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4888 E. Jensen Ave Fresno, CA 93725 KINGS RIVER FISHERIES MANAGEMENT PROGRAM ANNUAL TECHNICAL REPORT Water Year 2022-2023



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EXECUTIVE SUMMARY

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 2022 and September 2023 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 2023 (October 1, 2022- September 30, 2023) and CDFW stocking activity for Calendar Year 2023.

Key Elements of the program in recent years includes:

- All 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 242,000 rainbow trout eggs in the incubator building;
- Continued implementation of a supplemental Rainbow Trout stocking plan in addition to CDFW annual budgeted stocking program;

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 2022 and September 2023 and CDFW stocking in 2023 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, 2022 through September 30, 2023; KRWA (Table 1-1), KRCD (Table 1-2), CDFW (Table 1-3). Estimated in-kind support from agencies for the KRFMP was 3,066 hours or about 1.47 Full-Time Equivalent (FTE). Additionally, volunteers involved with assisting the KRFMP are vital for the program success,

providing approximately 638 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 2023, the CDFW allotment for the Kings River included approximately \$130,678 or 29,300 pounds of catchable size trout to the Lower Kings River, Avocado Lake, and Pine Flat Reservoir. The upper Kings River received an additional \$10,133 or 2,272 pounds of catchable trout. Fish stocking by CDFW also included approximately \$5,129 or 1,150 pounds of sub-catchables in Pine Flat., the Kings River below Pine Flat reservoir received an additional \$11,150 or 2500 pounds of sub-catchables, \$4,460 or 1000 pounds of super-catchables and \$4,460 or 1000 pounds of trophy trout. Section 2 outlines hydrologic conditions for Water Year 2023. 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, 2022 -Sep | tember |
|-----------------------------|--------------------------------|----------------------|--------|
| 30, 2023 | | | |

| KRFMP Support Activity | Hours/Year | Days/Year | FTE |
|-------------------------------|------------|-----------|------|
| Weir Management (Dennis Cut) | 115 | 14.4 | 0.06 |
| Weir Management (Fresno Weir) | 130 | 16.3 | 0.06 |
| Fall Electrofishing Survey | 160 | 20.0 | 0.08 |
| Incubator Operation | 17 | 2.1 | 0.01 |
| Incubator Fry Release | 18 | 2.3 | 0.01 |
| River Clean-Up | 15 | 1.9 | 0.01 |
| River Operations | 115 | 14.4 | 0.06 |
| Internal Water Accounting | 120 | 15.0 | 0.06 |
| Administrative Activities | 400 | 50.0 | 0.19 |
| Total In-Kind Support | 1090 | 136.3 | 0.52 |

Table 1-2: Estimate of KRCD In-Kind Support for the KRFMP, October 1, 2022 -September 30, 2023

| KRFMP Support Activity | Hours/Year | Days/Year | FTE |
|-----------------------------|------------|-----------|------|
| Administrative | 439 | 54.9 | 0.21 |
| Education Outreach | 2 | 0.3 | 0.00 |
| Fall Electrofishing Survey | 491 | 61.4 | 0.24 |
| Fishing Access Maintenan | 12 | 1.5 | 0.01 |
| Incubator Fry Release | 33 | 4.1 | 0.02 |
| Incubator Maintenance | 2 | 0.3 | 0.00 |
| Incubator Operation | 315 | 39.4 | 0.15 |
| Pine Flat Reservoir Profile | 72 | 9.0 | 0.03 |
| Public Relations/Outreach | 42 | 5.3 | 0.02 |
| Total In-Kind Support | 1408 | 176.0 | 0.68 |

Table 1-3: Estimate of CDFW In-Kind Support for the KRFMP, October 1, 2022 -September 30, 2023

| KRFMP Support Activity | Hours/Year | Days/Year | FTE |
|----------------------------|------------|-----------|------|
| Fall Electrofishing Survey | 184 | 23 | 0.09 |
| Administrative Activities | 384 | 48 | 0.18 |
| Total In-Kind Support | 568 | 71 | 0.27 |

| Table 1-4: Estimate of Volunteer Hours for the KRFMP | , October 1, | 2022 -September 3 | 0, |
|--|--------------|-------------------|----|
| 2023 | | | |

| KRFMP Support Activity | Hours/Year | Days/Year | FTE |
|----------------------------|------------|-----------|------|
| Fall Electrofishing Survey | 204 | 25.5 | 0.10 |
| Incubator Fry Release | 28 | 3.5 | 0.01 |
| Incubator Operation | 35 | 4.4 | 0.02 |
| Public Advisory Group | 26 | 3.3 | 0.01 |
| River Clean-up | 345 | 43.1 | 0.17 |
| Total In-Kind Support | 638 | 79.8 | 0.31 |

