## TABLE OF CONTENTS

Page



## LIST OF TABLES

No table of figures entries found.

## LIST OF FIGURES

No table of figures entries found.

## LIST OF ACRONYMS

| | |
|---|---|
| CFR | Code of Federal Regulations |
| FERC or Commission | Federal Energy Regulatory Commission |
| PAD | Pre-Application Document |
| Project | Kaweah Project |
| SD | Supporting Document |
| TSP | Technical Study Plan |
| TSR | Technical Study Report |

This Page Intentionally Left Blank

# 7.0 AFFECTED ENVIRONMENT

This section follows the Federal Energy Regulatory Commission's (FERC or Commission) content requirements at Title 18 of the Code of Federal Regulations (CFR) §5.18(b)(5)(ii)(A) which specify that, "the applicant must provide a detailed description of the affected environment or area(s) to be affected by the proposed project by each resource area. This description must include the information on the affected environment filed in the Pre-Application Document (PAD) provided for in §5.6, developed under the applicant's approved study plan, and otherwise developed or obtained by the applicant. The section must include a general description of socio-economic conditions in the vicinity of the project including general land use patterns (e.g., urban, agricultural, forested), population patterns, and sources of employment in the project vicinity." In addition, as required under §5.18(b), this section follows the Commission's "Preparing Environmental Documents: Guidelines for Applicants, Contractors, and Staff" (FERC 2008).

The affected environment was developed from information included in Southern California Edison Company's PAD and collected during implementation of 17 FERC-approved Technical Study Plans (TSP) developed for the relicensing of the Kaweah Project (Project). Results of these studies are provided in Technical Study Reports (TSR) included in Supporting Document (SD) A. The affected environment descriptions identify existing resource conditions under current operations and maintenance of the Kaweah Project (baseline conditions).

This section is organized as follows:

- 7.1 – Description of the Kaweah River Basin
- 7.2 – Water Use and Hydrology Affected Environment
- 7.3 – Water Quality Affected Environment
- 7.4 – Fish and Aquatics Resources Affected Environment
- 7.5 – Botanical and Wildlife Resources Affected Environment
- 7.6 – Geology and Soils Affected Environment
- 7.7 – Geomorphology Affected Environment
- 7.8 – Riparian Resources Affected Environment
- 7.9 – Land Use Affected Environment
- 7.10 – Recreation Resources Affected Environment
- 7.11 – Aesthetic Resources Affected Environment
- 7.12 – Cultural Resources Affected Environment

- 7.13 – Tribal Resources Affected Environment
- 7.14 – Socioeconomic Affected Environment

## 7.1 LITERATURE CITED

FERC (Federal Energy Regulatory Commission). 2008. Preparing Environmental Documents: Guidelines for Applicants, Contractors, and Staff.

## TABLE OF CONTENTS

Page



## LIST OF TABLES



## LIST OF FIGURES



## LIST OF MAPS

## LIST OF ACRONYMS

| | |
|---|---|
| °F | degrees Fahrenheit |
| ac-ft | acre-feet |
| Basin or Watershed | Kaweah River Basin |
| BLM | Bureau of Land Management |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| Commission | Federal Energy Regulatory Commission |
| CRWQCB | California Regional Water Quality Control Board |
| FERC | Federal Energy Regulatory Commission |
| ft | feet |
| mi | mile |
| $mi^2$ | square mile |
| msl | mean sea level |
| NPS | National Park Service |
| POR | Period of record |
| Project | Kaweah Project |
| SCE | Southern California Edison Company |
| SNP | Sequoia National Park |
| SUP | Special Use Permit |
| USACE | United States Army Corps of Engineers |
| WY | water year |

## 7.1 DESCRIPTION OF THE KAWEAH RIVER BASIN

This section describes the Kaweah River Basin (Basin or Watershed), which contains Southern California Edison Company's (SCE or Licensee) Kaweah Project (Project). The Federal Energy Regulatory Commission's (FERC or Commission) content requirements for this section are specified in Title 18 of the Code of Federal Regulations (CFR) §5.18(b)(1).

This section provides an overview of the Kaweah River Basin, including information on the overall watershed area and sub-watershed areas; rivers and streams affected by the Project; major land and water uses; and other dams and diversions in the Watershed.

### 7.1.1 Information Sources

This section was prepared utilizing the following information sources:

- California Regional Water Quality Control Board (CRWQCB) Central Valley Region's Water Quality Control Plan for the Tulare Lake Basin (CRWQCB 2018);
- FERC's Order Amending License for the Terminus Dam Project (FERC Project No. 3947) (FERC 2003a and b);
- FERC's SCE Kaweah Project Environmental Assessment, FERC Project No. 298-000 (FERC 1991);
- National Park Services' (NPS) Final General Management Plan and Comprehensive River Management Plan/Environmental Impact Statement for Sequoia and Kings National Parks (NPS 2006);
- SCE's Pre-Application Document for the Kaweah Project (SCE 2016);
- Southern Sierra Integrated Regional Water Management Plan (Provost & Prichard 2014);
- U.S. Army Corps of Engineers' (USACE) final feasibility investigation for providing increased flood protection and upstream storage for irrigation water supply (USACE 1996); and
- U.S. Bureau of Land Management (BLM) Bakersfield Field Office Resource Management Plan (BLM 2014).

These references are cited throughout the text and complete reference information is provided at the end of this section.

### 7.1.2 Overview of the Kaweah River Basin

The upper and lower watersheds of the Kaweah River are separated by the USACE's Terminus Dam, which impounds the Kaweah River forming Lake Kaweah. Lake Kaweah is situated where mountainous terrain transitions into a gentle foothill and valley environment. The Kaweah River Basin upstream of Lake Kaweah is comprised of five primary forks, including the Middle, Marble, East, North, and South forks of the Kaweah River (Map 7.1-1). The upper watersheds originate at elevations higher than 8,400 feet above mean sea level (msl) in the southern portion of the Sierra Nevada in lands administered by the NPS. The Marble and Middle forks of the Kaweah River are contained wholly within the Sequoia National Park (SNP). In the lower elevations, the East, North, and South forks of the Kaweah River flow through private lands and lands administered by the BLM. Land jurisdictions in the Project vicinity are shown on Map 7.1-2.

Together, the Watershed, including the local sub-basins surrounding Lake Kaweah, encompass a 561-square mile area. Table 7.1-1 provides a summary of the sub-basin areas, stream length, and elevations in the Project vicinity. The Middle, Marble, and East forks of the Kaweah River originate along the Great Western Divide at elevations higher than 8,400 feet above msl. The Middle Fork Kaweah River drains a 103.1-square mile area. It originates in a glacial U-shaped valley and intersects with the Marble Fork approximately 20.3 miles downstream forming the Kaweah River. The Marble Fork Kaweah River drains approximately 52.5 square miles and terminates at the confluence with the Middle Fork Kaweah River approximately 17.4 miles downstream from the headwater at the Kaweah River. The Kaweah River downstream from the confluence of the Middle and Marble forks of the Kaweah River drains approximately 36.6 square miles. The local watershed surrounding Lake Kaweah drains approximately 46.9 square miles.

The East Fork Kaweah River drains a 95-square mile area, flows through the U-shaped, glaciated Mineral King Valley before joining the Kaweah River 23.3 miles downstream. The East Fork Kaweah River joins the Kaweah River approximately 4 miles downstream from the confluence of the Middle and Marble forks of the Kaweah River. The North Fork Kaweah River, with a drainage area of 137.5 square miles, originates in several headwater streams along the Kings-Kaweah Divide and flows out of the Jennie Lakes Wilderness. The river joins the Kaweah River 26.4 miles downstream from its headwaters, approximately 5.3 miles downstream from the East Fork and Kaweah River confluence. The South Fork Kaweah River originates on the Hockett Plateau west of the Great Western Divide at approximately 9,500 feet above msl. It drains an 89.4-square mile area, and flows approximately 24.7 miles to the confluence with the Kaweah River, 2.7 miles downstream of the North Fork Kaweah River and Kaweah River confluence.

Downstream of Lake Kaweah, the Kaweah River flows southwest into the Central Valley near the town of Visalia where it splits into various creeks in which flows are depleted for irrigation purposes (non-FERC Project related diversion).

The Basin is characterized by hot, dry summers and mild, wet winters. Precipitation falls as rain in the lower elevations and primarily as snowfall at elevations greater than approximately 4,000 feet above msl. Snowpack in the high elevations within the Basin can persist well into the summer months in wetter years. Mean annual precipitation in the lower elevations (near the town of Three Rivers) is approximately 24 inches and at higher elevations is about 45 inches (in the SNP).[1]

Precipitation and snowfall accumulation are recorded in the vicinity of the Kaweah Project through a network of monitoring and recording stations operated by SCE, USACE, BLM, and Sequoia and Kings Canyon National Parks (Table 7.1-2). Measurements are collected at higher elevations in the headwaters near Mineral King (9,500 feet above msl) down to the lower elevations near Three Rivers (1,400 feet above msl) and Lake Kaweah (752 feet above msl). Real-time and historical rainfall and snowfall data are available on the California Data Exchange Center website (http://cdec.water.ca.gov).

Air temperatures in the Watershed can range from over 100 degrees Fahrenheit (°F) during the summer months in the lower elevations to below freezing during the winter in the headwaters. Average annual air temperatures near Three Rivers, CA, near the Project, range from 48°F to 76°F.

The amount of runoff derived from rainfall and snowmelt can vary greatly. The typical snowmelt period, when runoff and stream flows are high, starts in March, peaks in May or early June, and ends by July. Runoff peaks earlier in years with below average precipitation and lasts longer during wet years.

Total annual inflow into the Project (combined inflow at the Kaweah No. 1 and No. 2 diversions) between water years 1994–2018 ranged from approximately 78,000 acre-feet (ac-ft) (2015) to more than 668,000 ac-ft (2017). The median total annual inflow was approximately 229,000 ac-ft during this period (Figure 7.1-1).

The principal Kaweah Project facilities under FERC jurisdiction are shown on Map 7.1-3. A detailed description of the Project facilities and operations is presented in Section 3.0 – No-Action Alternative. The operation of the Project affects flows and potentially affects resources on the following river reaches:

- East Fork Kaweah River, from the Kaweah No. 1 Diversion to the confluence with the Kaweah River (4.7 miles); and
- Kaweah River, from the Kaweah No. 2 Diversion to the confluence of the Kaweah No. 2 Powerhouse Tailrace and the Kaweah River (4.1 miles).

### 7.1.3 Major Land Uses in the Project Vicinity

The Watershed, upstream of the community of Three Rivers, is mostly forested, rural in nature, and sparsely populated. The Watershed contains public and private lands. The upper watershed originates in the higher elevations of the SNP, with a portion of the watersheds managed as National Wilderness Areas (Sequoia-Kings Canyon and John Krebs Wilderness areas). The Middle, Marble, and East forks of the Kaweah River

[1] Climate data obtained from US weather data: http://www.usclimatedata.com/climate/

originate in the upper watershed. The upper watershed, is a popular wilderness recreation area for both summer and winter recreation activities.

Upstream of the Project, SCE operates several non-FERC Project facilities within the SNP. These facilities include Eagle, Lady Franklin, Crystal, and Upper Monarch lakes and their associated dams (referred to as the Mineral King Lakes); the Marble Fork Diversion Dam and Flowline; and the Middle Fork Diversion Dam and Flowline. SCE has a Special Use Permit (SUP) with the NPS for the continued operation and maintenance of the dams and diversions on the Marble and Middle forks of the Kaweah River and for the storage of water at the Mineral King Lakes to better facilitate the timing of generation.

The Project facilities within the FERC Project boundary are located on private lands and public lands administered by the BLM. Downstream of the Project, the Kaweah River flows through private property and lands managed by the USACE (Lake Kaweah and associated recreation areas). Land jurisdiction in the Watershed is shown in Map 7.1-2.

Residents in the vicinity of the FERC Project live in the community of Hammond along State Highway 198 near Kaweah No.1 Powerhouse; at Oakgrove along Mineral King Road near the Kaweah No. 2 Diversion Dam; in dispersed locations particularly in the vicinity of Washburn Cove near the Kaweah No. 2 Powerhouse; and in the community of Three Rivers (FERC 1991). Residences and businesses border the river corridor in the vicinity of the FERC Project. There are also several grazing leases in the Project vicinity (BLM 2014). Land uses within and adjacent to the FERC Project boundary include residential, commercial, agriculture, industrial, public/institutional, and open space/wilderness (Tulare County 2018).

In the Project vicinity, river access is very limited due to the rugged terrain, lack of access trails, and private property adjacent to the river corridor. Two main paved roads provide the primary access to the Kaweah Project vicinity. Mineral King Road parallels the East Fork Kaweah River from the confluence with the Kaweah River to the SNP upstream of the Project. State Highway 198 parallels the Kaweah River from the confluence with Lake Kaweah to areas upstream of the Project in the SNP. Because of the private land ownership, public access to the Kaweah River from State Highway 198 is restricted in the Project vicinity (FERC 1991). There are several other public paved roads that provide access in the Project vicinity, including Dinely Road, Kaweah River Drive, Craig Ranch Road, and North Fork Drive. Map 7.1-3 shows the principal Project facilities and primary access roads in the Project vicinity.

In the vicinity of Lake Kaweah, downstream of the Project, the USACE manages several recreation areas, including Slick Rock and Cobble Ridge, which provide public access to the river and floodplain areas. These recreation areas support a variety of activities, including fishing, hiking, picnicking, boating, sunning, and other water-based activities. Lake Kaweah is also a popular recreation attraction, supporting camping, boating, fishing, and various water sport activities.

### 7.1.4 Major Water Uses in the Project Vicinity

Existing and potential beneficial uses that apply to the surface waters within the Watershed are identified in the *Water Quality Control Plan for the Tulare Lake Basin* (Basin Plan) (CRWQCB 2018). Beneficial uses identified in the Basin Plan that pertain to the Kaweah River above Lake Kaweah include: (1) municipal and domestic water supply; (2) hydropower generation; (3) water contact and non-contact water recreation; (4) warm freshwater fisheries; (5) cold freshwater fisheries; (6) wildlife habitat; (7) rare, threatened, and endangered species; (8) spawning, reproduction, and/or early development for fisheries; and (9) freshwater replenishment.

SCE operates the FERC Project for hydroelectric generation and consumptive use. Consumptive water is delivered to local water users from the Kaweah No. 1 and Kaweah No. 2 flowlines, consistent with SCE's contractual obligations. The required flow to protect water users during low-runoff periods is up to 1.0 cubic foot per second (cfs) from the Kaweah No. 1 Diversion and 3.0 cfs from the Kaweah No. 2 Diversion. During low-runoff periods, no water is diverted for generation purposes. Refer to Section 3.0 – No-Action Alternative and Section 7.2 – Water Use and Hydrology for more detailed information on operations of the Project.

### 7.1.5 Other Dams and Diversions

Flows in the Kaweah River Basin upstream of the Project are influenced by several SCE-owned and operated non-FERC Project facilities located in the SNP that store and/or divert water. SCE operates two non-FERC Project diversions under the SUP on the Middle and Marble forks of the Kaweah River (Kaweah No. 3 diversions) that divert flow via the Kaweah No. 3 Flowline to the Kaweah No. 3 Powerhouse. The Kaweah No. 3 diversions (Marble and Middle Fork diversions) were constructed in 1907 and 1913, respectively. Both Kaweah No. 3 diversions are operated in run-of-the-river mode and have limited storage (less than one ac-ft total combined storage).

SCE also stores water in four small non-FERC Project lakes near Mineral King in the upper East Fork Kaweah River watershed (Eagle Lake, Lady Franklin Lake, Crystal Lake, and Upper Monarch Lake) (up to 1,152 ac-ft). The lakes were originally constructed in 1903 and 1905 and are operated under a SUP with the NPS (FERC 1991). SCE releases water from these reservoirs in the late summer and fall months to augment low flows in the East Fork Kaweah River. Flows are diverted from the East Fork Kaweah River to the Kaweah No. 1 Flowline via the Kaweah No. 1 Diversion Dam (FERC Project facilities).

Approximately 10 miles downstream of the FERC Project, the Kaweah River is impounded by USACE's Terminus Dam that forms Lake Kaweah. The Terminus Dam was constructed in 1962 for flood management and to provide river control for irrigation purposes. During the spring runoff season the reservoir stores up to 185,000 ac-ft of water. Water is released from the dam at the direction of the USACE for flood control and to meet irrigation needs. Downstream of Terminus Dam, the Kaweah River flows are diverted for irrigation of adjacent farmlands. Water releases serve multiple local water districts, including the Tulare Irrigation District and the Kaweah Delta Water Conservation

District, and urban areas, including the cities of Tulare and Visalia. The Terminus Power Plant, completed in 1992 by the Kaweah River Power Authority, generates hydroelectricity at the dam. The power plant is jointly managed by Tulare Irrigation District and the Kaweah Delta Water Conservation District, and the electricity is distributed by SCE. The power plant has a capacity of 20.09 megawatts (FERC 2003a and b).

### 7.1.6 Literature Cited

BLM (U.S. Bureau of Land Management). 2014. Bakersfield Field Office Resource Management Plan. December. Available at: https://eplanning.blm.gov/epl-front-office/projects/lup/70273/92254/111143/Bakersfield_ROD-ARMP.pdf.

CRWQCB (California Regional Water Quality Control Board) Central Valley Region. 2018. Water Quality Control Plan for the Tulare Lake Basin Second Edition. Revised May 2018. Available at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/tlbp_201805.pdf.

FERC (Federal Energy Regulatory Commission). 1991. Environmental Assessment Federal Energy Regulatory Commission, Office of Hydropower Licensing, Division of Project Review Kaweah Project, FERC Project No. 298-000 – California. August 16, 1991.

FERC. 2003a. Order amending license re Kaweah River Power Authority's Terminus Dam Project under P-3947. FERC eLibrary No. 20031217-3018.

FERC. 2003b. Errata notice to notice dated December 17, 2003, Amending License re Kaweah River Power Authority under P-3947. FERC eLibrary No. 20040115-3024.

NPS (National Park Service). 2006. Sequoia and Kings Canyon National Parks and Middle and South Forks of the Kings River and North Fork of the Kern River Tulare and Fresno Counties, California Final General Management Plan and Comprehensive River Management Plan/Environmental Impact Statement. Available at: http://parkplanning.nps.gov/document.cfm?parkID=342&projectID=11110&documentID=17344.

NPS. 2016. Sequoia and Kings Canyon National Parks, Special Use Permit. Permit No. PWR-SEKI-6000-2016-015.

Provost & Prichard Consulting Group. 2014. Southern Sierra Integrated Regional Water Management Plan. Prepared in Cooperation with the Sequoia Riverlands Trust, Kamansky's Ecological Consulting, and GEOS Institute. November.

SCE (Southern California Edison Company). 2016. Pre-Application Document for the Kaweah Project. December.

Tulare County. 2018. *Three Rivers Community Plan: 2018 Update*. Tulare County, June 26, 2018. Available at: https://tularecounty.ca.gov/rma/index.cfm/planning-building/community-plans/updated-community-plans/three-rivers-community-plan/.

USACE (U.S. Army Corps of Engineers). 1996. Kaweah River Investigation, California, Final Feasibility Report. United States Department of the Army, South Pacific Division, Sacramento District. September. Available at: http://elibrary.ferc.gov/idmws/File_list.asp?document_id=13759225.

This Page Intentionally Left Blank

# TABLES

This Page Intentionally Left Blank

**Table 7.1-1. Information on Drainage Area and Stream Length of Waters in the Kaweah Watershed**

| Kaweah River Watershed Sub-Basin | Total Area ($mi^2$) | Sub-divided Areas ($mi^2$) | Stream Length (mi) | Elevation (ft) | |
|---|---|---|---|---|---|
| | | | | Starting | Ending |
| **Kaweah River Watershed** | | | | | |
| **Marble Fork Kaweah River Sub-Basin** | | | | | |
| Marble Fork Kaweah River – Headwaters to confluence with Middle Fork Kaweah River | 52.5 | | 17.4 | 10,920 | 2,020 |
| **Middle Fork Kaweah River Sub-Basin** | | | | | |
| Middle Fork Kaweah River – Headwaters to confluence with Marble Fork Kaweah River | 103.1 | | 20.3 | 11,005 | 2,020 |
| **East Fork Kaweah River Sub-Basin** | | | | | |
| East Fork Kaweah River – Headwaters to confluence with Kaweah River | 95 | | 23.3 | 10,200 | 1,270 |
| East Fork Kaweah River – Headwaters to Kaweah No. 1 Diversion Dam | | 85.7 | 18.6 | 10,200 | 2,585 |
| East Fork Kaweah River – Kaweah No. 1 Diversion Dam to confluence with Kaweah River | | 9.3 | 4.7 | 2,585 | 1,270 |
| **Kaweah River Sub-Basin** | | | | | |
| Kaweah River – Confluence of Middle Fork and Marble Fork to Lake Kaweah | 36.6 | | 12.6 | 2,020 | 720 |
| Kaweah River – Confluence of Middle Fork and Marble Fork to Kaweah No. 2 Diversion Dam | | 10.3 | 3.6 | 2,020 | 1,360 |
| Kaweah River – Kaweah No. 2 Diversion Dam to confluence with East Fork Kaweah River | | 2.1 | 0.6 | 1,360 | 1,260 |
| Kaweah River – Confluence with East Fork Kaweah River to Lake Kaweah | | 24.2 | 8.4 | 1,260 | 720 |
| **North Fork Kaweah River Sub-Basin** | | | | | |
| North Fork Kaweah River – Headwaters to confluence with Kaweah River | 137.5 | | 26.4 | 8,400 | 820 |

| Kaweah River Watershed Sub-Basin | Total Area ($mi^2$) | Sub-divided Areas ($mi^2$) | Stream Length (mi) | Elevation (ft) | |
|---|---|---|---|---|---|
| | | | | Starting | Ending |
| **South Fork Kaweah River Sub-Basin** | | | | | |
| South Fork Kaweah River – Headwaters to confluence with Kaweah River | 89.4 | | 24.7 | 9,480 | 750 |
| **Lake Kaweah Sub-Basin** | | | | | |
| Lake Kaweah – Local Watershed | 46.9 | | – | 720 | 694 |
| **Kaweah River Watershed – Total Area** | **561.0** | | | | |

## Table 7.1-2. Snow Courses and Meteorological Stations Located in the Vicinity of the Kaweah Project

| Name | Operator | Agency | Elevation (ft) | Location | |
|---|---|---|---|---|---|
| | | | | Latitude | Longitude |
| **Snow Courses** | | | | | |
| Panther Meadow | PTM | SEKI NP | 8600 | 36.588 | -118.717 |
| Mineral King | MNK | SEKI NP | 8000 | 36.437 | -118.587 |
| Giant Forest | GFR | SEKI NP | 6400 | 36.57 | -118.768 |
| **Meteorological Stations** | | | | | |
| Three Rivers PH No. 1 | 3RV | SCE | 1140 | 36.467 | -118.867 |
| Lake Kaweah Weather | LKW | USACE | 570 | 36.4153 | -118.6975 |
| Giant Forest | GFR | USACE | 6650 | 36.562 | -118.765 |
| Atwell Camp | ATW | USACE | 6400 | 36.464 | -118.631 |
| Lake Kaweah | KAWC1 | USACE | 540 | 36.41583 | -119.00556 |
| Three Rivers Museum | D0117 | APRSWXNET/CWOP and MADIS | 860 | 36.44829 | -118.90016 |
| Ash Mountain | TSHC1 | BLM and NPS | 1730 | 36.491389 | -118.825278 |
| Sequoia Natl Park-Lower Kaweah | CQ161 | California Air Resources Board and Local Air District | 6234 | 36.56611 | -118.77778 |
| WX6HNX-11 Sequoia NP | AT846 | APRSWXNET/CWOP and MADIS | 6690 | 36.60417 | -118.73306 |
| Case Mountain | CSWC1 | BLM and National Interagency Fire Center | 6450 | 36.410667 | -118.809222 |
| Pumpkin Hollow Bridge | CW4177 | CWOP | 1250 | 36.4775 | -118.8445 |

APRSWXNET/CWOP and MADIS = APRSWXNET/Citizen Weather Observer Program and Meteorological Assimilation Data Ingest System
BLM = Bureau of Land Management
NPS = National Park Service
SCE = Southern California Edison Company
SEKI NP = Sequoia and Kings Canyon National Parks
USACE = U.S. Army Corps of Engineers

This Page Intentionally Left Blank

# FIGURES

This Page Intentionally Left Blank

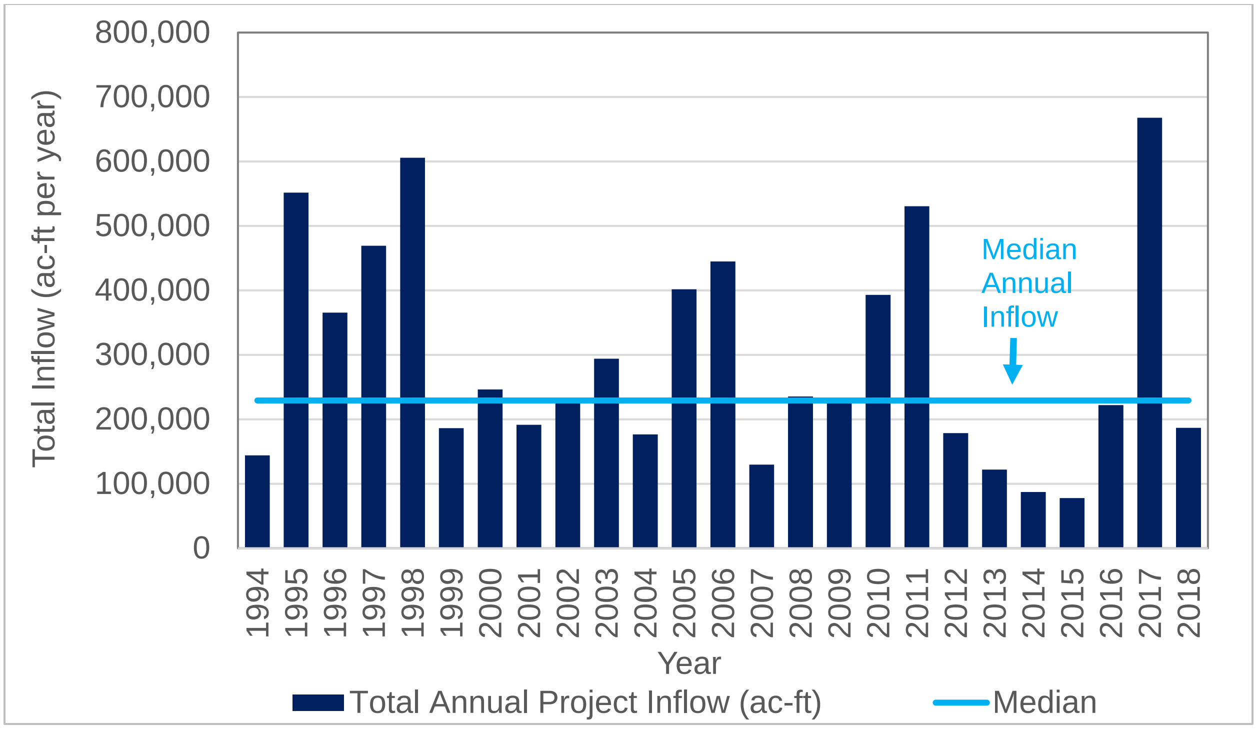


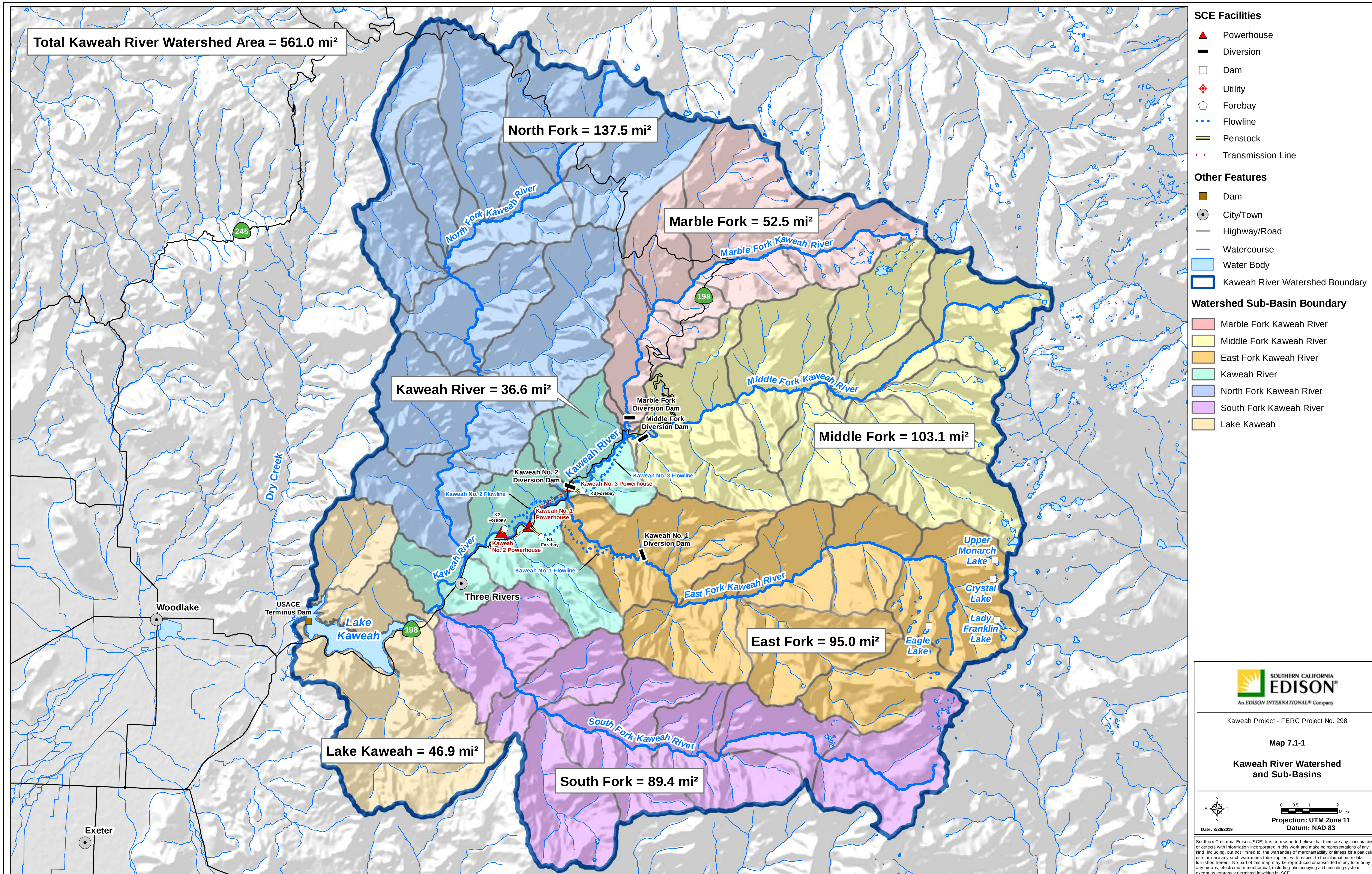

**Figure 7.1-1. Annual Inflow to the Kaweah Project (WY 1994–2018)[2]**

[2] The period of record (POR) used to characterize recent historical flows in the Kaweah River and East Fork Kaweah River extends from water year 1994 through 2018. This time period best represents Project operations since issuance of the FERC license and recent climatic conditions.

