



**KINGS RIVER FISHERIES MANAGEMENT PROGRAM  
ANNUAL TECHNICAL REPORT  
Water Year 2020-2021**



*Executive Policy Committee*

Steve Haugen, KRWA

David Merritt, KRC D

Gerald Hatler, CDFW

Steve Haugen  
*Executive Officer*  
559.266.0767

4888 E. Jensen Ave  
Fresno, CA 93725

Prepared by Technical Steering Committee

Steve Haugen (member)  
Matthew Meadows (alternate)  
KINGS RIVER WATER ASSOCIATION

Soua Lee (member)  
Lori Werner (alternate)  
KINGS RIVER CONSERVATION DISTRICT

Brian Beal (member)  
Kenneth Johnson (alternate)  
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

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## EXECUTIVE SUMMARY

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The Kings River Water Association, Kings River Conservation District, and California Department of Fish and Wildlife have jointly implemented habitat and trout population enhancement projects and conducted a series of monitoring programs in the lower Kings River and Pine Flat Reservoir. These habitat enhancement projects have been implemented over the past eighteen years in response to the Kings River Fisheries Management Program (KRFMP) Framework Agreement, which was approved on May 28, 1999, with the financial commitment extended for another ten-year period on June 26, 2009, and again on May 28, 2019. The Framework Agreement includes actions designed to protect and enhance fishery habitat within the lower Kings River and in Pine Flat Reservoir. The Technical Steering Committee is responsible for implementing the actions authorized under the agreement and approved by the Executive Policy Committee. The scope of activities undertaken as part of the KRFMP between October 2020 and September 2021 described in this annual technical report includes: a compilation and synthesis of information regarding habitat enhancements, trout population enhancements, and monitoring activities conducted as part of the KRFMP. Report timeline for activities includes Water Year 2021 (October 1, 2020- September 30, 2021) and CDFW stocking activity for Calendar year 2021.

Key Elements of the program in recent years includes:

- Most instream flow targets met as outlined in the Framework Agreement, with most days greatly exceeding these targets;
- Kings River Fisheries Management Program website improved and maintained;
- Incubated 205,000 rainbow trout eggs in the incubator building;
- Continued implementation of a supplemental Rainbow Trout stocking plan in addition to CDFW annual budgeted stocking program;
- Signed a contract with Cramer Fish Sciences to provide a technical memorandum and create 30% concept designs for two of the sixteen habitat enhancement projects identified in their 2019 report, *Lower Kings River Habitat Characterization and Identification for habitat Enhancement Opportunities* – Cramer Fish Sciences;

## **1.0 INTRODUCTION**

The Kings River Water Association (KRWA), Kings River Conservation District (KRCD), and California Department of Fish and Wildlife (CDFW) have jointly implemented habitat and trout population enhancement projects and conducted a series of monitoring programs in the lower Kings River and Pine Flat Reservoir. These habitat enhancement projects have been implemented over the past twenty years in response to the Kings River Fisheries Management Program (KRFMP) Framework Agreement, which was approved on May 28, 1999. The Framework Agreement includes actions designed to protect and enhance fishery habitat within the lower Kings River and in Pine Flat Reservoir. The Technical Steering Committee (TSC) is responsible for implementing the actions authorized under the agreement and approved by the Executive Policy Committee. The scope of activities undertaken as part of the KRFMP between October 2020 and September 2021 and CDFW stocking in 2021 described in this annual technical report includes:

- Monitoring hydrology and operations including inflow to Pine Flat Reservoir, reservoir storage, reservoir releases, operation of remote sensing telemetry systems, turbine bypass operation, and activities to implement enhanced winter flows for fishery habitat as outlined in Exhibits C and D of the Framework Agreement;
- Monitoring water quality including water temperature and dissolved oxygen within Pine Flat Reservoir and the lower Kings River, compliance with dissolved oxygen requirements within the lower river, and planning and monitoring water temperature conditions at the completion of the irrigation season;
- Routine fish stocking by the CDFW, KRFMP supplemental stocking, and continued contributions of rainbow trout fry produced from the incubator building.

The annual report provides a project management structure for reviewing and prioritizing existing and proposed activities, fish stocking, and implementation of other elements contained in the Framework Agreement. Results of the fishery and habitat monitoring program are intended to provide a technical and scientific framework for identifying design criteria and priorities for determining the appropriate scale and location of habitat enhancement projects, linkages among potential projects to maximize biological benefits and reduce cost, identify priorities for habitat enhancement project locations, and identify potential opportunities for expanding enhancement projects through funding augmentation from collaborative grant applications from state, federal, and private funding sources. In addition, one of the key objectives of the annual report improves coordination and communication among the parties involved in implementing various elements of the Framework Agreement, and to facilitate a process for reviewing and evaluating the performance of management actions in achieving the overall goals of the KRFMP.

## 1.1 ADMINISTRATIVE ACTIVITIES

Along with the financial commitment, in-kind support from KRFMP agencies are estimated below. In-kind support may include staff time for data collection, weir management, analysis, reporting, water operations, meetings, and other administrative activities which vary by agency. The following tables show estimates of agency in-kind support for October 1, 2020 through September 30, 2021; KRWA (Table 1-1), KRCD (Table 1-2), CDFW (Table 1-3). Estimated in-kind support from agencies for the KRFMP was 3,223 hours or about 1.55 Full-Time Equivalent (FTE). Additionally, volunteers involved with assisting the KRFMP are vital for the program success, providing approximately 174 hours of service (Table 1-4).

The in-kind support does not account for CDFW fish stocking or the loss of water supply and storage loss for temperature control pool management. Section 5 outlines stocking activities related to the KRFMP. In 2021, the CDFW allotment for the Kings River included approximately \$172,725 or 35,250 pounds of catchable size trout to the Lower Kings River, Avocado Lake, and Pine Flat Reservoir. Fish stocking by CDFW also included approximately \$47,530 or 9,700 pounds of fish in sub-catchable, super-catchable, and trophy size trout. Section 2 outlines hydrologic conditions for Water Year 2021. The temperature control pool has been maintained above 100,000 acre-feet, a storage volume unavailable to water users.

**Table 1-1: Estimate of KRWA In-Kind Support for the KRFMP, October 1, 2020 - September 30, 2021**

<b>KRFMP Support Activity</b>	<b>Hours/Year</b>	<b>Days/Year</b>	<b>FTE</b>
Weir Management (Dennis Cut)	115	14.4	0.06
Weir Management (Fresno Weir)	130	16.3	0.06
Education and Outreach	12	1.5	0.01
River Operations	375	46.9	0.18
Reservoir Operations	65	8.1	0.03
Incubator Operation and Fry Release	45	5.6	0.02
Internal Water Accounting	104	13.0	0.05
Administrative Activities	420	52.5	0.20
<b>Total In-Kind Support</b>	<b>1266</b>	<b>158.3</b>	<b>0.61</b>

**Table 1-2: Estimate of KRCD In-Kind Support for the KRFMP, October 1, 2020 -September 30, 2021**

<b>KRFMP Support Activity</b>	<b>Hours/Year</b>	<b>Days/Year</b>	<b>FTE</b>
Administrative	966	120.8	0.46
Education Outreach	20	2.5	0.01
Fishing Access Maintenance	12	1.5	0.01
Incubator Fry Release	45	5.6	0.02
Incubator Operation	396	49.5	0.19
Pine Flat Reservoir Profile	84	10.5	0.04
Public Relations/Outreach	50	6.3	0.02
<b>Total In-Kind Support</b>	<b>1573</b>	<b>196.6</b>	<b>0.76</b>

**Table 1-3: Estimate of CDFW In-Kind Support for the KRFMP, October 1, 2020 - September 30, 2021**

<b>KRFMP Support Activity</b>	<b>Hours/Year</b>	<b>Days/Year</b>	<b>FTE</b>
Fall Electrofishing Survey	0	0	0
Administrative Activities	384	48	0.18
<b>Total In-Kind Support</b>	<b>384</b>	<b>48</b>	<b>0.18</b>

**Table 1-4: Estimate of Volunteer Hours for the KRFMP, October 1, 2020 -September 30, 2021**

<b>KRFMP Support Activity</b>	<b>Hours/Year</b>	<b>Days/Year</b>	<b>FTE</b>
Incubator Operation	3	0.4	0.00
Public Advisory Group	57	7.1	0.03
River Clean-up	114	14.3	0.05
<b>Total In-Kind Support</b>	<b>174</b>	<b>21.8</b>	<b>0.08</b>

## **1.2 ANNUAL TECHNICAL REPORT**

Interested parties and stakeholders, including the KRFMP Executive Policy Committee (ExCom), KRFMP Public Advisory Group (PAG), resource and water agencies, local angling groups, and others have expressed interest in the information being collected as part of the KRFMP's monitoring program. Preparation and distribution of an Annual Technical Report has been identified as a useful method of conveying information regarding the program status and monitoring results to interested parties.



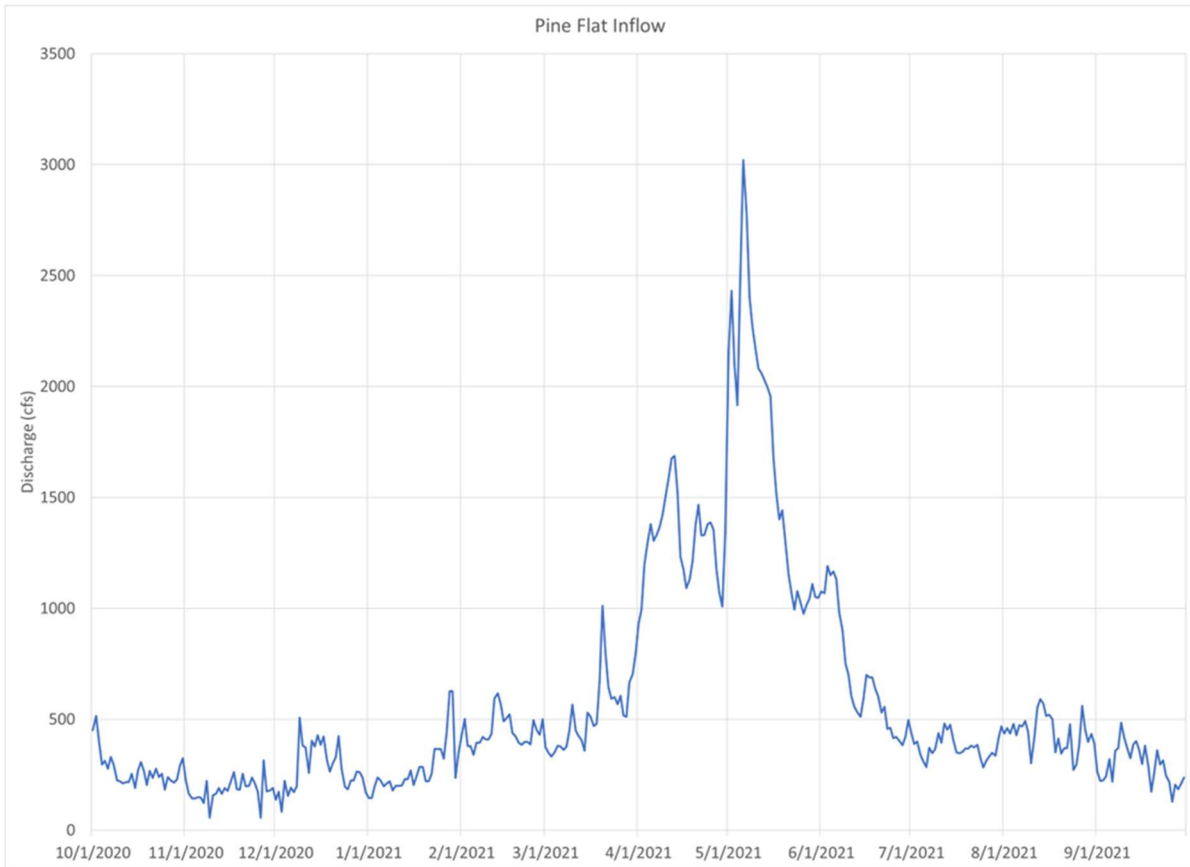
## 2.0 HYDROLOGY AND OPERATIONS

### 2.1 RESERVOIR INFLOW

Daily average inflow into Pine Flat Reservoir from hydrologic year 2021, October 1, 2020 through September 30, 2021, are shown in Figure 2-1. Inflow into Pine Flat Reservoir is characterized by high seasonal and inter-annual variability reflecting variation in precipitation, snowpack, and runoff within the watershed. Kings River basin discharge averaged 566 cfs, ranging from 56 to 3,020 cfs. Table 2-1 shows the Kings River calculated annual runoff and the corresponding percent water year for the past 21 years; years included in this report are in bold text.

**Table 2-1: Kings River basin calculated annual runoff by Water Year, October-September**

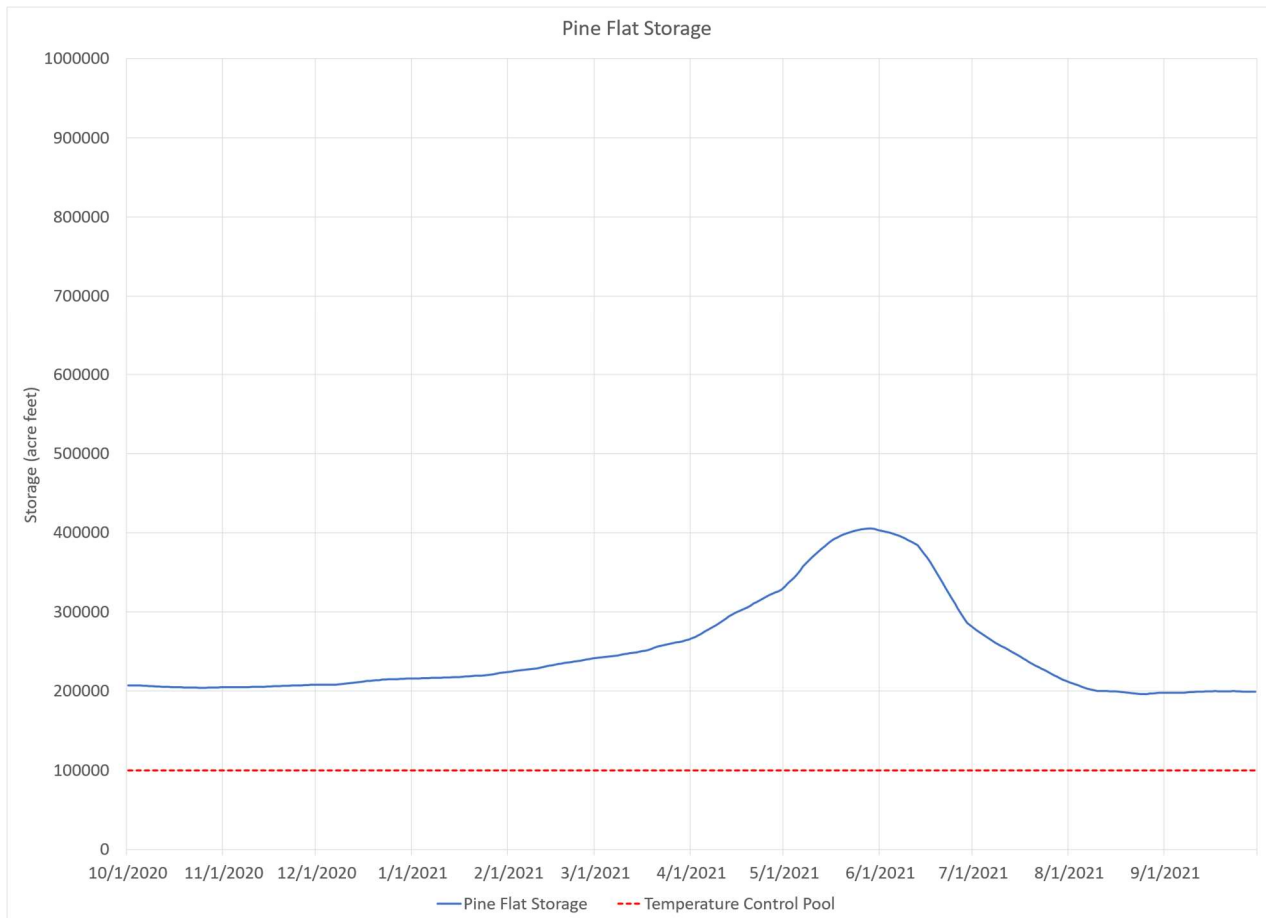
Water Year (Oct-Sept)	Annual Runoff (TAF)	Percent Water Year
2000	1,534	91%
2001	1,010	60%
2002	1,141	67%
2003	1,426	84%
2004	1,050	62%
2005	2,531	149%
2006	2,952	174%
2007	679	40%
2008	1,216	72%
2009	1,348	80%
2010	2,062	122%
2011	3,318	196%
2012	826	49%
2013	691	41%
2014	537	32%
2015	361	21%
2016	1,253	74%
2017	4,096	242%
2018	1,275	75%
2019	2,177	171%
2020	913	54%
<b>2021</b>	<b>396</b>	<b>23%</b>



**Figure 2-1: The annual inflow into Pine Flat Reservoir from October 1, 2020 through September 30, 2021**

**2.2 RESERVOIR STORAGE**

Daily reservoir water storage volume in Pine Flat Reservoir from October 1, 2020 through September 30, 2021 is shown in Figure 2-2. Reservoir storage reflects the combined effects of reservoir inflow, releases from Pine Flat Reservoir to the lower Kings River, and evaporation. As part of the Framework Agreement, a voluntary 100,000 acre-feet temperature control pool was established. Pine Flat reservoir storage was maintained above the temperature control pool during this report period.



