Furthermore, because of their lack of observations of kit foxes in the Don Pedro Project, the Districts did not perform additional surveys for the subspecies within the La Grange Project boundary. In its draft BA for terrestrial species in the Don Pedro Project, the Districts addressed its rodent control practices claiming that because the Districts do no perform burrow blasting or use rodenticide, the project would have "no effect" on the San Joaquin kit fox.

FWS disagrees with the Districts' reasoning for excluding an evaluation of project effects on the San Joaquin kit fox. FWS 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for San Joaquin kit fox. They also recommend that the Districts prohibit the use of burrow fumigants or rodenticides on Federal land unless authorized by BLM, especially within San Joaquin kit fox habitat until either ESA section 7 consultation is completed or a permit is issued under ESA section 10. The Districts replied they do not plan to utilize rodenticides.

FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures for the San Joaquin kit fox that include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the San Joaquin kit fox.
2. Provisions to minimize impacts from roads on San Joaquin kit fox, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.

3. Provisions to minimize impacts from transmission lines on the San Joaquin kit fox, developed in collaboration with the resource agencies. This would include measures to discourage raptor use of transmission lines as perches within suitable habitat for the San Joaquin kit fox.
4. Monitoring and habitat surveys for the San Joaquin kit fox to be conducted every 3 years, or as determined by the resource agencies.
5. Considering the Recovery Plan for Upland Species of the San Joaquin Valley (FWS, 1998) for inclusion of protective measures in the plan.
6. Consultation with FWS for San Joaquin kit fox during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the species.
7. Direction for formal consultation with the FWS for any pesticides planned for use within the project area.
8. Direction for consultation with FWS during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the San Joaquin kit fox.

BLM Don Pedro revised 4(e) condition 7 and La Grange preliminary 4(e) condition 5 support the Districts' development, with their approval, of a revised Don Pedro TRMP and additional La Grange TRMP within 1 year of license issuance. The Districts replied that they would review the plans submitted by BLM and would draft revised TRMPs.

California DFW 10(a) recommendation M9-3 specifies that the Districts' license applications are missing management actions to address potential adverse effects on San Joaquin kit fox. Specifically, its recommendation M9-3.1 suggests that rodent control measures, which could result in take of San Joaquin kit foxes, should have burrow-specific monitoring and require avoidance of burrows occupied or potentially occupied by San Joaquin kit fox. California DFW also recommend that the Districts prohibit the use of burrow fumigants or rodenticides on federal land unless authorized by BLM, or in potential San Joaquin kit fox habitat until either ESA section 7 consultation is completed or a permit is issued under ESA section 10. The Districts replied that additional protective measures for San Joaquin kit fox are unwarranted because they found that the project is not likely to adversely affect San Joaquin kit fox, which has not been observed in the project vicinity for more than 40 years. Additionally, the Districts state that they do not conduct burrow blasting or use rodenticide for rodent control activities, and they will not conduct any rodent control on BLM lands without prior consultation.

Our Analysis

Project activities, such as maintenance activities and recreation, could result in noise that could disturb kit fox in the project vicinity. The Districts' proposed rodent

control could adversely affect the San Joaquin kit fox by reducing prey availability and eliminating potential burrows.

The Districts did not find any evidence of San Joaquin kit fox within the Don Pedro Project boundary during field surveys, although they did not complete protocol-level surveys. They performed daytime reconnaissance surveys and focused on potential natal dens for detecting San Joaquin kit fox. The Districts found no large burrows within the Don Pedro Project, but San Joaquin kit fox often change dens throughout the year and the majority of dens often do not show evidence of use (Orloff et al., 1986). The Districts did not use scent stations, camera traps, or spotlighting, which are required by the FWS protocol (1999a). FWS commented that that the Districts' surveys should have used a methodology that can detect kit foxes when numbers are low (i.e., using dogs to detect kit foxes by scent).

The Districts' lack of detecting San Joaquin kit fox does not constitute known absence of the species and additional information is needed to sufficiently assess potential project effects on the species. Suitable habitat and historical occurrences nearby indicate that kit foxes could potentially be present within the projects. Also, the majority of the uplands within the project boundaries are potential San Joaquin kit fox dispersal habitat. Under the right conditions, San Joaquin kit foxes could occur within the Don Pedro and La Grange Projects. Thus, conducting protocol-level surveys in accordance with FWS (1999a) within the Don Pedro Project, and documenting incidental sightings or anecdotal evidence of San Joaquin kit fox during other biological surveys of both projects, would help to document the use of the projects by San Joaquin kit fox. Including these provisions in the TRMPs, in consultation with FWS, the Water Board, California DFW, and BLM would ensure that appropriate protection and mitigation measures are consistent with agency guidelines.

The San Joaquin kit fox can be adversely affected by rodent control and insecticide use. As noted by FWS, the San Joaquin kit fox populations in the project vicinity are likely suppressed as a result of the basin-wide ground-squirrel eradication programs and predation pressure. By lethally removing ground-squirrel and thus reducing availability of their burrows, kit foxes could experience increased risk of predation by coyotes. This could also cause San Joaquin kit foxes to be increasingly vulnerable to starvation and predation due to the loss of ground-squirrels for prey and burrows for cover. As described in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the *Burrowing Owls* subsection, including BMPs in the Don Pedro TRMP for managing burrowing rodents would minimize potential project effects on San Joaquin kit fox. Additional provisions to avoid potential incidental take of San Joaquin kit fox could include conducting protocol-level surveys in accordance with FWS (1999a) prior to any rodent control, and instituting avoidance measures for any occupied or potentially occupied burrows, as well as documenting any anecdotal evidence of San Joaquin kit fox during other biological surveys of both projects. These revisions would also provide a means for continued consultation regarding potential project effects on San Joaquin kit fox. No rodent control activity occurs in the La Grange Project, so this potential effect

would not be a concern. Also, the Districts could ensure that any potential project effects are minimized by reviewing the Recovery Plan for Upland Species of the San Joaquin Valley (FWS, 1998) and including any suggested protective measures, if applicable, in their TRMPs.

Raptors such as large hawks and owls and golden eagles can be a significant source of mortality for adult and juvenile San Joaquin kit foxes. Raptors opportunistically use powerlines for perches, which could facilitate predation on kit foxes. These potential predators of kit fox would likely be attracted to powerlines in proximity to where kit foxes occur because their primary prey item, California ground squirrels, provides burrows that are often modified and used by kit foxes. Conducting surveys of ground squirrel habitat in proximity to power lines would document if this potential effect is occurring within the projects. The Districts have not mapped California ground squirrel colonies within the Don Pedro and La Grange Projects, and the FWS recommendation does not specify where this effect could occur. Nonetheless, no project nexus exists for this recommendation because the Districts are not responsible for any transmission lines: the project ties into the electric grid at the Don Pedro Powerhouse.

Vehicles are another major cause of kit fox mortality. However, the analysis reveals that the roads used by the Districts within the Don Pedro Project boundary do not experience traffic volumes high enough to warrant mitigation measures for wildlife-friendly road crossings. For example, Cypher et al. (2005) found few negative effects on kit foxes by two-lane highways with moderate traffic volumes (800 to 1,500 vehicles per day). Additional measures to protect kit foxes from pesticide usage beyond those already specified for special-status amphibians and reptiles would be duplicative. Project activities such as human recreation at Don Pedro recreational areas, particularly those occurring at dusk and dawn, could directly affect kit fox through disturbance. However, there is not a demonstrated project effect that would necessitate additional surveys of the project due to these activities. Any sightings or evidence of San Joaquin kit fox during surveys associated with rodent control activities and other biological surveys would provide the necessary information to determine if additional protective measures are needed.

Because there is a lack of definitive evidence from protocol-level surveys that San Joaquin kit foxes do not occur in the Don Pedro and La Grange Projects, we cannot support the Districts' assessment that the Don Pedro Project would have "no effect" on the species. However, the Districts do not propose major changes to project operation or construction activities that would adversely affect potential habitat for San Joaquin kit fox. With the implementation of protocol-level surveys for San Joaquin kit fox prior to the Districts' rodent control activities, and documenting incidental sightings or anecdotal evidence of the species during other biological surveys, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect" the San Joaquin kit fox.

California Red-legged Frog

Project operation and maintenance activities that have a potential to affect California red-legged frog include vegetation management and other ground-disturbing activities, recreation, the application of pesticides, the spread of the non-native invasive American bullfrog and chytrid fungus, the management of water levels in Don Pedro Reservoir and La Grange Reservoir, and woody debris management in Don Pedro Reservoir. However, no California red-legged frogs are known to occur within the project boundary, so any actual effects are uncertain.

In its draft BA for terrestrial species in the Don Pedro Project, the Districts determined that there would be "no effect" on California red-legged frogs. FWS claims this determination is incorrect, and FWS 10(j) recommendation 8 for both projects recommends that operation and maintenance activities should not proceed until consultation with FWS is concluded for the species. If California red-legged frogs were to occur within the projects, roads and facility maintenance could cause fatalities from vehicle collisions. The Districts' facility and road maintenance and construction, as well as recreation, could also cause minor erosion and sedimentation of aquatic habitats used by the species. Recreationist could also trample shoreline vegetation that is important to California red-legged frogs and could also potentially spread chytrid fungus between water bodies. The California red-legged frog could be adversely affected by the use of herbicides to control vegetation around project infrastructure and facilities. The perimeters of wastewater treatment facilities are sprayed annually, using herbicides labeled for aquatic use, when appropriate to manage aquatic weeds and algae. The Districts' proposed Don Pedro TRMP does not include any measures to avoid or minimize the potential adverse effects of pesticide use within the project. We discussed the use of pesticides and herbicides near aquatic areas above in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the subsection *Special-status Amphibians and Reptiles*.

American bullfrogs are a threat to native species of frogs within the Don Pedro and La Grange Projects. These large predatory invasive frogs threaten the California red-legged frog, and combined with non-native predatory fishes, are likely a major reason for the species decline in the Tuolumne River Watershed. American bullfrogs outcompete and prey upon California red-legged frogs, and are a primary reason that both species are threatened with endangerment. Any project effects that cause American bullfrog populations to increase would have direct and indirect adverse effects on California red-legged frogs. For example, project operation could indirectly affect California red-legged frogs by causing seasonally low-water surface elevation at the mouths of certain tributaries (coves) on Don Pedro Reservoir, which provide conditions that are suitable for American bullfrogs. Their spread from Don Pedro Reservoir into the upper Tuolumne River could also threaten California red-legged frog habitat within the Core Area # 6 (Tuolumne River), which occurs upstream of the project on Park Service and Forest Service lands.

The management of woody debris (e.g., trees and limbs) that floats down the Tuolumne River and accumulates in Don Pedro Reservoir could affect the recovery of California red-legged frogs. Stockpiling of logs and other woody debris within Don Pedro Reservoir provides artificial habitat for American bullfrogs. In recent years, the Districts and the BLM have not been in agreement about the need for a burn permit and large mats of woody debris have accumulated along the reservoir shoreline. This would also provide artificial habitat for any California red-legged frogs that could disperse from the nearby Piney Creek Core Area, which could be injured during subsequent burning or removal of this debris. California DFW 10(a) recommendation M9-2 recommends that the TRMPs for both projects include provisions to avoid woody debris stockpiling and the burning of those piles. The Districts' proposed Woody Debris Management Plan for the Don Pedro Project does not mention of how they would avoid potential adverse effects on the California red-legged frog.

To minimizes the threat of death or injury to California red-legged frogs, FWS Don Pedro 10(j) recommendation 9 and California DFW 10(a) recommendation M4-4 both request that the Districts revise the plan to address safe and expeditious wood-removal in Don Pedro Reservoir when the volume exceeds 5,000 cubic yards of woody debris entering the reservoir in any one year. The recommended method would use an excavator placed on dry land and loading the wood from the water onto trucks. The wood would be hauled off-site promptly and transported to a lumber yard, chipping facility, or storage area for wood used in lower Tuolumne River salmonid habitat restoration. The Districts contend that additional protective measures for California red-legged frog during woody debris management activities are unnecessary due to the presumed extirpation of the species from the Don Pedro Project.

The Districts identified 17 sites that met the minimum criteria for California red-legged frog breeding habitats and were considered potentially affected by the Don Pedro Project operation and maintenance. Ten sites were located within or adjacent to the Don Pedro Dam spillway channel. Plunge pools and seepage pools that occur at the base of most dams are prime California red-legged frog habitat, and viable populations have persisted despite dams in other watersheds (FWS, 2002a). The Districts identified another seven sites that could potentially support California red-legged frog breeding that would be affected by project operations and maintenance activities, including six sewage treatment ponds near the project recreational areas and the Fleming Meadows swimming lagoon (HDR, 2013m). Most of the sewer treatment ponds have little to no emergent vegetation, but California red-legged frogs have been found in such a habitats elsewhere (FWS, 2018a). Nevertheless, the Districts concluded those sites to be marginal habitat due to their lack of dense emergent and overhanging vegetation and lack of suitable adjacent upland habitat.

FWS argued that protocol-level surveys are the only means to determine whether California red-legged frogs exist within the suitable habitats identified by the Districts. In their reply comments, the Districts state that they conducted a detailed assessment of habitat availability for federally listed amphibians, in accordance with the approved study

plan for the Don Pedro Project. The Districts believe their studies were adequate to demonstrate that the Don Pedro Project offers extremely limited potential for the California red-legged frog and argue that FWS provides no data or analyses to refute their findings.

FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 state that the Districts should revise the Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures for the California red-legged frog that include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the California red-legged frog.
2. Suppression or control of aquatic invasive species populations (bullfrog and crayfish), in collaboration with the resource agencies. Surveys should be conducted to determine the extent of their range within the project, assess their spread, and management actions to control their spread should be included in the plan.
3. Efforts to manage chytrid fungus, including survey efforts to determine its status within the project boundary, its vectors for movement, potential interactions between the disease and other stressors (such as pesticides, recreation, non-native species, and flows), and management actions to control its spread should be included in the plan.
4. Establishment of decontamination protocols in collaboration with BLM, FWS, and California DFW to ensure that any project activities that require movement from one waterbody to another have decontamination measures implemented (use protocols from Peek et al., 2017).
5. Provisions that any cut hazard trees or fuels reduction debris be removed within 24 hours, or be left in place in perpetuity, and not be stored within 1,000 feet of a wetland or riparian area, or core areas for federally listed species recovery.
6. Provisions to work with the resource agencies to develop additional minimization measures for when ground disturbance actions are planned within 300 feet of wetlands, riparian areas, critical habitat, or core areas for federally listed species recovery.
7. Provisions to minimize impacts from roads on California red-legged frog, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
8. Monitoring and habitat surveys for the California red-legged frog to be conducted every 3 years, or as determined by the resource agencies.
9. Considering the California Red-Legged Frog Recovery Plan (FWS, 2002a) for inclusion of protective measures in the plan.

10. Direction for formal consultation with the FWS for any pesticides planned for use in the project.

11. Consultation with FWS for California red-legged frog during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the species.

The Districts did not reply to these specific conservation measures because they argue that additional protective measures for California red-legged frog management activities are unnecessary due to the presumed extirpation of the species from the Don Pedro Project.

California DFW 10(a) recommendation M9-2 specifies that the Districts' license applications are missing management actions to address potential adverse effects on California red-legged frogs. Specifically, it suggests that wood stockpiling and burning could result in take of California red-legged frogs and should be phased out and replaced with a rapid wood removal strategy that includes immediate off-site transport. As discussed above, they provide specific details for LWM management under California DFW 10(a) recommendation M4-4. The Districts replied that additional protective measures for California red-legged frog are unwarranted because their studies demonstrate that project effects on the species are limited or discountable, and that California DFW provides no data or analysis refuting their conclusions. The Districts contend that their proposed bi-annual environmental training and annual agency consultation would provide a path for new protection measures for California red-legged frog in the event they become established at either project.

Our Analysis

The Districts conducted reconnaissance surveys of California red-legged frog habitat. Although this followed FWS (2005) protocol, the Districts did not conduct protocol-level surveys for the species within areas of suitable habitat in the Don Pedro or La Grange Projects. The Districts found suitable breeding habitat at 17 sites at the Don Pedro Project. The Districts thus cannot conclude that the species does not occur within either project. However, based on the evidence presented by the Districts' surveys and considering comments by the resource agencies, we agree that it is very unlikely that any California red-legged frogs occur in the Don Pedro or La Grange Projects. Therefore, project operation and maintenance, as well as non-routine ground-disturbing activities are not likely to affect the California red-legged frog or its habitat. These activities would include operation of the three recreational areas, facilities and road maintenance, vegetation management, woody debris management in Don Pedro Reservoir, new project construction and other ground-disturbing activities.

The potential adverse effects of pesticide use in proximity to suitable habitat for California red-legged frog is a valid threat, even if the species is absent from the Don Pedro and La Grange Projects. Given the lack of documented occurrences of California red-legged frog in projects, BLM's recommendation to implement BMPs to avoid

adverse effects from pesticide use within 500 feet of known locations of California red-legged frogs would be unnecessary. However, we agree that it would be a reasonable recommendation to limit potential effects on sensitive amphibians and reptiles within the projects. Herbicide drift has been documented as occurring nearly 100 feet away from its application (Segawa et al., 2001). A 2006 Stipulated Injunction and Order in U.S. District Court for the Northern District of California's imposed avoidance buffers around California red-legged frog upland and aquatic habitats for certain pesticides in California, which, for ground applications, extend 260 feet from the edge of red-legged frog aquatic habitats in areas with adjacent suitable upland habitat (i.e., uncultivated or undeveloped land) (California Department of Pesticide Regulation, 2006). Therefore, a 260-foot avoidance buffer for herbicide use around suitable California red-legged frog habitat would avoid any adverse effects of pesticide use on the species. However, neither FWS nor California DFW recommend a specific avoidance buffer size for pesticide restrictions. Any potential adverse effects would be avoided by including BMPs consistent with California pesticide regulations in the TRMP.

American bullfrogs are arguably the greatest threat to the recovery of California red-legged frogs. The Districts documented this invasive species as well established across all portions of the Don Pedro Project. For example, American bullfrog were found in three of the pools in the spillway channel that were identified as suitable California red-legged frog breeding habitat and are likely present in other potential breeding habitats. American bullfrog would be extremely difficult to eradicate due to their lack of predators, prolific breeding, and large dispersal ability. No effective American bullfrog suppression strategies exist, and successful bullfrog eradication is usually labor-intensive and costly, with methods not applicable to large, open aquatic systems or elimination of established populations (Adams and Pearl, 2007; Hull and Rushton, 2012; Kraus, 2009; Snow and Witmer, 2010). Furthermore, unless eradication programs are performed on a large enough area to encompass whole landscapes, their populations would recover. Such a large-scale effort in the Don Pedro and La Grange Projects would not be feasible to perform.

While we agree that an evaluation of the status of chytrid fungus[143] in the projects would provide useful information, FWS provides no details on how this evaluation would be used to inform project operation or indicate how the project affects the spread of chytrid. Spread of the fungus between bullfrogs and red-legged frogs is a concern (FWS, 2002a) because red-legged frogs are susceptible to chytrid fungus infection, and although direct mortality has not been documented, this fungus likely has sub-lethal effects (Padgett-Flohr, 2008). However, as noted above, bullfrog control is not feasible. The Districts did not address the recommendation for decontamination protocols for project

[143] The chytrid fungus (*Batrachochytrium dendrobatidis*) affects the skin of amphibians, causing a disease known as amphibian chytridiomycosis and has been linked to dramatic population declines in amphibian species across the United States.

activities that require movement from one waterbody to another to prevent the spread of chytrid fungus or other undesirable aquatic invasive species. Including procedures for decontaminating field equipment to prevent spread of aquatic pests and disease between waterbodies in the plan would provide additional protections for California red-legged frog, as well as other fish and wildlife.

Lastly, vegetation management or other ground-disturbing activities, when carried out within 300 feet of a wetland or aquatic feature, could result in negative effects on California red-legged frog habitat. The proposed TRMP does not provide buffer distances or other minimization measures to protect wetlands and riparian areas from project activities. Including additional such provisions, in consultation with the resource agencies, would be a beneficial measure to ensure that California red-legged frogs would not be affected. The Districts could also stockpile woody debris within suitable upland habitat or dispersal habitat, which could attract California red-legged frogs and cause them to be killed if the Districts burn or remove the debris. FWS recommends that adverse effects could be avoided by removing any fuels, slash, or hazard trees within 24 hours, leaving them in place or removing them the same day when cut, and not storing any debris within at least 1,000 feet of a wetland, riparian area, or critical habitat. However, based on the vegetation management practices proposed by the Districts and the lack of any known California red-legged frogs within the projects, this protective measure would not be necessary.

The Recovery Plan for the California Red-legged Frog (FWS, 2002a) identifies the following conservation needs in the nearby Piney Creek Core Area: "control bullfrogs, reestablish populations." However, as discussed above, bullfrog control is not feasible. Our analysis finds that, although some suitable habitat exists and the Districts did not conduct protocol-level surveys, the species is very unlikely to occur within the project boundaries. The Piney Creek population is extirpated and the Districts' surveys found no evidence of the species at the Don Pedro Project. Implementing measures to minimize the effects of vegetation management and pesticide usage on aquatic habitats, and reducing the possible spread of chytrid fungus by project staff, would avoid and minimize effects on California red-legged frog and its potential habitat within the projects. Therefore, we conclude that the proposed action for both the Don Pedro and La Grange Projects would have "no effect" on the California red-legged frog or its critical habitat.

California Tiger Salamander

California tiger salamanders occupy ground squirrel burrows for more than 10 months of the year. Without access to ground squirrel burrows, California tiger salamander populations are not able to persist. As discussed above, under *California Red-legged Frog*, the Districts' lethal control of ground squirrels and pocket gophers would cause California tiger salamanders to die from asphyxiation and lose protective habitat due to burrow collapsing after ground-squirrel control.

The Districts documented nearly 40 field-assessed sites that were characterized as potentially suitable for California tiger salamander breeding, 29 of which would be more favorable to breeding due to the presence of small burrows and upland habitat suitable for dispersal. Although no evidence of the species was documented by the Districts, FWS, in its 10(j) comments, suggests that they were not provided the opportunity to identify sensitive locations where California tiger salamanders were likely to occur in the Don Pedro Project. The Districts replied that FWS's statement that burrows within the project are "highly likely" to be occupied by California tiger salamander is speculative and unsupported by data. However, because suitable habitat is present, and protocol-level surveys were not conducted, it must be assumed that California tiger salamanders are present in the project.

The Districts determined that the Don Pedro Project would have "no effect" on the California tiger salamander. FWS claims this determination is incorrect and FWS 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for the species. FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 state that the Districts should revise the Don Pedro TRMP and develop a La Grange TRMP within 6 months of license issuance to include protective measures for the burrowing wildlife, which include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the California tiger salamander. Providing direction for formal consultation with the FWS for any pesticides planned for use in the project area.
2. Provisions that any cut hazard trees or fuels reduction debris be removed within 24 hours, or be left in place in perpetuity, and not be stored within 1,000 feet of a wetland or riparian area, or core areas for federally listed species recovery.
3. Provisions to work with the resource agencies to develop additional minimization measures when ground disturbance actions are planned within 300 feet of wetlands, riparian areas, critical habitat, or core areas for federally listed species recovery.
4. Provisions to minimize impacts from roads on California tiger salamander, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
5. Monitoring and habitat surveys for the California tiger salamander to be conducted every 3 years, or as determined by the resource agencies.
6. Direction for formal consultation with the FWS for any pesticides planned for use in the project area.

7. Direction for consultation with FWS during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the California tiger salamander.

California DFW 10(a) recommendation M9-2 specifies that the Districts' license applications are missing management actions to address potential adverse effects on California tiger salamanders. It specifies that all rodent control measures should have avoidance of small mammal burrows occupied or potentially occupied by California tiger salamanders. The Districts replied that additional protective measures for California tiger salamanders are unwarranted because their studies demonstrate that project effects on the species are limited or discountable, and that California DFW provides no data or analysis refuting their conclusions. They argue further that their environmental training requirements and annual agency consultation would provide a path for new protection measures for California tiger salamander if they become established at either project.

Our Analysis

Our review of the Districts' study report for California tiger salamander reveals inconclusive evidence that California tiger salamander would not be affected by project activities. The species is presumed to potentially occur within the Don Pedro Project boundary and implementation of protection measures would minimize project effects. Field assessments documented the minimum components of California tiger salamander at 38 field-assessed sites within 1.24 miles of the project boundary, including 22 within the project boundary. A total of 16 sites met the minimum criteria for California tiger salamander breeding and are potentially affected by project operations and maintenance. Thus, the study demonstrates that suitable habitat does exists in numerous locations at the Don Pedro Project. Furthermore, suitable California tiger salamander habitat was documented in proximity to the historic (2007) occurrence of the species within the project boundary. Those sites, south of Fleming Meadows Recreation Area, were not field-assessed, presumably due their location on private property (see map 14 of 18 in attachment B of HDR, 2013n). Adult California tiger salamander movements can extend as far as 1.3 miles to and from breeding ponds (Orloff, 2007). Several perennial ponds in the Don Pedro Project are within the dispersal distance of project activities (e.g., rodent control).

The granting of a new license for the Don Pedro Project could adversely affect California tiger salamander if they occur within ground squirrel burrows subject to rodent control. As discussed above for San Joaquin kit fox, the Districts' rodent control activities include the occasional use of a Gopher X smoke and carbon monoxide-producing machine. California tiger salamanders spend the majority of their lives underground, usually in ground squirrel burrows, and depend on this habitat for cover and protection from desiccation. Without access to ground squirrel burrows, California tiger salamander populations are not able to persist. The reduction of ground squirrel populations would reduce the availability of burrows. California tiger salamanders could also die from asphyxiation if their burrows are smoked. However, this is one of the most

effective and environmentally benign rodent control techniques because it has far fewer adverse effects on non-target wildlife.

The analysis suggests that potential adverse effects from the Districts' rodent control on California tiger salamander could be avoided if the Districts take measures to avoid small mammal burrows occupied or potentially occupied by salamanders. This is not possible because the Districts have not performed surveys for the presence of California tiger salamander in either project. As discussed above for burrowing owls and San Joaquin kit foxes, including provisions in the Don Pedro TRMP for checking ground squirrel burrows for occupancy by California tiger salamanders prior to rodent control would avoid any incidental take of salamanders. No rodent control activity occurs in the La Grange Project, so this potential effect would not be a concern. Conducting protocol-level surveys in accordance with FWS (2003), and instituting avoidance measures for any occupied or potentially occupied burrow, prior to any rodent control would ensure the protection of California tiger salamanders. Furthermore, including a provision in the plan requiring the Districts to seek authorization from the BLM for any rodent control on Federal land would further ensure appropriate avoidance of California tiger salamanders. As discussed above, under *California Red-legged Frog*, amphibians are sensitive to the potentially adverse effects of pesticide use. Implementing BMPs in the TRMPs that are consistent with California pesticide regulations for any pesticide use in the projects would avoid or minimize any potential adverse project effects on California tiger salamander and would ensure compliance with California pesticide restrictions. Based on this analysis, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect" the California tiger salamander.

Valley Elderberry Longhorn Beetle

Project operation and maintenance activities such as vegetation management, road maintenance, and other ground-disturbing activities could affect elderberry shrubs, which the threatened valley elderberry longhorn beetle requires for survival and reproduction. FWS assumes the valley elderberry longhorn beetle is present for any elderberry shrub located within a riparian area and uses exit holes to evaluate the site for occupancy when a shrub is in non-riparian habitat.

The valley elderberry longhorn beetle is the only federally listed animal for which environmental measures are proposed in the Districts' Don Pedro TRMP. The Districts would avoid injury to the valley elderberry longhorn beetle by following the FWS conservation guidelines for the species (FWS, 1999b), as attachment B of the Don Pedro TRMP. Protective measures would include a 100-foot avoidance buffer around potential elderberry shrubs with stems greater than 1 inch and providing for FWS consultation before any ground disturbance within the buffer area occur. If effects on elderberry shrubs are unavoidable, the guidelines also detail the appropriate methods for transplanting shrubs into a conservation area that would be protected in perpetuity. FWS 10(j) recommendation 8, for both Don Pedro and La Grange Projects, support the Districts' adherence to these guidelines, but also recommend they Districts follow the

Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (FWS, 2017c). FWS 10(j) recommendation 8 also states that project operation and maintenance should not proceed within valley elderberry longhorn beetle habitat until ESA consultation with FWS is concluded for the species. The resource agencies otherwise generally agree that valley elderberry longhorn beetles are provided sufficient protections in the Districts' proposed license application.

The Districts did not perform surveys for valley elderberry longhorn beetle or prepare a draft BA for terrestrial species in the La Grange Project. The Districts claim that their license application for the La Grange Project provides sufficient information for consultation purposes. They note that no study requests were made in the La Grange Project licensing process, or studies required, to investigate the presence of valley elderberry longhorn beetle.

Our Analysis

Project operation and maintenance activities that could affect valley elderberry longhorn beetle include brush control, mowing, and herbicide use for vegetation control around campsites, structures, and roadsides, and recreational use that causes trampling of vegetation. The most common observed potential stressors to surveyed elderberry plants included: proximity to roads and trails, affecting 19 occurrences; cattle grazing, affecting 18 occurrences; and noxious weeds, affecting 15 occurrences. Additionally, two elderberry occurrences were located directly next to sewage treatment plants and may be subject to disturbance by project operation and maintenance. The Districts' amended final license application and associated draft BA for terrestrial species in the Don Pedro Project include sufficient detail regarding potential effects on and conservation measures for valley elderberry longhorn beetle. Therefore, any additional modifications to the Districts' proposed protection of known occurrences of valley elderberry longhorn beetle host plants in the Don Pedro Project boundary would not be necessary. In addition, the Districts' Don Pedro TRMP proposes site-specific surveys for special-status plants prior to new ground-disturbing activities affecting more than 0.5 acre, which we assume would also identify any elderberry shrubs. Incorporating protective measures for the valley elderberry longhorn beetle in a La Grange TRMP would be necessary to protect the species from project effects.

According to the FWS Conservation Guidance (FWS, 1999b), surveys for valley elderberry longhorn beetle host plants are valid for a period of 2 years. The resource agencies did not recommend additional surveys during the duration of the license, but new elderberry shrubs could become established within the project boundaries during the term of any license issued for both projects. Thus, the continued recovery of valley elderberry longhorn beetle would be better facilitated by recording occurrences of elderberry plants during the Districts' special-status plant surveys of both projects.

We have reviewed FWS (2017c) to evaluate potential effects of the Don Pedro and La Grange Projects on the valley elderberry longhorn beetle. If elderberry shrubs occur

within 165 feet of project-related ground disturbances, adverse effects on the valley elderberry longhorn beetle may occur as a result of project implementation (FWS, 2017c). The Districts surveyed for elderberry shrubs within 100 feet of Don Pedro Project features, so it is possible that elderberry shrubs could exist within the non-surveyed area between 100 and 165 feet of project activities. Undocumented elderberry shrubs that could host valley elderberry longhorn beetles may also occur within the La Grange project. Although most project operation and maintenance activities would be unlikely to affect nearby elderberry shrubs, because ground disturbance would be localized, these activities could affect beetles dispersing from the plants. Surveys for elderberry plants within a larger radius (165 feet) around ground disturbances, as recommended by FWS (2017c), would update the Districts' proposed management of the species based upon the latest understanding of its ecology. There are no additional conservation measures recommended by FWS (2017c) that would be necessary to ensure that project operation and maintenance do not affect the beetle. Based on this analysis, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect" the valley elderberry longhorn beetle.

Federally Listed Plants

Potential adverse effects on plants listed under the ESA in the Don Pedro Project would include recreation on lands within the Red Hills ACEC, the treatment of noxious weeds in their vicinity, and fluctuating Don Pedro Reservoir levels due to project operations. Because the Districts did not perform surveys for federally listed plants in the La Grange Project, the potential effects on any possible occurrences are unknown.

The Districts determined that the Don Pedro Project would have "no effect" on the Layne's butterweed and the Red Hills vervain. FWS claims this determination is incorrect and FWS Don Pedro 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for these federally listed plants. The three Layne's butterweed occurrences were recorded at Kanaka Point, near a day-use area off Jacksonville Road. Due to multiple footpaths throughout the area, including one that runs within a few feet of two occurrences, these three occurrences are potentially subject to trampling by recreationists in the area. Also, two noxious weeds, distaff thistle and barbed goatgrass, occur in the general vicinity of numerous Layne's butterweed occurrences, which could spread quickly and threaten the persistence of Layne's butterweed. BLM commented that four yellow starthistle populations, which the Districts documented on Kanaka Point next to a day-use recreational area, area also in the same vicinity as Layne's butterweed populations. Furthermore, BLM contends that noxious weeds on Kanaka Point are an indirect effect of the day-use parking area off Jacksonville Road and threaten ESA species in the Red Hills ACEC. The Layne's butterweed occurrences near Poor Man's Gulch and Sixbit Gulch are also subject to other potential stressors, including grazing and recreation. FWS speculated that suitable Layne's butterweed habitat occurs along many

roadsides and the species may be prevented from growing because the Districts would spray herbicides in these areas.

As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the subsection *Special-status Plants*, operation of Don Pedro Reservoir would potentially affect one Layne's butterweed occurrence, which was located near the reservoir shoreline. Small portions of this population extended below the reservoir normal maximum surface elevation. The Districts note that the Layne's butterweed plants at this site are not adversely affected by current operations, but could be impacted by substantial changes in the duration or timing of inundation. FWS 10(j) recommendation 8 notes that because Layne's butterweed can be killed or destroyed if inundated for too great a period of time, this potential threat from Don Pedro Reservoir's operation should not be discounted. The Districts reply that only a portion of the affected Layne's butterweed population could be affected by substantial changes in the duration or timing of inundation, but that no such changes are expected under a new license issuance.

Our Analysis

Noxious weeds were documented as potentially threatening populations of Layne's butterweed. Six of the smooth distaff thistle populations that the Districts propose to treat with herbicide are in the general vicinity of three occurrences of Layne's butterweed (within 250 feet of one occurrence), located on Kanaka Point. For this reason, the resource agencies recommended an emphasis on manual control of noxious weeds in areas where special-status plants are likely to occur. The co-location of noxious weeds in proximity to federally listed plants could also occur in other locations not documented by the Districts' surveys. As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the *Noxious Weeds* subsection, the analysis supports the benefits of emphasizing manual control over chemical usage in areas where special-status plants, including those listed under the ESA, are likely to occur. Furthermore, under *Special-status Plants*, we discussed the benefits of flagging or fencing around special-status plants prior to any vegetation management activities. This would also apply to federally listed plants to ensure that the treatment of smooth distaff thistle and other noxious weeds does not adversely affect Layne's butterweed, or other federally listed plants.

Because human recreation, such as hiking, horseback riding, and motorized vehicle use, is known to threaten occurrences of Layne's butterweed and Red Hills vervain, it would be prudent to better manage public access in these areas. As described in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the *Special-status Plants* subsection, we support the installation of signage that informs visitors of their potential effects on special-status plants in the Red Hills ACEC. Increasing public awareness with signage could effectively reduce effects, but the issue should be monitored by the Districts in coordination with BLM. If adverse effects were to increase, future measures such as fencing may be needed to protect some populations of federally listed plants in the Red Hills ACEC. Because some adverse effects associated with future

increases in project-related recreation are possible, we conclude that the Don Pedro Project "may affect, but is not likely to adversely affect" Layne's butterweed and Red Hills vervain. Because neither Layne's butterweed nor Red Hills vervain are expected to occur within the La Grange Project boundary, the La Grange Project would have "no effect" on either species.

Although no surveys for federally listed plants were conducted at the La Grange Project, records indicate one species, Hartweg's golden sunburst, as historically occurring within the La Grange USGS quad. However, these occurrences would comprise one of two known locations of the species in Tuolumne County, from 1937 and 1963, for which no field work has been done to verify the presence or location of the species (FWS, 2007b). Suitable habitat (mima mounds) is not known to occur within the La Grange Project boundary. Furthermore, potential effects are unlikely due to the lack of public roads or human recreation within the project. Therefore, we conclude that the La Grange Project would have "no effect" on the Hartweg's golden sunburst. As we discussed for *Special-status Plants*, conducting a survey for special-status plants at the La Grange Project, and performing pre-construction surveys prior to any project-related ground disturbance involving heavy machinery, would provide for any conservation measures needed to ensure that the project has no effect on special-status plants.

3.3.5 Recreation

3.3.5.1 Affected Environment

The Don Pedro and La Grange Projects, located on the Tuolumne River in Tuolumne and Stanislaus Counties, California, provide diverse and substantial recreation opportunities. Regional recreational resources near the projects extend from the crest of the Sierra Nevada Mountain range to the San Joaquin Valley of central California. Federally managed public lands along the Tuolumne River along and upstream of the Don Pedro Reservoir, include the BLM-managed Red Hills Recreation Area, Stanislaus National Forest, and Yosemite National Park, which provide extensive opportunities for many popular recreational activities, including hiking, camping, fishing, and whitewater boating in forested, mountainous settings that have little to no development. Downstream of La Grange Diversion Dam, which is located about 2 miles below Don Pedro Dam, the lower Tuolumne River provides opportunities for fishing, swimming, and low gradient or flat-water boating in rural and urban settings with evidence of agricultural use and gravel mining occurring along much of the river corridor.

Other large reservoirs near the projects include New Melones Reservoir, located to the north on the Stanislaus River, and Lake McClure and Lake McSwain, located about 5 miles to the south on the Merced River. Similar to the project reservoirs, these large reservoirs are situated in the Sierra Nevada foothills and provide settings for many recreational activities including flatwater boating, fishing, developed camping and day use, hiking, and bicycling. Several whitewater boating runs exist upstream of these reservoirs, and portions of the Tuolumne and Merced Rivers upstream of Don Pedro

Reservoir and Lake McClure, respectively, are designated wild and scenic rivers. State Highway 49 (known as the Golden Chain Highway), a 317-mile state highway that is eligible for state scenic highway designation, also crosses the Tuolumne River at the upstream end of Don Pedro Reservoir. This route is popular for scenic driving through river canyons and touring small historic towns established during the gold rush-era in the Sierra Nevada Mountains (Sierra Nevada Geotourism, 2018).

Access to the lower Tuolumne River, downstream of La Grange Diversion Dam for non-motorized, recreational river boating, is available at eight public put-in and take-out locations located on the 46-mile reach from La Grange to Shiloh Bridge Fishing Access (west of Modesto). Points of public access within about 15 miles downstream of Don Pedro Dam include Old La Grange Bridge, Basso Bridge, and Turlock State Park. This valley section of the Tuolumne River is scenic and an excellent beginner boating run. The river gradient is low but has many riffles, narrow channels, and sharp turns. Although minor maneuvering skills are necessary to avoid the occasional obstacle, it is a very forgiving stretch of water (American Whitewater, 2017). The Districts' 1995 agreement that increased flows from the project to the lower Tuolumne River to protect aquatic resources also benefits boating use. Boater responses provided in *Lower Tuolumne River Lowest Boatable Flow Study Report*, indicate a flow of 200 cfs, as measured at the La Grange gage, provides the lowest boatable flow for canoes and hardshell and inflatable kayaks (HDR, 2010).

Whereas regional demand for recreation opportunities is reflected in the percent of the population participating in different recreational activities, population growth is the most determinant factor influencing future recreational demand. Because project visitors reside in high-growth counties[144] that are expected to increase by 35 percent by 2050, demand for the full spectrum of rural types of recreational activities, such as camping, hiking, boating (flatwater and whitewater), wildlife viewing, and fishing, are expected to similarly increase.

The county general plans for Tuolumne and Stanislaus Counties (see section 3.3.6, *Land Use and Aesthetics*), applicable to the area where these projects are located, contain general guidance for providing public recreational facilities including funding for their acquisition, construction, operation, and maintenance. The Sierra Resource Management Plan (BLM, 2008a), BLM manuals, and Tuolumne Wild and Scenic River Management Plan (Forest Service, 1988) contain specific recreational resource management objectives applicable to the public land the agency manages within and adjacent to the projects' boundary.

[144] Most of the visitors surveyed reside in Stanislaus, Merced, Tuolumne, San Joaquin, and Santa Clara Counties.

- Provide for quality day-use and overnight recreation opportunities associated with the projects, and ensure that other resources are not adversely affected by this recreational use;
- Ensure adequate river flows for boating, fishing, swimming, and other water contact recreation;
- Ensure project-related facilities meet current BLM design standards and standards for accessibility;
- Provide a safe recreational experience for the public;
- Provide public safety information at project reservoirs and primary river recreational access points;
- Provide an administrative presence during the public recreation and whitewater boating season;
- Ensure licensees provide for, and are responsible for, project-related recreation, including providing facilities, long-term maintenance, and periodic heavy maintenance;
- Post appropriate signs, including interpretive signs; and
- For project-affected reaches and reservoirs, provide streamflow and reservoir level information that is available to the general public and adequate for river and reservoir recreational use.

Don Pedro Project

Don Pedro Reservoir

Don Pedro Reservoir, which is primarily operated as a storage reservoir, has a normal maximum surface area of slightly less than 13,000 acres at the normal maximum water surface elevation of 830 feet. After achieving peak storage, which typically occurs sometime between early June and early July, the water level is gradually drawn down until its lowest elevation is reached in mid-winter. By October 7 of each year, the reservoir must be lowered to at least elevation 801.9 feet to provide capacity for flood control storage. Current operating protocols permit reservoir drawdown to elevation 600 feet at which point boating access to the reservoir upstream of old Don Pedro Dam (located at RM 56.4, 1.6 miles upstream of Don Pedro Dam) becomes limited. The Districts report that since its construction, the reservoir has been operated between 690 and 830 feet, depending on hydrologic conditions and water management factors. However, between 2015 and 2016, during California's recent 5-year drought, it appears the reservoir elevation lowered to less than 690 feet (figure 3.3.5-1).

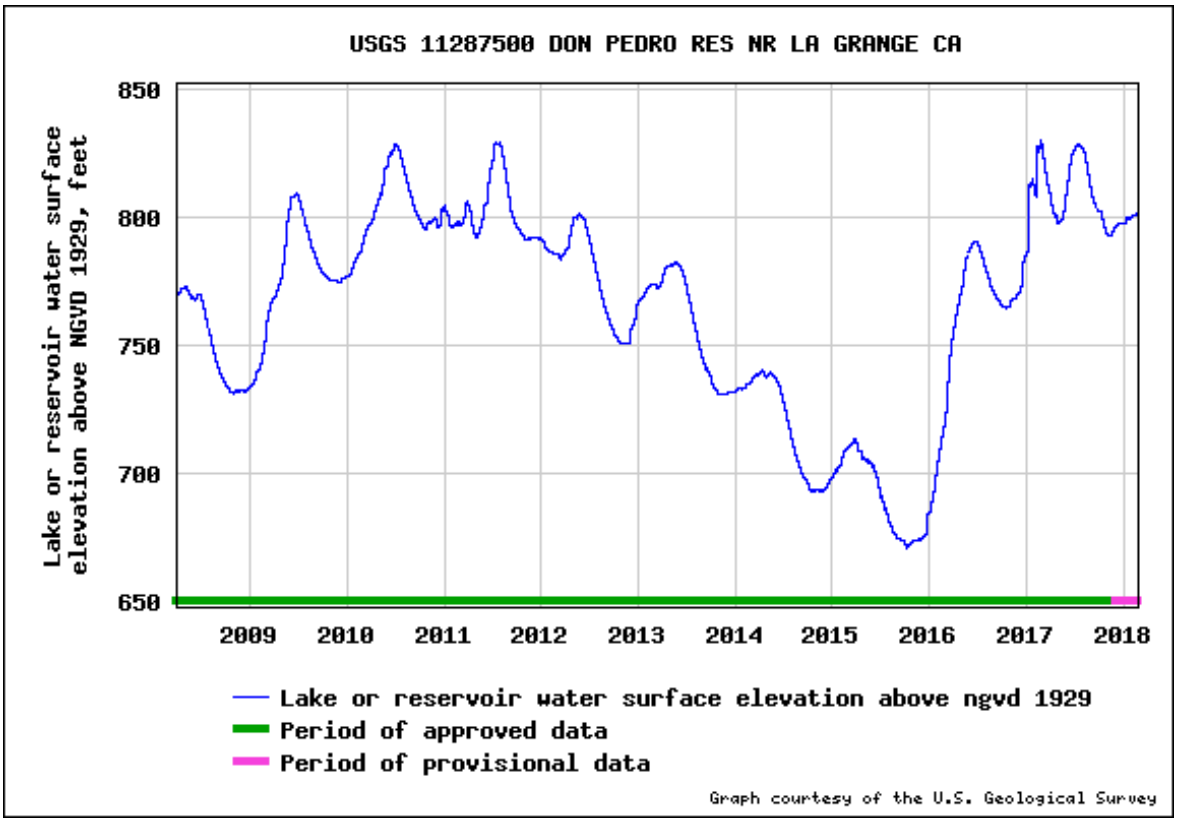


Figure 3.3.5-1. Don Pedro Reservoir water surface elevation 2008 to 2018 (Source: USGS, 2018m).

Recreation Facilities

The three recreation areas located at Don Pedro Reservoir have many amenities provided for visitors' comfort such as paved roads, flush restrooms, showers, and campsites with recreational vehicle hookups. Facilities to support recreational activities, such as volleyball and baseball, are also provided. The recreational areas include Moccasin Point, Blue Oaks, and Fleming Meadows. Figure 3.3.5-2 shows the locations of these recreational areas, and table 3.3.5-1 lists the amenities provided at each development.

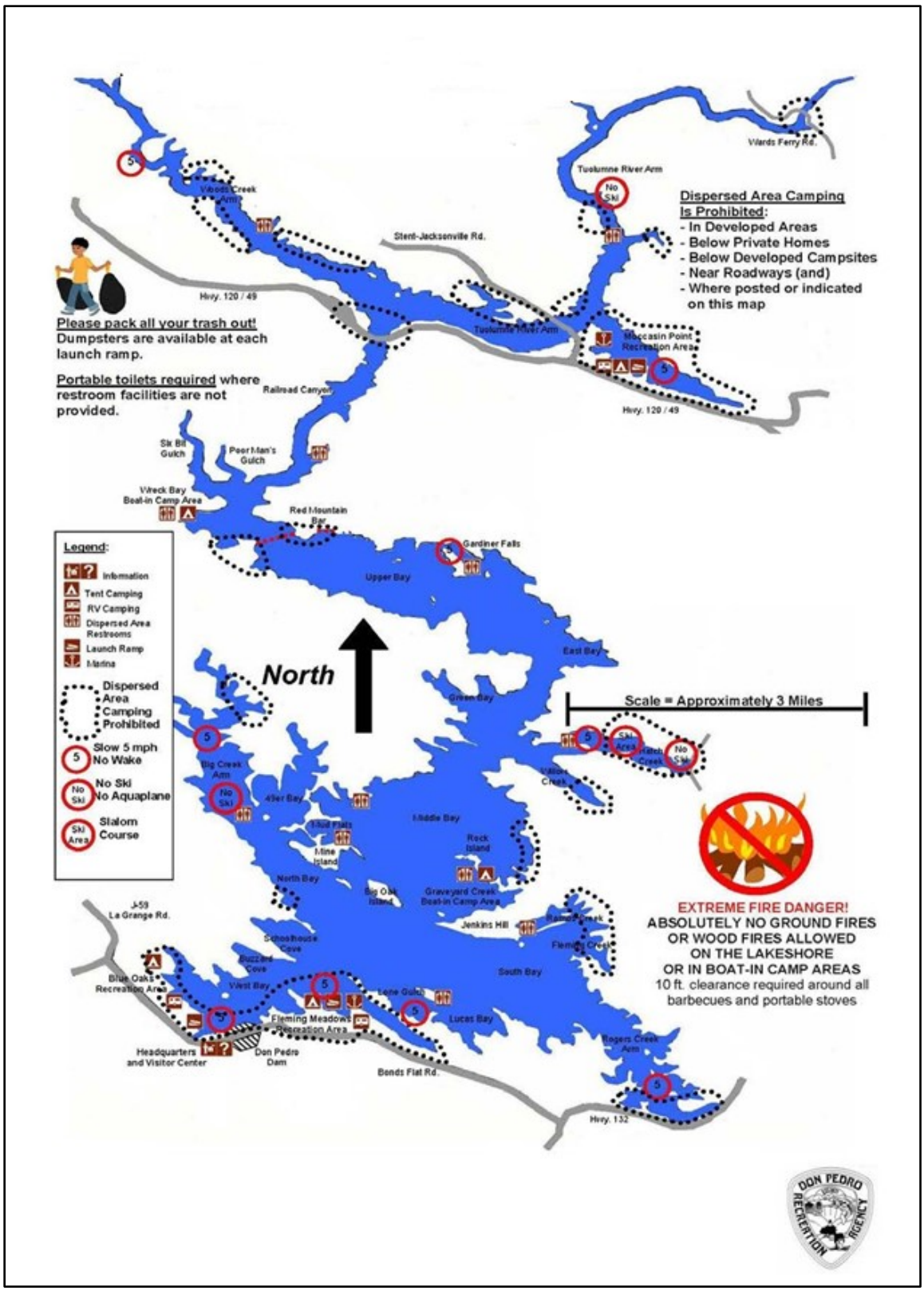


Figure 3.3.5-2. Recreation areas, amenities, and use restrictions at Don Pedro Reservoir (Source: Districts, 2017a).

Table 3.3.5-1 Capacities and amenities provided at developed recreational areas at Don Pedro Reservoir (Source: Districts, 2017a).

Amenities	Moccasin Point Recreation Area	Blue Oaks Recreation Area	Fleming Meadows Recreation Area
Camping units, total	96	195	267
With water and electric hookups	18	34	90
Picnic areas, total	2	1	2
Group picnic sites	1	1	1
Boat launch ramp	1	1	1
Fish cleaning stations	1	1	1
Restrooms, total	8	11	14
With hot showers	3	5	5
Additional Onsite Recreation Amenities			
Concession store	Yes	No	Yes
Swimming lagoon	No	No	Yes
Volleyball/softball area	No	No	Yes
Marina	Yes	No	Yes
Amphitheatre	No	No	Yes
Houseboat mooring	Yes	No	Yes
Boat rentals	Yes	No	Yes
Houseboat rentals	Yes	No	Yes
Boat repair yard	No	Yes	No
Gas and oil	Yes	No	Yes
Sewage dump station	Yes	Yes	Yes

Don Pedro has approximately 160 miles of shoreline, including islands. The three developed recreational areas occupy less than 10 percent of the reservoir shoreline, and the remaining shoreline is undeveloped. Dispersed boat-in camping and day use is permitted, with some exceptions, along much of the undeveloped portions of the shoreline. Wreck Bay has six boat-in campsites, each with a picnic table and two restrooms. Eight floating restrooms, and three vault restrooms, are located around the

shoreline at areas with high visitor use, and an additional vault restroom is provided near Ward's Ferry Bridge.

The Districts report that, in general, the recreational facilities are in excellent to good condition. Individual components of the recreational facilities that are in fair and poor condition include:

- Fleming Meadows—marina access road and parking area, water faucets and fountain, and restrooms (loops A and D and entrance station), and sign;
- Blue Oaks—boat launch parking area (main), water faucets, tables, boat launch, restrooms (concrete roof support structures), and signs; and
- Moccasin Point—roads, marina parking lot, campsite spurs, food lockers, water faucets, trash receptacles, restroom (concrete roof support structures), and signs;
- Wreck Bay Boat-in Campground—restroom and signs; and
- Floating and dispersed restrooms—Exterior surfaces, roofs, and toilets.
- Most, but not all, components of the three recreational areas are inaccessible to persons with disabilities. Most commonly identified inaccessible site components include campsites, picnic areas, water faucets, restrooms, roads, and parking areas. Campsites and restrooms at Wreck Bay Boat-in Campground and all floating and dispersed restrooms do not meet accessibility requirements.
- Several hiking and biking trails are within, or partially within, the project boundary. Red Hills is a region of 7,100 acres of public land with about 17.3 miles of trails located just south of the historic town of Chinese Camp and immediately east, west, and northwest of the Railroad Canyon and Woods Creek arm of Don Pedro Reservoir. Common visitor activities include hiking, horseback riding, wildflower viewing, birding, mountain biking, and some limited hunting. Within the project boundary, scenic biking and hiking is available on the Shoreline Trail that extends between Blue Oaks Recreation Area and Buzzard Point (figure 3.3.5-3). The Districts are responsible for maintaining this 5.9-mile project trail, and the existing condition is unknown.[145]

[145] This trail is used for project operation and maintenance and non-motorized recreation. Although the Districts report the condition as "4WD and/or ATV passable" (Districts, 2017g), this description does not indicate whether the trail is properly maintained. The Districts also cite inconsistent lengths among various license application documents for this trail.

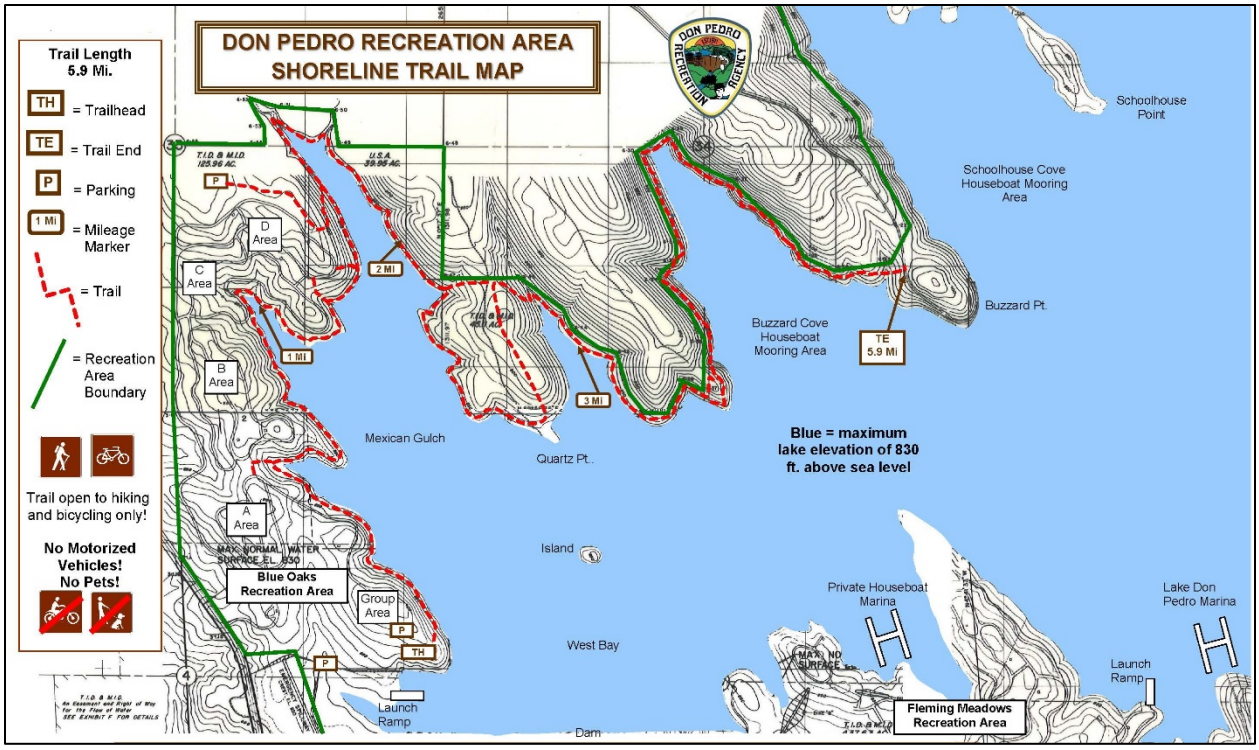


Figure 3.3.5-3. Shoreline trail at Don Pedro Reservoir (Source: Districts, 2017g).

Ward's Ferry Bridge, which crosses the Tuolumne River at the upstream end of Don Pedro Reservoir, is the downstream terminus for whitewater boating on the reach known as the Meral's Pool run (Figure 3.3.5-4). The Forest Service manages commercial and private boating use on this reach, allowing 52 commercial boaters and 96 private boaters on the upper Tuolumne River each day. The estimated annual whitewater boating use from 2003 to 2012 on this reach was about 4,225 boaters. During the boating season, generally from May to October, commercial outfitters temporarily park as many as three truck cranes on the bridge to retrieve boats from the river. This area is on BLM-managed lands within the project boundary; however, Tuolumne County owns and maintains the road and bridge. Access to the shoreline is available at all river flows and water levels, although access at low water levels is challenging because of steep banks in a narrow canyon, and the unconsolidated surface at an elevation of about or less than 810 feet. Under the terms of the current license, the Districts maintain a restroom on the shoulder of Ward's Ferry Road near the south end of the bridge (river left). Despite the appearance of graffiti, the Districts report the building is in good condition. The area is not regularly patrolled and the Districts report regularly occurring problems of vandalism and vehicle break-ins.

Figure 3.3.5-4. Whitewater boating take-out location and restroom at Ward's Ferry Bridge (Source: Google Earth; Districts, 2017a)

The Districts' recreation map (Figure 3.3.5-2) shows a visitor center and headquarters near the west end of the dam. The Districts report that the building was destroyed by a fire in 2016, and they plan to construct a new headquarters and visitor center near the entrance to Fleming Meadows Campground. The building was a Don Pedro Project recreation-related resource under the existing license.[146]

Recreation Visitation

Don Pedro Reservoir is a major recreational destination in the region, having an estimated annual visitation of 262,309 of visitor-days in 2012. By 2050, the Districts anticipate annual visitation to increase by 35 percent to 384,224 visitor-days. Seventy percent of the annual visitation to the project occurs during June, July, and August; however, the typically mild climate during other months provides suitable conditions for year-round recreational use.

Projected use at Fleming Meadows Recreation Area through 2050 is not expected to exceed the capacity of the campgrounds, picnic areas, and parking areas, except for the houseboat marina parking facility. In 2012, the peak season weekend occupancy at the houseboat marina parking area was greater than 80 percent and is projected to exceed capacity by 2020. The level of use correlates to the number of marina slips; however, marina expansion is not proposed at this time. The high level of existing use is attributed to marina users seeking to park as close to the marina as possible. Projected use at Blue Oaks Recreation Area through 2050 is not expected to exceed the capacity of the campgrounds, picnic areas, and parking areas (including boat launch and group picnic area parking). Projected use at Moccasin Point Recreation Area through 2050 is not

[146] See footnote on page 3-349 and table 3.7-11 on page 3-356 of the amended license application (Districts, 2017g).

expected to exceed the capacity of the campgrounds, picnic areas, and parking areas, except for the marina and group picnic parking facilities. In 2012, peak weekend occupancy of 115 percent at Moccasin Point marina parking area exceeded the facility capacity. The parking area for the group picnic area is expected to exceed the existing capacity by 2020, while occupancy at the other three parking areas is projected to be sufficient through 2050.

Recreational Activities

The most popular recreational activities at the project include fishing, boating, and camping. Don Pedro Reservoir supports year-round fishing for coldwater and warmwater species, and it is a popular location for fishing tournaments. California DFW manages the Don Pedro Reservoir fishery as a put-and-grow resource with substantial stocking. Boating on the reservoir is associated with a wide spectrum of activities including watersports (e.g., wakeboarding), fishing, kayaking, canoeing, personal watercraft use, windsurfing, and sailing. Commercial marinas at the reservoir provide boat rentals, repairs, docks, and moorings. Developed recreational facilities (table 3.3.5-1) provide abundant opportunities for overnight and day-use activities.

Dispersed use (both day and overnight) is permitted along the majority of the undeveloped Don Pedro Reservoir shoreline; however, use of some shoreline areas is restricted near developed recreational areas, roads, near-shore hazards, and adjacent to private land. Twenty-three discrete locations showing signs of recurrent dispersed shoreline recreational use were documented within the project boundary. The majority of the sites (70 percent or 16 sites) showed *low* impact; five sites (22 percent) showed *moderate* impact; and two sites showed *high* impact.[147] The Districts routinely patrol and maintain these shoreline areas.

Recreation Needs

The Districts investigated needed improvements and changes related to recreational resources in Study RR-01, *Recreation Facility Condition and Public Accessibility Assessment, and Recreation Use Assessment* (HDR, 2013d). In addition to conducting facility condition assessments, which is discussed above, the Districts

[147] *Low* impact sites either showed low or no sign of use impact or only a few minimal impacts. *Moderate* impact sites had one to three signs of impact with at least a few signs of litter and toilet paper, but also some unauthorized tree cutting, large areas of bare/compacted ground and/or user-created trails. *High* impact sites, had four or more signs of use impact but had significant or widespread impacts such as toilet paper (more than 5 occurrences); large areas of bare/compacted ground with trampled vegetation; user-created trails; and/or a fire ring without adequate clearance (Districts, 2017a).

surveyed project visitors about their perceptions, preferences, and desired changes relative to recreational facilities and management.

The Districts investigated potential effects such as shoreline/beach access, scenic quality, and boat use that could be affected by reservoir elevation; however, the survey responses indicate most visitors did not experience reservoir elevation-related problems. The most frequent responses for an individual effect as being *a large problem* accounted for no more than 6 percent of the responses for any given type of potential effect. The problems associated with these few responses related to the scenic quality of the shoreline, shoreline/beach access, and ability to launch and use a boat.

Study findings determined that only about 10 percent of visitors experienced some event or circumstance that conflicted with their recreational activity. The most common user conflicts were related to inappropriate behavior (e.g., noise and speeding watercraft) and were not the result of overlapping types of recreational activities. Most survey respondents said they either felt *not at all crowded* or *slightly crowded.* However, 17 to 78 percent of the visitors surveyed did not think the survey question about crowding at various locations was applicable to their visit. Of those few visitors who felt crowded, most did not modify their behavior, and the remainder moved to another location to avoid feeling crowded. Regarding water surface congestion, about 70 percent of the visitors perceived little to no crowding on the reservoir. Anglers' responses were similar with 76 to 81 percent saying they did not feel at all crowded.

Survey responses indicate a high level of satisfaction with the condition of the existing recreational facilities, but visitor responses indicate some needed improvements. Notable visitor comments about facility needs include: leveling or widening campsites; providing additional amenities such as lighting, electricity, restrooms, showers, food storage lockers, and trash receptacles; better facility cleaning and maintenance; improving directional signage; providing interpretive and educational signage; providing more parking/wider spaces; and providing or improving pedestrian shoreline trails.

The 2015 Statewide Comprehensive California Outdoor Recreation Plan was developed for all local agencies within California. It serves as a guide for all public outdoor recreation in urban and rural neighborhoods, cities, and regions, and provides a strategy for statewide outdoor recreational leadership and actions to meet the state's identified outdoor recreational needs (California DPR, 2015). The plan lists broadly scoped actions including:

- Inform decision-makers and communities of the importance of parks;
- Improve the use, safety, and condition of existing parks;
- Use GIS mapping technology to identify park deficient communities and neighborhoods;
- Increase park access for Californians including residents in underserved communities; and

- Share and distribute success stories to advance park and recreational services.

Although the Statewide Comprehensive California Outdoor Recreation Plan does not make any specific recommendations about lands at or near the project, the Statewide Comprehensive California Outdoor Recreation Plan reports the results of the Survey on Public Opinions and Attitudes on Outdoor Recreation in California, 2012 (California DPR, 2014), which characterize Californians' recreational preferences and trends. Some of the relevant findings from this survey are summarized below:

- During the past 12 months Californians mostly participated in picnicking (70.4 percent), walking (63.8 percent), beach activities (52.8 percent), shopping at farmers' markets (49.5 percent), and swimming in a pool (48.2 percent).
- The respondents would like to participate more often in picnicking (55.1 percent), walking (37.4 percent), camping (35.1 percent), and beach activities (34.6 percent).
- Few (7.9 percent) of the respondents reported engaging in off-road motor vehicle use once a month or more. Nearly 20 percent (18.2 percent) of respondents reported ever using an off-road vehicle in the last 12 months.
- The most important facilities were wilderness type areas with no vehicles or development; play areas for children; areas for environmental and outdoor education; large group picnic sites; recreational facilities at lakes, rivers, and reservoirs; and single-use trails.
- More than 60 percent of Californians thought more emphasis should be placed on protecting natural resources, maintaining park and recreational areas, protecting historic resources, and cleaning up pollution of oceans, lakes, rivers, and streams in park and recreational areas. About one-third of respondents felt that less emphasis should be placed on providing opportunities for motorized vehicle operation on dirt trails and roads.
- A majority of respondents (55.2 percent) reported spending between 5 and 10 minutes walking to the place they most often go to recreate. Meanwhile, a majority of respondents (54.5 percent) reported spending between 11 and 60 minutes driving there.
- The activities youth would like to participate in more often included horseback riding (50.2 percent), camping (47.1 percent), mountain biking (46.3 percent), and backpacking (46.3 percent).

La Grange Project

Project Recreation Resources

The 2-mile-long La Grange Reservoir is located in a narrow canyon between Don Pedro Powerhouse and La Grange Diversion Dam; recreational facilities and formal

public access points are not provided. The upper two-thirds of the reservoir is riverine in nature and the entire shoreline is undeveloped. Downstream of La Grange Diversion Dam, pedestrian access for fishing and other activities is available via La Grange Dam Road, which is gated near where the main canal crosses Highway 132. Visitors to the reservoir also gain access by walking and wading upstream from a public access point in the town of La Grange near the Old La Grange Bridge. Safety signs posted near the dam and powerhouse warn users of potential hazards.

The La Grange Diversion Dam is located at the exit of a narrow canyon, and the spillway, which spans between the two canal intakes, cannot be portaged because of steep canyon walls. The project operates in a run-of-the-river mode, and changing flows entering the reservoir from the Don Pedro Powerhouse have the potential to rapidly change the water level. When not in spill mode, the water surface elevation is between 294 and 296 feet about 90 percent of the time.

Recreation Needs

Although public use is not currently prohibited, recreational use is almost non-existent at the reservoir because of private landownership, steep topography, and public safety issues. The Districts conducted the Recreation Access and Safety Assessment Study to provide information about the adequacy of public access to support future recreational use (HDR, 2017e). The study report discusses the risk associated with various recreational activities (e.g., motorized and non-motorized boating, fishing, hiking, and swimming) that could take place on the reservoir and in the reach downstream of La Grange Diversion Dam.[148] The Districts determined that all of these activities pose either a high or medium risk to public safety. The Districts' access assessment determined it may be possible to accommodate public shoreline use for land-based activities upstream of the La Grange Diversion Dam on river right at approximately RM 53.3 by constructing a non-motorized trail originating near the top of Don Pedro Dam, provided that public safety and project security concerns could be addressed. The Districts determined providing public access in the vicinity of the La Grange Diversion Dam and intakes is not appropriate because of project operation and infrastructure.

3.3.5.2 Environmental Effects

The projects provide suitable settings for various recreational activities that attract visitors, and if unmanaged, could affect environmental resources (e.g., soil erosion,

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[148] The study area extended from RM 51.2 (which is approximately 0.25 mile downstream of USGS gage 11289650) upstream to Don Pedro Dam, located at RM 54.8 and included any potential public access ways that may be reasonably safe and feasible along the river left (east) and river right (west) banks of the Tuolumne River along this reach.

vegetation removal). Additionally, consistent with Commission regulation 18 CFR § 2.7, licensees are responsible for developing, operating, and maintaining suitable public recreational facilities providing public access, where appropriate, and informing the public of opportunities for recreation at licensed projects. Appropriate measures to address these issues consider the recreational needs of the area and effectiveness for minimizing or eliminating potential recreation-related effects on environmental resources.

The Districts propose one recreational measure that involves both projects—to construct and maintain a pedestrian trail extending between the parking area of the former visitor center located adjacent to the Don Pedro Dam and the shoreline of the La Grange Reservoir near the Don Pedro spillway channel. All other proposed measures are specifically related to individual projects.

Recreation Resource Management

The Districts propose to implement their Recreation Resource Management Plan[149] for the Don Pedro Project. The plan would address the development of new facilities downstream of Geer Road near RM 25 for non-motorized boating access and public viewing at a proposed fishway and counting window. Developing additional unspecified facilities during the license term would be based on need as determined by periodic monitoring. The plan states the Districts would be responsible for operating and maintaining: (1) three existing recreational areas with campgrounds, day-use areas, and boat launches; (2) areas with limited infrastructure (e.g., floating restrooms and boat-in campsites); and (3) areas receiving recurrent dispersed recreation that have no infrastructure. The Districts propose to report annual use every 6 years concurrent with FERC Form 80 reporting and summarize visitor survey responses collected every 12 years to assess recreational facilities and visitor needs and preferences. The report filed every 12 years would also recommend, for Commission approval, facility modifications, closures, or new facilities and include a proposed implementation schedule and a determination of whether the existing plan needs to be updated.