This Page Intentionally Left Blank

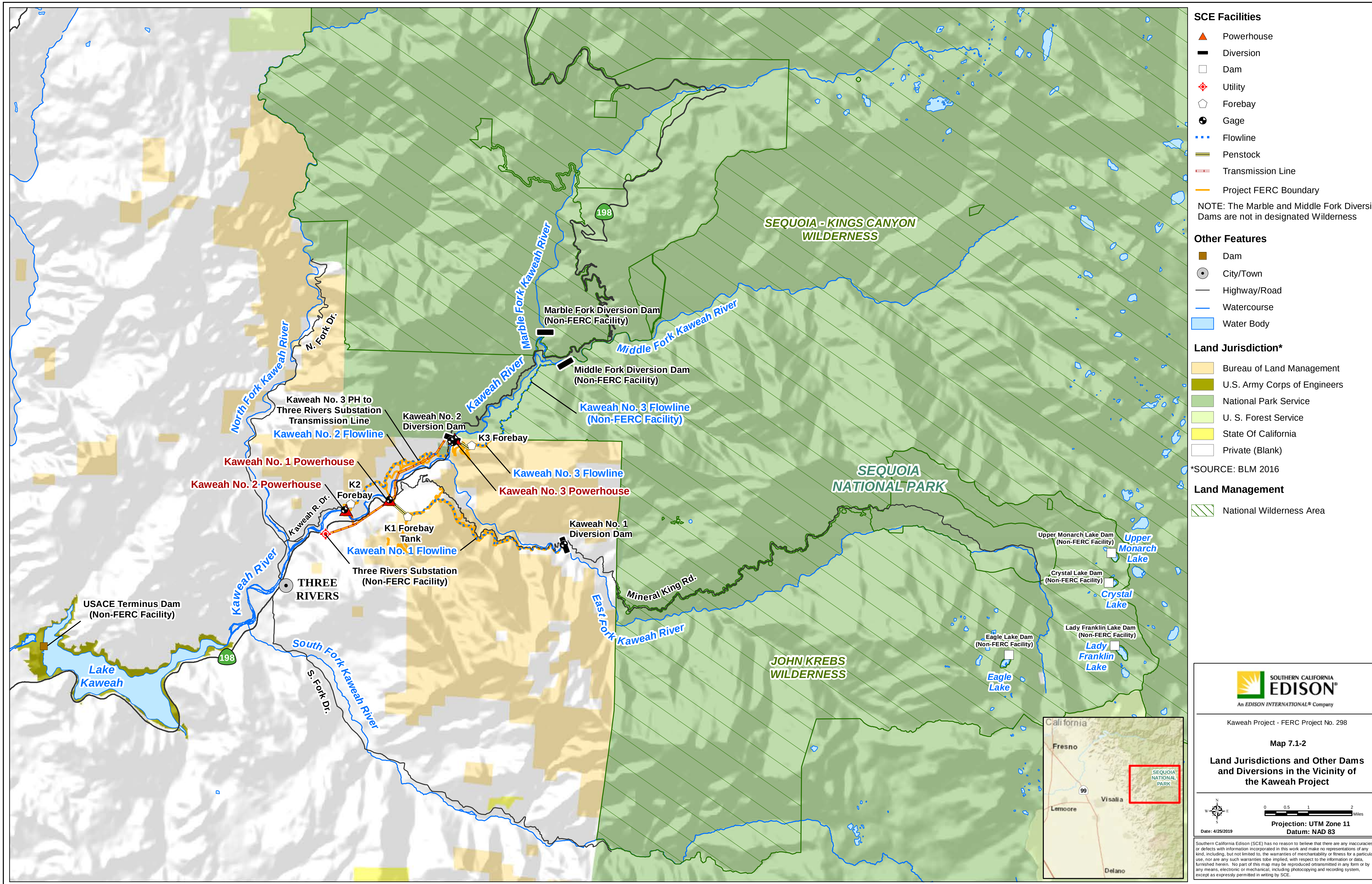
# MAPS

This Page Intentionally Left Blank



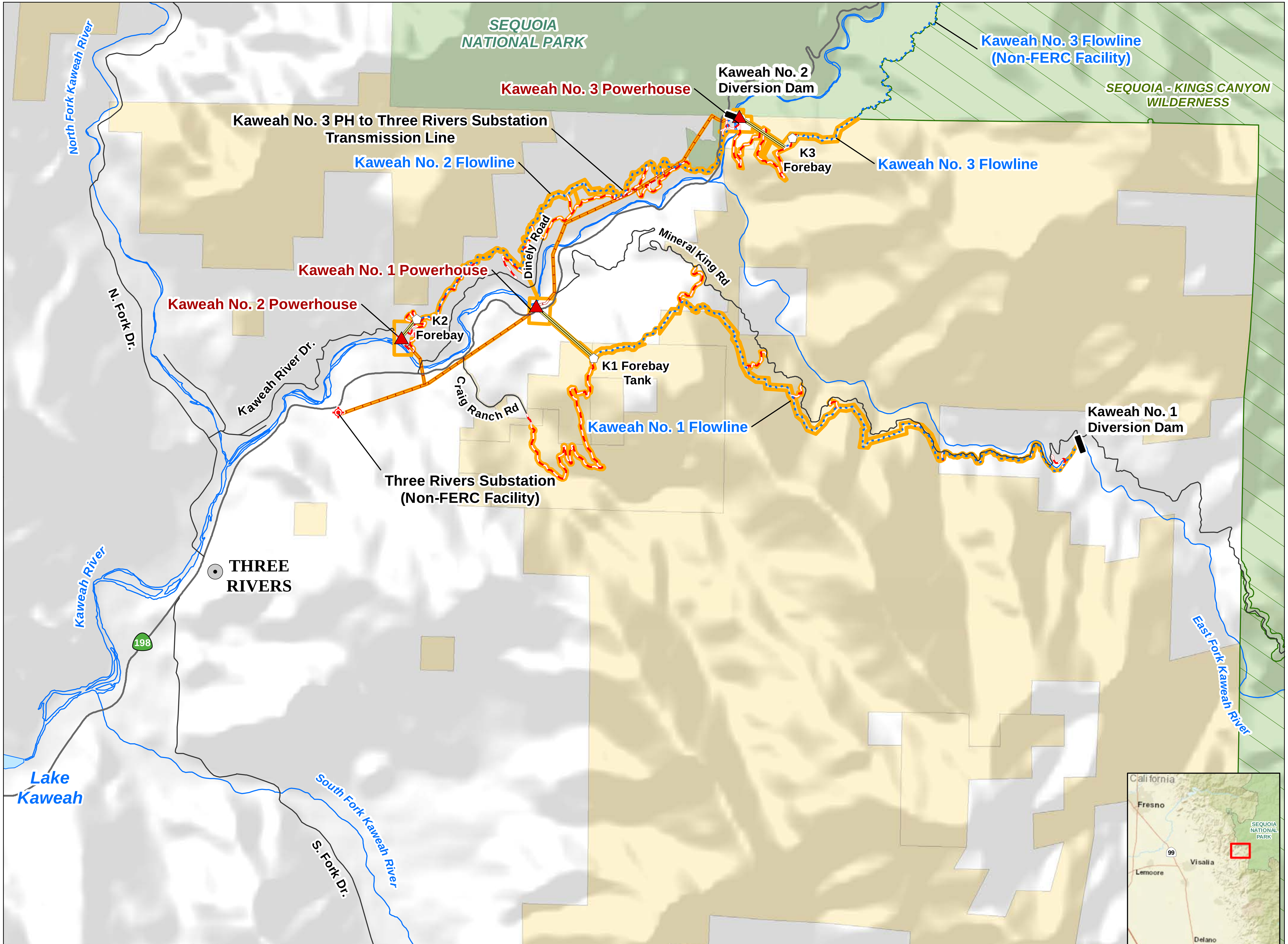

C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\HydroMaps\SCE_Eastern_KAWEAH_Wshed_Subbasins_17i11i_01.mxd

This Page Intentionally Left Blank




Z:\30735240_SCE_EasternHydro\map\Kaweah\SCE_Eastern_KAWEAH_Juris_OtherDams_17i11i_01.mxd

This Page Intentionally Left Blank




**Facilities**

- Powerhouse
- Diversion
- Utility
- Forebay
- Flowline
- Penstock
- Transmission Line
- Project Road
- FERC Boundary

**Other Features**

- City/Town
- Highway/Road
- Watercourse
- Water Body

**Land Jurisdiction***

- Bureau of Land Management
- National Park Service
- Private (Blank)

*SOURCE: BLM 2016

**Land Management**

- National Wilderness Area

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Kaweah Project - FERC Project No. 298

**Map 7.1-3**

**Principal Kaweah Project Facilities**

N W E S

0 0.25 0.5 Miles

Date: 3/28/2019

**Projection: UTM Zone 11**
**Datum: NAD 83**



C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\FacilitiesMaps\SCE_Eastern_KAWEAH_Principal_Project_Facilities_17i11i_01.mxd

This Page Intentionally Left Blank

## TABLE OF CONTENTS



## LIST OF TABLES



## LIST OF FIGURES

## LIST OF MAPS



## LIST OF APPENDICES

## LIST OF ACRONYMS

| | |
|---|---|
| ac-ft | acre-feet |
| CDFW | California Department of Fish and Wildlife |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| Commission | Federal Energy Regulatory Commission |
| CRWQCB | California Regional Water Quality Control Board |
| DWR | Department of Water Resources |
| FERC | Federal Energy Regulatory Commission |
| MIF | minimum instream flow |
| NPS | National Park Service |
| POR | period of record |
| Project | Kaweah Project |
| SCE | Southern California Edison Company |
| SNP | Sequoia National Park |
| SUP | Special Use Permit |
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| Watershed | Kaweah River Watershed |

This Page Intentionally Left Blank

## 7.2 WATER USE AND HYDROLOGY

This section describes water use and hydrology associated with Southern California Edison Company's (SCE) Kaweah Project (Project). This section specifically addresses the water use and hydrology components of the FERC regulations. Information on water quality is addressed in Section 7.3 – Water Quality.

Information on (1) upstream and downstream requirements by other parties that may constrain operations of the Project; and (2) existing water rights and water rights applications that could potentially affect or be affected by the Project is also provided in Section 3.0 – Project Description and Section 7.1 – Description of the Kaweah River Basin.

### 7.2.1 Information Sources

Existing information regarding water use and hydrology associated with the Project was collected, compiled, and reviewed. Relevant information used to prepare this section was obtained from the following sources:

- Department of Water Resources (DWR) Bulletin 120 (DWR 2019);
- Environmental Assessment, Kaweah Project FERC Project No. 298-000 (FERC 1991);
- Errata notice to notice dated 12/17/03 Amending License re Kaweah River Power Authority under P-3947 (FERC 2003b);
- Kaweah River Investigation, California, Final Feasibility Report (USACE 1996);
- Order amending license re Kaweah River Power Authority's Terminus Dam Project under P-3947 (FERC 2003a);
- Order Amending Minimum Flow Release Requirements for Southern California Edison's Project No. 298 (FERC 1994);
- Order Issuing New License (Major) for Southern California Edison's Project No. 298 (FERC 1992);
- Special Use Permit (SUP) for Southern California Edison (NPS 2016);
- United States Geological Survey (USGS) Surface-Water Data for the Nation (USGS 2019); and
- Water Quality Control Plan for the Tulare Lake Basin (CRWQCB 2004).

### 7.2.2 Existing Water Uses

This section describes existing water uses associated with the Project and other water uses upstream and downstream of the Project.

#### 7.2.2.1 Existing Project Water Uses

Existing and potential beneficial uses that apply to the surface waters within the Kaweah River Watershed (Watershed) are identified in the *Water Quality Control Plan for the Tulare Lake Basin* (Basin Plan) (CRWQCB 2018). Beneficial uses identified in the Basin Plan that pertain to the Kaweah River above Lake Kaweah include: (1) municipal and domestic water supply; (2) hydropower generation; (3) water contact and non-contact water recreation; (4) warm freshwater fisheries; (5) cold freshwater fisheries; (6) wildlife habitat; (7) rare, threatened, and endangered species; (8) spawning, reproduction, and/or early development for fisheries; and (9) freshwater replenishment.

SCE operates the Project for hydroelectric generation. Consumptive water is also delivered to local water users from the Kaweah No. 1 and Kaweah No. 2 flowlines, consistent with SCE's contractual obligations, and to the Hammond Fire Station near Hammond consistent with SCE's water rights and agreements.

The Project has three powerhouses: Kaweah No. 1 Powerhouse, Kaweah No. 2 Powerhouse, and Kaweah No. 3 Powerhouse. Water is diverted from the East Fork Kaweah River at the Kaweah No. 1 Diversion Dam and conveyed to the Kaweah No. 1 Powerhouse via the Kaweah No. 1 Flowline. Water is diverted from the Kaweah River at the Kaweah No. 2 Diversion Dam and conveyed to the Kaweah No. 2 Powerhouse via the Kaweah No. 2 Flowline. Water conveyed to Kaweah No. 3 Powerhouse is diverted at the Middle Fork and Marble Fork diversions (non-FERC facilities). The Project's annual net generation since issuance of the current license (1992–2018) and estimated dependable capacity is provided in Section 3.0 – Project Description.

The Project has two conflicting obligations (demands) associated with operation of the Project. These obligations include providing: (1) minimum instream flow (MIF) releases consistent with the flow schedule in License Article 405 of the existing FERC license (Table 7.2-1); and (2) domestic water to local users through the Project flowlines based on a prior contractual entitlement dating back to 1903. SCE must maintain a continuous flow up to a maximum of 1 cfs from the Kaweah No. 1 Diversion and up to a maximum of 3 cfs from the Kaweah No. 2 Diversion to meet SCE's contractual obligations to local water users consistent with their pre-1914 water rights. During low-runoff periods, consumptive water is diverted and delivered to local water users, but no water is diverted for generation purposes. Figures 7.2-1 and 7.2-2 illustrate actual inflow compared to MIF release requirements and water supply obligations at the Kaweah No. 1 Diversion and Kaweah No. 2 Diversion, respectively.

Historically, SCE has requested and obtained approval from resource agencies (California Department of Fish and Wildlife [CDFW] and U.S. Fish and Wildlife Service [USFWS]) to temporarily modify (reduce) MIF releases below the Kaweah No. 1 and

Kaweah No. 2 diversions when forecasted inflows were approaching the combined flow necessary to meet both water supply and MIF release requirements. These temporary flow modifications from the resource agencies were necessary to ensure that SCE could comply with the license conditions based on uncertainty in actual runoff (magnitude and/or timing). SCE obtained agency approval for temporary modifications of MIFs below the Kaweah No. 1 Diversion in four Dry years and below Kaweah No. 2 Diversion in eight years (four Dry years and four Normal years) (Table 7.2-2 and Figure 7.2-3).[1]

Although, SCE obtained agency approval for temporary modifications of MIFs when inflows were projected to not meet both the MIF requirements and the water supply commitments, the approved reductions in MIF were only implemented at the Kaweah No. 2 Diversion in 2002, 2012, 2015, and 2016 (Table 7.2-2). In 2002, SCE implemented the flow modifications, reducing the MIF release by 1.5 cfs on average for 13 days. In 2012, SCE reduced the MIF release by 1 cfs on average for three days. In 2015, SCE reduced the MIF release by 0.35 cfs on average for four days. In 2015, SCE reduced the MIF release by 0.35 cfs on average for four days. In 2016, SCE's original request for a temporary flow modification (through August 31) needed to be extended as runoff in the Kaweah Watershed was projected to remain low, due to drought conditions in the region. On August 30, 2016, SCE requested a temporary flow variance through December 31, 2016. SCE's temporary flow variance request was approved by FERC on September 8, 2016. During the entire flow modification period, SCE reduced the MIF release by 2.68 cfs on average for 25 days.

In the East Fork Kaweah River, stream flows were sufficient to meet both the MIF requirements and the water supply commitments in all years despite requests for flow modifications based on projected inflow.

#### 7.2.2.2 Other Projects Upstream and Downstream of the Kaweah Project

Flows upstream of the Project are influenced by several SCE operated non-FERC facilities located in the Sequoia National Park (SNP). All non-FERC facilities are currently operated under a special use permit (SUP) issued to SCE by the National Park Service (NPS). In the upper East Fork Kaweah River Watershed, SCE stores water in four small non-FERC reservoirs (Eagle Lake, Lady Franklin Lake, Crystal Lake, and Upper Monarch Lake). The reservoirs (collectively referred to as Mineral King Lakes) were originally constructed between 1903 and 1905 and have a combined storage capacity of approximately 1,152 acre-feet (ac-ft). SCE releases water from these reservoirs in the late summer and fall months to augment flows in the East Fork Kaweah River.

On the Middle and Marble forks of the Kaweah River, SCE operates two non-FERC diversions (Middle Fork Diversion and Marble Fork Diversion) and flowlines. The Middle Fork and Marble Fork diversions and associated flowlines were constructed between 1907 and 1913, respectively. Both diversions are operated in a run-of-river mode and have limited storage capacity (less than one ac-ft total combined storage). Flows from the Middle and Marble forks of the Kaweah River are diverted and conveyed through the

[1] See Table 7.2-1 for a definition of water year designations.

Kaweah No. 3 Flowline to the Kaweah No. 3 Powerhouse. All but the last 2,975 feet of the flowline is located in the SNP and is not part of the FERC License. The portion of the flowline outside the SNP and the Kaweah No. 3 Powerhouse are FERC Project facilities.

Approximately ten miles downstream of the Project, the Kaweah River is impounded by the United States Army Corps of Engineers' (USACE) Terminus Dam that forms Lake Kaweah. The Terminus Dam was constructed in 1962 for flood control and irrigation purposes. During the spring runoff season, the reservoir stores up to 185,000 ac-ft of water. Downstream of Terminus Dam, the Kaweah River flows are diverted for irrigation of adjacent farmlands. Water releases serve multiple local water districts, including the Tulare Irrigation District and the Kaweah Delta Water Conservation District, and urban areas, including the cities of Tulare and Visalia. The Terminus Power Plant (FERC Project No. 3947), completed in 1992 by the Kaweah River Power Authority, generates hydroelectricity at the dam. The power plant is jointly managed by Tulare Irrigation District and the Kaweah Delta Water Conservation District. The power plant has a capacity of 20.09 megawatts (FERC 2003a, 2003b).

### 7.2.3 Hydrology

This section describes existing FERC license flow requirements, flow gages, hydrology, and reservoir storage associated with operations of the Project.

#### 7.2.3.1 Existing FERC License Flow Requirements

The MIF requirements, as specified in License Article 405 of the existing FERC License, for the bypass reaches[2] associated with the Project are presented in Table 7.2-1. MIF release requirements at the Project diversions are based on water year type. In the existing FERC license, water year types for the Project are defined as either "Normal" or "Dry" based on the April 1 through July 1 forecast of runoff in the Kaweah River at Terminus Reservoir as published by the DWR in its May 1 forecast. A Dry Year is defined as a year when the forecast is equal to or less than 172,000 ac-ft of runoff. A Normal Year is defined as a year when the forecast is greater than 172,000 ac-ft of runoff. The MIF release schedules take effect on May 10 following the May 1 forecast and extend through May 9 of the following calendar year (FERC 1994).

A summary of water year types from 1974-2018, based on the definition of Normal and Dry in the existing FERC license are provided in Table 7.2-3 (DWR 2018). This time period (1974-2018) is representative of long-term runoff patterns and climate conditions in the Watershed including wet and dry years in the 1970s and 1980s, prior to issuance of the existing FERC license in 1994. Water year types over a longer time period (1938 through 2018) are provided in Appendix 7.2-A for reference. Between 1974 and 2018, 67% of the years were classified as Normal and 33% were classified as "Dry". The distribution of DWR April – July and Water Year runoff forecasts in the Kaweah River at Terminus Reservoir from 1974-2018 and associated water year types is shown in Figure 7.2-3. In general, the pattern of each forecast type is similar and the exceedance

[2] A bypass reach is a segment of a river downstream of a diversion facility where Project operations result in the diversion of a portion of the water from the river.

ranks are comparable. Years where a flow modification was requested (Table 7.2-2) and years with critically low flow where forecasted inflows were approaching the combined flow necessary to meet both water supply and MIF release requirements (Figure 7.2-1 and 7.2-2) are depicted in Figure 7.2-3.

In addition to MIF requirements, License Article 404 specifies that the "Licensee shall operate the Project such that flows below diversion dams and Powerhouses Nos. 1 and 2 are not altered at a rate greater than 30 percent of the existing streamflow per hour" (i.e., ramping rates).

#### 7.2.3.2 Existing Flow Gages

SCE currently maintains a network of flow gaging stations to monitor and record flows associated with operation of the Project. This network consists of eight stations that currently measure flow in bypass reaches, Project flowlines, and Project powerhouses (Table 7.2-4). Additional gages have historically recorded flows in the bypass reaches and flowlines associated with the Project and these are identified on Table 7.2-5. Additional Watershed gages are listed in Table 7.2-6. The location of current and historic flow gages in the bypass reaches and flowlines associated with the Kaweah Project, and other non-Project flow gages in the Kaweah Watershed are shown on Map 7.2-1.

#### 7.2.3.3 Hydrology Associated with Project Operations

Flow data from existing and historic Project gages and other gages in the Watershed were collected and compiled into an Excel database (Tables 7.2-4 through 7.2-6). Data were reviewed to identify gages with data gaps or questionable data and those that only recorded low flows. Records with poor data were not included in the hydrology summaries.

The period of record (POR) used to characterize recent historical flows in the Kaweah River and East Fork Kaweah River extends from water year 1994 through 2018 (October 1, 1994 through September 30, 2018)[3]. As discussed above, this time period best represents Project operations since issuance of the FERC license and recent climatic conditions.

#### Hydrology

The Project is operated in a run-of-river mode. The Project diverts water from the East Fork Kaweah River at the Kaweah No. 1 Diversion and from the Kaweah River at the Kaweah No. 2 Diversion for power generation and to meet contractual obligations with pre-1914 water users. These diversions alter the volume of water in the rivers

[3] A water year is defined as the period between October 1 of one year and September 30 of the following year. The water year is designated by the calendar year in which it ends, so that the 2013 water year started on October 1, 2012 and ended on September 30, 2013.

downstream of Project diversions (bypass reaches), with minimal to no change in the annual seasonal flow pattern. The bypass reaches associated with the Project include:

- East Fork Kaweah River, from the Kaweah No. 1 Diversion to the confluence with the Kaweah River (4.7 miles); and
- Kaweah River, from the Kaweah No. 2 Diversion to the confluence of the Kaweah No. 2 Powerhouse Tailrace and the Kaweah River (4.1 miles).

The amount and timing of flow diverted is a function of inflow (runoff), FERC License requirements for MIF and ramping rates, flowline capacities, and the minimum flow required to maintain sufficient head in the flowline to meet water delivery contractual obligations. Total annual inflow into the Project (combined inflow at the Kaweah No. 1 and No. 2 diversions) in water years 1994-2018 ranged from approximately 78,000 ac-ft (2015) to more than 668,000 ac-ft (2017). The median total annual inflow was approximately 229,000 ac-ft during this period (Figure 7.2-4).

The Kaweah No. 1 Flowline (East Fork Kaweah River) can divert up to 24 cfs, and the Kaweah No. 2 Flowline (Kaweah River) can divert up to 87 cfs. To maintain sufficient head pressure to meet water delivery contractual obligations along the flowlines, SCE must maintain a continuous flow up to a maximum of 1 cfs in the Kaweah No. 1 Flowline and up to a maximum of 3 cfs in the Kaweah No. 2 Flowline. Water diverted into the flowlines at Project diversions passes through Project powerhouses generating electricity prior to returning to the Kaweah River downstream of the Project tailraces (with the exception of water diverted for consumptive purposes). Additional information on consumptive water use, including water user diversion points, is provided in Section 3.0 – Project Description.

Figures 7.2-5a-c show monthly average flows in the bypass reaches (below the diversions), Project flowlines, and flow into the powerhouses for example water years that are representative of different runoff conditions into the Project diversions. The following example water years were selected to be representative of different water year types:

- Normal Water Year – 2006
- “Drier” Normal Year – 2009
- Dry – 2014

SCE typically diverts water throughout the year in wetter years, peaking in the winter and early summer months (Figures 7.2-5a-c). In drier years, low summer and winter flows (e.g., August to November) typically preclude diversion for generation. Diversions for generation in dry years typically only occur in spring (including Normal years with low runoff and Dry years) (Figures 7.2-5a-c). In “Drier” Normal years, inflows can be extremely low in the late summer/fall resulting in reductions in flow diversions (e.g., Figure 7.2-5, 2009). In all years, after runoff and during the driest months (e.g., August through December), water withdrawals due to Project operation appreciably reduce flow exceedance in all Project reaches.