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 2023, October 1, 2022 through September 30, 2023, 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 inflow into Pine Flat averaged 5,944 cfs, ranging from 147 to 32,141 cfs. Table 2-1 shows the Kings River calculated annual runoff and the corresponding percent water year for the past 23 years; years included in this report are in bold text. Water Year 2023 had more runoff than any other year on record, since 1895. Roughly 4.5-million-acre-feet of water was yielded from the Kings basin, which on average yields about 1.7-million-acre-feet. The Army Corps of Engineers started a flood release on February 22, 2023 at 00:01 hours, which continued for 152-days until July 24, 2023 at midnight. This was the sixth flood release since the signing of the KRFMP Framework Agreement. Prior flood releases occurred in water years 2005, 2006, 2011, 2017, and 2019.

| Water Year (Oct-Sept) | Annual Runoff (TAF) | Percent Water Year |
|-----------------------|---------------------|--------------------|
| 2000 | 1,534 | 90% |
| 2001 | 1,010 | 59% |
| 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 | 79% |
| 2010 | 2,062 | 121% |
| 2011 | 3,318 | 195% |
| 2012 | 826 | 49% |
| 2013 | 691 | 41% |
| 2014 | 537 | 32% |
| 2015 | 361 | 21% |
| 2016 | 1,253 | 74% |
| 2017 | 4,096 | 241% |
| 2018 | 1,275 | 75% |
| 2019 | 2,177 | 128% |
| 2020 | 913 | 54% |
| 2021 | 396 | 23% |
| 2022 | 786 | 46% |
| 2023 | 4,509 | 265% |

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

 October-September



Figure 2-1: The annual inflow into Pine Flat Reservoir from October 1, 2022 through September 30, 2023

2.2 Reservoir Storage

Daily reservoir water storage volume in Pine Flat Reservoir from October 1, 2022 through September 30, 2023 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. Minimum storage in Pine Flat, 150,468 acre feet, occurred at the beginning of the water year October 1, 2022. Maximum storage in Pine Flat, 982,634 acre feet, occurred on July 25, 2023, one day after the Army Corps of Engineers ended the flood release criteria.



Figure 2-2: Average daily storage in Pine Flat from October 1, 2022 through September 30, 2023

2.3 Reservoir Releases

The 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 shows 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, 2022 through September 30, 2023 ranged from 52 to 13,202 cfs, all above target flows. Average discharge from Pine Flat was 5,213 cfs during the report period.

Daily average Kings River flow at Piedra from October 1, 2022 through September 30, 2023 ranged from 100 to 13,371 cfs, all above target flows. Flow at Piedra averaged 5,412 cfs during the report period.

Daily average flow at Dennis Cut from October 1, 2022 through September 30, 2023 ranged from 5 to 476 cfs, all above target flows. Flow at Dennis Cut averaged 198 cfs during the report period. (Figure 2-5).

Target flow to Fresno Weir followed 'Exhibit C' flow schedule (Table 2-2) in WY 2023, due to preceding year conditions in WY 2022. Daily average Kings River flow to Fresno Weir from October 1, 2022 through September 30, 2023 was 4,819 cfs, ranging from 95 to 12,280 cfs (Figure 2-6). Flows to Fresno Weir during the report period were all above target flows.

Daily average flow below Fresno Weir from October 1, 2022 through September 30, 2023 ranged from 40 to 10,022 cfs (Figure 2-7). Flow below Fresno Weir averaged 3,676 cfs during the report period, all above target flows.



Figure 2-3: Average daily discharge from Pine Flat into the Kings River from October 1, 2022 through September 30, 2023



Figure 2-4: Average daily flow of Kings River at Piedra from October 1, 2022 through September 30, 2023



Figure 2-5: Average daily flow in Dennis Cut from October 1, 2022 through September 30, 2023



Figure 2-6: Average daily flow of Kings River at Fresno Weir from October 1, 2022 through September 30, 2023



Figure 2-7: Average daily flow of Kings River below Fresno Weir from October 1, 2022 through September 30, 2023

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. However, the record runoff observed will initiate Exhibit "D" flow requirements for the next water year. Target flows observed were 'Exhibit C' flows for the entire Water Year (Table 2-2).

| Exhibit C flows | Oct 1 - Nov 15 | Nov 16 - Mar 31 | Apr 1 - Sept 30 |
|-------------------------------------|----------------|-----------------|-----------------|
| 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 |

 Table 2-2. 'Exhibit C' target flows (cfs) from the Framework Agreement.

