3.3.2 Water Resources

The discussion of water resources is divided into five sections. The affected environment is discussed in Section 3.3.2.1, environmental effects of the Project are discussed in Section 3.3.2.2, cumulative effects are described in Section 3.3.2.3, unavoidable adverse effects are addressed in Section 3.3.2.4., and proposed measures recommended by agencies or other Relicensing Participants in written comments on the DLA that were not adopted by SSWD are discussed in Section 3.3.2.5.

SSWD augmented existing, relevant, and reasonably available information on water resources by conducting three studies: 1) Study 2.1, *Water Temperature Monitoring*; 2) Study 2.2, *Water Temperature Modeling*; and 3) Study 2.3, *Water Quality*. The results of these studies are discussed throughout this section and data are provided in Appendix E1.

3.3.2.1 Affected Environment

This section describes existing water resources conditions (environmental baseline) in two general areas – water quantity and water quality – for waters affected by the Project.[1, 2]

3.3.2.1.1 Water Quantity

This section describes: 1) the development of Project hydrologic datasets; 2) the Project's storage and flows; 3) the existing and proposed uses of Project waters; and 4) existing and proposed water rights that might affect or be affected by the Project.

Hydrologic Datasets

As described in Section 4.1 of Exhibit B of this Application for New License, SSWD developed five hydrology datasets, each of which covers WYs 1976 through 2014 and are provided in Exhibit E, Appendix E1, of this Application for New License. These datasets are: 1) Historical Hydrology; 2) Unimpaired Hydrology; 3) Baseline; 4) Near-Term Condition – Proposed Project; 5) Future Condition – Proposed Project. The first dataset is composed of gaged flow data, while the other five datasets are products of SSWD's Ops Model. The model run of the Baseline is the No Action Alternative, and is used throughout SSWD's Application for New License to represent baseline reservoir and flow conditions. SSWD uses this dataset instead of the Historical Hydrology dataset to represent operations under current conditions because using historical data would be misleading given changes in Project operations overtime. The Ops Model run of the Near-Term Condition – Proposed Project is also used throughout SSWD's Application for New License to represent reservoir and flow conditions under SSWD's Proposed Project as described in this Application for New License under near-term conditions. The Ops

[1] Refer to Section 3.1.2 of this Exhibit E for a description of the Bear River basin from its headwaters to the confluence with the Feather River, a description of the Feather River basin from the Yuba River to the Sacramento River.
[2] Refer to Table 2.1-2 of this Exhibit E for information regarding the volume, surface area, depth and shoreline length of Camp Far West Reservoir.

Model run of the SSWD's Future Condition – Proposed Project is used in Exhibit E Sections 3.3.2.3, which address water resources and aquatic resources cumulative effects, respectively. Each Ops Model run is provided in Exhibit E, Appendix E1.

Project Flows and Storage

SSWD currently operates the Project to provide irrigation water to growers in SSWD's and CFWID's service districts. A schematic of these service districts is shown in Figure 3.0-1 of Exhibit B. Water supply deliveries to SSWD's Service Area is described in Section 5.2.2 of Exhibit B. Water supply deliveries to CFWID's Service Area is described in Section 5.2.4 of Exhibit B. SSWD also operates the Project to meet Bear River flow requirements and to generate power. A complete description of the existing Project operations is provided in Exhibit E Section 2, and a description of SSWD's Ops Model's representation of Project operations under the No Action Alternative can be found in Exhibit E, Appendix E1, *Operations Model Documentation and Validation* report.

Table 3.3.2-1 provides inflows to the Project and Project flows and storage for the 0 percent (i.e., maximum), 10 percent (i.e., wet conditions), 50 percent (i.e., median), 90 percent (i.e., dry conditions) and 100 percent (i.e., minimum) exceedance values at critical locations for the No Action Alternative model run. Long-term averages are also provided in the table.

Table 3.3.2-1. No Action Alternative flows and storage by month from Baseline dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
INFLOW INTO CAMP FAR WEST RESERVOIR (cfs)												
0%	578	8,306	27,304	45,966	29,243	13,609	11,836	4,741	1,183	669	290	219
10%	98	406	1,213	1,817	2,347	2,574	1,711	1,125	645	284	101	56
50%	15	21	46	130	431	703	586	536	71	13	9	12
90%	7	11	14	20	40	85	61	27	10	7	6	6
100%	6	7	10	10	10	17	14	11	6	6	6	6
Average	*36*	*169*	*540*	*788*	*1,005*	*1,073*	*767*	*561*	*245*	*99*	*36*	*24*
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	69,015	94,174	94,251	94,272	94,288	94,280	94,290	94,294	94,284	94,279	86,883	71,366
10%	55,986	60,784	85,815	93,910	94,125	94,199	94,220	94,224	94,132	87,796	70,030	55,217
50%	17,159	17,795	22,445	38,861	76,726	93,737	93,859	93,917	85,076	59,539	33,685	18,638
90%	3,010	3,553	4,594	6,625	10,707	21,350	33,188	37,943	37,094	25,932	10,874	3,676
100%	2,500	2,500	2,729	3,723	3,897	8,913	13,157	12,000	8,376	4,833	2,500	2,500
Average	*21,576*	*24,378*	*33,860*	*47,745*	*62,420*	*74,162*	*79,408*	*79,529*	*74,379*	*58,235*	*37,685*	*23,243*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	286	300	300	300	300	300	300	300	300	300	296	287
10%	277	280	296	300	300	300	300	300	300	297	286	276
50%	235	236	243	262	290	300	300	300	295	279	257	237
90%	192	195	201	209	221	241	256	261	260	248	222	196
100%	188	188	190	196	197	217	227	224	215	202	188	188
Average	*231*	*234*	*246*	*261*	*274*	*285*	*289*	*289*	*286*	*275*	*255*	*236*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	114	8,367	27,379	46,031	29,394	13,736	11,925	4,737	1,215	680	521	399
10%	104	13	10	1,510	2,230	2,563	1,717	1,120	630	495	489	281
50%	17	11	10	10	12	510	531	494	453	476	431	110
90%	14	10	10	10	11	10	29	123	144	133	125	22
100%	5	8	10	10	10	10	26	42	47	38	4	4
Average	*40*	*63*	*370*	*504*	*803*	*916*	*733*	*575*	*415*	*391*	*366*	*135*
DIVERSION INTO CFWID'S NORTH CANAL (cfs)												
0%	3	1	0	1	2	2	7	18	25	29	28	17
10%	2	1	0	0	2	2	6	18	25	29	27	12
50%	2	1	0	0	2	1	4	15	23	27	26	5
90%	1	0	0	0	1	0	1	9	21	23	22	3
100%	0	0	0	0	0	0	0	4	11	13	0	0
Average	*2*	*1*	*0*	*0*	*1*	*1*	*4*	*14*	*23*	*26*	*25*	*7*
DIVERSION INTO CFWID'S SOUTH CANAL (cfs)												
0%	7	2	0	0	0	1	21	22	26	25	23	12
10%	7	1	0	0	0	0	21	22	25	25	22	10
50%	5	0	0	0	0	0	5	21	24	25	20	7
90%	3	0	0	0	0	0	1	19	19	23	12	5
100%	0	0	0	0	0	0	0	11	11	14	0	0
Average	*5*	*0*	*0*	*0*	*0*	*0*	*9*	*21*	*23*	*24*	*18*	*7*

Table 3.3.2-1. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
DIVERSION INTO SSWD'S MAIN CANAL (cfs)												
0%	96	0	0	0	0	0	396	446	438	434	433	361
10%	86	0	0	0	0	0	174	396	422	431	430	244
50%	0	0	0	0	0	0	10	301	354	415	369	84
90%	0	0	0	0	0	0	0	63	70	70	67	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*24*	*0*	*0*	*0*	*0*	*0*	*53*	*264*	*296*	*322*	*300*	*106*
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	10	8,366	27,379	46,031	29,392	13,735	11,923	4,502	825	210	47	47
10%	10	10	10	1,510	2,229	2,562	1,663	725	225	47	47	47
50%	10	10	10	10	10	510	425	95	25	10	10	10
90%	10	10	10	10	10	10	25	25	25	10	10	10
100%	5	8	10	10	10	10	25	25	25	10	4	4
Average	*10*	*62*	*370*	*504*	*802*	*915*	*669*	*278*	*73*	*18*	*22*	*15*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	14	8,369	27,384	46,036	29,396	13,739	11,927	4,508	830	216	54	52
10%	14	14	15	1,515	2,232	2,566	1,667	731	230	53	54	52
50%	14	14	15	15	14	514	430	101	30	16	17	15
90%	14	14	15	15	14	14	30	31	30	16	17	15
100%	9	12	15	15	14	14	30	31	30	16	11	9
Average	*14*	*66*	*375*	*509*	*806*	*919*	*674*	*284*	*79*	*25*	*29*	*20*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	14	8,369	27,384	46,036	29,396	13,739	11,927	4,508	830	216	54	52
10%	14	14	15	1,515	2,232	2,566	1,667	731	230	53	54	52
50%	14	14	15	15	14	514	430	101	30	16	17	15
90%	14	14	15	15	14	14	30	31	30	16	17	15
100%	9	12	15	15	14	14	30	31	30	16	11	9
Average	*14*	*66*	*375*	*509*	*806*	*919*	*674*	*284*	*79*	*25*	*29*	*20*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	398	10,035	32,792	51,938	35,166	15,880	15,191	4,731	869	223	66	58
10%	18	33	849	1,719	2,478	2,787	1,731	778	231	54	54	52
50%	14	15	21	50	110	557	467	109	34	18	18	15
90%	14	14	16	17	18	24	35	34	31	17	17	15
100%	9	12	15	15	14	17	32	31	30	16	11	10
Average	*16*	*85*	*465*	*639*	*965*	*1,037*	*719*	*300*	*83*	*26*	*30*	*21*

Refer to Section 2.1.4.3 in Exhibit E and Exhibit B of this Application for new License for a more detailed description of water quantity under the Environmental Baseline.

Existing Designated Beneficial Uses

As described in Section 1.3.9 of Exhibit E, Basin Plan water quality standards “consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.” [33 USC § 1313(C) (2) (A)]. Section 1.3.9 of Exhibit E describes existing designated Beneficial Uses of water in the Project Vicinity, which include: 1) Municipal and Domestic Supply; 2) Agricultural Supply (Irrigation); 3) Industrial Process Supply (Power Generation); 4) Industrial Services Supply; 5) Water Contact Recreation; 6) Non-Water Contact Recreation; 7) Warm Freshwater Habitat; 8) Cold Freshwater Habitat; and 9) Wildlife Habitat. The Basin Plan identifies potential designated Beneficial Uses of water in the Project Vicinity as Migration of Aquatic Organisms and Spawning. Refer to Section 1.3.9 for a definition of each Beneficial Use.

Existing and Proposed Water Rights Potentially Affecting or Affected by the Project

This section provides a list of water rights held by SSWD and other existing or proposed water rights potentially affecting or affected by the Project.

<u>Water Rights Upstream of the Project Area That Affect the Project</u>
Numerous water rights holders divert and store waters upstream of the Project Area. The upstream projects with significant impacts on inflows to the Project include PG&E’s Drum-Spaulding Project, NID’s Yuba-Bear Hydroelectric Project and NID’s Lake Combie. Details regarding PG&E’s Drum-Spaulding Hydroelectric Project water rights in the Bear River are provided in Table 3.3.2-2. Details on NID’s Yuba-Bear Hydroelectric Project water rights in the Bear River are provided in Table 3.3.2-3. Details regarding NID’s water rights at Lake Combie in the Bear River drainage are provided in Table 3.3.2-4.

Table 3.3.2-2. Summary of water rights held by PG&E related to the Drum-Spaulding Hydroelectric Project (FERC project number 2310) in the Bear River.

Priority Date	SWRCB Designation		Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit or License Number		cfs	ac-ft		Diversion	Storage	
7/5/1928	5970	8888	Bear River	525	--	Dutch Flat 1 Intake	1/1-12/31	--	Power
2/9/1922	2753	987	Bear River	100	--	Bear River Canal Intake	1/1-12/31	--	Power
6/19/1929	6332	1375	Bear River	120	--	Bear River Canal Intake	1/1-12/31	--	Power
1852	--	957	Bear River	475	--	Bear River Canal Intake	1/1-12/31	--	Power, Irrigation, Domestic, Public Service
1864	--	--	Little Bear River	60	--	Boardman Canal below Alta PH	1/1-12/31	--	Irrigation and Domestic

Table 3.3.2-3. Summary of water rights held by NID related to the Yuba-Bear Hydroelectric Project (FERC project number 2266) in the Bear River.

Priority Date	SWRCB Designation			Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit	License		cfs	ac-ft		Diversion	Storage	
2/5/1963	21151	14799	9903 (4/19/72)	Bear River	1,056	--	Chicago Park Flume	1/1-12/31	--	Power
2/5/1963	21152	14800	9902 (4/19/72)	Bear River	550	-	Dutch Flat Flume	1/1-12/31	--	Power
1/9/1976	24983	16953	In Progress	Bear River	700	62,080	Rollins Reservoir	1/1-12/31	11/30-6/1	Power
1853	S14354	--	Pre-1914 Right	Bear River	--	--	Rollins	--	--	--
1853	S14355	--	Pre-1914 Right	Bear River	--	--	Bear River Canal	--	--	--

Table 3.3.2-4. Summary of non-consumptive water rights held by NID for the purpose of power generation and irrigation.

Priority Date	SWRCB Designation			Source	Amount		Place of Storage or Diversion	Season of		Beneficial Use
	Application	Permit	License		cfs	ac-ft		Diversion	Storage	
11/22/1921	2652A	5803	10350	Bear River	--	5,555	Combie Reservoir	--	11/30-6/1	Irrigation
6/3/1981	26866	18757	--	Bear River	1,000	--	Combie Reservoir	1/1-12/31	--	Power

NID also holds senior pre-1914 water rights to the Bear River. In August 2015, NID filed an application with the SWRCB for the annual appropriation of 222,000 ac-ft of water from the Bear River, related to the development of a proposed water storage project (i.e., Centennial ;) immediately upstream of Combie Reservoir.[3] Refer to Section 3.2.3.2 for additional discussion regarding NID's Proposed Project.

<u>Water Rights within the Project Area</u>

SSWD operates the Project consistent with the terms and conditions of each of the water rights and agreements listed below.

SSWD's Water Right for Power (No Expiration Date)

Refer to Section 2.1.5.2.1 in Exhibit E for a description of SSWD's water rights related to power.

<u>Water Rights Downstream of the Project Affected by the Project</u>

Water Supply Deliveries from the Bear River to SSWD's Service Area (No Expiration Date)

Refer to Section 2.1.5.2.2 in Exhibit E for a description of water rights related to SSWD's water supply deliveries from the Bear River to SSWD's Service Area.

[3] Details on NID's proposed water storage project can be found at https://centennial.nidwater.com.

Water Supply Deliveries from the Bear River to CFWID (No Expiration Date)

Refer to Section 2.1.5.2.4 in Exhibit E for a description of water SSWD provides to CFWID.

Water Deliveries to Satisfy Bay-Delta Bear River Voluntary Agreement (Expires December 31, 2035)

Refer to Section 2.1.5.2.3 in Exhibit E for a description of water SSWD supplies to CDFW and DWR to settle the responsibilities of SSWD, CFWID, and all other Bear River water rights to implement the objectives in the *Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary* adopted May 22, 1995 (1995 Bay-Delta Plan).

Other Water Deliveries

No other active water rights than those listed above[4] are identified downstream of Camp Far West Dam along the Bear River.

3.3.2.1.2 Water Quality

This section first describes the regulatory context of water quality in the basin, and then describes existing water quality conditions in five areas: 1) general water quality, including results of synoptic dissolved oxygen (DO) sampling; 2) water temperature and DO conditions in reservoirs; 3) water temperature conditions in streams; 4) SSWD's relicensing water temperature model; and 5) the CWA Section 303(d) constituent mercury and existing conditions regarding mercury bioaccumulation in fish.

Existing Water Quality Objectives

Table 3.3.2-5 lists Water Quality Objectives described in the Basin Plan related to the designated Beneficial Uses.

Table 3.3.2-5. Basin Plan Water Quality Objectives to support designated Beneficial Uses in the Project Vicinity.

Water Quality Objective	Description
Bacteria	In terms of fecal coliform. Less than a geometric average of 200/100 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.

[4] An Initial Statement of Water Diversion and Use was filed in 1978 in support of a riparian and pre-1914 water right claim; however, the SWRCB currently lists Statement S009549 as inactive.

Table 3.3.2-5. (continued)

Water Quality Objective	Description
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 Project. Electrical conductivity (at 77 ºF) shall not exceed 150 micromhos (µmhos)/cm (90 percentile) in well-mixed waters of the Feather River from the Fish Barrier Dam at Oroville to Sacramento River. 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 C.F.R. Part 131).
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.
Dissolved Oxygen (DO)	Monthly median of the average daily dissolved oxygen concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percent concentration shall not fall below 75 percent of saturation. Minimum level of 7 mg/L. Specific DO water quality objectives below Oroville dam are 8.0 mg/L from September 1 to May 31 for Feather River from Fish Barrier Dam at Oroville to Honcut Creek (surface water body #40). When natural conditions lower dissolved oxygen below this level, the concentrations shall be maintained at or above 95 percent of saturation.
Floating Material	Water shall not contain floating material in amounts that cause a nuisance or adversely affect beneficial uses.
Oil and 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.
Temperature	The natural receiving water temperature of interstate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board 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 (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.

Section 303(d) of the CWA requires that each State submit to EPA a list of rivers, lakes and reservoirs in the State for which pollution control or requirements have failed to provide for water quality every 2 years. The CVRWQCB and SWRCB work together to research and update the list for the Central Valley region of California. Based on a review of this list and its associated TMDL Priority Schedule in the Project Vicinity, the Bear River from Combie Lake to Camp Far West Reservoir has been identified by the SWRCB as CWA Section 303(d) State Impaired for mercury. Downstream of the Project, the Bear River has been listed as CWA

Section 303(d) State Impaired for mercury, copper, and chlorpyrifos (SWRCB 2016). The Project does not use or introduce to the Bear River mercury, copper, or chlorpyrifos.

General Water Quality

Water quality parameters discussed in this section include all parameters except water temperature and mercury, which are discussed in subsequent sections. Conditions upstream of the Project, within the Project, and below the Project in the lower Bear River are presented.

Upstream of the Project

Water quality was measured at one location in the Bear River as part of the SWRCB's Surface Water Ambient Monitoring Program (SWAMP) Statewide Perennial Stream Assessment (SWRCB 2013); in 2013 upstream of the Little Wolf Creek confluence (RM 24). Table 3.3.2-6 provides the results of that sampling event.

Table 3.3.2-6. Water quality results from the SWAMP Perennial Streams Assessment.

Analyte	Units	Bear River above Little Wolf Creek
Nitrogen, Total, Total	mg/L	0.223
Phosphorus as P, Total	mg/L	0.0139
Silica as SiO2, Dissolved	mg/L	8.9
Ammonia as N, Total	mg/L	0.0078
OrthoPhosphate as P, Dissolved	mg/L	0.0393
AFDM_Algae, Particulate	g/m2	2.45
Chlorophyll a, Particulate	mg/m2	4.05
Total Suspended Solids, Particulate	mg/L	1.4
Sulfate, Dissolved	mg/L	2.83
Chloride, Dissolved	mg/L	8.55
Hardness as CaCO3, Total	mg/L	42.8
Dissolved Organic Carbon, Dissolved	mg/L	2.65
pH	units	7.78
Turbidity, Total	NTU	0.68
Alkalinity as CaCO3, Total	mg/L	55
Oxygen, Dissolved, Total	mg/L	9.06
Specific Conductivity, Total	uS/cm	124.2
Temperature	°C	25.2

Source: SWRCB 2013

In 2017, SSWD completed a relicensing water quality study which included one sampling location upstream of the Camp Far West Reservoir NMWSE. Results of the sampling are similar to those observed from SWRCB's 2013 sampling and are provided in Table 3.3.2-7.The data from SSWD's 2017 water quality study are also provided in Appendix E1. Alkalinity was the only parameter that was inconsistent with the identified benchmark (20 mg/L) with two of the three samples only slightly higher.

Table 3.3.2-7. Water quality results from SSWD's 2017 study at the Bear River upstream of Camp Far West Reservoir.

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS					
Temperature	--	°C	15.01	25.59	13.04
Specific Conductance	900	µSiemens/cm	60	124	NS

Table 3.3.2-7. (continued)

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS (cont'd)					
pH	6.5-8.5	pH units	7.12	8.06	NS
Dissolved Oxygen	> 7 mg/L	mg/L	10.14	8.27	NS
Turbidity	--	NTU	1.8	2	NS
BASIC WATER QUALITY					
Alkalinity, Total (as CaCO3)	20	mg/L	23	49	22
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.117	ND
Calcium	--	mg/L	5.29	11.5	4.68
Carbon, Dissolved Organic	--	mg/L	1.59	3.17	1.54
Carbon, Total Organic	--	mg/L	1.46	2.53	1.54
Chloride	250	mg/L	3.26	6.5	2.19
Hardness, Total	--	mg/L	22	47.5	18.7
Magnesium	--	mg/L	2.14	4.55	1.71
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.16
o-Phosphate (as P)	--	mg/L	0.014	ND	ND
Phosphorus, Total	--	mg/L	0.255	ND	0.018
Potassium	--	mg/L	0.4	0.71	0.59
Sodium	20	mg/L	3.17	5.25	2.12
Solids, Total Dissolved	500	mg/L	58.7	88.3	33
Solids, Total Suspended	--	mg/L	ND	ND	ND
Sulfate	250	mg/L	2.31	3.59	3.43
Sulfide, Total	--	mg/L	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.38	0.55	2.26
TOTAL METALS CONCENTRATIONS					
Aluminum	87	µg/L	32.2	8.6	66.9
Arsenic	10	µg/L	0.68	2.09	0.55
Cadmium	5	µg/L	ND	ND	ND
Chromium	50	µg/L	ND	ND	0.25
Copper	1000	µg/L	0.64	1.14	1.08
Iron	300	µg/L	117	63.5	135
Lead	15	µg/L	0.056	0.027	0.133
Nickel	100	µg/L	0.92	1.07	1.11
Selenium	50	µg/L	ND	ND	ND
Silver	100	µg/L	ND	ND	ND
Zinc	5000	µg/L	ND	2	ND
Mercury	50	ng/L	4.9	2.4	11.3
Methyl Mercury	--	ng/L	ND	0.5	ND
DISSOLVED METALS CONCENTRATIONS					
Aluminum	--	µg/L	9.2	4.1	74.9
Arsenic	--	µg/L	0.54	1.99	0.54
Cadmium	Hardness Dep't	µg/L	ND	ND	ND
Chromium	Hardness Dep't	µg/L	ND	ND	0.28
Copper	Hardness Dep't	µg/L	1.16	1.32	0.98
Iron	Hardness Dep't	µg/L	49.4	31.5	125
Lead	Hardness Dep't	µg/L	0.038	ND	0.108
Nickel	Hardness Dep't	µg/L	1.03	0.93	1.08
Silver	Hardness Dep't	µg/L	ND	ND	ND

Table 3.3.2-7. (continued)

Analyte	Benchmark	Sample Location	Bear River above CFW Reservoir		
		Sample ID	10051111-1		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
DISSOLVED METALS CONCENTRATIONS (cont'd)					
Zinc	Hardness Dep't	µg/L	ND	ND	ND
Methyl Mercury	--	ng/L	NS	0.3	ND
PESTICIDES					
Diazinon	1.2	µg/L	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND

NS = not sampled
ND = not detected based on the method detection limit

Camp Far West Reservoir

SSWD collected water quality data at one location in Camp Far West Reservoir near the dam as part of its 2017 water quality study on three occasions. Samples were collected at two depths: near the surface and below the thermocline at a depth of about 80 ft (Table 3.3.2-8). Four parameters were inconsistent with identified benchmarks during at least one sampling event; dissolved oxygen (three of six samples, all at depth), alkalinity (six of six samples), aluminum (one sample), and iron (one of six samples). DO concentrations below 7 mg/L are expected at depth in a reservoir and are discussed more below. Alkalinity concentrations in the reservoir were consistent with values both upstream and downstream, all of which were above the Basin Plan benchmark of 20 mg/L.

Table 3.3.2-8. Water quality results from SSWD's 2017 study at Camp Far West Reservoir near the dam.

Analyte	Benchmark	Sample Location	Camp Far West Reservoir near dam, surface			Camp Far West Reservoir near dam, near bottom		
		Sample ID	10051111-2			10051111-3		
		Sample Depth	1 ft			80 ft		
		Date	6/15/2017	8/31/2017	11/21/2017	6/15/2017	8/31/2017	11/21/2017
IN SITU MEASUREMENTS								
Temperature	--	°C	23.15	27.34	14.85	11.06	12.38	13.22
Specific Conductance	900	µSiemens/cm	77	80	77	71	98	54
pH	6.5-8.5	pH units	8.03	8.63	7.5	6.72	6.88	7.34
Dissolved Oxygen	> 7 mg/L	mg/L	8.93	8.25	9.39	6.45	0	0
Turbidity	--	NTU	2.9	5.3	14	8.9	8.6	30
BASIC WATER QUALITY								
Alkalinity, Total (as CaCO3)	20	mg/L	31	31	32	31	31	43
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.082	ND	ND	0.087	0.324
Calcium	--	mg/L	6.68	6.72	7.43	6.18	6.57	8.91
Carbon, Dissolved Organic	--	mg/L	2.89	1.81	1.39	2.05	1.71	1.87
Carbon, Total Organic	--	mg/L	1.72	1.89	1.36	1.36	1.62	1.48
Chloride	250	mg/L	3.83	3.75	3.6	4.1	3.37	3.42
Hardness, Total	--	mg/L	29.4	29.1	31.7	26.8	28.3	37.2
Magnesium	--	mg/L	3.09	3	3.19	2.75	2.88	3.63
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.055	ND	ND	ND
o-Phosphate (as P)	--	mg/L	ND	ND	ND	ND	0.01	ND
Phosphorus, Total	--	mg/L	ND	0.014	ND	0.09	0.011	0.067
Potassium	--	mg/L	0.86	0.64	0.79	0.59	0.67	1.06

Table 3.3.2-8. (continued)

Analyte	Benchmark	Sample Location	Camp Far West Reservoir near dam, surface			Camp Far West Reservoir near dam, near bottom		
		Sample ID	10051111-2			10051111-3		
		Sample Depth	1 ft			80 ft		
		Date	6/15/2017	8/31/2017	11/21/2017	6/15/2017	8/31/2017	11/21/2017
BASIC WATER QUALITY (cont'd)								
Sodium	20	mg/L	3.82	3.68	3.87	3.59	3.53	3.69
Solids, Total Dissolved	500	mg/L	68.7	63.3	56	55.5	61.5	67.5
Solids, Total Suspended	--	mg/L	ND	5	ND	ND	28.5	31.5
Sulfate	250	mg/L	3.85	3.37	4.18	4.02	3.74	3.59
Sulfide, Total	--	mg/L	ND	ND	ND	ND	ND	0.071
Total Kjeldahl Nitrogen	--	mg/L	0.58	0.66	0.24	0.51	0.7	0.58
TOTAL METALS CONCENTRATIONS								
Aluminum	87	µg/L	17.2	64.8	55.4	34.7	64.2	684
Arsenic	10	µg/L	0.71	0.96	0.82	0.74	1	1.74
Cadmium	5	µg/L	0.025	ND	ND	ND	ND	0.034
Chromium	50	µg/L	ND	0.36	ND	0.21	ND	1.98
Copper	1000	µg/L	1.16	1.23	1.63	1.1	1.19	3.64
Iron	300	µg/L	21.6	50.7	74.7	63.8	61	1450
Lead	15	µg/L	0.033	0.058	0.06	0.194	0.059	0.91
Nickel	100	µg/L	0.69	0.43	0.76	1.01	0.39	4.37
Selenium	50	µg/L	ND	ND	ND	ND	ND	ND
Silver	100	µg/L	ND	ND	ND	ND	ND	ND
Zinc	5000	µg/L	44.7	2.1	ND	8.5	ND	8.3
Mercury	50	ng/L	2	6	2.8	5.6	3.5	33.8
Methyl Mercury	--	ng/L	ND	0.2	ND	ND	0.1	ND
DISSOLVED METALS CONCENTRATIONS								
Aluminum	--	µg/L	5.2	13.8	41.1	ND	16.3	396
Arsenic	--	µg/L	0.67	0.81	0.79	0.66	0.84	1.25
Cadmium	Hardness Dep't	µg/L	0.07	ND	ND	ND	ND	0.037
Chromium	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	1.06
Copper	Hardness Dep't	µg/L	1.82	1.18	1.64	1.3	1.32	2.83
Iron	Hardness Dep't	µg/L	5.4	3.5	38.1	9.5	12.9	760
Lead	Hardness Dep't	µg/L	0.035	ND	0.03	0.023	ND	0.503
Nickel	Hardness Dep't	µg/L	0.71	0.28	0.61	0.93	0.36	3.62
Silver	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	ND
Zinc	Hardness Dep't	µg/L	7.1	ND	ND	15.7	ND	19.7
Methyl Mercury	--	ng/L	ND	ND	ND	ND	ND	0.1
PESTICIDES								
Diazinon	1.2	µg/L	ND	ND	ND	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND	ND	ND	ND

Source: SSWD 2017
ND = not detected based on the method detection limit

SSWD collected monthly water quality profiles at three locations in Camp Far West Reservoir from May 2015 to December 2017 (Table 3.3.2-9). Water temperature, DO, specific conductivity and pH were recorded at approximately 10-ft intervals at each monitoring location.

Table 3.3.2-9. SSWD reservoir water quality profile locations at Camp Far West.

Location	First Profile Date	Last Profile Date	Latitude	Longitude
Near Camp Far West Dam	4/9/2015	1/30/2018	39.05140	-121.31237
Rock Creek Arm of Reservoir	4/9/2015	1/30/2018	39.05972	-121.29323
Bear River Arm of Reservoir	4/9/2015	1/30/2018	39.03301	-121.27238

DO profiles in Camp Far West Reservoir between April and August 2017 were generally a negative heterograde curve indicating a metalimnetic oxygen minimum. DO concentrations decreased sharply in the first 50 ft below the surface before beginning to increase. Profiles taken near the dam saw DO values decrease again near the bottom. DO concentrations on the surface were usually 7 mg/L or greater, whereas DO concentrations in the metalimnion were less than 1.0 mg/L. The cause of the metalimnion minimum is unknown, yet similar curves occur in other reservoirs. In some cases, the reason is oxidizable material that is either produced in the reservoir's epilimnion (e.g., autochthonous material, such as phytoplankton), or oxidizable material that enters the reservoir from outside sources (e.g., allochthonous material, such as leaves, twigs and insects). The material sinks in the reservoir, and the rate of sinking slows down as it encounters the more dense metalimnetic water. Here, the material has more time under more conducive (i.e., warmer) water temperatures than deeper in the reservoir, to decompose. As a result, more readily oxidizable material is decomposed in the metalimnion with a concomitant consumption of oxygen by bacterial respiration. Another potential cause of the metalimnetic oxygen minimum is very high concentrations of zooplankton microcrustaceans in the metalimnion, which due to respiratory consumption, lower DO concentrations. DO profiles for 2017 are presented in Figures 3.3.2-1 through 3.3.2-3, as examples of present conditions.

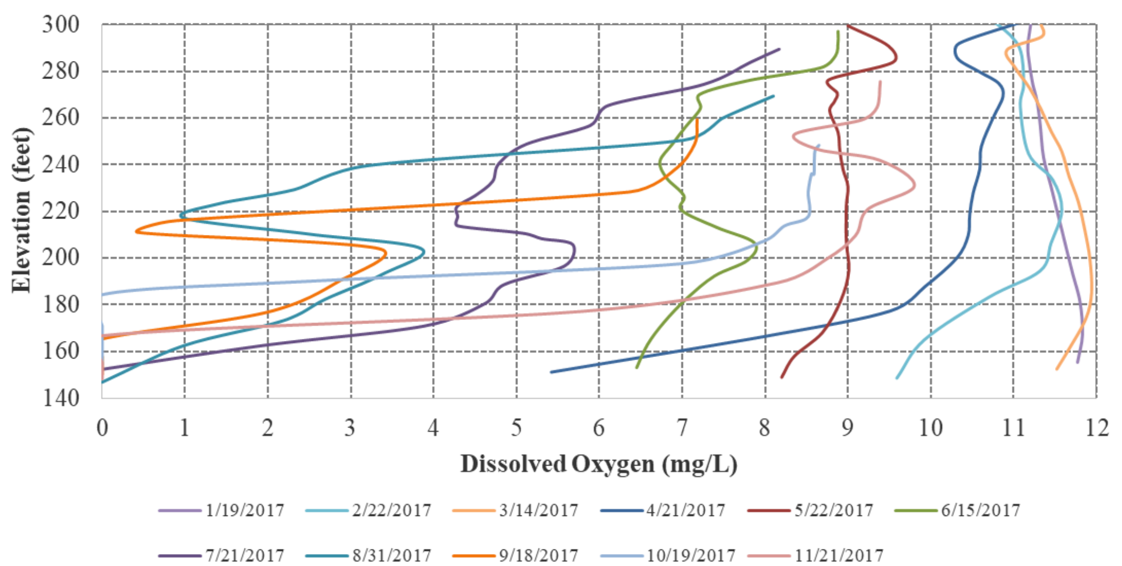

Figure 3.3.2-1. Reservoir dissolved oxygen profiles near the Camp Far West Dam.