A detailed summary of the hydrology associated with the Project (river reaches, flowlines, and powerhouses) and at selected gages upstream and downstream of the Project is provided in the following appendices:

- Appendix 7.2-B – This appendix includes daily flow graphs in the bypass reaches and flowlines associated with the Project by location.
- Appendix 7.2-C – This appendix includes tables of monthly summary statistics (maximum, minimum, and average discharge) and exceedances (10%, 20%, 50%, 80%, and 90%) for the bypass reaches and flowlines associated with the Project.
- Appendix 7.2-D – This appendix includes monthly exceedance plots (10%, 20%, 50%, 80%, and 90%) bypass reaches and flowlines associated with the Kaweah Project from WY 1994–2018.
- Appendix 7.2-E – This appendix includes exceedance probability plots for existing and unimpaired daily discharge by month for bypass reaches associated with the Project.
- Appendix 7.2-F – This appendix includes tables summarizing monthly average flows in the bypass reaches and flowlines associated with the Project.
- Appendix 7.2-G – This appendix includes a table summarizing instantaneous peak annual flows for the bypass reaches and flowlines associated with the Project.
- Appendix 7.2-H – This appendix includes flows at selected gages upstream and downstream of the Project.

#### 7.2.3.4 Reservoir Storage

The Project facilities have minimal water storage (approximately 11.93 ac-ft combined) in one forebay tank and two small forebays located at the terminus of the flowlines, above the powerhouses (Kaweah No. 1 Forebay Tank – 0.18 ac-ft; Kaweah No. 2 Forebay – 0.75 ac-ft; and Kaweah No. 3 Forebay – 11 ac-ft). Water levels in the forebays remain constant (full) during Project operations. The forebays may be drained during the Project's annual maintenance outage. The Project also includes diversion pools behind Kaweah No. 1 Diversion Dam and Kaweah No. 2 Diversion Dam (<0.03 ac-ft and 1 ac-ft of storage, respectively). Elevations of the diversion pools remain constant (full) year-round. The locations of these Project facilities are shown on Map 7.2-1.

Water stored in four small reservoirs (with combined storage capacity of 1,152 ac-ft) located on tributaries to the East Fork Kaweah River, upstream of the Kaweah No. 1 Diversion Dam within the SNP are also utilized by the Project. These reservoirs are operated under a SUP with the SNP and are, therefore, not under FERC jurisdiction. However, the water rights associated with these reservoirs influence the operation of the Kaweah No. 1 Powerhouse, which is under FERC jurisdiction.

### 7.2.4 References

CRWQCB (California Regional Water Quality Control Board) Central Valley Region. 2018. Water Quality Control Plan for the Tulare Lake Basin Second Edition. Revised May 2018. Available at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/tlbp_201805.pdf.

DWR (Department of Water Resources). 2019. Department of Water Resources Bulletin 120. Available at: http://cdec.water.ca.gov/snow/bulletin120/.

FERC (Federal Energy Regulatory Commission). 1991. Environmental Assessment. Kaweah Project (FERC Project No. 298). Dated August 16, 1991.

FERC. 1992. Order Issuing New License (Major) for Southern California Edison's Project No. 298. Issued January 31, 1992.

FERC. 1994. Order Amending Minimum Flow Release Requirements for Southern California Edison's Project No. 298. Issued April 20, 1994.

FERC. 2003a. Order amending license re Kaweah River Power Authority's Terminus Dam Project under P-3947. FERC eLibrary No. 20031217-3018.

FERC. 2003b. Errata notice to notice dated 12/17/03 Amending License re Kaweah River Power Authority under P-3947. FERC eLibrary No. 20040115-3024.

USACE (United States Army Corps of Engineers). 1996. Kaweah River Investigation, California, Final Feasibility Report. United States Department of the Army, South Pacific Division, Sacramento District. September.

NPS (United States Department of the Interior, National Park Service). 2016. Special Use Permit for Southern California Edison. Permit No. PWR-SEKI-6000-2016-015.

USGS (United States Geological Survey). 2019. USGS Surface-Water Data for the Nation. Available at: http://waterdata.usgs.gov/nwis/sw.

# TABLES

This Page Intentionally Left Blank

**Table 7.2-1. Minimum Instream Flow Requirements for Bypass Reaches Associated with the Kaweah Project.[1,2]**

| Month | Kaweah No. 1 Diversion | | Kaweah No. 2 Diversion | |
|---|---|---|---|---|
| | Normal Year (cfs) | Dry Year (cfs) | Normal Year (cfs) | Dry Year (cfs) |
| October | 5 | 5 | 11 | 5 |
| November | 5 | 5 | 11 | 5 |
| December | 5 | 5 | 11 | 5 |
| January | 5 | 5 | 20 | 10 |
| February | 5 | 5 | 20 | 10 |
| March | 10 | 10 | 30 | 20 |
| April | 10 | 10 | 30 | 30 |
| May | 10 | 10 | 30 | 30 |
| June | 10 | 10 | 30 | 30 |
| July | 10 | 10 | 20 | 10 |
| August | 5 | 5 | 20 | 10 |
| September | 5 | 5 | 11 | 5 |

Source: FERC License Article 405, as amended on April 20, 1994.

[1] Runoff of Kaweah River at Terminus Reservoir for April 1 through July 31, for the current year, as estimated by the California Department of Water Resources (DWR) on or about May 1 of each such calendar year shall be used to distinguish between a normal water year and a dry water year for the purpose of this article. A "Normal Year" is defined as a forecasted runoff of 172,000 acre-feet or more. A "Dry Year" is defined as a forecasted runoff is equal to or less than 172,000 acre-feet. The determination of either a normal water year or a dry water year shall then be used in maintaining the appropriate minimum flow release for the period May 10 of each calendar year through May 9 of the succeeding calendar year.

[2] This flow schedule may be temporarily modified if required by operating emergencies beyond the control of the licensee or for short periods on mutual agreement between the licensee, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. If the flow is so modified, the licensee shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

### Table 7.2-2. Recent History of Temporary Flow Modifications Requested by SCE and Approved by Resource Agencies (2002–2019)

| SCE Modification Request | Resource Agency Approval | Water Year Type | Modification Implemented (yes/no) | Amount/ Duration of Offset Water (cfs/days) |
|---|---|---|---|---|
| **Kaweah No. 1 Diversion** | | | | |
| June 29, 2015 | CDFW: July 16, 2015<br>USFWS: August 26, 2015 | Dry | No | N/A |
| August 8, 2014 | CDFW: August 28, 2014<br>USFWS: September 2, 2014 | Dry | No | N/A |
| September 5, 2013 | CDFW: September 16, 2013<br>USFWS: September 11, 2013 | Dry | No | N/A |
| September 10, 2007 | CDFW: Approved<br>USFWS: October 19, 2007 | Dry | No | N/A |
| **Kaweah No. 2 Diversion** | | | | |
| August 11, 2016[1] | CDFW: August 17, 2016<br>USFWS: August 18, 2016 | Normal | Yes | Average 2.68 cfs/25 days |
| June 29, 2015 | CDFW: July 16, 2015<br>USFWS: August 26, 2015 | Dry | Yes | Average 0.35 cfs/4 days |
| August 25, 2014 | CDFW: August 28, 2014<br>USFWS: September 2, 2014 | Dry | No | N/A |
| August 16, 19, 21, and 22, 2013 | CDFW: August 27, 2013<br>USFWS: August 23, 2013 | Dry | No | N/A |
| August 3, 2012 | CDFW: August 8, 2012<br>USFWS: August 9, 2012 | Normal | Yes | Average 1 cfs/3 days |
| September 25, 2009 | CDFW: Approved<br>USFWS: Approved | Normal | No | N/A |
| September 10, 2007 | CDFW: Approved<br>USFWS: October 19, 2007 | Dry | No | N/A |
| August 16, 2002 | CDFW: August 16, 2002<br>USFWS: August 16, 2002 | Normal | Yes | Average 1.5 cfs/13 days |

[1] In 2016, SCE's original request for a temporary flow modification (through August 31) needed to be extended as runoff in the Kaweah Watershed was projected to remain low, due to drought conditions in the region. On August 30, 2016, SCE requested a temporary flow variance through December 31, 2016. SCE's temporary flow variance request was approved by FERC on September 8, 2016 (156 FERC ¶62,183).

**Table 7.2-3. Historic Water Year Types for the Kaweah River at Terminus Reservoir Based on Department of Water Resources Bulletin 120 May 1 Runoff Forecast (1974-2016).[1]**

| Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification |
|---|---|---|
| 1974 | 320 | Normal |
| 1975 | 290 | Normal |
| 1976 | 80 | Dry |
| 1977 | 40 | Dry |
| 1978 | 600 | Normal |
| 1979 | 250 | Normal |
| 1980 | 495 | Normal |
| 1981 | 255 | Normal |
| 1982 | 605 | Normal |
| 1983 | 720 | Normal |
| 1984 | 220 | Normal |
| 1985 | 220 | Normal |
| 1986 | 490 | Normal |
| 1987 | 110 | Dry |
| 1988 | 110 | Dry |
| 1989 | 150 | Dry |
| 1990 | 95 | Dry |
| 1991 | 210 | Normal |
| 1992 | 125 | Dry |
| 1993 | 360 | Normal |
| 1994 | 135 | Dry |
| 1995 | 500 | Normal |
| 1996 | 320 | Normal |
| 1997 | 320 | Normal |
| 1998 | 540 | Normal |
| 1999 | 160 | Dry |
| 2000 | 240 | Normal |
| 2001 | 190 | Normal |
| 2002 | 195 | Normal |
| 2003 | 225 | Normal |
| 2004 | 160 | Dry |
| 2005 | 380 | Normal |
| 2006 | 480 | Normal |
| 2007 | 95 | Dry |
| 2008 | 230 | Normal |

| Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification |
|---|---|---|
| 2009 | 195 | Normal |
| 2010 | 380 | Normal |
| 2011 | 490 | Normal |
| 2012 | 175 | Normal |
| 2013 | 83 | Dry |
| 2014 | 72 | Dry |
| 2015 | 38 | Dry |
| 2016 | 210 | Normal |
| 2017 | 550 | Normal |
| 2018 | 249 | Normal |

[1] Data obtained from: DWR Bulletin 120. Available at: http://cdec.water.ca.gov/snow/bulletin120/. Water Year Types for Apr 1 – Jul 1 Forecast of Runoff in the Kaweah River at Terminus Reservoir based on Bulletin 120 May 1 Forecast.

TAF = thousand acre-feet

## Table 7.2-4. Current Project Flow Gages.

| Gage Name | SCE Gage Number | USGS Station Number | Period of Record | Latitude, Longitude | Notes |
|---|---|---|---|---|---|
| **East Fork Kaweah River** | | | | | |
| East Fork Kaweah River near Three Rivers, CA | 201 | USGS 11208730 | 6/1/52-present | 36°27'05”, 118°47'15" | Traditional stage-discharge stream gage located on the south-west bank of the East Fork Kaweah River. Gage measures streamflow between the intake dam and the gage pool weir.<br>Data gaps: 10/1/1955 - 9/30/1957; 10/1/1978 - 9/30/1993 |
| | 201a | | 10/1/95-present | 36°27'05”, 118°47'15" | Operational AVM on a release pipe that comes out of the sandbox used by SCE to measure minimum instream flow releases. |
| East Fork Kaweah River Conduit 1 near Three Rivers, CA | 202 | | 10/1/02-present | 36°27'05", 118°47'19" | Operational AVM just downstream from the flowline intake that measures flow in the flowline. |
| East Fork Kaweah River Conduit 1 at Power Plant near Hammond, CA | 200a | USGS 11208800 | 10/1/02-present | 36°27'55", 118°51'43" | AVM located on the penstock to the Kaweah No. 1 Powerhouse that measures flow into the powerhouse. |

| Gage Name | SCE Gage Number | USGS Station Number | Period of Record | Latitude, Longitude | Notes |
|---|---|---|---|---|---|
| **Kaweah River** | | | | | |
| Kaweah River below Conduit No. 2 near Hammond, CA | 203 | USGS 11208600 | 10/1/93-present | 36°29'04", 118°50'06" | Traditional stage-discharge stream gage located on the west bank of the Kaweah River that measures stream flow approximately 500 feet downstream of the Kaweah No. 2 Diversion Dam. |
| Kaweah River Conduit No. 2 near Hammond, CA | 204a | | 12/8/05-present | 36°29'10", 118°50'09" | Operational Acoustic Doppler Current Profiler (ADCP) located on the Kaweah No. 2 Flowline that measures flow from the Kaweah No. 2 Intake into the flowline. |
| Kaweah River Conduit No. 2 at Powerhouse near Hammond, CA | 205a | USGS 11208818 | 10/1/02-present | 36°27'42", 118°52'46" | This gage is an AVM located on the penstock to the Kaweah No. 2 Powerhouse that measures flow into the powerhouse. |
| Middle Fork Kaweah River Conduit No. 3 A Power Plant near Hammond, CA | 206a | USGS 11208565 | 10/1/02-present | 36°29'10", 118°50'08" | This gage is an AVM located on the penstock to the Kaweah No. 3 Powerhouse that measures flow into the powerhouse. This gage measures the combination of flows measured at SCE gage nos. 208 and 210. |

## Table 7.2-5. Historic Gages in the Project Vicinity.

| Gage Name | SCE Gage Number | USGS Station Number | Period of Record | Lat, Long | Notes |
|---|---|---|---|---|---|
| **East Fork Kaweah River** | | | | | |
| Combined Flow East Fork Kaweah River near Three Rivers CA | -- | USGS 11208731 | 6/1/52-9/30/02 | 36°27'05", 118°47'15" | **Historic Calculated Flow Gage.** Combined flow of USGS gage 11208730 and USGS gage 11208720.<br>**Data gaps:** 10/1/1955 - 9/30/1957; 10/1/1978 - 9/30/1993 |
| East Fork Kaweah River Conduit 1 near Three Rivers, CA | 202 | USGS 11208720 | 10/1/74 – 9/30/02 | 36°27'05", 118°47'19" | **Historic Flow Gage.** Measured flow in the Kaweah No. 1 Flowline.<br>**Data gaps**: 10/1/1978 - 9/30/1993; 9/1/2005 - 9/9/2005; 8/26/2009 - 9/30/2009 |
| **Kaweah River** | | | | | |
| Combined Flow of 11208570+ 11208600 CA | -- | USGS 11208601 | 10/1/93-9/30/02 | 36°29'10", 118°50'09" | **Historic Calculated Flow Gage.** Combined flow of USGS gage 11208570 and USGS gage 11208600. |
| Kaweah River Conduit No. 2 near Hammond, CA | 204 | USGS 11208570 | 10/1/93-12/8/05 | 36°29'10", 118°50'09" | Traditional stage-discharge stream gage historically used by SCE to monitor flows in the flowline (replaced with SCE gage 204a). |

## Table 7.2-6. Other Flow Gages in the Kaweah River Watershed.

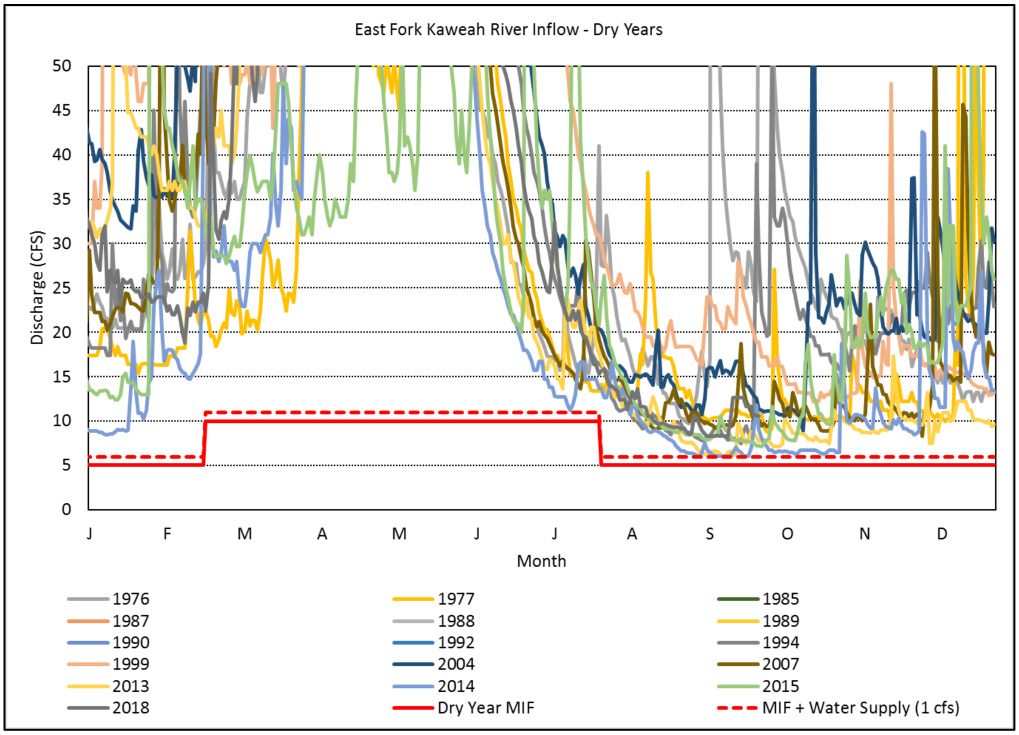
| Gage Name | Gaging Station Number | Period of Record | Lat, Long | Notes |
|---|---|---|---|---|
| **Kaweah River - downstream of Project** | | | | |
| Kaweah River at Three Rivers CA | USGS 11209900 | 10/1/58-9/30/90 | 36°26'38", 118°54'09" | **Historic Flow Gage.** Located 2.6 miles downstream from the East Fork Kaweah River and Kaweah River confluence. |
| Kaweah River at Three Rivers | USACE | 2007-2015 | 36° 26' 37.9998, 118° 54' 15.997 | **Real-time Stage Gage.** Located 2.6 miles downstream from the North Fork Kaweah River and Kaweah River confluence. |
| **Middle Fork Kaweah River - upstream of Project** | | | | |
| Middle Fork Kaweah River No 3 Conduit near Potwisha Camp CA | USGS 11206000 | 10/1/75-9/30/02 | 36°30'41", 118°47'48" | **Historic Flow Gage.** Measured flow in the flowline near the point of diversion. Flow is currently measured at this location for operational purposes by SCE at gage no. 210. |
| Middle Fork Kaweah River near Potwisha Camp (river flow only) CA | USGS 11206500 | 7/12/49-9/30/14 | 36°30'47", 118°47'27" | Measured flow downstream of the diversion. Beginning October 2003, no records computed above 38 $ft^3/s$. Incomplete data used in calculations made between 2003-2015. |
| Middle Fork Kaweah River near Potwisha Camp (total flow) CA | USGS 11206501 | 7/1/49-9/30/02 | 36°30'48", 118°47'27" | **Historic Calculated Flow Gage.** Computed combined flow USGS gage 11206000 and USGS gage 11206500. |

| Gage Name | Gaging Station Number | Period of Record | Lat, Long | Notes |
|---|---|---|---|---|
| **Marble Fork Kaweah River - upstream of Project** | | | | |
| Marble Fork Kaweah River No 3 Conduit at Potwisha CA | USGS 11207500 | 10/1/75-9/30/02 | 36°31'10", 118°48'00" | **Historic Flow Gage.** Measured flow in the flowline near the point of diversion. Flow is currently measured at this location for operational purposes by SCE at gage no. 208. |
| Marble Fork Kaweah River (R only) at Potwisha Camp CA | USGS 11208000 | 4/1/50-9/30/14 | 36°31'19", 118°47'54" | Measures flow downstream of the diversion. Beginning October of 2003, no records recorded above 8 ft³/s. Incomplete data used in calculations. |
| Marble Fork Kaweah River (total flow) at Potwisha Camp CA | USGS 11208001 | 10/1/50-9/30/02 | 36°31'08", 118°48'03" | **Historic Calculated Flow Gage.** Computed combined flow USGS Gage 11207500 and 11208000. |
| Marble Fork Kaweah River above Horse Creek near Lodgepole CA | USGS 11206820 | 10/01/13-4/22/15 | 36°27'05", 118°37'04" | Located 11.0 of miles upstream of the Marble Fork Diversion Dam. Measures flow in the Marble Fork Kaweah River. |
| **East Fork Kaweah River - upstream of Project** | | | | |
| East Fork Kaweah River below Mosquito Creek near Hammond CA | USGS 11208620 | 9/1/68-10/11/73 | 36°27'05", 118°37'04" | **Historic Flow Gage.** Located 11.1 miles upstream of the Kaweah No. 1 Diversion Dam. Measures flow in the East Fork Kaweah River. |
| East Fork Kaweah River at Sequoia National Park Boundary near Hammond CA | USGS 11208625 | 8/1/68-10/19/71 | 36°27'30", 18°39'11" | **Historic Flow Gage.** Located 9.5 miles upstream of the Kaweah No. 1 Diversion Dam. Measures flow in the East Fork Kaweah River. |

| Gage Name | Gaging Station Number | Period of Record | Lat, Long | Notes |
|---|---|---|---|---|
| **Tributary to Kaweah River** | | | | |
| Middle Fork Kaweah Tributary near Hammond CA | USGS 11208500 | 6/1/67-9/30/73 | 36°29'35", 118°49'30" | **Historic Flow Gage.** Located on an unnamed tributary that flows into the Kaweah River approximately 1 mile upstream of the Kaweah No. 2 Diversion. |
| **North Fork Kaweah River (above Confluence with Kaweah River)** | | | | |
| North Fork Kaweah River at Kaweah CA | USGS 11209500 | 10/1/1910-9/30/81 | 36°29'25", 118°55'12" | **Historic Flow Gage.** Located 3.5 miles upstream of the confluence with the Kaweah River. Measures flow in the North Fork Kaweah River. |

# FIGURES

This Page Intentionally Left Blank



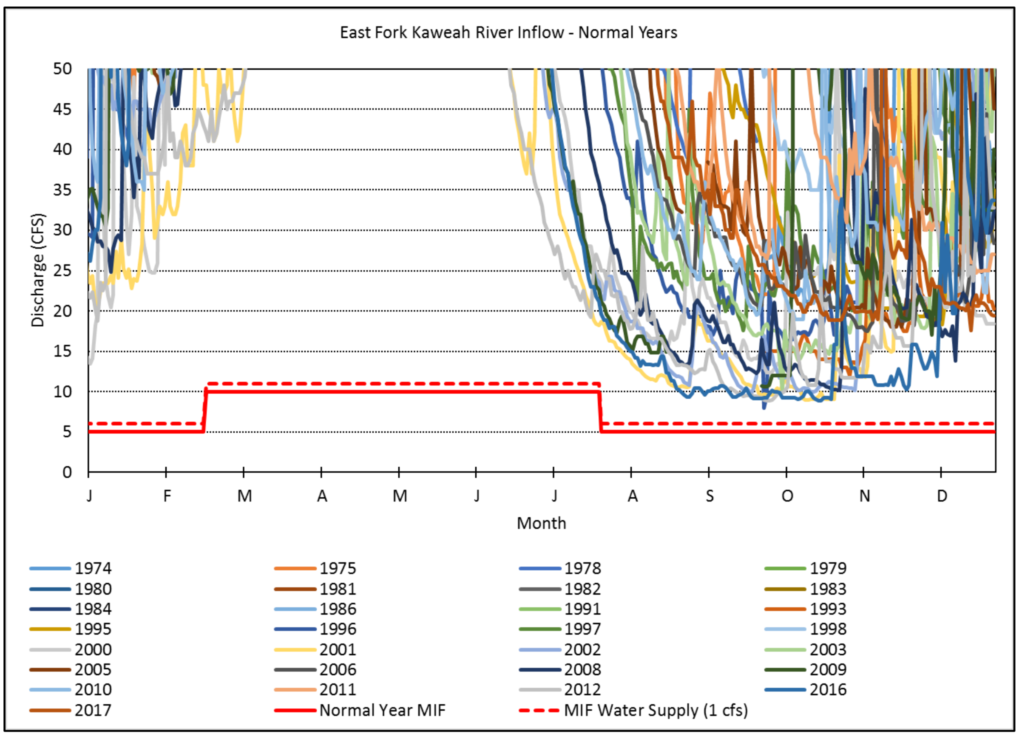




**Figure 7.2-1. East Fork Kaweah River Inflow at Kaweah No. 1 Diversion Dam in Relation to Minimum Instream Flow Requirements and Water Supply Commitments in Dry (top) and Normal (bottom) Years (October 1974–September 2018)[4]**

[4] There is a data gap in the flow record of on USGS Gage 11208720 from WY 1979 to WY 1994.

