April 24, 2017

Filed via Electronic Submittal (E-File)

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE
Washington, DC 20426

Subject: La Grange Hydroelectric Project, FERC Project No. 14581
Draft License Application

Dear Secretary Bose:

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts), co-owners of the La Grange Diversion Dam located on the Tuolumne River, herewith file their Draft License Application (DLA) for an original license for the La Grange Hydroelectric Project (Project) in accordance with Federal Energy Regulatory Commission (FERC or Commission) regulations at 18 CFR § 4.61 (Contents of Application for License for Minor Water Power Projects and Major Water Power Projects 5 Megawatts or Less).

This DLA filing includes the following:

- Exhibit A – Project Description describes the Project location and all Project facilities.
- Exhibit E – Environmental Report summarizes the existing affected environment and integrates study information from each resource area to provide a description of the resources associated with the Project.
- Exhibit F – Project Drawings contains general arrangement drawings of the existing Project structures and facilities. These drawings will be updated to current FERC drawing guidelines and filed with the Final License Application (FLA). Project drawings are being filed under separate cover as Critical Energy Infrastructure Information (CEII).

In accordance with the schedule approved by FERC on May 27, 2016, in its Determination on Requests for Study Modifications and New Study, the Districts plan to file the FLA with FERC no later than September 25, 2017. An Exhibit G (Project Maps) will be filed as part of the FLA.

If you have any questions about this filing, please contact the undersigned at the addresses or telephone numbers listed below.

Sincerely,

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Enclosure: La Grange Hydroelectric Project Draft License Application

LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

TRANSMITTAL LETTER
EXHIBITS A, E, AND F
ATTACHMENTS A THROUGH L

TID WATER & POWER
Serving Central California since 1887

MID Modesto Irrigation District

Prepared by:
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and

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April 2017

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LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

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MASTER TABLE OF CONTENTS

Exhibit **Description**

List of Attachments

Attachment C	Workshops and Technical Committee meetings held in 2015 and 2016 in support of the Upper Tuolumne River Reintroduction/Fish Passage Assessment Framework process
Attachment D	Effects of the Project and Related Activities on Losses of Marine-Derived Nutrients in the Tuolumne River Study Report
Attachment E	La Grange Fish Barrier Assessment Study Report
Attachment F	Topographic Survey Technical Memorandum
Attachment G	Salmonid Habitat Mapping Technical Memorandum
Attachment H	Fish Presence and Stranding Assessment Technical Memorandum
Attachment I	Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes Study Report
Attachment J	Fish Passage Facilities Alternatives Assessment Progress Report
Attachment K	Recreation Access and Safety Assessment Study Report
Attachment L	Cultural Resources Study Report (filed as Privileged with FERC)

LA GRANGE HYDROELECTRIC PROJECT

FERC NO. 14581

DRAFT LICENSE APPLICATION

EXHIBIT A – PROJECT DESCRIPTION

Prepared by:
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April 2017

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List of Acronyms and Abbreviations

ac-ft ....acre-feet
cfs...............................cubic feet per second
CG ....Conservation Group
Districts.......................Turlock Irrigation District and Modesto Irrigation District
DLA ....Draft License Application
FERC..........................Federal Energy Regulatory Commission
FLA ....Final License Application
kW..............................kilowatt
LGDD ....La Grange Diversion Dam
M&I............................municipal and industrial
MID............................Modesto Irrigation District
MW ....megawatt
MWh ....megawatt hour
NMFS.........................National Marine Fisheries Service
Project ....La Grange Hydroelectric Project
RM ....river mile
TID.............................Turlock Irrigation District
USGS ....United States Geological Survey
USR............................Updated Study Report
WY ....water year

EXHIBIT A – PROJECT DESCRIPTION

EXCERPT FROM CODE OF FEDERAL REGULATIONS (CFR) DESCRIBING CONTENTS OF THE EXHIBIT (18 CFR §4.61)

Subpart G—Application for License for Minor Water Power Projects and Major Water Power Projects 5 Megawatts or Less

(c) Exhibit A is a description of the project and the proposed mode of operation.
(1) The exhibit must include, in tabular form if possible, as appropriate:
(i) The number of generating units, including auxiliary units, the capacity of each unit, and provisions, if any, for future units;
(ii) The type of hydraulic turbine(s);
(iii) A description of how the plant is to be operated, manual or automatic, and whether the plant is to be used for peaking;
(iv) The estimated average annual generation in kilowatt-hours or mechanical energy equivalent;
(v) The estimated average head on the plant;
(vi) The reservoir surface area in acres and, if known, the net and gross storage capacity;
(vii) The estimated minimum and maximum hydraulic capacity of the plant (flow through the plant) in cubic feet per second and estimated average flow of the stream or water body at the plant or point of diversion; for projects with installed capacity of more than 1.5 megawatts, monthly flow duration curves and a description of the drainage area for the project site must be provided;
(viii) Sizes, capacities, and construction materials, as appropriate, of pipelines, ditches, flumes, canals, intake facilities, powerhouses, dams, transmission lines, and other appurtenances; and
(ix) The estimated cost of the project.
(x) The estimated capital costs and estimated annual operation and maintenance expense of each proposed environmental measure.
(2) State the purposes of project (for example, use of power output).
(3) An estimate of the cost to develop the license application; and
(4) The on-peak and off-peak values of project power, and the basis for estimating the values, for projects which are proposed to operate in a mode other than run-of-river.
(5) The estimated average annual increase or decrease in project generation, and the estimated average annual increase or decrease of the value of project power due to a change in project operations (i.e., minimum bypass flows, limiting reservoir fluctuations) for an application for a new license;
(6) The remaining undepreciated net investment, or book value of the project;
(7) The annual operation and maintenance expenses, including insurance, and administrative and general costs;
(8) A detailed single-line electrical diagram;
(9) A statement of measures taken or planned to ensure safe management, operation, and maintenance of the project.

1.0 PROJECT LOCATION

1.1 General Project Setting and Location

The La Grange Diversion Dam (LGDD)is located on the Tuolumne River near the border of Stanislaus and Tuolumne counties in central California at river mile (RM) 52.2. The La Grange Project includes the diversion dam, impoundment, two penstock intakes, Turlock Irrigation District's (TID) sluiceway, two penstocks, a powerhouse, excavated tailrace, and substation. It also includes Modesto Irrigation District's (MID) side-hill release gates, associated Tainter gates, and the channel leading from the Tainter gates to the side-hill release gates. The intakes for the TID powerhouse are located just upstream of TID's Upper Main Canal headworks. The general site arrangement is depicted in Figure 1.1-1.

The following sections describe the La Grange Project in its entirety, including elements of the La Grange Hydroelectric Project (Project), i.e., that which is being considered for licensing by the Federal Energy Regulatory Commission (Commission or FERC), and non-Project features, which are operated by the Districts to achieve the primary purposes of the La Grange Project, i.e., diverting water for irrigation and municipal and industrial (M&I) uses. Non-Project features are identified as such throughout this Exhibit A. Hydroelectric generation is a secondary purpose of the La Grange Project. Water diversions at the La Grange Project are not dependent on the issuance of a FERC license and would occur with or without the licensing of the hydroelectric project. As such, these primary uses are not interrelated or interdependent with the issuance of a FERC license for hydroelectric power generation.

1.2 Drainage Area

The 150-mile-long Tuolumne River begins at the confluence of the Dana Fork and the Lyell Fork in the Tuolumne Meadows area of Yosemite National Park. After traversing nearly 8,600 feet of elevation drop, the Tuolumne River flows into the San Joaquin River in the Central Valley region of California. The Tuolumne River initially passes through high mountain valleys and deeply incised canyons, then through the foothills of the Sierra Nevada Mountains, and then through the eastern side of the low-lying Central Valley. The 1,960-square-mile watershed can be subdivided into three river reaches—the upper Tuolumne River above roughly RM 80, the foothills reach between RM 54 and 80, and the valley reach from the mouth to RM 54. The drainage area of the Tuolumne River upstream of LGDD is approximately 1,550 square miles. Flows reaching LGDD are regulated by four upstream reservoirs: Hetch Hetchy, Lake Eleanor, Cherry Lake (also known as Lake Lloyd), and Don Pedro.

1.3 Purpose of La Grange Project

TID and MID (collectively the Districts) are public agencies with headquarters located in Turlock and Modesto, California, respectively. Both Districts are organized under the laws of the State of California to provide water supplies and retail electric services. LGDD is jointly owned by the Districts. Originally constructed between 1891 and 1893, the purpose of the dam is to raise the level of the Tuolumne River to permit the diversion of water from the river for irrigation by means gravity of Central Valley farmland and M&I water supply. TID alone owns and operates the La Grange powerhouse.

TID was established in June 1887 and was California's first publicly owned irrigation district. TID provides irrigation water to 150,000 acres of land and serves approximately 100,000 electric customers in a 662-square-mile electric service area (TID 2010). MID was established in July 1887. MID provides irrigation water to almost 60,000 acres of land and serves approximately 111,000 electric customers in a 560-square-mile electric service area (MID 2010). MID also supplies treated municipal water to the City of Modesto, and the Districts provide treated drinking water to the community of La Grange.

1.4 Purpose of TID's La Grange Hydroelectric Project

TID placed the La Grange powerhouse in service in 1924, thirty years after construction of LGDD. The electricity produced by the powerhouse is used as part of TID's portfolio of electric power generation to serve its retail customers. Under non-spill conditions, water not needed for irrigation purposes by TID is passed downstream through one or both of the turbine-generator units located in the powerhouse. If the powerhouse is out of service, then water not needed for irrigation purposes is passed downstream at the sluice gate structure located adjacent to the penstock intake, as discussed further below.

2.0 PROJECT FACILITIES

This Section provides a summary of characteristics of facilities, including elements of the La Grange Hydroelectric Project, i.e., that which is being considered for licensing by FERC, and non-Project features, which are operated by the Districts to achieve the primary purposes of the La Grange Project, i.e., diverting water for irrigation and M&I uses. The location and configuration of facilities is shown in Figure 2.1-1.

2.1 Diversion Dam and Spillway

The original 127.5-foot-high arched dam placed in service in 1893 was constructed of boulders set in concrete and faced with roughly-dressed stones from a nearby quarry. In 1923, an 18-inch-high concrete cap was added, and in 1930 an additional 24-inch-high concrete cap was added, resulting in the final and current height of 131 feet. The crest elevation was raised to increase the flows that could be diverted to each of the Districts' irrigation canals. There have been no significant modifications to LGDD and spillway since 1930, except for routine maintenance and repairs.

The dam was constructed such that the top of the dam is almost entirely an uncontrolled overflow spillway (Figure 2.1-2 and Figure 2.1-3). The spillway crest is at elevation 296.5 feet (all elevations are referenced to 1929 National Geodetic Vertical Datum) and has a length of 310 feet. A rating curve for the spillway is presented in Table 2.1-1. The maximum flow over the spillway occurred in 1997 and was approximately 59,462 cubic feet per second (cfs).

Table 2.1-1. Rating table for La Grange spillway.

Reservoir Elevation (ft)	Discharges in cfs			
	0.00 ft	0.25 ft	0.50 ft	0.75 ft
296	-	-	10	120
297	320	600	980	1,350
298	1,800	2,280	2,780	3,400
299	4,010	4,680	5,380	6,150
300	6,900	7,720	8,560	9,410
301	10,310	11,300	12,300	13,350
302	14,500	15,590	16,680	17,900
303	19,100	20,290	21,500	22,700
304	23,900	25,050	26,800	28,400

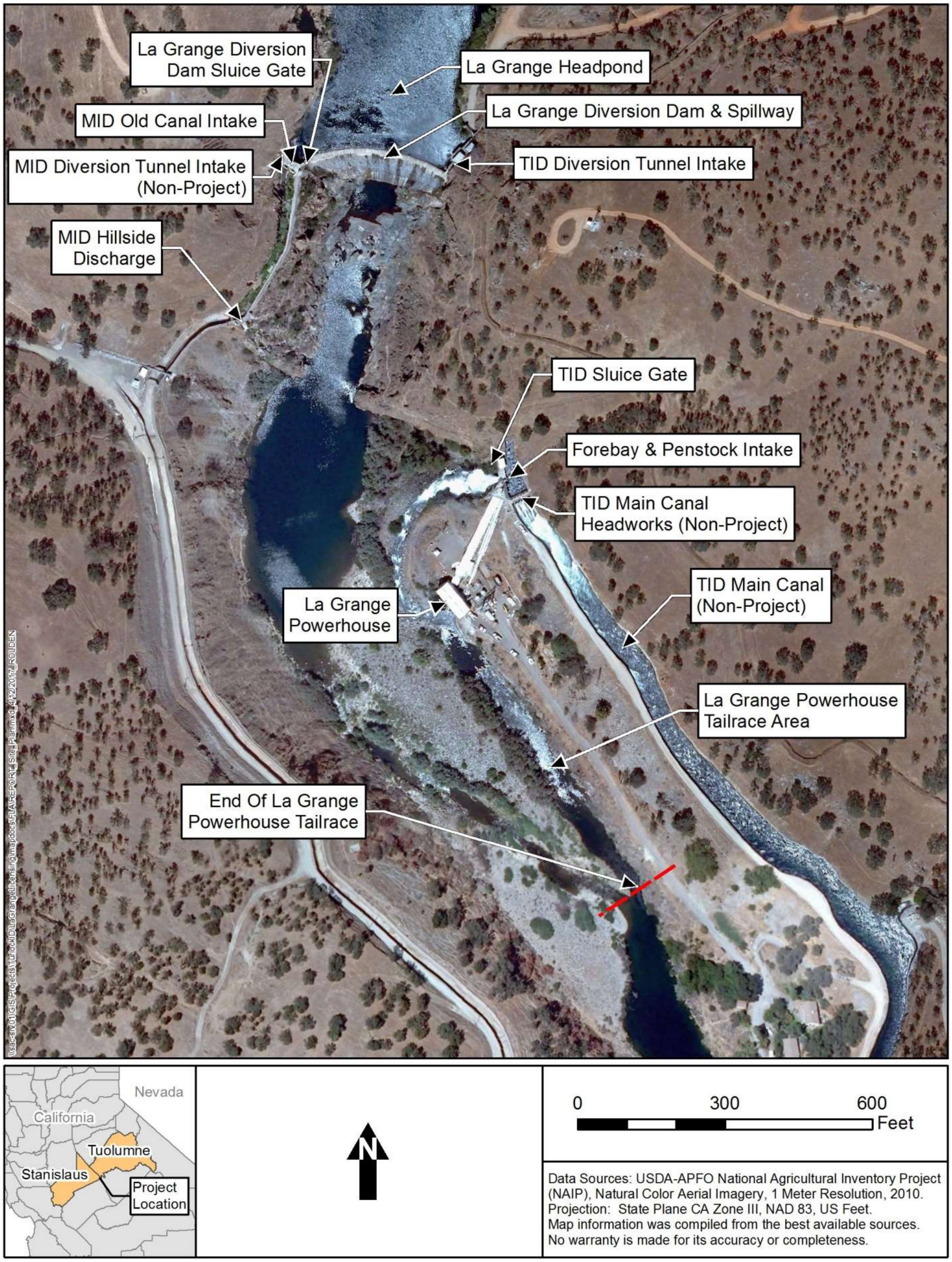

Figure 2.1-1. La Grange Project facilities.

Figure 2.1-2. La Grange Diversion Dam seen from old MID irrigation canal on right bank.

Figure 2.1-3. La Grange Diversion Dam from TID intake on left bank. Note water flowing from MID hill-side outlet to river below.

2.2 Headpond

The diversion dam was constructed for the purpose of raising the level of the Tuolumne River to a height which enabled gravity flow of diverted water into the Districts' irrigation systems. When not in spill mode, the water level above the diversion dam is between 294 feet and 296 feet approximately 90 percent of the time.

Based on hydraulic modeling performed by the Districts[1], the upper end of the headpond formed by LGDD under non-spill conditions terminates approximately one mile above the diversion dam. This creates a shoreline length of approximately two miles and a surface area of approximately 29.2 acres. The headpond has a maximum depth of 35 feet, a mean depth of approximately 11 feet, a gross storage capacity of approximately 340 acre-feet (ac-ft), and a usable storage capacity of less than 100 ac-ft.

[1] The backwater study was submitted to the Commission under Docket UL11-1 (TID 2011) as part of the Commission's deliberations related to the jurisdictional status of the La Grange powerhouse.

2.3 Intakes and Tunnels

Don Pedro Reservoir, owned jointly by the Districts, is located approximately two miles upstream of LGDD. Water released from Don Pedro Reservoir is either diverted by TID or MID at LGDD for irrigation or M&I water supply purposes at LGDD or passes to the lower Tuolumne River through one of the flow passageways available at the diversion dam. MID's diversion tunnel intake is located on the west (looking downstream, river right) end of the dam, and TID's diversion tunnel intake is located on the east (river left) end of the dam. Consistent with each irrigation districts' share of ownership of the Don Pedro Project, the irrigation canals were constructed such that approximately 68 percent of diverted flow is routed to the TID system and 32 percent to the MID system.

2.3.1 MID's Diversion Tunnel and Intake

MID's diversion tunnel and intake are non-Project facilities, as they are not used in conjunction with TID's hydropower facility. The description provided is for informational purposes only.

Due to maintenance and repair issues experienced along its Upper Main Canal, MID constructed in 1987/1988 the current diversion tunnel and intake to bypass this upper section of the Main Canal. The intake to the MID diversion tunnel is located in the face of a cliff on the west (river right) bank about 100 feet upstream of LGDD (Figure 2.3-1). The invert of the MID tunnel is at elevation 277.4 feet. Flow is conveyed through the 15-foot, 6- inch-diameter tunnel for 895 feet to a control structure. Flow is then conveyed through a 5,300- foot-long tunnel to an outlet structure which controls flow to the MID non-Project Main Canal. The design maximum flow rate for this tunnel is approximately 2,000 cfs. The MID intake and tunnel provide water to MID's non-Project irrigation and M&I water systems.

Figure 2.3-1. Retired MID main canal on west (right) bank. Gate stems and hand-wheels controlling the openings of the gates that pass flow to the hill-side release are seen in the far left of the photo.

2.3.2 TID's Intake and Diversion Tunnel

TID's diversion tunnel and intake is a non-Project facility as its primary purpose is to divert Tuolumne River flows to its main irrigation canal. The TID intake is located on the east (left) bank just upstream of the diversion dam and consists of two separate structures. The south intake structure contains two 8-foot by 11-foot, 10-inch-high control gates driven by electric motor hoists. The north intake structure contains a single 8-foot by 12-foot control gate (Figure 2.3-2).

Figure 2.3-2. TID diversion tunnel intake on east (left) bank.

The north intake structure was added in 1980 to increase the delivery capability to TID's irrigation canal system by reducing head losses through the single intake and lowering the tunnel invert. Flows from the intake are conveyed to a 600-foot-long tunnel to the 110-foot-long forebay for the TID non-Project Main Canal. The forebay was modified in the 1980s to reinforce the structure. Flows to TID's irrigation system are regulated at the non-Project Main Canal Headworks consisting of six slide gates, each of which being 5-feet-wide by 8-feet, 4-inches-tall.

2.4 Forebay, Powerhouse Intake, and Main Canal Headworks

Flows from the TID tunnel discharge nearly 600 feet downstream from the intake into a concrete forebay that contains the penstock intake structure and TID's non-Project Upper Main Canal Headworks (Figure 2.4-1). At the tunnel outlet portal, the forebay invert is approximately 18 feet wide and gradually expands to 39 feet wide at the face of the Upper Main Canal Headworks. The forebay runs 118 feet along the centerline of flow and is constructed with a gradual bend to the south as it enters the TID non-Project Upper Main Canal.

The original invert of the forebay was constructed at an elevation of approximately 281.2 feet, but was excavated and rebuilt at a lower elevation of nearly 278 feet as a result of the new tunnel construction in 1980 undertaken to improve the delivery capacity to the TID Upper Main Canal.

TID currently maintains in an open position an 18-inch pipe that continuously delivers flow from the TID forebay to the channel downstream of the sluice gates. This water flows into the tailrace just upstream of the powerhouse. The flow quantity is not measured but is estimated to be approximately 5 to 10 cfs.

Located at the west side of the forebay structure, the penstock intake structure contains a trashrack structure and three 7.5-foot-wide by 14-foot-tall concrete intake bays that deliver water to the penstocks. Manually-operated steel gates are used to shut off flows through these intakes. Immediately upstream and adjacent to the penstock intakes are two automated 5-foot-high by 4-foot-wide sluice gates that discharge water over a steep rock outcrop to the tailrace channel just upstream of the powerhouse.

The TID irrigation canal headworks structure was originally constructed with five 5-foot-wide by 8-foot, 4-inch-tall outlets, which are controlled by fabricated steel gates. In 1980, a sixth gate was added as part of the rehabilitation of the forebay. The sixth gate is the same dimensions of the original five gates. All the 1980 modifications were performed to improve the control of flows as part of improvements to the TID irrigation system.

Figure 2.4-1. TID forebay and penstock intake. In the photo, flow is being discharged at the forebay sluice gates.

2.5 Powerhouse

The La Grange powerhouse is located approximately 0.2 miles downstream of LGDD on the south (left) bank of the Tuolumne River (Figure 2.5-1). The power plant is owned and operated by TID. Water diverted through the TID intake and tunnel to the forebay can enter the two penstocks that deliver flow to the powerhouse. The two-unit powerhouse was built in 1924. The powerhouse is a 72-foot by 29-foot structure with a reinforced concrete substructure and steel superstructure. The intakes for the two penstocks are located in the west (right) side of the forebay. The penstock for Unit 1 is a 235-foot-long, 5-foot-diameter steel pipe. The penstock for Unit 2 is a 212-foot-long, 7-foot-diameter steel pipe.

There have been no modifications to the powerhouse since its original construction in 1924, except for routine maintenance and repairs.

Figure 2.5-1. View looking downstream of TID's penstocks, powerhouse, tailrace, and substation.

2.6 Turbines, Generators, and Accessory Equipment

The La Grange powerhouse contains two turbine-generator units originally installed circa 1924/1925 (Bechtel Civil 1987). The turbine of the smaller unit (Unit 1) contains a Voith runner rated, at its cavitation limit, at 1,650 horsepower at 140 cfs and 115 feet of net head. The larger unit (Unit 2) also contains a Voith runner rated, at its cavitation limit, at 4,950 horsepower at 440 cfs and 115 feet of net head. The actual net head at the plant varies with flow, which affects flow capacity and unit output. The runners of the original turbine-generator units were replaced with the current Voith runners in 1989.

Historically, the flow capacity of the original 1924 units exceeded 600 cfs (Bechtel Civil 1987). The units with the Voith replacement runners have a combined capacity of about 580 cfs at the guaranteed maximum capacity (i.e., their cavitation limit). The original Unit 1 design was an unconventional configuration, even for the 1910/1920s, consisting of a single horizontal Francis turbine coupled to two 500-kilowatt (kW) generators, one on each side of the turbine (Bechtel Civil 1987). The powerhouse has a minimum hydraulic capacity of approximately 110 cfs.

This two-generator configuration was replaced with an industry-standard single-generator configuration as part of the 1989/1990 rehabilitation work. The original Unit 2 design was a conventional configuration consisting of a single vertical Francis turbine coupled to a single 3,750 kW generator (Bechtel Civil 1987). At their guaranteed maximum capacity, the combined generator output is approximately 4.6 megawatts (MW).

2.7 Substation and Transmission Line

There are no FERC-jurisdictional transmission lines associated with the La Grange Hydroelectric Project. The transmission line connecting the La Grange powerhouse to the grid originates at the 4.16/69 kilovolt transformer in the substation located on the east side of the powerhouse. This transmission line connects to both TID's Tuolumne Line No. 1 and its Hawkins Line. In the event that the Project powerhouse is decommissioned in the future, this transmission line would need to be retained to provide power needed to operate the Main Canal Headworks associated with the irrigation canal systems and the sluice gates. Therefore, under FERC's transmission line jurisdictional criteria, the transmission line currently serves as part of the existing distribution/transmission grid and, therefore, would not fall under FERC jurisdiction. A single-line diagram of the grid connection is provided in Figure 2.7-1.

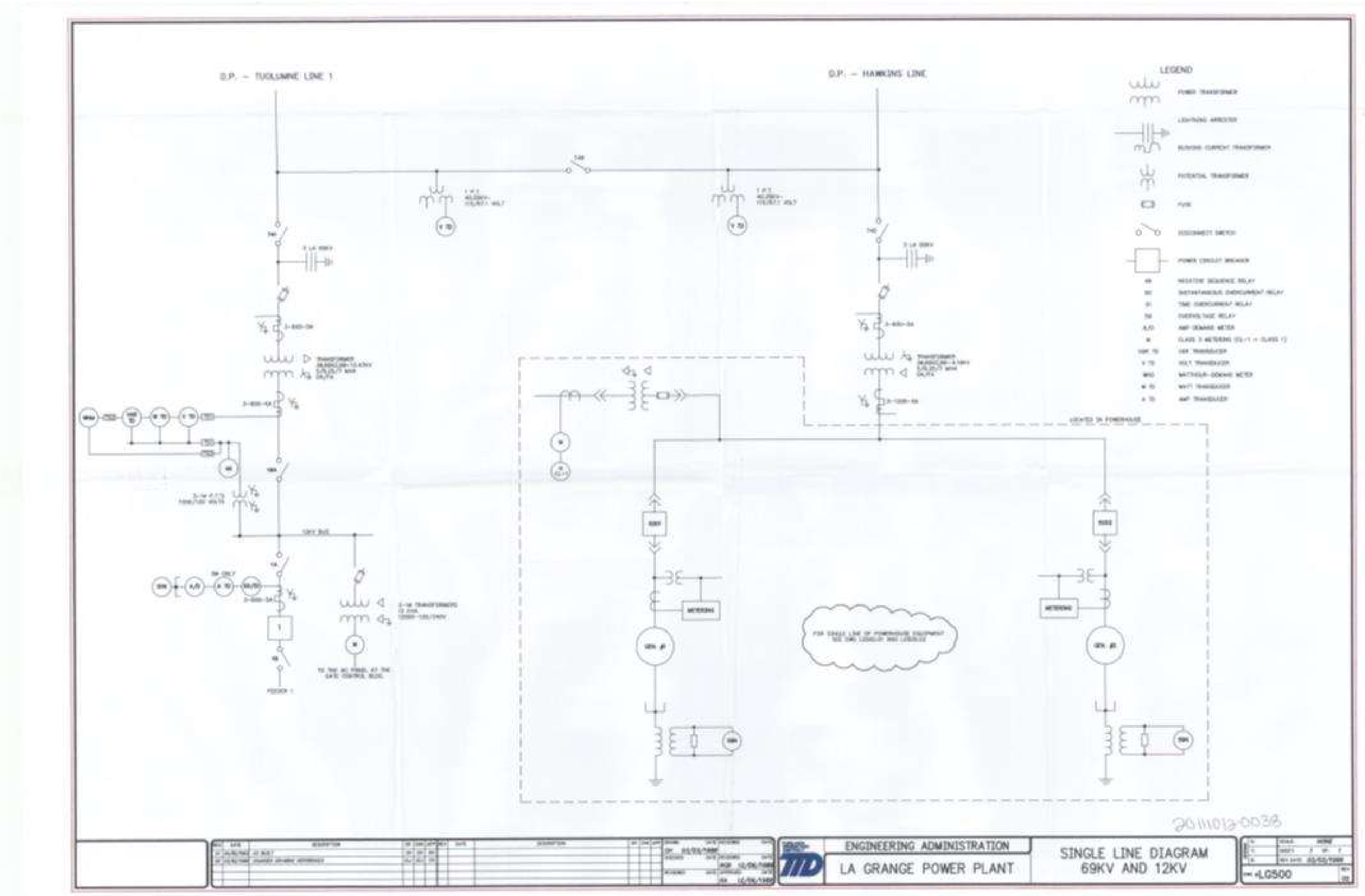

Figure 2.7-1. Single line diagram showing grid interconnection.

3.0 PROJECT OPERATIONS

3.1 Project Operations

TID's La Grange powerhouse operates in a run-of-river mode. The Districts propose to continue existing operations under the new license. The diversion dam is located at the exit of a narrow canyon and the impoundment provides little to no active storage. LGDD allows for the withdrawal of water from the Tuolumne River to the TID and MID water supply canal systems. Combined, these canals provide water for over 200,000 acres of prime Central Valley farmland and a portion of the City of Modesto's M&I supply. The powerhouse operation is monitored around-the-clock from the TID remote operations desk located at TID's central control. Although remote start-up is possible, for safety reasons, operators are generally dispatched to the Project to check conditions following a station trip and to start the unit(s). If a unit or station trip, remote operators immediately open the two sluice gates to make certain flows continue downstream without disruption. The disruption to downstream flow as measured at the nearby U.S. Geological Survey (USGS) La Grange gage was examined by the Districts at the request of the National Marine Fisheries Service (NMFS) and FERC as part of the Don Pedro Project relicensing. The results of this analysis showed that flow fluctuations were less than 2 inches 99.4 percent of the time. This study (Districts' Response to NMFS-4, Element 1 through 6) is attached to this Draft License Application (DLA).

All flows released from the Don Pedro Project are diverted by TID and/or MID, spilled over the La Grange spillway, or pass through one of the dam's outlet structures. Diverted water is delivered to the Districts' water supply delivery systems. On the MID side of the river, sluice gates can pass water to the river approximately 400 feet downstream of the dam. Normally, a flow of approximately 10 cfs is discharged from these gates to the river. On the TID side of the river, water can flow to the river through either two 5-foot-wide by 4-foot-high sluice gates located adjacent to the penstock intakes or through the La Grange powerhouse. A portal gate is also located in the spillway near the MID side of the river.

A portion of the flows that pass downstream to the Tuolumne River at LGDD are releases made at the upstream Don Pedro Project intended to meet that project's required instream flows in the lower Tuolumne River as measured at the USGS La Grange streamflow gauge. In 1996, FERC approved the Don Pedro Project Settlement Agreement (Settlement Agreement) among the Districts, resource agencies, and Conservation Groups (CG) wherein the Districts agreed, as part of Don Pedro Project operations, to provide increased flows in the lower Tuolumne River to be measured at a location downstream of LGDD. The FERC-required minimum flows are normally passed at LGDD through the TID intake and tunnel, then via the penstocks and powerhouse. Turbine discharges at the La Grange powerhouse flow into a tailrace that joins the lower Tuolumne River about 0.5 miles below LGDD. The two sluice gates in the TID forebay can also discharge flows into the tailrace. A description of flow-related operations of LGDD can be found in the Districts' January 6, 2014, Updated Study Report (USR) filing as part of the Don Pedro Project (TID/MID 2013). Estimated flows at each of the diversion dam's outlet gates can also be found in the Districts' USR for the Project (TID/MID 2017).

From 1980 to 1996, the average annual generation of the La Grange powerhouse was 15,613 megawatt hours (MWh), and ranged from a low of 514 MWh during the drought year of 1989 to a high of 38,150 MWh during the wet year of 1983 (Table 3.1-1). Subsequent to the 1996 implementation of the Settlement Agreement, between 1997 and 2012, the average annual generation at the La Grange powerhouse was 20,365 MWh, with a low of 9,384 MWh in 2009 (dry year) and a high of 35,849 MWh in 2011 (wet year). Since 1996, the capacity factor of the TID plant has been approximately 50 percent.

Table 3.1-1. La Grange powerhouse annual generation from 1980 through 2012.

Year	Annual Generation (MWh)	Year	Annual Generation (MWh)
1980	14,631	1997	9,840
1981	13,606	1998	32,923
1982	36,538	1999	25,663
1983	38,150	2000	28,827
1984	20,223	2001	14,657
1985	15,008	2002	10,051
1986	24,782	2003	14,449
1987	12,620	2004	15,406
1988	2,864	2005	30,409
1989	514	2006	34,440
1990	4,388	2007	15,622
1991	4,705	2008	10,025
1992	5,509	2009	9,384
1993	19,913	2010	23,250
1994	9,976	2011	35,849
1995	31,314	2012	15,050
1996	10,687		

3.1.1 Description of Safety Measures

There are no formal recreational facilities at or public recreation access to the La Grange headpond. Warning signs are placed in the headpond area to keep any users away from the tunnel intakes and spillway. A protective buoy system stretches across the river approximately 300 feet upstream of the spillway to prevent inadvertent access to the tunnels or spillway from potential use of the headpond. The Districts have standard safety procedures in place to protect personnel working on or near the diversion tunnels or spillway and in the powerhouse.

3.2 Project Costs

The estimated cost of the Project, estimated original capital costs, estimated annual operation and maintenance cost, the cost of proposed environmental protection measures, the estimated cost to develop the license application, and the book value of the Project will be provided in the Final License Application (FLA).

4.0 PROJECT HYDROLOGY

Monthly flow duration data are provided in Appendix A to this Exhibit A for the locations listed below. Curves are based on mean daily flows for the period of Water Year 1997 to 2012.

- Don Pedro Project releases which represent inflows to the La Grange headpond,
- Tuolumne River below La Grange Diversion Dam,
- Turlock Canal at La Grange Diversion Dam, and
- Modesto Canal at La Grange Diversion Dam.

Table 4.0-1 provides estimated mean, maximum, and minimum monthly flows from 1997 to 2012.

Table 4.0-1. Flows downstream of La Grange Diversion Dam, water deliveries to TID and MID, and total Don Pedro Project outflows, 1997-2012.

Month	Monthly mean flow (cfs)[1]																Mean monthly flow (cfs)	Highest mean monthly flow (cfs)	Lowest mean monthly flow (cfs)
	1997[2]	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
USGS 11289650 - Tuolumne River Below La Grange Diversion Dam Near La Grange, CA (cfs)																			
Jan	13,070	2,114	1,247	324	325	177	184	223	187	4,456	353	171	165	232	4,096	342	1,729	13,070***	165
Feb	8,116	6,168	4,903	2,284	1,273	172	185	220	1,823	2,373	358	173	168	225	3,176	340	1,997	8,116***	168
Mar	2,443	5,407	3,285	4,602	615	165	182	1,098	3,875	4,234	357	172	169	284	5,142	323	2,022	5,407	165
Apr	1,457	5,392	2,034	1,548	558	665	685	1,010	4,524	7,436	487	533	372	1,342	7,400	271	2,232	7,436	271
May	953	3,621	1,697	1,164	706	419	477	412	4,868	7,847	385	680	687	2,706	3,396	798	1,926	7,847	385
Jun	269	4,433	284	340	54	97	234	127	3,809	4,657	127	95	149	2,555	5,027	134	1,399	5,027	54
Jul	290	2,845	287	421	89	88	243	108	1,913	834	114	93	107	813	2,132	107	655	2,845	88
Aug	287	1,019	259	603	110	86	236	106	773	584	110	99	102	316	2,498	104	467	2,498	86
Sep	285	1,423	294	473	112	68	250	110	328	412	89	97	106	308	1,197	102	365	1,423	68
Oct	465	628	424	412	189	202	297	209	464	449	141	174	385	491	491	In WY 2013	367	628	141
Nov	380	316	338	347	184	191	231	186	369	379	174	161	255	399	366		292	399	161
Dec	330	1,321	336	334	177	187	226	178	1,285	352	169	164	256	4,152	366		904	4,625	164
USGS 11289000 - Modesto Canal Near La Grange, CA (cfs)																			
Jan	6	117	66	237	72	40	76	87	83	143	9	27	31	16	34	358	88	358	6
Feb	168	56	47	72	142	67	58	44	204	135	113	45	29	11	93	69	84	204	11
Mar	642	121	301	231	213	434	328	355	260	142	348	346	219	253	96	340	289	642	96
Apr	601	250	630	586	607	720	325	720	450	249	483	575	474	337	453	275	483	720	249
May	872	310	697	659	773	724	605	653	665	716	682	656	573	533	674	736	658	872	310
Jun	701	655	769	733	802	791	801	751	695	802	763	646	716	769	708	767	742	802	646
Jul	962	787	781	915	905	891	894	825	1,043	846	803	748	791	704	761	869	845	1,043	704
Aug	813	869	927	878	767	707	825	704	827	824	781	793	721	754	858	764	801	927	704
Sep	550	482	566	474	567	583	525	461	604	594	411	506	474	482	589	453	520	604	411
Oct	347	344	334	293	387	358	380	270	299	304	321	301	266	271	233	In WY 2013	314	387	233
Nov	78	73	195	44	36	105	172	84	141	173	162	100	112	184	169		122	195	36
Dec	26	86	72	75	72	58	13	43	126	8	9	18	2	0	0		40	126	0
USGS 11289500 - Turlock Canal Near La Grange, CA (cfs)																			
Jan	387	69	506	0	91	27	6	25	316	299	164	4	82	108	301	581	185	581	0
Feb	599	326	313	0	8	6	323	302	339	529	257	101	151	180	190	202	239	599	0
Mar	1,457	454	623	603	595	1,023	637	1,035	872	644	1,113	1,132	601	601	581	477	778	1,457	454
Apr	1,222	699	1,304	1,135	1,110	1,249	771	1,272	1,184	529	1,082	866	1,013	712	1,070	623	990	1,304	529
May	1,710	800	1,321	1,246	1,455	1,121	1,073	1,336	1,256	1,339	1,166	1,136	1,021	1,171	1,145	1,248	1,222	1,710	800
Jun	1,445	1,243	1,525	1,725	1,664	1,483	1,639	1,552	1,504	1,624	1,599	1,310	1,525	1,569	1,398	1,425	1,514	1,725	1,243

Month	Monthly mean flow (cfs)[1]																Mean monthly flow (cfs)	Highest mean monthly flow (cfs)	Lowest mean monthly flow (cfs)
	1997[2]	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
Jul	2,081	1,817	1,938	1,898	1,805	1,817	1,883	1,840	1,917	2,000	1,816	1,572	1,899	1,846	1,845	1,788	1,860	2,081	1,572
Aug	1,587	1,681	1,796	1,784	1,526	1,489	1,516	1,510	1,706	1,674	1,494	1,314	1,482	1,656	1,718	1,510	1,597	1,796	1,314
Sep	812	977	952	1,063	825	736	714	617	991	936	631	571	793	1,097	1,069	953	847	1,097	571
Oct	505	613	566	527	445	358	742	577	259	379	305	129	180	430	533	In WY 2013	442	742	129
Nov	30	0	59	24	4	22	1	1	3	8	35	2	27	279	95		37	279	0
Dec	109	0	301	173	12	94	36	12	27	1	45	149	20	600	29		102	600	0
USGS 11289651 - Combined Flow Tuolumne River + Modesto Canal + Turlock Canal (~ total Don Pedro Project outflow)[3] (cfs)																			
Jan	13,630	2,301	1,818	561	489	244	266	335	585	4,897	525	203	278	355	4,430	1,282	2,012	13,630	203
Feb	8,885	6,551	5,262	2,355	1,424	245	565	566	2,365	3,038	728	320	348	415	3,458	611	2,321	8,885	245
Mar	4,544	5,983	4,210	5,435	1,423	1,622	1,146	2,487	5,005	5,020	1,818	1,651	989	1,139	5,818	1,142	3,090	5,983	989
Apr	3,280	6,341	3,968	3,269	2,276	2,634	1,781	3,001	6,158	8,211	2,052	1,973	1,860	2,392	8,922	1,168	3,705	8,922	1,168
May	3,535	4,732	3,714	3,067	2,935	2,263	2,155	2,402	6,790	9,902	2,234	2,472	2,280	4,408	5,216	2,783	3,806	9,902	2,155
Jun	2,415	6,332	2,579	2,796	2,519	2,371	2,672	2,430	6,009	7,083	2,488	2,049	2,391	4,894	7,134	2,328	3,656	7,134	2,049
Jul	3,333	5,448	3,006	3,234	2,798	2,795	3,021	2,772	4,872	3,678	2,732	2,414	2,798	3,363	4,738	2,766	3,361	5,448	2,414
Aug	2,687	3,569	2,982	3,264	2,403	2,281	2,578	2,319	3,305	3,082	2,385	2,205	2,304	2,725	5,074	2,377	2,846	5,074	2,205
Sep	1,647	2,882	1,812	2,009	1,504	1,386	1,489	1,188	1,922	1,942	1,130	1,175	1,371	1,888	2,855	1,509	1,732	2,882	1,130
Oct	1,318	1,584	1,324	1,231	1,021	917	1,419	1,055	1,021	1,133	766	604	832	1,193	1,258	In WY 2013	1,141	1,587	604
Nov	489	389	592	415	224	318	404	270	513	559	371	263	394	862	630		443	862	224
Dec	466	1,407	709	582	261	339	275	233	1,437	361	223	330	277	4,752	394		1,043	4,752	223

[1] Values Calculated using USGS NWIS monthly statistics module: http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289650&agency_cd=USGS, http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289000&agency_cd=USGS, http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289500&agency_cd=USGS, and http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289651&agency_cd=USGS

[2] The flood of record occurred in January, 1997, with high reservoir releases continuing on into February, 1997. These values skew the January and February mean monthly flow averages for the 1997 to 2012 period. Without 1997 values, the mean monthly flow in January is 973 cfs and February is 1,589, compared to 1,729 and 1,997 cfs, respectively.

[3] Some values rounded by USGS - sum of individual gage monthly mean flows might not precisely equal combined gage monthly mean flows.

5.0 REFERENCES

Bechtel Civil. 1987. La Grange power plant rehabilitation proposal evaluation for turbine/generator equipment and auxiliaries including associated civil/structural work. Prepared for Turlock Irrigation District by Bechtel Civil, Inc. March 1997.

Modesto Irrigation District (MID). 2010. Irrigation district statistics and history. Modesto Irrigation District. [Online] URL: http://www.mid.org. (Accessed July 2010.)

Turlock Irrigation District (TID). 2010. Irrigation district statistics and history. Turlock Irrigation District. [Online] URL: http://www.tid.org. (Accessed August 2010.)

_______. 2011. La Grange Reservoir Backwater Analysis. Prepared by HDR, Inc. October 2011.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2013. Project Operations/Water Balance Model Study Report (W&AR-02). Attachment to Don Pedro Hydroelectric Project Updated Study Report. December 2013.

_______. 2017. Flow Records for Five Discharge Structures at the La Grange Project Technical Memorandum. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

EXHIBIT A – PROJECT DESCRIPTION

APPENDIX A-1
FLOW DURATION CURVES

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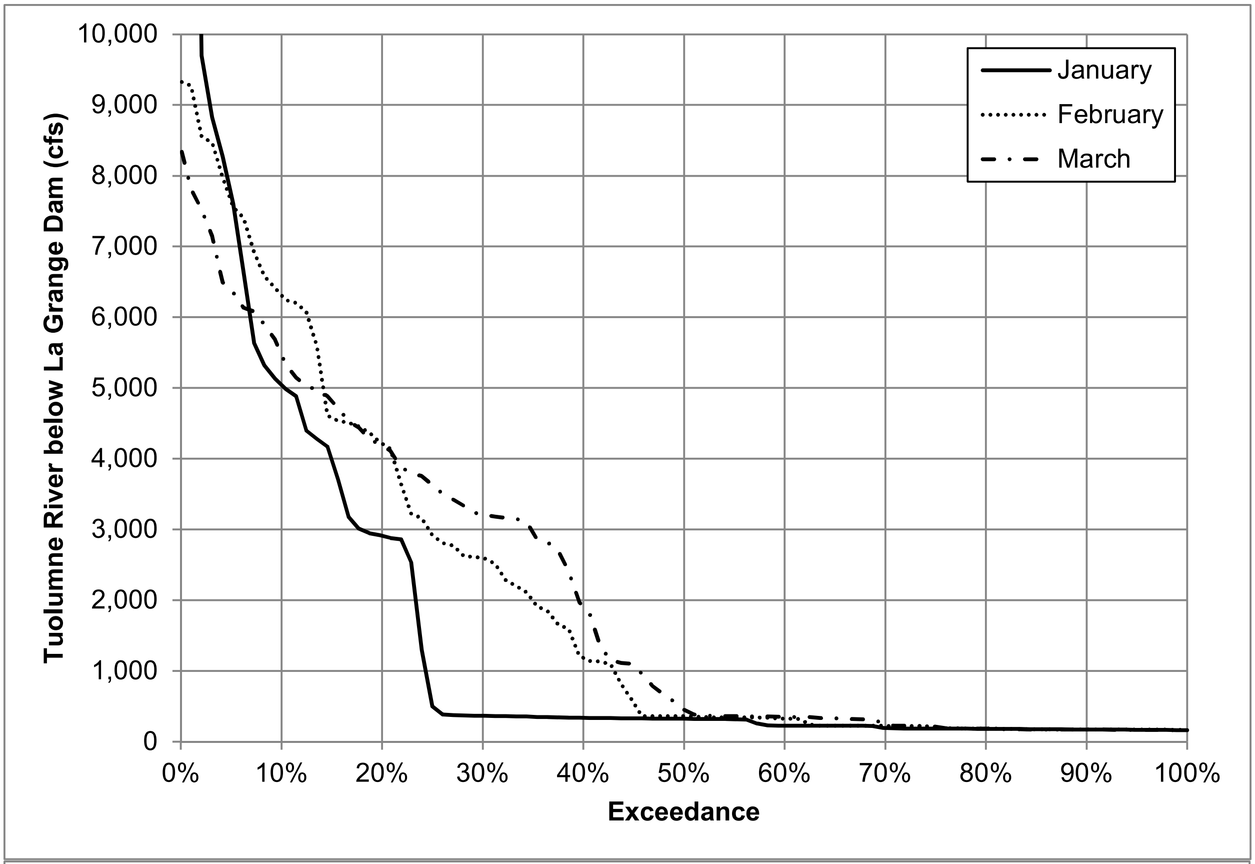
Monthly flow duration data are provided herein for the following locations:

- Tuolumne River below La Grange Diversion Dam
- Turlock Canal at La Grange Diversion Dam
- Modesto Canal at La Grange Diversion Dam
- Don Pedro Project releases

Curves are based on mean daily flows for the period: Water Year 1997 to 2012.