2.6 Summary

Hydrologic conditions, Pine Flat Reservoir operations and flows within the lower river during Water Year 2023 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations for the wettest, most runoff, Water Year on record. Several large storms in January and March resulted in large inflows into Pine Flat, as well as large from tributaries below the dam. On March 9-12 Mill Creek had a reported unregulated peak flow into the Kings River over 19,000 cfs although it was measured at a significantly lower than reported value, about 12,100 cfs. Of the 4.5-million-acre feet of runoff observed in Water Year 2023, approximately 145-thousand-acre-feet was produced by Mill Creek alone. That volume is roughly 40% of the entire Water Year 2015 natural flow volume. 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, Kings River flow at Piedra, flow in Dennis Cut, flow to Fresno Weir, and flow over Fresno Weir 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 2023, however, water orders often exceeded these requirements;
- Kings River Flow regime was influenced by flood control criteria determined by the Army Corps of Engineers for 152-days, from February 22, 2023 through July 24, 2023

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. 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. Blending to maintain habitat conditions did not occur during this reporting period.

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 throughout most of the year but was most pronounced in September and April through September, with isothermal temperatures in November (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 5.0 mg/L occurred throughout the reservoir between December and August and remained greater than 5.0 mg/L throughout all but the bottommost levels of the reservoir through the remainder of the water year.



PINE FLAT RESERVOIR 10/11/2022 (Time: 1021-1113) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 740.36

Figure 3-1: Pine Flat Reservoir profile taken 10/11/2022

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 6.7°C, 22.1°C, and 11.8°C respectively. The daily minimum, maximum, and average temperatures recorded at Fresno Weir were 7.6°C, 23.6°C, and 13.1°C. Throughout the season, daily average water temperature at Fresno Weir were approximately 1.3 °C higher than at ACOE Bridge. However, daily average water temperature at Fresno Weir were recorded as much as 5.0 °C higher and 2.0 °C lower than at ACOE Bridge.



Figure 3-2: Daily average water temperature at the ACOE Bridge October 1, 2022 through September 30, 2023.



Figure 3-3: Daily average water temperature at Fresno Weir October 1, 2022 through September 30, 2023

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 2022-2023 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 2022 through September 2023 is presented in Figure 3-4. The Manta dissolved oxygen meter used for monitoring has an accuracy of ± 0.1 mg/L. Minimum and maximum dissolved oxygen content recorded during this reporting period was 7.1 mg/L and 12.5 mg/L respectively. The daily average dissolved oxygen content exceeded 7.0 mg/L throughout this reporting period, with an annual average of 9.6 mg/L.



Figure 3-4: Daily average dissolved oxygen content at the ACOE Bridge October 1, 2022 through September 30, 2023

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 2023 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 2022-2023 water year reservoir profiles indicate thermal stratification occurred throughout most of the year but was most pronounced in September and April through September, with isothermal

temperatures in November. 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 between December and August and remained greater than 5.0 mg/L throughout all but the bottommost levels of the reservoir through the remainder of the water year.

- 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 intended 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. In 2021 Cramer Fish Sciences was contracted to create a technical memorandum and to bring the following habitat enhancement projects to a 30% design level:

- 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 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.

These documents were completed and accepted into the program at the end of the 2022 reporting period. These projects remain on hold pending available grant funding.

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 the spring of 2022, after consultation between the ACOE and CDFW Reservoir Biologist, it was recommended that prefabricated fish habitat structures be purchased from Pond King for installation into the reservoir. CDFW purchased 18 "Honey Hole" habitat structures which were later placed in 2023 in the vicinity of Flume Cove/Lefever Creek. The 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 2023, sub-catchable, catchable, super-catchable and trophy rainbow trout were planted in the Lower Kings River, below Pine Flat Dam. The upper Kings River, above Pine Flat Reservoir, received a catchable brown trout allotment. Pine Flat Reservoir received a catchable brown trout allotment. No fingerling Chinook salmon were planted in Pine Flat Reservoir in 2023. 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 diploid trout, when available, 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. 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 lb.) to 50,000 (16,600 lb.) catchable diploid rainbow trout between October and March each year. Catchable sized trout measure between 9and 10-inches fork length and weigh 3 fish per pound. In 2022, CTF shut down operations due to anticipated poor water conditions, with a plan to resume once operations improved. As a result, a contract was established with Desert Springs Trout Farm (DSTF) to provide catchable sized trout which averaged 3 fish/pound. KRCD also purchased supplemental fish for the Kings River from DSTF in this reporting period.