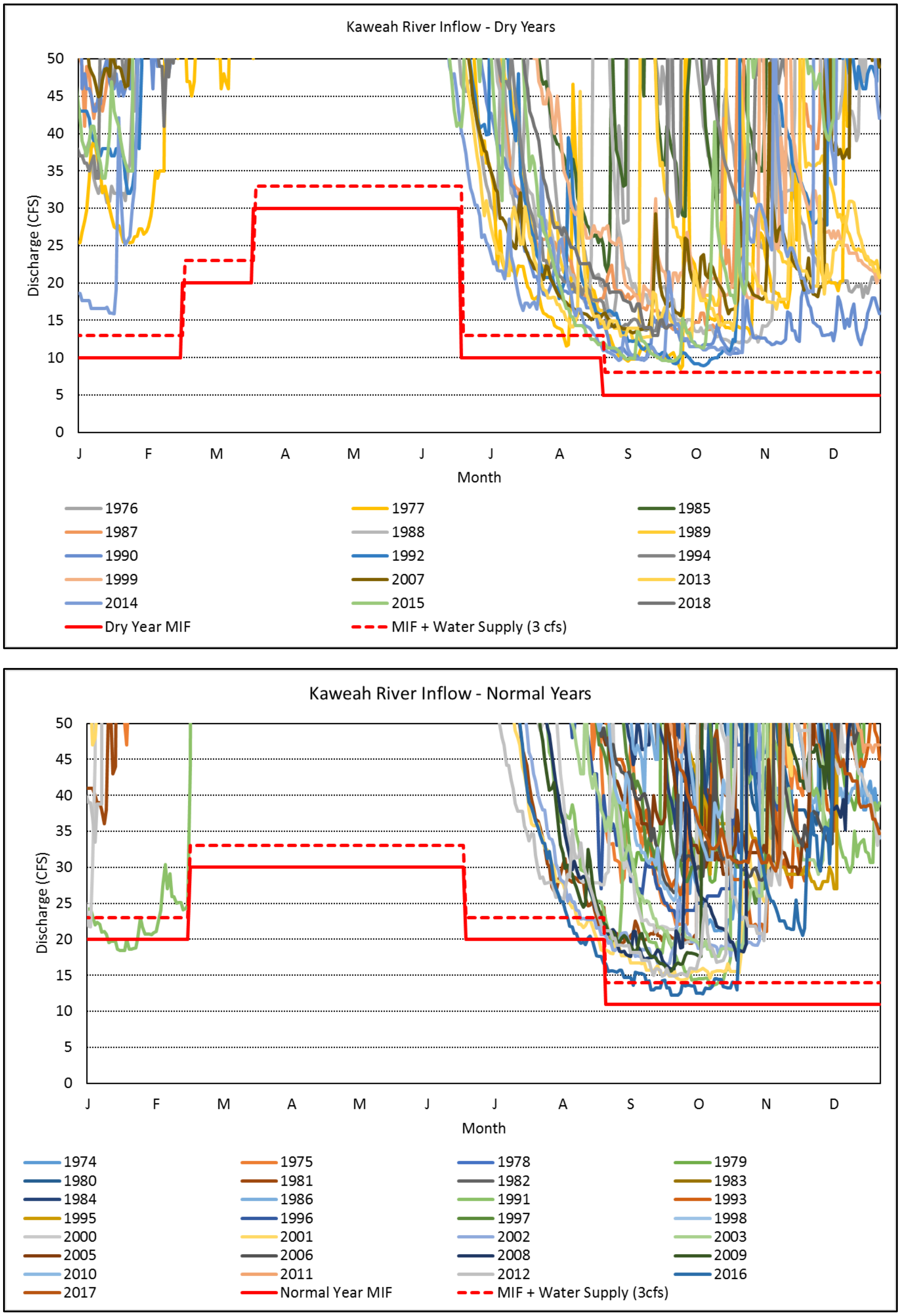



**Figure 7.2-2. Kaweah River Inflow at Kaweah No. 2 Diversion Dam in Relation to Minimum Instream Flow Requirements and Water Supply Commitments in Dry (top) and Normal (bottom) Years (October 1974–September 2018)**

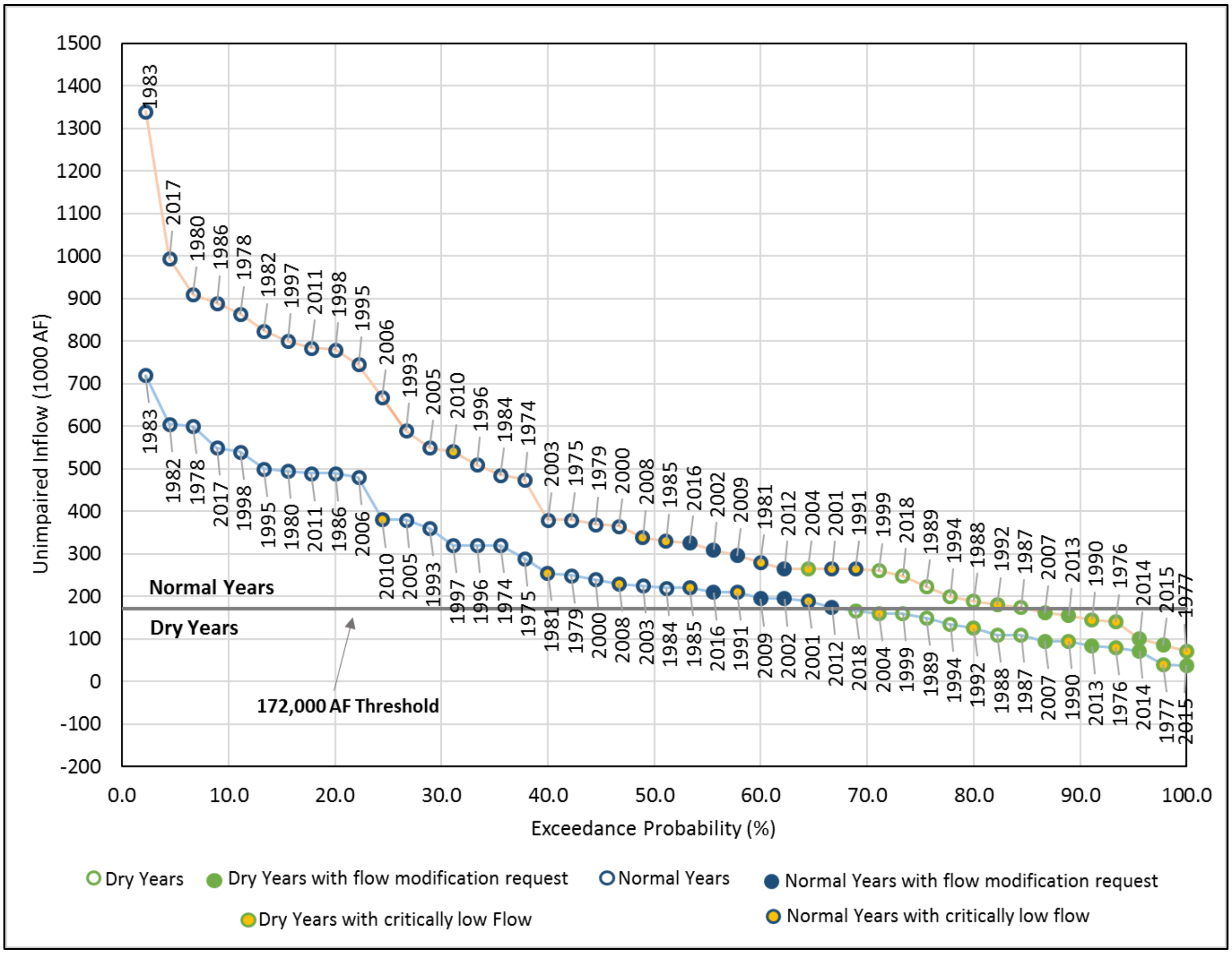



**Figure 7.2-3. Distribution of the April 1 to July 1 Forecast of Runoff in the Kaweah River at Terminus Reservoir based on the Bulletin 120 May 1 Forecast (1974–2018).**

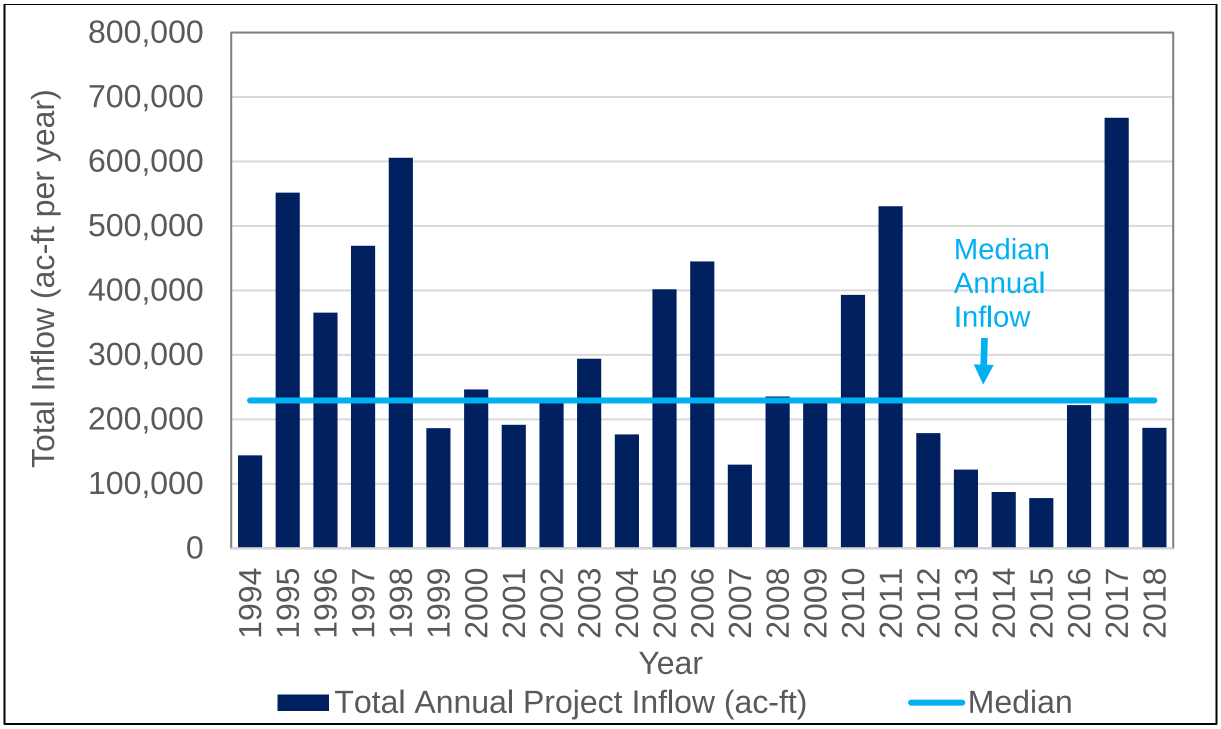
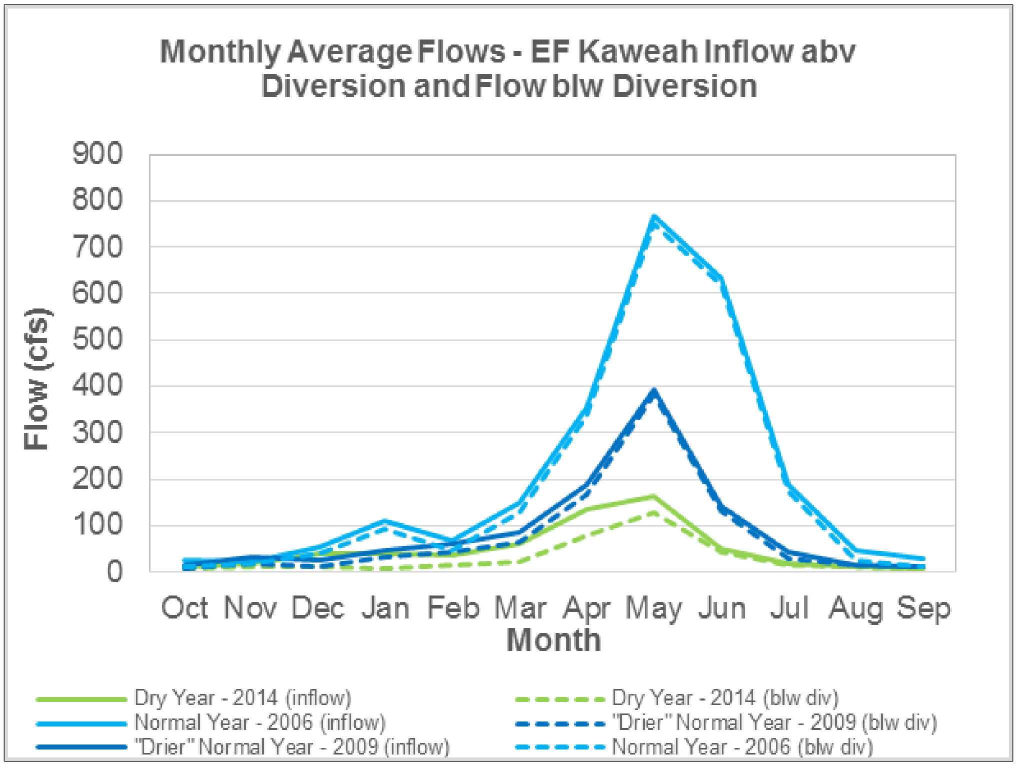



**Figure 7.2-4. Annual Inflow to the Kaweah Project (WY 1994–2018)**



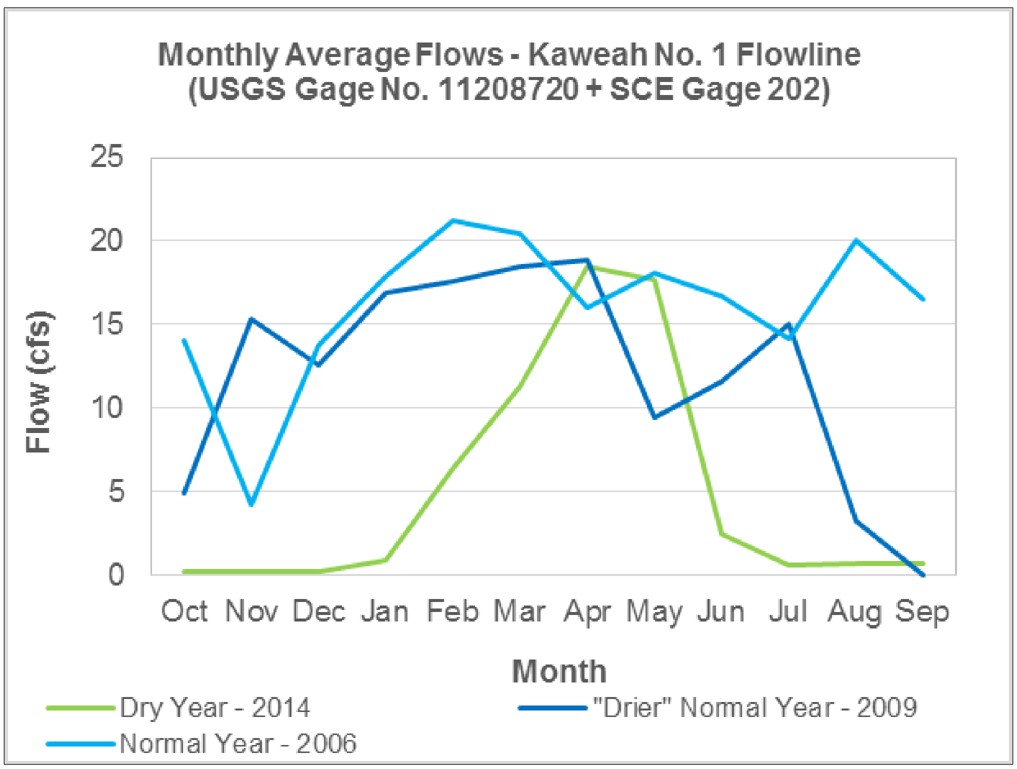
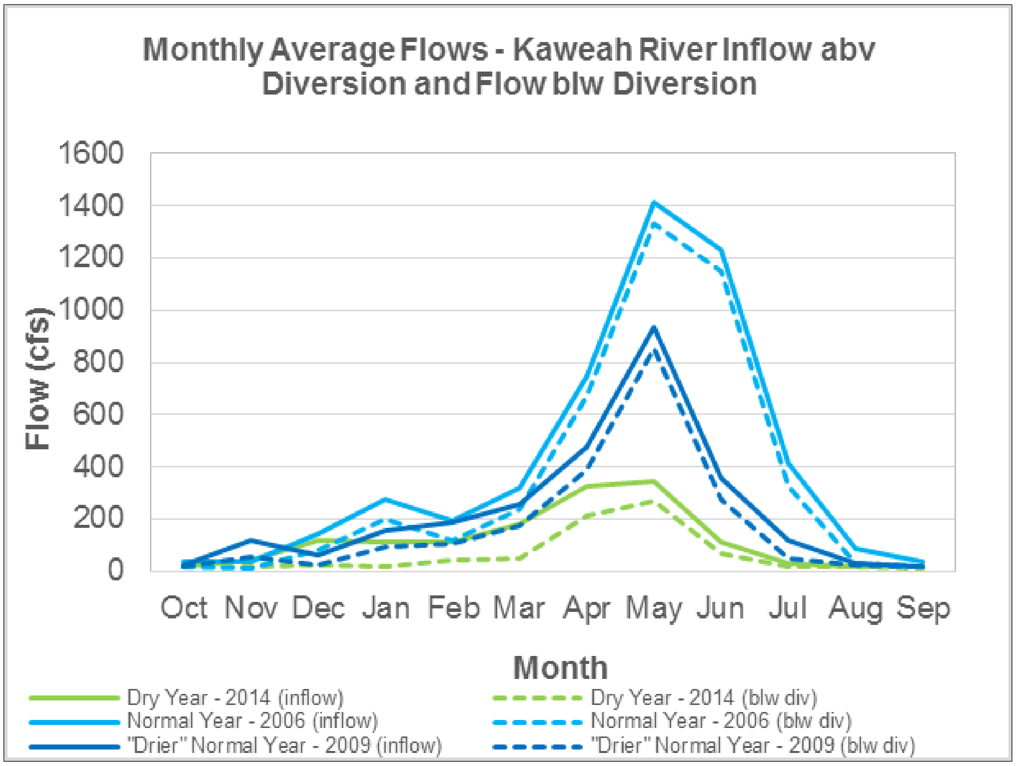




**Figure 7.2-5a. Monthly Average Flows in a Representative Dry Year (2014), Normal Year (2006), and "Drier" Normal Year (2009) in the East Fork Kaweah River Bypass Reach and Kaweah No. 1 Flowline/Kaweah No. 1 Powerhouse**



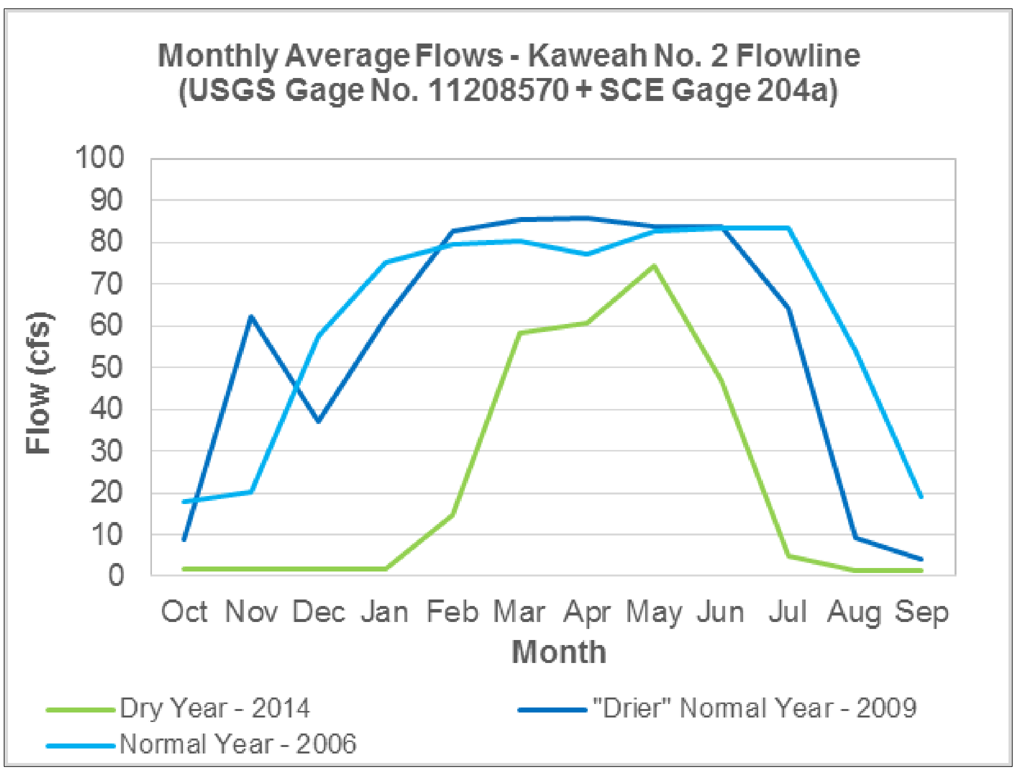




**Figure 7.2-5b. Monthly Average Flows in a Representative Dry Year (2014), Normal Year (2006), and "Drier" Normal Year (2009) in the Kaweah River Bypass Reach and Kaweah No. 2 Flowline/Kaweah No. 2 Powerhouse**

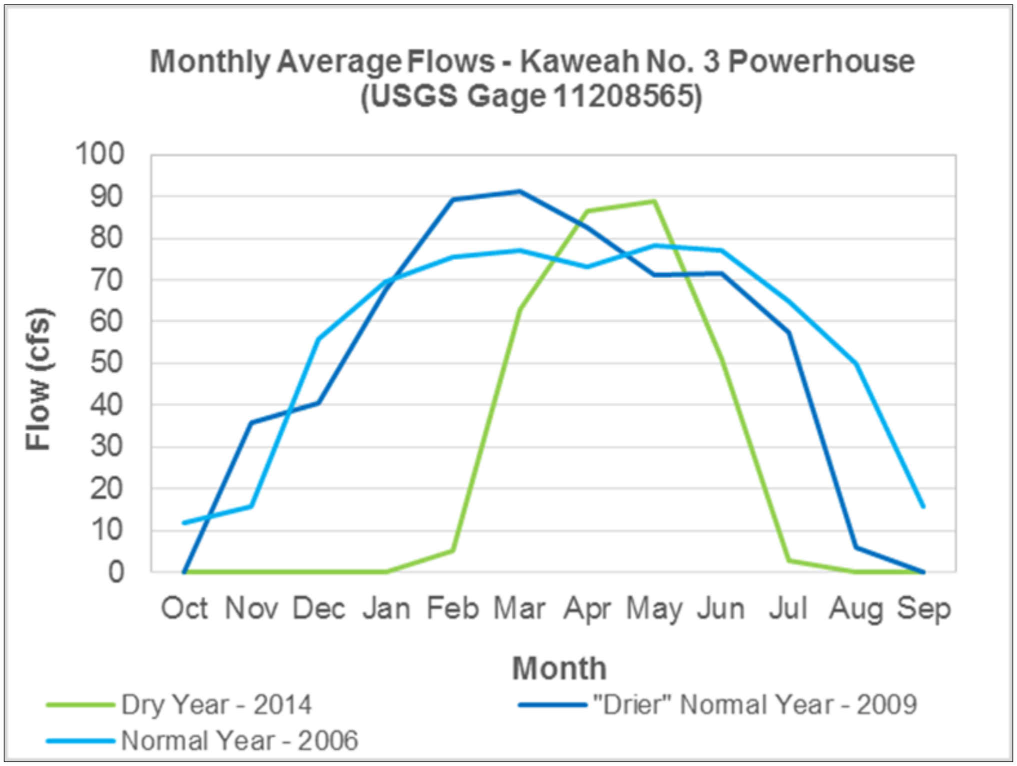
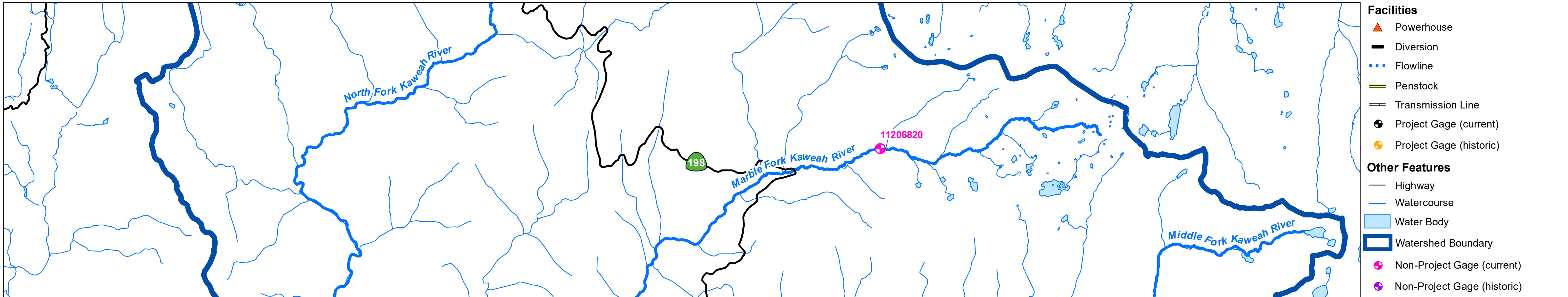



**Figure 7.2-5c. Monthly Average Flows in a Representative Dry Year (2014), Normal Year (2006), and "Drier" Normal Year (2009) at the Kaweah No. 3 Powerhouse**

This Page Intentionally Left Blank

# MAPS

This Page Intentionally Left Blank




SOUTHERN CALIFORNIA EDISON®

An EDISON INTERNATIONAL® Company

Kaweah Project – FERC Project No. 298

**Map 7.2-1**

**Current and Historic Flow Gages in the Vicinity of the Kaweah Project and Other Flow Gages in the Kaweah Watershed**

Date: 7/24/2019

0 0.5 1 2 Miles

Projection: UTM Zone 11
Datum: NAD 83



C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\HydroMaps\SCE_Eastern_KAWEAH_Gages_Current_Historic_17i11i_02.mxd

This Page Intentionally Left Blank

# APPENDIX 7.2-A

## Historic Water Year Types for the Kaweah River at Terminus Reservoir Based on Department of Water Resources Bulletin 120 May 1 Runoff Forecast (1938-2015)

This Page Intentionally Left Blank

**Table 7.2 A-1. Historic Water Year Types for the Kaweah River at Terminus Reservoir Based on Department of Water Resources Bulletin 120 May 1 Runoff Forecast (1938–2018).[1]**

| Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification | Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification | Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification |
|---|---|---|---|---|---|---|---|---|
| 1938 | 400 | Normal | 1973 | 440 | Normal | 2007 | 95 | Dry |
| 1939 | 120 | Dry | 1974 | 320 | Normal | 2008 | 230 | Normal |
| 1940 | 250 | Normal | 1975 | 190 | Normal | 2009 | 195 | Normal |
| 1941 | 440 | Normal | 1976 | 80 | Dry | 2010 | 380 | Normal |
| 1942 | 350 | Normal | 1977 | 40 | Dry | 2011 | 490 | Normal |
| 1943 | 320 | Normal | 1978 | 600 | Normal | 2012 | 175 | Normal |
| 1944 | 270 | Normal | 1979 | 250 | Normal | 2013 | 83 | Dry |
| 1945 | 340 | Normal | 1980 | 495 | Normal | 2014 | 72 | Dry |
| 1946 | 240 | Normal | 1981 | 255 | Normal | 2015 | 38 | Dry |
| 1947 | 145 | Dry | 1982 | 490 | Normal | 2016 | 210 | Normal |
| 1948 | 210 | Normal | 1983 | 720 | Normal | 2017 | 550 | Normal |
| 1949 | 170 | Dry | 1984 | 220 | Normal | 2018 | 249 | Normal |
| 1950 | 200 | Normal | 1985 | 220 | Normal | | | |
| 1951 | 90 | Dry | 1986 | 490 | Normal | | | |
| 1952 | 600 | Normal | 1987 | 110 | Dry | | | |
| 1953 | 170 | Dry | 1988 | 110 | Dry | | | |
| 1954 | 230 | Normal | 1989 | 150 | Dry | | | |
| 1955 | 180 | Normal | 1990 | 95 | Dry | | | |
| 1956 | 300 | Normal | 1991 | 210 | Normal | | | |
| 1957 | 170 | Dry | 1992 | 125 | Dry | | | |
| 1958 | 490 | Normal | 1993 | 360 | Normal | | | |
| 1959 | 75 | Dry | 1994 | 135 | Dry | | | |
| 1960 | 125 | Dry | 1995 | 500 | Normal | | | |

| Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification | Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification | Year | Apr-Jul Runoff Forecast (TAF) | Water Year Type Classification |
|---|---|---|---|---|---|---|---|---|
| 1961 | 55 | Dry | 1996 | 320 | Normal | | | |
| 1962 | 300 | Normal | 1997 | 320 | Normal | | | |
| 1963 | 235 | Normal | 1998 | 540 | Normal | | | |
| 1964 | 140 | Dry | 1999 | 160 | Dry | | | |
| 1965 | 250 | Normal | 2000 | 240 | Normal | | | |
| 1966 | 110 | Dry | 2001 | 190 | Normal | | | |
| 1967 | 610 | Normal | 2002 | 195 | Normal | | | |
| 1968 | 110 | Dry | 2003 | 225 | Normal | | | |
| 1969 | 800 | Normal | 2004 | 160 | Dry | | | |
| 1970 | 150 | Dry | 2005 | 380 | Normal | | | |
| 1971 | 170 | Dry | 2006 | 480 | Normal | | | |

[1] Data obtained from: DWR Bulletin 120. Available at: http://cdec.water.ca.gov/snow/bulletin120/. Water Year Types for Apr 1 - Jul 1 Forecast of Runoff in the Kaweah River at Terminus Reservoir based on Bulletin 120 May 1 Forecast.

