DISTRICTS' RESPONSE TO NMFS-1, ELEMENTS 3 AND 6: LA GRANGE DEVELOPMENT AFFECTED ENVIRONMENT

AS ATTACHED TO THE DON PEDRO HYDROELECTRIC PROJECT UPDATED STUDY REPORT, FILED WITH FERC ON JANUARY 6, 2014

This Page Intentionally Left Blank

Districts' Response to NMFS-1, Elements 3 and 6: La Grange Development Affected Environment

1.0 Background

On June 10, 2011, the National Marine Fisheries Service ("NMFS") filed a number of requests for studies in connection with the relicensing of the Don Pedro Project, FERC No. 2299. NMFS's Study Request 1 ("NMFS-1") contained six subsections, referred to as "elements."

In the Study Plan Determination ("SPD") issued December 22, 2011, FERC staff recommended that Turlock Irrigation District ("TID") and Modesto Irrigation District ("MID") (collectively, the "Districts") provide a description of existing facilities at their La Grange development which influence flow allocation at the La Grange diversion dam. NMFS and other agencies subsequently filed a Notice of Study Dispute on January 11, 2012 contesting parts of FERC's SPD. FERC convened a Dispute Resolution Panel which filed its findings on May 4, 2012, and on May 24, 2012, FERC issued the Director's Study Dispute Determination.

As part of the Dispute Determination, FERC directed the Districts to identify and provide in their Initial Study Report ("ISR") existing information for NMFS-1, Elements 3 and 6, and to further consult with NMFS and other agencies using the Workshop Consultation protocols to provide and analyze certain flow-related information contained in NMFS Study Request 4 ("NMFS-4")[1].

The Districts filed the ISR on January 16, 2013, and held an ISR Meeting on January 30 and 31, 2013. The ISR included a section that identified existing information on the reach of the Tuolumne River from La Grange diversion dam to USGS gage no. 11289650. In the same section of the ISR, the Districts provided an analysis of the hydrologic effects of the La Grange project operations on flows in the Tuolumne River between La Grange diversion dam and USGS gage no. 11289650.

On March 11, 2013, NMFS filed comments on the Districts' ISR stating that the Districts did not address the full requirements of NMFS-1, Elements 3 and 6. The Districts filed response comments on April 9, 2013; and on May 21, 2013, FERC issued its Determination on Requests for Study Modifications and New Studies in which the Districts were directed to provide in the Updated Study Report ("USR") additional information on each of the items identified in NMFS-1, Elements 3 and 6, and to provide a description of the La Grange project's potential impacts to anadromous fish.

This report fulfills the requirements of FERC's May 21, 2013 Determination.

[1] The Districts' response to NMFS-4 is provided under separate cover in the Updated Study Report document.

2.0 General Description of La Grange Project

FERC directed the Districts to provide a description of the La Grange facilities, including those affecting flow allocation. The La Grange diversion dam is located on the Tuolumne River near the border of Stanislaus and Tuolumne counties in central California at River Mile ("RM") 52.2. Originally constructed between 1891 and 1893, the primary purpose of the diversion dam is to raise the level of the Tuolumne River to permit the diversion of water from the Tuolumne River for irrigation of Central Valley farmland and municipal and industrial ("M&I") water supply.

The La Grange diversion dam is jointly owned by the Districts, which combined forces to build the diversion dam to divert stream flows the Districts had rights to in the Tuolumne River. The La Grange diversion dam has been serving that purpose for approximately 120 years, having replaced the Wheaton Dam which was built by other parties in the early 1870s. La Grange diversion dam was constructed at the downstream end of a narrow, steep-sided canyon. The canyon walls contain the pool formed by the present day La Grange diversion dam.

The Districts' La Grange development includes the dam, impoundment, two intakes and diversion tunnels, forebays, sluiceways, two penstocks, powerhouse, excavated tailrace, substation, and short transmission line. Facilities on the north side of the river are owned by MID and facilities on the south side of the river are owned by TID. The general site arrangement is depicted in Figure 1. Individual descriptions of the primary facilities of the La Grange project are provided below.

2.1 La Grange Diversion Dam and Spillway

Construction of La Grange diversion dam started in the fall of 1891 and was completed in December 1893. The original 127.5-foot-high arched diversion dam 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 two raises to the crest elevation were for the purpose of increasing the flows that could be diverted to each of the Districts' irrigation canals.

The diversion dam was constructed such that the top is almost entirely a spillway. 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 table for the La Grange spillway is presented in Table 1. A cross-section through the spillway is shown in Figure 2. There have been no modifications to the height or crest of the La Grange diversion dam and spillway since 1930, except for routine maintenance and repairs.

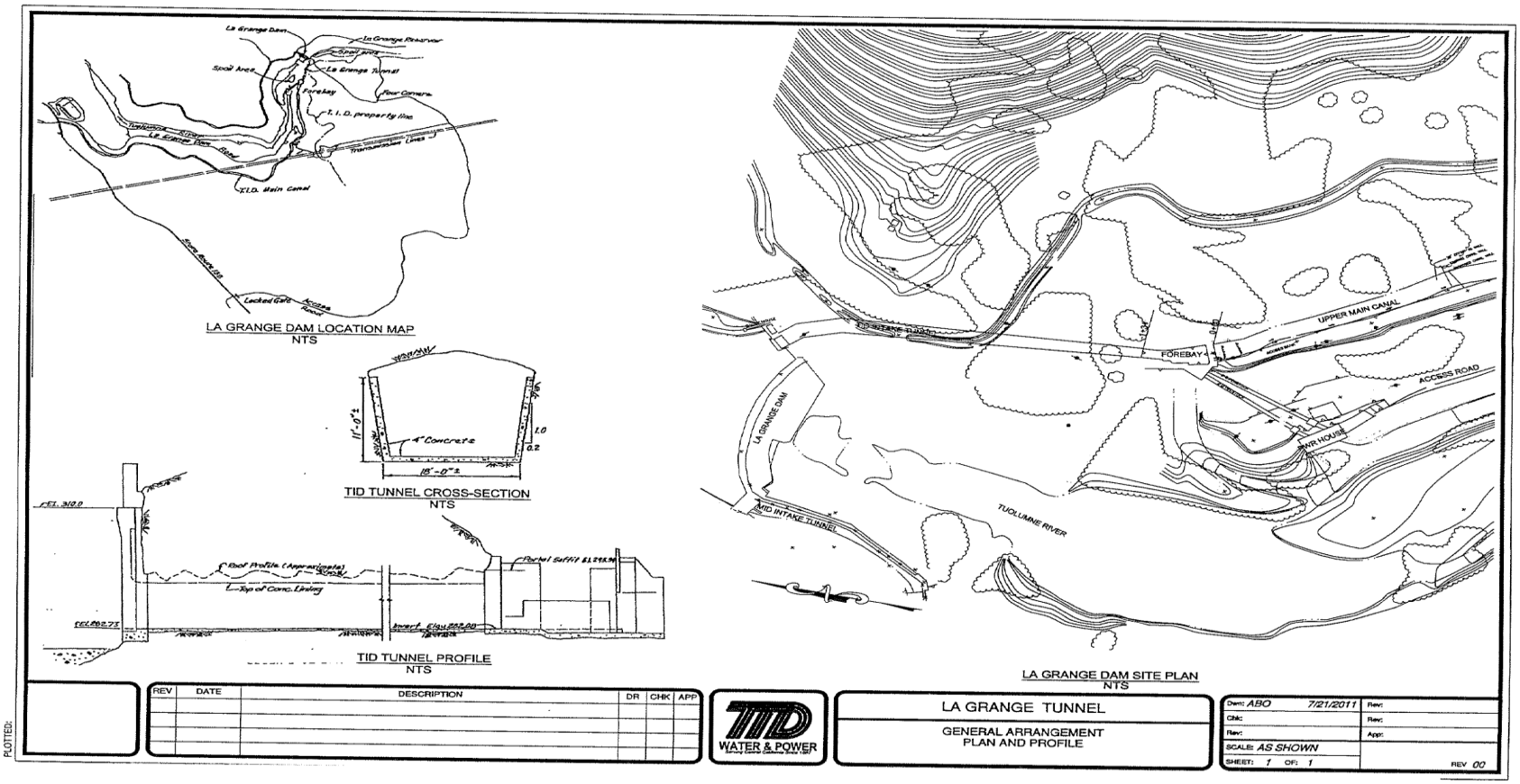


Figure 1. Site plan of La Grange diversion dam and facilities showing diversion dam, TID tunnel intake, tunnel location, penstocks, powerhouse, and TID's Upper Main Canal.