The goals of the KFRMP 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 67%. Reach 1 and 33% Reach 2. Total pounds and number of fish delivered are reported in Table 5-1. An additional 2,000 pounds had been scheduled for delivery in late March but was cancelled when the Fresno County Sherriff's Office closed the river to recreational use below Pine Flat Dam due to unsafe instream flows on March 14.

| | Reach 1 | | | | Reach 2 | | | KRFMP + KRCD | | | |
|----------|------------|--------|-------|------------|---------|-------|-------|--------------|---------|--------|----------|
| | KRFMP KRCD | | CD | KRFMP KRCD | | CD | Total | | Average | | |
| Month | # Ibs | #fish | # Ibs | #fish | # Ibs | #fish | # Ibs | # fish | # Ibs | #fish | lbs/fish |
| November | 900 | 2,646 | 0 | 0 | 300 | 882 | 0 | 0 | 1,200 | 3,528 | 0.34 |
| December | 2,664 | 6,608 | 1,581 | 3,496 | 536 | 1,338 | 519 | 1,151 | 5,300 | 12,593 | 0.42 |
| January | 2,250 | 4,069 | 0 | 0 | 750 | 1,357 | 0 | 0 | 3,000 | 5,426 | 0.55 |
| February | 1,953 | 5,646 | 1,372 | 3,701 | 647 | 1,870 | 678 | 1,830 | 4,650 | 13,047 | 0.36 |
| March | 0 | 0 | 1,340 | 3,993 | 0 | 0 | 660 | 1,967 | 2,000 | 5,960 | 0.34 |
| Total | 7,767 | 18,969 | 4,293 | 11,190 | 2,233 | 5,447 | 1,857 | 4,948 | 16,150 | 40,554 | 0.40 |

 Table 5-1: Summary of 2022-2023 KRFMP and KRCD supplemental stocking by Desert Springs Trout

 Farm.

For 2023-2024 supplemental stocking of catchable-sized trout will be provided by Desert Springs Trout Farm through the KRFMP, and by Calaveras Trout Farm through the KRCD. This stocking is anticipated between October and May.

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 2022 - 2023 program year diploid rainbow trout eggs were purchased from Cold Springs Trout Farm, with two 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.

Table 5-2: Incubator building activity 2022 – 2023. 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.

| | Number of Eggs | Estimated | Estimated Fry | Put & Take | Catch & Release |
|----------------------|----------------|------------|---------------|------------|-----------------|
| Incubation Period | Incubated | Hatch Rate | Released | Zone | Zone |
| 12/28/2022-2/16/2023 | 121,000 | 96% | 66,000 | 48% | 52% |
| 2/22/2023-4/12/2023 | 121,000 | 97% | 81,000 | 66% | 34% |

During the December through February rearing period average water temperatures were within the range Woynarovich et al. (2011) consider optimal (7°C-12.5°C) for the incubation of rainbow trout eggs until January 9. On January 9, it was observed that the hatch was 99% complete and average water temperature for the remainder of this rearing period was within the range Woynarovich et al. (2011) consider optimal for both sac- and swim-up fry (7°C-20°C).

Heavy losses occurred between January 9 and January 16 due to high turbidity and the deposition of heavy sediment within the raceways during a storm event which saw a culvert, immediately upstream of the intake pool transport high volumes of mud toward the intake, along with reduced flows from the dam of around 50 cfs (Figure 5-1). During flows below 100 cfs, there is poor inflow into the intake pool, and no exit for water other than the incubator, thus little dilution of transported sediment. The heaviest losses were noted in raceway three, which had sac-fry within the troughs at the time of the event. It was estimated that upwards of 15,000 sac-fry may have been lost in raceway three alone. Fry which had been released into raceways three and four were collected and placed back in the incubation jars until water clarity

improved. On January 16 all sac-fry were released into the raceways to complete the incubation process. Some sac-fry are known to have escaped the building through the drains during the process of collecting fish and removing sediment as the troughs had to be drained in order to remove the heavy clay-like sediment which had been deposited.

On January 20, twenty-four days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage. Mortalities throughout most of this period were low, however a high portion of fry with severely deformed spines were observed and removed over the course of the rearing period. It is unknown what caused the spinal deformities, which primarily consisted of fish with a strong "C" shape which when extreme causes the fish to spin when swimming, rather than travel in a straight line or proper orientation. These deformities are commonly observed but seemed to be in a greater proportion ~30-40% of the hatched population.



Figure 5-1. Egg jars, raceways with hatched fry, mud being scraped from raceway, culvert upstream of intake pool, and intake pool and main channel at 52 cfs on January 11, 2023.