10,000
9,000
8,000
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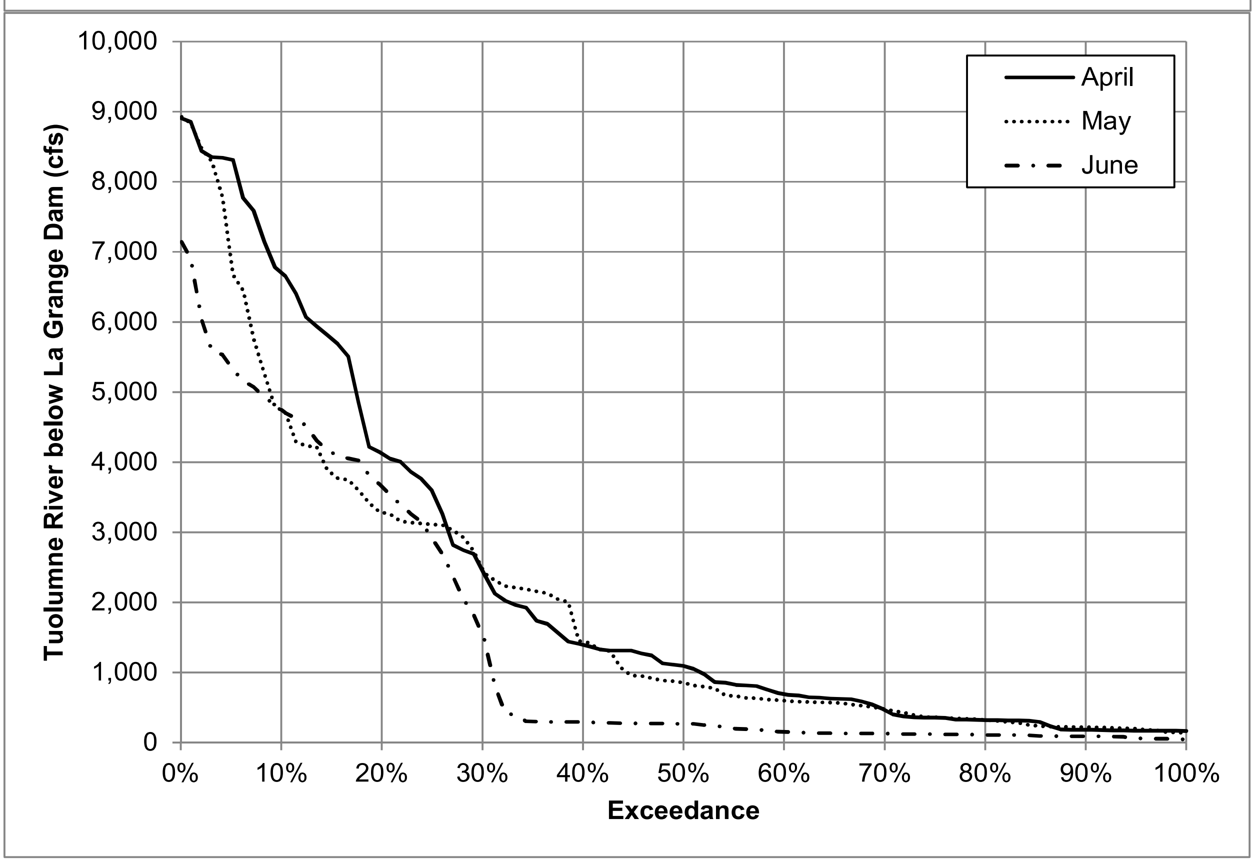
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Tuolumne River below La Grange Dam (cfs)
Exceedance
January
February
March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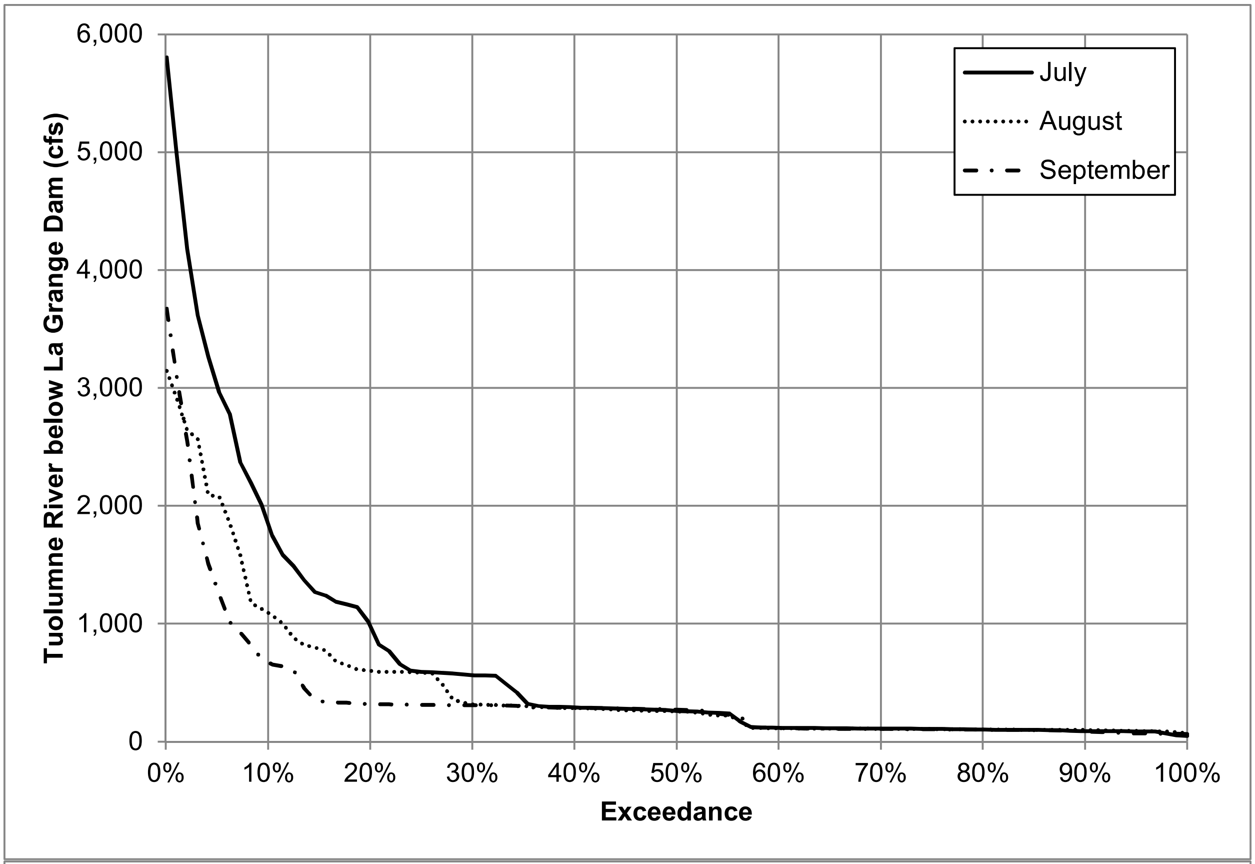
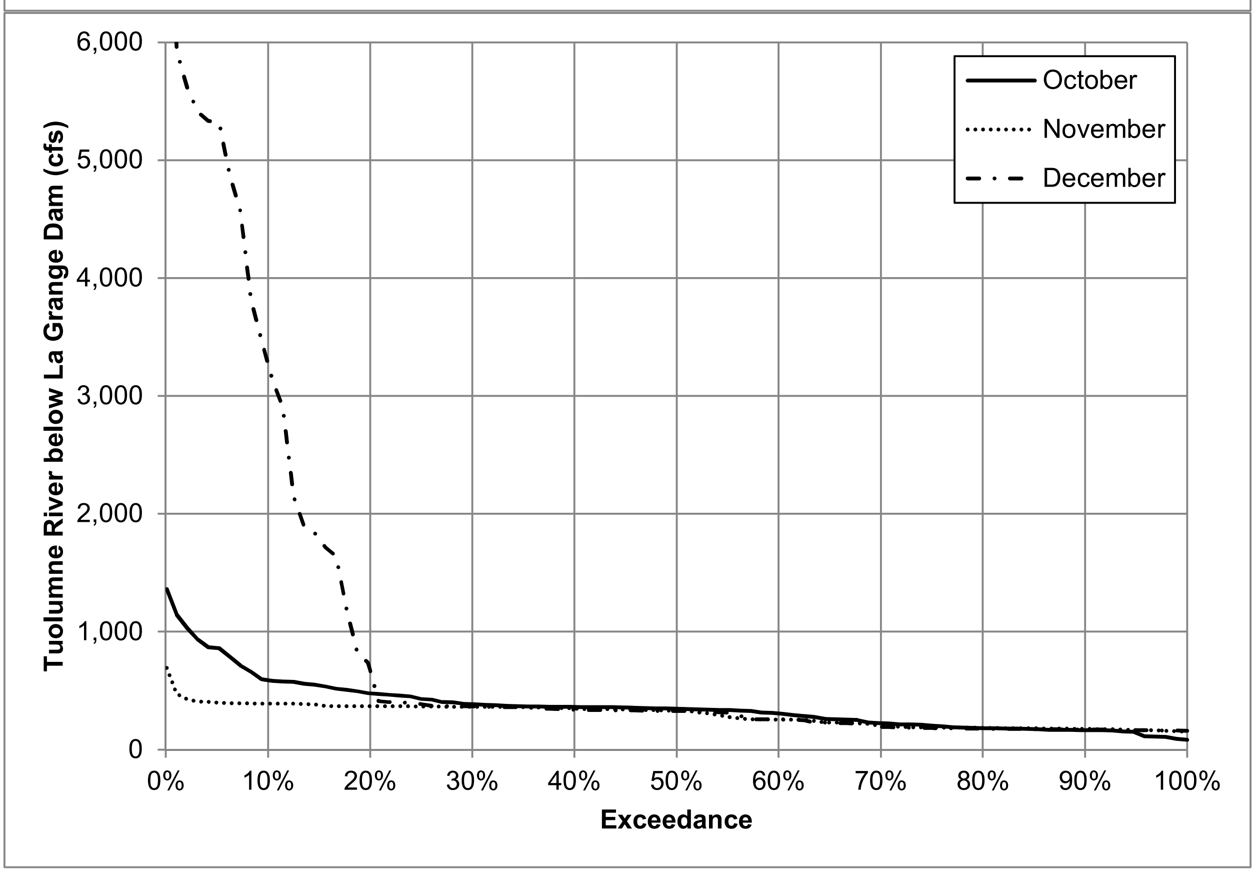
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Tuolumne River below La Grange Dam (cfs)
Exceedance
April
May
June



Tuolumne River below La Grange Dam (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance
July
August
September



Tuolumne River below La Grange Dam (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
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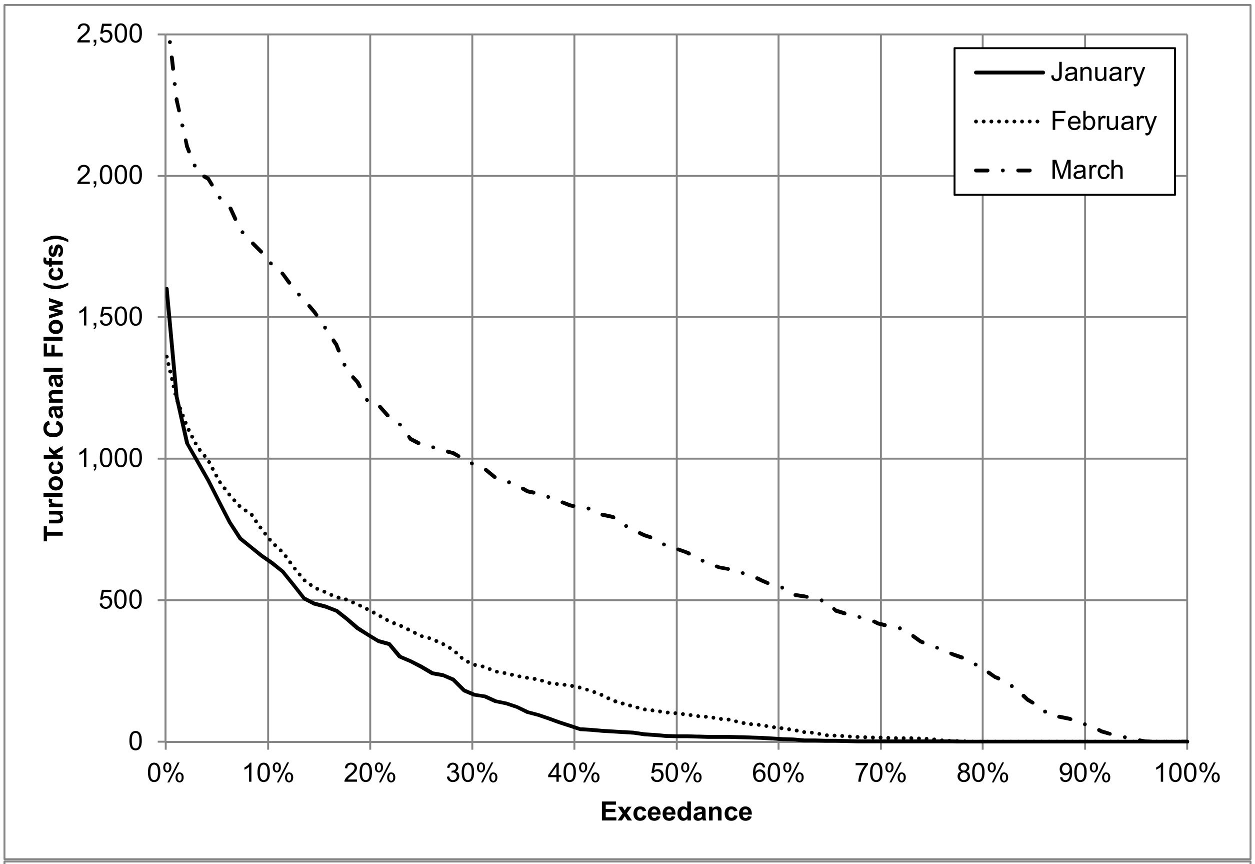
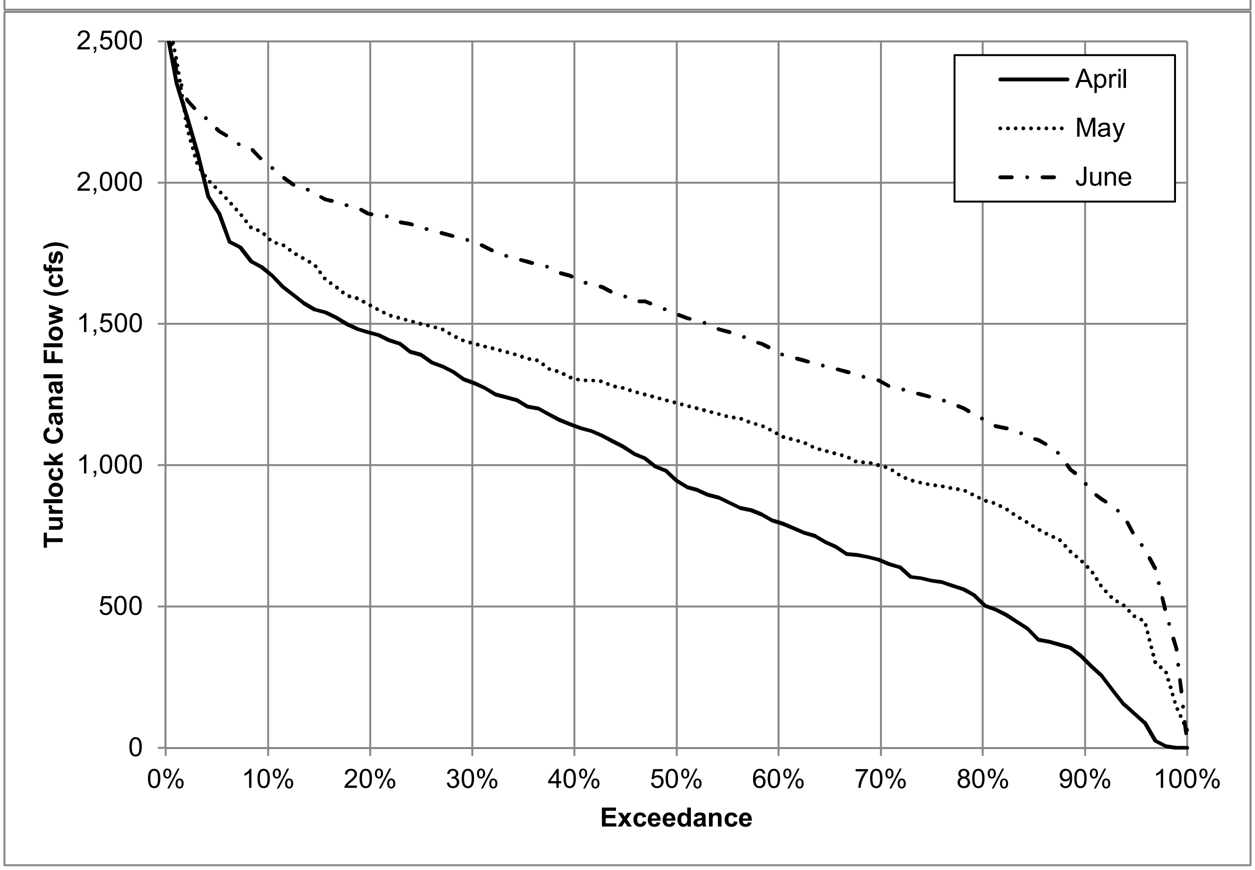
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance
October
November
December



2,500
2,000
1,500
1,000
500
0
Turlock Canal Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance
January
February
March



2,500
2,000
1,500
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500
0
Turlock Canal Flow (cfs)
0%
10%
20%
30%
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60%
70%
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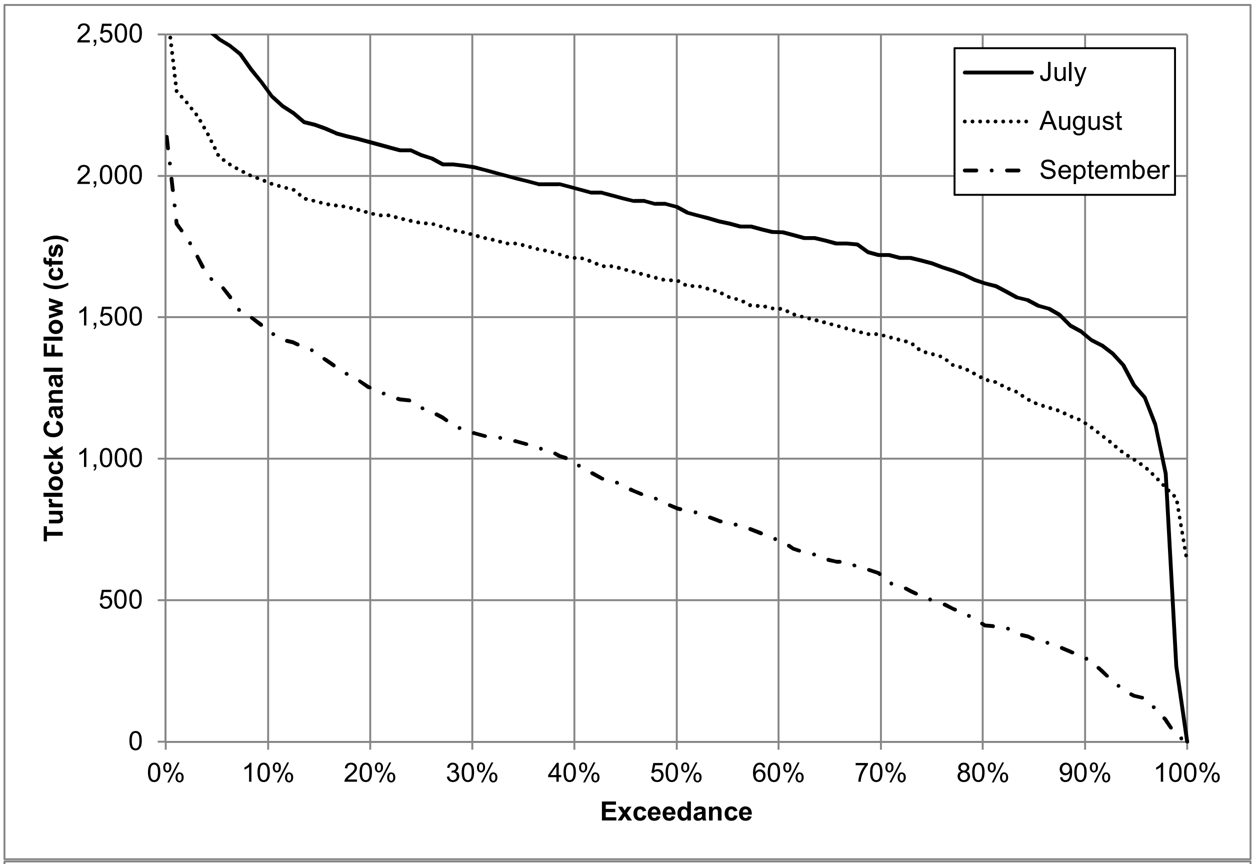
90%
100%
Exceedance
April
May
June


Turlock Canal Flow (cfs)
Exceedance
July
August
September
2,500
2,000
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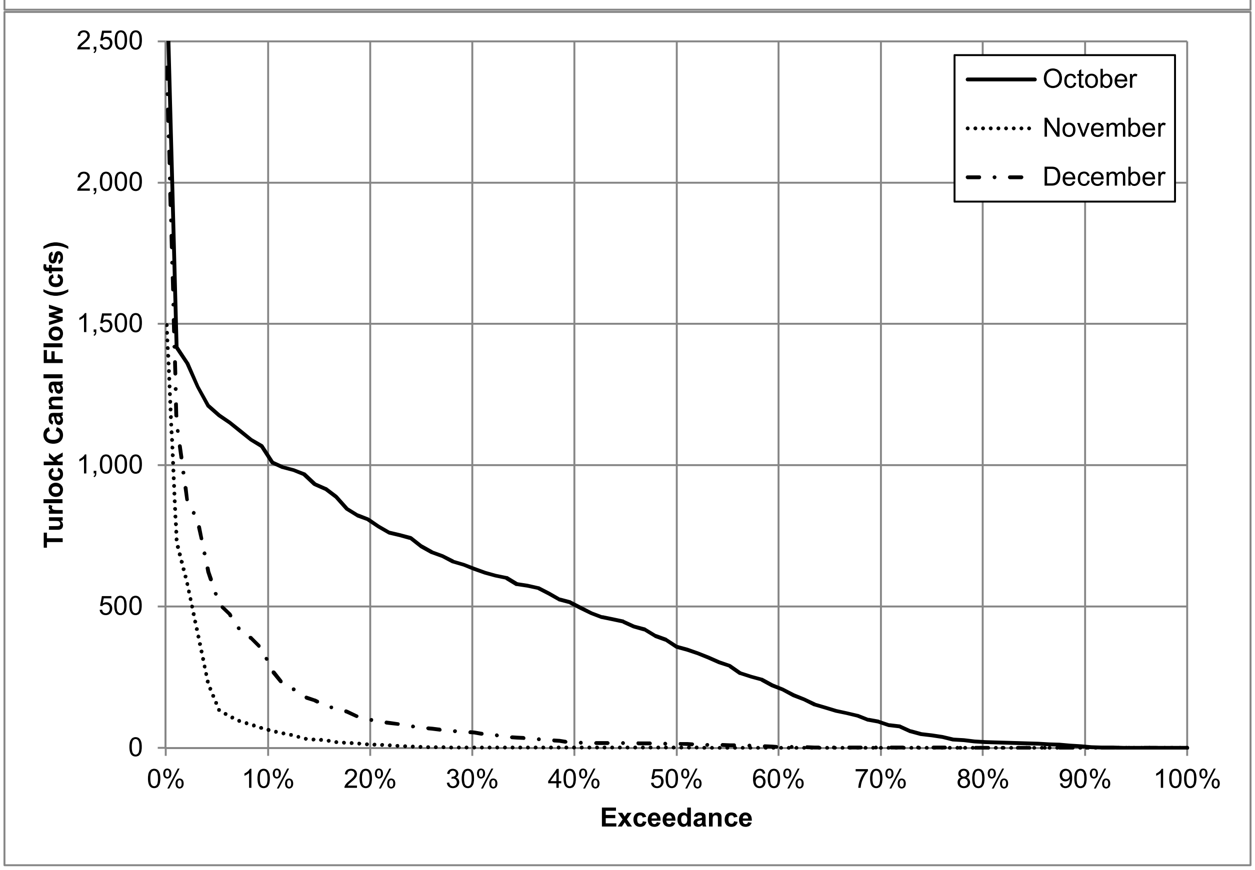
Turlock Canal Flow (cfs)
Exceedance
October
November
December
2,500
2,000
1,500
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20%
30%
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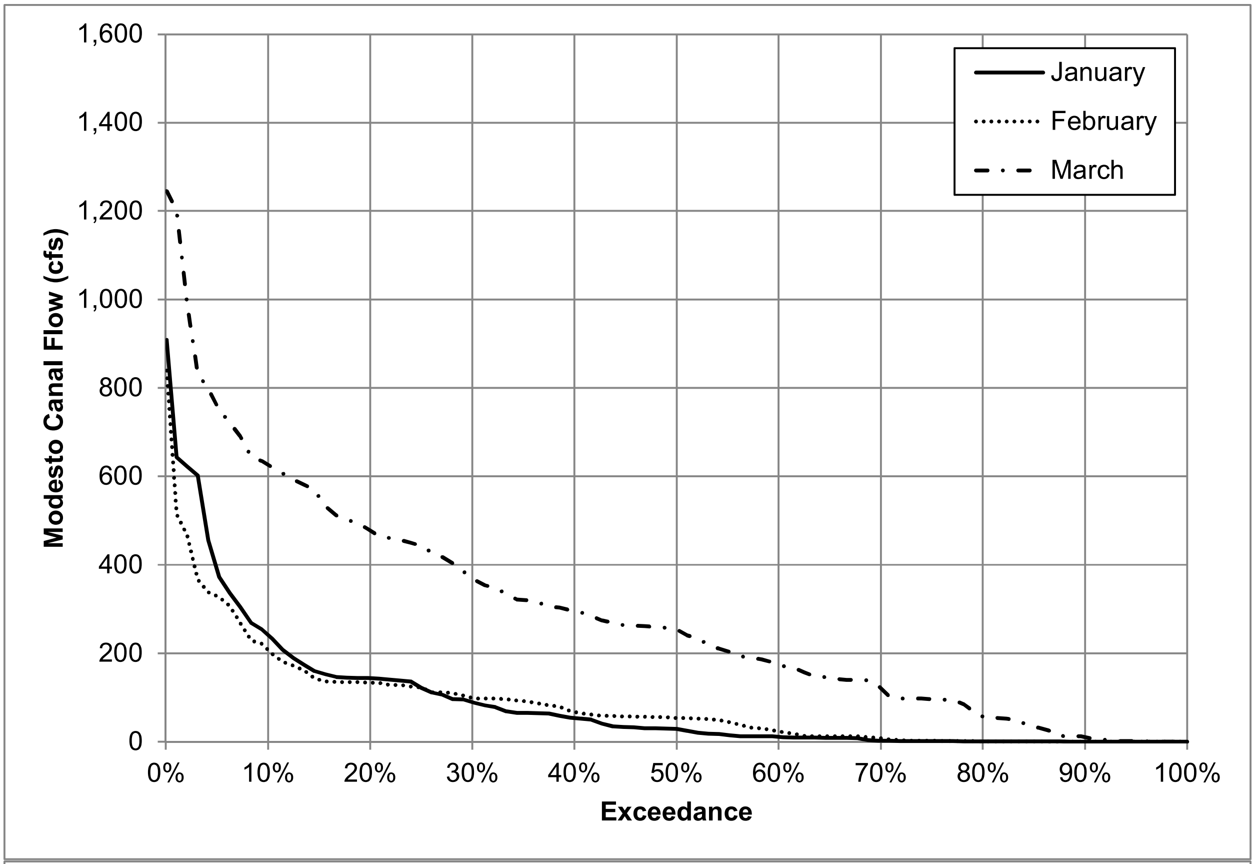
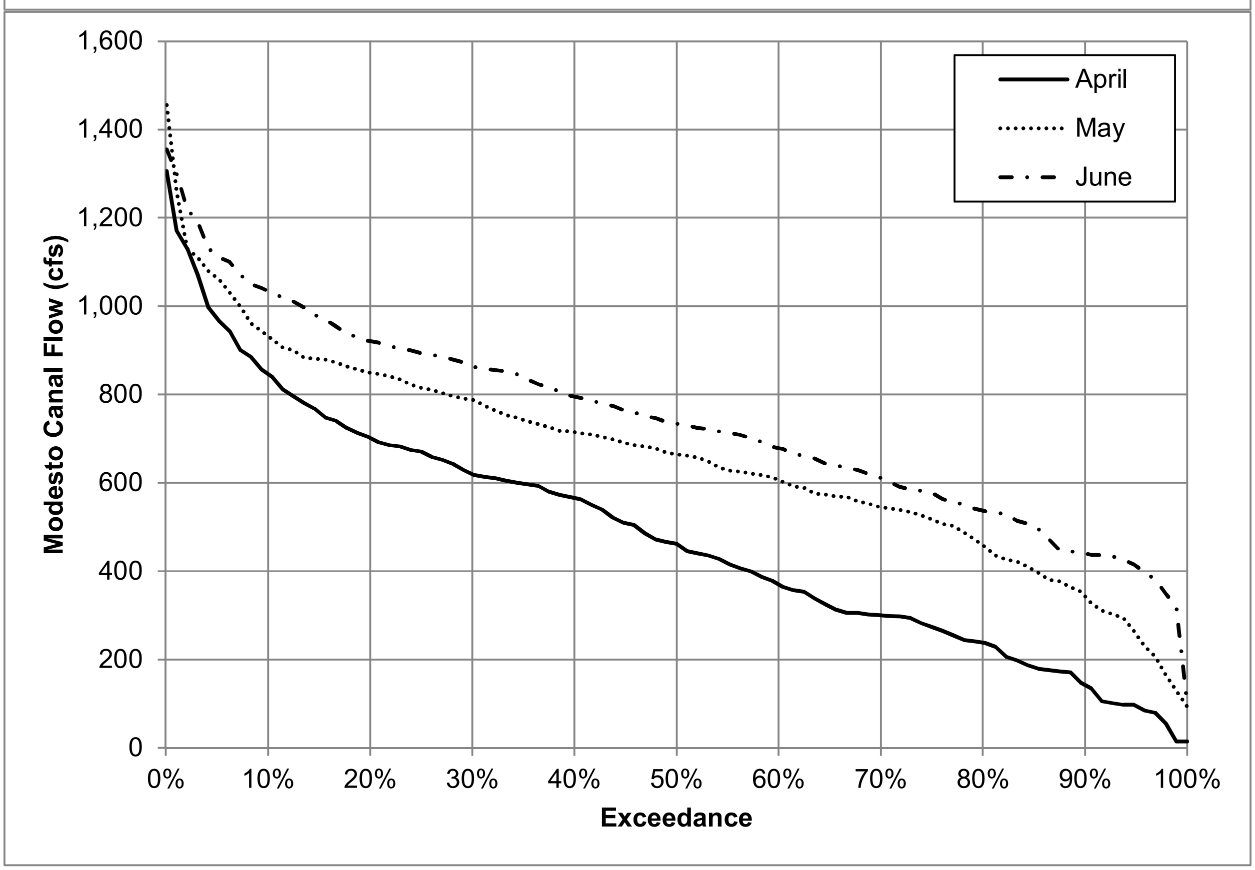


1,600
1,400
1,200
1,000
800
600
400
200
0
Modesto Canal Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance
January
February
March



1,600
1,400
1,200
1,000
800
600
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0
Modesto Canal Flow (cfs)
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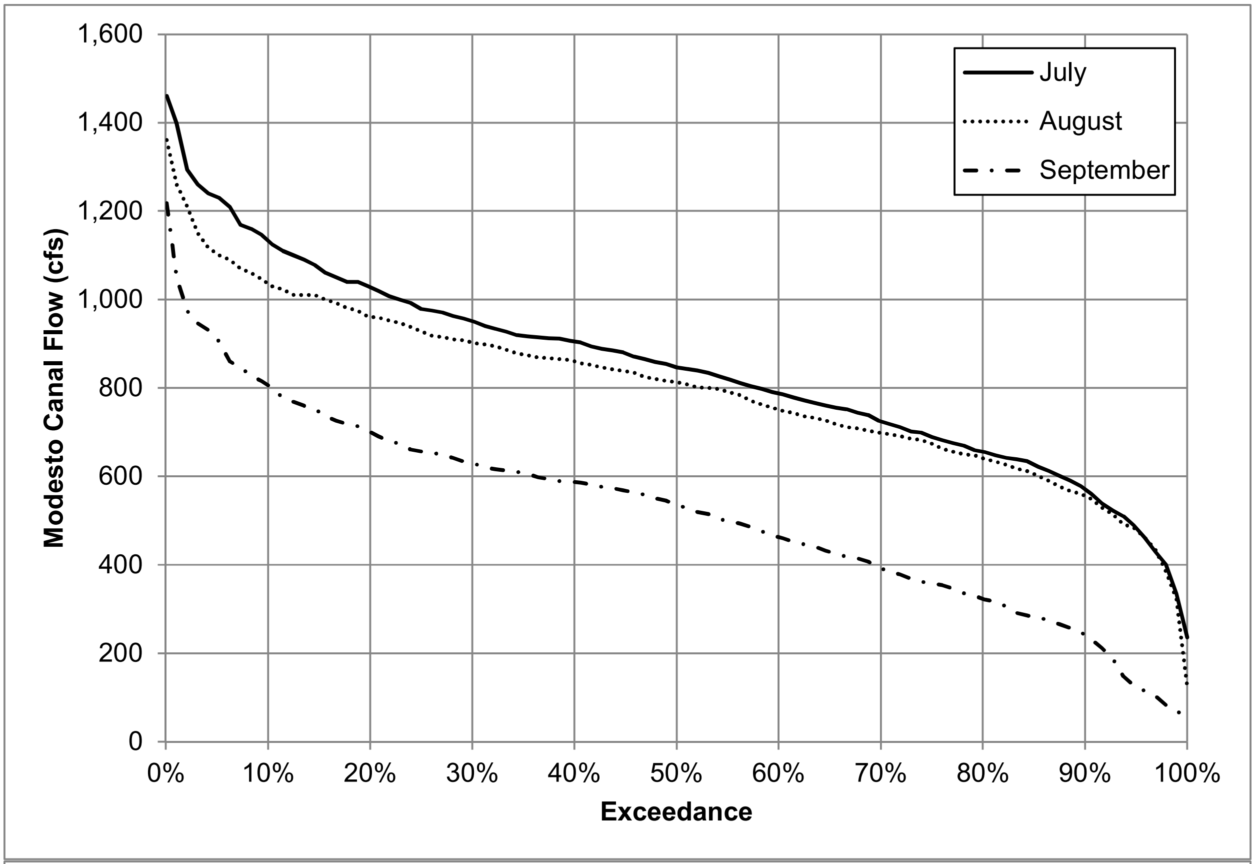
80%
90%
100%
Exceedance
April
May
June


July
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September
Modesto Canal Flow (cfs)
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1,200
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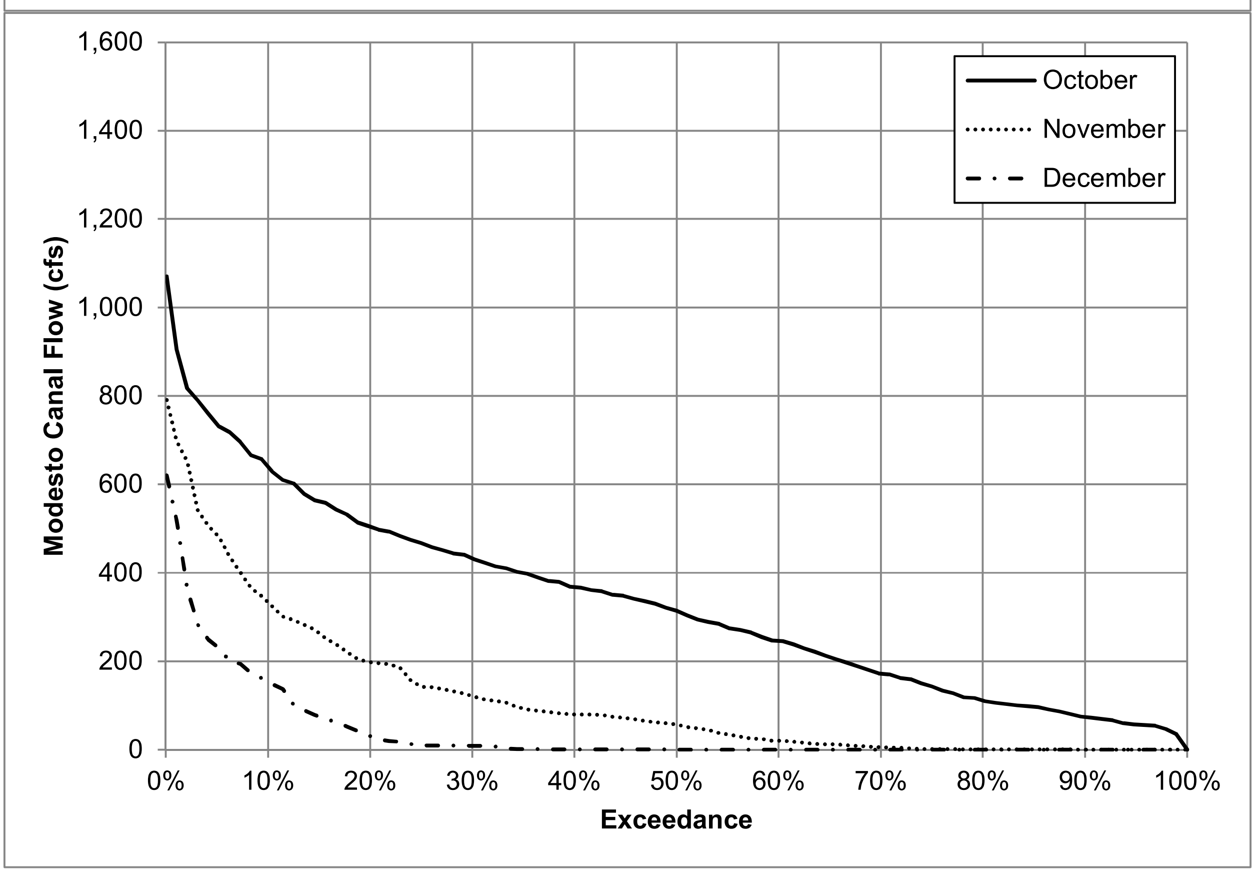
Exceedance


October
November
December
Modesto Canal Flow (cfs)
1,600
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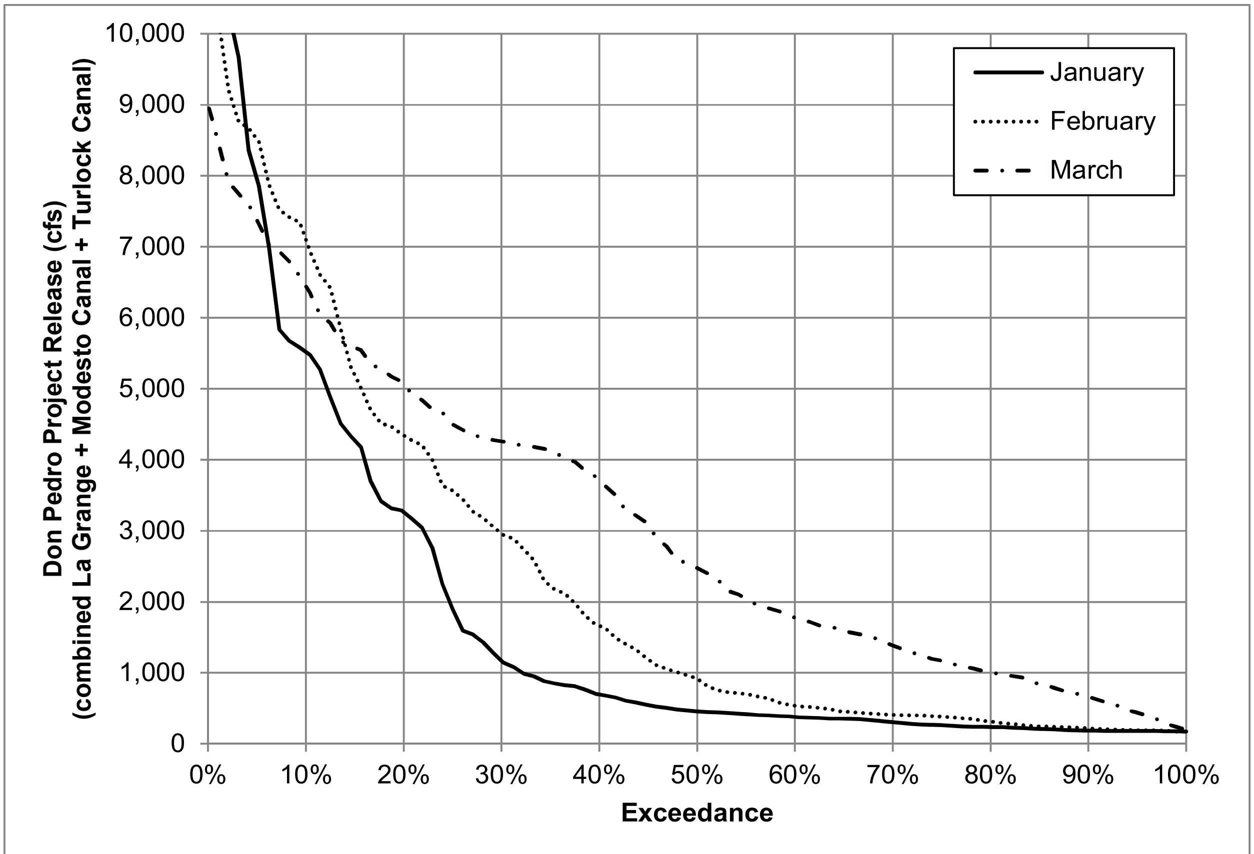
100%
Exceedance