**Figure 2-2: Average daily storage in Pine Flat from October 1, 2020 through September 30, 2021**

### 2.3 RESERVOIR RELEASES

Framework Agreement established minimum instream Exhibit C and Exhibit D flow releases from Pine Flat Reservoir (Figure 2-3), flow at Piedra (Figure 2-4), in Dennis Cut (Figure 2-5), to Fresno Weir (Figure 2-6) and below Fresno Weir (Figure 2-7) to support resident fish populations in the lower river (Table 2-2).

Water discharge from Pine Flat Reservoir to the lower Kings River show high variability within the year as shown in Figure 2-3. Average daily discharge from Pine Flat in the lower Kings River from October 1, 2020 through September 30, 2021 ranged from 95 to 3,929 cfs, all above target flows. Average discharge from Pine Flat was 561 cfs during the report period.

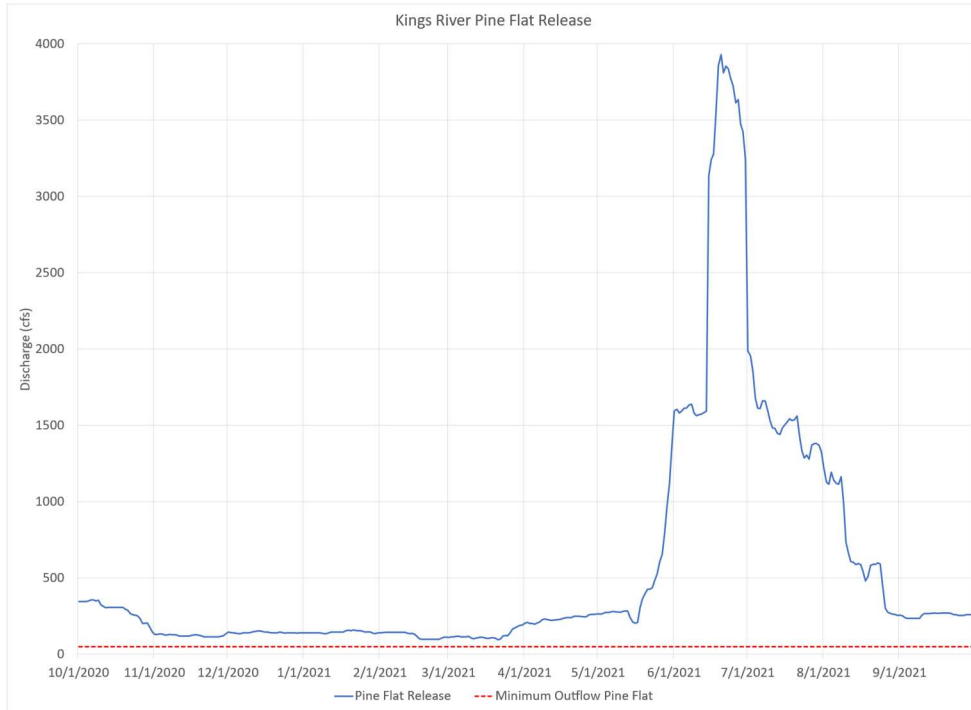
Daily average Kings River flow at Piedra from October 1, 2020 through September 30, 2021 ranged from 100 to 3,929 cfs, all above target flows. Flow at Piedra averaged 565 cfs during the report period.

Daily average flow at Dennis Cut from October 1, 2020 through September 30, 2021 demonstrated two slight departures from the 5 cfs target as outlined in the Framework Agreement, 2-days occurred with daily average flow of 4 cfs (Figure 2-5). These occurred on February 17-18, 2021 averaged 44 cfs during the report period, ranging from 4 to 100 cfs.

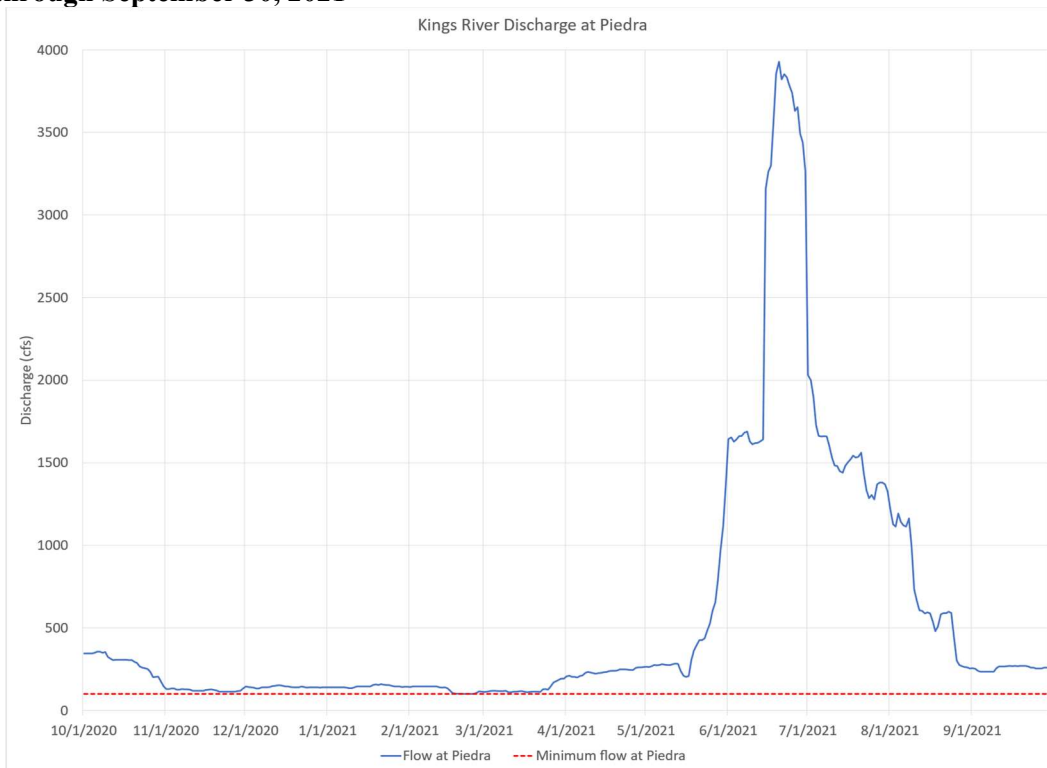
Target flow to Fresno Weir followed ‘Exhibit C’ flow schedule (Table 2-2) in WY 2021, due

to preceding year conditions in WY 2020. Daily average Kings River flow to Fresno Weir from October 1, 2020 through September 30, 2021 was 451 cfs, ranging from 90 to 3,679 cfs (Figure 2-6). Several departures from target flows occurred in WY 2021. Between January 9, 10, 11, 12, and 14, 2021, flow at Fresno Weir was 90, 91, 90, 94, and 93 cfs, respectively. These occurred immediately following a reduction in diversions at Fresno Weir. The average for the month of January was 97.5 cfs at Fresno Weir. Minimum air temperatures during this time period at Fresno Weir were 4.5-6.5°C, and water temperatures averaged 11.7°C at Fresno Weir. On March 1, 2021 resultant daily average flow to Fresno Weir was 94 cfs. At that time, an additional 1 cfs was diverted at Dennis Cut, which had 6 cfs instead of 5 cfs. Minimum air temperatures on March 1st at Fresno Weir was 10.3°C, and daily average water temperature was 13.7°C.

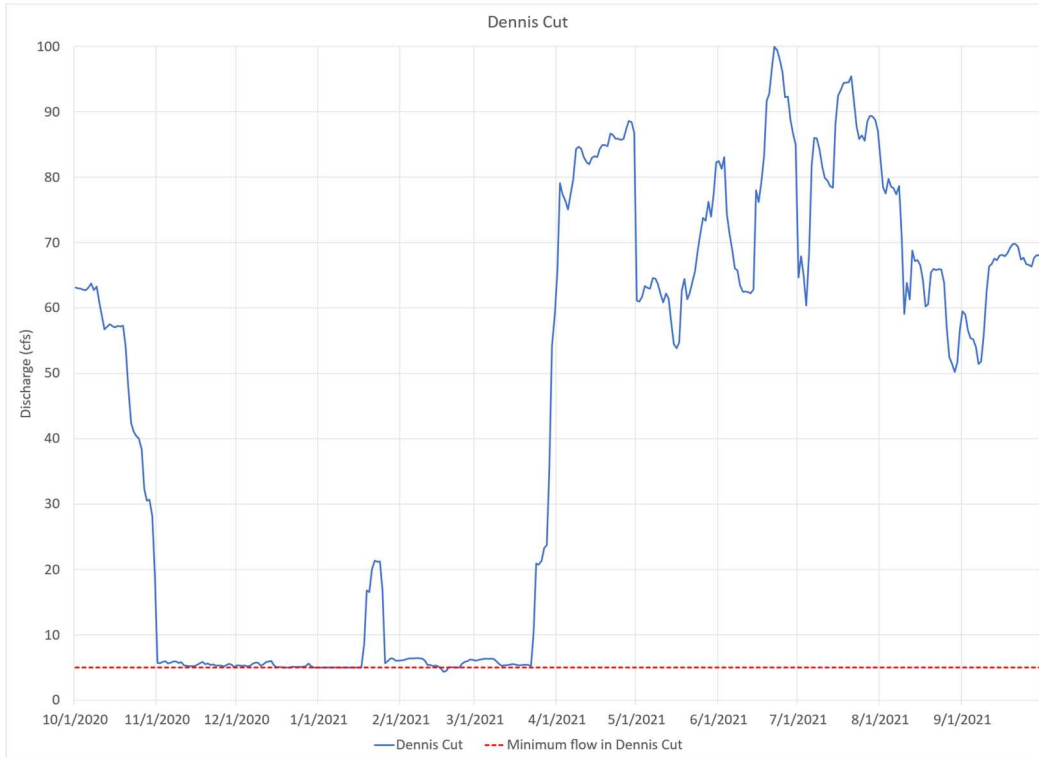
Daily average flow below Fresno Weir from October 1, 2020 through September 30, 2021 ranged from 30 to 2,019 cfs (Figure 2-7). Flow below Fresno Weir averaged 249 cfs during the report period. Several departures from target flows occurred in WY 2021. November 6, 2020 flow below Fresno Weir was 39 cfs. At that time, an additional 1 cfs was diverted at Dennis Cut, which had 6 cfs instead of 5 cfs. Minimum air temperatures on November 6th at Fresno Weir was 11.0°C, and daily average water temperature was 18.9°C. During the months of March and April, several departures from target flows over Fresno weir occurred, which were likely the result of release and diversion adjustments at times of changing unregulated inflow from Mill and Hughes creek, as well as increasing diversions into Dennis cut. The monthly average flow over Fresno Weir for March was 45.5 cfs (45 cfs required), and the monthly average flow over Fresno Weir for April was 38.2 cfs (35 cfs required). However, the daily average flows on March 1, 6, 7, 8, 11, 13, 14, 18, 22, 27 and April 16, 17, 19 were 43, 44, 44, 40, 44, 43, 43, 41, 44, 33, 33, 34 cfs, respectively. In most cases during real-time operations the reported flow was above target minimums. However, when final calculations were made, incorporating measurements, rating adjustments, and gauging's from multiple locations, the final calculated daily averages were below target. Average water temperature at Fresno Weir in March was 15.0°C. Average water Temperature in April was 18.8°C.



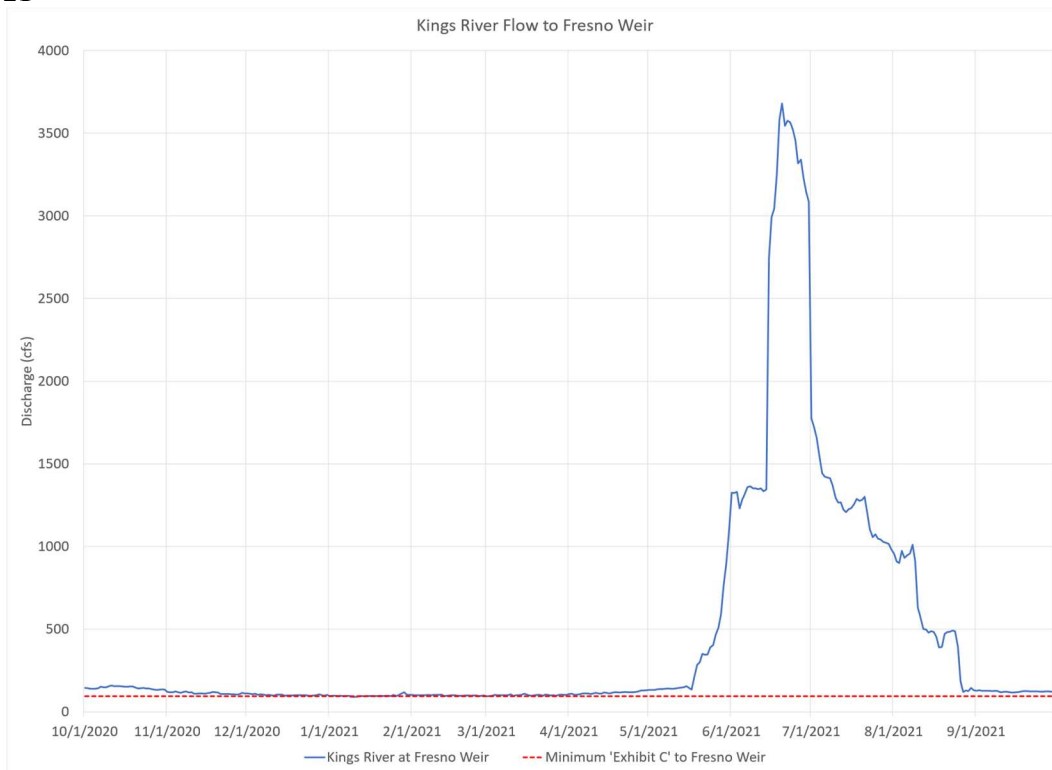
**Figure 2-3: Average daily discharge from Pine Flat into the Kings River from October 1, 2020 through September 30, 2021**



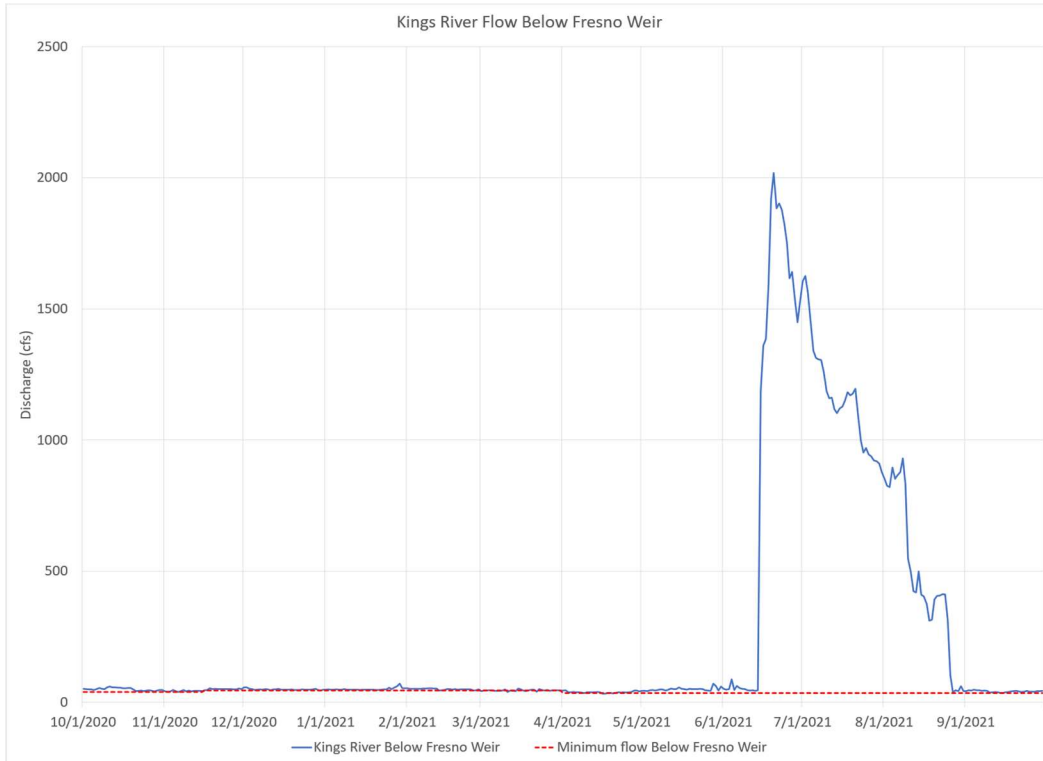
**Figure 2-4: Average daily flow of Kings River at Piedra from October 1, 2020 through September 30, 2021**



**Figure 2-5: Average daily flow in Dennis Cut from October 1, 2020 through September 30, 2021**



**Figure 2-6: Average daily flow of Kings River at Fresno Weir from October 1, 2020 through September 30, 2021**



**Figure 2-7: Average daily flow of Kings River below Fresno Weir from October 1, 2020 through September 30, 2021**

## 2.4 TELEMETRY SYSTEM

Use of real-time flow monitoring stations below Fresno Weir and at Dennis Cut continued. These systems provide data that supports informed decisions on water temperature and flow management after completing the irrigation and delivery season when elevated water temperatures may affect habitat quality for trout within the lower river. The real-time water temperature monitoring system complements temperature monitoring at fixed locations within the river (Section 3.1.2) for use in evaluating factors affecting habitat conditions and the potential health and condition of biota within the river.