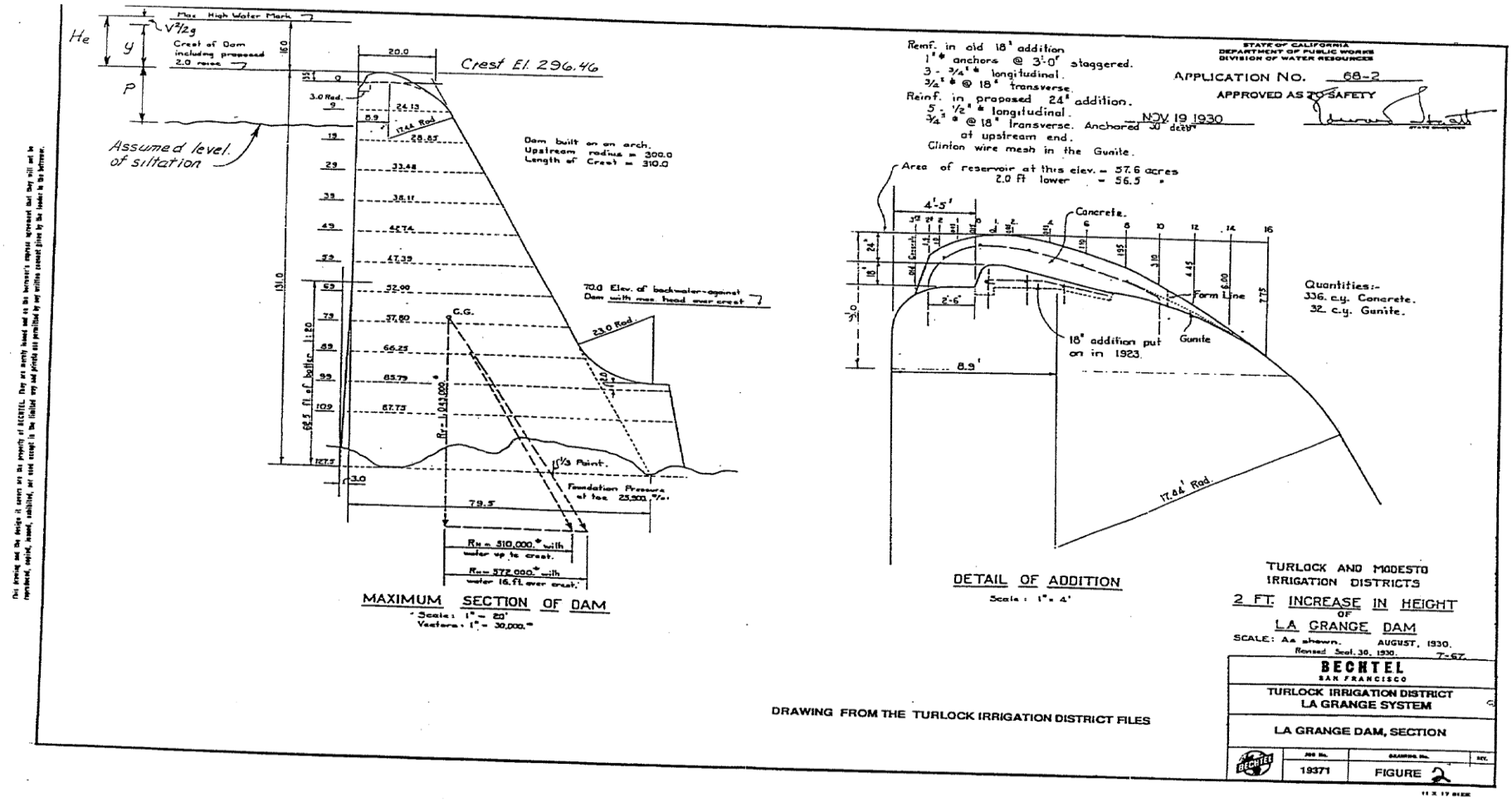


Figure 2. La Grange spillway section showing original crest and crest modification to present elevation of 296.5 ft.

Table 1. Estimated spillway rating table for La Grange diversion dam.

Reservation Elevation	Discharges in CFS			
ft.	0.00	0.25	0.50	0.75
296	-	-	10	120
297	320	600	980	1350
298	1800	2280	2780	3400
299	4010	4680	5380	6150
300	6900	7720	8560	9410
301	10310	11300	12300	13350
302	14500	15590	16680	17900
303	19100	20290	21500	22700
304	23900	25050	26800	28400

2.2 La Grange Impoundment

The drainage area of the Tuolumne River upstream of the La Grange diversion dam is approximately 1,550 square miles. Flows from the drainage area above La Grange diversion dam are regulated by four upstream reservoirs: Hetch Hetchy, Lake Eleanor, Cherry Lake, and Don Pedro. Don Pedro is owned jointly by TID and MID, and the other three dams are owned by the City and County of San Francisco. Inflow to the La Grange project is the sum of releases from the Don Pedro Project located 2.3 miles upstream and minor contributions from two small intermittent drainage channels. As mentioned above, the pool formed by La Grange diversion dam is contained within a narrow, steep-sided canyon. It extends for approximately one mile upstream of the dam at normal river flows. The active storage is less than 100 acre-feet ("AF"). 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 TID and MID irrigation systems, and not for any water storage purpose.

2.3 Intakes and Tunnels

As mentioned above, La Grange diversion dam was constructed to permit the diversion of irrigation water and M&I water into the TID and MID water delivery systems. MID's system is located on the north (right, looking downstream) side of the river and TID's is on the south (left) side.

Water released from the upstream Don Pedro Project is either diverted by TID or MID at La Grange diversion dam or flows downstream to the lower Tuolumne River. MID's tunnel intake is located on the north end of the diversion dam, and TID's tunnel intake is located on the south end of the diversion dam. The Districts' irrigation canals were constructed such that approximately 68% of diverted flow would be routed to the TID system and 32% to the MID system.

Annual water diversions and streamflows are provided in Table 2. These flow records provide the existing volumes of water used for irrigation and M&I purposes; the Districts are not currently proposing any change in uses of diverted waters (see NMFS-1, Element 3b).

Due to continuing maintenance and repair issues experienced at its upper Main Canal, MID constructed a new diversion tunnel in 1987/1988 to replace the upper section of its Main Canal. The intake to the MID tunnel is located in the face of a cliff on the right bank about 100 feet upstream of La Grange diversion dam. The invert of the tunnel is at elevation 277.4 feet. Flow is conveyed through the 15-foot 6-inch diameter tunnel 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 Main Canal. The MID intake and tunnel provide water to MID's irrigation and M&I water systems.

A TID intake and diversion tunnel is located on the left bank of the La Grange diversion dam and consists of two separate structures. As shown in Figure 3, the first intake tunnel portal contains two 8-foot by 11-foot 10-inch high control gates driven by electric motor hoists. The second intake tunnel portal, located to the left of the first portal, contains a single 8-foot by 12-foot control gate.

The second part of the intake was added in 1980 for the purpose of decreasing headloss and increasing the flow delivery capability to the TID irrigation canal system. Flows from the intake control gates are conveyed to the 600-foot-long tunnel to the 110-foot-long forebay upstream of the TID Upper Main Canal. The Upper Main Canal headworks were modified in 1980. Flows to TID's irrigation system are controlled by six slide gates, each 5-foot by 8-foot 4-inch.

2.4 Forebay, Canal Headworks, and Powerhouse Intake

Flow from the TID tunnel discharges nearly 600 feet downstream from the intake into a concrete forebay which contains the TID irrigation canal headworks and, separately, a penstock intake structure. At the tunnel outlet portal, the forebay invert is approximately 18-foot wide and gradually expands to 39-foot wide at the face of the irrigation canal headworks facility. The forebay is 118 feet long along the centerline of flow and is constructed with a gradual bend to the south as it enters the TID 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 1980 work to improve the delivery capacity to the TID Upper Main Canal.

At the west side of the canal, a trash rack structure and three 7.5-foot wide by 14-foot high concrete intake bays make up the powerhouse intake structure. There are no automatic gates to control these bays. Manually-operated steel gates are used to shut off flows to the penstocks.

Table 2. Flows downstream of La Grange diversion dam, water deliveries to TID and MID, and total Don Pedro Project outflows, 1997-2009.