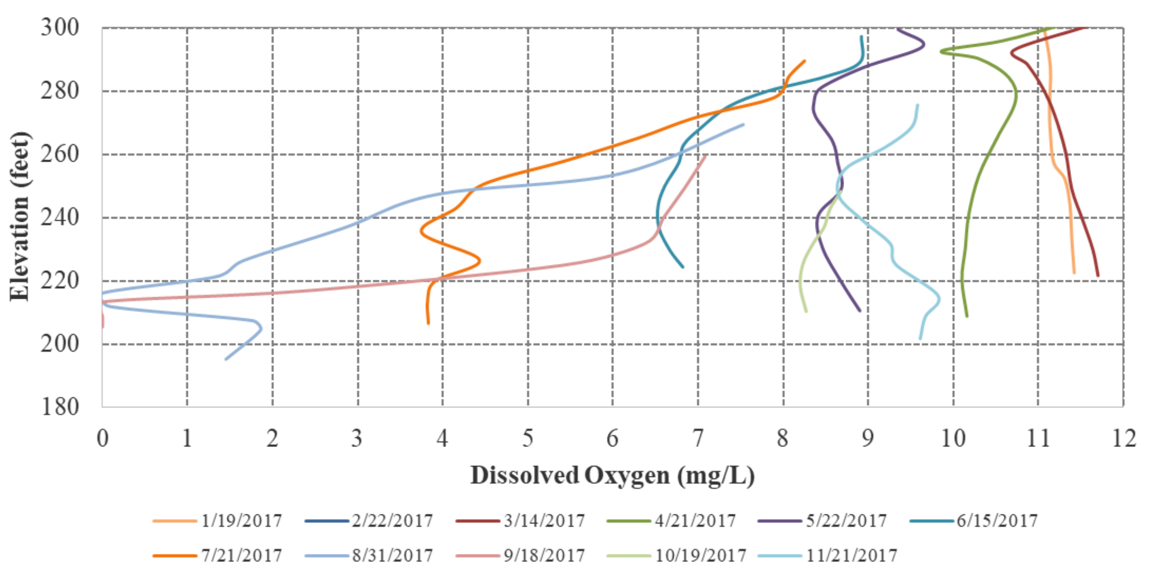

Figure 3.3.2-2. Reservoir dissolved oxygen profiles in the Rock Creek Arm of Camp Far West Reservoir.

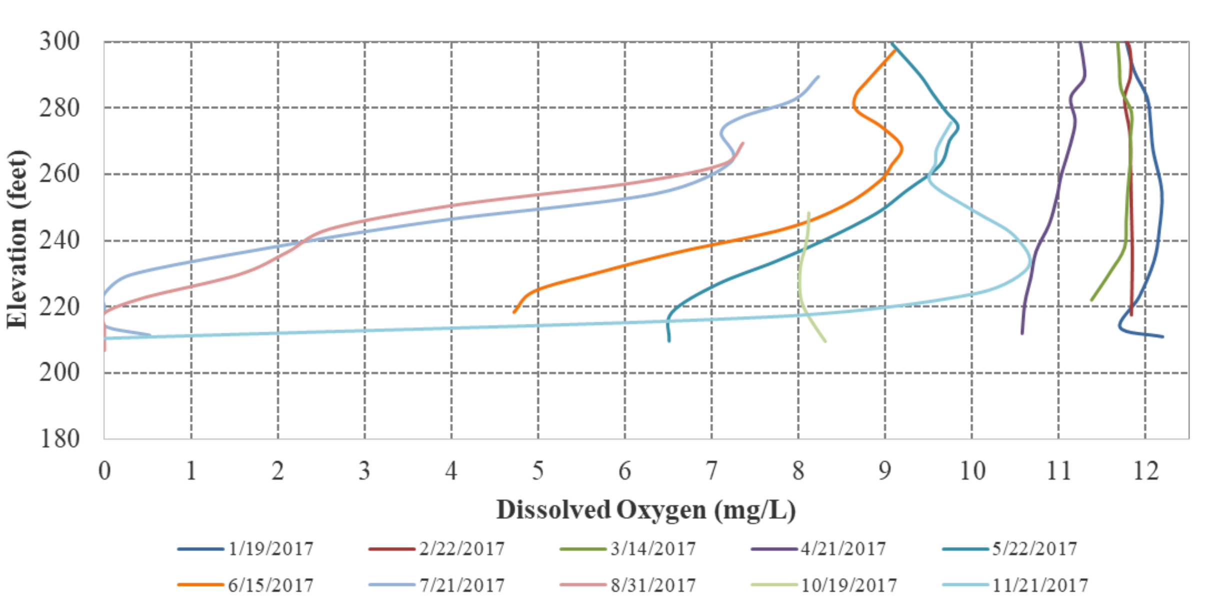

Figure 3.3.2-3. Reservoir dissolved oxygen profiles in the Bear River Arm of Camp Far West Reservoir.

Specific conductivity ranged from 11 µS/cm to 315 µS/cm during the monitoring period and tended to decrease with depth. Specific conductivity values increased as water temperatures increased during the year, particularly near the surface. Levels of pH ranged from 5.7 to 9.2 units during the monitoring period and were highest near the surface (Table 3.3.2-10). The most variation in values for specific conductivity and pH occurred at the sampling location near the dam due to the depth of water sampled.

Table 3.3.2-10. Conductivity and pH values for three monitoring locations at Camp Far West reservoir.

	Specific Conductivity (µS/cm)			pH (pH units)		
	Near Dam	**Rock Creek Arm**	**Bear River Arm**	**Near Dam**	**Rock Creek Arm**	**Bear River Arm**
MONTHLY RANGE						
January	52-68	53-71	37-64	6.8-7.5	7.3-7.5	7.2-7.5
February	54-275	58-79	55-120	7.1-7.6	7.4-7.6	7.5-7.6
March	59-86	59-81	60-80	6.8-8.0	7-8.1	7.3-7.6
April	11-93	65-93	66-111	6.5-8.5	6.7-8.5	6.8-7.8
May	66-189	60-103	60-112	6.5-8.5	6.8-8.6	6.7-8.6
June	62-79	62-81	48-75	6.3-8.7	6.8-9.0	6.7- 8.4
July	55-80	57-80	50-81	5.7-9.2	6.1-9.1	6-8.8
August	57-121	60-125	63-150	6.3-7.6	6.6-8.6	6.3-8.31
September	69-99	76-88	87-100	6.4-7.6	6.7-7.5	6.8-7.4
October	82-137	84-128	85-140	6.6-7.6	7.1-7.5	6.7-7.36
November	63-315	59-141	54-145	6.7-7.6	6.9-7.6	7.3-7.7
December	66-79	70-93	58-62	7.2-7.5	7.4-7.6	7.3-7.6
OVERALL STATISTICS						
Minimum	11	53	37	5.7	6.1	6
Average	78.4	76	75.7	7.1	7.3	7.2
Maximum	315	141	150	9.2	9.1	8.8

Alpers et al. (2008) reported on water quality samples collected from October 2001 through August 2003 in order to develop bioaccumulation factors (BAF) for reservoir dwelling biota. Water quality sampling sites were focused along the reservoir thalweg as well as sampling in the Rock Creek and Dairy Farm arms of the reservoir. Water quality samples were collected at approximately 3-month intervals during the duration of the Alpers et al. study for a total of eight samples. The results for six field measured parameters are provided in Figure 3.3.2-4. The data collected for temperature, DO, pH and specific conductance were similar to those observed by SSWD in 2015.

	Temperature (°C)	Dissolved oxygen (mg/L)	pH	Specific conductance (µS/cm)	Total suspended solids (mg/L)	Suspended silt plus clay (mg/L)
All samples						
Mean	14.6	8.1	7.0	164	9.8	8.4
Standard error of mean	0.78	0.44	0.13	32	1.0	0.9
Standard deviation	6.5	3.7	1.1	267	7.9	7.1
Minimum	7.0	0.0	3.0	69	0	0
25th percentile	9.6	6.6	6.8	84	5	3
Median	11.4	8.7	7.3	90	7.5	6
75th percentile	17.6	10.3	7.7	127	11	10
Maximum	27.5	14.6	8.4	1,660	30	30
n	69	69	71	71	68	68

Figure 3.3.2-4. Statistical data for field measurements and suspended solids concentrations.
From: Alpers et. al. 2008. Figure 8.

Bear River between Camp Far West Reservoir and the non-Project Diversion Dam

The only sources of water quality data for this reach were those collected during SSWD's 2017 relicensing water quality study. Samples were collected at one location downstream of the powerhouse and low-level outlet releases at three dates (Table 3.3.2-11). Four parameters were inconsistent with the Basin Plan during at least one sampling event: DO (one sample), alkalinity (three samples), aluminum (two samples), and iron (one sample).

Table 3.3.2-11. Water quality results from SSWD's 2017 study at the Bear River downstream of the Camp Far West Powerhouse.

Analyte	Benchmark	Sample Location	Bear River downstream of Powerhouse		
		Sample ID	10051111-4		
		Sample Depth	1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017
IN SITU MEASUREMENTS					
Temperature	--	°C	14.92	24.46	13.43
Specific Conductance	900	µSiemens/cm	71	59	66
pH	6.5-8.5	pH units	6.76	6.65	7.56
Dissolved Oxygen	> 7 mg/L	mg/L	7.92	4.57	10.43
Turbidity	--	NTU	5.1	7.1	14.4
BASIC WATER QUALITY					
Alkalinity, Total (as CaCO3)	20	mg/L	29	24	27
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	0.052	0.077
Calcium	--	mg/L	6.36	5.28	6.08
Carbon, Dissolved Organic	--	mg/L	1.47	1.33	2.15
Carbon, Total Organic	--	mg/L	1.47	1.23	1.88
Chloride	250	mg/L	3.74	2.54	2.84
Hardness, Total	--	mg/L	27.4	22	25.1
Magnesium	--	mg/L	2.79	2.13	2.42
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.267
o-Phosphate (as P)	--	mg/L	0.016	ND	ND
Phosphorus, Total	--	mg/L	0.011	0.012	0.033
Potassium	--	mg/L	0.61	0.53	0.84
Sodium	20	mg/L	3.58	2.71	2.82
Solids, Total Dissolved	500	mg/L	70.5	58.7	48
Solids, Total Suspended	--	mg/L	ND	ND	11
Sulfate	250	mg/L	3.2	2.63	3.9
Sulfide, Total	--	mg/L	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.35	0.47	0.83
TOTAL METALS CONCENTRATIONS					
Aluminum	87	µg/L	61.1	95	259
Arsenic	10	µg/L	0.72	0.85	1.04
Cadmium	5	µg/L	ND	ND	0.027
Chromium	50	µg/L	0.26	0.28	0.77
Copper	1000	µg/L	1.12	1.42	2.5
Iron	300	µg/L	112	123	486
Lead	15	µg/L	0.102	0.114	0.398
Nickel	100	µg/L	1.23	0.79	2.04
Selenium	50	µg/L	ND	ND	ND
Silver	100	µg/L	ND	ND	ND
Zinc	5000	µg/L	4.7	ND	3.1
Mercury	50	ng/L	9.1	5.5	13.9
Methyl Mercury	--	ng/L	ND	ND	0.1
DISSOLVED METALS CONCENTRATIONS					
Aluminum	--	µg/L	13.9	62.1	57.8
Arsenic	--	µg/L	0.59	0.9	0.79
Cadmium	Hardness Dep't	µg/L	ND	ND	ND
Chromium	Hardness Dep't	µg/L	0.21	ND	0.29
Copper	Hardness Dep't	µg/L	1.17	1.53	1.41
Iron	Hardness Dep't	µg/L	33.3	75.4	121

Table 3.3.2-11. (continued)

Analyte	Benchmark	Sample Location	Bear River downstream of Powerhouse		
		Sample ID	10051111-4		
		Sample Depth	1 ft		
DISSOLVED METALS CONCENTRATIONS (cont'd)					
Lead	Hardness Dep't	µg/L	0.027	0.068	0.106
Nickel	Hardness Dep't	µg/L	0.98	0.59	1.44
Silver	Hardness Dep't	µg/L	ND	ND	ND
Zinc	Hardness Dep't	µg/L	ND	ND	3.1
Methyl Mercury	--	ng/L	ND	ND	ND
PESTICIDES					
Diazinon	1.2	µg/L	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND

Source: SSWD 2017
ND = not detected based on the method detection limit

In addition, SSWD monitored dissolved oxygen concentrations over two periods in 2017 at a location downstream of the powerhouse and low-level outlet. One sampling period was during powerhouse operations (Figure 3.3.2-5) and the second was when water was released from the low-level outlet (Figure 3.3.2-6). During the September monitoring event, DO concentrations were inconsistent with the Basin Plan Objective (greater than 7.0 mg/L) for the entire sampling period likely due to high water temperatures in Camp Far West Reservoir. During the November sampling period, DO concentrations were consistent with the Basin Plan throughout the sampling.

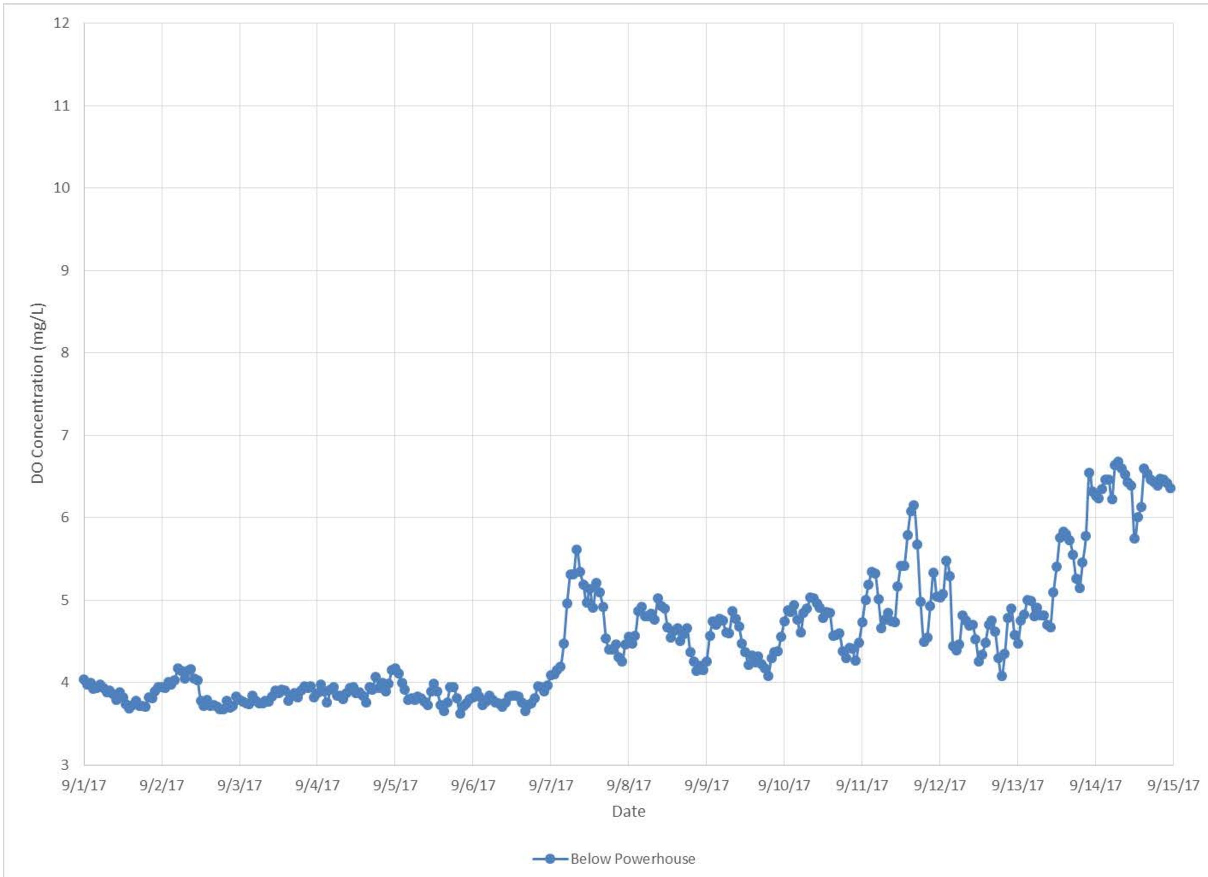

Figure 3.3.2-5. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse operating (249-390 cfs), diversions occurring (199-381 cfs), and flows at Wheatland Gage (13-31 cfs).

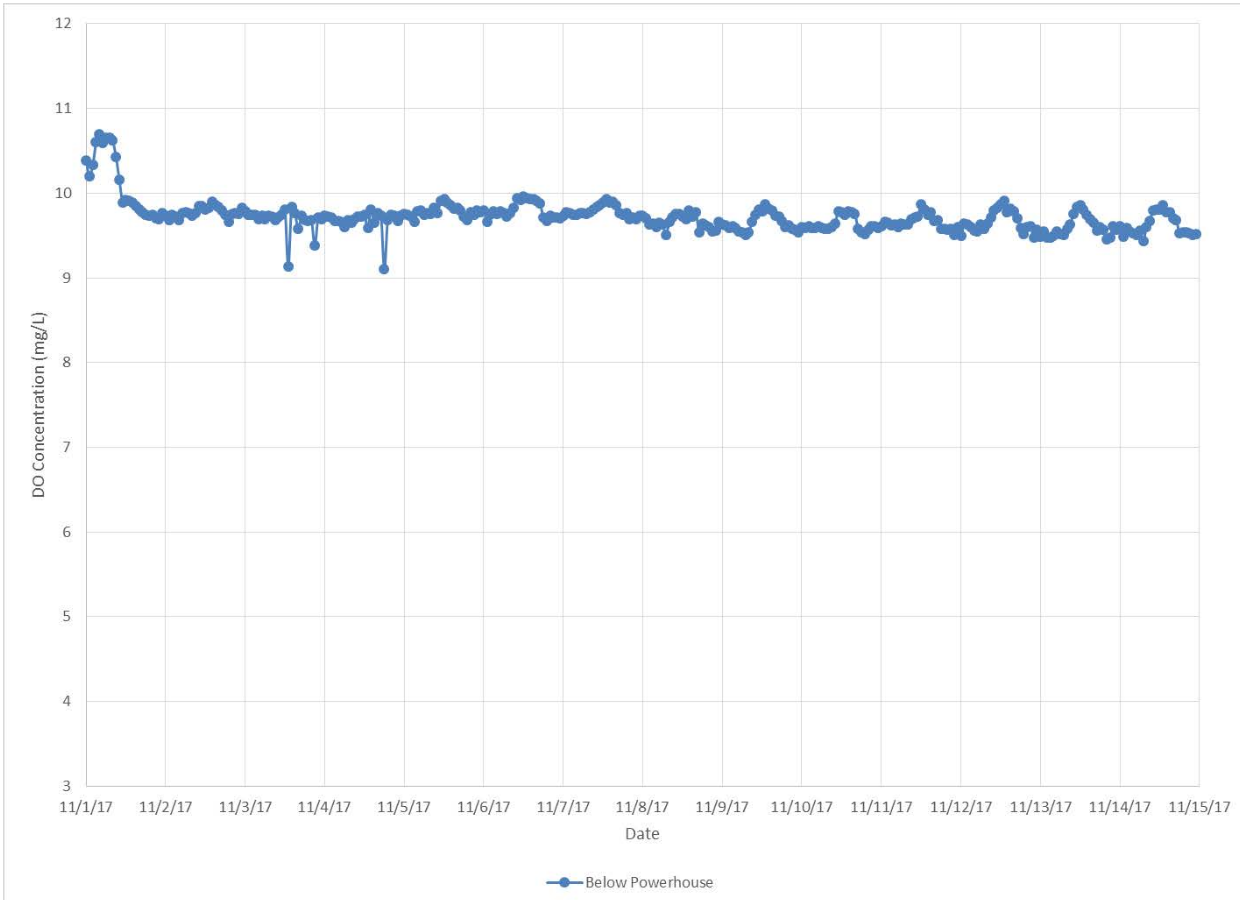

Figure 3.3.2-6. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse not operating, no diversions occurring, and flows at Wheatland Gage (15-26 cfs).

Lower Bear River

SSWD found four sources of water quality data in the lower Bear River.

Water quality was measured at two locations in the lower Bear River as part of the SWAMP Statewide Perennial Stream Assessment (SWRCB 2013); in 2011 upstream of the Pleasant Grove Bridge (RM 7.1) and in 2013 upstream of the Highway 65 Bridge (RM 11.8). Table 3.3.2-12 provides the results of those sampling events.

Table 3.3.2-12. Water quality measurements from the SWAMP Perennial Streams Assessment.

Analyte	Units	Sampling Location	
		Upstream of Pleasant Grove (9/7/11)	Upstream of Highway 65 (6/10/13)
Ammonia as N, Total	mg/L	--	0.0042
Chlorophyll a, Particulate	mg/m2	21.88	21.1
OrthoPhosphate as P, Dissolved	mg/L	0.0134	0.0166
Sulfate, Dissolved	mg/L	3.26	4.46
Silica as SiO2, Dissolved	mg/L	14.2	9.55
Nitrogen, Total, Total	mg/L	0.104	0.242

Table 3.3.2-12. (continued)

Analyte	Units	Sampling Location: Upstream of Pleasant Grove (9/7/11)	Sampling Location: Upstream of Highway 65 (6/10/13)
Total Suspended Solids, Particulate	mg/L	1	2.8
Chloride, Dissolved	mg/L	4.18	4.12
Dissolved Organic Carbon, Dissolved	mg/L	1.38	2.44
AFDM_Algae, Particulate	g/m2	9.76	4.76
Phosphorus as P, Total	mg/L	0.0092	0.0072
Hardness as CaCO3, Total	mg/L	32.8	34.3
Oxygen, Dissolved, Total	mg/L	8.72	9.92
pH	none	9.1	7.1
Alkalinity as CaCO3, Total	mg/L	41	40
Specific Conductivity, Total	uS/cm	88.6	92
Temperature	Deg C	25.9	21
Turbidity, Total	NTU	0.67	1.36

Source: SWRCB 2013

As part of DWR's Oroville Facilities relicensing, DWR completed an extensive water quality study, which included one location in the Bear River near its confluence with the Feather River. Figures 3.3.2-7 through 3.3.2-9 provide summaries of the data collected. During sampling, only turbidity and phosphorus levels exceeded the identified Water Quality Objective.

Bear R near Mouth (A6-5010.50)

	Dissolved Oxygen (ppm)	pH units	Conductivity (field) umhos/cm	Conductivity (lab) umhos/cm	Alkalinity mg/L	Turbidity NTU
Maximum detected	13.4	7.5	236	233	81	58
Minimum detected	6.7	6.8	84	83	31	2.2
Number of samples	28	29	28	29	28	29

Figure 3.3.2-7. Field measurements taken in the Bear River near the Feather River confluence.
From: DWR 2004. Appendix 2c.

Bear R near Mouth (A6-5010.50)

	Ammonia T	Ammonia D	Nitrate + Nitrite D	Ortho-phosphate D	Phosphorus T	Organic Carbon T	Organic Carbon D
Maximum detected	0.2	0.08	0.58	0.07	0.28	14.3	9.2
Minimum detected	<0.02	<0.01	<0.01	<0.01	0.03	2	2
Number of samples	29	28	28	29	29	28	28

Figure 3.3.2-8. Nutrient measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.
From: DWR 2004. Appendix 3a-3.

Bear R near Mouth (A6-5010.50)

	Calcium		Magnesium		Sodium	Potassium	Sulfate	Chloride	Boron	Hardness	
	T	D	T	D	D	D	D	D	D	T	D
Maximum detected	13	17	8	10	16	7.0	8	21	<0.1	84	84
Minimum detected	7	6	4	3	4	0.7	3	<1.0	<0.1	30	27
Number of samples	16	29	16	29	29	29	29	29	29	29	29

Figure 3.3.2-9. Mineral measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.
From: DWR 2004. Appendix 3b-3.

Total and fecal coliform samples were collected by DWR at this monitoring location 36 times between March 2002 and April 2004. Total coliform counts per 100 mL ranged from 0 to 231 and fecal coliform counts per 100 mL ranged from 0 to 168 (DWR 2004). None of the values exceeded SWRCB criteria.

Total suspended solids and settleable solids were sampled 29 times during the study. Total suspended solids concentrations ranged from less than 1 mg/L to 57 mg/L and settleable solids ranged from undetectable to 0.2 mL/L (DWR 2004).

Metals were also sampled at this location, and DWR determined six metals exceeded identified water quality criterion established by the California Environmental Protection Agency (Cal/EPA), EPA or the SWRCB during at least one sampling event: aluminum, arsenic, copper, iron, manganese and lead (Figure 3.3.2-10).

Bear R near Mouth (A6-5010.50)

	Aluminum		Arsenic		Cadmium		Chromium		Copper		Iron		Mercury	Methyl Mercury	Manganese		Nickel		Lead		Selenium		Silver		Zinc	
	T	D	T	D	T	D	T	D	T	D	T	D	T	T	T	D	T	D	T	D	T	D	T	D	T	D
Maximum detected	1504	1203	1.57	1.320	0.034	0.009	3.46	2.22	8.36	5.82	2880	1768	0.04070	0.000934	390	284	5.40	3.73	1.57	1.01	0.33	0.370	0.55	0.035	8.11	4.23
Minimum detected	53	5.5	0.39	0.282	<0.004	<0.004	0.23	<0.02	1.52	1.12	224	35.6	0.00205	0.000056	13.2	0.33	0.51	0.38	0.070	<0.011	<0.04	<0.04	<0.006	<0.001	0.38	0.19
Number of samples	29	29	29	29	29	29	29	29	29	29	29	29	29	28	29	29	29	29	29	29	29	29	14	14	29	29
Number of samples exceeding criteria or																										
Public Health Goal[1]	9	-	-	-	0	-	-	-	0	-	-	-	0	-	0	-	0	-	0	-	-	-	-	-	-	-
Primary MCL[2]	3	-	0	-	0	-	0	-	0	-	-	-	0	-	-	-	0	-	0	-	0	-	-	-	-	-
Secondary MCL[2]	30	-	0	-	-	-	-	-	0	-	25	-	-	-	14	-	-	-	-	-	-	-	0	-	0	-
Agricultural Goal[3]	0	-	0	-	0	-	0	-	0	-	0	-	-	-	2	-	0	-	0	-	0	-	-	-	0	-
Cal/EPA Cancer Potency Factor[4]	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CTR[5] Humans	-	-	-	-	-	-	-	-	0	-	-	-	0	-	-	-	0	-	-	-	-	-	-	-	-	-
CTR[5] Aquatic Life	-	-	-	0	0	0	-	0	15[9]	2[9],1[10]	-	-	-	-	-	-	-	0	1[9]	1[9]	-	-	0	0	0	0
NTR[6]	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-
NAWQC[7] Humans	-	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NAWQC[7] Aquatic Life	28[9], 4[10]	-	-	-	-	-	-	-	-	-	8	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-
USEPA IRIS Reference Dose[8]	-	-	-	-	-	-	0	-	-	-	-	-	-	0	-	-	-	-	-	-	0	-	0	-	0	-

Figure 3.3.2-10. Metals measurements taken in the Bear River near the Feather River confluence. T = total, D = dissolved.
Source: From DWR 2004, Appendix 3c-3.
Footnotes:
1 California Environmental Protection Agency (Cal/EPA), Office of Environmental Health Hazard Assessment, *Public Health Goals for Chemicals in Drinking Water*
2 California Department of Health Services, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring
3 Food and Agriculture Organization of the United Nations, 1985. Water Quality for Agriculture
4 Cal/EPA, Office of Environmental Health Hazard Assessment, Cal/EPA Toxicity Criteria Database
5 California State Water Resources Control Board, Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (2 March 2003)
6 U.S. Environmental Protection Agency, Federal Register, Volume 64, No. 216 (Tuesday, 9 November 1999) [National Toxics Rule revisions]
7 U.S. Environmental Protection Agency, Quality Criteria for Water, 1986 (May 1986) [The Gold Book] plus updates (various dates)
8 U.S. Environmental Protection Agency, Integrated Risk Information System [IRIS] database
9 Chronic (4 day average)
10 Acute (1 hr average)

The Irrigated Lands Regulatory Program (SWRCB 2005) regulates agricultural discharges into receiving waters through waste discharge requirements or waivers. The program had a single monitoring location on the Bear River near Pleasant Grove Road (RM 6.8) where four samples were taken in June and July 2005 (Table 3.3.2-13). None of the parameters sampled during the four events exceeded the identified water quality criteria established by SWRCB (2016), EPA (2000) or the CVRWQCB (1998).

Table 3.3.2-13. Water quality data collected near Pleasant Grove Bridge as part of the Irrigated Lands Regulatory Program.

Analyte	Units	Sampling Dates			
		6/14/05	6/27/05	7/11/05	7/25/05
Boron, Total	mg/L	0.0046	--	0.0034	--
Arsenic, Total	ug/L	0.51	0.28	0.29	0.71
Zinc, Total	ug/L	0.63	0.32	0.15	0.5
Lead, Total	ug/L	0.06	0.05	0.05	0.04
Nickel, Total	ug/L	1.05	--	0.69	--
Copper, Total	ug/L	1.39	--	1.18	1.71
Ortho Phosphate as P, Dissolved	mg/L	0.0084	--	0.0076	0.0078
Total Organic Carbon, Total	mg/L	2.256	--	1.559	1.8
Nitrate + Nitrite as N, Dissolved	mg/L	0.0601	0.0217	--	0.0091
Ammonia as N, Total	mg/L	0.042	--	--	0.095
Phosphorus as P, Total	ug/L	--	2.47	--	2.84
Total Dissolved Solids, Dissolved	mg/L	53	53	39	63
Hardness as CaCO3, Total	mg/L	28.3	25.2	25.2	--
Specific Conductivity, Total	uS/cm	83.1	80.6	77.8	107.2
Temperature	°C	17.6	19.4	22.2	32.4
Discharge	cfs	238	217.7	146	--
Oxygen, Dissolved, Total	mg/L	7.4	9.1	9.1	7.4
pH	units	7.55	7.49	7.56	8.31
Turbidity, Total	NTU	2.1	1.5	1.7	1.2

Source: SWRCB 2005

In 2017, SSWD collected water quality data at three locations in the lower Bear River as part of the water quality study; 1) downstream of the non-Project diversion dam, 2) at the Pleasant Grove Bridge, and 3) below the Highway 70 Bridge (Table 3.3.2-14). Two parameters were inconsistent with the Basin Plan Objectives for at least one sample at the location downstream of the non-Project diversion dam: alkalinity (3 of 3 samples) and aluminum (1 of 3 samples). One parameter was inconsistent with the Basin Plan Objective at the sampling location upstream of Pleasant Grove Bridge: alkalinity (3 of 3 samples). Four parameters were inconsistent with Basin Plan Water Quality Objectives at the sampling location downstream of the Highway 70 Bridge: dissolved oxygen (1 of 3 samples); alkalinity (3 of 3 samples); aluminum (2 of 3 samples); and iron (3 of 3 samples).

Table 3.3.2-14. Water quality results for SSWD's 2017 study at three locations in the lower Bear River.