January
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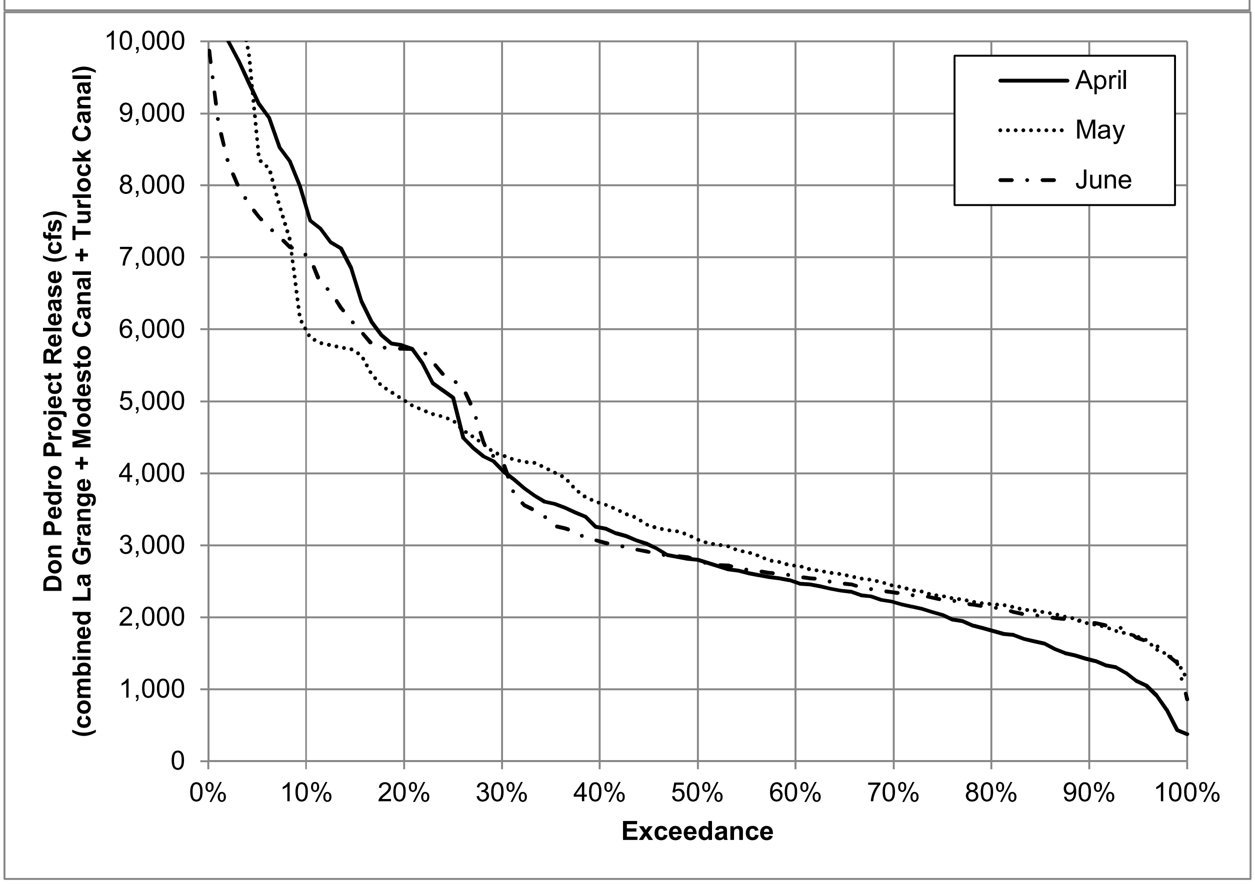
Exceedance
Don Pedro Project Release (cfs)
(combined La Grange + Modesto Canal + Turlock Canal)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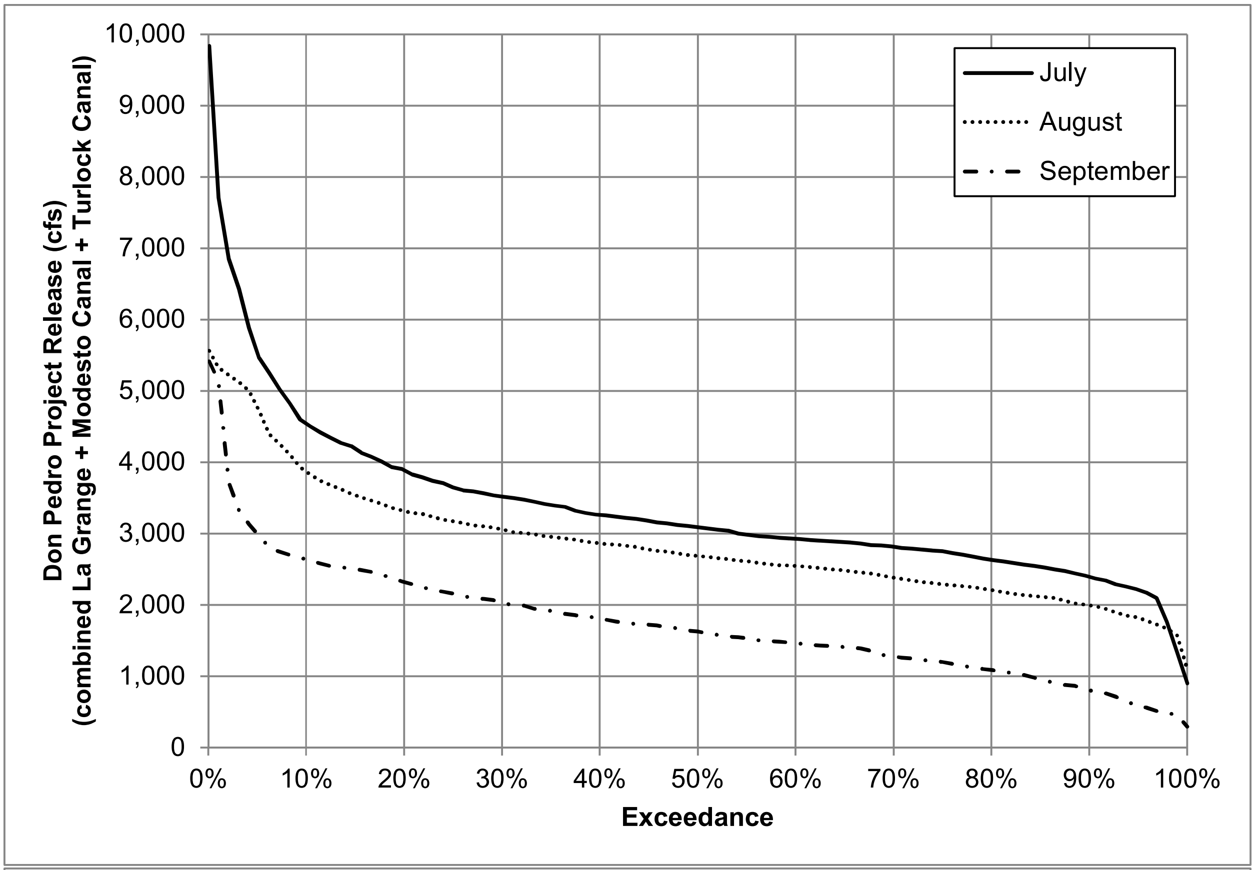
Exceedance
Don Pedro Project Release (cfs)
(combined La Grange + Modesto Canal + Turlock Canal)


Don Pedro Project Release (cfs)
(combined La Grange + Modesto Canal + Turlock Canal)
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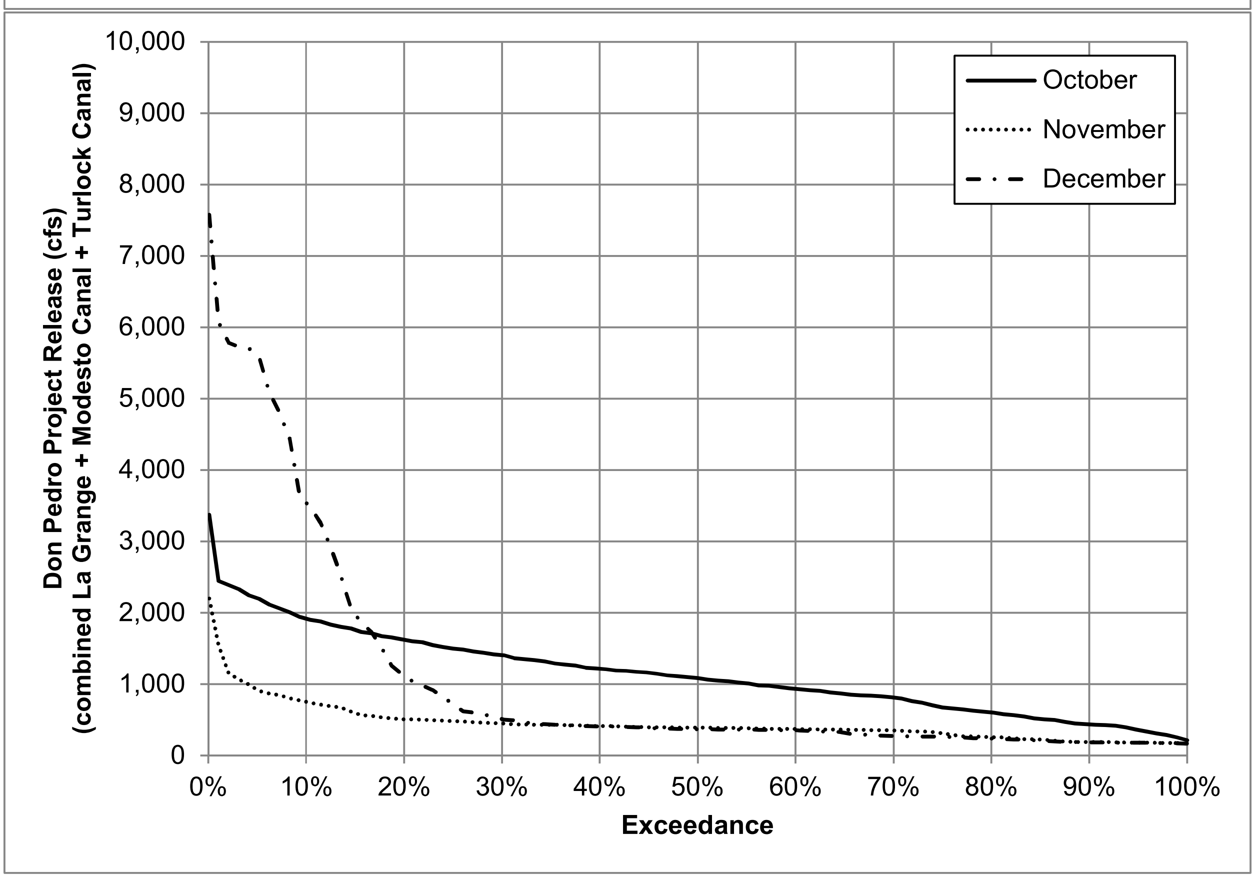
Exceedance
July
August
September


Don Pedro Project Release (cfs)
(combined La Grange + Modesto Canal + Turlock Canal)
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Exceedance
October
November
December

LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

EXHIBIT E – ENVIRONMENTAL REPORT

TID WATER & POWER
Serving Central California since 1887

MID Modesto Irrigation District
The Power to Grow

Prepared by:
Turlock Irrigation District
P.O. Box 949
Turlock, CA 95381

And

Modesto Irrigation District
P.O. Box 4060
Modesto, CA 95352

April 2017

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Section No.	Description	Page No.

List of Figures

List of Tables

List of Acronyms and Abbreviations

ACOE.........................Army Corps of Engineers
ac-ft ....acre-feet
APE ....area of potential effect
BLM ....Bureau of Land Management
CCSF..........................City and County of San Francisco
CDFA ....California Department of Food and Agriculture
CDFG ....California Department of Fish and Game, now CDFW
CDFW ....California Department of Fish and Wildlife
CDWR........................California Department of Water Resources
CESA ....California Endangered Species Act
cfs ....cubic feet per second
CNDDB......................California Natural Diversity Database
CNPS..........................California Native Plant Society
CVRWQCB ....Central Valley Regional Water Quality Control Board
Districts ....Turlock Irrigation District and Modesto Irrigation District
DLA ....Draft License Application
DO ....dissolved oxygen
DPRA ....Don Pedro Recreation Agency
EFH ....Essential Fish Habitat
ESA ....Endangered Species Act
FERC..........................Federal Energy Regulatory Commission
FFS ....Foothills Fault System
FLA ....Final License Application
FPA ....Federal Power Act
Framework ....Upper Tuolumne River Reintroduction/Fish Passage Assessment Framework process
GIS ....geographic information system
IFIM ....instream flow incremental methodology
ILP.............................Integrated Licensing Process
ISR ....Initial Study Report
LGDD ....La Grange Diversion Dam
LWD ....large woody debris
km ....kilometer
M&I...........................municipal and industrial
mg/L ....milligram/liter
MID ....Modesto Irrigation District
ml ....milliliter
mm ....millimeter
MW ....megawatt
MWh ....megawatt-hours
mya............................million years ago
NGO ....non-governmental organization
NEPA ....National Environmental Policy Act
NMFS.........................National Marine Fisheries Service

NRHP ....National Register of Historic Places
NTU ....nephelometric turbidity unit
NWI...........................National Wetland Inventory
NWIS ....National Water Information System
O&M ....operation and maintenance
PAD...........................Pre-Application Document
PM&E ....protection, mitigation, and enhancement
POAOR ....Public Opinions and Attitudes in Outdoor Recreation
Project ....La Grange Hydroelectric Project
PSP............................Proposed Study Plan
RM ....river mile
RSP ....Revised Study Plan
RTE ....rare, threatened, and endangered
SCORP.......................State Comprehensive Outdoor Recreation Plan
SD1 ....Scoping Document 1
SD2 ....Scoping Document 2
SFPUC ....San Francisco Public Utilities Commission
SHPO ....State Historic Preservation Officer
SRA...........................State Recreation Area
SSJNWA....................Sierra-San Joaquin Noxious Weeds Alliance
SPD ....Study Plan Determination
TCP ....traditional cultural properties
TID............................Turlock Irrigation District
TLP ....Traditional Licensing Process
TM.............................technical memorandum
USDA.........................United States Department of Agriculture
USFS ....United States Forest Service
USFWS ....United States Fish and Wildlife Service
USGS ....United States Geological Survey
USR...........................Updated Study Report
WSNMB ....Western Sierra Nevada Metamorphic Belt
WUA..........................weighted usable area
WY............................water year
YOY ....young-of-year

EXHIBIT E – ENVIRONMENTAL REPORT

EXCERPT FROM CODE OF FEDERAL REGULATIONS (CFR) DESCRIBING CONTENTS OF THE EXHIBIT (18 CFR §4.61)

(d) Exhibit E is an Environmental Report.
(2) For minor projects and major projects at existing dams 5 MW or less. An application for license for either a minor water power project with a total proposed installed generating capacity of 1.5 MW or less or a major project—existing dam with a proposed total installed capacity of 5 MW or less must contain an Exhibit E under this subparagraph. See §4.38 for consultation requirements. The Environmental Report must contain the following information:
(i) A description, including any maps or photographs which the applicant considers appropriate, of the environmental setting of the project, including vegetative cover, fish and wildlife resources, water quality and quantity, land and water uses, recreational uses, historical and archeological resources, and scenic and aesthetic resources. The report must include a discussion of endangered or threatened plant and animal species, any critical habitats, and any sites included in, or eligible for inclusion in, the National Register of Historic Places. The applicant may obtain assistance in the preparation of this information from state natural resources agencies, the state historic preservation officer, and from local offices of Federal natural resources agencies.
(ii) A description of the expected environmental impacts from proposed construction or development and the proposed operation of the power project, including any impacts from any proposed changes in the capacity and mode of operation of the project if it is already generating electric power, and an explanation of the specific measures proposed by the applicant, the agencies, and others to protect and enhance environmental resources and values and to mitigate adverse impacts of the project on such resources. The applicant must explain its reasons for not undertaking any measures proposed by any agency consulted.
(iii) A description of the steps taken by the applicant in consulting with Federal, state, and local agencies with expertise in environmental matters during the preparation of this exhibit prior to filing the application for license with the Commission. In this report, the applicant must:
(A) Indicate which agencies were consulted during the preparation of the environmental report and provide copies of letters or other documentation showing that the applicant consulted or attempted to consult with each of the relevant agencies (specifying each agency) before filing the application, including any terms or conditions of license that those agencies have determined are appropriate to prevent loss of, or damage to, natural resources; and
(B) List those agencies that were provided copies of the application as filed with the Commission, the date or dates provided, and copies of any letters that may be received from agencies commenting on the application.

PREFACE

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) are filing this draft application for license with the Federal Energy Regulatory Commission (Commission or FERC) for the existing La Grange Hydroelectric Project (Project) located on the Tuolumne River in the Central Valley of California. This Exhibit E, the Environmental Report of the Draft License Application (DLA), is prepared in accordance with 18 CFR §4.61. Exhibit E is supported by data and analysis from a number of studies conducted by the Districts in support of the Project licensing process, as well as resource studies submitted by the Districts as part of the upstream Don Pedro Hydroelectric Project (Don Pedro Project, FERC No. 2299) relicensing process and referenced herein. Numerous other studies of the resources of the Tuolumne River conducted by the Districts prior to the relicensing of the Don Pedro Project are also relevant to the La Grange licensing process.

Exhibit E provides an environmental analysis by resource area. For each resource area, the existing environment is described. The Districts have developed the information on environmental resources contained in this license application in consultation with state and federal fish and wildlife agencies, local governments, Tribes, non-governmental organizations (NGO), and members of the public. The Districts are continuing to undertake studies of resources and potential resource impacts as a result of the Proposed Action, and will present their findings in the Final License Application (FLA).

1.0 INTRODUCTION

The Districts jointly own the La Grange Diversion Dam (LGDD) located on the Tuolumne River in Stanislaus County, California (Figures 1.0-1 and 1.0-2). LGDD is 131 feet (ft) high and is located at river mile (RM) 52.2 at the exit of a narrow canyon, the walls of which contain the headpond formed by the diversion dam. Under normal river flows, the headpond formed by the diversion dam extends for approximately 1 mile upstream. When not in spill mode, the water level upstream of the diversion dam is between elevation 294 ft and 296 ft approximately 90 percent of the time. Within this 2-foot range, the headpond storage is estimated to be less than 100 acre-feet (ac-ft) of water.

The drainage area of the Tuolumne River upstream of LGDD is approximately 1,550 square miles. Tuolumne River flows upstream of LGDD are regulated by four upstream reservoirs: Hetch Hetchy, Lake Eleanor, Cherry Lake (also known as Lake Lloyd), and Don Pedro. The Don Pedro Hydroelectric Project (Federal Energy Regulatory Commission [FERC] No. 2299) is owned jointly by the Districts, and the other three dams are owned by City and County of San Francisco (CCSF) and operated by the San Francisco Public Utilities Commission (SFPUC). Inflow to the La Grange headpond is the sum of releases from the Don Pedro Project, located 2.3 miles upstream, and very minor contributions from two small intermittent streams downstream of Don Pedro Dam.

LGDD was constructed from 1891 to 1893 displacing Wheaton Dam, which was built by other parties in the early 1870s. LGDD raised the level of the Tuolumne River to permit the diversion and delivery of water by gravity to irrigation systems owned by TID and MID. The Districts' irrigation systems currently provide water to over 200,000 acres of prime Central Valley farmland and drinking water to the City of Modesto. Built in 1924, the La Grange hydroelectric plant is located approximately 0.2 miles downstream of LGDD on the east (left) bank of the Tuolumne River and is owned and operated by TID. The powerhouse has a capacity of slightly less than 5 megawatts (MW). The La Grange Hydroelectric Project operates in run-of-river mode. The LGDD provides no flood control benefits, and there are no recreation facilities associated with the Project or the La Grange headpond.

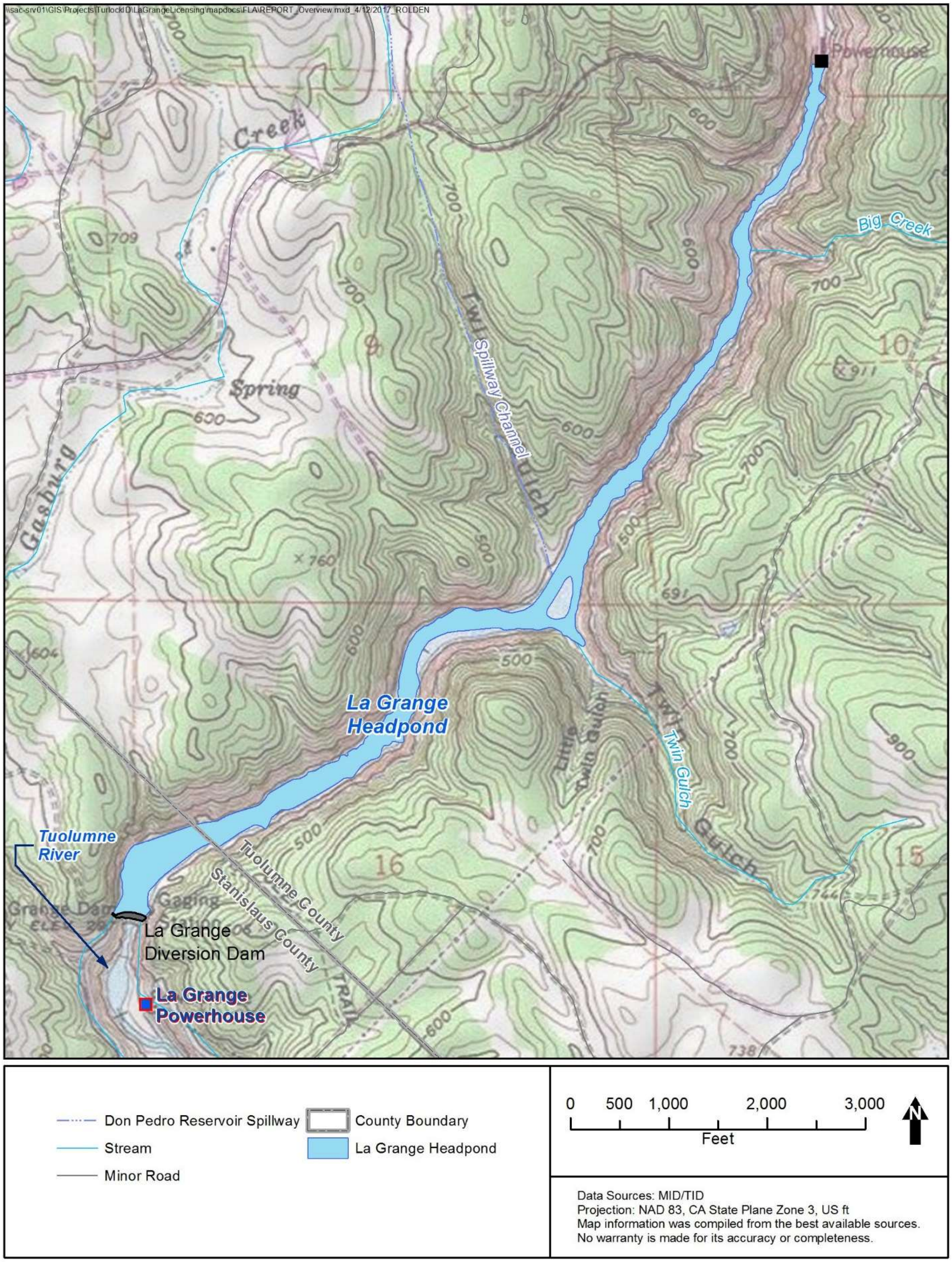

Figure 1.1-1. La Grange Hydroelectric Project location map.

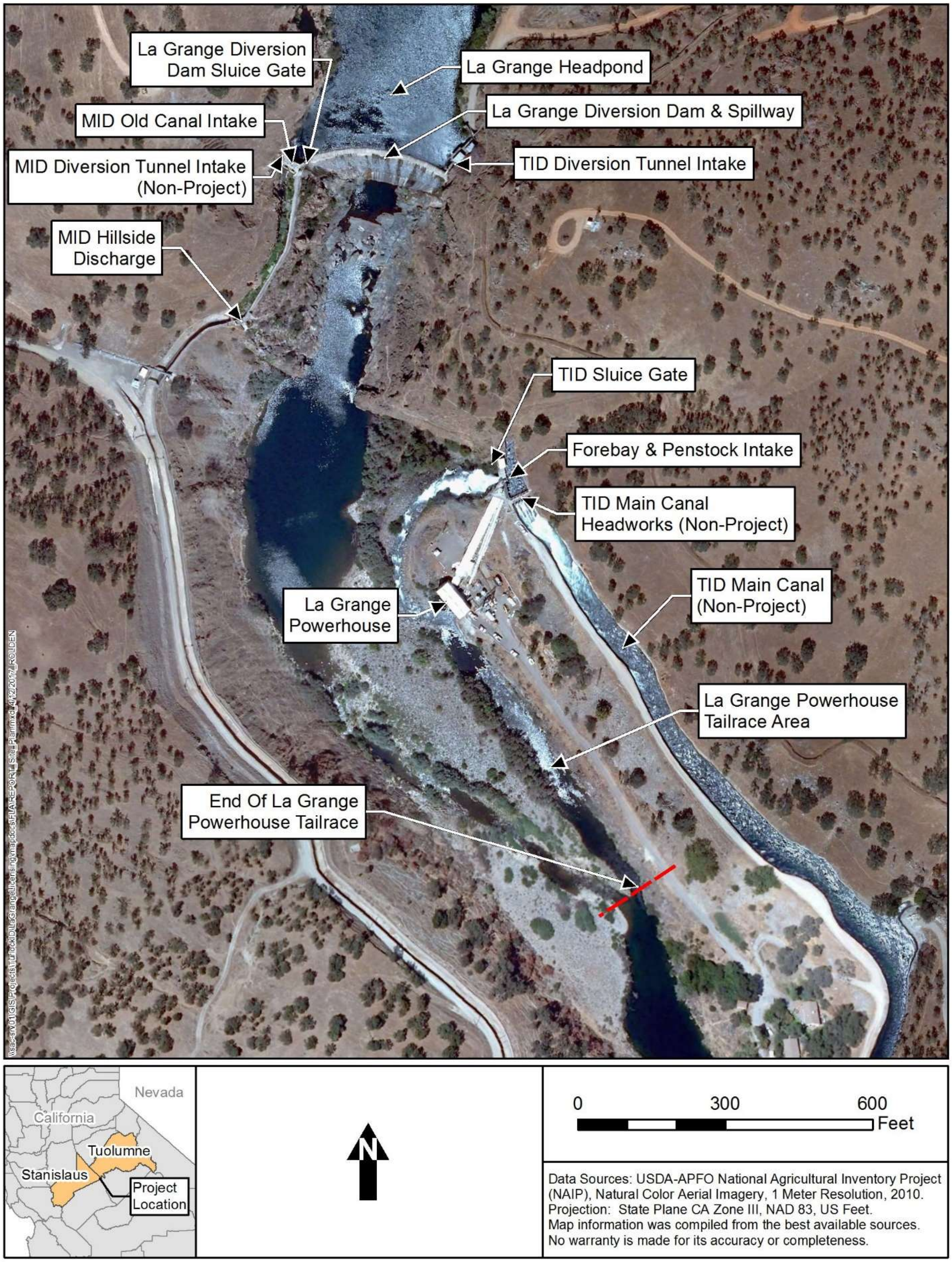

Figure 1.1-2. La Grange Hydroelectric Project site plan.

1.1 Purpose of Action and Need for Power

1.1.1 Purpose of Action

FERC is the federal agency authorized to issue licenses for the construction, operation, and maintenance of the nation's non-federal hydroelectric facilities. In accordance with the Federal Power Act (FPA), as amended, FERC is able to issue such licenses for a period not less than 30 years, but no more than 50 years. Under the FPA, FERC issues licenses that are best adapted to a comprehensive plan for improving or developing a waterway, and, in so doing, must consider a suite of beneficial public uses including, among others, water supply, irrigation, recreation, and fish and wildlife. As the federal "action agency", FERC must also comply with the requirements of the National Environmental Policy Act (NEPA). Under NEPA, FERC must clearly define the specific Proposed Action it is considering and state the purpose and need for the Proposed Action.

In the case of the La Grange Hydroelectric Project, the Proposed Action under review by FERC is the issuance of an original license to the Districts to authorize the generation of hydroelectric power at LGDD.

1.1.2 Need for Power

Issuing an original license will authorize the generation of hydroelectric power at LGDD for the term of the license, producing low-cost electricity from a non-polluting renewable resource.

The electricity generated by the Project is important to the State of California. In January 2016, the California Energy Commission issued the California Energy Demand 2016–2026, Revised Electricity Forecast. The updated forecast presents low, mid, and high forecasts for the state: average annual growth rates for electricity consumption for 2014–2026 are 0.54 percent, 0.97 percent, and 1.27 percent, respectively (Kavalec 2016).

The electricity generated by the Project also helps the State of California to achieve targets set for the use of renewable energy sources. California State Senate Bill 350 (SB 350) revised the California State Renewables Portfolio Standard Program and required the State to obtain 50 percent of its energy from renewable energy resources by 2030. As a hydroelectric generation facility of less than 30 MW, the Project meets the qualifications for a renewable energy resource under SB 350.

1.2 Statutory and Regulatory Requirements

1.2.1 Federal Power Act

The issuance of an original license for the Project is subject to numerous requirements under the FPA and other applicable statutes. Potentially applicable statutes and regulatory requirements are summarized below in chronological order based on date of enactment of the applicable statute. Actions undertaken by the Districts or the agency with jurisdiction related to each requirement are described below, or an explanation is provided as to why the statute is not applicable to the Proposed Action.

1.2.1.1 Section 18 Fishway Prescription

Section 18 of the FPA, 16 U.S.C. § 811, states that FERC shall require construction, maintenance, and operation by a licensee of such fishways as the secretaries of the Department of Commerce and the Department of the Interior may prescribe. The Districts consulted with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) during study plan development and implementation of the Integrated Licensing Process (ILP) for the Project. In its Scoping Document 2 (SD2), FERC identified the effects of the Project on upstream and downstream migration of anadromous fish as a potential resource issue.

1.2.1.2 Section 4(e) Conditions

According to the order finding the Project to be subject to FERC's jurisdiction, the Project occupies U.S. lands administered by the Bureau of Land Management (BLM). Section 4(e) of the FPA gives the Secretary of the land administering agency authority to prescribe conditions on licenses issued by FERC for hydropower projects located on "reservations" under the Secretary's supervision (16 U.S.C. §§ 796(2), 797(e)). The Districts have consulted with the BLM during the ILP.

1.2.1.3 Section 10(j) Recommendations

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by FERC may include conditions based on recommendations of federal and state fish and wildlife agencies for the protection, mitigation, or enhancement (PM&E) of fish and wildlife resources affected by the Project, unless FERC determines such conditions are inconsistent with the purposes and requirements of the FPA or other applicable law. During the Project licensing proceeding, the Districts have consulted with NMFS, the USFWS, and the California Department of Fish and Wildlife (CDFW).

1.2.1.4 Section 30(c) Fish and Wildlife Conditions

This section is applicable to projects that would impound or divert the water of a natural watercourse by means of a new dam or diversion. The Districts are not seeking a license to construct a new dam or diversion; therefore, this section of the FPA is not applicable to the licensing of the Project.

1.2.2 Clean Water Act

Under Section 401(a)(1) of the Clean Water Act of 1970, as amended, 33 USC § 1329(a)(1), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Clean Water Act 33 USC § 1251 *et seq*. In the State of California, the State Water Resources Control Board is designated to carry out certification requirements prescribed by Section 401. The State Water Resources Control Board and the State's nine Regional Water Quality Control Boards work in a coordinated effort to implement and enforce the Clean Water Act, as provided for in the State's Porter-Cologne Water Quality Act. The Project falls within the jurisdiction of the Central Valley Regional Water Quality Control Board (CVRWQCB).

Within 60 days following FERC's Notice of Acceptance and Ready for Environmental Analysis, an application will be filed requesting a Section 401 Water Quality Certificate from the State Water Resources Control Board.

1.2.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) 16 U.S.C. § 1536(a)(2) requires federal agencies to ensure that their actions are "not likely to jeopardize the continued existence of endangered and threatened species or to cause the destruction or adverse modification of the critical habitat of such species...".

FERC is the lead federal agency for licensing the Project, and therefore must consult with the USFWS and NMFS to determine whether its actions would jeopardize the continued existence of any endangered or threatened species or adversely affect any designated critical habitat. Jeopardy exists when an action would "…appreciably reduce the likelihood of both the survival and recovery of a listed species…" (50 CFR § 402.02). Consultation involves a request to the USFWS and NMFS for an inventory of endangered and threatened species, and species proposed by USFWS or NMFS for listing as endangered or threatened that may be present in the vicinity of the Project. Pursuant to Section 7(a)(3) of the ESA, FERC then prepares a biological assessment to determine whether these listed species or their critical habitats are likely to be adversely affected by the federal action. At the end of the consultation process, the USFWS or NMFS (or both) issue a biological opinion that specifies whether or not the action will place an endangered or threatened species or its critical habitat in 'jeopardy'. If a jeopardy opinion is issued, the USFWS or NMFS must include reasonable and prudent alternatives to the action. A non-jeopardy opinion may be accompanied by an 'incidental take statement' that specifies impacts on a threatened or endangered species associated with the taking of the species, mitigation measures, and terms and conditions for implementation of the mitigation measures.

On May 23, 2014, FERC initiated informal consultation with the USFWS and the NMFS under Section 7 of the ESA and the joint agency regulations thereunder at 50 CFR, Part 402, and designated the Districts as FERC's non-federal representatives for carrying out informal consultation. The Districts consulted with USFWS and NMFS in developing the study plans for the La Grange Hydroelectric Project.

1.2.4 Coastal Zone Management Act

Under § 307(c)(3)(A) of the Coastal Zone Management Act of 1972, as amended, (16 U.S.C. § 1456(3)(A)), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state Coastal Zone Management Act agency concurs with the 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 Project is not located within California's coastal zone boundary and is not subject to California coastal zone program review. No consistency certification is required.

1.2.5 National Historic Preservation Act

FERC licenses may permit activities that may "…cause changes in the character or use of historic properties, if any such historic properties exist…" (36 CFR § 800.16[d]). FERC must therefore comply with Section 106 of the National Historic Preservation Act of 1966, as amended, (54 U.S.C. 300101 et seq.) and its implementing regulations at 36 CFR Part 800 that require any federal department or independent agency having authority to license any undertaking to take into account the effects of the undertaking on historic properties.

As defined under 36 CFR 800.16(l), historic properties are prehistoric or historic sites, buildings, structures, objects, districts, *or locations of traditional use or beliefs* that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). Historic properties are identified through a process of evaluation against specific criteria found at 36 CFR 60.4. FERC is required to make a good faith effort to identify historic properties that may be affected by the proposed federal undertaking (i.e., the licensing of the Project) (36 CFR § 800).

On May 23, 2014, FERC designated the Districts as its non-federal representatives for purposes of consultation during the licensing under Section 106 of the National Historic Preservation Act and associated regulations found at 36 CFR § 800.2(c)(4). As FERC's non-federal representatives, the Districts have consulted during the Project licensing with potentially affected Tribes, BLM, and the State Historic Preservation Officer (SHPO), including obtaining the SHPO's agreement that the area of potential effects (APE) was sufficient for the proposed undertaking, per 36 CFR § 800.4(a)(1). SHPO provided this agreement on the APE in a letter dated July 8, 2016. Consultation efforts included a kick-off meeting held on June 27, 2016 in which all agency and tribal participants were invited, including SHPO, BLM, and FERC. The Tuolumne Band of Me-Wuk Indians, FERC, and the Districts participated in this meeting. Further efforts included providing tribal monitors to participate in the field inventory of the APE. To assist FERC in identifying historic properties that may be affected by the Project, as required under Section 106, the Cultural Resources Study Report (TID/MID 2017) was submitted to potentially affected Tribes and the BLM for review and will be submitted to SHPO for review and concurrence before it is filed with FERC.

1.2.6 Wild and Scenic Rivers Act

Congress formally designated portions of the upper Tuolumne River, upstream of the Don Pedro Project Boundary, as Wild and Scenic by PL98-425 on September 28, 1984. All sections of Wild and Scenic River within the Tuolumne River basin are far upstream of the La Grange Hydroelectric Project and as a result are unlikely to be affected by the Proposed Action.

1.2.7 Magnuson-Stevens Fishery Conservation and Management Act

The purpose of the Magnuson-Stevens Fishery Conservation and Management Act is to conserve and manage, among other resources, the anadromous fishery resources of the United States. The

Act establishes eight Regional Fisheries Management Councils to prepare, monitor, and revise fishery management plans that will achieve and maintain the optimum yield from each fishery. In California, the Pacific Fisheries Management Council is responsible for achieving the objectives of the statute. The Secretary of Commerce has oversight authority.

The Act was amended in 1996 to establish a new requirement to describe and identify "essential fish habitat" (EFH) in each fishery management plan. EFH is defined as "…those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH has been established by NMFS for waters in California supporting anadromous fish. The Act requires that all federal agencies, including FERC, consult with NMFS on all actions, or proposed actions, permitted, funded, or undertaken by the agency, that may adversely affect EFH. An adverse effect is any impact that reduces the quality and/or quantity of EFH. Comments from NMFS following consultation are advisory only; however, a written explanation must be submitted to NMFS if the implementing federal agency does not agree with NMFS' recommendations.

1.3 Public Review and Consultation

1.3.1 Pre-Application Document

The Districts began the multi-year licensing process for the Project by filing a Pre-Application Document (PAD) with FERC on January 29, 2014. The Districts' PAD included descriptions of the Project facilities and operations. It also contained a summary of the extensive amount of information available on water resources; fish and aquatic resources; terrestrial and wildlife resources; rare, threatened, and endangered (RTE) species; recreation and land use; cultural resources; and socioeconomic resources relevant to the Project. A preliminary assessment of the resource effects of Project operations was also provided in the PAD. The Districts distributed the PAD to federal and state resource agencies, non-governmental organizations, local governments, Tribes, and other licensing participants.

1.3.2 Discussion of Licensing Process with Interested Participants

On January 29, 2014, the Districts requested that FERC approve use of the Traditional Licensing Process (TLP) for licensing the Project, instead of the default ILP. The due date for comments on the TLP request was February 28, 2014. The Districts hosted a meeting with interested participants to discuss the possible use of the TLP instead of the ILP. Representatives from NMFS, USFWS, CDFW, the State Water Resources Control Board, California Sportfishing Protection Alliance, Tuolumne River Trust, CCSF, and Friends of the River attended the meeting.

Attendees at the meeting requested a 21-day extension to the February 28, 2014 deadline for comments on the La Grange Hydroelectric Project TLP request. The Districts agreed to seek additional time and on February 25, 2014 filed with FERC a request for a three-week extension to the due date for comments. In letters dated February 26 and 27, 2014, CDFW and NMFS, respectively, filed letters supporting the use of the ILP. On February 28, 2014, FERC extended the deadline for comments to March 21, 2014.

On March 21, 2014, NMFS and the Conservation Groups filed comment letters declining to adopt the TLP and supporting use of the ILP for licensing the Project. On March 24, 2014, the Districts stated they did not object to use of the ILP and, subject to FERC's final decision, would plan to proceed using the ILP. On April 17, 2014, FERC established March 24, 2014 as the pre-filing process start date for the ILP.

1.3.3 Scoping

Following the Districts' submittal of the PAD, FERC conducted scoping to determine what issues and alternatives should be addressed during the licensing process. Commission staff conducted two public scoping meetings in Turlock and Modesto, California, on June 18, 2014. The purpose of scoping was to identify the significant environmental issues to be evaluated in FERC's environmental assessment.

FERC issued Scoping Document 1 (SD1) on May 23, 2014, to solicit comments on the scope of environmental studies in the licensing process, and to encourage participation in the licensing process. SD1 was noticed in the Federal Register on June 2, 2014 and included FERC's preliminary view of the scope of environmental issues associated with the Project. Based on verbal comments received during two scoping meetings held on June 18, 2014, in Turlock and Modesto, California, as well as written comments received through the scoping process, FERC issued Scoping Document 2 (SD2) on September 5, 2014. SD2 presents FERC's current view of issues to be considered in its environmental review.

1.3.4 Study Plan Development

On September 5, 2014, the Districts filed their Proposed Study Plan (PSP) document with the Commission and distributed the PSP to licensing participants for review and comment. On October 6, 2014, the Districts held a PSP meeting at MID's office in Modesto, California. Based on discussions at the PSP meeting, the Districts prepared an Updated Study Plan document and provided this document to licensing participants for review on November 21, 2014. Also on November 21, the Districts provided notes from the PSP meeting to licensing participants. On December 4, 2014, NMFS, the Conservation Groups, and CDFW filed comments on the PSP and/or Updated Study Plan documents.

On January 5, 2015, in response to comments from licensing participants, the Districts filed a Revised Study Plan (RSP) containing three study plans, (1) Cultural Resources Study Plan, (2) Recreation Access and Safety Assessment Study Plan, and (3) Fish Passage Assessment Study Plan[1]. The Fish Passage Assessment contains three related elements that together comprise the entire study plan, (1) Fish Passage Facilities Assessment, (2) Upper Tuolumne River Basin Habitat Assessment, and (3) Habitat Assessment and Fish Stranding Observations below LGDD and Powerhouse. Comments on the RSP were received from CDFW on January 16, 2015, and from NMFS, the Conservation Groups, and the City of Modesto on January 20, 2015.

[1] The Fish Passage Assessment Study Plan contained a number of individual, but related, study elements.

1.3.5 Study Plan Determination

On February 2, 2015, FERC issued the Study Plan Determination (SPD), approving or approving with modifications six studies (Table 1.2-1). Of those six studies, five had been proposed by the Districts in the RSP. The Districts note that although FERC's SPD identified the Fish Passage Barrier Assessment, Fish Passage Facilities Alternatives Assessment, and Fish Habitat and Stranding Assessment below LGDD as three separate studies, all three assessments are elements of the larger Fish Passage Assessment as described in the RSP. The sixth study approved by FERC, Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River, was requested by NMFS in its July 22, 2014 comment letter. Of the eight studies requested by licensing participants, FERC approved the NMFS study noted above.

Table 1.3-1. Studies approved or approved with modifications in FERC's Study Plan Determination.

No.	Study	Approved by FERC in SPD without Modifications	Approved by FERC in SPD with Modifications
1	Recreation Access and Safety Assessment		X
2	Cultural Resources Study		X
3	Fish Passage Barrier Assessment		X[1]
4	Fish Passage Facilities Alternatives Assessment		X
5	Fish Habitat and Stranding Assessment below La Grange Dam		X
6	Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River	X[2]	

[1] Page A-1 of Appendix A of FERC's SPD states that FERC approved with modifications the Fish Passage Barrier Assessment. However, the Districts found no modifications to this study plan in the SPD. On page B-7 of the SPD states that "no modifications to the study plan are recommended."

[2] FERC directed the Districts to conduct the study plan as proposed by NMFS.

In addition to the six studies noted in Table 1.2-1, the SPD required the Districts to develop a plan to monitor anadromous fish movement in the Project's powerhouse draft tubes and to determine the potential for injury or mortality from contact with the turbine runners. Per the SPD, the Districts developed a study plan in consultation with NMFS and other licensing participants. The Districts filed the Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes study plan with FERC on June 11, 2015, and on August 12, 2015, FERC approved the study plan as filed.

1.3.6 Resolution of Disputed Studies

On February 23, 2015, NMFS filed a timely request with FERC for dispute resolution with regard to two of its study requests rejected by FERC staff in the SPD. The two disputed studies were:

- Request 3 – Quantifying Existing Upper Tuolumne River Habitats for Anadromous Fish as They Pertain to Fish Passage Blockage at La Grange Dam.
- Request 4 – Effects of the Project and Related Activities on the Genetic Makeup of Steelhead/Rainbow Trout *Oncorhynchus mykiss* in the Tuolumne River.

On February 27, 2015, FERC issued a letter to NMFS stating that FERC had determined that Request 3 would not be considered by the Study Dispute Panel because it had already been afforded the Commission's formal dispute resolution process in the Don Pedro Project dispute resolution proceeding. On May 1, 2015, FERC issued a Formal Study Dispute Determination, which stated that upon consideration of the findings and recommendations of the Study Dispute Panel, the Director of the Office of Energy Projects was not requiring the La Grange Hydroelectric Project study plan to be modified to incorporate a genetics study.

1.3.7 Upper Tuolumne River Reintroduction/Fish Passage Assessment Framework

Work performed by the Districts in 2015 as part of the Fish Passage Facilities Alternatives Assessment resulted in the identification of a number of significant data gaps relevant to informing the biological and engineering basis for the development of fish passage concept alternatives. The Fish Passage Facilities Alternatives Assessment Progress Report (TID/MID 2016) provides a summary of consultation with licensing participants and site-specific considerations and potential biological and engineering criteria intended to inform Phase 2 of the Assessment. Given that anadromous salmonids are not currently present in the target reintroduction area, much of the biological information presented in TID/MID (2016) is based upon assumptions. Therefore, this information may not be representative of conditions in the Tuolumne River. In addition, there remain a number of data gaps relevant to informing the biological and related engineering basis of conceptual alternatives that are necessary to be able to produce reliable estimates of fish passage facility performance and cost.[2]

Through a series of workshops conducted in 2015 and 2016, the Districts, in an attempt to further collaboration with licensing participants, broadened the scope of the Fish Passage Facilities Alternatives Assessment to implement an Upper Tuolumne River Reintroduction/Fish Passage Assessment Framework process (Framework). Information describing the structure and function of the Framework is provided in TID/MID (2016) and the Districts' Updated Study Report (USR). Elements of the Framework are interconnected and fish passage engineering is just one of several key elements. Other Framework elements include ecological feasibility, biological constraints, and economic, regulatory, and other key considerations. The assessment of fish passage is inherently linked to the potential for aiding the recovery of ESA-listed anadromous fish by their reintroduction to the Tuolumne River[3], and as such, it is appropriate to consider fish passage at LGDD in this broader context.