During the February through April rearing period average water temperatures within the incubator 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 23, thirty days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage (Figure 5; Appendix C). Mortalities remained low throughout most of this rearing period (L. Werner, KRCD, personal communication) despite poor water conditions associated with high turbidity throughout most

of the egg incubation and post-hatch days that wasn't unlike that experienced during the prior run (Figure 5-1). Due to high turbidity and a continued series of atmospheric rivers that moved into the area over the rearing period, hatched fry were held in the rearing jars for one to two-weeks post-hatch, with the fry released into the troughs only once water clarity improved and heavy sediments loads were no longer being deposited into the raceways. It is believed that because these heavy sediment loads were experienced prior to hatch and while the fry were still in the incubation losses were decreased as the heavy sediment did not deposit in the jars where egg movement kept the sediment suspended until it entered the raceways. While some fry did manage to escape the jars and into the raceways during this period, some of those fry were subsequently flushed through the drains in the process of daily draining the raceways in order to remove the accumulated sediment loads, despite keeping screens in place while the drains were pulled. It is unknown how many sac-fry may have been swept into the high-water channel, via the drains, and were then able to continue successful rearing to the swim-up stage. In addition to those sac-fry lost during these clean-up efforts, an unknown number of swim-up fry also escaped the building via the drains prior to release.

5.3 CDFW Stocking

The CDFW annual stocking between January 1 – December 31, 2023 are summarized here. CDFW provided hatchery grown salmonids in several different size categories to the Kings River below Pine Flat Reservoir (46,591 fish, 15,600 pounds), the upper Kings River, above Pine Flat Reservoir (7,498 fish, 2,272 pounds), Pine Flat Reservoir (42.265 fish, 16,150 pounds), and Avocado Lake (6,040 fish, 3,200 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

Fingerling trout are defined as trout that are 16.1 or more fish/pound and are generally less than 4 inches in length. Table 5-3 details stocking of sub-catchable trout. No fingerling rainbow trout or brown trout were stocked in the Kings River, below Pine Flat Reservoir, Pine Flat Reservoir nor the upper Kings River in 2023

| | | Finge | rlings |
|--|---------------------|---------|--------|
| Water | Enocios | Year | |
| water | Species | 20 | 23 |
| | | # Trout | Pounds |
| Kings River below Pine Flat Reservoir | Rainbow/Brown Trout | 0 | 0.0 |
| Pine Flat Reservoir | Rainbow/Brown Trout | 0 | 0.0 |
| Upper Kings River, above Pine Flat Reservoir | Rainbow/Brown Trout | 0 | 0.0 |
| Total | | 0 | 0.0 |

 Table 5-3:
 CDFW fingerling trout stocked in 2023.

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. Sub-catchable rainbow trout were stocked in the Kings River, below Pine flat

Reservoir and sub-catchable brown trout were stocked in Pine Flat Reservoir in 2023.

| | | Sub-Catchables | | |
|-----------------------|---------------|----------------|--------|--|
| Wator | Species | Year | | |
| water | species | 2023 | | |
| | | # Trout | Pounds | |
| Kings River below | Brook Trout | 0 | 0 | |
| Pine Flat Reservoir | Rainbow Trout | 25,000 | 2,500 | |
| Dino Elat Poconvoir | Brown Trout | 10,465 | 1,150 | |
| Fille Flat Resel Voli | Rainbow Trout | 0 | 0 | |
| Total | | 35,465 | 3,650 | |

Table 5-4: CDFW sub-catchable trout stocked 2023.

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 11,100 pounds (20,920 fish) of catchable size rainbow trout were stocked in the lower Kings River during 2023. Pine Flat received a total of 15,000 pounds (31,800 catchable rainbow trout), Avocado Lake received a total of 3,200 pounds (6,040 catchable rainbow trout) and the upper Kings River received 2,272 pounds (7,498 catchable brown trout) during this same period. No catchable brook trout were stocked during this period.

 Table 5-5: CDFW catchable sized trout stocked 2023.

| | | Catchables | | |
|---------------------|---------------|------------|--------|--|
| Mator | Creasian | Year | | |
| water | species | 2023 | | |
| | | # Trout | Pounds | |
| Kings River below | Brook Trout | 0 | 0 | |
| Pine Flat Reservoir | Rainbow Trout | 20,920 | 11,100 | |
| Pine Flat Reservoir | Rainbow Trout | 31,800 | 15,000 | |
| Avocado Lake | Rainbow Trout | 6,040 | 3,200 | |
| Upper Kings River | Brown Trout | 7,498 | 2,272 | |
| Total | | 66,258 | 31,572 | |

5.3.4 Super-Catchables

Super-catchable size trout are defined as trout greater than one pound and less than 3.00 pounds. Table 5-6 details stocking of super-catchable size trout. Kings River below Pine Flat Reservoir received a total of 1,000 pounds (373 trout) of super-catchable rainbow trout in 2023.

| | | Super-Catchables | | |
|---------------------|----------------------------|------------------|---------|--|
| Wator | Species | Year | | |
| water | species | 20 | 23 | |
| | | # Trout | Pounds | |
| Kings River below | Brook Trout | 0 | 0.0 | |
| Pine Flat Reservoir | Rainbow Trout | 373 | 1,000.0 | |
| Pine Flat Reservoir | Rainbow Trout | 0 | 0.0 | |
| Avocado Lake | Avocado Lake Rainbow Trout | | 0.0 | |
| Total | | 373 | 1,000.0 | |

 Table 5-6: CDFW super-catchable sized trout stocked 2023.