Analyte	Benchmark	Sample Location	Bear River downstream of non-Project Diversion			Bear River upstream of Pleasant Grove Bridge			Bear River downstream of Highway 70 Bridge		
		Sample ID	10051111-5			10051111-6			10051111-7		
		Sample Depth	1 ft			1 ft			1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/31/2017	11/21/2017
IN SITU MEASUREMENTS											
Temperature	--	°C	16.42	24.54	13.44	24.93	29.52	12.9	24.5	24.03	12.18
Specific Conductance	900	µSiemens/cm	71	61	87	90	88	110	102	180	147
pH	6.5-8.5	stnd units	7.21	6.99	7.56	7.92	7.53	7.55	7.24	7.06	7
Dissolved Oxygen	> 7 mg/L	mg/L	10.18	8.19	10.38	9.48	7.83	9.99	7.69	6.83	8.63
Turbidity	--	NTU	3.7	5.1	6.9	2.3	2.2	2	35.1	9.5	19.6
BASIC WATER QUALITY											
Alkalinity, Total (as CaCO3)	20	mg/L	30	24	37	33	38	46	48	66	50
Ammonia (as N)	Temp & pH Dep't	mg/L	ND	ND	0.076	ND	0.108	ND	ND	0.088	0.051
Calcium	--	mg/L	6.28	5.51	8.22	7.82	7.47	9.85	10.6	13.7	11.5
Carbon, Dissolved Organic	--	mg/L	1.59	1.26	1.88	2.35	1.57	1.78	3.99	3.95	5.4
Carbon, Total Organic	--	mg/L	1.45	1.19	1.34	2.12	1.53	1.97	3.95	3.84	5.43
Chloride	250	mg/L	3.63	2.6	3.64	4.38	3.21	4.49	5.41	13.6	11.1
Hardness, Total	--	mg/L	27.3	23.1	34.2	34.3	33.8	43.3	48	64.3	52
Magnesium	--	mg/L	2.81	2.26	3.31	3.59	3.67	4.54	5.22	7.3	5.65
Nitrate+Nitrite (as N)	10	mg/L	ND	ND	0.183	0.068	ND	0.099	0.052	ND	0.147
o-Phosphate (as P)	--	mg/L	0.016	0.015	ND	0.015	ND	ND	0.021	0.054	0.047
Phosphorus, Total	--	mg/L	ND	0.011	0.02	0.176	ND	ND	0.092	0.098	0.108
Potassium	--	mg/L	0.61	0.57	0.9	0.72	0.78	0.87	1.28	1.81	3.87
Sodium	20	mg/L	3.57	2.83	3.58	4.08	3.7	4.5	5.1	9.43	7.62
Solids, Total Dissolved	500	mg/L	69.5	57.8	58.7	80	72.5	62	90.3	118	96.2
Solids, Total Suspended	--	mg/L	ND	ND	5	ND	ND	5.5	44	14	20
Sulfate	250	mg/L	3.21	2.75	4.09	4.95	3.47	5.3	5.81	2.67	9.05
Sulfide, Total	--	mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen	--	mg/L	0.63	0.7	0.93	0.54	0.52	1.54	0.84	0.68	1.09
TOTAL METALS CONCENTRATIONS											
Aluminum	87	µg/L	65.8	105	79.5	55.1	62.7	24.3	68.6	218	331
Arsenic	10	µg/L	0.81	0.91	0.84	0.82	0.64	ND	1.31	1.32	0.95
Cadmium	5	µg/L	ND	0.033	0.222	ND	ND	ND	0.022	ND	0.035
Chromium	50	µg/L	0.3	0.29	0.31	0.28	ND	ND	2.06	0.67	1.13
Copper	1000	µg/L	1.16	1.32	1.74	1.59	1.22	1.06	4.97	2.03	3.87
Iron	300	µg/L	125	132	158	150	85.6	73.4	1730	821	1400
Lead	15	µg/L	0.166	0.119	0.175	0.12	0.047	0.032	1.04	0.364	0.501
Nickel	100	µg/L	1.13	0.75	1.41	1.19	0.65	0.72	3.3	2	2.76
Selenium	50	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	100	µg/L	ND	ND	ND	ND	ND	ND	0.023	ND	0.022

Table 3.3.2-14. (continued)

Analyte	Benchmark	Sample Location	Bear River downstream of non-Project Diversion			Bear River upstream of Pleasant Grove Bridge			Bear River downstream of Highway 70 Bridge		
		Sample ID	10051111-5			10051111-6			10051111-7		
		Sample Depth	1 ft			1 ft			1 ft		
		Date	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/29/2017	11/21/2017	6/14/2017	8/31/2017	11/21/2017
TOTAL METALS CONCENTRATIONS (cont'd)											
Zinc	5000	µg/L	ND	4.5	2.5	ND	ND	ND	5.1	ND	2.8
Mercury	50	ng/L	7.10	5.0	6.40	5.2	5.5	2.3	15.3	3.8	3.7
Methyl Mercury	--	ng/L	ND	ND	0.1	0.2	0.2	0.1	0.2	0.1	0.1
DISSOLVED METALS CONCENTRATIONS											
Aluminum	--	µg/L	6.2	19.3	39	12.6	ND	15.2	206	21.1	23.3
Arsenic	--	µg/L	0.64	0.74	0.72	0.75	0.57	ND	0.9	1.03	0.57
Cadmium	Hardness Dep't	µg/L	ND	ND	ND	0.05	ND	ND	0.021	ND	ND
Chromium	Hardness Dep't	µg/L	ND	ND	0.24	ND	ND	ND	0.75	ND	0.27
Copper	Hardness Dep't	µg/L	0.74	1.34	1.8	1.68	1.24	1.43	3.44	1.39	2.52
Iron	Hardness Dep't	µg/L	19.2	20.5	72	65.7	15	42.2	609	73.8	136
Lead	Hardness Dep't	µg/L	ND	ND	0.064	0.037	ND	0.028	0.311	0.033	0.039
Nickel	Hardness Dep't	µg/L	0.94	0.51	1.28	0.99	0.39	0.77	2.16	1.46	1.87
Silver	Hardness Dep't	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	Hardness Dep't	µg/L	ND	ND	6.6	ND	2.6	ND	3.6	ND	ND
Methyl Mercury	--	ng/L	ND	0.1	0.1	ND	ND	ND	ND	0.1	ND
PESTICIDES											
Diazinon	1.2	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorpyrifos	2	µg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND

Source: SSWD 2017.
ND = not detected based on the method detection limit

SSWD also monitored dissolved oxygen at two locations in the lower Bear River as part of its 2017 water quality study; the first location was downstream of the non-Project diversion dam and the second was downstream of the Highway 65 Bridge. One sampling period was during powerhouse operations and diversions (Figure 3.3.2-11) and the second was when water was released from the low-level outlet and SSWD was not diverting at the non-Project diversion dam (Figure 3.3.2-12). DO concentrations downstream of the non-Project diversion dam were consistent with the Basin Plan during both sampling periods and ranged between 8 mg/L and 10 mg/L. DO concentrations downstream of Highway 65 were inconsistent with the Bain Plan for some of the period during September 2017. The hourly DO concentrations showed a consistent diurnal fluctuation with concentrations ranging between about 6.5 mg/L and 9.5 mg/L (Figure 3.3.2-13). During the September 2017 sampling period, 116 of the 360 total readings were below the 7.0 mg/L objective (32%).

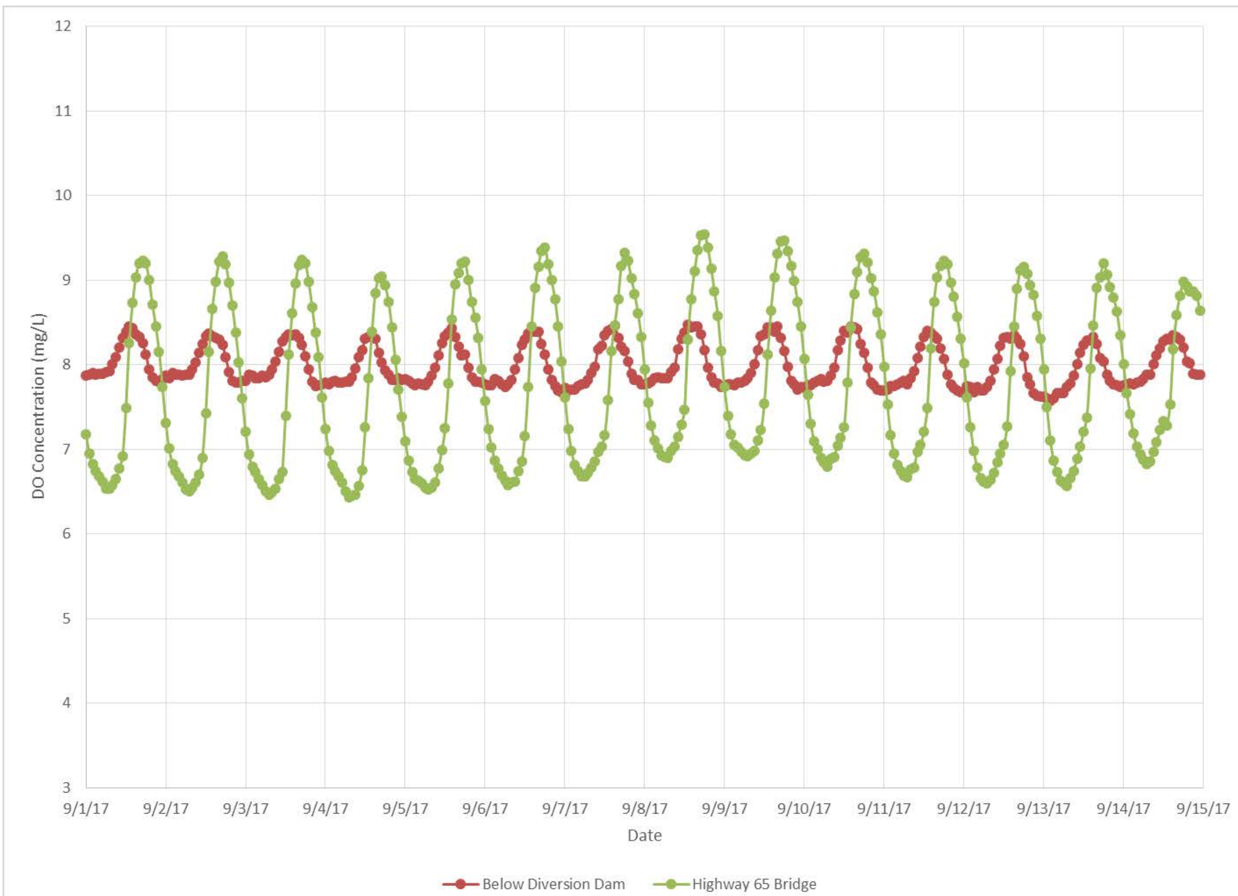

Figure 3.3.2-11. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse operating (249-390 cfs), diversions occurring (199-381 cfs), and flows at Wheatland Gage (13-31 cfs) in September 2017.

Figure 3.3.2-12. Hourly DO concentrations (mg/L) with Camp Far West Powerhouse not operating, no diversions occurring, and flows at Wheatland Gage (15-26 cfs) in November 2017.

Water Temperature

Data collected by SSWD since 2015 is the most comprehensive water temperature data available in Camp Far West Reservoir and in the Bear River upstream and downstream of the Project. Other water temperature sources described below are spot measurements or short-term recordings.

In 2015, SSWD installed a series of water temperature recorders as part of relicensing Study 2.1 to better understand conditions upstream, within, and downstream of the Project (Table 3.3.2-15). In addition, SSWD began collecting monthly reservoir profiles at three locations (Table 3.3.2-9) in April 2015 to monitor reservoir water temperatures. Monitoring continued through 2018 (Table 3.3.2-15).

Table 3.3.2-15. SSWD water temperature monitoring locations in the Bear River.

Location	Bear River Mile	Installation Date	Removal Date[1]	Latitude	Longitude
UPSTREAM OF PROJECT AREA					
Bear River above Camp Far West Reservoir	25.1	4/10/15	7/3/18	39.011685	-121.220506
Rock Creek above Camp Far West Reservoir	--	8/6/15	7/2/18	39.063471	-121.263205
DOWNSTREAM OF PROJECT AREA					
Bear River below Powerhouse Outflow	18.0	4/10/15	9/12/18	39.04898	-121.31841
Bear River below CFW Spillway Channel	17.9	9/29/15	10/25/17	39.04719	-121.31969
Bear River below Diversion Dam	16.9	4/10/15	9/12/18	39.04163	-121.33235
Bear River at BRW gage, Highway 65 Crossing	11.4	4/10/15	9/12/18	38.99901	-121.40810
Bear River at BPG gage, Pleasant Grove Bridge	7.1	5/1/15	9/12/18	38.98561	-121.48329
Dry Creek above Bear River	--	12/1/15	9/12/18	38.99596	-121.49121
Bear River near Highway 70 Crossing	3.5	5/1/15	9/12/18	38.97249	-121.54343
Bear River above Feather River Confluence	0.1	5/1/15	9/12/18	38.93906	-121.57831
Feather River above Bear River Confluence	--	8/6/15	9/12/18	38.94277	-121.57928
Feather River below Bear River Confluence	--	5/1/15	9/12/18	38.93802	-121.58038

[1] This is the date the logger was removed. In some cases there are large data gaps due to vandalism, high flows, or logger malfunction.

<u>Upstream of the Project</u>

SSWD monitored water temperature at two locations upstream of the Project: in Rock Creek and the Bear River upstream of Camp Far West Reservoir (Table 3.3.2-14). Water temperatures in Rock Creek were fairly consistent during the monitoring period with temperatures ranging between approximately 5 degrees Celsius (°C) and 25°C (Figure 3.3.2-13). Water temperatures in the Bear River above Camp Far West Reservoir (RM 25.1) followed the pattern expected for a lower elevation river with water temperatures ranging between approximately 5°C and over 30°C (Figure 3.3.2-14). Both locations showed similar trends across all years of monitoring.

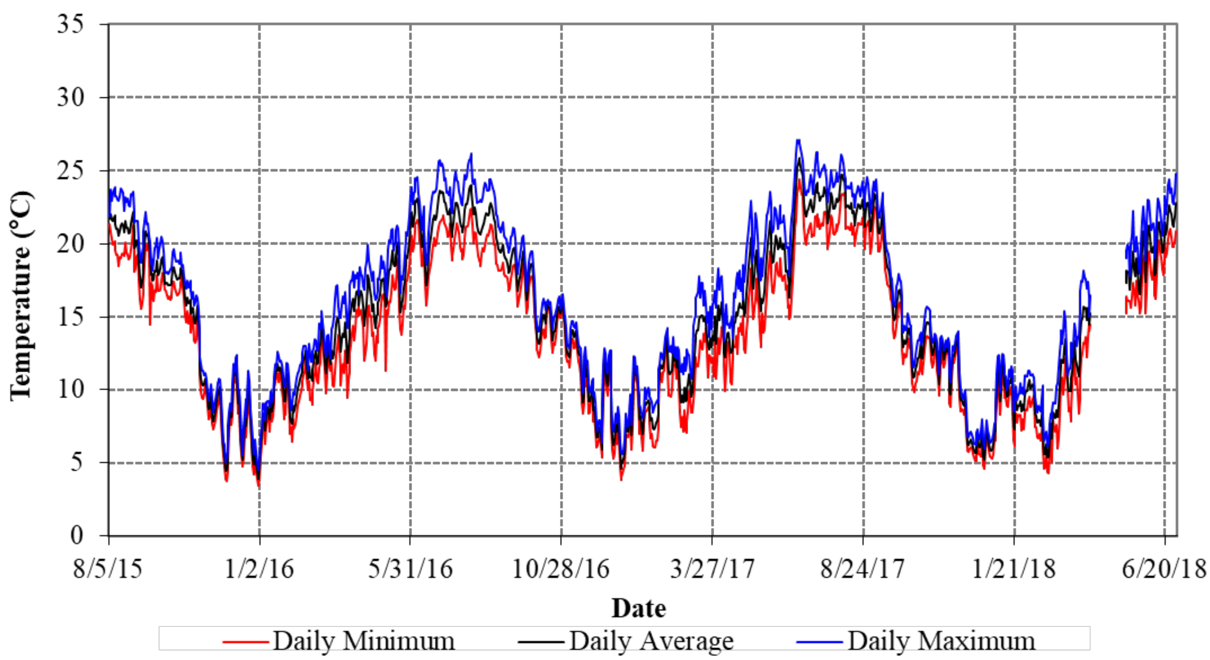

Figure 3.3.2-13. Daily minimum, average and maximum water temperature in Rock Creek upstream of Camp Far West Reservoir.

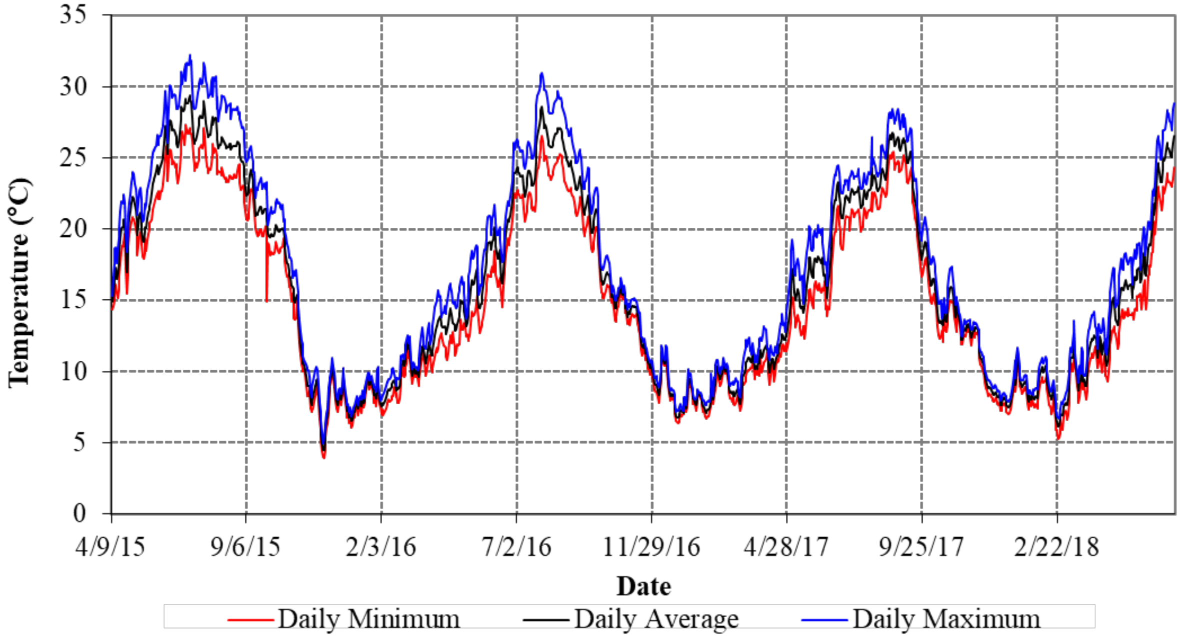

Figure 3.3.2-14. Daily minimum, average and maximum water temperature in the Bear River upstream of Camp Far West Reservoir (RM 25.1).

SSWD found no other information regarding water temperatures immediately upstream of Camp Far West Reservoir.

<u>Camp Far West Reservoir</u>

SSWD collected monthly water temperature profiles at three locations in Camp Far West Reservoir (Table 3.3.2-15) from April 2015 to November 2017. Reservoir profiles for 2017 are provided as an example of the variation seen throughout the year at each location (Figures 3.3.2-15 through 3.3.2-17)

Water temperatures in Camp Far West Reservoir followed the expected patterns for a reservoir of its size and depth. Surface water temperatures warmed through the spring and summer as air temperatures increased while temperatures near the bottom remained cooler, especially in the deeper areas near the dam. Colder water (i.e. less than 20°C) generally persisted for the entire monitoring period near the dam. However, the amount of cold water was greatly reduced between the April and October sampling events (Figure 3.3.2-15). The Rock Creek arm generally showed minimal vertical mixing from in the spring and summer until reservoir levels in the arm became low enough that water temperatures became almost vertically uniform (Figure 3.3.2-16). Water temperature profiles in the Bear River arm also showed minimal vertical mixing in the spring and summer until temperatures reached equilibrium with the Bear River inflow usually in the fall (Figure 3.3.2-17) and the vertical water temperatures became fully mixed.

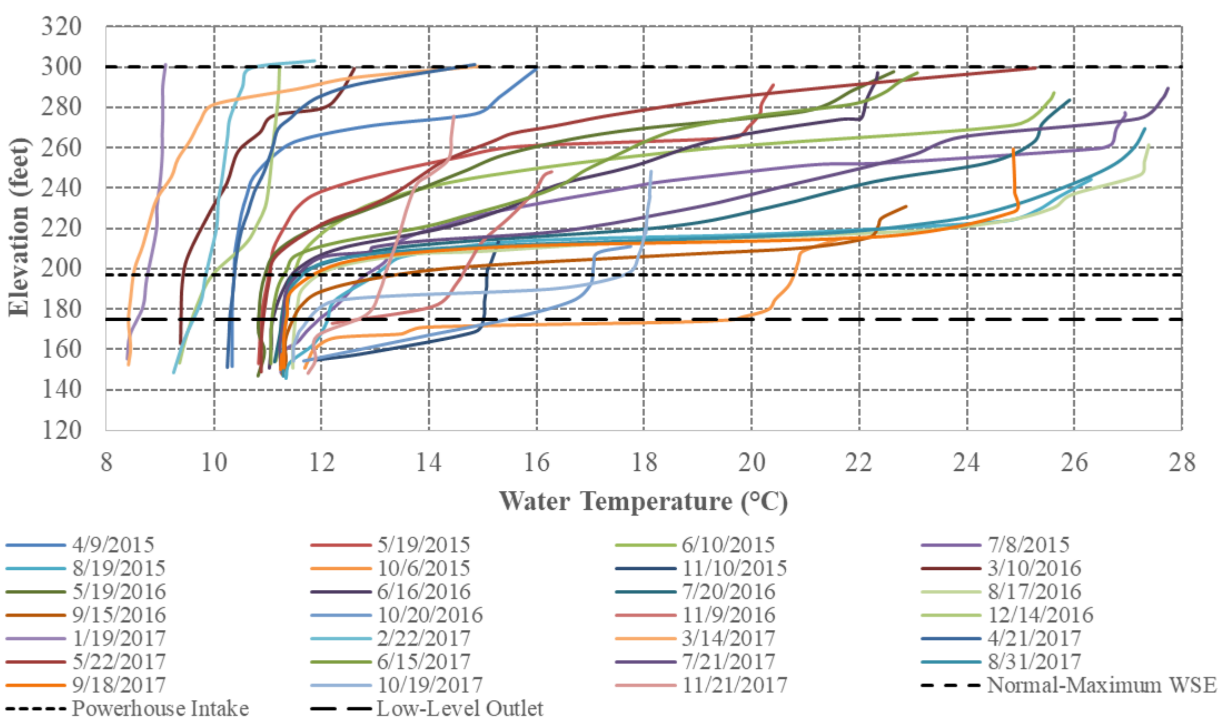

Figure 3.3.2-15. Reservoir water temperature profiles near the Camp Far West Dam.

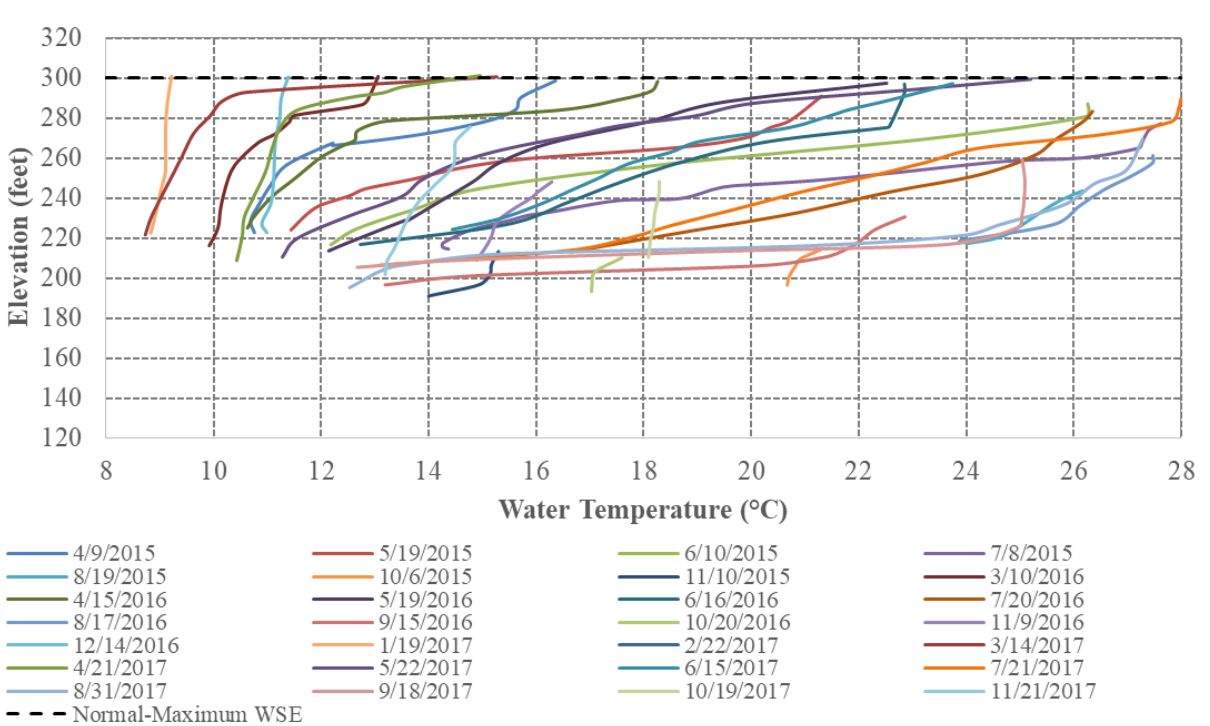

Figure 3.3.2-16. Reservoir water temperature profiles in the Rock Creek Arm of Camp Far West Reservoir.

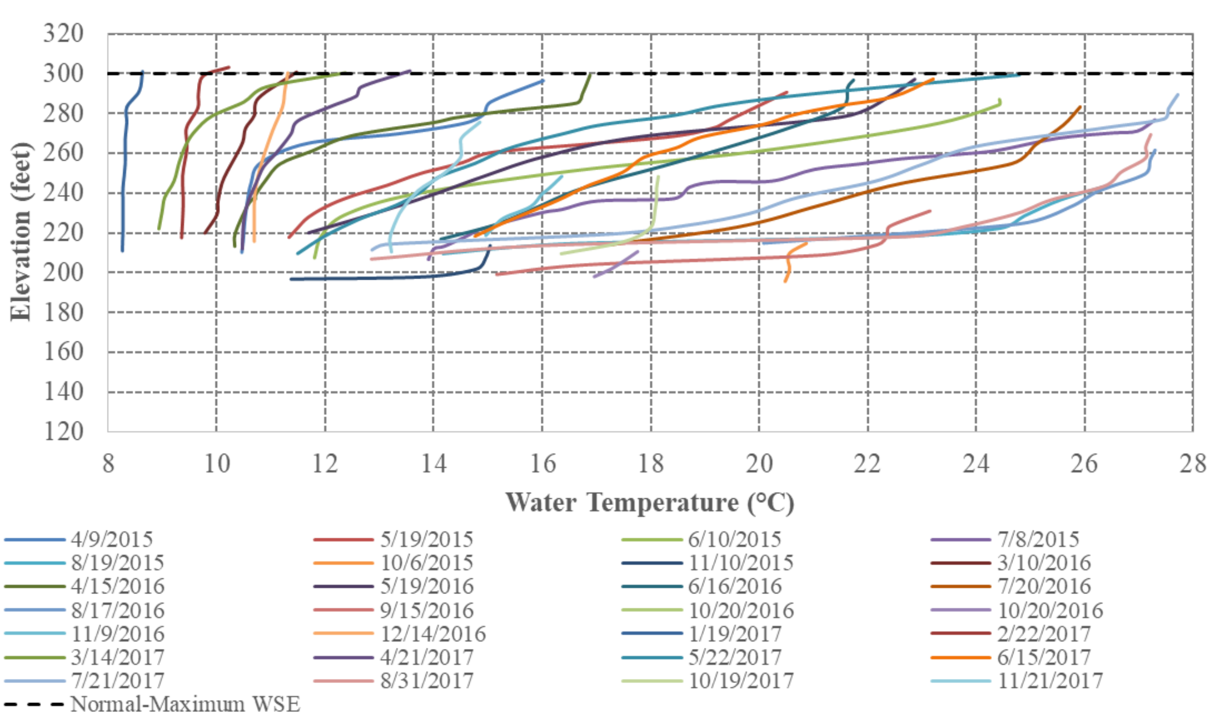

Figure 3.3.2-17. Reservoir water temperature profiles in the Bear River Arm of Camp Far West Reservoir.

Alpers et al. (2008) collected water temperature profile data in Camp Far West Reservoir at multiple locations from 2001 to 2003 during their study of environmental factors affecting mercury in the reservoir. Table 3.3.2-16 provides the minimum and maximum water temperatures observed by Alpers et al. during their sampling at three of the locations: 1) near the dam; 2) in the Bear River arm of the reservoir; and 3) in the Rock Creek arm of the reservoir. These locations are similar to where SSWD collected profiles in 2015. These three locations provide an overall picture of reservoir temperatures during the Alpers et al. study. In general, water temperatures observed by Alpers et al. are similar to those recorded by SSWD.

Table 3.3.2-16. Minimum and maximum water temperatures recorded at three locations in Camp Far West Reservoir by Alpers et al. (2008).

Date	Near Dam (Site No. 2)		Bear River Arm (Site No. 5)		Rock Creek Arm (Site No. 7)	
	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)
11/01/2001	11.2	17.3	11.2	13.0	--	--
11/28/2001	11.2	13.3	--	--	--	--
1/2/2002	8.4	10.2	--	--	--	--
2/12/2002	6.7	9.5	--	--	--	--
4/22/2002	9.1	18.4	10.0	16.6	--	--
6/18/2002	10.3	25.8	11.4	26.1	--	--
8/7/2002	10.5	26.0	12.9	27.0	25.3	26.9
9/6/2002	11.3	23.4	--	--	--	--
11/4/2002	11.0	15.1	--	--	--	--
11/6/2002	11.0	14.0	--	--	--	--
11/21/2002	12.3	13.6	--	--	--	--
12/4/2002	11.5	12.2	--	--	--	--

Table 3.3.2-16. (continued)

Date	Near Dam (Site No. 2)		Bear River Arm (Site No. 5)		Rock Creek Arm (Site No. 7)	
	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)
12/23/2002	8.6	9.9	8.9	9.9	--	--
1/17/2003	8.1	9.6	8.2	9.1	--	--
1/28/2003	8.1	12.0	8.2	11.0	--	--
3/7/2003	8.4	12.5	8.4	11.2	--	--
4/16/2003	9.6	15.7	10.0	15.5	10.6	17.0
7/7/2003	10.9	26.4	12.5	26.0	--	--
10/10/2013	11.2	21.8	20.5	21.9	--	--

Source: Alpers et al. 2008.
-- = No data collected

Bear River between Camp Far West Dam and the non-Project Diversion Dam

SSWD monitored water temperature at two locations in the reach between Camp Far West Dam and the non-Project Diversion Dam; downstream of the powerhouse and low-level outlet channel and downstream of the spillway channel.

Water temperatures in the Bear River downstream of Camp Far West Dam (RM 18.0) and upstream of the non-Project diversion dam pool generally ranged from 5°C to 25°C for the monitoring period. Fluctuations in water temperature were influenced by two factors: 1) water temperatures in Camp Far West Reservoir; and 2) where SSWD was drawing water from the reservoir (i.e. powerhouse intake or low-level outlet intake) (Figure 3.3.2-18). Abrupt changes in the water temperature below the dam were usually during an operational change. Water temperatures observed downstream of where the Camp Far West spillway delivers flow to the Bear River were similar to those of the upstream logger. There was limited data for this location due to the nature of flows at the installation.

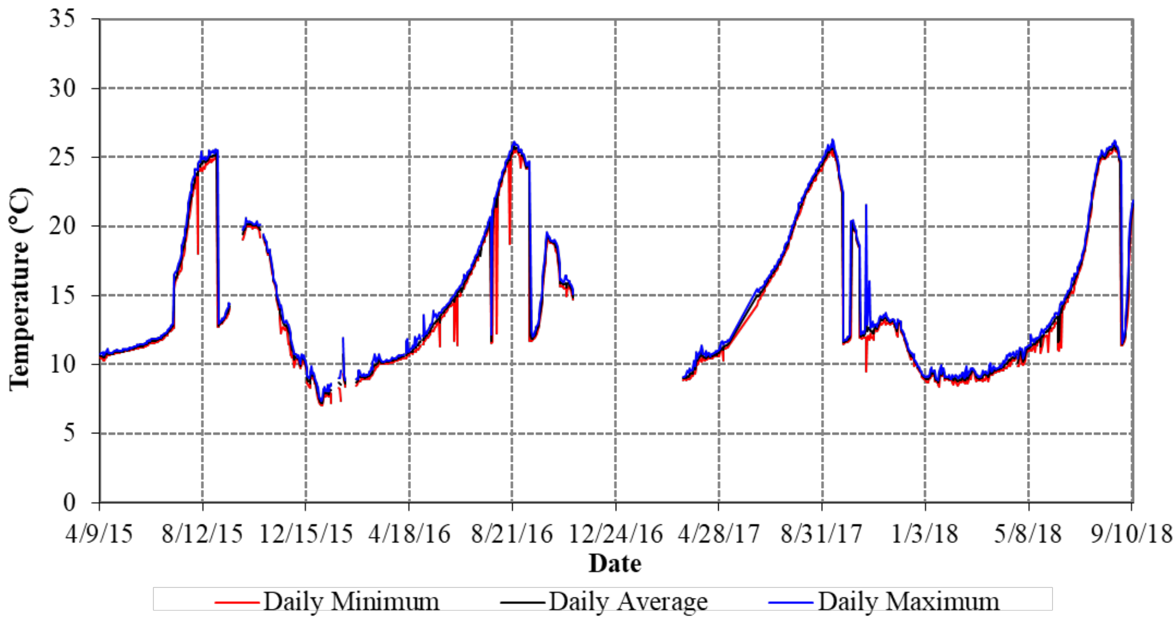

Figure 3.3.2-18. Daily minimum, average and maximum water temperature in the Bear River downstream of the Camp Far West Dam (RM 18.0).

SSWD found no other water temperature data for the Bear River between Camp Far West Dam and the non-Project diversion dam.

Lower Bear River

SSWD monitored water temperature at eight locations downstream of the non-Project Diversion Dam: five in the Bear River; one in Dry Creek; and two in the Feather River (Table 3.3.2-14).

Water temperatures in the Bear River downstream of the non-Project diversion dam (RM 16.9) ranged from approximately 6°C to 27°C during the monitoring period and were influenced by operations at Camp Far West Dam (Figure 3.3.2-19). Water temperatures followed similar trends to those observed immediately downstream of the powerhouse and low-level outlet (Figure 3.3.2-19, above).

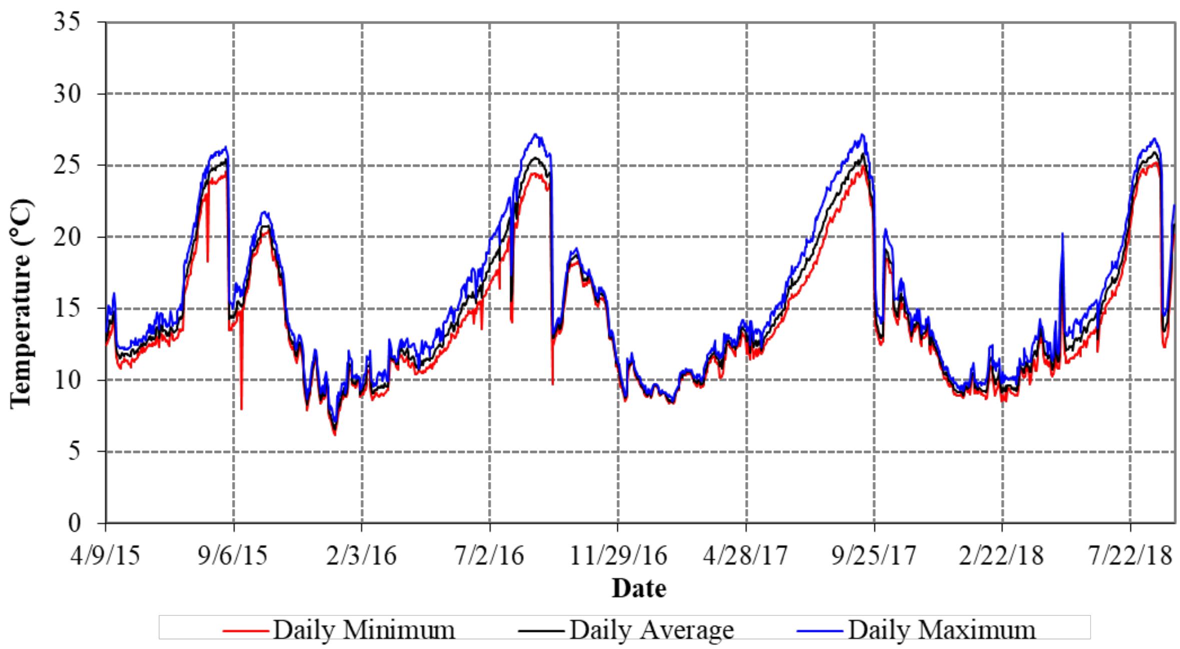

Figure 3.3.2-19. Daily minimum, average and maximum water temperature in the Bear River downstream of the SSWD Non-Project Diversion Dam (RM 16.9).