BLM Don Pedro revised 4(e) condition 14 would require implementing the Districts' plan as revised by BLM to: include information about facility condition and accessibility; include a GIS map showing landownership at recreational facilities; categorize Ward's Ferry as a developed, multi-use recreational facility; add text with guidance for constructing and reconstructing facilities on BLM-managed lands; consult BLM to develop visitor survey questions; and consult BLM about the need for updating the plan.

[149] Filed as Appendix E-7 of the amended license application for Don Pedro Project.

Our Analysis

The proposed Recreation Resource Management Plan for the Don Pedro Project lists the existing project recreational facilities and their amenities and contains maps showing their locations. The plan thoroughly explains the Districts' responsibility for operating and maintaining campgrounds, day-use areas, and areas with few or no site amenities and would ensure these project recreational facilities are safe and functional through the license term. However, because the plan does not identify the Don Pedro shoreline access trail, which is partially located on BLM-managed land, as a project facility, or describe the Districts' responsibility for operating and maintaining the trail, it is not clear whether safe and adequate public access to the project reservoir would be provided throughout the term of a new license. Consistent with study results that indicate the existing campgrounds and day-use areas have sufficient capacity to meet expected demand, the Districts do not propose constructing additional facilities for day and overnight use. The plan includes a monitoring component whereby the Districts would consider changes or revisions to the plan in response to visitor use data it compiles and reports every 12 years. Although an adaptive approach would respond to future trends, the plan does not describe any threshold or condition that would need to be met or specify how BLM (the public land manager) would be involved in the review to determine the need for additional facilities or a plan revision. Including this element in the plan would ensure agency objectives and land management guidance are incorporated into planning for project recreational development on public land.

Monitoring recreational use through the license term would document whether project visitor needs are being met and identify recreational use-related effects. The schedule and monitoring elements proposed in the plan are consistent with the Commission's regulations related to filing Form 80 recreational use reports at 6-year intervals (18 CFR § 8.11). The report would adequately describe recreational use, but because the plan does not specify regular and frequent agency consultation, project recreational management, actions, or adjustments that may be necessary to address recreational effects and visitor use needs could be delayed for up to 12 years—the minimum frequency stated in the plan for consulting with agencies. The effects of delaying necessary actions could result in health and safety issues at project recreational facilities and diminish the quality of visitors' experience.

Land management agency coordination is also a missing component of the plan with regard to constructing or reconstructing recreational facilities located on BLM-managed public land and designing visitor use surveys. BLM's Don Pedro revised 4(e) condition 14 specifies including text describing construction and reconstruction guidance on public land that would ensure project recreational facilities are designed and constructed consistent with BLM policies and regulations. Developing visitor survey questions in consultation with BLM would ensure relevant data are collected during recreational monitoring to make decisions about managing recreation on public land. Including these provisions in the plan would also be consistent with the Commission's

regulation to encourage licensees to cooperate with agencies to determine recreational needs.

The Districts intend to construct a new visitor center near Fleming Meadows to replace the building destroyed by fire in 2016; however, the Districts state this facility is not part of the proposed project. The visitor center fits within the definition of a project recreational facility because the Districts would be building this facility at an existing project recreational development, and it is at a central location where project visitors can obtain information about the project. Additionally, providing the visitor center is consistent with Commission guidelines for licensees to inform the public about recreation opportunities available at licensed projects. Including this facility in the Recreation Resource Management Plan, and providing for its operation and maintenance, would ensure visitor information services are available to the public at a properly maintained and accessible site.

BLM's Don Pedro revised 4(e) condition 14 specifies some changes to the plan that would not necessarily improve its effectiveness or provide consistency with agency policy or requirements. Including information about facility condition and accessibility, as BLM specifies, would not be necessary because that information is already provided in the relicensing study results and would be outdated by the time the license is issued and the plan is implemented. Landownership is shown on GIS maps provided in relicensing study reports and Exhibit G maps; however, it may help readers to see this information on the recreational facility maps provided in the plan. BLM also specifies categorizing the restroom at Ward's Ferry as a day-use area described as a developed multi-use recreational facility. The Districts use this facility category for recreational areas that have abundant and diverse amenities such as Fleming Meadows which have campsites, an amphitheater, a boat launch, a picnic area, and a swim lagoon. Because Ward's Ferry consists of a single vault restroom and does not have tables, grills or other such site amenities, it appropriately fits within the Districts' category definition of a recreational area with limited facility infrastructure.

Although the Districts would be responsible for operating and maintaining the project recreational facilities, the plan does not provide a schedule or indicate an intention to reconstruct the facilities during the license term. The Districts report most recreational facilities, which were constructed in the 1960s and 1970s, are in good condition. However, as confirmed by visitor survey responses, the facilities are worn and outdated. Further, the facility condition surveys indicate many facilities, especially restrooms, do not meet accessibility requirements. Without providing for recreational facility reconstruction during the license term, project visitor needs and expectations would not likely be met in the future and it is uncertain when project facilities would comply with accessibility requirements.

Two other proposed measures and agency conditions or recommendations involve recreational facility development: (1) constructing a trail between the parking area of the former visitor center and the shoreline of the La Grange Reservoir (Districts' proposed

measure,[150] California DFW 10(a) recommendation M7-3.1, and BLM La Grange preliminary 4(e) condition 8); and (2) constructing a new boat launch facility to be located upstream of old Don Pedro Dam (Districts' proposed measure). The various trail measures have slight differences but all would be beneficial by creating about a 1-mile route of non-motorized access to the reservoir, where no trail currently exists, thereby increasing trail opportunities in the area. The scope of access development contained in the Districts' measure does not provide a schedule or describe the standard of trail that would be constructed, but this information is specified in BLM's condition and, if implemented, would provide suitable access consistent with BLM's land management guidance within a reasonable time frame. Implementing California DFW 10(a) recommendation M7-3.1, which includes providing boat access, would encourage boating and swimming at La Grange Reservoir. As documented in the Districts' Recreation Access and Safety Assessment Study Report, water contact recreation at the reservoir has a high risk incident consequence rating because water velocities can rapidly change (HDR, 2017e). Accordingly, boating and swimming at the reservoir constitute high risk recreational activities and, if allowed or encouraged, could present unsafe conditions for the public.

The proposed non-motorized trail would provide access to the La Grange Project, but the proposed route traverses land within the Don Pedro Project boundary owned by the Districts, and public land managed by BLM. Although the trail is contained in the Districts' proposed measure and agency conditions and recommendations for the La Grange Project, it would be more appropriate to include the trail in the license for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway. Identifying the development of the proposed non-motorized trail in the Recreation Resource Management Plan and specifying the Districts' responsibility for its operation and maintenance would ensure adequate and safe public shoreline access. Because the proposed route passes near project infrastructure, signage, fencing, and gates, diverting use away from project features could be incorporated into the trail design to address project security and public safety concerns. The route also passes near privately owned lands, so providing signage to identify private property boundaries near the trail would minimize the potential for trail users to inadvertently trespass.

The Districts' proposal to construct a new boat launch near old Don Pedro Dam would allow boating access to Don Pedro Reservoir when the water surface elevation is at or below 600 feet. This facility would be a project recreational facility but its location, design, concepts, and provision for operation and maintenance are not provided in the

[150] Conservation Groups support the Districts' measure to provide a pedestrian trail to support fishing and low impact activities such as birdwatching and nature viewing.

Recreation Resource Management Plan. Consequently, it is not possible to determine whether this facility, as described in the Districts' proposed measure, would adequately accommodate potential use and visitor needs for reservoir access. In terms of the boating access that would be needed to accommodate the new proposed minimum pool of 550 feet, simulations of the various operational scenarios presented in the Districts' application or in agency conditions and recommendations, maintain a minimum water surface elevation higher than 600 feet, the elevation of the existing minimum pool (table 3.3.5-2). However, sequential low-flow years would likely result in lower water surface elevations than simulated. Consequently, it appears the proposed new boat launch would not be necessary to maintain boating access to Don Pedro Reservoir unless hydrologic conditions are drier than those that occurred within the 42-year period of record that was analyzed, which would likely be very infrequent.

Table 3.3.5-2. Minimum water surface elevation of Don Pedro Reservoir under proposed and recommended flow regime (Source: Districts' modeling data from Districts 2018a,b, as modified by staff).

Flow Regime	Minimum Water Surface Elevation over the Period of Record (1971 to 2012) (feet)
Base case	617.9
Districts interim	618.5
Districts with-IG	617.9
FWS	601.1
NMFS	615.5
California DFW	647.2
Water Board	619.6
Conservation Groups	601.0
The Bay Institute	614.3
ECHO	610.1

The Districts' relicensing studies report resource impacts ranging from low to high at some areas with recurrent dispersed recreational use. The Districts' proposal to periodically monitor and clean up these areas (i.e., continue the existing practice) would not address existing resource damage associated with *high impact sites*. Under the Districts' proposed measure, effects such as frequent signs of toilet paper, user-created trails, bare and compacted ground, trampled vegetation, and fire rings without adequate clearances would continue to exist and likely would be exacerbated. Additionally, these same conditions would likely emerge at additional locations unless specific actions, in

addition to the current practice of monitoring and clean up, are implemented. Revising the Recreation Resource Management Plan to specify treatments for addressing recreation-related damage at areas receiving recurrent use would address these project effects.

Although project effects would be more fully addressed by modifying the plan, the general scope of improvements and recreational facility management described in the plan would be consistent with meeting California recreational demand as reflected in the Survey of Public Opinions and Attitudes, 2012. Specifically, the Recreation Resource Management Plan aligns with the public's desire for providing facilities for day use (including group use) and trails; providing facilities at lakes, rivers, and reservoirs; and maintaining park and recreational areas.

Coordination with Resource Agencies

Project recreational facilities and use occur on public land managed by BLM and land owned by the Districts. The proposed Recreation Resource Management Plan states the Districts would consult with BLM, Park Service, California Department of Parks and Recreation, California Division of Boating and Waterways, and California DFW to prepare the visitor survey report that would be filed every 12 years and would report annual visitor use and any proposed changes related to recreational facilities. BLM Don Pedro revised 4(e) condition 11 has a much broader scope than the coordination the Districts describe in the plan and specifies annual consultation about many recreation-related topics: garbage and sanitation needs; dispersed camping areas; recreational facility operation and maintenance issues (raised by BLM, Districts, or others); fees for public recreational facilities located on BLM-managed land (fee increases subject to BLM approval); recreational use data, including recreational facility construction and rehabilitation activities, status of ongoing program of work, implementation schedule, permitting and environmental documentation needs, and coordination with other activities or resource management needs.

BLM Don Pedro revised 4(e) condition 11 also specifies that the Districts invite BLM to participate in field evaluations and condition assessments and provide BLM with FERC inspection and follow-up documentation.

Our Analysis

As discussed above, the lack of scheduled and frequent consultation about the spectrum of recreational management topics may delay actions and adjustments necessary to address recreational impacts and visitor use needs for up to 12 years, the minimum frequency stated in the plan for consulting with agencies. BLM Don Pedro revised 4(e) condition 11 specifies annual consultation, at a minimum, to create an annual opportunity to initiate or adjust actions within the scope of the plan to meet visitor needs and protect environmental resources (e.g., periodic monitoring and cleaning at dispersed sites, addressing deferred facility maintenance items). The comprehensive list of topics included in the preliminary condition provides a reasonable checklist of project

recreation-related items that could prompt actions to address emerging recreational effects or needs. Implementing the BLM condition would ensure agency coordination to protect environmental resources when operating and maintaining project recreational facilities located on federal land. Considering that the Districts' programs of work and operating seasons for recreational facilities are established well in advance of implementation, consultation on an annual basis should be sufficient to achieve the objectives of the BLM preliminary condition. Consulting with BLM, Park Service, California Department of Parks and Recreation, California Division of Boating and Waterways, and California DFW every 12 years, as the Districts propose, would enable input from these agencies to be considered during the plan revision process. The overarching benefits of frequent and structured consultation include achieving or exceeding visitor needs and expectations and providing safe public recreational facilities that are consistent with applicable agency land management guidance and requirements.

Inviting BLM staff to participate in field and facility inspections, as BLM Don Pedro revised 4(e) condition 11 specifies, could be beneficial in terms of fostering the partnership between the Districts and BLM to jointly manage public recreational resources by efficiently identifying and addressing deficiencies. The element of the BLM condition about conducting joint inspections or reviews would not constrain the Districts' program of work because it specifies inviting but does not require BLM staff participation.

Large Woody Debris Management

LWM passes down the Tuolumne River to Don Pedro Reservoir where it can be a boating hazard and large concentrations of wood accumulating near Ward's Ferry Bridge can obstruct water surface and shoreline use. The Districts propose to implement their Woody Debris Management Plan, which calls for continuing the current practice of collecting LWM on Don Pedro Reservoir in boom rafts, anchored along the reservoir's edge; burning this material during fall and winter when reservoir levels are low; and informing BLM of its prior year actions in an annual memo. BLM Don Pedro revised 4(e) condition 4 specifies that the Districts obtain and maintain a BLM-approved burn plan for any LWM stored and burned on BLM-administered lands and make all reasonable efforts to prevent LWM from interfering with accessible take-out areas at Ward's Ferry Bridge. All Outdoors, OARS, Sierra Mac River Trips, American River Touring Association, and ECHO The Wilderness Company also recommend that the Districts manage LWM on the reservoir to maintain access at Ward's Ferry Bridge and reservoir surface with an objective to maintain access and navigability.

Our Analysis

Although the existing license requires the Districts to collect and remove floating debris, documented problems associated with LWM accumulation on Don Pedro Reservoir include restricted access, impaired navigability, effects on public safety, and effects associated with delayed disposal. Because the Districts propose to continue the

existing practices, these problems would continue to occur even if the Districts' Woody Debris Management Plan were to be implemented. The Districts' plan states removal would be conducted to limit public safety hazard, but it does not state any objective for maintaining navigability. Accumulations of LWM, topographic constraints, and the availability of few suitable disposal areas located on public land create a need for a plan that considers BLM agency land management guidance and integrates BLM staff into planning debris disposal. BLM's preliminary condition specifies that Districts obtain a burn plan, but it is not clear what entity would develop the plan. Requiring the Districts to develop the plan in consultation with BLM to include designated disposal site maps, treatment descriptions, and description of the coordination necessary for managing other resources (including consultation with other agencies) would address project-related effects. Incorporating these elements into a plan as required by the BLM preliminary condition and requiring Districts to make reasonable efforts to prevent LWM from interfering with whitewater boating access would ensure public access is not impaired, reduce delays in disposal, and accomplish disposal consistent with BLM and other resource management requirements.

Recreation Management at Ward's Ferry Bridge

Ward's Ferry Bridge, located at the upstream end of Don Pedro Reservoir, serves as the take-out location for the Meral's Pool whitewater boating run on the Tuolumne River. In the amended license application, the Districts propose to design and construct improvements at Ward's Ferry Bridge to improve public safety during river-egress[151] but would not be responsible for the long-term operation or maintenance of the facility because it would not be a project recreational facility.

High use in this topographically constrained and undeveloped location generated several preliminary agency conditions and recommendations, and recommendations from others, including BLM Don Pedro revised 4(e) condition 13; Forest Service preliminary 10(a) recommendation 1, California DFW preliminary 10(a) recommendation M7-3.2; Tuolumne County; Conservation Groups recommendation 8; and whitewater boating interests including All-Outdoors Whitewater, Oars West, Inc., Sierra Mac River Trips, Inc., American River Touring Association, ECHO: The Wilderness Company, and numerous individuals.

Although the content of measures provided by each of these entities is slightly different in terms of specific capacity and types of amenities, each of these preliminary conditions and recommendations describe extensive construction to provide vehicular

[151] Exhibit E, page 3-292 states, "the Districts are proposing to enhance river recreation and help ameliorate bridge and road safety concerns by improving the take-out." However, the Districts' November 27, 2017, AIR response states, "the Districts are not proposing the Ward's Ferry rafting take-out improvement as a project facility, but as an off-license enhancement."

access for extracting watercraft at all water levels, restrooms, trails, parking, and day-use facilities and indicate the Districts would also be responsible for operating and maintaining the facility.

BLM 10(a) recommendation 1 also recommends that the Districts conduct geotechnical studies to assist in the design and layout of the boating take-out facility specified in BLM Don Pedro revised 4(e) condition 13.

Our Analysis

Reservoir fluctuation affects whitewater boating use at Ward's Ferry Bridge because whitewater boaters have an increasing distance to carry boats and equipment up to the road as the reservoir lowers. The steep canyon is rocky and having trails with appropriate slope, width, and tread to access the shoreline would improve footing for boaters taking out at Ward's Ferry Bridge and reduce erosion potential.

The existing restroom was installed to address sanitation concerns near this point of public access to Don Pedro Reservoir. Occurrences of recurrent and destructive vandalism call into question the benefit of the restroom because it is often inoperable or unsuitable for visitor use, which is only provided to commercial whitewater boaters who are issued a key. Considering these circumstances, continuing to require the Districts to expend burdensome time and funding to maintain this restroom would not likely provide a safe, functional, suitable restroom at this location. Even if an adequate restroom could be provided at this location, it would mostly benefit whitewater boating users and serve few project visitors who use this point of access to the shoreline.

The Don Pedro Project does not affect the timing or quantity of flow in the whitewater boating reach. Instead, whitewater boating use and the resulting congestion and other associated problems at Ward's Ferry Bridge are related to Forest Service whitewater boating permitting decisions, flows provided by power generation from CCSF's Holm Powerhouse (non-project) and Tuolumne County road management.

The Forest Service authorizes commercial and private whitewater boating on the Meral's Pool run of the Tuolumne River by issuing permits. As such, the agency is responsible for managing this activity and can specify logistical elements such as the number of whitewater boaters and the types of water craft permitted, as well as the timing and places of use on public land. As evidenced by the documented problems, it appears the agency has authorized a level of use that exceeds the carrying capacity of the take-out at Ward's Ferry Bridge. BLM's Don Pedro revised 4(e) condition 13 and recommendations for this location from all other entities, seek to remedy this situation by increasing capacity at the take out by constructing facilities to improve boat extraction efficiency, safety, and user experience. The need for such facilities is not generated by the project, and their construction would not address any project effect.

BLM states the take-out facilities are necessary to address the project effects of the reservoir inundating other suitable take-out locations. However, because the upstream

whitewater boating use is not project related, this does not provide a sufficient nexus to require these facilities.

Peaking flows from Holm Powerhouse (non-project) also contribute to the congestion at Ward's Ferry Bridge by concentrating whitewater boating use within a short period. Because releases are not determined or controlled by the Don Pedro Project, this is not a project effect.

With regard to public safety on Ward's Ferry Road and the bridge, Tuolumne County requests safety improvements and maintenance including spot widening, turn outs, guard rails, paved shoulders, and parking stops. Tuolumne County owns and maintains Ward's Ferry Road, including the bridge, and because it is a county road used primarily for public purposes, it does not meet the Commission's definition of a project road. The county, which has jurisdiction over public road use, has the ability to prevent road obstruction at Ward's Ferry Bridge through enforcing its county ordinances.

The agency and whitewater boating interests contend their conditions and recommendations are necessary because they believe a direct relationship exists between the project and whitewater boating, but as discussed above, none of the rationale provided by these entities describes what aspects of the project or its operation are responsible for such relationship. The Districts proposed any take-out facility development to be included as part of an off-license agreement because such development does not address an effect of the project. Other than providing shoreline trail access to address effects of reservoir fluctuation and removing accumulation of LWM, these entities have not identified any project-related effect that would be addressed by the facilities they describe.

Non-motorized, Recreational River Boating

The project affects boating opportunities on the reach downstream of La Grange Diversion Dam because current operation alters flow in the reach and minimum flow releases do not provide sufficient flow for boating. The analysis of flow data provided by the Districts found that from 1997 through 2012 during the typical boating season of May through October, a flow of 200 cfs was exceeded 95 percent of the time in May; 56 percent of the time in June, July, August and September; and 74 percent of the time in October.[152]

[152] Note that these frequencies are not consistent with information presented in the *Lower Tuolumne River Lowest Boatable Flow Study Report* (HDR, 2010), which reports a flow of 200 cfs was exceeded 94 percent of the time in May; 54 percent of the time in June; 56 percent of the time in July, August and September; and 74 percent of the time in October.

The Districts propose to provide the following flows to enhance conditions non-motorized, recreational river boating on the lower Tuolumne River:

- From April 1–May 31 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. During this time period, the infiltration galleries would either be shut off, or additional flows to be withdrawn for water supply purposes would be released to the La Grange gage.
- From June 1–June 30 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of RM 25.9.[153]
- From July 1–October 15, a flow of at least 350 cfs in wet, above normal, and below normal water years and at least 300 cfs in dry and critical water years as measured at the La Grange gage. In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the 3-day July 4 holiday, the 3-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August. Park Service 10(a) recommendation 3 for the Don Pedro Project is a refinement of the Districts' proposed measure, which recommends scheduling the proposed 200-cfs boatable flow for the July 4 on the 3-day weekend that occurs closest to the actual holiday.[154]

Park Service 10(a) recommendation 3 for the Don Pedro Project is a refinement of the Districts' proposed measure, which recommends scheduling the proposed 200-cfs boatable flow for the July 4 on the 3-day weekend that occurs closest to the actual holiday.[155]

Flow scenarios contained in conditions and recommendations of others (see section 3.3.2, *Aquatic Resources*) and operation of the infiltration galleries would also affect the frequency of flows suitable for boating in the lower Tuolumne River.

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[153] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS, we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

[154] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

[155] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

The Districts also propose to provide a new boat put-in/take-out at RM 25.5 at the location of the proposed fish counting and barrier weir.

Our Analysis

Operation modeling results show the expected frequency of flows sufficient for boating in the lower Tuolumne River below the proposed infiltration galleries if the project were operated using the Districts' proposed flow scenario as well as the scenarios contained in the conditions and recommendations of others (table 3.3.5-3).

Table 3.3.5-3. Percent of time flows would be at least 200 cfs in the lower Tuolumne River below the infiltration galleries under existing conditions (base case) and flow regimes proposed by the Districts and recommended or prescribed by stakeholders. Months with at least 200 cfs all of the time are shaded (Source: Districts' modeling data from Districts, 2018b,c).

	Percent of Time Flow is at Least 200 cfs at RM 25.9						
Month	**Base Case**	**Districts Interim**	**Districts with-IGs**	**NMFS, Calif. DFW, Conservation Groups**	**Water Board**	**The Bay Institute**	**ECHO**
All Water Year Types							
May	100	100	100	100	100	100	100
June	52	61	39	100	100	100	100
July	50	99	59	100	53	98	54
August	50	100	58	100	50	90	50
September	50	100	59	100	50	84	50
October	87	100	79	100	96	99	87
All	64.9	93.5	65.9	100.0	75.0	95.4	73.4
Wet Water Years							
May	100	100	100	100	100	100	100
June	100	100	84	100	100	100	100
July	100	100	99	100	100	100	100
August	100	100	100	100	100	100	100
September	100	100	100	100	100	100	100
October	91	100	79	100	97	99	91
All	98.5	100.0	93.7	100.0	99.5	99.9	98.5
Above Normal Water Years							
May	100	100	100	100	100	100	100

	Percent of Time Flow is at Least 200 cfs at RM 25.9						
Month	**Base Case**	**Districts Interim**	**Districts with-IGs**	**NMFS, Calif. DFW, Conservation Groups**	**Water Board**	**The Bay Institute**	**ECHO**
June	100	100	38	100	100	100	100
July	100	100	97	100	100	100	100
August	100	100	100	100	100	100	100
September	100	100	100	100	100	100	100
October	98	100	91	100	98	100	98
All	99.6	100.0	87.9	100.0	99.6	100.0	99.6
Below Normal Water Years							
May	100	100	100	100	100	100	100
June	7	100	17	100	100	100	100
July	0	100	94	100	10	100	10
August	0	100	100	100	0	100	0
September	0	100	100	100	0	100	0
October	96	100	65	100	96	100	96
All	33.9	100.0	79.5	100.0	50.8	100.0	50.8
Dry Water Years							
May	100	100	100	100	100	100	100
June	5	10	7	100	100	100	100
July	0	97	18	100	6	100	7
August	0	100	6	100	0	100	0
September	0	100	10	100	0	100	0
October	97	100	93	100	97	100	97
All	34.1	84.8	39.2	100.0	50.7	100.0	50.8
Critically Dry Water Years							
May	100	100	100	100	100	100	100
June	3	10	6	100	100	100	100
July	0	97	0	100	6	93	7
August	0	100	0	100	0	64	0
September	0	100	0	100	0	41	0
October	65	100	67	100	94	99	65

	Percent of Time Flow is at Least 200 cfs at RM 25.9						
Month	Base Case	Districts Interim	Districts with-IGs	NMFS, Calif. DFW, Conservation Groups	Water Board	The Bay Institute	ECHO
All	28.4	84.8	29.2	100.0	50.0	82.8	45.3

Note: All indicates May to October period.

Across all water year types, the flow scenarios recommended by the agencies and NGOs would provide the greatest increase in the number of boatable days with suitable flows occurring 100 percent of the time from May through October. The Water Board's recommended flows would double the expected frequency of suitable flows in June, providing at least 200 cfs throughout the month; the frequency in July through September, about 50 percent, would be about the same as currently exists and the frequency in October, 97 percent, would be slightly higher than what currently exists. The flows recommended by The Bay Institute would also provide boatable days throughout most of June and October while July through September would have flows of at least 200 cfs for most (84 to 98 percent) of the time. The Districts' proposed operation would provide the least improvement for boating in the lower Tuolumne River with about the same frequency (39 to 79 percent) of boatable days expected to occur from May through October as what currently exists.

The effects of the different operational scenarios are more pronounced when analyzed by water year type. In wet and above normal water year types the expected suitable flow frequencies for all operational scenarios are fairly similar, with flows of at least 200 cfs occurring almost 100 percent of the time from May through October. One notable exception to this characterization is in June of above normal water year types when the Districts' proposed operation would only provide suitable flows 38 percent of the time. As the water years get progressively drier from below normal to critically dry, NMFS, California DFW, the Water Board, and the Conservation Groups' operational scenarios would continue providing flows suitable for boating almost 100 percent of the time from May through October. The Districts' proposed operation in dry and critically dry years sharply differs from all but the Water Board scenario by providing flows suitable for boating 0 to 18 percent of the time from June through September. Whereas the Water Board scenario would provide flows of at least 200 cfs in June and October most (94 to 97 percent) of the time, suitable flows would infrequently occur from about 0 to 10 percent of the time from July through September.

Park Service 10(a) recommendation 3 to schedule flow releases for boating to occur on the weekend that is nearest to July 4 would align the event with a predictably higher recreational use period. This approach would enable more boaters to take advantage of suitable flows. Park Service does not specify when releases would take place when the holiday occurs on a Wednesday, and because predicting whether more use

would occur on either of the two weekends surrounding the holiday, it would be appropriate for the Districts to use their discretion for scheduling the event.

The Districts' proposed fish counting/barrier weir would obstruct boating in the lower Tuolumne River. The Districts' proposal to provide a new boat put-in and take-out facility at RM 25.5 would allow boaters to circumnavigate the barrier as well as provide a point of access for those who want to begin or end their boating trips at this location. This facility would address the project effect of impaired boating access and provide an enhancement for boating use.

It is likely that increased flows resulting from all of the flow scenarios would periodically decrease wading suitability in lower Tuolumne River. However, this effect would occur from April to May, which is outside the peak recreation season and when visitors would expect unsuitable conditions because of high flows from snowmelt. Scheduled increased flows for boating from June through October 15 would affect more waders because they would occur during weekends of the peak recreation season. Few visitors during this period would be displaced by increased flows because wading was not identified as a frequent recreational activity and the low gradient of the reach likely provides opportunities for visitors to find alternative wading locations.

3.3.5.3 Cumulative Effects

Hydroelectric project operation and diversions for municipal water supply facilitated by four dams upstream of La Grange Diversion Dam, have historically affected the timing and quantity of flow in the lower Tuolumne River resulting in about 40 percent of the unimpaired flow passing to the lower Tuolumne River (CCSF, 2005). The upstream non-project flow diversion and the project operation contribute to the effects on boating and angling in the lower Tuolumne River. If the project were operated as the Districts propose or as described in various agency conditions and recommendations from others, flows in the lower Tuolumne River would be higher than what currently exists. Higher flows would provide increased opportunities for boating and improve fish habitat, thereby increasing angling opportunities. Despite the project's lack of control over the flows delivered to the lower Tuolumne River, the project may have a cumulative beneficial effect on boating and angling.

3.3.6 Land Use and Aesthetics

Lands near the projects are within Tuolumne and Stanislaus Counties. Primary land uses in the vicinity are single-family residential, non-irrigated farmland, and irrigated farmland. Land use downstream of the projects consists mainly of irrigated agricultural land and related uses as well as urban, suburban, and rural residential uses. Privately owned lands in the vicinity of the projects are subject to the counties' general plans and zoning ordinances and public lands are managed under agency management plans, as discussed below. The downstream extent of the Don Pedro Project boundary coincides with the upstream extent of the proposed boundary of the La Grange Project.

The projects are located in the Sierra Nevada foothills region, an area characterized by rolling hills, rural landscapes, native grasslands, and blue oak woodland. Project features include Don Pedro Reservoir, Don Pedro Dam and spillway, Don Pedro Powerhouse, La Grange Diversion Dam and Reservoir, La Grange Powerhouse, and a number of recreational facilities at Don Pedro Reservoir. The Districts own all facilities and lands within the existing Don Pedro Project boundary, except for 4,802 acres of federal land that BLM administers. BLM's visual resource objective for these lands is to protect and enhance the scenic and visual integrity of the characteristic landscape by maintaining the existing visual quality of the (1) Don Pedro Reservoir/Highway 49 viewshed (Visual Resource Management Class III) and (2) Red Hills ACEC (Visual Resource Management Class II) (BLM, 2008b).[156]

3.3.6.1 Affected Environment

Don Pedro Project

The existing project boundary encompasses approximately 18,370 acres of which 4,802 acres are federal lands within BLM's Sierra Resource Management Area (figure 3.3.6-1), including land within the Red Hills ACEC, which was designated to protect the rare plant species found in this area. Ninety percent of the 160-mile Don Pedro Reservoir shoreline is undeveloped and the Districts' land use policies include rules and regulations that strictly limit the use of lands outside the developed recreational areas. These policies are designed to protect and preserve the natural character and integrity of the area by prohibiting shoreline development and disturbances such as dredging, docks, moorings, and piers and prohibiting all vehicle use on lands, except at designated boat launches.

Lands upstream of the Don Pedro Project consist primarily of public land managed by BLM and the Forest Service (Stanislaus National Forest). Public land administered by BLM is managed under the Sierra Resource Management Plan (BLM, 2008a), the Visual Resource Inventory (BLM, 1986a), and the Visual Resource Contrast Rating (BLM, 1986b). National Forest System lands are managed under the Stanislaus National Forest Land and Resource Management Plan. The Don Pedro Project boundary also includes

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[156] The Class I Visual Resource Management objective is to preserve the natural character of the landscape, and minimal visual change from human activities is allowed. Class II and III allow progressively greater amounts of visual change to the existing landscape, while Class IV allows management activities that require major modification of the existing character of the landscape, and the level of change to the characteristic landscape can be high. Once the class is determined for a tract of BLM-administered land in the Sierra Resource Management Plan, BLM policy requires that proposed management activities on that tract, such as constructing and operating energy facilities, must meet the requirements of the designated classification.

land within the management corridor of the Tuolumne River, a designated National Wild and Scenic River. In 1988, the Forest Service approved the Tuolumne Wild and Scenic River Management Plan, which established a 0.25-mile management corridor on each side of the designated river segment from its source to Don Pedro Reservoir for a distance of 83 miles. The aliquot[157] parcel description of the corridor overlaps the Don Pedro Project lands at the upstream end of Don Pedro Reservoir.[158]

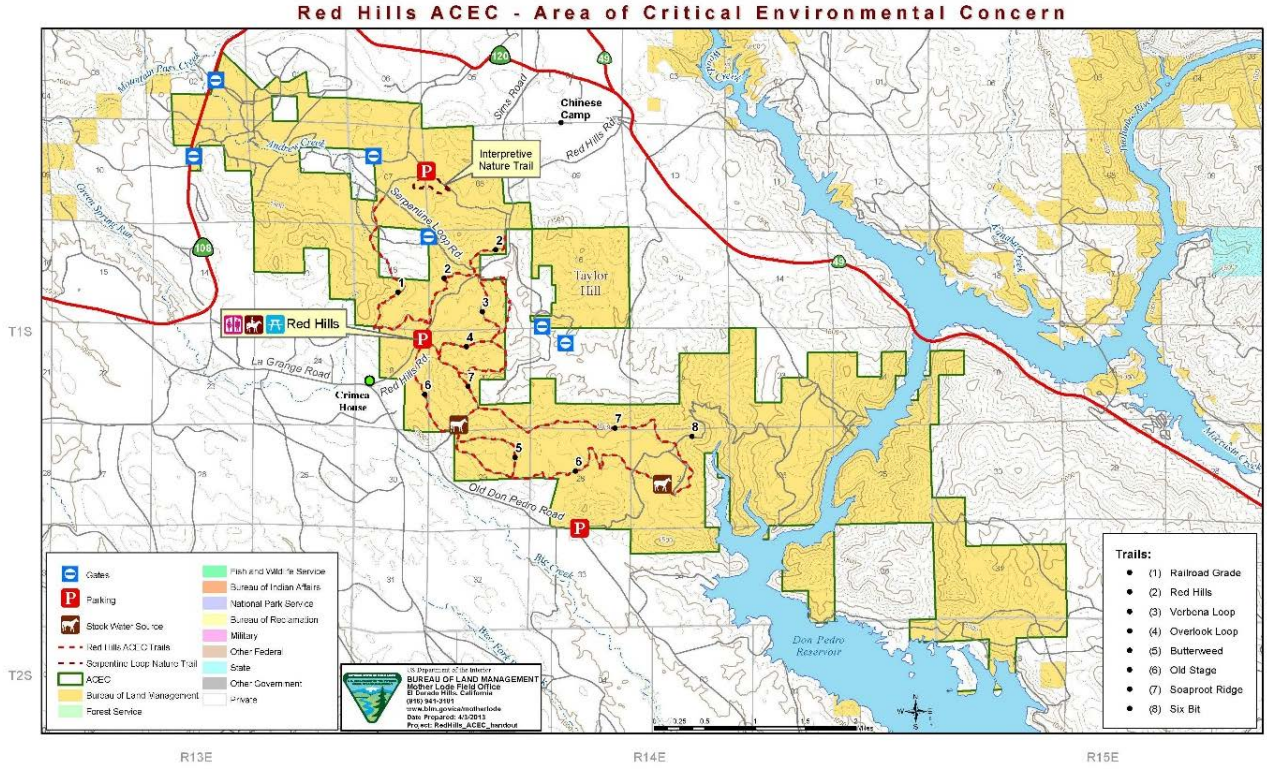

Figure 3.3.6-1. BLM-managed land in the vicinity of Don Pedro Reservoir, including Red Hills Area of Critical Environmental Concern (Source: BLM, 2013).

[157] A location descriptor used in the public land survey system in which the townships and sections are indexed based on: (1) the township's position relative to the initial point, (2) the section's location within the designated township, and (3) the principal meridian reference.

[158] The corridor description in the Tuolumne Wild and Scenic River Management Plan includes land within T.1N, R.16E, S1/2N1/2 and N1/2S1/2 of section 31. Project land overlapping the management corridor is within T.1N, R.16E, S1/2NW1/4 and N1/2SW1/4 of section 31.

Other than the three developed recreation areas, two of which have facilities partially situated on BLM land, the Districts do not allow residential and commercial development within the Don Pedro Project boundary; however, project facilities are structural elements that visually contrast with the surrounding rural or natural landscape. The Districts conducted a Visual Quality Study to document current visual conditions of the Don Pedro Project as viewed from BLM-managed lands during various times of the year and identified the visual elements related to the project include the view of: the horizontal, unvegetated margin of the reservoir shoreline that is exposed as the water level lowers[159]; buildings and amenities associated with developed recreational areas (e.g., campgrounds, marina facilities); and the project roads, dam, spillway and powerhouse.

A small portion of the Blue Oak Recreation Area is situated within BLM-administered land. Project facilities that exist within this BLM land are a short, paved segment of Loop D campground road, a restroom building, and several campsites. A small portion of the Moccasin Point Recreation Area, along the Moccasin Arm section of Don Pedro Reservoir, is situated within BLM-administered land. Project facilities that exist within this BLM land are a short, paved segment of the MPC1 road, the marina store/office, and a portion of the floating marina dock.

The Districts use more than 63 miles of paved and unsurfaced or graveled roads and a 5.9-mile-long shoreline access trail to operate and maintain the project and provide recreational access. About 6 miles of these roads are located on BLM-managed land and the remainder are on privately owned land, District-owned land, or on road easements within Tuolumne County. The 5.9-mile-long shoreline trail is located on BLM-managed land. Several entities are responsible for maintaining the roads and trail used to access, operate and maintain the project, including the Districts, BLM, CCSF, private landowners, and Tuolumne County. The Districts have sole or shared responsibility for maintaining about 40 miles of roads and sole responsibility for maintaining the 5.9-mile-long shoreline access trail. About 38 miles of roads are in good condition with the remainder ranging from poor condition to passable with 4-wheel drive or high clearance vehicles. About 4 of the 6 miles of roads located on BLM-managed lands are in good condition with the remainder ranging from poor condition to passable with 4-wheel drive or high clearance vehicles.

Some roads used to access project infrastructure are gated to restrict public access for security or public safety reasons and to prohibit public access to the Districts' easements for operating and maintaining the project. Where appropriate, pedestrian

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[159] Since construction of the new Don Pedro Dam, the Districts report the Don Pedro Reservoir has operated between elevations 690 and 830 feet, depending on hydrologic, precipitation, and water management factors; however, current operating protocols permit reservoir drawdown to elevation 600 feet.

travel on gated roads is allowed for recreational access. Bonds Flat Road, a county road that crosses the top of Don Pedro Dam and passes within about 600 feet downstream of the Don Pedro spillway, is a heavily traveled road that connects county road J-59 and state Highway 132. Bonds Flat Road is excluded from the project boundary. The project does not have an existing transportation system management plan.

La Grange Project

Land within the proposed project boundary for the La Grange Project consists of MID-owned land and public land managed by BLM and a single owner, Coleman Ranch (figure 3.3.6-2).[160] The 14 acres of public land within the proposed project boundary are managed by BLM under the Sierra Resource Management Plan (BLM, 2008a). The proposed project boundary follows an elevational contour of 300 feet around the reservoir and extends about 500 feet downstream of the dam and 700 feet downstream of the powerhouse (figure 1.1.1-2). The proposed project boundary encompasses the project infrastructure and a portion of La Grange Dam Road. The shoreline is undeveloped and no policies have been adopted by the Districts' Boards of Directors regarding shoreline development along the La Grange Reservoir (Districts, 2017e).

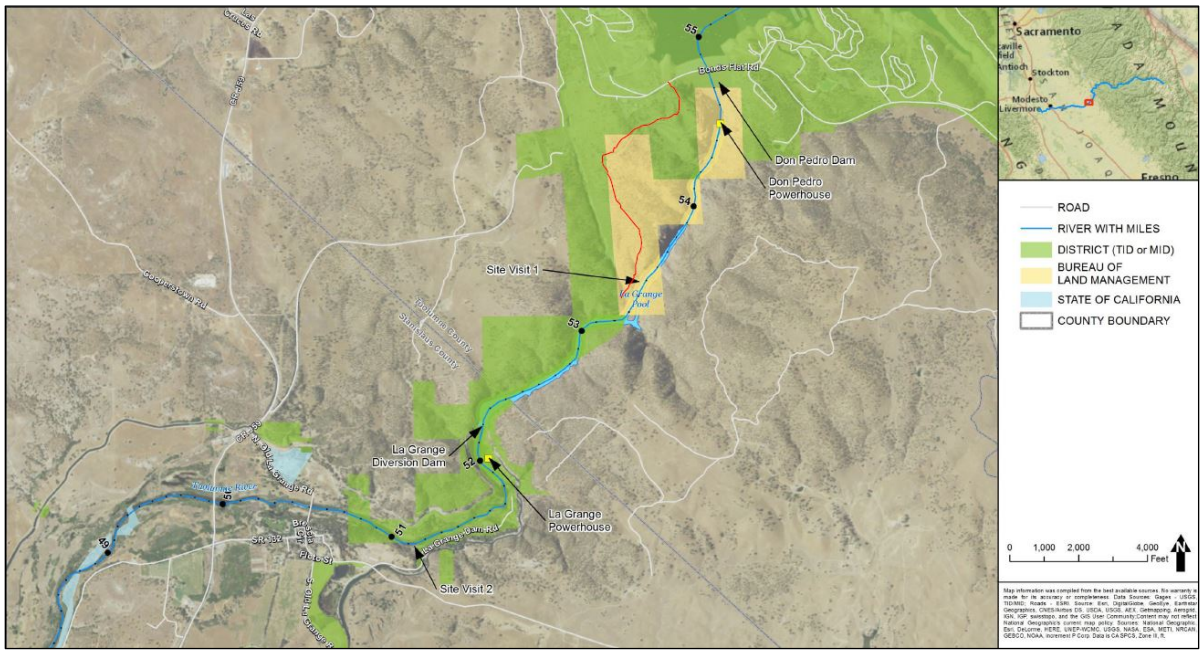

Figure 3.3.6-2. Landownership in the vicinity of the La Grange Project (Source: Districts, 2017b).

The 2-mile-long La Grange Reservoir is located in a narrow canyon between Don Pedro Powerhouse and La Grange Diversion Dam, and the upper two-thirds of the

[160] The license application does not report the acreage within the proposed project boundary by landowner.

reservoir is riverine in nature and widens in the lower third to appear more reservoir-like with impounded water. The entire La Grange Reservoir shoreline is undeveloped. Project infrastructure and the reservoir are visual elements of the La Grange Project, but prominent views of the project by the public are not possible because of restricted road access and steep terrain that limits distant views.

The Districts use more than 2 miles of paved and unsurfaced or graveled roads to operate and maintain the project (figure 3.3.6-3). All of these roads are located on the Districts' or private land and public access is not allowed. The Districts are responsible for maintaining these roads.

Figure 3.3.6-3. Roads used for accessing the La Grange Project (Source: Districts, 2017e).

3.3.6.2 Environmental Effects

Elements of project operation and maintenance related to flow regulation, reservoir elevations, recreation and water surface use, public access, roads, visual resources, and fire and fuel management are often interrelated and need to be coordinated to ensure consistency with public land management policies and regulation, avoid conflicting activities, and provide for public safety.

Coordination with Resource Agencies and Stakeholders

Effects of project operation and maintenance related to flow regulation, reservoir elevations, recreation and water surface use, public access, roads, visual resources, and fire and fuel management are often interrelated and occur across jurisdictional boundaries. Public land management agencies, NGOs, and individuals actively

participated in the pre-filing stage of this proceeding because project operation and features have the potential to affect land that agencies are responsible for managing or lands serving particular interests.

Tuolumne County recommendations include elements for consultation and administration support associated with the projects. The county also recommends the Districts coordinate with the county to explore options for coordinating patrol requirements for the Ward's Ferry Bridge among BLM, the Forest Service, and the Districts, including maintenance to manage the site's cleanliness, and to provide assistance to provide cellular telephone service at Ward's Ferry Bridge to improve visitor safety and emergency response.

Our Analysis

In its recommendations, Tuolumne County seeks support for services and improvements at Ward's Ferry Bridge. As discussed in section 3.3.5.2, *Recreation, Environmental Effects*, in the subsection *Recreation Management at Ward's Ferry Bridge*, the county recommendations are intended to address non-project effects of whitewater recreation rather than effects of the project. Coordination among the various entities with interests and responsibilities at Ward's Ferry Bridge could improve management efficiencies. However, such coordination should be on a voluntary basis because the Commission cannot require the participation of other entities. Further, coordination should exclude any supplemental funding from the Districts because the county and BLM are responsible for law enforcement and emergency response in this area and the Commission has no way of ensuring any supplemental funds provided by the Districts would be used for project purposes. Providing cellular telephone service would improve public safety, but this service does not exist at countless other similar remote locations across the Sierra Nevada Mountains. Topography and economics determine whether cellular service is provided in any particular area and the Don Pedro Project does not affect or create a need for this costly development that would mostly benefit non-project users. The county's recommendation for funding for site maintenance at Ward's Ferry Bridge would be consistent with the Districts' proposed measure to routinely patrol and clean the area as it is currently developed (i.e., the restroom but no development for whitewater take-out facilities).

Transportation System Management

The Districts use roads and trails crossing public and private lands to operate and maintain the projects and for public recreational access. The Districts propose to

continue implementing the existing license article 17[161] and annually notify BLM of the location and type of any road maintenance projects on BLM-managed land and, if necessary, convene a meeting to discuss these projects. BLM Don Pedro revised 4(e) condition 16 specifies that the Districts develop a transportation system management plan for BLM approval. The Districts, upon Commission approval, would implement the plan. Tuolumne County recommends the Districts meet with the county to discuss assisting with improvements to Ward's Ferry Road and the intersection of County road J-59 and Bonds Flat Road.

Our Analysis

The Districts' existing manner of managing the roads and trails associated with the project has resulted in poor road conditions and expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies are uncertain. Because the Districts propose to continue their current practices, these same conditions would likely continue under the Districts' proposed measure.

Under BLM's Don Pedro revised 4(e) condition 16, roads and trails would be managed under a BLM-approved transportation system management plan. As discussed in its rationale for the preliminary condition, BLM states the plan would identify all roads crossing BLM-managed land, require road rehabilitation, and provide for scheduled condition assessments and maintenance activities. These provisions would likely reduce the number of roads that are in poor condition which, in turn, would improve the quality of public access and reduce any effects of poor road maintenance such as erosion. The Districts' maps and table provided in its November 27, 2017, response to the Commission's AIR contains much of the basic information needed to develop the plan. Additional plan content necessary to ensure proper annual and long-term maintenance of project roads and trails over the license term would include information about identified road and trail maintenance needs and implementation schedule for completing repairs; description of routine road and trail maintenance practices, including applicable BMPs, and frequency; condition assessment frequency; other management plans (i.e., vegetation, cultural resources) that contain guidance relevant to road maintenance activities; and process for consulting with BLM and any other entity that shares maintenance responsibilities for roads and trails used for project purposes.

Ward's Ferry Road is a county road that passes near the project and crosses the upper end of Don Pedro Reservoir. The Districts use Ward's Ferry Road on about a

[161] Standard article in Form L-2 states, "In the construction and maintenance of the project, the location and standards of roads and trail, and other land uses, including the location and condition of quarries, borrow pits, spoil disposal areas, and sanitary facilities, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved."

weekly basis, but because the road is primarily used for public purposes it does not meet the Commission's definition of a project road. The intersection of county maintained roads J-59 and Bonds Flat Road about 1.5 miles northwest of Don Pedro spillway is also mainly used by the general public. The project use of these roads is considered incidental and project assistance to Tuolumne County to make road improvements would mainly serve non-project users.

Bonds Flat Road Crossing Downstream of Don Pedro Spillway

When Don Pedro Reservoir spills, the flow passes through a bedrock channel beneath Bonds Flat Road. Since the project was licensed in 1966, the Districts have removed the road crossing twice in advance of spill conditions—in 1997 and 2017. Tuolumne County recommends the road be engineered to operate independently of spillway operation to maintain public access during spill events. Tuolumne County states it is committed to working with the Districts to devise a solution, but it is not clear if the recommendation seeks funding from the Districts to construct a bridge over the spillway.

Our Analysis

The practice of removing the road crossing prevents this material from flowing into the Tuolumne River; however, public and emergency traffic are diverted around the spillway via State Highways 49 or 132 to cross Tuolumne River upstream or downstream, respectively, of Don Pedro Reservoir. During the 2017 spill event the road was impassable from about March 20 to June 28.

Having only occurred twice during the license term, high flow spill events that prevent traffic from crossing downstream of the spillway are extremely uncommon. Although other routes of travel are available, local residents would be inconvenienced and emergency response times would be delayed for about 3 months while the road is repaired. Because high flow events rarely occur and have a short duration, alternative routes of travel around the spillway exist, and the Districts have restored access as timely a manner as possible, the Districts' current approach of removing and restoring the roadbed represents a practical approach to addressing the effect of a high flow spill event.

Fire Prevention and Response

The Districts propose to implement their Fire Prevention and Response Management Plan for the Don Pedro Project which identifies fire prevention procedures, reporting, and safe fire practices for Districts' personnel and contractors responsible for operating and maintaining the Don Pedro Project. The plan identifies the various agency plans and regulations that the Districts referenced to prepare the plan and identifies the state and federal laws and regulations with which it would comply when operating and maintaining the Don Pedro Project. Elements of the plan include descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting, including equipment, vehicles, and tools for District staff and job sites; fire index monitoring and activity curtailment, as appropriate; debris burning; vegetation

clearance; communication systems; access routes, water sources, and helicopter landing areas; fire investigation; emergency contact information; and fire safety signage at recreational facilities.

The plan would be reviewed and potentially revised in consultation with BLM and the California Department of Forestry and Fire Protection during the license term on an unspecified schedule. The Districts would provide the revised plan to the agencies for a minimum 60-day review period before filing it with the Commission for approval.

BLM Don Pedro revised 4(e) condition 17 specifies implementing a version of the Districts' plan that includes revisions to include information such as fire history, references, analysis descriptions, permits, and use and storing of explosives. BLM also specifies that the plan be approved by BLM before filing with the Commission for its approval.

Our Analysis

BLM Don Pedro revised 4(e) condition 17, which includes consultation with BLM to finalize and approve the plan, would likely meet BLM's objective for the plan to describe processes for obtaining authorizations and approvals and the requirements necessary to adhere to BLM fire restriction orders. Because fire-related circumstances would likely change over the term of a new license, it would be appropriate to periodically review the plan, as the Districts propose, to determine if the plan should be revised. Implementing BLM's version of the fire plan would likely improve planning for and management of wildfires and improve the coordination of wildfire protection and prevention measures that could reduce wildfire occurrence in the vicinity of the project and meet BLM requirements.

However, the Commission would find it difficult to determine compliance with the BLM-revised version of the plan because the revisions inaccurately refer to Merced Irrigation District as the licensee. Additionally, some of the revised text, for example, explosives and permitting, is duplicative of administrative conditions submitted by BLM, and this may create conflicting compliance requirements and multiple points of reporting compliance for a single action. Some of the BLM-inserted text to the Districts' fire plan such as adding information to the plan about fire history, references, and analysis descriptions would not add value to the plan effectiveness because they document past investigations rather than describe future actions the Districts should take to prevent, suppress, and report fires.

Although the Districts' plan indicates it would be implemented within the Don Pedro Project boundary, the threat of wildland fire also exists at the La Grange Project. For this reason, it would be appropriate to provide separate plans for each project.

Visual Resource Management

The amended license application for the Don Pedro Project does not include proposed measures related to visual resources, although it states the Districts would

implement BMPs and consult with BLM during planning and construction for two proposed construction projects. BLM Don Pedro revised 4(e) condition 18 specifies the Districts prepare and implement a visual resources management plan for BLM-managed land within the project boundary. The plan would be approved by BLM before submittal to the Commission for its approval.

Our Analysis

The Districts' visual quality report adequately characterizes the visual elements associated with the Don Pedro Project. Existing project facilities situated on BLM-administered land occur on BLM land classified by the BLM Visual Resource Management System (VRMS) as Class III. The objective of Class III is to partially retain existing characteristics of the landscape and to guide management activities not to dominate the view of the casual observer (BLM, 1986a). The degree of contrast allowed for Class III areas is moderate, wherein visual elements, presumably those not occurring naturally, attract attention and begin to dominate the existing landscape (BLM, 1986b). When compared to the BLM VRMS Class III objective and the degree of allowable contrast within the Class III area, the few project facilities at Blue Oak Recreation Area and Moccasin Point Recreation Area, situated within BLM land, are not inconsistent with these visual resource management parameters. In addition, there is no supporting evidence that shows this small number of project facilities are in unacceptable condition or do not conform to the BLM VRMS Class III objectives.

Proposed new construction, such as the whitewater boating take-out facility upstream of Ward's Ferry Bridge (an off-license enhancement) and the extension of riprap on the upstream face of Don Pedro Dam could affect the existing visual appearance at the project, including on BLM-administered land. However, the proposed extension of riprap, to limit the potential for erosion if the reservoir is drawn down lower than the current minimum elevation of 600 feet, would occur on the Districts' land. Additionally, the riprap extension would increase riprap on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet. Furthermore, the Districts' proposed lower minimum pool elevation for the Don Pedro Reservoir of 550 feet would occur infrequently; therefore, the likelihood that the extension of riprap would have a significant impact on visual quality of the project is minimal, and any potential impacts would occur infrequently.

The Districts' proposal to construct a whitewater boating take-out facility upstream of Ward's Ferry Bridge would occur on BLM-administered land, and the BLM VRMS Class III objectives for this BLM land in the area would apply to the proposed take-out facility. Therefore, developing and implementing a visual resources management plan, consistent with BLM's VRMS Class III objectives for this site, would ensure the visual quality is not degraded by construction of the take-out facility. Beneficial elements of the plan would include describing desired project feature appearances (e.g., construction materials, color, and scale) relative to guidance contained in applicable plans, monitoring visual resources over the term of a new license to

determine whether additional treatments would be necessary to achieve visual quality objectives, and consulting with BLM about new facilities on BLM-administered land. Providing for BLM approval of the plan before it is submitted to the Commission would ensure the plan contains agency guidance applicable to visual resources at the project and describes adequate consultation and approval processes for new construction. While we do not recommend the proposed whitewater boating take-out facility at Ward's Ferry Bridge, BLM revised 4(e) condition 13, which would be included as a mandatory condition in any license issued for the project, requires the Districts to implement a Ward's Ferry Take-Out Management Plan that includes the construction of: (1) an elevated hoisting platform; (2) an Americans with Disabilities Act-compliant vault restroom; (3) two access roads; and (4) two pedestrian access trails. To be consistent with the BLM VRMS Class III objectives for this site, the hoisting platform should be constructed of similar materials used in the existing Ward's Ferry Bridge, closely match the colors of the bridge elements, and blend with the existing topography and environment to minimize effects on visual resources. The vault restroom should be constructed to match the materials and colors used in the construction of the hoisting platform and the bridge and should blend with the existing environment. Construction of the access roads and pedestrian access trails should blend with the existing environment and topography. The La Grange Project infrastructure is not visible from publicly accessible locations, so a plan is not necessary to address visual resources at this project.

Project Boundary

The Districts propose locating the project boundaries for the projects as shown in Exhibit G of each license application.

Our Analysis

Commission regulations require including only lands within the project boundary that are necessary for operating and maintaining the project and for other project purposes, such as recreation, shoreline control, or protection of environmental resources. For both projects, all project infrastructure, recreational facilities, and project roads are located within the proposed project boundary, and the boundary locations appear consistent with the Commission's regulations providing a sufficient buffer of about 50 feet from project infrastructure and recreational facilities.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the National Historic Preservation Act

Section 106 of the NHPA, as amended, and its implementing regulations found at 36 CFR 800 require the Commission, as lead federal agency, and the cooperating agencies to consider the effect of their undertakings on any historic properties and allow the ACHP an opportunity to comment.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In this document, we also use the term *cultural resources* to include properties that have not been evaluated for eligibility for listing in the National Register. Historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4. For example, dilapidated structures or heavily disturbed archaeological sites may not have enough contextual integrity to be considered eligible. TCPs are a type of historic property eligible for listing in the National Register because of their association with cultural practices or beliefs of a living community that: (1) are rooted in that community's history; or (2) are important in maintaining the continuing cultural identity of the community (Parker and King, 1998). In most cases, cultural resources less than 50 years old are not considered eligible for listing in the National Register. However, properties that are less than 50 years old may be considered eligible for the National Register if they have achieved significance within the past 50 years and are of exceptional importance or if they are a contributing part of a National Register-eligible district.

Section 106 also requires that the Commission seek concurrence with the California SHPO on any finding involving effects or no effects on historic properties and allow the ACHP an opportunity to comment. If Native American properties have been identified, section 106 requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties (i.e., TCPs).

The Districts provided the Commission with cultural resources information, analyses, and recommendations, in accordance with the ACHP's regulations for implementing section 106 at 36 CFR 800.2(a)(3) and the Commission's regulation at 18 CFR 380(f). The federal land managing agencies have obligations regarding cultural resources under other federal laws and regulations, including the Federal Land Policy and Management Act, the Antiquities Act of 1906, section 110 of the NHPA, the Archaeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1970, and the Native American Graves Protection and Repatriation Act.

Construction activities, maintenance, and operation of the projects could adversely affect historic properties (i.e., cultural resources listed or eligible for listing in the National Register). These historic properties could include prehistoric or historic archaeological sites, districts, buildings, structures, and objects, as well as locations with traditional value to Native Americans or other groups. Direct effects could include destruction or damage to all, or a portion, of an historic property. Indirect effects could include the introduction of visual, atmospheric, or audible elements that affect the setting or character of a historic property.

If existing or potential adverse effects have been identified on historic properties at the projects, the Districts must develop an HPMP for each project, providing measures to avoid, reduce, or mitigate the effects. During development of the HPMPs, the Districts should consult with the Commission, ACHP, California SHPO, BLM, and Native

American tribes to obtain their views on the management of historic properties. In most cases, the HPMPs would be implemented by execution of PAs that would be signed by the Commission, ACHP (if it chooses to participate), California SHPO, BLM, and other consulting parties as appropriate.

On February 23, 2011, the Commission sent letters to six federally recognized Indian tribes for the Don Pedro Project. Federally recognized Indian tribes who received letters from the Commission included the Tuolumne Band of Me-Wuk Indians, Picayune Rancheria of Chukchansi Indians, Buena Vista Rancheria, California Valley Miwok Tribe, Chicken Ranch Rancheria of Me-Wuk Indians, and the North Fork Rancheria of Mono Indians. These letters invited the tribes to meet with Commission staff to discuss their participation in the process and to establish communication procedures. On May 12, 2011, Commission staff met with representatives from the Picayune Rancheria of Chukchansi Indians, Chicken Ranch Rancheria of Me-Wuk Indians, California Valley Miwok Tribe, and Tuolumne Band of Me-Wuk Indians at the Tuolumne Band Headquarters in California. On May 15, 2014, Commission sent letters to the same federally recognized Indian tribes for the La Grange Project. No follow-up meetings with Indian tribes were organized for the La Grange Project.

In its April 8, 2011, Notice of Intent for the Don Pedro Project and its May 23, 2014, Notice of Filing of Pre-Application Document for the La Grange Project, the Commission designated the Districts as the Commission's non-federal representatives for carrying out day-to-day consultation with regard to the projects' licensing efforts, pursuant to section 106 of the NHPA; however, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the projects on any historic property. The Districts also established Cultural Resources Working Groups for each project and provided the Commission with documentation of regular consultation with group participants regarding study status, results, and the development of HPMPs for each project.

On January 27, 2012, and December 16, 2015, respectively, the Commission issued a Notice of Proposed Restricted Service List for the Don Pedro Project and the La Grange Project. The Commission proposed to include the following entities on the list: Central Sierra Me-Wuk Cultural and Historic Preservation Committee, Tuolumne Band of Me-Wuk Indians, Chicken Ranch Rancheria of Me-Wuk Indians, Buena Vista Rancheria, California Valley Miwok Tribe, ACHP, Park Service, California SHPO, and the Districts. The notices also stated that the Commission would be consulting with the California SHPO and ACHP to prepare and execute PAs for the two projects. In a letter filed on April 3, 2017, the Buena Vista Rancheria of Me-Wuk Indians responded that they deferred to the Tuolumne Band of Me-Wuk Indians regarding the La Grange Project (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from R.C. Columbro, Tribal Historic Preservation Officer, Buena Vista Rancheria of Me-Wuk Indians, Sacramento, California, dated February 8, 2017).

Areas of Potential Effect

Pursuant to section 106, the Commission must take into account whether any historic property within a project's APE could be affected by the issuance of a new license. The APE is determined in consultation with the California SHPO and is defined as "the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties," including TCPs (36 CFR 800.16[d]).

The Districts filed revised cultural resources study plans for the Don Pedro Project on November 22, 2011. The Historic Properties Study Plan for archaeological and historic-era properties defined the APE for the Don Pedro Project as follows (Districts, 2011a):

> …all lands within the FERC boundary that are (1) within 100 ft. beyond the normal maximum water surface elevation (830 ft.), (2) within designated Project facilities and formal recreation use areas, (3) within informal recreation use areas identified by the Don Pedro Recreation Agency, (4) within the Red Hills Area of Critical Environmental Concern (ACEC), or (5) along the reservoir edges, especially the reservoir reaches, where there are portions of intermittent and perennial flowing streams. It is possible that the studies implemented as part of the relicensing process may identify Project-related activities that have the potential to affect historic properties outside this APE. It is also possible that during relicensing, Project improvements may be proposed that are outside the APE. If such areas are identified, the APE will expand in accordance with 36 CFR 800.4(a)(1) in consultation with the SHPO, BLM, Tribes, and other interested parties, as appropriate. Additional cultural resource inventories will be completed as part of this study if the APE is expanded. If unforeseen Project-related activities are planned to be undertaken outside of the APE in the future, the Section 106 process will again be complied with, prior to implementation of the activities.

The Districts' Traditional Cultural Properties Study Plan for potential TCPs at the Don Pedro Project states that the Districts would submit maps depicting the APE to the California SHPO for formal review, comment, and concurrence (Districts, 2011b). The study plan also states that the Districts might request California SHPO concurrence on a modified APE during the study if the Districts determine that the project affects historic properties outside the previously approved APE. In its December 22, 2011, Study Plan Determination, the Commission concurred with the two cultural resources study plans and thereby also concurred with the definition of the APE. In a subsequent letter filed on October 11, 2017, with the amended final license application, the California SHPO concurred with the Districts' redefinition of an APE for the Don Pedro Project that had been expanded by an additional 376 acres (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated

February 23, 2015). This expansion incorporated several additional areas where project-related operations and maintenance activities could affect historic properties.

The Districts filed a revised cultural resources study plan for archaeological and historic-era properties (CR-01, Cultural Resources Study) associated with the La Grange Project on January 5, 2015. The Commission's February 2, 2015, Study Plan Determination modified the APE and defined it as follows:

> Lands immediately downstream of the La Grange Diversion Dam and the La Grange impoundment upstream of the La Grange Diversion Dam. For the downstream portion, the APE includes the La Grange Project powerhouse, tailrace, and La Grange Project access roads. For the upstream portion, the APE includes a 100-foot buffer zone beyond the normal maximum water surface elevation (reservoir spillway elevation of 296.46 feet msl) of the La Grange impoundment, starting at the La Grange Diversion Dam and extending upriver to the Don Pedro Dam. The APE may be modified after consultation with interested parties if the consultation results in the identification of additional lands that may be affected by La Grange Hydroelectric Project-related activities outside of these areas.

In a letter filed with its amended final license application for the La Grange Project, the Districts provided the Commission with documentation of consultation with the California SHPO regarding the APE and included a copy of the California SHPO's January 8, 2016, letter concurring with the boundaries of the APE.

Cultural History Overview

The Districts conducted archival research to obtain background information relevant to understanding past lifeways, cultural sequences, and historic period developments within and adjacent to the Don Pedro and La Grange Projects. Based on this gathered background information, a cultural context was prepared and is summarized below (as provided in Districts, 2017d,g).

Prehistory

The cultural history of the region near the Don Pedro and La Grange Projects can be divided into five major archaeological periods—the Early Archaic period (11,500–7000 Before Present [B.P.]), Middle Archaic period (7000–3000 B.P), Late Archaic period (3000–1100 B.P.), Recent Prehistoric I period (1100–610 B.P.), and Recent Prehistoric II period (610–100 B.P). These periods reflect changes in tool technology through time as reflected in artifact assemblages recovered from a number of archaeological sites.

During the Early Archaic period (11,500–7000 B.P.) generalist hunter-gatherers subsisted on a variety of plant and animal resources. Early Archaic sites in the foothills of the Sierra Nevada Mountains are rare, but artifacts recovered from two sites located

upstream of New Melones Reservoir (CA-CAL-342, CA-CAL-629/630) contain a large number of wide-stem and large-stemmed dart points and a small number of other stemmed and notched projectile points. Toolstone used for bifaces and projectile points is primarily traced to local sources and may indicate that land use by Early Archaic populations near the projects was not the highly mobile strategy used elsewhere by other people of the same period. However, some obsidian from eastern Sierra Nevada sources has been recovered from the two sites discussed above. Groundstone implements are also present at these sites. Numerous handstones and milling slabs were recovered from CA-CAL-629/630 and botanical remains reflect the processing of pine nuts and acorns.

Evidence also indicates that lands near the projects were occupied during the Middle Archaic period (7000–3000 B.P.). Although hunting and gathering remained the primary subsistence strategy, evidence dating to the Middle Archaic indicates a shift from larger stemmed projectile points to smaller Corner-notched dart points. Milling slabs, handstones, and various cobble-based processing tools are also commonly found at sites dating to this period. The archaeological record suggests that during the summer, populations gathered seasonal plant resources including berries, seeds, fruits, bulbs and roots at higher elevations. Lower elevation villages were inhabited during the cooler fall and winter seasons. Underground granaries at sites dating to this period indicate that pine nuts and acorns were important plant resources and were stored for future use.

Life during the Late Archaic period (3000–1000 B.P.) was very similar to that of the Middle Archaic period. Seasonal movement between the foothills and higher elevation conifer forests continued to be the primary subsistence strategy and Corner-notched dart points remain the predominant projectile form. However, an increase in the use of obsidian and the recovery of obsidian flaked stone implements from high elevation archaeological sites of the western Sierra Nevada indicates that populations now traversed the range from the east where obsidian was the primary toolstone.

The Recent Prehistoric I period (1100–610 B.P.) is marked by the introduction of the bow and arrow as reflected by the abundance of small-stemmed and corner-notched arrow points in archaeological deposits, but archaeological assemblages from this period do not provide adequate information about life during this time. Sites dating to the Recent Prehistoric II period (610–100 B.P.) are common. An abundance of bedrock milling features found throughout the area, both isolated and associated with midden deposits, indicates that the importance of acorns intensified at this time. Further, residential sites frequently contain both structural remains and house depressions. Populations continued to hunt large mammals, including sheep and deer found at elevations above 6,000 feet. Tools including Desert Sid-notched projectile points and shaft straighteners associated with bow and arrow technology are frequently found at Recent Prehistoric II period sites.

Ethnography

The Don Pedro and La Grange Projects lie in the traditional territory of the Central Sierra Miwok who inhabited the mountains and foothills of the upper drainages of the Tuolumne and Stanislaus Rivers. The Central Sierra Miwok were politically independent but were one of five Miwok groups. Tribelets of approximately 25 persons controlled several semi-permanent settlements and seasonal campsites. Structures within settlements were primarily conical in shape with posts or frameworks that supported bark slabs. Sierra Miwok subsistence was focused on gathering local plant resources and hunting following a seasonal round. During the summer, groups traveled to higher elevations to take deer and visited lower elevations to procure elk and antelope. Acorns were a dietary staple but were supplemented with greens and pine nuts. In addition to the manufacture of lithic projectile points, scrapers, choppers, and knives, Sierra Miwok technology also included basketry and ground stone implements used to process acorns.

European contact with the Eastern Miwok first occurred during the second part of the eighteenth century. At this time, Spanish explorers traversed the Sacramento and San Joaquin Valleys. This contact resulted in drastic changes in Miwok lifeways with tribelets cooperating to resist missionization, forced labor, and displacement. Many Miwok were lost to Spanish violence and introduced diseases. The subsequent arrival of European fur trappers, followed by gold miners and settlers further caused Miwok cultural disruption. While the United States government entered into treaties with several tribelets, these treaties were never ratified and several groups of Miwok were removed to the vicinity of Fresno. However, most of the Miwok remained on rancherias and a dependence on wage labor resulted in a decrease in the importance of traditional hunting and gathering as primary economic and subsistence endeavors.

Today, the Chicken Ranch Rancheria of Jamestown and the Tuolumne Band of Me-Wuk Indians are the two federally recognized Sierra Miwok tribes near the Don Pedro and La Grange Projects. However, several other tribes also retain ties to lands near the projects.