5.3.5 Trophy Trout

Trophy size trout are defined as trout greater than 2.99 pounds each. Table 5-7 details stocking of trophy size trout. Kings River below Pine Flat Reservoir received a total of 1,000 pounds (248 trout) of trophy rainbow trout in 2023.

| Table 5-7: | CDFW | trophy | sized | trout | stocked | 2023. |
|-------------------|------|--------|-------|-------|---------|-------|
|-------------------|------|--------|-------|-------|---------|-------|

| | | Trophy | |
|---------------------------------------|---------------|---------|---------|
| Watar | Creation | Year | |
| water | species | 2023 | |
| | | # Trout | Pounds |
| Kings Biyer below Dine Elet Beservoir | Brook Trout | 0 | 0 |
| Kings River below Pine Flat Reservoir | Rainbow Trout | 248 | 1,000.0 |
| Total | | 248 | 1,000.0 |

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.

Electro-fishing surveys have been used since 1983 by KRCD and CDFW biologists to monitor the fish

population in the Kings River. Methods have varied over time, but since 2007, a multi-pass depletion method, utilizing backpack electro-fishers and block nets on the upstream and downstream ends of each 300-foot-long survey site has been used. This method allows for more rigorous sampling and provides a more complete assessment of the species composition and abundance found in the sample site. Sampling the same sites can show trends in the fish populations. Sampling is conducted at six sites within the three uppermost management reaches of the lower Kings River (Figure 6-1). Reach One which consists of the section of river between Pine Flat Dam and Cobbles (Alta) Weir is managed as a put-and-take trout fishery, permitting take of up to five trout daily, between the ACOE Bridge and Cobbles (Alta) Weir. The area above the ACOE Bridge has been closed to fishing by order of Homeland Security since September 2001. Additionally, within Reach One, the Thorburn Channel and a 200' radius from the channel exit is closed to fishing by CDFW regulations. Both Reach Two and the portion of Reach Three above Highway 180 are managed as a catch-and-release trout fishery, with special regulations permitting zero take of trout and prohibitions on the use of bait and barbed hooks between Cobbles (Alta) Weir and the Highway 180 crossing. Reach Two is located between Cobbles (Alta) Weir and Fresno Weir while Reach Three consists of the portion of river from Fresno Weir to the Reedley Narrows gauging station. This reach is an opportunistic trout fishery as water temperatures downstream of Fresno Weir may not remain suitable for trout in some years.

Each fish collected was identified to the lowest practical taxon, weighed, and total length measured, except for trout which are measured to fork length. Further, rainbow trout are classified as either hatchery trout or "wild" trout based on characteristics observed while in hand. CDFW (2010) defines a wild trout as "A trout that was born in the wild and lives its life cycle in the wild, regardless of the origin of its parents." Since 1983 KRCD has used visual inspection of fin condition as the primary means to distinguish between "wild" and hatchery origin rainbow trout. Rainbow trout with fins in excellent condition were classified as "wild" rainbow trout while rainbow trout exhibiting missing or abraded fins were categorized as hatchery rainbow trout. Because of morphological similarity trout may be misclassified. There may be little morphological difference in rainbow trout assumed to have originated via natural in-river reproduction, the KRFMP incubator facility, or hatchery trout who have carried over from a past season. Reports of past Fall Population Electro-fishing Surveys can be found on the KRFMP website: http://krfmp.org/resources/reports-documents/.



Figure 6-1: Electro-fishing sites in the Kings River and their respective KRFMP management zones

During this reporting period electro-fishing surveys were conducted at all six sample sites between November 29 and December 8 (Figure 6-1). A total of 5,585 fish were collected, with complete data collected for 4,894 fish and entered into MicroFish 3.0 for further analysis. In Wildwood, both quantity of collected fish and time restraints due to the onset of sunset forced surveyors to resort to tallying fish. As a result, 87% of the fish collected at Wildwood were fully sampled. Species composition reported here is reflective of the entire capture, while all other results are based only on the fish entered in MicroFish 3.0.

Native fishes dominated the survey in abundance (98.6%) and biomass (95%), with introduced fish accounting for the remainder. While catch results show populations of different species fluctuate by site, the assemblage continues to be dominated by native Sacramento suckers, cyprinid species, and sculpin. These fish most accurately meet the criteria of the pikeminnow-hardhead-sucker assemblage as described by Moyle (2002). While deep-bodied fishes were present, they made up less than one percent of the species assemblage. "Wild" trout were present, but were less than one percent of the species assemblage, as expected for a low elevation, low gradient, fish assemblage.