Water temperatures in the Bear River showed similar patterns and ranges at the four locations between Highway 65 (RM 11.4) and the Feather River confluence (RM 0.1) (Figures 3.3.2-20 through 3.3.2-23). The warmest summer temperatures were observed near the Pleasant Grove bright location, which was about five miles downstream of the non-Project diversion dam but just upstream of the Dry Creek confluence, which added both flow and slightly cooler water temperature to the Bear River.

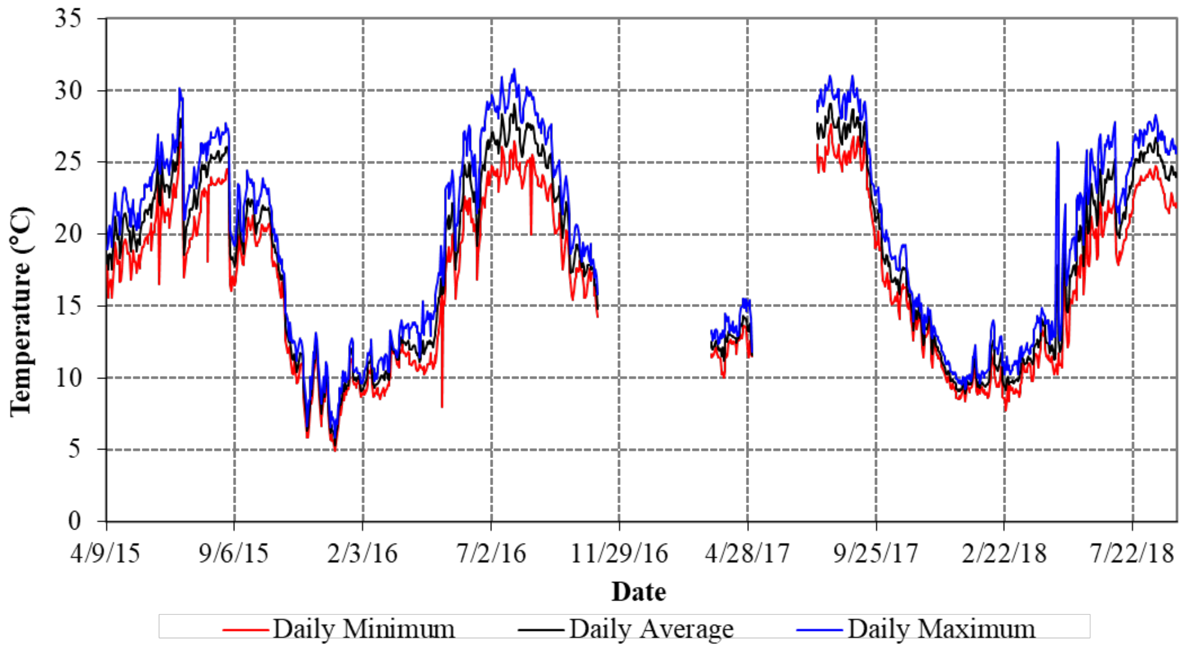

Figure 3.3.2-20. Daily minimum, average and maximum water temperature in the Bear River downstream of the Highway 65 Bridge (RM 11.4).

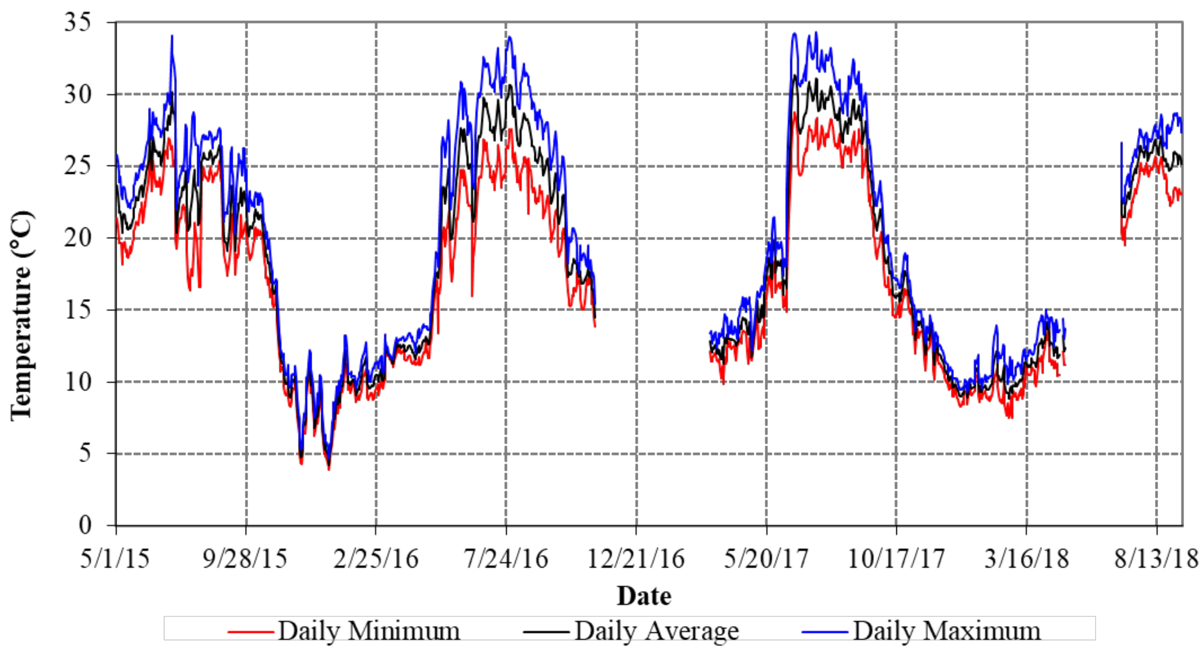

Figure 3.3.2-21. Daily minimum, average and maximum water temperature in the Bear River upstream of the Pleasant Grove Rd. Bridge (RM 7.4)

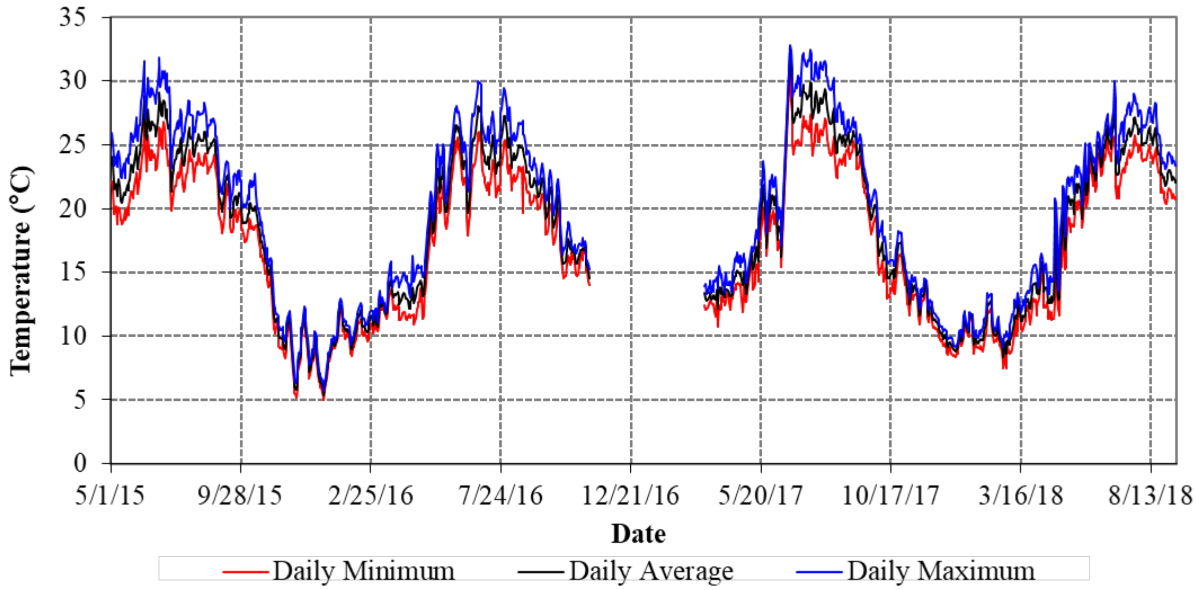

Figure 3.3.2-22. Daily minimum, average and maximum water temperature in the Bear River downstream of the Highway 70 Bridge (RM 3.5).

Water temperatures measured in the Bear River upstream of the Feather River confluence showed less diurnal variation and also lower maximum temperatures compared to the next upstream location near Highway 70, which SSWD believes is due to mixing of tributary inflow from Dry Creek.

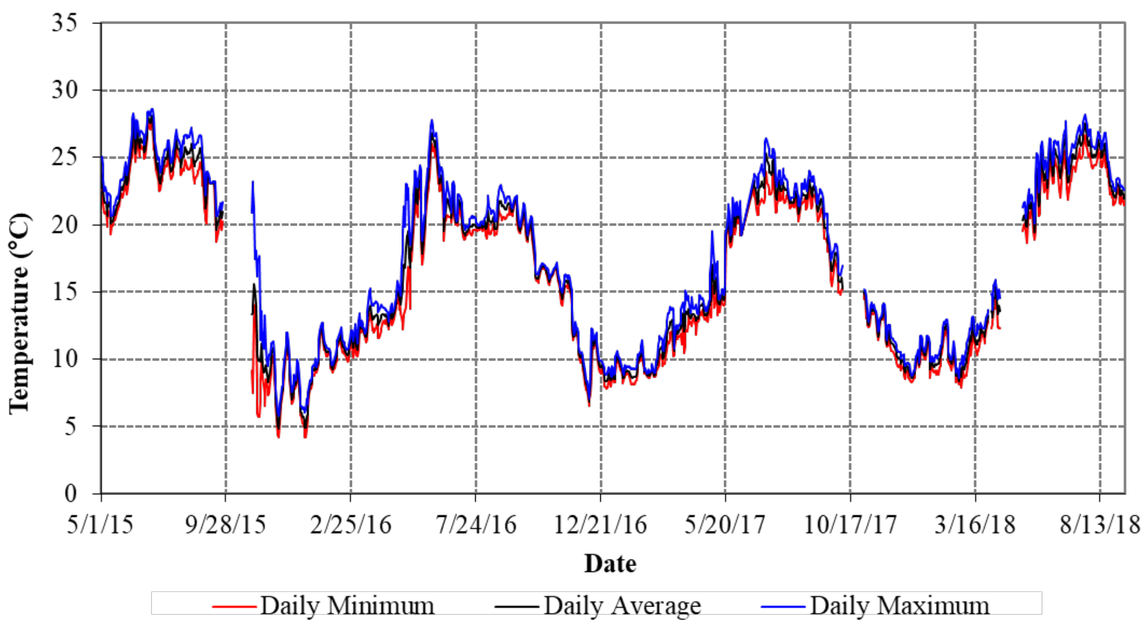

Figure 3.3.2-23. Daily minimum, average and maximum water temperature in the Bear River upstream of the Feather River confluence (RM 0.1)

SSWD also monitored water temperature in Dry Creek, which is the only major tributary in the lower Bear River and the confluence is between the Pleasant Grove and Highway 70 bridges. Due to access issues and variable flows during the monitoring period, only about 1 year of reliable data was collected. In general, water temperatures were slightly cooler in the summer compared to the Bear River but showed a similar seasonal pattern (Figure 3.3.2-24).

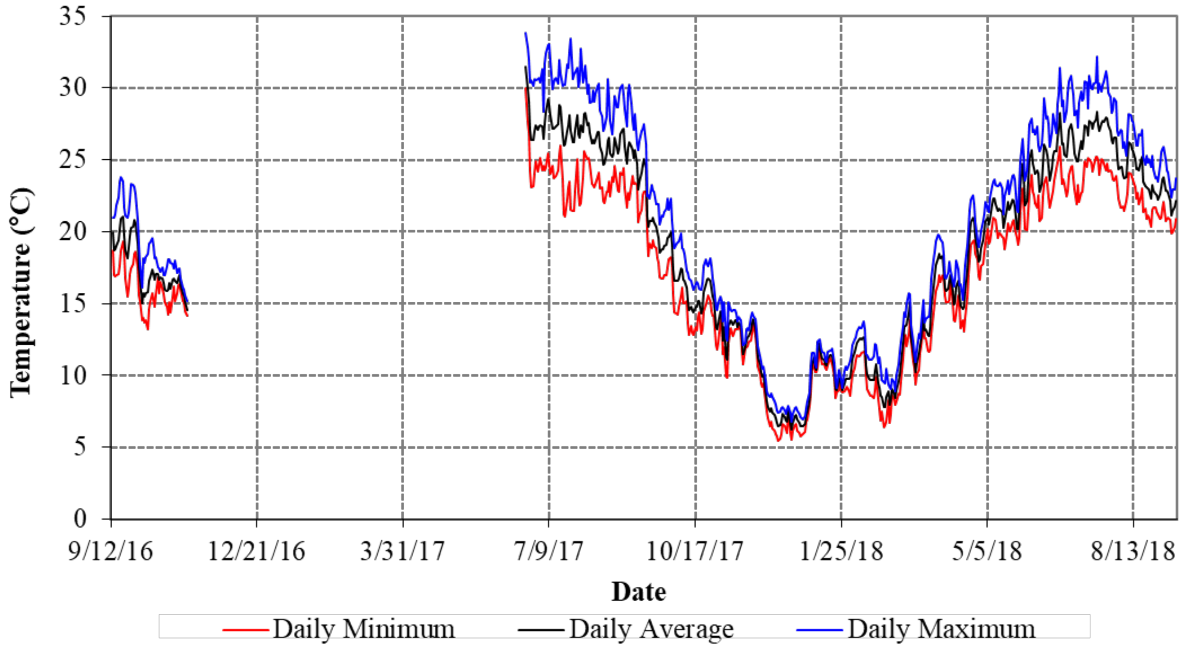

Figure 3.3.2-24. Daily minimum, average and maximum water temperature in Dry Creek upstream of the Bear River confluence.

SSWD also monitored water temperatures in the Feather River upstream and downstream of the Bear River confluence (Figures 3.3.2-25 and 3.3.2-26, respectively). The Feather River upstream of the Bear River confluence was generally cooler in the summer and warmer in the winter compared to the Bear River. The Feather River below the Bear River confluence was warmer compared to the upstream location, yet still generally cooler versus the Bear River. The water temperature at each Feather River location showed less diurnal variability (e.g., daily minimum and maximum) compared to the Bear River locations likely due to the higher flows and water depth and velocity at the installation points.

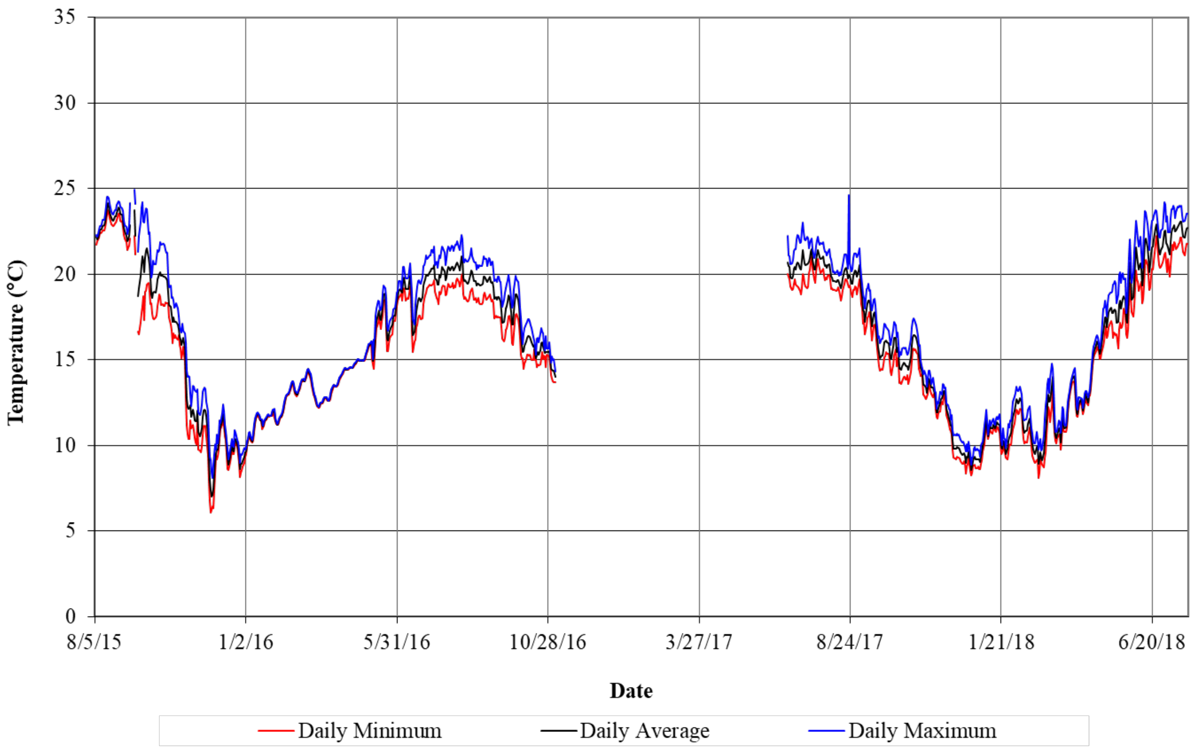

Figure 3.3.2-25. Daily minimum, average and maximum water temperature in the Feather River upstream of the Bear River confluence.

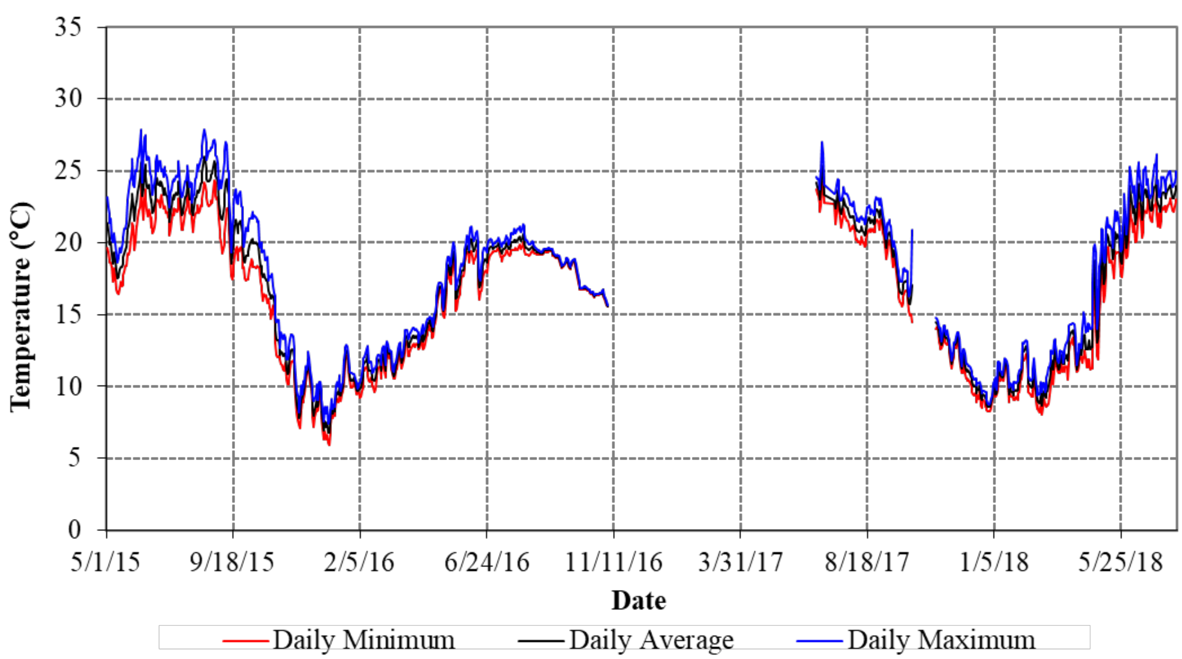

Figure 3.3.2-26. Daily minimum, average and maximum water temperature in the Feather River downstream of the Bear River confluence.

One source of long-term water temperature data available downstream of the Project was collected by DWR staff during monthly sampling from 1964 to 1987 near Wheatland, CA. While these data include only spot (i.e., once-monthly) recordings, they do show general trends in water temperature over a 24-year period (Table 3.3.2-17). These data are consistent with those collected by SSWD at a similar location.

Table 3.3.2-17. Minimum, mean and maximum monthly water temperatures in the Bear River near Wheatland. Collected once monthly by California Department of Water Resources for WY 1964 through WY 1987.

Temperatures (°C)	Month											
	Oct	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sep**
Minimum	12	11	7	6	6	7	9	12	16	21	22	17
Mean	18	14	11	9	9	11	15	19	24	26	26	22
Maximum	23	16	13	11	16	16	28	31	33	33	31	29
# of Readings	17	15	19	19	20	22	22	20	19	18	17	19

Source: CDFG 1991.

In addition, Bailey (2003) monitored water temperature at two locations near the Patterson Sand and Gravel operation: one approximately 2,000 ft downstream of the non-Project diversion dam (RM 16.5) and the second at the downstream end of the gravel operation (RM 15.0) (Figures 3.3.2-27 and 3.3.2-28). These data are also consistent with those collected by SSWD at a similar location.

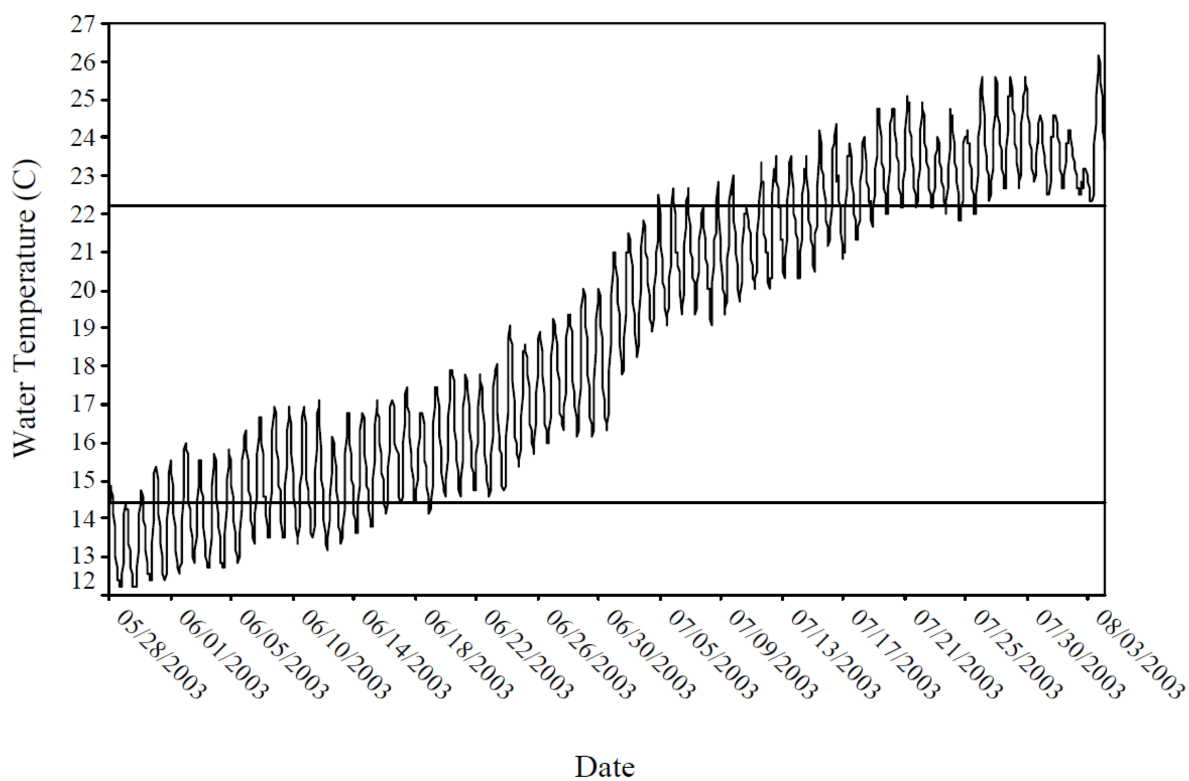

Figure 3.3.2-27. Water temperature time series from the upper Patterson Sand and Gravel site for the period of May 28 to August 4, 2003.
From: Bailey 2003, Figure 1.

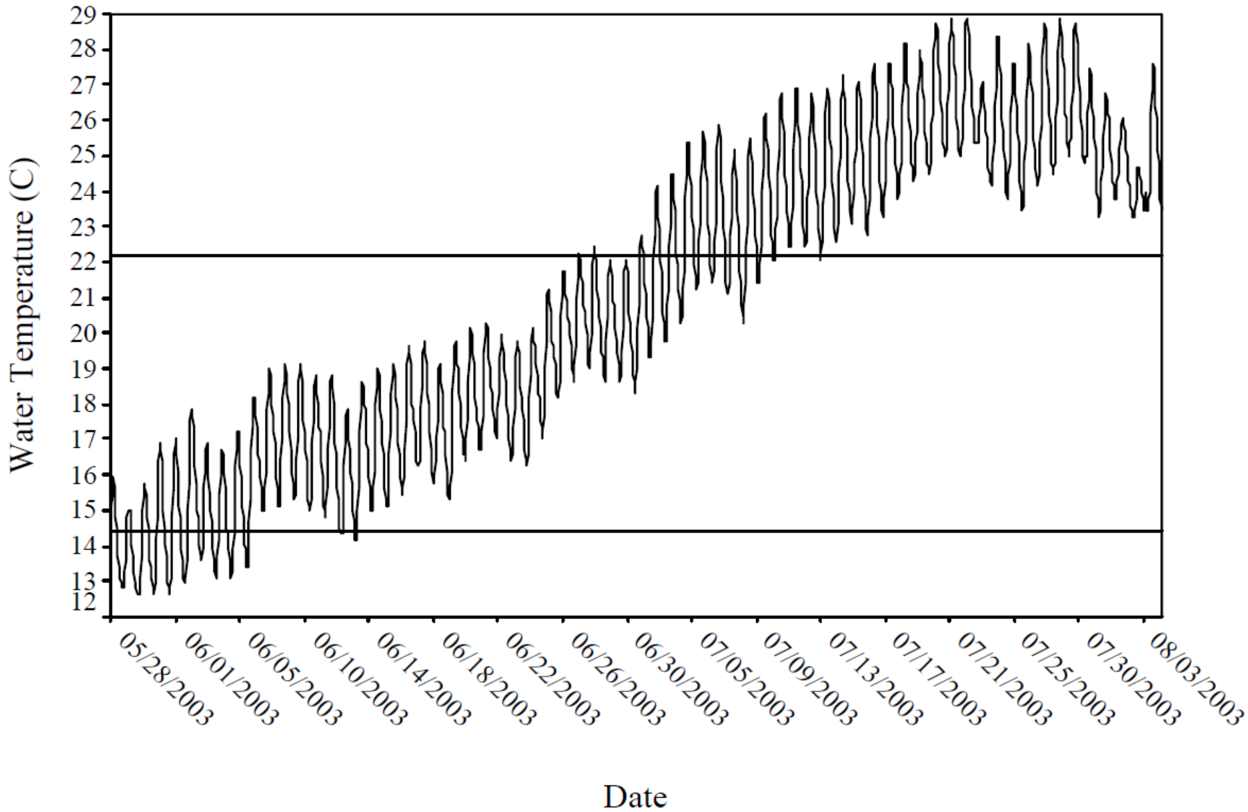

Figure 3.3.2-28. Water temperature time series from the lower Patterson Sand and Gravel site for the period of May 28 to August 4, 2003.
From: Bailey 2003, Figure 2.

A water temperature model of Dry Creek was developed by USFWS as part of the Dry Creek/Best Slough Baseline Habitat Assessment (USFWS 2016). The model simulated water temperatures at three locations in Dry Creek, including one location immediately upstream of the Bear River using the Stream Network Temperature Model (SNTEMP) modeling platform (Payne and Associates 2005). Model validation focused on a period of observed data collected from October 6, 2015 to September 29, 2016. Validation results are shown in Figure 3.3.2-29. Observed data in this figure are consistent with temperature data collected by SSWD at a similar location.

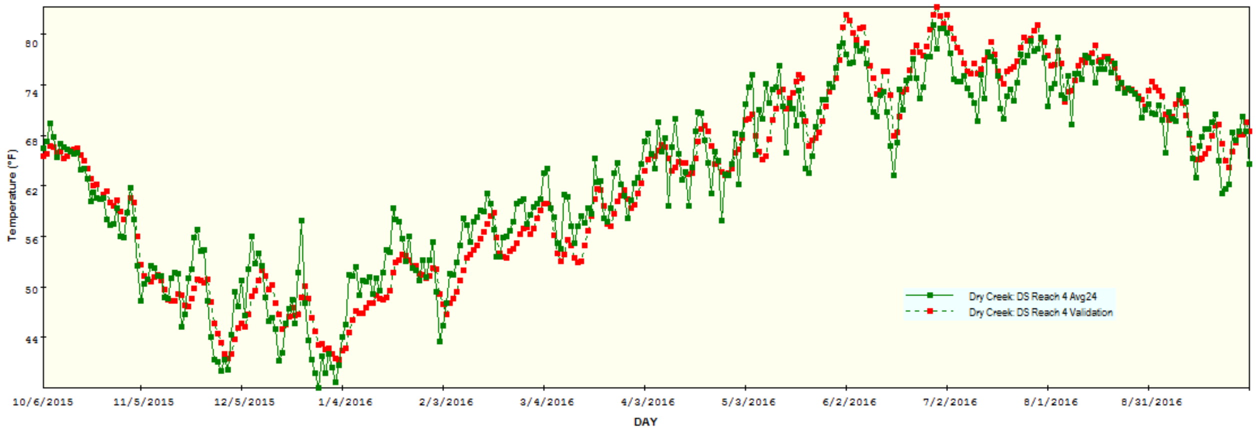

Figure 3.3.2-29. Results of water temperature model validation in Dry Creek upstream of the Bear River for the period of October 6, 2015 to September 29, 2016. Daily average simulated water temperature are red, daily average observed water temperatures are green.
From: USFWS 2016, Appendix E, Figure 3.

<u>Relicensing Water Temperature Model</u>

While a substantial quantity of water temperature data has been collected throughout the Project Area, available data are limited to a few years, and are generally collected from readily accessible locations and regulatory compliance points. Analysis of potential Project effects is greatly enhanced through the examination of a longer period-of-record of data than was historically available, representing a wide range of hydrologic and meteorological conditions. Accordingly, SSWD developed a water temperature model with the capability of simulating water temperatures throughout the Project Area for a period of record matching that of the Ops Model, WYs 1976 through 2014. SSWD relicensing Technical Memorandum 2-2, *Water Temperature Model Documentation, Calibration and Validation*, in Exhibit E, Appendix E1 provides a detailed description of the model platform used in the development of the water temperature model, which is summarized below.

SSWD elected to use a single model platform, CE-QUAL-W2 (Version 4.1), to develop three water temperature models that are run in series to simulate water temperatures from upstream to downstream. CE-QUAL-W2, by the Waterways Experiment Station of the U.S. Army Corps of Engineers (USACE), is a two-dimensional, laterally averaged, hydrodynamic water quality model for rivers, estuaries, lakes, reservoirs, and river basin systems (Cole and Wells 2017). The three models simulate: 1) Camp Far West Reservoir; 2) the non-Project diversion dam; and 3) the lower Bear River. Each model is summarized below.

Camp Far West Reservoir

This Temp Model uses CE-QUAL-W2 to simulate water temperature conditions in Camp Far West Reservoir. The model uses hydrologic output from the Ops Model; a historically-based synthetic time series for water temperatures in the Bear River upstream of Camp Far West Reservoir; a historically-based synthetic time series of water temperatures in Rock Creek above Camp Far West Reservoir; and historically-based synthetic meteorological conditions to simulate Project effects on Camp Far West Reservoir water temperatures. The model provides a two-dimensional (2D) representation of Camp Far West Reservoir, and includes releases from the powerhouse, low-level outlet and spillway at Englebright Dam.

Non-Project Diversion Dam

This Temp Model uses CE-QUAL-W2 to simulate water temperature conditions in the non-Project diversion dam, located immediately downstream of Camp Far West Reservoir. The model uses hydrologic output from the Ops Model, simulated water temperatures in the Bear River below Camp Far West Reservoir from the upstream model; and historically-based synthetic meteorological conditions to simulate Project effects on non-Project diversion dam water temperatures. The model provides a 2D representation of the diversion dam impoundment, including releases to the CFWID North Canal, the SSWD Conveyance Canal, and the Bear River.

Lower Bear River

This Temp Model uses CE-QUAL-W2 to simulate water temperatures in the Bear River from the non-Project diversion dam to the Bear River's confluence with the Feather River. The model uses hydrologic output from the Ops Model, simulated water temperatures in the Bear River below the non-project diversion dam from the upstream model; a historically-based synthetic time series of water temperatures in Dry Creek upstream of the Bear; and historically-based synthetic meteorological conditions to simulate Project effects on Bear River water temperatures. The model provides a 2D representation of lower Bear River, including inflows from the non-Project diversion dam and Dry Creek. The model is unable to simulate backwater effects from the Feather River.

The three Temp Models were developed using available physical information such as reservoir bathymetry and LiDAR. Historically-measured water temperature data described above were used to calibrate each water temperature model. The Camp Far West Reservoir and non-Project diversion dam temperature models calibrated well-below targeted error thresholds. The lower Bear River did not calibrate as well, yet still provides adequate representation of reach water temperature conditions. There are many possible reasons for the Bear River calibration challenges, including inadequate representation of accretion flows and accretion temperatures throughout the reach, and the lack of channel morphology data to develop the lower Bear River model grid. After calibration, each model was validated using a different period of hydrology than was used for the calibration. Validation results were similar to calibration results. For both calibration and validation, simulated water temperature output was compared to historical data when and where available. Model results were able to reasonably match observed water temperature data, and were sensitive to changes in flow meteorological conditions.