History

The historic context of the Don Pedro and La Grange Projects focus on several main themes—mining, agriculture, transportation, and water development.

Following the discovery of gold at Sutter's Mill in 1848, four primary methods of gold retrieval were developed in the Sierra Nevada foothills. Placer mining practices used water to erode "free" gold from stream sediments. This method quickly depleted the lower elevation streambeds and drainages and miners began to explore gravels associated with old rivers at higher elevations. Hydraulic mining replaced placer mining in the 1860s. This method used gravity-fed water to erode lands thought to hold gold. By 1880, the La Grange Hydraulic Mining Company held a mining field that encompassed approximately 1,200 acres. For the most part, hydraulic mining ended in 1884 when the United States Circuit Court made it illegal to discharge mining sediments

into streams and rivers. Hard rock mining began near the projects in the 1850s. This method used the construction of mine shafts, adits, tunnels, and other features to access subsurface gold deposits. In the late 1880s, many of the mines were closed due to the advent of World War I, but many in Tuolumne County were subsequently reopened, and by 1915, mining was the main industry in the county. While the dredging of placer-bearing gravels in Tuolumne County began in earnest the 1930s, the La Grange Gold Dredging Company purchased a 9-mile field of land on the Tuolumne River in 1905 with the intent to mine it by dredging. These lands were dredged between 1907–1942 and 1945–1951. Tailings from the dredge mining were used during construction of the new Don Pedro Dam.

Farming and ranching have been the primary economic endeavors in Tuolumne and Stanislaus Counties since about 1870. Hay, wheat, alfalfa, and orchard fruits were the main crops. Hay and alfalfa were particularly important because they served to feed livestock. By 1909, large-scale cattle ranches in Tuolumne County resulted in an economic boon to the region. Sheep, hogs, goats, llamas, and poultry were also raised. However, competition for land with crop farmers resulted in some animosity. Laws passed in 1870 and 1872 required ranchers to pay for any damage to adjacent crops as a result of livestock intrusion, resulting in a decrease in cattle ranching in the region. Hog farming, which required less land than that used by cattle and sheep, increased at this time. However, an 1878 law required hogs to be tied up, and this too resulted in a decline in animal husbandry in the region. This decline led to an increase in crop cultivation, particularly wheat, and water-intensive orchard crops. The increase in crop farming resulted in a need for transportation, irrigation, and water development projects.

The first roads in Tuolumne and Stanislaus Counties followed trails established by the Miwok that were later used by Euro-Americans. Several wagon roads dating to the late nineteenth century have been documented on General Land Office plats and USGS topographic maps. Bridges, ferries, and fords are located near both the Don Pedro and La Grange Projects. Construction of the Southern Pacific San Joaquin Valley railroad to Los Angeles began in December of 1869 and was completed in 1876. The railroad resulted in the founding of several major towns in Stanislaus County, including Modesto, Merced, and Turlock and allowed for the easy transportation of people between the central valley, Southern California, and eastern cities. The farming and ranching economies also benefited from the railroad, which was used to move agricultural products. A railroad in Tuolumne County was not established until 1901 when the Sierra Railway built a railroad between Angels Camp in Calaveras County and Oakdale, on the Southern Pacific line.

Gold mining near the Don Pedro and La Grange Projects required water. Between 1851 and 1927, when it was purchased by Pacific Gas and Electric Company, the Tuolumne County Water Company constructed an elaborate system of ditches and flumes that carried water from dams and reservoirs to large mining camps in the region. Two other water companies were established in 1854, the Franklin Water Company and the French Bar Water Company, but the rights of these two companies were absorbed by the

Stanislaus Water Company in 1855. A dam was constructed near the current location of the La Grange Diversion Dam, but it was washed out by flooding in 1861. The mining camp at La Grange was established in the early 1850s and for a time, was one of the most important camps on the river. Between 1871 and 1872, the La Grange Ditch and Hydraulic Mining Company constructed a 17-mile-long ditch along the Tuolumne River between a low diversion dam at Indian Bar and La Grange. By the 1880s, the La Grange Ditch was in poor condition but continued to be used for dredging into the earlier twentieth century. With construction of old Don Pedro Dam, the ditch was abandoned.

Water was also desperately needed near the Don Pedro and La Grange Projects for irrigation and other purposes. In 1871, J.M. Thompson, Charles Elliott, and M.A. Wheaton obtained the rights to the location of the original mining dam that had been constructed by the Tuolumne Water Company. A new timber dam (the Wheaton Dam) was built, and water from this site was used to irrigate orchards and gardens in the area. The Wright Act of 1887 allowed for the development of irrigation districts and for the acquisition of water and property rights. TID was the first irrigation district to be established in California. The Districts purchased Wheaton Dam and associated property in 1890 and the stone La Grange Diversion Dam was completed in 1893. When the dam was finished, the Districts were still constructing associated irrigation canals. MID's main canal was excavated between 1891 and 1894 and contained a wooden flume connecting it to the dam headworks. The first full season of irrigation from this canal was in 1904. TID also completed a main canal by 1895 but continued work on the associated irrigation system. Irrigation began in 1900 when the system was completed. In 1906 and 1907, the La Grange Water and Power Company obtained the assets of the La Grange Ditch and Hydraulic Mining Company and installed a hydropower plant about 1 mile downstream from the La Grange Diversion Dam. The plant provided power to river dredgers and, later, to the city of Turlock and other nearby communities. In 1911, the La Grange Water and Power Company was combined with two other companies to form the Yosemite Power Company, which sold the La Grange system to the Sierra and San Francisco Power Company in 1917. In 1920, Pacific Gas and Electric Company acquired the Sierra and San Francisco Power Company. However, in 1923, TID purchased the former decommissioned La Grange Water and Power Company power plant. The plant was reopened in 1924 but only contributed to TID's generation when water was in excess of what was needed for irrigation purposes.

In 1915, the Districts agreed to construct a water storage dam at the Don Pedro site, and by 1923, the old Don Pedro Dam and Reservoir had been completed. However, to ensure continued water rights, the Districts planned to construct a larger, new Don Pedro Dam and Reservoir. In 1944, the California Legislature authorized the construction of a 1,200,000 acre-foot reservoir and the California DWR issued water rights in 1953. Construction of a diversion tunnel associated with the new Don Pedro Dam was completed in 1969 and construction of the dam itself was completed in 1971. The facility included a powerhouse, switchyard, power intake tunnel, outlet/diversion tunnel, spillway, and dikes.

Previous Investigations

To determine the extent of previous studies and to identify previously recorded cultural resource sites documented within 0.25 mile of the project APEs, between 2010 and 2012, the Districts reviewed existing records housed at the Central California Information Center, BLM Mother Lode Field Office, California State Library, California State University Stanislaus Special Collections, other county museums, and other state and local repositories. The Districts and their consultants also contacted Indian tribes to inquire about existing information that they might have with regard to known cultural resources.

The record search indicated that 62 cultural resource investigations have previously been conducted in the immediate vicinity of the Don Pedro Project (Districts, 2017h). Of these, 32 studies were located within the project APE. These previous studies resulted in the documentation of 160 prehistoric, historic, and multi-component archaeological sites within the record search study area. Ninety-seven of these resources are located within project APE consisting of 49 prehistoric sites, 34 historic-period sites, 9 sites containing both prehistoric and historic components, 1 protohistoric site, 1 site containing both prehistoric and protohistoric components, and 3 unknown site types. A review of historic General Land Office plats and USGS topographic quadrangles also suggested that an additional 50 previously unrecorded historic period sites could be located within the APE.

The record search indicated that nine cultural resource investigations have previously been conducted in the vicinity of the La Grange Project (Districts, 2018f). Of these, six studies were located within the project APE. These previous studies resulted in the documentation of 18 prehistoric, historic, and multi-component archaeological sites within the record search study area. Four of these resources are located within the project APE. All of these resources are associated with water transportation and/or hydroelectric generation including the La Grange Diversion Dam (P-50-550), the Don Pedro outlet works/diversion tunnel (P-55-8887), the La Grange Ditch (P-55-8888), and the gated dam spillway (P-55-8889). A review of historic General Land Office plats and USGS topographic quadrangles also suggested that an additional 10 previously unrecorded historic period sites could be located within the APE of each of these projects.

Archaeological and Historic Resources

Following completion of the record searches, the Districts conducted intensive archaeological and built environment field investigations within the Don Pedro and La Grange Project APEs in accordance with the study plans filed for the Don Pedro Project on November 22, 2011, and the La Grange Project on January 5, 2015. Information gathered during the record searches was used to identify and relocate previously recorded sites within the APEs and to ensure that all previous site forms were accurate and met current standards. All newly discovered resources, including isolated finds (three or less artifacts per 50 square meters), were documented on California

Department of Parks and Recreation site forms. Recordation included taking digital photographs of each site and preparing site sketch maps. GPS units were used to record all resource locations.

During field recordation of archaeological sites, the condition of each site was assessed to aid in the identification of project-related effects. National Register evaluations of affected sites were undertaken based on background research, documented remains, and other factors. A recommendation was made for the potential National Register eligibility of each site based on the criteria specified in 36 CFR 800.4 and the guidance provided in National Register Bulletin 15 (Park Service, 1997) and National Register Bulletin 36 (Park Service, 1993). These criteria are:

- **Criterion A.** Association with events that have made a significant contribution to the broad patterns of our history;
- **Criterion B.** Association with the lives of persons significant in our past;
- **Criterion C.** [Resources] that embody the distinctive characteristics of a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- **Criterion D.** [Resources] that have yielded or may be likely to yield, information important in prehistory or history.

Typically, the National Register does not include properties that are less than 50 years old. However, properties that are less than 50 years old may be eligible for listing in the National Register if they are of exceptional importance (**Criterion G)**.

During the field investigations, the research potential of each site was also assessed based on site condition, integrity, location, and other factors.

Don Pedro Project Archaeological Resources

The results of archaeological survey at the Don Pedro Project were presented in a historic properties study report (HDR and FWARG, 2014a) submitted to the California SHPO on October 28, 2014. An addendum report that addressed lands within the expanded APE and lands exposed by drought (HDR and FWARG, 2014b) and was submitted to the California SHPO at the same time. The historic properties survey resulted in the documentation of 264 archaeological sites and 172 isolated finds within the within the project APE (Districts, 2017h).

The 85 prehistoric sites at the Don Pedro Project consist primarily of lithic scatters (30) that contain flaked stone debitage and/or tools. Short-term habitation sites (17 sites), long-term habitation sites (13 sites), and quarries (13 sites) are also prevalent. Short term-habitation sites contain both flaked and groundstone tools and other artifacts and may also contain bedrock milling stations. Long-term habitation sites include sites that contain prominent midden development, housepits, or extensive milling features. Other

sites include solitary milling features (7 sites), rock shelters (2 sites), a possible tool cache and a possible hunting blind. Additionally, a historic district, the Tuolumne River Prehistoric Archaeological District, was also documented.

Many historic-period sites were also identified at the Don Pedro Project, including transportation sites (53 sites), mining-related sites (45 sites), sites related to water control/hydroelectric generation (23 sites), utility sites (6 sites), habitation sites (3 sites), and refuse scatters (2 sites). Classification of an additional 8 historic-period sites could not be ascertained.

Multi-component sites (39 sites) contain a varied combination of both prehistoric and historic site artifacts and features as described above.

In its reports filed with the Commission, the Districts recommended that 28 sites were eligible or recommended as eligible for listing in the National Register and 146 sites were ineligible for listing. The remaining 90 sites remained unevaluated pending further investigation.

By letter filed on October 11, 2017, the California SHPO concurred with the Districts' recommendation that all isolated finds identified at the Don Pedro Project are ineligible for listing in the National Register (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated February 23, 2015). In its letter, the California SHPO also concurred with all of the Districts' other recommendations of National Register eligibility for archaeological resources. Additionally, the California SHPO concurred that 33 of the archaeological resources contribute to the eligibility of the Tuolumne River Prehistoric Archaeological District and 43 do not contribute to the district's eligibility.

In letters filed on September 19 and October 25, 2019, the California SHPO referred to subsequent reports that it had received from the Districts providing National Register evaluations of 47 of the 90 unevaluated archaeological sites that are potentially affected by the project[162] (letters to S. Boyd, TID, and J. Davids, MID, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated September 19, 2018, and October 24, 2018). In its letters, the California SHPO concurred that 13 of the sites are ineligible for listing in the National Register and one site is eligible. However, the California SHPO did not concur with the remaining 33 evaluations and stated that additional information for each site was needed to better understand site composition and whether or not any of the sites contribute to any of the historic districts at the project.

[162] HDR (2018) *Cultural Resources Evaluation Report, Don Pedro Hydroelectric Project, FERC No. 2299* as referenced in the California SHPO's letters has not been filed with the Commission.

Table 3.3.7-1 provides a summary of current National Register status of archaeological sites documented within the APE at the Don Pedro Project. Of the 105 eligible or unevaluated archaeological resources, 49 are prehistoric sites, 28 are historic-period sites, and 28 are multi-component sites.

Table 3.3.7-1. National Register status of Don Pedro Project archaeological sites documented within the project APE (Source: Districts, 2017h; California SHPO, 2018a,b).

Site Type	Eligible	Unevaluated	Ineligible	Total
Prehistoric	12	37	36	85
Historic	8	20	112	140
Multi-Component	12	16	11	39
Total	**32**	**73**	**159**	**264**

La Grange Project Archaeological Resources

The results of archaeological survey of lands contained within the La Grange Project APE were presented in a historic properties study report (HDR, 2017f) submitted to the California SHPO on August 2, 2017. The historic properties survey resulted in the documentation of 5 archaeological sites and 2 isolated finds within the within the project APE (table 3.3.7-2).

Table 3.3.7-2. National Register status of La Grange Project archaeological resources within the project APE (Source: Districts, 2018f).

Site Number	Site Type	Description	National Register Eligibility
CA-STA-438H	Historic	Historic habitation (residential building)	Ineligible
CA-STA-440	Prehistoric	Bedrock milling features	Ineligible
CA-STA-441H	Historic	Historic habitation and powerhouse support facilities	Ineligible
CA-TUO-5992H	Historic	Two abandoned road segments	Ineligible
CA-TUO-6004H	Historic	Historic placer mining tailings	Ineligible

In its report, the Districts recommended that none of the 5 sites or 2 isolated finds are eligible for listing in the National Register. In a letter filed on October 11, 2017, the California SHPO concurred with these recommendations (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated February 23, 2015).

Built Environment Resources

During field studies for the Don Pedro and La Grange Projects, built environment resources were inspected and documented by individuals meeting the Secretary of the Interior's Standards for Architecture and Engineering Documentation.

Don Pedro Project Built Environment Survey Results

The results of the Don Pedro Project built environment survey were presented in the Districts' historic properties study report (HDR and FWARG, 2014a). This study resulted in the documentation of 37 built environment resources within the project APE. Most of these include resources associated with the Don Pedro Project, including the dam system resources (15 resources), operations support resources (8 resources), recreation-related resources (4 resources), Districts' transmission lines (2 resources), construction-related resources (1 resource), and two historic districts—the Don Pedro Project Historic District and the Don Pedro Recreation Agency Historic District. Additionally, 5 other built resources not associated with the project were also documented. Table 3.3.7-3 describes these built environment resources.

The Districts evaluated each of the resources for their current and potential future National Register eligibility. Future eligibility was evaluated on both an individual basis and on each resources' potential to contribute to the eligibility one of the two identified historic districts. Currently, only one of the resources, the La Grange Ditch (P-55-8888), was recommended as eligible for listing in the National Register at the current time. In its February 23, 2015, letter, the California SHPO concurred with this recommendation. The California SHPO also concurred that the two transmission lines (P-55-8884, P-55-8885), the Guy F. Atkinson Company Construction Camp Powder House (P-55-8898), and all of the Don Pedro Project Operations Support Resources (P-55-8899 through P-55-8906) are also not eligible for listing. In its letter, the California SHPO stated that evaluation of the Hetch Hetchy Moccasin-Network Transmission Line (P-55-8693) was outside the scope of the project relicensing but that the Districts should assume that it is eligible. Additionally, the California SHPO stated that the Moccasin Creek Stone Building (P-55-1346), the Red Mountain Bar Siphon (P-55-3913), and the Kanaka Creek Cabin (P-55-8874) should be evaluated for their eligibility to the National Register.

Table 3.3.7-3. National Register Evaluations of Don Pedro Project built environment resources within the project APE (Source: Districts, 2017h, as modified by staff).

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
Historic Districts					
P-55-8880	Don Pedro Project Historic District	Ineligible	Eligible	NA	NA
P-55-8881	Don Pedro Recreation Agency Historic District	Ineligible	Eligible	NA	NA
Don Pedro Project Dam System Resources[a]					
P-55-8871	Don Pedro Dam (1970)	Undetermined	Eligible	Contributing	NA
P-55-8872	Powerhouse (1968–1970)	Undetermined	Eligible	Contributing	NA
P-55–8882	Don Pedro Reservoir (1970)	Undetermined	Undetermined	Contributing	NA
P-55-8883	Switchyard (1971)	Undetermined	Undetermined	Contributing	NA
P-55-8886	Power Tunnel (1968–1970)	Undetermined	Eligible	Contributing	NA
P-55-8887	Outlet Works (1968)	Undetermined	Eligible	Contributing	NA
P-55-8889	Gated Dam Spillway (1969)	Undetermined	Eligible	Contributing	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-8890	Ungated Dam Spillway (1969)	Undetermined	Eligible	Contributing	NA
P-55-8891	Dike A (1969–1970)	Undetermined	Undetermined	Contributing	NA
P-55-8892	Dike B (1969–1970)	Undetermined	Undetermined	Contributing	NA
P-55-8893	Dike C (1969–1970)	Undetermined	Undetermined	Contributing	NA
P-55-8894	Gasburg Creek Dike (1970)	Undetermined	Undetermined	Contributing	NA
P-55-8895	Unit 1 Substation (1970)	Undetermined	Undetermined	Non-contributing	NA
P-55-8896	Unit 2 Substation (ca 1972)	Undetermined	Undetermined	Non-contributing	NA
P-55-8897	Cable Hoist/Incline Track (1969–1971)	Undetermined	Eligible	Contributing	NA
TID and MID Transmission Lines					
P-55-8884	TID (east) Transmission Line	Ineligible	Ineligible	NA	NA
P-55-8885	MID (west) Transmission Line	Ineligible	Ineligible	NA	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
Don Pedro Dam Construction-related Resources					
P-55-8898	Guy F. Atkinson Construction Camp Powder House	Ineligible	Ineligible	NA	NA
Don Pedro Project Operations Support Resources					
P-55-8899	Dam Storage Yard Warehouse (1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8900	Riley Ridge Microwave Building and two towers (1970–1971; 1986)	Ineligible	Ineligible	Non-contributing	NA
P-55-8901	Riley Ridge Employee Housing House 1 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8902	Riley Ridge Employee Housing House 2 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8903	Riley Ridge Employee Housing House 3 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8904	Riley Ridge Employee Housing House 4 (1972)	Ineligible	Ineligible	Non-contributing	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-8905	Riley Ridge Employee Housing House 5 (1972)	Ineligible	Ineligible	Non-contributing	NA
P-55-8906	Riley Ridge Water Tank (1971)	Ineligible	Ineligible	Non-contributing	NA
Don Pedro Project Recreation-Related Resources					
P-55-8574	Moccasin Point Recreation Area	Ineligible	Eligible	NA	Contributing
P-55-8803	Fleming Meadows Recreation Area	Ineligible	Eligible	NA	Contributing
P-55-8907	Headquarters and Visitor Center	Ineligible	Eligible	NA	Contributing
P-55-8908	Blue Oaks Recreation Area	Ineligible	Eligible	NA	Contributing
Other Non-Project Resources					
P-55-1346	Moccasin Creek Stone Building	Ineligible	NA	NA	NA
P-55-3913	Red Mountain Bar Siphon	Unevaluated	NA	NA	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-8693	Hetch Hetchy Moccasin-Newark Transmission Line	Unevaluated	Unevaluated	+	NA
P-55-8874	Kanaka Creek Cabin	Unevaluated	NA	NA	NA
P-55-8888	La Grange Ditch	Eligible	NA	NA	NA
Totals		Eligible = 1 Ineligible = 17 Unevaluated = 19 Total = 37	Eligible = 13 Ineligible = 11 Undetermined = 9 NA = 4 Total = 37	Contributing = 13 Non-contributing = 10 NA = 14 Total = 23	Contributing = 4 Non-contributing = 0 NA = 33 Total = 4

Notes: NA—not applicable

[a] The Districts recommended that the 15 structures that comprise the Don Pedro System resources are not currently eligible for listing in the National Register. By letter dated February 23, 2015, the California SHPO did not concur and recommended that their eligibility be re-evaluated.

With regard to the Don Pedro Project system resources (15 structures), the Districts recommended that these resources are not eligible for listing in the National Register because they do not yet meet the 50-year threshold for eligibility and are not considered to be exceptionally significant under Criterion G. However, in its February 23, 2015, letter, the California SHPO stated that it could not concur with the Districts' recommendations. The California SHPO's position is that it is common practice to evaluate properties that are 45 years and older. When the Districts submitted their recommendations, these structures were 46 years old. For this reason, the California SHPO recommended that the eligibility of these structures (which would include the two historic districts) be re-examined. In its November 27, 2017, response to the Commission's October 27, 2017, AIR, the Districts propose to re-evaluate these structures when they all reach 50 years of age, except for the Don Pedro Recreation Agency Headquarters and Visitors Center building [P-55-8907], which burned down and no longer exists. Until that time, the National Register eligibility of these resources remains undetermined.

La Grange Project Built Environment Survey Results

The results of the La Grange Project built environment survey were presented in the Districts' Historic Properties Study Report (HDR, 2017f). This study resulted in the documentation of 14 built environment resources within the project APE. Most of these include resources associated with the La Grange Project Diversion Dam (P-50-0550) and irrigation system (eight resources) or the La Grange Project hydroelectric system (four resources). One resource is a garage associated with a residential property and one is the La Grange Ditch (P-55-8888). Table 3.3.7-4 describes all 14 built environment resources.

Table 3.3.7-4. National Register status of La Grange Project built environment resources within the project APE (Source: Districts, 2018f, as modified by staff).

Primary Number	Resource	National Register Eligibility (criteria)
La Grange Diversion Dam and Irrigation System Resources		
P-50-0550	La Grange Diversion Dam (1893)	Eligible
None	La Grange Forebay Bypass Spillway (1910)	Ineligible
None	La Grange Headpond (1893)	Ineligible
None	La Grange Irrigation Canal Forebay (1910)	Ineligible
None	La Grange MID Old Canal Intake Structure (1893)	Ineligible

Primary Number	Resource	National Register Eligibility (criteria)
None	La Grange TID Diversion Tunnel Intake Structure (1910)	Ineligible
None	La Grange MID Old Canal Discharge Structure (1910)	Ineligible
None	La Grange MID Old Canal Segment (1904)	Ineligible
La Grange Project Hydroelectric System Resources		
None	La Grange Powerhouse (1924)	Ineligible
None	La Grange Powerhouse Penstocks (1924)	Ineligible
None	La Grange Powerhouse Tailrace(1924)	Ineligible
None	La Grange Powerhouse Access Road (ca. 1922)	Ineligible
Residential Properties		
None	Garage on La Grange Powerhouse Access Road (ca. 1930)	Ineligible
Historic Mining Resources		
P-55-8888	La Grange Ditch (1872)	Eligible

In their report, the Districts recommended that the La Grange Diversion Dam (P-50-0550) is eligible for listing in the National Register under Criteria A and C for its role in the development and growth of irrigation in the Central Valley and for its association with the 1887 Wright Act. Additionally, it is unique because of its integrated spillway and materials and height. The La Grange Ditch (P-55-8888) was previously determined to be eligible for listing. All other structures were recommended as ineligible for listing in the National Register due to alterations made over the years, resulting in a lack of any individual integrity for these structures. In a letter filed with the license application, the California SHPO concurred with these recommendations (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California. Dated September 18, 2017).

Traditional Cultural Properties

The Districts consulted with participating Indian tribes and implemented studies to identify potential TCPs within the project APEs.

Don Pedro Project TCP Results

To identify potential TCPs within the Don Pedro Project APE, the Districts implemented the 2011 Study Plan (CR-2), conducted archival research, interviewed tribal elders, visited archaeological sites, conducted National Register evaluations of identified locations, and assessed project-related effects on eligible TCPs. Representatives of the Central Sierra Me-Wuk Cultural and Historic program at Tuolumne, Chicken Ranch Rancheria of Me-Wuk, Southern Sierra Miwuk Nation, and Tuolumne Band of Me-Wuk Indians and an individual Yokuts/Me-Wuk elder not affiliated with a federally recognized tribe, participated in study interviews. The results of this work were presented a report filed with the Commission on May 22, 2015 (Applied Earthworks, 2015).

The study resulted in the identification of several locations that could qualify as TCPs; these locations included a cultural location encompassing a number of archaeological sites also known as a traditional fishing and plant-gathering location, auriferous streams, four separate archaeological sites, and two traditional plant gathering locations. All of these locations were evaluated for listing in the National Register following the guidance provided in National Register Bulletin 38 (Parker and King, 1998).

The Districts determined that only one of these areas meets the criteria for National Register eligibility. The cultural location containing archaeological sites and plant-gathering and fishing areas (P-55-8925) was recommended to be eligible as a historic district. In a letter filed with the amended license application, the California SHPO determined that this district is eligible under National Register Criterion A for its association with a "pattern of events or a historic trend that made a significant contribution to the development of a community" and for its association with the cultural practices of the community that are important in maintaining and continuing its cultural identify (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, undated). While the area has been affected by mining activity, it has retained its integrity of location, feeling, and association.

La Grange Project TCP Results

Unlike the Don Pedro Project, no specific study plan for TCPs at the La Grange Project was developed. However, the Cultural Resources Study plan (CR-01) called for the Districts to consult with local Indian tribes, invite them to attend a field visit, and allow them the opportunity to provide information regarding locations of cultural importance. To accomplish this task, the Districts contacted all organizations identified on the Districts' tribal list via email and by telephone, interviewed nine individuals, and provided a tour of the study area. Additionally, the Districts spoke with residents of La Grange and discussed the project with staff at the La Grange Museum. The results of the study were filed with the amended license application (King et al., 2017).

The Districts' study did not result in the identification of any places at the La Grange Project that could be classified as TCPs. However, the report recommends that further study should take place if and when any changes in the structure or operation of the project are planned in the future.

3.3.7.2 Environmental Effects

Project-related effects on cultural resources within the Don Pedro and La Grange Project APEs are likely to occur from operation and maintenance activities. Project effects are considered to be adverse when an activity may alter—directly or indirectly—the characteristics of a historic property that qualify the property for inclusion in the National Register. If adverse effects are found, consultation with the California SHPO and other parties would be required to develop alternatives or modifications to avoid, minimize, or mitigate such adverse effects.

Over the license term, various project-related actions may affect historic properties at the project and include routine operation and maintenance of buildings and structures, reservoir inundation and fluctuation, vegetation management, grazing, road maintenance, construction and use, recreation, emergency repairs, and artifact collection/management. The Districts have identified project effects on all eligible or unevaluated resources that may occur as a result of these activities

Don Pedro Project

In its letters filed on October 11, 2017, September 19, 2018, and October 25, 2018, the California SHPO determined that 159 archaeological sites within the project APE are ineligible for listing in the National Register. Under section 106, no further assessment of effects or continued management of these resources is required. However, during its field investigations, the Districts evaluated project-related effects at the remaining 105 eligible and unevaluated sites documented within the APE. Ongoing project-related effects were identified at 88 archaeological resources—25 eligible sites and 76 unevaluated site (table 3.3.7-5). No effects were observed at 3 eligible sites and 14 ineligible sites.

Sites within drawdown or seasonal fluctuation zones of a reservoir may be subject to erosion, scouring, deflation, hydrologic sorting, and the horizontal and vertical movement of artifacts. Reservoir fluctuation and/or drawdowns may also result in the exposure of previously submerged cultural resources making them more susceptible to artifact collection and vandalism. Table 3.3.7-6 demonstrates the number of sites affected solely by fluctuating water levels, recreational activities, looting, cattle grazing and/or combinations of multiple disturbances.

Of the 88 eligible and unevaluated archaeological sites that are experiencing project-related effects, almost all (78 sites) are experiencing effects as a result of fluctuating water levels.

Table 3.3.7-5. Summary of ongoing project-related effects for eligible and unevaluated archaeological sites at the Don Pedro Project (Source: Districts, 2017h, as modified by staff to reflect September 19, 2018, and October 25, 2018, California SHPO letters).

Ongoing Project-related Effects	Prehistoric Sites	Historic Sites	Multicomponent Sites	Total
Eligible Archaeological Resources				
Effects	12	7	10	29
No Effects	0	1	2	3
Subtotal	**12**	**8**	**12**	**32**
Unevaluated Archaeological Resources				
Effects	33	13	13	59
No Effects	4	7	3	14
Subtotal	**37**	**20**	**16**	**73**
Effects Total				**88 sites**
No Effects Total				**17 sites**

Table 3.3.7-6. Types of project-related effects observed at eligible and unevaluated archaeological sites at the Don Pedro Project (Source: Districts, 2017h, as modified by staff to reflect September 19, 2018, and October 25, 2018, California SHPO letters).

Identified Project-related Effect	Number of Sites Affected
Fluctuating water levels only	41
Recreation only	2
Cattle grazing only	8
Fluctuation water levels and recreation	25
Fluctuating water levels and looting	3
Fluctuating water levels and cattle grazing	1
Fluctuating water levels, recreation, and looting	5
Fluctuating water levels, recreation, and cattle grazing	1
Fluctuating water levels, looting and cattle grazing	1
Fluctuating water levels, recreation, cattle grazing, and looting	1
Total Number of Affected Sites	**88**

Recreational activities, such as camping, fishing, picnicking, boating, and hiking, may also affect cultural resources through increased public access and traffic. These activities may cause soil erosion and artifact collection and/or vandalism at sites. Additionally, maintenance and improvement of formal recreation facilities can also result in site disturbances. Ongoing effects resulting from recreational use were observed at 34 eligible or unevaluated sites within the Don Pedro Project APE. Intentional looting was observed at 10 eligible or unevaluated sites. Finally, the issuance of cattle grazing leases can deplete vegetation cover and result in trampling and erosion of sensitive cultural resource sites. Within the Don Pedro Project APE, disturbances as a result of cattle grazing were observed at eight eligible or unevaluated archaeological sites.

Project-related Effects to Built Environment Resources

Eligible hydroelectric facilities may require maintenance to ensure that they remain in good condition. Planned and unplanned maintenance and operation activities could affect the qualities of these structures that make them eligible for inclusion in the National Register. These activities may include but are not limited to structural or mechanical upgrades and the repair or replacement of existing building components. Additionally, changes in viewscape may also affect the setting, association, and feel of eligible structures.

Of the 37 built environment resources documented within the Don Pedro Project APE, only 1 has been previously determined to be eligible for listing in the National Register (the historic La Grange Ditch). In its amended license application, the Districts recommended a finding that project operations and maintenance activities were not affecting this structure. Effects on 4 unevaluated structures were assessed, and the Districts recommended a finding that they were also not being affected by project operations and maintenance. The Districts recommended a finding that the remaining 32 are ineligible for listing in the National Register because at they are not yet 50 years old. For this reason, the Districts did not assess project effects on these resources. However, as mentioned in section 3.3.7.1, *Cultural Resources, Affected Environment*, in the subsection *Don Pedro Project Built Environment Survey Results*, the California SHPO did not concur with the Districts' recommendation that the 15 structures associated with the Don Pedro Project dam system are not eligible.

Project-related Effects to Traditional Cultural Properties

The Districts identified a single TCP within the Don Pedro Project APE. This location, a traditional plant gathering area (P-55-8925), is accessible by a public road. For the most part, the location is located above the high-water line, although a small area of the site may be periodically inundated by Don Pedro Reservoir. No other potential effects were identified.

La Grange Project

The Districts identified 5 archaeological sites and 2 isolated finds during archaeological surveys conducted within the La Grange Project APE. The California SHPO determined that all of these resources are ineligible for listing in the National Register. For this reason, project-related effects were not assessed and no further consideration of these properties is required under section 106.

The Districts identified 14 built environment resources within the La Grange Project APE. The California SHPO determined that all but 2 of these resources are ineligible for listing in the National Register. The Districts own and operate the La Grange Diversion Dam (P-50-0550). The La Grange Ditch (P-55-8888) is located close to the project but is not a project facility. This structure is currently abandoned. The Districts did not identify any current project-related effects on these two resources. However, the Districts acknowledge that continued operations and maintenance activities and any future project-related construction activities have the potential to affect both of these structures.

The Districts did not identify any locations that may qualify as TCPs within the project APE.

Historic Properties Management Plans

Continued project operation and enhancements, recreational use, and new construction could affect cultural resources listed in or eligible for inclusion in the National Register. The Districts propose to manage effects on historic properties through the implementation of separate HPMPs for the projects. The purpose of the HPMPs is to resolve (i.e., reduce, avoid, or mitigate) existing or potential project-related adverse effects on historic properties within the Don Pedro and La Grange Project APEs throughout the term of each license.

The Districts filed separate draft HPMPs with the license applications for the Don Pedro and La Grange Projects. The draft HPMPs were prepared in accordance with the ACHP and Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects* (ACHP and Commission, 2002).

In both HPMPs, the Districts propose both general and specific management measures. General measures include but are not limited to: (1) plans for the curation of recovered archaeological materials; (2) a list of activities that are exempt from section 106 consideration; (3) a program for future cultural resources inventories on unsurveyed lands as conditions allow; (4) a public education and information program, including interpretive opportunities; (5) training for project personnel and contractors; (6) procedures for unanticipated discoveries of cultural materials and human remains; (7) protocols for emergency situations, (8) roles and responsibilities for the Districts' staff, Commission, BLM, California SHPO, Indian tribes, and other agencies; (9) reporting requirements, including the submittal of HPMP status reports every other

year; (10) procedures for HPMP review, updates, and amendments; and (11) a plan for dispute resolution.

Additionally, each HPMP discusses specific project effects identified at each resource and provides measures to avoid, lessen, or mitigate adverse effects on those that are eligible or potentially eligible for listing in the National Register. These measures include programs for additional cultural resource evaluations, avoidance measures for known cultural resources, and a program for mitigating adverse effects on historic properties.

In its draft HPMP for the Don Pedro Project, the Districts propose various specific measures for each of the 118 eligible or unevaluated archeological sites. The Districts state that 17 of these sites are not be affected by the project (see table 3.3.7-7). The Districts propose to avoid these resources during operation and maintenance activities.

Table 3.3.7-7. HPMP measures for identified archaeological sites at the Don Pedro Project (Source: Districts, 2017h, as modified by staff to reflect September 19, 2018, and October 25, 2018, California SHPO letters).

Management Measure	Number of Sites Affected
Ineligible—no management required	159
No identified effects—monitoring	17
National Register evaluation of sites on BLM lands	22
Eliminate cattle grazing and monitor	8
Inclusion in a Mitigation Plan (50% sample)	36
No treatment	22
Total Number of Sites	**264**

At the request of the BLM, the HPMP for the Don Pedro Project calls for formal National Register evaluation of 22 of the 26 unevaluated sites at the project that are located on lands administered by the BLM. These 22 sites are experiencing various project-related effects; no effects were identified at the other 4 sites documented on BLM lands. To avoid large-scale excavations that would be necessary to determine National Register eligibility of the remaining 64 unevaluated archaeological sites that are not located on public lands, the Districts propose to assume that all are eligible for listing in the National Register under Criterion D.

Cattle grazing is affecting 8 sites located on Districts' lands that are leased to neighboring property owners.[163] In the draft HPMP, the Districts state that grazing in these areas will be discontinued and that these sites would be monitored at 3-year or 10-year intervals thereafter. The Districts identified a 50 percent representative sampling strategy (based on site type) for the remaining 71 sites that are being adversely affected. A total of 36 of these sites would be subject to mitigation measures that would include data recovery excavations, artifact collection, and analysis of recovered materials to provide relevant scientific data. Specific measures for each site in the sample would be contained within a mitigation plan to be developed in consultation with the Commission, California SHPO, BLM (as appropriate), and potentially affected Indian tribes.

The Districts identified 37 built environment resources in the Don Pedro Project APE. Four of these resources are eligible for listing in the National Register, but the Districts state that they are not currently being affected by the project. However, the draft HPMP calls for these structures to be avoided and monitored. In the draft HPMP, the Districts state that 1 of the remaining 33 unevaluated structures would also be avoided and monitored, while the remaining 32 structures would be evaluated in 2023 when they are all 50 years in age. The Districts suggest that 13 of these resources are likely to be determined to be eligible. To resolve potential adverse effects on eligible built environment resources, the HPMP calls for the development of a mitigation plan in the future to resolve any unavoidable project-related adverse effects. This plan would be developed in consultation with the Commission, California SHPO, and BLM (as appropriate).

A single TCP that is eligible for listing in the National Register was identified within the Don Pedro Project APE. No ongoing project-related effects were identified at this location and no specific management is proposed. However, the draft HPMP calls for a treatment plan to be negotiated among the California SHPO, Commission, Districts, BLM (as appropriate) and potentially affected Indian tribes in the future if any project-related adverse effects are identified at this site, or any as yet unidentified potential TCP located within the APE.

No archaeological sites or TCPs that are eligible for listing in the National Register were documented within the La Grange Project APE. For this reason, the La Grange Project HPMP does not include any specific measures for these resources. Fourteen built environment resources were identified, but only the La Grange Diversion Dam and the La Grange Ditch have been determined to be eligible for listing in the National Register. The Districts state that neither of these structures are being affected

[163] Grazing was also identified at five additional sites; however, these sites are also experiencing other project-related effects that require implementation of other management measures.

by project-related activities, but they could both be affected by future operations and maintenance activities. If the Districts propose any activity in the future that could affect the characteristics of the La Grange Diversion Dam or La Grange Ditch that qualify them for inclusion in the National Register, the HPMP calls for the Districts to consult with the California SHPO prior to commencing with the activity. Additionally, the HPMP calls for the Districts to reconsider the boundaries of the project APE within 1 year of any license issuance based on the Commission's final approval of a project boundary. If the project boundary includes lands outside the current APE, these lands will be included in the APE and the results of any additional surveys, evaluations, and assessments of effect included in a revised HPMP to be filed within 2 years of license issuance.

The Districts provided a draft of the Don Pedro Project HPMP to the California SHPO in August 2016 and received comments back on November 10, 2016 (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California). However, the draft HPMP that was filed with the amended license application in October 2017 is the same version of the document that was submitted to the California SHPO in August 2016 and did not address the California SHPO's November 2016 comments. Consultation with the California SHPO, agencies, and Indian tribes regarding the La Grange Project HPMP had not yet been initiated when the draft HPMP was filed with the amended license application.

In its October 27, 2017, AIRs for each project, the Commission requested that both HPMPs be revised to address any comments received (including the California SHPO's November 27, 2016, comments on the draft HPMP for the Don Pedro Project). The HPMPs would also present a discussion of the extent to which comments were addressed and provide copies of all correspondence. Additionally, for the Don Pedro Project, the Commission requested that the Districts reconcile discrepancies between the counts of archaeological sites identified in the cultural resources reports, amended license application, and draft HPMP. In their responses to the AIRs filed on November 27, 2017, the Districts stated that the final HPMPs to be filed for each project would include the requested consultation documentation. Additionally, the Districts stated that the counts of archaeological sites at the Don Pedro Project had been corrected. The Districts stated that a final HPMP for the Don Pedro Project would be filed with the Commission by May 2018 and a final HPMP for the La Grange Project would be filed by May 30, 2018. In separate letters to the Districts filed on December 5, 2017, the Commission requested that the final HPMPs for both the Don Pedro Project and the La Grange Project be filed no later than April 27, 2018.

On May 7, 2018 for the Don Pedro Project, and on April 6 and July 9, 2018, for the La Grange Project, the comments of the California SHPO on the Don Pedro Project HPMP and the La Grange Project HPMP were filed with the Commission (letters to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, from J. Polanco,

California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California). These letters contained a number of editorial or corrective comments but some substantive comments as well.

The California SHPO provided 29 separate comments on the Don Pedro Project HPMP in its correspondence. A number of these comments pertained to minor corrections or clarifications, but the following comments are more substantive:

1. Section 4.2: The General Management Measures section discusses a Program for Resources Evaluations (4.3) and moves on to the Program for Mitigating Adverse Effects (4.5) without discussing measures to assess adverse effects in consultation with the California SHPO, tribes, consulting parties, and the public as required at 36 CFR § 800.5(a).

2. Section 4.2.3: The use of physical protection or stabilization measures should be considered actions that can cause unintended effects and should not be used absent formal National Register evaluation.

3. Section 4.2.4: Mitigation is necessary when adverse effects to historic properties cannot be avoided and is not limited to situations where "imminent loss of a historic property cannot be avoided."

4. Section 4.3: The process and timeline for resource evaluations needs to be clearly stated and understood.

5. Section 4.3.1: Sites where effects cannot be avoided, including from inundation, will require formal evaluation.

6. Section 4.3.1.1: Assuming eligibility under Criterion D is appropriate for properties when effects to potential data can be avoided but inappropriate when properties might be significant under other criteria and effects to those characteristics cannot be avoided.

7. Section 4.3.1.1: The California SHPO disagrees that the resource evaluation program as proposed meets statutory requirements per 36 CFR § 800. The California SHPO acknowledges the concerns expressed by Tribal consulting parties regarding excavations at prehistoric sites. Further, the California SHPO recognizes the ACHP statement provided in Section 4.5.1.1: "contrary to the view held by some Section 106 practitioners, data recovery is not required by law or regulation…" and "the law does not prescribe any specific measures to resolve adverse effects." In consideration of the concerns raised by consulting parties, the SHPO recommends a limited archaeological testing program that requires ground disturbance not exceed 5 percent of the overall site area or 4 cubic meters of excavated soil volume without further SHPO consultation.

8. Section 4.4-4.5: These sections discuss avoidance measures for known resources and move on to a program for mitigating adverse effects without a discussion on assessing effects per 36 CFR § 800.5. The HPMP should include a section that outlines the process of applying the criteria of adverse effects including timelines and consultation procedures.

9. Section 4.5.1.1: The Districts have stated: "many sites appear to contain much of the same data and generally represent similar historic and prehistoric activities." The California SHPO reminds the Districts that to qualify for inclusion in the National Register under Criterion D, archaeological sites must not only have information to contribute to our understanding of human history or prehistory but that information must also be considered important. Information is considered "important" when it is shown to have a significant bearing on a research design that addresses current data gaps or alternative theories that challenge existing ones. The California SHPO recommends that the Districts apply the National Register criteria at 36 CFR § 63 more judiciously.

10. Archaeological sites determined to be not individually eligible for listing in the National Register under Criterion D because the data they contain is similar and repetitive should be considered as potential contributors to the Tuolumne River Prehistoric Archaeological District.

11. Section 4.5.1.1: Data recovery and dissemination of information is not an adequate or sufficient mitigation measure for adverse effects to archaeological sites eligible under Criterion A.

12. Section 4.5.2: Paragraph 2 states that once a mitigation for a particular project activity has been agreed upon, "no further cultural resources management consideration for that particular resource" will be necessary. Please clarify this language. If the property remains eligible following completion of the undertaking, it will still need to be managed accordingly. An adverse effect to a historic property does not mean that the property automatically becomes ineligible.

13. Section 7.0: Include a provision for annual reporting on the implementation of the HPMP, including discussion of outcomes, how the HPMP is working and potential suggested changes, and analysis of direct, indirect, and cumulative effects, in addition to a summary of activities implemented over the course of the reporting period.

14. Section 7.2.3: Provide a more detailed process for dispute resolution prior to going to the ACHP, including time frames for consultation. Also include a section for resolving objections from the public.

In its letter regarding the Don Pedro Project HPMP, the California SHPO stated that it could not concur with the Districts' finding of adverse effect for the relicensing until its comments were addressed in a revised draft HPMP submitted for continued consultation.

The California SHPO provided nine separate comments on the La Grange Project HPMP in its correspondence:

1. As the HPMP essentially takes the place of a full PA, all of the required elements and stipulations of such an agreement should be incorporated into the HPMP. Please review the ACHP's Guidance on Section 106 Agreement Documents.

2. Section 4.1: Please update this section to reflect the California SHPO's previous concurrence on the National Register eligibility of the La Grange Diversion Dam and the La Grange Ditch.

3. Section 4.1: Please revise the last line of the third paragraph of this section to eliminate "NRHP architectural qualities." The correct terminology should be character-defining features.

4. I recommend adding a section that briefly describes the eligibility and character-defining features of the La Grange Diversion Dam and La Grange Ditch. Including this information in the HPMP will prevent the Districts or their consultants from having to search in multiple documents and make the HPMP easier to implement.

5. Section 4.1.1.1: Remove replacement or removal of utility poles from (item 3) of exempt activities. Removal or replacement of poles generally requires additional excavation around the pole site, which would be new ground disturbance.

6. Section 4.5: Include a clear process for notification of emergencies—who will be notified, when, and what information will be included in the notification.

7. Section 5.2.2: The Status Report needs to be an annual report, rather than biennial. It should include a discussion (of) outcomes, how the HPMP is working and potential suggested changes, and analysis of direct, indirect, and cumulative effects of any effects, in addition to the activities implemented in the previous year.

8. Section 6.1: Include language stating that the cultural resources specialist will meet the Secretary of the Interior's Professional Qualifications Standards (36 CFR § 61) in the appropriate discipline for the undertaking.

9. Section 7.3: Include a more detailed process for dispute resolution prior to going to the ACHP, including a timeframe for consultation. Also include a section for resolving objections from the public.

On May 3, 2018, the Districts filed a request to postpone the submitted of a final HPMP for the La Grange Project to the Commission until July 15, 2018. The Commission granted this request on May 9, 2018 and on July 10, 2018, the Districts filed a final HPMP. A similar request to postpone until October 30, 2018 the submittal of the final HPMP for the Don Pedro Project was filed on May 8, 2018. On October 24, 2018, the Districts filed a second request to postpone the submittal of the final HPMP until January 31, 2019. The reasons for these extension requests was to allow the Districts adequate time to complete necessary section 106 consultation on the project and to address the results of this consultation in the final HPMP. On October 30, 2018, the Commission granted the Districts' request to postpone the submittal of the HPMP for the Don Pedro Project until January 31, 2019. On January 31, 2019, the Districts requested postponement of the submittal of the HPMP for the Don Pedro Project until February 21, 2019.

BLM Don Pedro revised 4(e) condition 15 and La Grange preliminary 4(e) condition 7 would require the Districts' to implement each HPMP upon approval by the Commission.

Our Analysis

The Districts' draft HPMPs for the Don Pedro and La Grange Projects provide measures that are consistent with the ACHP and Commission's 2002 guidelines. We are in agreement with the California SHPO that inclusion of additional information in a final HPMP for each project would improve the documents and ensure adequate compliance with the requirements of section 106. We agree that the Districts should file a revised HPMP for the Don Pedro Project that addresses all of the California SHPO's specific comments provided in previous correspondence (including its September 19 and October 25, 2018, letters) and in any correspondence received subsequent to the date of this EIS. However, one of the California SHPO's comments pertained to dispute resolution. The California SHPO requested that the HPMP provide a more detailed process for dispute resolution prior submitting disputes to the ACHP, including timeframes for consultation. A dispute resolution process will be provided in the Commission's anticipated PA for the project. As a signatory to the PA, the Commission must follow the process provided in the PA. For this reason, we recommend that this section of the Don Pedro HPMP be revised to clarify that all parties involved in any dispute regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the PA.

As mentioned in our October 27, 2017, AIRs, we expect the HPMP will contain an appendix with documentation of all section 106 consultation undertaken for the project, including copies of all correspondence with the California SHPO, BLM, and participating Indian tribes. The appendix should also identify each comment received on the draft

HPMP and the extent to which they were addressed in the revised HPMP. Implementation of the revised HPMP for the Don Pedro Project would ensure that project-related effects on cultural resources would be considered and the appropriate management measures would be implemented prior to undertaking project activities.

The Districts' revised HPMP for the La Grange Project filed on July 10, 2018, adequately addresses all comments received from the California SHPO in its letter filed on April 6, 2018. We agree that this HPMP is now adequate to address the potential effects of the project on historic properties over any new license term. However, the process for dispute resolution detailed in section 7.3 puts specific requirements on the Commission, including requirements to respond to disputes within a specified period of time. Regarding the Don Pedro HPMP, while this process is not unreasonable, as a signatory to the PA, the Commission must follow the process that will be provided in the PA. For this reason, we recommend revising this section of the La Grange HPMP to clarify that all parties involved in any dispute on cultural resources management or the HPMP will follow the process provided in the Dispute Resolution stipulation of the PA.

To meet section 106 requirements, the Commission intends to execute individual PAs with the California SHPO for each project for the protection of historic properties that would be affected by project construction and operation. The terms of each PA would require the Districts to implement the revised HPMPs.

3.3.8 Socioeconomics

The Don Pedro Project is located within Tuolumne County, and the La Grange Project is located within Stanislaus and Tuolumne Counties. Waters released from the Don Pedro Project flow into La Grange Reservoir where water is diverted by the Districts to meet consumptive needs or passes the La Grange Diversion Dam and flows into the lower Tuolumne River.

The Don Pedro Project receives inflow from CCSF's upstream Hetch Hetchy System, a series of reservoirs, diversion conduits, and powerhouses located on the upper Tuolumne River. Consistent with the requirements of the Raker Act and agreements between the Districts and CCSF, the project provides a "water bank" of up to 570,000 acre-feet of storage. The water bank allows CCSF to meet its need to satisfy the Districts' senior water rights by using the Don Pedro storage to store water released from its upstream facilities. By using the allotted reservoir storage, CCSF can then divert water when releases are required to satisfy the Districts' water rights.

The Districts supply water for municipal and industrial uses to Stanislaus, Merced, and Tuolumne Counties. SFPUC, a department of CCSF, purchases the water diverted by the Hetch Hetchy System and uses it to support municipal and industrial water use in Alameda, San Francisco, San Mateo, and Santa Clara Counties. The study area for this analysis is composed of all seven counties grouped into two service areas: (1) economic benefits from agricultural uses are concentrated within the Districts' service area, and

(2) more generalized economic benefits are concentrated in the SFPUC service area, resulting from the water banking agreement between CCSF and the Districts.

3.3.8.1 Affected Environment

Population, Housing, and Income

The population of the study area was 5.9 million in 2016, an increase of more than 600,000 people from the year 2000. Of the three counties adjacent to the proposed project, Merced County grew the fastest with a 1.4 percent annual growth rate between 2000 and 2016. All three of the counties adjacent to the project have experienced slower growth between 2010 and 2016. Tuolumne County is the only county in the seven-county area where the population declined during the last 16 years. The four counties in the SFPUC service area—Alameda, San Francisco, San Mateo, and Santa Clara Counties—experienced a population growth between 0.4 percent and 0.8 percent during the past 16 years, increasingly slightly in the last 6 years. The three counties in proximity to the Don Pedro and La Grange Projects—Stanislaus, Merced, and Tuolumne Counties—make up 14 percent of the population of the study area. In recent years, the study area's population has grown slightly faster than the population of the state of California. Between 2010 and 2016, the population of the study area increased by a 0.9 percent compound annual growth rate compared to 0.6 percent for the state of California. The number of households also increased at a higher rate in the study area compared to the state in more recent years (U.S. Census Bureau, 2000, 2010, and 2016).

Important population centers in the study area include the towns of Modesto (population of 208,512), located 30 miles west of the La Grange Diversion Dam; Turlock (population of 71,166), located 25 miles west of the La Grange Diversion Dam; and Merced (population of 81,461), located 25 miles south of the La Grange Diversion Dam. The city of San Francisco (population: 850,282) is located 108 miles west of La Grange Diversion Dam (U.S. Census Bureau, 2016). The population within the study area is expected to grow to 8.5 million people by 2060, with a combined annual growth rate of 0.7 percent between 2020 and 2060. Among all the counties in the study area, Merced County is expected to lead this growth with a 1.1 percent combined annual growth rate, followed by Stanislaus County at 0.8 percent. This growth rate will exceed the forecasted growth rate for the state by 0.1 percentage points. Most of this growth is forecasted to occur in the near-term, tapering off in later decades (table 3.3.8-1).

Approximately 2.2 million housing units were located in the study area in 2016, and 13 percent of these housing units were concentrated in the three-county region—Merced, Stanislaus, and Tuolumne Counties—located in proximity to the projects. Five percent of these housing units were vacant in 2016. Of the seven counties in the study area, Tuolumne County had the highest rate of vacancy at 30 percent of all housing in 2016. The next highest vacancy rates were in San Francisco and Merced Counties at 8 and 7 percent vacancy, respectively.

Table 3.3.8-1. Population projections in the study area 2020 to 2060 (Source: California Department of Finance, 2018).

Area	2020	2030	2040	2050	2060	M&I Water Source
California	40,639,392	43,939,250	46,804,202	49,077,801	50,975,904	--
Alameda County	1,703,660	1,873,622	2,027,328	2,154,848	2,260,737	SFPUC
Merced County	286,746	326,923	369,542	410,444	452,868	MID
San Francisco County	905,637	982,639	1,048,803	1,118,562	1,197,009	SFPUC
San Mateo County	792,271	844,778	884,198	913,131	936,154	SFPUC
Santa Clara County	2,011,436	2,223,743	2,436,897	2,633,652	2,804,044	SFPUC
Stanislaus County	572,000	638,840	699,022	747,188	787,145	SFPUC / Districts
Tuolumne County	53,976	54,801	55,400	55,534	56,595	SFPUC / Districts
California 10-year combined annual growth rate	0.9%	0.8%	0.6%	0.5%	0.4%	--
Study area 10-year combined annual growth rate	1.1%	0.9%	0.8%	0.7%	0.6%	--

Note: M&I – municipal and industrial

In 2016, the median household income in the study area ranged from $45,343 in Merced County to $103,328 in Santa Clara County. The median household income declined in Merced, Stanislaus, and Tuolumne Counties between 2010 and 2016. In Alameda, San Francisco, San Mateo, and Santa Clara Counties, the median household income increased slightly over the same period. The median household income declined in the state of California by -0.8 percent; within the study area, only in Merced and Stanislaus Counties did median household income decline by a larger amount (table 3.3.8-2). Total employee compensation from wages and salaries in the study area was $389.1 billion in 2016, representing 28 percent of all wages and salaries in the state of California (USBEA, 2017a).

Table 3.3.8-2. Median household income and employee compensation for the study area and California in 2010 and 2016 (adjusted to 2017 dollars) (Source: U.S. Census Bureau, 2010, 2016; USBEA, 2017a).

	Median Household Income			
Area	**2010**	**2016**	**Compound Annual Growth Rate 2010–2016**	**Compensation of Employees 2016 (thousands of dollars)**
Alameda County	$77,996	$81,532	0.7%	$72,346,040
Merced County	$49,286	$45,343	-1.4%	$4,531,208
San Francisco County	$80,154	$89,569	1.9%	$92,817,291
San Mateo County	$96,278	$100,645	0.7%	$53,073,817
Santa Clara County	$97,629	$103,328	1.0%	$153,658,553
Stanislaus County	$57,436	$52,690	-1.4%	$11,611,170
Tuolumne County	$53,353	$51,812	-0.5%	$1,062,505
California	$68,439	$65,142	-0.8%	$1,407,535,663

California DWR defines a *disadvantaged community* as a community with an annual median household income less than 80 percent of the statewide annual median household income. Census geographies with an annual median household income less than 60 percent of the annual statewide average are considered *severely disadvantaged communities*. Also, Water Code § 79702.(k) defines an *economically distressed area* as a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 20,000 persons or less and has an annual median household income less than 85 percent of the statewide median household income with one or more of the following conditions as determined by California DWR: (1) financial hardship, (2) an unemployment rate at least 2 percent higher than the statewide average, or (3) a low population density (California DWR, n.d.). Sixty-three percent of the Turlock and Modesto sub-basin includes communities designated as *disadvantaged communities* or *severely disadvantaged communitie*s by the State of California, and sixty-seven percent are considered economically distressed areas (WTSGSA and ETSGSA, 2018).

Employment

Both projects are located at the southern end of California's Mother Lode region, which shaped the region's economy during the California gold rush of the mid- to late-1800s. The three counties in the Districts' service area had unemployment rates between 11.6 and 15.7 percent in 2016, higher than state unemployment estimates over the same period. County unemployment rates in the SFPUC service area were lower than statewide unemployment levels in California in 2016, from 5.6 percent in San Mateo County to 7.1 percent in Alameda County (table 3.3.8-3) (U.S. Census Bureau, 2016).

The largest industry by total employment in the three counties in the Districts' service area is health care and social assistance, which had approximately 46,700 full- and part-time employees in 2016. This service area is most highly specialized in farm employment with a location quotient of 5.44, indicating the area is 5.44 times more specialized in farming as compared to the state level. The area is also highly specialized in forestry, fishing, and related industries as well as in manufacturing. Large sectors, in terms of total employment, include local government, retail trade, and manufacturing (USBEA, 2017c). Much of the employment in the Districts' service area relies directly and indirectly on water from the projects, made available for agricultural purposes because of agreements with the Districts. The Districts' water supply directly supports many jobs in agriculture production (particularly vineyards), jobs that indirectly rely on farming operations (e.g., farm machinery and fertilizers), and industries that rely on agricultural commodities (e.g., wineries and food processing plants). In Stanislaus County, 11 of the 14 largest employers are in agricultural production or food processing; in Merced County, 4 of the 11 largest employers are in agricultural production or food processing. In Tuolumne County, 2 of the 6 largest employers are in hydroelectric power production (California Employment Development Department, 2018).

Table 3.3.8-3. Labor force characteristics in the study area with gross domestic product, 2016 (Source: U.S. Census Bureau, 2016; National Association of Counties, 2017; USBEA, 2017b).

Location	Civilians in Labor Force	Employed (population employed)	Unemployment (unemployment rate)	Gross Domestic Product (billions in 2017 dollars)
Alameda County	864,007	801,026 (92.7%)	61,327 (7.1%)	$121.9
Merced County	115,412	97,146 (84.2%)	18,143 (15.7%)	$9.1
San Francisco County	521,164	488,560 (93.7%)	32,234 (6.2%)	$153.9
San Mateo County	419,603	395,999 (94.4%)	23,439 (5.6%)	$93.3
Santa Clara County	1,005,037	938,545 (93.4%)	65,981 (6.6%)	$244.7
Stanislaus County	246,661	212,544 (86.2%)	33,913 (13.7%)	$21.3
Tuolumne County	22,167	19,597 (88.4%)	2,570 (11.6%)	$2.1
California	19,391,320	17,577,142 (90.6%)	1,683,726 (8.7%)	$2,619.6

For counties in the SFPUC service area, the largest industry by employment was professional, scientific, and technical services with 573,025 employees in 2016. The area is most highly specialized in the information industry and has a location quotient of 1.76. Other large sectors, in terms of total employment, include health care and social assistance, manufacturing, and accommodation and food services (USBEA, 2017c). The four counties in the SFPUC service area have fewer companies specializing in agricultural production and food processing than the three counties in the Districts' service area. Municipal and industrial water supplies are used across this four-county area to support all the businesses in this area. The gross domestic product (GDP) produced in the San Francisco-Oakland-Hayward metropolitan statistical area, which includes Alameda, San Francisco, and San Mateo Counties, was $470.5 billion in 2016. In 2016, the GDP of the San Jose-Sunnyvale-Santa Clara metropolitan statistical area, which includes Santa Clara County, was $252.5 billion (USBEA, 2017d).

Municipal and Industrial Use

The Tuolumne Watershed, where the Don Pedro and La Grange Projects are located, is an important source of water for municipal and industrial users located in the SFPUC RWS. As previously described, water released from the Don Pedro Project enters La Grange Reservoir created by the La Grange Diversion Dam. At the La Grange Project, the Districts convey water from the river for irrigation and municipal and industrial water supply. Water released from the Don Pedro Project, and not diverted by the Districts at the La Grange Project, passes through La Grange Reservoir to the lower Tuolumne River.

SFPUC supplies retail drinking water and wastewater services to San Francisco County and wholesale water to Alameda, San Mateo, and Santa Clara Counties. SFPUC's customers include 27 water agencies and water companies and approximately 2.7 million people in its service area (SFPUC, 2018). SFPUC's wholesale customers receive more than 66 percent of the water delivered by the RWS, 13 wholesale customers rely on SFPUC for 95 percent or more of their total water supply, and 8 wholesale customers rely on the SFPUC for 100 percent of their total water supply. SFPUC is the third largest supplier of water for domestic and municipal users in California, and approximately 85 percent of San Francisco's total water needs is satisfied by water delivered from the Tuolumne River. The remaining 15 percent of the water supply that CCSF needs is diverted from the combined Alameda and Peninsula Watersheds.

CCSF's water rights on the Hetch Hetchy System are junior to the most senior rights held by the Districts. The Hetch Hetchy System was authorized under the Raker Act, which has been supplemented by a series of agreements between CCSF and the Districts to reduce the effects of storage and diversion constraints imposed under the Raker Act and allowing CCSF to obtain storage credits in the new Don Pedro Reservoir. These storage credits currently equal up to 570,000 acre-feet; these credits are not delivered to CCSF but, rather, are used to ensure reliability of the Hetch Hetchy System. As part of the 1996 amendment to the Don Pedro Project license, CCSF and the Districts

entered into an agreement that required CCSF to make annual payments to the Districts in return for the Districts meeting all the minimum flow requirements for San Francisco's municipal and industrial water supply (1995 side agreement). These agreements are critical in ensuring a secure source of water to CCSF.

During fiscal year 2016–2017, SFPUC delivered an average of approximately 181 mgd to wholesale and retail customers. Wholesale customers received 116 mgd, SFPUC's retail customers received approximately 62 mgd, and retail customers outside of the SFPUC service area received 3 mgd (SFPUC, 2017).

The Districts also supply about 67,500 acre-feet of water to meet consumptive water demands in the counties in the vicinity of the projects, including water for municipal and industrial use and agricultural use. In addition to those currently served, a number of municipalities in Stanislaus County are currently interested in using Don Pedro Project water as a substitute for groundwater supplies.

Agricultural Use

According to the 2012 Census of Agriculture, the number of irrigated acres of harvested cropland in Merced County grew by almost 5 percent between 1997 and 2012 (USDA, 2014a). During this period, several businesses operating irrigated cropland consolidated, reducing the number of such businesses by approximately 20 percent. In addition, the amount of pastureland increased in size by almost 30 percent. The most notable change in cropland and pastureland occurred in Stanislaus County where the total number of irrigated acres decreased by nearly 7 percent between 1997 and 2012, matching an increase in the number of acres that were turned into pastureland over this same period (table 3.3.8-4). In 2012, approximately 5 percent of the pastureland in Stanislaus and Merced Counties was irrigated (USDA, 2014a).

Much of the harvested cropland (irrigated and non-irrigated) is dedicated to supporting the area's livestock production. In 2012, the main crops grown to support livestock were corn and alfalfa. In 2012, farmers irrigated 107,331 acres of corn in Merced County and 62,971 acres of corn in Stanislaus County for use as grain or silage. Additionally, farmers irrigated 78,019 acres of alfalfa in Merced County and 22,538 acres of alfalfa in Stanislaus County for use as hay and haylage. Much of the irrigated land is also dedicated to almond production. In 2012, 115,599 acres and 138,162 acres of almonds were cultivated in Merced and Stanislaus Counties, respectively (USDA, 2014c). Other important crops in the two counties include cotton and wheat (USDA, 2014d).

Table 3.3.8-4. Acres of irrigated harvested cropland and pastureland (with number of operations) (Source: USDA, 2004a,b; 2014a,b).

	Merced County		Stanislaus County	
Year	**Irrigated Harvested Cropland**	**Pastureland (excluding cropland and woodland)**	**Irrigated Harvested Cropland**	**Pastureland (excluding cropland and woodland)**
1997	429,715 (2,340)	317,856 (421)	320,282 (3,316)	352,075 (633)
2002	461,311 (2,169)	359,896 (591)	334,705 (2,946)	342,125 (969)
2007	458,017 (1,810)	456,195 (553)	297,053 (2,526)	403,786 (1,156)
2012	449,569 (1,769)	411,166 (556)	299,331 (2,763)	380,662 (1,210)
Net change, 1997–2012 (acres)	**4.6%**	**29.4%**	**-6.5%**	**8.1%**

Farmers in the Districts' service area annually contribute an estimated $1.232 billion directly into the local economy, including $527.9 million from crop production and $665.5 million from livestock operations. These agricultural operations support about 7,230 on-farm, full-time and part-time jobs, generating an estimated $202.5 million in labor income. The estimated $1.232 billion in annual gross agricultural production supports an additional $2.9 billion in annual output from backward-linked industries such as those that supply goods and services to agricultural operations that depend on project water for irrigation, and those forward-linked industries, such as dairies, that use grains as inputs into their operations. These forward- and backward-linked industries create another 11,670 jobs, generating $532.3 million in labor income. In 2011, Merced and Stanislaus Counties were the fifth and sixth largest counties in California as measured by gross value of agricultural production. Together, they contributed $6.5 billion, or 12.3 percent, of total gross value for the state; a significant portion of this production comes from land irrigated with water that the Districts supply. Half of the major employers in Stanislaus and Merced Counties are agriculture-related businesses.

The Don Pedro Project provides irrigation water to more than 230,000 acres of farmland in both Merced and Stanislaus Counties (Districts, 2018a). The project also indirectly supports the larger agricultural sector in and around these counties and includes suppliers that provide goods and services to farms, dairy plants, food processing facilities, creameries, food transportation companies, and point-of-sale operations, such as grocery stores. Agricultural operations support many more jobs and provide more income than the farms and their suppliers alone. For example, once a cow produces milk at a dairy, that milk can be sent to a creamery where is it further processed into yogurt, cheese, or some other milk product adding value and supporting additional jobs and income. These products are then sold to regional or national vendors that transport these goods to final points of sale, such as local specialty shops or grocery stores, thereby supporting additional jobs and income. The Districts estimated that water from the Don Pedro Project supports approximately 18,900 total jobs and $734.8 million in total annual labor income when considering both directly supported activities and forward-linked sectors. In total, the Districts provide irrigation supplies that contribute an estimated annual average of $4.1 billion in total economic output to the local economy through agricultural production and processing (Districts, 2018a).

Of the approximately 233,000 acres that are irrigated with water from the project, approximately 122,000, acres are dedicated to feed, 88,300 acres are dedicated to fruit and nuts, 20,300 acres are dedicated to field crops, and 2,600 acres are dedicated to vegetables. Milk composes the largest share of total commodity value, estimated at $537 million (annual average from 2007–2011), and cattle and calves produce another $128 million. Combined animal production makes up 55 percent of the commodity value supported by crops grown with project water. Fruit and nut production accounts for approximately $360 million of the total commodity value. The magnitude of agricultural production output in the region has given rise to a large agricultural processing sector in the region. The agricultural processing sector is conservatively estimated to create 6,540 jobs (Districts, 2018a).

Land Value

In 2012, the estimated market value of all land and buildings on average per farm was estimated to be $3.3 million in Merced County, $1.9 million in Stanislaus County, and $1.1 million in Tuolumne County (adjusted for inflation to 2017 dollars). Overall, after adjusting for inflation, average agricultural land values decreased by 9 percent in Merced County, 11 percent in Stanislaus County and 8 percent in Tuolumne County between 2007 and 2012.

Land values in the Districts' service area have been relatively stable despite the national economic recession that lasted from December 2007 to June 2009, the effects of which have been offset by high crop prices, low interest rates, and available water supplies (NBER, 2018). Additionally, cropland in the Districts' service area is valued between 30 to 50 percent higher than similar cropland in other districts served by both surface water and groundwater.

3.3.8.2 Environmental Effects

Don Pedro Project

Effects of Proposed Capital Infrastructure Improvements on Socioeconomic Resources

The Districts' proposal includes the construction of a fish exclusion barrier at the TID sluice channel entrance, a recreational foot trail, a fish counting/barrier weir, and a new boat take-out/put-in. Construction of these facilities would require employing construction personnel for 1 year. Because of the limited size of the proposed facilities, the number of construction workers is not anticipated to exceed 10 workers at any time during the construction period.

The Districts' proposed measures include the implementation of its Don Pedro Recreation Resource Management Plan. The Districts also propose to construct two facilities that would not be part of the licensed projects: two in-river infiltration galleries and an improved boater take-out facility at the Ward's Ferry Bridge to relieve congestion caused by numerous whitewater boaters who want to take advantage of peaking flows at the CCSF's Holm Powerhouse. Although the Districts propose to include the infiltration galleries as part of the Don Pedro Project, the primary purpose of these galleries is to provide water for consumptive use.