Catch results provided evidence of successful reproduction for native species as both juvenile and adult life stages were collected for most taxa during the survey. Exceptions being the lack of immature three-spine stickleback and adult "wild" rainbow trout captured on the survey. Three-spine stickleback typically live no more than one year, and all members of the annual cohort would have reached adulthood by the time of the survey. A lack of adult "wild" rainbow trout should not be interpreted to mean they are absent from the river below Pine Flat Dam as only 2.7% of the river is sampled between the dam and Highway 180 leaving most of the river unsampled, thus missing "wild" trout which may be present within the unsampled area. Catch results suggested that introduced non-native bass could reproduce in the Kings River.

For each of the species captured in the Kings River several different variables were calculated for each 300-foot sample site. Collected data was entered into MicroFish 3.0 which then generated the total catch, population estimates, and biomass for each species collected for each site. Population estimates were used to calculate the estimated fish per mile for each species per site. For species collected during the 2022 survey, species composition, lengths of captured fish, and the ranges across sites for population estimates, fish per mile, and biomass are summarized below in Table 6-1.

| | Range across Survey Sites | | | Captured |
|---------------------------------------|-----------------------------|---------------------------|---------------|--------------|
| Species Collected | Population Estimates | Fish per Mile (estimated) | Biomass (lbs) | Lengths (in) |
| Sacramento Sucker | 208-697 | 3,661-12,267 | 1.7-96.0 | 2-22 |
| Sacramento Pikeminnow | 168-334 | 2,112-5,878 | 0.7-4.6 | 0.4-9 |
| California Roach | 2-342 | 35-6,019 | 0.002-2.2 | 1-6 |
| Three-spine Stickleback | 45-551 | 792-9,698 | 0.07-0.2 | 1-2 |
| Sculpin | 10-338 | 176-5,949 | 0.1-4.4 | 2-5 |
| Lamprey | 2-262 | 35-4,611 | 0.02-0.6 | 1-7 |
| Hardhead | 0-32 | 0-563 | 0-0.1 | 2-4 |
| Bass ^a | 0-24 | 0-422 | 0-0.8 | 3-10 |
| Western Mosquitofish ^a | 0-11 | 0-194 | 0-0.02 | 1-3 |
| Rainbow Trout - Hatchery ^a | 0-7 | 0-123 | 0-4.5 | 8-15 |
| Brown Trout ^a | 0-8 | 0-141 | 0-0.3 | 5-7 |
| Rainbow Trout - "Wild" | 0-1 | 0-18 | 0-0.2 | 5-8 |
| Bhuegill ^a | 0-1 | 0-18 | 0-0.01 | 2.8 |
| Catfish ^a | 0-1 | 0-18 | 0-0.8 | 12.6 |

Table 6-1: Summary results, Fall Population Electro-fishing Survey, 2022.

^a Introduced (non-native to the watershed or hatchery reared trout)

Condition factor of collected trout was also examined. While Fulton's condition factor suggested "wild" rainbow trout were in worse condition than the hatchery produced brown trout and rainbow trout, length-weight regression analysis indicated all trout were in excellent condition at the time of capture. This is not surprising as hatchery reared trout rear in an environment where they are fed artificial diets daily before release, while condition of resident fish will be reflective of survival through recent riverine conditions including thermal conditions, prey availability, energetic expenditures, intraspecific interactions, predator avoidance and/or angler pressure, or some other unconsidered variable.

Fluctuations in fish populations are normal. While native fish currently dominate the species assemblage throughout the Kings River below Pine Flat Dam, there may be years when release temperatures are warmer, and instream flows lesser and of longer duration which may provide better conditions for introduced non-native fish. Variations in species composition cannot be attributed to any single cause and most likely a combination of environmental and anthropogenic factors influences the fishery population.

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. Creel surveys were not performed in 2022-2023 due to insufficient staffing needs. CDFW purchased Floy Tags in 2023 to run a tagging study, using supplemental stocked fish, concurrent with the Creel Survey. Floy Tags (5,500 Floy Tags) were purchased in eleven different colors (500 Floy Tags per color). Cost of Floy Tags were \$3,992.70

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: <u>http://krfmp.org/</u>.

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 monthly September – November 2022, a timeframe when reservoir outflow was being reduced and temperature concerns following a dry year persisted into the autumn. Mid November a cooling trend diminished those concerns. The winter following that produced significant flow and water availability to keep river flow high through autumn and the end of the water year. No reports were circulated in the Fall of 2023.

7.3 Educational Tours

7.3.1 Incubator Building

Two tours were hosted at the incubator during the 2022-2023 rearing period (Table 7-1). 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.