Once Temp Model development was complete, the three models were setup to run in series to simulate the full period of record, WYs 1976 through 2014. A graphical user interface (GUI) was developed in Microsoft™ Excel to streamline the process of taking hydrologic output from the Ops Model, converting it to input for the Temp Models, and then running the three models in series. The GUI was used to make three runs of the water temperature model in support of FERC license application: 1) the No Action Alternative, 2) the Proposed Project-near term scenario, and 3) the Proposed Project-future scenario. The GUI and the No Action Alternative are described in the *Water Temperature Model Documentation Calibration and Validation* report located in Exhibit E, Appendix E1. All three Temp Model runs use the same meteorological and water temperature boundary conditions. Hydrologic boundary conditions for each scenario come from their respective Ops Model run.

Standard water temperature model output includes mean- and maximum-daily water temperature, and seven day average daily maximum water temperature for WYs 1976 through 2014 for the following Bear River locations:

- Below Camp Far West Reservoir (RM 18.0)
- Below the non-project diversion dam (RM 16.9)
- At Highway 65 (RM 11.4)
- At Pleasant Grove Bridge (RM 7.1)
- At Highway 70 (RM 3.5)

Below Highway 70, the Bear River is affected by backwater effects from the Feather River, which is not simulated by the water temperature model. Therefore, results downstream below Highway 70 are not included as standard model output.

Figures 3.3.2-30, 3.3.2-31, and 3.3.2-32 show simulated mean-daily water temperatures under the No Action Alternative (i.e., existing conditions) for three representative WYs: 1995 (wet hydrology); 2003 (normal hydrology); and 2001 (dry hydrology). To demonstrate how simulated water temperature changes longitudinally along the Bear River, each figure shows mean-daily water temperatures for each WY at several locations. In all three representative WYs, water temperatures throughout the reach exceed 20°C for most of the June through September period. In each year, simulated water temperatures were very similar at all locations below Highway 65, indicating that water temperatures were at equilibrium with the ambient environment. Warming does occur at the head of the reach below Camp Far West Reservoir to Highway 65 from late spring through summer; cooling occurs at the head of the reach in the fall. Water Temperatures at Highway 70 are impacted by inflows from Dry Creek, which are slightly cooler than the Bear River in summer and fall months, and slightly warmer than the Bear River in spring months.

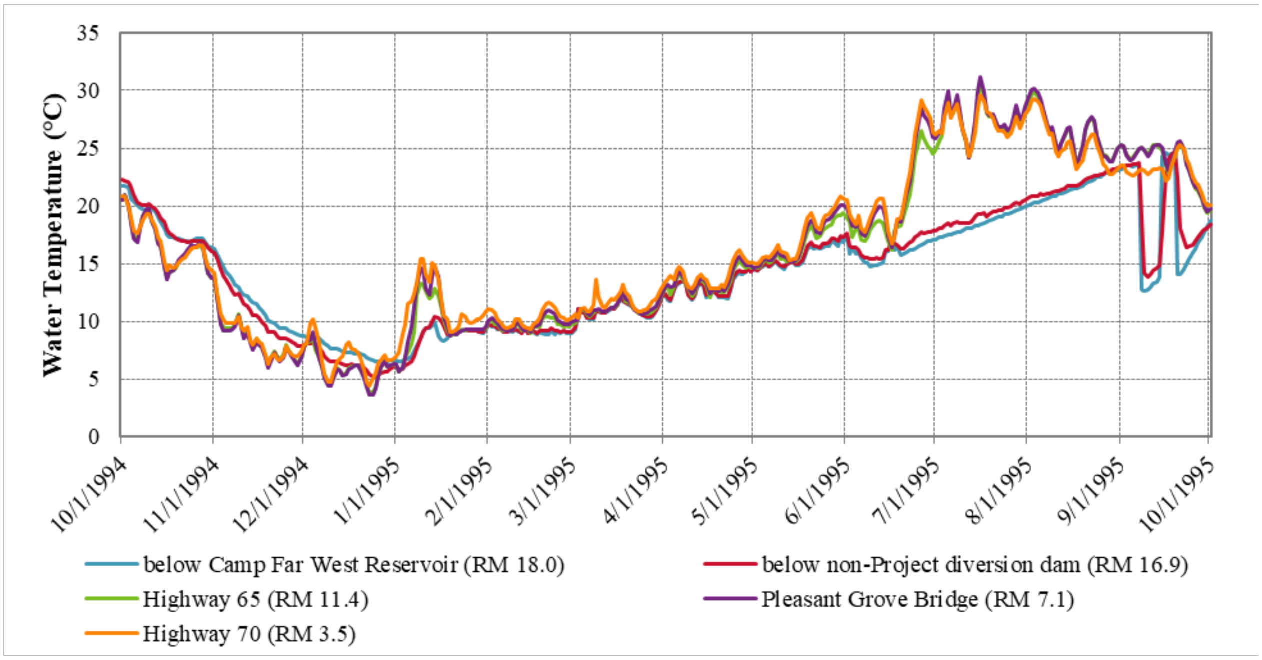

Figure 3.3.2-30. Simulated daily average water temperatures for a representative wet WY (1995) at various locations in the Bear River downstream of the non-Project diversion dam.

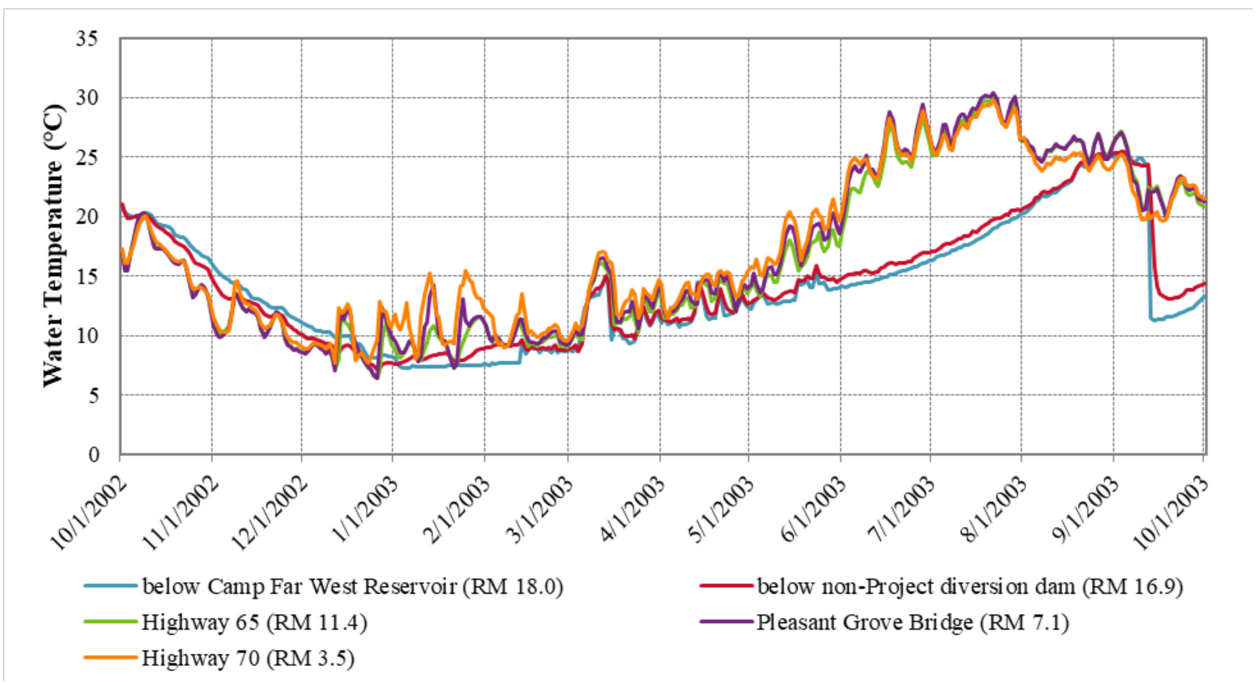

Figure 3.3.2-31. Simulated daily average water temperatures for a representative normal WY (2003) at various locations in the Bear River downstream of the non-Project diversion dam.

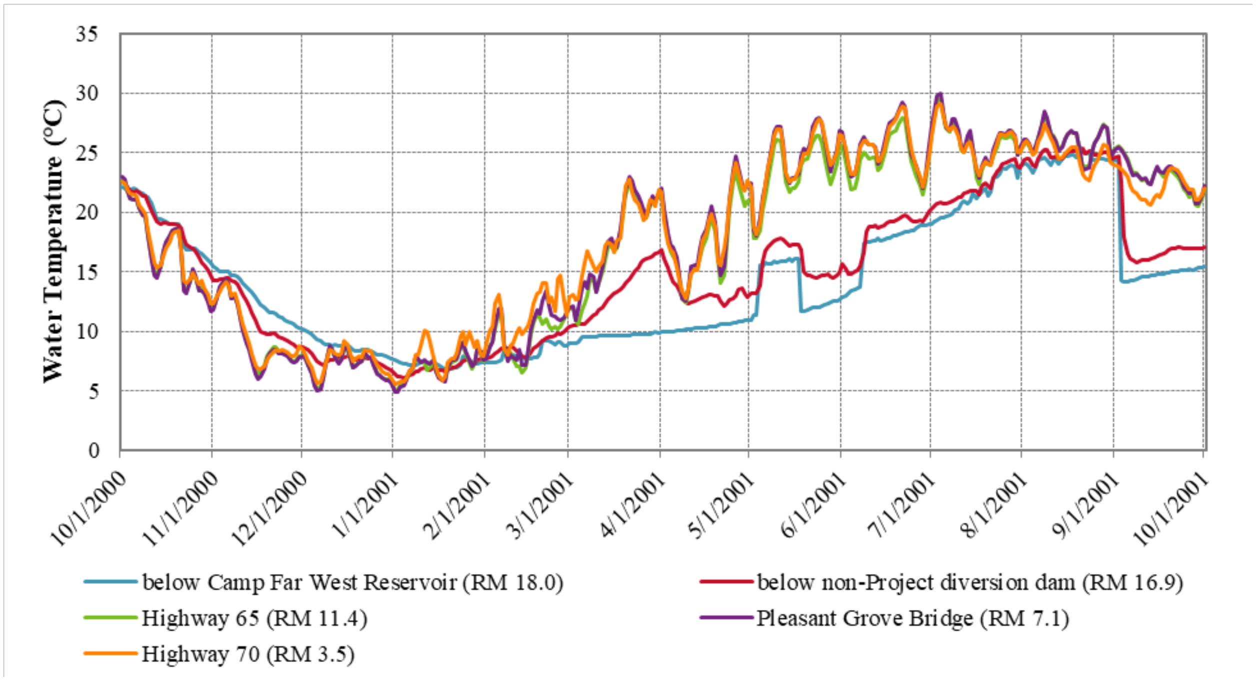

Figure 3.3.2-32. Simulated daily water temperatures for a representative dry WY (2001) at various locations in the Bear River downstream of the non-Project diversion dam.

Mercury

Mercury contamination is common in California aquatic food webs, affecting both the fishing and aquatic life, and beneficial uses in many areas of the state with long-term trends, indicating little change over the past few decades (Davis et al. 2007). In the Bear River watersheds, local sources of mercury, and hence of methylmercury, are a legacy of historic gold mining practices on the river, which used mercury amalgamation in the gold recovery process. Much of the mercury used was lost to the environment (Alpers et al. 2005; Hunerlach et al. 1999; May et al. 2000; Slotton et al. 1995 as cited in May et al. 2000). Regional and global atmospheric sources of mercury also substantially contribute to mercury impacts to the Sacramento–San Joaquin River system (Davis et al. 2009).

As described in Section 3.3.2.1.2, the SWRCB has identified Camp Far West Reservoir and the lower Bear River as CWA Section 303(d) State Impaired for mercury, citing fish tissue concentrations and surface water concentrations, to support their listing (SWRCB 2012).

SSWD has not and does not now introduce mercury into Project waters, nor perform any Project O&M activity associated with the release or mobilization of mercury. SSWD voluntarily participates in the SWRCB and Regional Water Board's Owner and Operators Committee to develop a California-wide water quality control program for mercury (Statewide Mercury Program or Program) that will include: 1) mercury control program for reservoirs; and 2) mercury water quality objectives. It is expected that research performed on Camp Far West Reservoir will inform the TMDL development process.

Mercury has been comprehensively studied in Camp Far West Reservoir fish tissue, surface water and sediment. A brief description of recent studies related to mercury is provided below.

Camp Far West Reservoir

SSWD found five sources of information related to mercury within the Project. The first, Saiki et al. (2010), reported on fish collected by USGS in August 2002 and August 2003 from three locations: the Bear River arm (inflow); the Rock Creek arm; and near the dam. Total mercury (reported as dry weight concentrations) in whole fish was highest in spotted bass (mean, 0.93 ppm; range, 0.16 to 4.41 ppm) and lower in bluegill (mean, 0.45 ppm; range, 0.22 to 1.96 ppm) and threadfin shad (0.44 ppm; range, 0.21 to 1.34 ppm). Spatial patterns for mercury in fish indicated high concentrations upstream in the Bear River arm and generally lower concentrations elsewhere, including downstream near the dam. These findings coincided with patterns exhibited by methylmercury in water and sediment, and the source of mercury to Camp Far Reservoir is Bear River inflows.

Davis et al. (2009) reported on fish collected by CDFW in September 2007 from two locations, the Bear River arm of the reservoir and near the dam. A total of 23 sample composites were generated from two species: spotted bass (21) and channel catfish (2). Mercury in spotted bass ranged from 0.205 to 1.55 ppm, while mercury in catfish ranged from 0.318 to 0.44 ppm.

Alpers et al. (2008) reported on water quality samples collected from October 2001 through August 2003, and developed mercury Bioaccumulation Factors (BAFs) for reservoir dwelling biota. Water quality sampling was done at approximately 3-month intervals on eight occasions at several stations in the reservoir, including a group of three stations along a flow path in the reservoir. Concentrations of total mercury (filtered and unfiltered water) were highest during fall and winter; these concentrations decreased at most stations during spring and summer. Anoxic conditions developed in deep parts of the reservoir during summer and fall in association with thermal stratification. The highest concentrations of methylmercury in unfiltered water were observed in samples collected during summer from deep-water stations in the anoxic hypolimnion. In the shallow (i.e., ≤14 m depth) oxic epilimnion, concentrations of methylmercury in unfiltered water were highest during the spring and lowest during the fall. The ratio of methylmercury to total mercury increased systematically from winter to spring to summer, largely in response to the progressive seasonal decrease in total mercury concentrations, and also to some extent because of increases in methylmercury concentrations during summer.

Alpers et al. (2008) computed mercury BAFs in Camp Far West Reservoir using data from linked studies of biota spanning a range of trophic positions: zooplankton; midge larvae; mayfly nymphs; crayfish; threadfin shad; bluegill; and spotted bass. Significant increases in total mercury in tissue with increasing organism size were observed for all three fish species and for crayfish. The BAF values were computed using the average methylmercury concentration (wet) in biota divided by the arithmetic mean concentration of methylmercury in filtered water (0.04 nanograms per liter). As expected, the BAF values increased systematically with increasing trophic position. Values of BAF were 190,000 for zooplankton; 470,000 to 930,000 for three taxa of invertebrates; 2.7 million for threadfin shad (whole body); 4.2 million for bluegill (fillet); and 10 million for spotted bass (fillet).

Kuwabara et al. (2003) conducted field and laboratory studies in April and November 2002 to provide the first direct measurements of the benthic flux of dissolved mercury species (total and methylated forms) between the bottom sediment and water column at three sampling locations within Camp Far West Reservoir: one near the Bear River inlet to the reservoir; a second at a mid-reservoir site of comparable depth to the inlet site; and the third at the deepest position in the reservoir near the dam. Results were reported in molar quantities and are not reproduced here. Kuwarbara et al. (2003) observed seasonal and spatial variation in benthic flux, and suggested the information can inform reservoir management to minimize methylmercury production.

The California Office of Environmental Health and Hazard Assessment (OEHHA 2009) implemented the following safe eating guidelines for fish in Camp Far West Reservoir based on mercury:

- Women between ages 18 to 45 and children between ages 1 to 17 should not consume more than one serving per week of bluegill or other sunfish species. OEHHA recommended that this group not consume any black bass or catfish species from the reservoir.
- Men over age 17 and women over age 45 should not consume more than three servings per week of bluegill or other sunfish. OEHHA recommended that this group not consume more than one serving per week of black bass or catfish species from the reservoir.

SSWD analyzed water samples for mercury as part of its 2017 study at one location in Camp Far West Reservoir, near the dam. Mercury concentrations ranged from 2.0 µg/L to 6.0 µg/L near the surface and between 3.5 µg/L and 33.8 µg/L near the bottom over three sampling events (Table 3.3.2-8).

<u>Lower Bear River</u>

SSWD found two sources of information related to mercury in the lower Bear River. DWR's Oroville Facilities relicensing (DWR 2004) included collection of a total of 29 water samples at one location in the Bear River downstream of Camp Far West Reservoir, representing sixteen 30-day average samples. The total recoverable mercury concentrations in water ranged from 2.6 ng/l to 20.8 ng/l with an average of 0.84 ng/l for the sixteen 30-day average samples. None of the sixteen 30-day average samples exceeded the EPA (California Toxics Rule) mercury-based numeric criterion for human health.

Grenier et al. (2007) collected fish samples from various Sacramento-San Joaquin rivers and streams, including the lower Bear River. Fish were sampled for tissue analysis at one location from this reach, near Highway 70. A total of 5 out of 21 samples exceeded the EPA fish tissue criterion for human health. The average wet weight mercury concentration in fish tissue was 0.21 ppm for all 21 samples collected. The number of fish collected per sample, the measured mercury concentrations in fish tissue, and the number of exceedances are, by species: redear sunfish–10 samples, 0.07-0.42 ppm (average 0.14 ppm), 1 exceedance; Sacramento pikeminnow – 4 samples, 0.30-0.51 ppm (average 0.40 ppm), 4 exceedances; Sacramento sucker – 4 samples, 0.06-0.25 ppm (average 0.14 ppm), no exceedances; spotted bass – 3 samples, 0.25-0.27 ppm (average 0.26 ppm), no exceedances. All 21 samples were collected from fish with total lengths greater than 150 mm, which represent fish most commonly caught and consumed by sport fishers and their families.

SSWD analyzed water samples for mercury as part of its 2017 study at four locations in the Bear River downstream of Camp Far West Reservoir; 1) downstream of the Camp Far West Dam, 2) downstream of the non-Project diversion dam, 3) near Pleasant Grove Road Bridge, and 4) near highway 70 Bridge. Mercury concentrations ranged from 2.3 µg/L to 15.3 µg/L near the bottom over three sampling events at all locations (Table 3.3.2-14).

3.3.2.2 Environmental Effects

This section discusses the potential environmental effects of SSWD's Proposed Project, as described in Section 2.2 of this Exhibit E. As part of the Project relicensing, SSWD proposes a Pool Raise, modifications of existing recreation facilities, and modification of the existing Project Boundary. Besides the Pool Raise itself, SSWD proposes four license measures that will affect water resources: 1) WR1, Implement Water Year Types; 2) AR1, Implement Minimum Streamflows; 3) AR2, Implement Fall and Spring Pulse Flows; and 4) Implement Ramping Rates. Refer to Appendix E 2 in Exhibit E for the full text of each measure.

The remainder of this section is divided into the following areas: 1) effects of construction-related activities; and 2) effects of continued Project O&M, especially with regards to a) effects on water quantity and use, b) effects on water quality, and c) effects on CWA Section 303(d) constituent – mercury.

3.3.2.2.1 Effects of Construction-Related Activities

SSWD anticipates there to be little-to-no effect from the construction of the Pool Raise, as described in Section 2.2.1.1.2 in Exhibit E, on water quantity or quality under the construction sequence and schedule proposed by SSWD. Construction is anticipated to last a total of 126 days (Task 4, Table 2.2-1), which can be completed in one summer season after the preceding winter spills have ended typically by the end of June, and before the subsequent winter spills have begun typically in the month of December (Exhibit B, Figure 6.3-1). Construction activities will not impact SSWD's ability to make dam releases from either the powerhouse or the low-level outlet. SSWD will obtain all necessary permits and approvals for the Pool Raise construction and related activities, and SSWD anticipates the permits and approvals will contain conditons for the protection and mitigation of any potential impacts to water quality.

3.3.2.2.2 Effects of Proposed Project Operations and Maintenance

Effects on Water Quantity and Use

Under SSWD's Proposed Project, water quantity and use would change, as compared to the No Action Alternative. This section discusses effects of SSWD's Proposed Project on: 1) Project flows and reservoir storage; 2) water supply; and 3) water rights. The Project is described in Exhibit B, Section 2.0.

Project Flows and Reservoir Storage

Project flows and storage would be directly affected by a number of proposed Measures. Five WY types, defined in SSWD's Proposed Measure WR1, would determine the minimum flows described in proposed Measure AR1 and seasonal pulse flows described in proposed Measure AR2. Proposed Measure AR1 would require increased releases from Camp Far West Dam from approximately mid-October through mid-May in all WYs when flows would otherwise have been stored in Camp Far West Reservoir. Proposed Measure AR1 would require decreased releases from April through mid-June in Dry and Critically Dry WYs. Pulse flows and ramping rates in proposed Measures AR2 and AR3, respectively, would have a minor effect on flows and storage as compared to the No Action Alternative.

Project flows and storage are directly affected by the Pool Raise. The Pool Raise would create additional storage space in Camp Far West Reservoir, which allows for more water to be stored when Camp Far West Reservoir fills and spills. On average, carryover storage in Camp Far West Reservoir is anticipated to increase in Wet, Above Normal and Below Normal WYs and decrease in Dry and Critically Dry WYs, when additional water would be required to be released to meet increased minimum streamflow requirements. Average carryover store would be 4,700 ac-ft higher under to Proposed Project than it would be under the No Action Alternative across all years of the period of record.

The difference in flow downstream of the non-Project diversion dam between the two alternatives would be substantial given the change in minimum streamflow and the pulse flows under SSWD's Proposed Project, and the delay in spills resulting from the increased storage capability under the Proposed Project (Near-Term Condition). Flows between the two alternatives would be most often different in the fall months of most years, and in the spring of Dry WYs. Flows would be frequently higher under the Proposed Project, but can be lower for shorter periods of time. Simulated daily flows for the Bear River below the non-Project diversion dam are presented in Figures 3.3.2-33 through 3.3.2-35 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, dry and normal WYs, respectively. In Figure 3.3.2-35, flows in August and September include Bay-Delta Settlement Agreement releases. Differences in settlement agreement releases between the Proposed Project and the No Action Alternative are the result of differences in carryover storage from the previous year (shown in Figure 3.3.2-36).

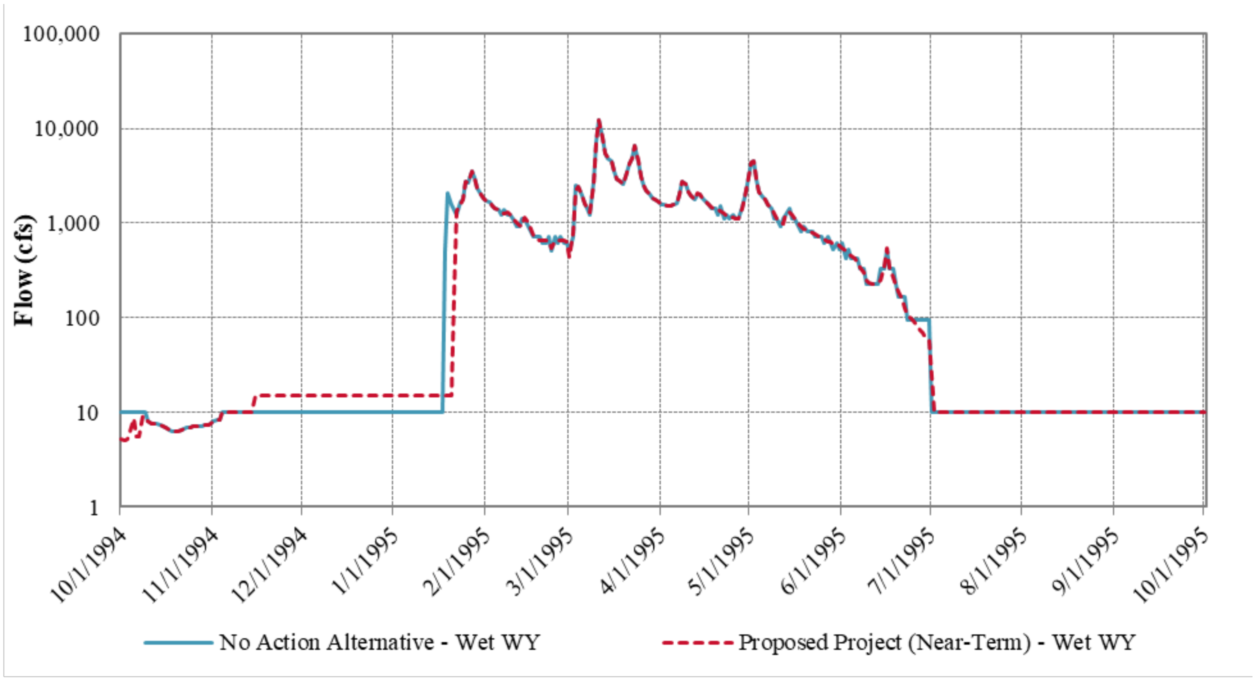

Figure 3.3.2-33. Simulated daily flows for the Bear River below the non-Project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative wet WY (1995). Flow is plotted in logarithmic scale to better show both high and low values.

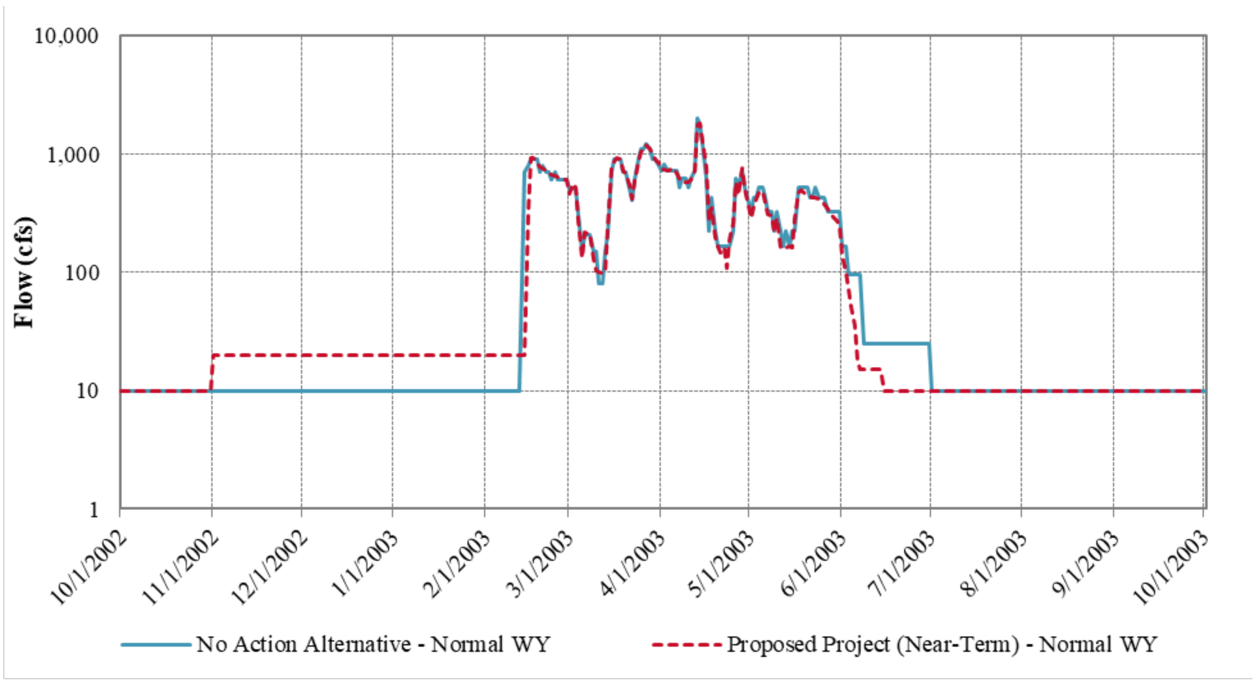

Figure 3.3.2-34. Simulated daily flows for the Bear River below the non-Project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative normal WY (2003). Flow is plotted in logarithmic scale to better show both high and low values.

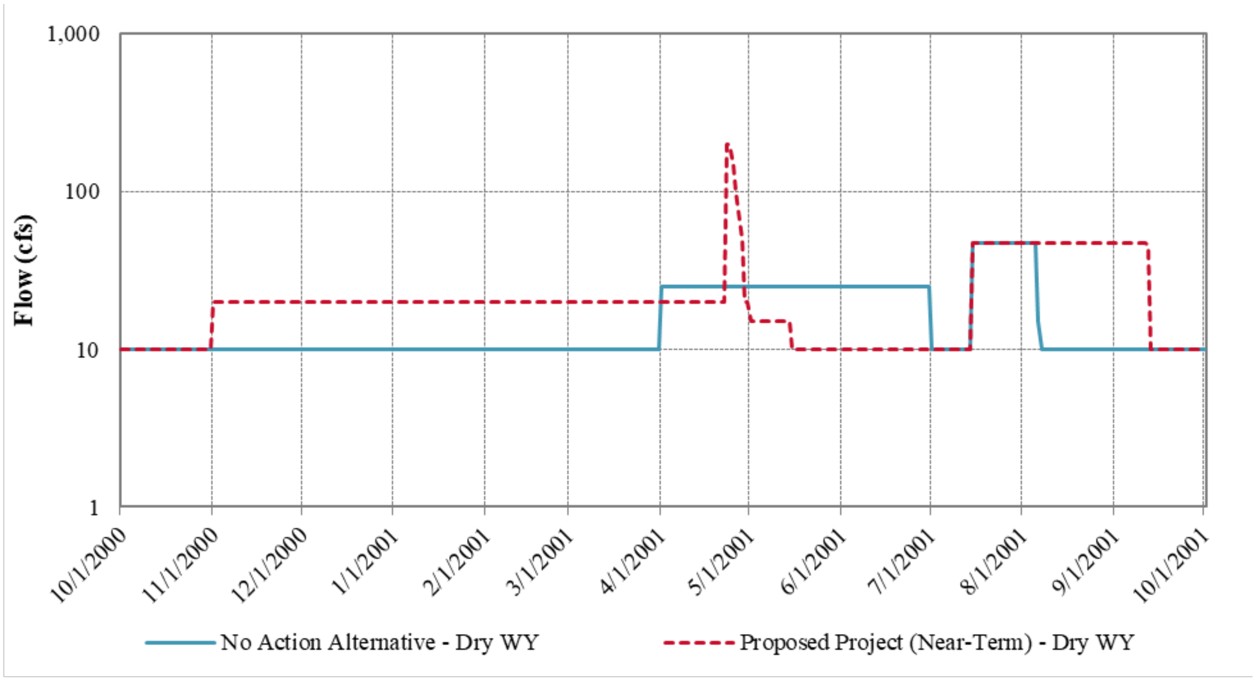

Figure 3.3.2-35. Simulated daily flows for the Bear River below the non-project diversion dam for the No Action Alternative and SSWD's Proposed Project for a representative dry WY (2001). Flow is plotted in logarithmic scale to better show both high and low values.

Typical reservoir operations would be largely unaffected by the increase in available storage under the Proposed Project (Near-Term Condition). Reservoir storage would be often higher, although the reservoir often fills slightly later in the year given the increased minimum flow requirements in the fall under the new license. However, the reservoir's fill and drawdown pattern is essentially identical to the No Action Alternative. Simulated daily Camp Far West Reservoir storages are presented in Figure 3.3.2-36 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, dry and normal WYs. Simulated daily Camp Far West Reservoir water-surface elevations are presented in Figure 3.3.2-37 for the No Action Alternative and SSWD's Proposed Project (Near-Term) for representative wet, normal and dry WYs.

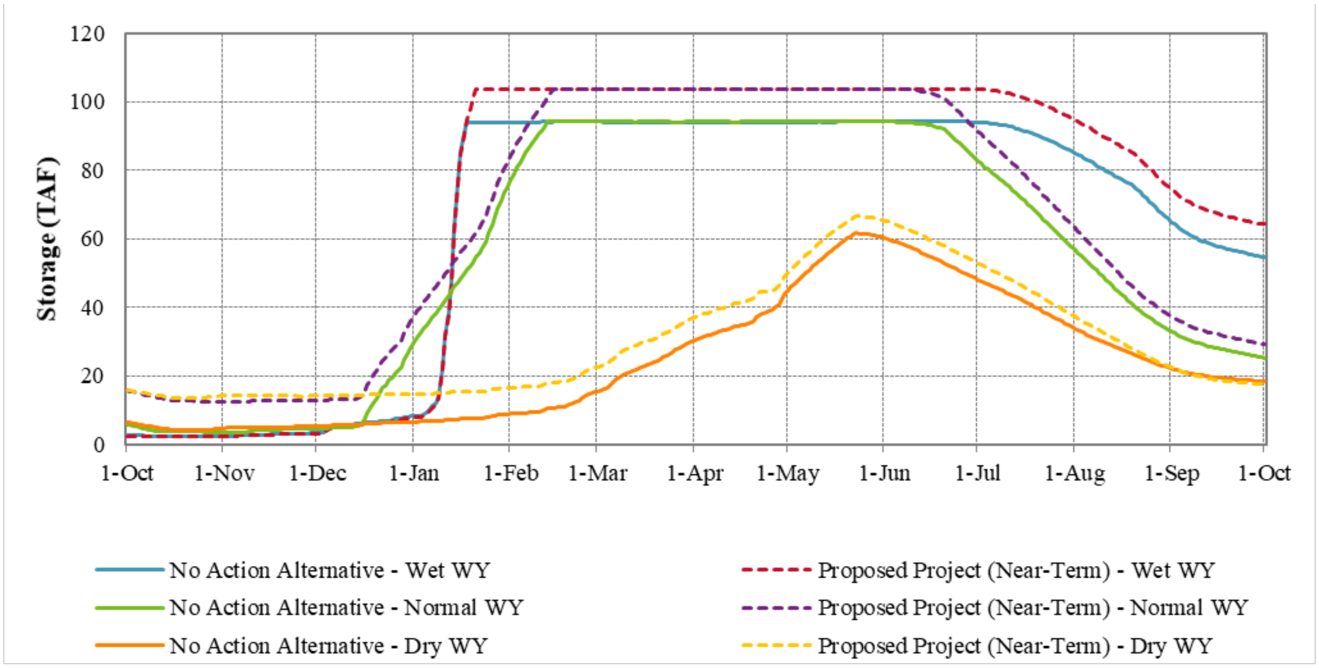

Figure 3.3.2-36. Simulated daily Camp Far West Reservoir storage for the No Action Alternative and SSWD's Proposed Project for representative wet (1995), normal (2003) and dry (2001) WYs.