Month	Mean Monthly Flow (cfs)*													Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
USGS 11289650 - Tuolumne River Below La Grange Diversion Dam Near La Grange, CA (River in-stream flow only)																
Jan	13,070	2,114	1,247	324	325	177	184	223	187	4,456	353	171	165	1,769	13,070***	165
Feb	8,116	6,168	4,903	2,284	1,273	172	185	220	1,823	2,373	358	173	168	2,170	8,116***	168
Mar	2,443	5,407	3,285	4,602	615	165	182	1,098	3,875	4,234	357	172	169	2,046	5,407	165
Apr	1,457	5,392	2,034	1,548	558	665	685	1,010	4,524	7,436	487	533	372	2,054	7,436	372
May	953	3,621	1,697	1,164	706	419	477	412	4,868	7,847	385	680	687	1,840	7,847	385
Jun	269	4,433	284	340	54	97	234	127	3,809	4,657	127	95	149	1,129	4,657	54
Jul	290	2,845	287	421	89	88	243	108	1,913	834	114	93	107	572	2,845	88
Aug	287	1,019	259	603	110	86	236	106	773	584	110	99	102	336	1,019	86
Sep	285	1,423	294	473	112	68	250	110	328	412	89	97	106	311	1,423	68
Oct	465	628	424	412	189	202	297	209	464	449	141	174	In	338	628	141
Nov	380	316	338	347	184	191	231	186	369	379	174	161	WY	271	380	161
Dec	330	1,321	336	334	177	187	226	178	1,285	352	169	164	2010	422	1,321	164
USGS 11289000 - Modesto Canal Near La Grange, CA																
Jan	6	117	66	237	72	40	76	87	83	143	9	27	31	76	237	6
Feb	168	56	47	72	142	67	58	44	204	135	113	45	29	91	204	29
Mar	642	121	301	231	213	434	328	355	260	142	348	346	219	303	642	121
Apr	601	250	630	586	607	720	325	720	450	249	483	575	474	513	720	249
May	872	310	697	659	773	724	605	653	665	716	682	656	573	660	872	310
Jun	701	655	769	733	802	791	801	751	695	802	763	646	716	740	802	646
Jul	962	787	781	915	905	891	894	825	1,043	846	803	748	791	861	1,043	748

Month	Mean Monthly Flow (cfs)*													Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
Aug	813	869	927	878	767	707	825	704	827	824	781	793	721	803	927	704
Sep	550	482	566	474	567	583	525	461	604	594	411	506	474	523	604	411
Oct	347	344	334	293	387	358	380	270	299	304	321	301	In	328	387	270
Nov	78	73	195	44	36	105	172	84	141	173	162	100	WY	114	195	36
Dec	26	86	72	75	72	58	13	43	126	8	9	18	2010	50	126	8
USGS 11289500 - Turlock Canal Near La Grange, CA																
Jan	387	69	506	0	91	27	6	25	316	299	164	4	82	152	506	0
Feb	599	326	313	0	8	6	323	302	339	529	257	101	151	250	599	0
Mar	1,457	454	623	603	595	1,023	637	1,035	872	644	1,113	1,132	601	830	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	1,034	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	1,229	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	1,526	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	1,868	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	1,581	1,796	1,314
Sep	812	977	952	1,063	825	736	714	617	991	936	631	571	793	817	1,063	571
Oct	505	613	566	527	445	358	742	577	259	379	305	129	In	450	742	129
Nov	30	0	59	24	4	22	1	1	3	8	35	2	WY	16	59	0
Dec	109	0	301	173	12	94	36	12	27	1	45	149	2010	80	301	0
USGS 11289651 - Combined Flow Tuolumne River + Modesto Canal + Turlock Canal (~ total Don Pedro Project outflow) **																
Jan	13,630	2,301	1,818	561	489	244	266	335	585	4,897	525	203	278	2,010	13,630	203
Feb	8,885	6,551	5,262	2,355	1,424	245	565	566	2,365	3,038	728	320	348	2,512	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	3,179	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	3,600	8,211	1,781
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	3,729	9,902	2,155

Month	Mean Monthly Flow (cfs)*													Mean Monthly Flow (cfs)	Highest Mean Monthly Flow (cfs)	Lowest Mean Monthly Flow (cfs)
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
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	3,395	7,083	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	3,300	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	2,720	3,569	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	1,651	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	In	1,116	1,584	604
Nov	489	389	592	415	224	318	404	270	513	559	371	263	WY	401	592	224
Dec	466	1,407	709	582	261	339	275	233	1,437	361	223	330	2010	552	1,437	223

*Values Calculated using USGS National Water Information System (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

** Some values rounded by USGS - sum of individual gage monthly mean flows may not precisely equal combined gage monthly mean flows.

***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 2009 period. Without 1997 values, the mean monthly flow in January is 827 cfs and February is 1,675, compared to the values in the table 1,769 and 2,170 cfs, respectively.

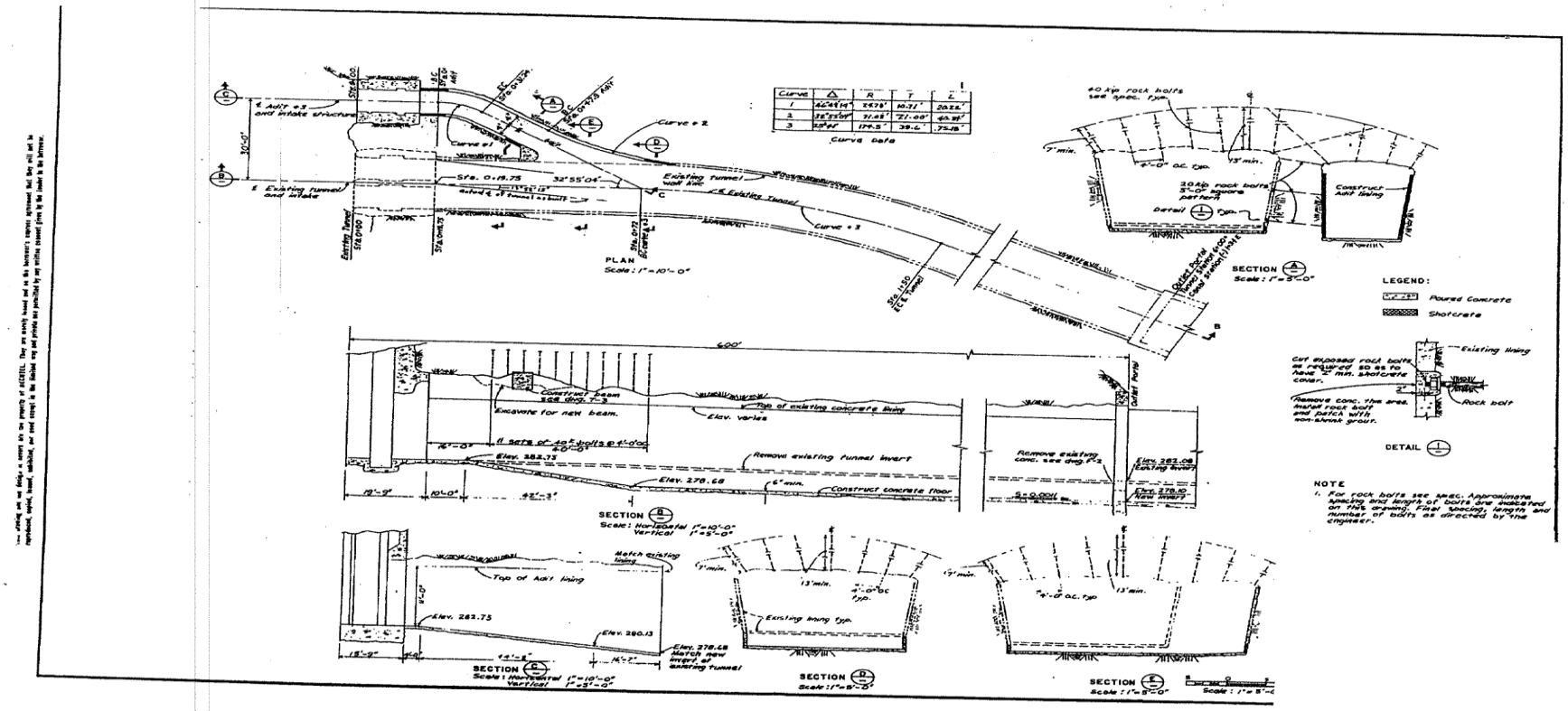


Figure 3. TID intake tunnel portals site plan and profile.

The TID irrigation canal headworks structure was originally constructed with five 5-foot-wide by 8-foot 4-inch-high outlets which are all controlled by fabricated steel gates. In 1980, a sixth gate was added. The sixth gate that was added matches the original gate dimensions. The invert of all outlets was built to an elevation of 281.2 feet and the top of the outlet training walls were at elevation 294 feet.