Our Analysis

Construction of the proposed facilities are unlikely to have any measurable effect on population, housing, or income in the immediate area of the projects or the study area. The temporary increase in employment associated with the construction of the proposed facilities would not be noticeable because it would consist of only specialized construction workers who may temporarily relocate to the study area for the duration of the construction of these facilities. The majority of the employees associated with project operation already live and work in the study area and the project would continue to support their existing jobs. As a result, the construction of the proposed facilities and continued operation of the projects would not generate increases in demand for local housing, strain public services, or contribute to social disruption that might be observed in other settings where larger scale or longer-term capital improvement projects have occurred.

Recreational sites would continue to provide public access to the projects, and improved recreational facilities could attract increased recreational use, and new recreational facilities would have sufficient capacity to accommodate existing and future use. The Districts' proposal to enhance certain recreational facilities would have minor, beneficial effects on the three counties in its service area—Stanislaus, Merced, and Tuolumne Counties. Initially these beneficial effects would be associated with direct and indirect spending for construction, while over time, the beneficial effects would stem from spending that would result from the marginal growth of visitors to the sites.

Effects of Proposed and Recommended Flow Regimes on Municipal and Industrial Use

The analysis of economic effects of the proposed and recommended flow regimes on municipal and industrial use is based on two documents: (1) *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area*, prepared by Dr. David Sunding (2018) for the SFPUC, and (2) the *Supplemental Reply Comments of the Bay Area Water Supply and Conservation Agency* (BAWSCA, 2018a). BAWSCA is a special district that represents the interests of the CCSF. In its analysis, BAWSCA provides the results of the CCSF water systems operations model that shows changes in water supply under each of the proposed and recommended flow regimes. The water supply shortages forecast in that model were used to predict economic impacts calculated within the Sunding study.

City and County of San Francisco—Sunding (2018) Study based on Percent Reduction in Water Supply: As described in section 3.3.8.1, *Socioeconomics, Affected Environment*, SFPUC withdrawals from Don Pedro Reservoir serve its RWS, which includes all or part of Santa Clara, San Mateo, Alameda, and San Francisco Counties. In March 2014, CCSF filed a draft report of potential socioeconomic impacts of reduced water supply within the SFPUC service area, such as the result of proposed and recommended instream flow measures included in a new Don Pedro license (Sunding, 2018). The Sunding (2018) report, filed by CCFS in January 2018, provides estimates of welfare losses, job losses, and business losses resulting from assumed shortages in the RWS supply.

The report does not attempt to predict any actions SFPUC might take to acquire new sources of water to replace water supply loss from Don Pedro Reservoir. Also, the report does not analyze the Districts' proposed instream flow recommendation or any of the recently filed alternative instream flow recommendations submitted in response to the Commission's November 30, 2017, Ready for Environmental Analysis notice.

The Sunding (2018) report estimates economic impacts based on shortages in RWS supply. These shortages are assumed to last no longer than 1 year and assume that any non-RWS water supplies are at levels recorded in planning documents during dry years. It also assumes the Districts' proposed infiltration galleries on the Tuolumne River are functional and that any increased minimum instream flow requirements would require SFPUC to contribute 51.7 percent of the increase in required flow, as stated in the original 1965 license requirement.

Because of several recent dry water years in California, the report calculates a "base year" starting with the 220 mgd demand for July 2010 to July 2011 (fiscal year) and adjusts this demand to a value considered to be more typical for weather, population, and employment. This adjusted value of 238 mgd is then increased to 243 mgd to account for the reduced non-RWS water supply availability during dry years.

The report also attempts to forecast water demand for the year 2040 using a model that estimates growth for residential households, household income, water price, employment, and conservation. The demand forecast model uses statistics to relate the estimated growth in the demand factors to generate a water demand and predicts a water demand growth of about 1 percent per year during the 30-year analysis period.

Table 3.3.8-5 shows the Sunding (2018) study results for welfare loss for the 243 mgd adjusted base year water demand and defines RWS welfare losses by consumers as an increased cost to consumers who are unable to receive water supply under current water rates, requiring the rationing of water at an estimated level. The report considers the economic welfare changes, shown in table 3.3.8-5, as the amount of money individual consumers would be willing to pay to avoid the water shortages. The welfare analysis, which is based on water prices derived from a survey of RWS users, represents a customer's willingness to pay to avoid rationed water. Those survey results suggest residential prices range from $875 to $2,975 per acre-foot, and non-residential prices range from $1,119 to $3,132 per acre-foot.

Table 3.3.8-5. Annual welfare losses—base year demand of 238 mgd (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Base Year Demand of 238 mgd (in millions of dollars)
10%	$33
20%	$93
30%	$188
40%	$322
50%	$471
60%	$703

Sunding (2018) states that the area served by the RWS is one of the largest centers of employment and economic activity in the United States. About 1.4 million jobs are located in the SFPUC service area, and firms located in this service area produce more than $366 billion in goods and services each year.

San Francisco depends on water that is imported from other areas. For this reason, Sunding (2018) finds it important to analyze the sales and employment impacts resulting from a water shortage in the commercial and industrial sector and estimates how the estimated water shortages could affect business and job losses. Table 3.3.8-6 presents the estimated effects of each percent reduction in water supply on businesses, and table 3.3.8-7 presents potential job losses.

Table 3.3.8-6. Annual estimated business losses by county (in millions of dollars) for the 238 mgd base year (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Alameda	San Francisco	San Mateo	Santa Clara	Total
10%	$0	$0	$314	$212	$526
20%	$307	$0	$668	$405	$1,380
30%	$1,456	$0	$3,676	$771	$5,904
40%	$3,143	$5,338	$5,709	$1,050	$15,240
50%	$4,098	$5,338	$8,561	$2,899	$20,896
60%	$5,704	$11,817	$11,081	$8,371	$36,973

Table 3.3.8-7. Annual potential job losses by county (in millions) for the base year demand of 238 mgd (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Alameda	San Francisco	San Mateo	Santa Clara	Total
10%	0	0	2,311	782	3,093
20%	465	0	4,296	2,253	7,014
30%	5,224	0	10,911	6,199	22,334
40%	6,559	24,489	15,278	9,768	56,094
50%	8,686	24,489	23,748	14,744	71,667
60%	12,262	54,439	29,903	23,377	119,981

In addition to informing the Districts' water supply operations modeling, SFPUC, a department of CCSF, also simulated the seven alternative flow proposals using the SFPUC water system operations model (HHLSM). The HHLSM model has been developed to include additional years from the hydrologic record that are useful for SFPUC to consider in its water supply planning; those results are included in SFPUC's analysis.

Using the HHLSM, SFPUC evaluated the proposed and alternative flow schedules at three different levels of service area demand: 238 mgd, 265 mgd, and 287 mgd. The results of SFPUC's study were presented as the amount of water rationing needed in the service area under each alternative for the three levels of service area demands.

In the report, SFPUC says that, if any of these alternative instream flow proposals were established on the Tuolumne River, it would be required to find or develop substantial amounts of new sources of water supply. Although SFPUC did not evaluate new sources of water supply in its response to instream flow recommendations, it says that the water supply rationing estimates are provided so that the effects of the proposed and alternative instream flow schedules on the amount of Tuolumne River water supply available to SFPUC can be compared.

Each of the instream flow alternatives would result in greater and more frequent water supply rationing in the SFPUC service area compared to the Districts' proposal. In each case, the estimated rationing is consistent with the SFPUC water supply planning methodology, which considers a water balance based on water supply available to SFPUC, the use of the SFPUC water supply storage facilities, and the assumed level of demand. SFPUC says that within each level of demand, the only differences between the model simulations are the proposed and alternative instream flow requirements. Table 3.3.8-8 summarizes the effects of the Districts' proposed instream flow and the seven alternative recommendations (BAWSCA, 2018a).

Under the current normal-year water demands of 238 mgd, the Districts' proposed flow regime with operational infiltration galleries would result in the same number of years of rationing as the base case, but because of the loss in water supply from greater instream flow requirements, the rationing levels would be higher under the Districts' proposed flow regime with infiltration galleries (BAWSCA, 2018b).

Modesto—Effects on the City of Modesto would also be substantial in terms of shortages of municipal and industrial water (table 3.3.8-9). The City of Modesto receives water from MID, and by purchasing water from MID, it avoids costs associated with pumping groundwater, which is the least-cost alternative to purchasing from MID. Based on an avoided cost of $143 per acre-foot for pumping groundwater, the estimated economic losses to the City of Modesto is anticipated to begin at $478,127 under baseline conditions (current operations) and increase to $956,253 for a 10 percent shortage and reach nearly $2.4 million for a 40 percent shortage (Cardno ENTRIX, 2014).

Table 3.3.8-8. Summary of effects of Tuolumne River instream flow alternatives on SFPUC water supply delivery at an annual demand of 238 mgd (Source: BAWSCA, 2018a).

	Relative Effect of the Flow Proposal and Alternatives								
	Base Case	**Amended Final License Application for the Don Pedro Project**	**California DFW**	**NMFS**	**Water Board 40%**	**FWS[a]**	**Conservation Groups**	**The Bay Institute**	**ECHO**
Total years of operation simulated	97	97	97	97	97	97	97	97	97
Years in simulations in which full supply is delivered	87	87	76	73	73	73	73	66	64
Total number of years in simulation with some level of supply rationing	10	10	21	24	24	24	24	31	33
Years with 10% rationing	10	5	0	0	0	0	0	0	0
Years with 11% to 20% rationing	0	5	0	0	0	0	0	0	0
Years with 21% to 30% rationing	0	0	0	0	0	16	16	0	0
Years with 31% to 40% rationing	0	0	0	15	15	8	8	0	0
Years with 41% to 50% rationing	0	0	12	9	0	0	0	0	0
Years with 51% to 60% rationing	0	0	9	0	9	0	0	0	0

	Relative Effect of the Flow Proposal and Alternatives								
	Base Case	**Amended Final License Application for the Don Pedro Project**	**California DFW**	**NMFS**	**Water Board 40%**	**FWS[a]**	**Conservation Groups**	**The Bay Institute**	**ECHO**
Years with 61% to 70% rationing	0	0	0	0	0	0	0	0	0
Years with 71% to 80% rationing	0	0	0	0	0	0	0	23	24
Years with 81% to 90% rationing	0	0	0	0	0	0	0	8	9

[a] On October 2, 2018, subsequent to the BAWSCA (2018) study, FWS filed revised 10(j) recommendations no. 2 (Spill Management Plan) and no. 4 (Creation of Tuolumne Partnership Advisory Committee) that replaced its original recommendations no. 2 (Maintain Minimum Streamflows in Lower Tuolumne River to Conserve Salmonids and Ecosystem Function) and no. 7 (Establish Riparian Regeneration Flows in the Lower Tuolumne River). The revised recommendations are consistent with the Districts' proposed flows with the exception that in years when spills are expected to occur, the Districts would be advised by the TPAC on how to manage spill flows to maximize the benefit for fall-run Chinook salmon floodplain rearing. The TPAC would consist of the Districts, FWS, CCSF, and other interested parties. Recommendation no. 2 stipulates that the spill management plan shall not interfere with the project's operations related to water supply management, minimum instream flow releases, flood control, and project safety. Accordingly, we conclude that FWS's revised recommendations would have the same effect on SFPUC water supply delivery as the Districts' proposed flow regime.

Table 3.3.8-9. Estimated economic losses to the City of Modesto resulting from municipal and industrial water supply shortages (Source: Cardno ENTRIX, 2014).

	Water Supply (percentage of full supply)				
Impact	**100%**	**90%**	**80%**	**70%**	**60%**
Reductions in surface water supplies from MID (acre-feet/year)	-3,131	-6,262	-9,392	-12,523	-15,654
Loss in economic value (2018 dollars)	-$478,127	-$956,253	-$1,434,380	-$1,912,507	-$2,390,634

Our Analysis

CCSF Study—As SFPUC states in its May 2018 response, if the Commission includes any of the alternative instream flow proposals in a new project license, SFPUC would be required to find and develop substantial new sources of replacement water supply. Alternative water supplies could include imported water, desalination of brackish water, local groundwater, local surface water, banked groundwater, and recycled water. To increase and diversify water supplies, SFPUC is in the process of completing its Water System Improvement Program, a $4.8 billion, multi-year capital program to upgrade the SFPUC's regional and local water systems, consisting of 87 separate projects spread over seven counties from the Sierra foothills to San Francisco.

Although CCSF's study of economic effects from a decreased water supply and its water supply rationing estimates of the proposed and alterative instream flows provide a way to compare the effects of each proposal, neither approach estimates the likely amount and cost of water supply that SFPUC would need to replace if any of these new instream flow schedules are included in a new Don Pedro Project license. As SFPUC states, as the agency responsible for providing a long-term water supply to the RWS, SFPUC would respond to any new license requirement that reduces supply from the Tuolumne River by acquiring new water resources to avoid sustaining major economic losses to jobs and businesses in the supply area.

To first estimate how proposed instream flow alternatives would reduce the current RWS water supply, we used the results of SFPUC's water simulation model filed in May 2018. But, rather than calculating amount of rationing required, we calculated the maximum reduction in RWS water supply over two extended dry periods. We examined the HHLSM's results for the recent 4-year (fiscal years 2013 to 2017) critically dry period and a previous 5-year (fiscal years 1988 to 1993) critically dry period. We examined the effects on water supply at what we assume to be a representative RWS base

year demand of 220 mgd for fiscal year 2010 and at a future demand level of 265 mgd, which we think corresponds to what we consider to be SFPUC's full use of the existing Tuolumne River's water supply in dry years based on its HHLSM simulations.

We chose RWS water deliveries of 220 mgd during fiscal year 2010–2011 (an above normal water year) for our base year because it occurred before the recent drought period and is about the same as the 223 mgd RWS water deliveries during fiscal year 2012–2013 (a dry water year). Also, as CCSF's 2008 final socioeconomic report notes, RWS conservation efforts have resulted in a decrease in water use from 1987 to 2013 despite a population increase. We also consider the recent rate increase to RWS customers resulting from the Water System Improvement Program will act to further reduce customer water demand.

Our estimate of what we consider full dry-year use (i.e., 265 mgd) of the Tuolumne River water corresponds to SFPUC's total contractual obligation to its wholesale customers of 184 mgd and an estimated future demand for the San Francisco retail area of 81 mgd. As SFPUC's simulation results show, higher RWS demand levels during dry years, such as the 297 mgd that SFPUC modelled, would cause rationing up to 30 percent under existing conditions, and, therefore, would require SFPUC to add additional water sources to sustain.

Table 3.3.8-10 presents the maximum deficits in water supply for each instream flow requirement. Both critically dry periods studied, fiscal years 2013–2017 and fiscal years 1987–1993, have the same maximum storage deficits in RWS water supply for each instream flow requirement.

Table 3.3.8-10. Maximum supply deficit in water deliveries for the critically dry periods of fiscal years 2013–2017 and 1987–1993, at the alternative instream flow proposals (thousands of acre-feet/year) (Source: staff).

Annual Demand	**220 mgd**	**265 mgd**
Base case	6	60
Amended final license application for the Don Pedro Project	19	60
FWS[a]	19	60
Conservation Groups	86	119
NMFS	99	149
Water Board	128	160
California DFW	139	178
The Bay Institute	206	252
ECHO	206	252

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018.

To estimate SFPUC's cost to replace the maximum storage deficit under each instream flow schedule, we calculated the replacement cost of our estimated deficits at the current water demand of 220 mgd and our estimated full dry-year demand of 265 mgd because water needs would grow in future years. We estimate the alternative cost to replace water storage would be $3,000 per acre-foot, which is about the estimated cost for the Bay Area Regional Desalination Project ($3,200 per acre-foot) and the Utah Board of Water Resources' recent $3,600 per acre-feet estimate of a reverse osmosis water treatment plant. As stated, in addition to the cost of conservation measures to reduce water demand, costs to SFPUC to acquire new water supplies could include the cost of imported water supplies, brackish water desalination, local groundwater, local surface water, banked groundwater, and recycled water. Although some amounts of water may be available from these sources, and possibly new technologies, at costs less than our assumed $3,000, the cost of water supplies tend to escalate rapidly when large amounts of water need to be acquired.

Table 3.3.8-11 presents our estimate of the cost to replace the maximum deficits in water supply for each instream flow alternative during both critically dry year periods studied, both at current demand and a demand level that represents a full dry-year use of the RWS allocated reservoir storage. By incurring the cost to replace the reduced water supply from any increase in instream flows, SFPUC could avoid potential job and business losses from having to ration water supplies.

Table 3.3.8-11. Cost to replace the maximum water deficit in the critically dry years of fiscal years 2013–2017 and 1987–1993, at the alternative instream flow proposals (in millions of dollars) (Source: staff).

Annual Demand	**220 mgd**	**265 mgd**
Base case	$18	$180
Amended final license application for the Don Pedro Project	$57	$180
FWS[a]	$57	$180
Conservation Groups	$258	$357
NMFS	$297	$447
Water Board	$378	$480
California DFW	$417	$534
The Bay Institute	$618	$756
ECHO	$618	$756

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018.

The cost of municipal water may also increase under the proposed and recommended flow regimes, raising the cost of living in the study area. The increased cost of water is one small factor contributing to the increased cost of living and it is unlikely, under any of the alternative flow regimes, to result in such adverse conditions as to negatively affect population growth in the study area.

Modesto—The cost of the various reductions in water supply to the city of Modesto was not estimated for the instream flow alternatives but as a reduction in surface water supplies. Although not specific to the recommended instream flow alternatives, the Districts' economic analysis provides a reasonable approach for estimating potential effects of reduced water supplies with groundwater, including the groundwater pumping cost.

Effects of Proposed and Recommend Flow Regimes on Agriculture

As described in the Affected Environment section, the Districts provide irrigation water from Don Pedro Reservoir for 230,000 acres of fruit and nut, feed, vegetable, and row crops. In 2014, the Districts filed a study with the Commission on the economic contribution of regional agriculture to show the potential socioeconomic effects of a reduced water supply on agricultural operations in the study area as the result of proposed and recommended instream flow measures for Don Pedro. The study titled *Regional Economic Impact Caused by a Reduction in Irrigation Water Supplied to Turlock Irrigation District and Modesto Irrigation District*, amended in May 2018, provides estimated changes in output, labor income, and employment associated with the proposed and recommended flow regimes (Districts, 2018a,b).

The Districts' analysis assumed that irrigation contributes directly to agricultural production, which subsequently supports other industries such as animal production, fruit and meat processing and dairy production. The Districts further assumed that historical pumping volumes of groundwater would be available and would continue to meet up to 15 percent of total annual demand for irrigation water supply.

The Districts' economic model estimated changes in annual economic output based on annual changes in available irrigation water for proposed and recommended flow regimes. Potential effects were based on modeled on-farm irrigated crop revenue, modeled dairy and livestock production, and an IMPLAN®[164] analysis of changes in labor income, employment, and total economic output. The model did not account for cumulative effects of reduced agricultural production in years following water shortages and did not consider the long-term decline in yields from stress irrigation or structural

[164] IMPLAN® is an input-output modeling software program that uses inter-industry relationships to estimate the change in economic activity that can be expected in the study area as a result of generated demand for goods and services associated with the directly affected industry (in this case, agricultural crop production).

shifts (e.g., installation of high-efficiency water systems and shifting to a different crop mix) in the local agricultural sector as a result of reduced irrigation supply. The Districts noted that farmers in the area may respond to long-term droughts by shifting farming patterns to more drought tolerant crops to offset declines in the agricultural economy, diminishing the long-term adverse effects of a change in crop production.

The Districts' model also estimated the forward-linked effects of reduced local agricultural production, including effects on wineries, meat processors, and dairies. This analysis assesses two levels of effects on forward-linked industries:

- High impact estimate—assumes that output from animal producers and crop processors is affected immediately and proportionately to a change in crop production.

- Low Impact Estimate—assumes that animal producers and crop processors can find alternative crop sources to offset 100 percent of the reduction in Districts' crop production in reduced water years.

Currently, the total volume of water released to the lower Tuolumne River downstream of the La Grange Diversion Dam is 300,923 acre-feet during a wet year and as low as 94,000 acre-feet during a critically dry year. Table 3.3.8-12 shows the percent of full demand for consumptive water uses that would be supplied during an average year, by water year type, for the proposed and recommended flow regimes and for the base case. The base case represents existing operations, under which 92 percent of demand is met, even under critically dry water years. The Districts' proposed flow regime with infiltration galleries would be nearly identical to the base case but would meet only 90 percent of demand under a critical water year. Whereas, under ECHO's recommended flow regime, only 87 percent of demand would be met during a wet water year, declining to 63 percent of demand during a critical water year.

Table 3.3.8-12 Percent of demand met for irrigation water delivered, by water year type for flow regime (Source: Districts, 2018a,b).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Base case	100%	100%	100%	100%	92%
Districts—interim	100%	100%	100%	100%	88%
Districts—with infiltration galleries	100%	100%	100%	100%	90%
FWS[a]	100%	100%	100%	100%	88/90%
NMFS	99%	100%	93%	87%	78%
California DFW	99%	100%	99%	96%	70%

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Water Board	88%	94%	68%[a]	93%[a]	69%
Conservation Groups	98%	94%	90%	88%	77%
The Bay Institute	90%	73%	72%	73%	66%
ECHO	87%	65%	63%	64%	63%

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018. Effects would be identical to the Districts' proposal with and without infiltration galleries.

[b] The Water Board's recommended flow regime would result in a 93 percent fulfillment of full demand in dry years but would drop to 68 percent in below normal water years because of the relatively few number of below normal years that occurred and because a relatively low volume of irrigation water would be provided. Dry years under this flow regime would provide relatively higher amounts of water for irrigation.

Our Analysis

Table 3.3.8-12 shows that all of the proposed and recommended flow regimes reduce the amount of water available for irrigation, ranging from 8 percent to more than 30 percent for certain water years. To estimate the economic effects on agricultural production resulting from changes to the project flow regimes, we prepared tables that combine operations data from the alternative flow regimes with economic data (tables 3.3.8-13, 3.3.8-14, and 3.3.8-15). These tables present the average annual economic impacts associated with each of the proposed and recommended flow regimes in wet, above normal, below normal, dry and critical water years. The modeling period corresponds with the Districts' hydrologic model and covers a 42-year period from 1971 to 2012. Several important assumptions inform the development of these tables. First, our baseline for estimating the economic effects of changes in agricultural production resulting from reduced irrigation deliveries is existing project operations. Second, we do not account for losses, such as evaporation or leakage, from the canals and we assume that water is not transferred into or out of the irrigation system. Finally, our analysis includes an estimated impact to other economic sectors that depend on agricultural products, such as dairies and wineries, which could face increased costs as a result of reduced availability of certain inputs.

The Districts' economic analysis estimates that water supplies provided by the project sustains 18,900 jobs in Stanislaus and Merced Counties (Districts, 2018a,b). Under the Districts' high impact estimate (as shown in table 3.3.8-14), up to 5,676 jobs could be lost under the ECHO flow regime in a critical water year (26 percent of all years). This estimate would represent 30 percent of the jobs supported by irrigation water from the project and 1.7 percent of all jobs in the three-county region included in the Districts' service area. Additionally, as shown in table 3.3.8-15, labor income would

be similarly affected; up to $293 million in labor income would be affected under the ECHO flow regime in a critical water year, representing 40 percent of all labor income supported by irrigation water from the Don Pedro Project and 1.7 percent of all labor income in the three-county region. Finally, as shown in table 3.3.8-13, effects on the economic output could be as great as $1.5 billion during a critical water year under the ECHO flow regime, which is approximately 5 percent of annual GDP in the three-county region. Base case results are presented in the tables below to provide a basis for comparing the proposed and recommended flow regimes. For the base case, economic impacts would only occur in a critical water year when full irrigation demand cannot be met.

The Districts' low impact estimate indicates that crop processors would be able to transition to alternate crops. Where reasonable alternative crop sources can be developed, the total job losses would be substantially lower, approximately 1,850 jobs, representing a decline of approximately 10 percent from baseline conditions, and a decrease of less than one percent of total employment in the three county area. Using the low impact estimate, labor income would decline by approximately $141 million, and total output would decline by 6 percent. Total output would decline by approximately $240 million, or less than 1 percent of total GDP in the three-county area. In either the high or low impact estimate, this analysis indicates the economic effects on the three-county area would be substantial and would have meaningful and lasting adverse effects on socioeconomic resources, including loss of jobs and income that would impact the overall economic conditions in the area.

Table 3.3.8-13. Average annual effects on economic output from agricultural production from reductions in irrigation deliveries associated with the alternative flow regimes, using the high impact estimate, over the 42-year modeling term (millions in 2017 dollars) (Source: Districts, 2018a,b; email regarding economic study values from J. Devine, HDR, to J. Hastreiter, FERC, filed August 29, 2018).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Base case	$0	$0	$0	$0	-$306
Districts—interim	$0	$0	$0	$0	-$442
Districts—with infiltration galleries	$0	$0	$0	$0	-$357
FWS[a]	$0	$0	$0	$0	-$442/357
NMFS	-$13	$0	-$249	-$535	-$884
California DFW	-$13	$0	$0	-$134	-$1,138

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Water Board	-$437	-$220	-$1,172	-$294	-$1,171
Conservation Groups	-$77	-$222	-$375	-$456	-$853
The Bay Institute	-$337	-$1,061	-$1,123	-$1,070	-$1,278
ECHO	-$528	-$1,284	-$1,316	-$1,316	-$1,478

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018. Effects would be identical to the Districts' proposal with and without infiltration galleries.

Table 3.3.8-14. Employment losses (number of jobs) due to effects on agricultural production compared to full demand, associated with the alternative flow regimes, using the high impact estimate (Source: Districts, 2018a,b; email regarding economic study values from J. Devine, HDR, to J. Hastreiter, FERC, filed August 29, 2018).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Base case	0	0	0	0	-1,170
Districts—interim	0	0	0	0	-1,686
Districts—with infiltration galleries	0	0	0	0	-1,369
FWS[a]	0	0	0	0	-1,686/-1,369
NMFS	-47	0	-957	-2,050	-3,395
California DFW	0	0	0	-513	-4,386
Water Board	-1,685	-836	-4,576	-1,128	-4,563
Conservation Groups	0	-828	-1,427	-1,733	-3,278
The Bay Institute	-1,292	-4,065	-4,300	-4,098	-4,934
ECHO	-2,008	-4,908	-5,030	-5,030	-5,676

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018. Effects would be identical to the Districts' proposal with and without infiltration galleries.

Table 3.3.8-15. Labor income losses due to effects on agricultural production compared to full demand, associated with the alternative flow regimes, using the high impact estimate (millions in 2017 dollars) (Source: Districts, 2018a,b; email regarding economic study values from J. Devine, HDR, to J. Hastreiter, FERC, filed August 29, 2018).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Base case	$0	$0	$0	$0	-$62
Districts—interim	$0	$0	$0	$0	-$90
Districts—with infiltration galleries	$0	$0	$0	$0	-$72
FWS[a]	$0	$0	$0	$0	-$90/72
NMFS	-$3	$0	-$50	-$107	-$176
California DFW	$0	$0	$0	-$27	-$228
Water Board	-$89	-$44	-$248	-$58	-$246
Conservation Groups	$0	-$45	-$77	-$92	-$172
The Bay Institute	-$67	-$209	-$220	-$210	-$259
ECHO	-$104	-$253	-$260	-$260	-$293

[a] Based on FWS's revised 10(j) recommendations filed on October 2, 2018. Effects would be identical to the Districts' proposal with and without infiltration galleries.

Because the effects presented in tables 3.3.8-13, 3.3.8-14, and 3.3.8-15 do not show the economic impacts that could accumulate over multiple dry years of drought conditions, the effects could be greater than shown in tables 3.3.8-13, 3.3.8-14, and 3.3.8-15 during extended droughts. Agricultural production, animal production, and food processes may be able to withstand temporary effects of one dry year, whereas consecutively occurring dry water years could contribute to permanent losses in agriculture as farmers lay off labor, have fallow fields, and require agricultural processors and consumers to look for other vendors to provide agricultural products. Flow regimes that result in lengthy consecutive annual reductions in irrigation water supply are likely to shrink the regional agricultural sector. Tables 3.3.8-13, 3.3.8-14, and 3.3.8-15 show that the largest changes in flow regime, those associated with California DFW, the Water Board, ECHO, and The Bay Institute, would have 3 to 5 times the level of adverse economic impacts compared to the Districts' proposed flow regimes.

Finally, the Districts state that the availability and reliability of affordable water and electricity from the Don Pedro Project would also affect land values, particularly agricultural land values. The Districts determined that the land values in its service area

have a clear premium compared to land values in other nearby regions that do not have access to surface or groundwater supplies, and that there was a clear value differential when comparing irrigated cropland to rangeland without water supplies. Although other factors that drive land value are not attributable to water supply, reliable surface water supplies provided by the Don Pedro Project likely have a positive influence on land values. It is expected that the conversion of high-value cropland (such as almond orchards) to lower value cropland (such as annual silage crops) or pastureland would decrease the value of the land permanently. The exact decline in land value associated with agricultural and water supply losses is unknown but is expected to have a significant effect on the region under flow regimes that cause greater reductions in water supply.

Over time, individual farmers may react to shortages of water and increased cost of replacement water, if available, in a number of ways that may temper some of the socioeconomic impacts of the proposed and recommended flow regimes. For example, at their own expense, farmers may choose to switch to less water intensive crops or install more efficient irrigation systems. These business decisions would be made at the individual farm level and are not quantified in our analysis. Nonetheless, the economic effects of the recommended flow regimes, in particular the recommendations by the California DFW, the Water Board, The Bay Institute, Conservation Groups, and ECHO, would have substantial socioeconomic effects on the region.

La Grange Project

The La Grange Project does not store water for consumptive use, provides no flood control benefits, and has no recreational facilities associated with the project or La Grange Reservoir. Therefore, the Districts' proposal would not result in any adverse effects on socioeconomic resources.

3.3.8.1Cumulative Effects

The Districts play key roles in the agricultural economies of Stanislaus and Merced Counties and the entire San Joaquin Valley. Through the Don Pedro Project, the Districts provide highly reliable water supplies to their customers, including consistent annual deliveries of high-quality surface water to maintain crops during periods of drought. With the reliable water supply available, growers and producers have invested heavily in high-valued perennial crops, such as almonds and peaches, and dairy production, resulting in the development of a large complex of agricultural support industries in the area. Dry and drought conditions over multiple years would have cumulative impacts on agricultural production, including structural shifts in the local agricultural economy as livestock and dairy producers turn to alternate sources of feed and incur additional costs for feed, and almond growers move to more efficient methods of irrigation.

The Hetch Hetchy System supplies 85 percent of the water supply for CCSF and its 27 wholesale customers in the RWS. The outcome of the project licensing process could affect future water supply available to the Bay Area from the Hetch Hetchy

System. Under certain circumstances, the Districts and CCSF share responsibility for meeting FERC license requirements in the lower Tuolumne River downstream of the Don Pedro Project. Additionally, demand for municipal and industrial water supply is expected to continue to increase, in part as a result of expected population growth in the study area. The projects would provide increasing value as a result of increased demand for reliable water sources. Because the proposed and recommended flow regimes would reduce the availability of municipal and industrial water supplies, the adverse effects of reductions in supply would also increase in the future as demand increases.

Don Pedro Reservoir provides 340,000 acre-feet of flood control storage, which provides flood control benefits along the Tuolumne and San Joaquin Rivers. Use of the Don Pedro Project spillway during flood conditions has occurred only twice since dam construction. Flood control provides financial security to homeowners, businesses, and landowners located along the rivers, and supports ongoing development downstream of the project. The La Grange Project provides no flood control benefits.

The projects would provide minor cumulative benefits to socioeconomic resources near them in the form of electricity generated and employment opportunities. These benefits have existed since hydroelectric generation began at the project in 1924 and would continue throughout the next 30 to 50 years if the Commission were to grant a license for the projects.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the projects would continue to operate as they have in the past. None of the Districts' proposed measures or the resource agencies' recommendations and mandatory conditions would be required. None of the staff-recommended measures would be implemented, including measures to enhance environmental conditions for fish and wildlife within the project and measures that would expand and improve recreation opportunities.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Don Pedro and La Grange Projects' use of the Tuolumne River for hydropower purposes to see what effect various environmental measures would have on the projects' costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[165] the Commission compares current project costs to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower projects' power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

As currently operated, the Don Pedro Project has an authorized installed capacity of 168.015 MW and generates an average of 612,967 MWh annually (based on operation model results); the La Grange Project has a capacity of 4.7 MW and generates an average of 18,077 MWh annually.

Tables 4.1-1 and 4.1-2 summarize the assumptions and economic information we use in our analyses. The Districts provided this information in their license applications. We find that the values provided by the Districts are reasonable for the purposes of our analyses. Cost items common to all alternatives include taxes and insurance costs, net investment (the total investment in power plant facilities remaining to be depreciated),

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[165] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

estimated future capital investment required to maintain and extend the life of plant equipment and facilities, relicensing costs, normal operation and maintenance cost, and Commission fees.

Table 4.1-1. Parameters for the economic analysis of the Don Pedro Project (Source: Districts, as modified by staff).

Parameter	Value
Period of analysis (years)	30
Period of financing (years)	20
Net investment, $[a]	63,014,000
Relicensing cost, $[b]	21,398,960
Current and proposed operation and maintenance, $/year[c]	9,629,530
Tax status	Exempt
Commission fees, $/year[d]	345,730
Composite energy rate ($/MWh)[e]	62.20
Capacity rate ($/MW-year)[f]	48.65
Interest rate[g]	3.5
Discount rate[h]	5.0

[a] Net investment is the depreciated project investment allocated to power purposes. The value provided by the Districts (2017c, in AIR response 5(d)) was depreciated to 2018 dollars.

[b] Relicensing costs include the administrative, legal/study, and other expenses to date. The value provided by the Districts (2017a) was escalated to 2018 dollars.

[c] Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license. The values provided by the Districts (2017a) were escalated to 2018 dollars.

[d] Commission fees are based on statements of annual charges from the Commission for use of federal lands and administrative charges based on authorized capacity.

[e] The Districts provided an on-peak energy rate of $67/MWh (60 percent of annual generation) and an off-peak energy rate of $55/MWh (40 percent), which results in a composite energy rate of $62.20/MWh (2017c, in AIR response 5(c)).

[f] Source: Districts (2017c, in AIR response 5(d)).

[g] Source: Districts (2017c, in AIR response 5(d)).

[h] Rate assumed by staff.

Table 4.1-2. Parameters for the economic analysis of the La Grange Project (Source: Districts, as amended by staff).

Parameter	Value
Period of analysis (years)	30
Period of financing (years)	20
Net investment, $[a]	4,370,800
Relicensing cost, $[b]	4,921,760
Current and proposed operation and maintenance, $/year[c]	482,550
Tax status	Exempt
Commission fees, $/year[d]	5,150
Composite energy rate ($/MWh)[e]	62.20
Capacity rate ($/MW-year)[f]	48.65
Interest rate[g]	3.5
Discount rate[h]	5.0

[a] Net investment is the depreciated project investment allocated to power purposes. The value provided by the Districts (2017d, in AIR response 2(a)) was depreciated to 2018 dollars.

[b] Relicensing costs include the administrative, legal/study, and other expenses to date. The value provided by the Districts (2017d, in AIR response 2(a)) was escalated to 2018 dollars.

[c] Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license. The values provided by the Districts (2017b, exhibit E, section 4.1.3) were escalated to 2018 dollars.

[d] Commission fees were estimated by staff for use of federal lands and administrative charges based on installed capacity.

[e] The Districts provided an on-peak energy rate of $67/MWh (assumed 60 percent of annual generation, same as Don Pedro) and an off-peak energy rate of $55/MWh (40 percent), which results in a composite energy rate of $62.20/MWh (Districts 2017d, AIR response 2(d)).

[f] Source: Districts (2017d, AIR response 2(e)).

[g] Source: Districts (2017d, AIR response 2(c)).

[h] Rate assumed by staff.

4.2 COMPARISON OF ALTERNATIVES

4.2.1 Don Pedro Project

Table 4.2.1-1 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this draft EIS for the Don Pedro Project: no action, Districts' proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4.2.1-1. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Don Pedro Hydroelectric Project (Source: staff).

	No Action	Districts' Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity (MW)	168.015	232.5	232.5	232.5
Annual generation (MWh)	612,967	633,412	633,412	633,412
Dependable capacity (MW)	168	220	220	220
Annual cost of alternative power ($ and $/MWh)	46,297,400 75.53	50,102,890 79.10	50,102,890 79.10	50,102,890 79.10
Annual project cost ($ and $/MWh)	14,958,750 24.40	21,238,590 33.53	15,674,290 24.75	16,874,840 26.64
Difference between the cost of alternative power and project cost ($ and $/MWh)	31,338,650 51.13	28,864,300 45.57	34,428,600 54.35	33,228,050 52.46

4.2.1.1 No-action Alternative

Under the no-action alternative, the Don Pedro Project would continue to operate as it does now. The project has an installed capacity of 168.015 MW and a dependable capacity of 168 MW, and it generates an average of 612,967 MWh of electricity

annually. The average annual cost of alternative power (energy and capacity) would be $46,297,400, or about $75.53/MWh. The average annual project cost of operating the project would be $14,958,750, or about $24.40/MWh. Overall, the project would produce power at a cost that is $31,338,650, or $51.13/MWh, less than the cost of alternative power.

4.2.1.2 Districts' Proposal

The Districts' proposed environmental measures and recreational resource measures are presented in table 4.3-1 in section 4.3, *Cost of Environmental Measures*.

The Districts propose to upgrade Units 1, 2, and 3 at the Don Pedro Project. The upgrades would increase the installed capacity by 64,485 kilowatts (kW) from 168,015 kW to 232,500 kW and would increase the annual generation by approximately 20,445 MWh from 612,967 to 633,412 MWh. The annual generation would have a value of $1,271,680. The capital cost is projected to be $48,800,000 in 2016 dollars ($51,328,500 in 2018 dollars). The levelized annual cost of the construction would be $3,030,280. Therefore, the annual cost would be less than the cost of alternative power by $1,758,600 ($2.78/MWh).

As proposed by the Districts, the Don Pedro Project would have an installed and dependable capacity of 220 MW and generate an average of 633,412 MWh of electricity annually. The average annual cost of alternative power would be $50,102,890, or about $79.10/MWh. The average annual project cost of operating the project would be $21,238,590, or about $33.53/MWh. Overall, the project would produce power at a cost that is $28,864,300, or $45.57/MWh, less than the cost of alternative power.

4.2.1.3 Staff Alternative

Table 4.3-1 in section 4.3, *Cost of Environmental Measures*, also shows the staff-recommended measures, including additions, deletions, and modifications to the Districts' proposed environmental protection and enhancement measures along with the estimated cost of each.

As proposed by staff, the project would have an installed and dependable capacity of 220 MW and generate an average of 633,412 MWh of electricity annually. The average annual cost of alternative power would be $50,102,890, or about $79.10/MWh. The average annual project cost of operating the project would be $15,674,290, or about $24.72/MWh. Overall, the project would produce power at a cost that is $34,428,600, or $54.35/MWh, less than the cost of alternative power.

4.2.1.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative with the exception of the addition of mandatory conditions that were not adopted in the staff alternative, and the exclusion of staff-recommended measures that would conflict or be redundant with the mandatory conditions. This alternative would have an installed and dependable capacity of 220 MW

and generate an average of 633,412 MWh of electricity annually. The average annual cost of alternative power would be $50,102,890, or about $79.10/MWh. The average annual project cost of operating the project would be $16,874,840, or about $26.64/MWh. Overall, the project would produce power at a cost that is $33,228,050, or $52.46/MWh, less than the cost of alternative power.

4.2.2 La Grange Project

Table 4.2.2-1 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this draft EIS for the La Grange Project: no action, Districts' proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4.2.2-1. Summary of the annual cost of alternative power and annual project cost for the alternatives for the La Grange Hydroelectric Project (Source: staff).

	No Action	**Districts' Proposal**	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Installed capacity (MW)	4.7	4.7	4.7	4.7
Annual generation (MWh)	18,077	18,077	18,077	18,077
Dependable capacity (MW)	4.7	4.7	4.7	4.7
Annual cost of alternative power ($ and $/MWh)	1,353,060 74.85	1,353,060 74.85	1,353,060 74.85	1,353,060 74.85
Annual project cost ($ and $/MWh)	1,031,160 57.04	881,120 48.74	934,680 51.71	902,250 49.91
Difference between the cost of alternative power and project cost ($ and $/MWh)	321,900 17.81	471,940 26.11	418,380 23.14	450,810 24.94

4.2.2.1 No-action Alternative

Under the no-action alternative, the La Grange Project would continue to operate as it does now. The project has an installed and dependable capacity of 4.7 MW and

generates an average of 18,077 MWh of electricity annually. The average annual cost of alternative power (energy and capacity) would be $1,353,060, or about $74.85/MWh. The average annual project cost of operating the project would be $1,031,160, or about $57.04/MWh. Overall, the project would produce power at a cost that is $321,900, or $17.81/MWh, less than the cost of alternative power.

4.2.2.2 Districts' Proposal

The Districts' proposed environmental measures and recreational resource measures are presented in table 4.3-1 in section 4.3, *Cost of Environmental Measures*.

As proposed by the Districts, the project would have an installed and dependable capacity of 4.7 MW and generate an average of 18,077 MWh of electricity annually. The average annual cost of alternative power would be $1,353,060, or about $74.85/MWh. The average annual project cost of operating the project would be $881,120, or about $48.74/MWh. Overall, the project would produce power at a cost that is $471,940, or $26.11/MWh, less than the cost of alternative power.

4.2.2.3 Staff Alternative

Table 4.3-2 in section 4.3, *Cost of Environmental Measures*, also shows the staff-recommended measures, including additions, deletions, and modifications to the Districts' proposed environmental protection and enhancement measures along with the estimated cost of each.

As proposed by staff, the project would have an installed and dependable capacity of 4.7 MW and generate an average of 18,077 MWh of electricity annually. The average annual cost of alternative power would be $1,353,060, or about $74.85/MWh. The average annual project cost of operating the project would be $934,680, or about $51.71/MWh. Overall, the project would produce power at a cost that is $418,380, or $23.14/MWh, less than the cost of alternative power.

4.2.2.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative with the exception of the addition of mandatory conditions that were not adopted in the staff alternative, and the exclusion of staff-recommended measures that would conflict or be redundant with the mandatory conditions. This alternative would have an installed and dependable capacity of 4.7 MW and generate an average of 18,077 MWh of electricity annually. The average annual cost of alternative power would be $1,353,060, or about $74.85/MWh. The average annual project cost of operating the project would be $902,250, or about $49.91/MWh. Overall, the project would produce power at a cost that is $450,810, or $24.94/MWh, less than the cost of alternative power.

4.3 Cost of Environmental Measures

Table 4.3-1 gives the cost of each of the environmental enhancement measures considered in our analysis for the Don Pedro Project and table 4.3-2 gives the cost of each of the environmental enhancement measures considered in our analysis for the La Grange Project. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4.3-1. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Don Pedro Hydroelectric Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
General				
1. Reduce the minimum reservoir level from elevation 600 feet to 550 feet.	Districts, staff	$0	$0	$0
Geology and Soil Resources				
1. Develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the project. (Water Board preliminary 401 condition 9)	Water Board	$10,000[d]	$4,000[d]	$4,590
2. Develop an erosion control plan for actions affecting BLM lands that are within or adjacent to the project boundary. (BLM Don Pedro revised 4(e) condition 3)	BLM, staff	$5,000[d]	$0[e]	$300
3. Develop a soil erosion and sediment control plan for all project construction activities authorized by the license.	Staff	$0[f]	$0[f]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
4. If the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Districts must consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity. (BLM Don Pedro revised 4(e) condition 35)	BLM	$0	$0[f]	$0
Aquatic Resources				
1. Establish an ecological group and host annual meeting. (FWS Don Pedro 10(j) recommendation 12, California DFW 10(a) recommendation M3-1, Conservation Groups recommendation 3)	FWS, California DFW, Conservation Groups	$0	$25,000[d]	$25,000
2. Create the TPAC. (FWS revised 10(j) recommendation 4)	FWS, Districts	$0	$25,000[d]	$25,000
3. Develop a coordinated operations plan. (California DFW 10(a) recommendation M3-2)	California DFW	$20,000[d]	$10,000[d]	$11,180

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
4. Maintain the minimum streamflows identified in table 5.6-2 of Exhibit E in the Don Pedro amended final license application, which provides two sets of flow requirements: (1) interim flows to be released until the infiltration galleries are operational and (2) flows to be provided after the infiltration galleries are operational.	Districts	$0	$50,200 (energy loss 807 MWh)[g]	$50,200
5. Maintain the interim minimum streamflows identified in table 5.6-2 of Exhibit E in the Don Pedro amended final license application for the duration of the license.	Staff	$0	$50,200 (energy loss 807 MWh)[h]	$50,200
6. Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7 to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.	Districts, staff	$0	-$9,330 (150 MWh energy gain – negative cost)[g]	-$9,330

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
7. Develop a spring pulse flow release plan to encourage salmonid smolt outmigration and increase survival.	Districts, staff	$5,000[d]	-$67,740 (1,089 MWh energy gain – negative cost)[g]	-$67,450
8. Provide gravel mobilization flows of 6,000 to 7,000 cfs during years when sufficient spill is projected to occur.	Districts, staff	$0	$32,830[g]	$32,830
9. Implement the FWS Spill Management Plan. (FWS revised 10(j) recommendation 2)	FWS, Districts, staff	$10,000[i]	$9,060[i]	$9,650
10. Provide minimum instream flows downstream of La Grange Diversion Dam. (NMFS 10(a) recommendations 1.1 and 1.2)	NMFS	$0	$90,310 (energy loss 1,452 MWh)[j]	$90,310
11. Provide seasonal pulse flows in the lower Tuolumne River. (NMFS 10(a) recommendation 1.3)	NMFS	$0	-$262,920 (energy gain 4,227 MWh)[j]	-$262,920
12. Provide minimum instream flows to be specified by the Water Board. (Water Board preliminary 401 conditions 1 and 2)	Water Board	$0	$13,250 (energy loss 213 MWh)[k]	$13,250

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
13. Provide the year-round minimum instream flows and minimum Don Pedro Reservoir storage requirements recommended by California DFW. (California DFW 10(a) recommendation M1-2 and M1-4)	California DFW	$0	$674,560 (energy loss 10,845 MWh)[j]	$674,560
14. Provide for release of spring floodplain activation flows. (California DFW 10(a) recommendation M1-5)	California DFW	$0	$0 (no energy change)[j]	$0
15. Provide geomorphic flood pulse flows. (California DFW 10(a) recommendation M1-9)	California DFW	$0	-$680 (energy gain 11 MWh (negative cost))[j]	-$680
16. Provide an adult Chinook salmon fall attraction pulse. (California DFW 10(a) recommendation M1-7)	California DFW	$0	$0[j]	$0
17. Provide The Bay Institute's recommended minimum flows and pulse flows.	The Bay Institute	$0	-$610,000 (energy gain 9,787 MWh (negative cost))[g]	-$610,000
18. Provide the Conservation Groups' recommended minimum flows and pulse flows. (Conservation Groups recommendation 1.C.1 and 3-6)	Conservation Groups	$0	$1,279,520 (energy loss 20,571 MW MWh)[j]	$1,279,520

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
19. Provide 60% of the unimpaired flow from February to June to protect salmon. (ECHO recommendation 1)	ECHO	$0	$638,610 (energy loss 10,267 MWh)[g]	$638,610
20. Develop a drought plan if three or more consecutively dry and/or critically dry water years occur. (NMFS 10(a) recommendation 1.6)	NMFS	$10,000[d]	$800[d]	$390
21. Develop a drought plan, in consultation with FWS, NMFS, BLM, the Water Board, and California DFW, that identifies the conditions under which license requirements would be temporarily modified during prolonged drought conditions and how the project would be operated when drought conditions occur.	Staff	$5,000[d]	$0	$300
22. Develop a plan to include monitoring of water temperatures in Don Pedro Reservoir and in the lower Tuolumne River whenever reservoir elevations are lower than 600 feet.	Staff	$10,000[l]	$2,540[l]	$3,130

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
23. Develop a stream flow and reservoir level compliance plan in consultation with FWS, NMFS, the Water Board, and California DFW. (Water Board preliminary 401 condition 3)	Water Board, staff	$5,000[d]	$1,000[d]	$1,300
24. Develop a streamflow and reservoir level compliance monitoring plan to include monitoring flow downstream of the infiltration galleries. (FWS Don Pedro 10(j) recommendation 1, California DFW 10(a) recommendation M1-1)	FWS, California DFW	$5,000[d]	$1,000[d]	$1,300
25. Install a flow gage near RM 25 that is capable of recording up to 8,000 cfs. (FWS Don Pedro 10(j) recommendation 1, NMFS 10(a) recommendation 1.4, California DFW 10(a) recommendation M1-1, Conservation Groups recommendation I.C.2)	FWS, NMFS, California DFW, Conservation Groups	$50,000[d]	$1,000[d]	$3,950
26. Implement the Spill Prevention and Countermeasure Management Plan filed with the Don Pedro amended final license application.	Districts	$0	$0	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
27. Develop a hazardous substance plan. (BLM Don Pedro revised 4(e) condition 43)	BLM, staff	$0[m]	$0[m]	$0
28. Modify the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application) in consultation with the Water Board, California DFW, FWS, and NMFS. (Water Board preliminary 401 condition 10)	Staff, Water Board[n]	$10,000[d]	$0[f]	$590
29. Develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches. (Water Board preliminary 401 condition 6)	Water Board	$0	$85,000[o]	$85,000
30. Develop a plan to monitor water temperature in Don Pedro Reservoir, La Grange Reservoir, and lower Tuolumne River. (Water Board preliminary 401 condition 7)	Water Board	$0	$360,000[o]	$360,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
31. Establish temperature gages co-located with the recommended flow gage near RM 25 and a new temperature gage near Robert's Ferry Bridge crossing at RM 39.5 and file annual water temperature monitoring reports with resources agencies and the Commission that describe the magnitude and duration of any temperature exceedance events. (NMFS 10(a) recommendations 1.4 and 1.5)	NMFS	$11,600[d]	$10,000[d]	$10,690
32. Develop a water temperature monitoring/compliance plan. (FWS Don Pedro 10(j) recommendation 6, California DFW 10(a) recommendation M2)	FWS, California DFW	$0	$360,000[o]	$360,000
33. Develop a facilities salmonid protection and monitoring plan to provide for fish protection at project facilities. (California DFW 10(a) recommendation M8-1)	California DFW	$25,000[d]	$75,000[o]	$76,580

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
34. Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5 to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat. (Districts RPM-6)	Districts	$11,465,520	$620,570	$1,297,460
35. Install fish counting weir and installation of a temporary weir to capture and remove non-salmonid piscivorous fish in critically dry years. (Conservation Groups recommendation 7)	Conservation Groups	$0	$633,300º	$633,300
36. Implement a predator control and suppression program that would involve active control and suppression of striped bass and black bass upstream and downstream of the proposed barrier weir.	Districts	$152,850	$195,720	$204,740

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
37. Modify the Predator Control and Suppression Plan to include recommendations for temperature requirements, floodplain activation and spring recession flows, sediment and LWM placement to favor native fish over non-native predators, performance measures, and monitoring and reporting. (California DFW 10(a) recommendation M6-1 and M6-2)	California DFW	$200,000[p]	$195,720[p]	$207,520
38. Implement a fall-run Chinook salmon spawning superimposition reduction program.	Districts	$2,840,080	$37,620	$205,290
39. Develop a fish passage program plan. (NMFS 10(a) recommendation 5)	NMFS	$2,500[q]	$205,960[q]	$206,110
40. Conduct a 5-year program of experimental gravel cleaning, including interstitial fines before and after gravel cleaning.	Districts	$1,222,800	$124,820	$197,010
41. Conduct coarse sediment augmentation in the Tuolumne River between RM 39 and RM 52 over a 10-year period, annual spawning surveys for 5 years, and a spawning gravel evaluation in year 12.	Districts	$5,196,400	$52,860	$418,670

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
42. Conduct sediment enhancement and management. (NMFS 10(a) recommendation 2)	NMFS	$51,982,460[r]	$63,440[r]	$3,132,330
43. Update the 2004 coarse sediment management plan, annual placement of sediment to minimize predation habitat (hot spots), and annual gravel augmentation. (California DFW 10(a) recommendation M4-1, M4-2, M4-3)	California DFW	$205,682,620[s]	$63,440[s]	$12,206,340
44. Gravel augmentation and rehabilitation and reduction of habitat for piscivorous fish. (Conservation Groups recommendation 6)	Conservation Groups	$205,682,620[s]	$63,440[s]	$12,206,340
45. Develop a coarse sediment management plan, in consultation with NMFS, FWS, California DFW, and the Water Board, that includes a gravel augmentation program to mitigate annual project effects on gravel supply in the lower Tuolumne River. (Water Board preliminary 401 condition 5)	Water Board[n], staff	$705,390[t]	$0[t]	$41,640

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
46. Revise the Woody Debris Management Plan for Don Pedro Reservoir to include rapid removal and supply specific sizes and amounts of LWM for restoration projects. (FWS Don Pedro 10(j) recommendation 9)	FWS	$5,000[d]	$25,000[d]	$25,300
47. Collect, sort and place 80 to 100 pieces of LWM per year in the lower Tuolumne River to achieve and maintain 100 LWM pieces per mile in four restoration reaches. (NMFS 10(a) recommendation 3)	NMFS	$5,000[d]	$75,000[d]	$75,300
48. Design a large woody debris placement and management plan that includes specific targets for the number (maintain a total of 1,600 pieces) and size of LWM to be placed in the lower Tuolumne River. (California DFW 10(a) recommendation M4-4, 5 and 6; Conservation Groups recommendation 5)	California DFW, Conservation Groups	$5,000[d]	$75,000[d]	$75,300

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
49. Develop, in consultation with FWS, NMFS, and California DFW, a LWM management plan to mitigate project effects on LWM supply in the lower Tuolumne River. (Water Board preliminary 401 condition 4).	Water Board[n], staff	$5,000[d]	$75,000[d]	$75,300
50. Increase floodplain rearing habitat for juvenile salmonids. (Conservation Groups recommendation 4)	Conservation Groups	$36,550,000[u]	$0	$2,157,810
51. Develop a floodplain rearing habitat restoration plan. (California DFW 10(a) recommendation M5-1, Conservation Groups recommendation 4)	California DFW, Conservation Groups	$26,843,690[u]	$7,350[u]	$1,592,120
52. Restore and create floodplain rearing habitat. (California DFW 10(a) recommendation M5-2)	California DFW	$50,000,000[d]	$0	$2,951,850
53. Develop a monitoring plan for floodplain habitat restoration projects. (California DFW 10(a) recommendation M5-3)	California DFW	$10,000[v]	$11,960[v]	$12,550
54. Remove construction damage caused during building of New Don Pedro Dam and related Tuolumne River restoration in the area of Buck Flat. (Tuolumne River Conservancy)	Tuolumne River Conservancy	$250,000[o]	$0	$14,760

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
55. Implement the FWS Lower Tuolumne River Habitat Improvement Program. (FWS revised 10(j) recommendation 3)	FWS, Districts	$28,927,920[w]	$1,000,000[w]	$2,707,820
56. Develop a salmonid monitoring plan. (NMFS 10(a) recommendation 4)	NMFS	$5,000[d]	$915,000[o]	$915,000
57. Develop a salmonid monitoring plan. (FWS Don Pedro 10(j) recommendation 5)	FWS	$5,000[d]	$885,000[o]	$885,000
58. Develop a salmonid monitoring plan. (California DFW 10(a) recommendations M11-1, 11-2, and 11-3)	California DFW	$5,000[d]	$800,000[o]	$800,000
59. Develop a fisheries genetic management plan and a conservation hatchery plan. (California DFW 10(a) recommendation M7-1)	California DFW	$5,000[d]	$1,090,000[o]	$1,090,000
60. Provide for reservoir fish stocking. (California DFW 10(a) recommendation M7-2)	California DFW	$0	$140,000[o]	$140,000
61. Implement the Aquatic Invasive Species Management Plan filed with the Don Pedro amended final license application.	Districts	$0	$25,000[d]	$25,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
62. Develop an Aquatic Invasive Species Management Plan that includes additional measures to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. (BLM Don Pedro revised 4(e) condition 6, California DFW 10(a) recommendation M10)	BLM, California DFW, staff	$0[x]	$0[x]	$0
63. Modify the Aquatic Invasive Species Management Plan (filed as appendix E-4 of the Don Pedro amended final license application) to include the requirements in BLM Don Pedro revised 4(e) conditions 6 and a provision to reassess the vulnerability of Don Pedro Reservoir for the introduction of non-native dreissenid mussel species. (Water Board preliminary 401 condition 8)	Water Board[n], staff	$5,000[d]	$26,000[d]	$26,300

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Terrestrial Resources				
1. Provide for annual environmental training for employees and contractors, rather than bi-annual as proposed. (BLM Don Pedro revised 4(e) condition 2, FWS Don Pedro 10(j) recommendation 10, California DFW 10(a) recommendation M9-1.6, M9-4.1)	BLM, FWS, California DFW	$0	$2,000[d]	$2,000
2. Require the Districts to host an annual consultation meeting with the resource agencies and interested stakeholders to discuss management of special-status species. (BLM Don Pedro revised 4(e) condition 9, California DFW 10(a) recommendations M3-1 and M9-1.7)	BLM, California DFW	$0	$2,000[d]	$2,000
3. Annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM within the project boundary. (BLM Don Pedro revised 4(e) condition 9, FWS Don Pedro 10(j) recommendation 8, California DFW 10(a) Recommendation M9-1.9)	BLM, FWS, California DFW	$0	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
4. Shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years.	Districts, staff	$0	$0[f]	$0
5. Shape the descending limb of the snowmelt runoff hydrograph to ensure that flows are not reduced by more than 7 to 10 percent (depending on flow volume) of the previous day's 24-hour average flow. (NMFS 10(a) recommendation 1.7)	NMFS	$0	-$270,630 (energy gain 2,269 MWh plus energy gain 2,082 MWh)[y]	-$270,630
6. Follow a spring recession rate during the month of June each year following the flow rates specified in table 3.3.2-33 and 3.3.2-34. (California DFW 10(a) recommendation M1-6)	California DFW	$0	-$96,220 (energy gain 1,547 MWh)[j]	-$96,220
7. Provide a riparian recession flow in above normal, below normal, and dry water years to allow a multi-day ramp-down at specified rates to base flow from the flow value on the final day of any water year ("Recession Initiation Flow Value") on which minimum flows are determined by a percent of unimpaired flow. (Conservation Groups recommendation 2.C.7)	Conservation Groups	$0	$152,760 (energy loss 2,456 MWh)[z]	$152,760

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
8. Implement the TRMP filed as appendix E-6 of the Don Pedro amended final license application.	Districts	$0	$329,190	$329,190
9. Develop a revised TRMP for the Don Pedro Project. (BLM Don Pedro revised 4(e) condition 7, FWS 10(j) recommendation 11, California DFW 10(a) recommendation M9-4.1)	BLM, FWS, California DFW, staff	$10,700[d]	$0[f]	$630
10. Modify the Don Pedro TRMP to include pre-construction surveys by a qualified biologist for special-status or threatened and endangered species before the start of any project-related ground disturbance involving heavy machinery, where suitable habitat exists, and implementation of 50-foot buffers around special-status or threatened and endangered plants, marked with flagging or fencing, prior to the implementation of vegetation management or ground-disturbing activities	Staff	$0	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
11. Modify the Don Pedro TRMP to include focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; using manual control of noxious weeds in areas with sensitive resources; and control measures for the giant reed population on the Don Pedro Powerhouse access road. (BLM Don Pedro revised 4(e) condition 7)	BLM, staff	$0	$1,100[aa]	$1,100
12. Modify the Don Pedro TRMP to include surveys every 5 years for special-status plants in several specified areas subject to project operations and maintenance activities or recreational use. (BLM Don Pedro revised 4(e) condition 7, California DFW 10(a) recommendation M9-4)	California DFW	$0	$4,400[bb]	$4,400
13. Modify the Don Pedro TRMP to include surveys for special-status plants within the Red Hills ACEC every 5 years and every 10 years elsewhere within the project boundary. (BLM Don Pedro revised 4(e) condition 7)	BLM, staff	$0	$6,830[cc]	$6,830

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
14. Modify the Don Pedro TRMP to include: (1) pre-construction surveys for special-status plants prior to any ground disturbance, rather than the proposed 0.5-acre minimum threshold; (2) installation of interpretive signs about the unique plants of the Red Hills ACEC; (3) procedures for project staff to recognize and report occurrences of special-status plants; and (4) consultation with the BLM to develop specific usage plans for areas around known occurrences of special-status plants that could be affected by recreational use. (BLM Don Pedro revised 4(e) condition 7, California DFW 10(a) recommendation M9-4)	BLM, California DFW	$10,000[d]	$3,000[d]	$3,590
15. Modify the Don Pedro TRMP to include: (1) pre-construction surveys for special-status plants prior to any project-related ground disturbance requiring heavy machinery (rather than the proposed 0.5-acre minimum threshold); (2) installation of interpretive signs about the unique plants of the Red Hills.	Staff	$8,000[d]	$3,000[d]	$3,470

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
16. Modify the Don Pedro TRMP, including (1) protocols for collecting field signs of white nose syndrome during bat surveys; and (2) public education actions to avoid and minimize impacts at recreation facilities. (California DFW 10(a) recommendation M9-3.2)	California DFW	$0	$2,000[d]	$2,000
17. Modify the Don Pedro TRMP to provide for: (1) a survey of special-status bats to update where bats are present and/or roosting in the project area; (2) resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and (3) protection guidelines and BMPS to avoid and minimize impacts, including the installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. (FWS Don Pedro 10(j) recommendation 11, California DFW 10(a) recommendation M9-3.2)	FWS, California DFW, staff	$0	$1,720[dd]	$1,720

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
18. Modify the Don Pedro TRMP to include protective buffers for use of pesticides and avoiding pesticide use within suitable habitat for the San Joaquin kit fox, western burrowing owl, California red-legged frog, and California tiger salamander; and within 500 feet of any documented bat maternity colony. (FWS Don Pedro 10(j) recommendation 11)	FWS	$0	$0[f]	$0
19. Modify the Don Pedro TRMP to include BMPs to avoid adverse effects from any pesticide use on BLM lands within 500 feet of suitable aquatic habitat for special-status or threatened and endangered amphibians and reptiles. (BLM Don Pedro revised 4(e) condition 32)	BLM	$0	$0[f]	$0
20. Modify the Don Pedro TRMP to include BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance is planned within 300 feet of wetlands and riparian areas. (FWS Don Pedro 10(j) recommendation 11)	FWS, staff	$0	$0[f]	$0

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
21. Revise the applicant-prepared BA for terrestrial species to correct its deficiencies and (1) include procedures to minimize adverse effects on federally listed species; (2) ensure project-related activities meet restrictions included in site management plans for special-status species; and (3) develop implementation and effectiveness monitoring of measures taken or employed to reduce effects on listed species. (FWS Don Pedro 10(j) recommendation 8)	FWS	$2,000 [d]	$0	$120
22. Modify the Don Pedro TRMP to provide for protection of burrowing animals, including the federally listed California tiger salamander, San Joaquin kit fox by specifying locations where ground squirrel activity is problematic and where the Districts' rodent control activities would potentially occur, limiting use of burrow fumigants or rodenticides, conducting surveys for burrowing owl, San Joaquin kit fox, and California tiger salamander prior to fumigant use, and documenting incidental sightings of these species. (FWS Don Pedro 10(j) recommendation	FWS, California DFW, staff	$0	$4,000[d]	$4,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
11, California DFW 10(a) recommendation M9-2 and M9-3.1)				
23. Modify the Don Pedro TRMP to include protective measures for the San Joaquin kit fox, including (1) discouraging raptor use of transmission line as perches and (2) habitat surveys. (FWS Don Pedro 10(j) recommendation 11)	FWS	$15,000[ee]	$4,300[ee]	$5,190
24. Modify the Don Pedro TRMP to provide protection of California red-legged frog and California tiger salamander by establishing decontamination protocols to prevent the spread of chytrid fungus. (FWS Don Pedro 10(j) recommendation 11)	FWS, staff	$0	$500[d]	$500
25. Modify the Don Pedro TRMP to provide protection of San Joaquin kit fox, California red-legged frog and California tiger salamander, and western burrowing owl, and special-status bats by including (1) control of bullfrog and crayfish populations; (2) surveys for chytrid fungus; (3) protocols for slash removal and storage; (4) provisions to minimize impacts from roads, including	California DFW, FWS	$110,000[ff]	$53,500[ff]	$60,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
potential wildlife-friendly road crossings; and (5) species and habitat monitoring every 3 years. (California DFW 10(a) recommendation M9, FWS Don Pedro 10(j) recommendation 11)				
26. Implement the proposed protections for valley elderberry longhorn beetle in the Don Pedro TRMP, filed as appendix E-6 of the Don Pedro amended final license application to provide protections for valley elderberry longhorn beetle in accordance with the FWS (1999b) conservation guidelines for the species. (FWS Don Pedro 10(j) recommendation 8)	Districts, FWS, staff	$0[f]	$2,000[d]	$2,000
27. Modify the Don Pedro TRMP to provide protections for valley elderberry longhorn beetle by following the protocols from FWS (2017a) framework for assessing impacts to the species from project activities, which requires surveys for valley elderberry longhorn beetles and avoidance and minimization measures within 165 feet from project activities. (FWS Don Pedro 10(j) recommendation 8)	FWS, staff	$0[f]	$0[f]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
28. Develop a stand-alone bald eagle and special-status bird management plan that includes annual surveys, protection buffers, limited operation periods, public signage, and reporting incidental observations of all special-status raptor species, including burrowing owl. (BLM Don Pedro revised 4(e) condition 8, FWS Don Pedro 10(j) recommendation 10 and 11, California DFW 10(a) recommendation M9-1)	BLM, FWS, California DFW, staff	$15,000[d]	$20,000[d]	$20,890
Recreational Resources				
1. Annually meet with BLM to discuss measures needed to ensure use and management, public safety, and protection and utilization of the recreation facilities and resources on BLM land. (BLM Don Pedro revised 4(e) condition 11)	BLM, staff	$0	$2,000[d]	$2,000
2. Implement the Recreation Resource Management Plan (filed as appendix E-7 of the Don Pedro amended final license application).	Districts, staff	$1,197,680	$130,490	$201,200
3. Modify the proposed Recreation Resource Management Plan to include: (1) installation of signs, fences, and	BLM, staff	$16,000[gg]	$4,790[gg]	$5,740

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) an annual coordination meeting with BLM and other interested parties to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) a description of BLM guidance for design and construction of project recreation facilities that would be located on BLM-managed-land, to develop facilities consistent with agency requirements; (6) consultation with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands; (7) inclusion of the				

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
visitor center near Fleming Meadows as a project facility where visitors can learn about the project and obtain information about project recreation facilities and points of public recreation access; (8) a description of the operation and maintenance of Fleming Meadows visitor center; (9) identification of land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, which includes proposed accessibility upgrades and allows adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities; (11) specific measures to address				

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (12) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user-created trails; and (13) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir. (BLM Don Pedro revised 4(e) condition 14)				
4. Construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir. (BLM La Grange preliminary 4(e) condition 8, Conservation Groups)	Districts, BLM, Conservation Groups, staff	$72,560	$8,230	$12,510

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
5. Construct a new boat launch facility to provide boating access upstream of the old Don Pedro Dam when reservoir levels are low.	Districts	$666,670	$2,000	$41,360
6. Develop recreation opportunities at La Grange Reservoir. (California DFW 10(a) recommendation M7-3.1)	California DFW	$78,910[hh]	$12,340[hh]	$17,000
7. Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) to minimize boating hazards in Don Pedro Reservoir.	Districts	$0	$10,000[d]	$10,000
8. Modify the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) consistent with BLM Don Pedro revised 4(e) condition 4 and to include designated disposal site maps, treatment descriptions, and description of the coordination necessary for managing other resources, in consultation with BLM and other applicable agencies.	BLM, staff	$5,000[d]	$10,000[d]	$10,300

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
9. Install an improved boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.	Districts	$6,419,690	$26,750	$405,750
10. Improve recreational access at Ward's Ferry. (Forest Service 10(a) recommendation 1, California DFW 10(a) recommendation M7-3.2, Conservation Groups recommendation 8, All Outdoors Whitewater, OARS, ARTA, SierraMac Rafting, ECHO recommendation 2, Tuolumne County Board of Supervisors)	Forest Service, California DFW, Conservation Groups, All Outdoors Whitewater, OARS, ARTA, SierraMac Rafting, ECHO, Tuolumne County Board of Supervisors	$12,714,000[ii]	$100,000[ii]	$850,600
11. Improve recreation access at Ward's Ferry, and address public safety and transportation issues. (Forest Service 10(a) recommendation 1, Tuolumne County Board of Supervisors)	Forest Service, Tuolumne County Board of Supervisors	$1,149,000[jj]	$1,000[jj]	$68,830
12. Develop a Ward's Ferry day-use facility engineered plan. (BLM Don Pedro revised 4(e) condition 13)	BLM	$11,714,000[kk]	$100,000[kk]	$791,560
13. Provide boatable flows from April 1 through October 15 in the lower Tuolumne River as described on page E2-15 and 16 of the Don Pedro amended final license application.	Districts, Conservation Groups, staff	$0	-$3,360 (energy gain 54 MWh)[ll]	-$3,360

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
14. Provide a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting and barrier weir.	Districts	$140,000	$0	$8,270
15. Provide the 3-day weekend flows on the weekend closest to July 4. (Park Service 10(a) recommendation 3)	Park Service, staff	$0	$0[f]	$0
16. Ensure that all measures to remove water hyacinth that would render the river non-navigable are conducted well before the summer recreational flow season. (Park Service 10(a) recommendation 3)	Park Service	$0	$0[f]	$0
Land Use and Aesthetics				
1. Annually notify BLM about the location and type of any road maintenance projects on BLM lands, and convene a meeting to confer on project details if requested by BLM.	Districts	$0	$7,000[d]	$7,000
2. Develop a BLM-approved transportation system management plan. (BLM Don Pedro revised 4(e) condition 16)	BLM, staff	$5,000[d]	$45,000[d]	$45,300
3. Implement the Fire Prevention and Response Management Plan.	Districts	$5,000[d]	$2,000[d]	$2,300

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
4. Implement a BLM-approved Fire Prevention and Response Management Plan. (BLM Don Pedro revised 4(e) condition 17)	BLM, staff	$5,000[d]	$2,000[d]	$2,300
5. Prepare a visual resources management plan (expanded to include all lands within project boundary). (BLM Don Pedro revised 4(e) condition 18)	BLM, staff	$5,000[d]	$1,000[d]	$1,300
Cultural Resources				
1. Upon approval, implement the HPMP filed as appendix E-8 of the Don Pedro amended license application. (BLM Don Pedro revised 4(e) condition 15)	Districts, BLM, staff	$410,150	$177,160	$201,380
2. Modify the HPMP (filed as appendix E-8 of the Don Pedro amended license application) to include additional information that addresses all of California SHPO's specific comments in previous correspondence and in any correspondence received subsequent to the date of this EIS. Appendices should identify each comment received on the draft HPMP and the extent to which	Staff	$2,000[mm]	$0[mm]	$120

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
they were addressed in the revised HPMP.				