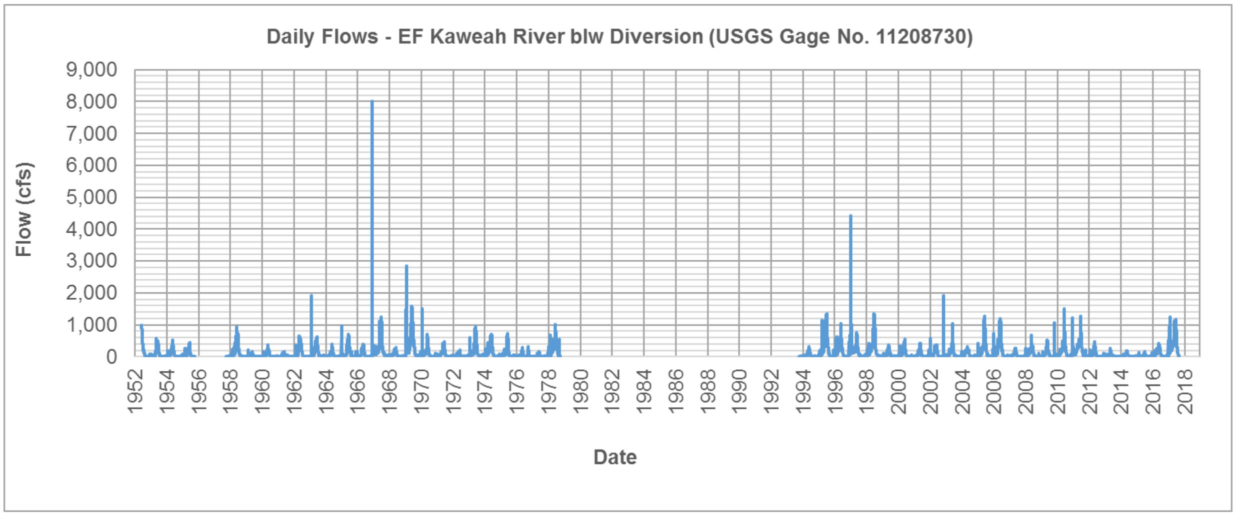
# APPENDIX 7.2-B

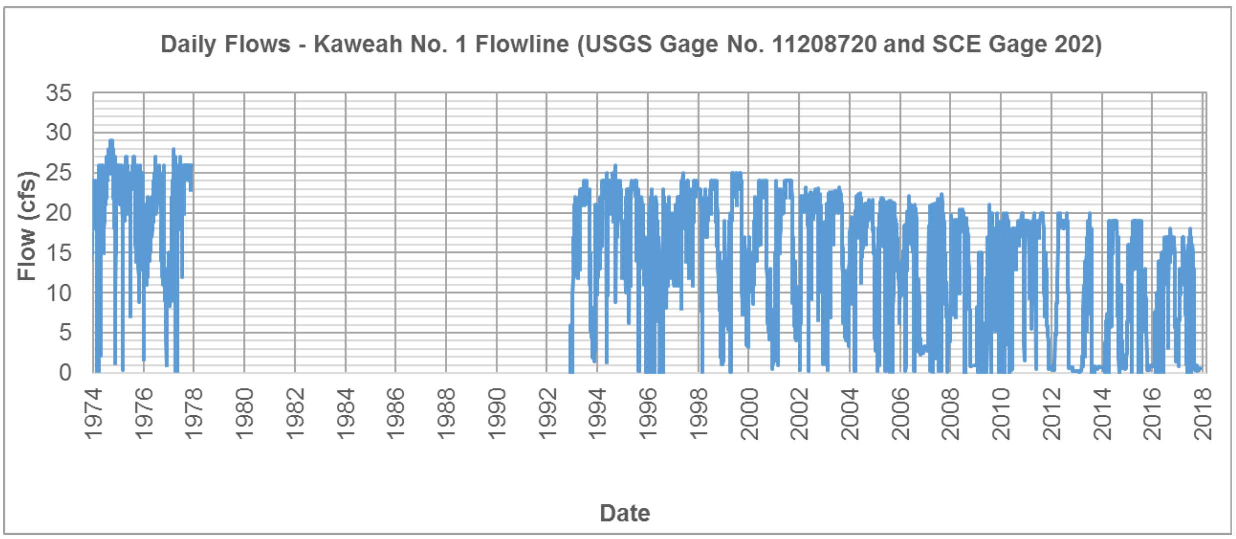
## Daily Flow in Bypass Reaches and Flowlines Associated with the Kaweah Project

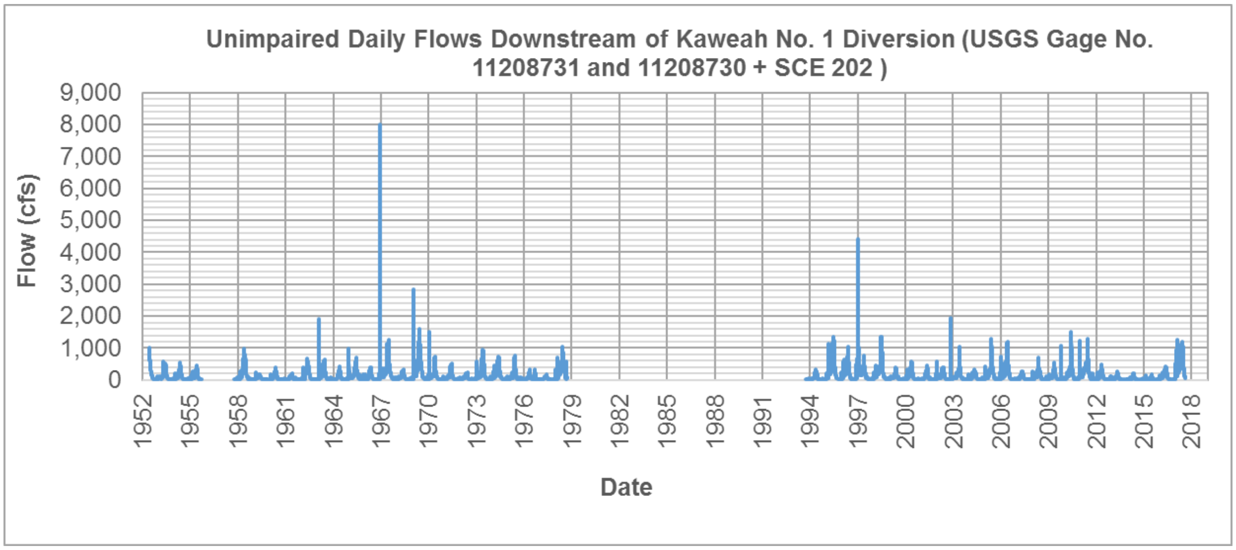
This Page Intentionally Left Blank

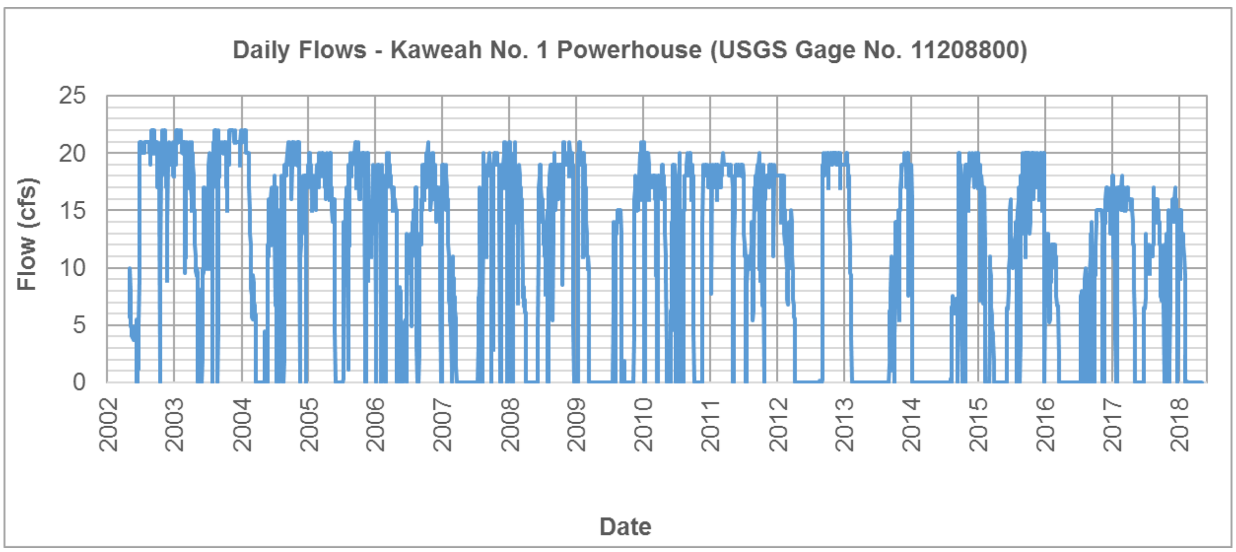
Data are presented for period of record available. Note, y-axis scales are different.

**East Fork Kaweah River**

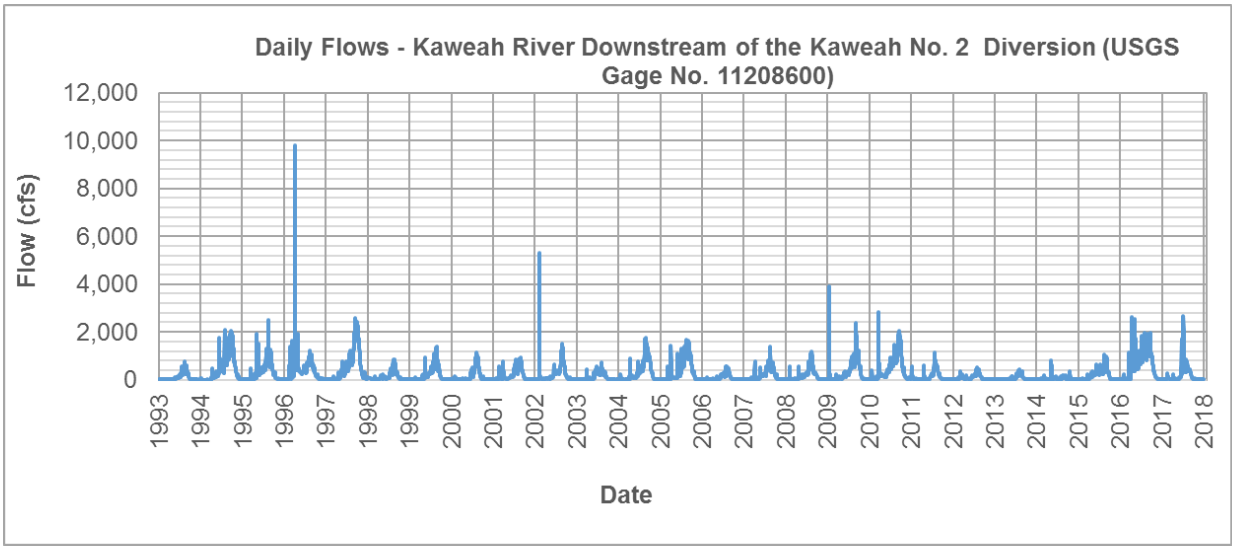


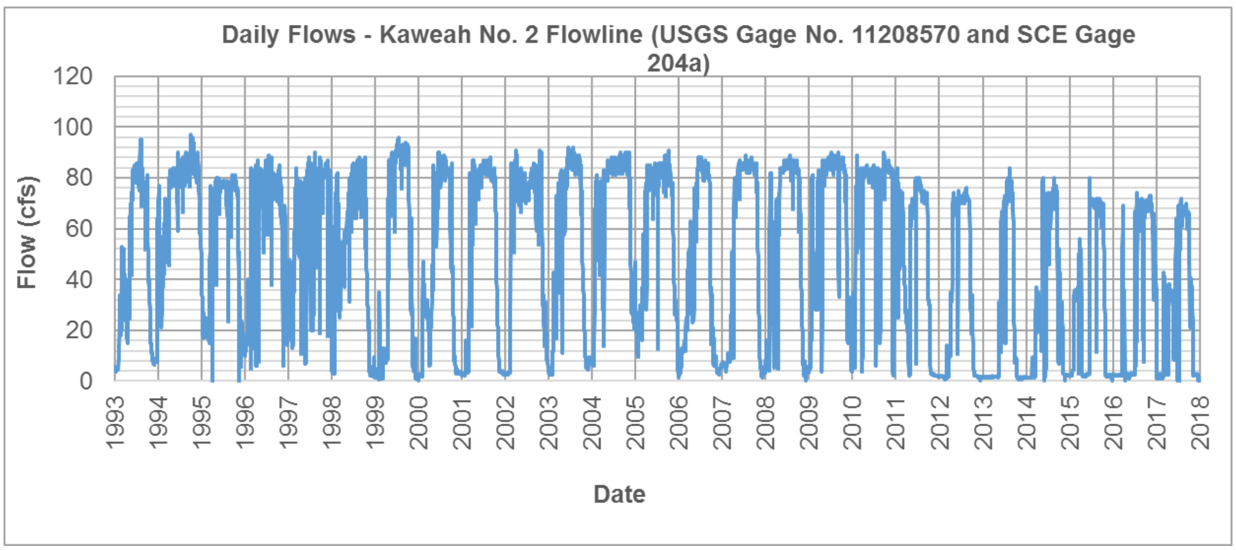



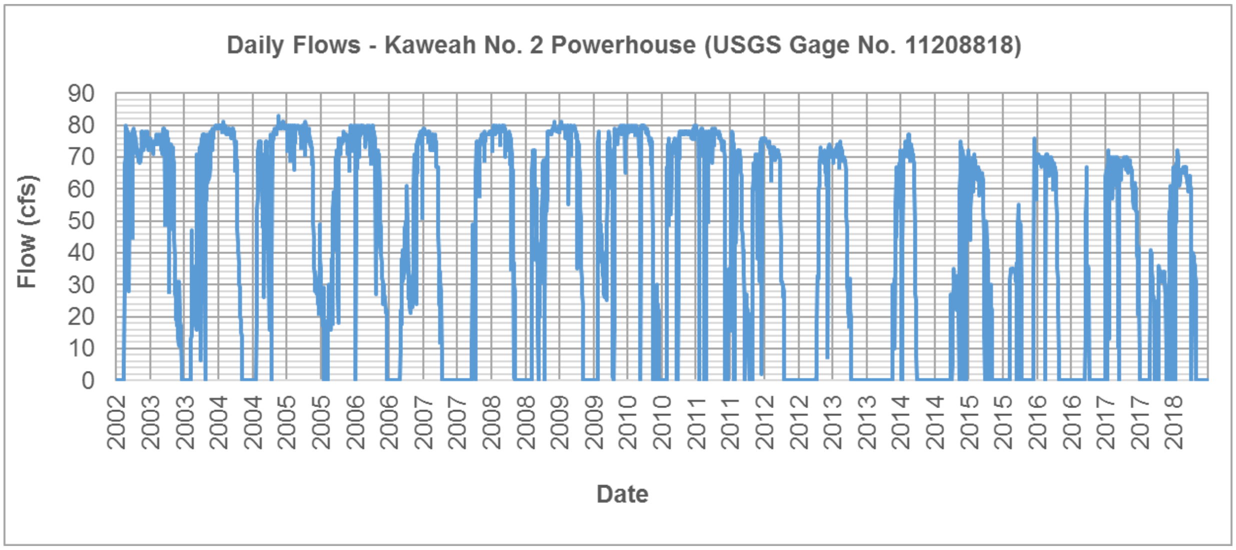

Unimpaired Daily Flows Downstream of Kaweah No. 1 Diversion (USGS Gage No. 11208731 and 11208730 + SCE 202 )
Flow (cfs)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
Date

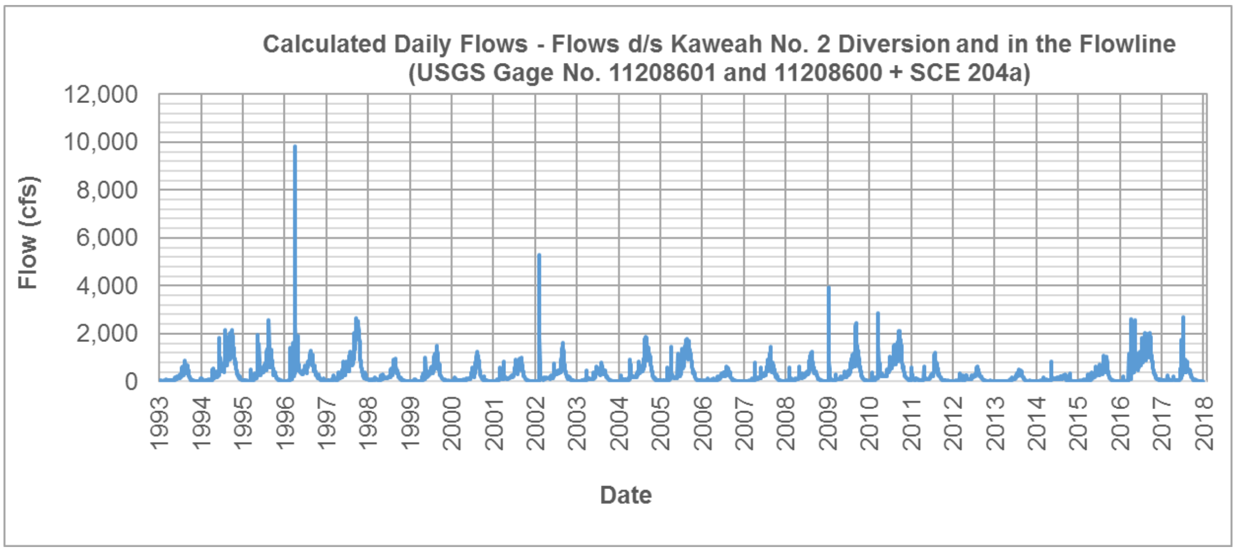

Daily Flows - Kaweah No. 1 Powerhouse (USGS Gage No. 11208800)
Flow (cfs)
25
20
15
10
5
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Date

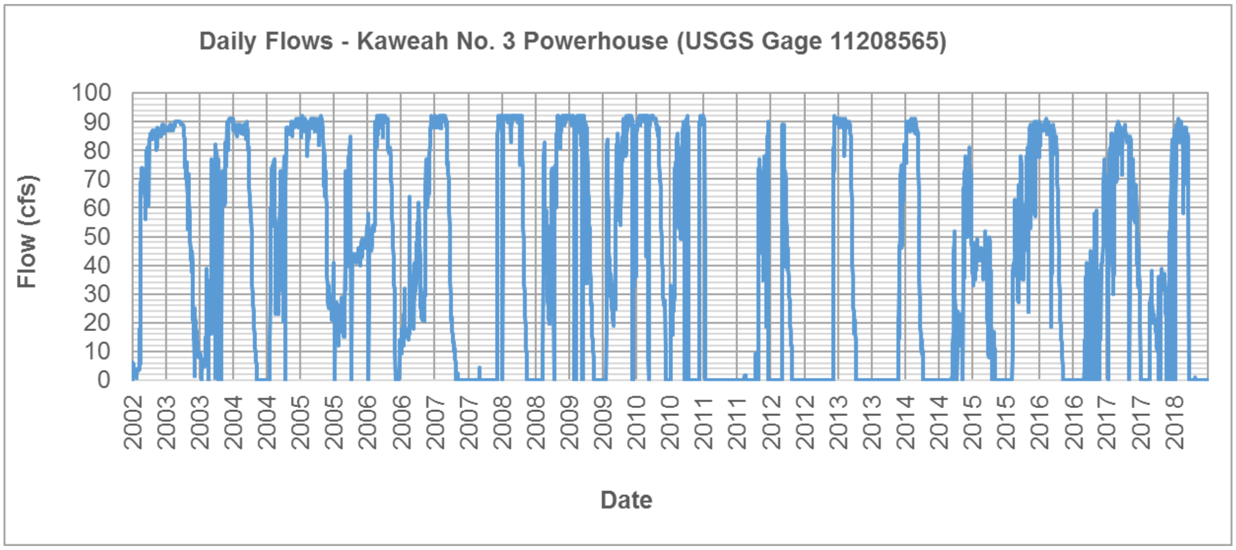
## Kaweah River




Daily Flows - Kaweah No. 2 Powerhouse (USGS Gage No. 11208818)
Flow (cfs)
90
80
70
60
50
40
30
20
10
0
2002
2003
2003
2004
2004
2005
2005
2006
2006
2007
2007
2008
2008
2009
2009
2010
2010
2011
2011
2012
2012
2013
2013
2014
2014
2015
2015
2016
2016
2017
2017
2018
Date


Calculated Daily Flows - Flows d/s Kaweah No. 2 Diversion and in the Flowline (USGS Gage No. 11208601 and 11208600 + SCE 204a)
Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Date


Daily Flows - Kaweah No. 3 Powerhouse (USGS Gage 11208565)
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
2002
2003
2003
2004
2004
2005
2005
2006
2006
2007
2007
2008
2008
2009
2009
2010
2010
2011
2011
2012
2012
2013
2013
2014
2014
2015
2015
2016
2016
2017
2017
2018
Date

This Page Intentionally Left Blank

# APPENDIX 7.2-C

## Tables of Monthly Summary Statistics (maximum, minimum, average discharge) and Exceedances for Gaging Stations in Bypass Reaches and Flowlines Associated with the Kaweah Project

This Page Intentionally Left Blank

**Table 7.2 C-1. Flow Statistics for Stream Gages and Flowlines Associated with the Kaweah Project for the Available Flow Data Period of Record.**

| Month | Daily Exceedance Flows by Month (cfs) | | | | | Maximum, Minimum, and Average Daily Flows (cfs) | | |
|---|---|---|---|---|---|---|---|---|
| | 10% | 20% | 50% | 80% | 90% | Max | Min | Average |
| **Flow to Kaweah No. 3 Powerhouse (USGS Gage 11208565) (WY 2002-2018)** | | | | | | | | |
| Oct | 24.0 | 15.0 | 0.0 | 0.0 | 0.0 | 84.0 | 0.0 | 7.9 |
| Nov | 66.1 | 44.0 | 14.5 | 0.0 | 0.0 | 86.0 | 0.0 | 21.4 |
| Dec | 78.0 | 65.0 | 29.5 | 0.0 | 0.0 | 91.0 | 0.0 | 32.7 |
| Jan | 86.0 | 77.0 | 25.0 | 0.0 | 0.0 | 92.0 | 0.0 | 34.9 |
| Feb | 89.0 | 87.0 | 51.5 | 0.0 | 0.0 | 92.0 | 0.0 | 47.4 |
| Mar | 91.0 | 91.0 | 85.0 | 48.0 | 34.0 | 92.0 | 0.0 | 69.8 |
| Apr | 91.0 | 90.2 | 88.0 | 47.0 | 0.0 | 92.0 | 0.0 | 70.6 |
| May | 92.0 | 90.0 | 88.0 | 45.0 | 0.0 | 92.0 | 0.0 | 71.4 |
| Jun | 92.0 | 90.0 | 86.0 | 37.8 | 1.4 | 92.0 | 0.0 | 67.0 |
| Jul | 91.0 | 88.0 | 36.0 | 0.0 | 0.0 | 92.0 | 0.0 | 43.4 |
| Aug | 69.5 | 45.0 | 0.0 | 0.0 | 0.0 | 88.0 | 0.0 | 18.1 |
| Sep | 27.0 | 9.2 | 0.0 | 0.0 | 0.0 | 68.0 | 0.0 | 6.0 |
| **Calculated Unimpaired Flow Upstream of Kaweah No. 2 Diversion[1] (WY 1994-2018)** | | | | | | | | |
| Oct | 142.0 | 60.8 | 32.7 | 19.9 | 18.3 | 260.4 | 16.4 | 51.4 |
| Nov | 189.9 | 96.1 | 55.3 | 33.4 | 24.0 | 377.4 | 20.6 | 80.8 |
| Dec | 329.0 | 135.8 | 90.3 | 49.7 | 26.8 | 409.6 | 24.2 | 109.8 |
| Jan | 275.2 | 245.0 | 136.8 | 77.8 | 52.0 | 1292.7 | 18.9 | 197.0 |
| Feb | 436.4 | 234.2 | 184.9 | 102.6 | 91.2 | 514.1 | 57.5 | 199.3 |
| Mar | 458.4 | 417.8 | 291.9 | 188.1 | 159.7 | 600.2 | 109.6 | 307.0 |
| Apr | 741.8 | 632.5 | 491.4 | 339.9 | 306.0 | 771.5 | 273.5 | 502.1 |
| May | 1213.9 | 1052.5 | 905.0 | 486.7 | 355.9 | 1413.8 | 345.6 | 832.0 |
| Jun | 1612.1 | 1442.5 | 555.2 | 179.6 | 116.8 | 2075.0 | 114.0 | 726.2 |
| Jul | 1188.5 | 513.6 | 133.9 | 50.8 | 31.1 | 1647.5 | 24.6 | 331.0 |
| Aug | 320.3 | 93.7 | 37.0 | 22.2 | 18.6 | 334.2 | 17.9 | 81.4 |
| Sep | 92.0 | 44.0 | 24.5 | 16.5 | 14.6 | 161.8 | 11.3 | 36.9 |
| **Kaweah No. 2 Flowline (USGS Gage No. 11208570 + SCE Gage 204a) (1994-2002 and 2002-2018)** | | | | | | | | |
| Oct | 35.0 | 22.0 | 4.4 | 2.1 | 1.6 | 97.0 | 0.3 | 13.1 |
| Nov | 74.0 | 58.0 | 21.0 | 2.5 | 1.6 | 89.0 | 0.7 | 29.2 |
| Dec | 78.0 | 70.0 | 40.0 | 14.0 | 3.6 | 91.0 | 0.8 | 41.4 |
| Jan | 82.0 | 79.0 | 52.0 | 13.0 | 2.6 | 90.0 | 0.0 | 47.2 |
| Feb | 84.0 | 82.4 | 74.0 | 40.0 | 5.0 | 90.0 | 1.0 | 63.1 |
| Mar | 87.0 | 85.0 | 79.0 | 67.0 | 30.4 | 92.0 | 0.1 | 70.8 |
| Apr | 87.5 | 85.5 | 81.0 | 70.0 | 63.0 | 96.0 | 0.2 | 75.8 |

| Month | Daily Exceedance Flows by Month (cfs) | | | | | Maximum, Minimum, and Average Daily Flows (cfs) | | |
|---|---|---|---|---|---|---|---|---|
| | 10% | 20% | 50% | 80% | 90% | Max | Min | Averag e |
| May | 87.0 | 85.5 | 81.0 | 72.0 | 69.0 | 95.0 | 12.0 | 78.1 |
| Jun | 87.0 | 85.0 | 79.0 | 68.0 | 56.0 | 94.0 | 6.9 | 73.9 |
| Jul | 86.0 | 83.0 | 69.0 | 28.0 | 8.9 | 97.0 | 0.7 | 56.8 |
| Aug | 82.0 | 70.0 | 9.7 | 2.6 | 2.1 | 90.0 | 0.0 | 27.7 |
| Sep | 53.0 | 26.9 | 4.8 | 2.2 | 1.8 | 90.0 | 0.0 | 15.8 |
| **Kaweah River Downstream Kaweah No. 2 Diversion (USGS Gage No. 11208600) (WY 1994-2018)** | | | | | | | | |
| Oct | 50.0 | 28.0 | 16.0 | 12.0 | 10.0 | 3910.0 | 5.6 | 32.9 |
| Nov | 65.0 | 31.2 | 18.0 | 12.1 | 11.0 | 5300.0 | 5.6 | 43.8 |
| Dec | 112.2 | 60.4 | 19.0 | 12.9 | 9.4 | 2830.0 | 5.5 | 60.5 |
| Jan | 323.2 | 147.2 | 49.0 | 21.0 | 15.3 | 9800.0 | 10.0 | 151.3 |
| Feb | 326.0 | 200.0 | 80.3 | 30.0 | 24.4 | 2550.0 | 11.0 | 158.0 |
| Mar | 474.6 | 337.6 | 188.0 | 95.0 | 59.0 | 1760.0 | 24.0 | 240.8 |
| Apr | 780.7 | 606.9 | 374.5 | 219.6 | 151.6 | 2680.0 | 34.0 | 433.3 |
| May | 1290.0 | 1070.0 | 668.0 | 350.0 | 238.8 | 2500.0 | 40.0 | 725.6 |
| Jun | 1620.6 | 1159.3 | 355.5 | 95.0 | 39.9 | 2590.0 | 29.8 | 622.9 |
| Jul | 764.6 | 364.6 | 37.0 | 20.0 | 14.0 | 2440.0 | 11.0 | 246.0 |
| Aug | 97.4 | 37.0 | 22.4 | 16.0 | 12.6 | 602.0 | 9.5 | 47.4 |
| Sep | 25.3 | 18.0 | 13.7 | 11.0 | 8.5 | 322.0 | 5.8 | 19.1 |
| **Flow to Kaweah No. 1 Powerhouse (USGS Gage No. 11208800) (WY 2002-2018)** | | | | | | | | |
| Oct | 13.0 | 5.9 | 0.0 | 0.0 | 0.0 | 19.0 | 0.0 | 3.0 |
| Nov | 18.0 | 14.0 | 0.0 | 0.0 | 0.0 | 21.0 | 0.0 | 6.2 |
| Dec | 18.0 | 14.0 | 10.0 | 0.0 | 0.0 | 21.0 | 0.0 | 7.9 |
| Jan | 20.0 | 19.0 | 15.0 | 0.0 | 0.0 | 22.0 | 0.0 | 11.8 |
| Feb | 20.0 | 20.0 | 18.0 | 8.7 | 2.0 | 22.0 | 0.0 | 15.2 |
| Mar | 20.0 | 20.0 | 18.0 | 5.0 | 0.0 | 22.0 | 0.0 | 14.0 |
| Apr | 21.0 | 20.0 | 18.0 | 14.0 | 0.0 | 22.0 | 0.0 | 15.8 |
| May | 20.0 | 20.0 | 18.0 | 15.0 | 12.0 | 22.0 | 0.0 | 16.6 |
| Jun | 21.0 | 20.0 | 18.0 | 11.0 | 0.0 | 22.0 | 0.0 | 15.0 |
| Jul | 19.0 | 18.0 | 14.0 | 0.0 | 0.0 | 22.0 | 0.0 | 11.5 |
| Aug | 19.0 | 18.0 | 7.5 | 0.0 | 0.0 | 21.0 | 0.0 | 8.8 |
| Sep | 18.0 | 16.0 | 0.0 | 0.0 | 0.0 | 21.0 | 0.0 | 6.0 |
| **Flow to Kaweah No. 2 Powerhouse (USGS Gage No. 11208818) (WY 2002-2018)** | | | | | | | | |
| Oct | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 78.0 | 0 | 7.3 |
| Nov | 72.0 | 63.0 | 13.0 | 0.0 | 0.0 | 80.0 | 0 | 25.2 |
| Dec | 74.0 | 62.0 | 34.0 | 0.0 | 0.0 | 79.0 | 0 | 33.8 |