 Table 7 - 1: Organizations and classes provided with tours of the KRFMP Trout Incubator during the 2022-2023 season.

| Date | Organization |
|-----------|--|
| 1/27/2023 | Kings River Conservancy Program - Get Curious on the Kings |
| 5/1/2023 | Fresno County Farm Bureau - Future Advocates for Agriculture Concerned |
| | About Tomorrow (FAACT) Class |

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 (ACOE), 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 from 8:00AM – 9:30AM and public participation was encouraged. Heavy storm events in January 2023 and March 2023 resulted in flood releases from Pine Flat Dam from February 22, 2023 through July 24, 2023.

The monthly Kings River Cleanups were cancelled from March 2023 – July 2023 due to safety concerns. The Kings River Cleanups resumed on August 19, 2023. 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 2023 cleanup was originally scheduled for September 16th but was moved to September 23rd 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 7-2.

| Table 7 - 2: Location, number of volunteers, and quantity of trash removed during the 2022-20 | 23 |
|---|----|
| reporting period. | |

| Date | Location | # Volunteers | Trash Bags |
|------------|---------------------------------------|---------------|----------------------|
| | | (Agency Staff | Collected |
| | | & Public) | |
| 10/15/2022 | Reedley where the Kings River cross | 71 | 75 bags, tires, |
| | beneath Manning Ave | | mattress, small |
| | | | furniture, shopping |
| | | | carts |
| 11/19/2022 | Cobbles Weir/Alta electrofishing site | 15 | 12 bags, 1 kiddie |
| | | | pool, bedding, 2 |
| | | | tires, kid's water |
| | | | table toy |
| 12/17/2022 | North Riverside Access Park including | 11 | 11 bags, fixed holes |
| | the southern riverbanks | | on public trail |
| 1/21/2023 | Sycamore Point River Access Area | 8 | 11 bags |
| 2/18/2023 | Kings River Wildlife Area | 9 | 7 bags |
| 8/19/2023 | North Riverside Access Park and | 8 | 8 bags |
| | southern riverbanks | | |
| 9/23/2023 | Kings River Wildlife Area | No Data | Activities included |
| | | | planting grain and |
| | | | flower seeds for |
| | | | wildlife and picked |
| | | | up trash along the |
| | | | Kings River |

7.5 Fishing Regulation Signs

Signs for the general regulations are posted throughout Reach 1 between the Army Corps of Engineer Bridge and Cobbles (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. These signs are posted in locations where they are readily visible to any person using or entering the area and close to those areas where stocking trucks plant fish. In this reporting period, to best assist law enforcement with enforcement of the regulations the KRFMP provided graffiti wipes to individuals whose responsibility area includes the Kings River and replaced signs which became damaged, unreadable, or were missing.

8.0 MAINTENANCE ACTIVITIES

8.1 Thorburn Channel

The headgate was opened in April 2023 to accommodate flood flows and flush accumulated sediment from the Thorburn Channel.

8.2 Incubator Building

While in service, daily operation and maintenance of the incubator facility is the responsibility of KRCD staff Monday through Friday. Weekends, weekdays as needed, and holidays are covered by KRWA staff or public volunteers. Staff and public volunteers assist with planting 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. 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 2022-2023 season.

| Incubation Period | Volunteers (#) | \sim Time (Hours) |
|----------------------|----------------|---------------------|
| 12/28/2022-2/16/2023 | 20 | 53 |
| 2/22/2023-4/12/2023 | 5 | 10 |

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

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- Moyle, P. B. 2002. Inland Fishes of California: Revised and Expanded. University of California Press. Berkeley, California. 502 pp.
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APPENDIX A

Pine Flat Reservoir Temperature and Dissolved Oxygen Profiles October 2022 – September 2023



PINE FLAT RESERVOIR 10/11/2022 (Time: 1021-1113) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 740.36



PINE FLAT RESERVOIR 11/1/2022 (Time: 1022-1059) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 740.97



PINE FLAT RESERVOIR 12/6/2022 (Time: 1134-1236) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 752.32



PINE FLAT RESERVOIR 01/04/2023 (Time: 0950-1050) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 792.50



PINE FLAT RESERVOIR 2/8/2023 (Time: 1029-1154) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 859.13



PINE FLAT RESERVOIR 03/07/2023 (Time: 0958-1109) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 864.00



PINE FLAT RESERVOIR 4/4/2023 (Time: 1019-1146) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 893.83



PINE FLAT RESERVOIR 5/3/2023 (Time: 1018-1140) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 831.18



PINE FLAT RESERVOIR 6/6/2023 (Time: 1018-1140) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 863.02



PINE FLAT RESERVOIR 07/06/2023 (Time: 0954 - 1121) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 933.90



PINE FLAT RESERVOIR 8/1/2023 (Time: 0922-1053) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 945.42



PINE FLAT RESERVOIR 9/6/2023 (Time: 1034-1216) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 915.38