Numerous data gaps related to potential fish passage concepts critical to advancing the fish passage assessment process were identified in the Districts' Technical Memorandum (TM) No. 1, and the

[2] The Districts issued Technical Memorandum (TM) No. 1 to licensing participants on September 4, 2015 and reviewed data gaps identified in the TM at a Workshop on September 17, 2015. The Districts explained that these data gaps required resource agency input in order to continue to make progress on the Fish Passage Assessment. Comments were requested to be provided by October 23, 2015, which was subsequently extended to October 30, 2015. Despite continuing requests, the Districts have still received no input or comments on TM No. 1 from any participant in the collaborative process. At subsequent Workshops in 2016, the Districts continued to highlight the need for comment and input from licensing participants in order to proceed with the next steps in the Fish Passage Facilities Alternatives Assessment.

[3] Since all the available information regarding historical spring-run Chinook and steelhead distribution in the Tuolumne River is anecdotal, the Districts do not agree that these species have been shown to have consistently populated the river upstream of the Don Pedro Project, and as such, do not necessarily consider this potential action under consideration to be a "reintroduction".

proposed Framework process was intended to provide an opportunity for obtaining and discussing this information in a transparent and open forum and confirming appropriate values for biological and engineering parameters. The siting, configuration, design, construction, and operation of fish passage facilities at high head dams is a relatively recent and somewhat experimental undertaking, which has proven to be complex and costly. As such, a thorough investigation of the engineering, biological, regulatory, social and economic issues surrounding such a proposal is necessary to ensure that scientifically defensible information is used to inform prudent, cost-effective and efficient fish passage facility design. The Framework process introduced by the Districts is consistent with guidance provided in Anderson et al. (2014), *Planning Pacific Salmon and Steelhead Reintroductions Aimed at Long-Term Viability and Recovery*. This peer-reviewed journal article authored by the NMFS Northwest Fisheries Science Center in collaboration with state fish and wildlife agencies, stresses the need for implementing a broad evaluation process that describes benefits, risks, and constraints prior to implementing a fish introduction or reintroduction program.

The Framework process continued throughout 2016 and into 2017. Workshops were conducted on January 27, 2016 and May 19, 2016 for all Framework participants. At these meetings, a process and schedule, a summary of the information data gaps, a list of information being obtained by NMFS studies, and a list of potential voluntary studies to be conducted by the Districts to address information gaps, and the formation of technical subcommittees were discussed to help guide 2016 activities. Nine additional engagements (meetings or conference calls) took place in 2016[4] and 2017[5], involving technical subcommittees composed of interested licensing participants. In general, technical subcommittee meetings were focused on specialized technical topics related to the Framework, including: (1) collaborative development of study plans for voluntary upper Tuolumne River studies that the Districts might consider undertaking, (2) discussions to define reintroduction goals and objectives to evaluate the prudency of undertaking a reintroduction program, and (3) discussions to identify appropriate water temperature criteria to evaluate thermal suitability in the potential reintroduction reach. Detailed information for all workshops held in 2015 and 2016 related to the La Grange licensing process are included in the consultation record, described in Section 6.0 and filed as an attachment to this DLA.

1.3.8 Voluntary Studies

The Districts are currently conducting a number of voluntary studies as part of the Fish Passage Facilities Alternatives Assessment and Framework process. In 2015, the Districts voluntarily implemented the Upper Tuolumne River Basin Fish Migration Barriers Study and the Upper Tuolumne River Basin Water Temperature Monitoring and Modeling Study. In addition, based on discussions of identified data gaps held in the Framework Workshops the Districts developed a preliminary list of potential data gap studies, and after licensing participants provided input, the Districts subsequently drafted and circulated study plans for seven additional voluntary studies: (1) Upper Tuolumne River Chinook Salmon and Steelhead Spawning Gravel Mapping Study, (2) Upper Tuolumne River Habitat Mapping Assessment, (3) Upper Tuolumne River Macroinvertebrate Assessment, (4) Upper Tuolumne River Instream Flow Study, (5) Hatchery and

[4] Dates of engagements in 2016: February 16, March 18, April 13, April 18, September 15, October 14, October 20, December 1.
[5] Dates of engagements in 2017: January 26.

Stocking Practices Review, (6) Socioeconomic Scoping Study, and (7) Regulatory Context for Potential Anadromous Salmonid Reintroduction into the Upper Tuolumne River Basin.

The study plans were refined through a collaborative process as part of the Framework workshops and final study plans were posted to the La Grange Hydroelectric Project licensing website in July 2016. In the summer of 2016, the Districts began the process of implementing these seven additional studies and continued the second year of implementation on the two voluntary studies that began in 2015 (i.e., the Upper Tuolumne River Basin Fish Migration Barriers Study and the Upper Tuolumne River Basin Water Temperature Monitoring and Modeling Study).

In addition to the Districts' studies described above, NMFS is currently conducting two studies directly relevant to the Framework process and the data gaps presented in TM No.1: (1) Estimation of Steelhead and Spring-Run Chinook Salmon Habitat Capacity in the Upper Tuolumne and Upper Merced Rivers, and (2) Genetic Evaluation of *O. mykiss* Populations in the Upper Tuolumne and Merced Watersheds. NMFS originally anticipated that results from the habitat capacity study would be available by the fall of 2015; results from both studies are now scheduled for public release in July 2017. As FERC notes on page B-9 of the SPD, information on "the suitability of upstream habitat for anadromous salmonids, as it relates to recovery planning under NMFS guidelines, pertains to management decisions and actions which most appropriately fall under NMFS jurisdiction", and therefore, it is NMFS' responsibility to characterize habitat conditions and carrying capacity of the upper Tuolumne River. Results from the *O. mykiss* genetics study are also expected to play an important role in this licensing proceeding. NMFS stated during the Project study dispute hearing that data on *O. mykiss* genetics "is needed to know before we [NMFS] can make a decision of whether to reintroduce fish [specifically, steelhead] above, below the [Don Pedro] dam. It's at the core of the decision here" (FERC 2015).

1.3.9 Initial Study Report

On February 2, 2016, the Districts filed the Initial Study Report (ISR) for the La Grange Hydroelectric Project. The Districts held an ISR meeting on February 25, 2016, and on March 3, 2016, filed a meeting summary. Comments on the meeting summary and requests for new studies and study modifications were to be submitted to FERC by Monday, April 4. One new study request was submitted; NMFS requested a new study entitled Effects of La Grange Hydroelectric Project Under Changing Climate (Climate Change Study). On May 2, 2016, the Districts filed with FERC a response to comments received from licensing participants and proposed modifications to the Fish Passage Facilities Alternatives Assessment and the La Grange Project Fish Barrier Assessment. On May 27, 2016, FERC filed a determination on requests for study modifications and new study. The May 27, 2016, determination approved the Districts' proposed modifications, but did not approve the NMFS proposed Climate Change Study.

1.3.10 Revisions to Pre-filing Schedule

SD1 contained a schedule of pre-filing activities, many of which extended well into 2017. However, SD1 also included a filing date for the FLA in June 2016, a year before the completion of the ILP schedule. On May 2, 2016, the Districts proposed a new pre-filing schedule in their response to comments on the ISR. FERC approved the new schedule and provided a new process plan and schedule on May 27, 2016, as part of the determination on requests for study modifications and new study.

1.3.11 Updated Study Report

On February 1, 2017, the Districts filed the USR for the La Grange Hydroelectric Project. The Districts held a USR meeting on February 16, 2017, and on March 3, 2017, filed a meeting summary. Comments on the meeting summary and requests for new studies and study modifications were to be submitted to FERC by Monday, April 3. Comments on the USR were received from the Central Sierra Environmental Resource Center on February 27, 2017. Additional comments on the USR were received from NMFS on April 3, 2017. On April 13, 2017, CDFW provided brief comments on the USR meeting notes and the La Grange Project Fish Barrier Assessment Progress Report. In accordance with ILP schedule, the Districts will file with FERC a response to comments received from licensing participants by May 2, 2017.

1.3.12 Draft and Final License Applications

This DLA is being filed on April 24, 2017, which will be followed by a 90-day public comment period. The Districts plan to file a FLA no later than September 25, 2017.

2.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the no-action alternative, the Districts' proposal for operating the La Grange Hydroelectric Project under an original license, and other alternatives considered but eliminated from detailed study.

2.1 No-action Alternative

Under the no-action alternative, the TID powerhouse units would be removed from service. This alternative is used to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The Districts completed construction of the LGDD in 1893. TID's powerhouse containing the two hydroelectric units was built in 1924. The primary Project facilities are: (1) LGDD, (2) the La Grange headpond, (3) two penstock intakes, (4) TID's sluiceway, (5) two penstocks, (6) the La Grange powerhouse, (7) an excavated tailrace, and (8) a substation. Further details about and specifications for these facilities are provided in Exhibit A of this DLA.

A Project Boundary for the La Grange Hydroelectric Project will be provided in the FLA as it will depend upon the potential inclusion of certain recreation access facilities. Lands surrounding the Project are a mixture of private land, land owned by the Districts, and federal land administered by BLM.

2.1.2 Current Project Operation

The La Grange Hydroelectric Project operates in a run-of-river mode. The diversion dam is located at the exit of a narrow canyon and the impounded water provides little to no active storage. Therefore, the LGDD acts as a diversion dam delivering flow through its tunnel intakes to the TID and MID canal systems. Combined, these canals provide water to over 200,000 acres of prime Central Valley farmland and the City of Modesto to supplement its primary municipal and industrial (M&I) water supply coming from groundwater sources.

All flows released from the Don Pedro Project, located upstream of LGDD, are either diverted by TID and/or MID for water supply purposes, or are passed downstream at the La Grange facility. On the MID side of the river, sluice gates can deliver water to the river approximately 400 ft downstream of the dam. Normally, a flow of approximately 10cfs is discharged from these gates to the river. On the TID side of the river, water can be passed to the river through either two 5-foot-wide by 4-foot-high sluice gates located adjacent to the penstock intakes or through TID's powerhouse.

2.1.3 Existing Resource Measures

Current resource protection measures include the passing of water from the MID side of the river to the plunge pool located below the LGDD. In addition, TID's sluice gates are opened immediately upon a unit or powerhouse trip to continue the passage of water downstream without interruption. Depending on the outcome of ongoing studies, additional resource protection measures may be proposed in the FLA.

2.2 Districts' Proposal

2.2.1 Proposed New Project Facilities

At this time, no new facilities are proposed as the Districts are awaiting the outcome of ongoing studies. No facilities are proposed to be removed from the Project.

2.2.2 Proposed Project Operations

The Project would continue to operate in a run-of-river mode. No changes to operations are proposed at this time.

2.2.3 Proposed Resource Measures

The Districts may propose additional PM&E measures in the FLA. Proposed measures will be described in the FLA and will be informed by the Districts' ongoing studies, NMFS' ongoing studies, and an assessment of the Project effects.

2.3 Alternatives Considered but Eliminated from Detailed Study

2.3.1 Decommissioning the Project's Generating Equipment

If the Commission denies an original license or the Districts decide not to accept a license, TID would be required to cease generating power at the existing two-unit station. Without electrical generation, a license would not be required and LGDD would continue to operate to fulfill its primary purpose, which is the diversion of water for water supply purposes.

3.0 ENVIRONMENTAL ANALYSIS

3.1 General Description of the Tuolumne River Basin and La Grange Hydroelectric Project

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 ft), 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 3,500 ft). Six miles below O'Shaughnessy Dam, which impounds Hetch Hetchy Reservoir, the Tuolumne River leaves Yosemite National Park and enters the Stanislaus National Forest. Except for a short reach at Early Intake 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.

The mainstem Tuolumne River is joined by several tributaries–including (from upstream to downstream) Cherry Creek, the South Fork Tuolumne River, the Clavey River, and the North Fork of the Tuolumne River–before entering the Don Pedro Reservoir. There are two dams in the Cherry Creek basin: Cherry Dam, which impounds Cherry Lake, located on Cherry Creek about 12 miles above its confluence with the Tuolumne River and Eleanor Dam, which impounds Lake Eleanor, located about 3.5 miles upstream of its confluence with Cherry Creek (SFPUC 2008).

Downstream of Don Pedro Reservoir, the rolling hills of the eastern Central Valley gradually flatten to become a terraced floodplain. Two small, intermittent drainages enter the La Grange headpond between Don Pedro Dam and LGDD. Below the LGDD, 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 ≈ 204 mi^2) downstream of LGDD. Subbasins in the Tuolumne River watershed are shown in Figure 3.1-1.

The Tuolumne River watershed covers 1,960 square miles and encompasses a wide range of climates and hydrologic conditions. Annual precipitation within the watershed ranges from over 60 inches in the high mountains to 12 inches in the Central Valley (Western Regional Climate Center 2010). At its headwaters in the Sierra Nevada, the Tuolumne River experiences significant snow accumulation from December to April. Downstream in the foothills the climate is described as Mediterranean: winters are wet and cool, with most precipitation occurring as rain, and summers are hot and dry. Runoff from the upper basin occurs from April to July, when the winter snowpack melts (ACOE 1972). In the Sierra foothills and valley floor, runoff occurs from December to March, coinciding with the rainy season.

Lands within the Tuolumne River basin have a number of uses and land ownership patterns. Upstream of the Don Pedro Project, lands are primarily federally owned, with the National Park Service managing Yosemite National Park and the United States Forest Service (USFS) managing the Stanislaus National Forest. Developed land in this section of the subbasin is limited to small communities, such as Groveland and Smith Station, dispersed individual residences, and small tracts of non-irrigated farmland.

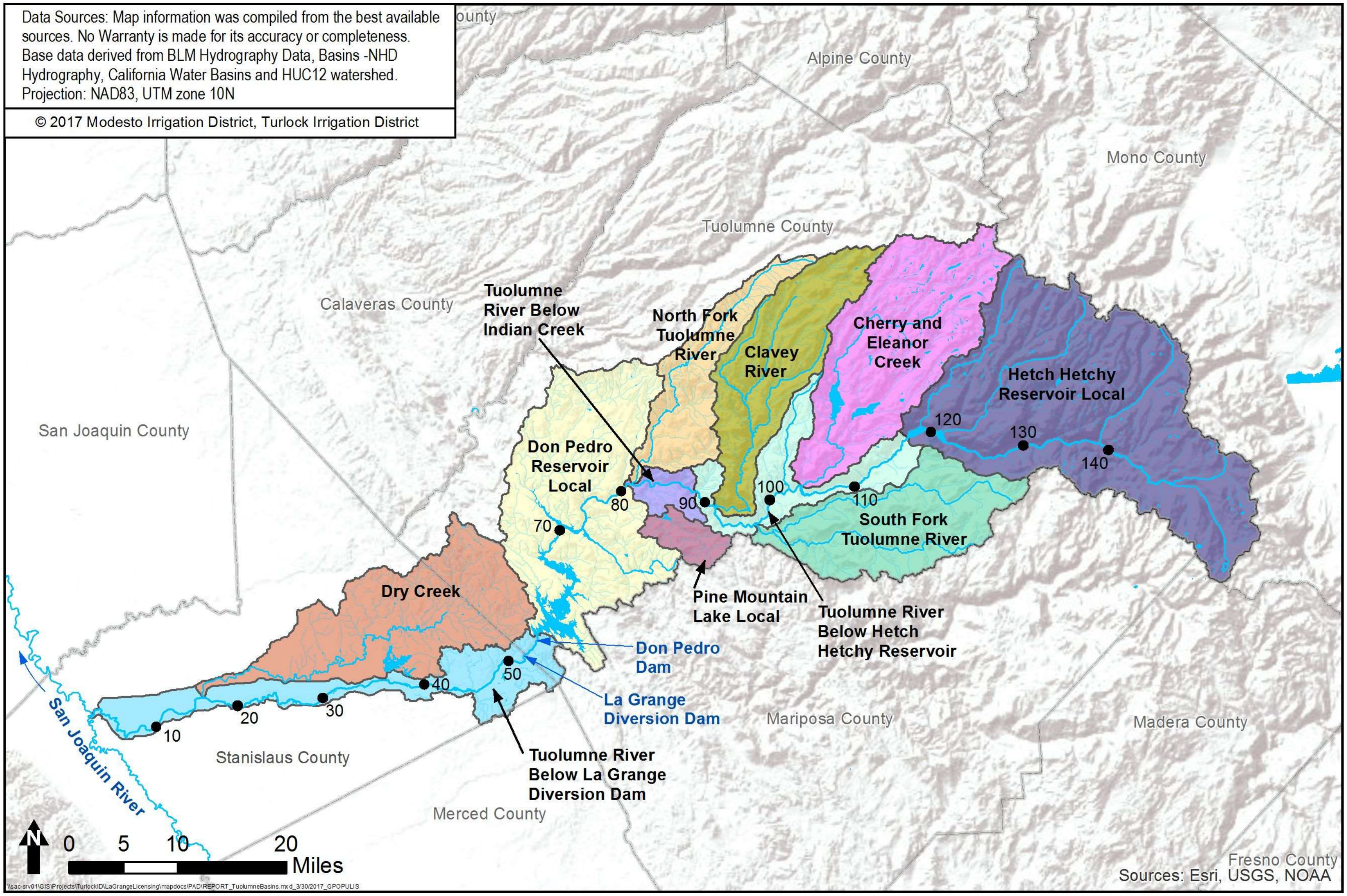

Figure 3.1-1. Subbasins of the Tuolumne River watershed.

Upstream of the Don Pedro Project at RM 118, O'Shaughnessy Dam impounds Hetch Hetchy Reservoir and diverts water to the Bay Area through the Canyon, Mountain, and Foothill tunnels, and San Joaquin Pipelines. Owned by CCSF, the 360,400-AF Hetch Hetchy Reservoir is an integral component of CCSF's Hetch Hetchy Water and Power System, which provides approximately 85 percent of CCSF's Bay Area municipal and industrial water supply and generates on average 1,700,000 megawatt-hours (MWh) of electricity each year. CCSF also owns the Early Intake Diversion Dam, located at RM 105, which can be used to divert water supplied by CCSF's Cherry Creek facilities through the Mountain and Foothill tunnels to the San Joaquin Pipelines during emergency and extreme drought conditions. The Districts divert water at LGDD to meet demands associated with the La Grange Project's primary purposes of diverting water for irrigation and M&I water supplies. As noted earlier, this primary purpose is independent of the La Grange Hydroelectric Project and as a result have no nexus to the Proposed Action in this DLA.

All lands downstream of the La Grange headpond are privately owned, either by the Districts or other entities. Land in the Central Valley along the lower Tuolumne River is primarily privately owned and used for agriculture, grazing, rural residential purposes, and denser residential purposes in the communities of Waterford and Modesto (Stanislaus County 2006). A small portion of land downstream of the Project is under state ownership; Turlock Lake State Recreation Area (SRA) is a small state park spanning from the southern bank of the Tuolumne River to the north shore of Turlock Lake.

The region surrounding the Project has a diverse economic base. Detailed information on socioeconomic resources is available in the Socioeconomics Study Report for the Don Pedro Project (TID/MID 2014).

3.2 Scope of Cumulative Effects Analysis

As described in FERC's SD2 (FERC 2014), the scope of FERC's environmental assessment for the Project licensing is to include an analysis of how the Proposed Action would or would not contribute to cumulative effects. According to the Council on Environmental Quality's regulations for implementing NEPA (50 CFR §1508.7), cumulative effects on a resource are the result of the combined influence of past, present, and reasonably foreseeable future actions within a specified geographical range (FERC 2008), regardless of which agency (federal or non-federal) or entity undertakes such actions. Related specifically to the Tuolumne River basin, cumulative effects can result from individually minor but collectively significant actions taking place over a prolonged period of time, including hydropower operations, diversions for irrigation and drinking water supply, past gravel and gold mining activities, other land and water development activities, and the introduction of non-native species to the watershed.

Based on FERC's scoping meetings, comments received during scoping, and information in the PAD, FERC identified the following resources as having the potential to be cumulatively affected by the continued operation and maintenance (O&M) of the La Grange Hydroelectric Project: water resources (water quality), aquatic resources, geomorphology, recreation, and socioeconomic resources. The approach to assessing these cumulative effects is the Tuolumne River is described in Section 4 of this Exhibit E.

3.2.1 Geographic Scope

In accordance with FERC's SD2, the geographic scope to be considered is defined by the physical limits of the proposed action's effect on the resources, and the contributing effects from other hydropower and non-hydropower activities within the Tuolumne River basin (FERC 2014).

The effects of the La Grange Hydroelectric Project are limited to the immediate area in the vicinity of the TID powerhouse potentially affected by its operation for hydropower purposes.

The FLA will discuss potential cumulative effects on resources with respect to the geographic scope identified in FERC's SD2 as appropriate to the operation of hydropower generation, as follows:

- Water resources, aquatic resources, and socioeconomic resources may extend upstream on the Tuolumne River to Hetch Hetchy and downstream to San Francisco Bay.
- Geomorphology extends upstream on the Tuolumne River to Hetch Hetchy and downstream to the confluence of the Tuolumne and San Joaquin rivers.
- Recreation extends upstream to the upper extent of Don Pedro Reservoir and downstream to the confluence of the Tuolumne and San Joaquin rivers.

3.2.2 Temporal Scope

In accordance with FERC's SD2, the temporal scope of the cumulative effects analysis will include a discussion of the past, present, and reasonably foreseeable future actions and their effects on each resource that could be cumulatively affected. The historical discussion is limited by the amount of available information available for each resource. The temporal scope will extend 30 to 50 years into the future in order to coincide with the potential term of a new license for the La Grange Hydroelectric Project.

3.3 Geology and Soils

The La Grange Hydroelectric Project (Project) is located in the Western Sierra Nevada Metamorphic Belt (WSNMB) within the Sierra Nevada Block, a tilted fault block approximately 400 miles long that trends north-northwest, is 40 to 80 miles wide, and includes a broad region of foothills along the western slope of the Sierra Nevada Range (Harden 2004 as cited in TID/MID 2011). The eastern face of the tilted Sierra Nevada Block is high and rugged, consisting of multiple fault scarps (Eastern Sierra Nevada Frontal Shear Zone) separating it from the Basin and Range Province. This contrasts with the gentle western slope that disappears under sediments of the Great Valley. The Sierra Nevada block continues under the Great Valley and is bounded on the west by an active fold and thrust belt that marks the eastern boundary of the Coast Range Province (Wentworth and Zoback 1989 as cited in TID/MID 2011). The northern boundary of the tilted fault block is marked by the disappearance of typical Sierra bedrock under the volcanic cover of the Cascade Range. The southern boundary of the fault block is along the Garlock Fault located in the Tehachapi Mountains approximately 210 miles southeast of the Project, where characteristic rocks of the Sierra Nevada are abruptly truncated by this east-west fault system. The Project is located a few miles east of the surficial boundary with the Great Valley geomorphic province (Figure 3.3-1).

The area upstream of the Project along the Tuolumne River is underlain by a series of bedrock and surficial deposits. Above LGDD the river runs westerly in metavolcanic rock of the Jurassic age Gopher Ridge Formation. To the west of the Gopher Ridge Formation, through most of the area below LGDD, the river runs in slates of the Jurassic age Merced Falls Slate and volcanic rocks of the Peaslee Creek Volcanics. West of the Merced Falls Slate and Peaslee Creek Volcanics, the river is underlain by alluvium of Holocene Age and is locally flanked by historic dredger tailings. Most of the riverbed between La Grange Regional Park and the confluence with the San Joaquin River runs in alluvium of Holocene Age that overlies the Riverbank, Turlock Lake, and Modesto Formations of Pleistocene age. These units are in turn generally underlain by Cenozoic valley fill (TID/MID 2011).

Several unnamed faults related to the Bear Mountains Fault Zone cross the river in the La Grange Project vicinity, striking northeasterly (Figure 3.3-1). None of these faults is classified by the California Geological Survey (CGS) as active within Holocene time (movement within the last 11,400 years). The reach that extends upstream from LGDD to the toe of Don Pedro Dam is in the western lithotectonic belt of the Western Sierra Nevada (Figure 3.3-2).

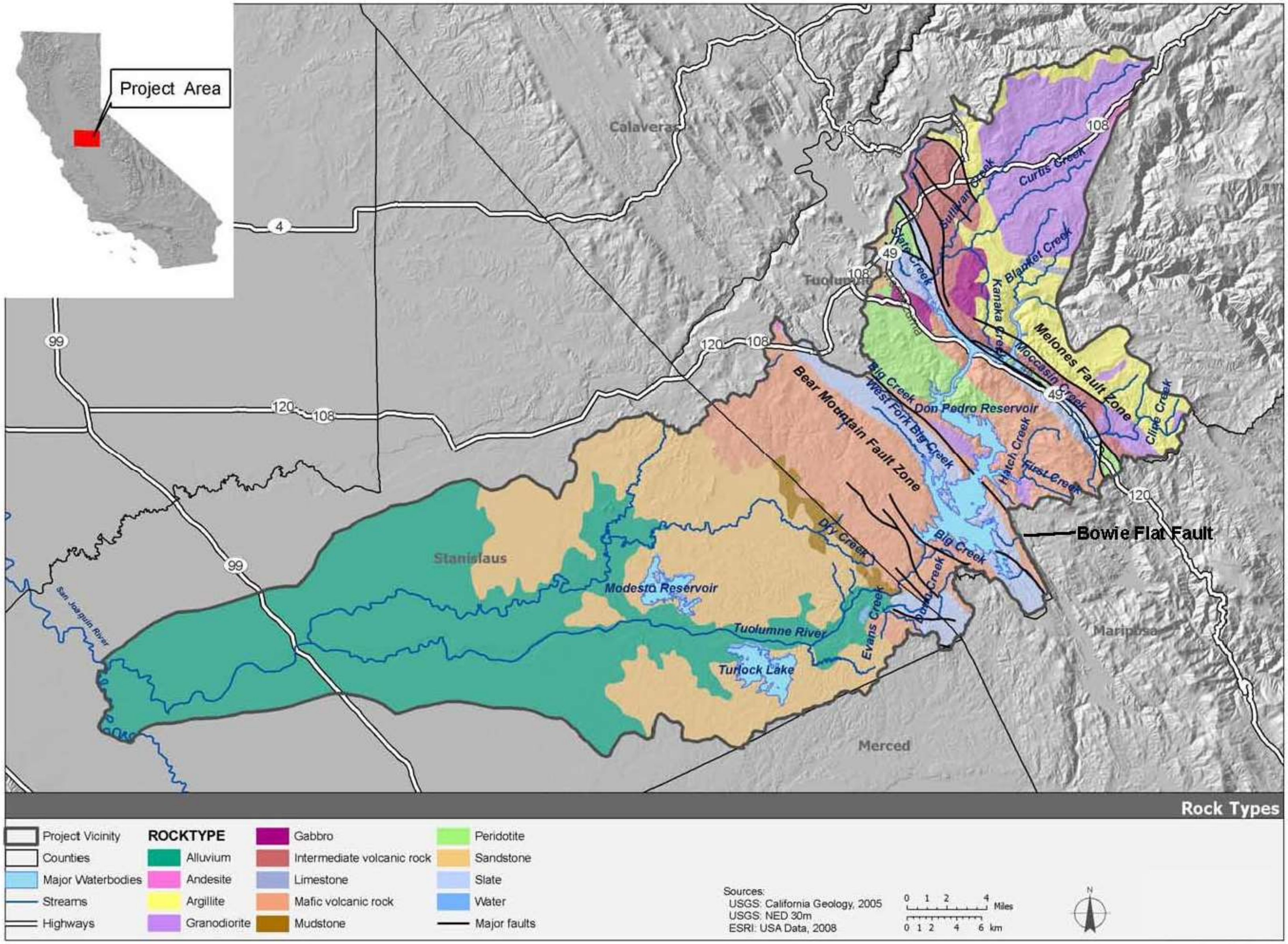

Figure 3.3-1. Geological map of the La Grange Project vicinity showing major rock types and fault zones.

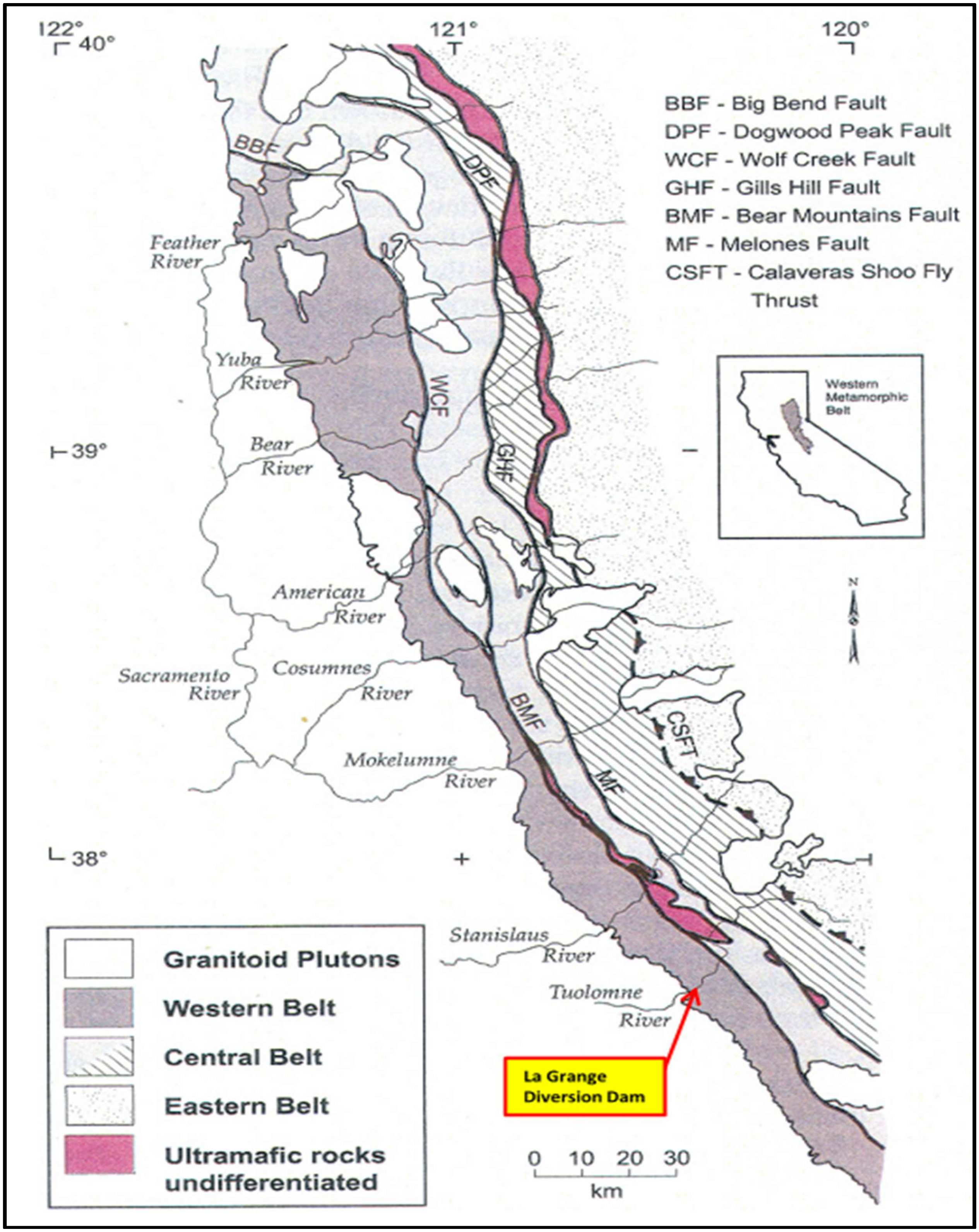

Figure 3.3-2. Lithotectonic belts of the western Sierra Nevada Metamorphic Belt and the location of the LGDD (Mayfield and Day 2000).

3.3.1 Soils

The Project is located within the foothills of the Sierra Nevada near the Bear Mountain Fault Zone. The soils in the vicinity are derived from a variety of parent materials including schist, serpentine (ultramafic rocks), metavolcanic, and metasedimentary rocks (TID/MID 2011). Many of the soils are shallow, and associations with "rock outcrop" cover virtually the entire Project vicinity. However, one soil association (i.e., Whiterock-rock outcrop-Auburn [s818]) dominates the area.

The Whiterock-rock outcrop-Auburn association is one of the more extensive associations in the foothills of the Sierra Nevada, and it typically develops in tilted slate, amphibolite schist, and partially metamorphosed sandstone formations. Whiterock soils are shallow, formed on bedrock, and located at elevations of 160 to 2,500 ft on slopes that are 3 to 60 percent. The soils formed in material weathered from slate and partially metamorphosed sandstone (TID/MID 2011). Whiterock soils tend to be shallower and less weathered than those of the Auburn series.

The Bear Mountains Fault Zone, which runs northwest to southeast near the Project, has serpentinized ultramafic rock in many areas along the zone. The areas underlain by these ultramafic rocks are reflected by the presence of the Henneke and Delpiedra series, which are often shallow and poorly developed as indicated by the large amount of "rock outcrop" in the association (TID/MID 2011).

3.3.2 Faulting

The three lithotectonic subunits of the WSNMB are separated by steeply dipping major faults collectively referred to as the Foothills Fault System (FFS) (Figure 3.3-2; Clark 1960; Clark and Huber 1975 as cited in TID/MID 2011). This fault system is an anastomosing (braided or interwoven) complex of north-northwest-striking fault-related structures with serpentinized or mineralized zones and sheared contacts between rocks (Clark 1960 as cited in TID/MID 2011). There is one major fault zone in the FFS that crosses the Tuolumne River near the Project vicinity (i.e., Bear Mountain Fault Zone) (Figure 3.3-1). The Bear Mountain Fault Zone is oriented northwest/southeast and is located to the northeast of the Project vicinity (Figure 3.3-1). It is believed that the Bear Mountain Fault Zone represents a splay of the Melones Fault zone and that the two merge at depth. The California Division of Mines and Geology (CDMG) open File Report 84-52 (1994) states that the Bear Mountain Fault zone did not warrant zoning as an active fault because it is poorly defined at the surface or lacks evidence of Holocene (recent) displacement (TID/MID 2011).

3.3.3 Tectonic History and Seismicity

The structural features within the WSNMB record deformation related to at least three orogenic (mountain building) events during the Devonian, Permian-Triassic, and Jurassic (Dickinson 1981 as cited in TID/MID 2011). The dominant northwest-trending structural grain of this belt was imposed during the late Jurassic Nevadan orogeny (Schweickert 1981; Varga and Moores 1981; Schweickert et al. 1984; Day et al. 1985 as cited in TID/MID 2011). This deformation produced the FFS, the northwest-trending folds, a variably developed fabric in the rocks, and regional greenschist-facies metamorphism. Present studies show an upward movement of the Sierran block of 20 to 30 inches per century (Avendian 1978 as cited in TID/MID 2011). Most of the elevation of the Sierra Nevada range is due to late Cenozoic uplift and tilting associated with fault activity along the eastern margin (Wakabayashi and Sawyer 2001 as cited in TID/MID 2011). The range slopes gently westward from the crest and abruptly eastward from the crest.

The LGDD is located within the Sierra Nevada block east of the boundary that separates the Central Valley and Sierra Nevada provinces that make up the block. The block is continental crust composed of Paleozoic and Mesozoic age granitic plutons intruded into Paleozoic and Mesozoic metamorphic basement and oceanic crust and is the result of plate convergence and accretion of several terranes to the North American plate (Wong and Savage 1983). After the Nevadan orogeny (160 to 123 mya) accreted an island arc terrane (that presently underlies the site), major magmatic activity related to subduction farther west created the large Cretaceous plutons in the central Sierra Nevada (Bateman et al. 1963). Subsequent uplift of the block along its eastern margin created a gently dipping slope to the west. The sediment of the Great Valley Sequence was eroded from the central Sierra Nevada magmatic arc and deposited into the basin between the arc and subduction zone (Hamilton and Meyers 1967). In the middle Tertiary, transform faulting was initiated along the continental margin and continues to the present (Wong and Savage 1983). The main present-day tectonic deformation of the Sierra Nevada block occurs along the western boundary (Central Valley thrust fault system), eastern boundary (Sierra Nevada Frontal Fault System - California Shear Zone), and southern boundary (Garlock Fault) of the block and is related to the transform faulting (San Andreas fault system) along the continental margin (Wong and Savage 1983; Hill et al. 1991).

The internal portion of the block is characterized by a low level of deformation and seismicity (Wong and Savage 1983; Uhrhammer 1991; Hill et al. 1991). Uplift and gradual tilting to the west related to the general transform regime that started during the middle Tertiary is the main tectonic activity currently affecting the block interior. Minor faulting in response to the tilting occurred along the older zones of weakness in the block, including the FFS (segments of which have undergone movement in the late Quaternary [Jennings and Bryant 2010; USGS 2013]). The system is presently undergoing east-west extension (Wong and Savage 1983; Hill et al. 1991; Uhrhammer 1991). The seismicity in the area of the FFS is diffuse, characterized by low levels of both historical and instrumental seismicity earthquakes with magnitudes less than 5, and by little direct correlation of earthquakes to particular geologic structures (Hill et al. 1991; Uhrhammer 1991).

The largest earthquake that has occurred on a segment of the FFS (Cleveland Hills Fault) is the August 1, 1975 Oroville earthquake (ML = 5.7; Mw =5.8), approximately 220 kilometers (km) northwest of LGDD (Morrison et al. 1976). The earthquake involved predominantly normal displacement along a west dipping plane (east-west extension, west side down) that extended from the hypocenter at a depth of about 8 km to the ground surface (Bufe et al. 1976; Lahr et al. 1976; Langston and Butler 1976).

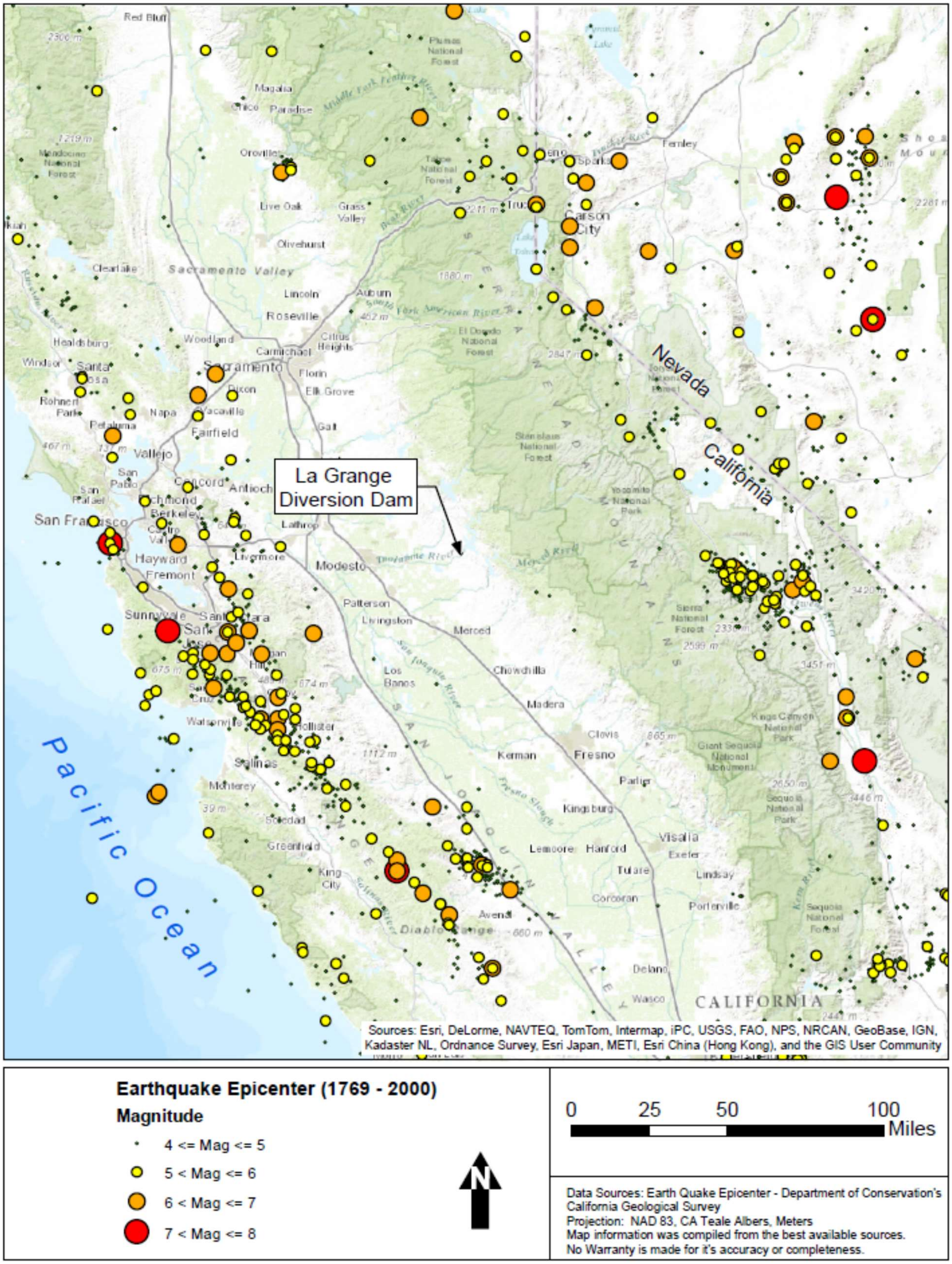

Figure 3.3-3. Historical seismicity.

3.3.4 Mining Resources

Past and present mines in the general vicinity of the La Grange Project are shown in Figure 3.3-4. The chief mineral commodity in the vicinity is gold. The immensely rich placers of Columbia and Springfield northwest of the Project produced approximately $55,000,000 in gold prior to 1899. The pocket mines of Sonora, Bald Mountain, and vicinity have also been highly productive and exceptionally long-lived (TID/MID 2011).

Marble and limestone products have been next to gold in value. The Columbia marble beds northwest of the Project had a long history of production prior to 1941, and two plants are processing the stone from these deposits (TID/MID 2011).

California leads the nation in aggregate production and virtually all of it is removed from alluvial deposits (Kondolf 1995). As of 1994, sand and gravel mining exceeded the economic importance of gold mining in the state. 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. Off-channel aggregate mining along the Tuolumne River has also been extensive. Aggregate in Stanislaus County is currently classified as Aggregate Resources (potentially useable aggregate that may be mined in the future but for which no mining permit has been granted) and Aggregate Reserves (aggregate resources for which mining and processing permits have been granted) (Higgins and Dupras 1993 as cited in TID/MID 2011). An estimated 540 million tons (338 million cubic yards) of Aggregate Resources are located in six different geographic areas of Stanislaus County (Higgins and Dupras 1993 as cited in TID/MID 2011).

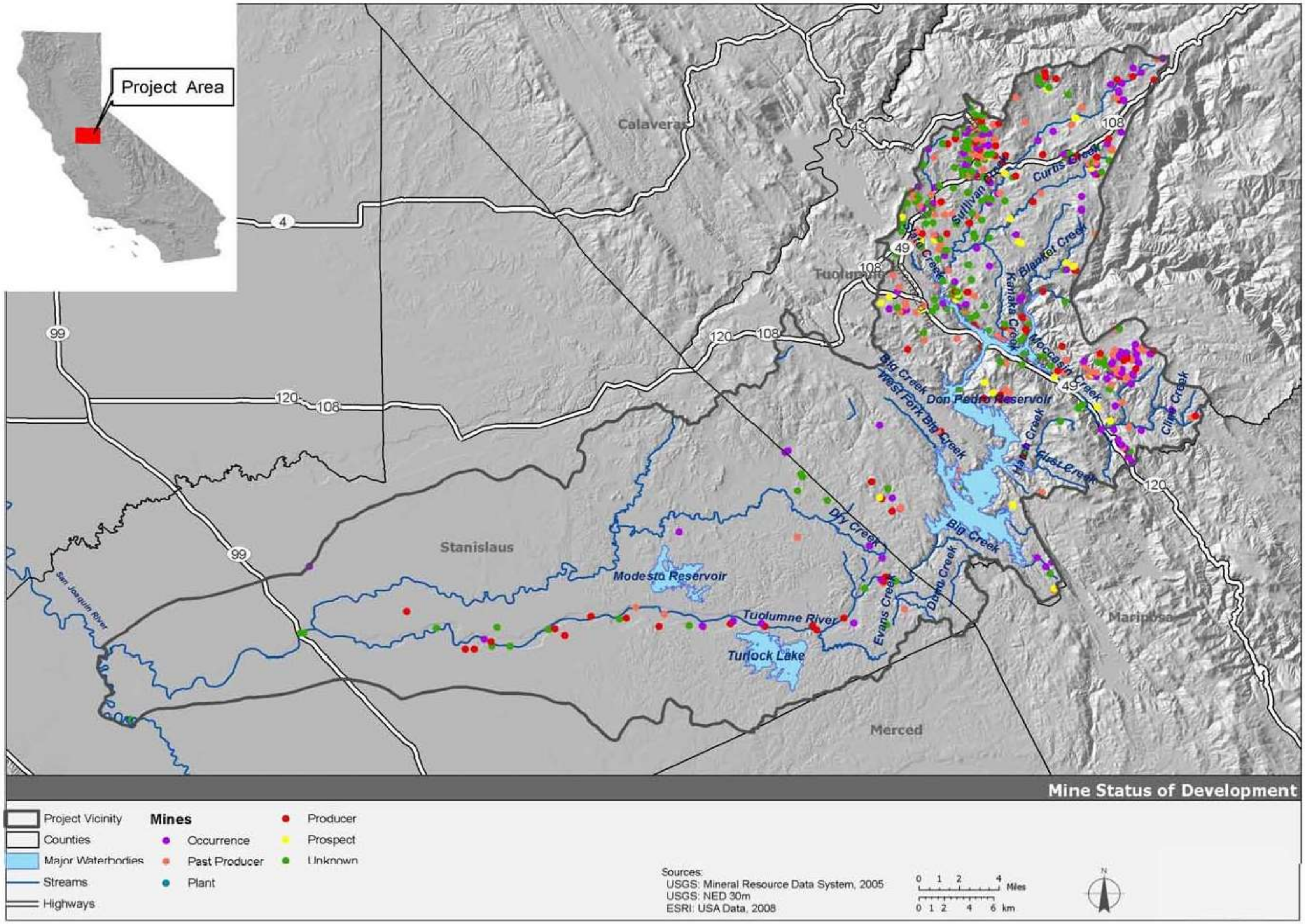

Figure 3.3-4. Past and present mines in the Tuolumne River basin.