2.5 Canals

The La Grange diversion dam enables the diversion of water to both TID and MID Main Canals which provide water to serve the Districts' irrigation and M&I customers. Water flows approximately 12 miles through the MID Main Canal to Modesto Reservoir. Based on records from USGS Gage No. 11289000 located on the MID canal, the highest mean monthly flow for the MID canal since 1997 occurred in July 2005 and was 1,043 cfs (Table 2).

The TID Upper Main Canal is controlled by the canal headworks structure and flows nearly eight miles downstream to Turlock Lake. Downstream of Turlock Lake, the TID Main Canal begins to branch off to provide water deliveries through the Highline Canal, Ceres Main Canal, and Turlock Main Canal.

In 1980, portions of the TID Upper Main Canal between the canal headworks and Turlock Lake were modified to increase irrigation water delivery capacity to approximately 3,000 cfs to enable TID to better manage its irrigation water supply. Since 1997, the highest mean monthly flow for the canal occurred in July 1997 at 2,081 cfs (Table 2).

2.6 Powerhouse

The La Grange powerhouse is located approximately 0.2 miles downstream of the La Grange diversion dam on the south (left) bank of the Tuolumne River. The power plant is owned and operated by TID. Water diverted through the TID intake and tunnel to the Upper Main Canal forebay may flow into two penstocks that deliver flow to the powerhouse. The 2-unit powerhouse was built in 1924. The powerhouse is a 72-foot by 29-foot structure with a reinforced concrete substructure and steel superstructure. As shown in Figure 4, the intakes for the two penstocks are located in the right side of the forebay. 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.

There have been no modifications to the penstock intakes, penstocks, or powerhouse since its original construction in 1924 except for routine maintenance and repairs or changes made to accommodate TID's irrigation canal improvements.

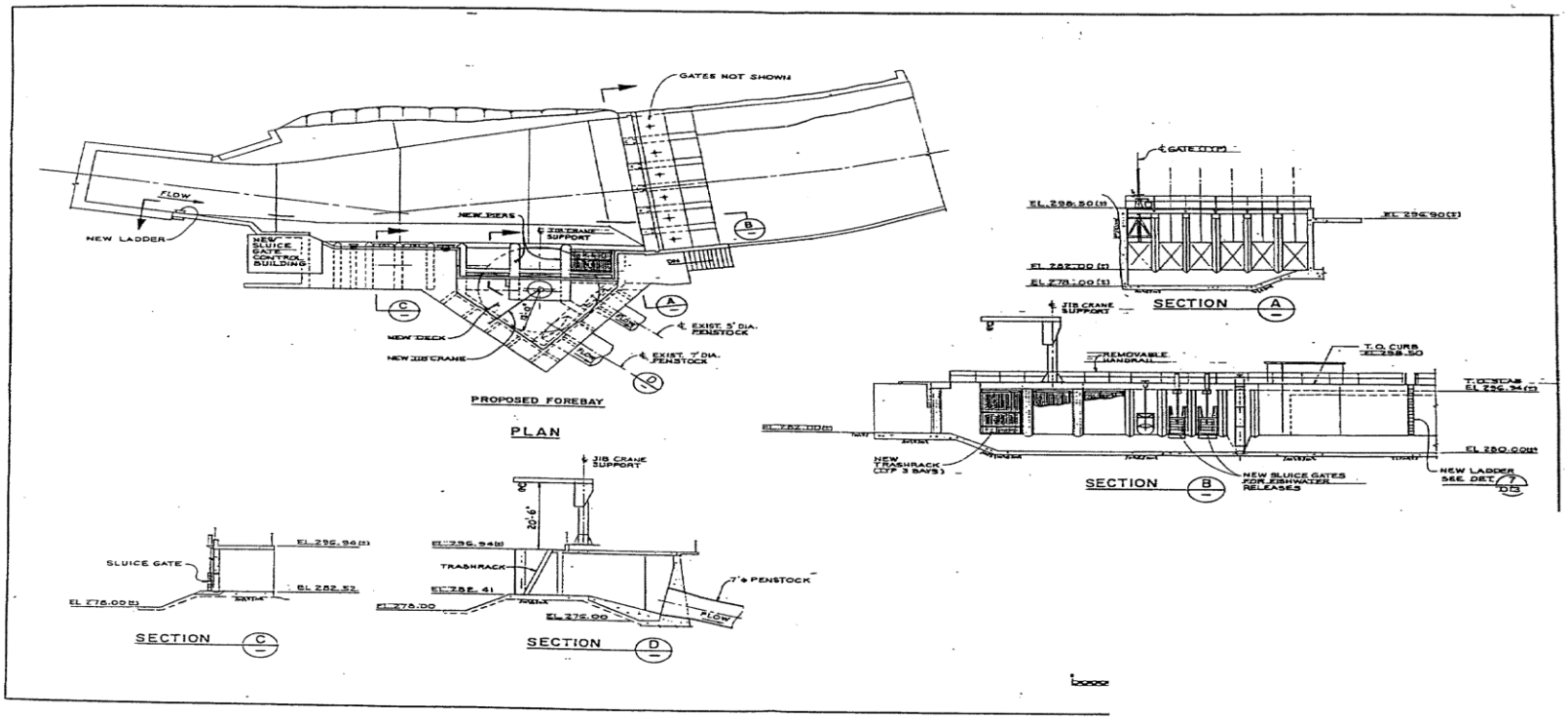


Figure 4. TID tunnel exit, forebay, and Upper Main Canal and powerhouse intakes.

2.7 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 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 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; the net head affects flow capacity and unit output. The runners in the original 65-year old 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 570 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 generators, one on each side of the turbine (Bechtel Civil 1987). This two-generator configuration was replaced with the industry-standard single generator configuration as part of the 1989/1990 rehabilitation work. The original Unit 2 design is a conventional configuration consisting of a single vertical Francis turbine coupled to a single, nominal 3,750 kW generator (Bechtel Civil 1987).

2.8 Substation and Transmission

The substation is located on the east side of the powerhouse and is equipped with a 4.16 kV/69 kV transformer. The outgoing transmission line can be interconnected to either TID's Tuolumne Line 1 or its Hawkins Line (Attachment A).

2.9 Tailwater

The tailwater elevation at the powerhouse varies with powerhouse flow and upstream releases into the river but generally ranges between elevation 175 and 180 feet.

2.10 Lands

Under normal river flows, all lands occupied by the La Grange development are privately owned either by the Districts or by other private landowners.

3.0 La Grange Project Operations

The La Grange project operates in a run-of-river mode. As mentioned previously, it was originally constructed in 1891-1893 to raise the level of the Tuolumne River so as to permit the diversion and delivery of water by gravity means to TID's and MID's canals. The diversion dam is located at the exit of a narrow canyon. There is little to no active storage. When not in spill mode, the La Grange pool operates between elevation 294 ft and 296 ft approximately 90 percent of the time. This 2-ft operating band contains about

100 acre-feet of water. La Grange Dam acts as a diversion dam, delivering flow through its tunnel intakes to the TID and MID canal systems. Combined, these irrigation canals serve over 200,000 acres of prime Central Valley farmland each year with over 800,000 acre-feet of water. MID also provides potable water to the City of Modesto's population of 250,000 people.

Flows released from the Don Pedro Project located upstream of La Grange diversion dam are either diverted into the TID canal system and/or the MID canal system, or are passed downstream. Diverted water can be delivered to the Districts' irrigation water delivery systems or passed back to the Tuolumne River below La Grange diversion dam. On the MID side of the river, sluice gates can deliver water back to the river approximately 400 feet downstream of the diversion dam. MID reports that control gates located at the upper and lower end of the old canal headworks are opened to pass about 25 cfs to the river into the large pool below the diversion dam. On the TID side of the river, diverted flows can also 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 the La Grange powerhouse.

In 1996, FERC approved a settlement agreement for the upstream Don Pedro Project among the Districts, resource agencies, and conservation groups wherein the Districts agreed, as part of its Don Pedro Project operations, to provide increased flows in the lower Tuolumne River to be measured at a location downstream of the La Grange diversion dam. These flows to protect anadromous fish are normally passed at La Grange diversion dam 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 one-half mile below La Grange diversion dam. The two sluice gates in the canal forebay can also discharge flows into the tailrace. In addition, a small 4-ft by 6-ft sluice gate is located in the main spillway on the MID side of La Grange diversion dam. This gate is normally closed, but can be used during periods of maintenance on the spillway crest. Records of its operation are not maintained.