[a] Costs were provided by the Districts in their amended final license application unless otherwise noted.

[b] Capital costs typically include equipment, construction, permitting, and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs that occur on a yearly basis.

[d] Cost estimated by staff.

[e] Staff estimates there would be no additional cost to implement the measure.

[f] The cost of this measure is covered by the cost of the previous staff-recommended measure (Geology and Soils measure 2).

[g] Districts' filing July 30, 2018 (Districts, 2018b).

[h] We estimate that the costs for the staff-recommended minimum flows are the same cost as the Districts' proposed minimum flows. Requiring only the interim flows as a license condition, as recommended by staff, would not preclude the Districts from installing the infiltration galleries or implementing their proposed "with infiltration galleries" flow regime.

[i] Staff estimate $10,000 in capital cost in year 1 for the plan and an annual cost of $250,000 in year 12.

[j] Districts' filing May 14, 2018 (Districts, 2018a).

[k] Districts filing May 14, 2018 (Districts 2018a). In modeling the Water Board's condition, the Districts assumed that the Water Board would require the flow regime specified their 2016 Substitute Environmental Document, which includes 40 percent of the unimpaired flow at Vernalis.

[l] Staff estimate $10,000 capital cost in year 1 and an annual cost of $25,000 per year in years 5, 15, and 25.

[m] The cost of this measure is covered by the cost of the following staff-recommended measure (Aquatic Resources measure 28).

[n] The Water Board's recommendation does not provide much detail, but appears to be consistent with the staff recommendation.

[o] Districts' filing May 14, 2018, Attachment P (Districts, 2018a).

[p] Staff added $50,000 in capital costs to the cost provided by the Districts in their filing May 14, 2018, Attachment P (Districts, 2018a).

[q] Staff estimated the capital cost to be $5,000 in year 1 and the annual cost to be $330,000 in years 2, 3, and 4, $5,130,000 in year 5, and $1,000,000 in years 6 and 7, and that cost has been split equally between the Don Pedro Project and the La Grange Project.

[r] Staff estimate includes $4,000,000 in years 1−15 and $1,600,000 in years 6−30. Annual cost includes $200,000 in years 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30.

[s] Staff estimate includes $26,000,000 in years 3−13. Annual costs include $200,000 in years 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30.

[t] Staff estimate includes a capital cost of $30,000 in year 1 and $750,000 per year in years 2−30.

[u] Cost provided by the Conservation Groups in their response to the REA notice (Conservation Groups, 2018).

[v] Staff estimate capital cost of $10,000 in year 1 and an annual cost $25,000 per year in years 2−11.

[w] Costs given in FWS's recommendation include capital costs of $9,500,000 in years 1, 6, 9, and 12, and an annual cost not to exceed $1,000,000 per year.

[x] The cost of this measure is covered by the cost of the following staff-recommended measure (Aquatic Resources measure 63).

[y] Districts' filing May 14, 2018, Attachment D, tables 2, 3, and 4 (Districts, 2018a).

[z] Districts' filing May 14, 2018, Attachment F, tables 2 and 3 (Districts, 2018a).

[aa] Staff estimate annual cost $5,000 per year every 5 years starting in year 1.

[bb] Staff estimate capital cost of $25,000 in year 2 and every fifth year thereafter, plus $20,000 in years 10, 20, and 30.

[cc] Staff estimate annual cost $25,000 in year 2 and every 5 years thereafter, and $20,000 per year in years 10, 20, and 30.

[dd] Staff estimate annual cost $15,000 in year 1 and $5,000 per year every 5 years thereafter.

[ee] Staff estimate capital cost of S15,000 for raptor perch deterrents and an annual cost of $15,000 every 3 years starting in year 1.

[ff] Staff estimate $110,000 in capital costs and annual costs of $50,000 per year plus $10,000 per year every 3 years.

[gg] Staff estimates the cost for each component as follows (numbers align with numbers in description): capital $5,000 to revise plan; (1) capital $7,000 in year 1, annual $1,000/year for sign operation and maintenance and $2,000/year for trail operation and maintenance; (2) included in cost to revise plan; (3) included in cost to revise plan; (4) included in cost to revise plan; (5) included in cost to revise plan; (6) annual $2,000/year in year 6, 12, 18, 24, 28; (7) included in cost to revise plan; (8) included in cost to revise plan; (9) included in cost to revise plan; (10) included in cost to revise plan; (11) annual $1,500/year; (12) capital $4,000 year 1 (annual cost assumed to be included in overall project annual operation and maintenance); (13) included in cost to revise plan.

[hh] Staff added a capital cost of $7,000 in year 3 for the boat launch in addition to the cost estimated by the Districts for development of the trail of $80,000 in year 3. Staff also added $5,000 per year starting in year 4 for maintenance of the launch to the $10,000 per year estimated by the Districts for maintenance of the trail.

[ii] Districts' filing comments on revised BLM conditions, September 20, 2018 (Districts, 2018g), plus $1,000,000 for a cell tower estimated by staff.

[jj] Staff estimate capital cost includes $1,110,000 in year 1, $2,000 for two one-time meetings, and $25,000 for an engineering study. Annual cost is 1,000 per year.

[kk] Districts' filing comments on revised BLM conditions, September 20, 2018 (Districts, 2018g).

[ll] Districts (2018a, Attachment C, tables 4 and 5).

[mm] Staff added a capital cost of $2,000 to the cost estimated by the Districts for implementation of the HPMP to cover plan revisions as recommended by staff.

Table 4.3-2. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the La Grange Hydroelectric Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Geology and Soil Resources				
1. Develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the project's operation and maintenance. (Water Board preliminary 401 condition 9)	Water Board	$10,000[d]	$1,000[d]	$1,590
2. Develop a soil erosion and sediment control plan for actions affecting BLM lands that are within or adjacent to the project boundary. (BLM La Grange preliminary 4(e) condition 3)	Staff, BLM	$5,000[d]	$0[e]	$300
3. Develop a soil erosion and sediment control plan for all project construction activities authorized by the license.	Staff	$0[ff]	$0[f]	$0
4. If the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Districts must consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity. (BLM La Grange preliminary 4(e) condition 26)	BLM	$0	$0[f]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Aquatic Resources				
1. Establish an ecological group and host annual meeting. (FWS La Grange 10(j) recommendation 11, California DFW 10(a) recommendation M3-1, Conservation Groups recommendation 3)	FWS, California DFW, Conservation Groups	$0	$10,000[d]	$10,000
2. Provide a minimum flow of 5–10 cfs to the plunge pool downstream of the dam at all times.	Districts, staff	$0	$26,750	$26,750
3. Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice gate channel during powerhouse outages.	Districts, staff	$641,970	$10,700	$48,600
4. Implement the Districts' flow proposal for the Don Pedro Project that includes both interim and "with infiltration galleries" minimum flows, boating flows, pulse flows, and flushing flows. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project.	Districts	$0	-$258,630 (4,158 MWh/yr energy gain (negative cost))[g]	-$258,630
5. Implement the Districts' flow proposal except maintain the interim flows for the duration of the license (i.e., do not require the "with infiltration galleries" minimum flows).	Staff	$0	-$258,630 (4,158 MWh/yr energy gain (negative cost))	-$258,630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
6. Implement NMFS's recommended flow proposal for the Don Pedro Project that includes minimum flows, pulse flows, recession rates, down-ramping and up-ramping. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (NMFS recommendation 1)	NMFS	$0	-$609,560 (9,800 MWh/yr energy gain (negative cost))[h]	-$609,560
7. Provide the minimum instream flows to be specified by the Water Board. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (Water Board conditions 1 and 2)	Water Board	$0	-$392,110 (6,304 MWh/yr energy gain (negative cost))[i]	-$392,110
8. Implement the California DFW recommended flow proposal for the Don Pedro Project that includes minimum flows, storage management, geomorphology flows, recession rates, and ramping. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (California DFW (10(a) recommendation 1)	California DFW	$0	-$584,240 (9,393 MWh/yr energy gain (negative cost))[h]	-$584,240

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
9. Implement The Bay Institute's recommended flow proposal for the Don Pedro Project that includes minimum flows and recession rate flows. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (The Bay Institute)	The Bay Institute	$0	-$764,310 (12,288 MWh/yr energy gain (negative cost))[g]	-$764,310
10. Implement the Conservation Groups recommended flow proposal for the Don Pedro Project that includes minimum flows, pulse flows, recession rates, and ramping. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (Conservation Groups)	Conservation Groups	$0	-$610,870 (9,821 MWh/yr energy gain (negative cost))[h]	-$610,870
11. Implement the ECHO recommended flow proposal for the Don Pedro Project including minimum flows. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (ECHO)	ECHO	$0	-$249,800 (4,016 MWh/yr energy gain (negative cost))[g]	-$249,800
12. Maintain a maximum down-ramping rate of 2 inches per hour as measured at the La Grange USGS gage.	Staff	$0	$0[f]	$0

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
13. Develop a stream flow and reservoir level compliance plan. (FWS La Grange preliminary 10(j) condition 1A, Water Board preliminary 401 condition 3)	FWS, Water Board,[j] staff	$5,000[d]	$1,000[d]	$1,300
14. Develop a hazardous substance plan. (BLM La Grange preliminary 4(e) condition 34)	BLM, staff	$0[d]	$0[f]	$0
15. Develop a spill prevention control and countermeasure management plan through consultation with the Water Board, California DFW, FWS, and NMFS.	Staff	$10,000[d]	$0[f]	$590
16. Conduct DO monitoring from September 1 to November 30 each year for the first 2 years of the license at 15-minute intervals at three locations: at the project forebay, immediately below the powerhouse, and at the lower end of the tailrace channel. (Districts)	Districts	$32,100	$970	$2,870
17. Develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches. (Water Board preliminary 401 condition 6)	Water Board	$0	$85,000[k]	$85,000
18. Develop a plan in consultation with the Water Board, California DFW, FWS, and NMFS to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.	Staff	$5,000[l]	$5,880[l]	$6,180

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
19. Develop water temperature monitoring plan. (FWS La Grange 10(j) recommendation 6)	FWS	$0	$360,000[d]	$360,000
20. Develop a fish rescue plan for the MID diversion. (FWS La Grange 10(j) recommendation 12)	FWS	$0	$150,000[d]	$150,000
21. Provide for fish protection at project facilities. (California DFW 10(a) recommendation M8-1)	California DFW	$0	$75,000[d]	$75,000
22. Develop an aquatic invasive species management plan. (Water Board preliminary 401 condition 8)	Water Board,[j] staff	$5,000[d]	$20,000[d]	$20,300
Terrestrial Resources				
1. Provide for annual environmental training of employees and contractors, rather than bi-annual as proposed. (BLM La Grange preliminary 4(e) condition 2, FWS La Grange 10(j) recommendation 9.4, California DFW 10(a) recommendation M9-1.6, M9-4.1)	BLM, FWS, California DFW	$0	$2,000[d]	$2,000
2. Require Districts to host an annual consultation meeting with the resource agencies and interested stakeholders to discuss management of special-status species. (California DFW 10(a) recommendations M3-1 and M9-1.7)	California DFW	$0	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
3. Annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project area. (BLM La Grange preliminary 4(e) condition 6, FWS Don Pedro 10(j) recommendation 8(H), California DFW 10(a) Recommendation M9-1.9)	BLM, FWS, California DFW	$0	$2,000[d]	$2,000
4. Implement the draft TRMP for the La Grange Project as provided by the BLM and FWS, which includes provisions for: (1) noxious weed surveys the first year following license issuance, and every fifth year thereafter; (2) special-status plant surveys in the first year of license issuance and every tenth year thereafter; and (3) annual employee and staff environmental training and annual reporting and agency consultation. (BLM La Grange 4(e) condition 5)	Districts, BLM	$1,000	$17,170[m]	$17,230
5. Develop a La Grange TRMP in consultation with FWS, BLM, and CDFW to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project activities, including: (1) noxious weeds; special-status plants; (3) special-status bats; (4) western pond turtle; (5) burrowing owl; (6) valley elderberry longhorn beetle; and (7) special-status amphibians and	BLM, FWS, staff	$7,500[d]	$0[f]	$440

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
reptiles, including the California red-legged frog and California tiger salamander, opposed to herbicides, where feasible, in areas of sensitive resources. (BLM La Grange 10(j) recommendation 5, FWS La Grange 10(j) recommendation 10)				
6. Include provisions in a La Grange TRMP for: (1) a noxious weed survey of the LG Project during the first year of license issuance and with the same schedule as proposed by the Districts for the Don Pedro Project (every 5 years); (2) future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants; and (3) an emphasis on the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources.	Staff	$0	$5,500[n]	$5,500
7. Include provisions in a La Grange TRMP for: (1) a survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; (2) pre-construction surveys for special-status or threatened or endangered plants prior to any project-related ground disturbance involving heavy machinery; and (3) implementation of 50-foot buffers around special-status plant occurrences, marked with flagging or fencing,	California DFW, staff	$0	$3,080[o]	$3,080

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatment. (California DFW 10(a) recommendation M9-4)				
8. Develop a bat monitoring and management plan, in consultation with the resource agencies, within 6 months of license issuance. The plan would consist of: (1) protocols for monitoring WNS; and (2) public education actions about bats in the project area. (California DFW 10(a) recommendation M9-3.2)	California DFW	$0	$1,990[p]	$1,990
9. Include provisions in a La Grange TRMP for a bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project area, resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use, including facilities without installed exclusion devices; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. (FWS La Grange 10(j) recommendation 10, California DFW 10(a) recommendation M9-3.2)	FWS, California DFW, staff	$0	$2,180[q]	$2,180

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
10. Modify the Don Pedro TRMP to include protective buffers for use of pesticides and avoiding pesticide use within suitable habitat for the San Joaquin kit fox, western burrowing owl, California red-legged frog, and California tiger salamander; and within 500 feet of any documented bat maternity colony. (FWS La Grange 10(j) recommendation 10)	FWS	$0	$0[f]	$0
11. Include provisions in a La Grange TRMP to include protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species. (FWS La Grange 10(j) recommendation 10)	FWS, staff	$5,000[d]	$0	$300
12. Include provisions in a La Grange TRMP for surveys for elderberry plants within 165 feet of any ground-disturbing activity and following the FWS (1999b) conservation guidelines for valley elderberry longhorn beetle and the protocols from FWS (2017a) framework for assessing impacts to the species from project activities. (FWS La Grange 10(j) recommendation 8)	FWS, staff	$0	$800[r]	$800

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
13. Include provisions in a La Grange TRMP for BMPs to avoid adverse effects on wildlife from any pesticide use on BLM lands within 500 feet of suitable aquatic habitat for special-status or threatened and endangered amphibians and reptiles. (BLM La Grange preliminary 4(e) condition 23)	BLM	$0	$0[f]	$0
14. Include provisions in a La Grange TRMP for BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance is planned within 300 feet of wetlands and riparian areas. (FWS La Grange 10(j) recommendation 10)	FWS, staff	$0	$0[f]	$0
15. Develop a bald eagle and special-status bird management plan, in consultation with California DFW and FWS. (BLM La Grange preliminary 4(e) condition 9, FWS La Grange 10(j) recommendation 9, California DFW 10(a) recommendation M9-1)	BLM, FWS, California DFW, staff	$10,000[d]	$5,000[d]	$5,590

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
16. Consult with the resource agencies regarding the planning and design of any ground-disturbing construction activities, and conduct pre-construction surveys by a qualified biologist for special-status or threatened and endangered species before the start of any ground disturbance involving heavy machinery. (BLM La Grange preliminary 4(e) condition 9)	BLM, staff	$0	$2,000[d]	$2,000
17. Prepare a draft BA to address the potential impacts of the project on the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle. (FWS La Grange 10(j) recommendation 8)	FWS	$2,000[d]	$0	$120
18. Include provisions in a La Grange TRMP for protecting California red-legged frog, California tiger salamander, and Western pond turtle, including: (1) protective buffers for pesticide application within suitable habitat; (2) decontamination protocols to prevent the spread of chytrid fungus; and (3) consultation with California DFW and FWS to identify protection measures for activities requiring ground disturbance within 300 feet of wetlands, riparian areas, critical habitat or core areas for recovery. (FWS La Grange 10(j) recommendation 10)	FWS, California DFW	$0	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
19. Include provisions in a La Grange TRMP for protecting California red-legged frog, California tiger salamander, and Western pond turtle, including (1) control of bullfrog and crayfish populations; (2) surveys for chytrid fungus; (3) protocols for slash removal and storage; (4) provisions to minimize impacts from roads, including potential wildlife-friendly road crossings; and (5) species and habitat monitoring every 3 years. (FWS La Grange 10(j) recommendation 10)	FWS	$60,000[s]	$17,250[s]	$20,790
20. Include provisions in a La Grange TRMP for protecting San Joaquin kit fox, including (1) discouraging raptor use of transmission lines as perches and (2) habitat surveys. (FWS La Grange 10(j) recommendation 10)	FWS	$5,000[t]	$5,250[t]	$5,550
Land Use and Aesthetics				
1. Develop a fire prevention and response management plan for the La Grange Project in consultation with BLM.	Staff	$5,000[d]	$2,000[d]	$2,300
Cultural Resources				
1. Implement the HPMP filed on July 10, 2018. (BLM La Grange preliminary 4(e) condition 7)	Districts, BLM, staff	$0	$8,000	$8,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
2. Modify the revised HPMP filed on July 10, 2018, to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the anticipated PA.	Staff	$500[d]	$0	$30

[a] Costs were provided by the Districts in their October 11, 2017, final license application unless otherwise noted (Districts, 2017b).

[b] Capital costs typically include equipment, construction, permitting, and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs that occur on a yearly basis.

[d] Cost estimated by staff.

[e] Staff estimates that there would be no additional cost to implement this measure.

[f] The cost to implement the plan is covered by the cost of the previous staff-recommended measure (Geology and Soils #2).

[g] Energy effects were provided by the Districts in their filing of July 30, 2018 (Districts, 2018b).

[h] Energy effects were provided by the Districts (2018a).

[i] Districts filing May 14, 2018 (Districts 2018a). In modeling the Water Board's condition, the Districts' assumed that the Water Board would require the flow regime specified their 2016 Substitute Environmental Document, which includes 40% of the unimpaired flow at Vernalis.

[j] The Water Board's recommendation does not provide much detail, but appears to be consistent with the staff recommendation.

[k] Districts (2018a, Attachment P).

[l] The cost was estimated by staff to be $5,000 to revise the Districts' plan and $33,200 per year in years 1–3 to implement the plan.

[m] Staff estimates cost to be $100,000 in years 1, 11, 21 and $50,000 in years 6, 16, and 26.

[n] Staff estimates cost to be $25,000 in years 1, 6, 11, 16, 21, and 26.

[o] Staff estimates cost to be $25,000 in years 1, 11, 21.

[p] Staff estimates cost to be $25,000 in years 10, 20, and 30.

[q] Staff estimates cost to be $30,000 in year 1 and $2,000 in years 6, 11, 16, 21, and 26.

[r] Staff estimates cost to be $10,000 in years 10, 20, and 30.

[s] Staff estimates the cost to be $60,000 capital ($40,000 for chytrid study and $20,000 for road crossings) and annual costs of $15,000 per year in year 1 and every 3 years thereafter, $10,000 per year for bullfrog control, and $2,000 per year for slash removal.

[t] Staff estimates cost to be a capital cost of $5,000 in year 1 to revise the plan and $15,000 in years 1, 4, 7, 10, 13, 16, 19, 22, 25, 28.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreation opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the Don Pedro Hydroelectric Project and licensing the La Grange Hydroelectric Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on these projects and our review of the environmental and economic effects of the proposed projects and their alternatives, we selected the staff alternative, as the preferred alternative. We recommend this option because: (1) issuances of new hydropower licenses by the Commission would allow the Districts to operate the projects as an economically beneficial and dependable source of electrical energy for their customers; (2) the combined 172.7 MW of electric capacity of the projects comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance fish and wildlife resources, and improve recreation opportunities at the projects.

In the following section, we make recommendations as to which environmental measures proposed by the Districts or recommended by agencies and other entities should be included in any licenses issued for the projects.

5.1.1 Measures Proposed by the Districts

Based on our environmental analysis of the Districts' proposals discussed in section 3 and the costs discussed in section 4, we recommend including the following environmental measures proposed by the Districts in any licenses issued for the projects. We show our recommended modifications to the Districts' proposed measures in *italic* and parts of measures that we do not recommend in ~~strikeout~~.

5.1.1.1 Don Pedro Project

General

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 feet to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions.

Aquatic Resources

- ~~Implement~~ *Modify* the Spill Prevention Control and Countermeasure Management Plan *in consultation with FWS, NMFS, the Water Board, and California DFW to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed ; (2) a description of equipment and procedures to be used to address hazardous substance spills; (3) a provision to notify the Water Board, California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future*.

- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating:

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Instream Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7 (La Grange Gage)**	**RM 25.9**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	~~200~~	~~100~~	150
July 1 through October 15	~~350~~	~~150~~	225
October 16 through December 31	~~275~~	~~275~~	275
January 1 through February 28/29	~~225~~	~~225~~	225
March 1 through April 15	~~250~~	~~250~~	250
April 16 through May 15	~~275~~	~~275~~	275
May 16 through May 31	~~300~~	~~300~~	300
Dry Water Year			
June 1 through June 30	~~200~~	~~75~~	125
July 1 through October 15	~~300~~	~~75~~	175
October 16 through December 31	~~225~~	~~225~~	225
January 1 through February 28/29	~~200~~	~~200~~	200
March 1 through April 15	~~225~~	~~225~~	225
April 16 through May 15	~~250~~	~~250~~	250
May 16 through May 31	~~275~~	~~275~~	275
Critical Water Years			

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Instream Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)	RM 25.9	RM 51.7 (La Grange Gage)
June 1 through June 30	~~200~~	~~75~~	125
July 1 through October 15	~~300~~	~~75~~	150
October 16 through December 31	~~200~~	~~200~~	200
January 1 through February 28/29	~~175~~	~~175~~	175
March 1 through April 15	~~200~~	~~200~~	200
April 16 through May 15	~~200~~	~~200~~	200
May 16 through May 31	~~225~~	~~225~~	225

- Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7, *as measured at the La Grange gage,* ~~with infiltration galleries shut off~~ to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would only be provided in wet, above normal, and below normal water years.[166]
- Provide spring pulse flows in the following amounts to facilitate outmigration of juvenile fall Chinook salmon from the lower Tuolumne River. The timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application.
    - Wet and above normal water years: 150,000 acre-feet
    - Below normal water years: 100,000 acre-feet
    - Dry water years: 75,000 acre-feet
    - Sequential dry water years: 45,000 acre-feet
    - First critical water year: 35,000 acre-feet
    - Sequential critical water years: 11,000 acre-feet

[166] Flushing flows are proposed to occur only during these water year types, when they would have less effect on the amount of water available for consumptive use than they would in dry or critical water years. Although the Districts propose to shut off the irrigation galleries when flushing flows occur, we recommend that compliance be measured at the La Grange gage because we do not consider the irrigation galleries to be project facilities.

- Provide gravel mobilization flows of 6,000 to 7,000 cfs during years when sufficient spill is projected to occur.
- ~~Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5 to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat~~.
- ~~Implement a predator control and suppression program that includes sponsoring fishing derbies and removal and/or isolation of predatory fish via electrofishing, seining, fyke netting, and other collection methods to control and suppression of striped bass and black bass upstream and downstream of the proposed barrier weir~~.
- Develop a spill management plan to maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates.
- ~~Develop a plan to implement the Lower Tuolumne River Habitat Improvement Program and associated $38 million capital fund and annual funding accounts. The plan would address establishment of the fund account, management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to the operation, maintenance, monitoring, and reporting associated with enhancement projects~~.
- ~~Create a TPAC to provide recommendations on development and implementation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program. The committee will consist of the Districts, FWS, and CCSF. Other parties, including NMFS and California DFW will be encouraged to participate in the committee as full members~~.
- ~~Conduct coarse sediment augmentation in the lower Tuolumne River between RM 39 and RM 52 over a 10-year period, annual surveys of fall-run Chinook salmon and *O. mykiss* spawning use of new gravel patches for 5 years following completion of gravel augmentation, and a spawning gravel evaluation in year 12, to improve spawning conditions for fall-run Chinook salmon and *O. mykiss*~~.
- ~~Implement a fall-run Chinook spawning superimposition reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used, but still suitable habitat~~.

- ~~Conduct a 5-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning, to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).~~

- ~~Implement~~ *Modify* the Aquatic Invasive Species Management Plan to include: *(1) educating recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program; (3) implementing BMPs, such as identifying aquatic invasive species that may be introduced by a given activity, identifying critical control points (locations and times), and implementing measures to prevent the spread of aquatic invasive species during routine operation and maintenance; (4) implementing public boating access restrictions and consultation with BLM, FWS, and California DFW regarding control measures to be implemented if aquatic invasive species are discovered; (5) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, California DFW, and the Commission; and (6) reassessing the vulnerability of Don Pedro Reservoir for the introduction of invasive species if dreissenid mussel species are identified in Tuolumne River or if reservoir calcium concentration of 13 mg/L or higher are documented in Don Pedro Reservoir.*

Terrestrial Resources

- Shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years.

- ~~Implement~~ *Modify* the TRMP (filed as appendix E-6 of the Don Pedro amended final license application), *to include additional provisions for:*

  - *Conducting pre-construction surveys for special-status or threatened and endangered plants or animals before the start of any project-related ground disturbance involving heavy machinery, where suitable habitat exists, and implementation of 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.*

  - *Focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources; and implementation of control measures for the giant reed population documented along the Don Pedro Powerhouse access road.*

- *Surveys for special-status plants within the Red Hills ACEC every 5 years and every 10 years elsewhere within the project boundary, and the installation of interpretive signs about the unique plant communities of the Red Hills ACEC requesting that recreationists stay on trails.*
- *A bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31); resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.*
- *BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.*
- *A description of specific locations where ground squirrel activity is problematic and where the Districts' rodent control activities could occur; conducting surveys of ground squirrel burrows for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox and California tiger salamander during other biological surveys.*
- *Decontaminating equipment during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and aquatic invasive species.*
- *Recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet for project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.*

Recreation Resources

- ~~Implement~~ *Modify* the proposed Recreation Resource Management Plan *to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) an annual coordination meeting with BLM and other interested parties to discuss*

the management, public safety, protection, and use of project recreation facilities and resources; (5) a description of the BLM guidance for design and construction of project recreation facilities that would be located on BLM-managed land, to develop facilities consistent with agency requirements; (6) consultation with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands; (7) the visitor center near Fleming Meadows as a project facility, where visitors can learn about the project and obtain information about project recreation facilities and points of access; (8) a description of the operation and maintenance of Fleming Meadows visitor center; (9) identification of land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, that includes proposed accessibility upgrades to allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities; (11) specific measures to address recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (12) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user-created trails; and (13) a non-motorized project trail, including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir.

- ~~Construct a new boat launch facility to provide boating access upstream of Old Don Pedro Dam when reservoir levels are low.~~

- ~~Implement~~ *Modify* the proposed Woody Debris Management Plan *to include designated disposal site maps, treatment descriptions, and description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. This measure will prevent large concentrations of wood from accumulating and becoming boating hazards and obstructing water surface and shoreline use.*

- Provide the following flows to enhance conditions for non-motorized, recreational river boating on the lower Tuolumne River downstream of La Grange Dam:

  - From April 1–May 31 ~~of~~ *in* all water years, a flow of at least 200 cfs as measured at *the La Grange gage, and when the non-project infiltration galleries are operational, at a compliance point at RM 25.9, immediately*

downstream of the infiltration galleries ~~the La Grange gage. During this time period, the infiltration galleries would either be shut off, or additional flows to be withdrawn for water supply purposes would be released to the La Grange gage~~.

- From June 1–June 30 ~~of~~ *in* all water years, a flow of at least 200 cfs as measured at the La Grange gage. *For one pre-scheduled weekend in June,* in wet, above normal, and below normal water years, *a flow of at least 200 cfs, with a compliance point at RM 25.9, immediately downstream of the infiltration galleries* ~~withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of RM 25.9~~.
- From July 1–October 15, ~~a flow of at least 350 cfs~~ in wet, above normal, and below normal water years, *a flow of at least 350 cfs* and ~~at least 300 cfs~~ in dry and critical water years, *a flow of at least 300 cfs* as measured at the La Grange gage. *For the 3-day weekend that occurs closest to the July 4 holiday, the 3-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August, in all but critical water years, a flow of at least 200 cfs with a compliance point at RM 25.9, immediately downstream of the infiltration galleries*. ~~In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the three-day July 4 holiday, the three-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August.~~ *If July 4 falls on a Wednesday, the Districts would provide this 3-day boating flow either the weekend before or the weekend after the holiday.*

- ~~Install a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting and barrier weir~~.
- ~~Install an improved boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge~~.

Land Use and Aesthetics

- ~~Annually notify BLM about the location and type of any road maintenance projects on BLM lands, and convene a meeting to confer on project details if requested by BLM~~.
- ~~Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.~~
- *Implement a BLM-approved Fire Prevention and Response Management Plan to ensure that project operation and maintenance activities are conducted in a manner that would not contribute to the ignition and spread of wildfires.*

Cultural Resources

- ~~Implement~~ *Modify* the HPMP *to include additional information that addresses all of the California SHPO's specific comments in previous correspondence and in any correspondence received subsequent to the date of this EIS. Appendices should identify each comment received on the draft HPMP and the extent to which they were addressed in the revised HPMP.*

5.1.1.2 La Grange Project

Water Quality

- Conduct DO monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel from September 1 to November 30 each year for the first 2 years of a new operating license.

Aquatic Resources

- Provide a minimum flow of ~~5 to 10~~ *at least 5 cfs* from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times to ensure consistent and adequate flow to support aquatic resources.
- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.

Recreation Resources

- ~~Construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange headpond including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow, and reservoir elevation changes).~~ *This measure has been incorporated into the Don Pedro Recreation Resource Management Plan.*

Cultural Resources

- *Modify the revised* ~~Develop a~~ *HPMP filed on July 10, 2018, to clarify that all parties involved in any dispute resolution regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the anticipated Programmatic Agreement* ~~in consultation with the tribes, BLM, and SHPO to manage potential effects on historic properties~~.

5.1.2 Additional Measures Recommended by Staff

In addition to the Districts' proposed measures listed above, as modified by staff, we recommend including the following new measures in any licenses issued for the Don Pedro Hydroelectric Project and for the La Grange Hydroelectric Project:

5.1.2.1 Don Pedro Project

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of BMPs for erosion control; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of surface water quality monitoring would occur during and after ground-disturbing activities.

Aquatic Resources

- Develop a drought management plan to include: (1) definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) which license requirements would be temporarily modified during drought conditions; and (3) how the project would be operated when drought conditions occur.
- Develop a plan to monitor water temperatures in Don Pedro Reservoir near the dam and in the lower river at the gage below La Grange (RM 51.7), Basso Bridge (RM 47.5), Roberts Ferry (RM 39.5), and above the proposed infiltration galleries (RM 26) whenever reservoir elevations are lower than 600 feet; including provisions for reporting monitoring results and identifying any actions proposed to address water temperatures that exceed the suitable range for survival of Tuolumne River salmonids.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in the license.
- Develop a LWM management plan to increase the amount of LWM downstream of the La Grange Diversion Dam via measures to guide the placement of LWM, monitoring of enhanced sites, and revising the plan based on monitoring data.

- Develop a coarse sediment management plan that includes gravel augmentation in the lower Tuolumne River between RM 39 and RM 52 to mitigate annual project effects on gravel supply in the lower Tuolumne River.

Terrestrial Resources

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.
- Develop a visual resources management plan, consistent with BLM's 4(e) condition that addresses the effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

5.1.2.2 La Grange Project

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project construction activities authorized by the license that includes: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

Water Quality

- Develop a spill prevention control and countermeasure management plan in consultation with the Water Board, California DFW, FWS, and NMFS to include: (1) a description of how oil, fuels, lubricant products, and other hazardous liquid substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of the equipment and procedures to be used to ensure containment and cleanup of any hazardous substances; (3) a provision to notify the Water Board, California DFW, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.
- Develop a plan to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange USGS gage.
- Develop an operation compliance monitoring plan.
- Develop an aquatic invasive species management plan to include: (1) a provision to provide information (i.e., signage and information pamphlets at designated public boat access sites and on public websites) to educate recreational users on ways to reduce the spread of invasive species; (2) continuation of the boater self-inspection permit program, and provide aquatic invasive species information, including prevention measures (such as self-inspection permits), on websites that provide the public with information on project facilities; (3) a provision to include the following BMPs for minimizing the spread of invasive species during project operation and management: (a) identifying invasive species that may be introduced by a given activity, (b) identifying critical control points (locations and times), (c) implementing measures to prevent the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs; (4) a provision to consult with California DFW and BLM if aquatic invasive species are discovered within the project boundary; and (5) a provision to record and communicate incidental observation of aquatic invasive species to BLM, FWS, California DFW, and the Commission.

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operations and maintenance activities within the La Grange Project, to include:
  - A noxious weed survey of the La Grange Project in the first year of license issuance and every 5 years, with future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control of noxious weeds, where feasible (instead of herbicides), in areas with special-status or threatened and endangered species.
  - A survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; and implementing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities.
  - Recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.
  - A bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use, including facilities without installed exclusion devices; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.
  - Protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species.
  - BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installing signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed; and (6) consulting with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a fire prevention and response management plan for the La Grange Project.

Below, we discuss our rationale for our additional staff-recommended measures and modifications to the proposed measures for both projects.

Erosion Control

BLM 4(e) condition 3 for both projects specifies that, within 1 year of license issuance, the Districts develop a soil erosion and sediment control plan for erosion and/or restoration actions to be carried out by the Districts on or affecting BLM lands that are within or adjacent to the project boundaries. BLM further specifies that an effective plan should include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 additionally specify that if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA process, the Districts, in consultation with BLM, would determine the scope of work and potential for project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Districts would enter into an agreement with BLM under which the Districts would fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

Water Board preliminary 401 condition 9 states that it would likely require the Districts to develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the projects' operations and maintenance.

Based on our analysis in sections 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*, and 3.3.3.2, *Terrestrial Resources, Environmental Effects*, we find that while project operation may result in some shoreline erosion along Don Pedro Reservoir, the potential effects of project operation on shoreline erosion rates would be limited because much of the shoreline consists of rock outcrop and shallow soil. Erosion from waves on the reservoir would also be limited because the irregular shaped reservoir keeps the fetch[167] relatively short and limits the heights of waves. However, the proposed construction (i.e., rehabilitate existing recreational facilities, construct new recreational facilities, and construct additional project features such as a fish exclusion barrier near the TID sluice gate channel) would likely result in ground-disturbing activities that could cause localized erosion and associated water quality and habitat degradation in Don Pedro Reservoir, La Grange Reservoir, and in the Tuolumne River downstream of the proposed project facilities. To minimize water quality degradation from erosion during construction, we recommend the Districts develop, in consultation with the Water Board, NMFS, California DFW, FWS, and BLM, soil erosion and sediment control plans for both projects. These plans would apply to all project construction activities authorized under the license and would include the five components specified by BLM. We estimate the plan would have a levelized annual cost of $300 for the Don Pedro Project and $300 for the La Grange Project, and the benefits to the aquatic environment by protection of water quality would be worth the costs.

Drought Management Plan

Drought management often requires temporary reapportionment of water in order to reduce adverse effects and meet critical needs. The Districts' proposal includes several flow-related measures that specify how flow releases into the lower Tuolumne River and storage requirements would be adjusted during years when water availability is limited. These measures include reducing minimum flows, spring pulse flows, and flows released to flush gravel and support boating during drier water years, and lowering the minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet. The reduced minimum operating elevation would make an additional 150,000 acre-feet of storage available to meet instream flow and water supply needs. NMFS 10(a) recommendation 1.6 recommends that in the event that three or more consecutive, dry and/or critically dry water years occur, operations of the Don Pedro and La Grange Projects would be modified. Specifically, by March 10 of the second or subsequent dry and/or critically dry water year, the Districts would notify the appropriate resource

[167] The term *fetch* is the straight-line distance across a waterbody that is subject to the forces of wind. The *fetch* is a factor used in determining wave heights in a reservoir.

agencies (NMFS, California DFW, FWS, and the Water Board) of the Districts' concerns in meeting one or more license conditions. By May 1 of the same year, the Districts would consult with the appropriate agencies to discuss the Don Pedro and La Grange operational plans to manage the drought conditions.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Drought Management*, we note that given the highly variable nature of hydrologic conditions and the increasing water demand in the region, an extreme or protracted drought could occur that would require a variance from conditions of any license issued for the Don Pedro Project. However, it is unclear how NMFS's recommendation to trigger the development of a drought plan when three or more consecutive dry and/or critically dry water years occur would result in a better balance among competing needs than the flows developed by the Districts based on model results. Additionally, the Districts' proposed lowering of the minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet would assist in meeting both environmental and consumptive water needs during any prolonged drought. However, it is possible that the flow adjustments proposed by the Districts during drier water years may not be sufficient to address shortages that could occur during a prolonged drought, and it would be beneficial to determine in advance what steps would be taken if such conditions were to occur. Therefore, we recommend the Districts develop a drought management plan, in consultation with California DFW, BLM, NMFS, the Water Board, and FWS, for the Don Pedro Project that includes a definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); which license requirements would be temporarily modified during drought conditions; and how the project would be operated when drought conditions occur. We estimate the plan would have a levelized annual cost of $300, and the benefits to water supply and the aquatic environment would be worth the cost.

Operation Compliance Monitoring Plan

The Districts have historically operated the projects on an annual cycle to be consistent with managing and providing a reliable water supply for consumptive use purposes, providing flood flow management, and ensuring delivery of downstream flows to protect aquatic resources. Compliance with existing license requirements has been recorded at existing USGS streamflow gages located downstream of the projects.

The Districts propose to use two flow monitoring locations to monitor compliance with the proposed license conditions: (1) the existing USGS gage 11289650 (Tuolumne River Downstream of La Grange Diversion Dam, or La Grange gage), and (2) a new USGS gage measuring the flow into the two new infiltration galleries pipelines. The La Grange gage would be used to monitor compliance for flows between the La Grange gage (RM 51.7) and RM 25.9. For flows downstream of RM 25.9, the Districts would

subtract flows measured at the proposed infiltration gallery pipeline gage from flows measured at the La Grange gage to yield the instream flow downstream of the infiltration galleries. Compliance would be deemed met if flows equaled or exceeded the monthly flows recommended in the Districts' proposed plan with no deficit allowed of more than 10 percent below the minimum for more than 60 minutes, and no flow deficit allowed that is greater than 20 percent below the specified minimum flows. The Districts also propose to release a minimum flow of 5 to 10 cfs to the plunge pool downstream of the La Grange Project at all times.

Water Board preliminary 401 condition 3 specifies that it would likely require the Districts to develop a streamflow and reservoir level compliance plan for both projects. At a minimum, this plan would include: (1) locations where the Districts would monitor streamflow and reservoir levels; (2) equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of the certification; (3) a description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of the certification would be deployed, calibrated, operated, and maintained; (4) a description of how the data would be retrieved from the equipment to monitor compliance with the requirements of the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage; and (5) a description of how streamflow and reservoir level data would be provided to the Water Board.

California DFW 10(a) recommendation M1-1 and FWS 10(j) recommendation 1 recommend that the Districts develop a plan to monitor compliance with flow and water level requirements specified in any new licenses for both projects. The plans would describe: (1) locations where the Districts would monitor compliance with license requirements related to streamflow and reservoir levels; (2) equipment to be used by the Districts to monitor compliance with streamflow and reservoir level requirements; (3) how the equipment to monitor compliance would be deployed; (4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage; (5) how the Districts would make streamflow and reservoir level data available to the Commission, agencies, and the public; and (6) how the Districts would update the proposed plan as needed in the future. NMFS, California DFW, FWS, and the Conservation Groups also recommend that the Districts add an additional minimum instream streamflow compliance gage in the lower Tuolumne River. The new gage would be located in the river up to 1,500 feet downstream of the Districts' existing and proposed infiltration galleries (RM 25.9).

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Streamflow and Reservoir Level Compliance Monitoring*, we find that the Districts provide few details regarding their plan to monitor compliance with flow and water level requirements specified in any new license issued for the Don Pedro Project. The provisions recommended by the Water Board, California DFW, and FWS would provide an effective plan for monitoring compliance with license requirements and

procedures for submitting streamflow and reservoir compliance data to the Commission. Therefore, we recommend that the Districts prepare an operation compliance monitoring plan for both projects, in consultation with the Water Board, California DFW, NMFS, and FWS, that incorporates the provisions recommended by these agencies. To document compliance with the boating flows to be provided in the Tuolumne River downstream of the infiltration galleries, the plans should also include a provision to provide information to the Commission about the amount of water diverted into the infiltration galleries during the time periods when the boating flows are provided.

However, the agencies' recommendation to add an additional streamflow compliance gage in the lower Tuolumne River downstream of the Districts' proposed infiltration galleries would be unrelated to compliance with the operational requirements of any license issued for the project.[168] As noted in section 3.3.2.1, *Aquatic Resources, Affected Environment,* in the subsection *Water Quantity*, California DWR lists 26 points of diversion along the lower Tuolumne River between La Grange Diversion Dam and the San Joaquin River, with an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Of the 26 points of diversion listed by California DWR, 12 exist between the La Grange gage (RM 51.7) and the agency recommended gage location (i.e., near RM 25) and account for over half (43 cfs) of the estimated total combined withdrawal capacity of all diversions on the lower Tuolumne River (Water Board, 2018a). As such, we do not recommend the agency-recommended gage located near RM 25 because it would not monitor compliance with potential license requirements and would have no nexus to the projects. We estimate that the plans would each have a levelized annual cost of $1,300, and the benefits to environmental resources would be worth the costs.

Spill Prevention, Control, and Countermeasures

Constructing new project facilities, modifying existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways. For the Don Pedro Project, the Districts propose to implement their Spill Prevention Control and Countermeasure Management Plan that identifies relevant federal, state, and local regulations.

BLM Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34 specify that within 1 year of issuance of any new licenses or prior to undertaking activities on BLM lands, the Districts file with the Commission a BLM approved plan for oil and hazardous substances storage and spill prevention and cleanup. At a minimum, the plan must require the Districts to: (1) maintain, in the

[168] We do not consider the infiltration galleries to be project facilities because their primary purpose is to provide water for consumptive use, and they are not necessary to maintain or operate the project.

project area, a cache of spill cleanup equipment suitable to contain any spill from the project; (2) periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (3) inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. BLM would require that the plan include a monitoring plan that details corrective measures that would be taken if spills occur. The plan would include a requirement for a weekly written report during any construction that documents the results of the monitoring. BLM specifies that during planning and prior to any new construction or maintenance not addressed in an existing plan, the Districts would notify BLM, and BLM would determine whether a new plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. BLM would require any such plan to be filed with the Commission.

Water Board preliminary 401 condition 10 specifies it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan for storage, use, transportation, and disposal of hazardous materials in the projects areas. The Water Board specifies that the plan should discuss the measures and equipment required to prevent or limit the extent of any hazardous material spill. This plan would also include protocols to prevent adverse effects on beneficial uses in the event that hazardous materials are spilled.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Spill Prevention, Control, and Countermeasures*, the Districts' proposed measures do not address management of oil or other hazardous materials associated with the projects' hydroelectric facilities. Therefore, we recommend that the Districts develop separate plans for each project, in consultation with the Water Board, California DFW, BLM, FWS, and NMFS, to manage oil or other hazardous materials associated with the projects' hydroelectric facilities. The plans should focus on the management of oil, fuels, lubricant products, and other hazardous liquid substances and describe: (1) how they would be transported, stored, handled, and disposed of in a safe and environmentally acceptable manner; (2) the equipment and procedures used to ensure containment and cleanup of any hazardous substances; (3) a provision to notify the Water Board, California DFW, BLM, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future. If the Districts are required to document all spill and cleanup activities as described above, BLM's specified weekly reporting during construction would not be warranted. However, we recognize that BLM's 4(e) conditions would be included as mandatory conditions in any licenses issued for the projects. We estimate that the plans would have a levelized annual cost of $590 for the Don Pedro Project and $590 for the La Grange Project, and the benefits to aquatic and terrestrial resources would be worth the costs.

Water Quality Management and Compliance

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, in the subsection *Water Quality*, existing water quality parameters (DO, dissolved copper, and mercury) have occasionally been recorded outside the recommended ranges that support designated beneficial uses. Changing the operations for either project has the potential to affect water quality. To address the low DO concentrations that have been observed in the La Grange Powerhouse tailrace,[169] the Districts propose to monitor DO from September 1 to November 30 in the first 2 years of a new La Grange Project operating license and to submit an action plan if the cause for low DO levels is found. This proposal includes collecting DO information at 15-minute intervals at three locations: (1) the La Grange Project forebay, (2) immediately below the La Grange Powerhouse, and (3) at the lower end of the La Grange Powerhouse tailrace channel. At the end of each year's monitoring period, the Districts would compile, analyze, and submit the DO data as an annual report to the Commission. The Districts state that in the event the monitoring indicates a specific cause for low DO, they would develop and submit an action plan to the Commission in year 3 of license issuance.

Water Board preliminary 401 condition 6 specifies that it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to monitor water quality. This plan would address: (1) monitoring locations, (2) monitoring periods, (3) monitoring parameters, and (4) reporting and would consider in-situ, DO, recreation-related water quality, and bioaccumulation monitoring components.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Water Quality Management and Compliance*, we conclude that the Districts' proposed operation of the Don Pedro Project would not substantially change the hydraulics or water quality in Don Pedro or La Grange Reservoirs or in releases from the project powerhouses. While the Districts are not proposing major changes in project flow releases, reservoir elevations could increase or decrease by 10 feet or more and potentially affect reservoir water quality under other stakeholders' recommended flow releases for the Don Pedro Project. Low DO concentrations near the bottom of Don Pedro Reservoir would likely continue and may contribute to the release of mercury from sediments and subsequently continue to cause bioaccumulation in aquatic organisms, some of which may be consumed by humans. However, while concentrations of mercury and other metals may increase in newly constructed reservoirs, such increases are less likely to occur in the project reservoirs that have been in place for decades. It is unclear how additional bioaccumulation data collected under Water Board preliminary 401 condition 6 would be used to guide project operation.

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[169] Instantaneous measurements of DO concentration are as low as 4.0 mg/L in the La Grange Powerhouse tailrace channel.

The Districts' proposed monitoring would enable the Districts to determine: (1) the diel pattern of DO concentrations and when DO concentrations are lower than the applicable Basin Plan objective, (2) whether low DO concentrations coincide at multiple sites, and (3) whether low DO concentrations in the La Grange Powerhouse tailrace are consistently reaerated to at least the Basin Plan objective by the downstream end of the powerhouse tailrace channel. However, this monitoring would not determine whether low DO concentrations in the forebay are caused by low-DO inflows from upstream or local conditions or document links between DO concentrations with water temperature and aquatic vegetation build-up and die-off. Additionally, the Districts' proposal does not include provisions to include the resource agencies in reporting monitoring results or for developing an approach to mitigate any observed project effects. Therefore, we recommend the Districts develop a plan for the La Grange Project, in consultation with the Water Board, California DFW, FWS, and NMFS, to manage DO concentrations in the La Grange Powerhouse tailrace. The goals of the plan would be to determine the extent of project-caused low DO concentrations in the La Grange Powerhouse tailrace and effectively mitigate any low DO concentrations. The plan should include: (1) monitoring of DO and water temperature at 15-minute intervals in the upper end of La Grange Reservoir, La Grange Powerhouse forebay, immediately downstream of the La Grange Powerhouse, and at the downstream end of the powerhouse tailrace channel for up to 3 years, beginning in 1 year of license issuance; (2) supplementing this data with weekly observations of aquatic vegetation and algae in the La Grange Powerhouse forebay and near the penstock intake; (3) identifying the monitoring season based on the timing of recent DO concentrations less than the water quality objective; (4) annual reporting on the monitoring program for distribution to the consulted agencies and the Commission; and (5) submitting, for Commission approval, a final report after 3 years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objective, proposed mitigation to address low DO concentrations, and plans for effectiveness monitoring for any measure(s) to be implemented to address low DO concentrations. We estimate that the plan would have a levelized annual cost of $6,180, and the benefits to water quality would be worth the cost.

Water Temperature Compliance

The lower Tuolumne River is listed under CWA section 303(d) as impaired for temperature, based on life-stage specific 7DADM values (EPA, 2011). Under current conditions, warm water temperatures reduce habitat suitability for Chinook salmon and *O. mykiss* downstream of La Grange Diversion Dam, particularly for spawning and egg incubation. Based on the Districts' modeling studies, the Don Pedro Project affects water temperatures in the main channel of the Tuolumne River downstream of Don Pedro Dam (RM 54.8). The Districts do not propose water temperature targets or monitoring for either project.

Water Board preliminary 401 condition 7 for both projects specifies that the Districts develop, in consultation with relevant resource agencies, a plan to monitor

potential effects on water temperature from the projects by monitoring water temperature in Don Pedro Reservoir, La Grange Reservoir, and the lower Tuolumne River. FWS 10(j) recommendation 6 for both projects and California DFW 10(a) recommendation M2-1 for both projects recommend that the Districts develop a water temperature monitoring plan that includes the projects' reservoirs and project-affected reaches of the lower Tuolumne River. California DFW 10(a) recommendation M2-1 further recommends the plan include location-specific, temperature-performance measures that are consistent with CWA section 303(d) water temperature objectives for the lower Tuolumne River, a reporting schedule for annual reports that details temperature gage and flow data, and summary reports every 5 years. California DFW 10(a) recommendation M2-2 recommends life-stage location-specific temperature objectives to be determined over short duration (e.g., hourly or daily) and applied under specific conditions after 5 years of implementing the plan. California DFW 10(a) recommendation M2-3 recommends developing a schedule for each report that includes providing the reports to the TREG, including California DFW, the Water Board, FWS, and NMFS, and holding the Districts financially responsible for implementing the plan, but includes a provision allowing any organization of the TREG to be assigned the lead in implementing portions of the plan. NMFS 10(a) recommendation 1.4 recommends establishing temperature gages near RM 25 and the Robert's Ferry Bridge crossing at RM 39.5. These gages would record water temperatures at 1-hour or shorter intervals so that the data can be made publicly available in real time. NMFS 10(a) recommendation 1.5 recommends that the Districts prepare an annual report for submittal to the Commission and the resource agencies. The report would use empirical temperature data from the lower Tuolumne River to describe the timing, magnitude, and duration of temperature criteria exceedance events and analyze operational changes needed to prevent similar exceedance events in the future. Although The Bay Institute does not recommend water temperature targets or criteria, it recommends a flow regime for the projects that is partially based on water temperature objectives. Temperature objectives incorporated into its recommended flow regime consist of 12.5ºC for spawning, 12.5ºC and 13.0ºC for incubation, 14.5ºC for holding, 15.5ºC for migration, 16.0ºC for rearing, and 16.0ºC for "suitable release."

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Water Temperature Compliance*, we find that the Districts' modeling of each scenario to represent corresponding proposed and recommended project operations (see tables 3.3.2-24 and 3.3.2-25) captures the issues that would influence temperature in the lower Tuolumne River, except the modeling does not adequately represent conditions that could occur in sequential low-flow years. Flow and water temperature conditions in sequential low-flow years would vary depending on the timing and the magnitude of hydrologic and meteorological conditions, and the model results would provide limited value in directing operations that would occur in these situations. Water temperature monitoring during extended drought conditions would aid in forecasting the potential benefits of revising project operation when these conditions

occur. Therefore, we recommend the Districts develop a plan to monitor temperature for the Don Pedro Project whenever reservoir elevations are lower than 600 feet. The plan should include monitoring locations in Don Pedro Reservoir near the dam (for vertical profiles), in the lower Tuolumne River at the La Grange gage (RM 51.7), at Basso Bridge (RM 47.5), at Roberts Ferry (RM 39.5), and just upstream of the proposed infiltration galleries (RM 26). The Districts, in consultation with the agencies, should develop an approach for monitoring the change in Don Pedro Reservoir's available coolwater storage using either an array of temperature loggers set at different elevations or monthly vertical profiles, and the use of temperature loggers at each lower river location to monitor river temperatures. The plan should also include provisions for reporting monitoring results each year that monitoring occurs, and the report should identify any actions proposed to address water temperatures that exceed the suitable range for survival of Tuolumne River salmonids. However, we conclude that little value would be gained by monitoring temperatures between Don Pedro Dam and the La Grange Diversion Dam because the short retention time and geomorphic characteristics limit warming in this reach, and the La Grange Project has virtually no influence on lower Tuolumne River water temperatures. We estimate that the plan would have a levelized annual cost of $3,130, and the benefits to water quality would be worth the cost.

Minimum Flows and Pulse Flows

Project operations affect instream flows in the lower Tuolumne River from Don Pedro Dam (RM 54.8) to its confluence with the San Joaquin River. These altered flow conditions affect the river's capacity to support spawning, rearing, and other life stages of resident and anadromous fish and may also affect additional physical processes, including sediment transport, floodplain connectivity, water temperature, and the maintenance of riparian vegetation. In regulated river reaches that contain productive aquatic habitat, resource managers often establish instream flow regimes to maintain ecological functions and processes that are important for sustaining aquatic and riparian biota. However, balancing the different resource values associated with a given flow regime often involves a complex series of tradeoffs that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation.

The Districts propose to implement base flows designed for specific salmonid life stages in the Tuolumne River, flushing flows to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. For all flow-related recommendations, the flow schedules are based on five water-year types (wet, above normal, below normal, dry, and critical) determined using the 60-20-20 San Joaquin River Index. The Districts propose two sets of base flows: interim base flows that would be implemented until the proposed infiltration galleries are operational, and a second set of flows that would be implemented after the infiltration galleries are operational (refer to table 3.3.2-26 in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the

subsection *Minimum Flows and Pulse Flows*). Once the infiltration galleries are operational, the proposed flows would provide additional flow in the 26-mile-long reach between La Grange Diversion Dam and the infiltration galleries from June 1 through October 15. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration gallery pipeline gage) that would be used in conjunction with the La Grange gage to monitor compliance with the flows downstream of the infiltration galleries. In addition, to facilitate the outmigration of juvenile fall Chinook salmon, the Districts propose to provide spring pulse flows that would use between 11,000 acre-feet and 150,000 acre-feet of water, depending on the water year type. At the La Grange Project, the Districts propose to formalize the practice of releasing a minimum flow of 5 to 10 cfs to the plunge pool below the La Grange Diversion Dam.

NMFS, California DFW, the Conservation Groups, and The Bay Institute recommend considerably higher flows than the Districts, with variable patterns based on a percentage of unregulated flow or on a percentage of overall water demand (see section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Minimum Flows and Pulse Flows*, for a complete description of each stakeholder's recommended minimum flow regime).

In addition to its recommended minimum flows, NMFS recommends the Districts maintain a flow of no less than 300 cfs in all years as measured at a new flow gage to be installed downstream of the proposed infiltration galleries and implement fall pulse flows, as shown in table 3.3.2-28, given the volume of water to be released along with the minimum instream flows.

In its preliminary terms and conditions, the Water Board indicates (preliminary 401 conditions 1 and 2) that it would likely set a condition on minimum instream flows by water year type in light of the whole record including, but not limited to, the Commission's record (including recommendations by resource agencies), the final NEPA document, the final CEQA document, the updated Bay-Delta Plan, and the Basin Plan.

Along with its recommended minimum flows, California DFW recommends that the Districts release spring floodplain activation flows at rates and timing (after February 16 and before May 1) according to recommendations by the TREG and approved by California DFW, FWS, and NMFS based on a pulse flow of 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years. In addition, California DFW recommends that the Districts implement spring recession flows (tables 3.3.2-31 and 3.3.2-32) and adult Chinook salmon fall attraction pulse flows as recommended by the TREG and approved by California DFW, FWS, and NMFS, using a fall pulse flow volume of 10,000 acre-feet in critical years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years. California DFW 10(a) recommendation M1-9 also recommends the Districts release geomorphic flood pulses that are greater than 6,000 cfs for at least 20 days, at least once every 10 years. If 8 years elapse without a geomorphic flood pulse occurring from flood

releases, the Districts should release a geomorphic flood pulse in the next wet or above normal water year.

In addition to its recommended minimum flows presented in table 3.3.2-33, the Conservation Groups recommend that the Districts release fall pulse flows to attract salmon with release specifics to be determined by an implementation committee. Flow volumes of pulse flows in addition to the October base flow volume would be 20,000 acre-feet in wet and above normal years, 15,000 acre-feet in below normal and dry years, 10,000 acre-feet in critical years, and 7,500 in super critically dry years. The Conservation Groups also recommend the Districts provide a riparian recession flow in above normal, below normal, and dry water year types. The recession rate would be 180 cfs per day when the recession initiation flow value is equal to or greater than 1,400 cfs and remain at that rate until the daily flow value is equal to or less than 1,400 cfs. The recession rate for flows equal to or less than 1,400 cfs would be a 9 centimeters per day (about 3.5 inches per day) drop in stage for the first 6 days, and a 3 centimeters per day (about 1.2 inches per day) drop in stage thereafter, until base flow is reached. Furthermore, the Conservation Groups call for a suite of measures intended to keep the water bank from going negative and to help to preserve CCSF's total system storage at a level where CCSF could limit the frequency of water rationing. The Districts would designate the water-year types based on the 50 percent exceedance estimated unimpaired inflow to La Grange given in the February, March, April, and May California DWR Bulletins 120. In its recommendation 1, ECHO recommends the Districts provide 60 percent unimpaired flow from February to June to protect salmon.

The Districts conducted a series of instream flow studies and modeling exercises to help develop their proposed seasonal instream flow releases for the lower Tuolumne River. The Districts also used a project operations model, a reservoir water temperature model, a Chinook salmon and *O. mykiss* population model, a socioeconomic model, and a floodplain hydraulic model to evaluate the effects of various project alternatives on fish productivity, water supply, recreation, socioeconomics, and project economics. The Districts also ran each flow recommended by the stakeholders through this suite of models. The Districts also evaluated non-flow measures (coarse sediment management program, gravel mobilization flows, gravel cleaning, instream habitat improvement, and predator control) proposed by the Districts and recommended by stakeholders, in runs through the project operations and fish population models; and analyzed the results of the model runs to inform potential benefits, impacts, and costs of the proposed flow and non-flow measures.

Based on our analysis of the Districts modeling results, presented in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Minimum Flows and Pulse Flows* (see figures 3.3.2-23 through 3.3.2-40), the resource agencies/stakeholders recommended streamflow regimes would more closely mimic an unregulated hydrograph in the Tuolumne River downstream of La Grange Diversion Dam. Mimicking an unregulated hydrograph would likely benefit native resident and anadromous fish populations and their habitat by, among other things, providing for a seasonal variety of

flows including pulses of high flows that facilitate flushing of gravels prior to the Chinook salmon spawning season and the outmigration of smolts and lower stable flow periods that benefit Chinook salmon spawning and the rearing lifestages of Chinook salmon and *O. mykiss*. However, the resource agencies' and stakeholders' recommended flow regimes would have a substantial negative effect on the water supplies of the Districts and CCSF, and any incremental ecological benefits of these flow regimes over those proposed by the Districts must be weighed against the cost of water used.

By increasing the amount of water in the Tuolumne River to meet aquatic species flow requirements, the amount of water available for agricultural operations would decrease. Our analysis of the Districts' modeling results (section 3.3.8.2, *Socioeconomics, Environmental Effects*, in the subsection *Effects of Proposed and Recommended Flow Regimes on Agriculture*) indicates that under the base case (existing conditions), full irrigation demand would be met under all water year types, except during critical years, when only 92 percent of irrigation demands would be met. In wet and above normal water years, the full demand of irrigators would be met within a percent or two for all proposed and recommended flow regimes except the Water Board's, which would meet 88 to 94 percent of demand, and the Conservation Groups', which would meet 94 to 98 percent of demand. Below normal, dry, and critical years would have larger differences among scenarios in the percentage of demand that would be met; the Water Board's recommended flow regime would have the greatest effect on water availability for consumptive uses with as little as 68 percent of demand being met in a below normal water year. Operations model data were then combined with the economic model to produce an estimate of the total economic impact under full demand over the 42-year modeling term. Table 3.3.8-13 presents the economic output loss in agricultural production compared to full demand under each proposed flow regime and shows that the Districts' proposed flow regimes would have a significantly lower impact on agricultural production than all other recommended flow regimes. Sequential losses of economic output of approximately $300 million under the Districts' proposed with-infiltration galleries flow regime in consecutive critical water years would be large, but economic recovery would be likely. The most adverse economic impacts would occur under below normal, dry and critically dry years, and the Water Board flow regime would result in the most adverse impacts in most water year types. All of the agency and NGO-recommended flow regimes would have 3 to 5 times the level of adverse effects on agricultural output compared to the base case and the Districts' preferred plan, with and without infiltration galleries.

Reduced surface water supplies can have widespread effects on the regional economy, including resulting in the displacement of households and businesses. Consecutive years of shortage would result in significant adverse impacts and over time would result in substantial economic losses to the four-county area. The Districts' proposed flow regime (with infiltration galleries) results in substantial adverse economic impacts, but they are much smaller in magnitude than the flow regimes recommended or prescribed by other stakeholders. As shown in table 3.3.8-11, in section 3.3.8.1,

Socioeconomics, Affected Environment, in the subsection *Municipal and Industrial Use*, the maximum annual loss in economic output under the Districts' proposed flow regime would be only marginally more than the base case during the current (normalized) RWS demand of 238 mgd ($57 million compared to $18 million), and identical to the base case ($180 million) during the full RWS demand of 265 mgd. Comparatively, NMFS's recommended flow regime would result in an annual loss 4 to 5 times greater than the base case; California DFW's recommended flow regime would result in an annual loss 6 to 7 times greater than the base case; and Water Board's and Conservation Groups' separate recommended flow regimes would result in an annual loss 3 to 3.5 times greater than the base case.

Under the resource agencies/stakeholders' recommendations, aquatic habitat conditions would be slightly better than those under the Districts' proposal, although the Districts' proposal would still sufficiently protect aquatic habitat. However, the Districts' proposal would continue to meet the Districts' irrigation demands and the CCSF's water supply needs. Within these constraints, we recommend implementing the Districts' proposed interim minimum flows without the infiltration galleries as a requirement of any license issued for the Don Pedro Project. However, we also recognize the benefits associated with the resource agencies' recommended floodplain inundation flows and their associated and gradual (natural) recession rates because these recommendations would provide valuable off-channel rearing habitat for Chinook salmon and would further benefit juvenile salmonids through the reestablishment of riparian vegetation.

Although the Districts propose incorporating the infiltration galleries into the license as project facilities, we do not recommend this proposal because the primary purpose of the infiltration galleries is to provide water for consumptive use and they are not necessary to maintain or operate the project. Because these galleries would not be considered project facilities, we also do not recommend a license requirement that the Districts must install their proposed gage in the flow line from the infiltration galleries (infiltration gallery pipeline gage) and to monitor compliance with the flows downstream of the infiltration galleries (RM 25.9) by subtracting the flow volume measured at the infiltration gallery pipeline gage from the flow measured at the La Grange gage. Rather, we recommend compliance with any minimum instream flows be measured at the La Grange gage. We note that our recommendation for the license to require only the interim flow regime does not preclude the Districts from constructing the infiltration galleries or the proposed infiltration gallery pipeline gage, or from implementing their proposed "with infiltration galleries" flow regime.

Regarding the need for fall pulse flows, the literature cited by the resource agencies discusses natural freshets and upstream salmon movements. Evidence showing managed pulse flows attract salmon is limited. On the Stanislaus River, Peterson et al. (2016) found that pulse flows resulted in immediate increases in passage, but the response was brief and represented a small portion of the total run. This study recommended additional experimental analysis of pulse flow timing and "control" or no-pulse years. No substantial differences in migration rates in the Klamath and Trinity

Rivers were observed between years with managed pulse flows and years without pulse flows (Strange, 2007). Consequently, we do not recommend including a requirement for fall pulse flows in any license issued for the Don Pedro Project.

California DFW's recommended geomorphic flood pulses (flows that are greater than 6,000 cfs for at least 20 days at least once every 10 years) are intended to support the geomorphic processes required to sustain a healthy river. Based on experimental flows conducted in McBain & Trush (2000), tracer rocks mobilized at a flow of 5,400 cfs with a duration of a few days. The Districts' proposal would provide a gravel mobilization flow of 6,500 cfs for 2 days (i.e., 25,800 acre-feet of water) when sufficient spill is projected to occur. Because the goal is to initiate gravel movement that would allow exposure and capture of fines, a flow duration greater than 2 days is not warranted. In addition, California DFW provides no site-specific justification for a flow duration of 20 days that would require a flow volume of 238,000 acre-feet (which is about 10 times the volume needed to accomplish the intended purpose), and that flow duration would reduce the number of years in which gravel mobilization flows could occur. Consequently, we do not recommend implementing California DFW's geomorphic flood pulses; instead, we recommend the Districts' proposed gravel mobilization flows.

At the La Grange Project, continuing to provide a minimum flow of at least 5 cfs would support favorable water quality for resident and migratory fish species, maintain a stable flow regime for fish present in the plunge pool, and allow sufficient egress to the tailrace channel for any fish that enter the TID sluice gate channel. We estimate that this measure would have an annualized cost of $26,750 and conclude that the benefits of this measure would be worth the cost.