3.3.5 Geomorphology

The Tuolumne River leaves a steep and confined bedrock valley and enters the eastern Central Valley downstream of LGDD near La Grange Regional Park, where hillslope gradients in the vicinity of the river corridor are typically less than five percent (TID/MID 2011). From the LGDD to the San Joaquin River, the Tuolumne River can be divided into two broad geomorphic reaches defined by channel slope and bed composition: a gravel-bedded reach that extends from LGDD (RM 52.1) to Geer Road Bridge (RM 24) and a sand-bedded reach that extends from Geer Road Bridge to the confluence with the San Joaquin River (McBain & Trush 2000 as cited in TID/MID 2011). The gravel-bedded and sand-bedded zones have been further subdivided into seven reaches based on present and historical land uses, the extent and influence of urbanization, valley confinement from natural and anthropogenic causes, channel substrate and slope, and salmonid use (McBain & Trush 2000 as cited in TID/MID 2011).

Past surveys of the channel downstream of LGDD indicate channel downcutting, widening, armoring, and depletion of sediment storage features (e.g., lateral bars and riffles) due to sediment trapping in upstream reservoirs, mining, and other land use changes (CDWR 1994; McBain & Trush 2004 as cited in TID/MID 2011). Bedload impedance reaches, defined as locations where current hydraulic conditions are insufficient to transport coarse bed material (>4 millimeters [mm]) through the reach, were identified from LGDD to the confluence of the San Joaquin River (McBain & Trush 2000 as cited in TID/MID 2011). These reaches are associated with long scour pools and former instream aggregate extraction and gold dredger pits (TID/MID 2011).

The coarse sediment budget developed through sediment transport modeling and analysis of changes in bed topography (TID/MID 2013) confirm that without gravel augmentation, the channel in the first 12.4 miles of the Tuolumne River downstream of LGDD would slowly lose substrate in response to a reduction in coarse sediment supply caused by sediment trapping in upstream reservoirs. Between 2005 and 2012, approximately 5,913–8,720 tons of coarse (>2 mm) bed material were lost from storage in the lower river between RM 45.8 and 52.1 (TID/MID 2013). The total estimated volume lost from storage in the reach between RM 45.8 and 52.1 is comparable in magnitude to the quantity of coarse sediment added during any one of the augmentation projects (approximately 7,000 to 14,000 tons) that have occurred since 2002 (TID/MID 2013).

Differencing of channel topography surveyed in 2005 and 2012 shows that little change in storage occurred during this period at the reach scale, but high-flow events in water year (WY) 2006 and WY 2011 locally scoured the bed and redistributed coarse and fine sediment deposits (TID/MID 2013).

3.3.6 Potential Resource Effects

FERC's SD2 identifies the following potential resource issues associated with geologic, geomorphic, and soil resources:

- Effects of project operation on erosion and sedimentation in the Tuolumne River downstream of LGDD.
- Effects of project O&M on shoreline erosion at La Grange reservoir.

- Effects of project O&M on upland erosion, including erosion caused by runoff from project-related roads and trails.
- Effects of project operation, including operation of spillways and dam outlet facilities, on erosion and sedimentation.
- Effects of project structures on landslides and erosion rates.

The Districts are currently evaluating the above issues and will discuss potential effects to geologic, geomorphic, and soil resources in the FLA.

3.4 Water Resources

3.4.1 Water Resource Studies

An extensive environmental resources study program was completed to support the ongoing relicensing of the Don Pedro Hydroelectric Project (FERC No. 2299) (TID/MID 2014a). Some of these studies addressed water resources associated with the Don Pedro Reservoir outflow to the La Grange headpond, and in some cases the lower Tuolumne River. As a result, they provide information relevant to characterizing the affected environment for the La Grange Hydroelectric Project (listed below).

- The Water Quality Assessment Study (TID/MID 2013a) was conducted to characterize existing water quality conditions within Don Pedro Reservoir, at the Don Pedro Project discharge, and just downstream of LGDD. Data are evaluated to assess the consistency of existing water quality conditions with the CVRWQCB's Basin Plan Objectives (CVRWQCB 1998).
- Don Pedro Project Operations/Water Balance Model Study (TID/MID 2013b) was developed to simulate operations and their effects on water supplies. The geographic scope of the model is from Hetch Hetchy Dam to the confluence of the Tuolumne River with the San Joaquin River.
- The Reservoir Temperature Model (TID/MID 2013c) simulates and characterizes the seasonal water temperature dynamics in Don Pedro Reservoir under current and alternative future conditions from the tailwater of Don Pedro powerhouse (which discharges into La Grange headpond) to about 20 ft above the Don Pedro Reservoir normal maximum water surface elevation of 830 ft.
- Lower Tuolumne River Temperature Model (TID/MID 2013d) simulates water temperature in the lower Tuolumne River from below Don Pedro Dam (RM 54.8) to the confluence with the San Joaquin River (RM 0) under existing conditions and under alternative Don Pedro Project operations scenarios. The Districts conducted a supplemental study entitled In-River Diurnal Temperature Variation Study, to investigate the occurrence of changes in diurnal temperature variation.

In addition to water quality investigations performed as part of licensing studies for the La Grange and Don Pedro hydroelectric projects, there are the following sources of water quality information for the Tuolumne River basin:

- EPA Storage and Retrieval (STORET) data and reports,
- United States Geological Survey (USGS) Water Resources Data Reports and data collected for the National Water Quality Assessment Program,
- CVRWQCB reports prepared for the Surface Water Ambient Monitoring Program, and
- California Department of Water Resources (CDWR) data.

3.4.2 Water Quantity

3.4.2.1 Drainage Area

The Tuolumne River can be divided into three subbasins: the upper Tuolumne River, the Don Pedro Project area, and the lower Tuolumne River. The La Grange Project occupies the most upstream section of the lower Tuolumne River, below Don Pedro Dam. Table 3.4-1 provides the approximate drainage areas and lengths of reaches in these subbasins.

Table 3.4-1. Approximate drainage areas and lengths of Tuolumne River subbasins.

Subbasin	Length of Reach (miles)	Drainage Area (mi^2)	Total Upstream Drainage Area (mi^2)
Upper Tuolumne River	60	1,300	1,300
Don Pedro Project Area	28	230	1,530
Lower Tuolumne River	51	410	1,940
Total	139	1,940	NA

The upper Tuolumne River includes the Hetch Hetchy Reservoir watershed (459 mi^2) and the Cherry Lake/Lake Eleanor Reservoir (Cherry/Eleanor) watershed (193 mi^2). Hetch Hetchy Reservoir has a normal pool elevation of about 3,800 ft, Cherry Lake has a normal pool elevation of 4,700 ft, and Lake Eleanor has a normal pool elevation of 4,657 ft. Don Pedro Reservoir has a normal maximum water surface elevation of 830 ft, and the surface elevation of the La Grange headpond varies between about 294 ft and 296 ft (TID/MID 2014b).

3.4.2.2 Climate

The climate and hydrology of the Tuolumne River basin varies considerably over the river's length. Annual precipitation above 10,000 ft exceeds 60 inches per year, occurring mostly as snow, whereas less than 100 miles away in the Central Valley, the annual precipitation is less than 12 inches. In addition to the geographic variation in precipitation, the seasonal and annual variations are also extreme. In the lower reaches of the river, the average precipitation from May through September, inclusive, is less than 1 inch. Year-to-year variation is also dramatic. During the period of WY 1971–2012, the lowest estimated unimpaired flow at the La Grange gage was 0.38 million (WY 1977) compared to a high of 4.6 million AF (WY 1983), i.e., an inter-annual range that varies by a factor of 12. Another characteristic of the basin's hydrology is that dry and wet years often come in consecutive, multi-year sequences. The third driest year in the WY 1971–2012 period was WY 1976 (672,000 AF), the year before the driest year of WY 1977, and the third wettest year was WY 1982 (3.8 million AF), the year before the wettest year of WY 1983.

Temperature and precipitation statistics for the Tuolumne River basin are provided in Table 3.4-2, and evapotranspiration rates at Modesto are shown in Figure 3.4-1. About 88 percent of the annual precipitation occurs from November through April. Precipitation usually occurs as rain at elevations below 4,000 ft and as snow at higher elevations. Snow cover below 5,000 ft is generally transient and may accumulate and melt several times during a winter season. Normally snow accumulates at higher elevations until about April 1, when the melt rate begins to exceed snowfall. The statistics in Table 3.4-2 also demonstrate why agriculture in the Central Valley is dependent upon irrigation.

Table 3.4-2. Monthly climatological data for the Tuolumne River watershed.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Downstream of Don Pedro Project MODESTO, CALIFORNIA (WRCC Station No. 045738) Period of Record : 1/ 1/1931 to 12/31/2005, Approx. Elevation: 90 ft												
Avg. High (°F)	54°	61°	67°	73°	81°	88°	94°	92°	88°	78°	64°	54°
Avg. Low (°F)	38°	41°	44°	47°	52°	56°	60°	59°	56°	50°	42°	38°
Mean (°F)	46°	51°	55°	60°	66°	72°	77°	75°	72°	64°	53°	46°
Avg. Rainfall (in)	2.4	2.1	2.0	1.1	0.5	0.1	0	0	0.2	0.6	1.3	2.1
Avg. snowfall (in)	0	0	0	0	0	0	0	0	0	0	0	0
Near Don Pedro Project Boundary SONORA Ranger Station, CALIFORNIA (WRCC Station No. 048353) Period of Record : 1/11/1931 to 12/31/2005, Approx. Elevation: 1,750 ft												
Avg. High (°F)	55°	58°	62°	68°	77°	87°	95°	94°	88°	77°	64°	56°
Avg. Low (°F)	33°	35°	38°	41°	47°	52°	58°	57°	53°	45°	37°	33°
Mean (°F)	44°	47°	50°	55°	62°	69°	77°	75°	70°	61°	51°	45°
Avg. Precipitation (in)	6.1	5.7	4.8	2.7	1.2	0.3	0.1	0.1	0.5	1.7	3.6	5.5
Avg. Snowfall (in)	1.6	0.8	0.4	0.2	0	0	0	0	0	0	0	0.5
Upper Tuolumne River Basin HETCH HETCHY, CALIFORNIA (WRCC Station No. 043939) Period of Record : 1/ 7/1931 to 12/31/2005, Approx. Elevation: 3,780 ft												
Avg. High (°F)	48°	52°	57°	63°	70°	78°	86°	86°	81°	71°	58°	49°
Avg. Low (°F)	29°	30°	33°	37°	43°	50°	56°	55°	51°	42°	34°	30°
Mean (°F)	38°	41°	45°	50°	57°	64°	71°	71°	66°	57°	46°	39°
Avg. Precipitation (in)	6.0	5.7	5.2	3.3	1.9	0.8	0.2	0.2	0.7	2.0	4.2	5.9
Avg. Snowfall (in)	15.2	12.9	14.7	6.3	0.3	0	0	0	0	0.1	2.7	11.7
High-Sierra Nevada Climate (north of Tuolumne River watershed) TWIN LAKES, CALIFORNIA (WRCC Station No. 049105) Period of Record : 7/ 1/1948 to 8/31/2000, Approx. Elevation: 8,000 ft												
Avg. High (°F)	38°	40°	41°	47°	54°	63°	71°	70°	65°	56°	45°	39°
Avg. Low (°F)	16°	16°	18°	22°	29°	36°	43°	42°	39°	31°	23°	18°
Mean (°F)	27°	28°	30°	34°	42°	49°	57°	56°	52°	44°	34°	29°
Avg. Precipitation (in)	9.0	7.3	6.7	3.9	2.5	1.1	0.7	0.7	1.2	2.6	6.1	7.8
Avg. Snowfall (in)	79.5	73.3	75.9	36.6	14.5	2.3	0	0.2	1.1	10.3	40.9	66.4

Source: Western Regional Climate Center 2006 - http://www.wrcc.dri.edu/summary/climsmnca.html.

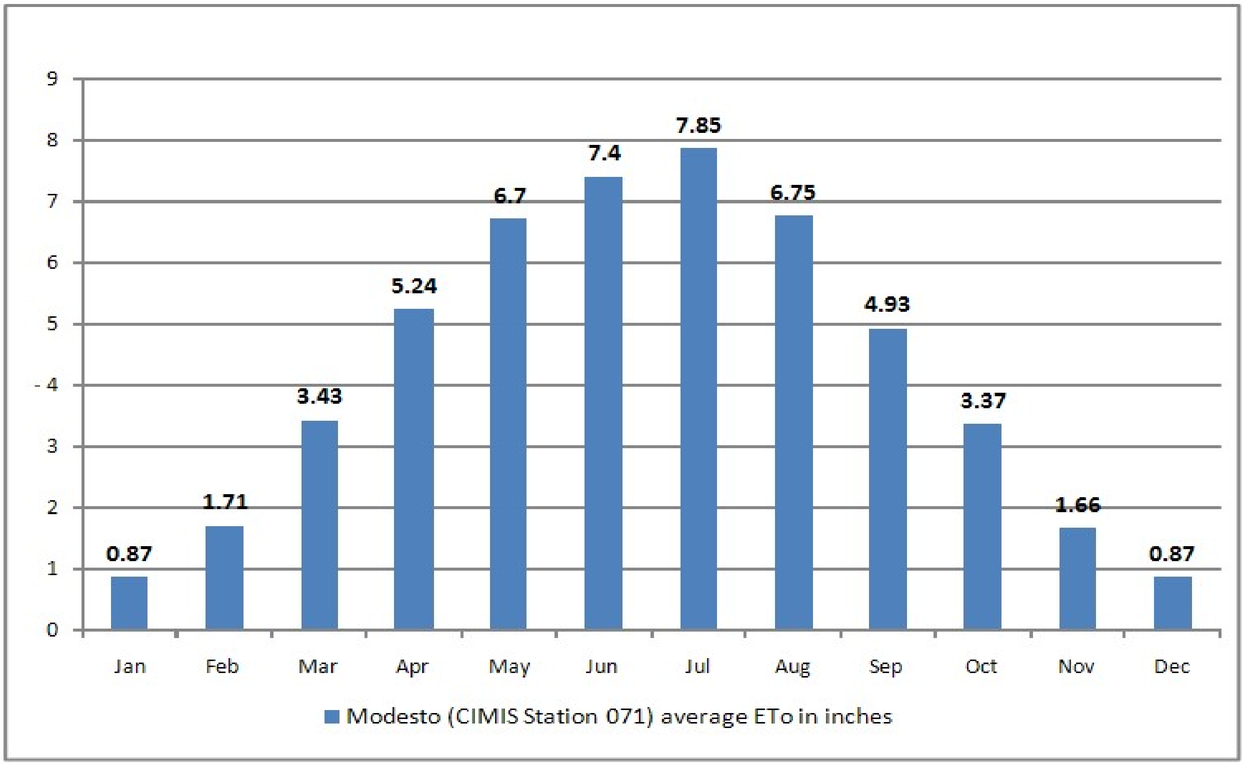

Figure 3.4-1. Modesto monthly average evapotranspiration rates (ETo in inches), June 1987 to 2013. Source: CDWR 2013.

3.4.2.3 General Description of Basin Hydrology

The hydrologic characteristics of the Tuolumne River and its tributaries vary significantly from headwater areas to the river's terminus at the San Joaquin River. Above about 5,000 ft, the Tuolumne River and its tributaries are snowmelt-dominated. Smaller streams in this area may have extremely low summer flows, although groundwater and interflow may continue to provide small amounts of late summer water. Approximately 75 percent of the runoff in these areas occurs between April and July, with 20 percent or less occurring from December through March, and as little as 5 percent occurring from August through November (ACOE 1972).

In the middle elevations, more precipitation occurs as rainfall, and there can be multiple rain-on-snow periods each year. As noted previously, several reservoirs are located upstream of the Don Pedro Project, from 3,000 to 5,000 ft elevation. Much of the runoff in these elevations occurs from December through March during winter rains, with much of the remaining runoff occurring from April through July (ACOE 1972).

The Tuolumne River derives much of its flow from snowmelt. Using estimates of natural flow, Don Pedro reservoir and La Grange headpond would normally receive about 88 percent of their inflow from January through July. However, because of upstream regulation, the pattern of inflow does not reflect a typical snow-melt driven hydrograph. Some low-elevation unregulated, rain-driven tributaries flow directly into the reservoirs, but these streams provide only a small fraction of the annual flow. The average annual flow of the Tuolumne River at Don Pedro Reservoir is approximately 1.7 million AF. Flood flows in the Don Pedro Project area can be the result of heavy rains, rain-on-snow (mainly in winter and early spring), and/or snowmelt-floods (mostly in spring through early summer). To protect downstream entities from flooding, the ACOE Flood Control Manual for the Don Pedro Project requires the maintenance of a flood envelope of 340,000 AF from October 7 through April 27 and conditional flood space thereafter depending on the anticipated snowmelt runoff during April, May, and June (ACOE 1972).

Water flows from the Don Pedro powerhouse or outlet works tunnel into the Tuolumne River and then into the impoundment formed by LGDD, the La Grange headpond. Downstream of LGDD, the Tuolumne River becomes a meandering stream, with an average gradient of about 2 ft/mile, in contrast to the upper Tuolumne where gradients can exceed 100 ft/mile. In the lower Tuolumne River valley, around 75 percent of the annual runoff occurs during rainstorms between December and March (ACOE 1972). Some flow in this area is derived from groundwater, but the groundwater contribution has not been well quantified

Hydrology Upstream of Don Pedro Reservoir

There are a number of streamflow gages on the upper Tuolumne River, either presently maintained or historical, which provide data that characterize hydrologic conditions upstream of the Don Pedro and La Grange reservoirs (Table 3.4-3). In particular, there are four locations of streamflow measurement below the last points of regulation on the mainstem Tuolumne or its larger tributaries upstream of the Don Pedro Project Boundary. The sum of these four gages constitutes the flow from the majority of the Tuolumne River watershed. Approximately 875 mi^2 of the 1,300 mi^2 of the watershed upstream of Don Pedro Reservoir is accounted for by these four gages: Tuolumne River below Early Intake near Mather, Cherry Creek below Dion R. Holm Powerhouse, South Fork Tuolumne River near Oakland Recreation Camp, and Middle Tuolumne River at Oakland Recreation Camp. Some regulation by smaller reservoirs occurs on Sullivan Creek and Big Creek (USGS 2008), but the regulation of Cherry and Eleanor creeks and the upper mainstem Tuolumne River constitutes the majority of regulation on the upper Tuolumne River.

Table 3.4-3. Flow and gages in the Tuolumne River watershed.[1]

Gage Number	Gage Name	Period of Record[2]	Notes
Relevant Streamflow Gages Upstream of Don Pedro Reservoir			
11276500	Tuolumne River Near Hetch Hetchy CA	10/1/1910-present	Located downstream of CCSF's Hetch Hetchy Reservoir. Period of record spans period of construction of O'Shaughnessy Dam
11276900	Tuolumne River Below Early Intake Near Mather CA	10/1/1966-present	Downstream of Hetch Hetchy and Kirkwood Powerhouse
11278400	Cherry Creek Below Dion R. Holm PH, Near Mather CA	4/1/1963-present	--
11281000	South Fork Tuolumne River Near Oakland Recreation Camp CA	4/1/1923-9/30/2002; 1/27/2009-present	Gage re-installed in 2006 by CCSF HHWP, but data after 2002 are not reported on USGS. Recent data available through CDEC
11282000	Middle Tuolumne River At Oakland Recreation Camp CA	10/1/1916-9/30/2002; 1/28/2009-present	Gage re-installed in 2009 by CCSF HHWP, but data after 2002 are not reported on USGS. Recent data available through CDEC

Gage Number	Gage Name	Period of Record[2]	Notes
Don Pedro Reservoir Gage			
11287500	Don Pedro Reservoir Near La Grange CA	1923-present	The period 1923-1970 reflects original Don Pedro Reservoir storage (max. 290,400 AF)
Relevant Streamflow Gages Downstream of Don Pedro Reservoir			
11289650	Tuolumne River Below LGDD Near La Grange CA	12/1/1970-present	Flow and temperature (from 11/10/1970)
11289000	Modesto Canal Near La Grange CA	12/1/1970-present	--
11289500	Turlock Canal Near La Grange CA	12/1/1970-present	--
11289651	Combined Flow Tuolumne River, Modesto Canal + Turlock Canal CA	10/1/1970-present	--
11290000	Tuolumne River At Modesto CA	present	Location of 9,000 cfs restriction

[1] All gage information is taken from the USGS National Water Information System (NWIS), and data from these locations is available to the public at: http://waterdata.usgs.gov.
[2] Note that some gages, particularly those with long-term records, may have missing data.

Tuolumne River below Early Intake, Near Mather, California (USGS Gage No. 11276900)

This location represents the flow in the mainstem Tuolumne River below Hetch Hetchy Reservoir plus discharges from Robert C. Kirkwood Powerhouse that are not diverted to CCSF's Mountain Tunnel (Table 3.4-4).

Table 3.4-4. Mean monthly flows for the 1975-2012 period for the Tuolumne River below Early Intake (RM 105.5).

Month	Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)
Jan	264	31	2917
Feb	314	35	1039
Mar	436	38	1145
Apr	597	34	1694
May	1619	52	4028
Jun	2077	37	6260
Jul	1006	30	5530
Aug	227	31	1726
Sep	114	29	370
Oct	77	30	247
Nov	95	35	313
Dec	168	29	1169

Source: USGS 11276900.

Cherry Creek below Dion R. Holm Powerhouse, Near Mather, California (USGS Gage No. 11278400)

This gage is located immediately downstream of the Dion R. Holm Powerhouse, about 600 ft upstream of the confluence of Cherry Creek with the Tuolumne River and represents nearly the full regulated flow of Cherry Creek (Table 3.4-5). Cherry Creek and its tributary, Eleanor Creek, both have regulating reservoirs upstream of this point. Cherry Creek enters the Tuolumne River at RM 104.

Table 3.4-5. Mean monthly flows for the 1975-2012 period for Cherry Creek below Dion R. Holm powerhouse.

Month	Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)
Jan	610	4	3266
Feb	703	4	1528
Mar	834	4	1497
Apr	1008	3	2199
May	1321	3	3768
Jun	1257	4	3728
Jul	746	11	2643
Aug	467	26	1161
Sep	380	20	898
Oct	341	13	962
Nov	365	15	1445
Dec	473	6	1394

Source: USGS 11278400.

South Fork Tuolumne River near Oakland Recreation Camp, CA (USGS Gage No. 11281000)

Historical data are available at this USGS gage for the period of 1923–2002 (Table 3.4-6). Measurement at this gage was discontinued at the end of September 2002, but the gage was reinstalled by CCSF in 2006. Data are now reported on the California Data Exchange Center website. There are no known diversions in the South Fork Tuolumne River watershed. The South Fork enters the Tuolumne River at RM 97.5.

Table 3.4-6. Mean monthly flows for the 1975-2012 period for South Fork Tuolumne River near Oakland Recreation Camp.

Month	Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)
Jan	98	8	429
Feb	164	9	725
Mar	207	11	750
Apr	222	16	730
May	246	26	654
Jun	143	13	656
Jul	44	3	242
Aug	14	0	58
Sep	11	1	39
Oct	14	2	51
Nov	32	6	211
Dec	52	6	416

Source: USGS 11281000; CCSF HHWP.

Middle Fork Tuolumne River at Oakland Recreation Camp, CA (USGS Gage No. 11282000)

Historical data are available at this USGS gage for the period of 1923–2002 (Table 3.4-7). Measurement at this gage was discontinued at the end of September 2002, but the gage was reinstalled by CCSF in 2006. Data are now reported on the California Data Exchange Center website. There are no known diversions on the Middle Fork Tuolumne River.

Table 3.4-7. Mean monthly flows for the 1975-2012 period for Middle Fork Tuolumne River at Oakland Recreation Camp.

Month	Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)
Jan	51	2	218
Feb	87	4	345
Mar	115	5	354
Apr	170	17	476
May	285	24	598
Jun	205	11	875
Jul	57	1	361
Aug	10	0	61
Sep	6	0	27
Oct	7	0	37
Nov	18	2	138
Dec	27	2	234

Source: USGS 11282000; CCSF HHWP.

Hydrology of the Lower Tuolumne River

Water releases from Don Pedro Reservoir that pass through the La Grange headpond and subsequently passed to the lower Tuolumne River are provided to benefit fish and aquatic resources in the lower Tuolumne River, as required by the current Don Pedro Project license. Flows in the lower Tuolumne River below LGDD are reported at three USGS gages: 11289650, 11289000, and 11289500 (Table 3.4-8). The data are combined to estimate total flow releases from the Don Pedro Project (Table 3.4-9). Records for these locations are available from the USGS NWIS website for October 1, 1970 to September 30, 2016. The mean annual flow at this location since completion of filling Don Pedro Reservoir is 2,300 cfs (WY 1975-2012). Mean monthly flows for the Tuolumne River at Modesto, below Dry Creek (WY 1975-2012) are shown in Table 3.4-10.

3.4.2.4 State Designated Beneficial Uses

Beneficial use designations for the Tuolumne River are established by the CVRWQCB through the issuance of the Water Quality Control Plan (Basin Plan) (CVRWQCB 1998). The La Grange Project lies within Basin Plan unit (HU) 535, which includes the Tuolumne River from Don Pedro Dam to the San Joaquin River. Table 3.4-11 lists the designated beneficial uses for HU 535. As provided in the Basin Plan, existing beneficial uses of the lower Tuolumne River from Don Pedro Dam to the San Joaquin River (HU 535) water include: (1) agricultural supply, (2) water contact recreation, (3) non-water contact recreation, (4) warm freshwater habitat, (5) cold freshwater habitat, (6) migration of aquatic organisms, (7) spawning, and (8) wildlife habitat. Municipal and domestic supply is a designated potential beneficial use.

3.4.3 Water Quality

3.4.3.1 Water Quality Objectives for the Lower Tuolumne River

The Lower Tuolumne River comprises the Tuolumne River subarea delineated by the Basin Plan (CVRWQCB 1998). The Tuolumne River subarea extends downstream from the Stanislaus-Tuolumne county line and upstream of the Shiloh Road Bridge. The CVRWQCB has adopted water quality objectives for the Tuolumne River subarea to protect beneficial uses (Table 3.4-12). The objectives are primarily narrative, incorporating California's numeric Title 22 drinking water standards by reference, although some (i.e., bacteria, dissolved oxygen [DO], pH, temperature, and turbidity), are numeric.

Two of the Basin Plan water quality objectives, temperature and turbidity, include, at least in part, a criterion limiting changes to receiving water. The temperature objective states that "natural receiving waters" should not be warmed by more than 5°F (approximately 2.8°C), and the turbidity objective provides restrictions for percentage increases in turbidity. The turbidity standard cannot be evaluated based on directly applicable information, because no information exists to characterize the natural receiving water turbidity levels.

However, simulation modeling can be used to estimate natural receiving water temperatures with reasonable certainty. With respect to the temperature regime of the natural receiving water of the Tuolumne River, the Districts have developed an estimate of the unimpaired flow and temperature regime of the Tuolumne River from above Hetch Hetchy Reservoir to its confluence with the San Joaquin River.

Table 3.4-8. Mean monthly outflows in the lower Tuolumne River (cfs) 1997-2012.

Month	Monthly mean flow (cfs)[1]																Mean monthly flow (cfs)	Mean monthly flow (cfs)	Lowest mean monthly flow (cfs)
	1997[2]	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
USGS 11289650 - Tuolumne River Below LGDD Near La Grange, CA (cfs)																			
Jan	13,070	2,114	1,247	324	325	177	184	223	187	4,456	353	171	165	232	4,096	342	1,729	13,070***	165
Feb	8,116	6,168	4,903	2,284	1,273	172	185	220	1,823	2,373	358	173	168	225	3,176	340	1,997	8,116***	168
Mar	2,443	5,407	3,285	4,602	615	165	182	1,098	3,875	4,234	357	172	169	284	5,142	323	2,022	5,407	165
Apr	1,457	5,392	2,034	1,548	558	665	685	1,010	4,524	7,436	487	533	372	1,342	7,400	271	2,232	7,436	271
May	953	3,621	1,697	1,164	706	419	477	412	4,868	7,847	385	680	687	2,706	3,396	798	1,926	7,847	385
Jun	269	4,433	284	340	54	97	234	127	3,809	4,657	127	95	149	2,555	5,027	134	1,399	5,027	54
Jul	290	2,845	287	421	89	88	243	108	1,913	834	114	93	107	813	2,132	107	655	2,845	88
Aug	287	1,019	259	603	110	86	236	106	773	584	110	99	102	316	2,498	104	467	2,498	86
Sep	285	1,423	294	473	112	68	250	110	328	412	89	97	106	308	1,197	102	365	1,423	68
Oct	465	628	424	412	189	202	297	209	464	449	141	174	385	491	491	In WY 2013	367	628	141
Nov	380	316	338	347	184	191	231	186	369	379	174	161	255	399	366		292	399	161
Dec	330	1,321	336	334	177	187	226	178	1,285	352	169	164	256	4,152	366		904	4,625	164
USGS 11289000 - Modesto Canal Near La Grange, CA (cfs)																			
Jan	6	117	66	237	72	40	76	87	83	143	9	27	31	16	34	358	88	358	6
Feb	168	56	47	72	142	67	58	44	204	135	113	45	29	11	93	69	84	204	11
Mar	642	121	301	231	213	434	328	355	260	142	348	346	219	253	96	340	289	642	96
Apr	601	250	630	586	607	720	325	720	450	249	483	575	474	337	453	275	483	720	249
May	872	310	697	659	773	724	605	653	665	716	682	656	573	533	674	736	658	872	310
Jun	701	655	769	733	802	791	801	751	695	802	763	646	716	769	708	767	742	802	646
Jul	962	787	781	915	905	891	894	825	1,043	846	803	748	791	704	761	869	845	1,043	704
Aug	813	869	927	878	767	707	825	704	827	824	781	793	721	754	858	764	801	927	704
Sep	550	482	566	474	567	583	525	461	604	594	411	506	474	482	589	453	520	604	411
Oct	347	344	334	293	387	358	380	270	299	304	321	301	266	271	233	In WY 2013	314	387	233
Nov	78	73	195	44	36	105	172	84	141	173	162	100	112	184	169		122	195	36
Dec	26	86	72	75	72	58	13	43	126	8	9	18	2	0	0		40	126	0
USGS 11289500 - Turlock Canal Near La Grange, CA (cfs)																			
Jan	387	69	506	0	91	27	6	25	316	299	164	4	82	108	301	581	185	581	0
Feb	599	326	313	0	8	6	323	302	339	529	257	101	151	180	190	202	239	599	0
Mar	1,457	454	623	603	595	1,023	637	1,035	872	644	1,113	1,132	601	601	581	477	778	1,457	454
Apr	1,222	699	1,304	1,135	1,110	1,249	771	1,272	1,184	529	1,082	866	1,013	712	1,070	623	990	1,304	529
May	1,710	800	1,321	1,246	1,455	1,121	1,073	1,336	1,256	1,339	1,166	1,136	1,021	1,171	1,145	1,248	1,222	1,710	800

Month	Monthly mean flow (cfs)[1]																Mean monthly flow (cfs)	Mean monthly flow (cfs)	Lowest mean monthly flow (cfs)
	1997[2]	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012			
Jun	1,445	1,243	1,525	1,725	1,664	1,483	1,639	1,552	1,504	1,624	1,599	1,310	1,525	1,569	1,398	1,425	1,514	1,725	1,243
Jul	2,081	1,817	1,938	1,898	1,805	1,817	1,883	1,840	1,917	2,000	1,816	1,572	1,899	1,846	1,845	1,788	1,860	2,081	1,572
Aug	1,587	1,681	1,796	1,784	1,526	1,489	1,516	1,510	1,706	1,674	1,494	1,314	1,482	1,656	1,718	1,510	1,597	1,796	1,314
Sep	812	977	952	1,063	825	736	714	617	991	936	631	571	793	1,097	1,069	953	847	1,097	571
Oct	505	613	566	527	445	358	742	577	259	379	305	129	180	430	533	In WY 2013	442	742	129
Nov	30	0	59	24	4	22	1	1	3	8	35	2	27	279	95		37	279	0
Dec	109	0	301	173	12	94	36	12	27	1	45	149	20	600	29		102	600	0
USGS 11289651 - Combined Flow Tuolumne River + Modesto Canal + Turlock Canal (~ total Don Pedro Project outflow)[3] (cfs)																			
Jan	13,630	2,301	1,818	561	489	244	266	335	585	4,897	525	203	278	355	4,430	1,282	2,012	13,630	203
Feb	8,885	6,551	5,262	2,355	1,424	245	565	566	2,365	3,038	728	320	348	415	3,458	611	2,321	8,885	245
Mar	4,544	5,983	4,210	5,435	1,423	1,622	1,146	2,487	5,005	5,020	1,818	1,651	989	1,139	5,818	1,142	3,090	5,983	989
Apr	3,280	6,341	3,968	3,269	2,276	2,634	1,781	3,001	6,158	8,211	2,052	1,973	1,860	2,392	8,922	1,168	3,705	8,922	1,168
May	3,535	4,732	3,714	3,067	2,935	2,263	2,155	2,402	6,790	9,902	2,234	2,472	2,280	4,408	5,216	2,783	3,806	9,902	2,155
Jun	2,415	6,332	2,579	2,796	2,519	2,371	2,672	2,430	6,009	7,083	2,488	2,049	2,391	4,894	7,134	2,328	3,656	7,134	2,049
Jul	3,333	5,448	3,006	3,234	2,798	2,795	3,021	2,772	4,872	3,678	2,732	2,414	2,798	3,363	4,738	2,766	3,361	5,448	2,414
Aug	2,687	3,569	2,982	3,264	2,403	2,281	2,578	2,319	3,305	3,082	2,385	2,205	2,304	2,725	5,074	2,377	2,846	5,074	2,205
Sep	1,647	2,882	1,812	2,009	1,504	1,386	1,489	1,188	1,922	1,942	1,130	1,175	1,371	1,888	2,855	1,509	1,732	2,882	1,130
Oct	1,318	1,584	1,324	1,231	1,021	917	1,419	1,055	1,021	1,133	766	604	832	1,193	1,258	In WY 2013	1,141	1,587	604
Nov	489	389	592	415	224	318	404	270	513	559	371	263	394	862	630		443	862	224
Dec	466	1,407	709	582	261	339	275	233	1,437	361	223	330	277	4,752	394		1,043	4,752	223

[1] Values Calculated using USGS NWIS monthly statistics module: http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289650&agency_cd=USGS, http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289000&agency_cd=USGS, http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289500&agency_cd=USGS, and http://waterdata.usgs.gov/nwis/nwisman/?site_no=11289651&agency_cd=USGS

[2] The flood of record occurred in January, 1997, with high reservoir releases continuing on into February, 1997. These values skew the January and February mean monthly flow averages for the 1997 to 2012 period. Without 1997 values, the mean monthly flow in January is 973 cfs and February is 1,589, compared to 1,729 and 1,997 cfs, respectively.

[3] Some values rounded by USGS - sum of individual gage monthly mean flows might not precisely equal combined gage monthly mean flows.

Table 3.4-9. Mean monthly flows for the 1975-2012 period for lower Tuolumne River in the vicinity of LGDD.

Month	Below LGDD (cfs)	Modesto Canal near La Grange (cfs)	Turlock Canal near La Grange (cfs)	Don Pedro Project Release (cfs)
Jan	1491	74	140	1705
Feb	1812	66	183	2061
Mar	1952	267	604	2823
Apr	1962	543	1069	3574
May	1790	660	1211	3661
Jun	1034	786	1474	3294
Jul	537	878	1798	3213
Aug	327	782	1568	2677
Sep	481	513	786	1780
Oct	618	288	400	1306
Nov	348	174	196	718
Dec	881	122	208	1211

Source: USGS 11289650, USGS 11289000, USGS 11289500, and USGS 11289651.

Table 3.4-10. Mean monthly flows for the 1975-2012 period for Tuolumne River at Modesto, below Dry Creek.

Month	Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)
Jan	1837	154	15500
Feb	2138	166	8782
Mar	2293	239	7658
Apr	2192	169	9268
May	1992	138	10420
Jun	1216	95	5683
Jul	716	79	4244
Aug	501	68	2415
Sep	680	73	4041
Oct	848	78	4760
Nov	647	93	2089
Dec	1129	110	5431

Source: USGS 11290000.

Table 3.4-11. Designated beneficial uses of the lower Tuolumne River from the Basin Plan.

Designated Beneficial Use Description from Basin Plan, Section II		Use	Designated Beneficial Use Don Pedro Dam to San Joaquin River (HU 535)
Municipal and Domestic Supply (MUN)	Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.	Municipal And Domestic Supply	Potential
Agricultural Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing.	Irrigation	Existing
		Stock Watering	Existing
Industrial Process Supply (PRO)	Uses of water for industrial activities that depend primarily on water quality.	Process	--

Designated Beneficial Use Description from Basin Plan, Section II		Use	Designated Beneficial Use Don Pedro Dam to San Joaquin River (HU 535)
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.	Service Supply	--
		Power	--
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.	Contact	Existing
		Canoeing and Rafting[1]	Existing
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but where there is generally no body contact with water, nor any likelihood of ingestion of water. These uses include, but are not limited to, picnicking, sunbathing, hiking, beach-combing, camping, boating, tide-pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.	Other Non-Contact	Existing
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	Warm[2]	Existing
Cold Freshwater Habitat (COLD)	Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.	Cold[2]	Existing
Migration of Aquatic Organisms (MGR)	Uses of water that supports habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.	Warm[3]	--
		Cold[4]	Existing
Spawning (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.	Warm[3]	Existing
		Cold[4]	Existing
Wildlife Habitat (WILD)	Uses of water that support terrestrial or wetland ecosystems including, but not limited to, preservation or enhancement of terrestrial habitats or wetlands, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, or invertebrates), or wildlife water and food sources.	Wildlife Habitat	Existing

[1] Applies to streams and rivers only.
[2] Resident does not include anadromous. Any hydrologic unit with both WARM and COLD beneficial use designations is considered a COLD water body by the State Water Resources Control Board for the application of water quality objectives.
[3] Warm water fish species include striped bass, sturgeon, and shad.
[4] Cold water fish species include salmon and steelhead.
Source: CVRWQCB 1998 and amendments (CVRWQCB Basin Plan revised April 2016).

Table 3.4-12. Water quality objectives to support beneficial uses in the vicinity of the La Grange Project as designated by the CVRWQCB and listed in the Basin Plan.

Water Quality Objective	Description
Bacteria	In terms of fecal coliform, less than a geometric average of 200/100 milliliter (ml) on five samples collected in any 30-day period and less than 400/100 ml on ten 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. Specific trace element levels are given for certain surface waters, none of which include the waters in the vicinity of the Don Pedro Project. Other limits for organic, inorganic and trace metals are provided for surface waters that are designated for domestic or municipal water supply. In addition, waters designated for municipal or domestic use must comply with portions of Title 22 of the California Code of Regulations. For protection of aquatic life, surface water in California must also comply with the California Toxics Rule (40 CFR Part 131).
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
Dissolved Oxygen (DO)	The DO concentrations shall not be reduced below the following minimum levels at any time. Waters designated WARM 5.0 milligram/liter (mg/L) Waters designated COLD 7.0 mg/L Waters designated SPWN 7.0 mg/L The Tuolumne River also has a water body specific DO objective (Table III-2). DO concentrations shall not be reduced below 8.0 mg/L from October 15 – June 15 from Waterford to La Grange.
Floating Material	Water shall not contain floating material in amounts that cause a nuisance or adversely affect beneficial uses.
Oil & Grease	Water shall not contain oils, greases, waxes or other material in concentrations that cause a nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
pH	The pH of surface waters will remain between 6.5 and 8.5, and cause changes of less than 0.5 in receiving water bodies.
Pesticides	Waters shall not contain pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses. Other limits established as well.
Radioactivity	Radionuclides shall not be present in concentrations that are harmful to human, plant, animal or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal or aquatic life.
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 the deposition of material that causes a nuisance or adversely affects beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.
Tastes 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 or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.

Water Quality Objective	Description
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the CVRWQCB that such alteration in temperature does not adversely affect beneficial uses. Increases in water temperatures must be less than 5 ºF above natural receiving-water temperature.
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 analyses of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the CVRWQCB.
Turbidity	In terms of changes in turbidity (nephelometric turbidity units [NTU]) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where 5 to 50 NTUs, increases shall not exceed 20 percent; where 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Source: CVRWQCB 1998 and amendments (CVRWQCB Basin Plan revised April 2016).

3.4.3.2 California List of Impaired Waters

Section 303(d) of the federal Clean Water Act (CWA) requires that every two years each state submit to the Environmental Protection Agency (EPA) a list of rivers, lakes, and reservoirs for which pollution control and/or requirements have failed to provide adequate water quality. The SWRCB and CVRWQCB work together to research and update the list for the State of California. Based on a review of this list, the surface water bodies identified by the SWRCB as CWA § 303(d) State Impaired in the vicinity of the La Grange Project are listed in Table 3.4-13 (SWRCB 2012). The § 303(d) list 2012 updates, approved by EPA in 2015, are unchanged from 2010. There are currently no approved TMDL plans for the Tuolumne River.

Table 3.4-13. 2012 CWA Section 303(d) list of water quality limited segments for the lower Tuolumne River.

Waterbody Segment	Pollutant/Stressor	Potential Sources
Lower Tuolumne River (Don Pedro Reservoir to San Joaquin River)	Chlorpyrifos	Agriculture
	Diazinon	Agriculture
	Group A Pesticides[1]	Agriculture
	Mercury	Resource Extraction
	Temperature	unknown
	Unknown Toxicity	unknown

[1] The Group A Pesticides consist of aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene (SWRCB 2012).

3.4.4 Potential Resource Effects

FERC's SD2 (page 19) identifies the following issues related to water resources:

- Effects of project operation on the quantity and timing of streamflow in the project-affected downstream reach, including water storage, peaking operations, and ramping rates.

- Effects of project O&M on water quality, water temperature, and water quantity in the project reservoir and the project-affected downstream reach.

The Districts are currently evaluating the above issues and will discuss potential effects to water resources in the FLA.

3.5 Aquatic Resources

3.5.1 Historical Distribution of Fishes in the San Joaquin Valley and Lower Tuolumne River

Historically, the San Joaquin River and its tributaries below an elevation of about 80 ft[6] consisted of warm sluggish channels, swamps, and sloughs (Moyle 2002). The native fish fauna of the Central Valley floor was composed primarily of species from the deep-bodied fish assemblage, such as Sacramento perch (*Archoplites interruptus*), tule perch (*Hysterocarpus traskii*), hitch (*Lavinia exilcauda*), Sacramento blackfish (*Orthodon microlepidotus*), and Sacramento splittail (*Pogonichthys macrolepidotus*). Large Sacramento pikeminnow (*Ptychocheilus grandis*) and Sacramento sucker (*Catostomus occidentalis*) were also abundant, migrating upstream to spawn in tributaries to the San Joaquin River, including the Tuolumne River. Anadromous fish passed through the river reaches of the Central Valley floor on their way upstream to spawn (Moyle 2002).