## 2.5 EXHIBIT C AND D FLOWS

Minimum flow targets are dependent on prior water year volumes. Exhibit “D” flows were not required. Target flows observed were ‘Exhibit C’ flows for the entire Water Year (Table 2-2).

**Table 2-2. ‘Exhibit C’ target flows (cfs) from the Framework Agreement.**

<b>Exhibit C flows</b>	<b>Oct 1 - Nov 15</b>	<b>Nov 16 - Mar 31</b>	<b>Apr 1 - Sept 30</b>
Required from Pine Flat	50	50	50
Total flow at Piedra	100	100	100
Minimum in Dennis Cut	5	5	5
Minimum to Fresno Weir	95	95	95
Water divertible to China Slough	10	5	15
Required over Fresno Weir	40	45	35



## **2.6 SUMMARY**

Hydrologic conditions, Pine Flat Reservoir operations and flows within the lower river during Water Year 2021 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations for the third driest Water Year on record. Additionally, Water Years 2020-2021 ranked 5<sup>th</sup> for the driest 2-consecutive years on record. Findings and recommendations regarding hydrology and operations for this reporting period include:

- Pine Flat Reservoir operations were successful in maintaining the temperature control pool in the reservoir above the minimum level specified in the Framework Agreement;
- Daily average discharge from Pine Flat and Kings River flow at Piedra demonstrated 100% compliance with the instream flow targets as outlined in the Framework Agreement, with most days greatly exceeding these targets;
- A real-time telemetry system provided information on flow at Fresno Weir and Dennis Cut that is available for monitoring and managing conditions within the lower river as part of the fishery program;
- Flows levels representing Exhibit “C” flow schedule was observed during WY 2021, however, water orders often exceeded these requirements;
- Dennis Cut, King River to Fresno Weir, and Kings River Flow below Fresno Weir showed slight departures from target instream flow as outlined in the Framework Agreement, with most days greatly exceeding these flow targets.

## **3.0 WATER QUALITY**

Water quality monitoring as part of the KRFMP has focused on measurements of water temperature and dissolved oxygen concentrations that directly affect habitat quality for fish and macroinvertebrates within Pine Flat Reservoir and the lower Kings River.

### **3.1 RESERVOIR WATER QUALITY**

Reservoir temperature and dissolved oxygen measurements are monitored monthly throughout the year. Reservoir profile data are used in temperature control pool management during the fall months after completion of the irrigation season to provide suitable temperature conditions for trout and other fish species within Pine Flat Reservoir and the lower river. Water temperature at each outlet (dam and power plant) are used on a real-time basis for use in evaluating water temperature released from the reservoir into the lower Kings River. At the end of the prior water year releases through the dam were being provided via both the turbine bypass and low-level sluices. By taking advantage of blending colder water from the lower levels of the reservoir with well oxygenated water from the turbine bypass, conditions within the tailrace could be maintained better for the fishery than would have occurred otherwise. This blending continued until October 22, 2020 when releases blending ceased and all releases passed through the turbine bypass.

Vertical profiles in Pine Flat Reservoir of temperature and dissolved oxygen are collected on a regular basis. An example reservoir profile is presented in Figure 3-1. Appendix A includes monthly vertical reservoir temperature and dissolved oxygen profile measurements during the reporting period. A characteristic seasonal pattern of thermal stratification beginning in the spring includes formation of a reservoir hypolimnion (cold water layer near the bottom) and epilimnion (warmer water layer near the surface), which increases through the summer months. In the late fall and winter, the water temperature in the reservoir becomes almost uniform. Reservoir profiles indicate thermal stratification occurred in April through September (Appendix A). Destratification began in October, and temperatures were nearly isothermal through March (Appendix A). In many water bodies, turnover occurs during late fall and winter when cold air temperatures cool the upper layer of water so that the epilimnion is colder than the hypolimnion. Pine Flat Reservoir did not experience turnover in this reporting period. Reservoir profiles also indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir December through March and remained above 6.0 mg/L through May. By August, dissolved oxygen levels greater than 7.0 mg/L existed only within the epilimnion and approached 0 mg/L in the lower levels of the reservoir.

PINE FLAT RESERVOIR 10/14/2020 (Time: 1019-1102 New Buoy Line Placement  
 (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 761.66

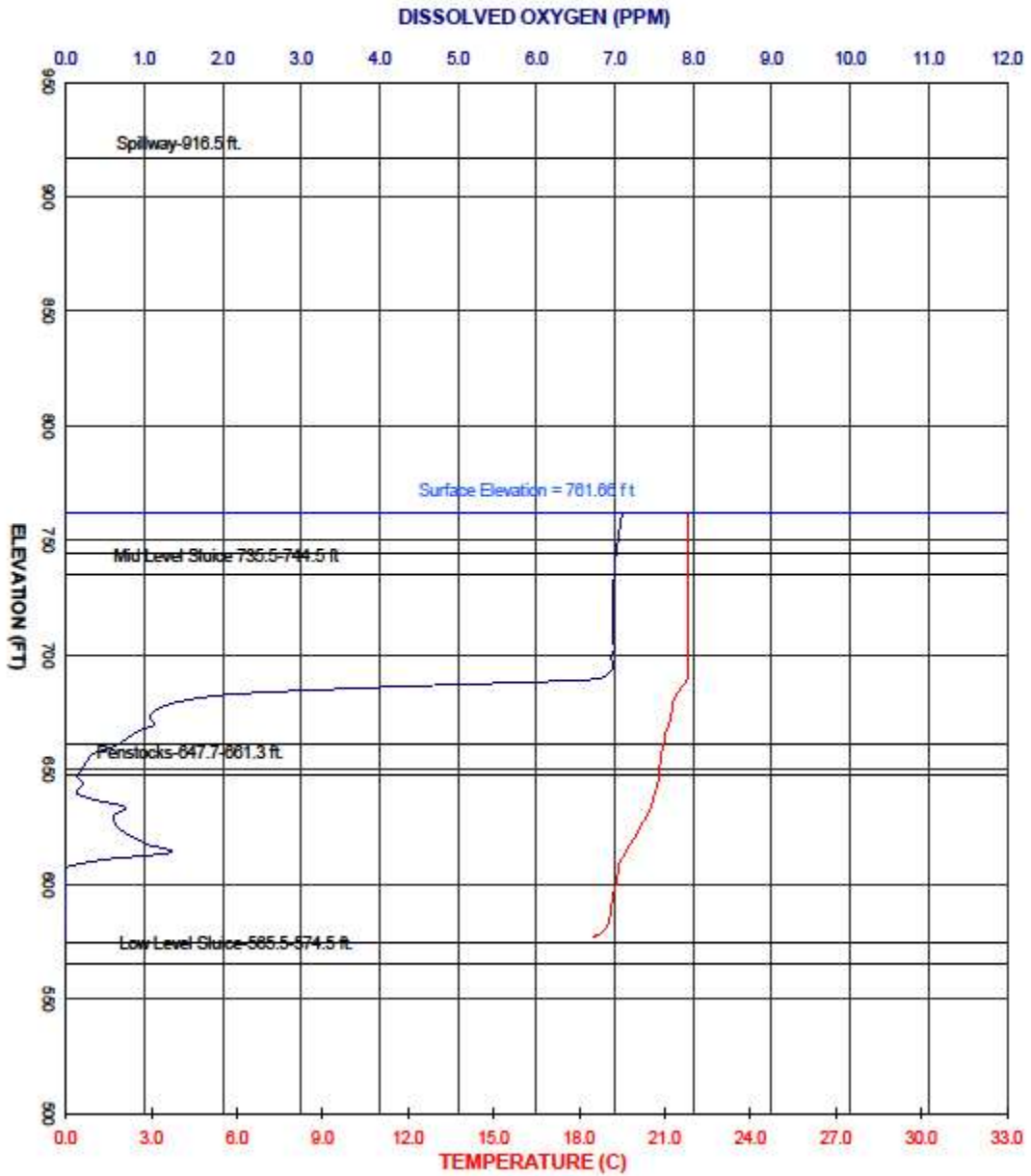
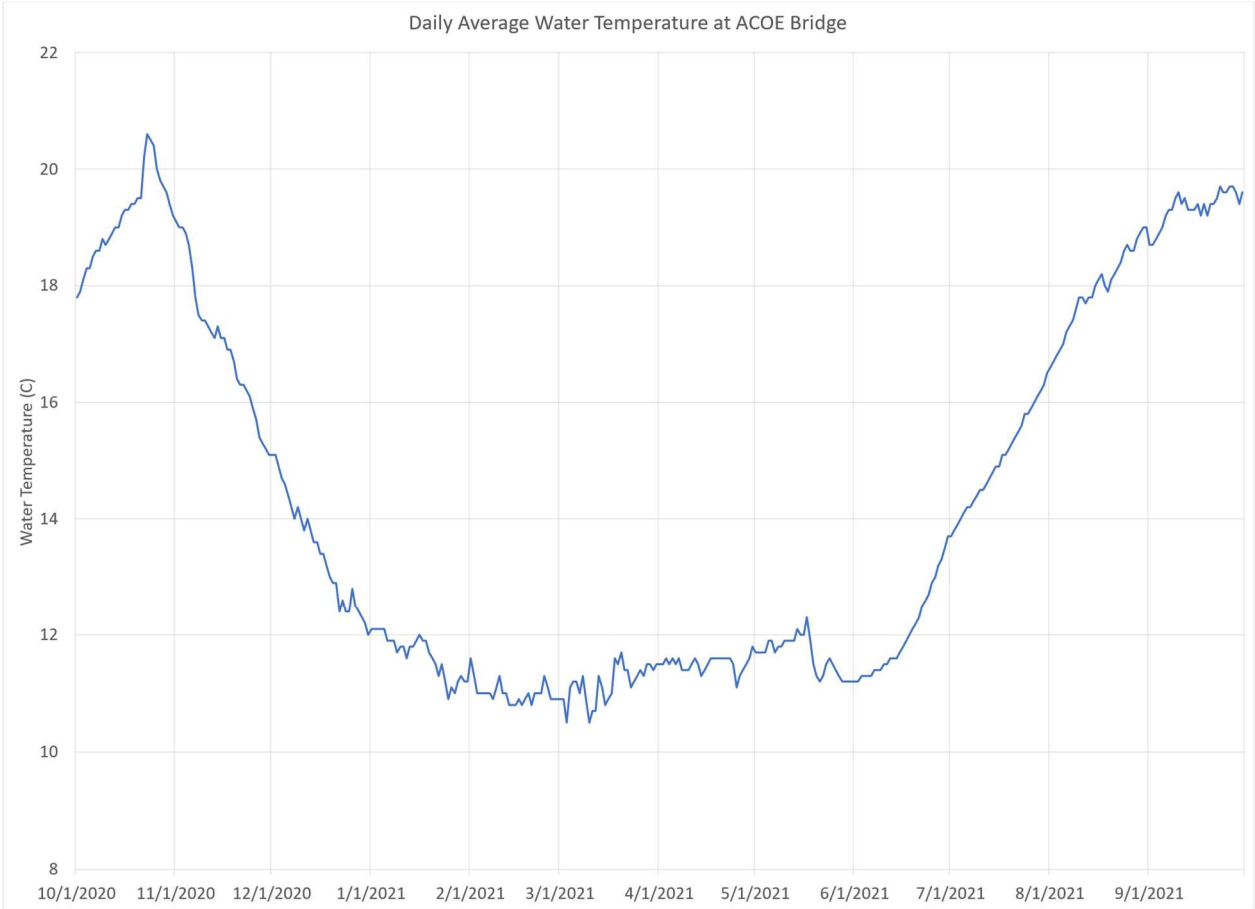


Figure 3-1: Pine Flat Reservoir profile taken 10/14/2020

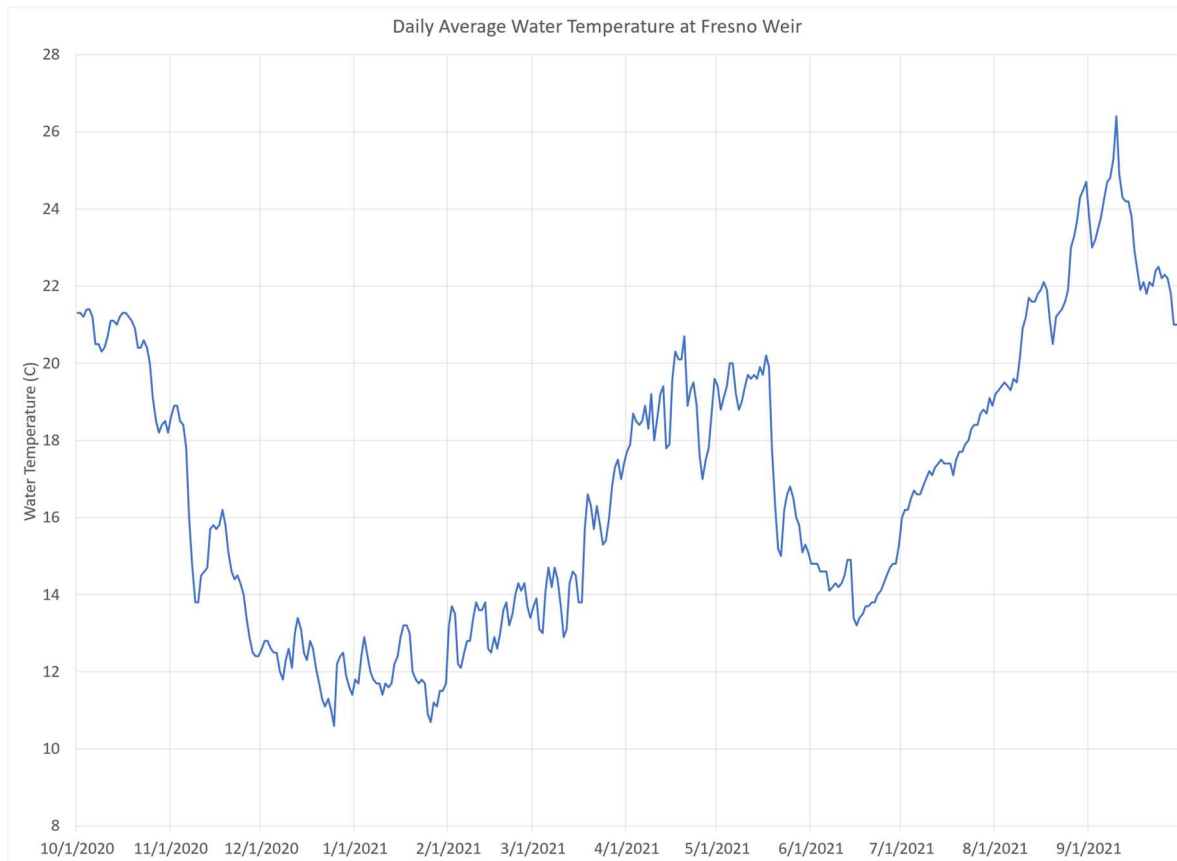
### 3.2 RIVER WATER QUALITY

Water temperature and dissolved oxygen concentrations within the lower Kings River are continuously monitored at the Army Corps of Engineers (ACOE) Bridge, which is located 0.6 miles downstream of Pine Flat Dam by a Eureka Manta. Water temperature is also measured at Fresno Weir at the stilling well in the weir pool. Although not ideal for measurement of main current temperature, these locations allow for real-time data collections throughout the season.