Spill Management Plan

On October 2, 2018, FWS filed revised 10(j) recommendation 2 for the Don Pedro Project, which calls for the development of a spill management plan that would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would offer a means for the agencies to provide recommendations on how to control the magnitude, timing, and duration of spill events into the Lower Tuolumne River to improve fall-run Chinook salmon floodplain rearing habitat. In its supporting documentation, FWS suggests target months for management of available flow volumes, minimum spill flow releases to be managed, minimum durations, and schedules for spring and fall pulse flows. FWS also suggests that the Districts seek recommendations on implementation of the spill management plan from the TPAC that would be created pursuant to FWS's revised Don Pedro 10(j) recommendation 4. However, FWS also states that the Districts would retain ultimate control over actual spill amounts, timing, and management but should make all reasonable efforts to implement TPAC recommendations regarding spill management whenever possible.

In response to FWS's revised 10(j) recommendations, the Districts support the Commission's adoption of revised 10(j) recommendations 2, 3, and 4 for the Don Pedro

Project.[170] The Districts also acknowledge in their letter filed October 17, 2018, that in many years, sufficient flexibility exists to manage releases from Don Pedro Reservoir that exceed the minimum flow requirements to benefit native fish species downstream of the reservoir and to meet the Districts' primary obligations and responsibilities related to water supply, instream flow requirements, flood control, and project safety.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Spill Management Plan,* we determine that a spill flow of at least 1,750 cfs, which FWS states should be the minimum spill release to maximize habitat benefits, could be maintained from March through April during wet and above normal water year types and for an average of 13 days during below normal water year types. However, in dry or critical water years, flows of 1,750 cfs would likely be unavailable. We also find that excess water would be available, particularly in wet and above normal water years, and that water could be used to provide either additional pulse flows to benefit outmigrating smolts or potentially optimize juvenile floodplain rearing habitat. We conclude that the spill management plan would allow key water-supply-entities (the Districts and the CCSF) to work collaboratively with fish and wildlife resource agencies (FWS and potentially NMFS and California DFW) to develop management strategies to make the best use of this excess water. Therefore, we recommend the Districts develop a spill management plan for the Don Pedro Project in consultation with FWS, NMFS, California DFW, and CCSF and file it for Commission approval. We estimate that the plan would have a levelized annual cost of $9,650 and the benefits to aquatic resources would be worth the cost.

Ramping Rates and Fish Stranding

Rapid changes in streamflow associated with hydroelectric project operation have the potential to adversely affect aquatic resources by stranding fish in shallow, low-gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). Unit outages at the La Grange Powerhouse can result in a disruption of otherwise continuous flows downstream of the powerhouse, and the resulting flow releases over the dam sluice gates can attract migratory fishes into the sluice gate channel, where they are vulnerable to stranding when flow resumes through the La Grange Powerhouse.

The Districts propose to install a fish exclusion barrier at the sluice gate channel entrance to allow the sluice gate to divert flows during an outage and prevent fish from entering the sluice gate channel where dewatering or stranding could occur once hydropower generation is restored. The barrier would be designed to function during flows of up to 7,000 cfs.

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[170] Revised 10(j) recommendation 3 is for Lower Tuolumne River Habitat Improvement Program.

As noted above, California DFW 10(a) recommendation M1-6 recommends that the Districts follow daily spring recession rates from May 31 through July 1 that range between about 3,500 and 250 cfs (see tables 3.3.2-31 and 3.3.2-32 in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Ramping Rates and Fish Stranding*) for the Tuolumne River at the La Grange gage and downstream of the infiltration galleries, respectively. California DFW 10(a) recommendation M1-8 further recommends that for all controllable flow rate changes above 200 cfs that are not already managed by their recommended recession rates, flow increases should be less than or equal to double the amount of release during any 1-hour period and decreases in flow should be no more than 2 inches per hour and less than or equal to 500 cfs in any single 24-hour period.

NMFS 10(a) recommendation 1.7 recommends that incremental upramping at both projects should occur evenly over a 24-hour period with a maximum of 500 cfs per 24-hour period in all water years. Compliance would be measured at La Grange gage and at a new gage located near RM 25. When flows at the La Grange gage are less than 4,000 cfs between April 1 and July 31 in wet, above normal, and below normal water years, NMFS recommends the Districts avoid reducing flows by more than 7 percent of the previous 24-hour average flow, unless required because of flood control operations or emergencies. When flows at the La Grange gage are less than 2,000 cfs between April 1 and July 31 in dry water years, NMFS recommends the Districts avoid reducing flows by more than 10 percent of the previous 24-hour average flow, unless required because of flood control operations or emergencies. When the above two down-ramping scenarios are not in effect, downramping should occur evenly over a 24-hour period, and the Districts should not reduce flows by more than 500 cfs in any single 24-hour period.

Numerous studies in California have shown that ramping rates in the 1 to 6 inches per hour range minimize any adverse effects on aquatic biota. For example, in 2004, PacifiCorp completed a literature-based assessment of the potential effects associated with ramping regimes in river reaches affected by the Klamath Hydroelectric Project. The study found that ramping rates ranging from 0.1 to 0.6 foot per hour resulted in minimal stranding and were well within the natural range of those found in unregulated river systems (PacifiCorp, 2004), and recommendations described in Hunter (1992) also suggest that reductions in river stage of no more than 1 to 2 inches per hour are generally protective of juvenile anadromous salmonids. Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsections *Ramping Rates and Fish Stranding* and *Reservoir Fish Stranding,* we determined that the proposed flow regime for the Don Pedro Project is compatible with maintaining an hourly stage change downstream of La Grange of 1-inch per hour, or less, from 97 to 100 percent of the time. However, more rapid changes in stage could occur, with an associated increase in the risk of fish stranding, if the rate at which flows are diverted into the TID or MID canals at the La Grange Project were to change rapidly. Therefore, for flow releases downstream of the La Grange Project, we recommend the Districts implement a year-round downramping rate not to exceed 2 inches per hour to protect juvenile salmonids in the

lower Tuolumne River. Additionally, we recommend that to the extent possible, the Districts conduct downramping at night, when Chinook salmon are less vulnerable to stranding. We estimate that maintaining these ramping rates would have a negligible cost to the project and would benefit fishery resources in the lower Tuolumne River.

Instream Habitat Improvement

LWM provides habitat structure in rivers and streams and can influence sediment storage and channel morphology through its effect on flow, water velocity, and sediment transport. Reducing the amount of LWM can reduce the complexity of aquatic habitat and the carrying capacity for aquatic biota. The Districts propose to implement their draft Woody Debris Management Plan, which calls for continuing the current practice of collecting woody debris on Don Pedro Reservoir in boom rafts that are anchored along the reservoir's edge, burning this material during fall and winter when reservoir levels are low, and informing BLM of its prior year actions in an annual memorandum.

NMFS 10(a) recommendation 3 recommends LWM enhancement and management for both projects, including provisions for: (1) counting and acquiring LWM from the projects' reservoirs and roads and during sediment harvesting from nearby dredger tailings; (2) collecting, storing, and prioritizing LWM for enhancement projects; (3) placing LWM in the lower Tuolumne River; and (4) monitoring and reporting on the overall LWM enhancement and management effort. Under NMFS's recommendation, LWM is defined as structurally sound logs with or without rootwads that are at least 3 feet long and at least 8 inches in diameter measured 4 feet from the large end, while key pieces of LWM are logs greater than 25 feet long with rood wad attached and 24 inches or greater in diameter (measured 4 feet from the rootwad). Under NMFS's 10(a) recommendation 3, the Districts would survey the upper reaches of Don Pedro Reservoir following any peak flow equal to or greater than a 1.5-year return interval flow and secure all LWM floating in the reservoir or perched on the reservoir margin so that it can be retrieved for removal later that season. The Districts would also annually remove LWM from the projects' reservoirs and store the material at locations that minimize transport time to the restoration reaches and are secure from illegal firewood cutting and other non-designated consumptive uses. NMFS's specific recommendations on the quantities, placement locations, and replenishment quantities and frequencies are detailed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Instream Habitat Improvement.* In its 10(a) recommendation 3, NMFS further recommends that the Districts map the LWM in the lower Tuolumne River to inventory all LWM in four lower Tuolumne restoration reaches. The mapping effort would begin with an initial inventory of existing wood to prioritize the initial LWM augmentation efforts and update the inventory as LWM is augmented each year. The augmented reaches would be remapped to verify existing wood locations during water years when a high flow occurs that is sufficient to mobilize and transport LWM. The Districts would also prepare an annual report to the Commission on the status of the LWM management program and monitoring, including the amount and types (e.g., size

ranges) of LWM collected during the year, amount and location of material transported, and any noted biological use of LWM.

California DFW 10(a) recommendation M4 recommends LWM enhancement and management provisions for both projects. California DFW recommends the Districts place 1,600 pieces of LWM in the lower Tuolumne River from La Grange Diversion Dam downstream to the confluence with the San Joaquin River, within or adjacent to floodplain lowering and planting sites, where feasible, and at an appropriate distribution, density, and configuration as recommended by a qualified restoration ecologist and in consultation with the resource agencies. California DFW recommends the Districts comply with California DFW Fish and Game Code § 1602, which requires any person, state or local governmental agency, or public utility to notify California DFW before beginning any activity that will substantially modify a river, stream, or lake. Additionally, California DFW further recommends the Districts submit an implementation monitoring report that includes: (1) the quantity and quality of placed gravel and LWM; (2) the locations and duration of placed LWM, if dislodged, and placement/augmentation; (3) the results of monitoring of the placement/augmentation of gravels, subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change), and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach; and (4) the quantity, timing, and disposal method of LWM removed from Don Pedro Reservoir and La Grange Reservoir. California DFW recommends the Districts submit this report to the TREG by March 1 each year and submit a final annual report to the Commission, following approval by California DFW, BLM, FWS, and NMFS. California DFW also recommends that the Districts submit a separate annual report to the Commission and California DFW, BLM, FWS, NMFS, and the Water Board by March 15, describing the implementation and effectiveness monitoring.

California DFW 10(a) recommendation M4-4 and FWS Don Pedro 10(j) recommendation 9 recommend that the Districts revise the Woody Debris Management Plan filed October 11, 2017, to address safe and expeditious wood removal from Don Pedro Reservoir when the volume exceeds 5,000 cubic yards of woody debris entering Don Pedro Reservoir in any one year. Specifically, the agencies recommend that the revised plan include: (1) removing wood from Don Pedro Reservoir using an excavator placed on dry land and loading the wood from the water onto trucks; (2) promptly transporting wood off site and moving to a lumber yard, chipping facility, or storage area for wood to be used in lower Tuolumne River salmonid habitat restoration; and (3) making available 200 key pieces of LWM to entities conducting salmonid restoration actions in the lower Tuolumne River whenever the volume of LWM in Don Pedro Reservoir exceeds 5,000 cubic yards and during or immediately following rapid LWM removal. The Districts would not use this material to meet other requirements of any licenses issued for the projects.

Water Board preliminary 401 condition 4 specifies that it would likely require the Districts, in consultation with relevant resource agencies and the boating community, to

develop a plan to address the reduction of LWM downstream of La Grange Diversion Dam. The Districts may also be required to monitor the implementation and effectiveness of LWM augmentation and submit associated reports to the Water Board's deputy director. The Districts would be required to develop a plan to minimize effects on beneficial uses (e.g., turbidity and wildlife) from LWM placement and installation.

The Conservation Groups' recommendation 5 recommends LWM management provisions that are identical to California DFW 10(a) recommendation M4 with a few exceptions. The Conservation Groups recommend that within 6 months of any new licenses issued for the projects, the Districts develop a large woody debris placement and management plan in consultation with TRTAC. The Conservation Groups recommend that the plan: (1) describe potential collection locations of LWM in Don Pedro Reservoir or other locations in the Tuolumne River Watershed; (2) describe potential options for moving LWM from Don Pedro Reservoir to the Tuolumne River downstream of La Grange Diversion Dam; (3) identify suitable LWM placement locations in the active channel of the Tuolumne River downstream of La Grange Diversion Dam to the confluence with the San Joaquin River; (4) require consultation with state and federal agencies regarding effects of LWM on safety or maintenance of bridges; (5) require consultation with qualified recreational boating groups to ensure safety with regard to placement of LWM in the context of channel design; (6) require an evaluation of the efficacy, costs, and permitting requirements of providing permanent anchorage to the placed LWM; (7) reinstall LWM annually to ensure no net loss of LWM; (8) develop a regular LWM effectiveness monitoring and reporting process; and (9) describe necessary permits and a permitting timeline.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Instream Habitat Improvement,* we find that the Don Pedro and La Grange Dams intercept most LWM moving downstream from the upper Tuolumne River Basin, and the projects reduce the frequency and magnitude of high flows in the lower river, limit LWM transport, and reduce geomorphic processes that often deliver local sources of wood to the channel. Implementing a comprehensive LWM management plan, as recommended by the resource agencies, would likely provide much more complex habitat over a longer period and would have a clear nexus to the project. However, it is unlikely that LWM measuring less than 16 inches in diameter (at 4 feet from the large end) and less than 20 feet in length would provide the structural benefits that are currently lacking in the lower Tuolumne River (given its existing bankfull width) and even then, pieces of this size may need to be aggregated into log jams to provide the desired benefits. Additionally, the availability of larger pieces of LWM in Don Pedro Reservoir appears to be somewhat limited. Although the resource agencies identify placement targets for the lower Tuolumne River, the LWM management plan should be designed to mitigate the ongoing effects of the projects on wood recruitment. Therefore, we recommend the Districts develop a comprehensive LWM management plan for the Don Pedro Project, in consultation with BLM, FWS, NMFS, the Water Board, and California DFW, that includes provisions for: (1) identifying the frequency at which

LWM is collected from Don Pedro Reservoir for downstream placement; (2) developing viable options for storing and transporting collected LWM; (3) identifying suitable LWM size classes, locations for placement, and placement methods (i.e., anchoring) in the lower Tuolumne River; (4) monitoring and mapping the location of LWM over time to indicate their stability and inform the need for future placement activities; and (5) developing LWM disposal site maps and treatment descriptions. Revisiting the LWM management plan goals and the timing and frequency of placement events once within the first 3 years of license issuance and, then, in license year 10 and every 10 years thereafter (i.e., license years 20 and 30) would also facilitate adaptive revisions to the plan as conditions improve in the lower river. We estimate that the staff-recommended plan would have a levelized annual cost of $75,300, and the benefits to aquatic habitat would be worth the cost.

Coarse Sediment Management Plan

The availability and composition of river gravels influence the suitability of spawning habitat for anadromous and resident fish. Coarse gravel provides substrate for growth of algae and invertebrates, both of which are important components of the aquatic food web.

The Districts propose several measures to improve salmonid spawning habitat, including (1) augmenting the river gravels with approximately 75,000 tons (54,000 cubic yards) of coarse (0.125 to 5.0 inches in diameter) sediment from RM 52 to RM 39 over a 10-year period following issuance of a new license; (2) providing gravel mobilization flows of 6,000 to 7,000 cfs measured at the La Grange gage for at least 2 days at an estimated average frequency of once every 3 to 4 years; (3) conducting a 5-year experimental gravel cleaning program; and (4) developing and installing a temporary barrier weir to encourage spawning on less used, but still suitable, high-quality riffles in the lower Tuolumne River, and in-turn, reducing fall-run Chinook redd superimposition. The Districts also propose to implement annual surveys of fall-run Chinook salmon and *O. mykiss* spawning use of new gravel patches for 5 years following completion of gravel augmentation.

NMFS and California DFW recommend the Districts develop a gravel augmentation program for the lower Tuolumne River. Specifically, NMFS 10(a) recommendation 2 recommends that over the duration of any licenses issued for the projects, the Districts should add a total volume of 752,000 cubic yards of coarse gravel (spawning and non-spawning) in the lower Tuolumne River, at a rate of 18,800 cubic yards per year. California DFW 10(a) recommendation M4 recommends that the Districts update the coarse sediment management plan (McBain & Trush, 2004) for both projects and develop project designs with the TREG within 2 years of license issuance. The updated plan would: (1) describe potential locations for gravel collection to place into the reaches of the Tuolumne River between La Grange Diversion Dam (RM 52.2) and Geer Road Bridge (RM 24.0); (2) describe any other potential options for providing and placing gravel in the La Grange Diversion Dam to Geer Road Bridge reaches;

(3) require consultation with the TREG regarding annual gravel augmentation with respect to geomorphic and hydrologic annual variations; (4) plan for annual gravel augmentation with respect to geomorphic and hydrologic factors, access, and suitability for gravel addition; (5) include an implementation timeline; (6) report and evaluate any legal constraints on gravel placement, and any federal, state, or local permits that may be needed; and (7) receive approval by California DFW, NMFS, and FWS. Upon completion of the updated plan, the Districts would place at least 200,000 cubic yards of sediment annually for 10 years to mitigate for project impacts until at least 1,950,824 cubic yards of additional sediment has been placed in the river to fill SRPs.

The Conservation Groups comment that the Districts' coarse sediment augmentation proposal is inadequate and recommend (recommendation 6) gravel augmentation and restoration and predatory habitat reduction provisions for both projects that are identical to California DFW's 10(a) recommendation 4. Water Board preliminary 401 condition 5 specifies that it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Spawning Habitat Improvement*, it is apparent that the projects have reduced the amount of coarse sediment entering the lower Tuolumne River and that without some form of ongoing gravel augmentation over the term of the licenses, the river channel would slowly degrade and eventually become gravel limited. It is also evident that gravel augmentation efforts associated with the projects' 1995 Settlement Agreement have helped increase coarse sediment storage in the reach and that most of this coarse sediment has been retained, increasing the amount of available salmonid spawning habitat.

Because the projects intercept gravel that would otherwise be available as spawning habitat in the lower Tuolumne River, and would continue to do so for longer than 10 years, we recommend the Districts develop a coarse sediment management plan, in consultation with NMFS, FWS, California DFW, and the Water Board, that includes a gravel augmentation program that would extend throughout the term of any new licenses issued for the projects. However, river channel impacts associated with gold and aggregate mining and filling the bedload traps/SRPs have no direct nexus to the project or project operation. Rather, the coarse sediment management plan should focus on providing high-quality spawning habitat for anadromous salmonids in those reaches that have the greatest potential for increasing salmon and steelhead production (i.e., the first 12.4 miles downstream of La Grange Diversion Dam). Periodic monitoring and mapping of augmented spawning gravels (i.e., once every 10 years over the term of the licenses), as recommended by NMFS, California DFW, and the Conservation Groups, should also be required to evaluate the performance of the augmentation efforts and inform the need for future augmentation. The annual volume of gravel added to the river should be commensurate with the estimated annual amount of coarse bed material lost from storage in the lower Tuolumne River, which is about 1,300 tons per year (1,000 cubic yards per

year). Obtaining the gravel to be placed in the lower reaches from the existing dredger-tailings piles along the river, as recommended by NMFS, California DFW, and the Conservation Groups, would potentially make implementation relatively efficient, as opposed to importing gravels from outside the projects, which could result in off-site environmental effects at the harvest site. We estimate the plan would have a levelized annual cost of $41,640, and the benefits to aquatic resources would be worth the cost.

We do not recommend that the Districts develop a 5-year program of gravel cleaning and monitoring because continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality that is caused by the interruption of gravel transport by Don Pedro Reservoir. We estimate that the plan would have a levelized annual cost of $197,010, and the benefits to spawning habitat would not be worth the cost. While we recognize that implementation of the Districts' proposed spawning surveys would provide data on the annual distribution and abundance of fall-run Chinook salmon and *O. mykiss* entering the Tuolumne River for 5 years, it is unclear how these data would be used to inform future gravel augmentation measures because annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by multiple factors that are outside the Districts' control. Consequently, we do not recommend the Districts' proposed spawning surveys in any licenses issued for the projects. Regarding the Districts' proposed fall-run Chinook salmon spawning superimposition reduction program and installation of a temporary barrier weir, we conclude that this program would not provide appreciably more benefits than the coarse sediment management plan and could result in the "take" of federally listed species due to potential injury from the temporary barrier that the Districts would install annually. Furthermore, implementation of the coarse sediment management plan, as recommended by staff, would address the lack of suitable spawning habitat more fully than the proposed superimposition reduction program and without the potential "take" of federally listed species. As such, we do not recommend including a requirement to implement the fall-run Chinook salmon spawning superimposition reduction program proposed by the Districts, in any licenses issued for either project. This program would have a levelized annual cost of $205,290 and would be much more expensive than the staff-recommended coarse sediment management plan.

Aquatic Invasive Species Management Plan

New Zealand mudsnails, quagga mussels, and zebra mussels are invasive aquatic mollusk species that compete for habitat and food resources and have the potential to affect aquatic communities. While neither the Districts nor the resource agencies have reported these species in Don Pedro Reservoir or the Tuolumne River, the New Zealand mudsnail has been documented in the lower Merced River between Crocker-Huffman Diversion Dam (RM 52.2) and the Highway 59 Bridge (RM 42.0). Water hyacinth is an invasive aquatic plant species that the Districts have documented throughout the lower Tuolumne River between RM 24.5 and the confluence with the San Joaquin River.

The Districts propose to implement their Aquatic Invasive Species Management Plan (filed on October 11, 2017) that includes: (1) providing information to recreational users on ways to reduce the spread of invasive species; (2) continuing the boater self-inspection permit program for invasive mollusks; and (3) conducting routine operation and management activities, including the following BMPs: (a) identifying aquatic invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs.

Water Board preliminary 401 condition 8 specifies the Districts develop a plan, in consultation with resource agencies, to manage aquatic invasive species by establishing a framework with specific activities to minimize the spread and impact of aquatic invasive species on native fauna and habitats and identifying and describing aquatic invasive species currently established within the project areas and aquatic invasive species with high potential to become established within the project areas. California DFW 10(a) recommendation M10 recommends the Districts implement the revised Aquatic Invasive Species Management Plan filed with California DFW's recommendation. California DFW's revised plan would address the same species as the Districts' plan but would also address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. Many of California DFW's recommended provisions are either similar to or slightly modified from provisions in the Districts' plan. California DFW's revised plan also includes provisions for annual consultation among the Districts, California DFW, and BLM to ensure that the goals and objectives of the plan are met, the proposed recommendations are implemented, and the plan is reviewed, updated, and/or revised, as needed, when changes to the existing aquatic invasive species conditions occur. BLM Don Pedro revised 4(e) condition 6 specifies that, following consultation with BLM, the Districts file a BLM-approved aquatic invasive species management plan within 1 year of any new licenses issued for the project. BLM provided an approved plan containing its preliminary condition and the same provision as listed previously in California DFW's plan and addressing the same invasive species. However, in BLM's plan, all invasive plant species would be addressed in the TRMP specified by BLM Don Pedro revised 4(e) condition 7.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Aquatic Invasive Species Management*, we conclude that while most of the components of the resource agencies' recommended plans are similar to those proposed in the Districts' plan, the Districts' plan lacks certain beneficial components included in the resource agencies' plans. These components include implementing access restrictions and consultation with California DFW and BLM as the default action to be taken if aquatic invasive species are discovered within the project boundary. Therefore, we recommend the Districts revise the Aquatic Invasive Species Management Plan to include provisions to: (1) provide information (i.e., signage and information pamphlets at designated public boat access sites) to educate recreational users on ways to reduce the

spread of invasive species; (2) continue the boater self-inspection permit program and provide aquatic invasive species information, including prevention measures (such as self-inspection permits), on websites that provide the public with information on project facilities; (3) implement the following BMPs in routine operation and management activities (a) identifying invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs; (4) implement public boating access restrictions and consultation with FWS, California DFW, and BLM regarding control measures to be implemented, as the default action if aquatic invasive species are discovered within the project boundary; (5) record and communicate incidental observations of aquatic invasive species to the Commission, BLM, FWS, and California DFW; and (6) include a provision to reassess the vulnerability of Don Pedro Reservoir for the introduction of non-native dreissenid mussel species if dreissenid mussel species are identified in Tuolumne River or reservoir calcium concentrations of 13 mg/L or higher are documented in Don Pedro Reservoir. We estimate the plan would have a levelized annual cost of $26,300, and the benefits to aquatic resources would be worth the cost. We additionally recommend that the Districts develop an aquatic invasive species management plan for the La Grange Project, similar to that described for the Don Pedro Project, and include the provision to assess the vulnerability of La Grange Reservoir for the introduction of these species and develop additional program modifications if significant new information becomes available that changes current understandings on the water chemistry thresholds that support non-native dreissenid mussel species. We estimate the plan for the La Grange Project would have a levelized annual cost of $20,300, and the benefits to aquatic resources would be worth the cost.

Bald Eagle and Special-status Bird Management Plan

Don Pedro Reservoir supports multiple nesting bald eagles, and three active nests were observed during the Districts' 2012 nesting survey. Although the Districts did not conduct surveys for bald eagles within the La Grange Project, La Grange Reservoir likely supports bald eagles, at least occasionally, because of its abundance of fish. Activities that could disturb bald eagle foraging and nesting include operation and maintenance of the projects, such as woody debris management and recreational uses (e.g., camping, hiking, motorized and non-motorized boating, and off-highway vehicle use). These activities could also affect bald eagles roosting on Don Pedro Reservoir during the winter.

Based on our analysis in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* in the subsection *Bald Eagles,* increasing the buffer distance around active bald eagle nests from 660 feet, as proposed, to 0.25 mile and providing signs to inform recreationists of the temporary closure(s) would benefit bald eagles because evidence suggests that human disturbance at the Don Pedro Project has been responsible for previous bald eagle nest failures. Including annual nesting surveys in a revised,

stand-alone bald eagle and special-status bird management plan, rather than the periodic surveys proposed by the Districts, would allow the Districts to protect active nests every year. Because golden eagles rarely occur within the projects, and no nests have been reported, we do not see any benefit to the species by including additional protective measures for golden eagle in a revised bald eagle and special-status bird management plan. However, the reporting of incidental sightings as part of the TRMPs for both projects would serve to protect golden eagle by noting their location in relationship to potential project-related disturbances. BLM and Central Sierra Audubon have conducted wintering counts for bald eagles near Don Pedro Reservoir during mid-January from 1994–2012 with the number of bald eagles on Don Pedro Reservoir varying from 5 to 34 per survey and averaging 20 bald eagles per year (BLM, 2018). Conducting annual winter population and night roost surveys, as recommended by FWS, in a revised, stand-alone bald eagle and special-status bird management plan for the Don Pedro Project would minimize potential adverse effects on wintering bald eagles.

Project operation and maintenance and recreational activities could disturb several other birds of prey that potentially nest and forage at the Don Pedro Project but are not addressed by the Districts' Don Pedro TRMP, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Of these, the Districts have documented occurrences of the osprey and golden eagle, but Swainson's hawk have been seen nearby and suitable habitat exists. We recommend that the Districts document incidental observations of all raptor species, including burrowing owl, while performing bald eagle surveys and other activities at the Don Pedro Project, and implementing protective buffers around any active nests of special-status birds. This measure would help avoid or minimize project effects on these special-status birds. We analyze this measure separately from bald eagles in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, in the subsection *Other Special-status Birds,* but evaluate its costs together with bald eagle management in section 4 and recommend that measures to manage all birds be included in the bald eagle and special-status bird management plans for both projects.

We recommend the Districts modify the bald eagle management section of the Districts' Don Pedro TRMP to develop a stand-alone bald eagle and special-status bird management plan, in consultation with the resource agencies. This plan would include: (1) annually conducting bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shoreline of Don Pedro Reservoir; (2) conduct surveys in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004); (3) if any new nests or communal night roosts of wintering eagles are located, coordinate with BLM, FWS, and California DFW to establish a protective buffer around each area; (4) increase the protective buffer around active bald eagle nests and communal roosting sites from 660 feet as proposed, to 0.25 mile, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater

tolerance; (5) install signs to inform recreationist of any temporary closure(s) around active bald eagle nests; (6) collect incidental observations of all raptor species while performing other activities within the Don Pedro Project boundary, to determine if protective buffers are needed; and (7) consult with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds. We estimate the plan would have a levelized annual cost of $20,890, and the benefits to bald eagles and other special-status birds would be worth the cost. We additionally recommend the Districts develop a similar bald eagle and special-status bird management plan for the La Grange Project. We estimate the plan would have a levelized annual cost of $5,590.

Terrestrial Resources Management Plan

To minimize potential adverse effects on terrestrial resources at the Don Pedro Project, the Districts propose to implement their TRMP (Districts, 2017a, appendix E-6) for the duration of a new license. The Districts, however, do not propose a management plan for terrestrial resources at the La Grange Project. The Don Pedro TRMP covers the following components: (1) special-status plant species protection and monitoring; (2) noxious weed prevention and management measures; (3) valley elderberry longhorn beetle host plant guidelines; (4) descriptions of bi-annual employee and contractor training; and (5) procedures for revegetation following ground-disturbing activities. The plan includes specific guidelines for protecting and managing special-status bats, bald eagles, western pond turtles, and the federally threatened valley elderberry longhorn beetle.

BLM, FWS, and California DFW comment that the Districts' proposed Don Pedro TRMP would not provide adequate protections for several special-status plants and animals and federally listed species. Specifically, FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend that the Districts revise the Don Pedro TRMP and develop a La Grange TRMP with protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, and California tiger salamander. FWS also included Layne's butterweed and Red Hills vervain in this recommendation for the Don Pedro Project and included the western pond turtle in its recommendation for the La Grange Project. BLM Don Pedro 4(e) condition 7 specifies that the Districts file a revised, BLM-approved Don Pedro TRMP that addresses the western pond turtle, California red-legged frog, special-status bats, noxious weeds, and special-status plants. BLM La Grange 4(e) condition 5 specifies that the Districts file a BLM-approved La Grange TRMP that addresses noxious weeds and special-status plants. For guidance, BLM and FWS provided the Districts with a revised Don Pedro TRMP and a template version for the La Grange TRMP, the latter being an edited version of the Districts' plan for the Don Pedro Project. California DFW 10(a) recommendation M9 recommends that the Districts include the La Grange Project in a revised TRMP for both projects with similar protective measures for special-status or threatened and endangered species as included in the BLM conditions and FWS recommendations.

The Districts propose several capital improvement projects that could have both short-term and long-term, direct and indirect impacts on vegetation (i.e., habitat) and wildlife. While the Districts' proposed noxious weed surveys would serve to ensure that noxious weeds do not increase, it would be most effective for the Districts to focus on areas where noxious weeds are most likely to occur or be introduced, which include the Don Pedro Reservoir shoreline, along busy roads and trails of Don Pedro Project recreational areas, in heavily grazed areas, and around project facilities. Modifying the Districts' Don Pedro TRMP to emphasize the use of manual control of noxious weeds in areas with special-status or threatened and endangered species resources, where feasible, would be a simple modification to protect all special-status plants in addition to ESA/CESA-listed species. Additionally, the Districts documented the occurrence of giant reed, a California DFA B-listed noxious weed, within the Don Pedro Project that was not proposed for management by the Districts in their Don Pedro TRMP. Controlling this population of giant reed would reduce its potential spread to other areas of either project.

Due to the substantial number of special-status plants at the Don Pedro Project, we find the Districts' proposed management of special-status plants to be lacking protections because the proposed surveys would only focus on known occurrences of special-status plants. It is likely that new populations of special-status species could become established over the duration of the license period and monitoring only known populations would be insufficient to protect new occurrences from project effects. Revising the Don Pedro TRMP, and a developing a similar plan for the La Grange Project, to include surveys of additional areas where project operation and maintenance activities could affect special-status plants would serve to further protect all populations. In addition, the conservation of special-status or threatened and endangered plants would be provided by Districts' implementation of buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatments, and removing the flagging or fencing when the work is complete.

The Districts last conducted a bat survey over 5 years ago, in 2012. Because bat habitat use could change for reasons such as drought or wildfire, a reevaluation of bat use at Don Pedro Project facilities, where the potential exists for conflict with humans, would provide for more accurate decisions about the proposed protective measures (i.e., exclusion devices). Performing this survey during peak bat maternity season (July 1 through August 31) would help to inform if and where any maternity roosts exist within the project. However, because either bat roosting behavior or human use of project facilities could change, periodic surveys would be necessary to ensure that project operations do not affect bats over the duration of the license. Bats would be afforded further protection if the Districts resurvey all project facilities that have the potential for bat occurrence every 5 years, rather than resurveying only facilities with installed exclusion devices. Furthermore, we expect that the licensees will follow herbicide and pesticide application labels, as directed by EPA, and support the responsible use of

pesticides in proximity to any documented maternity colony. The Commission does not enforce pesticide regulations and does not typically include such requirements as a condition of the project license. Also, the Districts have not proposed any protective measures for burrowing animals, including burrowing owls, in the Don Pedro or La Grange Projects because they concluded that there would be no project effects. However, the Districts' use of smoke and carbon monoxide to control rodents within developed recreational areas would present some risks to other non-target wildlife. While their method leaves rodent burrows intact following treatment, burrows would likely collapse without maintenance by ground squirrels and the important habitat they provide to other species could be lost. Including provisions in the Terrestrial Resource Management Plans for both projects to evaluate burrows for usage by burrowing owls, California tiger salamanders, and San Joaquin kit fox prior to rodent control activities would avoid this potential effect. The conservation of these three burrowing species would also be further advanced if the Districts document any incidental sightings of them at the Don Pedro Project. Lastly, the Districts have not proposed any protective measures for special-status, or federally listed reptiles and amphibians. Amphibians are sensitive to the potentially adverse effects of pesticide use and could be affected by reduced water quality as a result of runoff from ground-disturbing activities, however implementing BMPs to comply with California pesticide regulations would avoid or minimize any potential adverse project effects on California tiger salamanders, California red-legged frogs, and western pond turtles. Also, to ensure that ground-disturbing activities do not adversely affect aquatic habitats that amphibians depend upon, we recommend that the Districts implement BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

Based on our analysis in sections 3.3.3.2, *Terrestrial Resources, Environmental Effects,* and 3.3.4.2, *Threatened and Endangered Species, Environmental Effects,* we find that the districts should revise the Don Pedro TRMP, in consultation with BLM, FWS, and California DFW, to include additional protections for special-status or threatened or endangered species as described above in section 5.1.1.1, *Measures Proposed by the Districts, Don Pedro Project,* in the subsection *Terrestrial Resources*. Because the Districts did not propose a plan to manage terrestrial resources at the La Grange Project, we find it necessary for the Districts to also develop a La Grange TRMP. The La Grange TRMP should include the same provisions as the Don Pedro TRMP, with the exception of the following that apply to only the Don Pedro Project: (1) surveys for special-status plants within the Red Hills ACEC every 5 years and every 10 years elsewhere within the project boundary; (2) installation of interpretive signs about the unique plant communities of the Red Hills area requesting that recreationists stay on trails to conserve rare plants and their habitat; (3) controlling the giant reed population documented along the Don Pedro Powerhouse access road; (4) describing specific locations where ground squirrel activity is problematic and where the Districts' rodent control activities would potentially occur; (5) conducting surveys of ground squirrel burrows for occupancy by

San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows; and (6) documenting any anecdotal evidence of San Joaquin kit fox and California tiger salamander during other biological surveys. Furthermore, we recommend a La Grange TRMP should include the following additional provisions: (1) a noxious weed survey of the La Grange Project during the first year of license issuance and every 5 years, focusing on areas that support occurrences of special-status or threatened and endangered plants; (2) an emphasis on the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with special-status or threatened and endangered species; (3) a survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; (4) pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery; (5) implementing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities; (6) protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species; (7) recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle; and (8) BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. We estimate that all the components of the revised Don Pedro TRMP would have a total levelized annual cost of $22,250 and a La Grange TRMP would have a total levelized annual cost of $12,300, and the benefits to terrestrial resources would be worth the cost.

Recreation Resource Management Plan

The Districts propose to implement their Recreation Resource Management Plan for the Don Pedro Project (Districts, 2017a, appendix E-7). The plan would address the development of new facilities downstream of Geer Road near RM 25 for non-motorized boating access and public viewing at a proposed fishway and counting window at the counting weir. Developing additional unspecified facilities during the license term would be based on need as determined by periodic monitoring. The plan states the Districts would be responsible for operating and maintaining: (1) three existing recreational areas with campgrounds, day-use areas, and boat launches; (2) areas with limited infrastructure (e.g., floating restrooms and boat-in campsites); and (3) areas receiving recurrent dispersed recreation that have no infrastructure. The Districts also intend to construct a new visitor center near Fleming Meadow to replace the building destroyed by fire in 2016. At the La Grange Project, the Districts propose to construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange

Reservoir, including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes). The Conservation Groups support the Districts' measure to provide a pedestrian trail. BLM Don Pedro revised 4(e) condition 14 specifies implementing the Districts' plan as revised by BLM to: (1) include information about facility condition and accessibility; (2) include a GIS map showing landownership at recreational facilities; (3) categorize Ward's Ferry as a developed, multi-use recreational facility; (4) add text with guidance for constructing and reconstructing facilities on BLM-managed lands; (5) consult BLM to develop visitor survey questions; and (6) consult BLM about the need for updating the plan. In addition, BLM Don Pedro revised 4(e) condition 11 specifies annual consultation, at a minimum, to create an annual opportunity to initiate or adjust actions within the scope of the plan to meet visitor needs and protect environmental resources and specifies inviting BLM staff to participate in field and facility inspections.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects,* in the subsection *Recreation Resource Management*, we determined that while the proposed Recreation Management Plan for the Don Pedro Project thoroughly explains the Districts' responsibility for operating and maintaining campgrounds, day-use areas, and areas with few or no site amenities would ensure these project recreational facilities are safe and functional through the license term, it does not identify the Don Pedro shoreline access trail, which is partially located on BLM-managed land, as a project facility or describe the Districts' responsibility for operating and maintaining the trail. Additionally, while the plan includes a monitoring component whereby the Districts would consider changes or revisions to the plan in response to visitor use data it compiles and reports every 12 years, it does not describe any threshold or condition that would need to be met or specify how BLM (the public land manager) would be involved in the review to determine the need for additional facilities or a plan revision. Land management agency coordination is also a missing component of the Districts' plan with regard to constructing or reconstructing recreational facilities located on BLM-managed public land and designing visitor use surveys. The Districts do not propose to include their proposed visitor center as a project facility. However, the visitor center fits within the definition of a project recreational facility because the Districts would be building this facility at an existing project recreational development, and it is at a central location where project visitors can obtain information about the project. Regarding BLM's recommendation for categorizing the restroom at Ward's Ferry as a developed multi-use recreational facility, Ward's Ferry consists of a single vault restroom and does not have tables, grills or other such site amenities, and consequently fits within the Districts' category definition of a recreational area with limited facility infrastructure. The Districts' proposed plan does not provide a schedule or indicate an intention to reconstruct worn and outdated facilities, especially restrooms that do not meet accessibility requirements, during the license term. Without providing for recreational facility reconstruction during the license term, project visitor needs and expectations

would not likely be met in the future, and it is uncertain when project facilities would comply with accessibility requirements.

The proposed non-motorized trail would provide access to the La Grange Project, but the proposed route traverses land within the Don Pedro Project boundary owned by the Districts and public land managed by BLM. Although the trail is proposed as a La Grange Project facility, we conclude that the trail should be included in the license for the Don Pedro Project because (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway. Identifying the development of the proposed non-motorized trail in the Recreation Resource Management Plan and specifying the Districts' responsibility for its operation and maintenance would ensure adequate and safe public shoreline access. Because the proposed route passes near project infrastructure, signage, fencing, and gates, diverting use away from project features should be incorporated into the trail design to address project security and public safety concerns. The Districts' proposed new boat launch near old Don Pedro Dam would be a project recreational facility but its location, design concepts and provision for operation and maintenance are not provided in the Recreation Resource Management Plan.

Therefore, we recommend the Districts modify the Recreation Resource Management Plan for the Don Pedro Project (Districts, 2017a, appendix E-7), in collaboration with BLM to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) an annual coordination meeting with BLM and other interested parties to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) a description of the BLM guidance for design and construction of project recreation facilities that would be located on BLM-managed land, to develop facilities consistent with agency requirements; (6) consultation with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands; (7) inclusion of the visitor center near Fleming Meadows as a project facility where visitors can learn about the project and obtain information about project recreation facilities and points of public recreation access; (8) a description of the operation and maintenance of Fleming Meadows visitor center; (9) identification of land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, which includes proposed accessibility upgrades and allows

adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities; (11) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (12) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user-created trails; and (13) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir. We estimate that the revised Recreation Resource Management Plan would have a levelized annual cost of $219,450, and the benefits to recreational resources would be worth the cost.

Woody Debris Management Plan

Woody debris that passes down the Tuolumne River to Don Pedro Reservoir under current conditions can be a boating hazard, and large concentrations of wood accumulating near Ward's Ferry Bridge can obstruct water surface and shoreline use. The Districts propose to implement their draft Woody Debris Management Plan, which calls for continuing the current practice of collecting woody debris on Don Pedro Reservoir in boom rafts that are anchored along the reservoir's edge, burning this material during fall and winter when reservoir levels are low, and informing BLM of its prior year actions in an annual memorandum.

BLM Don Pedro revised 4(e) condition 4 specifies that the Districts obtain and maintain a BLM-approved burn plan for any large woody debris stored and burned on BLM-administered lands and make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry. All Outdoors, OARS, Sierra Mac River Trips, American River Touring Association, ECHO, and The Wilderness Company also recommend that the Districts manage woody debris on the reservoir to maintain access at Ward's Ferry Bridge and on the reservoir surface to maintain access and navigability.

Based on our analysis in 3.3.5.2, *Recreation, Environmental Effects,* in the subsection *Large Woody Debris Management,* and in the subsection *Recreation Management at Ward's Ferry Bridge*, we find that documented problems associated with woody debris accumulation on Don Pedro Reservoir, including restricted access, impaired navigability, effects on public safety, and effects associated with delayed disposal would likely continue because the Districts propose to continue the existing practices. While the Districts' plan states removal would be conducted to limit public safety hazard, but it does not state any objective for maintaining navigability. Additionally, accumulations of woody debris, topographic constraints, and the availability of few suitable disposal areas located on public land create a need for a plan that considers BLM agency land management guidance and integrates BLM staff into planning debris disposal. Therefore, we recommend the Districts revise the Woody

Debris Management Plan, filed October 11, 2017, to include designated disposal site maps, treatment descriptions, and description of the coordination between the Districts and Bureau of Land Management to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge, in consultation with FWS, BLM, the Water Board, and California DFW. We estimate that developing and implementing the plan would have a levelized annual cost of $10,300, and the benefits to recreational boating would be worth the cost.

Ward's Ferry Access and Facility Improvements

Forest Service (10(a) recommendation 1) recommends in part, that to minimize user conflict at river access sites, the Districts should provide trails from parking areas to picnic tables, fish cleaning stations, and areas with changing water levels. The Conservation Groups (recommendation 8-3) and All-Outdoors Whitewater recommends the Districts provide pedestrian access to the Tuolumne River at or near Ward's Ferry Bridge that is functional at all water levels, that minimizes conflicts with motorized vehicles, and that is sufficient to meet current and future needs.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects*, in the subsection *Recreation Management at Ward's Ferry Bridge*, we recommend including the above trails into any license for the Don Pedro Project because the existing trails are steep with uneven footing, and whitewater boaters have an increasing distance to carry boats and equipment up to the road as the reservoir lowers. Having trails that are constructed to meet trail standards, including slope, width, and tread, would improve footing for boaters taking out at Ward's Ferry Bridge and reduce erosion potential. The trails would additionally provide shoreline access necessary to address various effects of reservoir fluctuations.

Non-motorized, Recreational River Boating

The Districts propose to provide the following flows to enhance conditions non-motorized, recreational river boating on the lower Tuolumne River:

- From April 1–May 31 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. During this time period, the infiltration galleries would either be shut off, or additional flows to be withdrawn for water supply purposes would be released to the La Grange gage.
- From June 1–June 30 of all water years, a flow of at least 200 cfs as measured at the La Grange gage. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of RM 25.9.
- From July 1–October 15, a flow of at least 350 cfs in wet, above normal, and below normal water years and at least 300 cfs in dry and critical water years as measured at the La Grange gage. In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.9 for the 3-day July 4 holiday, the 3-day

Labor Day holiday, and for two pre-scheduled additional weekends in either July or August. Park Service 10(a) recommendation 3 for the Don Pedro Project is a refinement of the Districts' proposed measure, which recommends scheduling the proposed 200-cfs boatable flow for the July 4 on the 3-day weekend that occurs closest to the actual holiday.[171]

Minimum flow regimes recommended by the stakeholders for aquatic resources, as well as the operation of the infiltration galleries, would also affect the frequency of flows suitable for boating in the lower Tuolumne River. Based on our analysis of the percent of time each proposed flow regime would be at least 200 cfs at RM 25.5 (*see* table 3.3.5-3 in section 3.3.5.2, *Recreation, Environmental Effects*, in the subsection *Non-motorized, Recreational River Boating*), FWS, NMFS, California DFW, and the Conservation Groups' flow scenarios would provide the greatest increase in the number of boatable days with suitable flows of 200 cfs occurring 100 percent of the time from May through October across all water year types. The Districts' proposed operation would provide the least improvement for boating in the lower Tuolumne River with about the same frequency (39 to 79 percent, depending on water year) of boatable days from May through October as occur under current operations.

However, as discussed above in the subsection *Minimum Flows and Pulse Flows*, increasing the amount of water in the Tuolumne River to benefit aquatic resources and boating conditions also decreases the amount of water available for agricultural operations and municipal and industrial use. All of the flow regimes recommended by the resource agencies and NGOs would have 3 to 7 times the level of adverse economic impacts relative to the Districts' proposed flows with and without infiltration galleries. NMFS's recommended flow regime would result in an annual loss 4 to 5 times greater, California DFW's recommended flow regime would result in an annual loss 6 to 7 times greater, and the flow regimes recommended by FWS, the Water Board, and the Conservation Groups would result in an annual loss 3 to 3.5 times greater than the Districts' proposed flows with and without the infiltration galleries. While the stakeholders' proposed flow scenarios would provide more boatable days than the Districts' proposal, the Districts' proposal would continue to meet both the Districts' irrigation demands as well as the CCSF's domestic water supply needs and have the least economic impact. Therefore, we recommend including the Districts' proposed boating flows in any license issued for the Don Pedro Project.

Park Service 10(a) recommendation 3 to schedule the July 4 holiday boating flow releases on the weekend that is nearest to July 4 would align the event with a predictably higher recreational use period. This approach would enable more boaters to take advantage of suitable flows. Park Service does not specify when releases should take

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[171] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

place when the holiday occurs on a Wednesday. Because it would be difficult to predict in advance which of the two weekends surrounding the holiday would generate the most use, the Districts should use their discretion for scheduling the event. We estimate that this measure would have no cost, and we recommend its inclusion as a license condition for any license issued for the Don Pedro Project.

Transportation System Management

The Districts use roads and trails crossing public and private lands to operate and maintain the projects and for public recreational access and propose to continue implementing the existing Don Pedro License Article 17,[172] which requires them to annually notify BLM of the location and type of any road maintenance projects on BLM-managed land and, if necessary, convene a meeting to discuss these projects. BLM Don Pedro revised 4(e) condition 16 specifies that the Districts develop a Transportation System Management Plan for BLM approval. Tuolumne County recommends the Districts meet with the county to discuss assisting with improvements to Ward's Ferry Road and the intersection of County Road J-59 and Bonds Flat Road.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects,* in the subsection *Transportation System Management*, we find that under the Districts' proposal to continue implementing the existing Don Pedro License Article 17, expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies would continue to be uncertain during the duration of any new license issued. Conversely, the provisions specified under BLM Don Pedro revised 4(e) condition 16 would clarify responsibilities thereby reducing the number of roads that are in poor condition, improve the quality of public access, and reduce other effects of poor road maintenance such as erosion. As such, we recommend the Districts develop a transportation system management plan, as specified by BLM, at the Don Pedro Project that applies to all roads and trails that are necessary for project purposes in accordance with the Commission's 2006 policy statement on hydropower licensing settlements (FERC, 2006). To ensure proper annual and long-term maintenance of project roads and trails over the license term, the plan should also: (1) identify all roads and trails that are predominately used for project-related purposes; (2) demonstrate that each identified road is predominately used for project-related purposes and describe all non-project-related uses on each identified road; (3) develop condition assessments for each identified project road and trail; and (4) specify maintenance standards. We estimate that developing and implementing a modified version of BLM's plan, with the

[172] Standard article in Form L-2 which states, "In the construction and maintenance of the project, the location and standards of roads and trail, and other land uses, including the location and condition of quarries, borrow pits, spoil disposal areas, and sanitary facilities, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved."

additional provisions recommended above would have a levelized annual cost of $45,300, and the benefits to transportation and environmental resources would be worth the cost. Regarding Tuolumne County's recommendation, the intersection of county-maintained roads J-59 and Bonds Flat Road is about 1.5 miles northwest of Don Pedro spillway, both roads are county roads used primarily for public purposes, and neither road meet the Commission's definition of a project road. The project use of these roads is considered incidental and project assistance to Tuolumne County to make road improvements would mainly serve non-project users. As such, we do not recommend including Tuolumne County's recommendation in any license issued for the Don Pedro Project.

Fire Prevention Plan

The Districts propose to implement a Fire Prevention and Response Management Plan to provide fire prevention procedures, reporting, and safe fire practices for Districts' personnel and contractors responsible for operating and maintaining the Don Pedro Project. The plan includes descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting, including (1) equipment, vehicles, and tools for District staff and job sites; (2) fire index monitoring and activity curtailment, as appropriate; (3) debris burning; (4) vegetation clearance; (5) communication systems; (6) access routes, water sources, and helicopter landing areas; (7) fire investigation; (8) emergency contact information; and (9) fire safety signage at recreational facilities. BLM Don Pedro revised 4(e) condition 17 specifies implementing a version of the Districts' plan for the Don Pedro Project that includes revisions to include information such as fire history, references, analysis descriptions, permits, and use and storing of explosives. The revised version also requires BLM approval before filing with the Commission for its approval.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects,* in the subsection *Fire Prevention and Response*, we find that the Districts' plan would not ensure project activities are conducted in accordance with agency requirements. BLM Don Pedro revised 4(e) condition 17, which includes consultation with BLM to finalize and approve the plan, would likely meet BLM's objective for the plan to describe processes for obtaining authorizations and approvals and the requirements necessary to adhere to BLM fire restriction orders. Although, as noted in our analysis, some of the content of BLM's fire plan would create difficulty for determining compliance, we expect some of this content would be corrected during consultation with BLM to finalize the plan or, if necessary, in response to Commission plan review comments prior to plan approval. Adopting BLM Don Pedro revised 4(e) condition 17 would likely address BLM's concerns about permitting and coordination; therefore, we recommend adopting this agency condition. We estimate that finalizing the plan in consultation with BLM and implementing the plan would have a levelized annual cost of $2,300, and the benefits to environmental resources would be worth the cost. Additionally, because the threat of wildland fire also exists at the La Grange Project, we

further recommend the Districts develop a similar separate fire prevention and response management plan for the La Grange Project. We estimate that developing and implementing the plan would have a levelized annual cost of $2,300, and the benefits to environmental resources would be worth the cost.

Visual Resources Management Plan

Aesthetic effects related to new construction could include changed visual appearance of project infrastructure and disturbances caused by future maintenance activities related to new construction, such as vegetation removal. The Districts do not propose any specific measures to manage visual resources at either project. However, the Districts state in their amended final license application for the Don Pedro Project, they will adhere to BMPs and consult with BLM during the planning and construction of the extended riprap on Don Pedro Dam and regarding the proposed off-license boating access platform immediately upstream of Ward's Ferry Bridge, to minimize impacts to BLM aesthetic resources, and ensure conformance with BLM aesthetic resources goals. BLM Don Pedro revised 4(e) condition 18 specifies that within 1 year of any license issued for the Don Pedro Project, the Districts develop a visual resources management plan on BLM-administered lands that are within the FERC project boundary.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects,* in the subsection *Visual Resource Management,* we find that the small number of existing project facilities situated within BLM-administered land are not inconsistent with the visual resource management parameters associated with the BLM land on which those facilities are located. We also find that the proposed extension of riprap on the upstream face of Don Pedro Dam could affect the existing visual appearance at the project; however, it is not on BLM land and any potential associated visual impacts would likely occur infrequently. Also in section 3.3.6.2, we find that the Districts' proposed measures are inadequate because they do not provide for BLM approval of the plan, nor do the Districts address effects of proposed new facilities or future maintenance activities for new facilities (e.g., painting infrastructure at the proposed Ward's Ferry take-out). Therefore, we recommend the Districts develop a visual resources management plan for the Don Pedro Project as specified by BLM, to include, at a minimum, a description of the materials and color of the materials to be used in construction of the new take-out facilities, to ensure the new facilities blend with the existing environment and minimize any effects on visual resources. We estimate that the plans would each have a levelized annual cost of $1,300, and the benefits to visual resources would be worth the cost.

Historic Properties Management Plan

Continued operation, recreational use, new construction, and mitigation measures associated with other environmental resources that would be included in any new licenses issued for the projects could affect cultural resources listed in or eligible for inclusion in the National Register. The Districts filed separate draft HPMPs with the license

applications for the Don Pedro and La Grange Projects and propose to manage project effects on historic properties through the implementation of these HPMPs. BLM Don Pedro revised 4(e) condition 15 and La Grange preliminary 4(e) condition 7 specify that upon Commission approval, the Districts must implement the respective HPMPs.

Based on our analysis in section 3.3.7.*2*, *Cultural Resources, Environmental Effects*, in the subsection *Historic Properties Management Plans*, we conclude the Districts' HPMPs provide measures that are consistent with the ACHP and Commission's 2002 guidelines. However, we are in agreement with the California SHPO that inclusion of additional information in a revised HPMP for the Don Pedro Project would improve the document and would ensure adequate compliance with the requirements of section 106 of the NHPA. Therefore, we recommend the Districts file a revised HPMP for the Don Pedro Project that address all of the California SHPO's specific comments provided in previous correspondence and in any correspondence received subsequent to the date of this EIS. As mentioned in our October 27, 2017, AIRs, we expect that the HPMP will contain an appendix that contains documentation of all section 106 consultation undertaken for the project, including copies of all correspondence with the California SHPO, BLM, and participating Native American tribes. The appendix should identify each comment received on the draft HPMP and the extent to which they were addressed in the revised HPMP. Implementation of the revised HPMP for the Don Pedro Project would ensure that project-related effects on cultural resources would be considered and any management measures that are needed to comply with section 106 are implemented prior to undertaking project activities.

The Districts' revised HPMP for the La Grange Project filed on July 10, 2018, adequately addresses all comments received from the California SHPO in its letter filed on April 6, 2018. We consider this HPMP to be now adequate to address the potential effects of the project on historic properties over any license term. However, the process for dispute resolution detailed in section 7.3 puts specific requirements on the Commission, including requirements to respond to disputes within a specified period of time. While this process is not unreasonable, it does not mirror the plan for dispute resolution that is found in the Commission's PAs for hydroelectric projects; as a signatory to the PA, the Commission must follow the process that will be provided in the PA. For this reason, we recommend that this section of the HPMP be revised to clarify that all parties involved in any dispute regarding the HPMP will follow the process provided in the Dispute Resolution stipulation of the PA.

We estimate the revised HPMPs would have a levelized annual cost of $201,500 for the Don Pedro Project and $8,030 for the La Grange Project, and the benefits to cultural resources would be worth the cost.

5.1.3 Other Measures Not Recommended by Staff

In addition to those measure discussed in the previous section for which staff-recommended alternatives or modifications, staff finds that some of the measures

proposed by the Districts or recommended by other interested parties would not contribute to the best comprehensive use of the Tuolumne River water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following section presents the basis for staff's conclusion not to recommend those measures.

Additional Consultation and Review

FWS 10(j) recommendation 12 for the Don Pedro Project and FWS 10(j) recommendation 11 for the La Grange Project, California DFW 10(a) recommendation M3-1, and Conservation Groups recommendation 3 recommend and BLM 4(e) condition 9 specifies the formation or reestablishment of an ecological group for the Don Pedro Project that would meet annually to review federally listed and special-status species (FWS 10(j) recommendation 8), assess newly added species occurring on federal land, and consult with agencies on the effectiveness of implemented license conditions. BLM 4(e) conditions 6 and 32 for the Don Pedro Project also specifies that during the annual meetings, the Districts should discuss any activities related to aquatic invasive species management as well as submit a request for approval of planned use of pesticides for the upcoming year. FWS 10(j) recommendation 11, California DFW 10(a) recommendation M3-1, and Conservation Groups recommendation 3 made similar recommendations and BLM 4(e) condition 6 made similar specifications for the La Grange Project.

As indicated in our analysis in sections 3.3.2.2 *Aquatic Resources, Environmental Effects,* and 3.3.3.2, *Terrestrial Resources, Environmental Effects*, consultation prior to new construction and non-routine maintenance would help protect federally listed species and their habitats over the term of the license; however, we see no specific project-related purpose that would be served by requiring a generic provision for ongoing consultations and review in order to ensure compliance with applicable environmental statutes, such as the ESA. If ESA issues arise during the term of the license, either based on new listings or availability of new information, post-licensing procedures developed by the Commission and resource agencies (FERC et al., 2000) provide a framework for identifying issues, information gaps, and the need for additional protection measures. Any license issued would contain a fish and wildlife reopener article that could be used to require changes to project facilities or operations upon Commission motion, or as recommended by the state or federal fish and wildlife agencies, after notice and opportunity for hearing. This standard reopener retains authority for the Commission to implement any measures that may be needed to protect threatened or endangered species or other fish and wildlife resources over the term of the license. We also assume that any licensee would be responsible for complying with all federal and state environmental laws, and a license article is not needed to require that compliance. Additionally, the Districts' proposed plans and any additional plans recommended by staff would require agency review and consultation for development of plans and associated reports, prior to filing with the Commission for approval. Implementation of an annual ecological group meeting would be redundant because there would already be mechanisms for agency

consultation on a multitude of plans, and it is unclear how the meeting would provide additional benefit to environmental resources within the projects. We find the benefits of an annual consultation meeting and annual review of sensitive species lists are not worth the estimated levelized annual cost of $29,000 because it would duplicate other ongoing consultations. Therefore, we do not recommend including these requirements as part of any licenses issued for the projects. However, we recognize these annual review and consultation measures are included in BLM revised 4(e) conditions 9 and 12 for the Don Pedro Project and in BLM preliminary 4(e) condition 6 for the La Grange Project and therefore would be included as mandatory conditions in any licenses issued for the projects.

Annual Training

Implementation of project operation and maintenance activities could require Districts' staff to deal with invasive species or with sensitive resources. To minimize potential for inadvertent effects, the Districts propose to provide routine environmental training for employees. The Districts' proposed TRMP includes protocols for environmental training of project staff and contractors once every 2 years for the term of the license. This biennial training would include information about the recognition of high-priority invasive or noxious weed species, emphasizing the Districts' noxious weed prevention guidelines and reporting procedures to document any infestations. Additionally, the Districts' proposed TRMP would provide for employee training on western pond turtle identification, with the requirement that incidental observations of western pond turtle by staff and contractors must be recorded, assembled, and made available to BLM and California DFW as part of an annual consultation memo. BLM 4(e) condition 2 for both projects specifies annual employee awareness training to familiarize District staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundaries. FWS 10(j) recommendation 10 for the Don Pedro Project and 10(j) recommendation 9 for the La Grange Project also include annual employee awareness training at part of the recommended bald eagle and special-status bird management plans for each project. California DFW (10(a) recommendation M9-1.6 and M9-4.1) recommends annual employee awareness training. While such training would benefit environmental resources, licensees are expected to train employees to the extent needed to maintain compliance with a license, and the Districts already include training as a component of the proposed TRMP. Therefore we do not recommend incorporating stand-alone training as a license condition, which we estimate would have an annual levelized cost of $2,000 for each project. This measure, however, would be required by BLM 4(e) condition 2 and would be included as a mandatory condition in any licenses issued for the projects.

Coordinated Operations Plan

California DFW 10(a) recommendation M3-2 recommends that, the licensees develop a coordinated operations plan to provide for coordination of environmental

requirements and actions (i.e., flood control, water storage, and water diversion) between the Districts and other hydroelectric facilities in the San Joaquin River Basin. The coordinated operations plan would include: (1) a listing of other participating projects and operators; (2) the roles and responsibilities of participating projects and operators;(3) a list of coordination goals and objectives; (4) a description of the extent of ability to cooperate and coordinate flood control, water storage, and water diversion with other hydroelectric facilities of the San Joaquin River Basin; (5) the roles and responsibilities related to the STM Work Group organized by the Water Board; and (6) a list of voluntary actions aimed at increasing effectiveness of actions, monitoring, and data synthesis.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the subsection *Coordination of Project Operations*, we find that development of a coordinated operations plan would not be necessary to assure efficient and timely implementation of future license conditions. Furthermore, the measure recommended by California DFW would put the responsibility on the Districts to develop a plan to facilitate coordination of operations among multiple projects and entities in a large river basin that cover a wide range of project purposes, many of which are outside of the Commission's jurisdiction. As noted by the California DFW, the Water Board is considering the establishment of STM Work Group as part of the update to the 2006 Water Quality Control Plan for the San Francisco Bay Sacramento-San Joaquin Delta Estuary. The Districts' voluntary participation in this type of regional planning effort would be better suited to address basin-wide coordination associated with the range of project purposes identified by California DFW in its recommendation. Therefore, we conclude that development of a coordinated operations plan is not worth the estimated levelized annual cost of $11,180, and do not recommend including this measure as part of any licenses issued for the projects.

Floodplain Habitat Restoration

Storing water and diverting water associated with operation of the projects and irrigation diversions in the lower Tuolumne River restrict fish passage; block the downstream movement of LWM and coarse sediment; alter the timing, magnitude, and duration of river flows; and modify the natural thermal regime in the lower Tuolumne River. The Districts propose to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph to improve riparian habitat conditions (see section 3.3.3, *Terrestrial Resources*) and have stated their support for FWS's revised Don Pedro 10(j) recommendation 3, development of the Lower Tuolumne River Habitat Improvement Program (discussed in the next section), which would provide funding for planning, design, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species.

California DFW 10(a) recommendation M5 recommends that the Districts develop a floodplain rearing habitat restoration plan in consultation with TREG within 2 years of any new licenses issued for the projects. The plan would identify the river reaches with

the greatest need for rearing habitat, the target amount of rearing habitat to be developed for each reach, potential locations for rearing habitat, a floodplain inundation analysis to identify elevations for flooding at flows of 1,500 to 3,000 cfs, a revegetation plan, and other relevant details. Under the plan, the Districts would restore and create sufficient acreage of salmon fry and juvenile rearing habitat by either: (1) lowering historic floodplain surfaces that currently inundate at flows greater than 5,000 cfs to attain 77,640 acre-days of inundation at flows >1,000 cfs between February 1 and June 15; or (2) creating 810 acres of 100 percent suitable floodplain habitat. As the floodplain habitat quality decreases, acreage would need to increase, whichever creates more total acreage. California DFW recommends the same implementation monitoring, effectiveness monitoring, and reporting as FWS revised 10(j) recommendation 3 described previously.

The Tuolumne River Conservancy recommends that the Districts fund the final cleanup and restore the spawning riffle of a 57-acre area on the north bank of the Tuolumne River on the northwest corner of the new La Grange Bridge known as Buck Flat and an additional area approximately 3 miles downstream. The Tuolumne River Conservancy further comments that both areas have been damaged and contain construction material left behind from the construction of Don Pedro Dam and are within salmonid spawning and rearing sections of the Tuolumne River. Conservation Groups recommendation 4 is largely the same as California DFW 10(a) recommendation M5 described previously, except that Conservation Groups recommendation 4: (1) does not include Buck Flat as one of the six minimum restoration sites; (2) provides numbers of acre-days of inundation (similar to FWS revised 10(j) recommendation 3) for (a) above normal water years (a median of at least 100,000 acre-days), (b) below normal water years (a median of at least 65,000 acre-days), and (c) dry water years (a median of at least 36,000 acre-days); (3) recommends inundation amounts for the 810 acres of 100 percent suitable floodplain habitat (i.e., 25 percent must inundate at 1,500 cfs or lower flow; 50 percent must inundate at 3,000 cfs or lower flow; 75 percent must inundate at 4,000 cfs or lower flow; and 100 percent must inundate at 5,000 cfs or lower flow); and (4) does not include an effectiveness monitoring component.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Floodplain Habitat Restoration*, we determined that the quality of floodplain habitat for aquatic organisms, particularly salmonids, has been reduced by altered flows in the Tuolumne River associated with project operations and by mining, grazing, and agricultural activities that began in the mid-1800s and continue to this day for a number of miles along the river, particularly upstream of RM 34. Project operations have reduced the magnitude and frequency of high flow events, thereby affecting habitat diversity and complexity in the lower river, while excavation of riverbed material for gold and aggregate to depths well below the river thalweg also formed large in-channel SRPs and off-channel ponds. In section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Floodplain Habitat Restoration*, we present our analysis of the Districts' modeling results that sought to: (1) reproduce observed water surface

elevations, within reasonable calibration standards, over the sampled range of hydrologic conditions; (2) determine floodplain inundation extents for flows at 250 cfs intervals between 1,000 and 3,000 cfs and 500 cfs intervals between 3,000 cfs and 9,000 cfs; (3) estimate the area, frequency, and duration of inundation over a range of flows for the base case (water years 1971–2012) hydrology; and (4) apply modeled water depths and velocities to quantify the amount of suitable salmonid rearing habitat for juvenile Chinook salmon and *O. mykiss* at the designated flow increments. The Districts used three models for three reaches of the lower Tuolumne River: Model A (RM 51.7 to RM 40), Models B (RM 40 to RM 21.5), and Model C (RM 21.5 to RM 0.9). This analysis found that flows above bankfull discharge substantially increase the amount of important off-channel habitat for juvenile Chinook salmon in the river downstream of La Grange Diversion Dam.

The Districts estimated a river-wide carrying capacity of 3.3 million Chinook fry at 1,000 cfs, 8.5 million fry at 2,000 cfs, 12.7 million fry at 3,000 cfs, and 18.4 million fry at 5,000 cfs. The Districts also calculated a river-wide carrying capacity of 0.6 million Chinook juveniles at 1,000 cfs, 2.6 million juveniles at 2,000 cfs, 4.9 million juveniles at 3,000 cfs, and 8.8 million juveniles at 5,000 cfs. Although the Districts developed corresponding estimates of usable habitat for juvenile *O. mykiss* as a basis of comparison (see table 3.3.2-44), they did not provide a carrying capacity estimate for this species, as juvenile *O. mykiss* have not been observed using floodplain habitat in the lower Tuolumne River.

The Districts also determined that approximately 60 to 80 percent of the total inundated floodplain area under Model A (RM 51.7 to RM 40) is usable by Chinook salmon and *O. mykiss* fry at the lowest modeled flow (1,000 cfs). However, as flows increase, increased depths and velocities in the floodplain areas reduce suitability for fry life stages such that usable habitat falls to 25 to 40 percent of total inundated habitat at 9,000 cfs (figure 3.3.2-46). This decrease in the percentage of floodplain habitat availability as flows increase is also evident under Models B (RM 40 to RM 21.5) and C (RM 21.5 to RM 0.9) (figures 3.3.2-47 and 3.3.2-48).

Based on this analysis, flows above bankfull discharge are associated with increases in habitat area for fry and juvenile life stages of lower Tuolumne River salmonids. Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs, and based on flows in the 1971 to 2012 period of record, flows at the La Grange gage greater than 1,500 cfs would occur from February through July in 28 years (or more than 60 percent of the years) under the District's proposed flow regime. Flows exceeding 2,500 cfs would occur in 45 percent of the years in that period. Extended periods of springtime floodplain inundation (e.g., 14 to 21 days) regularly occurs at a 2- to 4-year recurrence interval in the lower Tuolumne River under the base case (water years 1971–2012) hydrology. In addition, in spill years, as part of their agreement with FWS revised 10(j) recommendation 2 (the spill management plan), the Districts state that they would make reasonable efforts to shape the descending limb of

the snowmelt runoff hydrograph to mimic natural conditions and benefit salmonid floodplain rearing.

Based on our analysis, we are not recommending a floodplain rearing habitat restoration plan because available information indicates that floodplain rearing habitat is inundated at regular intervals under current operations, and that inundation provides substantial rearing habitat for both Chinook and *O. mykiss* fry and juveniles. The estimated levelized annual cost for implementing the plan as recommended by California DFW would be $2,951,850, and the expected benefits would not be worth the cost.