Central Valley foothill streams and rivers from 80 to 1,500 ft supported what is referred to as the pikeminnow-hardhead-sucker fish assemblage (Moyle 2002), which included Sacramento pikeminnow, Sacramento sucker, and hardhead (*Mylopharodon conocephalus*), among other species. The California roach assemblage, which overlapped in elevation with the pikeminnow-hardhead-sucker assemblage, included species that occurred in small, warm tributaries and larger streams that flowed through open foothill woodlands. Many of these streams were intermittent during summer and flood-prone during winter and spring.

Historically, three anadromous fish species are reported to have occurred in the Tuolumne River: fall- and spring-run Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and Pacific lamprey (*Entosphenus tridentatus*). Fall-run Chinook salmon spawning escapement to the Tuolumne River varied widely. Anadromous fish abundance in the lower Tuolumne River downstream of LGDD has been reduced by habitat degradation due to extensive instream and floodplain mining that began in the mid-1800s as well as other land uses. Dams and water diversions associated with mining had affected fish migration as early as 1852 (Snyder 1993 unpublished memorandum, as cited in Yoshiyama et al. 1996). Access to historical 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 LGDD, ranged from 16 – 30 ft high (USGS 1899), and was a barrier to upstream fish migration (Paterson 1987).

[6] All elevations are NGVD 29.

3.5.2 Fish Populations between Don Pedro Reservoir and LGDD

In 2012, as part of the relicensing of the Don Pedro Hydroelectric Project, the Districts conducted a study to characterize the fish assemblage in the 2.3-mile-long reach of the Tuolumne River between the Don Pedro Powerhouse (RM 54.5) and LGDD (RM 52.2) (TID/MID 2013a, W&AR-13). Reconnaissance surveys were conducted to evaluate habitat, and fish were sampled at sites selected to represent the availability of near-shore habitats. Boat electrofishing was conducted at each sampling site, with the duration of sampling recorded to ensure there was consistent effort among sites. Prior to this study, almost nothing was known about this reach, with all information based on a single sampling event that occurred in 2008 (Stillwater Sciences 2009). No known angler harvest or stocking data exist for this reach.

Two fish species were found in the study reach during 2012: rainbow trout and prickly sculpin (*Cottus asper*), both of which were distributed across the reach (TID/MID 2013a, W&AR-13). Relative abundance, length, and weight of fish collected in 2012 are shown in Table 3.5-1.

Table 3.5-1. Summary of relative abundance, length, and weight of fish species collected at all sites between Don Pedro Powerhouse and LGDD in 2012.

Species	Composition		Length (mm)			Weight (g)		
	N	Percent	Min	Max	Mean	Min	Max	Mean
Rainbow Trout (*O. mykiss*)	86	64.7	85	344	153.5	5.5	469.5	67.1
Prickly sculpin (*C. asper)*	47	35.3	48	110	80.1	1.3	106.1	14.8
Total	133	100						

The rainbow trout population in the reach exhibited four age classes, indicating that some reproduction occurs in the reach (as noted above, there are no records of stocking having been conducted in this reach). Rainbow trout were present in both lacustrine and riverine reaches, documenting that they use the range of available habitat (TID/MID 2013a, W&AR-13). Average condition (i.e., Kn = 0.99) and appearance of the rainbow trout collected in 2012 indicated that fish were healthy (TID/MID 2013a, W&AR-13).

The prickly sculpin population also exhibited multiple age classes, and the presence of young-of-the-year (YOY) fish indicates that reproduction is occurring in the reach (TID/MID 2013a, W&AR-13). Sculpin were most abundant in riverine habitats (i.e., upstream sampling sites). Overall, sculpin condition (i.e., Kn = 0.99) indicated that fish were healthy.

3.5.3 Fish and Aquatic Resources in the Lower Tuolumne River

The lower Tuolumne River extends approximately 52 miles from LGDD (RM 52.2) downstream to its confluence with the San Joaquin River (RM 0). The lower river can be divided into two broad geomorphic zones defined by channel slope and bed material. The upper zone (RM 24–52) is gravel-bedded with moderate slope (0.10–0.15 percent), whereas the lower zone (RM 0–24) is sand-bedded with a slope generally less than 0.03 percent (McBain & Trush 2000). The gravel-bedded and sand-bedded zones are subdivided into seven reaches based on present and historical land uses, valley confinement, channel substrate and slope, and salmonid use:

- Reach 1 (RM 0–10.5): Lower sand-bedded reach,

- Reach 2 (RM 10.5–19.3): Urban sand-bedded reach,
- Reach 3 (RM 19.3–24.0): Upper sand-bedded reach,
- Reach 4 (RM 24.0–34.2): In-channel gravel mining reach,
- Reach 5 (RM 34.2–40.3): Gravel mining reach,
- Reach 6 (RM 40.3–45.5): Dredger tailings reach, and
- Reach 7 (RM 45.5–52.1): Dominant salmon spawning reach.

The description of fish and aquatic resources in this DLA is based primarily on three sets of studies conducted by the Districts: (1) studies conducted prior to the relicensing of the Don Pedro Hydroelectric Project, (2) studies conducted as part of the Don Pedro relicensing, and (3) studies conducted as part of the licensing proceedings associated with the La Grange Hydroelectric Project.

3.5.3.1 Fish Studies Conducted in the Lower Tuolumne River

Fish Studies Conducted Prior to 2010

The Districts, in cooperation with state and federal resource agencies and environmental groups, conducted over 200 resource investigations between 1971 and 2010. The first 20 years of study led to the development of a FERC-mediated settlement agreement (in 1995) with resource agencies and NGOs, whereby the Districts agreed to modify Don Pedro Project operations to increase flows released to the lower Tuolumne River for the benefit of fish, especially fall-run Chinook salmon. The record created by the continuous process of environmental investigation and resource monitoring has produced detailed baseline information.

Major studies conducted by the Districts since the 1995 Settlement Agreement but prior to 2010 fall into the following general categories: (1) salmon population models, (2) salmon spawning surveys, (3) seine, snorkel, and fyke net reports and various juvenile salmon studies, (4) screw-trap monitoring, (5) flow fluctuation assessments, (6) smolt monitoring and survival evaluations, (7) fish community assessments, (8) aquatic invertebrate reports, (9) Delta salmon salvage reports, (10) gravel, incubation, redd distribution studies, (11) water temperature and water quality assessments, (12) instream flow incremental methodology (IFIM) assessments, (13) flow and delta water export reports, (14) restoration and associated monitoring, and mapping, and (15) general monitoring.

Fish Studies Conducted by the Districts as Part of the Don Pedro Hydroelectric Project Relicensing

Spawning Gravel in the Lower Tuolumne River (W&AR-04)

In 2012, the Districts conducted a spawning gravel survey (TID/MID 2013b, W&AR-04) in the Tuolumne River from RM 52.1 to RM 23, which accounts for the extent of riffle habitats documented in historical surveys. Study results include: (1) estimates of average annual sediment yield to Don Pedro Reservoir, (2) estimated changes in the volume of coarse bed material in the lower Tuolumne River channel from 2005 to 2012, (3) maps of fine bed material in the lower Tuolumne River, (4) a reach-specific coarse sediment budget of the lower Tuolumne River, (5) maps of riffle, spawning gravel, and suitable spawning habitat, and (6) estimated theoretical maximum Chinook spawning run sizes supported under current conditions.

Salmonid Population Information Integration and Synthesis (W&AR-05)

The Districts conducted a Salmonid Population Information Integration and Synthesis Study in 2012 (TID/MID 2013c, W&AR-05) to collect and summarize existing information to characterize Chinook salmon and *O. mykiss* populations in the Tuolumne River and develop hypotheses related to factors potentially affecting those populations. The study area included the lower Tuolumne River downstream of LGDD (RM 52.2), the lower San Joaquin River from the Tuolumne River confluence (RM 84) to Vernalis (RM 69.3), the Delta[7], San Francisco Bay Estuary[8], and the Pacific Ocean.

Chinook Salmon Population Model Study (W&AR-06)

The Tuolumne River Chinook Salmon Population Model (TRch) (TID/MID 2013d, W&AR-06) was developed to investigate the relative influences of various factors on the life-stage-specific production of Chinook salmon in the Tuolumne River, identify critical life-stage-specific limitations that may represent population "bottlenecks," and compare relative changes in population size between potential alternative management scenarios. The model was developed with substantial involvement of relicensing participants.

Predation Study (W&AR-07)

The Districts conducted a study to assess the effects of fish predation on rearing and outmigrating juvenile Chinook salmon in the lower Tuolumne River (TID/MID 2013e, W&AR-07). Results include estimates of the relative abundance of native and non-native piscivores and predation rates, and an evaluation of habitat use by juvenile Chinook salmon and predator species at typical flows encountered during the juvenile outmigration period.

Salmonid Redd Mapping (W&AR-08)

The Salmonid Redd Mapping study (TID/MID 2013f, W&AR-08) was conducted to document the spatial distribution of Chinook salmon and *O. mykiss* redds and evaluate the current spawning capacity and redd/recruit relationships in the lower Tuolumne River (RM 52 - 22). Bi-weekly redd mapping surveys were conducted to evaluate redd characteristics, redd status, redd superimposition, and fish presence on or near redds during the 2012-2013 spawning season.

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7 The Delta received its first official boundary in 1959 with the passage of the Delta Protection Act (Section 12220 of the California Water Code), with the southern boundary in the San Joaquin River located at Vernalis (RM 69.3) and the western boundary at the confluence of the Sacramento and San Joaquin Rivers (RM 0) near Chipps Island.

8 The greater San Francisco Bay estuary extends from the Golden Gate Bridge in San Francisco Bay eastward across salt and brackish water habitats included in San Leandro, Richardson, San Rafael, and San Pablo bays, as well as the Carquinez Strait, Honker, and Suisun bays farther to the east near the western edge of the Delta.

Oncorhynchus mykiss Population Study (W&AR-10)

The Tuolumne River *O. mykiss* model (TROm) (TID/MID 2014a, W&AR-10) was developed to examine the relative influences of various factors on the production of in-river life-stages of *O. mykiss*, identify life-stages that may represent population "bottlenecks," and compare estimated relative changes in the population among potential alternative resource management scenarios. The model was also developed to compare relative *O. mykiss* production in the Tuolumne River under different water year types.

Chinook Salmon Otolith Study (W&AR-11)

The objective of the Chinook Salmon Otolith Study (TID/MID 2016a, W&AR-11) was to use otolith microstructural growth patterns and/or microchemistry to: (1) evaluate whether adult Chinook salmon returning to the Tuolumne River originated from hatcheries or riverine environments other than the Tuolumne River, and (2) estimate growth rates and sizes of "wild" fish at exit from the Tuolumne River and from the freshwater Delta.

Oncorhynchus mykiss Habitat Survey (W&AR-12)

The *O. mykiss* habitat survey (TID/MID 2013g, W&AR-12) consisted of an inventory of instream habitat types and physical habitat characteristics and an appraisal of the distribution, abundance, and function of large woody debris (LWD). The habitat survey was conducted in the *O. mykiss* spawning and rearing reach, i.e., approximately RM 52-39, and the LWD evaluation was conducted from RM 52-24.

Thermal Performance of Wild Juvenile Oncorhynchus mykiss in the Lower Tuolumne River: A Case for Local Adjustment to High River Temperature (W&AR-14)

The Thermal Performance of Wild Juvenile *Oncorhynchus mykiss* in the Lower Tuolumne River: A Case for Local Adjustment to High River Flows study (Farrell et al. 2015) was conducted to investigate the thermal performance of juvenile *O*, *mykiss* from the lower Tuolumne River in response to seasonal maximum water temperatures they experience during the summer months. The study tested the hypothesis that the Tuolumne River *O. mykiss* population below LGDD is locally adapted to the relatively warm thermal conditions that exist, both now and historically, in the river during summer. A draft report was submitted to relicensing participants for review and comment in January 2015. Comments on the draft study report were received from the Tuolumne River Trust, the California Sportfishing Protection Alliance, and the State Water Resources Control Board in March 2015. CDFW provided comments in August 2016, and NMFS provided comments in February 2017. A final report will be filed in September 2017.

Oncorhynchus mykiss Scale Collection and Age Determination (W&AR-20)

The *Oncorhynchus mykiss* Scale Collection and Age Determination Study (TID/MID 2013h, W&AR-20) was conducted to estimate the age-at-length relationship of *O. mykiss* collected in the reach that extends from LGDD (RM 52.2) to Turlock Lake SRA (RM 42) and a single sample collected from the rotary screw trap survey near Waterford (RM 30).

Lower Tuolumne River Floodplain Hydraulic Assessment (W&AR-21)

The goal of the Lower Tuolumne River Floodplain Hydraulic Assessment (TID/MID 2015, W&AR-21) was to develop a hydraulic model to simulate the interaction between flow in the main channel and the floodplain in the lower Tuolumne River to address the following objectives: (1) determine floodplain inundation extents for flows between 1,000 and 3,000 cfs at 250 cfs intervals and between 3,000 cfs and 9,000 cfs at 500 cfs intervals, (2) estimate the area, frequency, and duration of inundation over a range of flows for base case (WY 1971–2012) hydrology, and (3) apply modeled water depths and velocities to quantify the amount of suitable rearing habitat for juvenile Chinook salmon and *O. mykiss* at the designated flow increments. A draft report was submitted to relicensing participants for review and comment in September 2015. Comments were received from USFWS in October 2015. The final report for this study will be filed with FERC in September 2017.

One-Dimensional (1-D) PHABSIM model (Stillwater Sciences 2013)

The purpose of this one-dimensional (1-D) physical habitat simulation (PHABSIM) model (Stillwater Sciences 2013) was to identify flows necessary to maximize fall-run Chinook salmon and *O. mykiss* production and survival throughout their life histories. A mesohabitat and transect-based approach was used for implementing the PHABSIM component of the USFWS IFIM (Bovee 1982) to address flow-habitat relationships from RM 51.7 to 29.0. As a supplement to this PHABSIM study, weighted usable area (WUA) versus flow analyses were developed for Sacramento splittail and Pacific lamprey using existing Habitat Suitability Criteria (HSC) (Stillwater Sciences 2014).

Fish Studies Conducted by the Districts as Part of the La Grange Hydroelectric Project Licensing

La Grange Project Fish Barrier Assessment

The La Grange Project Fish Barrier Assessment (TID/MID 2017a, attached to this DLA) is being conducted to evaluate the potential for the LGDD and the La Grange powerhouse to act as potential barriers to the upstream migration of adult fall-run Chinook salmon and, if they occur in the lower Tuolumne River, steelhead. Specific objectives of the study are to:

- Determine the number of fall-run Chinook salmon and steelhead migrating upstream to LGDD and the La Grange powerhouse during the 2015-2016 and 2016-2017 migration seasons;
- Compare the number of fall-run Chinook salmon and steelhead migrating upstream to the LGDD and the La Grange powerhouse to total escapement during the 2015-2016 and 2016-2017 migration seasons;
- Document carcass condition (egg retention) to evaluate pre-spawn mortality rates of fall-run Chinook salmon and steelhead migrating upstream to LGDD and the La Grange powerhouse, which do not move back downstream to spawn; and

- Implement formal documentation of incidental fish observations in the vicinity of LGDD, La Grange powerhouse tailrace, and the TID sluice gate channel (see Fish Presence and Stranding Assessment, below).

Topographic Survey

The goal of the Topographic Survey (TID/MID 2017b, attached to this DLA) was to collect information to evaluate the effects of Project operation on stream flow and anadromous fish habitat in the Tuolumne River between LGDD and the La Grange USGS gage. Specific objectives of the survey were to:

- Survey a longitudinal profile and transects along the channel thalweg in the La Grange powerhouse tailrace, TID sluice gate channel, and the Tuolumne River mainstem channel upstream of where it joins the tailrace channel and take survey measurements that characterize the large cobble and bedrock island that separates the La Grange powerhouse tailrace and the mainstem Tuolumne River below LGDD;
- Take survey measurements at geomorphic hydraulic control features in the channels below the LGDD and La Grange powerhouse; and
- Measure water depths at a flow of approximately 25 cfs in the mainstem river channel upstream of where it joins the tailrace channel and at approximately 75 to 100 cfs in the La Grange powerhouse tailrace channel and the TID sluice gate channel.

Salmonid Habitat Mapping

The Salmonid Habitat Mapping study (TID/MID 2016b, attached to this DLA) examined potential effects of Project operations on anadromous fish habitat in the Tuolumne River in the vicinity of the LGDD and La Grange Hydroelectric Project facilities. Specific objectives of the study were to:

- Map substrate and habitat in the main channel and tailrace, delineating the presence of pools, runs, high- and low-gradient riffles, step-pools, and chutes;
- Map patches (< 2 m^2 [21.5 ft^2] of spawning-sized gravels in the tailrace and main channel; and
- Conduct pebble counts in riffles, runs, and pool tailouts to document substrate particle size distribution in these habitats.

<u>Fish Presence and Stranding Assessment</u>

The Fish Presence and Stranding Assessment (TID/MID 2017c, attached to this DLA) is being conducted to formally document fish observations in the vicinity of the LGDD, La Grange powerhouse tailrace, and the TID sluice gate channel. Specific objectives of the study are to:

- Record daily observations of fish in the immediate vicinities of the LGDD, La Grange powerhouse, and within the sluice gate channel;

- If the La Grange powerhouse trips offline (i.e., unexpectedly stops operating), conduct sluice gate channel surveys to record fish presence and, if necessary, conduct relocation activities; and
- Document redds that become dewatered, and the duration of any dewatering, due to changes in La Grange powerhouse operations.

Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes

The goal of the Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes (TID/MID 2017d, attached to this DLA) was to evaluate the potential impact of certain La Grange powerhouse facilities on adult fall-run Chinook salmon and *O. mykiss*. Specific objectives of the study were to:

- Document adult resident *O. mykiss* and adult anadromous salmonid behavior in the vicinity of the La Grange powerhouse discharge during the fall 2015 (fall-run Chinook) to spring 2016 (*O. mykiss*) migration season;
- Identify anadromous fish reaching the La Grange powerhouse;
- Describe behavioral activities of fish in relation to La Grange powerhouse operations; and
- Determine if fish are moving into the draft tubes of operating units.

Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River

The goal of the Losses of Marine-Derived Nutrients study (TID/MID 2016c, attached to this DLA), as cited by NMFS, was to evaluate the potential effects of the Project and Project-related activities on the degree of reduction in or loss of nutrient replenishment in the upper and lower Tuolumne River. Specific objectives of this study, as requested by NMFS, are described below:

- NMFS Request Element #1: Estimate a range of the historical mass of marine-derived nitrogen transported annually by Chinook salmon (all runs) to the Tuolumne River.
- NMFS Request Element #2: Estimate the historical mass of marine-derived nitrogen that was transported annually by spring-run Chinook salmon to the upper Tuolumne River.
- NMFS Request Element #3: Estimate the current annual mass of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River.
- NMFS Request Element #4: Estimate annual losses, from historical to current levels, of marine-derived nitrogen transported by fall-run Chinook salmon to the Tuolumne River.
- Estimate the annual loss, from historical to current levels, of marine-derived nitrogen to the upper Tuolumne River.

Fish Passage Facilities Alternatives Assessment

The goal of the Fish Passage Facilities Alternatives Assessment (TID/MID 2016d, attached to this DLA) is to identify and develop concept-level alternatives for upstream and downstream passage of Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*) at the La Grange and Don Pedro projects. Specific objectives of the study are to:

- Obtain available information to establish existing baseline conditions relevant to impoundment operations and siting passage facilities;
- Obtain available hydrologic data and basic biological criteria to identify potential types, configurations, and locations of fish passage facilities consistent with estimated run size, fish periodicity, life-stage requirements, and anticipated passage efficiencies for the selected species of interest;
- Formulate and develop preliminary facility sizing and functional design for select, alternative potential upstream and downstream fish passage facilities consistent with the resource agencies' anadromous fish reintroduction goals and objectives; and
- Develop reliable opinions of probable construction cost and annual operations and maintenance costs for select fish passage concept(s).

3.5.3.2 Fish Species in the Lower Tuolumne River

Fish species documented in the lower Tuolumne River are shown in Table 3.5-2, with a notation as to whether a species is native or non-native and resident or migratory. The distributions of native and non-native fishes are influenced by water temperature and velocity, which vary by location, season, and in response to flow. Most native resident fish species are riffle spawners and are generally more abundant in the gravel-bedded reach (RM 24-52). Sacramento sucker is the most abundant and widespread native fish species in the lower river.

Non-native fishes are present throughout the lower river but are typically most abundant in the sand-bedded reach and in the lower 6 to 7 miles of the gravel-bedded reach, where water temperatures are warmer and Special Run Pools (SRPs) 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 (*Morone saxatilis*) (TID/MID 1992; TID/MID 2007).

Of the 22 non-native fish species documented in the lower Tuolumne River, 18 were introduced by state or federal agencies (CDFW, NMFS, USFWS, and the State Board of Human Health) between 1874 and 1954, and one was introduced with permission from CDFW (1967) (Dill and Cordone 1997; Moyle 2002). The remaining three were introduced by aquarists (goldfish [*Carassius auratus*] in 1862), catfish farms (red shiner [*Cyprinella lutrensis*] in 1954), or private individuals (common carp in 1877, although released in the same year by CDFW) (Dill and Cordone 1997). Sixteen of the fish species released by state or federal agencies were introduced intentionally for sport or commercial fisheries, as a prey base for sport fish, or for mosquito control; two were introduced incidentally with shipments of sport fish (Dill and Cordone 1997). The most abundant and widespread non-native fish species in the lower Tuolumne River (bluegill, redear sunfish, and green sunfish) were released in California between 1891 and 1954. Largemouth and smallmouth bass were released in California by CDFW between 1874 and 1891 (Dill and Cordone 1997; TID/MID 1992).

Table 3.5-2. Fish species documented in the lower Tuolumne River.

Family/Common Name	Scientific Name	Native (N) Or Introduced (I)	Resident (R) Or Migratory (M)
Lampreys (Petromyzontidae)			
Pacific lamprey	*Entosphenus tridentatus*	N	M
Shad and Herring (Clupeidae)			
Threadfin shad	*Dorosoma petenense*	I	R
Salmon and Trout (Salmonidae)			
Chinook salmon	*Oncorhynchus tshawytscha*	N	M
Rainbow trout/steelhead	*Oncorhynchus mykiss*	N	R/M
Minnows (Cyprinidae)			
Common carp	*Cyprinus carpio*	I	R
Fathead minnow	*Pimephales promelas*	I	R
Golden shiner	*Notemigonus crysoleucas*	I	R
Goldfish	*Carassius auratus*	I	R
Hardhead	*Mylopharodon conocephalus*	N	R
Hitch	*Lavinia exilicauda*	N	R
Red shiner	*Cyprinella lutrensis*	I	R
Sacramento blackfish	*Orthodon microlepidotus*	N	R
Sacramento splittail	*Pogonichthys macrolepidotus*	N	M
Sacramento pikeminnow	*Ptychocheilus grandis*	N	R
Suckers (Catostomidae)			
Sacramento sucker	*Catostomus occidentalis*	N	R
Catfish (Ictaluridae)			
Black bullhead	*Ameiurus melas*	I	R
Brown bullhead	*Ameiurus nebulosus*	I	R
Channel catfish	*Ictalurus punctatus*	I	R
White catfish	*Ameiurus catus*	I	R
Livebearers (Poeciliidae)			
Western mosquitofish	*Gambusia affinis*	I	R
Silversides (Atherinidae)			
Inland silverside	*Menidia beryllina*	I	R
Temperate Basses (Percichthyidae)			
Striped bass	*Morone saxatilis*	I	M
Basses and Sunfish (Centrarchidae)			
Black crappie	*Pomoxis nigromaculatus*	I	R
Bluegill	*Lepomis macrochirus*	I	R
Green sunfish	*Lepomis cyanellus*	I	R
Largemouth bass	*Micropterus salmoides*	I	R
Redear sunfish	*Lepomis microlophus*	I	R
Smallmouth bass	*Micropterus dolomieu*	I	R
Warmouth	*Lepomis gulosus*	I	R
White crappie	*Pomoxis annularis*	I	R
Perch (Percidae)			
Bigscale logperch	*Percina macrolepida*	I	R
Surf Perch (Embiotocidae)			
Tule perch	*Hysterocarpus traski*	N	R
Sculpins (Cottidae)			
Prickly sculpin	*Cottus asper*	N	R

Family/Common Name	Scientific Name	Native (N) Or Introduced (I)	Resident (R) Or Migratory (M)
Riffle sculpin	*Cottus gulosus*	N	R

Sources: TID/MID 2017e; Ford and Brown 2001; TID/MID 2010a, b, c, Reports 2009-3, 2009-4, and 2009-5.

Fall-Run Chinook Salmon

The lower Tuolumne River supports Central Valley fall-run Chinook salmon. Adult Chinook salmon spawn from late October through December (with peak activity in November) (TID/MID 2013c, W&AR-05). Spawning occurs in the gravel-bedded reach (RM 24-52) where water temperatures are suitably cool and spawning riffles are present (TID/MID 2013c, W&AR-05). Egg incubation and fry emergence occur from November through January. Chinook salmon rearing in the Tuolumne River primarily occurs from January to April (TID/MID 2013c, W&AR-05).

A Chinook salmon population estimate was conducted by the Districts from 2008 to 2011 (TID/MID 2012). In 2011 the survey was conducted from RM 51.8 to 35.0, and juvenile population size was estimated to be 24,299 (TID/MID 2012). These estimates were higher than the 2008 and 2010 estimates, but slightly lower than 2009 estimates (TID/MID 2012). A number of additional surveys have been conducted to study the Chinook salmon population in the lower Tuolumne River as summarized in the Don Pedro Final License Application (TID/MID 2014b). Since 1971, the CDFW has conducted annual salmon spawning surveys. In addition to the CDFW, the Districts have studied Chinook salmon in the lower Tuolumne River through annual seine surveys since 1986 and annual snorkel surveys since 1982. Many of the juvenile Chinook salmon the Tuolumne River are consumed by introduced predators between RM 5.1 (location of the Grayson rotary screw trap) and RM 30.3 (location of the Waterford rotary screw trap) (TID/MID 2013e, W&AR-07).

Rainbow Trout/Steelhead (*O. mykiss*)

O. mykiss exhibits two life history forms: a resident form known as rainbow trout and an anadromous form known as steelhead. The causes for the expression of anadromous or resident life-histories in *O. mykiss* occupying the lower Tuolumne River is poorly understood (TID/MID 2014a, W&AR-10). Although rare occurrences of anadromous *O. mykiss* have been documented in the Tuolumne River (Zimmerman et al. 2008), there is no empirical evidence of a self-sustaining "run" or population of steelhead in the lower river (TID/MID 2013c, W&AR-05).

California Central Valley (CCV) 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 progeny rear for one to three years in fresh water before they migrate to the ocean as smolts, where most of their growth occurs.

A population estimate of *O. mykiss* was conducted by the Districts in the lower Tuolumne River from 2008 to 2011 (TID/MID 2012). In 2011, population estimates for juveniles and adults from RM 51.8 to 35.0 were 47,432 and 9,541, respectively (TID/MID 2012). These estimates were higher than those from previous years (TID/MID 2012).

3.5.4 Potential Resource Effects

FERC's SD2 (pages 19 and 20) identifies the following issues related to aquatic resources:

- Effects of project operation on the quantity and timing of streamflow in the project-affected downstream reach, including operations and ramping rates.
- Effects of project operation and maintenance on water quality, water temperature, and water quantity in the project reservoir and the project-affected downstream reach.
- Effects of project operation and maintenance on fish populations in the project reservoir and the project-affected stream reach.
- Effects of retention of sediment in the project reservoir on downstream fish spawning habitat and benthic macroinvertebrate populations.
- Effects of project-related changes in the recruitment and movement of large woody debris on aquatic resources and their habitat.
- Effects of project operations on stranding or displacement of fish.
- Effects of the project on upstream and downstream migration of anadromous fish.
- Effects of entrainment at the project dam and intake on fish populations.

FERC's SD2 (page 21) identifies the following issues related to threatened and endangered (aquatic) species:

- Effects of project operation and maintenance on plants and wildlife species listed as threatened under the ESA.
- Effects of project operation and maintenance on designated critical habitat under the ESA.

The Districts are currently evaluating the above issues and will discuss potential effects to aquatic resources in the FLA.

3.6 Wildlife and Botanical Resources

The Project is situated near the western edge of the foothills of the west slope of California's Sierra Nevada. The terrestrial habitat in the Project area is dominated by blue oak woodlands, open annual grass-forb vegetation, and substantial components of shrub-dominated chaparral. Wetland and riparian habitats are mostly restricted to areas adjacent to the Tuolumne River, which flows through a bedrock valley in the Project vicinity. The majority of terrestrial habitats within the Project vicinity are above the maximum water surface elevation of the La Grange headpond and geographically removed from any Project activities.

3.6.1 Mammals

The vegetative community types associated with the Project vicinity provide suitable habitat for a variety of wildlife species. Although the area is dominated by annual grass-forb and blue oak vegetation associations (described in Section 3.6.3 below), wetland and riverine areas increase the diversity of wildlife habitats available to indigenous and transient mammal species in the Project vicinity. Mammal species that may exist or may use habitats in the vicinity of the Project are shown in Table 3.6-1.

Table 3.6-1. Partial list of mammals potentially occurring in the Project vicinity.

Common Name	Scientific Name
Virginia opossum	*Didelphis virginiana*
Pallid bat	*Antrozous pallidus*
Townsend's bigeared bat	*Corynorhinus townsendii*
Spotted bat	*Euderma maculatum*
Western mastiff bat	*Eumops perotis*
Western red bat	*Lasiurus blossevillii*
Western smallfooted myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Yuma myotis	*Myotis yumanensis*
Black-tailed jackrabbit	*Lepus californicus*
Beaver	*Castor canadensis*
Porcupine	*Erethizon dorsatum*
Brush mouse	*Peromyscus boylii*
Dusky-footed woodrat	*Neotoma fuscipes*
Bushy-tailed woodrat	*Neotoma cinerea*
Muskrat	*Ondatra zibethicus*
Western gray squirrel	*Sciurus griseus*
Coyote	*Canis latrans*
Red fox	*Vulpes vulpes*
Gray fox	*Urocyon cinereoargenteus*
Black bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Short-tailed weasel	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Spotted skunk	*Spilogale putorius*
Striped skunk	*Mephitis mephitis*
Bobcat	*Lynx rufus*
Elk	*Cervus elaphus*
Mule deer	*Odocoileus hemionus*
Brush rabbit	*Sylvilagus bachmani*
Desert cottontail	*Sylvilagus audubonii*
American badger	*Taxidea taxus*
Wild pig	*Sus scrofa*

Sources: American Society of Mammalogists 2013; TID/MID 2011; TID/MID 2013a.

3.6.2 Birds

Bird species with the potential to occur in the Project vicinity are listed in Table 3.6-2.

Table 3.6-2. Bird species with the potential to occur in the Project vicinity.

Common Name	Scientific Name
Greater white-fronted goose	*Anser albifrons*
Snow goose	*Chen caerulescens*

Common Name	Scientific Name
Ross's goose	*Chen rossii*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Gadwall	*Anas strepera*
American wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Northern pintail	*Anas acuta*
Green-winged teal	*Anas carolinensis*
Canvasback	*Aythya valisineria*
Ring-necked duck	*Aythya collaris*
Lesser scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Hooded merganser	*Lophodytes cucullatus*
Common merganser	*Mergus merganser*
Ruddy duck	*Oxyura jamaicensis*
White-tailed ptarmigan	*Lagopus leucura*
Sooty grouse	*Dendragapus fuliginosus*
Wild turkey	*Meleagris gallopavo*
Mountain quail	*Oreortyx pictus*
California quail	*Callipepla californica*
Common loon	*Gavia immer*
Pied-billed grebe	*Podilymbus podiceps*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmophorus occidentalis*
Clark's grebe	*Aechmophorus clarkii*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Turkey vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Northern harrier	*Circus cyaneus*
Sharp-shinned hawk	*Accipiter striatus*
Cooper's hawk	*Accipiter cooperii*
Northern goshawk	*Accipiter gentilis*
Peregrine falcon	*Falco peregrinus*
American kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Ferruginous hawk	*Buteo regalis*
Red-shouldered hawk	*Buteo lineatus*
Red-tailed hawk	*Buteo jamaicensis*
Golden eagle	*Aquila chrysaetos*
Bald eagle	*Haliaeetus leucocephalus*
Killdeer	*Charadrius vociferus*
Spotted sandpiper	*Actitis macularius*
Greater yellowlegs	*Tringa melanoleuca*
Wilson's snipe	*Gallinago delicata*
Mourning dove	*Zenaida macroura*
Barn owl	*Tyto alba*
Western screech owl	*Megascops kennicottii*
Great horned owl	*Bubo virginianus*

Common Name	Scientific Name
Northern saw-whet owl	*Aegolius acadicus*
White-throated swift	*Aeronautes saxatalis*
Black-chinned hummingbird	*Archilochus alexandri*
Anna's hummingbird	*Calypte anna*
Rufous hummingbird	*Selasphorus rufus*
Belted kingfisher	*Megaceryle alcyon*
Lewis's woodpecker	*Melanerpes lewis*
Acorn woodpecker	*Melanerpes formicivorus*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Red-breasted sapsucker	*Sphyrapicus ruber*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	*Leuconotopicus villosus*
Black-backed woodpecker	*Picoides arcticus*
Northern flicker	*Colaptes auratus*
Pileated woodpecker	*Hylatomus pileatus*
Olive-sided flycatcher	*Contopus cooperi*
Western wood-peewee	*Contopus sordidulus*
Willow flycatcher	*Empidonax traillii*
Hammond's flycatcher	*Empidonax hammondii*
Black phoebe	*Sayornis nigricans*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western kingbird	*Tyrannus verticalis*
Loggerhead shrike	*Lanius ludovicianus*
Steller's jay	*Cyanocitta stelleri*
Western scrub jay	*Aphelocoma californica*
American crow	*Corvus brachyrhynchos*
Common raven	*Corvus corax*
Tree swallow	*Tachycineta bicolor*
Cliff swallow	*Petrochelidon pyrrhonota*
California thrasher	*Toxostoma redivivum*
Cedar waxwing	*Bombycilla cedrorum*
Orange-crowned warbler	*Vermivora celata*
Yellow warbler	*Setophaga petechia*
Yellow-rumped warbler	*Setophaga coronata*
Townsend's warbler	*Setophaga townsendi*
Wilson's warbler	*Cardellina pusilla*
Western tanager	*Piranga ludoviciana*
Spotted towhee	*Pipilo maculatus*
California towhee	*Melozone crissalis*
Chipping sparrow	*Spizella passerina*
Lark sparrow	*Chondestes grammacus*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*
White-throated sparrow	*Zonotrichia albicollis*
Dark-eyed junco	*Junco hyemalis*
Black-headed grosbeak	*Pheucticus melanocephalus*
Red-winged blackbird	*Agelaius phoeniceus*
Western meadowlark	*Sturnella neglecta*
Pine grosbeak	*Pinicola enucleator*
Purple finch	*Haemorhous purpureus*
House finch	*Haemorhous mexicanus*
Red crossbill	*Loxia curvirostra*
Pine siskin	*Spinus pinus*

Common Name	Scientific Name
Lesser goldfinch	*Spinus psaltria*
Lawrence's goldfinch	*Spinus lawrencei*
American goldfinch	*Spinus tristis*
Evening grosbeak	*Coccothraustes vespertinus*
House sparrow	*Passer domesticus*
Chestnut-backed chickadee	*Poecile rufescens*
Oak titmouse	*Baeolophus inornatus*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolinensis*
Rock wren	*Salpinctes obsoletus*
Western bluebird	*Sialia mexicana*
Mountain bluebird	*Sialia currucoides*

Source: Central Sierra Audubon Society 2013.

3.6.3 Botanical Resources

Areas immediately adjacent to the La Grange headpond are in a natural condition, dominated by various grass species and scattered trees and underbrush. Based on review of aerial photography, a site visit conducted in 2013, and information derived from the USFS CalVeg mapping system (USFS 2004), the Project vicinity is dominated by three vegetation alliances: Blue Oak, Annual Grasses and Forbs, and Chamise (Figure 3.6-1). Descriptions of these vegetation alliances are provided below.

- ***Blue Oak Alliance -*** This alliance occurs below about 3,900 ft (TID/MID 2011) and is dominated by blue oak (*Quercus douglasii*), which is found in an oak-grass association on well-drained, gentle slopes. The alliance typically contains gray pine (*Arceuthobium occidentale*), and interior live oak (*Quercus wislizeni*), valley oak (*Quercus lobata*) and/or California buckeye (*Aesculus californica*) may also be present. Chaparral shrubs such as wedgeleaf ceanothus (*Ceanothus cuneatus*), manzanitas (*Arctostaphylos* spp.), coffeeberry (*Rhamnus* spp.), birchleaf mountain mahogany (*Cercocarpus montanus* var. *glaber*), and poison oak (*Toxicodendron diversilobum*) are also part of this alliance. The understory is dominated by annual grasses such as wild oats (*Avena* spp.) and cheatgrass (*Bromus* spp.).
- ***Annual Grasses and Forbs Alliance -*** Annual grasslands are abundant in the Project vicinity, generally occurring between urban/agricultural developments and foothill woodlands. Dominant species in this vegetation alliance include ripgut brome (*Bromus diandrus*), Italian ryegrass (*Lolium multiflorum*), soft chess (*Bromus hordeaceus*), wild oats (*Avena* spp.), and silver hairgrass (*Aira carophyllea*). Invasive Bermudagrass (*Cynodon dactylon*) is also common. Vernal pools (small depressions often containing hardpan soil layers) occur throughout the Annual Grasses and Forbs Alliance. Plant species in these vernal pools include downingia (*Downingia* spp.), meadowfoam (*Limnanthes douglasii*), goldfields (*Lasthenia chrysostoma*), water atarwart (*Callitriche marginata*), popcorn flower (*Plagiobothrys* spp.), Johnny-tuck (*Orthocarpus erianthus*), bur medic (*Medicago hispida*), and linanthus (*Linanthus* spp.) (TID/MID 2011).
- ***Chamise Alliance -*** Relatively pure stands of chamise (*Adenostoma fasciculatum*) occupy xeric sites at elevations up to about 4,000 ft and often are found in upper ridge slope positions. Chaparral shrubs such as wedgeleaf ceanothus, whiteleaf manzanita (*Arctostaphylos*

manzanita) and birchleaf mountain mahogany are associated shrubs. Scattered gray pine and interior live oak are also found in this alliance (TID/MID 2011).

Multiple studies were conducted by the Districts within the Project vicinity as part of the Don Pedro Project relicensing. Additional information describing botanical resources in the Project vicinity can be found in the License Application for the Don Pedro Project (TID/MID 2014) and the Districts' Special-Status Plants Study Report (TID/MID 2013b).

3.6.4 Noxious Weeds

Non-native invasive species and noxious weeds are typically prolific, pioneering species that have the ability to quickly outcompete native vegetation. They grow rapidly, mature early, and effectively spread seeds that can survive for significant periods in the soil until site conditions are favorable for their growth. Invasive plants often form vast single-species communities that are less suitable to birds and wildlife than native plant communities and can compromise native ecosystems by altering soil and water resources on a site. The introduction of non-indigenous invasive aquatic plant species to the United States has been escalating with widespread adverse consequences.

For the purpose of this DLA, noxious weeds are defined as those plant species listed as such by the California Department of Food and Agriculture (CDFA) (CDFA 2012) and the Sierra-San Joaquin Noxious Weeds Alliance (SSJNWA) (SSJNWA 2003). Based on these sources, 27 noxious weed species have the potential to occur within the Project vicinity (Table 3.6-3). State-designated noxious weeds are typically assigned one of three ratings: (1) A-list species are mandated for eradication or control, (2) B-list species are widespread plants that Agricultural Commissioners can designate for local control efforts, and (3) C-list species are considered too widespread for funding of control efforts (CDFA 2013).

Additional information describing noxious weeds that occur within the Project vicinity can be found in the Districts' Noxious Weeds Study Report, which was conducted as part of the Don Pedro Project relicensing (TID/MID 2013c). Twelve noxious weed species were observed and mapped in the Don Pedro Project vicinity. Of these, tree of heaven (*Ailanthus altissima*) and giant reed (*Arundo donax*) were documented downstream of Don Pedro Dam (i.e., near the La Grange headpond). Two other species, Bermudagrass (*Cynodon dactylon*) and medusahead grass (*Elymus caput-medusae*), are known to occur near the eastern edge of the La Grange headpond (TID/MID 2013c).

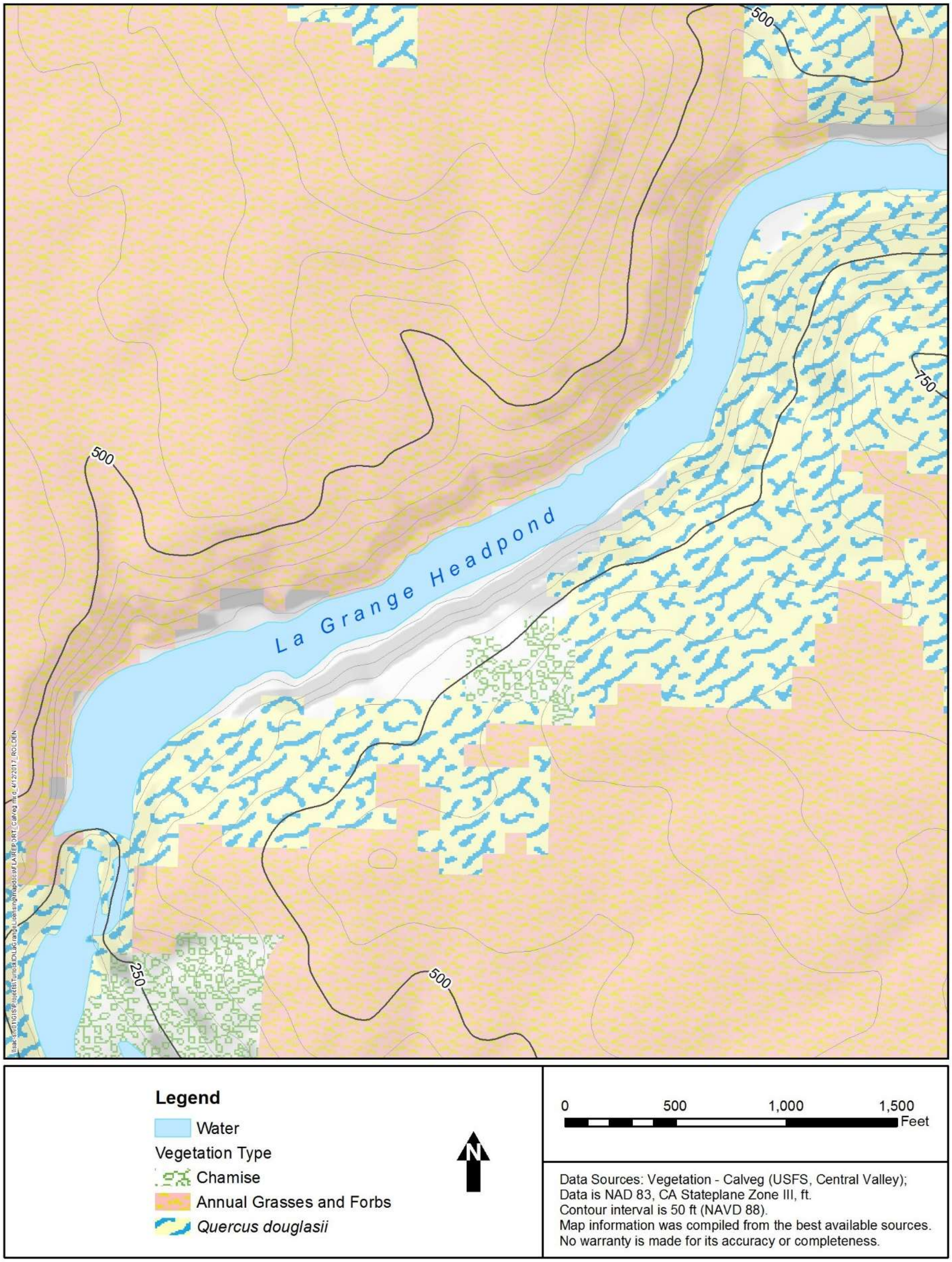

Figure 3.6-1. USFS CalVeg map of the Project vicinity.

Table 3.6-3. Noxious weed species occurring or potentially occurring in the Project vicinity.