The flows under the 1996 Don Pedro Project Settlement Agreement are normally discharged to the river at La Grange via the La Grange powerhouse and turbines. From 1980 to 1996, the average annual generation at the La Grange powerhouse was 15,608 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. Subsequent to the 1996 implementation of the Settlement Agreement, the average annual generation at the La Grange powerhouse has been 19,638 MWh, with a low of 9,384 MWh in 2009 (dry year) and a high of 34,439 MWh in 2006 (wet year). The dependable capacity of the La Grange powerhouse is approximately 400 kW, corresponding to the lowest minimum flow required to be provided by the Don Pedro Project to the lower Tuolumne River of 50 cfs (see NMFS-1, Element 3a).

As a run-of-river facility with no significant active storage, the La Grange diversion dam plays no role in flood control on the Tuolumne River. All flows released to comply with

FERC flow requirements of the Don Pedro Project are scheduled at and made by controlled releases from Don Pedro Reservoir. Flows not diverted at La Grange diversion dam for the Districts' irrigation or M&I purposes are normally passed downstream through the La Grange powerhouse. If the powerhouse is out of service for maintenance purposes, flows pass the La Grange project over the spillway or through a sluice gate depending on amount of flow and real-time river and project conditions. Except for flows through the TID powerhouse and to the two canal systems, no other flow records at the La Grange facilities are normally collected or maintained.

4.0 General Description of Affected Environment in the Vicinity of the La Grange Project

This section provides a description of the existing physical and biological information available for the reach of the Tuolumne River extending from below Don Pedro Dam (circa RM 54) to the La Grange USGS gage at RM 51.7 near the town of La Grange, CA (see NMFS-1, Elements 3e through 3h). The Districts have previously provided to all relicensing participants involved in the Don Pedro relicensing a copy of their water rights, and this information continues to be publicly available on the Don Pedro relicensing website at www.donpedro-relicensing.com (see NMFS-1, Element 3d). Other than the Tuolumne River, there are no other perennial streams between RM 51.7 and Don Pedro Dam (see NMFS-1, Element 3c). Two small intermittent drainages enter the Tuolumne River about one mile above the La Grange diversion dam at approximately RM 53.3.

4.1 Flow and Water Temperature Information

Tuolumne River flow downstream of the Don Pedro Dam (Station DNP) is reported as reservoir outflow (cfs) by the California Data Exchange Center ("CDEC") website dating back to October 1993 (http://cdec.water.ca.gov).

Also available at the CDEC website are records of flow diverted into both the TID canal (Station TID) and MID canal (Station MID) at the La Grange diversion dam dating back to October 1997. Discharge downstream of the La Grange project is measured at the La Grange gage (USGS Station 11289650). Records of average daily discharge (cfs) dating back to October 1970 are available at the USGS website (http://nwis.waterdata.usgs.gov). Water temperature data recorded at this same station is recorded as daily minimum and maximum over the same period of record (Figure 5).

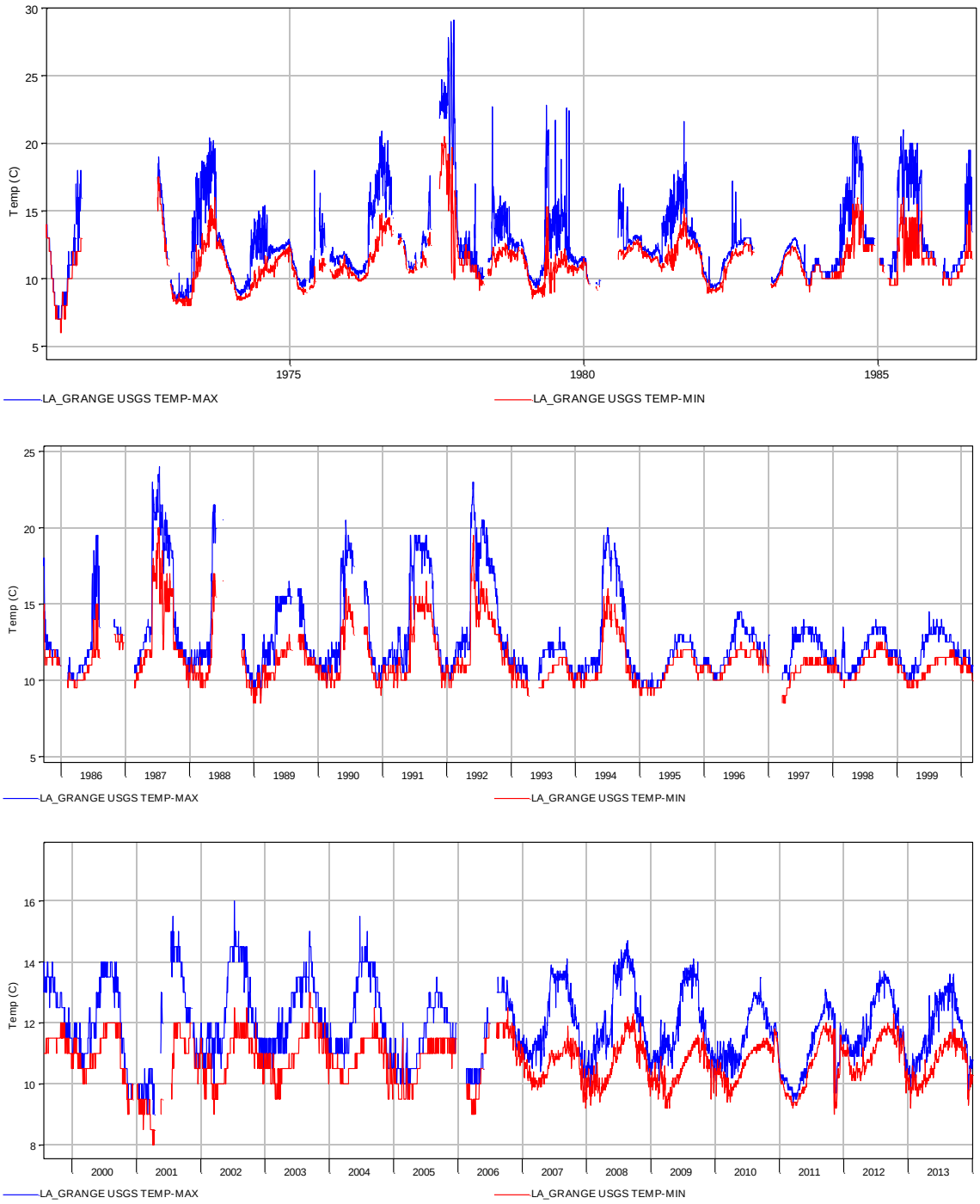


Figure 5. Daily minimum and maximum temperatures at USGS La Grange gage, 1971-2013.

4.2 Water Quality Information

Available water quality information (NMFS-1, Elements 3e and 3f) associated with the La Grange project is summarized in the PAD (TID/MID 2011) as well as the Don Pedro Water Quality Study (TID/MID 2013a, Study W&AR-01) at sampling sites below Don Pedro Reservoir (RM 54.6) and at the La Grange gage (RM 51.7). Water quality profile data collected as part of a mercury fish tissue assessment in the fall of 2008 indicates that water column conditions within the pool formed by the La Grange diversion dam are uniform with depth (Stillwater Sciences 2009a). Review of the information sources above show that water entering and exiting the La Grange development meets all applicable water quality objectives for designated beneficial uses under the Basin Plan (CVRWQCB 2011). The Districts' Pre-Application Document for Don Pedro Project (TID/MID 2011) also provides information on the designated beneficial uses of Hydro Unit 535, which encompasses the reach discussed in this report (see pg 3-22, Table 3.5.4-1, pgs 5-33 to 5-40, and Tables 5.2.1.10 and 5.2.1.11).

4.3 River Channel Geomorphology and Habitat Types

The Tuolumne River is confined by a steep bedrock valley comprised of shallow soils and rock outcrop between Twin Gulch (RM 53.2) and La Grange diversion dam (RM 52.2). Channel geometry and bathymetry (see NMFS-1, Element 3g) is characterized by channel depths of 2–10 feet within riverine habitats along the channel thalweg downstream of Twin Gulch, to 5–20 feet in the lacustrine habitats found upstream of La Grange diversion dam (TID/MID 2013a, Don Pedro Study W&AR-13). Twin Gulch (RM 53.2) was identified as being a major source of fine sediment during the January 1–2, 1997 flood event (McBain & Trush 2004). The gulch was estimated to be scoured down to bedrock as a result of the flood, with most of the suspended sediment passing over La Grange diversion dam and much of the coarse sediment trapped by the diversion dam. A bathymetry survey was performed by the Districts in 2012 and is provided in Attachment B to this report.