Average daily water temperature in the lower Kings River is shown for ACOE Bridge (Figure 3-2) and Fresno Weir (Figure 3-3). The daily minimum, maximum, and average water temperatures recorded at the ACOE Bridge were 9.3°C, 21.8°C, and 14.3°C respectively. The daily minimum, maximum, and average temperatures recorded at Fresno Weir were 10.6°C, 26.4°C, and 16.8°C. Throughout the season, daily average water temperature at Fresno Weir were approximately 2.5 °C higher than at ACOE Bridge. However, daily average water temperature at Fresno Weir were recorded as much as 9.1 °C higher and 3.6 °C lower than at ACOE Bridge. Efforts were made to keep temperatures below Pine Flat Dam suitable for the tailwater trout fishery. Water releases which blended cold water from the low-level sluices with the turbine bypass initiated in the prior water year continued through October 22, 2020. Upon cessation of blending with the low-level sluices a moderate increase in the daily average temperature of 0.6°C occurred, bringing the daily average above 20.0°C for the next five days.



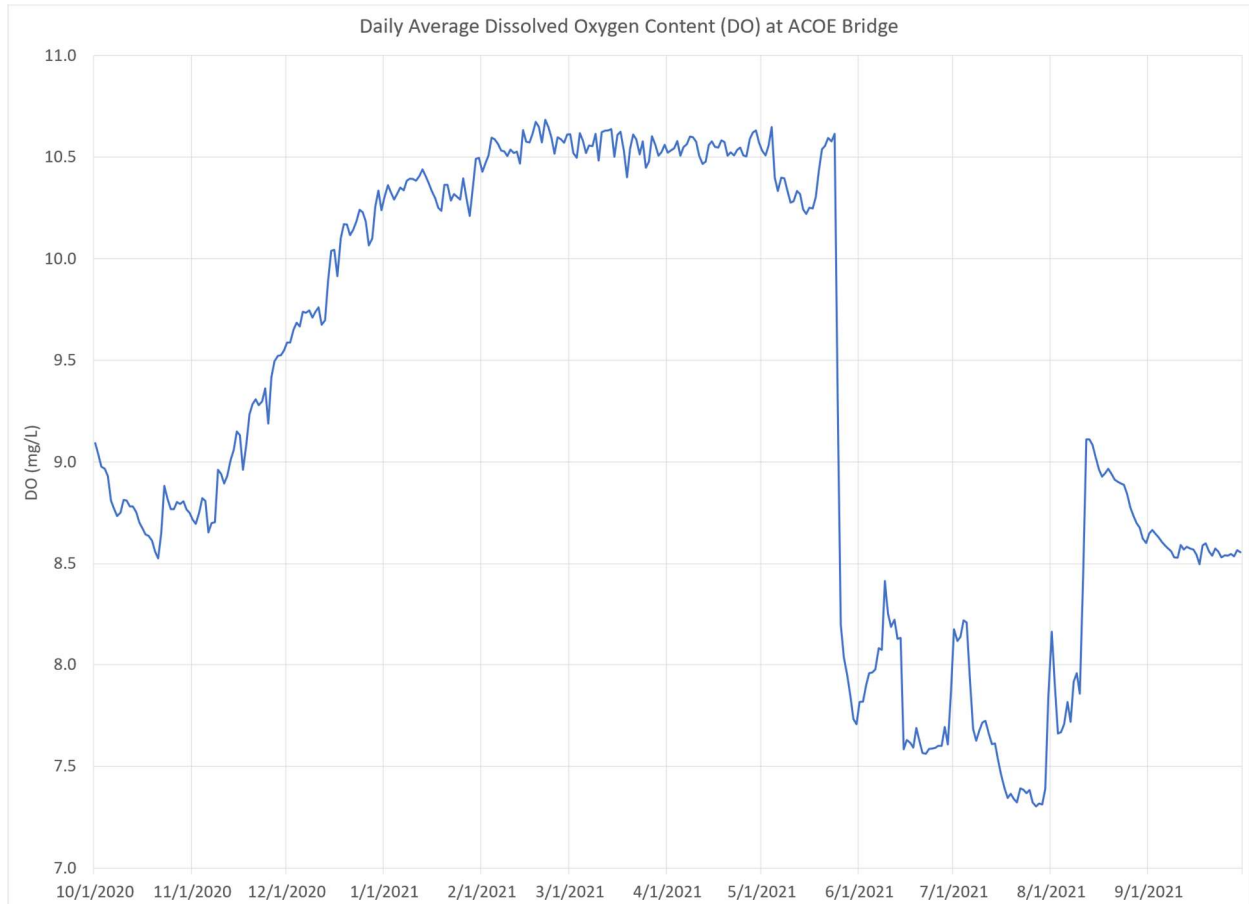
**Figure 3-2: Daily average water temperature at the ACOE Bridge October 1, 2020 through September 30, 2021.**



**Figure 3-3: Daily average water temperature at Fresno Weir October 1, 2020 through September 30, 2021**

Temperatures within the river have a seasonal pattern, with lowest temperatures occurring during the winter and early spring and increasing during the spring and summer months, with the greatest increase in seasonal temperatures occurring during the late summer and early fall after completion of the irrigation season. For much of the year, the diel temperature variation (difference between the maximum and minimum daily temperature) is typically lowest immediately downstream of Pine Flat Dam with diel temperature variation increasing as a function of distance downstream within the lower river. However, as atmospheric conditions cool in the fall and early winter, a reverse temperature gradient is observed, and cooler temperatures are recorded at Fresno Weir than at the ACOE Bridge.

During the 2020-2021 reporting period, dissolved oxygen concentrations within the lower Kings River remained within the range considered suitable for various fish and macroinvertebrate species that occur in this section of the river. The daily average dissolved oxygen concentration at the ACOE Bridge from October 2020 through September 2021 is presented in Figure 3-4. The Manta dissolved oxygen meter used for monitoring has an accuracy of  $\pm 0.1$  mg/L. Minimum and maximum dissolved oxygen content recorded during this reporting period was 7.1 mg/L and 11.5 mg/L respectively. The daily average dissolved oxygen content exceeded 7.3 mg/L throughout this reporting period, with an annual average of 9.3 mg/L.



**Figure 3-4: Daily average dissolved oxygen content at the ACOE Bridge October 1, 2020 through September 30, 2021.**

As a condition of the Federal Energy Regulatory Commission (FERC) Project License P-2741 license, KRCD is required to maintain a minimum dissolved oxygen concentration at the ACOE Bridge of 7.0 mg/L for the protection of fish and other aquatic organisms inhabiting the lower Kings River when the power plant is in operation. KRCD met its license operating and monitoring requirements for the duration of this reporting period.

### 3.3 SUMMARY

Several tools for managing water temperature in the lower river include cooperation from the ACOE in allowing the use of the lower sluice gates to release cold water during critical periods, and improved flexibility in managing water temperatures by using the turbine bypass. Water quality monitoring within Pine Flat Reservoir and the lower Kings River during Water Year 2021 have shown:

- Pine Flat Reservoir can become stratified during late spring, summer, and fall showing a characteristic pattern of warmer water near the surface (epilimnion) and colder water with reduced dissolved oxygen concentrations near the bottom of the reservoir (hypolimnion). Reservoir profile water temperature becomes almost uniform in the late fall and winter.

During the 2019-2020 water year reservoir profiles indicate thermal stratification occurred in the early fall and summer months. Destratification began in October and occurred throughout the winter into early spring. Pine Flat Reservoir did not experience lake turnover during the reporting period. Reservoir profiles also indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir during the winter and remained above 6.0 mg/L through May. By August, levels greater than 7.0 mg/L existed only within the epilimnion and approached 0 mg/L in the lower levels of the reservoir for the remainder of the water year.

- The temperature of water released from the reservoir into the lower river can be managed through selective operation of different outlet works, including the turbine bypass. The ability to manage water temperatures is limited by the availability of cold water in Pine Flat Reservoir at release points during critical times. The program successfully utilized releases from the low-level sluices for the benefit of the tailwater trout fishery beginning at the end of the prior water year and continuing through the first 22 days of this reporting period. Cooler water provided by these releases was successful in maintaining temperatures in the upper portion of the tailwater below 20°C except for the first five days of the water year, when the daily average release temperature was 20.6°C.
- Water temperatures are variable along a longitudinal gradient downstream of Pine Flat Dam. During much of the year the coldest temperatures are immediately downstream of the dam and temperatures typically increase with distance downstream. During the fall and winter, as atmospheric temperatures cool, a reverse temperature gradient may be observed with temperatures decreasing as a function of distance downstream.
- Aeration and mixing of water released from the reservoir are effective in maintaining suitable temperature and dissolved oxygen concentrations within the lower river. The daily average dissolved oxygen level exceeded 7.0 mg/L throughout the year.

#### **4.0 HABITAT ENHANCEMENT**

One goal of the KRFMP is to enhance the quality and availability of habitat for a variety of fish and macroinvertebrates within Pine Flat Reservoir and the lower Kings River. A brief description of the habitat enhancement projects planned and/or implemented as part of the KRFMP during the year is summarized below.

##### **4.1 RIVER**

Cramer Fish Sciences was contracted in 2018 to create a 2D hydrologic model, quantify the seasonal availability of spawning and rearing habitat by flow rate, locate and identify locations for future habitat enhancement projects and create weighted habitat suitability models. The final report was submitted to the KRFMP in September 2019. The document is anticipated to serve as a tool to direct future habitat enhancement projects within the tailwater fishery for rainbow trout. Findings indicated a substantial lack of spawning sized gravel in areas of seasonal inundation, channelization, fewer than optimal pool to riffle habitat transitions and a deficit in available habitat for young of the year. Upon approval by the Executive Committee (ExCom) in early 2020 the Technical Steering Committee (TSC) was tasked with reviewing the habitat enhancement projects

proposed in the report, and to make a recommendation back to the ExCom as to which project or projects should be pursued. During this reporting period the TSC selected and recommended to the ExCom the following habitat enhancement projects:

- Site ID 1 – Gravel augmentation or injection below the Pine Flat Bridge
  - This project entails the injection/placement of gravel for rainbow trout below the Pine Flat Bridge and will help replenish the coarse sediment supply immediately below Pine Flat Dam. Dependent on concept development gravel may be injected into high flow releases or augmented through riffle and bar construction. Key components to be identified include identifying available gravel sources, sediment augmentation volume, potential constraints, and feasibility of construction methods.
  
- Site ID 5 – Channel habitat restoration
  - This project is located on the right bank of the Kings River, approximately 0.8 miles downstream of Piedra Road. An area outside of the current baseflow channel would be excavated and lowered to facilitate inundation under current flow regimes. The key component to be identified is identifying available sources of sediment. Project actions include: 1) excavation of off-channel areas on river right, and 2) screening of excavated material and coarse sediment placement into the main river channel.
  
- SITE ID 6 – Thorburn Channel enhancements
  - This project would enhance juvenile rearing habitat for rainbow trout in the Thorburn Channel considering alterations to the intake structure and grading of the channel. This project will examine if structure removal benefits habitat performance and/or if modifications to the side channel’s topography could improve physical habitat and water temperature.

The ExCom approved the selections of Site ID 1 and 6, but not Site ID 5 in May 2021. A contract was signed with CFS to conduct visits at the two approved sites, determine potential gravel sources, develop 30% concept designs, and produce a technical memorandum. Work began late in this reporting period and is expected to be completed in the 2021-2022 reporting period.

## **4.2 PINE FLAT RESERVOIR**

The KRFMP budgets for projects to enhance and/or benefit the fishery created within Pine Flat Reservoir. The Pine Flat ACOE staff has been instrumental in helping the program discern the size, type, and locations of such projects. In addition, the ACOE has provided the necessary personnel and logistic resources needed to ensure project completion. In 2021, due to the ongoing Covid-19 pandemic and mandated social distancing guidelines, no reservoir enhancement projects were undertaken. KRFMP plans to continue working with the ACOE through the foreseeable future.

## **5.0 FISH STOCKING**

CDFW transitioned from stocking triploid rainbow trout into the lower Kings River in favor of diploid rainbow trout at the start of 2018. In 2021, sub-catchable, catchable, super-catchable and trophy rainbow trout were planted in the Lower Kings River, below Pine Flat Dam. Brook trout were also planted in the catchable and trophy size classes, in the Kings River below Pine Flat Dam. Only catchable rainbow trout were planted in Pine Flat Reservoir. No brown trout and no fingerling Chinook salmon were planted in Pine Flat Reservoir in 2021. Avocado Lake received a



catchable allotment of rainbow trout. In addition, rainbow trout eggs were incubated by KRCD and released in the lower river. The supplemental rainbow trout stocking program initiated by the KRFMP in the fall of 2018 was continued during this reporting period.

### 5.1 SUPPLEMENTAL STOCKING

In 2017 the KRFMP developed a supplemental rainbow trout stocking plan for the tailwater fishery below Pine Flat Dam. The plan focuses on stocking only diploid trout with increased stocking in the fall and winter months when river flows and temperature are best for angler success. The intent is to provide a population of hatchery-produced catchable sized trout capable of sustaining the current level of angler pressure in both the put-and-take and catch-and-release zones. Additionally, the reinstatement of stocking diploid trout provides the potential for holdover trout to spawn and contribute to the resident population when and where conditions are suitable. The plan was fully approved in May 2018 and Calaveras Trout Farm (CTF), a private aquaculture facility in Snelling, CA was awarded a 3-year renewable contract to provide the KRFMP 30,000 (10,000 lbs) to 50,000 (16,600 lbs) catchable diploid rainbow trout between October and March each year. Catchable sized trout measure between 9- and 10-inches fork length and weigh 3 fish per pound. Additionally, in 2020, CTF was contracted to provide an additional 1,000 super-catchable sized trout to the KRFMP while the KRCD contracted with CTF to receive 8,900 pounds of super-catchable trout. These super-catchable trout would be between 16- and 19-inches fork length and would weigh between 1.5 and 2.5 pounds each. Due to water temperature conditions unfavorable for trout stocking in October 2020, supplemental stocking was delayed until November and extended through April. Goals of the KRFMP are to stock supplemental trout at a ratio of 75% into the Put & Take Zone (Reach 1) and 25% into the Catch & Release Zone (Reach 2), while those stocked for the KRCD are stocked at a ratio of 70% Reach 1 and 30% Reach 2. Results of supplemental stocking can be found in Tables 5-1 and 5-2. Due to egg supplier importation difficulties in the fall of 2020, CTF was unable to provide catchable trout in the 3 fish per pound for the duration of the stocking period, with trout sizes approaching 1 fish per pound at the end of the supplemental stocking period.