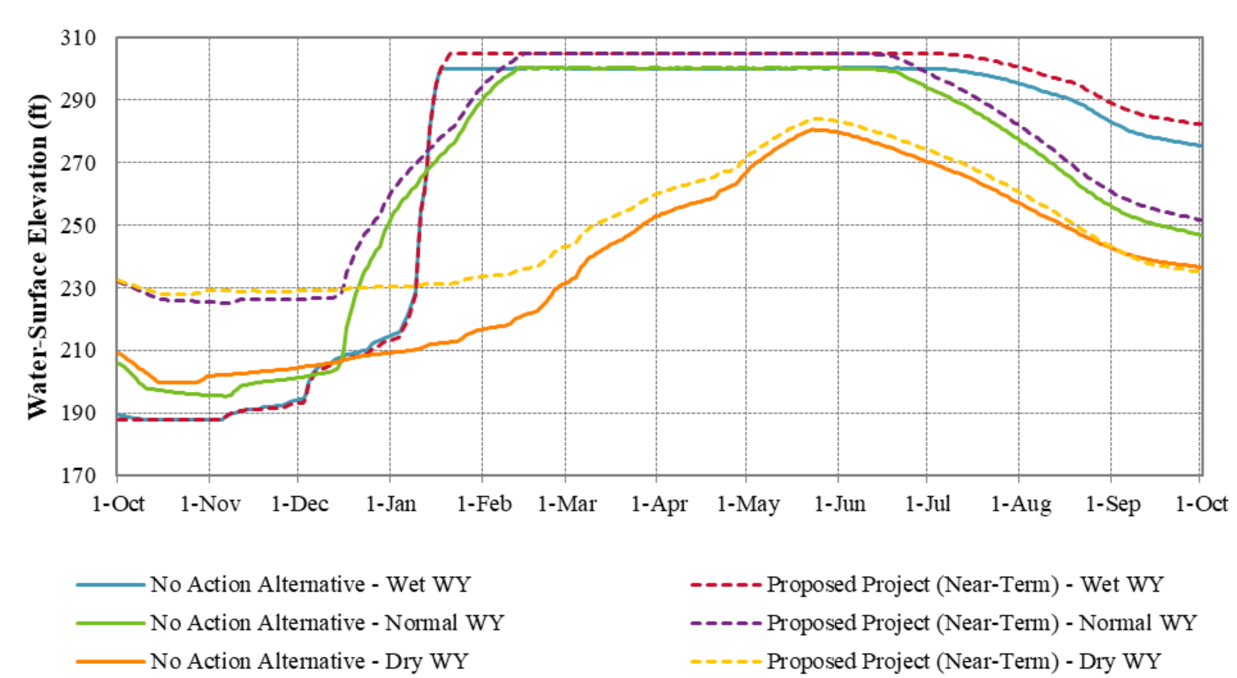

Figure 3.3.2-37. Simulated daily Camp Far West Reservoir water-surface elevation for the No Action Alternative and SSWD's Proposed Project for representative wet (1995), normal (2003) and dry (2001) WYs.

Table 3.3.2-18 provides Project flows and storages exceedance values for the Proposed Project (Near-Term) similar to those provided in Table 3.3.2-1 for the No Action Alternative. Averages are also provided in the table.

Table 3.3.2-18. Proposed Project flows and storage by month from SSWD's Near-Term Condition dataset.

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	77,131	103,573	103,573	103,573	103,573	103,573	103,573	103,573	103,573	103,573	96,515	80,918
10%	63,862	64,759	88,541	103,573	103,573	103,573	103,573	103,573	103,573	97,636	79,721	64,673
50%	18,853	18,472	21,888	40,004	69,965	103,573	103,573	103,573	94,598	67,817	38,980	21,185
90%	3,680	3,416	5,552	9,636	12,331	21,925	32,742	35,853	34,735	24,223	12,091	4,095
100%	2,500	2,500	2,560	3,854	4,174	7,845	8,653	8,574	7,355	4,133	2,500	2,500
Average	*26,421*	*27,992*	*36,123*	*49,547*	*64,862*	*78,139*	*84,737*	*84,964*	*80,137*	*64,000*	*43,169*	*28,500*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	291	305	305	305	305	305	305	305	305	305	301	293
10%	282	283	297	305	305	305	305	305	305	302	292	283
50%	237	237	242	263	286	305	305	305	300	285	262	241
90%	196	195	205	219	225	242	256	259	258	245	225	198
100%	188	188	188	197	199	213	216	216	212	199	188	188
Average	*239*	*240*	*249*	*262*	*275*	*287*	*292*	*292*	*289*	*278*	*260*	*243*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	144	7,472	27,385	46,035	29,405	13,745	11,931	4,737	1,195	678	521	399
10%	107	103	175	1,359	2,229	2,505	1,707	1,111	628	495	490	287
50%	32	22	20	30	62	235	518	487	449	478	436	114
90%	14	13	15	15	17	17	24	124	143	168	143	34
100%	5	8	15	15	15	15	16	26	27	31	4	4
Average	*50*	*92*	*381*	*504*	*796*	*877*	*727*	*572*	*409*	*396*	*368*	*139*
DIVERSION INTO CFWID NORTH CANAL (cfs)												
0%	3	1	0	1	2	2	7	18	25	29	28	17
10%	2	1	0	0	2	2	6	18	25	29	27	12
50%	2	1	0	0	2	1	4	15	23	27	26	5
90%	1	0	0	0	1	0	1	9	21	23	21	3
100%	0	0	0	0	0	0	0	3	9	10	0	0
Average	*2*	*1*	*0*	*0*	*1*	*1*	*3*	*14*	*23*	*26*	*25*	*6*
DIVERSION INTO CFWID SOUTH CANAL (cfs)												
0%	7	2	0	0	0	1	21	22	26	25	23	12
10%	7	1	0	0	0	0	21	22	25	25	22	10
50%	5	0	0	0	0	0	5	21	24	25	20	7
90%	3	0	0	0	0	0	1	19	19	23	12	5
100%	0	0	0	0	0	0	0	8	8	11	0	0
Average	*5*	*0*	*0*	*0*	*0*	*0*	*8*	*20*	*23*	*24*	*18*	*7*
DIVERSION INTO SSWD MAIN CANAL (cfs)												
0%	96	0	0	0	0	0	396	446	438	434	433	361
10%	88	0	0	0	0	0	172	396	424	431	430	245
50%	0	0	0	0	0	0	11	311	365	418	380	87
90%	0	0	0	0	0	0	0	77	88	89	79	0
100%	0	0	0	0	0	0	0	0	0	0	0	0
Average	*28*	*0*	*0*	*0*	*0*	*0*	*54*	*267*	*300*	*327*	*303*	*111*

Table 3.3.2-18. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	50	7,472	27,385	46,035	29,403	13,744	11,929	4,502	810	208	47	47
10%	25	100	175	1,359	2,227	2,504	1,659	745	203	47	47	47
50%	10	20	20	30	60	234	442	94	15	10	10	10
90%	10	10	15	15	15	15	20	10	10	10	10	10
100%	5	8	15	15	15	15	15	10	10	10	4	4
Average	*15*	*91*	*381*	*504*	*794*	*876*	*662*	*270*	*63*	*18*	*22*	*15*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	54	7,476	27,389	46,040	29,407	13,748	11,933	4,508	815	214	54	52
10%	29	104	180	1,364	2,231	2,508	1,664	751	209	53	54	52
50%	14	24	25	35	64	239	447	100	20	16	17	15
90%	14	14	20	20	19	19	25	16	15	16	17	15
100%	9	12	20	20	19	19	20	16	15	16	11	9
Average	*19*	*95*	*385*	*509*	*798*	*881*	*667*	*276*	*68*	*25*	*29*	*19*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	54	7,476	27,389	46,040	29,407	13,748	11,933	4,508	815	214	54	52
10%	29	104	180	1,364	2,231	2,508	1,664	751	209	53	54	52
50%	14	24	25	35	64	239	447	100	20	16	17	15
90%	14	14	20	20	19	19	25	16	15	16	17	15
100%	9	12	20	20	19	19	20	16	15	16	11	9
Average	*19*	*95*	*385*	*509*	*798*	*881*	*667*	*276*	*68*	*25*	*29*	*19*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	438	9,044	32,797	51,942	35,176	15,888	15,200	4,734	854	221	66	58
10%	34	129	864	1,609	2,477	2,741	1,687	787	217	54	54	52
50%	15	35	67	89	134	453	472	106	24	18	18	15
90%	14	19	24	27	29	36	31	20	16	17	17	15
100%	9	12	20	21	19	22	22	17	15	16	11	9
Average	*22*	*114*	*475*	*639*	*957*	*998*	*712*	*292*	*72*	*26*	*30*	*21*

The primary differences in flows between the Proposed Project (Near-Term) and the No Action Alternative are changes in minimum instream flow requirements, pulse flows and differences in the timing of spills at Camp Far West Dam resulting from the proposed Pool Raise. The Pool Raise would provide additional storage to capture reservoir inflows from the Bear River and Rock Creek. The additional storage created by the Pool Raise would offset the water supply impacts created by the proposed minimum streamflows and pulse flow requirements. Table 3.3.2-19 shows: 1) the differences in Project flows and storages for the same locations and exceedance values shown in Tables 3.3.2-1 and 3.3.2-18 resulting from: 1) the Proposed Project (Near-Term) less No Action Alternative; and 2) the percent change, shown in parentheses.

Table 3.3.2-19. Changes in Project flows and storage from No Action Alternative to SSWD's Proposed Project (Near-Term).

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CAMP FAR WEST RESERVOIR STORAGE (ac-ft)												
0%	8,116 (11.8%)	9,399 (10.0%)	9,322 (9.9%)	9,301 (9.9%)	9,285 (9.8%)	9,293 (9.9%)	9,283 (9.8%)	9,279 (9.8%)	9,289 (9.9%)	9,294 (9.9%)	9,632 (11.1%)	9,552 (13.4%)
10%	7,876 (14.1%)	3,975 (6.5%)	2,726 (3.2%)	9,663 (10.3%)	9,448 (10.0%)	9,374 (10.0%)	9,353 (9.9%)	9,349 (9.9%)	9,441 (10.0%)	9,840 (11.2%)	9,691 (13.8%)	9,456 (17.1%)
50%	1,694 (9.9%)	677 (3.8%)	-557 (-2.5%)	1,143 (2.9%)	-6,761 (-8.8%)	9,836 (10.5%)	9,714 (10.3%)	9,656 (10.3%)	9,522 (11.2%)	8,278 (13.9%)	5,295 (15.7%)	2,547 (13.7%)
90%	670 (22.3%)	-137 (-3.9%)	958 (20.9%)	3,011 (45.4%)	1,624 (15.2%)	575 (2.7%)	-446 (-1.3%)	-2,090 (-5.5%)	-2,359 (-6.4%)	-1,709 (-6.6%)	1,217 (11.2%)	419 (11.4%)
100%	0 (0.0%)	0 (0.0%)	-169 (-6.2%)	131 (3.5%)	277 (7.1%)	-1,068 (-12.0%)	-4,504 (-34.2%)	-3,426 (-28.6%)	-1,021 (-12.2%)	-700 (-14.5%)	0 (0.0%)	0 (0.0%)
Average	*4,845 (22.5%)*	*3,614 (14.8%)*	*2,263 (6.7%)*	*1,802 (3.8%)*	*2,442 (3.9%)*	*3,977 (5.4%)*	*5,329 (6.7%)*	*5,435 (6.8%)*	*5,758 (7.7%)*	*5,765 (9.9%)*	*5,484 (14.6%)*	*5,257 (22.6%)*
CAMP FAR WEST RESERVOIR WATER-SURFACE ELEVATION (ft)												
0%	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.1%)
10%	5 (1.8%)	3 (1.1%)	1 (0.3%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.1%)	7 (2.5%)
50%	2 (0.9%)	1 (0.4%)	-1 (-0.4%)	1 (0.4%)	-4 (-1.4%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	5 (1.7%)	6 (2.2%)	5 (1.9%)	4 (1.7%)
90%	4 (2.1%)	0 (0.0%)	4 (2.0%)	10 (4.8%)	4 (1.8%)	1 (0.4%)	0 (0.0%)	-2 (-0.8%)	-2 (-0.8%)	-3 (-1.2%)	3 (1.4%)	2 (1.0%)
100%	0 (0.0%)	0 (0.0%)	-2 (-1.1%)	1 (0.5%)	2 (1.0%)	-4 (-1.8%)	-11 (-4.8%)	-8 (-3.6%)	-3 (-1.4%)	-3 (-1.5%)	0 (0.0%)	0 (0.0%)
Average	*8 (3.5%)*	*6 (2.6%)*	*3 (1.2%)*	*1 (0.4%)*	*1 (0.4%)*	*2 (0.7%)*	*3 (1.0%)*	*3 (1.0%)*	*3 (1.0%)*	*3 (1.1%)*	*5 (2.0%)*	*7 (3.0%)*
BEAR RIVER FLOW BELOW CAMP FAR WEST RESERVOIR FLOW (RM 12.6) (cfs)												
0%	30 (26.3%)	-895 (-10.7%)	6 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-20 (-1.6%)	-2 (-0.3%)	0 (0.0%)	0 (0.0%)
10%	3 (2.9%)	90 (692.3%)	165 (1650.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-10 (-0.6%)	-9 (-0.8%)	-2 (-0.3%)	0 (0.0%)	1 (0.2%)	6 (2.1%)
50%	15 (88.2%)	11 (100.0%)	10 (100.0%)	20 (200.0%)	50 (416.7%)	-275 (-53.9%)	-13 (-2.4%)	-7 (-1.4%)	-4 (-0.9%)	2 (0.4%)	5 (1.2%)	4 (3.6%)
90%	0 (0.0%)	3 (30.0%)	5 (50.0%)	5 (50.0%)	6 (54.5%)	7 (70.0%)	-5 (-17.2%)	1 (0.8%)	-1 (-0.7%)	35 (26.3%)	18 (14.4%)	12 (54.5%)
100%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-10 (-38.5%)	-16 (-38.1%)	-20 (-42.6%)	-7 (-18.4%)	0 (0.0%)	0 (0.0%)
Average	*10 (25.0%)*	*29 (46.0%)*	*11 (3.0%)*	*0 (0.0%)*	*-7 (-0.9%)*	*-39 (-4.3%)*	*-6 (-0.8%)*	*-3 (-0.5%)*	*-6 (-1.4%)*	*5 (1.3%)*	*2 (0.5%)*	*4 (3.0%)*
DIVERSION INTO CFWID NORTH CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
DIVERSION INTO CFWID NORTH CANAL (cfs) (continued)												
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-4.5%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-1 (-25.0%)	-2 (-18.2%)	-3 (-23.1%)	0 (0.0%)	0 (0.0%)
Average	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-25.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-14.3%)*
DIVERSION INTO CFWID SOUTH CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-3 (-27.3%)	-3 (-27.3%)	-3 (-21.4%)	0 (0.0%)	0 (0.0%)
Average	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-11.1%)*	*-1 (-4.8%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*
DIVERSION INTO SSWD MAIN CANAL (cfs)												
0%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
10%	2 (2.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-2 (-1.1%)	0 (0.0%)	2 (0.5%)	0 (0.0%)	0 (0.0%)	1 (0.4%)
50%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (10.0%)	10 (3.3%)	11 (3.1%)	3 (0.7%)	11 (3.0%)	3 (3.6%)
90%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	14 (22.2%)	18 (25.7%)	19 (27.1%)	12 (17.9%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*4 (16.7%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*	*1 (1.9%)*	*3 (1.1%)*	*4 (1.4%)*	*5 (1.6%)*	*3 (1.0%)*	*5 (4.7%)*
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs)												
0%	40 (400.0%)	-894 (-10.7%)	6 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-1.0%)	0 (0.0%)	0 (0.0%)
10%	15 (150.0%)	90 (900.0%)	165 (1650.0%)	-151 (-10.0%)	-2 (-0.1%)	-58 (-2.3%)	-4 (-0.2%)	20 (2.8%)	-22 (-9.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (100.0%)	10 (100.0%)	20 (200.0%)	50 (500.0%)	-276 (-54.1%)	17 (4.0%)	-1 (-1.1%)	-10 (-40.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER BELOW THE NON-PROJECT DIVERSION DAM (RM 16.9) (cfs) (continued)												
90%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-5 (-20.0%)	-15 (-60.0%)	-15 (-60.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	5 (50.0%)	-10 (-40.0%)	-15 (-60.0%)	-15 (-60.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (50.0%)*	*29 (46.8%)*	*11 (3.0%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-39 (-4.3%)*	*-7 (-1.0%)*	*-8 (-2.9%)*	*-10 (-13.7%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*
BEAR RIVER FLOW AT WHEATLAND (RM 11.5) (cfs)												
0%	40 (285.7%)	-893 (-10.7%)	5 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	15 (107.1%)	90 (642.9%)	165 (1100.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-3 (-0.2%)	20 (2.7%)	-21 (-9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (71.4%)	10 (66.7%)	20 (133.3%)	50 (357.1%)	-275 (-53.5%)	17 (4.0%)	-1 (-1.0%)	-10 (-33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-5 (-16.7%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-10 (-33.3%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (35.7%)*	*29 (43.9%)*	*10 (2.7%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-38 (-4.1%)*	*-7 (-1.0%)*	*-8 (-2.8%)*	*-11 (-13.9%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-5.0%)*
BEAR RIVER FLOW AT PLEASANT GROVE ROAD (RM 7.1) (cfs)												
0%	40 (285.7%)	-893 (-10.7%)	5 (0.0%)	4 (0.0%)	11 (0.0%)	9 (0.1%)	6 (0.1%)	0 (0.0%)	-15 (-1.8%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	15 (107.1%)	90 (642.9%)	165 (1100.0%)	-151 (-10.0%)	-1 (0.0%)	-58 (-2.3%)	-3 (-0.2%)	20 (2.7%)	-21 (-9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	0 (0.0%)	10 (71.4%)	10 (66.7%)	20 (133.3%)	50 (357.1%)	-275 (-53.5%)	17 (4.0%)	-1 (-1.0%)	-10 (-33.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-5 (-16.7%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	5 (33.3%)	5 (35.7%)	5 (35.7%)	-10 (-33.3%)	-15 (-48.4%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Average	*5 (35.7%)*	*29 (43.9%)*	*10 (2.7%)*	*0 (0.0%)*	*-8 (-1.0%)*	*-38 (-4.1%)*	*-7 (-1.0%)*	*-8 (-2.8%)*	*-11 (-13.9%)*	*0 (0.0%)*	*0 (0.0%)*	*-1 (-5.0%)*
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs)												
0%	40 (10.1%)	-991 (-9.9%)	5 (0.0%)	4 (0.0%)	10 (0.0%)	8 (0.1%)	9 (0.1%)	3 (0.1%)	-15 (-1.7%)	-2 (-0.9%)	0 (0.0%)	0 (0.0%)
10%	16 (88.9%)	96 (290.9%)	15 (1.8%)	-110 (-6.4%)	-1 (0.0%)	-46 (-1.7%)	-44 (-2.5%)	9 (1.2%)	-14 (-6.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
50%	1 (7.1%)	20 (133.3%)	46 (219.0%)	39 (78.0%)	24 (21.8%)	-104 (-18.7%)	5 (1.1%)	-3 (-2.8%)	-10 (-29.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
90%	0 (0.0%)	5 (35.7%)	8 (50.0%)	10 (58.8%)	11 (61.1%)	12 (50.0%)	-4 (-11.4%)	-14 (-41.2%)	-15 (-48.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
100%	0 (0.0%)	0 (0.0%)	5 (33.3%)	6 (40.0%)	5 (35.7%)	5 (29.4%)	-10 (-31.3%)	-14 (-45.2%)	-15 (-50.0%)	0 (0.0%)	0 (0.0%)	-1 (-10.0%)

Table 3.3.2-19. (continued)

Value	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
BEAR RIVER FLOW AT FEATHER RIVER CONFLUENCE (RM 0.0) (cfs) (continued)												
Average	*6 (37.5%)*	*29 (34.1%)*	*10 (2.2%)*	*0 (0.0%)*	*-8 (-0.8%)*	*-39 (-3.8%)*	*-7 (-1.0%)*	*-8 (-2.7%)*	*-11 (-13.3%)*	*0 (0.0%)*	*0 (0.0%)*	*0 (0.0%)*

Water Supply

Under SSWD's Proposed Project (Near-Term), average annual irrigation diversions would increase in all but Critically Dry WYs relative to the No Action Alternative. Average annual water supply diversions would increase by approximately 1,600 ac-ft per year, or by 1.2 percent, with an increase of 4,800 ac-ft in Below Normal WYs, 1,000 ac-ft per year in Above Normal WYs, 1,000 ac-ft/yr in Dry WYs, and 400 ac-ft per WY in Wet WYs. In Critical WYs, average annual water supply diversions would decrease by approximately by 1,000 ac-ft per year, 300 ac-ft per year for SSWD and by 650 ac-ft per year for CFWID. A comparison of existing irrigation diversions under the No Action Alternative and SSWD's Proposed Project (Near-Term) is presented in Figure 3.3.2-38.

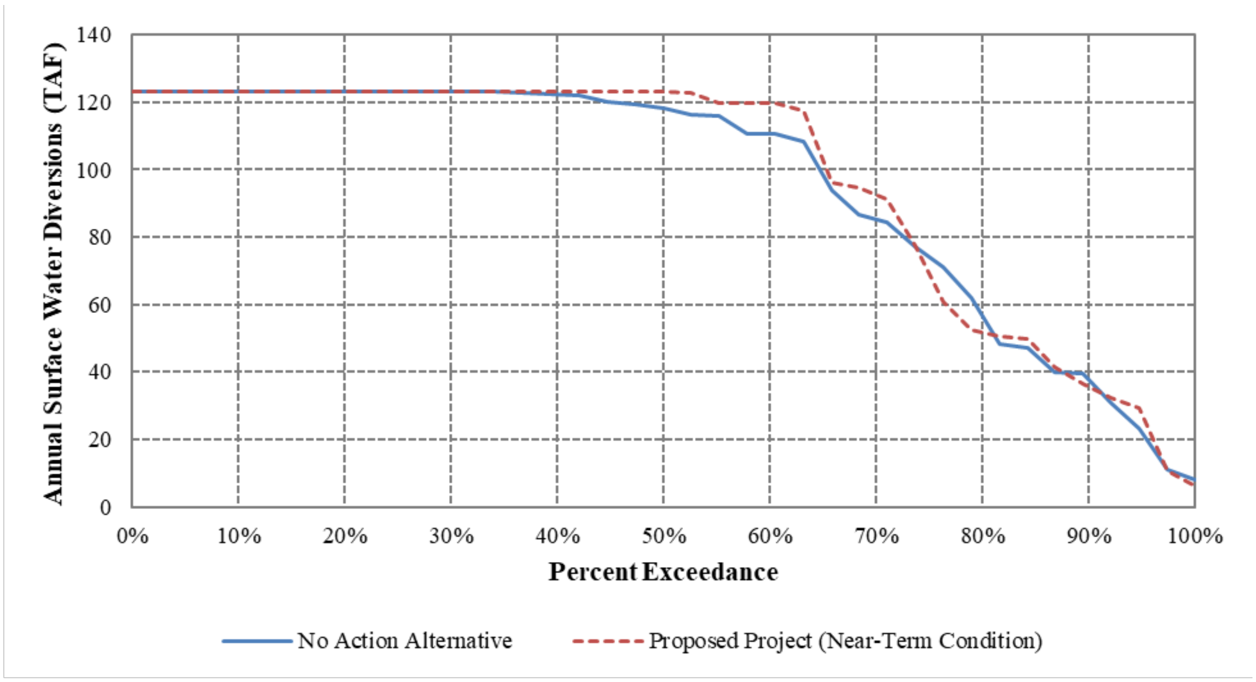

Figure 3.3.2-38. Exceedance curves of modeled annual irrigation diversions to SSWD and CFWID customers for the No Action Alternative and SSWD's Proposed Project for WYs 1976 through 2014.

Water Rights

CFWID has senior water rights to the Bear River downstream of the Project, and SSWD provides CFWID water under terms of a 1973 agreement. Diversions to CFWID would only be reduced if Camp Far West Reservoir is at deadpool and is only releasing what is flowing into the reservoir. As shown in Table 3.3.2-19, there would be a small reduction in diversions to CFWID under the Proposed Project (Near-Term) relative to the No Action Alternative. Impacts to CFWID would be limited to two Critical WYs and a Dry WY following a Critical WY, relative to No Action Alternative. A comparison of existing irrigation diversions under the No Action Alternative and SSWD's Proposed Project (Near-Term) is presented in Figure 3.3.2-39.

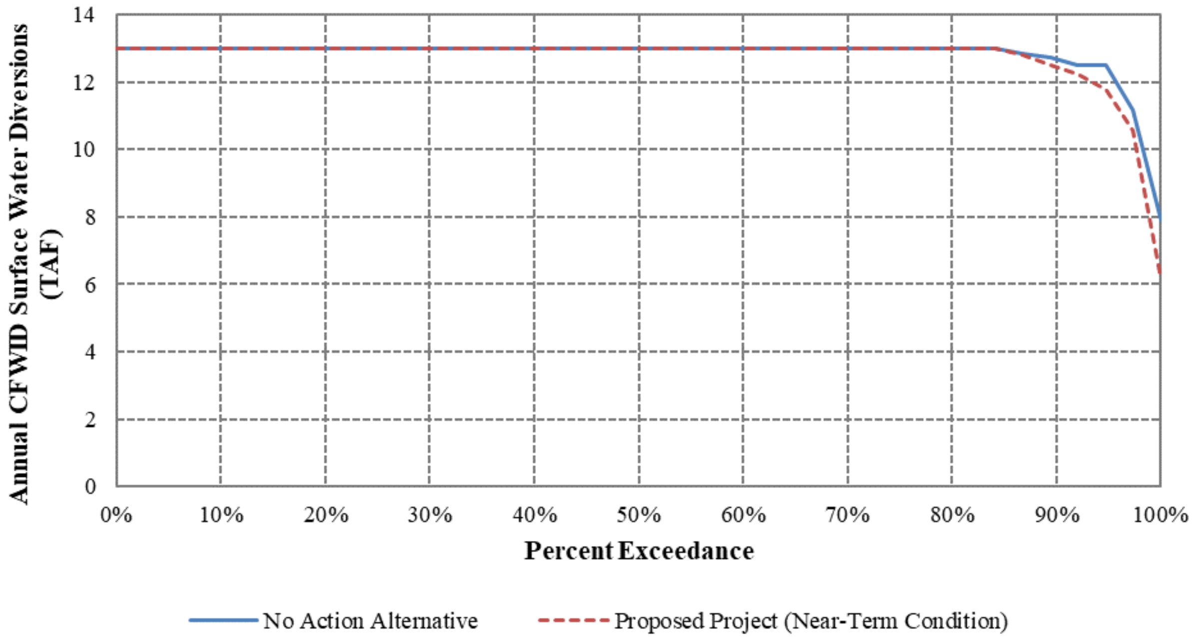

Figure 3.3.2-39. Exceedance curves of modeled annual irrigation diversions to CFWID customers for the No Action Alternative and SSWD's Proposed Project (Near-Term) for WYs 1976 through 2014.

Effects on Water Quality

Camp Far West Reservoir

SSWD's Proposed Project would have very little effect on water quality in Camp Far West Reservoir. Considering that the Pool Raise would increase water-surface elevations and overall storage, some water quality parameters may decrease as constituents (e.g., metals and nutrients) are further diluted by the increase in water. Regarding DO, this reservoir change would not substantially alter the size or stability of the epilimnion or hypolimnion. The current DO conditions are expected to continue to occur with SSWD's Proposed Project; however, the Proposed Project is not expected to cause DO concentrations to be lower than under existing conditions.

Under existing conditions, reservoir water temperatures typically exceed 20°C during May through September at depths of up to 50 ft below the Camp Far West Reservoir surface (2015-2017, Figure 3.3.2-15). Reservoir release temperatures through the powerhouse intake regularly exceed 20°C beginning in late July and continue to exceed 20°C through the end of the irrigation season, typically in mid-October, or until reservoir water levels are too low to run water through the powerhouse (Figure 3.3.2-18). A small coldwater pool is accessible to the low-level outlet that is not accessible to the powerhouse intake, but it is typically exhausted in a few weeks (Figure 3.3.2-18).

Under SSWD's Proposed Project, the Pool Raise would provide additional storage in Camp Far West Reservoir to capture addition relatively cool runoff from winter storms. Table 3.3.2-20 depicts thermal conditions in Camp Far West Reservoir under the No Action Alternative and

SSWD's Proposed Project. There would be a very small increase in usable cold water as a result of the Pool Raise.

Table 3.3.2-20. Average usable storage in Camp Far West Reservoir at the 10°C and 15°C isotherms for the modeled period of record (WYs 1976 through 2014) based on Ops Model and Temp Model results.

Operations Scenario	Average Usable Storage below 15°C Isotherm (ac-ft)		Average Usable Storage below 10°C Isotherm (ac-ft)	
	July 1	October 15	July 1	October 15
No Action Alternative	8,939	832	540	15
Proposed Project (Near-Term)	10,079	974	676	17

Figure 3.3.2-40 presents results of the Proposed Project Temp Model run compared to the No Action Alternative for the Bear River below Camp Far West Reservoir. Table 3.3.2-21 presents a comparison of simulated monthly water temperatures for the same location. Simulated mean-daily Camp Far West Reservoir release temperatures exceeds 20°C in August under both the No Action Alternative and Proposed Project (Near-Term) conditions (Table 3.3.2-21).

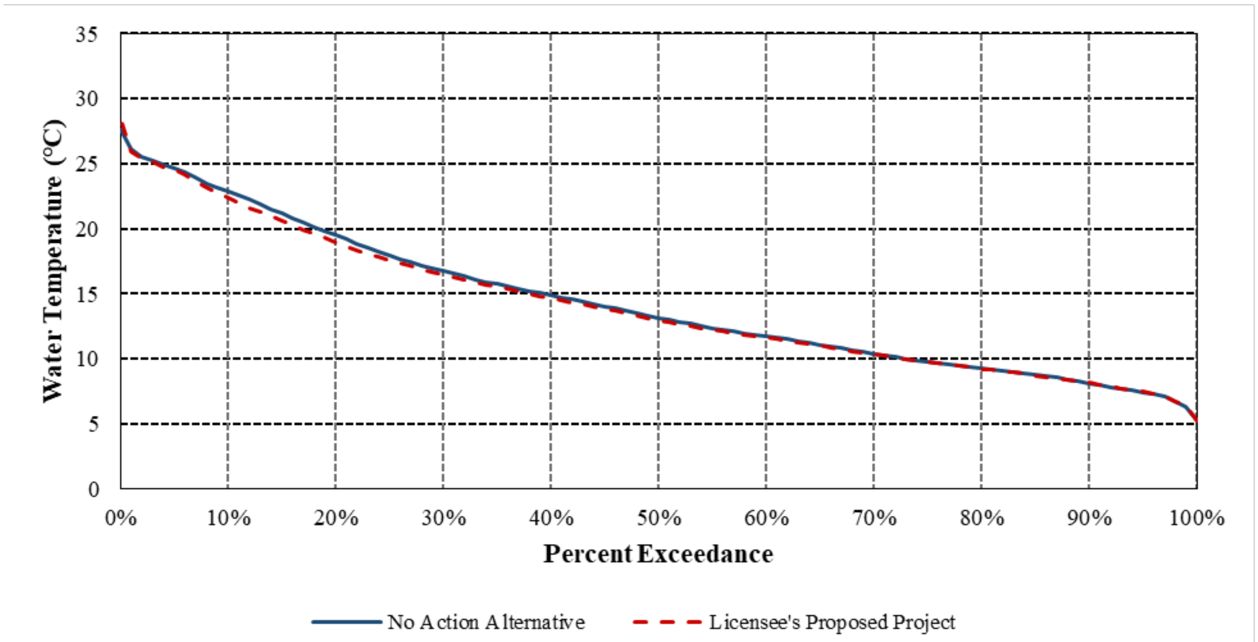

Figure 3.3.2-40. Exceedance curves of modeled mean daily water temperatures in the Bear River downstream of Camp Far West Reservoir for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Table 3.3.2-21. Comparison of simulated mean monthly Camp Far West Reservoir release water temperatures for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	11.6	18.0	24.1	11.1	17.7	22.5	-0.5	-0.3	-1.6
November	8.7	14.8	20.7	8.7	15.1	20.7	0.0	0.3	0.0
December	5.3	10.1	15.6	5.4	10.2	15.7	0.1	0.1	0.1
January	5.3	7.9	11.1	5.2	7.9	11.3	-0.1	0.0	0.2
February	6.0	8.5	12.0	6.1	8.5	11.9	0.1	0.0	-0.1
March	6.3	10.0	16.6	6.5	9.9	15.7	0.2	-0.1	-0.9
April	6.8	11.4	18.8	6.8	11.3	17.3	0.0	-0.1	-1.5
May	9.0	13.1	19.1	8.9	12.9	18.8	-0.1	-0.2	-0.3
June	10.4	15.4	22.8	10.5	15.2	26.3	0.1	-0.2	3.5
July	10.4	19.7	27.2	11.1	19.0	28.4	0.7	-0.7	1.2
August	8.5	22.9	27.6	8.7	22.7	28.1	0.2	-0.2	0.5
September	10.4	19.5	27.0	9.3	18.6	26.7	-1.1	-0.9	-0.3

<u>Bear River</u>

The Proposed Project would have minimal effects to water quality in the Bear River downstream of the Project. In SSWD's Proposed Measure AR1, minimum flows in the Bear River below the non-Project diversion dam would not change from July 1 through October 14. Higher flows are proposed in the fall and winter when water quality, primarily water temperature, is less of a concern. Given the minor changes in flows (Figures 3.3.2-32 through 3.3.2-34) between the current and Proposed Project, SSWD does not expect any changes to water quality downstream. As discussed above, water quality downstream of the Project usually meets or exceeds Basin Plan Water Quality Objectives.