Downstream of La Grange diversion dam (RM 52.2), the Tuolumne River channel consists of a bedrock pool at the base of the dam extending to near the La Grange powerhouse at RM 52.0. LiDAR information collected in March 30, 2012 at a discharge of approximately 320 cfs was used in conjunction with in-channel bathymetry surveys to develop a longitudinal bed profile downstream of the La Grange diversion dam (TID/MID 2013a, Don Pedro Study W&AR-04). The depth of the plunge pool downstream of La Grange diversion dam is estimated to be approximately 14–18 feet.

Gravel deposits near the La Grange powerhouse tailrace have been mapped as two relatively small riffle areas near RM 51.9 and RM 51.7 (TID/MID 2013a, Don Pedro Study W&AR-04). These areas were both mapped in 1988, with the downstream area near RM 51.7 remapped in 2001 as part of ongoing studies related to Chinook salmon spawning habitat in the lower Tuolumne River (Table 3). The tailrace from the La

Grange powerhouse forms an eastern channel and enters the main channel near RM 51.9. A separate discussion of dewatering of the tailrace during 2008 is provided under Chinook salmon aquatic resources discussion for Chinook salmon below. Downstream of the tailrace channel, the main Tuolumne River channel becomes pool habitat extending to the small riffle area at RM 51.7 near the USGS gage.

Table 3. Gravel areas mapped near the La Grange tailrace, 1988 and 2001.

Mapped gravel areas (ft^2)	1988	2001
RM 51.9	7,603	--
RM 51.7	2,965	3,989

Fine sediment deposits downstream of La Grange diversion dam (RM 52.2) were mapped as discreet patches of fine bed material (FBM, <2 mm) deposited in one of six different geomorphic units: pool bottom, pool margin, other channel margin, alcove/backwater, side channel, and captured gravel pit (Table 4). The dominant surface texture along with the depth of the deposit was recorded for each patch.

Table 4. Fine sediment deposits mapped between the La Grange powerhouse and La Grange gage, 2012.

Fine bed material mapped in 2012	FBM deposit number	Texture	Average Depth (ft)	Area within 600 cfs (ft^2)	Area within 300 cfs (ft^2)
Pool margin at RM 51.9	2	Sand	1.0	976	693
Pool margin at RM 51.7	1	Sand	1.0	1,419	1,398
Pool margin at RM 51.7	3	Sand	1.9	4,068	2,583

A study focused on *O. mykiss* habitat distribution, abundance, and quality in the lower Tuolumne River emphasizing the availability of LWD was conducted in 2012 and showed no occurrence of LWD in habitats sampled within the Tuolumne River from La Grange diversion dam to the USGS gage (TID/MID 2013a, Don Pedro Study W&AR-12). Estimates of LWD trapped within the Don Pedro Reservoir were made as part of the study, but no data is available to determine how much of the LWD would deposit and persist in the lower Tuolumne River.

4.4 Description of Fish Communities and Aquatic Resources Upstream of La Grange Diversion Dam

Fish communities and aquatic resources (see NMFS-1, Element 3h) upstream of La Grange diversion dam include resident *O. mykiss* as well as prickly sculpin (*Cottus asper*) (TID/MID 2013a, Don Pedro Study W&AR-13). Although no ESA-listed species or designated critical habitat occur upstream of La Grange diversion dam, sampling was conducted within the portions of the TID and MID canal systems near La Grange to document the presence of resident *O. mykiss* that have been reported during annual

inspections of the canal system by District employees (Stillwater Sciences 2004). Due to structural fish passage barriers that would prevent anadromous fish from reaching the canals from downstream, it is believed that these are resident *O. mykiss*. The presence of several age classes of *O. mykiss* in surveys upstream of La Grange diversion dam suggests that a self-sustaining population of rainbow trout exists in this reach (TID/MID 2013a, Don Pedro Study W&AR-13). The resident *O. mykiss* upstream of La Grange diversion dam may potentially recruit to the downstream population during high flow events that result in flow over La Grange diversion dam.

4.5 Description of Fish Communities and Aquatic Resources Downstream of La Grange Diversion Dam

Downstream of La Grange diversion dam, resident and anadromous fish communities and aquatic resources in the lower Tuolumne River have been extensively studied over the years as part of the Don Pedro Project (FERC No. 2299) and are summarized in the PAD (TID/MID 2011). The lower Tuolumne River is known to support Central Valley fall-run Chinook salmon. ESA-designated critical habitat for Central Valley steelhead occurs in the lower Tuolumne River within the area under consideration in this report downstream of La Grange diversion dam[2]. Surveys conducted in portions of the Tuolumne River upstream of the La Grange gage (RM 51.7) include annual Chinook spawning surveys conducted by CDFW since 2001, targeted snorkel surveys as part of *O. mykiss* monitoring conducted in 2008–2010 (Stillwater Sciences 2008, 2009b, 2011), as well as *O. mykiss* angling and scale collection surveys in 2012 (TID/MID 2013a, Don Pedro Study W&AR-20).

4.6 Chinook salmon

Under the Magnuson-Stevens Fishery Conservation and Management Act, essential fish habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Based upon the above information summaries as well as related Don Pedro relicensing studies conducted for habitats downstream of RM 51.7, Chinook salmon EFH between the La Grange diversion dam and the USGS La Grange gage is characterized by adequate depths, flows and water temperatures for spawning, incubation, juvenile rearing, and emigration.

Suitable substrate for Chinook salmon spawning in the riffle area near the La Grange powerhouse was mapped in 2012 (TID/MID 2013a, Don Pedro Study W&AR-04). Annual salmon spawning surveys have been conducted by CDFW in the lower Tuolumne River since 1971 to estimate total escapement and provide biological information pertaining to the run (TID/MID 2013a, Don Pedro Study W&AR-05). Chinook salmon

[2] Critical habitat was designated for CV steelhead on September 2, 2005 (70 FR 52488). The designated critical habitat for CV steelhead in the Tuolumne River extends from La Grange diversion dam downstream to the confluence with the San Joaquin River and laterally to the edge of the bankfull channel.

spawning in the lower Tuolumne River typically begins in October and continues through December each year. Annual Chinook runs are typically comprised of two- to five-year-old fish, with three-year-old fish usually contributing the highest percentage of the run. The percentage of females in the 1971–2010 runs has ranged from 25% in 1983 to 67% in 1978 and 2005 (TID/MID 2013b, Report 2012-2). Beginning in 2001, CDFW spawning surveys included a foot survey of the riffle area downstream of the La Grange diversion dam near RM 51.9. Annual spawning survey reports produced by CDFW include an annual maximum redd count by riffle, summarized for the riffle area near the La Grange powerhouse in Table 5 below.

Table 5. Maximum Chinook salmon redd counts for the riffle area located near RM 51.9, 2001–2009.

Maximum redd counts recorded by CDFW at RM 51.9	2001	2002	2003	2004	2005	2006	2007	2008	2009
	7	7	1	10	5	6	4	7	1

Although CDFW annual reports do not report redd counts in the La Grange powerhouse tailrace channel and the adjacent riffle area at RM 51.9 separately, a forced outage of the La Grange powerhouse in 2008 resulted in the dewatering of isolated redds in the tailrace (TID/MID 2010, Report 2009-1). Because of the isolated occurrence of this incident and the fact that the Districts do not vary the discharge from La Grange powerhouse for power peaking, it is unlikely that redd dewatering incidents will occur in the future or otherwise contribute to direct Chinook salmon mortality (TID/MID 2013a, Don Pedro Study W&AR-05)[3]. Under current operations, if a forced outage of either or both units occurs, the adjacent automated sluice gates immediately open to pass flow downstream.

Although no other information specific to Chinook salmon within the vicinity of the La Grange project was identified, life history timing of Chinook salmon is similar to that found in other sub-reaches of the lower Tuolumne River downstream of the La Grange gage (TID/MID 2013a, Don Pedro Study W&AR-05). Following Chinook salmon egg incubation during early winter, fry emergence begins in January and typically peaks in mid-February (TID/MID 2013a, Don Pedro Study W&AR-05). Springtime juvenile rearing as well as smolt outmigration continues through May in most years, with over-summering of low numbers of juvenile Chinook salmon documented in annual snorkel surveys at locations downstream of the La Grange gage (RM 51.7).

4.7 Central Valley Steelhead

Based upon the above information summaries as well as related relicensing studies conducted for habitats downstream of RM 51.7, Central Valley steelhead habitat in the vicinity of the La Grange project is characterized by adequate depths, flows and water

[3] The Districts evaluated the historical occurrence of changes in river stage as part of NMFS-4, Element 4. This report is provided under separate cover in the USR document.

temperatures for spawning, incubation, juvenile rearing as well as smolt emigration. This is further discussed in the sections below.