**Table 5-1: Summary of 2020-2021 KRFMP catchable size supplemental stocking by Calaveras Trout Farm.**

Month	Reach 1		Reach 2		Total		Average
	# lbs	# fish	# lbs	# fish	# lbs	# fish	Fish/lb
November	2,750	8,250	750	2,250	3,500	10,500	3.00
December	2,850	8,550	950	2,850	3,800	11,400	3.00
January	2,700	6,900	900	2,300	3,600	9,200	2.56
February	1,200	2,400	400	800	1,600	3,200	2.00
March	1,500	3,000	500	1,000	2,000	4,000	2.00
April	1,125	1,503	375	501	1,500	2,004	1.34
<b>Total</b>	<b>12,125</b>	<b>30,603</b>	<b>3,875</b>	<b>9,701</b>	<b>16,000</b>	<b>40,304</b>	<b>2.52</b>

**Table 5-2: Summary of 2020-2021 KRFMP and KRCD super-catchable size supplemental stocking by Calaveras Trout Farm.**

Month	KRFMP				KRCD				KRFMP & KRCD		
	Reach 1		Reach 2		Reach 1		Reach 2		Total	Average	
	#lbs	#fish	#lbs	#fish	#lbs	#fish	#lbs	#fish	#lbs	#fish	lbs/Fish
December	1,500	756	500	252	0	0	0	0	2,000	1,008	1.98
January	0	0	0	0	1,891	946	709	355	2,600	1,301	2.00
February	0	0	0	0	1,250	580	450	209	1,700	789	2.15
March	0	0	0	0	1,800	904	800	400	2,600	1,304	1.99
April	0	0	0	0	1,400	560	600	230	2,000	790	2.53
Total	1,500	756	500	252	6,341	2,990	2,559	1,194	10,900	5,192	2.10

## 5.2 INCUBATOR BUILDING

The incubator building has run seasonally since November 2012. Maintenance has been facilitated by KRCD staff as well as volunteers interested in the fishery and the Kings River. During the 2020 – 2021 program year diploid rainbow trout eggs were purchased from Cold Springs Trout Farm, with three incubation periods completed. Table 5-2 summarizes the incubation periods, number of eggs incubated, estimated hatch rate, estimated number of fry released, and the percentage of fry released into both the Put & Take and Catch & Release Zones. When trout fry reached the button up stage (about 1” long) they were released at multiple locations within the fishery management area. These activities were conducted under SE4 and P1 of the 2020 Annual Implementation Plan.

**Table 5-3: Incubator building activity 2020 – 2021. Number of eggs incubated per rearing period, estimated hatch rate, estimated number of fry released, and percentage released in both the Put & Take and Catch & Release Zones.**

Incubation Period	Number of Eggs Incubated	Estimated Hatch Rate	Estimated Fry Released	Put & Take Zone	Catch & Release Zone
01/30/2020-02/11/2021	100,000	78%	67,000	2%	98%
02/17/2021-04/08/2021	105,000	93%	56,000	100%	0%

During the December 30 to February 11 rearing period conditions remained optimal for successful trout rearing. Eggs upon arrival were in good condition upon arrival. Eggs in nine of the shipping trays, approximately 90,000 eggs, were found to be firm, had good color and large uniform size, with minimal dead eggs present. One tray, approximately 10,000 eggs, while still in overall excellent condition also contained evidence of hatch pre-arrival, therefore incurring fry mortality loss as a result. It is unknown how much loss occurred but was less than 10% (1,000 eggs).

Average water temperatures within the incubator during this rearing period remained within the range Woynarovich et al. (2011) consider optimal (7°C-12.5°C) for the incubation of rainbow trout eggs and sac-fry as well as for swim-up fry (7°C-20°C). On January 22, twenty-four days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage. Throughout this period mortality was low, with anywhere from 30 to 200 deaths reported daily.

It is known that some fry escaped the incubator prior to release as they were observable within the high-water channel which the incubator drains into. The screens which separate the drain area from the rearing area of the raceways have perforations which are large enough that swim-up fry are able

to squeeze through. Fry were routinely found in the drain areas during daily staff visits. When fry are present in the drain area, staff and volunteers are instructed to net them back into the rearing portion of the raceway in order to minimize losses to the high-water channel the incubator drains into. While this channel does provide some of the best rearing habitat on the river, it is disconnected from the river except during high flow. The KRFMP should consider expanding this channel so that even at 50 cfs it is always fully connected to the river with visible flow throughout. Under the current configuration, the channel will completely dry up if the incubator pumps are turned off before river flows are enough to connect to the channel, resulting in potentially thousands of mortalities. In the past, attempts have been made to net trout from this channel and relocate them into the main river during low flows. This is labor intensive and results in very few trout being successfully relocated. When flow is sufficient, trout can continue rearing in the channel with the expectation they will move into the main river prior to the dewatering of the channel at the end of the irrigation season in the late summer or early fall.

During the February 17 to April 8 rearing period eggs were observed to be in mixed condition upon arrival. Eggs in four of the shipping trays (~42,000 eggs), were found to be in a mixed condition of healthy-looking eggs, dead eggs, and clear evidence hatching had occurred pre-arrival. Eggs in these trays were generally soft, and easily damaged, resulting in fry loss, if handled. The remaining six shipping trays (63,000 eggs) were found to have good color and large uniform size, with some dead eggs present. A shipping delay due to a winter storm led to receipt of the eggs a day late which may have contributed to the pre-arrival observed hatch, among the older aged eggs Cold Springs shipped. It was impossible to estimate the egg losses due to the pre-arrival hatch but was estimated to be around 10% (4,000 eggs). Despite concern 10% of the eggs were pre-hatched or experienced mortality, it was estimated that 93% of the incubated eggs successfully hatched.

Average water temperatures within the incubator during this rearing period remained within the range Woynarovich et al. (2011) consider optimal (7°C-12.5°C) for the incubation of rainbow trout eggs and sac-fry as well as for swim-up fry (7°C-20°C). On March 15, twenty-six days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage. Mortalities throughout this period were particularly high as fish were transitioning from the sac-fry stage into swim-up fry, and peaked again towards the end of the run, with anywhere from 200 to 1,400 deaths reported daily. In addition to observed mortalities, fry also escaped the incubator through the drains into the high-water channel prior to release.

It is unclear why the losses occurred. While average daily water temperatures were within the range considered optimal for trout fry in all stages, on thirteen days the maximum recorded temperature was within the range considered lethal. While these temperatures were only experienced for 3 to 5 hours each day they occurred, the increased thermal stress likely contributed to some of the observed losses. Additionally, many mortalities occurred during the transition to the swim-up stage and may have been attributed to fish unsuccessfully transitioning to exogenous feeding for unknown reasons. Despite the daily provision of food, and temperatures being within the range considered optimal for trout appetite (Woynarovich et al. 2011), many fish were observed showing no interest in offered food. Another potential cause of mortality was overcrowding of the raceways, particularly when combined with the warmer temperatures experienced towards the end of the rearing period which would have driven increased growth. While flows within the raceways were suitable to compensate for reduced oxygen levels at the increased water temperature, the fish also underwent a noticeable growth spurt, and required increased caloric inputs during this time. To alleviate these die-offs, the

daily food ration was increased and fish from crowded raceways were redistributed into less crowded raceways.

### 5.3 CDFW STOCKING

The CDFW annual stocking between January 1 – December 31, 2021 are summarized here. CDFW provided hatchery grown salmonids in several different size categories to the Kings River below Pine Flat Reservoir (50,484 fish, 25,250 pounds), Pine Flat Reservoir (28,200 fish, 15,000 pounds), and Avocado Lake (13,040 fish, 6,400 pounds). These numbers do not include the supplemental fish provided for the KRFMP. Details for each size class are summarized below.

#### 5.3.1 Fingerlings

No fingerling salmonids were stocked in 2021.

#### 5.3.2 Sub-Catchable Trout

Sub-catchable rainbow trout stocked by CDFW are generally 4-6 inches long. Table 5-4 details stocking of sub-catchable trout. A total of 1,700 pounds (24,990 fish) of sub-catchable rainbow trout were stocked in the lower Kings River as part of the put-and-grow program during 2021.

**Table 5-4: CDFW sub-catchable trout stocked 2021.**

Water	Species	Sub-Catchables	
		Year	
		2021	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	0	0
	Rainbow Trout	24,990	1,700
Pine Flat Reservoir	Brown Trout	0	0
	Rainbow Trout	0	0
Total		24,990	1,700

#### 5.3.3 Catchables

Catchable trout (2 fish per pound) are stocked either once or twice per week during the non-irrigation period (roughly October through March) and once each week during the irrigation season when flows are high. Table 5-5 details stocking of catchable size trout. A total of 13,850 pounds (23,080 fish) of catchable size rainbow trout and brook trout were stocked in the lower Kings River during 2021. Pine Flat received a total of 15,000 pounds (28,200 catchable rainbow trout) and Avocado Lake received a total of 6,400 pounds (13,040 catchable rainbow trout) during this same period.

**Table 5-5: CDFW catchable sized trout stocked 2021.**

Water	Species	Catchables	
		Year	
		2021	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	13,350	8,600
	Rainbow Trout	9,730	5,250
Pine Flat Reservoir	Rainbow Trout	28,200	15,000
Avocado Lake	Rainbow Trout	13,040	6,400
Total		64,320	35,250

### 5.3.4 Super Catchables

Super-catchable size trout are defined as trout greater than one pound. Table 5-6 details stocking of super-catchable size trout. Kings River below Pine Flat Reservoir received a total of 4,000 pounds of super-catchable trout (1,625 rainbow) in 2021.

**Table 5-6: CDFW super-catchable sized trout stocked 2021.**

Water	Species	Super-Catchables	
		Year	
		2021	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	0	0.0
	Rainbow Trout	1,625	4,000
Pine Flat Reservoir	Rainbow Trout	0	0.0
Avocado Lake	Rainbow Trout	0	0.0
Total		1,625	4,000

**5.3.5 Trophy Trout**

Beginning December 2005, CDFW implemented a trophy trout stocking program in the put-and take section as well as the catch-and-release section. Trophy trout are designated as trout greater than 2.99 pounds each. CDFW planted 4,000 pounds of Trophy Trout (789 fish) in the Kings River, below Pine Flat Dam, in 2021. Trophy Trout included brook trout and rainbow trout (Table 5-7).

**Table 5-7. Trophy size trout stocked in 2021.**

Water	Species	Trophy	
		Year	
		2021	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	709	3,650
	Rainbow Trout	80	350
<b>Total</b>		<b>789</b>	<b>4,000</b>

**6.0 MONITORING**

Section G (1)(k) of the Framework Agreement “Development of Criteria/Monitoring” calls for the agencies to carry out a monitoring program to determine the effects of various elements of the KRFMP and the overall status of the fishery. Water temperature and dissolved oxygen monitoring remain a priority. The KRFMP is also dedicated to continuing its annual fish population surveys in the fall.

**6.1 ANNUAL FISH POPULATION SURVEYS IN THE LOWER KINGS RIVER**

Long-term annual baseline trout fisheries monitoring within the lower Kings River is conducted as part of the KRFMP to determine (1) the assemblage, abundance, and condition of the fish community inhabiting the lower Kings River; (2) overall biomass; (3) hatchery and “wild” rainbow trout abundance and distribution; (4) overwintering survival, size, and age structure of rainbow trout populations. Surveys are completed with KRFMP agency staff and the assistance of local volunteers and college students. Due to the ongoing Covid-19 pandemic the annual fish population survey was canceled for fall 2020.

**6.2 Lower Kings River Angler Creel Survey**

CDFW implemented an angler creel survey in January through March 2020 to evaluate the effectiveness of the supplemental stocking program on the Kings River, below Pine Flat Reservoir. The surveyed reach started at the ACOE bridge and extended downstream to the Greenbelt parking lot. The reach was divided into 3 sections: Section 1 – ACOE bridge downstream to Piedra Bridge. Section 2 – Piedra Bridge downstream to Cobbles (Alta) Weir. Section 3 – Cobbles (Alta) Weir downstream to Greenbelt parking lot. Sections 1 and 2 are the traditional put-and-take reach and Section 3 is the catch-and-release reach. The three sections surveyed are historical sections used in past angler surveys. Due to the ongoing Covid-19 pandemic the creel survey was not conducted in program year 2020-2021.

## **7.0 PUBLIC EDUCATION AND OUTREACH**

### **7.1 WEBSITE**

KRCD staff has maintained and updated the website throughout the year. The site contains a photo album, contact page, volunteer site, access to program reports and documents, projects, and links to resources: <http://krfmp.org/>.

### **7.2 HYDROLOGY AND TEMPERATURE REPORT**

For operations, KRWA uses a real-time telemetry system for monitoring water temperature and streamflow at Fresno Weir. Typically, during the summer and fall of dry hydrologic years, information collected on the lower Kings River is compiled in weekly reports and distributed by KRWA to members of the PAG and other interested parties to provide current information on environmental conditions that would affect habitat quality. These reports have provided information on flows in the lower river and tributary streams as well as a summary of flow and temperature trends. Copies of these reports remain on file at KRWA. Hydrologic and Climate Summary Reports were circulated October 1 – November 17, 2020, a timeframe when reservoir outflow was being reduced from high irrigation levels and temperature blending of reservoir releases was used to provide flows to the lower Kings River and September 1, 2021 – September 30, 2021 where no blending of releases were made, but dry-hot conditions were being monitored.

### **7.3 EDUCATIONAL TOURS**

#### **7.3.1 Incubator Building**

No tours were hosted at the incubator during the 2020-2021 rearing period. Due to the Covid-19 pandemic the building was closed to the public. Tours may resume in January 2022 pending the status of the pandemic and relaxation of social distancing guidelines. Topics covered during tour events include a general overview of the purpose and history of the trout rearing program, the trout lifecycle, and the role of trout in the local ecosystem.

### **7.4 RIVER CLEAN-UP**

Beginning in July of 2021 the KRFMP member agencies partnered with the Kings River Conservancy, United States Army Corps of Engineers, County of Fresno, and the Public Advisory Group of the KRFMP to conduct monthly targeted clean-ups of the Kings River in different locations. Clean-up events typically occurred on the third Saturday of the month and public participation was encouraged. Participants removed trash and graffiti from along the riverbank, which restored the aesthetics of the waterway while removing potential hazards to the ecosystem, wildlife, and other users. The September 2021 cleanup was originally scheduled for September 18<sup>th</sup>, but was moved to September 25<sup>th</sup> to support the ACOE's annual Public Lands Day event. The partner agencies provided staff to support this one-day event. A summary of clean-up events is provided in Table 7-1.

**Table 7 - 1: Location, number of volunteers, and quantity of trash removed during the 2020-2021 reporting period.**

<b>Date</b>	<b>Location</b>	<b># Volunteers (Agency Staff &amp; Public)</b>	<b>Trash Bags Collected</b>
7/17/2021	North and South Riverside Access Area below ACOE bridge	31	No Data
8/21/2020	Winton Park and westside of Winton Park	20	19 bags + metal furniture pieces
9/25/2021	Kings River Wildlife Area, North Riverside Access Area, Pine Flat Reservoir	75	Activities included trash pickup, tree planting, & improvements to picnic areas

## **7.5 FISHING REGULATION SIGNS**

New fishing regulation signs were purchased and installed throughout the Kings River between Pine Flat Dam and Highway 180. While the language of the current regulations remained the same as that of years prior, the numbering of the statutes had changed. Signs for the general regulations were posted throughout Reach 1 between the Army Corps of Engineer Bridge and Alta Weir, while special regulation signs posted in Reach 2, and fishing closure signs posted for the area above the Army Corps of Engineer Bridge and the Thorburn Channel. To better assist law enforcement with enforcement of the regulations, signs were posted in locations where they were readily visible to any person using or entering the area and close to those areas where stocking trucks plant fish.

## **8.0 MAINTENANCE ACTIVITIES**

### **8.1 THORBURN CHANNEL**

Due to silt accumulation rendering the Thorburn Channel unsuitable for trout rearing and as the channel was one of the locations proposed for habitat enhancement by Cramer Fish Sciences, the TSC decided the headgate should be closed to prevent further degradation and to allow the channel to remain in an as-is condition for further evaluation by Cramer Fish Sciences. Additional routine maintenance activities of the channel, roadways, and trail did not occur during this reporting period.

### **8.2 INCUBATOR BUILDING**

While in service, daily operation and maintenance of the incubator facility is performed by KRCD Environmental staff Monday thru Friday. Public volunteers typically care for the trout fry in the facility weekends and holidays during incubator operation. Volunteers are also utilized to assist with planting of trout fry into the river. The total number of individuals who volunteered time to assist with either daily operation of the incubator building or with fry release are summarized in table 8-1. Volunteer assistance to the incubator was significantly reduced during the 2020-2021 rearing period due to the Covid-19 pandemic forced closure of the building to the public. on account of social distancing guidelines and the need to minimize potential exposures to employees. As a result, KRWA and KRCD staff took over most weekend coverage of trout fry and with fry release. During this reporting period no building or equipment maintenance utilizing staff from the KRCD Pine Flat Power Plant was required.