| Month | Daily Exceedance Flows by Month (cfs) | | | | | Maximum, Minimum, and Average Daily Flows (cfs) | | |
|---|---|---|---|---|---|---|---|---|
| | 10% | 20% | 50% | 80% | 90% | Max | Min | Average |
| Jan | 77.0 | 76.0 | 41.0 | 0.0 | 0.0 | 79.0 | 0 | 41.8 |
| Feb | 78.0 | 78.0 | 71.0 | 24.0 | 0.0 | 83.0 | 0 | 55.1 |
| Mar | 80.0 | 79.0 | 76.0 | 53.0 | 0.0 | 81.0 | 0 | 61.9 |
| Apr | 80.0 | 79.0 | 75.0 | 69.0 | 61.0 | 81.0 | 0 | 70.5 |
| May | 79.0 | 79.0 | 74.0 | 68.0 | 66.0 | 80.0 | 0 | 71.8 |
| Jun | 79.0 | 79.0 | 72.0 | 62.0 | 35.9 | 80.0 | 0 | 65.9 |
| Jul | 78.0 | 77.0 | 51.5 | 0.0 | 0.0 | 81.0 | 0 | 45.7 |
| Aug | 72.0 | 63.0 | 0.0 | 0.0 | 0.0 | 78.0 | 0 | 20.3 |
| Sep | 31.0 | 22.0 | 0.0 | 0.0 | 0.0 | 70.0 | 0 | 8.1 |
| **Calculated Unimpaired Flow Upstream of Kaweah No. 1 Diversion[2] (WY 1994-2018)** | | | | | | | | |
| Oct | Oct | 53.3 | 28.1 | 20.8 | 11.8 | 10.9 | 80.4 | 8.4 |
| Oct | 36.9 | 26.0 | 16.4 | 10.2 | 9.0 | 1061.0 | 6.3 | 22.1 |
| Nov | 41.9 | 32.1 | 21.1 | 14.8 | 10.8 | 1933.8 | 8.5 | 31.8 |
| Dec | 58.6 | 42.9 | 27.0 | 19.1 | 15.2 | 1220.0 | 7.5 | 42.7 |
| Jan | 137.5 | 80.0 | 39.7 | 23.1 | 17.2 | 4424.8 | 8.5 | 82.1 |
| Feb | 174.8 | 94.0 | 54.2 | 36.0 | 24.7 | 1260.0 | 10.2 | 83.5 |
| Mar | 229.6 | 178.0 | 97.8 | 53.9 | 41.7 | 1144.4 | 22.9 | 119.1 |
| Apr | 350.0 | 303.8 | 190.7 | 117.9 | 84.7 | 1246.7 | 31.0 | 208.9 |
| May | 624.2 | 477.2 | 338.0 | 199.8 | 152.8 | 1300.0 | 36.0 | 372.8 |
| Jun | 922.9 | 539.2 | 197.2 | 70.2 | 45.9 | 1503.7 | 19.0 | 343.7 |
| Jul | 355.1 | 197.4 | 52.3 | 23.6 | 19.2 | 1341.5 | 11.2 | 139.6 |
| Aug | 78.3 | 51.0 | 19.4 | 12.1 | 10.3 | 333.0 | 6.6 | 37.5 |
| **Kaweah No. 1 Flowline (USGS Gage No. 11208720 and SCE Gage 202) (WY 1994-2002 and 2002-2018)** | | | | | | | | |
| Oct | 18.9 | 13.8 | 4.0 | 0.8 | 0.2 | 26.0 | 0 | 6.8 |
| Nov | 19.0 | 16.6 | 11.0 | 1.0 | 0.7 | 23.3 | 0 | 10.0 |
| Dec | 21.2 | 19.6 | 13.0 | 4.7 | 0.5 | 24.0 | 0 | 12.3 |
| Jan | 22.0 | 21.2 | 16.0 | 6.2 | 0.8 | 24.0 | 0 | 14.0 |
| Feb | 22.3 | 21.5 | 19.0 | 13.0 | 5.7 | 24.0 | 0 | 16.6 |
| Mar | 23.0 | 22.0 | 19.0 | 13.0 | 4.3 | 25.0 | 0 | 16.9 |
| Apr | 23.5 | 22.9 | 19.0 | 16.0 | 8.1 | 24.4 | 0 | 18.1 |
| May | 23.8 | 23.0 | 19.0 | 16.0 | 13.4 | 24.7 | 0 | 18.4 |
| Jun | 23.6 | 23.0 | 19.1 | 12.0 | 3.3 | 25.1 | 0 | 17.2 |
| Jul | 22.8 | 21.0 | 17.0 | 7.6 | 0.7 | 26.0 | 0 | 14.7 |
| Aug | 21.0 | 20.0 | 11.0 | 2.5 | 0.7 | 24.0 | 0 | 11.6 |
| Sep | 20.7 | 18.3 | 6.8 | 0.6 | 0.4 | 24.0 | 0 | 9.1 |

| Month | Daily Exceedance Flows by Month (cfs) | | | | | Maximum, Minimum, and Average Daily Flows (cfs) | | |
|---|---|---|---|---|---|---|---|---|
| | 10% | 20% | 50% | 80% | 90% | Max | Min | Average |
| **East Fork Kaweah River downstream Kaweah No. 1 Diversion (USGS Gage No. 11208730) (1993-2018)** | | | | | | | | |
| Oct | 22.0 | 16.9 | 9.8 | 6.9 | 6.0 | 4420.0 | 5.2 | 15.3 |
| Nov | 26.3 | 19.0 | 10.4 | 7.3 | 6.4 | 1930.0 | 2.7 | 21.8 |
| Dec | 45.0 | 28.0 | 13.0 | 7.4 | 6.5 | 1220.0 | 3.1 | 30.4 |
| Jan | 126.6 | 61.2 | 23.0 | 9.0 | 7.4 | 4420.0 | 5.2 | 68.1 |
| Feb | 156.9 | 78.9 | 35.0 | 17.0 | 10.9 | 1260.0 | 5.2 | 66.9 |
| Mar | 214.0 | 161.1 | 79.5 | 34.0 | 26.0 | 1140.0 | 12.0 | 102.1 |
| Apr | 338.0 | 288.0 | 170.2 | 97.3 | 64.3 | 1240.0 | 13.0 | 190.8 |
| May | 610.1 | 458.7 | 317.4 | 181.8 | 132.4 | 1281.0 | 18.0 | 354.4 |
| Jun | 910.3 | 519.8 | 181.3 | 52.4 | 30.0 | 1500.0 | 11.9 | 326.5 |
| Jul | 338.6 | 181.3 | 33.2 | 13.8 | 12.0 | 1319.2 | 10.9 | 124.9 |
| Aug | 61.0 | 32.0 | 9.9 | 6.9 | 6.3 | 311.0 | 5.0 | 25.9 |
| Sep | 21.0 | 15.0 | 8.4 | 6.3 | 6.1 | 87.7 | 4.8 | 11.8 |

[1] 1994-2002: Sum of Kaweah No. 2 Flowline (USGS 11208570 [SCE 204a]), the main Kaweah River downstream of the Kaweah No. 2 Diversion (USGS 11208600 [SCE 203]), and the discharge of the Kaweah No. 3 Powerhouse (Sum of SCE 210 & SCE 208 gages). 2002-2018: Sum of Kaweah No. 2 Flowline (USGS 11208570 [SCE 204a]), the main Kaweah River downstream of the Kaweah No. 2 Diversion (USGS 11208600 [SCE 203]), and the discharge of the Kaweah No. 3 Powerhouse (SCE 206a.

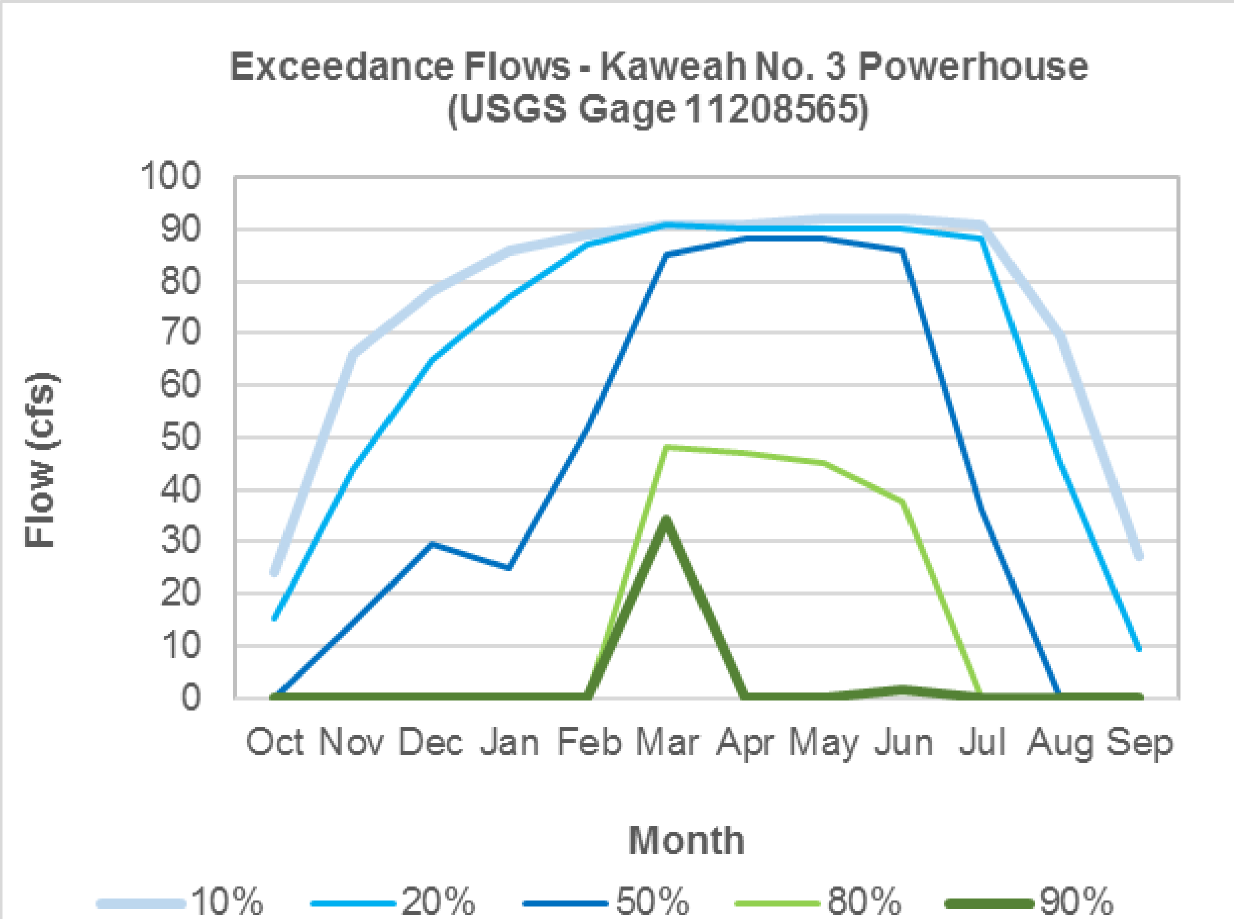
[2] 1994-2002: Sum of East Fork Kaweah River downstream of the Kaweah No. 1 Diversion (11208730 [SCE 201]) and the Kaweah No. 1 Flowline (USGS 11208720 [SCE 202]). 2002-2018: Sum of East Fork Kaweah River downstream of the Kaweah No. 1 Diversion (11208730 [SCE 201]) and the Kaweah No. 1 Flowline (USGS 11208720 [SCE 202]).

# APPENDIX 7.2-D

## Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) in Bypass Reaches and Flowlines Associated with the Kaweah Project from WY 1994-2018

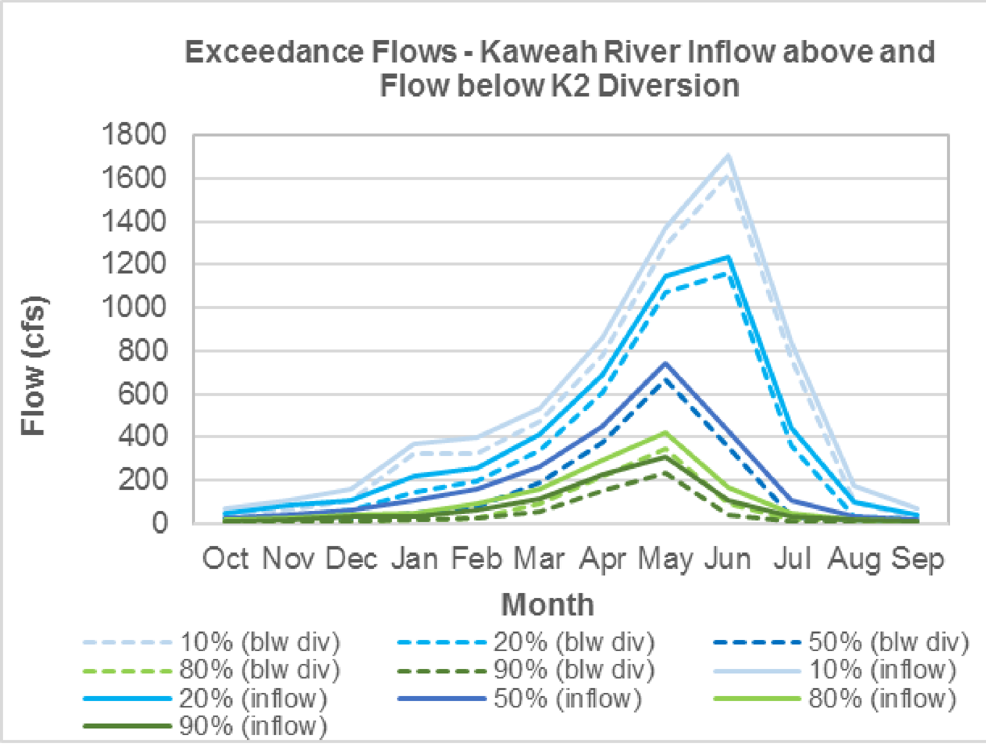
This Page Intentionally Left Blank

**Figure 7.2 D-1. Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) at the Kaweah No. 3 Powerhouse (WY 2002-2018).[1]**




[1] Kaweah No. 3 Powerhouse period of record is from 2002-2018.

**Figure 7.2 D-2. Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) in the Kaweah River Bypass Reach and Kaweah No. 2 Flowline (WY 1994-2018).**



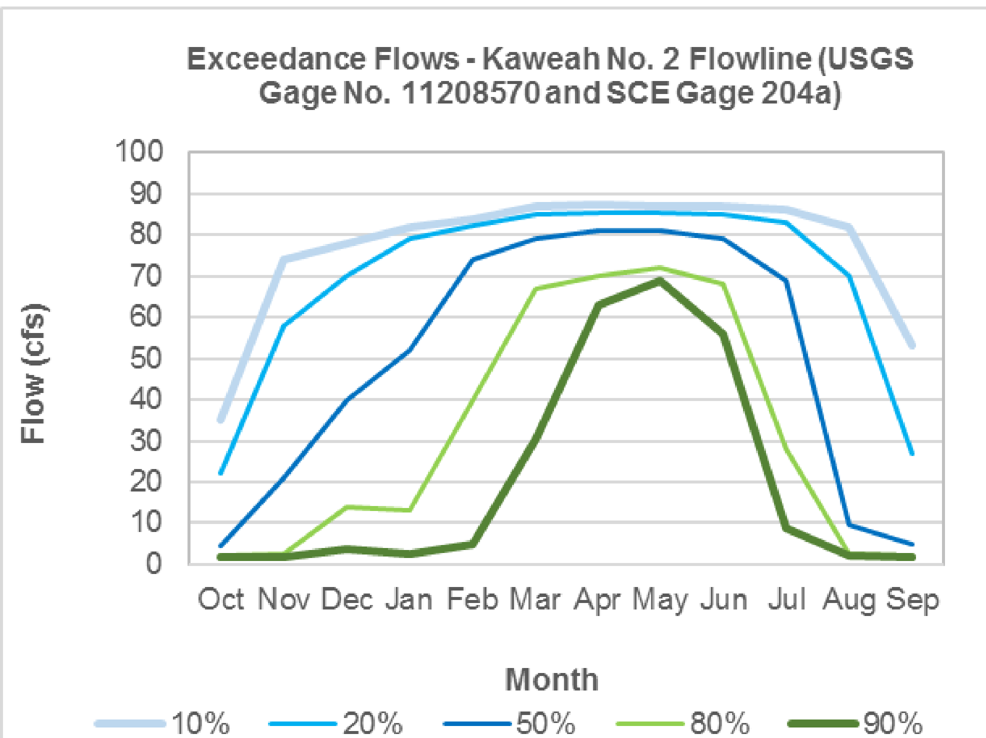
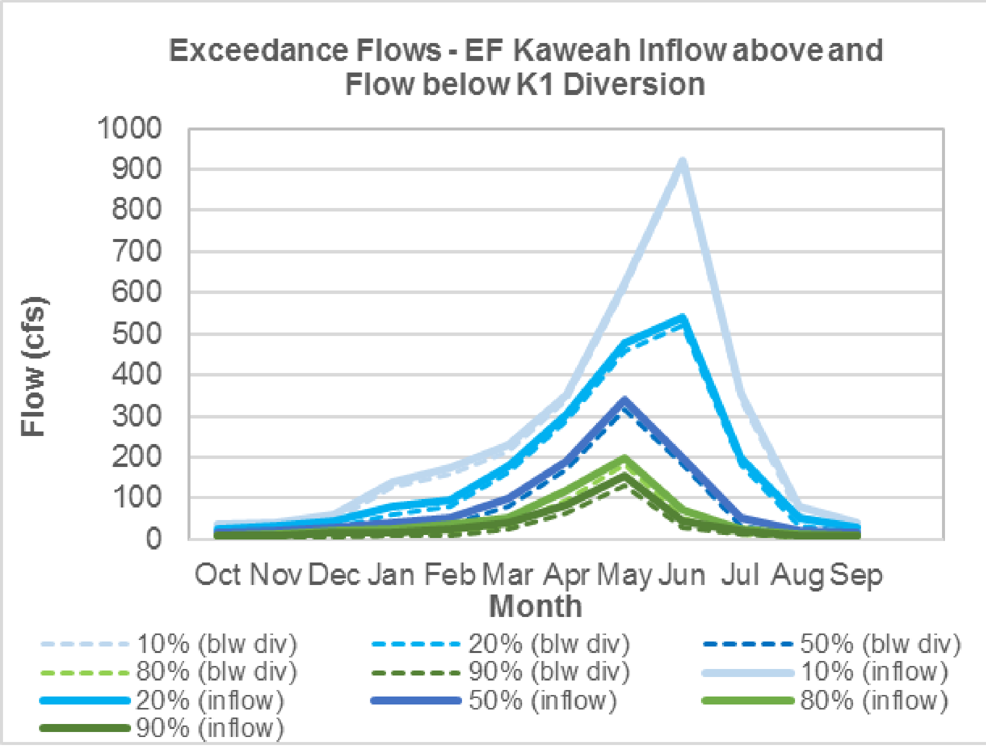



**Figure 7.25 D-3. Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) in the East Fork Kaweah River Bypass Reach and Kaweah No. 1 Flowline (WY 1994-2018).**



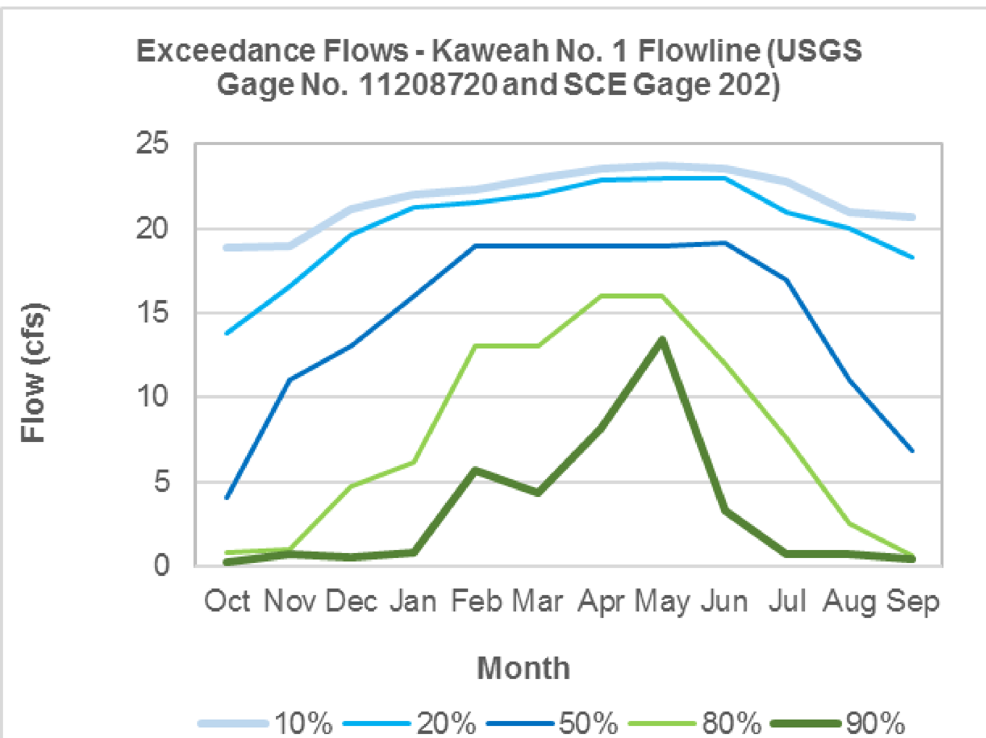
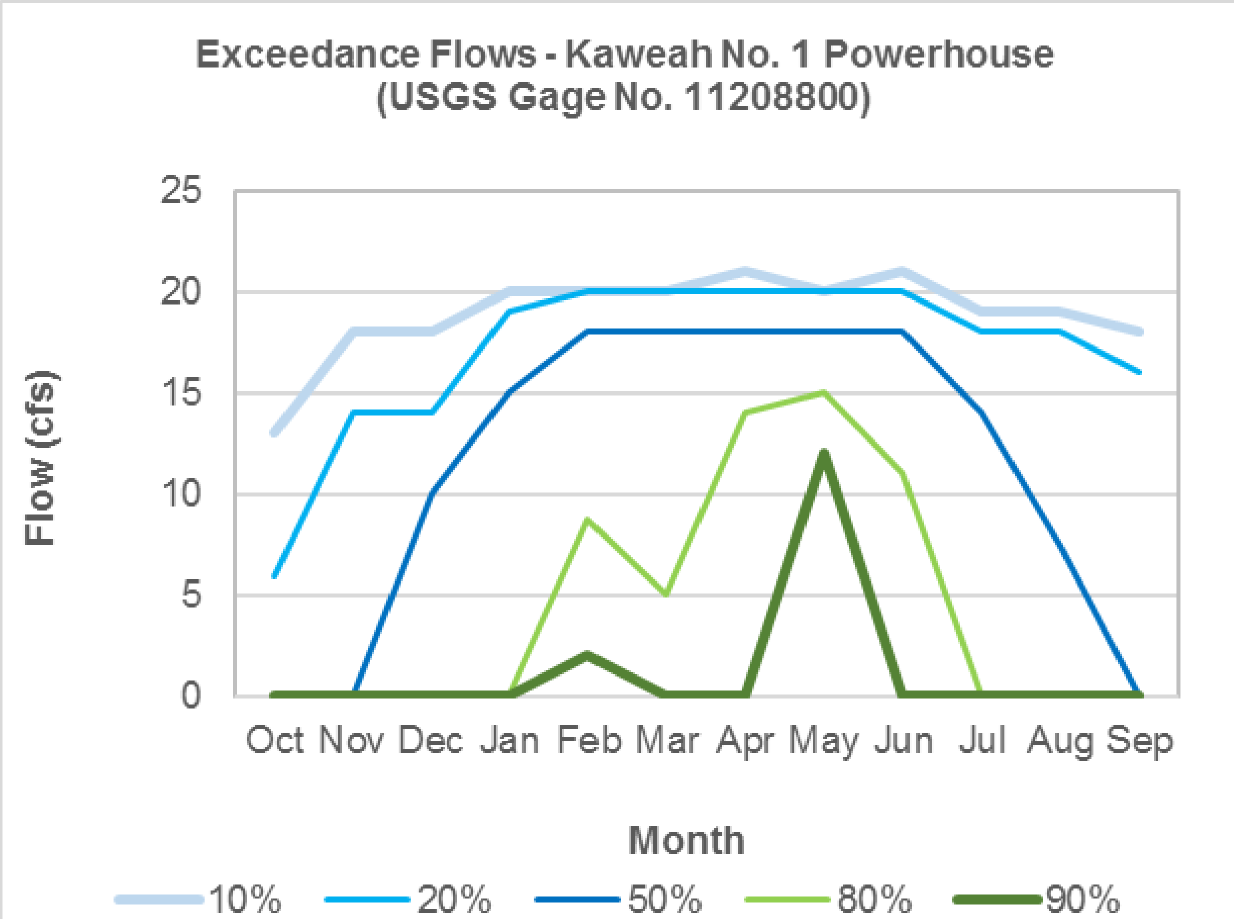
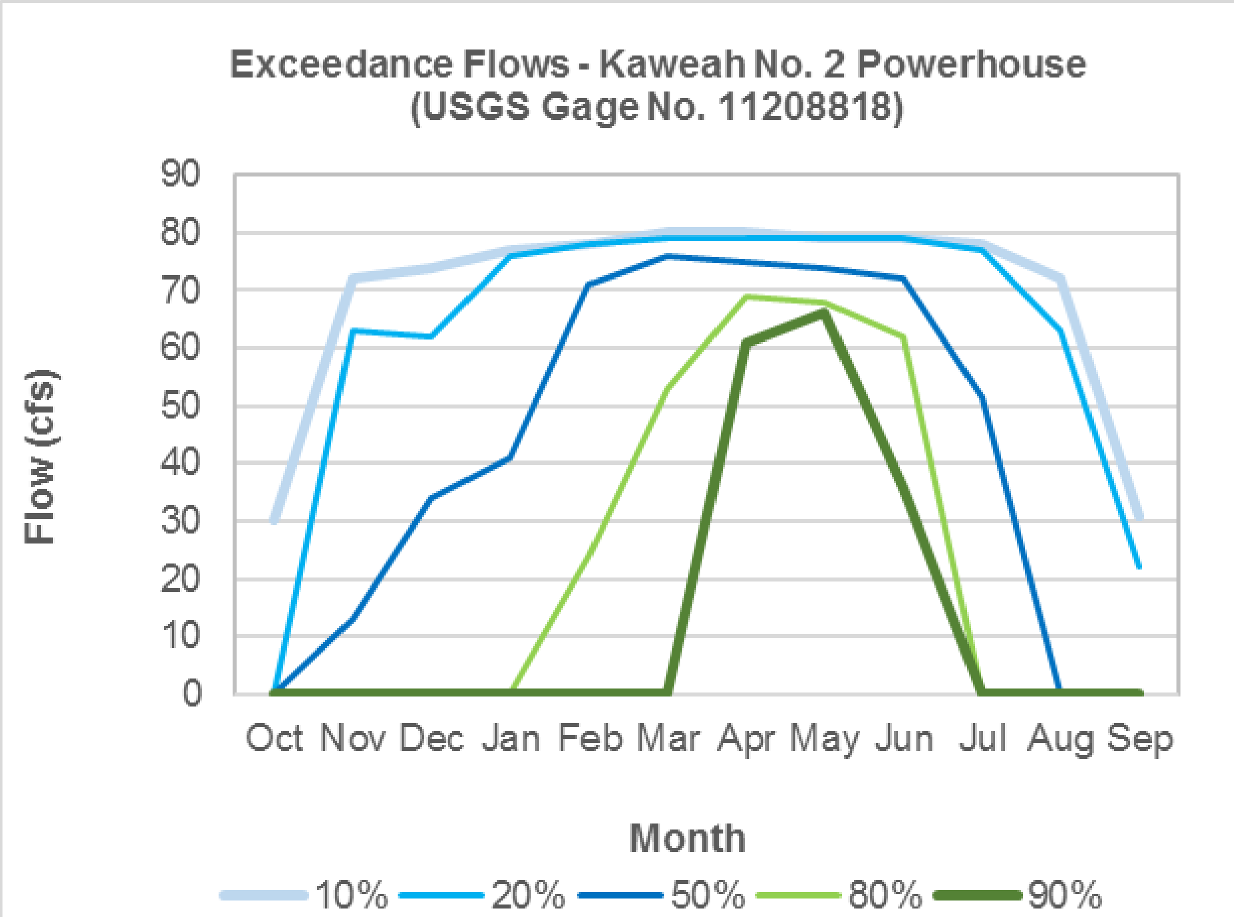



**Figure 7.2 D-4. Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) at the Kaweah No. 1 Powerhouse (WY 1994-2018) (continued).[1]**




[1] Kaweah No. 1 Powerhouse period of record is from 2002-2018.