Little information concerning Central Valley steelhead occurrence in the lower Tuolumne River exists beyond the low numbers of individuals analyzed by Zimmerman et al (2008) showing maternal anadromy. As such, there is no actual data or information regarding steelhead migration or spawning in the lower Tuolumne River. Based upon general life history timing of Central Valley steelhead, spawning in the Tuolumne River may potentially occur from December through April (TID/MID 2013a, Don Pedro Study W&AR-05). Although this is similar to redd construction timing for *O. mykiss* documented in 2012, no redds were found upstream of the La Grange gage in 2012/2013 surveys (TID/MID 2013a, TID/MID 2013c, Don Pedro Study W&AR-08). Water quantity and quality information discussed above, as well as documentation of substrate (TID/MID 2013a, TID/MID 2013c, Don Pedro Study W&AR-04), support the potential for *O. mykiss* spawning in the vicinity of the La Grange project.

Freshwater rearing sites for any Central Valley steelhead in the Tuolumne River are available in the vicinity of the La Grange project. Based upon general life history timing information for Central Valley steelhead (TID/MID 2013a, Don Pedro Study W&AR-05) as well as historical monitoring of juvenile *O. mykiss* in seine and RST monitoring (Ford and Kirihara 2010), peak *O. mykiss* fry emergence is typically seen during March and April in the Tuolumne River. Downstream of La Grange diversion dam, *O. mykiss* observations are limited to targeted sampling related to scale collection surveys in 2012 (TID/MID 2013a, Don Pedro Study W&AR-20) as well as snorkel survey data near the La Grange gage (Stillwater Sciences 2008, 2009b, 2011) (Table 6). Benthic macroinvertebrate (BMI) food resources (TID/MID 2011) as well as natural cover for rearing *O. mykiss* (TID/MID 2013a, Don Pedro Study W&AR-12) have been characterized for the lower Tuolumne River downstream of the La Grange gage.

Table 6. *O. mykiss* observations within the La Grange Project vicinity, 2008–2010.

O. mykiss observations	July 2008		July 2009		March 2010		August 201	
	< 150 mm	≥ 150 mm	< 150 mm	≥ 150 mm	< 150 mm	≥ 150 mm	< 150 mm	≥ 150 mm
Pool habitat near RM 51.8	0	5	0	14	1	1	0	6

The documented presence of rearing *O. mykiss* in snorkel surveys near the La Grange gage (Stillwater Sciences 2008, 2009b, 2011), as well as periodic RST captures of smolt sized *O. mykiss* between 1999–2009 (Ford and Kirihara 2010), suggests that flow and water temperature conditions for smolt emigration are provided during the general January–May smolt emigration period summarized from the Stanislaus River (TID/MID 2013a, Don Pedro Study W&AR-05). Water flow and temperature information discussed above, as well as information related to food resources, and other in-channel habitat assessments provided for downstream habitats are sufficient to characterize primary

constituent elements of Critical Habitat for any Central Valley steelhead emigrating from habitats in the vicinity of the La Grange project.

5.0 Resource Impacts of the La Grange Project

NMFS-1, Element 6, requested that the Districts provide a description of "known or potential adverse impacts to anadromous fishes associated with the construction, operation or maintenance" of the La Grange facilities, including cumulative impacts. FERC's May 2013 Determination directed the Districts to provide this assessment using existing information.

5.1 Construction-Related Impacts

The La Grange facilities were originally constructed between 1891 and 1893. Changes to the spillway were made in 1923 and 1930. The Districts were not able to locate any existing information about actual or potential construction-related impacts. As La Grange diversion dam replaced Wheaton Dam built in the 1870s, the construction of La Grange diversion dam did not result in any incremental impacts to the upstream or downstream migration of salmon or *O.mykiss.* According to newspaper reports at the time as reported in Paterson (2004), Wheaton Dam prevented the upstream migration of salmon.

5.2 O&M-Related Impacts

Aside from the single incident identified above in Section 4.6, there are no known direct impacts to anadromous fish due to the operation and maintenance of the La Grange project. La Grange diversion dam does act as a barrier to the upstream migration of anadromous fish to the reach between the La Grange diversion dam and Don Pedro Dam. Habitat suitability of the La Grange impoundment to support Chinook or *O.mykiss* life stages is unknown. Impoundments are generally not suitable habitat for Chinook or *O.mykiss* spawning; however, as noted above, recent studies found multiple year classes of *O.mykiss* in the reach between La Grange diversion dam and Don Pedro Dam.

The La Grange project passes flow released at Don Pedro intended to meet Don Pedro minimum flows required by its FERC license. The diversion of water out of the Tuolumne River potentially contributes to direct and/or cumulative effects to anadromous fish below the La Grange tailrace. MID and TID diversions create a bypassed reach between La Grange diversion dam and the La Grange tailrace. MID passes 25 cfs through its abandoned headwater canal to this bypass reach. There is no existing information on impacts due to this operation. As discussed above, adequate conditions to support life stages of Chinook salmon and *O.mykiss* exist in the vicinity of the La Grange project. Temperature data collected as part of the Don Pedro relicensing indicate that the La Grange project has little effect on water temperature and there is no evidence that La Grange pool thermally stratifies.

5.3 Description of Existing or Proposed Actions to Protect and Enhance Anadromous Fish

The La Grange project diverts Tuolumne River flows for the beneficial use of irrigation and M&I purposes. Flows greater than those needed for irrigation and M&I purposes are passed downstream. The Districts pass approximately 25 cfs through the MID abandoned main canal to the bypass reach and this may potentially protect salmon or *O.mykiss* that enter the pool immediately below La Grange diversion dam. The Districts are not planning any changes to La Grange diversion dam that might adversely or beneficially affect Chinook salmon or *O.mykiss* in the vicinity of the La Grange project or the lower Tuolumne River below the USGS La Grange gage.

References

Bechtel Civil, Inc 1987. La Grange Power Plant Rehabilitation; Proposal Evaluation for Turbine/Generator Equipment and Auxiliaries Including Associated Civil/Structural Work. Prepared for Turlock Irrigation District. March 1987.

Central Valley Regional Water Quality Control Board (CVRWQCB). 2011. The Water Quality Control Plan (Basin Plan) for the Sacramento River Basin and the San Joaquin River Basin. 4th ed. California Regional Water Quality Control Board, Central Valley Region, Sacramento, California.

Ford, T., and S. Kirihara. 2010. Tuolumne River Oncorhynchus mykiss monitoring report. Prepared by Turlock Irrigation District/Modesto Irrigation District, California and Stillwater Sciences, Berkeley, California for Federal Energy Regulatory Commission, Washington, D.C.

McBain and Trush. 2004. Coarse sediment management plan for the lower Tuolumne River. Revised Final Report. Prepared by McBain and Trush, Arcata, California for Tuolumne River Technical Advisory Committee, Turlock and Modesto Irrigation Districts, U.S. Fish and Wildlife Service Anadromous Fish Restoration Program, and California Bay-Delta Authority.

Paterson, A.M. 2004. Land, Water and Power: A History of the Turlock Irrigation District, 1887-1987.

Stillwater Sciences 2004. Summary of sampling for *O. mykiss* near La Grange. Technical Memorandum. Prepared for Turlock Irrigation District. March 30, 2004.

Stillwater Sciences. 2008. July 2008 population size estimate of Oncorhynchus mykiss in the lower Tuolumne River. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District.

Stillwater Sciences. 2009a. Don Pedro Reservoir fish mercury study. Final Report. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District, California. December

Stillwater Sciences. 2009b. March and July 2009 population size estimates of Oncorhynchus mykiss in the lower Tuolumne River. Prepared by Stillwater Sciences, Berkeley, California for Turlock Irrigation District and Modesto Irrigation District.

Stillwater Sciences. 2011. March and August 2010 population size estimates of Oncorhynchus mykiss in the Lower Tuolumne River. Prepared for the Turlock Irrigation District and the Modesto Irrigation District by Stillwater Sciences, Berkeley, CA. March.

Turlock Irrigation District and Modesto Irrigation District (TID/MID) 2010. 2009 Lower Tuolumne River Annual Report. Report 2009-1. 2009 Spawning Survey Report. Turlock Irrigation District and Modesto Irrigation District. March 2010.

TID/MID 2011. Pre-Application Document. Don Pedro Project, FERC No. 2299. Volume I and II. February 2011.

TID/MID 2013a. Initial Study Report. Pedro Project, FERC No. 2299. January 2013.