**Table 8 - 1: Number of volunteers and amount of time dedicated to the KRFMP Trout Incubator during the 2020-2021 season.**

Incubation Period	Volunteers (#)	~ Time (Hours)
01/30/2020-02/11/2021	3	3.5
02/17/2021-04/08/2021	0	0

**9.0 DEVELOPMENT OF A LONG-TERM IMPLEMENTATION PLAN**

Section G(1) of the Framework Agreement includes elements addressing adaptive management (Section 1b); stream temperature monitoring (Section 1d); funding for habitat enhancement projects (Section 1f); enforcement, education, and awareness program (Section 1i); stocking program (Section 1j); development of criteria/monitoring (Section 1k); and access (Section 1p). The Annual Implementation Plan helps to provide guidance, prioritize activities and the allocation of expenditures, and coordinate among the parties to facilitate efficient implementation of these elements of the Framework Agreement. The Long Term Implementation Plans (formerly 10 Year Plans): (1) provide a project management structure for reviewing and prioritizing proposed habitat enhancement activities, fish stocking, and other elements of the Framework Agreement; (2) identify the objectives and methods to be used to assess the overall response of trout and other species for use in evaluating achievement of the Kings River aquatic resource goals as identified in Section 1a of the Framework Agreement; and (3) provide a framework for the experimental design and evaluation of specific enhancement activities (e.g., enhancement projects funded under the Framework Agreement, fish stocking and supplementation, pulse flows for temperature management, etc.) within the context of the overall goals and activities being implemented through the Framework Agreement. Results of monitoring and evaluation activities serve, in part, as the basis for the adaptive management element of the Framework Agreement (Section 1b) and for identifying changes in program priorities, or the allocation of resources from one program element to another. The Long-Term Implementation Plan is a “living plan” that is reviewed by the TSC, Public and ExCom on an annual basis and revised as projects and elements of the program are implemented and as new scientific information becomes available.

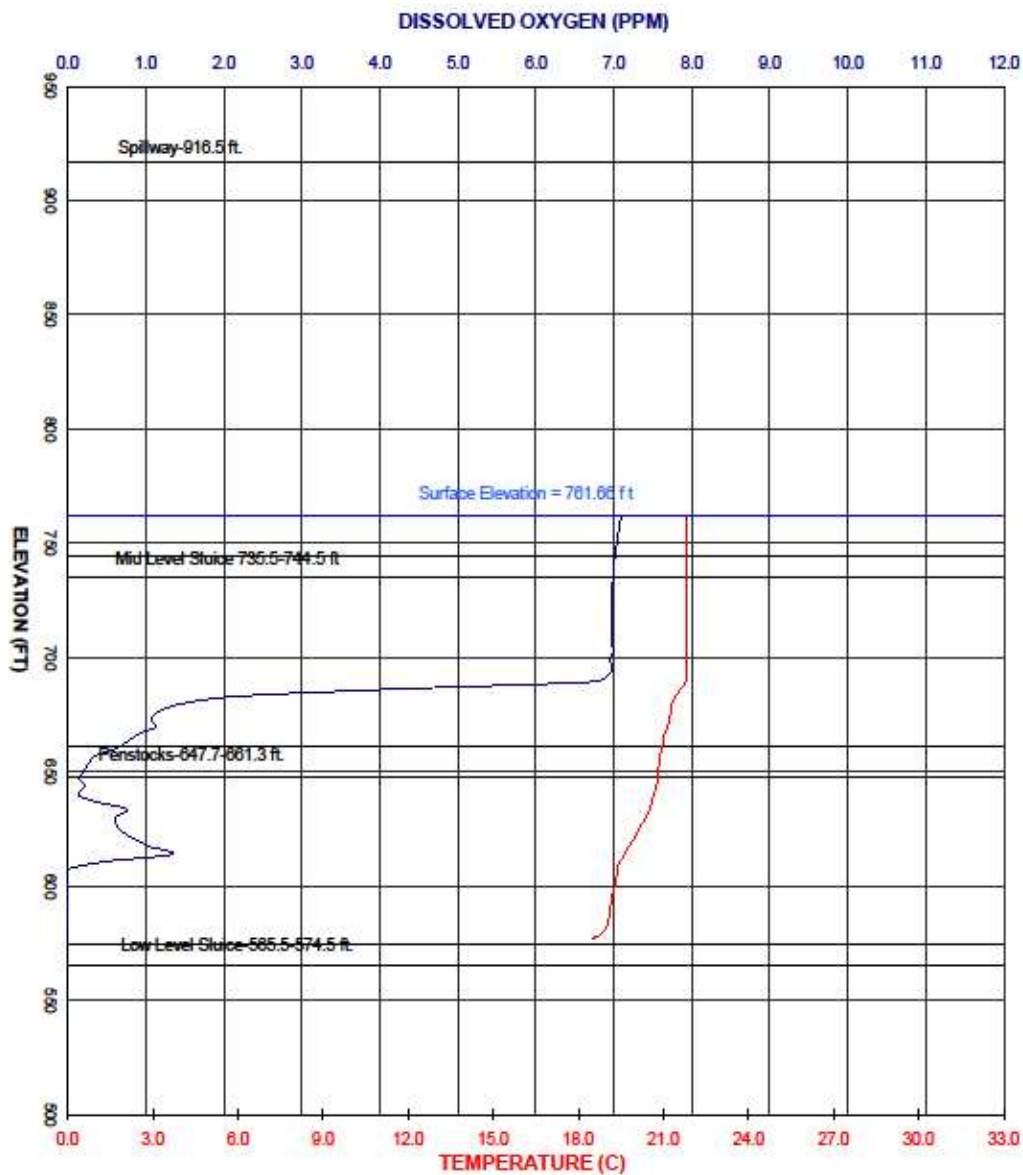
## REFERENCES

- Cramer Fish Sciences (CFS). 2019. Lower Kings River fishery habitat characterization and identification of habitat enhancement opportunities: A study by Cramer Fish Sciences for the Kings River Fishery Management Program. September 27, 2019.
- Kings River Fisheries Management Program (KRFMP). 1999. Kings River Fisheries Management Program Framework Agreement.  
[http://krfmp.org/pdf\\_fmp/FMP\\_FrameworkAgreement1999.pdf](http://krfmp.org/pdf_fmp/FMP_FrameworkAgreement1999.pdf)
- Moyle, P. B. 2002. Inland Fishes of California: Revised and Expanded. University of California Press. Berkeley, California. 502 pp.
- Woynarovich, A., G. Hoitsy, and T. Moth-Poulsen. 2011. Small-scale rainbow trout farming. FAO Fisheries and Aquaculture Technical Paper 561.

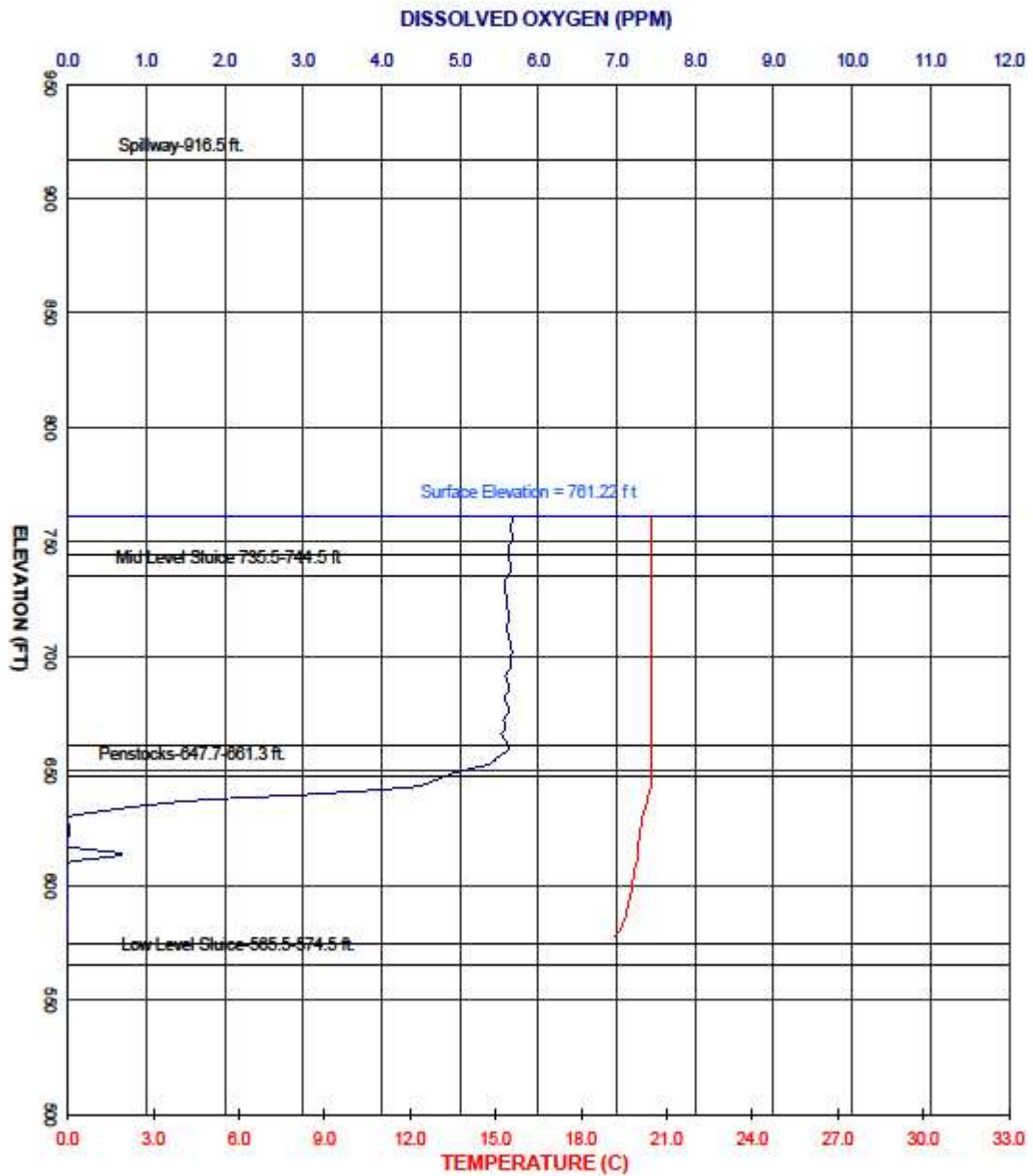
# Appendix A

Pine Flat Reservoir Temperature and Dissolved Oxygen Profiles  
October 2020 – September 2021

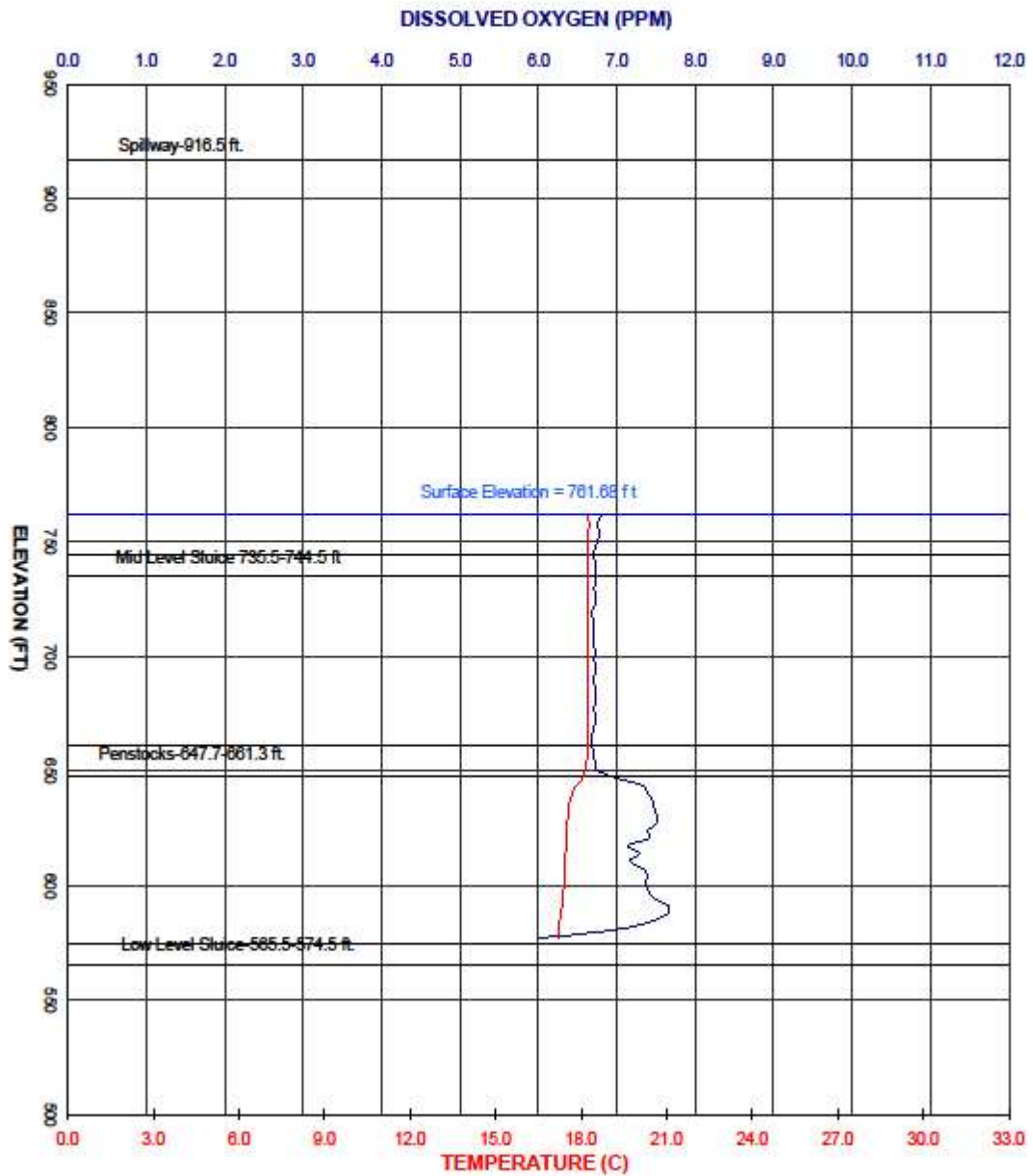
PINE FLAT RESERVOIR 10/14/2020 (Time: 1019-1102 New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 761.66



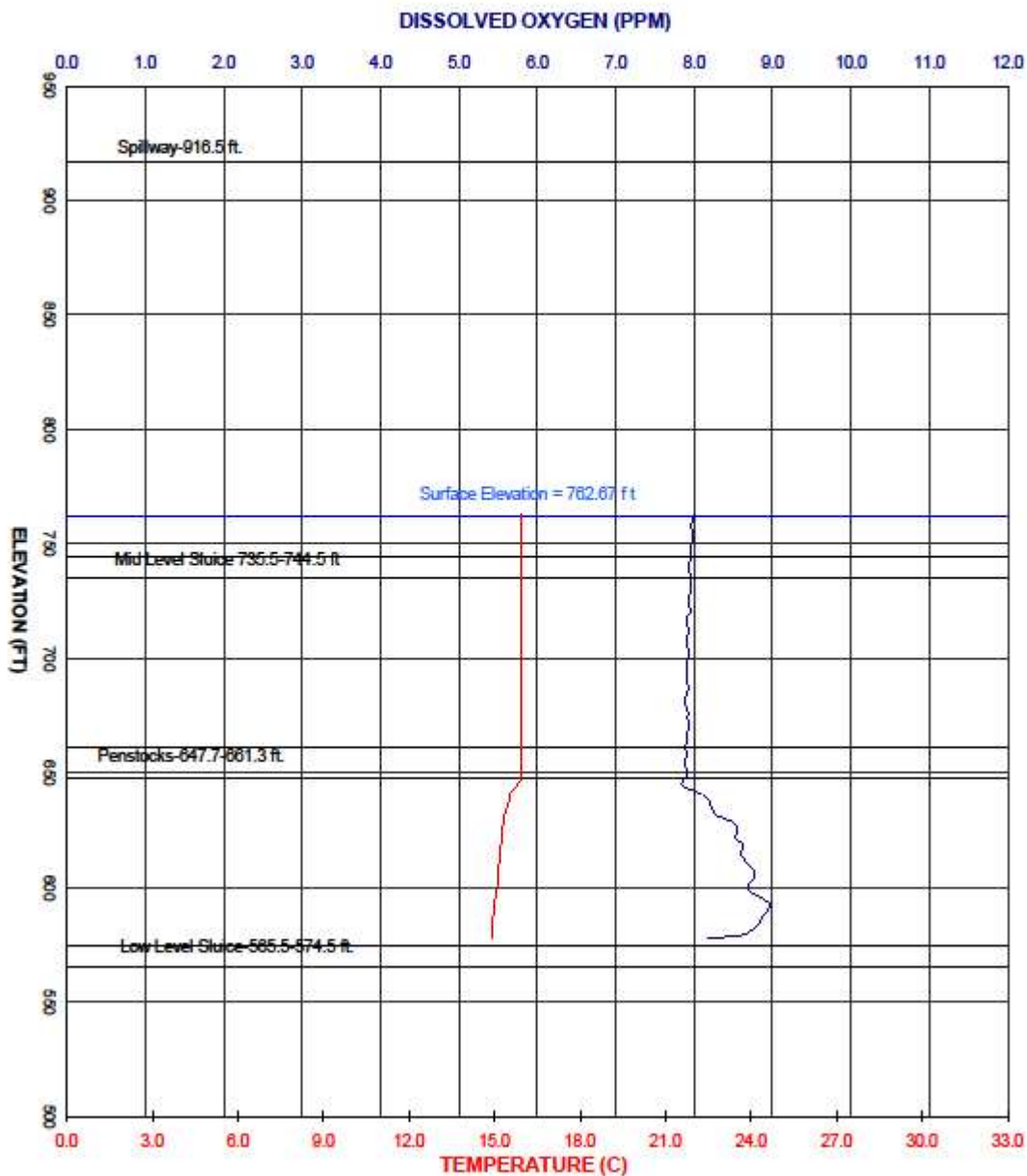
PINE FLAT RESERVOIR 10/28/2020 (Time: 1039-1130 New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 761.22