Figures 3.3.2-41 through 3.3.2-49 show simulated water temperatures along the Bear River downstream of the non-Project diversion dam for three representative WYs. Figures 3.3.2-41, 3.3.2-44, and 3.3.2-47 show water temperatures increasing from upstream to downstream, particularly in the spring and summer. In summer months, Proposed Project water temperatures would be slightly cooler during the No Action Alternative in the Bear River immediately downstream of the non-Project diversion dam (Figures 3.3.2-41, 3.3.2-46, and 3.3.2-47). By Highway 65, there would be very little difference between the No Action Alternative and Proposed Project water temperatures. Similarly, there would be little difference between the No Action Alternative and Proposed Project water temperatures at Pleasant Grove Bridge (Figure 3.3.2-43, 3.3.2-46, 3.3.2-48), or at Highway 70 (Figure 3.3.2-41, 3.3.2-46, 3.3.2-49).

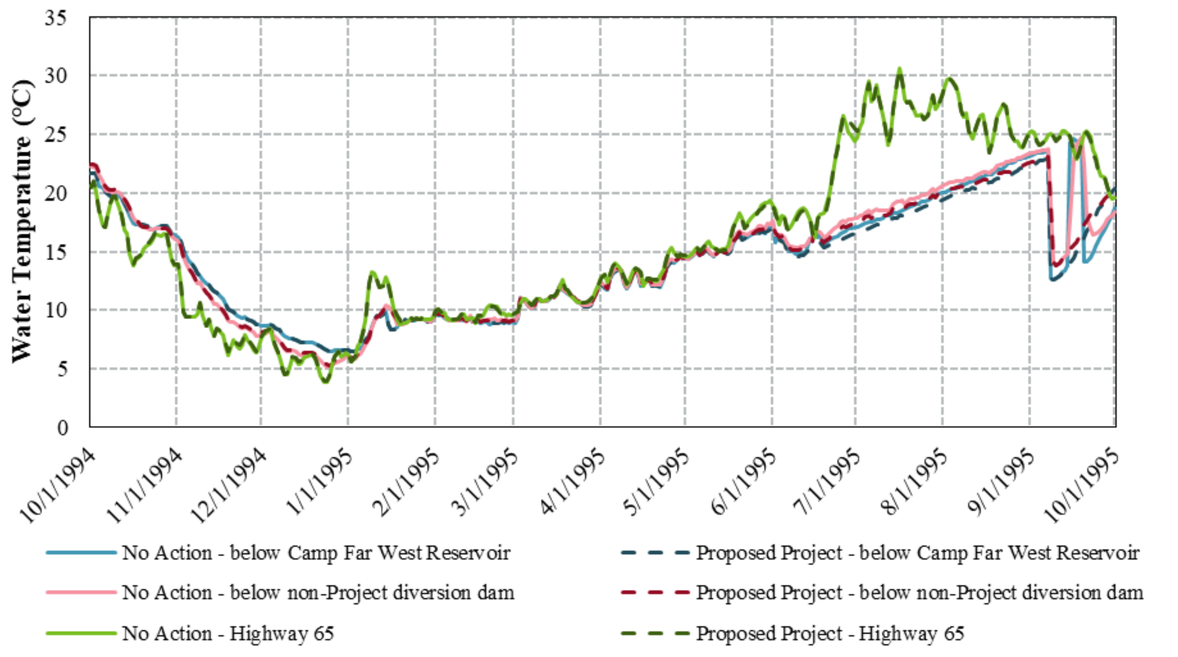

Figure 3.3.2-41. Simulated daily water temperatures for a representative wet WY (1995) at various locations in the Bear River downstream of the non-Project diversion dam.

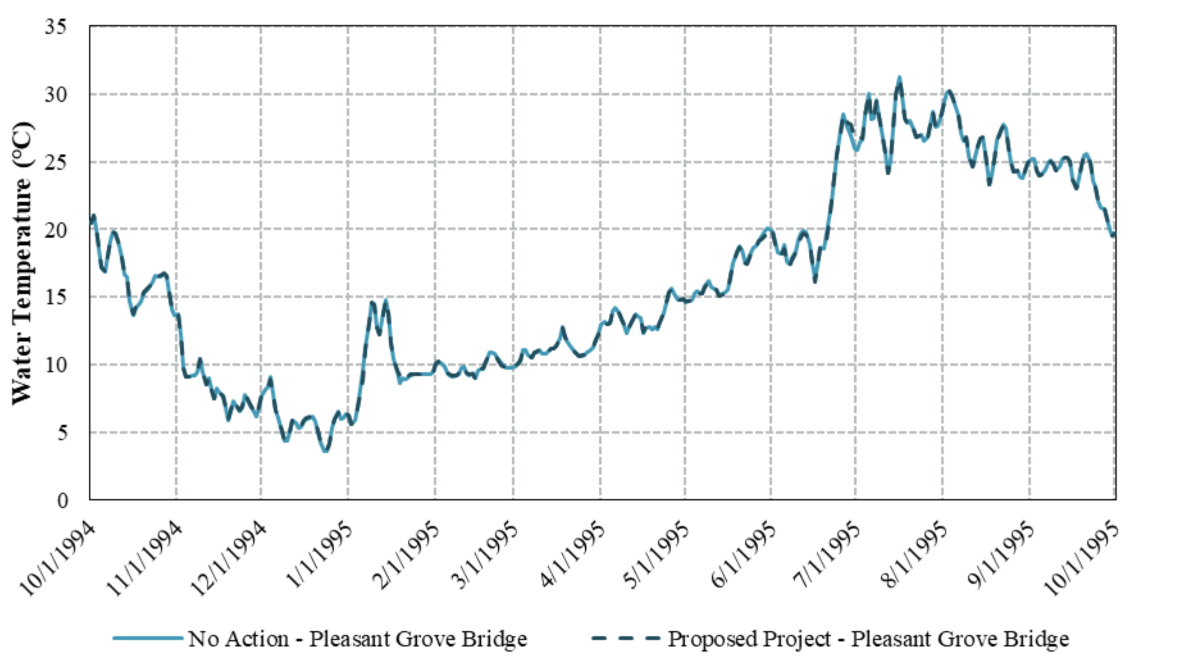

Figure 3.3.2-42. Simulated daily water temperatures for a representative wet WY (1995) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

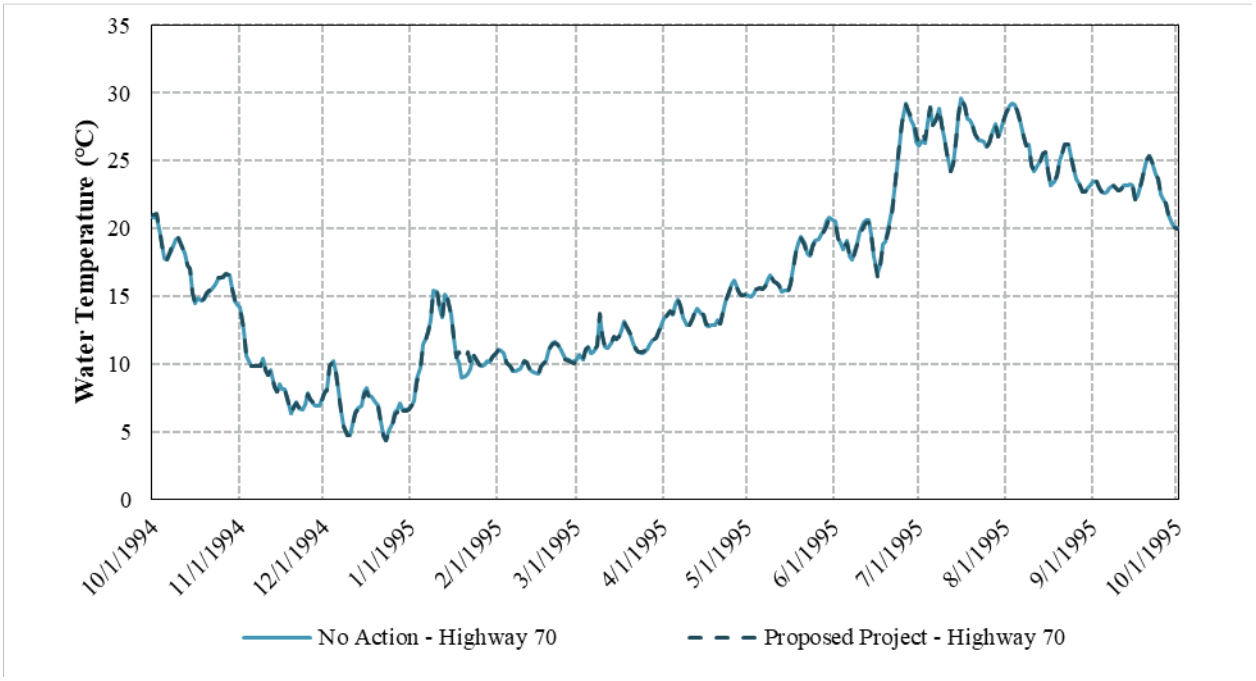

Figure 3.3.2-43. Simulated daily water temperatures for a representative wet WY (1995) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

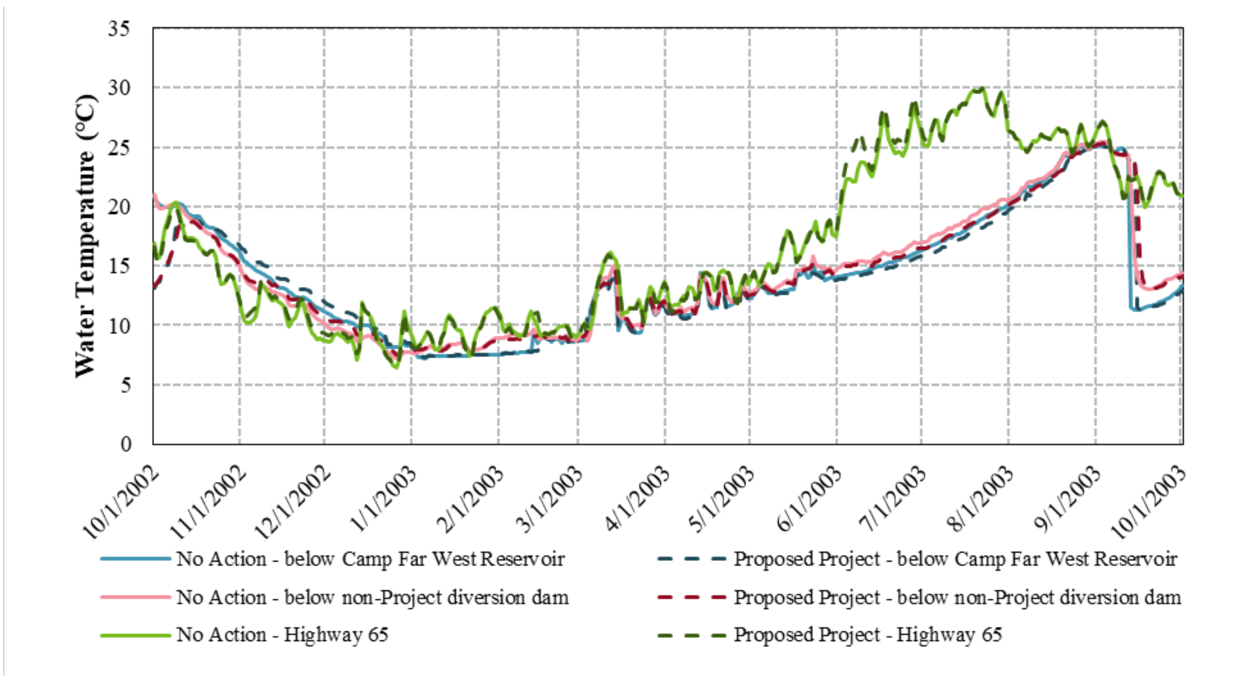

Figure 3.3.2-44. Simulated daily water temperatures for a representative normal WY (2003) at various locations in the Bear River downstream of the non-Project diversion dam.

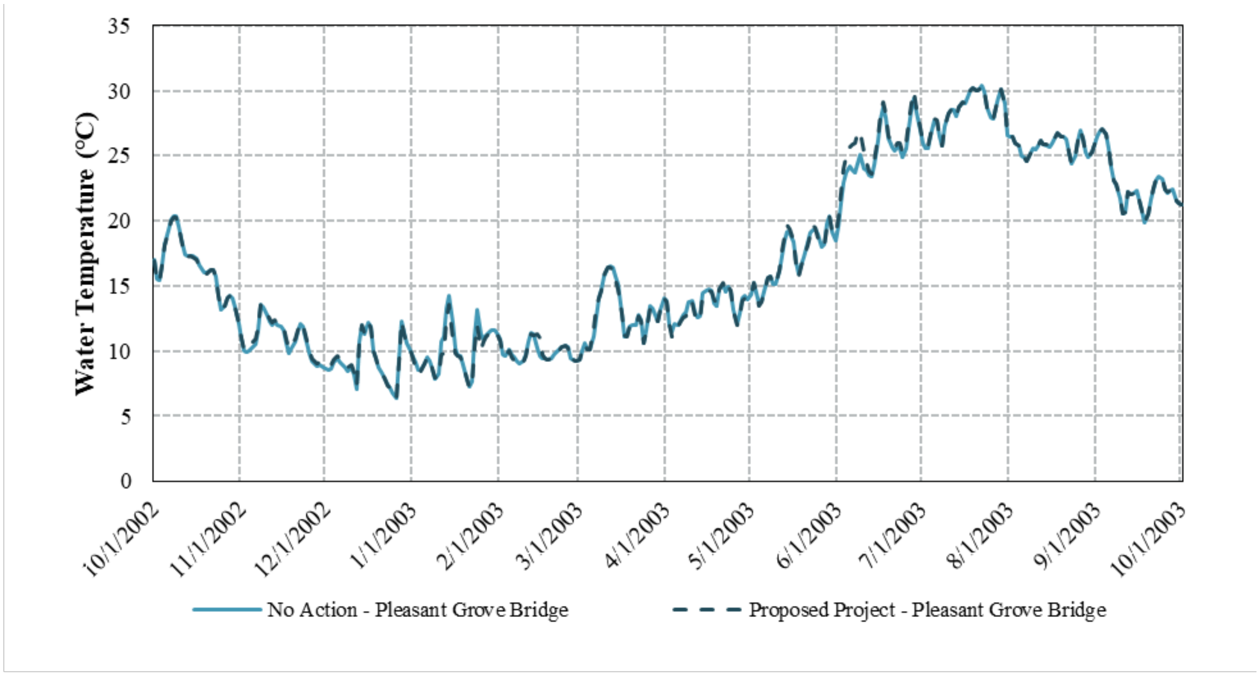

Figure 3.3.2-45. Simulated daily water temperatures for a representative normal WY (2003) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

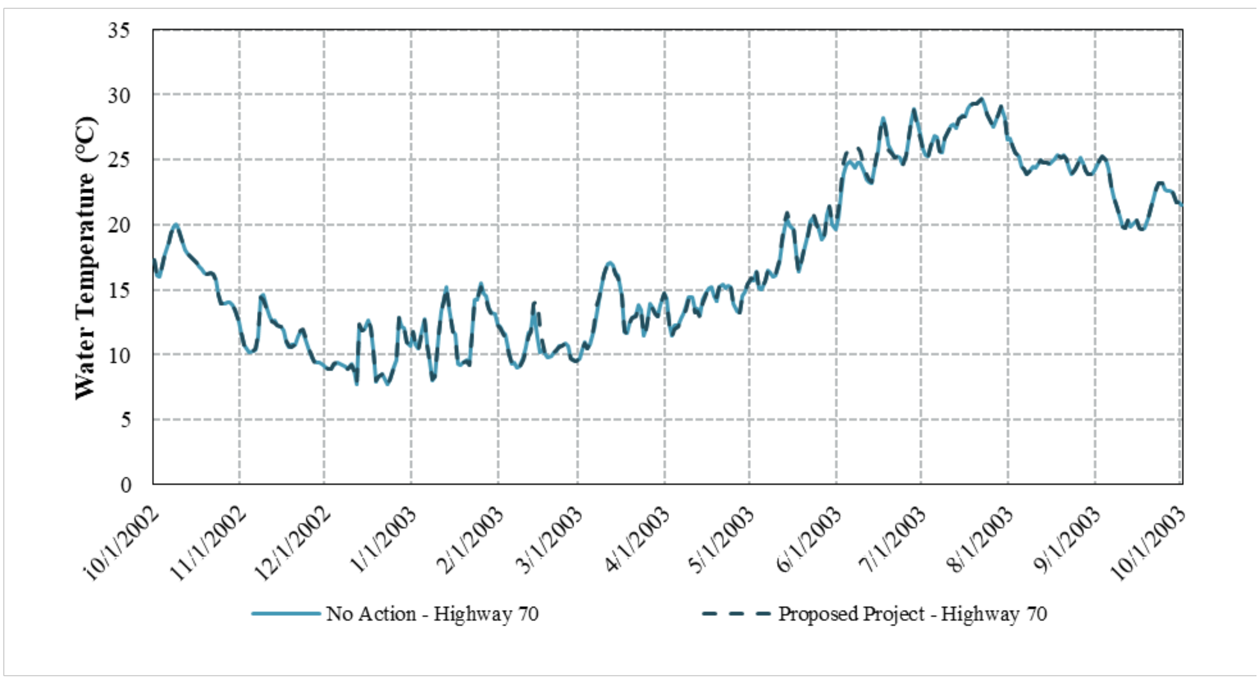

Figure 3.3.2-46. Simulated daily water temperatures for a representative normal WY (2003) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

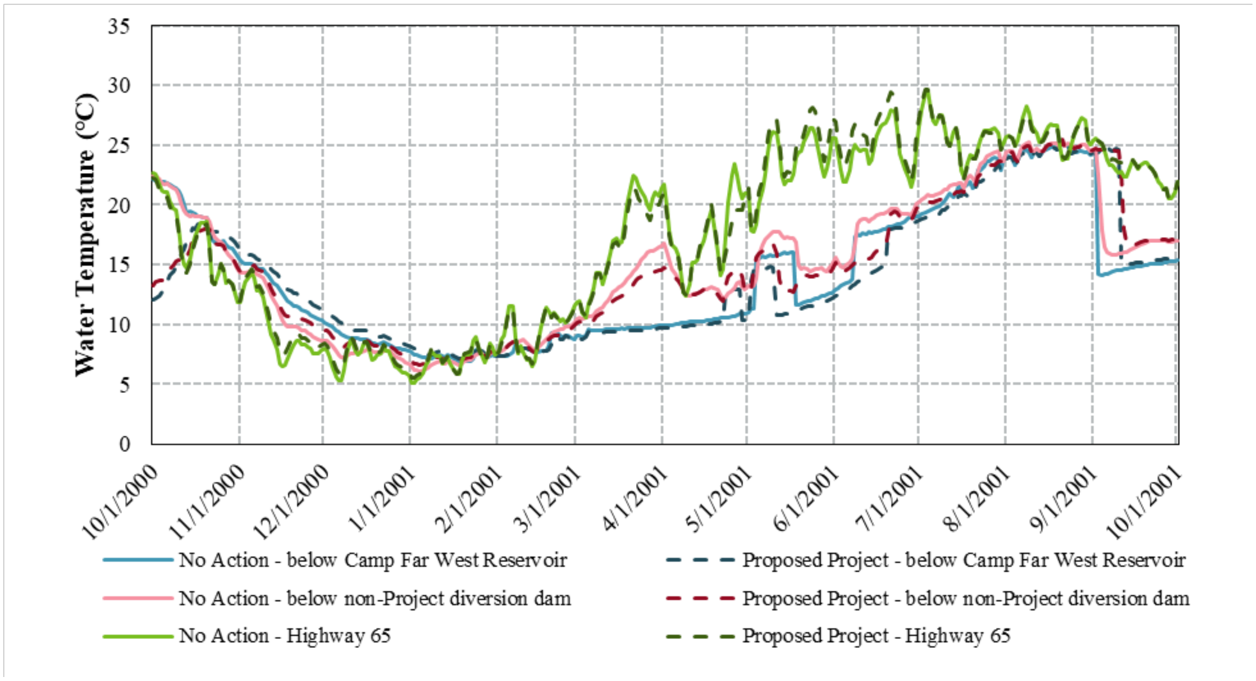

Figure 3.3.2-47. Simulated daily water temperatures for a representative dry WY (2001) at various locations in the Bear River downstream of the non-Project diversion dam.

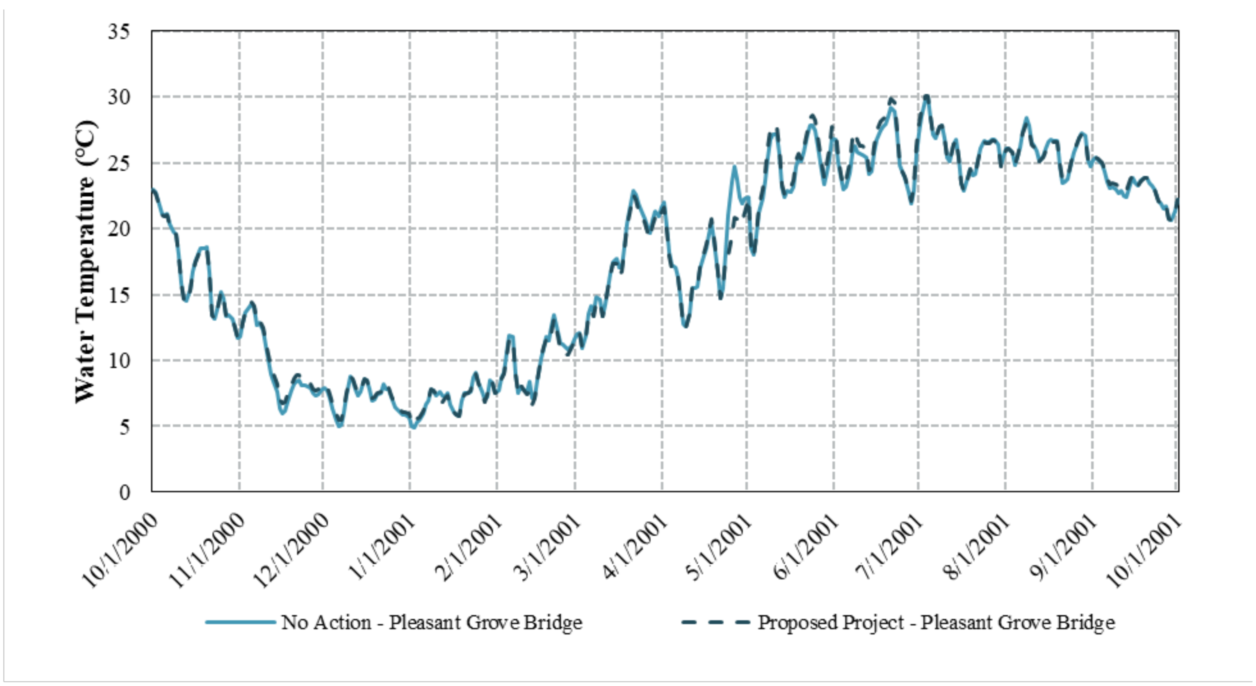

Figure 3.3.2-48. Simulated daily water temperatures for a representative dry WY (2001) at Pleasant Grove Bridge in the Bear River downstream of the non-Project diversion dam.

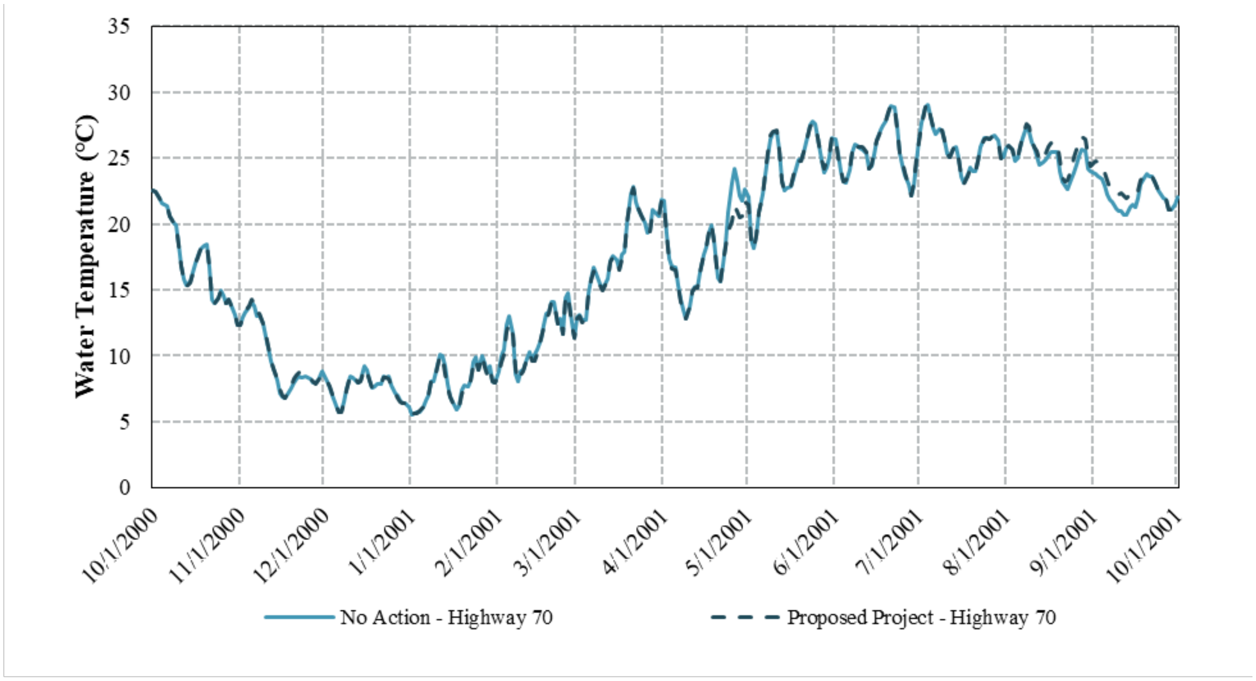

Figure 3.3.2-49. Simulated daily water temperatures for a representative dry WY (2001) at Highway 70 in the Bear River downstream of the non-Project diversion dam.

In the following sections, simulated water temperatures in the Bear River downstream of Camp Far West Reservoir are statistically presented for the full period of record (WYs 1976 through 2014). Temp Model results are presented only as far downstream as Highway 70 because of backwater effects from the Feather River that are not represented in the Temp Model.

Bear River below the Non-Project Diversion Dam

Figure 3.3.2-50 presents exceedance curves of mean-daily water temperatures for the Proposed Project water temperature model run compared to the No Action Alternative for the Bear River downstream of the non-Project diversion dam. Table 3.3.2-22 presents a comparison of simulated monthly water temperatures for the same location.

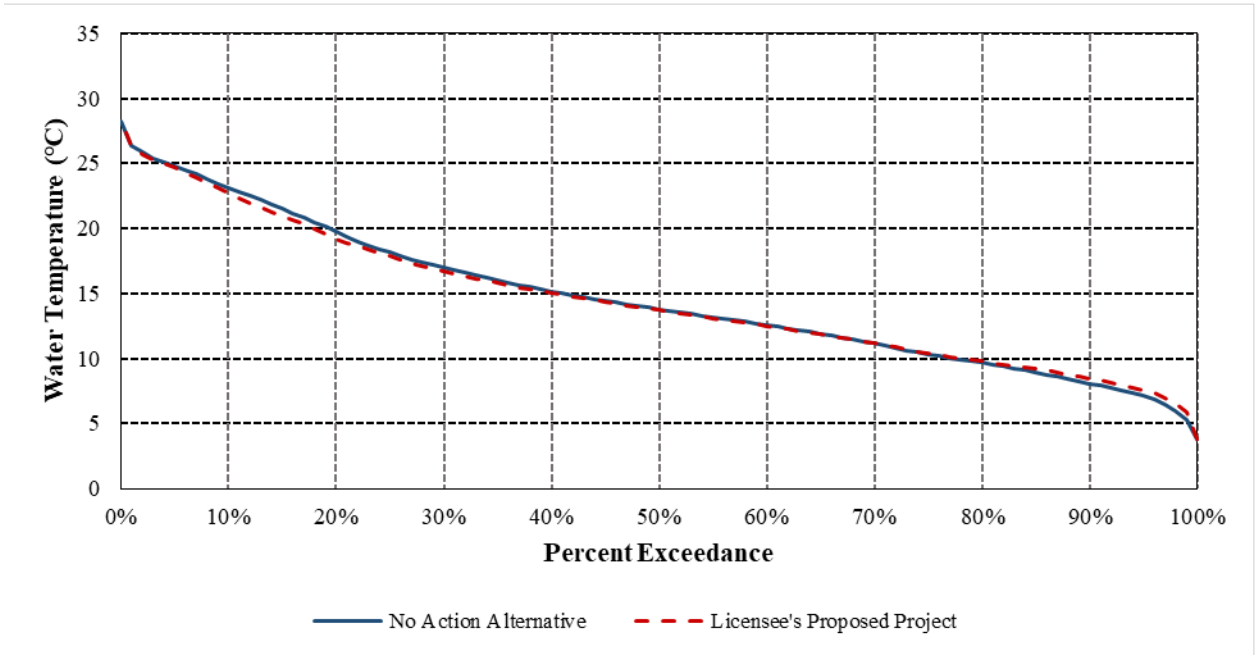

Figure 3.3.2-50. Exceedance curves of modeled mean daily water temperatures in the Bear River downstream of the non-Project diversion dam for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Table 3.3.2-22. Comparison of simulated mean monthly water temperatures in the Bear River downstream of the non-Project diversion dam for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	12.6	17.8	24.0	12.6	17.5	22.9	0.0	-0.3	-1.1
November	7.0	13.3	19.3	7.9	14.1	20.0	0.9	0.8	0.7
December	3.8	8.5	13.3	3.8	9.4	15.4	0.0	0.9	2.1
January	4.0	7.4	10.9	4.2	7.8	10.7	0.2	0.4	-0.2
February	5.2	9.4	13.6	5.8	9.2	13.1	0.6	-0.2	-0.5
March	7.7	11.6	16.6	7.9	11.2	16.2	0.2	-0.4	-0.4
April	8.0	12.7	17.8	8.2	12.6	17.9	0.2	-0.1	0.1
May	9.7	14.0	19.2	9.6	13.8	19.8	-0.1	-0.2	0.6
June	11.9	16.3	23.7	12.0	16.2	26.4	0.1	-0.1	2.7
July	12.8	20.4	28.0	13.2	19.7	28.3	0.4	-0.7	0.3
August	9.4	23.3	27.8	9.9	23.1	28.1	0.5	-0.2	0.3
September	12.1	20.3	28.2	10.4	19.6	28.3	-1.7	-0.7	0.1

Bear River at Highway 65 (Wheatland)

Figure 3.3.2-51 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Highway 65. Table 3.3.2-23 presents a comparison of simulated monthly water temperatures for the same location.

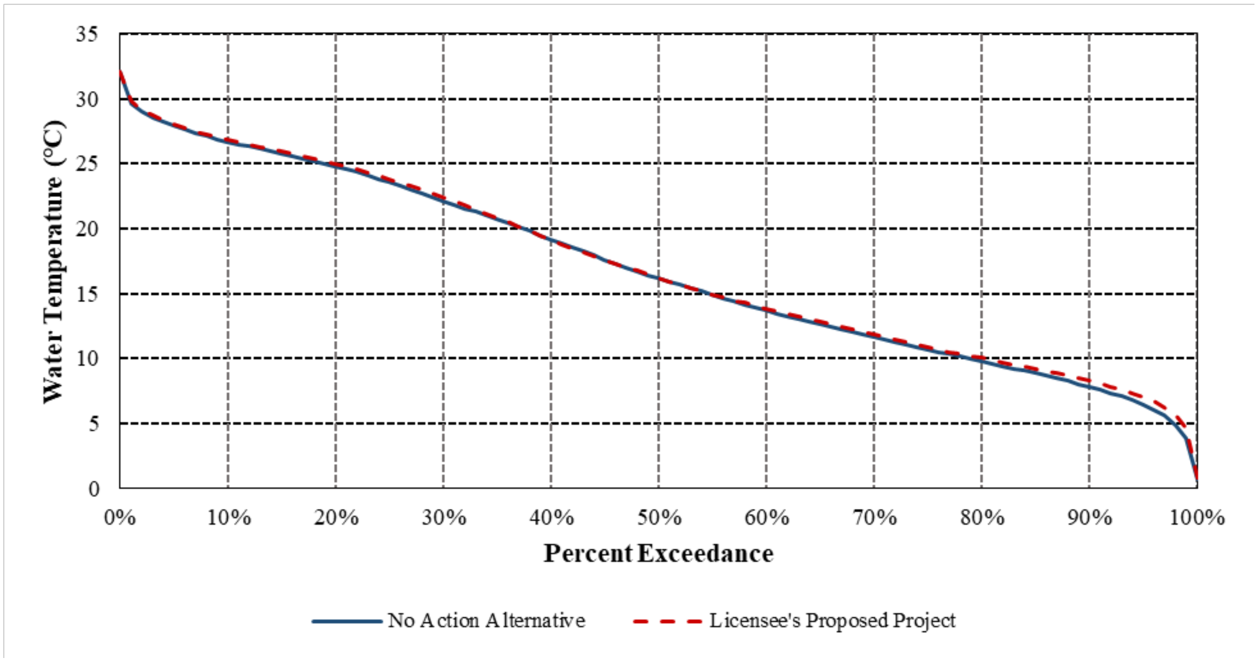

Figure 3.3.2-51. Exceedance curves of modeled mean daily water temperatures in the Bear River at Highway 65 for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-23. Comparison of simulated mean monthly water temperatures in the Bear River at Highway 65 for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.5	17.6	24.0	10.5	17.7	23.9	0.0	0.1	-0.1
November	4.0	11.5	17.5	5.1	12.4	18.9	1.1	0.9	1.4
December	0.7	7.4	15.0	0.8	8.2	15.0	0.1	0.8	0.0
January	1.9	7.8	14.8	2.7	8.0	14.5	0.8	0.2	-0.3
February	3.3	10.7	18.2	3.5	10.4	18.0	0.2	-0.3	-0.2
March	8.2	13.1	22.5	8.1	13.1	21.4	-0.1	0.0	-1.1
April	9.9	15.2	23.9	10.2	15.2	24.4	0.3	0.0	0.5
May	12.4	19.0	27.4	12.3	19.4	29.0	-0.1	0.4	1.6
June	14.7	23.8	29.9	14.5	24.3	30.8	-0.2	0.5	0.9
July	20.1	27.2	32.1	20.3	27.2	32.1	0.2	0.0	0.0
August	19.0	26.1	31.3	18.8	26.1	31.2	-0.2	0.0	-0.1
September	15.4	22.9	29.4	15.4	22.8	29.4	0.0	-0.1	0.0

Bear River at Pleasant Grove Road

Figure 3.3.2-52 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Pleasant Grove Road. Table 3.3.2-24 presents a comparison of simulated monthly water temperatures for the same location.