Common Name	Scientific Name	CDFA Status[1]
Russian knapweed	*Acroptilon repens*	B
Barbed goat grass	*Aegilops triuncialis*	B
Tree-of-heaven	*Ailanthus altissima*	C
Giant reed	*Arundo donax*	B
Lens-pod whitetop	*Cardaria chalepensis*	B
Hoarycress	*Cardaria* spp.	B
Italian thistle	*Carduus pycnocephalus*	C
Distaff thistle	*Carthamus* spp.	A, B
Purple starthistle	*Centaurea calcitrapa*	B
Diffuse knapweed	*Centaurea diffusa*	A
Iberian starthistle	*Centaurea iberica*	A
Yellow starthistle	*Centaurea solstitialis*	C
Spotted knapweed	*Centaurea stobe* ssp. *micranthos*	A
Rush skeletonweed	*Chondrilla juncea*	A
Canada thistle	*Cirsium arvense*	B
Bermudagrass	*Cynodon dactylon*	C
Scotch broom	*Cytisus scoparius*	A
Medusahead	*Taeniatherum caput-medusae*	C
Oblong spurge	*Euphorbia oblongata*	B
Klamath weed	*Hypericum perforatum*	C
Dyer's woad	*Isatis tinctoria*	B
Perennial pepperweed	*Lepidium latifolium*	B
Purple loosestrife	*Lythrum salicaria*	B
Russian thistle	*Salsola tragus*	C
White horsenettle	*Solanum elaeagnifolium*	B
Tamarisk	*Tamarix* spp.	B
Puncturevine	*Tribulus terrestris*	C

Source: TID/MID 2013c

[1] CDFA Noxious Weed Rating: A-rated weeds are highest priority for eradication in the State, followed by B- and then C-rated.

3.6.5 Wetland, Riparian, and Littoral Habitat

Wetlands are commonly understood to be transitional lands that occur between uplands and aquatic systems. However, wetlands include certain shallow aquatic areas and are more accurately defined according to the following attributes (Cowardin et al. 1979):

(1) At least periodically, the land supports predominantly hydrophytes (i.e., vegetation associated with moist soil conditions);

(2) The substrate is predominantly un-drained hydric soil (i.e., soils characterized by anaerobic conditions); and

(3) The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Wetlands along the Tuolumne River in the Project vicinity are primarily confined to narrow bands or small isolated wetlands adjacent to the river channel. Based on the classification system described by Cowardin et al. (1979), wetlands identified by the USFWS National Wetland Inventory (NWI) maps in the Project vicinity consist of three types: lacustrine unconsolidated bottom, riverine unconsolidated bottom, and palustrine unconsolidated shore (Figure 3.6.-2; USFWS 2010). Each of these wetland types is described below:

- Lacustrine unconsolidated bottom permanently flooded (L1UBH) wetlands have the following characteristics: (1) situated in a topographic depression or a dammed river channel, (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage, and (3) the total area exceeds 20 acres. These wetlands have at least 25 percent cover of particles smaller than stones (i.e., less than 6-7 centimeters) and a vegetative cover less than 30 percent. These wetlands are permanently flooded, i.e., water covers the land surface throughout the year in all years (Cowardin et al. 1979).
- Riverine unconsolidated bottom permanently flooded (R3UBH) wetlands are wetlands and deepwater habitats contained in natural or artificial channels periodically or continuously containing flowing water or which form a connecting link between two bodies of standing water. Upland islands or palustrine wetlands may occur in the channel, but they are not part of the riverine system. These wetlands have at least 25 percent cover of particles smaller than stones and a vegetative cover less than 30 percent. These wetlands are permanently flooded, i.e., water covers the land surface throughout the year in all years (Cowardin et al. 1979).
- Palustrine unconsolidated shore seasonally flooded (PUSC) wetlands include all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand (ppt). Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics: (1) are less than 20 acres, (2) do not have an active wave-formed or bedrock shoreline feature, (3) have at low water a depth less than 6.6 ft in the deepest part of the basin, and (4) have a salinity due to ocean-derived salts of less than 0.5 ppt. The unconsolidated shore class includes all wetland habitats having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock and (2) less than 30 percent areal cover of vegetation. Landforms such as beaches, bars, and flats are included in the unconsolidated shore class. These wetlands have surface water present for extended periods especially early in the growing season but absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface (Cowardin et al. 1979).

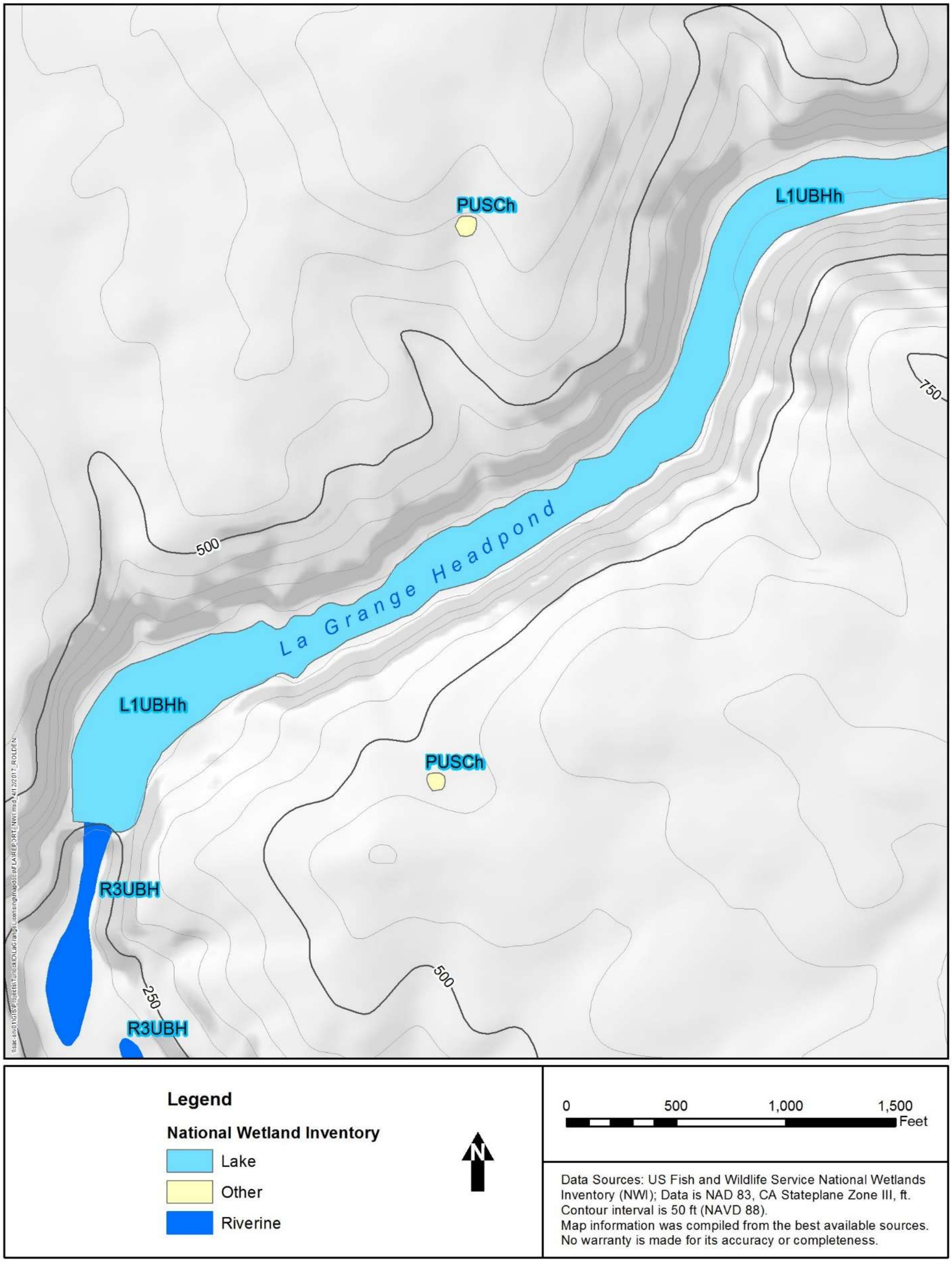

Figure 3.6-2. NWI map of the Project vicinity.

3.6.5.1 Wetland and Riparian Vegetation

The Districts conducted a Wetland Habitats Associated with Don Pedro Reservoir Study (TID/MID 2013d) as part of the relicensing of the Don Pedro Project. Table 3.6-4 provides a list of wetland and riparian plants that have the potential to occur in the Project vicinity based on the results of the Districts' wetland study conducted within and adjacent to the Don Pedro Project area. Many of the sites surveyed for the Districts' wetland study are located far from the La Grange headpond, and the inclusion of a particular species in Table 3.6-4 does not necessarily mean that species occurs in or even near the La Grange Hydroelectric Project.

Table 3.6-4. A partial list of wetland and riparian plants that have the potential to occur in the Project vicinity.

Common Name	Scientific Name
California barley	*Hordeum brachyantherum*
Rabbitfoot grass	*Polypogon monspeliensis*
Seepspring monkeyflower	*Mimulus guttatus*
Hedge nettle	*Stachys stricta*
Naked sedge	*Carex nudata*
Curly dock	*Rumex crispus*
Narrow leaf milkweed	*Asclepias fascicularis*
Red willow	*Salix laevigata*
Mountain rush	*Juncus balticus*
Spike rush	*Eleocharis ovata*
Leather root	*Hoita macrostachya*
Greensheath sedge	*Carex feta*
Spicebush	*Calycanthus occidentalis*
Western blue-eyed grass	*Sisyrinchium bellum*
Poison hemlock	*Conium maculatum*
Narrowleaf willow	*Salix exigua*
Field mint	*Mentha arvensis*
Oregon ash	*Fraxinus latifolia*
Common rush	*Juncus effusus*
Leather root	*Hoita macrostachya*
Alder	*Alnus incana*
Western sycamore	*Platanus racemosa*
Water buttercup	*Ranunculus aquatilis*
Rosella	*Helenium puberulum*
Tall flatsedge	*Cyperus eragrostis*
Broadleaf cattail	*Typha latifolia*
Lady's thumb	*Persicaria maculosa*
Floating primrose	*Ludwigia peploides*
Duckweed	*Lemna minor*
Yellow watercress	*Rorippa nasturtiumaquaticum*

Source: TID/MID 2013d

Of the sites mapped for the wetland habitat study (TID/MID 2013d), one (i.e., the Big Creek site), is located near the upstream end of the La Grange headpond. The Big Creek wetland site supports primarily herbaceous species, such as broad-leaved cattail (*Typha latifolia*), tall flatsedge (*Cyperus eragrostis*), rabbitfoot grass, dallisgrass (*Paspalum dilatatum*), spike rush (*Eleocharis ovata*), and lady's thumb (*Persicaria maculosa*). A few red willow shrubs and trees occur near saturated areas.

Two small ponds in the channel support aquatic plants, including floating primrose (*Ludwigia peploides*) and duckweed (*Lemna minor*).

3.6.5.2 Wetland and Riparian Wildlife

Many of the species likely to occur typically use wetland or riparian habitats at some time during their lives. Great blue herons (*Ardea herodias*), common mergansers (*Mergus merganser*), and mallards (*Anas platyrhynchos*) likely use the wetland and riparian habitats in the vicinity of the Project on a limited/seasonal basis. Many amphibians and reptiles including California toad (*Anaxyrus boreas halophilus*), American bullfrog (*Lithobates catesbeianus*), western yellow-bellied racer (*Coluber constrictor mormon*), Pacific gopher snake (*Pituophis catenifer catenifer*), and valley gartersnake (*Thamnophis sirtalis fitchi*) may occur in the Project vicinity. Other species likely to occur in the wetland or riparian habitats include raccoon (*Procyon lotor*), mule deer (*Odocoileus hemionus*), mink (*Mustela vison*), and coyote (*Canis latrans*) (California Herps 2013; American Society of Mammalogists 2013).

3.6.5.3 Wetland, Riparian Zone, and Littoral Maps

As noted previously, a wetland, riparian zone, and littoral map for the Project vicinity (Figure 3.6-2) was compiled from a USFWS NWI map (USFWS 2010).

3.6.5.4 Estimates of Wetland, Riparian, and Littoral Habitat Acreage

Estimates of wetland, riparian, and littoral habitat acreage will be provided following identification of an appropriate FERC boundary for the La Grange Hydroelectric Project.

3.6.6 Potential Resource Effects

FERC's SD2 identifies the following potential resource issues associated with terrestrial resources:

- Effects of project O&M on state-listed and special-status wildlife and plant species not protected under the ESA, occurring within the project boundary and related access roads and rights-of-way.
- Effects of project O&M on the presence and spread of terrestrial and aquatic noxious weeds, including water hyacinth and Ailanthus, within the project boundary and related access roads and rights-of-way.
- Effects of vegetation clearing and maintenance within the project boundary and related access roads and rights-of-way on wildlife and botanical resources.

The Districts are currently evaluating the above issues and will discuss potential effects to terrestrial resources in the FLA.

3.7 Rare, Threatened, Endangered, Protected, and Special Status Species

This section discusses species potentially occurring in the vicinity of the Project that are listed as threatened or endangered under either the federal ESA, the California Endangered Species Act (CESA), or both, or are designated as fully protected,[9] rare, or special-status under California State law. RTE, protected, and special-status species surveys conducted as part of the Don Pedro Project relicensing (referenced in subsequent sections) in some cases extended 0.25 miles outside the Don Pedro Project Boundary and, therefore, extended into a portion of the immediate La Grange Hydroelectric Project vicinity. The Districts conducted studies to investigate the habitat and populations of special status plants, bald eagles, and amphibians as part of the Don Pedro Project relicensing (TID/MID 2014a, b, c). These studies provide information on listed species in the La Grange Project vicinity.

3.7.1 Federal and State Listed Species

In May 2013, the Districts generated an official list of ESA-listed species for the La Grange 7.5-minute USGS topographic quadrangle, which includes the Project vicinity, using the on-line request service available at the USFWS's website.[10] The Districts eliminated from this list three fish species (Delta smelt, *Hypomesus transpacificus;* Central Valley spring-run Chinook salmon, *Oncorhynchus tschawytscha*; and winter-run Chinook salmon, *O. tschawytscha)* and one invertebrate species (Conservancy fairy shrimp, *Branchinecta conservatio*) because the fish species do not occur in the Tuolumne River basin, and the closest designated critical habitat for Conservancy fairy shrimp is over 10 miles from the Project, and no vernal pool habitats, which are required by Conservancy fairy shrimp, are known to occur around the La Grange headpond.

To identify CESA-listed animals, the Districts reviewed the California Natural Diversity Database (CNDDB), the CDFW January 2013 list of State and Federally Listed Endangered and Threatened Animals of California (CDFW 2013a), and the CDFW List of State Fully Protected Animals. To identify CESA-listed plants, the Districts reviewed the CDFW April 2013 list of State and Federally Listed Endangered, Threatened, and Rare Plants of California (CDFW 2013b), the U.S. Department of Agriculture's (USDA) PLANTS database, and the California Native Plant Society (CNPS) database.

The Districts then compiled information for each of the relevant listed, protected, and special-status species, including: (1) a description of the species' habitat requirements, (2) any known occurrences of the species adjacent to the Project, and (3) references to any recovery plans or status reports pertaining to the ESA-listed species (Table 3.7-1).

[9] In addition to the CESA, CDFW affords special protection to some fish and wildlife species, referring to them as "fully protected". Fishes are authorized under the California Fish and Game Code § 5515 and California Code of Regulations, Title 14, Division 1, Chapter 2, Article 4, Section 5.93. FP designations for amphibians and reptiles are authorized under § 5050 of the California Fish and Game Code.

[10] http://www.fws.gov/sacramento/es_species/ Lists/es_species_lists.cfm

Table 3.7-1. Federal and State of California threatened or endangered species and state rare or fully protected species occurring or potentially occurring in the vicinity of the Project.

Common Name / Scientific Name	Status	Suitable Habitat Type	Occurrence in Project Vicinity	Status Reports, Recovery Plans Relevant to Project Vicinity
Plants				
Hartweg's golden sunburst *Pseudobahia bahiifolia*	FE, SE	Cismontane woodland, valley and foothill grassland (CNDDB 2009)	Occurs within La Grange quadrangle (CNPS 2010). Three occurrences found on CNDDB within La Grange quadrangle (CNDDB 2009). Reported on the USFWS species list for the La Grange quadrangle (USFWS 2013).	5-Year Review (USFWS 2007a)
Succulent owl's clover *Castilleja campestris* ssp. *succulent*	FT, SE	Vernal pools (CNPS 2010)	Reported to occur in Stanislaus County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	Recovery Plan (USFWS 2005)
Colusa grass *Neostapfia colusana*	FT, SE	Vernal pools (CNPS 2010)	Reported to occur in Stanislaus County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	Recovery Plan (USFWS 2005) 5-Year Review (USFWS 2008)
Hairy orcutt grass *Orcuttia pilosa*	FE, SE	Vernal pools (CNPS 2010)	Reported to occur in Stanislaus County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	Recovery Plan (USFWS 2005) 5-Year Review (USFWS 2009)
Chinese Camp brodiaea *Brodiaea pallid*	FT, SE	Ultramafic, valley and foothill grassland, cismontane woodland, vernal streambeds, often serpentine (CNPS 2010)	Reported to occur in Tuolumne County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	5-Year Review (USFWS 2007b)
California vervain *Verbena californica*	FT, ST	Cismontane woodland, valley and foothill grassland, usually serpentine seeps and creeks (CNPS 2010)	Reported to occur in Tuolumne County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	5-Year Review (USFWS 2007c)

Common Name / Scientific Name	Status	Suitable Habitat Type	Occurrence in Project Vicinity	Status Reports, Recovery Plans Relevant to Project Vicinity
Layne's ragwort *Packera layneae*	FT, SR	Chaparral, cismontane woodland, serpentine or gabbroic, rocky (CNPS 2010)	Reported to occur in Tuolumne County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	Recovery Plan (USFWS 2002a)
Greene's tuctoria *Tuctoria greenei*	FE, SR	Vernal pools (CNPS 2010)	Reported to occur in Stanislaus County (USDA 2013). Not identified on La Grange quadrangle as a federally endangered or threatened species (USFWS 2013).	Recovery Plan (USFWS 2005) 5-Year Review (USFWS 2007d)
Invertebrates				
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	FT	Occurs only in the Central Valley and adjacent foothills up to 3,000 ft elevation in association with Blue elderberry.	Reported on the USFWS species list for the La Grange quadrangle (USFWS 2013).	Recovery Plan (USFWS 1984)
Vernal pool fairy shrimp *Branchinecta lynchi*	FT	Occurs mostly in vernal pools although it also inhabits a variety of natural and artificial seasonal wetland habitats, such as alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools (NatureServe 2012).	Reported on the USFWS species list for the La Grange quadrangle (USFWS 2013).	Recovery Plan (USFWS 2005)
Amphibians				
California tiger salamander, Central Valley DPS *Ambystoma californiense*	FT, ST	Breeds in seasonal ponds (or permanent ponds where fish are absent) and occasionally in intermittent streams. Occurs terrestrially in vacant or mammal-occupied burrows, occasionally other underground retreats, throughout most of the year; in grassland, savanna, or open woodland habitats (NatureServe 2012).	Five occurrences found on CNDDB within La Grange quadrangle (CNDDB 2009). Reported on the USFWS species list for critical habitat within the La Grange quadrangle (USFWS 2013).	None

Common Name / Scientific Name	Status	Suitable Habitat Type	Occurrence in Project Vicinity	Status Reports, Recovery Plans Relevant to Project Vicinity
California red-legged frog *Rana aurora draytonii*	FT	Suitable habitat is located in deep (>2.3 ft), still or slow- moving water within dense, shrubby riparian and upland habitats (Jennings and Hayes, 1994).	Reported on the USFWS species list within the La Grange quadrangle (USFWS 2013). The nearest known occurrence is at Piney Creek, where CRLF was last documented in 1984 at locations ranging from 0.96 mi east to 1.06 mi east of the Don Pedro Project Boundary (Basey, pers. comm., 2010, Jennings, pers. comm. 2010 *as cited in* TID/MID 2011).	Recovery Plan (USFWS 2002b)
Fish				
Steelhead[11], California Central Valley DPS *Oncorhynchus mykiss irideus*	FT	CCV steelhead spawn from December – April in cool, well oxygenated streams (NMFS 2014). Juveniles migrate to the ocean after spending two years in fresh water. They reside in the ocean for two or three years before returning to their natal streams to spawn. In the Central Valley, spawning occurs within the Sacramento and San Joaquin rivers and their tributaries. The majority of native, natural production occurs in upper Sacramento River tributaries below Red Bluff Diversion Dam (NatureServe 2012).	Reported on the USFWS species list for critical habitat within the La Grange quadrangle (USFWS 2013).	Recovery Plan for Sacramento River Winter-run Chinook Salmon, Central Valley Spring-run Chinook Salmon and Central Valley Steelhead (NMFS 2014)

[11] CCV steelhead is addressed in Section 3.5 of this DLA.

Common Name / Scientific Name	Status	Suitable Habitat Type	Occurrence in Project Vicinity	Status Reports, Recovery Plans Relevant to Project Vicinity
		Birds		
Bald eagle *Haliaeetus leucocephalus*	SE	Breeding habitat usually includes areas close to coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources. Preferentially roosts in conifers or other sheltered sites in winter in some areas (NatureServe 2012).	One occurrence within La Grange quadrangle (CNDDB 2009).	Status Report (CDFG 2005)
Golden eagle *Aquila chrysaetos*	SFP	Generally open country, in prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. Nests on rock ledge of cliffs or in large trees (NatureServe 2012).	Observed during the BLM and Central Sierra Audubon Society (CSAS) mid-winter eagle surveys on Don Pedro Reservoir. Eagles were observed during surveys in 1997 and each year between 1999 and 2009.	None
		Mammals		
San Joaquin kit fox *Vulpes macrotis mutica*	FE, ST	Alkali sink, valley grassland, foothill woodland. Hunts in areas with low sparse vegetation that allows good visibility and mobility (NatureServe 2012).	One occurrence found on CNDDB within La Grange quadrangle (CNDDB 2009). Reported on the USFWS species list for critical habitat within the La Grange quadrangle (USFWS 2013).	Recovery Plan (USFWS 1998)

FE: - Federally Endangered: Any species that is in danger of extinction throughout all or a significant portion of its range.
FT: - Federally Threatened: Any species likely to become endangered within the near future.
SE: - State Endangered: California State listed as Endangered.
ST: - State Threatened: California State listed as Threatened.
SFP: - California State listed as Fully Protected.
SR: - California State listed as Rare.

3.7.2 Potential Resource Effects

FERC's SD2 identifies the following potential resource issues associated with threatened and endangered species:

- Effects of project operation and maintenance on plants and wildlife species listed as threatened under the ESA.
- Effects of project operation and maintenance on designated critical habitat under the ESA.

- Effects of vegetation clearing and maintenance on species listed as threatened or endangered under the ESA.

The Districts are currently evaluating the above issues and will discuss potential effects to threatened and endangered species in the FLA.

3.8 Recreation and Land Use

The Project is located on the Tuolumne River in Tuolumne and Stanislaus counties, California. Extending from the foothills to the crest of the Sierra Nevada Mountains, Tuolumne County is a popular recreation area. The County contains historical gold mining towns, the Emigrant Wilderness area, Yosemite National Park, and numerous lakes and rivers, including the Wild and Scenic Tuolumne River (Tuolumne County 2005 as cited in TID/MID 2011).

Since the incorporation of Tuolumne County, the region has been a prominent area for industry and recreation. The principal industries were originally related to mining and timber. Early recreational visitors to Tuolumne County were primarily focused on Yosemite National Park. As transportation improved, many locations that were once inaccessible became popular for hiking, camping, gold panning, fishing, swimming, picnicking, climbing, and general river recreation activities (TID/MID 2011).

Stanislaus County is situated in the San Joaquin Valley within 100 miles of San Francisco Bay. Land uses in Stanislaus County include diversified agriculture and livestock husbandry. Recreation activities include fishing, hunting, public recreation areas, community parks, and access to reservoirs.

3.8.1 Existing Recreational Facilities and Opportunities in the Tuolumne River Basin

Recreation opportunities abound in the Tuolumne River basin. Upstream of the Don Pedro Project Boundary, the Tuolumne River is designated as a National Wild and Scenic River all the way to its source (except for Hetch Hetchy Reservoir), a total of about 80 miles. Yosemite National Park and Stanislaus National Forest provide opportunities for camping, fishing, whitewater boating, and other outdoor activities (TID/MID 2011).

Don Pedro Reservoir provides ample recreational opportunities. The public has access to the entire shoreline from the high-water line down and has vehicle access via a variety of small roads outside the major recreation areas (TID/MID 2011). The Districts have developed three major recreation areas at Don Pedro Reservoir, which are managed by the Don Pedro Recreation Agency (DPRA). Together, the three areas include 559 campsites of various types, 43 picnic sites within the three designated picnic areas, three boat launch facilities, two full-service marinas, a houseboat dock and repair yard, and one swimming lagoon (DPRA Recreation Facilities and Operations 2015).

Don Pedro Reservoir supports year-round fishing and supports populations of rainbow, brown, and brook trout; kokanee, coho and Chinook salmon; largemouth, smallmouth, and spotted bass; black and white crappie; bluegill and green sunfish; channel, white, and black bullhead catfish.

Day use visitors have access to fishing opportunities both along the shoreline and via boating. The many forks of the Don Pedro Reservoir afford opportunities for isolated and quiet settings for fishing.

There are no recreation facilities located along the reach of the Tuolumne River between Don Pedro Dam and the LGDD, and access to the area is limited. Boating above the LGDD is made difficult by infeasibility of portage at the spillway because the dam's abutments are vertical canyon walls, and the spillway spans directly between the two Districts' canal intakes, which creates hazardous conditions.

Downstream of the Project, most recreation takes place at Turlock Lake and Modesto Reservoir, although fishing, canoeing, and kayaking occur on the lower Tuolumne (TID/MID 2011). Turlock Lake State Recreation Area is located in eastern Stanislaus County approximately six miles from the Project, and houses the only developed camping facilities along the Tuolumne River downstream of the Project. It is open year-round and features camping, picnicking, fishing, swimming, boating, and water skiing. Bounded on the north by the Tuolumne River and on the south by Turlock Lake, the recreation area provides an ideal setting for water-oriented outdoor activities. Picnicking, day-use, and boat launch ramps are available as well as overnight camping on the south bank of the Tuolumne River (CDPR 2013).

Modesto Reservoir Regional Park is located a few miles east of the town of Waterford off Highway 132. This regional park offers 3,240 acres of land and 2,800 acres of reservoir for recreation and camping. Campsites are available on a "first-come first-serve basis." Recreation opportunities include swimming, fishing, boating, water/jet skiing, bird watching, waterfowl hunting (with permit during specific times of year), archery, and radio-control airplane flying (TID/MID 2011).

The Tuolumne River from LGDD to the San Joaquin River provides opportunities for kayaking, rafting, and tubing, with a few Class I-II rapids (TID/MID 2011). From below the La Grange tailrace down to the Basso Bridge boat ramp, the Tuolumne is scenic and constitutes a beginner's run. This approximately two-mile section of river is primarily flat, generally wide, with several small riffles and a small ledge drop. Turns are all fairly gradual. From Basso Bridge to Turlock Lake State Park, which is approximately six miles in length, the river alternates between flat wide slow water and narrow channels that are fast and sinuous (American Whitewater 2013). Most people take out at Turlock Lake, as there are limited river access and parking options farther downstream (TID/MID 2011).

The Tuolumne River downstream of the Project provides fishing opportunities with special regulations for trout and salmon fishing. From LGDD to the mouth of the San Joaquin River, no trout or salmon may be taken from the Tuolumne. Turlock Lake is stocked with trout, black bass, crappie, bluegill, and catfish. Anglers fish from boats on the reservoir or from the shoreline (TID/MID 2011).

There is limited developed river and fishing access along the lower Tuolumne River outside of Turlock Lake SRA. The two most common public access points are at Basso Bridge and Fox Grove. Basso Bridge is located off Route 132 west of the town of La Grange. Basso Bridge is part of the La Grange Regional Park, which provides about two acres of river access. The Regional

Park includes a parking lot, restrooms, informal boat launch, gravel beach area for swimming, trails and pathways, barbecues, picnic tables, and handicapped access. Fishing is permitted with only barbless hooks, synthetic baits, and tackles. Trout may not be taken and must be released. Basso Bridge fishing access is closed from October 16 through December 31 due to the Chinook salmon run (Stanislaus County 2010 as cited in TID/MID 2011).

3.8.2 Land Use

Lands in the Project vicinity are within Tuolumne and Stanislaus counties and are subject to the Tuolumne County and Stanislaus County general plans and zoning ordinances. Primary land uses in the Project vicinity are single-family residential, non-irrigated farmland, and irrigated farmland.

Land use downstream of the Project is predominately irrigated agriculture and related uses, urban/suburban, and rural residential. The Districts serve over 200,000 acres of high value farmland in the Central Valley.

3.8.3 Recreation Needs Identified in Management Plans

Management plans that address recreation resources within the Tuolumne River basin include the California Department of Parks and Recreation's State Comprehensive Outdoor Recreation Plan (SCORP), including the Survey on Public Opinions and Attitudes in Outdoor Recreation (CDPR 2015); the U.S. Department of Interior, USFWS Recreational Fisheries Policy (USFWS 1989); the Tuolumne County General Plan (Tuolumne County 1996); and the Stanislaus County General Plan (Stanislaus County 1994).

3.8.3.1 California Outdoor Recreation Plan

The 2015 SCORP, among other things, identifies and prioritizes outdoor recreation opportunities and constraints most critical in California. The 2015 SCORP summarizes key findings, introduces new geographic information system (GIS) tools to assess local park needs, and establishes priorities for statewide actions including the use of Land and Water Conservation Fund allocations to California. The 2015 SCORP establishes the following actions to address California's park and recreation needs:

- 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.
- Share and distribute success stories to advance park and recreation services.

The Survey on Public Opinions and Attitudes in Outdoor Recreation in California (POAOR), an element of the SCORP, uses various types of surveys, including an adult telephone survey, adult online/mail-back survey, and online/mail-back youth survey, to provide a comprehensive perspective of the outdoor recreation opinions and attitudes of Californians.

As determined by the 2012 POAOR, the top five recreational activities in California with the highest latent demand are listed in Table 3.8-1. These are activities that Californians would participate in, from a statewide perspective, if more facilities and opportunities were provided. The table provides an overview of the results from the adult and youth surveys.

Table 3.8-1. Top Five Recreational Activities with the Highest Latent Demand in California.

Activity (Adults)	Would participate more often (% Yes)	Activity (Youths)	Would participate more often (% Yes)
Picnicking in picnic areas (with tables, fire pits, or grills)	55.1	Horseback riding	50.2
Walking for fitness or pleasure on paved surfaces	37.4	Camping (tent, recreational vehicle, trailer)	47.1
Camping in developed sites with facilities such as toilets and tables (not including backpacking)	35.1	Mountain biking	46.3
Beach activities (swimming, sunbathing, surf play, wading, playing on beach)	34.6	Backpacking (overnight hiking)	46.3
Swimming in a pool	33.0	Archery	44.9

3.8.3.2 Tuolumne County General Plan

The Tuolumne County General Plan (1996) includes seven mandated elements and an unlimited number of optional elements. The mandatory elements are Land Use, Circulation, Housing, Conservation, Open Space, Noise, and Safety. Currently, the plan includes the following optional elements: Cultural Resource, Economic Development, Agricultural, Recreation, Community Identity, Air Quality, and Public Facilities and Services (TID/MID 2011).

The Recreation Element focuses on the needs associated with its visitors and local residents as well as identifying acquisition funding sources and developing and maintaining parks and recreational facilities. Implementation of the Recreation Element revolves around the following seven key goals:

- Provide an adequate supply and equitable distribution of recreation facilities for residents;
- Cooperate with other public agencies and private enterprise to provide park and recreation facilities;
- Further the goals of other General Plan elements in the acquisition and development of lands for recreation facilities and opportunities;
- Address the impacts of new developments on the County's recreational facilities;
- Acquire, manage, and develop recreational lands according to principles which protect private property rights, maximize cost efficiency, promote accessibilities by all residents, advocate safety, and encourage public participation;
- Develop a broad-based financing program with a wide variety of revenue sources which equitably distributes and/or reduces the cost of providing new recreation facilities; and

- Provide for the ongoing acquisition, construction, and maintenance of recreation facilities.

3.8.3.3 Stanislaus County General Plan

The Stanislaus County General Plan (Stanislaus County 1994) consists of seven mandatory elements and as many optional elements as the local jurisdiction deems desirable. The mandatory elements include Land Use, Circulation, Housing, Open Space, Conservation, Safety, and Noise. Since the Open Space and Conservation Elements have overlapping requirements, they have been combined in the Stanislaus County General Plan. The County has also adopted one optional element, the Agricultural Element.

The Land Use Element focuses on the general distribution and general location and extent of the uses of the land for housing, business, industry, and open space, agriculture, natural resources, recreation, and enjoyment of scenic beauty, education, public buildings and grounds, solid and liquid waste disposal facilities, and other categories of public and private uses of land. The plan includes the following goals:

- Provide for diverse land use needs by designating patterns which are responsive to the physical characteristics of the land as well as to environmental, economic, and social concerns of the residents of Stanislaus County.
- Foster stable economic growth through appropriate land use policies.
- Ensure that an effective level of public service is provided in unincorporated areas.

3.8.4 Recreation Access and Safety Assessment Study

Significant portions of the west bank upstream of LGDD, and both banks of the river immediately downstream of it, are owned by TID or MID or are administered by the BLM. This combination of Districts' ownership and public land may present opportunities for public access, subject to considerations of risk, safety, LGDD security, and environmental impact.

Upstream of LGDD, an assessment of bank slope within 1 mile of Bonds Flat Road (the nearest public road) and within 75 ft of the high water line indicated that although slopes immediately adjacent to the La Grange headpond are generally less than seven percent in grade, the slopes steepen sharply as you move away from the river bank (TID/MID 2017). A similar assessment completed downstream of LGDD indicates that grades along this stretch of the river bank are generally less steep.

The public safety assessment (TID/MID 2017, attached to this DLA) determined that from Don Pedro Dam to a point approximately 100 yards upstream of the MID and TID diversion tunnel intakes, current activities are limited to occasional use by the adjacent private property owners. Normal operation of the Don Pedro Project during the irrigation season can cause high and rapid changes in water velocities through the entire reach of the La Grange headpond. While localized shoreline activities could be considered reasonably safe, in-water activities would be high risk.

The stretch of river between LGDD and a point approximately 100 yards upstream of the MID and TID diversion tunnel intakes may be accessible via the upstream reach of the La Grange headpond; access from the shore is unlikely due to steep slopes and private property. Public hazards in this stretch of river are extreme. One such hazard is the diversion dam overflow spillway. The La Grange spillway has a unique configuration in that there are no abutments; the spillway extends from canyon wall to canyon wall. This area spills when the forebay inflow exceeds the hydraulic capacity or gate settings of the TID and MID diversion tunnel intakes. Flow velocities in the area are frequently high. An individual or boat within this stretch of river is subject to being swept over the spillway and falling over about 100 ft to the rocks below.

Downstream of LGDD, access for fishing and other activities is available to individuals by walking along La Grange Dam Road, which is gated near where the main canal crosses Highway 132. Individuals also walk and wade upstream from a public access point in the town of La Grange near the Old La Grange Bridge. Safety signs are installed throughout the dam and powerhouse area to warn users of potential hazards. The most significant potential risk downstream of LGDD appears to be to individuals fishing in close proximity to LGDD or the powerhouse at the time of a spill event or an increase in flows. In addition, plant and LGDD security issues associated with allowing public access directly to the powerhouse or dam infrastructure must be recognized. Risk levels for a range of recreation activities associated with the La Grange headpond and immediately downstream of LGDD under an increased use scenario are shown in Table 3.8-2.

Table 3.8-2. Risk levels for a range of recreation activities associated with the La Grange headpond under an increased use scenario.

Risk Level	Activity
La Grange headpond	
High	• Fishing from Boat • Boating (under power) • Canoeing / Kayaking / Rowing • Swimming / Diving • Climbing
Medium	• Fishing from Shore • Walking / Hiking • Picnicking • Bird watching
Low	• None at this time
Downstream of LGDD	
High	• Fishing from Boat • Boating (under power) • Canoeing / Kayaking / Rowing • Swimming / Diving
Medium	• Fishing from Shore • Walking / Hiking • Climbing • Bird watching
Low	• None at this time

If security and safety concerns can be addressed, it may be possible to accommodate public use of the shoreline upstream of the LGDD, on river right at approximately RM 53.3. Use of this area would be restricted to day use, land-based activities only. Security concerns relate to the safety and operation of the Don Pedro powerhouse and dam, which is rated as a "high hazard" facility by FERC, indicating the potential for loss of life if the dam were to be compromised. The security of the Don Pedro Project must be ensured when considering the potential for permitting public use of the shoreline of the LGDD headpond. Assuming public safety concerns along the LGDD headpond and security concerns related to the Don Pedro powerhouse and dam can be addressed, it may be feasible to construct a walking trail that begins at DPRA headquarters, continues along the elevated contour, descends toward the river, and terminates at the shoreline. The trail would be open during daylight hours only. Individuals wishing to access the trail would park in the existing DPRA parking lot. Establishing the trailhead at DPRA would also allow the Districts to maintain a visitor log. Visitors would be required to check-in at DPRA when they arrive and to check-out when they return from using the trail. Maintaining a visitor log would allow the Districts to monitor trail usage and to confirm at the end of each day that all users have returned. Requiring users to check-in would also allow the Districts to limit use of the trail, if necessary. The following improvements would also be considered:

- Install information signage at trailhead.
- Provide signage at the base of the trail to indicate potential hazards associated with the spillway, rapidly changing river flows resulting in strong currents, tunnel intakes, and lack of egress.
- Provide signage to delineate private property in the area.

3.8.5 Potential Resource Effects

FERC's SD2 identifies the following potential effects of the Project on recreation and land use resources:

- Effects of Project operation on recreation.
- Adequacy of existing public access to support future recreation use.

The Districts are currently evaluating the above issues and will discuss potential effects to recreation and land use resources in the FLA.

3.9 Aesthetic Resources

The Project is located on the Tuolumne River near the border of Stanislaus and Tuolumne counties in Central California. The LGDD, which was originally constructed between 1891 and 1893, replaced Wheaton Dam, which was built by other parties in the early 1870s. The original 127.5-foot-high arched LGDD was constructed of boulders set in concrete and faced with roughly-dressed stones from a nearby quarry. In 1923, an 18-inch-high concrete cap was added, and in 1930 an additional 24-inch-high concrete cap was added, resulting in the current height of 131 ft (Figures 3.9-1 and 3.9-2).

Figure 3.9-1. LGDD.

Figure 3.9-2. Water spilling at LGDD (February 2017).

The La Grange headpond extends approximately one mile upstream from the LGDD and is contained in a narrow, steep-sided canyon (Figure 3.9-3). Views of the La Grange headpond are scenic, and because residential and commercial development do not occur along the headpond's shoreline, vegetation along the reservoir is generally established, and lands around the headpond blend into the surrounding landscape.

Figure 3.9-3. La Grange headpond.

The La Grange powerhouse is a 72-foot by 29-foot structure with reinforced concrete substructure and steel superstructure located approximately 0.2 miles downstream of the LGDD on the east bank of the Tuolumne River (Figure 3.9-4). A portion of the water discharged from the La Grange headpond is routed to a concrete forebay that contains the TID non-Project irrigation canal headworks and, separately, the intakes for the two powerhouse penstocks. The penstock for Unit 1 is a 235-foot-long, 5-foot-diameter riveted steel pipe. The penstock for Unit 2 is a 212-foot-long, 7-foot-diameter riveted steel pipe. Turbine discharges at the La Grange Powerhouse flow into a tailrace that joins the lower Tuolumne River about 0.5 mile below the LGDD. The Project facilities are structural elements that visually contrast with the surrounding landscape.

Figure 3.9-4. Penstock and powerhouse viewed from the MID canal.

3.9.1 Potential Resource Effects

FERC's SD2 identifies the following potential Project effects on aesthetic resources:

- Effects of the project's features, operation, and maintenance on the surrounding landscape.

The Districts are currently evaluating the above issues and will discuss potential effects to aesthetic resources in the FLA.

3.10 Cultural and Tribal Resources

The La Grange Project area has a varied and rich history related to cultural resources. The Districts have conducted a Cultural Resources Study in consultation with potentially affected Tribes, BLM, the SHPO, and other interested parties, to identify cultural resources within the APE, formulate a plan to evaluate their eligibility to the NRHP, if needed, and identify Project-related effects on those resources. The Cultural Resources Study Report, filed as an appendix to the Districts' USR, presented a detailed description of the history of cultural resources in the Project vicinity and the full results of the Cultural Resources Study (TID/MID 2017, attached to this DLA). A brief summary of Cultural Resources Study Report results is presented below.

The Cultural Resources Study resulted in the identification of 20 archaeological and built environment resources, of which 18 have been evaluated as ineligible for inclusion on the NRHP, and two have been evaluated as eligible for inclusion on the NRHP (Table 3.10-1).

A total of two isolated finds were located and documented within the APE. Both of these isolated finds are historic-era isolates and have been evaluated as ineligible for inclusion on the NRHP.

Table 3.10-1. Summary of NRHP recommendations for resources identified within the APE.

Resource Type	Ineligible	Unevaluated	Eligible	Totals
Isolated Find	2	0	0	**2**
Archaeological Site	5	0	0	**5**
Built Environment	11	0	2	**13**
TCP	0	0	0	**0**
Totals	**18**	**0**	**2**	**20**

A total of five archaeological sites were located and documented within the APE, of which all five were newly identified. Of the five archaeological sites identified, four contain historic-era deposits and features and one represents prehistoric or Native American use. Of the archaeological sites identified within the APE, all five have been evaluated as ineligible for inclusion on the NRHP.

A total of 13 built environment resources, 11 newly recorded, were identified and recorded. Of these, 11 are recommended ineligible for inclusion in the NRHP, and two are recommended eligible for inclusion: the LGDD and the La Grange Ditch. The La Grange Ditch was previously determined eligible and SHPO concurred with this determination in a letter dated December 12, 2014. The La Grange Project was also evaluated as a potential historic district comprised of those built environment facilities that represent the operation and support infrastructure facilities of the La Grange Project as a hydroelectric generation and water irrigation project and were part of the original Project facilities built between 1893 and 1924. The Project as a whole was found to have insufficient physical integrity to be eligible for listing in the NRHP as a historic district.

Interviews and background research were conducted to identify and evaluate traditional cultural properties (TCP) within the Project APE; however, no evidence of TCPs within the APE were revealed during the study. The Cultural Resources Study identified two historic properties (assuming SHPO concurs with the eligibility of the LGDD), the LGDD and the La Grange Ditch.

3.10.1 Potential Resource Effects

Page 22 of FERC's SD2 identifies the following issues associated with cultural resources:

- Effects related to the O&M on historic, archaeological, and traditional cultural resources that may be eligible for inclusion in the NRHP.

The Districts are currently evaluating the above issues and will discuss potential effects to cultural resources in the FLA.

3.11 Socioeconomic Resources

LGDD was constructed from 1891 to 1893. The purpose of the dam was to raise the level of the Tuolumne River to permit the diversion and delivery of water by gravity to irrigation systems owned by TID and MID. Built in 1924, the La Grange hydroelectric plant is owned and operated by TID and has a capacity of about 4.6 MW. LGDD provides no flood control benefits, and there are no recreation facilities associated with the Project or the La Grange headpond.

LGDD is located on the Tuolumne River near the border of Stanislaus and Tuolumne counties in the Central Valley of California. The dam is located in Stanislaus County, and the La Grange headpond spans both Stanislaus County and Tuolumne County. The following section provides population, demographic, employment, and household income information for Stanislaus County and Tuolumne County.

3.11.1 Historical and Current Population

Table 3.11-1 provides population data from 1980 to 2015 for Stanislaus County, Tuolumne County, and the state of California. From 1980 to 2015, the population of Stanislaus County grew by more than 98 percent. The population of Tuolumne County also grew during that time, but at a more modest pace. Since the 1980s and 1990s, population growth in both counties, as well as across the state, has slowed.

Table 3.11-1. Population growth in Stanislaus and Tuolumne counties, 1970 to 2014.