**Figure 7.2 D-5. Monthly Exceedance Flows (10%, 20%, 50%, 80%, and 90%) at the Kaweah No. 2 Powerhouse (WY 1994-2018).[1]**




[1] Kaweah No. 2 Powerhouse period of record is from 2002-2018.

This Page Intentionally Left Blank

# APPENDIX 7.2-E

## Daily Discharge Exceedance Plots by Month for Selected Bypass Reaches

This Page Intentionally Left Blank

**Figure 7.2 E-1a-l. Exceedance probability for existing and unimpaired daily discharge (WY 1994 to WY 2018) for each month of the year, downstream of the Kaweah No. 3 Powerhouse and upstream of the East Fork Kaweah.**

**Figure 7.2 E-1a.**

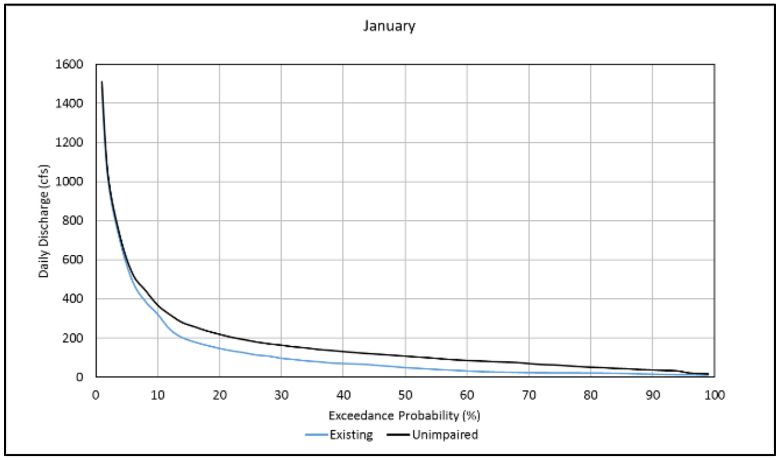



**Figure 7.2 E-1b.**

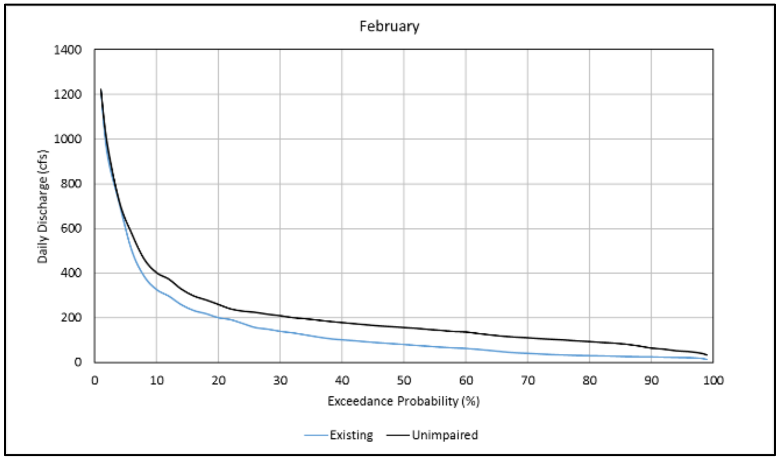



**Figure 7.2 E-1c.**

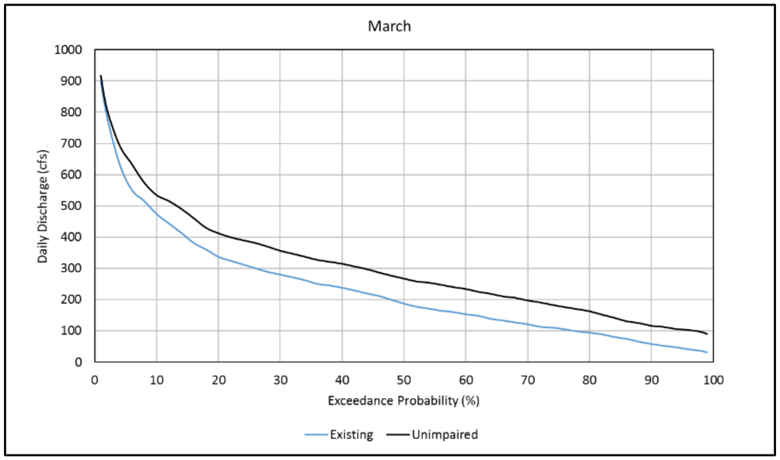



**Figure 7.2 E-1d.**

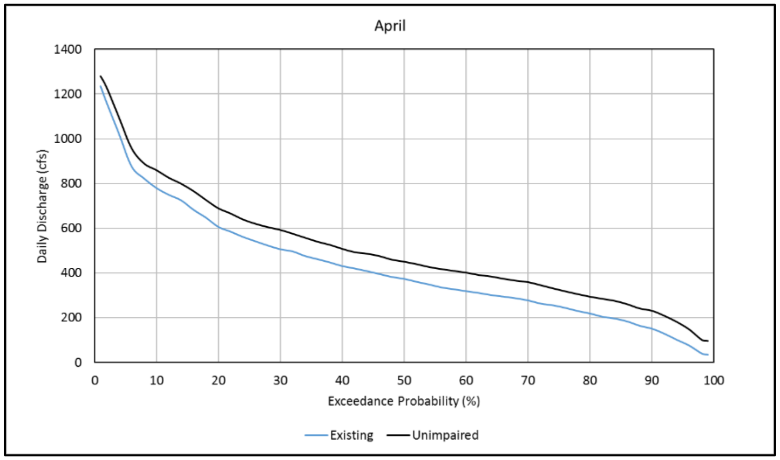


**Figure 7.2 E-1e.**

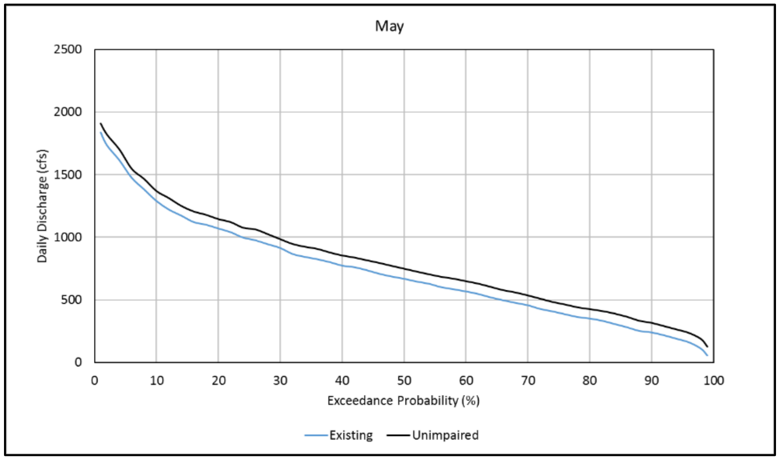



**Figure 7.2 E-1f.**

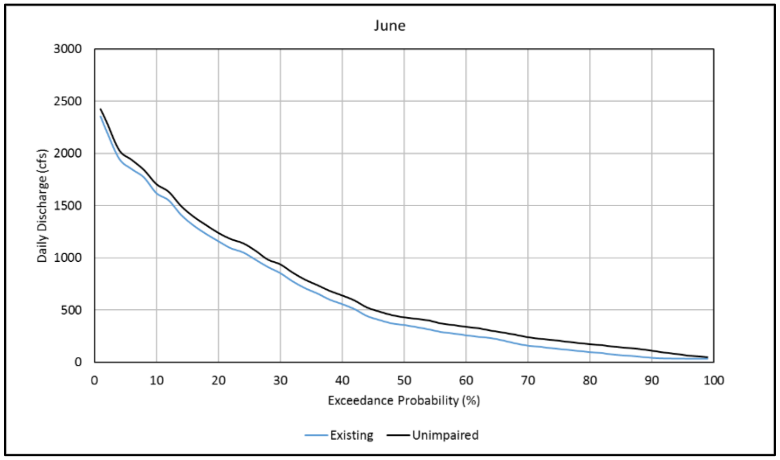



**Figure 7.2 E-1g.**

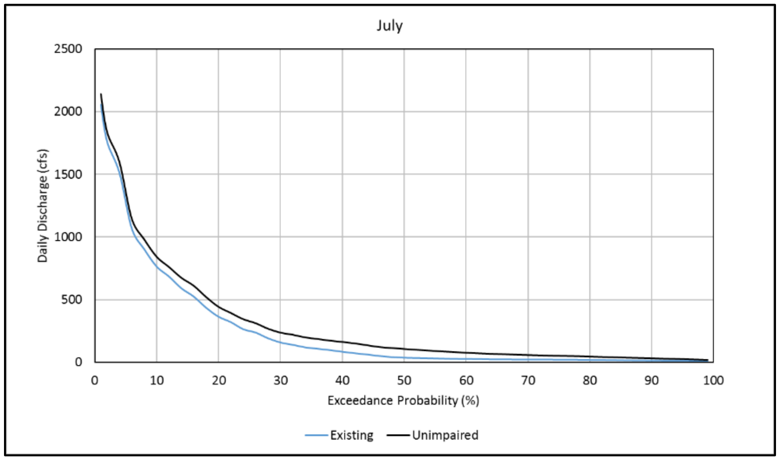



**Figure 7.2 E-1h.**

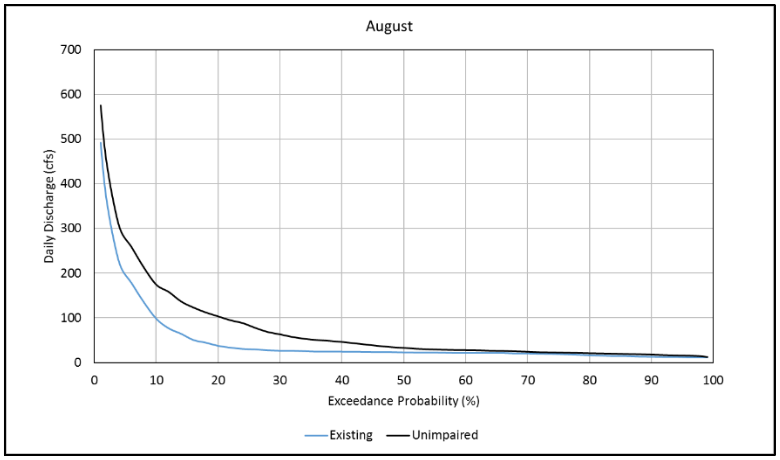


**Figure 7.2 E-1i.**

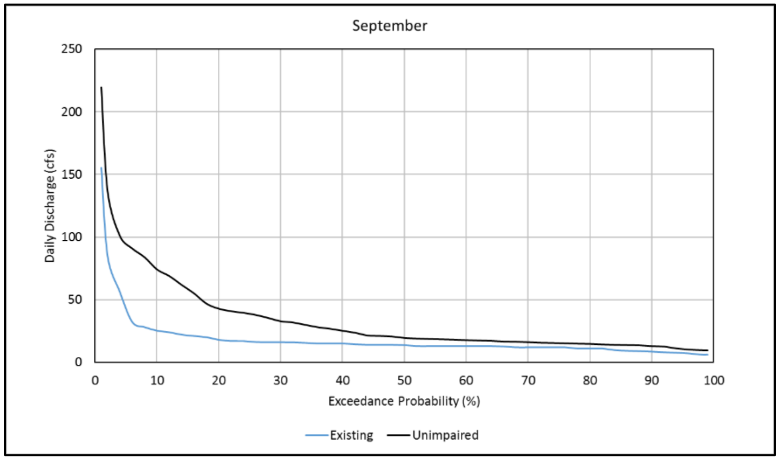



**Figure 7.2 E-1j.**

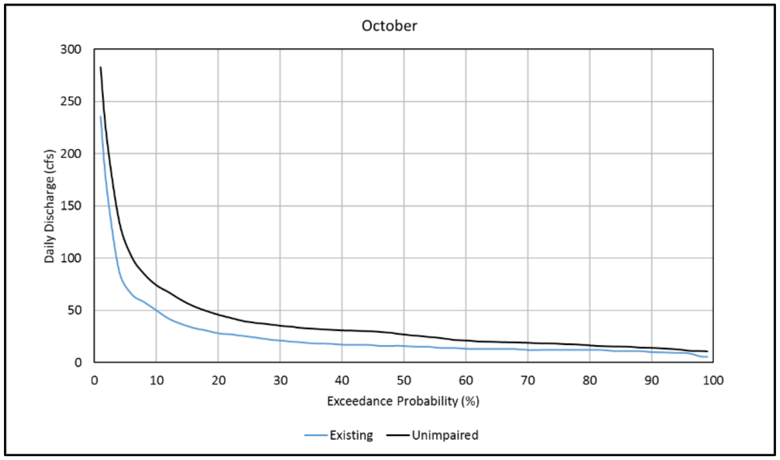



**Figure 7.2 E-1k.**

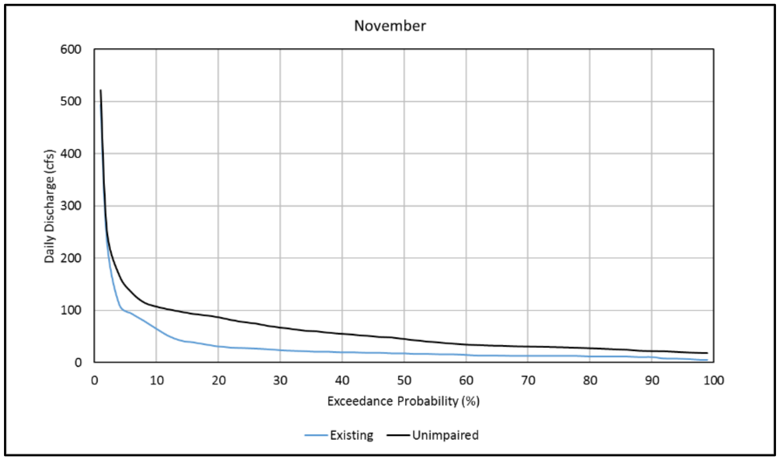



**Figure 7.2 E-1l.**

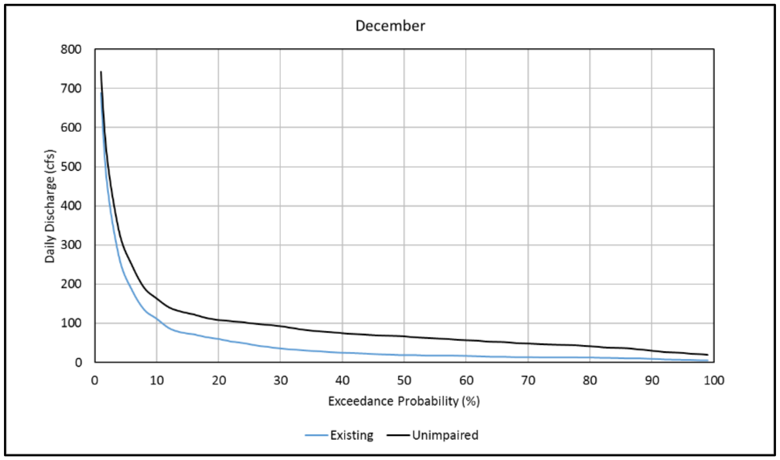


**Figure 7.2 E-2a-l. Exceedance probability for existing and unimpaired daily discharge (WY 1994 to WY 2018) for each month of the year, downstream of the East Fork Kaweah and upstream of the Kaweah No.1 Powerhouse.**