Lower Tuolumne River Habitat Improvement Program

On October 2, 2018, the FWS filed revised Don Pedro 10(j) recommendation 3, which calls for the development of a Lower Tuolumne River Habitat Improvement Program that would provide funding for planning, designing, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. The Lower Tuolumne River Habitat Improvement Program would be developed by the Districts in coordination with the FWS, NMFS, California DFW, and CCSF, and filed with the Commission for approval. The Lower Tuolumne River Habitat Improvement Program would have a total capital fund of $38 million to be funded with four equal payments of $9.5 million beginning within six months of the Commission's approval of the Lower Tuolumne River Habitat Improvement Program implementation plan and being fully funded by the 12th anniversary of license issuance. This recommendation would replace FWS's original Don Pedro 10(j) recommendation 3 (Restore and Enhance Juvenile Salmonid Rearing Habitat in the Lower Tuolumne River) and 10(j) recommendation 4 (Coarse Sediment and Gravel Replacement and Restoration Plan). FWS also states that establishment of the Lower Tuolumne River Habitat Improvement Program would be in lieu of the Districts' proposed hatchery, boulder placement, and hyacinth funding enhancement measures.

On October 17, 2018, the Districts filed a response to the FWS's October 2, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4 and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal, while its proposed restoration hatchery, boulder placement, and donations to California Boating and Waterways to aid in hyacinth control are considered withdrawn from the proposal.

The purpose of the Lower Tuolumne River Habitat Improvement Program is the development of a long-term habitat restoration strategy to be implemented via an associated capital fund ($38 million) and annual funding (up to $1 million per year for operation and maintenance, monitoring and reporting), for actions that protect and enhance salmonid populations and aquatic habitat in the lower Tuolumne River. The associated fund would support non-flow resource measures that enhance habitat for

native salmonid species. The Districts would be responsible for dispersing monies from the Lower Tuolumne River Habitat Improvement Program account, as recommended by the TPAC, and would be responsible for executing and implementing contracts for design, permitting, construction, monitoring, and reporting related to the improvement projects. Types of enhancement projects may include spawning habitat improvements, floodplain habitat improvements, riparian restoration, improved connectivity between the river channel and adjacent floodplains, slough development, improvements to in-channel structural complexity, and LWM installation and replacement. Habitat improvement projects would be prioritized and recommended by the TPAC, with the primary beneficiaries of the projects being native salmonid species. The project selection process would follow the SHIRA, or another technically rigorous approach approved by the TPAC. SHIRA focuses on traditional approaches for improving salmonid spawning and rearing habitat to decrease differences between existing riverbed elevations and adjacent floodplain habitats. Typically, initial work using SHIRA is focused on instream additions of gravel and contouring of existing gravels. Gravel cleaning, as proposed by the Districts, could be a complementary component of efforts to contour and improve existing gravel. FWS lists areas adjacent to the lower Tuolumne River that may be suitable for restoration efforts, based on GIS databases, totaling approximately 27 miles of shoreline on the lower Tuolumne River that are publically owned, are designated as open space, and/or have existing conservation easements.

Overall, the recommended Lower Tuolumne River Habitat Improvement Program overseen by the TPAC appears to be a program that could result in improvement to salmonid habitat in the lower Tuolumne River, potentially benefiting anadromous fish populations in the lower river. However, while FWS identifies a range of habitat enhancement projects that could be implemented using the $38 million capital fund, and lists potential enhancement sites in the lower 52.5 miles of the river, few specifics are provided as to how the $38 million would be spent, and whether this would mitigate project effects or serve as project-related enhancement. In the previous subsection, *Floodplain Habitat Restoration*, we conclude that additional measures for floodplain habitat restoration are not needed because existing project operations include periods of high flows on a regular basis (2- to 4-year recurrence interval in the 1971 to 2012 period of record) that would sufficiently inundate the floodplain and provide substantial habitat for Chinook salmon and *O. mykiss* fry and juveniles, the two life stages that would benefit the most from additional floodplain habitat.

However, in some lower-flow years when the Don Pedro Reservoir is storing the spring runoff, that operation would reduce downstream flows and the extent of floodplain inundation, adversely affecting salmonid rearing habitat. To estimate the effect of Don

Pedro Reservoir storage during spring runoff under proposed operations,[173] using the output from the Districts' operations model, we estimated the amount of storage (in acre-feet) retained in the months of March and April[174] and the average amount of inundation area that is lost due to reservoir storage. We ran this analysis for five water year types for the period of record, and found that the greatest effect of reservoir storage occurs in the month of March, when reservoir storage may result in the loss of from 22 acres to 148 acres of floodplain inundation, depending on water year type, with an overall loss of 44 acres for all water year types for the total lower river. The loss of inundated area in the more upstream gravel-bedded reach is about half of the total river loss. This indicates that the overall effect of reservoir storage on potential floodplain rearing habitat in the lower river is not substantial. The overall loss of 44 acres would represent about 49 percent of the total inundation at 1,000 cfs and about 2 percent of the total inundation at 9,000 cfs.

We also found that the Lower Tuolumne River Habitat Improvement Program $38 million capital fund would greatly exceed the cost for restoring our overall estimate of 44 acres of floodplain habitat lost due to reservoir storage, using the FWS average cost of $146,836 per acre for floodplain reconnection/restoration projects, although we understand that the Lower Tuolumne River Habitat Improvement Program may be used for other undefined habitat restoration projects. It is unclear: (1) precisely what habitat restoration projects would be funded, (2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights needed to access a property for restoration and maintenance activities for each proposed improvement site, (4) how compliance with the ESA and NHPA would be obtained at each site, and (5) the details on the project design and scope of operation and maintenance activities that would occur at each habitat improvement site to allow the Commission to determine whether the site should be included in the project boundary. Because of these uncertainties and the high cost of the program (levelized annual cost of $2,707,820) in light of the limited effects of the project reservoir storage on floodplain inundation, we are not recommending the Lower Tuolumne River Habitat Improvement Program.

Tuolumne Partnership Advisory Committee

On October 2, 2018, FWS filed revised Don Pedro 10(j) recommendation 2 (Spill Management Plan), revised 10(j) recommendation 3 (Lower Tuolumne River Habitat Improvement Program), and revised 10(j) recommendation 4 (Creation of Tuolumne Partnership Advisory Committee), and withdrew their original 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects. FWS states that this filing

[173] Note that this only estimates the effect of reservoir storage and not for any other consumptive uses.

[174] March and April are important months for fall Chinook rearing and are the months when floodplain inundation typically occurs.

resulted from meaningful discussions between the FWS and the Districts subsequent to the January 29, 2018, FWS filing of comments in response to the REA notice. On October 17, 2018, the Districts filed a response to the FWS October 2, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4 and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal for the Don Pedro Project.

While creation of the TPAC is included as a separate 10(j) recommendation,[175] the TPAC would be an integral part of the implementation of revised 10(j) recommendation 2 (Spill Management Plan) and revised 10(j) recommendation 3 (Lower Tuolumne River Habitat Improvement Program). As we describe in section 3.3.2.2, *Spill Management Plan*, the Districts would seek recommendations on implementation of the spill management plan from the TPAC. The TPAC would meet monthly or more frequently starting in the first January after any license issuance on or about the 10th of each month to review the Districts' projections of potential spills, and discuss use of any identified spill volumes. Further, under 10(j) recommendation 3, habitat improvement projects would be prioritized and recommended to the Districts by the TPAC (see section 3.3.2.2, *Lower Tuolumne River Habitat Improvement Program*). While the concept of an interagency committee to guide the implementation of a spill management plan and Lower Tuolumne River Habitat Improvement Program is reasonable, the Commission has no authority to require other agencies to participate in such a committee, and we therefore do not recommend the TPAC. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program, if that program is implemented in the future.[176]

Fish Stocking

California DFW stocks trout in Don Pedro Reservoir, while DPRA stocks largemouth bass. No known fish stocking has occurred in the reach of the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam, and no local hatchery supplementation occurs in the reach of river downstream of La Grange Diversion Dam. However, hatchery-raised fall-run Chinook salmon from other San Joaquin River tributaries often stray into the Tuolumne River and crossbreed with native Tuolumne River fall-run Chinook salmon.

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[175] TPAC would at a minimum include the Districts, FWS, and CCSF, but other agencies such as NMFS and California DFW would be invited to participate.

[176] We currently are not recommending the lower Tuolumne River habitat improvement program.

To genetically manage the Tuolumne River fisheries, California DFW (10(a) measure M7-1) recommends the Districts develop a fisheries genetic management plan for both projects, in consultation with TREG, as well as a conservation hatchery plan (10(a) measure M7-1). Furthermore, California DFW 10(a) recommendation M7-2 recommends that to mitigate lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities the Districts assume full responsibility for providing reservoir-based recreation, including angling opportunities, at both projects' reservoirs, which are currently or have historically been stocked by California DFW.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Fish Stocking*, we note that California DFW's recommendation is intended to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities. However, the fishery in Don Pedro Reservoir offers substantial recreation opportunities, and there is little basis for requiring the Districts to improve the fishery or to assume the responsibility for stocking the reservoir. Therefore we do not recommend California DFW's recommended Don Pedro Reservoir fish stocking, which we estimate would have an annual levelized cost of $140,000, be included as a requirement of any license issued for the Don Pedro Project. Regarding California DFW's recommended fisheries genetic management plan and conservation hatchery plan, these recommendations do not contain specific details regarding the contents of their plans or their nexus to the Don Pedro Project. Consequently, we do not recommend California DFW's recommended fisheries genetic management plan, which we estimate would have an annual levelized cost of $1,090,300, be included as a requirement of any licenses issued for either project.

Fish Entrainment

Fish entrained through powerhouses may be subjected to injury or mortality during turbine passage, or may be redistributed into irrigation canal systems, and this entrainment may affect the species composition and recruitment of fish to the reaches both upstream and downstream of the diversion facilities.

The Districts do not propose any measures to reduce the entrainment potential of their facilities. California DFW 10(a) measure M8-1 recommends that the Districts develop a facilities salmonid protection and monitoring plan for both projects, that includes provisions for: (1) assessments of all diversions from the Tuolumne River and of all gates where the Districts' canal systems enter the San Joaquin, Merced, Tuolumne, and Stanislaus River for potential access by salmonids; (2) proposed solutions to prevent salmonids from accessing the diversions and canal systems; (3) a monitoring program to determine entrainment rates at the diversions and canal systems at locations where return flow is spilled; (4) a reporting plan for annual and incidental notification requirements; and (5) a financial assurance plan to provide for the implementation of the facilities salmonid protection and monitoring plan.

FWS 10(j) recommendation 12 recommends the Districts develop a fish rescue plan for the La Grange Project that would include provisions for rescuing fish that are entrained into the MID Diversion Tunnel from April 1 through June 15, and tagging and releasing rescued fish into the Tuolumne River downstream of La Grange Diversion Dam. The measure would also require the Districts to perform rescues weekly until 10 or more rescues are made during a rescue attempt, after which, rescue attempts would be performed daily. Rescue attempts could return to a weekly frequency when 10 or fewer rescues per day are performed, and could cease entirely for the remainder of that year, if by May 16 less than 2 fish per day are rescued, for 3 consecutive sampling dates.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Fish Entrainment*, we conclude there is little need for a facilities salmonid protection and monitoring plan, as recommended by California DFW for both projects. California DFW states that the objective of its 10(a) recommendation M8-1 is to create the conditions necessary for healthy resident trout and anadromous salmonid populations throughout the Tuolumne River to achieve self-sustaining, viable populations. However, there are no anadromous species upstream of La Grange Diversion Dam, so anadromous species would not be exposed to entrainment at Don Pedro Dam. While resident trout and other species in Don Pedro Reservoir may be entrained through the power tunnel, considering the low number of fish occurring in deep water and the relatively high expected survival rate through the Don Pedro Powerhouse, operating the Don Pedro Powerhouse is not likely to adversely affect populations of resident trout and other species of fish in Don Pedro Reservoir. Additionally, fish species collected by the Districts in the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam exhibited multiple age classes, indicating successful reproduction and population sustainability in this reach. Furthermore, Lower Tuolumne River salmon do not ascend past the La Grange Dam so there is no possibility that these fish entered the canal via the TID/MID intakes at the La Grange Diversion Dam. Salmon can, however, enter the MID and TID canal systems through other diversions along the river. However, the MID and TID canal systems are used for water supply, are non-project facilities not associated with hydropower generation, and extend well beyond the La Grange Project boundary. Furthermore, the MID canal system is also connected to the Stanislaus River, which may allow salmonids access to the canal completely independent of La Grange Project operations or conditions in the Tuolumne River. Additionally, 26 diversions, owned by a variety of entities, are located downstream of the La Grange Diversion Dam to the Tuolumne River's confluence with the San Joaquin River. Therefore we do not recommend including California DFW's recommended facilities salmonid protection and monitoring plan, which we estimate would have an annual levelized cost of $75,000, or FWS's recommended rescue plan, which we estimate would have an annual levelized cost of $150,000, in any licenses issued for either project.

Fish Enumeration and Predator Control

There are no fish passage facilities at the La Grange and Don Pedro Projects; however, the Districts operate a temporary fish counting weir in the Tuolumne River downstream of La Grange Diversion Dam. While the Districts do not propose to construct or operate any fish passage facilities at the La Grange or Don Pedro Dams, they do propose to construct and operate a small permanent fish counting/barrier weir (less than 5 feet of head at normal flows) at approximately RM 25.5, to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitats. To further reduce predation on Chinook salmon by striped and black bass, the Districts propose to implement a predator control and suppression program that would include active control and suppression of striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir. Control and suppression measures would include, but would not be limited to, sponsoring and promoting black bass and striped bass derbies and reward-based angling in locations above and below the fish counting/barrier weir, and removal and/or isolation via electrofishing, seining, fyke netting, and other collection methods.

In its letter filed January 29, 2018, NMFS states that the Districts' proposed predator control suppression plan is not beneficial to salmonids and does not address the problem that juvenile salmonids have very little floodplain refugia in the lower Tuolumne River and that predator fields (mining pits) are maintained by projects' flows and sediment retention. California DFW 10(a) measure M6 recommends the Districts revise its proposed predator control and suppression plan to include: (1) recommendations for shaping spring pulse flows, recession flows, and how to best meet temperature requirements consistent with requirements of CWA § 303(d) that favors native fish and dissuades non-native predatory fish, (2) recommendations, priorities, and conceptual designs that would be used to conduct the annual placement of sediment and LWM to minimize predator habitat and to favor cover habitat for salmonids, (3) monitoring activities that can be readily incorporated in other required monitoring activities conducted by the Districts and members of the TREG, and (4) performance measures and monitoring actions to evaluate the outcomes of any recommendations from the revised predator control and suppression plan that are incorporated into on-going FERC required measures. The Conservation Groups commented that they strongly oppose the installation of a permanent fish counting/barrier weir, but do support installation of a temporary seasonal fish counting weir and a temporary weir to capture striped bass and black bass in critically dry and super critically dry water years only. Conservation Groups (recommendation 7) recommends that the Districts: (1) annually install a fish counting weir at or near RM 24, from September 15 through at least December 31, with the same basic configuration as the facility that the Districts have deployed since 2009, (2) install a temporary weir in critically dry and super critically dry years, from no later than April 15 to September 1, between RM 25.9 and RM 25 for the purpose of capturing and removing striped bass, black bass, and other non-salmonid piscivorous fish, with no

permanent infrastructure related to the weir, (3) relocate striped bass captured at the temporary weir to San Francisco Bay, and black bass and other warmwater piscivorous fish to reservoirs where salmonids are not present and are isolated from the Tuolumne River or other salmonid-bearing waters, and (4) conduct two snorkel surveys between April 20 and June 30 in any year that the weir is installed, both 300 feet upstream and downstream of the temporary weir, as well as monitor the numbers, species and size of fish captured at the weir.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Fish Enumeration and Predator Control*, we conclude that while the Districts' proposed measures would likely reduce predator abundance in the lower Tuolumne River, and theoretically decrease the amount of predation on juvenile Chinook salmon, it is not known if they would have a measurable benefit to Chinook salmon or *O. mykiss*. When California DWR removed 6,151 predatory fish weighing approximately 7,200 pounds (3.26 metric tons) from Clifton Court Forebay on the Old River in Contra Costa County, California, it did not detect any reductions in salmon mortality (California DWR, 2017). In its first 2 years of predator removal, California DWR did not find a statistically significant difference in Chinook salmon losses from predators (California DWR, 2016, 2017). Additionally, the permanent barrier/counting weir could act as a migration barrier to salmonids. We estimate that the Districts' proposed predator control and suppression plan would have an annual levelized cost of $204,740. However, because construction of a fish counting/barrier weir may not achieve its desired objective to exclude predators, while at the same time may result in additional adverse effects on anadromous salmonids, we do not recommend the Districts construct and operate their proposed permanent fish counting/barrier weir at RM 25.5, which we estimate would have an annual levelized cost of $1,297,460, or their proposed predator control and suppression program. We also do not recommend the measures recommended by the Conservation Groups, which would have an annualized cost of $633,300, for the same reasons that we do not recommend the Districts' proposal.

Anadromous Fish Passage and Reintroduction

Barriers to upstream fish passage can be natural or human-caused and often delay migrations and movements, fragment populations, or prevent access to critical habitat necessary to sustain populations. Under existing conditions, both La Grange and Don Pedro Dams completely block upstream fish migration and impede downstream fish passage. Historic accounts indicate salmon were present in the upper Tuolumne River, perhaps as far upstream as Preston Falls, and also in the lower Clavey River.

The Districts do not propose to evaluate or provide fish passage facilities at La Grange and Don Pedro Dams; however, the Districts did implement a series of workshops and technical studies (required and voluntary) during the Integrated Licensing Process to evaluate the feasibility of reintroducing spring-run Chinook salmon and steelhead to the upper Tuolumne River.

In its preliminary section 18 fishway prescription, NMFS reserves its authority to prescribe the construction, operation, and maintenance of fishways at the projects, including measures to determine, ensure, or improve the effectiveness of such prescribed fishways, pursuant to section 18 of the FPA. NMFS (10(a) recommendation 5) recommends the Districts develop a fish passage program plan for providing safe, timely, and effective passage of juvenile and adult fish at the projects. To ensure that fishway design and operations can best accomplish safe, timely and effective fish passage, NMFS recommends the development of a phased fish passage program plan that assesses the feasibility and design of fishways and procedures for effective up and downstream passage. The fish passage program plan would include several fish passage actions that are intended to proceed in phases and use an adaptive management approach. The ultimate goal is to create facilities and operations that provide successful fish passage. The main phase consists of short-term actions within 7 years from the issuance of licenses. Within this phase, actions could occur concurrently as new information is gained, evaluated, and adaptively managed. These short-term actions are outlined in table 3.3.2-43, section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, in the subsection *Anadromous Fish Passage/Reintroduction.* In their recommendation 2, the Conservation Groups advocate that NMFS should reserve its FPA section 18 authority to require fish passage for spring-run Chinook salmon and possibly steelhead to the upper Tuolumne River after 2025.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Anadromous Fish Passage/Reintroduction*, we conclude that both La Grange and Don Pedro Dams completely block upstream access to as much as 18.17 miles of accessible and 31.26 miles of potentially accessible anadromous fish habitat in the upper Tuolumne River Basin, and also prevent or impede downstream fish passage. Upstream passage would be feasible at La Grange Diversion Dam via a CHTR facility evaluated by the Districts in its pre-application studies. CHTR represents a relatively proven technology, with numerous similar facilities in operation that, in general, exhibit high overall fish passage performance characteristics meeting resource agency performance criteria. When sited and designed to accommodate the unique site-specific conditions exhibited at La Grange Diversion Dam, this alternative would likely meet performance criteria. The feasibility of providing successful downstream passage, however, is less likely. One alternative that is currently in use at other hydroelectric projects (a floating surface collector, which could be deployed near Don Pedro Dam) would be unlikely provide safe, timely or effective downstream fish passage for out-migrating anadromous salmonids. The high head of the dam combined with the dramatic (i.e., up to 213 feet) fluctuations in reservoir surface elevation in Don Pedro Reservoir and associated seasonal changes in temperature and velocity, along with an abundance of predator fish in the reservoir, would create challenging conditions for fish collection. No existing forebay collection facilities currently operate under such dynamic conditions, and operation of a juvenile downstream collection facility at the head of the reservoir (a second alternative) would similarly be challenging and experimental in

nature (Districts, 2017e). Inflows ranging from about 100 to 10,000 cfs during the outmigration period, unstable channel conditions, and an existing Wild and Scenic River designation immediately upstream would likely prohibit the construction and operation of a permanent in-river collector upstream of Don Pedro Reservoir. Given these constraints, a temporary/portable in-river collection device or series of these devices at the upstream end of Don Pedro Reservoir may be the only biologically viable option for downstream passage, and even then, the use of these devices may be restricted pursuant to the Wild and Scenic River designation, and may be less efficient than a permanent facility.

We find that NMFS's 10(a) recommendations are not justified, based on our analysis of the feasibility of establishing viable populations of federally listed salmonids in the upper Tuolumne River Basin. In addition, NMFS has not shown that fish passage above La Grange Diversion Dam would be reasonably certain to occur in the future. Therefore, we conclude that development and implementation of NMFS's 10(a) recommendations for anadromous fish passage and reintroduction is not worth the estimated levelized annual cost of $412,230 (split equally between the two projects; $206,110 each) and do no recommend including these measures as part of any licenses issued for the projects.

Salmonid Monitoring

NMFS recommends (10(a) recommendation 4) the Districts develop a salmonid monitoring plan within the first year of any new licenses issued for the projects. The plan would cover resident and anadromous salmonids with the option for green sturgeon to be added to the plan once NMFS has determined their presence in the lower Tuolumne River. Under NMFS's plan, monitoring would include: (1) annual snorkeling, pre-spawning mortality, and carcass surveys in the following reaches (a) downstream of La Grange Diversion Dam to Basso Bridge (RMs 52.0 to 47.5), (b) from Basso Bridge downstream to Roberts Ferry (RMs 47.5 to 39.5), (c) from Roberts Ferry downstream to Santa Fe Bridge (RMs 39.5 to 36.3), and (d) from Santa Fe Bridge to the Tuolumne River's confluence with the San Joaquin River (RMs 36.3 to 0); (2) annual juvenile emergence and outmigration monitoring from at least mid-January through the end of May, using a paired RST at RM 5.3 (Grayson RST) and one at RM 29.8 (Waterford RST); (3) operation of a seasonal counting weir at RM 24.5 to estimate Central Valley Chinook salmon and California Central Valley steelhead escapement and provide data on the percentage of females and migration timing; (4) annual otolith analysis to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population; and (5) supervision of all work by California DFW and NMFS field staff in consultation with TRTAC.

FWS recommends (10(j) recommendation 5) the Districts develop a salmonid monitoring plan in consultation with FWS, NMFS, California DFW, and the Water Board, within the first 3 years of any new licenses issued for the projects. Under FWS's plan, salmonid monitoring would include at a minimum: (1) measurement of fall-run Chinook salmon escapement by conducting annual carcass surveys, from October 1

through December 31; (2) morphometric measurements[177] of 100 percent of the Chinook salmon carcasses downstream of the existing seasonal fish counting weir at RM 24.5; (3) morphometric measurements of the first 500 Chinook salmon carcasses found upstream of the fish counting weir, plus morphometric measurements of 5 percent of the next 500 to 1,000 Chinook salmon carcasses found upstream of the fish counting weir; (4) annual paired RST surveys from February 1 through June 15 at RM 5.3 (Grayson RST) and at RM 29.8 (Waterford RST); (5) the operation and maintenance of the existing seasonal counting weir at RM 24.5; (6) snorkel surveys prior to each LWM placement action, within the area of the LWM placement and 10 meters upstream and downstream of the placement; two snorkel surveys should occur in the placement area following LWM placement (the first during the second week following placement and the second prior to spring flows returning to minimum instream flows in the calendar year following LWM placement); and (7) annual reporting of the results of salmonid monitoring to FWS, NMFS, and California DFW.

California DFW recommends (10(a) recommendation M11) a similar plan as FWS, however, with the provision that if STM Work Group is established by the Water Board, as part of the update to the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, then TREG would work with the STM Work Group, to further the goals and objectives of the California DFW's recommended salmonid monitoring plan.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, in the subsection *Salmonid Monitoring*, we conclude that while the agency-recommended salmonid monitoring measures would provide valuable information on annual anadromous salmonid escapement, pre-spawning mortality, spawning success, juvenile outmigration and abundance, and other parameters, we do not see how this information would specifically relate to project operations or how the data could be used to inform any future changes in these operations. In addition, the resource agencies do not explain what would be done with the data or how it would be used to better manage the resource. Furthermore, the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the operation of other dams and diversions in the watershed. All of these factors are outside of the Districts' control and unrelated to the projects. Therefore, we do not recommend including a stand-alone plan to monitor salmonids in the Tuolumne River, such as those recommended by NMFS (annual levelized cost of $915,300), FWS (annual levelized cost of $885,300), and California DFW (annual levelized cost of $800,300), as a requirement in any licenses issued for either project.

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[177] FWS recommend the morphometric measurements include: scale, otolith, and coded wire-tag collections; length; sex; egg-count in females; and pre-spawn mortality.

Recreational Enhancements at La Grange Reservoir

California DFW (10(a) recommendation M7-3-1) recommends that the District develop recreation opportunities at the La Grange Reservoir by: (1) providing angler access (both by foot and boat) to the reservoir; (2) providing the necessary facilities to support angler activities; and (3) meeting all health and safety requirements of the FPA at La Grange Reservoir.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects*, in the subsection *Recreation Resource Management*, we find that such a recommendation would encourage boating and swimming in the reservoir, which would constitute high risk recreational activities that could be unsafe for the public because of the potential for rapid changes in water velocity in the area. Therefore we do not recommend including California DFW (10(a) recommendation M7-3-1), which would have an annual levelized cost of $17,000, in any licenses issued for the projects.

Boating Facilities

The Districts' proposal to construct a new boat launch near old Don Pedro Dam would allow boating access to Don Pedro Reservoir when the water surface elevation is at or below 600 feet. In terms of the boating access that would be needed to accommodate the new proposed minimum pool of 550 feet, simulations of the various operational scenarios proposed by the Districts and recommended by the agencies/other stakeholders found that the minimum water surface elevation would not fall to below 600 feet in the 42-year period of record that was analyzed. Consequently, we do not recommend construction of the proposed boat launch near old Don Pedro Dam, which we estimate would have an annual levelized cost of $41,360 because it would seldom, if ever, be necessary to provide boating access to Don Pedro Reservoir at elevations less than 600 feet. The potential exists for elevations less than 600 feet to occur during hydrologic conditions drier than those that occurred during the 42-year period of record that was analyzed, but those conditions would likely be infrequent.

The Districts also propose to install a new boat take-out/put-in facility at RM 25.5, at the location of the proposed fish counting and barrier weir. While we recognize the proposed facility would allow boaters to circumnavigate the barrier and provide a point of access for those who want to begin or end their boating trips at this location, for reasons described in section 5.1.3, *Other Measures Not Recommended by Staff, Fish Enumeration and Predator Control*, we do not recommend the Districts construct and operate a proposed permanent fish counting/barrier weir at RM 25.5. If the counting/barrier weir is not constructed, the proposed boat take-out/put-in facility is not necessary to allow continued downstream boat passage, and the costs and impacts associated with construction of the take-out/put-in facility would increase. Therefore, we conclude that the benefits of constructing the facility, which would have an annualized cost of $8,270, do not justify its costs, and we do not recommend the Districts' proposed

take-out/put-in facility at RM 25.5 be included as a requirement in any license issued for either project.

Ward's Ferry Access and Facility Improvements

Ward's Ferry Bridge, located at the upstream end of Don Pedro Reservoir, serves as the take-out location for the Meral's Pool whitewater boating run on the Tuolumne River. In the amended final license application, the Districts propose to design and construct improvements at Ward's Ferry Bridge, including an improved boat take-out facility upstream of the bridge to improve public safety during river egress. However, the Districts would not be responsible for the long-term operation or maintenance of the facility because it would not be a project recreational facility.[178] Although the stakeholder recommendations that would require developing a take-out facility differ slightly in terms of specific capacity and types of amenities, each of these conditions and recommendations, including BLM Don Pedro revised 4(e) condition 13, describe extensive construction to provide vehicular access for extracting watercraft at all water levels, restrooms, trails, parking, and day-use facilities, and indicate the Districts should also be responsible for operating and maintaining the facility.

The Districts installed a restroom to address sanitation concerns near this point of public access to Don Pedro Reservoir under the current license. However, the restroom is subject to frequent destructive vandalism. Requiring the Districts to expend burdensome time and funding to maintain this site would not likely provide a safe, functional, suitable restroom at this location. The Forest Service authorizes commercial and private whitewater boating on the Meral's Pool run of the Tuolumne River by issuing permits. As the permitting agency, the Forest Service is responsible for managing this activity and can specify logistical elements such as the number of whitewater boaters and the types of water craft permitted, as well as the timing and places of use on public land. As evidenced by the documented problems with congestion, it appears the agency has authorized a level of use that exceeds the carrying capacity of the take-out at Ward's Ferry Bridge. BLM states the take-out facilities are necessary to address the project effects of the reservoir inundating other suitable take-out locations. The need for such facilities is not generated by the project, and their construction would not address any project effect. With regard to public safety concerns about congestion on the county road, the Ward's Ferry Road, including the bridge, is owned and maintained by Tuolumne County and because it is a county road used primarily for public purposes, it does not meet the Commission's definition of a project road. The agency and whitewater

[178] Exhibit E, page 3-292 states, "the Districts are proposing to enhance river recreation and help ameliorate bridge and road safety concerns by improving the take-out." However, the Districts' November 27, 2017, AIR response states, "the Districts are not proposing the Ward's Ferry rafting take-out improvement as a project facility, but as an off-license enhancement."

boating interests contend their conditions and recommendations are necessary because they believe a direct relationship exists between the project and whitewater boating, but as discussed above, none of the rationale provided by these entities describes what aspects of the project or its operation are responsible for such relationship. The take-out facility proposed for development at RM 78 does not address an effect of the project or otherwise fulfill a project-related purpose. As such, we do not recommend including the above facility improvements at Ward's Ferry Bridge as a condition of any license issued for the Don Pedro Project.

5.2 UNAVOIDABLE ADVERSE EFFECTS

The continued operation of the Don Pedro and La Grange Projects would result in some minor, unavoidable, adverse effects on geologic, soil, geomorphic, water quality, aquatic, and terrestrial resources. Effects on geologic and soil resources would include some minor continued erosion associated with project operation, the renovation of recreation facilities, and interruption of sediment transport at project reservoirs. Most of these effects would be reduced by recommended resource enhancement measures, including implementation of the following plans: (1) soil erosion and sediment control plan; (2) spill prevention control and countermeasure management plan, (3) coarse sediment management plan, (4) LWM management plan, (5) TRMP, (6) bald eagle and special-status bird management plan, and (7) fire prevention and response management plan.

Construction of new facilities and project maintenance have the potential to adversely affect aquatic habitat by introducing silt through erosion or via the accidental release of fuels, lubricants, and other hazardous substances into the aquatic environment. However, the extent of proposed new construction is limited, and implementation of soil erosion and sediment control and spill prevention, control, and countermeasures plans would limit the potential for adverse effects.

Project operations would continue to affect fishery resources. Reservoir storage and manipulation of flow releases for power production would continue to cause fluctuations in river flow and aquatic habitat downstream of the projects, potentially affecting the production of resident and anadromous species. Provision of increased instream flows, pulse flows, and ramping/recession rates as proposed, however, would mitigate many of these effects and would allow these species to successfully complete their life history requirements in the lower Tuolumne River. The La Grange Project would continue to block the upstream movement of anadromous fish, which once migrated upstream of both the La Grange and Don Pedro Project sites. While this blockage to migration would continue, habitat enhancement measures in the lower Tuolumne River would enhance production of anadromous species and at least partially mitigate for the loss of habitat upstream of the dams. Resident trout and other fish species in the project reservoirs may be entrained through the powerhouses and be subjected to stress, injury, and mortality. However, considering the low number of fish occurring at depth in Don Pedro reservoir, the low levels of fish entrainment at the

intakes, and the relatively high survival rate of fish entrained through the project powerhouses, it is likely that the number of fish that are subject to entrainment mortality is relatively low. However, some minor levels of mortality would still be likely to occur.

For terrestrial resources, unavoidable adverse effects could include limitation of riparian vegetation due to flow fluctuations downstream of the projects and some loss of vegetation and wildlife habitat from the construction, repair, and maintenance of existing or new project facilities and recreation facilities that may require permanent removal of vegetation. Effects on vegetation and wildlife habitat, however, would be reduced by implementation of the many components of the terrestrial resources management and bald eagle and special-status bird management plans, and by implementation of a flow regime and recession rates that would act to enhance establishment and growth of riparian vegetation.

Under the proposed action, the continued operation of the project would continue to adversely affect some archaeological sites by exposure, erosion, scouring, deflation, hydrologic sorting, and the horizontal and vertical movement of artifacts. Proposed construction activities, including recreational enhancements also have the potential for unavoidable adverse effects on cultural resources, particularly in areas that have not yet been surveyed. The execution of a PA and implementation of the final HPMP would ensure proper protection and management of significant cultural resources within the project's APE and would provide satisfactory resolution of any project-related adverse effects.

5.3 SUMMARY OF SECTION 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to our November 30, 2017, notice accepting the application to license the Don Pedro Project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, FWS filed 12 recommendations under section 10(j) of the FPA on January 29, 2018. However, on October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its Don Pedro 10(j) conditions 2, 3, 4, and 7, and replacing

them with revised 10(j) conditions 2, 3, and 4, resulting in 11 recommendations. We found 7 of the 11 recommendations to be within the scope of 10(j). Of these seven recommendations, we determined that three may be inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5.3.1-1 lists each of these recommendations and whether they are adopted in the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section.

In response to our November 30, 2017, notice accepting the application to license the La Grange Project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, FWS filed 12 recommendations under section 10(j) of the FPA on January 29, 2018. However, on October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its La Grange 10(j) conditions 2, 3, 4, and 7, resulting in eight recommendations. We found six of the eight recommendations to be within the scope of 10(j). Of these six recommendations, we determined that two may be inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5.3.1-2 lists each of these recommendations and whether they are adopted in the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section.

Sections 5.1.2, *Additional Measures Recommended by Staff*, and 5.1.3, *Other Measures Not Recommended by Staff*, discuss the reasons we do or do not recommend adopting measures that we have determined are within the scope of section 10(j).

Table 5.3.1-1. FWS preliminary section 10(j) recommendations for the Don Pedro Hydroelectric Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
1. Develop a streamflow and reservoir level compliance monitoring plan.	FWS (Recommendation 1)	Yes	$300	Yes, except that we do not recommend the addition of a new flow gage downstream of the infiltration galleries
2. Develop a spill management plan.	FWS (Revised Recommendation 2)	Yes	$9,650	Yes
3. Develop a Lower Tuolumne River Habitat Improvement Program and associated capital fund and annual funding accounts.	FWS (Revised Recommendation 3)	No, not a specific measure to protect fish and wildlife	$2,707,820	No (see section 5.1.3)
4. Create a TPAC.	FWS (Revised Recommendation 4)	No, not a specific measure to protect fish and wildlife	$25,000	No (see section 5.1.3)
5. Develop a salmonid monitoring plan.	FWS (Recommendation 5)	Yes	$885,300	No (see section 5.1.3)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
6. Develop a water temperature monitoring plan.	FWS (Recommendation 6)	Yes	$360,000	No (see section 5.1.3)
7. Prepare a draft BA to correct the deficiencies identified in the applicant-prepared BA for terrestrial species by addressing potential project impacts on the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle, Layne's butterweed, and Red Hills vervain.	FWS (Recommendation 8)	No, not a specific measure to protect fish and wildlife	$120	No – the threatened and endangered species section of this EIS serves as our BA
8. Revise the Woody Debris Management Plan to include rapid LWM removal.	FWS (Recommendation 9)	Yes	$75,300	Yes, in part (see section 5.1.3)
9. Develop a bald eagle management plan.	FWS (Recommendation 10)	Yes	$20,890	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
10. Revise the TRMP to include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, California tiger salamander, Layne's butterweed, and Red Hills vervain.	FWS (Recommendation 11)	Yes	$5,190	Yes, in part (see section 5.1.3)
11. Organize ecological group and host annual meeting.	FWS (Recommendation 12)	No, not a specific measure to protect fish and wildlife	$25,000	No (see section 5.1.3)

Table 5.3.1-2. FWS preliminary section 10(j) recommendations for the La Grange Hydroelectric Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
1. Develop a streamflow compliance monitoring plan for the lower Tuolumne River.	FWS (Recommendation 1)	Yes	$1,300[a]	Yes, except that we do not recommend the addition of a new flow gage downstream of the infiltration galleries
2. Develop a salmonid monitoring plan.	FWS (Recommendation 5)	Yes	$885,300	No (see section 5.1.3)
3. Develop a water temperature monitoring plan.	FWS (Recommendation 6)	Yes	$360,000	Yes, in part (see section 5.1.3)
4. Prepare a draft BA for the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle.	FWS (Recommendation 8)	No, not a specific measure to protect fish and wildlife	$120	No – the threatened and endangered species section of this EIS serves as our BA
5. Develop a bald eagle management plan.	FWS (Recommendation 9)	Yes	$5,590	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
6. Revise the TRMP to include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, California tiger salamander, and western pond turtle.	FWS (Recommendation 10)	Yes	$28,340	Yes, in part (see section 5.1.3)
7. Organize ecological group and host annual meeting.	FWS (Recommendation 11)	No, not a specific measure to protect fish and wildlife	$10,000	No (see section 5.1.3)
8. Develop a fish rescue plan for the MID Diversion.	FWS (Recommendation 12)	Yes	$150,000	No (see section 5.1.3)

5.3.1 Land Management Agencies' Section 4(e) Conditions

In this draft EIS, we analyze revised conditions filed by BLM in response to the ready for environmental analysis notice. In section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the 4(e) conditions submitted by BLM, and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we adopt the condition in our staff alternative.

Of the 43 revised conditions filed by BLM for the Don Pedro Project,[179] we consider 26 conditions (conditions 1, 5, 10, 19 through 31, 33, 34, 36 through 42, and 44) to be administrative or legal in nature and not specific environmental measures. Therefore, we do not analyze these conditions in this EIS. Table 5.3.2-1 summarizes our conclusions with respect to the 17 revised 4(e) conditions that we consider to be environmental measures. We include in the staff alternative nine conditions as specified by the agency, modify three conditions to adjust the scope of the measure, and do not recommend five conditions; the measures not adopted in total are discussed in more detail in section 5.1.3, *Other Measures Not Recommended by Staff.*

Table 5.3.2-1. BLM revised section 4(e) conditions for the Don Pedro Hydroelectric Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 2. Provide annual employee training.	$2,000	No
No. 3. Implement a soil erosion and sediment control plan.	$300	Yes
No. 4. Obtain and maintain a BLM-approved burn plan for any LWM stored and burned on BLM-administered lands and make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry.	$75,300	Yes
No. 6. Implement a BLM-approved Aquatic Invasive Species Management Plan.	$25,300	Yes, in part (see section 5.1.3)

[179] BLM withdrew preliminary condition 12 when it filed its revised conditions on August 23, 2018.

Condition	Annualized Cost	Adopted?
No. 7. Implement a BLM-approved TRMP.	$11,150	Yes, in part (see section 5.1.3)
No. 8. Implement a BLM-approved Bald Eagle Management Plan.	$20,890	Yes
No. 9. Annually review special-status species.	$2,000	No
No. 11. Hold annual recreation coordination meetings.	$2,000	Yes
No. 13. Implement a Ward's Ferry Take-out Management Plan.	$791,560	No
No. 14. Implement a BLM-approved Recreation Resource Management Plan.	$5,740	Yes, in part (see section 5.1.3)
No. 15. Implement the amended HPMP.	$201,380	Yes
No. 16. Implement a BLM-approved transportation system management plan.	$45,300	Yes
No. 17. Implement a BLM-approved Fire Prevention and Response Management Plan.	$2,300	Yes
No. 18. Implement a BLM-approved visual resources management Plan.	$1,300	Yes
No. 32. Implement pesticide-use restrictions on BLM lands.	$0	No
No. 35. Consult on ground-disturbing activities not addressed in the NEPA process.	$0	No
No. 43. Implement a BLM-approved hazardous substances plan.	$590	Yes

Of the 35 preliminary conditions filed by BLM for the La Grange Project, we consider 25 conditions (conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35) to be administrative or legal in nature and not specific environmental measures. Therefore, we do not analyze these conditions in this EIS. Table 5.3.2-2 summarizes our conclusions with respect to the 10 preliminary 4(e) conditions that we consider to be environmental measures. We include in the staff alternative five conditions as specified by the agency, modify one condition to adjust the scope of the measure, and do not

recommend four conditions; the measures not adopted in total are discussed in more detail in section 5.1.3, *Other Measures Not Recommended by Staff.*

Table 5.3.2-2. BLM preliminary section 4(e) conditions for the La Grange Hydroelectric Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 2. Provide annual employee training.	$2,000	No
No. 3. Implement a BLM-approved soil erosion and sediment control plan.	$300	Yes
No. 5. Implement a BLM-approved TRMP.	$17,670	Yes, in part (see section 5.1.3)
No. 6. Annually review special-status species.	$2,000	No
No. 7. Implement the amended HPMP.	$8,000	Yes
No. 8. Construct and maintain a trail from La Grange Headquarters to the Tuolumne River, a kiosk sign, and two picnic tables.	$12,510	Yes, but to be included as a Don Pedro Project facility
No. 9. Implement a BLM-approved Bald Eagle Management Plan.	$5,590	Yes
No. 23. Implement pesticide-use restrictions on BLM lands.	$0	No
No. 26. Consult on ground-disturbing activities not addressed in the NEPA process.	$0	No
No. 34. Implement a BLM-approved hazardous substances plan.	$590	Yes

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 24 comprehensive plans that are applicable to the Don Pedro and La Grange Projects, located in California. No inconsistencies were found.

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Peter Foote—Quality Control Review (Senior Fisheries Biologist; M.S., Fisheries Biology; B.S., Wildlife Biology)

Kenneth Hodge—Engineering, Need for Power, and Developmental Analysis (Principal Engineer; B.S., Civil Engineering)

Nicholas Funk—Geology and Soils, Water Quantity (Water Resources Planner; M.S., Water Resources Management and Hydrologic Science; B.S., Environmental Policy and Planning)

Bernward Hay— Geology and Soils, Senior Review (Principal Environmental Scientist; Ph.D., Oceanography (Marine Geology); M.S., Geological Sciences and Remote Sensing)

Brian Mattax—Water Quality (Senior Aquatic Scientist; B.S., Biology)

Steve Byrne—Fisheries Resources (Fisheries Biologist; M.S., Marine and Environmental Biology; B.S., Biology)

Phil Baigas—Terrestrial Resources and Threatened and Endangered Species (Junior Ecologist; M.S., Rangeland Ecology and Watershed Management; B.S., Geography/GIS)

Tyler Rychener—Terrestrial Senior Review (Environmental Scientist/GIS; M.S., Plant Biology; B.S., Biology)

Carol Efird—Recreation, Land Use, and Aesthetic Resources (Senior Recreational Specialist; B.S., Forestry)

Alison Macdougall—Cultural Resources (Senior Environmental Manager; B.A., Anthropology)

Ann Gray Koch—General Support (Aquatic Biologist; B.S., Biological Science; B.S. Civil Engineering)

Coreen Johnson—Editorial Reviewer (Technical Editor; B.A., English/Education)

Subcontractor Staff

Meridian Environmental

George Gilmour—Fisheries Resources and Threatened and Endangered Species (Senior Fisheries Biologist; B.S., Biology)

8.0 LIST OF RECIPIENTS

All Outdoors California Whitewater Rafting, Inc.

American Rivers

American River Touring Association, Inc.

American Whitewater

ARTA Rafting

Bay Area Water Supply and Conservation Agency

California Department of Fish and Wildlife

California Sportfishing Protection Alliance

Central Sierra Environmental Resource Center

City and County of San Francisco

Committee to Save the Kings

County of Tuolumne

Friends of the River

Golden West Women Flyfishers

Hanson Bridgett

JMR Energy Infra LLC

Merced River Conservation Committee

Modesto Irrigation District

National Marine Fisheries Service

OARS, Inc.

Office of the Governor of California

Restore Hetch Hetchy

San Francisco Bay Area Water Users Association

SierraMac Rafting

Stillwater Sciences

The Bay Institute

Trout Unlimited

Tuolumne River Conservancy

Tuolumne River Expeditions, Inc.

Tuolumne River Preservation Trust

Tuolumne River Trust

Turlock Irrigation District

U.S. Army Corps of Engineers

U.S. Fish & Wildlife Service

U.S. House of Representatives

U.S. Senate

APPENDIX A—License Conditions Recommended by Staff for the Don Pedro Project

I. MANDATORY CONDITIONS

On January 29, 2018, the California State Water Resources Control Board (Water Board) filed 11 preliminary conditions under section 401 of the Clean Water Act (appendix E). These conditions are described in section 2.2.5, Modifications to Applicant's Proposal—Mandatory Conditions, of the EIS. We consider preliminary condition 11 to be administrative. We anticipate that all valid section 401 conditions will be included in any new license issued for the project.

On August 23, 2018, the U.S. Department of Interior, Bureau of Land Management (BLM) filed 44 revised 4(e) conditions (appendix C).[1] These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the environmental impact statement (EIS). We consider revised conditions 1, 5, 10, 19 through 31, 33, 34, 36 through 42, and 44 to be administrative or legal in nature and not specific environmental measures. Of the 17 conditions we consider to be environmental measures applicable to the Don Pedro Project, we include in the staff alternative 9 conditions as specified by the agency, modify 3 conditions to adjust the scope of the measure, and do not recommend 5 conditions. We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, the BLM conditions that we do not recommend or that we recommend modifying in the manner noted above, would be included in a new license as specified by the agency and to the extent allowed by applicable law.

II. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the preliminary mandatory conditions.

Article 401. *Commission Approval, Reporting, and Filing of Amendments*.

(a) Requirement to File Plans for Commission Approval

Various conditions found in the Water Board's preliminary section 401 water quality certification (certification) require the licensees to prepare plans in consultation with other entities for approval by the Water Board for submittal to the Commission and to implement specific measures without prior Commission approval. Each such plan must also be submitted to the Commission for approval. These plans are listed below.

Certification Condition No.	Plan Name	Due Date
4	Large Woody Material Management Plan	Within one year of license issuance

[1] BLM withdrew preliminary condition 12 when it filed its revised conditions on August 23, 2018.

Certification Condition No.	Plan Name	Due Date
5	Sediment Management Plan	Within one year of license issuance
6	Water Quality Monitoring Plan	Within one year of license issuance
7	Water Temperature Monitoring Plan	Within one year of license issuance
8	Aquatic Invasive Species Management Plan	Within one year of license issuance
9	Erosion and Sediment Control Plan	Within one year of license issuance
10	Hazardous Material Plan	Within one year of license issuance

The licensees must include with each plan filed with the Commission documentation that the licensees developed the plan in consultation with, and received approval from, the Water Board. The Commission reserves the right to make changes to any plan filed. Upon Commission approval, the plan becomes a requirement of the license, and the licensees must implement the plan or changes in project operations or facilities, including any changes required by the Commission. Any further changes in the Commission-approved schedules or plans require approval by the Commission before implementing the proposed change.

(b) Requirement to File Reports

Certain conditions of the Water Board's 401 certification require the licensees to file reports with other entities. Because these reports relate to compliance with the requirements of this license, each such report must also be submitted to the Commission. These reports are listed in the following table:

Certification Condition No.	Description	Due Date
4	Reports that document the implementation and effectiveness of large woody material management in the Tuolumne River downstream of La Grange Diversion Dam.	One year after completion of each large woody material monitoring period.
5	Reports that document the implementation and effectiveness of the coarse and fine sediment transport past La Grange Dam in the Tuolumne River.	One year after completion of each sediment monitoring period.

The licensees must submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report. The Commission reserves the right to require changes to project operations or facilities based on the information contained in the report and any other available information.

Article 402. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensees to construct and maintain, or to provide for the construction, operation, and maintenance of, such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, pursuant to section 18 of the Federal Power Act.

Article 403. *Minimum Pool at Don Pedro Reservoir*. The licensees must maintain a minimum pool elevation in Don Pedro Reservoir of not less than 550 feet National Geodetic Vertical Datum of 1929, except for drawdowns necessary to maintain minimum streamflows specified in article 409.

Article 404. *Erosion and Sediment Control Plan.* Before the commencement of any ground-disturbing activity within the project boundary, the licensees must file for Commission approval, a soil erosion and sediment control plan. The plan must include, at a minimum, the following:

(1) a description of the best management practices for erosion control that will be applied in specific circumstances;

(2) provisions for inspecting erosion control measures while they are in place;

(3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event);

(4) techniques that will be used to stabilize sites once construction is completed;

(5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

The soil erosion and sediment control plan must be developed after consultation with the Bureau of Land Management, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife, and be filed with the Commission for approval at least 90 days in advance of initiating construction of recreation or other project facilities that require ground-disturbing activities. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Ground-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 405. *Spill Prevention Control and Countermeasure Management Plan.* Within 6 months of license issuance, the licensees must file for Commission approval, a revised Spill Prevention Control and Countermeasure Management Plan.

The licensees must revise the Spill Prevention Control and Countermeasure Management Plan, filed October 11, 2017, to include the following additional measures:

(1) a description of how hazardous substances would be transported, stored, handled, and disposed;

(2) a description of equipment and procedures to be used to address hazardous substance spills;

(3) a provision to notify the Bureau of Land Management, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife within 24 hours of discovering a hazardous substances spill; and

(4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

The revised Spill Prevention Control and Countermeasure Management Plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and

Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 406. *Drought Management Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a drought management plan. The plan must include, at a minimum, the following:

(1) a definition of drought conditions based on available data specific to the project (e.g., current storage in Don Pedro Reservoir, watershed snowpack and soil moisture conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations);

(2) which license requirements would be temporarily modified during drought conditions; and

(3) how the project would be operated when drought conditions occur.

The licensees must develop the drought management plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 407. *Water Temperature Monitoring Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a water temperature monitoring plan. The plan must include, at a minimum, the following:

(1) a provision to monitor water temperatures in Don Pedro Reservoir near the dam and in the lower river at the gage downstream of La Grange (river mile 51.7), Basso Bridge (river mile 47.5), Roberts Ferry (river mile 39.5), and above the proposed infiltration galleries (upstream of river mile 25.9), whenever Don Pedro Reservoir elevations are lower than 600 feet Nation Geodetic Vertical Datum of 1929; and (2) a provision for reporting monitoring results and identifying any actions proposed to address any water temperature concerns regarding the survival of Tuolumne River salmonids.

The licensees must develop the water temperature monitoring plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 408. *Operation Compliance Monitoring Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, an operation compliance monitoring plan to document compliance with the streamflow and reservoir level requirements specified in articles 403, 409, 410, 411, and 412.

The plan must describe, at a minimum, the following:

(1) locations where the licensees would monitor streamflow and reservoir levels;

(2) equipment that would be used by the licensees to monitor streamflow and reservoir levels;

(3) how the equipment would be deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained;

(4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage;

(5) how the licensees would make streamflow and reservoir level data available to the Commission, agencies, and the public;

(6) how the licensees would update the proposed plan as needed in the future; and

(7) a provision to provide information to the Commission, and make it available to the public, regarding the amount of water that is diverted into the infiltration galleries during the time periods when the boating flows are to be provided.

The licensees must develop the operation compliance monitoring plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 409. *Minimum Flows below La Grange Diversion Dam.* The licensees must release flows from the Don Pedro Dam such that the minimum flows in table 1 are maintained at the U.S. Geological Survey gage 11289650 downstream of La Grange Diversion Dam.

Table 1. Required minimum flows in cubic feet per second by water year type, as determined in accordance with the 60-20-20 San Joaquin River Index.

	Water Year Type		
Period	**Wet, Above Normal, Below Normal Water Years**	**Dry Water Years**	**Critical Water Years**
June 1 through June 30	150	125	125
July 1 through October 15	225	175	150
October 16 through December 31	275	225	200
January 1 through February 28/29	225	200	175

Period	Water Year Type		
	Wet, Above Normal, Below Normal Water Years	Dry Water Years	Critical Water Years
March 1 through April 15	250	225	200
April 16 through May 15	275	250	200
May 16 through May 31	300	275	225

The flow release requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. If the flow is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 410. *Spring Pulse Flow Release Plan.* Within 6 months of license issuance, the licensees must file for Commission approval, a spring pulse flow release plan to encourage salmonid smolt outmigration and increase survival.

The plan must include, but not necessarily be limited to, the following:

(1) a provision to provide a pulse flow release from Don Pedro Dam, during the juvenile fall Chinook salmon outmigration season, of a total volume of 150,000 acre-feet during wet and above normal water years; 100,000 acre-feet during below normal water years; 75,000 acre-feet during dry water years; 45,000 acre-feet during sequential dry water years; 35,000 acre-feet during the first critical water year; and 11,000 acre-feet during sequential critical water years, as determined in accordance with the 60-20-20 San Joaquin River Index;

(2) a description of the operational methods required to implement the spring pulse flow releases;

(3) a provision to file an annual report with the Commission by December 15 of each year that documents the timing of fall-run Chinook salmon spawning, juvenile development (i.e., fish size data from routine seine and rotary screw trap monitoring), pulse flow design, pulse flow implementation, and preliminary monitoring results;

(4) a provision to file a report with the Commission that assesses the results of the pulse flow implementation and monitoring after a period of seven years, to determine if any adjustments in pulse flow triggers and duration are needed, as well as whether other pulse flow management options should be considered.

The total volume of water must not include the volume of water associated with the minimum flow specified in article 409.

The licensees must develop the spring pulse flow release plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission. No changes to pulse flow volumes contained in this article shall occur without approval by the Commission.

Article 411. *Flushing Flows.* The licensees must provide a flow of 1,000 cubic feet per second for a period of 72 hours as measured at the U.S. Geological Survey gage 11289650 downstream of La Grange Diversion Dam, commencing on October 5 during wet, above normal, and below normal water years, to clean gravels of accumulated algae and fines prior to the peak fall-run Chinook salmon spawning period.

Article 412. *Spill Management Plan.* Within one year of license issuance, the licensees must file for Commission approval, a spill management plan to control the magnitude, timing, and duration of spill events into the lower Tuolumne River to improve fall-run Chinook salmon floodplain rearing habitat.

The plan must include, but not necessarily be limited to, the following:

(1) identification of the preferred timing of releases, minimum duration, and preferred flow rates;

(2) a provision to estimate projected spill volumes using the 90 percent runoff exceedance values as published by California Department of Water Resources in Bulletin 120, current Don Pedro Reservoir water surface elevation, the licensees' water supply demands, and other flow-related requirements of this license.

The licensees must provide their estimated projected spill volume to the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, California Department of Fish and Wildlife, and the City and County of San Francisco by no later than 7 days after publication of Bulletin 120 on February 1 for comments. The licensees must allow a minimum of 7 days for the consulted parties to comment and to make recommendations

regarding the schedule (both timing and magnitude) that the estimated project spill should be released to maximize the benefits to habitat for fall Chinook salmon. Within 7 days after receiving the comments and recommendations from the consulted parties, the licensees must file the proposed spill schedule with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The spill management plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, California Department of Fish and Wildlife, and the City and County of San Francisco. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 413. *Coarse Sediment Management Plan.* Within one year of license issuance, the licensees must file for Commission approval, a coarse sediment management plan to mitigate for annual project effects on gravel supply to the lower Tuolumne River.

The plan must include, but not necessarily be limited to, the following:

(1) annual coarse sediment (0.125 to 5.0 inches in diameter) augmentation in the lower Tuolumne River between river mile 39 and river mile 52, with the amount and locations for coarse sediment augmentation to be developed in consultation with the agencies listed below;

(2) provision of flows of 6,000 to 7,000 cubic feet per second (measured at U.S. Geological Survey gage 11289650 downstream of La Grange Diversion Dam) for at least two days at an estimated average frequency of once every three to four years (i.e., during years when sufficient spill is projected to occur), to mobilize gravel and fines;

(3) monitoring and mapping the augmented reaches every 10 years to inform the need for future augmentation; and

(4) following each 10-year monitoring and mapping effort, file a report and recommendations with the Commission, after consultation with the agencies initially consulted during development of the plan, for any changes to the annual amount of coarse sediment and locations to be augmented.

The licensees must prepare the plan after consultation with the Bureau of Land Management, National Marine Fisheries Service, U.S. Fish and Wildlife, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 414. *Large Woody Material Management Plan*. Within one year of license issuance, the licensees must file for Commission approval, a large woody material management plan to mitigate for annual project effects on the large woody material (LWM) supply to the lower Tuolumne River.

The plan must include, but not necessarily be limited to, the following:

(1) identifying the frequency at which LWM is collected from Don Pedro Reservoir for downstream placement;

(2) developing viable options for storing and transporting collected LWM;

(3) identifying suitable LWM size classes, locations for placement, and placement methods (i.e., anchoring) in the lower Tuolumne River;

(4) monitoring and mapping the location of LWM over time to indicate their stability and inform the need for future placement activities; and

(5) developing LWM disposal site maps and treatment descriptions.

Within 3 years of license issuance, the licensees must revisit the goals of the large woody material management plan and the timing and frequency of placement events, and file a report with recommendations with the Commission, regarding any required changes to the plan. Similarly, in license year 10 and every 10 years thereafter, the licensees must file a report with recommendations to the Commission, regarding any required further changes to the plan. These periodic reports must be prepared in consultation with the agencies initially consulted in preparation of the plan.

The large woody material management plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the

completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 415. *Aquatic Invasive Species Management Plan*. Within one year of license issuance, the Aquatic Invasive Species Management Plan required by the Bureau of Land Management condition 6 must be modified, and filed with the Commission for approval, to include the following:

(1) a provision to record and communicate incidental observations of aquatic invasive species to the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife within 24 hours, and to the Commission within 10 days; and

(2) a provision to reassess the vulnerability of Don Pedro Reservoir for the introduction of non-native dressenid mussel species if dressenid mussel species are identified in Tuolumne River or if reservoir calcium concentrations of 13 milligrams per liter or higher are documented in Don Pedro Reservoir.

The revised Aquatic Invasive Species Management Plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 416. *Terrestrial Resources Management Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a revised Terrestrial

Resources Management Plan. The licensees must revise the Terrestrial Resources Management Plan, filed October 11, 2017, to include the following additional provisions:

(1) pre-construction surveys for any special-status or threatened and endangered plants or animals before the start of ground-disturbing activities, where suitable habitat exists, and implementation of 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities;

(2) focus future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; the use of manual control of noxious weeds, as opposed to herbicides, where feasible in areas with sensitive resources; and implementation of control measures for the giant reed population documented along the Don Pedro Powerhouse access road;

(3) surveys for special-status plants within the Red Hills Area of Critical Environmental Concern every 5 years and every 10 years elsewhere within the project boundary, and the installation of interpretive signs about the unique plant communities of the Red Hills area requesting that recreationists stay on trails;

(4) recording the locations of elderberry plants during special-status plant surveys and surveying for elderberry plants within 165 feet of project-related ground-disturbing activities with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle.

(5) a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31); resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting;

(6) a description of specific locations where ground squirrel activity is problematic and where the licensees' rodent control activities would occur; conducting surveys of ground squirrel burrows for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California Department of Fish and Wildlife and U.S. Fish and Wildlife Service protocols prior to any rodent control activities, and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox and California tiger salamander during other biological surveys;

(7) BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground-disturbing activities involving heavy machinery are planned within 300 feet of wetlands and riparian areas; and

(8) decontamination of equipment during project activities that require movement of that equipment from one waterbody to another to prevent the spread of chytrid fungus and aquatic invasive species.

The licensees must revise the plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, and the California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 417. *Bald Eagle and Special-status Bird Management Plan.* Within one year of license issuance, the licensees must file for Commission approval, a bald eagle and special-status bird management plan to mitigate for potential disturbances to bald eagle and special-status bird foraging and nesting resulting from project operation and maintenance and project recreational use.

The plan must include, but not necessarily be limited to, the following:

(1) annual bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shorelines of Don Pedro Reservoir to identify areas where limited operating periods are needed, and in accordance with the California Department Fish and Wildlife's *Bald Eagle Breeding Survey Instructions* and the U.S. Fish and Wildlife Service's 2004 *Protocol for Evaluating Bald Eagle Habitat and Populations in California*;

(2) if any new nests or communal night roosts are located, coordinate with Bureau of Land Management, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife to establish a protective buffer around each nest;

(3) establish a 0.25 mile protective buffer around active bald eagle nests and communal roosting sites, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater tolerance;

(4) install signs to inform recreationist of any temporary closure(s) around active bald eagle nests to prevent disturbance to nesting birds;

(5) collect of incidental observations of all raptor species, while performing other activities in the Don Pedro Project boundary to determine if protective buffers are needed; and

(6) consult with U.S. Fish and Wildlife Service and California Department of Fish and Wildlife to identify suitable protective buffer distances around any active nests of other special-status birds.

The plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 418. *Recreation Resource Management Plan*. Within 6 months of license issuance, or at least 90 days prior to the start of any ground-disturbing activity, whichever comes first, the licensees must file for Commission approval, a revised Recreation Resource Management Plan.

The licensees must revise the Recreation Resources Management Plan, filed October 11, 2017, to include the following:

(1) install signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail;

(2) describe the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term;

(3) describe the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years;

(4) hold an annual coordination meeting with the Bureau of Land Management (BLM) and other interested parties to discuss the management, public safety, protection, and use of project recreation facilities and resources;

(5) describe the BLM guidance for design and construction of project recreation facilities that would be located on BLM-managed land, to develop facilities consistent with agency requirements;

(6) consult with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use on BLM-managed lands;

(7) include the visitor center near Fleming Meadows as a project facility where visitors can learn about the project and obtain information about project recreation facilities and points of public recreation access;

(8) describe the operation and maintenance of Fleming Meadows visitor center;

(9) identify land ownership on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land;

(10) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility requirements, which includes proposed accessibility upgrades and allows adequate time for design, permitting, agency approvals, and construction, as well as consideration of facility condition, capacity, and location when determining reconstruction priorities;

(11) identify specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites";

(12) construct and maintain shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user created trails; and

(13) construct a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir.

The revised Recreation Plan must be developed after consultation with BLM. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to BLM, and specific descriptions of how BLM comments are accommodated by the plan. The licensees must allow a minimum of 30 days for BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 419. *Boating Flows*. To enhance conditions for non-motorized, recreational river boating on the lower Tuolumne River downstream of La Grange Dam, the licensees must provide the following boating flows from April 1 through October 15:

- From April 1–May 31 in all water years, a flow of at least 200 cfs as measured at the La Grange gage, and when the non-project infiltration galleries are operational, at a compliance point at RM 25.9, immediately downstream of the infiltration galleries.
- From June 1–June 30 in all water years, a flow of at least 200 cfs as measured at the La Grange gage. For one pre-scheduled weekend in June, in wet, above

normal, and below normal water years, a flow of at least 200 cfs, at a compliance point at RM 25.9, immediately downstream of the infiltration galleries.

- From July 1–October 15, in wet, above normal, and below normal water years a flow of at least 350 cfs and in dry and critical water years, a flow of at least 300 cfs as measured at the La Grange gage. For the three-day weekend that occurs closest to the July 4 holiday, the three-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August, in all but critical water years, a flow of at least 200 cfs at a compliance point at RM 25.9, immediately downstream of the infiltration galleries. If July 4 falls on a Wednesday, the Districts would provide this 3-day boating flow either the weekend before or the weekend after the holiday.

The boating flow release requirements may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees and the California Department of Parks and Recreation. If the flow is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 420. *Woody Debris Management Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a revised Woody Debris Management Plan.

The licensees must revise the Woody Debris Management Plan, filed October 11, 2017, to include designated disposal site maps, treatment descriptions, and description of the coordination between the Districts and Bureau of Land Management to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge, in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife.

The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 421. *Transportation System Management Plan*. Within one year of license issuance, the licensees must file for Commission approval, a transportation system management plan for all project lands.

The plan must include, but not necessarily be limited to, the following:

(1) identify all roads and trails that are predominately used for project-related purposes;

(2) demonstrate that each identified road is predominately used for project-related purposes, and a description of all non-project-related uses on each identified road;

(3) develop condition assessments for each identified project road and trail; and

(4) specify maintenance standards.

The transportation system management plan must be developed after consultation with the Bureau of Land Management. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 422. *Visual Resources Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a visual resources management plan for the Don Pedro Project that incorporates the requirements specified in the Bureau of Land Management's (BLM) 4(e) condition 18 in Appendix C, and addresses the new facilities to be located on non-BLM land specified in the *Wards Ferry/Tuolumne River Take-Out Management Plan* required by BLM's 4(e) condition 13, to mitigate project effects on aesthetic resources. The plan should include, at a minimum:

(1) a description of the materials and color of materials to be used in construction of the new facilities to ensure that the new facilities blend with the existing environment and minimize any effects on visual resources; and

(2) a provision to monitor visual resources over the term of the new license to determine whether additional treatments would be necessary to retain the existing characteristics of the landscape.

The visual resources management plan must be developed after consultation with the BLM. The licensees must include with the plan an implementation schedule,

documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the BLM, and specific descriptions of how their comments are accommodated by the plan. The licensees must allow a minimum of 30 days for BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 423. *Programmatic Agreement and Historic Properties Management Plan*. The licensees must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to the Turlock Irrigation District and Modesto Irrigation District for the Continued Operation of the Don Pedro Hydroelectric Project in Tuolumne County, California (FERC No. 2299-082)," executed on XXX, 2019, and including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

Article 424. *Land Use and Occupancy*. (a) In accordance with the provisions of this article, the licensees must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensees may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensees must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensees for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensees must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensees may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensees must require multiple use and occupancy of facilities for access to project lands or waters. The licensees must also ensure, to the satisfaction of the Commission's authorized representative that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensees must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensees may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensees' costs of administering the permit program. The Commission reserves the right to require the licensees to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensees may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69 kilovolt or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensees must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensees may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality

certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is 5 acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensees must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date, requires the licensees to file an application for prior approval, the licensees may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensees must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensees must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensees to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensees under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX B—License Conditions Recommended by Staff for the La Grange Project

I. MANDATORY CONDITIONS

On January 29, 2018, the California State Water Resources Control Board filed 11 preliminary conditions under section 401 of the Clean Water Act (appendix E). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the environmental impact statement (EIS). We consider preliminary condition 11 to be administrative. We anticipate that all valid section 401 conditions will be included in any new license issued for the project.

On January 29, 2018, the U.S. Department of Interior, Bureau of Land Management (BLM) filed 35 preliminary 4(e) conditions (appendix D). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the EIS. We consider preliminary conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35 to be administrative or legal in nature and not specific environmental measures. Of the 10 conditions we consider to be environmental measures applicable to the La Grange Project, we include in the staff alternative 5 conditions as specified by the agency, modify 1 condition to adjust the scope of the measure, and do not recommend 4 conditions. We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, the BLM conditions that we do not recommend or that we recommend modifying in the manner noted above, would be included in a new license as specified by the agency and to the extent allowed by applicable law.

II. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the preliminary mandatory conditions.

Article 401. *Commission Approval, Reporting, and Filing of Amendments.*

(a) Requirement to File Plans for Commission Approval

Various conditions found in the California State Water Resources Control Board (Water Board's) preliminary section 401 water quality certification (certification) require the licensees to prepare plans in consultation with other entities for approval by the Water Board for submittal to the Commission and to implement specific measures without prior Commission approval. Each such plan must also be submitted to the Commission for approval. These plans are listed below.

Certification Condition No.	Plan Name	Due Date
4	Large Woody Material Management Plan	Within one year of license issuance

Certification Condition No.	Plan Name	Due Date
5	Sediment Management Plan	Within one year of license issuance
6	Water Quality Monitoring Plan	Within one year of license issuance
7	Water Temperature Monitoring Plan	Within one year of license issuance
8	Aquatic Invasive Species Management Plan	Within one year of license issuance
9	Erosion and Sediment Control Plan	Within one year of license issuance
10	Hazardous Material Plan	Within one year of license issuance

The licensees must include with each plan filed with the Commission documentation that the licensees developed the plan in consultation with, and received approval from, the Water Board. The Commission reserves the right to make changes to any plan filed. Upon Commission approval, the plan becomes a requirement of the license, and the licensees must implement the plan or changes in project operations or facilities, including any changes required by the Commission. Any further changes in the Commission-approved schedules or plans require approval by the Commission before implementing the proposed change.