Year	Stanislaus County	Tuolumne County	California
Population			
1980	265,900	33,928	23,667,902
1990	370,522	48,456	29,758,213
2000	446,997	54,504	33,873,086
2010	514,453	55,365	37,253,956
2015	527,367	54,079	38,993,940
Population Percent Change			
1980-1990	39.3%	42.8%	25.7%
1990-2000	20.6%	12.5%	13.8%
2000-2010	15.1%	1.6%	10.0%
2010-2015	2.5%	-2.3%	4.7%
1980-2015	98.3%	59.4%	64.7%

Sources: California Department of Finance (undated; 2007; 2012a; 2012b), U.S Department of Commerce, Census Bureau (2015 and 2016).

3.11.2 Projected Population

Between 2010 and 2060, the population of Stanislaus County is expected to grow by more than 85 percent and the population of Tuolumne County is estimated to grow by more than 15 percent (Table 3.11-2). The combined population of both counties is projected to increase from about 569,818 people in 2010 to about 1,018,000 in 2060, an increase of 78.6 percent. This growth outpaces the growth expected statewide, which is estimated to be about 41 percent.

Table 3.11-2. Population projections in the study area through 2060.

Region	2010	Projections 2020	2030	2040	2050	2060
Stanislaus County	514,453	589,156	674,859	759,027	861,984	953,580
Tuolumne County	55,365	55,938	57,982	60,593	61,678	69,947
California	37,253,956	40,643,643	44,279,354	50,365,074	50,365,074	52,693,583

Source: California Department of Finance 2013

3.11.3 Race and Ethnicity

Table 3.11-3 provides data on the racial and ethnic compositions of Stanislaus County and Tuolumne County in 2010. The predominant racial group in both counties is White (Caucasian). Stanislaus County has a relatively large minority and Hispanic population. Tuolumne County is less diverse, with Whites accounting for 87.2 percent of its population.

Table 3.11-3. Race and ethnicity in Stanislaus County and Tuolumne County, 2010.

Race / Ethnicity	Stanislaus County		Tuolumne County	
	Number	Percent	Number	Percent
White	337,342	65.6%	48,274	87.2%
Black or African American	14,721	2.9%	1,143	2.1%
American Indian and Alaska Native	5,902	1.1%	1,039	1.9%
Asian	26,090	5.1%	572	1.0%
Native Hawaiian and Other Pacific Islander	3,401	0.7%	76	0.1%
Some Other Race	99,210	19.3%	2,238	4.0%
Two or More Races	27,787	5.4%	2,023	3.7%
Hispanic or Latino of Any Race	215,658	41.9%	5,918	10.7%

Source: U.S Department of Commerce, Census Bureau 2010.

3.11.4 Regional Employment and Income

Information on employment characteristics in Stanislaus and Tuolumne counties is presented in Table 3.11-4. Between 2007 and 2011, the unemployment rate in Tuolumne County and Stanislaus County averaged 13.1 percent and 14.2 percent, respectively. During this time period, rates of unemployment in each county were greater than the rate of unemployment experienced statewide.

Table 3.11-4. Employment status in Stanislaus and Tuolumne counties and the State of California, 2007 through 2011 (annual average).

Employment Type	Stanislaus County	Tuolumne County	California
Civilian labor force	240,165	23,645	18,472,288
Employed	205,958	20,559	16,603,417
Unemployed	34,207	3,086	1,868,871
Unemployment Rate	14.2%	13.1%	10.1%

Source: U.S Department of Commerce, Census Bureau 2012.

Table 3.11-5 lists 10 of the largest employers in Stanislaus County. Eight of the 10 are in agricultural production or food processing, and the remaining two are in health-related industries.

Table 3.11-5. Major employers in Stanislaus County.

Employer	Employment Range
Alcott Ridge Vineyards	1,000-4,999
Carlo Rossi Vineyards	1,000-4,999
Con Agra Foods	1,000-4,999
Del Monte Foods	1,000-4,999
Doctors Medical Center	1,000-4,999
E&J Gallo Winery	1,000-4,999
Ecco Domani Winery	1,000-4,999
Emanuel Medical Center	1,000-4,999
Fairbanks Cellars	1,000-4,999
Foster Farms	1,000-4,999

Source: California Employment Development Department 2013a.

Table 3.11-6 lists 10 of the largest employers in Tuolumne County. The mix of employers in Tuolumne County includes two health-related businesses, three entertainment and recreation entities, a prison, a college, a utility, a nonprofit, and a big box retail store.

Table 3.11-6. Major employers in Tuolumne County.

Employer	Employment Range
Corrections Department	1,000-4,999
Sonora Regional Convalescent Home	1,000-4,999
Sonora Regional Hospital	1,000-4,999
Black Oak Casino	500-999
Dodge Ridge Ski Resort	500-999
Hetch Hetchy Water & Power	250-499
National Audubon Society	250-499
Walmart	250-499
Chicken Ranch Bingo & Casino	100-249
Columbia College	100-249

Source: California Employment Development Department 2013b.

Table 3.11-7 provides data on median household income in Stanislaus County and Tuolumne County. Median household incomes in both counties trail statewide values.

Table 3.11-7. Median household income (dollars).[1]

Year	Stanislaus County	Tuolumne County	California
2010	$57,443	$47,462	$60,883
2011	$56,996	$47,359	$61,632
2012	$55,548	$48,169	$61,400
2013	$55,432	$48,426	$61,049
2014	$55,357	$48,493	$61,489

[1] Values are not adjusted for inflation.
Source: U.S Department of Commerce, Census Bureau 2015.

3.11.5 Potential Resource Effects

Page 22 of FERC’s SD2 identifies the following issues associated with socioeconomic resources:

- Socioeconomic effects of any proposed measures to change La Grange operations on affected governments, residents, agriculture, businesses, and other related interests.

The Districts are currently evaluating the above issues and will discuss potential effects to socioeconomic resources in the FLA.

4.0 CUMULATIVE EFFECTS OF THE PROPOSED ACTION

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) (50 CFR §1508.7), cumulative effects on a resource are the result of the combined influences of past, present, and reasonably foreseeable future actions within a specified geographical range (FERC 2008), regardless of what agency (federal or non-federal) or other entity undertakes such actions. Cumulative effects may be beneficial or adverse. Resources of the Tuolumne River basin may be cumulatively affected by individually minor but collectively significant actions taking place over time.

4.1 Relevant Actions Inside and Outside of the Tuolumne River Basin

Activities contributing to cumulative effects to resources in the Tuolumne and San Joaquin river basins include water storage and diversion dams for irrigation and M&I uses, flood control operations, generation of hydroelectric power, historical and ongoing aggregate mining, in-channel dredging operations, channel modification for shipping and by levees, riparian diversions, agricultural runoff, urbanization and other land development, wastewater treatment plant discharges, stormwater management, the introduction of non-native fish species, state and federal hatchery operations, recreation, and a range of other potential activities. A detailed account of factors contributing to cumulative effects in the Tuolumne River basin, the San Joaquin River basin, and in the Bay Delta can be found in Section 4 of the FLA for the Don Pedro Hydroelectric Project (TID/MID 2014).

4.2 Cumulatively Affected Resources

Based on comments FERC received during scoping from the La Grange Hydroelectric Project and information in the PAD, FERC indicated that the Proposed Action could contribute to cumulative effects on the following resources: (1) water resources, (2) aquatic resources, (3) geomorphology, (4) recreation, and (5) socioeconomics (FERC 2014). For water resources, aquatic resources (including anadromous fish and their essential habitat), and socioeconomics, FERC defined the geographic scope as extending from Hetch Hetchy Reservoir to San Francisco Bay. For geomorphology, the geographic scope extends from Hetch Hetchy Reservoir to the confluence of the Tuolumne and San Joaquin rivers. For recreation resources, the geographic scope extends from the upstream extent of Don Pedro Reservoir to the confluence of the Tuolumne and San Joaquin rivers. The temporal scope includes past and present actions and reasonably foreseeable actions that could occur over the next 30 to 50 years.

The Districts are currently conducting an analysis of cumulative effects, which will be included in the FLA for the Proposed Action. The cumulative effects analysis provided in the FLA will address all components, facilities, operations, and maintenance that make up the overall La Grange Project. The Districts are seeking an original license to continue generating hydroelectric power at the Project, i.e., the Proposed Action. Being able to differentiate the effects of the hydropower operations from other effects of the La Grange Project will aid in defining the scope and substance of potential cumulative effects associated with the Proposed Action.

5.0 DEVELOPMENTAL ANALYSIS

A Developmental Analysis will be presented in the FLA.

6.0 CONSULTATION RECORD

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 5.18(b)(5)(G) describes the required content of the Consultation Record.

> *5.18(b)(5)(G) Consultation Documentation. Include a list containing the name, and address of every Federal, state, and interstate resource agency, Indian tribe, or member of the public with which the applicant consulted in preparation of the Environmental Document.*

The Districts have established and maintained an extensive licensing participant email group, which has been used to keep all licensing participants, including agencies, Tribes, NGOs, and interested members of the public, advised of all licensing activities. Table 6.0-1 lists parties on the email distribution list during the licensing process to date. All licensing participant workshop notes for 2015 and 2016 are attached to this DLA. In addition to all workshop notes, a full consultation record of all communication with licensing participants will be included in the FLA.

Table 6.0-1. List of parties consulted during the La Grange licensing process to date.

Name	Affiliation
Alves, Jim	City of Modesto
Amerine, Bill	Moaz Amerine and Associates
Ansley, J	Duane Morris LLP
Armstrong, George	Member of the public
Asay, Lynette	Newman-Romano LLC
Bahls, Amanda	U.S. Bureau of Reclamation
Barnes, Peter	State Water Resources Control Board
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7.0 REFERENCES

Section 1.0: Introduction

Anderson, J. H. et al. 2014. Planning Pacific Salmon and Steelhead Reintroductions Aimed at Long-Term Viability and Recovery. North American Journal of Fisheries Management, 34:1, 72-93.

Federal Energy Regulatory Commission [FERC]. 2015. Transcript from the March 31, 2015, Study Dispute Resolution Panel Meeting and Technical Conference for the La Grange Hydroelectric Project. March 2015. Available on FERC eLibrary.

Kavalec, Chris, Nick Fugate, Cary Garcia, and Asish Gautam. 2016. California Energy Demand 2016-2026, Revised Electricity Forecast. California Energy Commission. Publication Number: CEC-200-2016-001-V1.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2016. Fish Passage Facilities Alternatives Assessment Progress Report. Prepared by HDR, Inc. Appendix to La Grange Hydroelectric Project Initial Study Report. February 2016.

_____. 2017. Cultural Resources Study Report. Prepared by HDR, Inc. Appendix to La Grange Hydroelectric Project Updated Study Report [Filed with FERC as Privileged Information]. February 2017.

Section 2.0: Proposed Action and Alternatives

(No references cited in this section)

Section 3.0: Environmental Analysis

Section 3.1: General Description of the Tuolumne River Basin and La Grange Hydroelectric Project

San Francisco Public Utilities Commission (SFPUC). 2008. Final Program Environmental Impact Report, Volume 3 of 8, for the San Francisco Public Utilities Commission's Water System Improvement Program, Water Supply and System Operations, Chapter 5 Setting and Impacts. San Francisco Planning Department File No. 2005.0159E, State Clearinghouse No. 2005092026.

Stanislaus County. 2006. Stanislaus County General Plan. Stanislaus County Board of Supervisors, Modesto, California.

State of California, Employment Development Department. 2013. Major Employers in Tuolumne County. [Online] URL: http://www.labormarketinfo.edd.ca.gov/majorer/countymajorer.asp?CountyCode=000109 accessed March 26, 2013.

U.S. Army Corps of Engineers (ACOE). 1972. Don Pedro Lake, Tuolumne River, California: Reservoir Regulation for Flood Control. Department of the Army, Sacramento, California.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2014. Socioeconomics Study Report (W&AR-15). Prepared by Cardno ENTRIX. April 2014.

Western Regional Climate Center. 2010. Historical Climatological data for Northern California. Western Regional Climate Center, Reno, Nevada. [Online] URL: http://www.wrcc.dri.edu/summary/ climsmnca.html. (Accessed August 2010.)

Section 3.2: Scope of Cumulative Effects Analysis

Federal Energy Regulatory Commission (FERC). 2014. Scoping Document 2 for La Grange Hydroelectric Project No. 14581. Office of Energy Projects Division of Hydropower Licensing, Washington, D.C. September 5, 2014.

_____. 2008. Preparing Environmental Documents, Guidelines for Applicants, Contractors, and Staff. Office of Energy Projects Division of Hydropower Licensing, Washington, D.C.

Section 3.3: Geology and Soils

Avendian, C. 1978. Yosemite Nature Notes: Article on website created by Dan Anderson. [Online] URL: http://www.yosemite.ca.us/library/yosemite_nature_notes/47/3/plate_tectonics.html. (Accessed September 2010.)

Bateman, P. C., L. D. Clarke, N. K. Huber, J. G. Moore, and C. D. Rinehart. 1963. The Sierra Nevada batholith – a synthesis of recent work across the central part: United States Geological Survey Professional paper, 414-D, p. 1-46.

Bufe, C. G., F. W. Lester, K. M. Lahr, J. C. Lahr, L. C. Seekins, and T. C. Hanks. 1976. Oroville earthquakes, normal faulting in the Sierra Nevada foothills: Science, v.192, p.72-74.

California Department of Water Resources (CDWR). 1994. California Water Plan Update 1993. Bulletin 160-93. October. Available online at: http://www.water.ca.gov/waterdatalibrary/docs/historic/Bulletins/Bulletin_160/Bulletin_160-93-ES__1994.pdf.

Clark, L.D. 1960. Foothills Fault System, western Sierra Nevada, California: Geological Society of America Bulletin, v. 71, p. 483-496.

Clark, L.D. and N.K. Huber. 1975. Geologic observations and sections along selected stream traverses, northern Sierra Nevada metamorphic belt, California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-690, scale 1:62,500.

Day, H.W., E.M. Moores, and A.C. Tuminas. 1985. Structure and tectonics of the northern Sierra Nevada: Geological Society of America Bulletin, v. 96, p. 436-450.

Dickinson, W.R. 1981. Plate tectonics and the continental margin of California, in, Ernst, W. G., ed., The Geotectonic Development of California: Engelwood Cliffs, N. J., Prentice Hall, Inc., p. 1-28.

Hamilton, W. and W. B. Myers. 1967. The nature of batholiths: United States Geological Survey Professional Paper 554-C, 30p.

Harden, D.R. 2004. California Geology: Pearson Education, Inc., Upper Saddle River, New Jersey 07458, 2nd Edition, 552p.

Higgins, C.T. and D.L. Dupras. 1993. Mineral Land Classification of Stanislaus County, California. California Department of Conservation, Division of Mines and Geology, Sacramento, California.

Hill, D. P., J. P. Eaton, W. L. Ellsworth, R. S. Cockerham, F. W. Lester, and E. J. Corbett. 1991. The seismotectonic fabric of central California, p. 107-132, in, Slemmons, D. B., E. R. Engdahl, M. D. Zoback, and D. D. Blackwell, eds., 1991, Neotectonics of North America: Geological Society of America, Decade Map Volume 1, 498p.

Jennings, C.W. and W.A. Bryant. 2010. Fault activity map of California: California Geological Survey Geologic Data Map no. 6, scale 1:750,000.

Kondolf, G.M. 1995. Geomorphological stream channel classification in aquatic habitat restoration: Uses and limitations. Aquatic Conservation: Marine and Freshwater Ecosystems 5: 127-141. Doi: 10.1002/aqc.3270050205.

Lahr, K. M., J. C. Lahr, A. G. Lindh, C. G. Buffe, and F. W. Lester. 1976. The August 1975 Oroville earthquakes: Bulletin of the Seismological Society of America, v. 66, p. 1085-

Langston, C. A. and R. Butler. 1976. Focal mechanism of the August 1, 1975 Oroville earthquake: Bulletin of the Seismological Society of America, v. 66, p. 1121-1132.

Mayfield, J.D. and H.W. Day. 2000. Ultramafic rocks in the Feather River Belt, northern Sierra Nevada, California, in Brooks, E.R. and Dida, L.T., eds, Field guide to the geology and tectonics of the northern Sierra Nevada, National Association of Geoscience Teachers Far-Western Section Fall Conference 2000: California Division of Mines and Geology Special Publication 122, p. 1-15.

McBain and Trush. 2000. Habitat restoration plan for the Lower Tuolumne River corridor, Final Report. Prepared by McBain and Trush, Arcata, California for the Tuolumne River Technical Advisory Committee with assistance from U.S. Fish and Wildlife Service Anadromous Fish Restoration Program.

Morrison, P. W., B. W. Stump, Jr., and R. A. Uhrhammer. 1976. The Oroville earthquake sequence of August 1975: Bulletin of the Seismological Society of America, v. 66, p. 1065-1084.

Schweickert, R.A. 1981. Tectonic evolution of the Sierra Nevada range, in Ernst, W. G., ed., The Geotectonic Development of California: Englewood Cliffs, N.J., Prentice-Hall, Inc., p. 87-131.

Schweickert, R.A., N.L. Bogen, G.H. Girty, R.E. Hanson, and C. Merguerian. 1984. Timing and structural expression of the Nevadan orogeny, Sierra Nevada, California: Geological Society of America Bulletin, v. 95, p. 967-979.

Schweickert, R.A., C. Merguerian, and N.L. Bogen. 1988. Deformational and metamorphic history of Paleozoic and Mesozoic basement terranes in the western Sierra Nevada metamorphic belt, in Ernst, W. G., ed., Metamorphism and Crustal Evolution of the Western United States: Englewood Cliffs, N. J., Prentice Hall, Inc., p. 789-822.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2011. Pre-Application Document. Don Pedro Project. FERC No. 2299. February 2011.

_____. 2013. Spawning Gravel in the Lower Tuolumne River Study Report (W&AR-04). Attachment to Don Pedro Hydroelectric Project Updated Study Report. December 2013.

United States Geological Survey (USGS). 2013. Earthquake Hazards Program, [Online] URL: http://earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php

Uhrhammer, R. A. 1991. Northern California seismicity, p. 99-106, in, Slemmons, D. B., Engdahl, E. R., Zoback, M. D., and Blackwell, D. D., eds., 1991, Neotectonics of North America: Geological Society of America, Decade Map Volume 1, 498p.

Varga, R.J. and E.M. Moores. 1981. Age, origin, and significance of an unconformity that predates island-arc volcanism in the northern Sierra Nevada: Geology, v. 9, p. 512-518.

Wakabayashi, J. and T.L. Sawyer. 2001. Stream incision, tectonics, uplift, and evolution of topography of the Dierra Nevada, California. Journal of Geology 109: 539-562.

Wentworth, C.M. and M.D. Zoback. 1989. The style of later Cenozoic deformation at the eastern front of the California Coast Ranges: Tectonics, v. 8, p. 237-246.

Wong, I. G. and W. U. Savage. 1983. Deep intraplate seismicity in the western Sierra Nevada, central California: Bulletin of the Seismological Society of America, v. 73, no. 3, p. 797-812.

Section 3.4: Water Resources

Central Valley Regional Water Quality Control Board (CVRWQCB). 1998. The Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin.

Fourth Edition, Revised April 2016 (with Approved Amendments). California Regional Water Quality Control Board, Central Valley Region.

Jayasundara, N. C., M. L. Deas, E. Sogutlugil, E. Miao, E. Limanto, A. Bale, and S. K. Tanaka. 2014. Tuolumne River flow and temperature model: without project assessment. Prepared by Watercourse Engineering, Inc., Davis, CA.

State Water Resources Control Board (SWRCB). 2012. 2012 Integrated Report Clean Water Act Sections 303(d) and 305(b). Approved July 30, 2015. Board Resolution No. 2015-0021. Sacramento, California. Available online at: <http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2012.shtml>

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2013a. Water Quality Assessment Study Report (W&AR-01). Attachment to Don Pedro Hydroelectric Project License Application. December 2013.

_____. 2013b. Project Operations/Water Balance Model Study Report (W&AR-02). Attachment to Don Pedro Hydroelectric Project Updated Study Report. December 2013.

_____. 2013c. Reservoir Temperature Model Study Report (W&AR-03). Attachment to Don Pedro Hydroelectric Project Updated Study Report. December 2013.

_____. 2013d. Lower Tuolumne River Temperature Model Study Report (W&AR-16). Attachment to Don Pedro Hydroelectric Project Updated Study Report. December 2013.

_____. 2014a. Don Pedro Project, FERC No. 2299. Don Pedro Hydroelectric Project Final License Application. April 2014.

_____. 2014b. La Grange Project Pre-Application Document. January 2014.

U.S. Army Corps of Engineers (ACOE). 1972. Don Pedro Lake, Tuolumne River, California: Reservoir Regulation for Flood Control. Department of the Army, Sacramento, California.

United States Geologic Survey (USGS). 2008. Water Resources Data – California, Water Year 2008: Volume 3 – Southern Central Valley Basins and the Great Basin from Walker River to Truckee River. Available online at: http://ca.water.usgs.gov/waterdata/.

Western Regional Climate Center. 2006. Historical Climatological data for Northern California. Western Regional Climate Center, Reno, Nevada. [Online] URL: http://www.wrcc.dri.edu/summary/climsmnca.html.

Section 3.5: Aquatic Resources

Bovee, K. D. 1982. A guide to stream habitat analysis using instream flow incremental methodology. Instream Flow Information Paper No. 12. Instream Flow Group. U.S. Fish and Wildlife Service, Fort Collins, Colorado. FWS/OBS- 82/26. 248 pp.

Dill, W.A, and A.J. Cordone. 1997. History and status of introduced fishes in California, 1871-1996. California Department of Fish and Game Fish Bulletin 178. [Online] URL: http://www.escholarship.org/uc/item/5rm0h8qg#page-1. (Accessed August 2, 2010.)

Farrell, A.P., N.A. Fangue, C.E. Verhille, D.E. Cocherell, K.K. English. 2015. Thermal performance of wild juvenile *Oncorhynchus mykiss* in the lower Tuolumne River: a case for local adjustment to high river Temperature. Prepared for Turlock Irrigation District and Modesto Irrigation District for the Don Pedro Hydroelectric Project, FERC No. 2299.

Ford, T. and L.R. Brown. 2001. Distribution and Abundance of Chinook Salmon and Resident Fishes of the Lower Tuolumne River, California. Fish Bulletin.

McBain & Trush. 2000. Habitat restoration plan for the Lower Tuolumne River corridor, Final Report. Prepared by McBain and Trush, Arcata, California for the Tuolumne River Technical Advisory Committee with assistance from U.S. Fish and Wildlife Service Anadromous Fish Restoration Program.

Moyle, P.B. 2002. Inland Fishes of California. Revised and expanded. Berkeley: University of California Press. 502 pp.

Paterson, A.M. 1987. Land, Water, and Power (3rd ed.). The Arthur H. Clark Company, Spokane, Washington. 319 pp.

Stillwater Sciences. 2009. Don Pedro Reservoir Fish Mercury Study. Final Report for Turlock Irrigation District and Modesto Irrigation District.

_____. 2013. Lower Tuolumne River Instream Flow Study. Final Report. Prepared by Stillwater Sciences, Davis, California for Turlock and Irrigation District and Modesto Irrigation District, California. April 2013.

_____. 2014. Lower Tuolumne River Instream Flow Study - Pacific lamprey and Sacramento splittail 1-D PHABSIM habitat assessment. Prepared by Stillwater Sciences, Davis, California for Turlock and Irrigation District and Modesto Irrigation District, California. April 2014.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 1992. Lower Tuolumne River spawning gravel availability and superimposition report. Appendix 6 in Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299 Vol. VIII. Prepared by EA Engineering, Science, and Technology, Lafayette, California.

_____. 2007. 2006 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. 2 Volumes. March.

_____. 2010a. Report 2009-3: 2009 seine report and summary update. Prepared by Prepared by Tim Ford, Turlock and Modesto Irrigation Districts and Steve Kirihara, Stillwater Sciences, Berkeley, CA. June 2009.

_____. 2010b. Report 2009-4: 2009 rotary screw trap report. Prepared by Michele L. Palmer and Chrissy L. Sonke, FISHBIO Environmental, LLC, Oakdale, CA. February 2010.

_____. 2010c. Report 2009-5: 2009 snorkel report and summary update. Prepared by Tim Ford, Turlock and Modesto Irrigation Districts and Steve Kirihara, Stillwater Sciences, Berkeley, CA. March 2010.

_____. 2012. 2011 Annual Summary Report. [Online] URL: http://tuolumnerivertac.com/Documents/2012_FERC_ Report.pdf. (Accessed April 26, 2013.)

_____. 2013a. Fish Assemblage and Population Between Don Pedro Dam and La Grange Dam Study Report (W&AR-13). Attachment to Don Pedro Hydroelectric Project Initial Study Report. January 2013.

_____. 2013b. Spawning Gravel in the Lower Tuolumne River Study Report (W&AR-04). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2013c. Salmonid Population Information Integration and Synthesis Study Report (W&AR-05). Attachment to Don Pedro Hydroelectric Project Initial Study Report. January 2013.

_____. 2013d. Chinook Salmon Population Model Study Report (W&AR-06). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2013c. *Oncorhynchus mykiss* Scale and Age Determination Study Report (W&AR-20). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2013e. Predation Study Report (W&AR-07). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2013f. Salmonid Redd Mapping Study Report (W&AR-08). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2013g. *Oncorhynchus mykiss* Habitat Survey Study Report (W&AR-12). Attachment to Don Pedro Hydroelectric Project Draft License Application. December 2013.

_____. 2014b. Don Pedro Project, FERC No. 2299. Don Pedro Hydroelectric Project Final License Application. April 2014.

_____. 2015. Lower Tuolumne River Floodplain Hydraulic Assessment Draft Study Report (W&AR-21). Don Pedro Project, FERC No. 2299. September 2015.

_____. 2016a. Chinook Salmon Otolith Study (W&AR-11). Don Pedro Hydroelectric Project, FERC No. 2299. February 2016.

_____. 2016b. Salmonid Habitat Mapping Technical Memorandum. Prepared by Stillwater Sciences. Appendix to La Grange Hydroelectric Project Initial Study Report. February 2016.

_____. 2016c. Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River Study Report. Prepared by Stillwater Sciences. Appendix to La Grange Hydroelectric Project Initial Study Report. February 2016.

_____. 2016d. Fish Passage Facilities Alternatives Assessment Progress Report. Prepared by HDR, Inc. Appendix to La Grange Hydroelectric Project Initial Study Report. February 2016.

_____. 2017a. La Grange Project Fish Barrier Assessment Progress Report. Prepared by FISHBIO. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

_____. 2017b. Topographic Survey Technical Memorandum. Prepared by HDR, Inc. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

_____. 2017c. Fish Presence and Stranding Assessment Technical Memorandum. Prepared by FISHBIO. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

_____. 2017d. Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes Study Report. Prepared by FISHBIO and LGL Alaska Research Associates. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

_____. 2017e. 2016 Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 58 of the License for the Don Pedro Project, FERC No. 2299. Prepared by FISHBIO Environmental, Oakdale, California. March 2017.

U.S. Geological Survey (USGS). 1899. Water supply and irrigation papers. No. 19. Government Printing Office, Washington D.C.

Yoshiyama, R.M., E.R. Gerstung, F.W. Fisher, and P.B. Moyle. 1996. Historical and present distribution of Chinook salmon in the Central Valley drainage of California. Sierra Nevada Ecosystem Project: final report to Congress. In: University of California, Center for Water and Wildlife Resources, Davis. Assessments, commissioned reports, and background information. p 309-362. [Online] URL: http://www.sierraforestlegacy.org/

Resources/Conservation/SierraNevadaWildlife/Chinook/CHYoshiyama-etal1996.pdf. (Accessed August 10, 2010.)

Section 3.6: Wildlife and Botanical Resources

American Society of Mammalogists. 2013. Mammals of California. [Online] URL: http://www.mammalsociety.org/mammals-california. (Accessed April 2013.)

California Department of Food and Agriculture (CDFA). 2012. Encycloweedia: Data Sheets. Available online: <http://www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_table-commname.htm> Accessed June 21, 2012. CDFA. Sacramento, CA.

_____. 2013. Encycloweedia: Program Details. [Online] URL: http://www.cdfa.ca.gov/plant/ipc/encycloweedia/encycloweedia_ hp.htm. (Accessed April 2013.)

California Herps. 2013. A Guide to the Amphibian and Reptiles of California. [Online] URL: http://www.californiaherps.com/index.html. (Accessed April 2013.)

Central Sierra Audubon Society. 2013. Birds of Tuolumne County. [Online] URL: http://cc.bingj.com/cache.aspx?q=list+of+birds+for+tuolmne+county&d=4512121828213803&mkt=en-US&setlang=en-US&w=m13cDEPwsDoD4DVYpZAxcYS86fyVeAcB. (Accessed April 2013.)

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Sierra-San Joaquin Noxious Weed Alliance (SSJNWA). 2003. Field Guide to Invasive Nonnative Weeds of Mariposa, Madera and Fresno Counties.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2011. Pre-Application Document Volume II of II, Don Pedro Project (FERC No. 2299). Turlock Irrigation District and Modesto Irrigation District, Turlock and Modesto, California.

_____. 2013a. Special-Status Wildlife-Bats Study Report Don Pedro Project FERC No. 2299 (TR-09). Attachment to Don Pedro Hydroelectric Project Initial Study Report. January 2013.

_____. 2013b. Special-Status Plants Study Report. Don Pedro Project, FERC No. 2299 (TR-01). Attachment to Don Pedro Hydroelectric Project Initial Study Report. January 2013.

_____. 2013c. Noxious Weeds Study Report. Don Pedro Project, FERC No. 2299 (TR-04). Attachment to Don Pedro Hydroelectric Project Initial Study Report. January 2013.

_____. 2014. Don Pedro Project, FERC No. 2299. Don Pedro Hydroelectric Project Final License Application. April 2014.

U.S. Department of Agriculture, Forest Service (USFS). 2004. Vegetation Classification: CALVEG Zones and Alliances - Vegetation Descriptions. U.S. Department of Agriculture, Forest Service. [Online] URL: http://www.fs.fed.us/r5/rsl/projects/classification/zonemap.shtml. (Accessed March 30, 2017.)

U.S. Fish and Wildlife Services (USFWS). 2010. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. http://www.fws.gov/wetlands/. (Accessed April 2015.)

Section 3.7: Rare, Threatened, Endangered, Protected, and Special Status Species

California Department of Fish and Game (CDFG). 2005. The Status of Rare, Threatened, and Endangered Plants and Animals of California: 2000-2004.

California Department of Fish and Wildlife (CDFW). 2013a. State and Federally Listed Endangered and Threatened Animals of California.

_____. 2013b. State and Federally Listed Endangered, Threatened, and Rare Plants of California.

California Native Plant Society (CNPS). 2010. Inventory of Rare and Endangered Plants. California Native Plant Society, Sacramento, California. [Online] URL: cnps.site.aplus.net/cgi-bin/inv/inventory.cgi. (Accessed July 6, 2010.)

California Natural Diversity Database (CNDDB). 2009. List of Special Animals (883 Taxa). State of California, Resources Agency, Department of Fish and Game, Biogeographic Data Branch, California Natural Diversity Database, Sacramento, California. [Online] URL: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf. (Accessed July 28, 2010.)

Jennings, M.R. and M.P. Hayes. 1994. Amphibian and reptile species of special concern in California. Final report submitted to the CDFG, Inland Fisheries Division, Rancho Cordova, CA, under contract number 8023.

National Marine Fisheries Service (NMFS). 2014. 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 California Central Valley Steelhead. California Central Valley Area Office. July 2014.

NatureServe Explorer. 2012. An online encyclopedia of life [web application]. [Online] URL: http://www.natureserve.org/explorer/. (Accessed May 1, 2013.)

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2011. Pre-Application Document Volume II of II, Don Pedro Project (FERC No. 2299). Turlock Irrigation District and Modesto Irrigation District, Turlock and Modesto, California.

_____. 2014a. Special-Status Plants Study Report. Don Pedro Project, FERC No. 2299 (TR-01). Attachment to Don Pedro Hydroelectric Project Final License Application. April 2014.

_____. 2014b. Bald Eagle Study Report. Don Pedro Project, FERC No. 2299 (TR-10). Attachment to Don Pedro Hydroelectric Project Final License Application. April 2014.

_____. 2014c. Special-Status Amphibians and Aquatic Reptiles Study Report. Don Pedro Project, FERC No. 2299 (TR-06). Attachment to Don Pedro Hydroelectric Project Final License Application. April 2014.

U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). 2013. Plants Database. Online [URL]: http://plants.usda.gov/java/. (Accessed May 1, 2013).

U.S. Fish and Wildlife Service (USFWS). 1984. Valley Elderberry Longhorn Beetle Recovery Plan. U.S. Fish and Wildlife Service. Portland, Oregon. [Online] URL: http://ecos.fws.gov/docs/recovery _plan/840628.pdf. (Accessed August 23, 2010.)

_____. 1998. Recovery Plan for Upland Species of the San Joaquin Valley, California. U.S. Fish and Wildlife Service. [Online] URL: http://ecos.fws.gov/docs/recovery_plan/ 980930a.pdf. (Accessed June 16, 2008.)

_____. 2002a. Recovery Plan for Gabbro Soil Plants of the Central Nevada Foothills. Portland, OR.

_____. 2002b. Recovery Plan for the California Red-legged Frog (*Rana aurora draytonii*). U.S. Fish and Wildlife Service, Portland, Oregon.

_____. 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Available online: <http://www.fws.gov/sacramento/ed/recovery_plans/vp_recovery_plan_links.htm>

_____. 2007a. Pseudobahia bahiifolia (Hartweg's golden sunburst) and Pseudobahia peirsonii (San Joaquin adobe sunburst) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2007b. Chinese Camp Brodiaea (Brodiaea pallida) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2007c. Red Hills Vervain (Verbena californica) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2007d. Greene's tuctoria (*Tuctoria greenei*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2008. Colusa Grass (*Neostapfia colusana*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2009. Hairy Orcutt Grass (*Orcuttia pilosa*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service.

_____. 2013. Species Lists. Available online: <http://www.fws.gov/sacramento/es/spp_list.htm>. (Accessed October 23, 2013.) United States Fish and Wildlife Service, Sacramento, CA.

Section 3.8: Recreation and Land Use

American Whitewater. 2013. Tuolumne, California, US, Below La Grange. [Online] URL: http://www.americanwhitewater.org/content/River/detail/id/5041/. (Accessed March 26, 2013.)

California Department of Parks and Recreation (CDPR). 2013. Turlock Lake State Recreation Area. [Online] URL: http://www.parks.ca.gov/. (Accessed March 26, 2013.)

_____. 2015. California Outdoor Recreation Plan (SCORP). [Online] URL: http://www.parksforcalifornia.org/scorp. (Accessed November 9, 2016.)

Don Pedro Recreation Agency (DPRA). 2015. Don Pedro Lake Website. [Online] URL: http://donpedrolake.com/RecreationArea/Fishing/index.htm. (Accessed November 10, 2016.)

Stanislaus County. 1994. Stanislaus County General Plan. [Online] URL: http://www.co.stanislaus.ca.us/planning/pl/general-plan.shtm. (Accessed November 10, 2016.)

_____. 2010. River and Fishing Accesses. [Online] URL: http://www.co.stanislaus.ca.us/ER/Parks/pdf/RiverFishingAccesses.pdf. (Accessed September 2010.)

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2011. Pre-Application Document Volume II of II, Don Pedro Project (FERC No. 2299). Turlock Irrigation District and Modesto Irrigation District, Turlock and Modesto, California.

_____. 2017. Recreation Access and Safety Assessment Study Report. Turlock Irrigation District and Modesto Irrigation District, Turlock and Modesto, California. Appendix to La Grange Hydroelectric Project Updated Study Report. February 2017.

U.S. Fish and Wildlife Service (USFWS). 1989. Fisheries USA: The Recreational Fisheries Policy of the U.S. Fish and Wildlife Service. Washington, D.C.

Section 3.9: Aesthetic Resources

(No references cited in this section)

Section 3.10: Cultural and Tribal Resources

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2017. Cultural Resources Study Report. Prepared by HDR, Inc. Appendix to La Grange Hydroelectric Project Updated Study Report [Filed with FERC as Privileged Information]. February 2017.

Section 3.11: Socioeconomic Resources

California Department of Finance. <undated.> E-4 Historical Population Estimates for California Cities and Counties, 1971-1980, with 1970 and 1980 Census Counts. [Online] URL: http://www.dof.ca.gov/research/demographic/reports/estimates/e-4/1971-80/counties-cities/. (Accessed September 9, 2013.)

_____. 2007. E-4 Historical Population Estimates for Cities, Counties, and the State, 1991-2000, with 1990 and 2000 Census Counts. Sacramento. [Online] URL: http://www.dof.ca.gov/research/demographic/reports/estimates/e-4/1991-2000/. (Accessed March 13, 2013.)

_____. 2012a. E-4 Population Estimates for Cities, Counties, and the State, 2001-2010, with 2000 & 2010 Census Counts. Sacramento. [Online] URL: http://www.dof.ca.gov/research/demographic/reports/estimates/e-4/2001-10/. (Accessed March 13, 2013.)

_____. 2012b. E-1 Cities, Counties, and the State Population Estimates with Annual Percent Change— January 1, 2011 and 2012. Sacramento. [Online] URL: http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/view.php. (Accessed March 13, 2013.)

_____. 2013. Report P1 (County). State and County Population Projections, July 1, 2010-2060 (five year increments). [Online] URL: http://www.dof.ca.gov/research/demographic/reports/projections/P-1/. (Accessed March 13, 2013.)

California Employment Development Department. 2013a. Major Employers in Stanislaus County. [Online] URL: http://www.labormarketinfo.edd.ca.gov/majorer/countymajorer.asp?CountyCode=000099 (Accessed March 26, 2013.)

_____. 2013b. Major Employers in Tuolumne County. [Online] URL: http://www.labormarketinfo.edd.ca.gov/majorer/countymajorer.asp?CountyCode=000109 (Accessed March 26, 2013.)

U.S. Department of Commerce, Census Bureau. 2010. 2010 Census of Population and Housing. [Online] URL: https://www.census.gov/2010census/. (Accessed April 18, 2013.)

_____. 2012. 2007-2011 American Community Survey. 5-Year Estimates. [Online] URL: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t. (Accessed April 2013).

_____. 2015. 2011-2015 American Community Survey. 5-Year Estimates. [Online] URL: https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2015/. (Accessed March 6, 2017.)

_____. 2016. U.S. Census Bureau Population Estimates program. [Online] USR: https://www.census.gov/data/tables/2016/demo/popest/state-total.html. (Accessed March 6, 2017.)

Section 4.0: Cumulative Effects of the Proposed Action

Federal Energy Regulatory Commission (FERC). 2008. Preparing Environmental Documents, Guidelines for Applicants, Contractors, and Staff. Office of Energy Projects Division of Hydropower Licensing, Washington, D.C.

______. 2014. Scoping Document 2 for La Grange Hydroelectric Project No. 14581. Office of Energy Projects Division of Hydropower Licensing, Washington, D.C. September 5, 2014.

Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2014.

Section 5.0: Developmental Analysis

(No references cited in this section)

Section 6.0: Consultation Record

(No references cited in this section)

LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

EXHIBIT F – GENERAL DESIGN DRAWINGS

Prepared by:
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April 2017

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List of Appendices

EXHIBIT F – GENERAL DESIGN DRAWINGS

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.61(e) describes the required content of this Exhibit[1].

Exhibit F consists of general design drawings of the principal project works described under paragraph (b) of this section (Exhibit A) and supporting information used as the basis of design. If the Exhibit F submitted with the application is preliminary in nature, applicant must so state in the application. The drawings must conform to the specifications of § 4.39.

(1) The drawings must show all major project structures in sufficient detail to provide a full understanding of the project, including:
- *(i) Plans (overhead view);*
- *(ii) Elevations (front view);*
- *(iii) Profiles (side view); and*
- *(iv) Sections.*

(2) The applicant may submit preliminary design drawings with the application. The final Exhibit F may be submitted during or after the licensing process and must show the precise plans and specifications for proposed structures. If the project is licensed on the basis of preliminary designs, the applicant must submit a final Exhibit F for Commission approval prior to commencement of any construction of the project.

(3) Supporting design report. The applicant must furnish, at a minimum, the following supporting information to demonstrate that existing and proposed structures are safe and adequate to fulfill their stated functions and must submit such information in a separate report at the time the application is filed. The report must include:
- *(i) An assessment of the suitability of the site and the reservoir rim stability based on geological and subsurface investigations, including investigations of soils and rock borings and tests for the elevation of all foundations and construction materials sufficient to determine the location and type of dam structure suitable for the site;*
- *(ii) Copies of boring logs, geology reports and laboratory test reports;*
- *(iii) An identification of all borrow areas and quarry sites and an estimate of required quantities of suitable construction material;*
- *(iv) Stability and stress analyses for all major structures and critical abutment slopes under all probable loading conditions, including seismic and hydrostatic forces induced by water loads up to the Probable Maximum Flood as appropriate; and*
- *(v) The bases for determination of seismic loading and the spillway Design Flood in sufficient detail to permit independent staff evaluation.*

(4) The applicant must submit two copies of the supporting design report described in paragraph (g)(3) of this section at the time preliminary and final design drawings are submitted to the Commission for review. If the report contains preliminary drawings, it must be designated a "Preliminary Supporting Design Report."

[1] 18 CFR § 4.61(e) cross-references Exhibit F requirements published at 18 CFR § 4.41(g).

1.0 REQUEST FOR PRIVILEGED TREATMENT – CEII

In accordance with 18 CFR Part §388.113(c)(2) and (d)(i), the Districts are requesting special treatment as Critical Energy Infrastructure Information (CEII) by the Federal Energy Regulatory Commission (FERC) for the Exhibit F General Design Drawings. The Districts are requesting that the General Design Drawings be given special treatment because the drawings clearly show the location of the critical project features and design information. For this reason, the Districts have filed the Exhibit F General Design Drawings with FERC as CEII. The CEII information has been filed with FERC on April 24, 2017, concurrent with filing of the public information of this Draft License Application (DLA). The duration of the CEII designation should be indefinite, or until such time as the CEII regulations or the Project no longer exists.

In accordance with FERC's CEII Regulations, the following statement regarding access to CEII is provided:

> *Procedures for obtaining access to CEII may be found at 18 CFR §388.113. Requests for access to CEII should be made to the Commission's CEII Coordinator.*

2.0 GENERAL DESIGN DRAWINGS

The General Design Drawings show overall plan views, elevations, and sections of the principal project works in sufficient detail to provide a full understanding of the La Grange Project. The drawings depict the as-built condition of the La Grange Project as described in Exhibit A of this Draft License Application (DLA).

As noted above in Section 1.0, these drawings are designated CEII, are included in the version of Exhibit F filed only with FERC as Appendix F-1, and are summarized in Table 2.0-1.

Table 2.0-1. Exhibit F General Design Drawings for the La Grange Project

Drawing No.	Description
F-1	Site plan of La Grange Diversion Dam and facilities showing diversion dam, TID tunnel intake, tunnel location, and Upper Main Canal
F-2	La Grange spillway section showing original crest and crest modification to present elevation of 296.5 feet
F-3	TID diversion tunnel portals site plan and profile
F-4	TID diversion tunnel exit, forebay, Upper Main Canal, and powerhouse intakes

3.0 SUPPORTING DESIGN REPORT

Section 4.41(g)(3) requires that an applicant for new license file a Supporting Design Report (SDR) with the license application. The purpose of the Supporting Design Report is to demonstrate "…that existing structures are safe and adequate to fulfill their stated functions…". The Supporting Design Report for the La Grange Hydroelectric Project is under development. The Districts have previously submitted to FERC several documents that will support the SDR, including:

- An Initial Consultant Safey Inspection Report (Part 12 Report) and plan and schedule for additional work were submitted on September 29, 2015.
- Three supporting technical memoranda were submitted on March 28, 2016:
    - La Grange Diversion Dam Stability – Development of the Maximum Credible Earthquake (MCE) and Correspnding Response Spectra
    - La Grange Diversion Dam Stability – Potential Failure Mode, Rock Mass/Shear Strength Estimate, and Kinematic Analysis of Left and Rigth Abutments
    - La Grange Diversion Dam Stability – Inflow and Peak Storage Calculations for Inflow Design Flood (IDF)

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LA GRANGE HYDROELECTRIC PROJECT
FERC NO. 14581

DRAFT LICENSE APPLICATION

EXHIBIT F – GENERAL DESIGN DRAWINGS

APPENDIX F-1
GENERAL DESIGN DRAWINGS

[Note: Per guidance from the Federal Energy Regulatory Commission (FERC), General Design Drawings contain Critical Energy Infrastructure Information (CEII) and have therefore, been omitted from general distribution in the Draft License Application. This information has been filed with FERC with a CEII designation under separate cover as part of the Draft License Application submittal. Procedures for obtaining access to CEII may be found at 18 CFR § 388.113. Requests for access to CEII should be made to the Commission's CEII coordinator.]