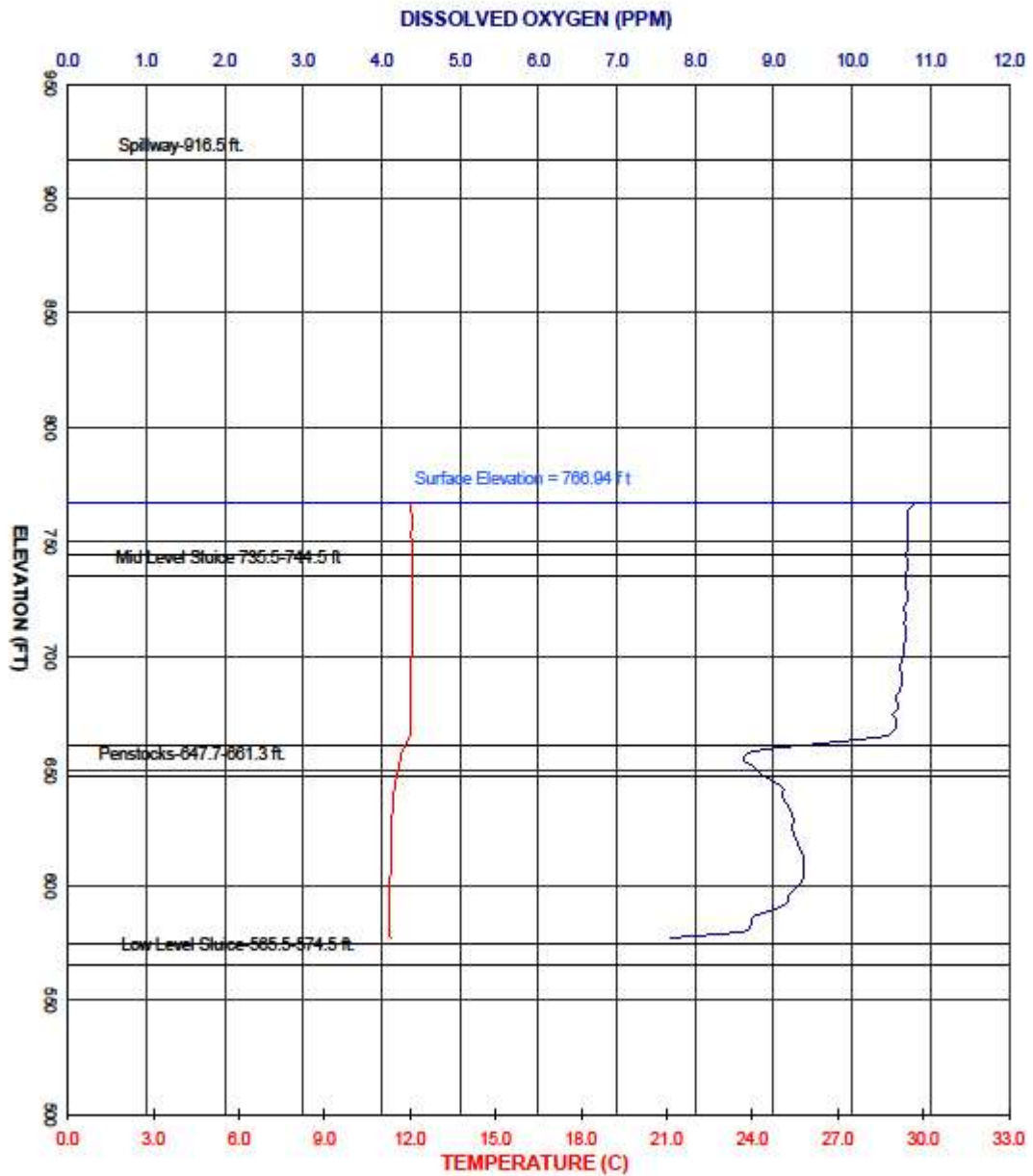
PINE FLAT RESERVOIR 11/13/2020 (Time: 1003-1106 New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 761.68



PINE FLAT RESERVOIR 12/2/2020 (Time: 1022-1124 New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 762.67

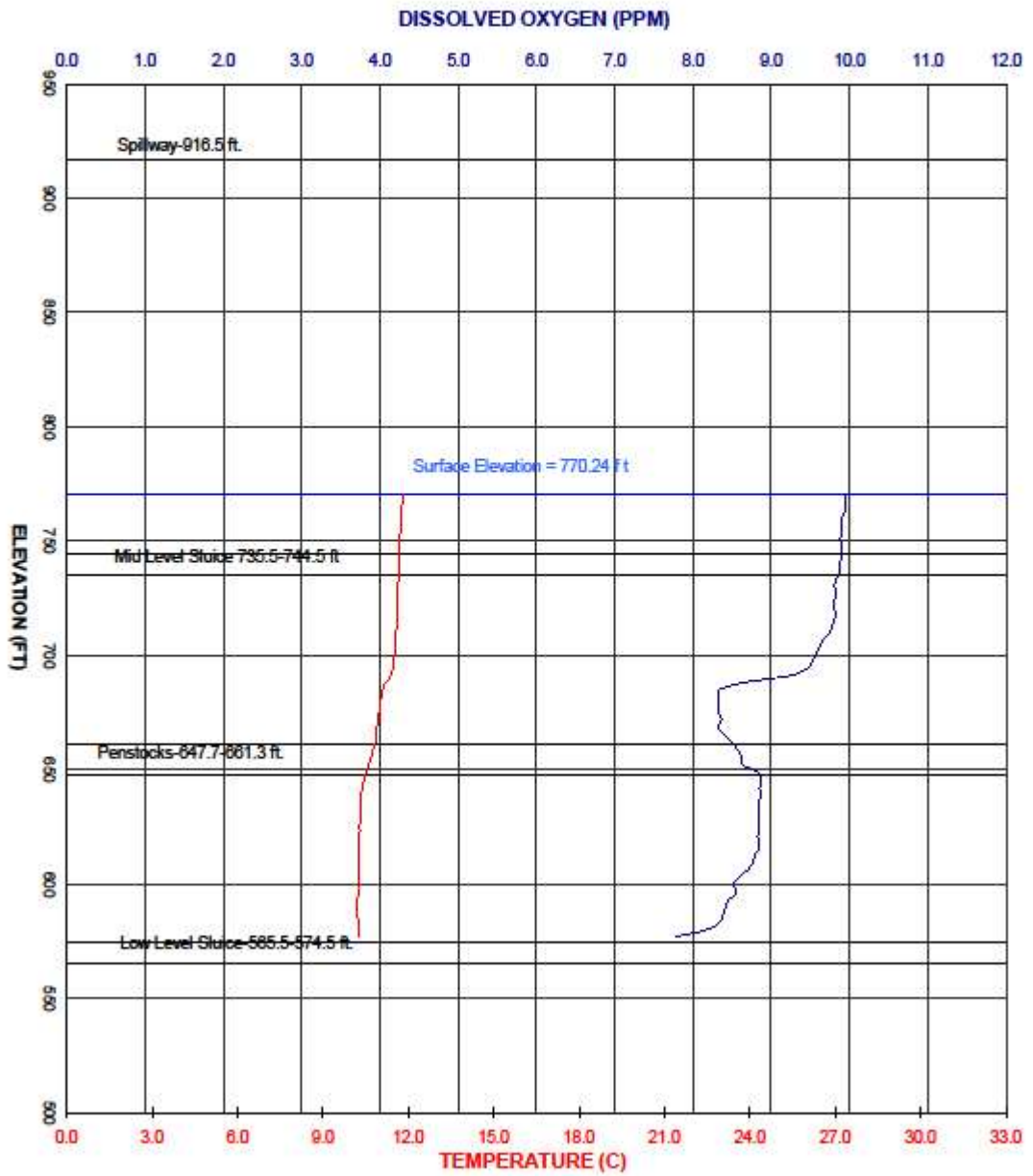


**PINE FLAT RESERVOIR 1/21/2021 (Time: 0947-1035) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 766.94**

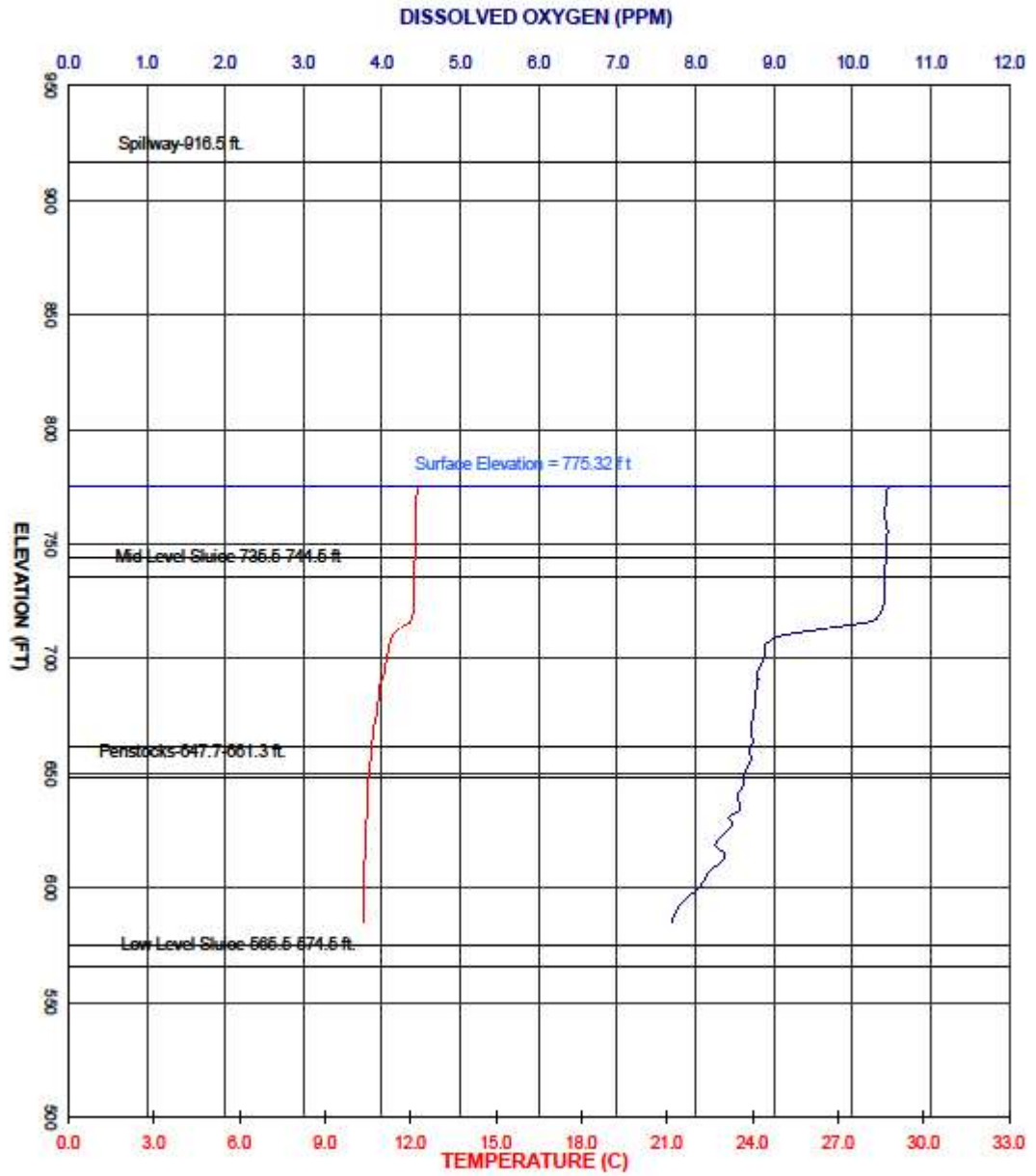




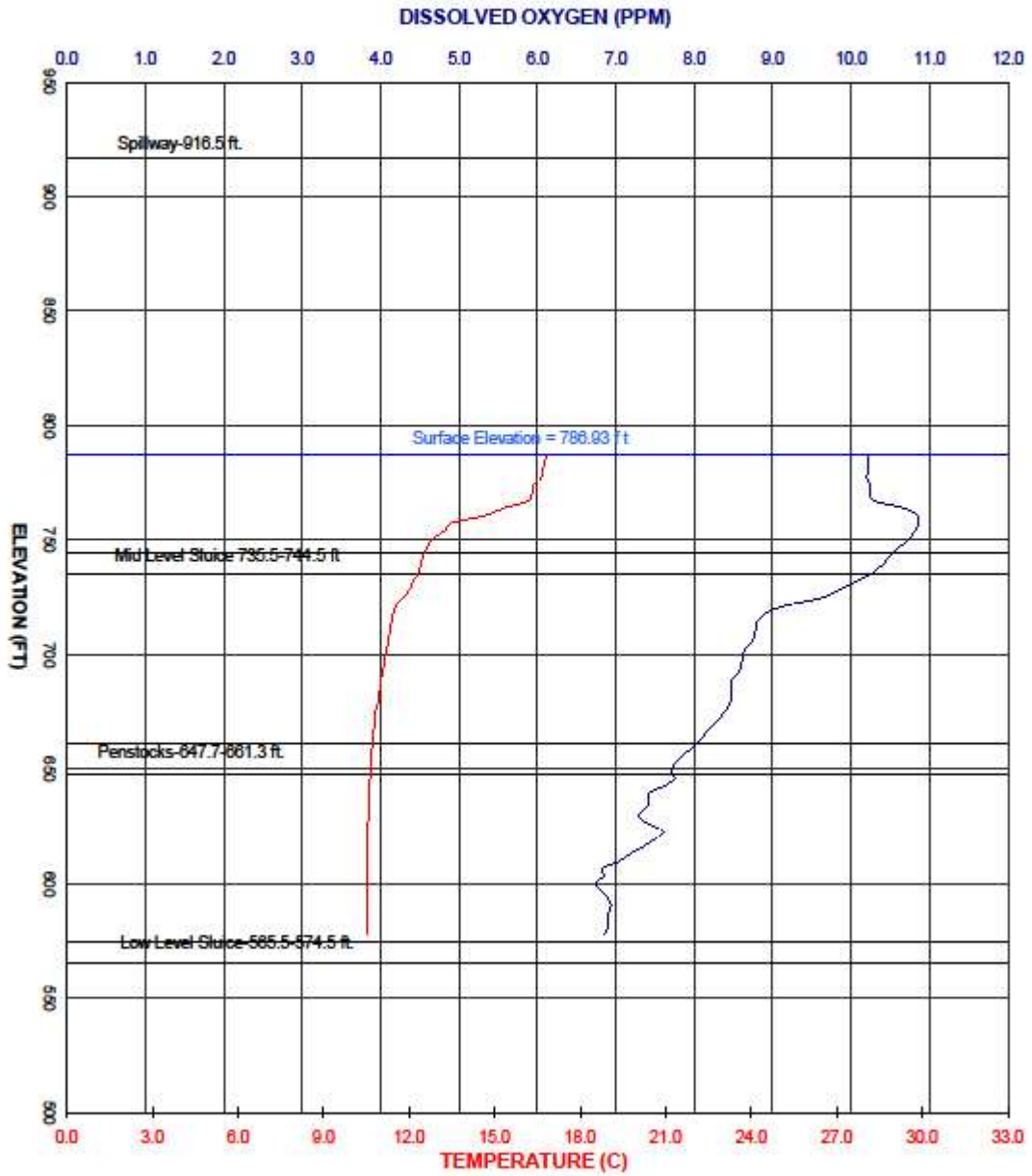
PINE FLAT RESERVOIR 2/9/2021 (Time: 1021-1117) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 770.24