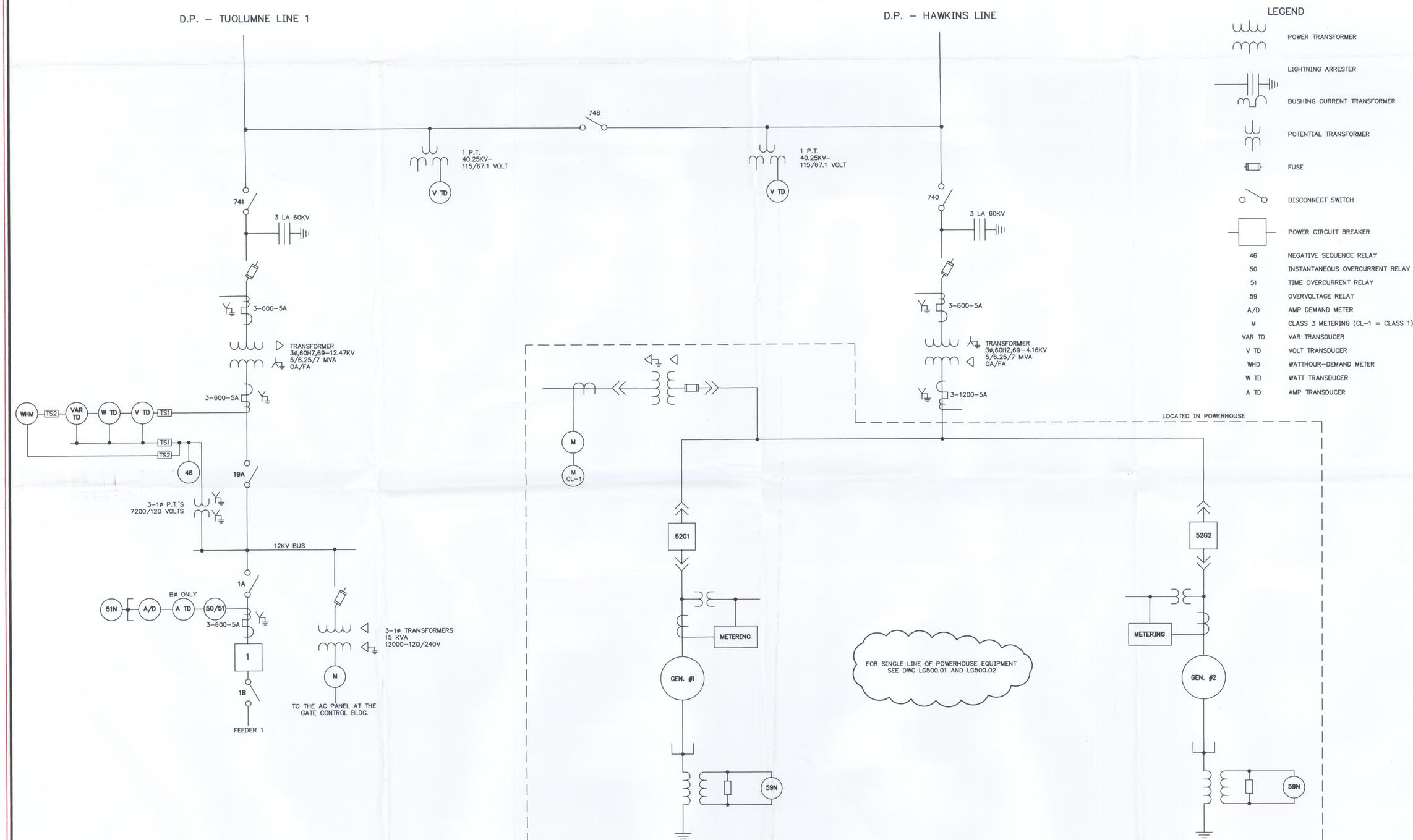
TID/MID 2013b. 2012 Lower Tuolumne River Annual Report. Report 2012-2. 2012 Spawning Survey Summary Update. Turlock Irrigation District and Modesto Irrigation District. March 2013.

TID/MID 2013c. Updated Study Report. Pedro Project, FERC No. 2299. January 2014.

Zimmerman, C. E., G. W. Edwards, K. Perry. 2008. Maternal origin and migratory history of *Oncorhynchus mykiss* captured in rivers of the Central Valley, California. California Dept. of Fish and Game.

ATTACHMENT A

Single Line Diagram



20111012-0038

REV	DATE	DESCRIPTION	DR	CHK	APP
01	04/05/1993	AS BUILT	CH	CH	RA
02	03/02/1999	CHANGED DRAWING REFERENCES	ELJ	ELJ	CH

	DATE	REVIEWED	DATE
DRAWN	CH 03/23/1988		
CHECKED		REVIEWED	RCB 12/09/1989
REVIEWED		APPROVED	RA 12/09/1989

TURLOCK IRRIGATION DISTRICT

ENGINEERING ADMINISTRATION

LA GRANGE POWER PLANT

SINGLE LINE DIAGRAM
69KV AND 12KV

MDB&M
S:
T:
R:
SCALE: NONE
SHEET: 1 OF: 1
REV DATE: 03/03/1999

DWG #LG500

REV 02

ATTACHMENT B

2012 Bathymetry Survey

GENERAL NOTES

(1) BATHYMETRIC DATA IS FROM A SURVEY CONDUCTED BY MERIDIAN SURVEYING ENGINEERING, INC. ON SEPTEMBER 12 AND 13, 2011 THIS REPRESENTS THE RIVER BOTTOM CONDITIONS ON THAT DATE.

(2) A TRIMBLE R8 REAL-TIME KINEMATIC GPS RECEIVER, AN INNERSPACE 455 ECHOSOUNDER WITH A SINGLE FREQUENCY TRANSDUCER AT 200 KHZ WERE USED FOR RIVER BOTTOM. A HYDROLITE ECHOSOUNDER WITH A SINGLE FREQUENCY TRANSDUCER WAS ASLO USED.

(3) THE CONTOURS SHOWN ARE INTERPOLATED FROM A 3 DIMENSIONAL MODEL CREATED FROM THE TRUE SOUNDINGS.

(4) SHORELINE CONTOURS PROVIDE BY TID.

BASIS OF COORIDATES AND ELEVATION

SURVEY WAS BASED ON TID POINT 102

ELEVATION OF THE RIVER SURFACE AT THE TIME OF SURVEY

DATE	TIME	ELEVATION
09/12/11	13:09	301.4'
09/13/11	11:05	298.4'
09/13/11	15:37	296.6'

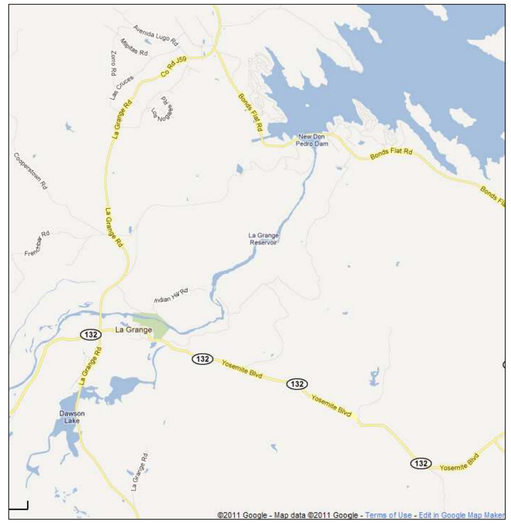
MATCHLINE – SEE BELOW MIDDLE

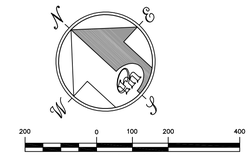
MATCHLINE – SEE BELOW RIGHT

MATCHLINE – SEE ABOVE LEFT

MATCHLINE – SEE ABOVE MIDDLE

VICINITY MAP





LEGEND

N.T.S. NOT TO SCALE
TID TURLOCK IRRIGATION DISTRICT

CONTOUR INTERVAL: 2 FEET

PRELIMINARY RESULTS

HYDROGRAPHIC SURVEY

TOULUMNE RIVER
SECTION 16, 9 AND 10
TOWNSHIP 4 SOUTH
RANGE 14 EAST

PREPARED AT THE REQUEST OF
TID

TOULUMNE/STANISLAUS CO. CALIFORNIA
SEPTEMBER 2011

MERIDIAN SURVEYING ENGINEERING, INC.
1812 UNION STREET
SAN FRANCISCO 94123
(415) 440-4131

777 GRAND AVENUE, #202
SAN RAFAEL, CA 94901
(415) 456-5450

SURVEY BY:	STG/DT/NDF	REVISION DATE:	08/15/11
DRAWN:	NDF	PROJ. NO.:	11092
APPROVED:	STG	SHEET	1 OF 1
FILE NAME:	11092		
SURVEY DATE:			