(b) Requirement to File Reports

Certain conditions of the Water Board's 401 certification require the licensees to file reports with other entities. Because these reports relate to compliance with the requirements of this license, each such report must also be submitted to the Commission. These reports are listed in the following table:

Certification Condition No.	Description	Due Date
4	Reports that document the implementation and effectiveness of the large woody material management in the Tuolumne River downstream of La Grange Diversion Dam.	One year after completion of each large woody material monitoring period.
5	Reports that document the implementation and effectiveness of the coarse and fine sediment transport past La Grange Dam in the Tuolumne River.	One year after completion of each sediment monitoring period.

The licensees must submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report. The Commission reserves the right to require changes to project operations or facilities based on the information contained in the report and any other available information.

Article 402. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensees to construct and maintain, or to provide for the construction, operation, and maintenance of, such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, pursuant to section 18 of the Federal Power Act.

Article 403. *Erosion and Sediment Control Plan.* Before the commencement of any ground-disturbing activity within the project boundary, the licensees must file for Commission approval, a soil erosion and sediment control plan. The plan must include, at a minimum, the following:

(1) a description of the best management practices for erosion control that will be applied in specific circumstances;

(2) provisions for inspecting erosion control measures while they are in place;

(3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event);

(4) techniques that will be used to stabilize sites once construction is completed; and

(5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

The soil erosion and sediment control plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife, and be filed with the Commission for approval at least 90 days in advance of initiating construction of recreation or other project facilities that require ground-disturbing activities. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Ground-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 404. *Minimum Flows below La Grange Diversion Dam.* The licensees must release a continuous minimum flow of at least 5 cubic feet per second from gates on the Modesto Irrigation District side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam to ensure consistent and adequate flow to support aquatic resources. The flow release requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife. If the flow is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 405. *Ramping Rates.* The licensees must operate the project to restrict down-ramping rates to 2 inches per hour, as measured at the U.S. Geological Survey gage 11289650 downstream of La Grange Dam. The ramping rate requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife. If the ramping rate is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 406. *Operation Compliance Monitoring Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, an operation compliance monitoring plan to document compliance with the streamflow requirements specified in articles 404 and 405, in coordination with the streamflow monitoring requirements for the Don Pedro Project No. 2299 that will also be measured downstream of the La Grange Project. The plan must describe, at a minimum, the following:

(1) locations where the licensees would monitor streamflow requirements;

(2) equipment that would be used by the licensees to monitor streamflow;

(3) how the equipment would be deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained;

(4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage;

(5) how the licensees would make streamflow data available to the Commission, agencies, and the public; and

(6) how the licensees would update the proposed plan as needed in the future.

The licensees must develop the operation compliance monitoring plan in consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 407. *Spill Prevention Control and Countermeasure Management Plan.* Within 6 months of license issuance, the licensees must file for Commission approval, a spill prevention control and countermeasure management plan.

The plan must include, at a minimum, the following:

(1) a description of how hazardous substances would be transported, stored, handled, and disposed;

(2) a description of equipment and procedures to be used to address hazardous substance spills;

(3) a provision to notify the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife within 24 hours of discovering a hazardous substances spill; and

(4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of

hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure similar spills do not occur in the future.

The spill prevention control and countermeasure management plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 408. *Water Quality Monitoring Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a water quality monitoring plan to manage dissolved oxygen (DO) concentrations in the La Grange Powerhouse tailrace. The plan must include, at a minimum, the following:

(1) monitoring of DO and water temperature at 15-minute intervals in the upper end of the La Grange Reservoir, La Grange forebay, immediately downstream of the La Grange Powerhouse, and at the downstream end of the powerhouse tailrace channel for up to 3 years, beginning in year 1 of license issuance;

(2) supplementing these data with weekly observations of aquatic vegetation and algae in the La Grange Powerhouse forebay and near the penstock intake;

(3) identifying the proposed monitoring season based on the timing of recently observed DO concentrations less than the water quality objective;

(4) annual reporting on the monitoring program for distribution to the consulted agencies and the Commission; and

(5) submitting, for Commission approval, a final report after 3 years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objective, proposed mitigation to address low DO concentrations, and plans for effectiveness monitoring for any measure(s) to be implemented to address low DO concentrations.

The water quality monitoring plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of

Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 409. *Fish Exclusion Design Plan.* Within one year of license issuance, the licensees must file for Commission approval, a fish exclusion design plan detailing the design of the fish exclusion barrier such that:

(1) the fish exclusion barrier is installed at the Turlock Irrigation Districts sluice gate channel entrance and able to pass flows up to 7,000 cubic feet per second; and

(2) fish are excluded from entering into the sluice gate channel during powerhouse outages.

The plan must also include testing, operation, and maintenance procedures and an implementation schedule.

The plan must be developed after consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 410. *Aquatic Invasive Species Management Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a plan to manage aquatic invasive species to minimize the potential introduction and spread of aquatic invasive species in the La Grange Project boundary.

The plan must include, but not necessarily be limited to, the following:

(1) a provision to provide information (i.e., signage and information pamphlets at designated public boat access sites and on public websites) to educate recreational users on ways to reduce the spread of invasive species;

(2) continuation of the boater self-inspection permit program, including prevention measures (such as self-inspection permits), on websites that provide the public with information on project facilities;

(3) a provision to include the following best management practices for minimizing the spread of invasive species during project operation and maintenance: (a) identifying invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs;

(4) a provision to consult with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife if aquatic invasive species are discovered within the project boundary; and

(5) a provision to record and communicate incidental observation of aquatic invasive species to the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife within 24 hours, and to the Commission within 10 days.

The plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 411. *Terrestrial Resources Management Plan.* Within one year of license issuance, the licensees must file for Commission approval, a plan to manage terrestrial resources and provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operations and maintenance activities within the La Grange Project boundary.

The plan must include, but not necessarily be limited to, the following:

(1) a noxious weed survey of the La Grange Project during the first year of license issuance and every 5 years thereafter, with future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants, and an emphasis on the use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with special-status or threatened and endangered species;

(2) a survey for special-status plants at the La Grange Project and a summary report assessing the need for future surveys; pre-construction surveys for special-status or threatened and endangered plants prior to any project-related ground-disturbance involving heavy machinery; and implementing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities;

(3) recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle;

(4) a bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use, including facilities without installed exclusion devices; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting;

(5) protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife to develop protective measures for the species; and

(6) BMPs consistent with California pesticide regulations and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

The plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 412. *Bald Eagle and Special-status Bird Management Plan.* Within one year of license issuance, the licensees must file for Commission approval, a bald eagle and special-status bird management plan to mitigate for potential disturbances to bald eagle and special-status bird foraging and nesting resulting from project operation and maintenance and project recreational use.

The plan must include, but not necessarily be limited to, the following:

(1) annual bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shorelines of La Grange Reservoir to identify areas where limited operating periods are needed, and in accordance with the California Department of Fish and Wildlife's *Bald Eagle Breeding Survey Instructions* and the U.S. Fish and Wildlife Service's 2004 *Protocol for Evaluating Bald Eagle Habitat and Populations in California*;

(2) if any new nests or communal night roosts are located, coordinate with the Bureau of Land Management, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife to establish a protective buffer around each nest;

(3) establish a 0.25 mile protective buffer around active bald eagle nests and communal roosting sites, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater tolerance;

(4) install signs to inform recreationists of any temporary closure(s) around active bald eagle nests to prevent disturbance to nesting birds;

(5) collect incidental observations of all raptor species, while performing other activities within the La Grange Project boundary to determine if protective buffers are needed; and

(6) consult with the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife to identify suitable protective buffer distances around any active nests of other special-status birds.

The plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 413. *Fire Prevention and Response Management Plan*. Within 6 months of license issuance, the licensees must file for Commission approval, a fire prevention and response management plan.

The plan must include, but not necessarily be limited to, the following descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting:

(1) equipment, vehicles, and tools for District staff and job sites;

(2) fire index monitoring and activity curtailment, as appropriate;

(3) debris burning;

(4) vegetation clearance;

(5) communication systems;

(6) access routes, water sources, and helicopter landing areas;

(7) fire investigation;

(8) emergency contact information; and

(9) fire safety signage at recreational facilities.

The fire prevention and response management plan must be developed after consultation with the Bureau of Land Management. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the Bureau of Land Management to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 414. *Programmatic Agreement and Historic Properties Management Plan*. The licensees must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to the Turlock Irrigation District and Modesto Irrigation District for the Continued Operation of

the La Grange Hydroelectric Project in Stanislaus and Tuolumne Counties, California (FERC No. 14581-002)," executed on XXX, 2019, and including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license

Article 415. *Land Use and Occupancy*. (a) In accordance with the provisions of this article, the licensees must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensees may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensees must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensees for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensees must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensees may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensees must require multiple use and occupancy of facilities for access to project lands or waters. The licensees must also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensees must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensees may, among other things, establish a program for issuing

permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensees' costs of administering the permit program. The Commission reserves the right to require the licensees to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensees may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69 kilovolt or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensees must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensees may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is 5 acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensees must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date,

requires the licensees to file an application for prior approval, the licensees may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensees must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensees must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensees to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensees under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX C—U.S. Bureau of Reclamation Revised Conditions for the Don Pedro Project

PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS FOR THE DON PEDRO HYDROELECTRIC PROJECT (FEDERAL ENERGY REGULATORY COMMISSION PROJECT NO. 2299)

Revised August 23, 2018

The BLM, through its preliminary recommendations, terms and conditions, and prescriptions seeks to ensure appropriate levels of resource protection are incorporated in any new license. The BLM recommends that the FERC include in any new license issued for the Don Pedro Hydroelectric Project 2299 the following BLM preliminary recommendations, terms and conditions. The BLM believes this comprehensive framework provides for the sustainable management and conservation of the natural resources of the Tuolumne watershed. This framework is within the context of agency statutory authorities under the FPA and other applicable laws. The agencies intent is to issue their protection, mitigation and enhancement measures, terms and conditions, and recommendations consistent with this framework.

Condition No. 1 – Consultation

Licensee shall annually consult with BLM regarding license implementation. Licensee shall set an agreed upon date beginning in the first full calendar year of the new license term and each year thereafter, meet with BLM at the MID office in Modesto, California, to discuss past and current year implementation of the license conditions affecting BLM land. The meeting will be open to the public, except during those parts of the meeting when confidential information (e.g., cultural resources or specific location of ESA-listed species) is discussed. In those instances, only Licensee and appropriate agencies shall be allowed to be in attendance. At least 30 days in advance of the meeting, Licensee shall notify via email or other written means BLM and other interested stakeholders (interested stakeholders are defined as anyone who sends a letter or email to the Licensee requesting to be a part of the consultation group. Any organized group will select an individual to represent them and will notify the Licensee who their representative will be when they are attending these meetings), confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to the: United States Fish and Wildlife Service (USFWS); National Park Service (NPS); National Marine Fishery Service (NMFS); California State Department of Fish and Wildlife (CDFW); and the State Water Resources Control Board (SWRCB) who may choose to participate in the meeting.

Three weeks prior to each annual meeting, Licensee shall make available to BLM, interested stakeholders, and the agencies listed above an operations and maintenance plan for project activities that may affect BLM land for the calendar year in which the meeting occurs.

The purposes of the meeting are to conduct discussions about forthcoming year's operations and maintenance plans that may affect BLM land; to have the Licensee present results from the past/current year monitoring, as well as any additional information that has been compiled for the project area including progress reports on any other issues related to preserving and protecting ecological values affected by the Project on or affecting BLM land; to share information on mutually agreed upon planned maintenance activities on or affecting BLM land; to identify concerns that BLM may have regarding project operations/activities and their potential effects on sensitive resources on or affecting BLM land, any measures required to avoid or mitigate those potential effects; and review and discuss the results of implementing Don Pedro Hydroelectric Projects -related conditions on or affecting BLM land.

Consultation shall include, but is not limited to, the items listed below as they pertain to project-effects on or affecting BLM land:

- A status report regarding implementation of license conditions.
- Discussion on any conditions that were not implemented, rationale on why they didn't get implemented, and when will they be implemented.
- Results of any monitoring studies performed over the previous year in formats agreed to by BLM and Licensee during development of implementation plans.
- Review of any non-routine maintenance.
- Discussion of any foreseeable changes to project facilities or features.
- Discussion of any necessary revisions or modifications to resource implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protection.
- Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any proposed pesticide use.
- Discussion of BLM identified concerns regarding project operations/activities and their potential effects on sensitive resources, and any measures required to avoid or mitigate those potential effects.
- Discussion of information on mutually agreed upon planned maintenance activities.
- Discussion on upcoming permitted events that are scheduled for the year.
- Discussion on any planned burning activities on BLM land.
- Discussions on other issues regarding project effects on BLM land.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by BLM for the protection of BLM land and resources. Licensee shall file the meeting record, if requested, with FERC no later than 60 days following the meeting.

A copy of the reports/records/studies on or affecting BLM land from the previous water year shall be provided to BLM by Licensee at least 90 days prior to the meeting date, unless otherwise agreed.

Copies of other non-CEII reports including, but not limited to, monitoring reports, non-compliance reports filed by Licensee, geologic or seismic reports, and structural safety reports for facilities affecting or on BLM land shall be submitted to BLM concurrently with submittal to the FERC, with the goal of providing the material to BLM no later than 90 days in advance of the annual meeting.

During the first several years of license implementation, it is likely that more consultation than just one annual meeting will be required, given the complexity of the project and the acreage of BLM land affected by project operations.

BLM will be included to be a participant on Technical Committees that focus on anadromous fish, inter-related resident fish and other ecological topics and issues that may have a direct or indirect effect on BLM managed lands. The Technical Committees shall develop a technical advisory plan or process for ground rules for decision making and implementing decisions. Members of the committee will include those agencies with direct management responsibilities for lands (riparian, wetland, recreation, fisheries, aquatics, water temperature and water quality), and the selection of an appropriate non-governmental representative. The Technical Committee will be finalized within one year of license issuance.

Condition No. 2 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensees' Operations and Maintenance (O&M) staff with special-status species, non-native invasive plants, and sensitive areas (e.g., special-status plant populations and invasive plant locations) that are known to occur within or adjacent to the FERC Project Boundary. Licensee shall provide to each O&M staff a confidential map showing these sensitive areas, including GPS coordinates, as well as pictures and other guides to assist staff in recognizing special-status species, non-native, invasive plants, and sensitive areas. It is not the intent of this measure that Licensees' O&M staff perform surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensees' contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, Licensee shall consult with BLM to minimize adverse effects to sensitive resources. This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 3 – Erosion Control and Restoration Plan

Within one year of license issuance, Licensees shall develop and implement an Erosion Control and Restoration Plan for erosion and/or restoration actions to be carried out by Licensees on or affecting BLM lands that are within or adjacent to the FERC Project boundary. Licensees must acquire BLM approval before submitting the Erosion Control and Restoration Plan for Commission approval. Licensees shall file the approved Erosion Control and Restoration Plan with the Commission at least 90-days in advance of initiating construction of recreation or other Project facilities. Upon Commission approval, Licensees shall implement the Erosion Control and Restoration Management Plan.

Condition No. 4 – Large Woody Debris Material Management

Licensees shall obtain and maintain a BLM-approved burn plan for any large woody debris stored and burned on BLM-administered lands. In furtherance of that burn plan, Licensees shall make all reasonable efforts to prevent large woody debris from interfering with accessible takeout areas for whitewater boaters at Wards Ferry.

Condition No. 5 – Reservation of Authority to Modify 4(e) Conditions in the Event of Anadromous Fish Re-introduction

BLM exercises its 4(e) authority by reserving that authority to modify these conditions to respond to any reintroduction of Chinook salmon or steelhead trout listed under the Endangered Species Act, to stream reaches through BLM lands where the flow is controlled by the Don Pedro Hydroelectric Project.

Condition No. 6 – Aquatic Invasive Species Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Aquatic Invasive Species Management Plan following consultation with the BLM. The BLM has provided an Aquatic Invasive Species Management Plan (Attachment 1) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Aquatic Invasive Species Management Plan as presented in Attachment 1, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Aquatic Invasive Species Plan shall be implemented.

Condition No. 7 – Terrestrial Resources Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Terrestrial Resources Management Plan following consultation with the BLM. The BLM has provided a Terrestrial Resources Management Plan (Attachment 2) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Terrestrial Resources Management Plan as presented in Attachment 2, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Terrestrial Resources Management Plan shall be implemented.

Condition No. 8 – Bald Eagle Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Bald Eagle Management Plan following consultation with the BLM. The BLM has provided a Bald Eagle Management Plan (Attachment 3) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Bald Eagle Management Plan as presented in Attachment 3, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Bald Eagle Management Plan shall be implemented.

Condition No. 9 – Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall consult with BLM within 3 months, after license issuance, and annually thereafter during the annual consultation meeting, to review the current list of special-status plant and wildlife species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, BLM Sensitive, State Threatened or Endangered, State Species of Special Concern, and CDFW Fully Protected) that might occur on public land administered by BLM in the Project area that may be directly or indirectly affected by Project operations.

When a species is added to one or more of the lists, BLM shall determine if the species, or unsurveyed suitable habitat for the species, is likely to occur on public land administered by BLM in or around the Project area. For any such newly added species, if BLM determines that the species is likely present on public land administered by BLM that may be directly or indirectly affected by the Project, Licensee shall develop and implement a study plan in consultation with BLM, and other appropriate agencies, to reasonably assess the effects of the Project on the species. Licensee shall prepare a report on the study, including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the final report to BLM and other appropriate agencies for review and approval. Licensee shall file the report, including evidence of consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of BLM special status plant or wildlife species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM. If BLM determines that the Project-related activities are adversely affecting BLM sensitive or watch list species, Licensee shall, in consultation with BLM, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM, FERC, and the relevant agency (USFWS or NMFS) for consultation or

conference in accordance with the Endangered Species Act (USFWS 1988). If state listed or fully protected species are affected, CDFW shall be notified.

Threatened, Endangered, and Sensitive Species Objectives:

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

- Ensure that proposed license conditions and recommended measures provide for well distributed, viable populations of special status species including threatened, endangered and BLM sensitive species, and are consistent with any applicable biological opinion issued under the federal or state Endangered Species Act (ESA). Ensure that proposed license conditions and recommended measures comply with BLM plans and policy.
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species.
- Manage special status species habitat to assist in the recovery of listed species.
- Maintain or improve habitat for special status species.
- Coordinate with the USFWS on implementation of recovery plans and conservation strategies for special status species.
- Manage sensitive species to ensure that species do not become threatened or endangered.
- Maintain and restore habitat to support viable populations of TES species. Work cooperatively to reduce impacts to native populations where invasive species are adversely affecting the viability of native species.
- Avoid impact to species designated as fully protected under FGC sections 3511(b) and 4700(b).
- Avoid or minimize impacts to species whose viability has been identified as a concern.
- If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- Conserve ESA-listed species and the ecosystems on which they depend and to the extent possible recover these species so that ESA protection is no longer needed (BLM 2012).
- Minimize the effects of stream diversion or other flow modifications from hydroelectric projects on threatened, endangered, or sensitive species.
- Monitor populations and habitats of federally listed and BLM sensitive plant species to determine whether management objectives are being met (BLM 2012).
- Develop site-specific management objectives for each occurrence of listed threatened and endangered plant species and BLM sensitive plant species on BLM lands that will be affected by BLM actions (BLM 2012).
- Modify proposed actions, to the extent possible, to avoid adverse impacts to special status plant species; where avoidance is not possible, develop measures to mitigate impacts to these species (BLM 2012).
- Conduct inventories to determine the occurrence and status of all special status plant species on lands managed by BLM or affected by BLM actions to ensure compliance with NEPA and the ESA by having sufficient information to adequately assess the effects of proposed actions on special status plants. Inventories are to be conducted at the time of year when such plant species can be found and positively identified (BLM 2012).

Condition No. 10 – Licensee Contacts

The Licensee shall designate an individual as its liaison with BLM, whenever planning or construction of recreation facilities, other major Project improvements, or Project-related maintenance activities are taking place on BLM lands. The Licensee agrees to coordinate with BLM through this individual in contract review and work inspection.

Condition No. 11–Annual Recreation Coordination Meeting

Each year during the term of the license, Licensees shall meet with BLM for an Annual Recreation Coordination Meeting to discuss the measures needed to ensure use and management, public safety, and protection and utilization of the recreation facilities and resources on BLM land. The date of the meeting will be mutually agreed to by Licensees and BLM but, in general, will be held within the first 90 days of each calendar year. A detailed agenda will be provided to BLM when the meeting date is proposed to assure that the appropriate parties are present.

The following will be discussed, at a minimum:

- Need for garbage collection based on the results of visitor surveys, evidence that wildlife is becoming habituated, and the status of garbage and litter left on site by users.
- Need for toilet facilities where dispersed camping is occurring will be discussed at least every 6 years (following submittal of Monitoring Report from the Recreation Resource Management Plan), and more frequently if warranted.
- Report on significant changes in sanitation issues and number and size of user-created dispersed camping areas.
- Other O&M issues identified by BLM or Licensees.
- Schedule and invite BLM to any recreation resource impact field evaluations and facility condition assessments to be conducted on BLM lands.
- Significant issues raised by the public.
- Any Licensee proposal for new or increases in recreation fees on BLM lands to help cover the costs of recreation facility construction, operation, and maintenance, as allowed by FERC regulations, will be discussed for consideration and approval by BLM.
- Recreation use data that is available from Licensee or the BLM, which includes summary data, at a minimum; and, upon request, raw data.
- Licensees will provide BLM a copy of all documentation associated with FERC inspections of Project recreation facilities and use on BLM lands, including follow-up action taken by the Licensees.
- Status of recreation projects from the previous year, including rehabilitation of existing recreation facilities, the establishment of new recreation facilities, and any other recreation measures or programs that were implemented.
- List of the recreation facilities scheduled for rehabilitation and any other Recreation Facilities Plan measures or programs to be implemented, including:
    - Logistical and coordination planning.
    - Implementation schedule.
    - Coordination needs.
    - Permitting requirement.
    - Key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects.

- Potential adjustments in schedule.

- Licensees and BLM will identify any coordination needed with other projects being implemented in the area. Permitting requirements, additional required environmental documentation and key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects will be addressed. Licensees shall submit for BLM approval any revisions to the Project's Recreation Facilities Plan schedule when BLM land is involved, and the revised schedule will be submitted to FERC. Within 60 days following the meeting, Licensees will file with FERC evidence of the meeting, which will summarize comments made by the agencies, and Plan revisions or other agreements that were reached by Licensees and the agencies. The Annual Recreation Coordination Meeting is a minimum requirement and it is anticipated that meetings may occur throughout each year as needed to implement the Recreation Facilities Plan.

Any adjustments in specific actions or schedules shall be approved by BLM and filed with FERC.

Condition No. 12 –

Intentionally omitted.

Condition No. 13 – Wards Ferry/Tuolumne River Take-Out Management Plan

No later than one year after license issuance, Licensees shall develop and submit to the Commission for approval a Wards Ferry/Tuolumne River Take-Out Management Plan ("Take-Out Plan"). Licensees shall submit the Take-Out Plan to BLM for review and approval before submission to the Commission. BLM's approval shall not be (1) unreasonably delayed or withheld, or (2) made conditional on Licensees agreeing to materially greater improvements, features, functions, or terms beyond those listed below. Licensees have the option to delay submission of the Take-Out Plan to the Commission until one year after the earlier of: (1) December 31, 2025; (2) the National Marine Fisheries Service's ("NMFS") and the U.S. Fish and Wildlife Service's ("FWS") confirmation of their respective decisions not to exercise their Federal Power Act Section 18 reservation of authority to prescribe fishways at the Project; or (3) NMFS' and FWS' respective exercise of such reservation of authority in a manner not significantly impacting the construction and utilization of the improvements at Wards Ferry. Licensees shall begin implementing the Take-Out Plan no later than one year after Commission approval of the Take-Out Plan and shall complete construction within five years of Commission approval of the Take-Out Plan, unless an extension is requested and approved by BLM and the Commission.

Take-Out Plan Components:

- Construction and maintenance of an elevated hoisting platform located on river left approximately 300 feet upstream from Wards Ferry Bridge (left and right determined by facing downstream on the Tuolumne River). The hoisting platform shall be sized and suitable to support no less than two and no more than three truck-mounted cranes and associated vehicles to allow commercial equipment and commercial boat extraction to occur. Licensees shall install and maintain signage to dissuade any use of the platform by non-boating users and non-commercial boating users.
- Construction and maintenance of an access road, approximately 12 feet wide, depending on site conditions, extending from Wards Ferry Road to the elevated platform for truck access to the platform. The access road shall have clear space, meaning no objects will intrude into the road path, and the river-facing side of the access road will have at least a three-foot high barrier. The

other side of the access road will have a curb or, where Licensees believe site conditions warrant, barriers.

- Removal of the existing vault toilet on river left, and construction of a new, ADA-compliant two-vault toilet on river right. Licensees shall regularly clean and maintain the toilet facility during the May 1 – October 15 period. Licensees will provide keys to commercial rafting companies so that the toilet can be made available to commercial and private boaters during the afternoon hours when boaters are offloading at Wards Ferry during the May 1 – October 15 period.
- Improvement or creation, and maintenance, of pedestrian access trails on river left to facilitate egress from the river by commercial outfitter customers, employees, and guides. This includes the existing switchback trail on BLM land located downstream from the proposed platform and a new trail located upstream from the platform to allow commercial outfitter customers to reach the platform area. Trails shall be constructed and/or hardened. Hardening in this case shall consist of smoothing rock surfaces and/or adding spaced water bars but shall not include adding concrete or asphalt. Trails above elevation 830 feet shall be up to 10 feet wide, depending on site conditions. Trails below elevation 830 feet shall be up to 6 feet wide, depending on site conditions.
- Improvement and maintenance of pedestrian access trails on river right to facilitate egress from the river by private boaters. Trails shall be constructed and/or hardened. Hardening in this case shall consist of smoothing rock surfaces and/or adding spaced water bars but shall not include adding concrete or asphalt. Trails above elevation 830 feet to the service road described below shall be up to 10 feet wide, depending on site conditions. Trails below elevation 830 feet shall be up to 6 feet wide, depending on site conditions, start at approximately 770 feet elevation, and end near the former Wards Ferry Road bridge abutment.
- Construction and maintenance on river right of one gravel vehicular service road for private boaters. The service road shall be from 10-12 feet wide, depending on site conditions, and shall extend from the interface area described below to elevation 835-840 feet (extending upstream 250-350 feet from Wards Ferry Road). At or near the upstream terminus of the service road, Licensees shall construct an apron or spur sufficient to allow automobiles and pickup trucks with no more than two axles to execute three-point turns. The service road shall have clear space, meaning no objects will intrude into the road path. The river-facing side of the service road will have at least a three-foot high barrier. The other side of the service road will have a curb or, where Licensees believe site conditions warrant, barriers.
- Hardening, either through laying asphalt or adding gravel, and maintenance of the interface between Wards Ferry Road and the new service road on river right to permit a bus/vehicle capable of holding 20-30 passengers to pull off of Wards Ferry Road. The interface shall be designed not to interfere with the service road for private boaters or with access to the vault toilet. Licensees shall not be responsible for ensuring that private boaters or third parties do not interfere with the commercial rafters' use of the interface area.
- Enhancement and maintenance of 4-8 parking spaces, if such spaces reasonably can be improved compliant with State, Federal, and local requirements, utilizing currently available parking pullout locations on each side of the river downstream of Wards Ferry Bridge on Wards Ferry Road. Enhancements should include hardened surfaces (up to or including asphalt), parking space indicators to maximize parking utilization, and berms/barriers to prevent vehicle entry into the reservoir, but shall not require the construction of retaining walls or placement of fill material. The design and exact location for these spaces must be coordinated with BLM and Tuolumne County. This element can be fulfilled through a program under which Licensees pay Tuolumne County for the enhancement and maintenance of the parking spaces.

- Licensees shall facilitate the operation and maintenance of these Wards Ferry take-out facilities by providing for the proper personnel to coordinate the safe and effective use of such resources. This element can be fulfilled through the establishment of a program under which Licensees provide annual funding to Tuolumne County or other appropriate entities for such services in the vicinity of Wards Ferry Bridge.
- Any facilities required to be constructed by this Condition No. 13 shall not be subject to Condition No. 14. The Take-Out Plan shall not be subject to Condition No. 39. Condition No. 19 shall only apply to any post-construction changes to those facilities.

Condition No. 14 – Recreation Resource Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Recreation Resource Management Plan following consultation with the BLM. The BLM has provided a Recreation Resource Management Plan (Attachment 4) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Recreation Resource Management Plan as presented in Attachment 4, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Recreation Resource Management Plan shall be implemented.

Condition No. 15 – Historic Properties Management Plan

Upon the Commission approval, Licensee shall implement the Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC.

Condition No. 16 - Transportation System Management Plan

Within one year of license issuance, Licensees shall file a BLM approved Transportation System Management Plan for the BLM land within the FERC Project Boundary. Upon Commission approval, Licensees shall implement the Transportation System Management Plan.

Condition No. 17 – Fire Prevention and Response Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Fire Prevention and Response Management Plan following consultation with the BLM. The BLM has provided a Fire Prevention and Response Management Plan (Attachment 5) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Fire Prevention and Response Management Plan as presented in Attachment 5, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Fire Prevention and Response Management Plan shall be implemented.

Condition No. 18 – Visual Resources Management Plan

Within one year of license issuance, Licensees shall develop and implement a Visual Resources Management Plan on BLM-administered lands that are within the FERC Project boundary. Licensees must acquire BLM approval before submitting the Visual Resources Management Plan for Commission approval. Upon the Commission approval, Licensees shall implement a Visual Resources Management Plan.

BLM PRELIMINARY 4(e) ADMINISTRATIVE CONDITIONS

The following Section 4(e) Conditions include requirements that serve to address the statutory and administrative rights and responsibilities of the BLM pursuant to Federal, State, and local laws.

Condition No. 19 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect BLM lands the Licensee shall obtain written approval from BLM prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from BLM, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of BLM for such changes. The Licensee shall file an exact copy of this report with BLM at the same time it is filed with the Commission.

Condition No. 20 – Maintenance of Improvements on or Affecting Bureau of Land Management Lands

The Licensee shall maintain all its improvements and premises on BLM lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to BLM. Disposal of all materials will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 21 – Existing Claims

The License shall be subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 22 – Compliance with Regulations

The Licensee shall comply with the regulations of the Department of the Interior on BLM lands for activities on BLM lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting BLM lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 23 – Surrender of License or Transfer of Ownership

Prior to any surrender of this License, the Licensee shall provide assurance acceptable to BLM that Licensee shall restore any Project area directly affecting BLM lands to a condition satisfactory to BLM upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall identify the measures to be taken to restore such BLM lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the License or sale of the Project, the Licensee shall assure that, in a manner satisfactory to BLM, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by BLM to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by BLM, to estimate the potential costs associated with surrender and restoration of any Project area directly affecting BLM lands to BLM specifications. In addition, BLM may require the Licensee to pay for an independent audit of the transferee to assist BLM in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 24 – Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this License.

Condition No. 25 – Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 26 – Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to BLM lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24.

Condition No. 27 – Risks and Hazards on Bureau of Land Management Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting BLM lands within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any nonemergency actions to abate such hazards on BLM lands shall be performed after consultation with BLM. In emergency situations, the Licensee shall notify BLM of its actions as soon as possible, but not more than 48 hours after such actions have been taken. Whether or not BLM is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 28 – Protection of Bureau of Land Management Special Status Species

Before taking actions to construct new Project features on BLM lands that were not addressed in the Commission's NEPA processes for relicensing that may affect BLM threatened and endangered species

or BLM special status species or their critical habitat, the Licensee shall prepare and submit a biological evaluation (BE) for BLM approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, BLM may require mitigation measures for the protection of the affected species.

The biological evaluation shall:

- Include procedures to minimize adverse effects to threatened and endangered species and special status species and their critical habitat.
- Include information on the current status of the special-status species within the project area, a full description of the Project and potential effects, if BLM determines that existing information is out of date.
- Ensure project-related activities shall meet restrictions included in site management plans for threatened and endangered species and special-status species and their habitat.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 29 – Access

Subject to the limitations set forth under the heading of "Access By The United States" in Condition No. 29 hereof, BLM reserves the right to use or permit others to use any part of the licensed area on BLM lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act.

Condition No. 30 – Crossings

The Licensee shall maintain suitable crossings as required by BLM for all roads and trails that intersect the right-of-way occupied by linear Project facilities (power lines, penstocks, ditches, and pipelines).

Condition No. 31 – Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on BLM lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of BLM. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 32 – Pesticide-Use Restrictions on Bureau of Land Management Lands

Pesticides may not be used on BLM lands or in areas affecting BLM lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of BLM. During the Annual Consultation Meeting described in Condition No. 1, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide at a minimum the following information essential for review:

- whether pesticide applications are essential for use on BLM lands;
- specific locations of use;
- specific herbicides proposed for use;

- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Any pesticide use that is deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations of BLM Special Status or culturally significant plant populations will be designed to avoid adverse effects to individuals and their habitats. Application of pesticides must be consistent with BLM riparian conservation objectives.

On BLM lands, the Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by BLM and approved through BLM review for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. The Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other BLM required documents to use pesticides on a regular basis for the term of the license as addressed further in Condition No. 7 – Terrestrial Resources Management Plan. Submission of this plan will not relieve the Licensee of the responsibility of annual notification and review.

Condition No. 33 – Modifications of 4(e) Conditions after Biological Opinion or Water Quality Certification

BLM exercises its 4(e) authority by reserving that authority to modify these conditions, if necessary, to respond to any Final Biological Opinion issued for this Project by the National Marine Fisheries Service, United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 34 – Signs

The Licensee shall consult with BLM prior to erecting signs related to safety issues on BLM lands covered by the License. Prior to the Licensee erecting any other signs or advertising devices on BLM lands covered by the License, the Licensee must obtain the approval of BLM as to location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

Condition No. 35 – Ground Disturbing Activities

If the Licensee proposes ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Licensee, in consultation with BLM, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Licensee shall enter into an agreement with BLM under which the Licensee shall fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

Condition No. 36 – Use of Bureau of Land Management Roads for Project Access

The Licensee shall obtain suitable authorization for all project access roads and BLM roads needed for Project access. The term of the permit shall be the same as the term of the License. The authorization

shall require road maintenance and cost sharing in reconstruction commensurate with the Licensees' use and project-related use. The authorization shall specify road maintenance and management standards that provide for traffic safety, minimize erosion and damage to natural resources, and that are acceptable to BLM.

The Licensee shall pay BLM for its share of maintenance costs or perform maintenance or other agreed to services, as determined by BLM for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of the Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by the Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable BMPs. In the event a road requires maintenance, restoration, or reconstruction work to accommodate the Licensee's needs, the Licensee shall perform such work at its own expense after securing BLM authorization.

The Licensee shall complete a condition survey and a proposed maintenance plan subject to BLM review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all of the above conditions are met as well as the conditions set forth in the proposed agreement.

In addition, all BLM roads used as Project Access roads and Right-of-Way access roads shall:

- Have a current condition survey.
- Be mapped at a scale to allow identification of specific routes or segments.
- Have BLM assigned road numbers to be used for reference on the maps, tables, and in the field.
- Have GIS compatible files of GPS alignments of all roads used for Project access be provided to BLM.
- Have adequate signage installed and maintained by the Licensee at each road or route, identifying the road by BLM road number.

Condition No. 37 – Access By The United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee's use in comparison to the use of the road by others.

Condition No. 38 – Road Use

The Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection equipment, to roads or specifically designed access routes, as identified in the Transportation System Management Plan (Condition No. 16). BLM, as appropriate, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation, or, if requested by Licensee, to require construction by the Licensee to the extent needed to accommodate the Licensee's use. BLM agrees to provide notice to the Licensee and the Commission prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Condition No. 39 – Bureau of Land Management Approval of Final Design

Before any new construction of the Project occurs on Bureau of Land Management lands, the Licensee shall obtain prior written approval of BLM for all final design plans for Project components, which BLM deems as affecting or potentially affecting Bureau of Land Management lands within the Project boundary. The Licensee shall follow the schedules and procedures for design review and approval specified in the conditions herein. As part of such written approval, BLM may require adjustments to the final plans and facility locations to preclude or mitigate impacts and to insure that the Project is either compatible with on-the-ground conditions or approved by BLM based on agreed upon compensation or mitigation measures to address compatibility issues. Should such necessary adjustments be deemed by BLM, FERC, or the Licensee to be a substantial change, the Licensee shall follow the procedures of FERC Standard Article 2 of the license. Any changes to the license made for any reason pursuant to FERC Standard Article 2 or Article 3 shall be made subject to any new terms and conditions of the Secretary of Interior made pursuant to Section 4(e) of the Federal Power Act to address Project effects within the Project boundary.

Condition No. 40 – Unattended Construction Equipment

The Licensee shall not place construction equipment on BLM lands prior to actual use or allow it to remain on BLM lands subsequent to actual use, except for a reasonable mobilization and demobilization period agreed to by BLM.

Condition No. 41 – Maintenance of Improvements

The Licensee shall maintain the improvements and premises on BLM lands within the Project boundary and Licensee adjoining property to standards of repair, orderliness, neatness, sanitation, and safety. For example, trash, debris, and unusable machinery will be disposed of separately; other materials will be stacked, stored neatly, or placed within buildings. Disposal will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 42 - Construction Inspections

Within 60 days of planned ground-disturbing activity on or affecting BLM lands, Licensee shall file with the Commission a Safety During Construction Plan that identifies potential hazard areas and measures necessary to address public safety. Areas to consider include construction activities near public roads, trails, and recreation areas and facilities.

Licensee shall perform daily (or on a schedule otherwise agreed to by BLM in writing) inspections of Licensee's construction operations on BLM lands and Licensee adjoining property while construction is in progress. Licensee shall document these inspections (informal writing sufficient) and shall deliver such documentation to BLM on a schedule agreed to by BLM. The inspections must specifically include fire plan compliance, public safety, and environmental protection. Licensee shall act immediately to correct any items found which need correction.

A registered professional engineer or other qualified employee of the appropriate specialty shall regularly conduct construction inspections of structural improvements on a schedule approved by BLM.

Condition No. 43 - Hazardous Substances Plan

Within 1 year of license issuance or prior to undertaking activities on BLM lands the Licensee shall file with FERC a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. In addition, during planning and prior to any new construction or maintenance not addressed in

an existing plan, the Licensee shall notify BLM and these entities shall make a determination whether a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. Any such plan shall be filed with FERC.

At a minimum, the plan must require the Licensee to (1) maintain in the Project area, a cache of spill cleanup equipment suitable to contain any spill from the Project; (2) to periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the Project area; and (3) to inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. The plan shall include a monitoring plan that details corrective measures that will be taken if spills occur. The plan shall include a requirement for a weekly written report during construction documenting the results of the monitoring.

Condition No. 44 - Use of Explosives

Use of explosives shall be consistent with state and local requirements.

1. The Licensee shall use only electronic detonators for blasting on BLM lands and Licensee adjoining property, except near high-voltage powerlines. BLM may allow specific exceptions when in the public interest.

2. In the use of explosives, the Licensee shall exercise the utmost care not to endanger life or property and shall comply with the requirements of BLM. The Licensee shall contact BLM prior to blasting to obtain the requirements from BLM. The Licensee shall be responsible for any and all damages resulting from the use of explosives and shall adopt precautions to prevent damage to surrounding objects. The Licensee shall furnish and erect special signs to warn the public of the Licensee's blasting operations. The Licensee shall place and maintain such signs so they are clearly evident to the public during all critical periods of the blasting operations and shall ensure that they include a warning statement to have radio transmitters turned off.

3. The Licensee shall store all explosives on BLM lands in a secure manner, in compliance with State and local laws and ordinances, and shall mark all such storage places “DANGEROUS - EXPLOSIVES.” Where no local laws or ordinances apply, the Licensee shall provide storage that is satisfactory to BLM and in general not closer than 1,000 feet from the road or from any building or camping area.

4. When using explosives on BLM lands, the Licensee shall adopt precautions to prevent damage to landscape features and other surrounding objects. When directed by the BLM, the Licensee shall leave trees within an area designated to be cleared as a protective screen for surrounding vegetation during blasting operations. The Licensee shall remove and dispose of trees left when blasting is complete. When necessary, and at any point of special danger, the Licensee shall use suitable mats or some other approved method to smother blasts.

APPENDIX D—U.S. Bureau of Reclamation Preliminary Conditions for the La Grange Project

PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS FOR THE LA GRANGE HYDROELECTRIC PROJECT (FEDERAL ENERGY REGULATORY COMMISSION PROJECT NO. 14581)

The BLM through its preliminary recommendations, terms and conditions and prescriptions seeks to ensure appropriate levels of resource protection are incorporated in any new license. The BLM recommends that the FERC include in any new license issued for the La Grange Hydroelectric Project 14581 the following BLM preliminary recommendations, terms and conditions. The BLM believes this comprehensive framework provides for the sustainable management and conservation of the natural resources of the Tuolumne watershed. This framework is within the context of agency statutory authorities under the FPA and other applicable laws. The agencies intent is to issue their protection, mitigation and enhancement measures, terms and conditions, and recommendations consistent with this framework.

Condition No. 1 – Consultation

Licensee shall annually consult with BLM regarding license implementation. Licensee shall set an agreed upon date beginning in the first full calendar year of the new license term and each year thereafter, meet with BLM at the MID office in Modesto, California, to discuss past and current year implementation of the license conditions affecting BLM land. The meeting will be open to the public, except during those parts of the meeting when confidential information (e.g., cultural resources or specific location of ESA-listed species) is discussed. In those instances, only Licensee and appropriate agencies shall be allowed to be in attendance. At least 30 days in advance of the meeting, Licensee shall notify via email or other written means BLM and other interested stakeholders (interested stakeholders are defined as anyone who sends a letter or email to the Licensee requesting to be a part of the consultation group). Any organized group will select an individual to represent them and will notify the Licensee who their representative will be when they are attending these meetings, confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to the: United States Fish and Wildlife Service (USFWS); National Park Service (NPS); National Marine Fishery Service (NMFS); California State Department of Fish and Wildlife (CDFW); and the State Water Resources Control Board (SWRCB) who may choose to participate in the meeting.

Three weeks prior to each annual meeting, Licensee shall make available to BLM, interested stakeholders, and the agencies listed above an operations and maintenance plan for project activities that may affect BLM land for the calendar year in which the meeting occurs.

The purposes of the meeting are to conduct discussions about forthcoming year's operations and maintenance plans that may affect BLM land; to have the Licensee present results from the past/current year monitoring, as well as any additional information that has been compiled for the project area including progress reports on any other issues related to preserving and protecting ecological values affected by the Project on or affecting BLM land; to share information on mutually agreed upon planned maintenance activities on or affecting BLM land; to identify concerns that BLM may have regarding project operations/activities and their potential effects on sensitive resources on or affecting BLM land, any measures required to avoid or mitigate those potential effects; and review and discuss the results of implementing La Grange Hydroelectric Projects -related conditions on or affecting BLM land.

Consultation shall include, but is not limited to, the items listed below as they pertain to project-effects on or affecting BLM land:

- A status report regarding implementation of license conditions.

- Discussion on any conditions that were not implemented, rationale on why they didn't get implemented, and when will they be implemented.
- Results of any monitoring studies performed over the previous year in formats agreed to by BLM and Licensee during development of implementation plans.
- Review of any non-routine maintenance.
- Discussion of any foreseeable changes to project facilities or features.
- Discussion of any necessary revisions or modifications to resource implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protection.
- Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any proposed pesticide use.
- Discussion of BLM identified concerns regarding project operations/activities and their potential effects on sensitive resources, and any measures required to avoid or mitigate those potential effects.
- Discussion of information on mutually agreed upon planned maintenance activities.
- Discussion on upcoming permitted events that are scheduled for the year.
- Discussion on any planned burning activities on BLM land.
- Discussions on other issues regarding project effects on BLM land.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by BLM for the protection of BLM land and resources. Licensee shall file the meeting record, if requested, with FERC no later than 60 days following the meeting.

A copy of the reports/records/studies on or affecting BLM land from the previous water year shall be provided to BLM by Licensee at least 90 days prior to the meeting date, unless otherwise agreed.

Copies of other non-CEII reports including, but not limited to, monitoring reports, non-compliance reports filed by Licensee, geologic or seismic reports, and structural safety reports for facilities affecting or on BLM land shall be submitted to BLM concurrently with submittal to the FERC, with the goal of providing the material to BLM no later than 90 days in advance of the annual meeting.

During the first several years of license implementation, it is likely that more consultation than just one annual meeting will be required, given the complexity of the project and the acreage of BLM land affected by project operations.

BLM will be included to be a participant on Technical Committees that focus on anadromous fish, inter-related resident fish and other ecological topics and issues that may have a direct or indirect effect on BLM managed lands. The Technical Committees shall develop a technical advisory plan or process for ground rules for decision making and implementing decisions. Members of the committee will include those agencies with direct management responsibilities for lands (riparian, wetland, recreation, fisheries, aquatics, water temperature and water quality), and the selection of an appropriate non-governmental representative. The Technical Committee will be finalized within one year of license issuance.

Condition No. 2 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensees' Operations and Maintenance (O&M) staff with special-status species, non-native invasive plants, and sensitive areas (e.g., special-status plant populations and invasive plant locations) that are known to occur within or adjacent to the FERC Project Boundary. Licensee shall provide to each O&M staff a confidential map showing these sensitive areas, including GPS coordinates, as well as pictures and other guides to assist staff in recognizing special-status species, non-native, invasive plants, and sensitive areas. It is not the intent of this measure that Licensees' O&M staff perform surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensees' contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, Licensee shall consult with BLM to minimize adverse effects to sensitive resources. This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 3 – Erosion Control and Restoration Plan

Within one year of license issuance, Licensees shall develop and implement an Erosion Control and Restoration Plan for erosion and/or restoration actions to be carried out by Licensees on or affecting BLM lands that are within or adjacent to the FERC Project boundary. Licensees must acquire BLM approval before submitting the Erosion Control and Restoration Plan for Commission approval. Licensees shall file the approved Erosion Control and Restoration Plan with the Commission at least 90-days in advance of initiating construction of recreation or other Project facilities. Upon Commission approval, Licensees shall implement the Erosion Control and Restoration Management Plan.

Condition No. 4 – Reservation of Authority to Modify 4(e) Conditions in the Event of Anadromous Fish Re-introduction

BLM exercises its 4(e) authority by reserving that authority to modify these conditions to respond to any reintroduction of Chinook salmon or steelhead trout, listed under the Endangered Species Act, to stream reaches through BLM lands where the flow is controlled by the La Grange Hydroelectric Project.

Condition No. 5 – Terrestrial Resources Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Terrestrial Resources Management Plan following consultation with the BLM. The BLM has provided a Terrestrial Resources Management Plan (Attachment 1) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Terrestrial Resources Management Plan as presented in Attachment 1, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Terrestrial Resources Management Plan shall be implemented.

Condition No. 6 – Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall consult with BLM within 3 months, after license issuance, and annually thereafter during the annual consultation meeting, to review the current list of special-status plant and wildlife species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, BLM Sensitive, State Threatened or Endangered, State Species of Special Concern, and CDFW Fully Protected)

that might occur on public land administered by BLM in the Project area that may be directly or indirectly affected by Project operations.

When a species is added to one or more of the lists, BLM shall determine if the species, or unsurveyed suitable habitat for the species, is likely to occur on public land administered by BLM in or around the Project area. For any such newly added species, if BLM determines that the species is likely present on public land administered by BLM that may be directly or indirectly affected by the Project, Licensee shall develop and implement a study plan in consultation with BLM, and other appropriate agencies, to reasonably assess the effects of the Project on the species. Licensee shall prepare a report on the study, including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the final report to BLM and other appropriate agencies for review and approval. Licensee shall file the report, including evidence of consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of BLM special status plant or wildlife species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM. If BLM determines that the Project-related activities are adversely affecting BLM sensitive or watch list species, Licensee shall, in consultation with BLM, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM, FERC, and the relevant agency (USFWS or NMFS) for consultation or conference in accordance with the Endangered Species Act (USFWS 1988). If state listed or fully protected species are affected, CDFW shall be notified.

Threatened, Endangered, and Sensitive Species Objectives:

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

- Ensure that proposed license conditions and recommended measures provide for well distributed, viable populations of special status species including threatened, endangered and BLM sensitive species, and are consistent with any applicable biological opinion issued under the federal or state Endangered Species Act (ESA). Ensure that proposed license conditions and recommended measures comply with BLM plans and policy.
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species.
- Manage special status species habitat to assist in the recovery of listed species.
- Maintain or improve habitat for special status species.
- Coordinate with the USFWS on implementation of recovery plans and conservation strategies for special status species.
- Manage sensitive species to ensure that species do not become threatened or endangered.
- Maintain and restore habitat to support viable populations of TES species. Work cooperatively to reduce impacts to native populations where invasive species are adversely affecting the viability of native species.
- Avoid impact to species designated as fully protected under FGC sections 3511(b) and 4700(b).
- Avoid or minimize impacts to species whose viability has been identified as a concern.

- If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- Conserve ESA-listed species and the ecosystems on which they depend and to the extent possible recover these species so that ESA protection is no longer needed (BLM 2012).
- Minimize the effects of stream diversion or other flow modifications from hydroelectric projects on threatened, endangered, or sensitive species.
- Monitor populations and habitats of federally listed and BLM sensitive plant species to determine whether management objectives are being met (BLM 2012).
- Develop site-specific management objectives for each occurrence of listed threatened and endangered plant species and BLM sensitive plant species on BLM lands that will be affected by BLM actions (BLM 2012).
- Modify proposed actions, to the extent possible, to avoid adverse impacts to special status plant species; where avoidance is not possible, develop measures to mitigate impacts to these species (BLM 2012).
- Conduct inventories to determine the occurrence and status of all special status plant species on lands managed by BLM or affected by BLM actions to ensure compliance with NEPA and the ESA by having sufficient information to adequately assess the effects of proposed actions on special status plants. Inventories are to be conducted at the time of year when such plant species can be found and positively identified (BLM 2012).

Condition No. 7 – Historic Properties Management Plan

Upon the Commission approval, Licensee shall implement the Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC.

Condition No. 8 – Public Access and Hiking Trail

Within 3 years of License issuance, the Licensee shall construct and maintain the following public recreation facilities on BLM land:

1. A 36-inch-wide trail that meets a grade of 5 - 8 percent or less from the parking area of La Grange Headquarters to the Tuolumne River.

2. A kiosk sign near the beginning of the trail, explaining the rules of the area.

3. Two picnic tables of coated wire mesh material in a level area that is above the Tuolumne River flood plain located near the shore of the river.

Condition No. 9 – Bald Eagle Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Bald Eagle Management Plan following consultation with the BLM. The BLM has provided a Bald Eagle Management Plan (Attachment 2) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Bald Eagle Management Plan as presented in Attachment 2, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Bald Eagle Management Plan shall be implemented.

PRELIMINARY 4(e) ADMINISTRATIVE CONDITIONS

The following Section 4(e) Conditions include requirements that serve to address the statutory and administrative rights and responsibilities of the BLM pursuant to Federal, State, and local laws.

Condition No. 10 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect BLM lands the Licensee shall obtain written approval from BLM prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from BLM, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of BLM for such changes. The Licensee shall file an exact copy of this report with BLM at the same time it is filed with the Commission.

Condition No. 11– Maintenance of Improvements on or Affecting Bureau of Land Management Lands

The Licensee shall maintain all its improvements and premises on BLM lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to BLM. Disposal of all materials will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 12 – Existing Claims

The License shall be subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 13 – Compliance with Regulations

The Licensee shall comply with the regulations of the Department of the Interior on BLM lands for activities on BLM lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting BLM lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 14 – Surrender of License or Transfer of Ownership

Prior to any surrender of this License, the Licensee shall provide assurance acceptable to BLM that Licensee shall restore any Project area directly affecting BLM lands to a condition satisfactory to BLM upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall identify the measures to be taken to restore such BLM lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the License or sale of the Project, the Licensee shall assure that, in a manner satisfactory to BLM, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by BLM to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by BLM, to estimate the potential costs associated with surrender and restoration of any Project area directly affecting BLM lands to BLM specifications. In addition, BLM may require the Licensee to pay for an independent audit of the transferee to assist BLM in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 15 – Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this License.

Condition No. 16 - Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 17 – Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to BLM lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24.

Condition No. 18 – Risks and Hazards on Bureau of Land Management Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting BLM lands within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on BLM lands shall be performed after consultation with BLM. In emergency situations, the Licensee shall notify BLM of its actions as soon as possible, but not more than 48 hours after such actions have been taken. Whether or not BLM is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 19 – Protection of Bureau of Land Management Special Status Species

Before taking actions to construct new Project features on BLM lands that were not addressed in the Commission's NEPA processes for relicensing that may affect BLM threatened and endangered species

or BLM special status species or their critical habitat, the Licensee shall prepare and submit a biological evaluation (BE) for BLM approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, BLM may require mitigation measures for the protection of the affected species.

The biological evaluation shall:

- Include procedures to minimize adverse effects to threatened and endangered species and special status species and their critical habitat.
- Include information on the current status of the special-status species within the project area, a full description of the Project and potential effects, if BLM determines that existing information is out of date.
- Ensure project-related activities shall meet restrictions included in site management plans for threatened and endangered species and special-status species and their habitat.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 20 – Access

Subject to the limitations set forth under the heading of "Access By The United States" in Condition No. 20 hereof, BLM reserves the right to use or permit others to use any part of the licensed area on BLM lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act.

Condition No. 21 – Crossings

The Licensee shall maintain suitable crossings as required by BLM for all roads and trails that intersect the right-of-way occupied by linear Project facilities (power lines, penstocks, ditches, and pipelines).

Condition No. 22 – Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on BLM lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of BLM. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 23 – Pesticide-Use Restrictions on Bureau of Land Management Lands

Pesticides may not be used on BLM lands or in areas affecting BLM lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of BLM. During the Annual Consultation Meeting described in Condition No. 1, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide at a minimum the following information essential for review:

- whether pesticide applications are essential for use on BLM lands;
- specific locations of use;
- specific herbicides proposed for use;

- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Any pesticide use that is deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations of BLM Special Status or culturally significant plant populations will be designed to avoid adverse effects to individuals and their habitats. Application of pesticides must be consistent with BLM riparian conservation objectives.

On BLM lands, the Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by BLM and approved through BLM review for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. The Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other BLM required documents to use pesticides on a regular basis for the term of the license as addressed further in Condition No. 5 – Terrestrial Resources Management Plan. Submission of this plan will not relieve the Licensee of the responsibility of annual notification and review.

Condition No. 24 – Modifications of 4(e) Conditions after Biological Opinion or Water Quality Certification

BLM exercises its 4(e) authority by reserving that authority to modify these conditions, if necessary, to respond to any Final Biological Opinion issued for this Project by the National Marine Fisheries Service, United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 25 – Signs

The Licensee shall consult with BLM prior to erecting signs related to safety issues on BLM lands covered by the License. Prior to the Licensee erecting any other signs or advertising devices on BLM lands covered by the License, the Licensee must obtain the approval of BLM as to location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

Condition No. 26 – Ground Disturbing Activities

If the Licensee proposes ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Licensee, in consultation with BLM, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Licensee shall enter into an agreement with BLM under which the Licensee shall fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

Condition No. 27 – Use of Bureau of Land Management Roads for Project Access

The Licensee shall obtain suitable authorization for all project access roads and BLM roads needed for Project access. The term of the permit shall be the same as the term of the License. The authorization

shall require road maintenance and cost sharing in reconstruction commensurate with the Licensees' use and project-related use. The authorization shall specify road maintenance and management standards that provide for traffic safety, minimize erosion and damage to natural resources, and that are acceptable to BLM.

The Licensee shall pay BLM for its share of maintenance costs or perform maintenance or other agreed to services, as determined by BLM for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of the Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by the Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable BMPs. In the event a road requires maintenance, restoration, or reconstruction work to accommodate the Licensee's needs, the Licensee shall perform such work at its own expense after securing BLM authorization.

The Licensee shall complete a condition survey and a proposed maintenance plan subject to BLM review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all of the above conditions are met as well as the conditions set forth in the proposed agreement.

In addition, all BLM roads used as Project Access roads and Right-of-Way access roads shall:

- Have a current condition survey.
- Be mapped at a scale to allow identification of specific routes or segments.
- Have BLM assigned road numbers to be used for reference on the maps, tables, and in the field.
- Have GIS compatible files of GPS alignments of all roads used for Project access be provided to BLM.
- Have adequate signage installed and maintained by the Licensee at each road or route, identifying the road by BLM road number.

Condition No. 28 – Access By The United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee's use in comparison to the use of the road by others.

Condition No. 29 – Road Use

The Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection equipment, to roads or specifically designed access routes. BLM, as appropriate, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation, or, if requested by Licensee, to require construction by the Licensee to the extent needed to accommodate the Licensee's use. BLM agrees to provide notice to the Licensee and the Commission prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Condition No. 30 – Bureau of Land Management Approval of Final Design

Before any new construction of the Project occurs on Bureau of Land Management lands, the Licensee shall obtain prior written approval of BLM for all final design plans for Project components, which BLM deems as affecting or potentially affecting Bureau of Land Management lands within the Project boundary. The Licensee shall follow the schedules and procedures for design review and approval specified in the conditions herein. As part of such written approval, BLM may require adjustments to the final plans and facility locations to preclude or mitigate impacts and to insure that the Project is either compatible with on-the-ground conditions or approved by BLM based on agreed upon compensation or mitigation measures to address compatibility issues. Should such necessary adjustments be deemed by BLM, FERC, or the Licensee to be a substantial change, the Licensee shall follow the procedures of FERC Standard Article 2 of the license. Any changes to the license made for any reason pursuant to FERC Standard Article 2 or Article 3 shall be made subject to any new terms and conditions of the Secretary of Interior made pursuant to Section 4(e) of the Federal Power Act to address Project effects within the Project boundary.

Condition No. 31 – Unattended Construction Equipment

The Licensee shall not place construction equipment on BLM lands prior to actual use or allow it to remain on BLM lands subsequent to actual use, except for a reasonable mobilization and demobilization period agreed to by BLM.

Condition No. 32 – Maintenance of Improvements

The Licensee shall maintain the improvements and premises on BLM lands within the Project boundary and Licensee adjoining property to standards of repair, orderliness, neatness, sanitation, and safety. For example, trash, debris, and unusable machinery will be disposed of separately; other materials will be stacked, stored neatly, or placed within buildings. Disposal will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 33 - Construction Inspections

Within 60 days of planned ground-disturbing activity on or affecting BLM lands, Licensee shall file with the Commission a Safety During Construction Plan that identifies potential hazard areas and measures necessary to address public safety. Areas to consider include construction activities near public roads, trails, and recreation areas and facilities.

Licensee shall perform daily (or on a schedule otherwise agreed to by BLM in writing) inspections of Licensee's construction operations on BLM lands and Licensee adjoining property while construction is in progress. Licensee shall document these inspections (informal writing sufficient) and shall deliver such documentation to BLM on a schedule agreed to by BLM. The inspections must specifically include fire plan compliance, public safety, and environmental protection. Licensee shall act immediately to correct any items found which need correction.

A registered professional engineer or other qualified employee of the appropriate specialty shall regularly conduct construction inspections of structural improvements on a schedule approved by BLM.

Condition No. 34 - Hazardous Substances Plan

Within 1 year of license issuance or prior to undertaking activities on BLM lands the Licensee shall file with FERC a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. In addition, during planning and prior to any new construction or maintenance not addressed in

an existing plan, the Licensee shall notify BLM and these entities shall make a determination whether a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. Any such plan shall be filed with FERC.

At a minimum, the plan must require the Licensee to (1) maintain in the Project area, a cache of spill cleanup equipment suitable to contain any spill from the Project; (2) to periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the Project area; and (3) to inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. The plan shall include a monitoring plan that details corrective measures that will be taken if spills occur. The plan shall include a requirement for a weekly written report during construction documenting the results of the monitoring.

Condition No. 35 - Use of Explosives

Use of explosives shall be consistent with state and local requirements.

1. The Licensee shall use only electronic detonators for blasting on BLM lands and Licensee adjoining property, except near high-voltage powerlines. BLM may allow specific exceptions when in the public interest.

2. In the use of explosives, the Licensee shall exercise the utmost care not to endanger life or property and shall comply with the requirements of BLM. The Licensee shall contact BLM prior to blasting to obtain the requirements from BLM. The Licensee shall be responsible for any and all damages resulting from the use of explosives and shall adopt precautions to prevent damage to surrounding objects. The Licensee shall furnish and erect special signs to warn the public of the Licensee's blasting operations. The Licensee shall place and maintain such signs so they are clearly evident to the public during all critical periods of the blasting operations and shall ensure that they include a warning statement to have radio transmitters turned off.

3. The Licensee shall store all explosives on BLM lands in a secure manner, in compliance with State and local laws and ordinances, and shall mark all such storage places “DANGEROUS - EXPLOSIVES.” Where no local laws or ordinances apply, the Licensee shall provide storage that is satisfactory to BLM and in general not closer than 1,000 feet from the road or from any building or camping area.

4. When using explosives on BLM lands, the Licensee shall adopt precautions to prevent damage to landscape features and other surrounding objects. When directed by the BLM, the Licensee shall leave trees within an area designated to be cleared as a protective screen for surrounding vegetation during blasting operations. The Licensee shall remove and dispose of trees left when blasting is complete. When necessary, and at any point of special danger, the Licensee shall use suitable mats or some other approved method to smother blasts.

APPENDIX E—California State Water Resources Control Board Preliminary Conditions for the Don Pedro and La Grange Projects

PRELIMINARY TERMS AND CONDITIONS FOR

DON PEDRO AND LA GRANGE HYDROELECTRIC PROJECTS

(FEDERAL ENERGY REGULATORY COMMISSION PROJECTS NOS. 2299 & 14581)

In accordance with the memorandum of understanding (MOU) executed between the Federal Energy Regulatory Commission (FERC) and the State Water Resources Control Board (State Water Board) on November 19, 2013, and to the extent that information is available, State Water Board staff is providing water quality certification (certification) preliminary terms and conditions in response to the notice of Ready for Environmental Analysis (REA) by FERC for the Don Pedro and La Grange Hydroelectric Projects (collectively, Projects), FERC Projects Nos. 2299 & 14581. The Projects are owned and operated by co-licensees Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts). This document is strictly preliminary in nature, and is being sent to further coordination regarding information needs and potential conditions between FERC and the State Water Board. Contrary to other recent relicensing projects, State Water Board staff reserves full analysis of the impacts of all proposed Protection, Mitigation, and Enhancement measures until more coordination has taken place between the Districts and resource agencies. This document does not reflect a decision by the State Water Board to adopt any particular term or condition, nor does it limit the State Water Board's consideration of terms or conditions different from or in addition to those presented here.

1. Minimum Instream Flows

The State Water Board will likely condition minimum instream flows in light of the whole record. The whole record includes, but is not limited to, the FERC record (including recommendations by resource agencies), the final National Environmental Policy Act (NEPA) document, the final California Environmental Quality Act (CEQA) document, the updated Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), and the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan).

2. Water Year Type Classification

The State Water Board will likely determine the criteria to classify water year types for the Projects-affected reaches. Water year type classification criteria for Projects-affected waters downstream of La Grange Dam will likely be based on the San Joaquin Valley 60-20-20 Index.

3. Streamflow and Reservoir Level Compliance

The State Water Board will likely require the Districts to develop and implement a Stream Flow and Reservoir Level Compliance Plan to document compliance with streamflow and reservoir level requirements in the new FERC license. At a minimum, this plan should include:

1. Locations where the Districts monitors streamflow and reservoir levels;
2. Equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of this certification;
3. A description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of this certification is deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained.
4. A description of how the data will be retrieved from the equipment used by the Districts to monitor compliance with the requirements in the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage.

5. A description of how streamflow and reservoir level data are provided to the State Water Board.

4. Large Woody Material Management Plans

The State Water Board will likely require the Districts, in consultation with relevant resource agencies, to develop and implement a plan to address for the reduction of LWM downstream of La Grange Dam. The goal of this plan is to increase the amount of LWM below La Grange Dam in order to improve downstream aquatic habitat. The Districts shall consult with representatives from the boating community (e.g., American Whitewater) to ensure LWM placement in the river is not hazardous to boaters. The Districts may also be required to monitor the implementation and effectiveness of LWM augmentation and to submit associated reports to the Deputy Director. Best management practices (BMPs) should be developed to minimize the impact to beneficial uses (e.g., turbidity and wildlife) from LWM placement and installation.

This condition will recognize that it is subordinate to safety determinations by FERC and the California Division of Safety of Dams, and shall include provisions related to safety concerns by other government entities.

5. Sediment Management Plans

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to facilitate coarse and fine sediment transport past La Grange Dam in the Tuolumne River. The goal of this plan is to replace sediment lost downstream of La Grange Dam in order to improve downstream habitat. The Districts may also be required to monitor implementation and effectiveness of the sediment augmentation and submit associated reports to the Deputy Director. BMPs should be developed to minimize the impact to beneficial uses (e.g., turbidity and wildlife) from initial sediment placement.

6. Water Quality Monitoring Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to monitor water quality. This plan should include monitoring sites at the Projects' reservoirs and locations throughout affected river reaches. The monitoring sites should be adequately abundant and spatially distributed to provide data that measures potential impacts to water quality as a result of the Projects' operations. Water quality monitoring should occur at intervals during the license term to document trends in time and changes in water quality related to operational changes that may impact water quality or designated beneficial uses of water. This plan should consider in-situ, dissolved oxygen, recreation related water quality, and bioaccumulation monitoring components. If at any point monitoring suggests water quality conditions are in exceedance of Basin Plan water quality objectives, the Districts shall immediately notify the State Water Board and Central Valley Regional Water Quality Control Board.

7. Water Temperature Monitoring Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to monitor potential effects on water temperature from the Projects. The objective of this plan is to monitor water temperature in Don Pedro Reservoir, La Grange Pool, and Lower Tuolumne River. This plan should include an adequate number of sites to track the changes in water temperature stored in impoundments and released below impoundments. In flowing water, the Districts should install and anchor appropriate devices to continuously record water temperature seasonally or throughout the year. In reservoirs, the Districts should monitor water temperature and thermocline depth by profile sampling near the

dam to determine reservoir stratification depths. Water temperature data will be used to help determine the effects of the Projects' operations on thermal conditions.

8. Aquatic Invasive Species Management Plan

The State Water Board will likely require the Districts, in consultation with relevant resource agencies, to develop and implement a plan to manage aquatic invasive species (AIS). The goal of this plan is to establish a framework with specific activities to minimize the spread and impact of AIS on native fauna and habitats. This plan should identify and describe AIS currently established within the Projects' area and AIS with high potential to become established within the Projects' area. This plan may include, but is not limited to, the following measures:

1. Implement actions to minimize and prevent the introduction and spread of AIS into and throughout Projects'-affected waters.
2. Provide education and outreach to ensure public awareness of AIS effects and management throughout Projects'-affected waters.
3. Implement monitoring programs for early detection of AIS.
4. Ensure all the Projects' AIS management activities comply with federal and State of California laws, regulations, policies, and management plans, and with Forest Service directives and orders regarding AIS.
5. Monitor and minimize the spread of established AIS.

9. Erosion and Sediment Control Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the Projects' operations and maintenance. This plan should contain erosion and sediment reduction protocols for ground-disturbing activities that include, but are not limited to, routine operations, maintenance, any new construction, and recreation improvements. Protocols shall abide by applicable regulations and reduce impacts to water quality within the Projects' area.

10. Hazardous Material Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan for storage, use, transportation, and disposal of hazardous materials in the Projects' area. This plan should discuss appropriate measures and equipment required to prevent the extent of any hazardous material spill. This plan should also include protocols to prevent adverse impacts to beneficial uses in the event that hazardous materials are spilled. On-site containment for hazardous-chemical storage shall be placed away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320. Protocols and methods in this plan shall abide by federal, state and local laws and policies.

11. Additional Conditions

In order to ensure that the Projects operate to meet water quality standards as anticipated, to ensure compliance with other relevant state and federal laws, and to ensure that the Projects will continue to meet state water quality standards and other appropriate requirements of state law over its lifetime, the certification will consider conditions regarding monitoring, enforcement, and potential future revisions. Additionally, California Code of Regulations, title 23, section 3860 requires imposition of certain mandatory conditions for all water quality certifications.