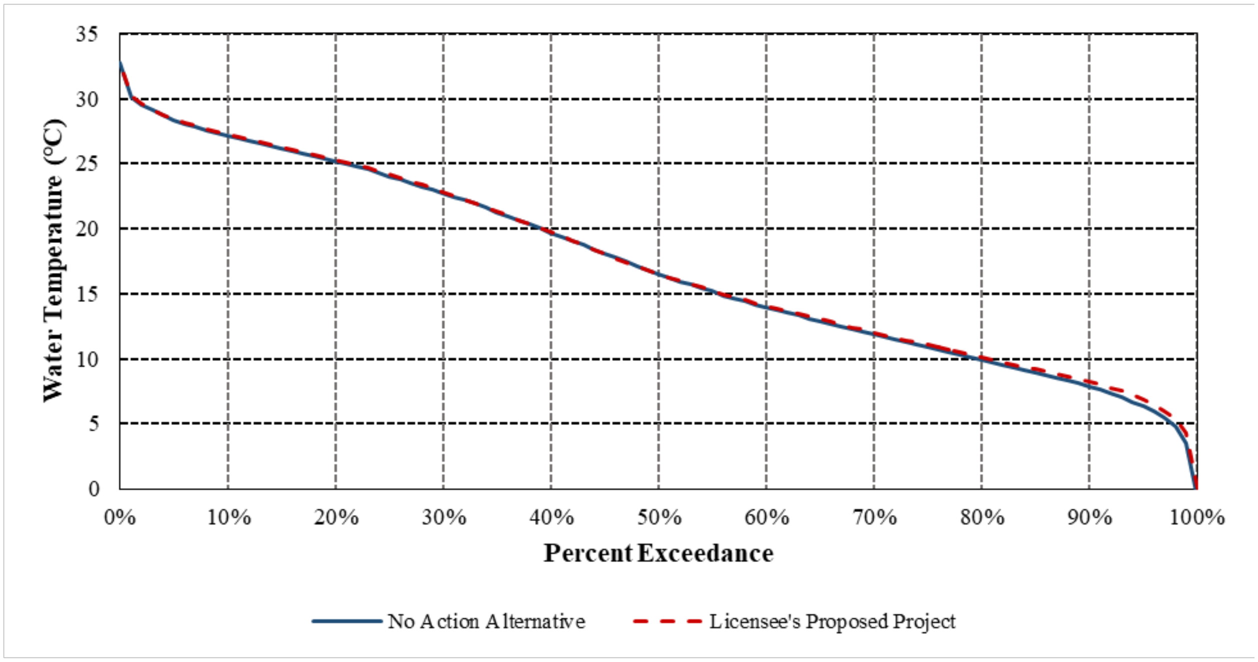

Figure 3.3.2-52. Exceedance curves of modeled mean daily water temperatures in the Bear River at Pleasant Grove Road for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-24. Comparison of simulated mean monthly water temperatures in the Bear River at Pleasant Grove Road for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.1	17.7	24.6	10.1	17.7	24.6	0.0	0.0	0.0
November	3.5	11.4	17.7	4.3	12.1	18.6	0.8	0.7	0.9
December	-0.8	7.4	16.2	0.0	8.0	15.3	0.8	0.6	-0.9
January	1.2	7.9	16.1	2.4	8.1	16.0	1.2	0.2	-0.1
February	3.0	10.9	18.5	3.1	10.7	18.4	0.1	-0.2	-0.1
March	8.0	13.4	22.9	8.2	13.5	22.6	0.2	0.1	-0.3
April	10.1	15.8	25.3	10.1	15.8	25.5	0.0	0.0	0.2
May	12.6	20.0	28.7	12.5	20.1	29.5	-0.1	0.1	0.8
June	15.6	24.7	30.9	15.4	25.0	31.3	-0.2	0.3	0.4
July	20.8	27.6	32.8	20.8	27.7	32.8	0.0	0.1	0.0
August	21.1	26.2	31.5	21.2	26.2	31.5	0.1	0.0	0.0
September	15.3	23.0	29.4	15.3	22.9	29.4	0.0	-0.1	0.0

Bear River at Highway 70

Figure 3.3.2-53 presents exceedance curves of mean daily water temperatures for the Proposed Project (Near-Term) water temperature model run compared to the No Action Alternative for the Bear River at Highway 70. Table 3.3.2-25 presents a comparison of simulated monthly water temperatures for the same location.

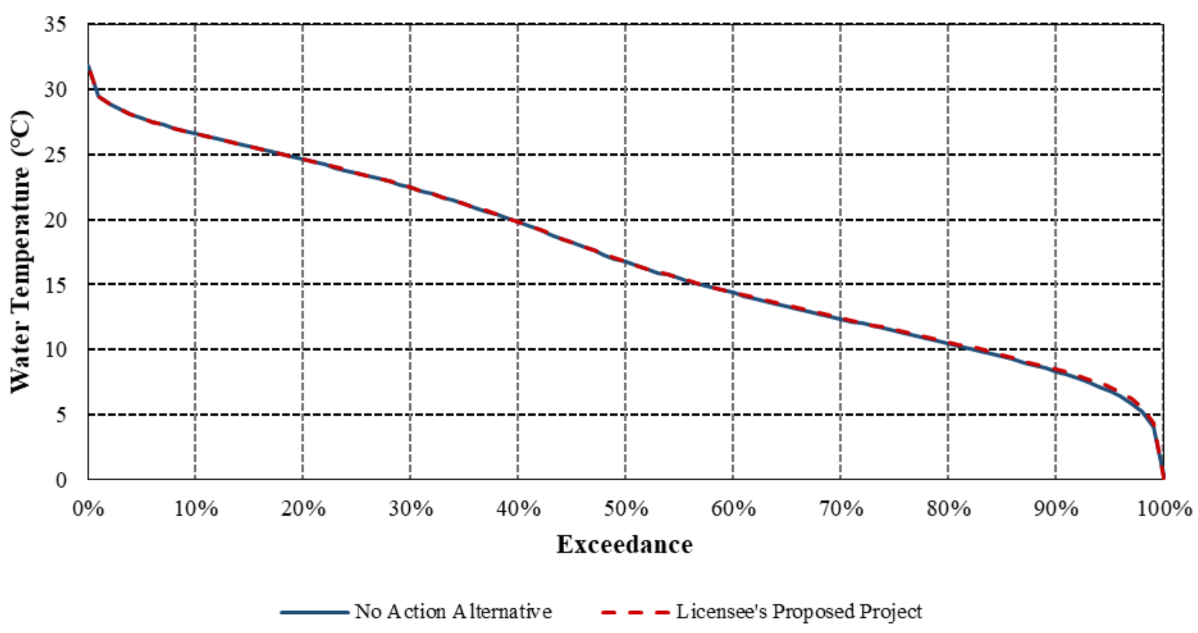

Figure 3.3.2-53. Exceedance curves of modeled mean daily water temperatures in the Bear River at Highway 70 for the No Action Alternative and Proposed Project for WYs 1976 through 2014.

Table 3.3.2-25. Comparison of simulated mean monthly water temperatures in the Bear River at Highway 70 for the No Action Alternative and Proposed Project (Near-Term) for WYs 1976 through 2014.

Month	No Action Alternative			Proposed Project (Near-Term)			Change		
	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)	Min (°C)	Mean (°C)	Max (°C)
October	10.9	17.8	24.5	11.3	17.8	24.5	0.4	0.0	0.0
November	3.9	11.6	17.8	4.4	12.0	18.2	0.5	0.4	0.4
December	0.3	7.9	16.9	0.1	8.2	16.8	-0.2	0.3	-0.1
January	1.8	8.6	16.6	2.6	8.6	16.6	0.8	0.0	0.0
February	3.8	11.4	18.0	3.6	11.3	18.1	-0.2	-0.1	0.1
March	8.0	13.7	22.8	8.5	13.8	22.7	0.5	0.1	-0.1
April	10.4	16.0	25.1	10.4	16.0	25.2	0.0	0.0	0.1
May	13.1	20.3	28.4	13.1	20.3	28.5	0.0	0.0	0.1
June	16.0	24.7	30.4	15.9	24.7	30.4	-0.1	0.0	0.0
July	21.1	27.2	31.9	21.0	27.2	31.9	-0.1	0.0	0.0
August	20.4	25.5	30.5	20.4	25.5	30.5	0.0	0.0	0.0
September	16.4	22.3	27.8	16.3	22.3	27.6	-0.1	0.0	-0.2

Effects on CWA Section 303(d) Constituent

Mercury

As pointed out above, based on data collected before 2012, the SWRCB identified the lower Bear River as CWA Section 303(d) State Impaired for mercury, citing fish tissue concentrations, water samples, and sediment samples to support their listing (SWRCB 2018).

SSWD has not and does not plan to perform any Project O&M activities associated with the release or mobilization of mercury.

3.3.2.3 Cumulative Effects

Cumulative effects resulting from past, present, and reasonably foreseeable future actions, including the Proposed Project, have the potential to affect water quantity and water quality in Camp Far West Reservoir and the lower Bear River. As described in Section 3.3.2 of this Exhibit E, these activities include timber harvesting, livestock grazing, mining, and operation of upstream and downstream water projects.

Discussed below are the cumulative effects on water quantity and water quality of the Proposed Project in combination with these past, present and future actions from the NMWSE of Camp Far West Reservoir downstream in the Bear River to the Bear River's confluence with the Feather River.

3.3.2.3.1 Cumulative Effects on Water Quantity

Upstream water projects in the Bear River, described in Section 3.1.2.1 and 3.1.2.5, control inflow into the Project. Projected increases in upstream water demands by NID and PCWA will reduce inflow into Camp Far West Reservoir by approximately 28,500 ac-ft per year by 2062, a 9 percent reduction relative to near-term average inflow. The Proposed Project creates additional storage space in Camp Far West Reservoir, which allows the reservoir to compensate for the decrease in available water supply to SSWD caused by reduced reservoir inflow. Section 7.2.2 of Exhibit B describes impacts on flows in the lower Bear River under future Proposed Project conditions. These changes are summarized in Table 3.3.2-26.

Table 3.3.2-26. Average annual results from WY 1976 through WY 2014 for the No Action Alternative (Baseline Condition) and the Proposed Project (Future Condition), and the difference between the two.

Water Year Type[1]	SSWD Diversions for Water Supply (ac-ft)	Camp Far West Reservoir Carryover Storage[2] (ac-ft)	Peak Project Energy Generation (MWhr)	Off-Peak Project Energy Generation (MWhr)	Total Project Energy Generation (MWhr)	Mean Flow Downstream of Non-Project Diversion Dam (cfs)
NO ACTION ALTERNATIVE (BASELINE CONDITION)						
Wet	109,600	39,700	14,375	22,780	37,155	826
Above Normal	109,000	23,600	11,722	18,584	30,306	365
Below Normal	100,500	14,500	8,321	13,164	21,485	178
Dry	53,700	13,000	2,138	3,378	5,515	42
Critical	19,200	5,400	412	650	1,062	15
All	**82,900**	**20,800**	**7,888**	**12,493**	**20,381**	**309**
PROPOSED PROJECT (FUTURE CONDITION)						
Wet	109,600	34,600	14,348	22,738	37,086	782
Above Normal	109,400	21,200	11,049	17,518	28,567	316
Below Normal	103,100	17,000	7,169	11,341	18,510	120
Dry	39,300	6,300	1,237	1,954	3,191	32
Critical	15,100	4,200	344	543	887	18
All	**79,700**	**18,100**	**7,278**	**11,529**	**18,807**	**274**
DIFFERENCE BETWEEN THE PROPOSED PROJECT FUTURE CONDITIONS AND NO ACTION ALTERNATIVE						
Wet	0	-5,100	-27	-42	-69	-44
Above Normal	400	-2,400	-673	-1,066	-1,739	-49
Below Normal	2,600	2,500	-1,152	-1,823	-2,975	-58
Dry	-14,400	-6,700	-901	-1,424	-2,324	-10

Table 3.3.2-26. (continued)

Water Year Type[1]	SSWD Diversions for Water Supply (ac-ft)	Camp Far West Reservoir Carryover Storage[2] (ac-ft)	Peak Project Energy Generation (MWhr)	Off-Peak Project Energy Generation (MWhr)	Total Project Energy Generation (MWhr)	Mean Flow Downstream of Non-Project Diversion Dam (cfs)
DIFFERENCE BETWEEN THE PROPOSED PROJECT FUTURE CONDITIONS AND NO ACTION ALTERNATIVE (CONT'D)						
Critical	-4,100	-1,200	-68	-107	-175	3
All	**-3,200**	**-2,700**	**-610**	**-964**	**-1,574**	**-35**

[1] For this summary, SSWD used the WY types in FERC's FEIS for the YB/DS Projects. Simulated WY types were as described in SSWD Proposed Condition WR1 in Appendix E2 in Exhibit E of SSWD's Application for New License.
[2] Carryover storage is reservoir storage on October 31, carried over into the following year.

The additional storage space created by the Proposed Project would create marginal effects to annual water supply diversion in Above and Below Normal WYs. However, average annual water supply would be reduced by 3,200 ac-ft, largely a result of reduced inflow in Dry and Critical WYs, the increase in required minimum flows, and the addition of pulse flows downstream of the non-Project diversion dam in most WY types under the new license.

Water diversions downstream of the Project have a major effect on flow in the lower Bear River. From approximately April 15 through October 15, flows up to 510 cfs are diverted at the non-Project diversion dam to meet downstream agricultural water demands during this period. Figure 3.3.2-54 illustrates the difference in Project releases below Camp Far West Dam and flows in the Bear River downstream of the non-Project diversion dam for the agricultural diversion period under the No Action Alternative and the Proposed Project (Near-Term). The difference in flow between these two locations is the result of agricultural diversions at the non-Project diversion dam. The Project provides water to CFWID and SSWD, but the Project itself does not include any in-basin or out-of-basin diversions. Diversions downstream of the project will continue with or without the continued operation of the Project.

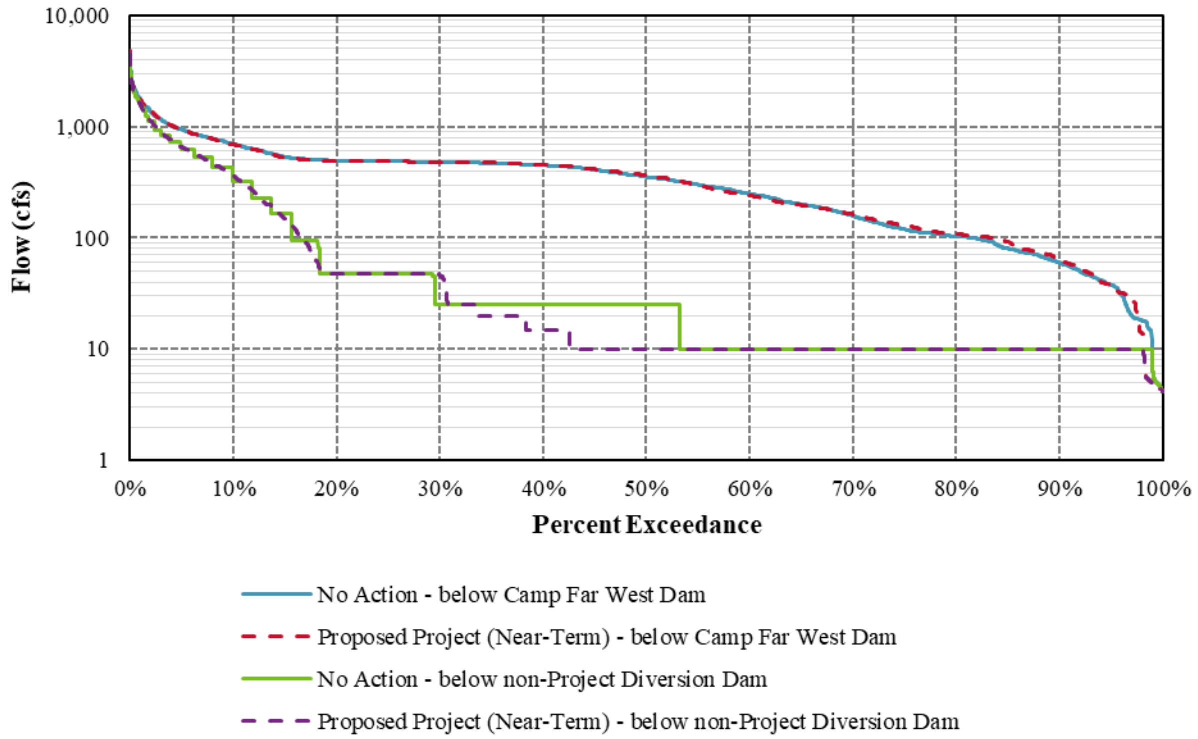

Figure 3.3.2-54. Exceedance curves of modeled mean daily flows below Camp Far West Dam and the non-Project Diversion Dam for the No Action Alternative and Proposed Project for WYs 1976 through 2014, limited to April 15 through October 15.

In addition to downstream diversions and upstream inflow, the presence of historical mining debris upstream of the Project impacts flows in the lower Bear River. Hydraulic mining debris located in streambeds upstream of the Project are mobilized during high flow events and deposited in Camp Far West Reservoir, resulting in a gradual loss of reservoir storage capacity through time. As storage capacity is lost, the ability of the reservoir to capture inflows during high flow events is reduced. As a result, Camp Far West Reservoir will spill sooner, and will have less ability to store water for subsequent reservoir releases. While reservoir sedimentation does not affect the quantity of water in the lower Bear River, it does affect the timing and magnitude of river flows. SSWD estimated a loss of approximately 10 percent of storage due to sedimentation based on the results of bathymetry surveys in 1968 and 2008, however some of this difference is likely attributed to advances in survey technology. Additional discussion of sedimentation in Camp Far West Reservoir is provided in Section 3.3.1.1.6 of this Exhibit E.

Timber harvesting and grazing also affect water quantity. Timber harvesting and grazing has occurred historically within the watershed, although it is on the decline. A decrease in timber harvesting would result in less inflow to Camp Far West Reservoir and less flow in the lower Bear River from water uptake by trees located upstream of the Project. Conversely, a decrease in grazing would result in more inflow to Camp Far West Reservoir and more flow in the lower Bear River. Overall, impacts from timber harvesting and grazing are minor.

3.3.2.3.2 Cumulative Effects on Water Quality

Impoundment of water by the Project and upstream water projects, downstream diversions, historical mining, timber harvesting, and grazing each cumulatively affect water quality and water temperature in Camp Far West Reservoir and in the lower Bear River.

Water Quality

Generally, water quality in Camp Far West Reservoir and in the lower Bear River is good and meets Basin Plan Water Quality Objectives for the majority of constituents. During SSWD's relicensing study, one constituent, alkalinity, exceeded the Water Quality Objective for samples upstream of Camp Far West Reservoir, in the reservoir, and downstream of Camp Far West Reservoir. Aluminum and iron concentrations exceeded Water Quality Objectives in Camp Far West Reservoir and downstream of the Project. Elevated metals are likely the result of legacy mining that happened throughout the Bear River watershed. The Proposed Project does not include any actions to introduce metals into Camp Far West Reservoir or the lower Bear River. If the Proposed Project was removed, trace metals from historic mining would still be present and transported downstream in the Bear River.

The presence of mercury, also a legacy from the long history of mining, has led to concerns regarding mercury concentrations in edible fish (Section 3.3.2.1.2). However, these concerns occur throughout the watershed, as they do in most California streams where gold mining occurred, and the potential to bioaccumulate mercury in fish is not exacerbated by the Proposed Project. OEHHA, the California agency responsible for advising the public of health concerns, has issued fish ingestion advisories for Camp Far West Reservoir. Further, with the except of rainbow trout, the fish in Camp Far West Reservoir that OEHHA has issued advisories for (e.g. bass and bluegill) are not native and were stock by resource agencies or the public, not SSWD. Mercury concentrations do not exceed the Water Quality Objective based on SSWD's study and, with the exception of one sample collected near the bottom of Camp Far West Reservoir, were similar upstream, within, and downstream of the Project. The Proposed Project does not include any actions to introduce mercury into Camp Far West Reservoir or the lower Bear River. If the Proposed Project were removed, mercury from historic mining would still be present and transported downstream in the Bear River.

Water Temperature

SSWD's Proposed Project, in combination with upstream projects and downstream diversions, affect water temperature in the lower Bear River. As discussed in 3.3.2.3.2, water diversions downstream of the Project have a major effect on flow in the lower Bear River. Consequently, water diversions also have a major effect on water temperature. With less water in the river, water temperature reaches ambient equilibrium quicker. Temp Model results showed that ambient conditions are present in the lower Bear River from approximately Highway 65 to the confluence with Dry Creek for much of the year (Figures 3.3.2-30 through 3.3.2-32).

Proposed Project Camp Far West Reservoir releases are cooler in summer months than Bear River inflow temperatures under Near-Term and Future conditions as shown in Figure 3.3.2-55 for a representative wet WY (1995), in Figure 3.3.2-56 for a representative normal WY (2003), and in Figure 3.3.2-57 for a representative dry WY (2001). Approximately 5 miles downstream of the non-Project diversion dam, near Highway 65, Bear River water temperatures reach ambient equilibrium and are similar to water temperatures in the Bear River upstream of the Project.

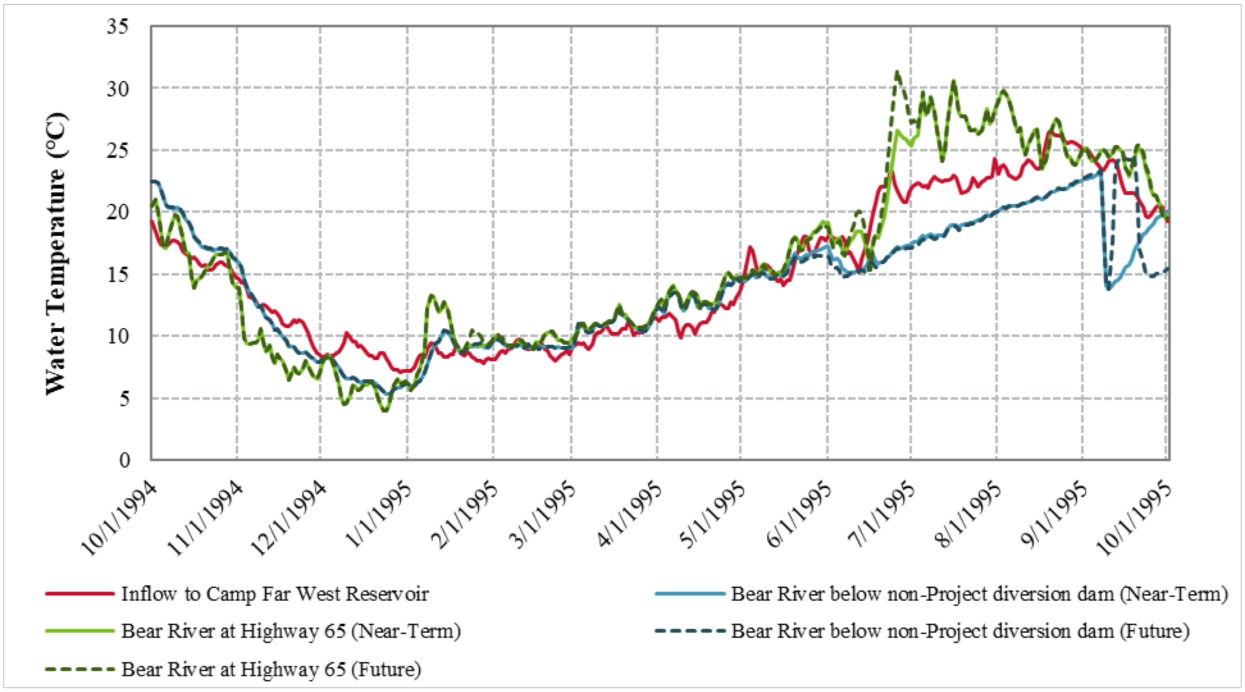

Figure 3.3.2-55. Simulated daily average water temperatures for a representative wet WY (1995) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

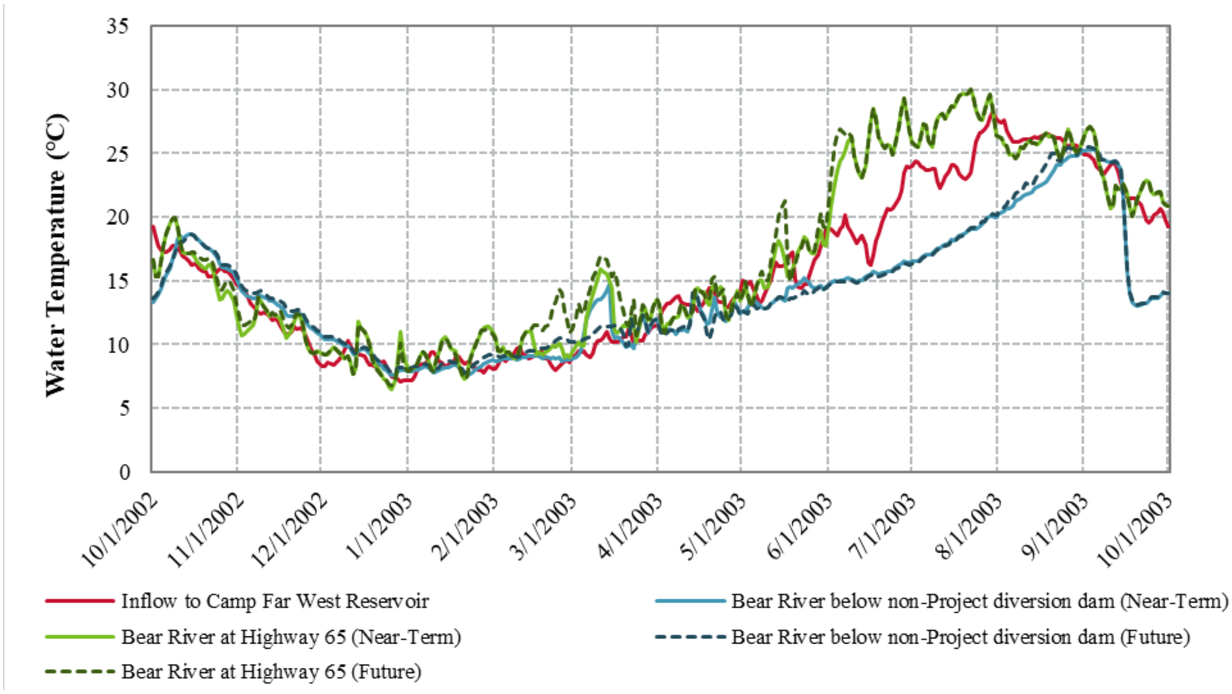

Figure 3.3.2-56. Simulated daily average water temperatures for a representative normal WY (2003) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

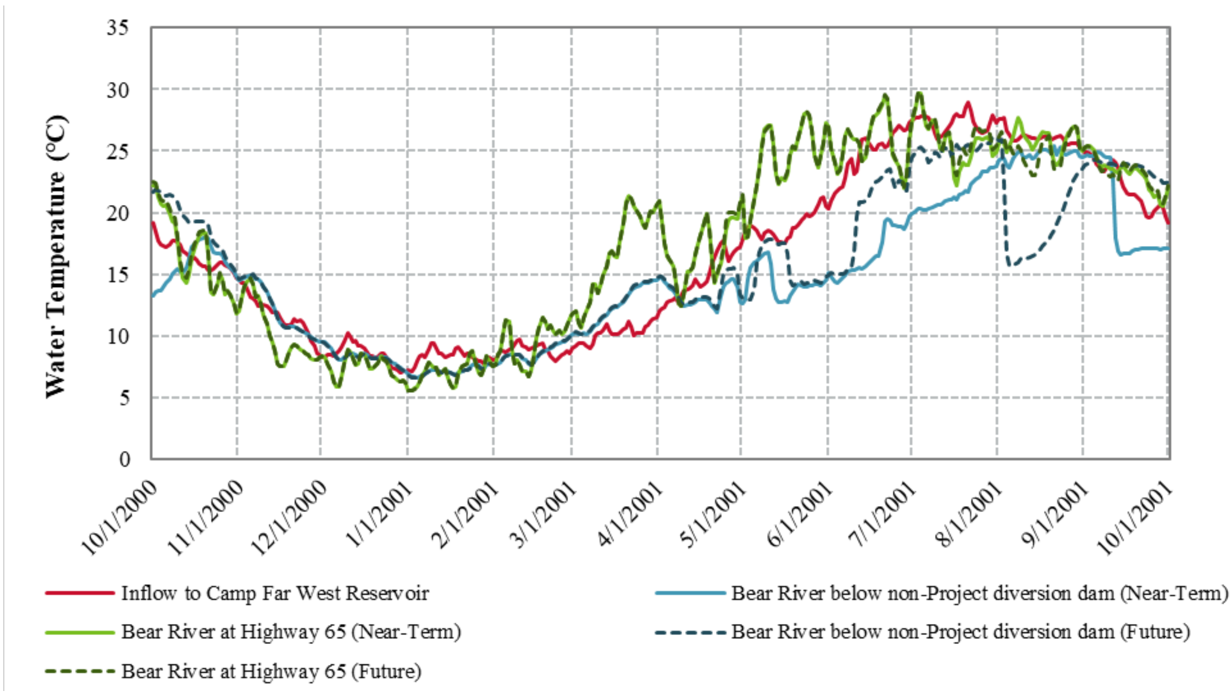

Figure 3.3.2-57. Simulated daily average water temperatures for a representative dry WY (2001) at various locations Bear River downstream of the non-Project diversion dam for the Proposed Project (Near-Term and Future) relative to reservoir inflow temperature.

As discussed in Section 3.3.2.3.1, Bear River inflow to Camp Far West Reservoir from upstream projects is projected to decrease because of changes in upstream project operations and increased water demands. Wet season spills from upstream reservoirs will occur less, as upstream reservoirs will capture more of the watershed runoff. This will impact the volume of available coldwater in Camp Far West Reservoir.

With decreased inflow, Camp Far West Reservoir water levels will be lower in Below Normal, Dry, and Critically Dry WYs. As a result the powerhouse intake is closer to the surface of the reservoir, making releases from higher in the metalimnion layer. This is seen in Figure 3.3.2-57 from mid-June through July. Camp Far West Reservoir releases temperatures are warmer under the Future condition relative to the Near-Term condition.

3.3.2.4 Unavoidable Adverse Effects

Operating and maintaining the Project consistent with SSWD's proposed conditions would not create any significant or unavoidable adverse effects. Camp Far West Reservoir will continue to truncate high flows that enter Camp Far West Reservoir and augment low summertime and fall flows, which will affect water quantity. However, storage in Camp Far West Reservoir would occur with or without the Project since it is necessary to meet CFWID and SSWD irrigation demands now and into the future. For that reason, long-term Project effects on water quantity are considered minor and cumulative.

Camp Far West Reservoir will continue to trap sediment contaminated with mercury, a legacy of hydraulic mining which historically occurred upstream of the Project. However, sediment would be trapped in Camp Far West Reservoir with or without the Project since it is necessary to meet CFWID and SSWD irrigation demands now and into the future. For that reason, long-term Project effects on water quantity are considered minor and cumulative.

Water temperatures in the Bear River downstream of the Project exceed 20°C in every year in both the Proposed Project and No Action Alternative (Tables 3.3.2-22 through 3.3.2-25). Cold water is limited in the Bear River because the watershed is relatively low in elevation (i.e., <5,000 ft) and experiences precipitation as rainfall rather than snowfall. As shown in Table 3.3.2-23, there is a small increase in usable cold water pool volumes below 10°C and 15°C in the Proposed Project compared to the No Action Alternative. However, even if Camp Far West Reservoir releases were made entirely from the low-level outlet, located approximately 46 ft below the powerhouse intake, there is not enough coldwater pool to maintain colder water temperatures in the Bear River below the Project. For that reason, long-term Project effects on water quantity and quality are considered minor and cumulative.

3.3.2.5 PM&E Measures Not Adopted by SSWD

As described in Appendix E4, five comment letters or emails (provided in Appendix E3) were submitted regarding SSWD's DLA. SSWD reviewed each letter or email and, with regards to Water Resources, no proposals or comments to modify a SSWD proposed measure or add a new measure were identified.

3.3.2.6 List of Attachments

None.