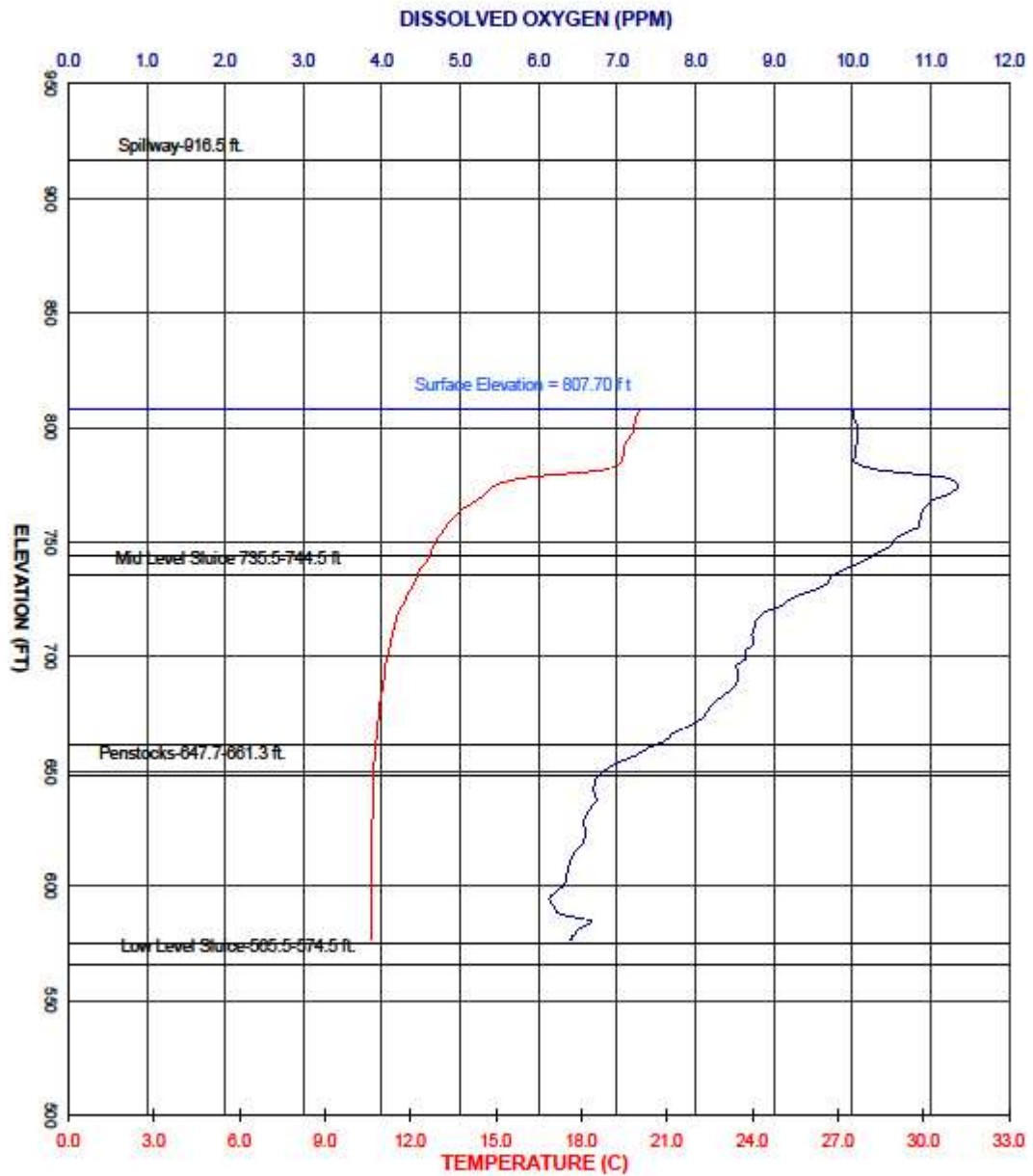
PINE FLAT RESERVOIR 3/2/2021 (Time: 0950-1050) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 775.32



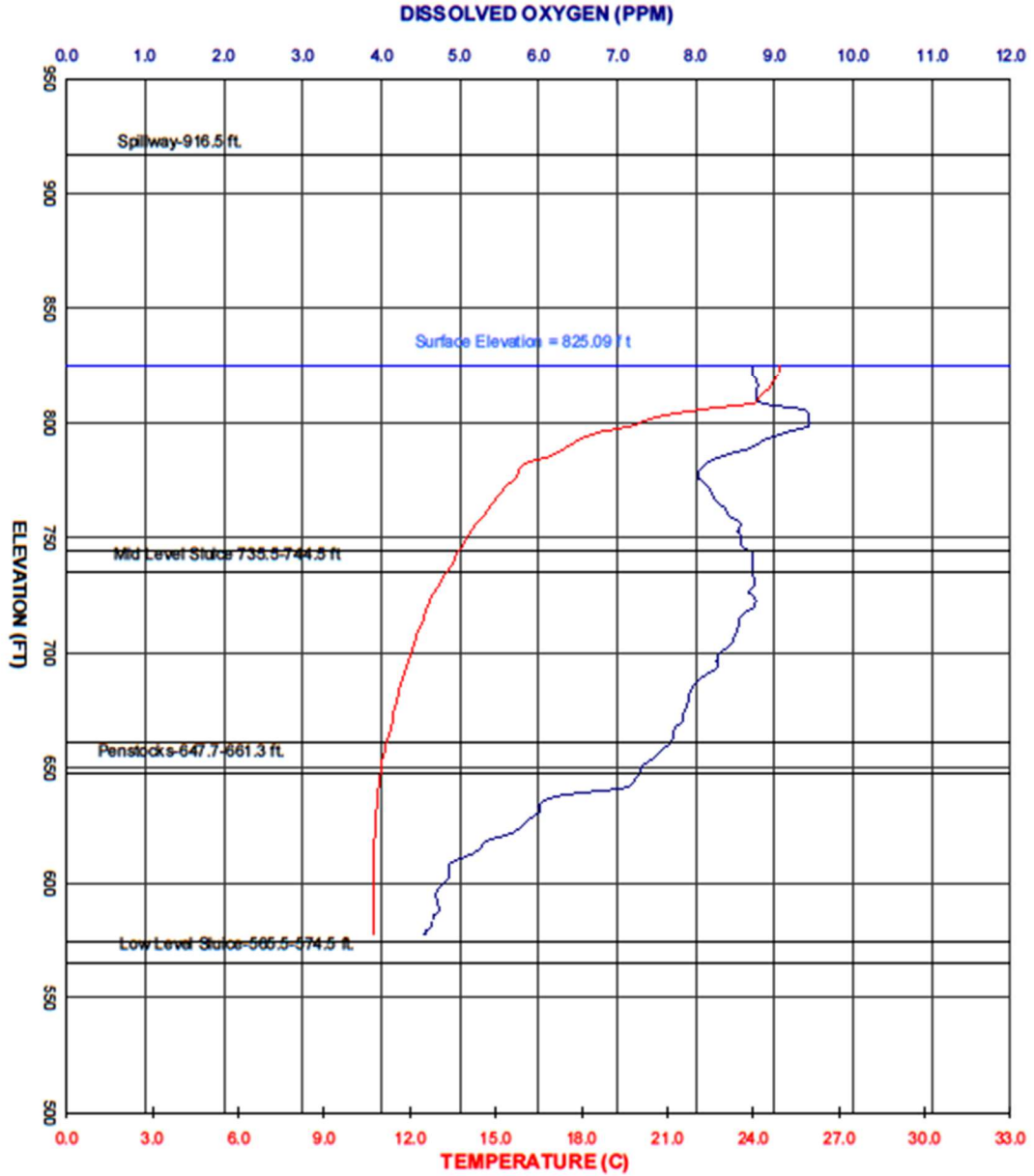
**PINE FLAT RESERVOIR 4/6/2021 (Time: 0922-1022) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 786.93**



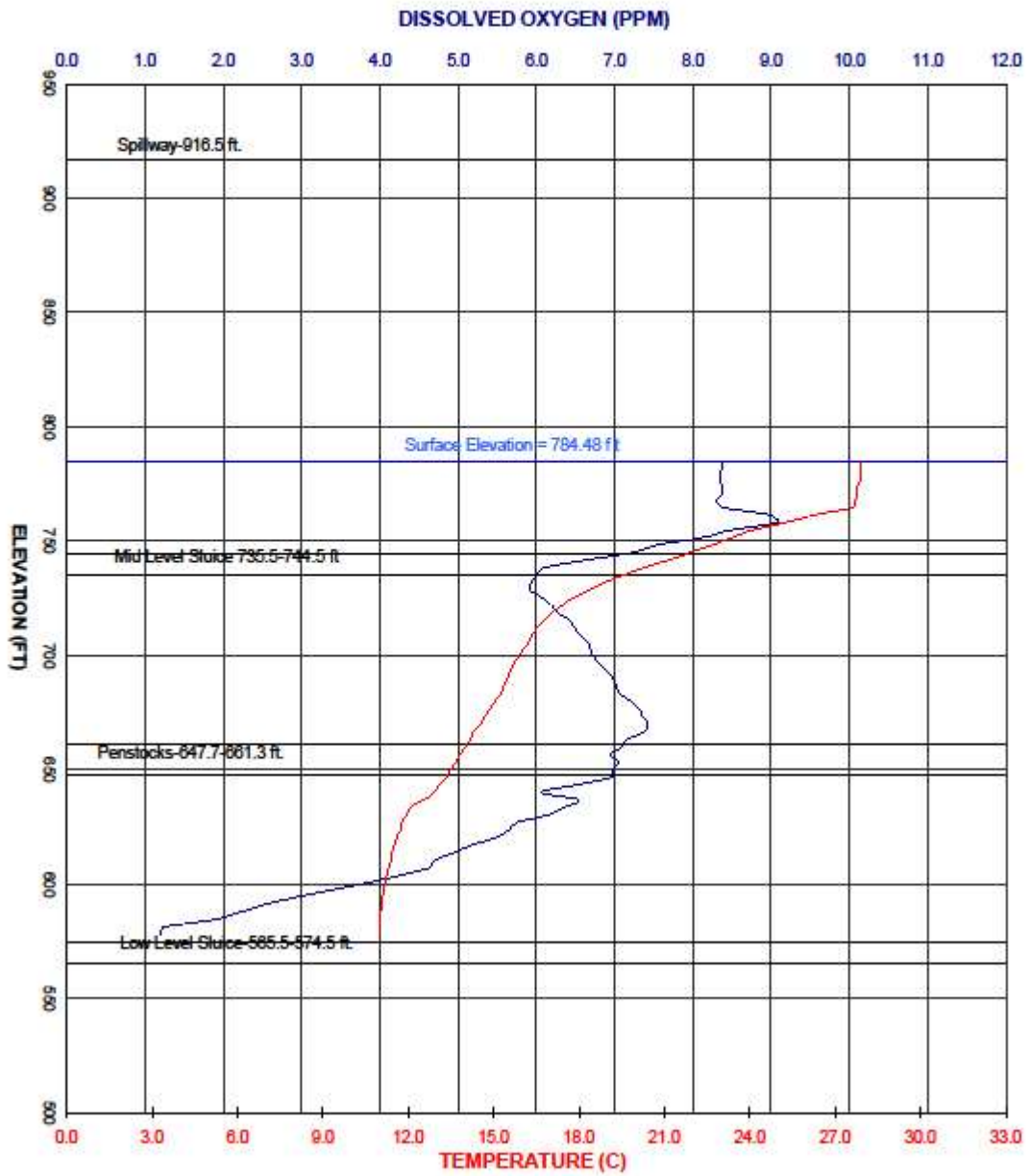
PINE FLAT RESERVOIR 5/4/2021 (Time: 0913-1015) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 807.70



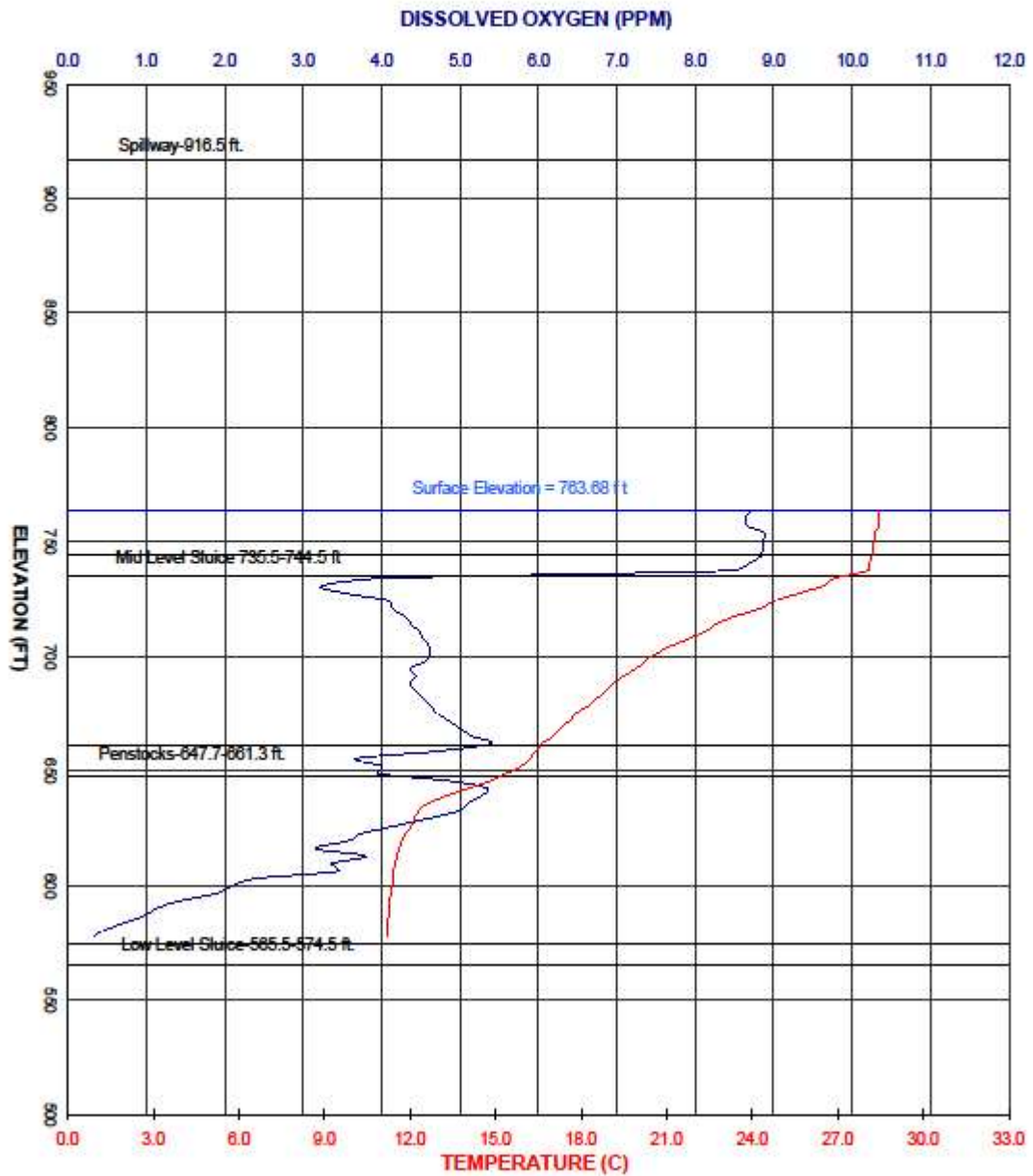
**PINE FLAT RESERVOIR 6/4/2021 (Time: 0919-1023) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 825.09**



**PINE FLAT RESERVOIR 7/7/2021 (Time: 0959-1057) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 784.48**



**PINE FLAT RESERVOIR 8/3/2021 (Time: 1105-1201) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 763.68**



PINE FLAT RESERVOIR 9/8/2021 (Time: 0948-1037) New Buoy Line Placement  
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 758.75