**Figure 7.2 E-2a.**

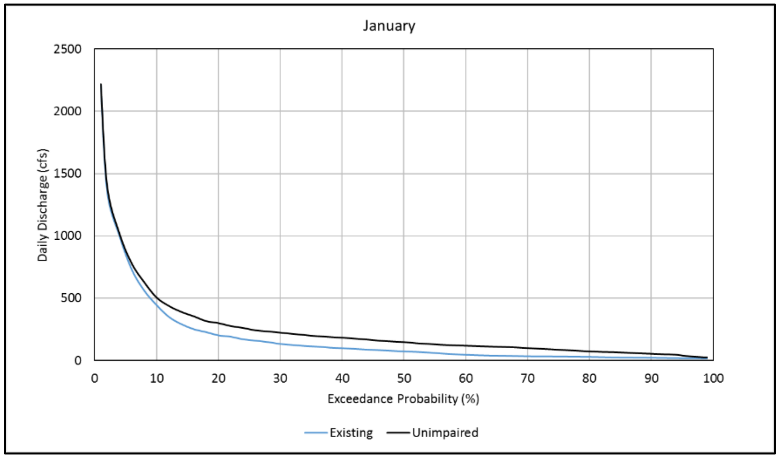



**Figure 7.2 E-2b.**

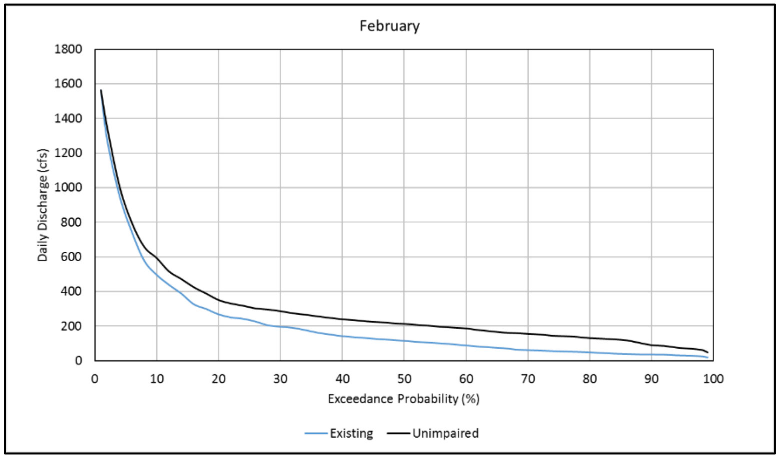



**Figure 7.2 E-2c.**

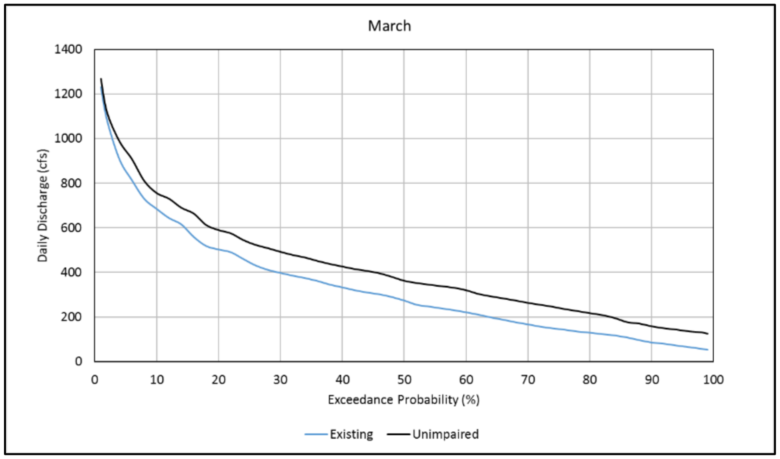



**Figure 7.2 E-2d.**

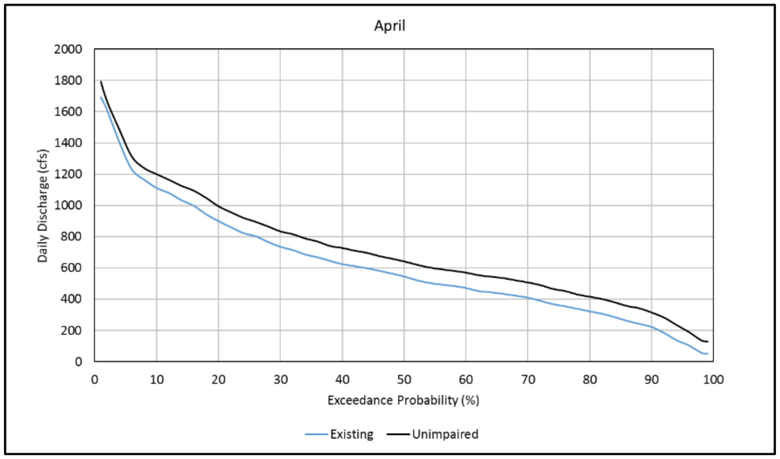


**Figure 7.2 E-2e.**

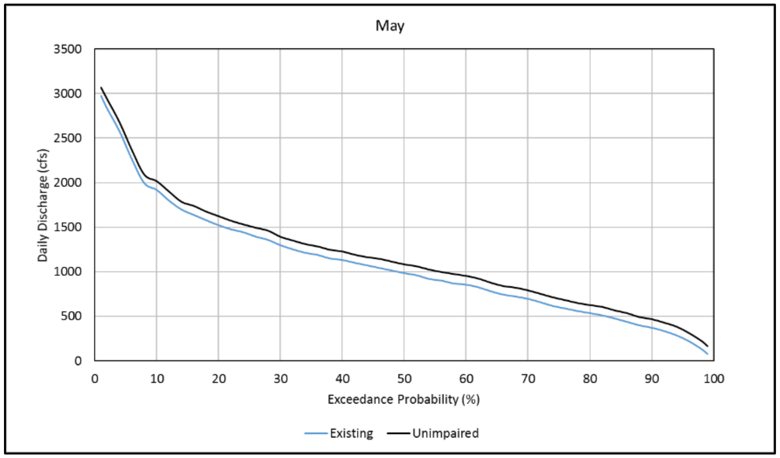



**Figure 7.2 E-2f.**

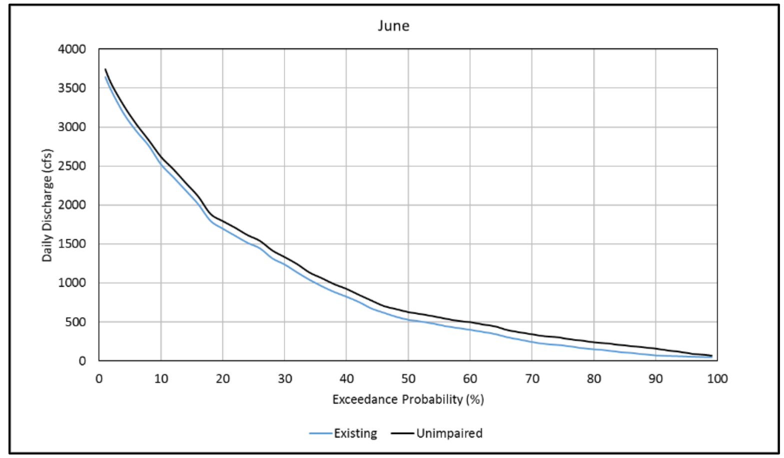



**Figure 7.2 E-2g.**

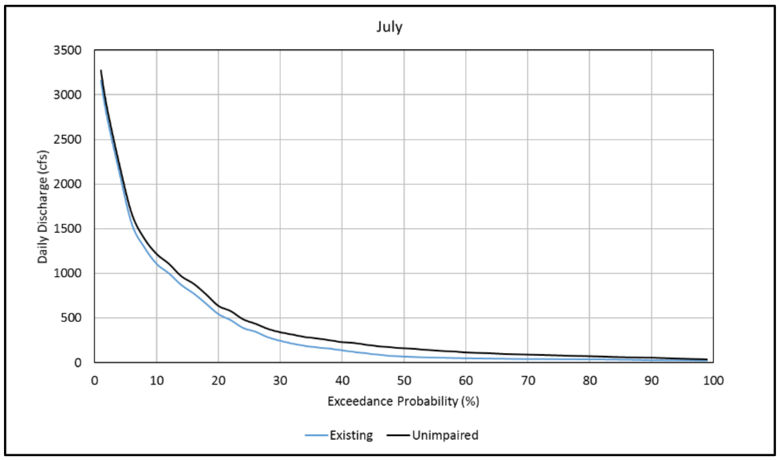



**Figure 7.2 E-2h.**

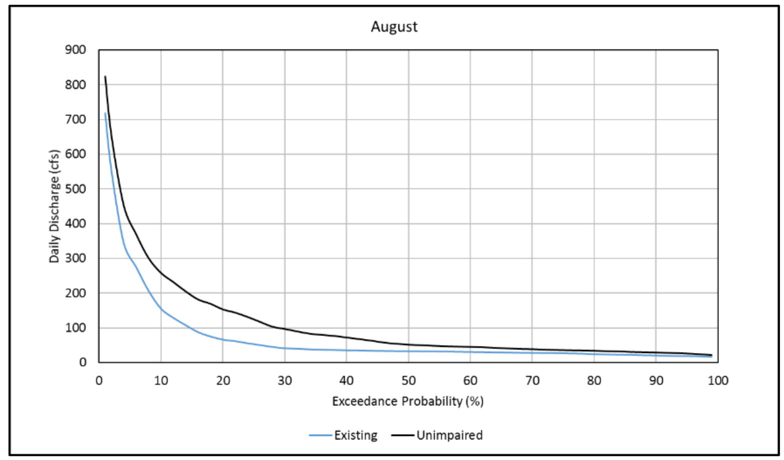


**Figure 7.2 E-2i.**

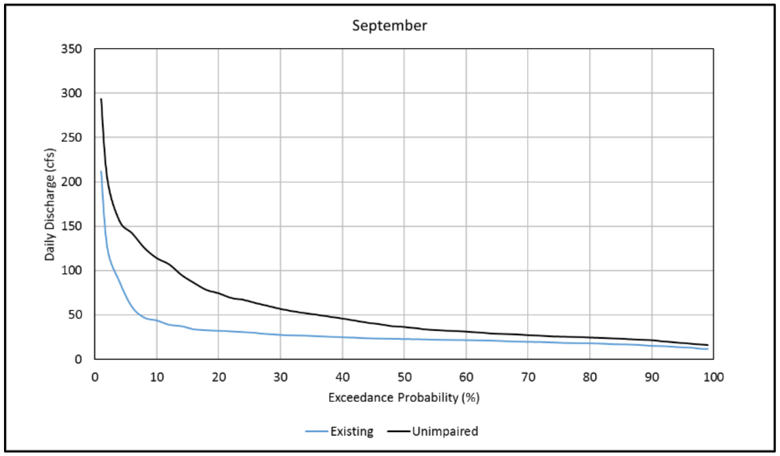



**Figure 7.2 E-2j.**

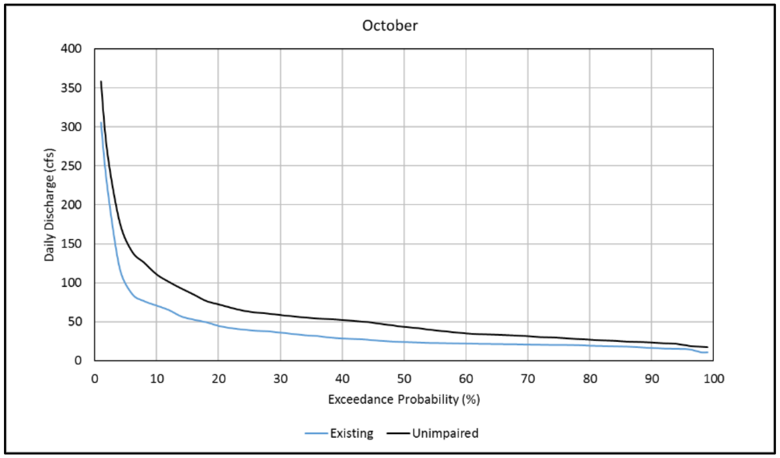



**Figure 7.2 E-2k.**

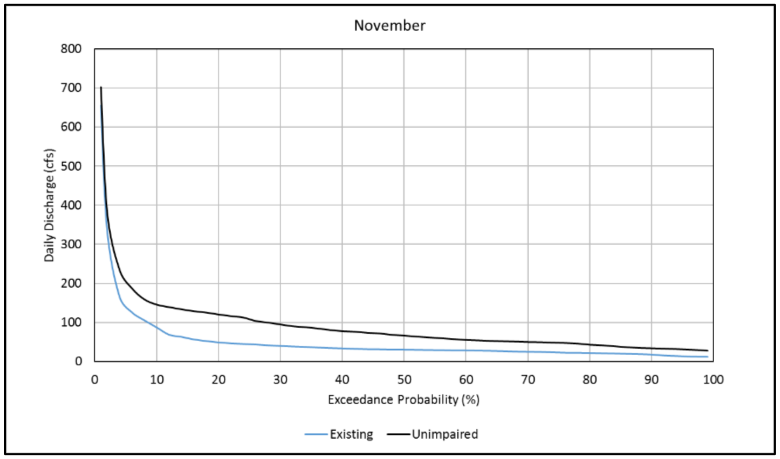



**Figure 7.2 E-2l.**

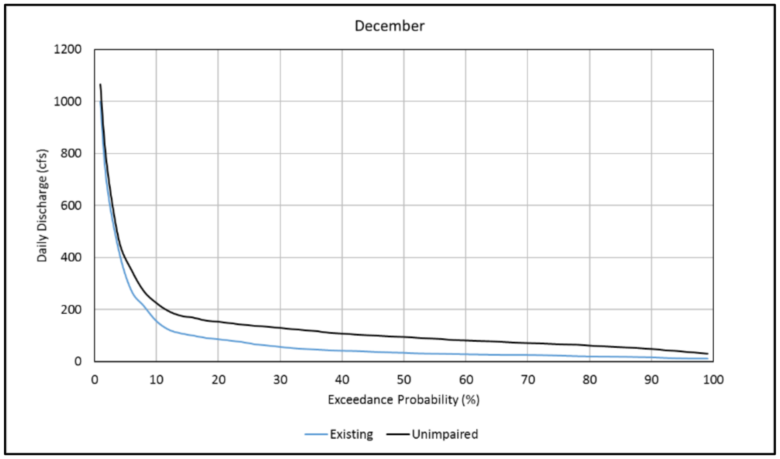


**Figure 7.2 E-3a-l. Exceedance probability for existing and unimpaired daily discharge (WY 1994 to WY 2018) for each month of the year, downstream of the Kaweah No. 1 Powerhouse and upstream of the Kaweah No. 2 Powerhouse.**

**Figure 7.2 E-3a.**

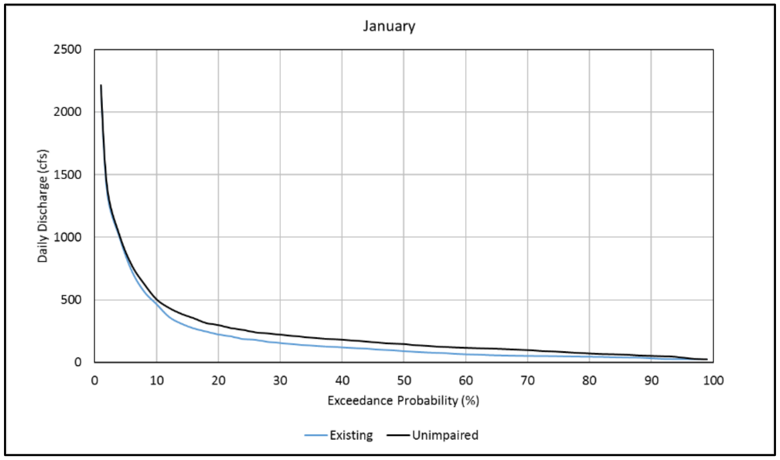



**Figure 7.2 E-3b.**

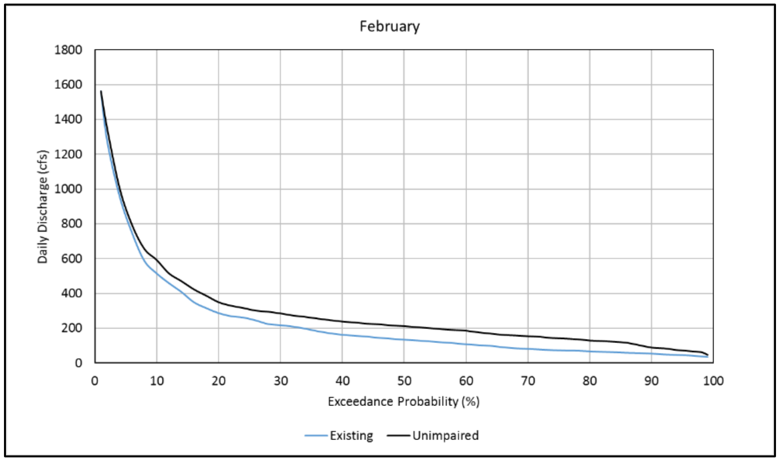



**Figure 7.2 E-3c.**

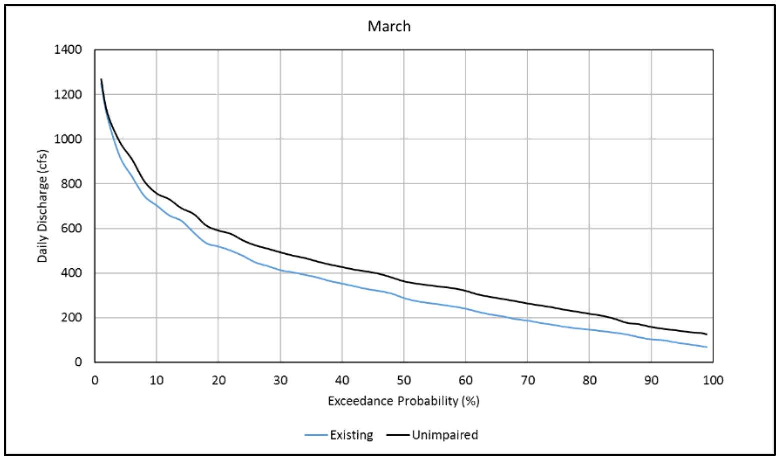



**Figure 7.2 E-3d.**

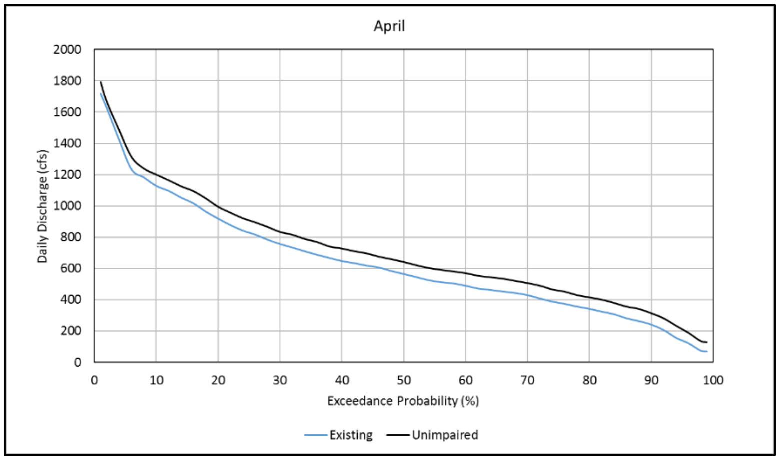


**Figure 7.2 E-3e.**

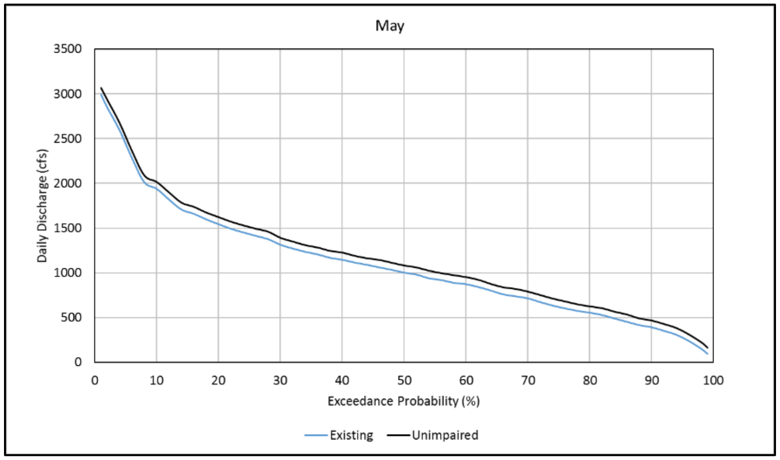



**Figure 7.2 E-3f.**

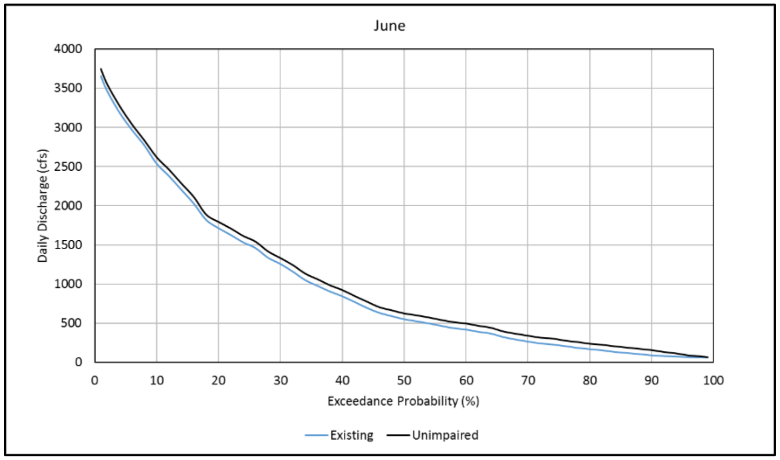



**Figure 7.2 E-3g.**

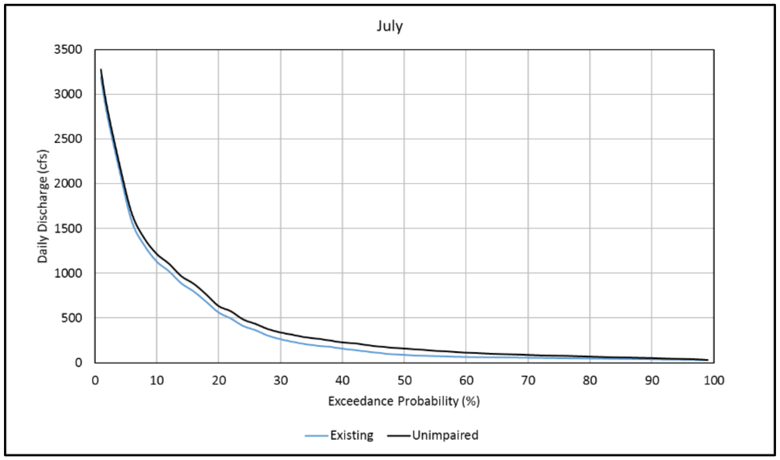



**Figure 7.2 E-3h.**

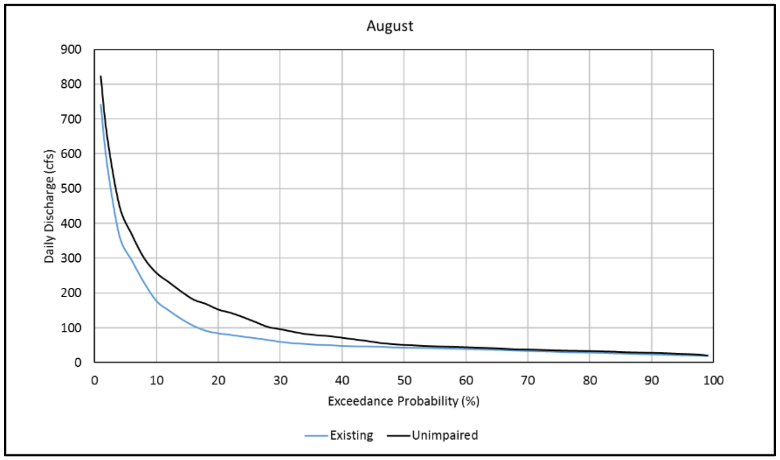


**Figure 7.2 E-3i.**

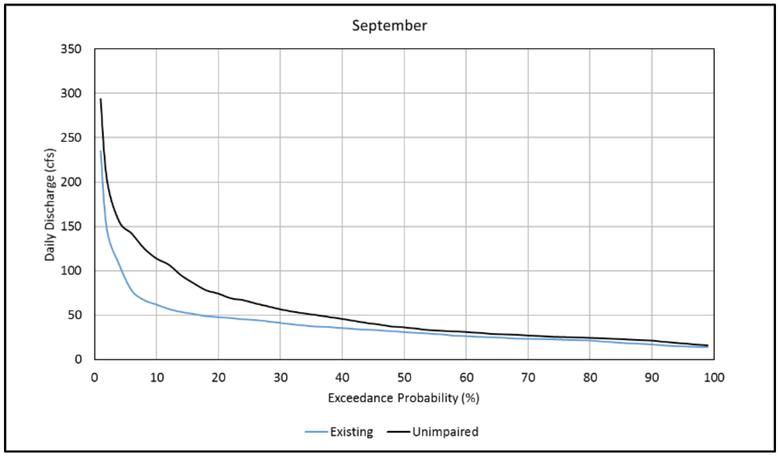



**Figure 7.2 E-3j.**

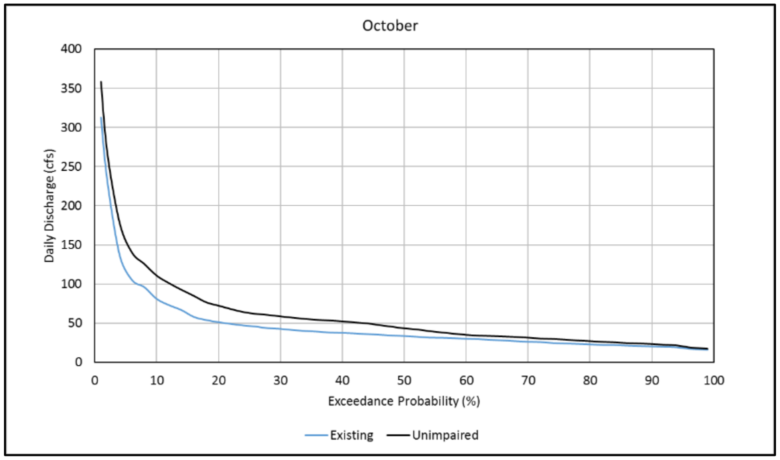



**Figure 7.2 E-3k.**

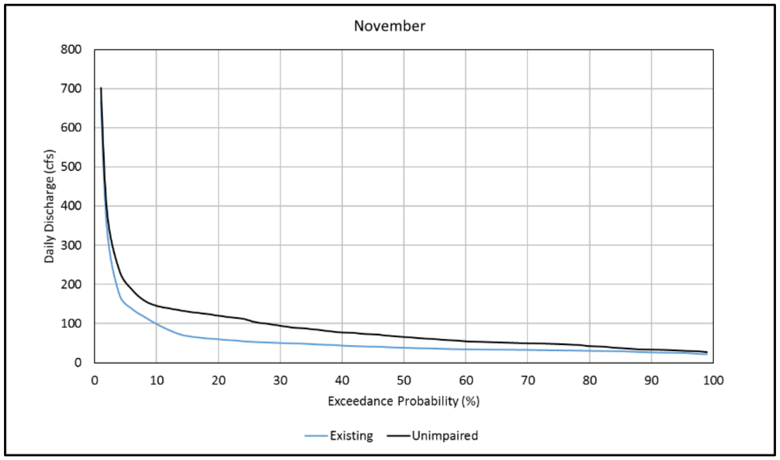



**Figure 7.2 E-3l.**

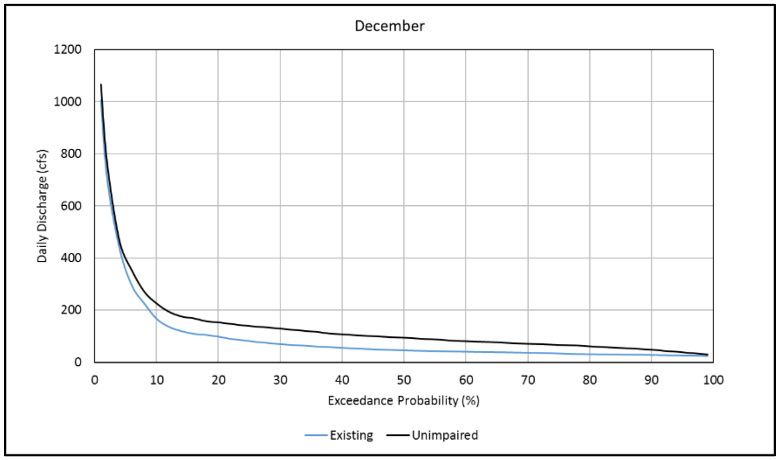


**Figure 7.7 E-4a-l. Exceedance probability for daily discharge (WY 1994 to WY 2018) for each month of the year, upstream of the East Fork Kaweah River confluence.**

**Figure 7.7 E-4a.**

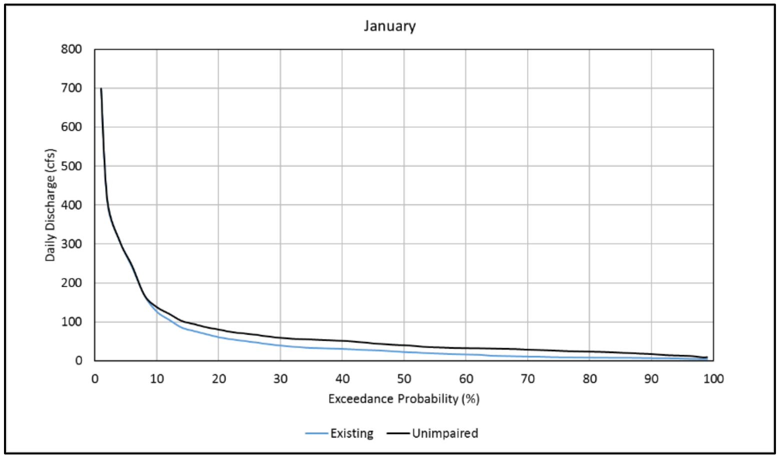



**Figure 7.7 E-4b.**

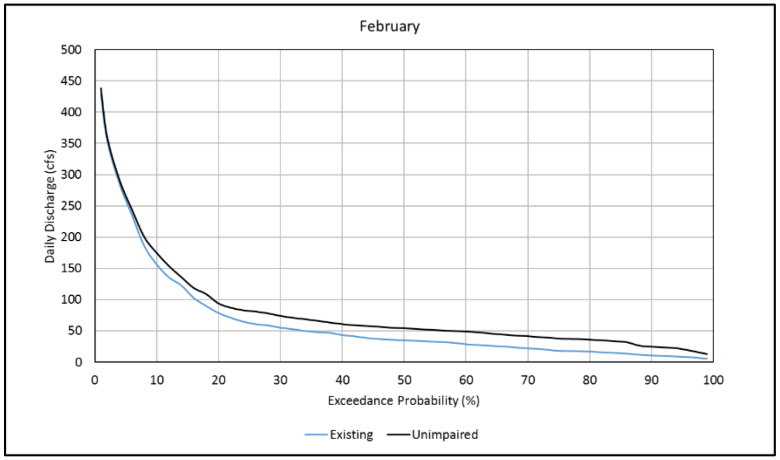



**Figure 7.7 E-4c.**

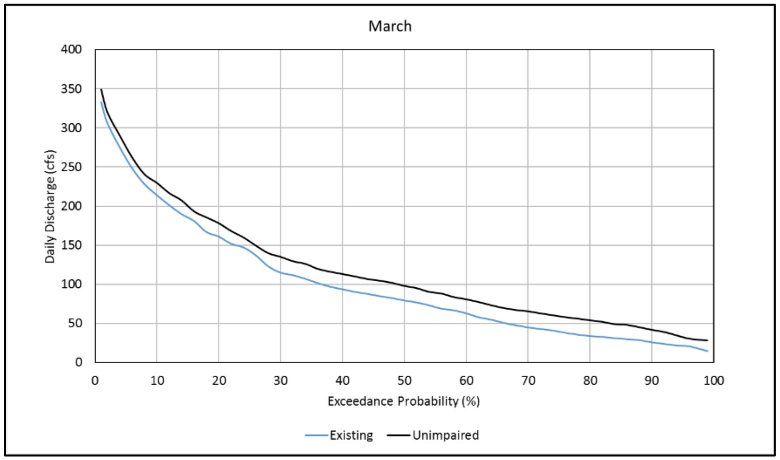



**Figure 7.7 E-4d.**

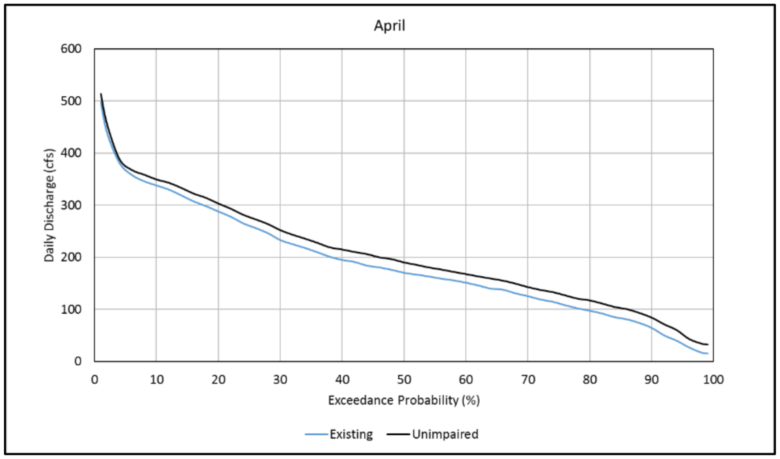


**Figure 7.7 E-4e.**

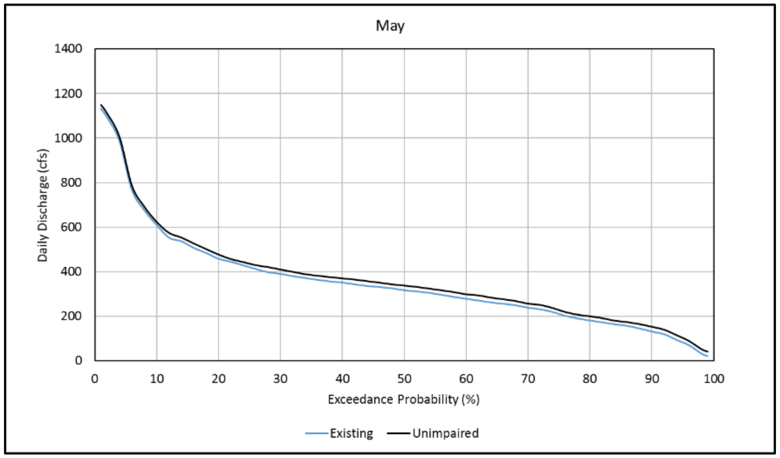



**Figure 7.7 E-4f.**

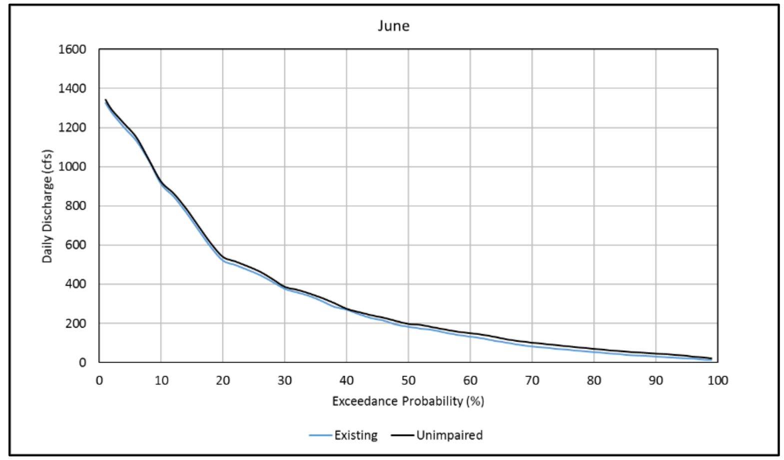



**Figure 7.7 E-4g.**

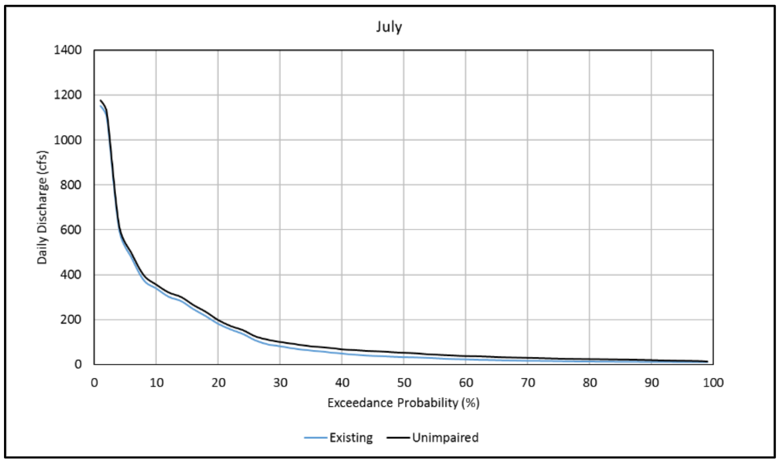



**Figure 7.7 E-4h.**

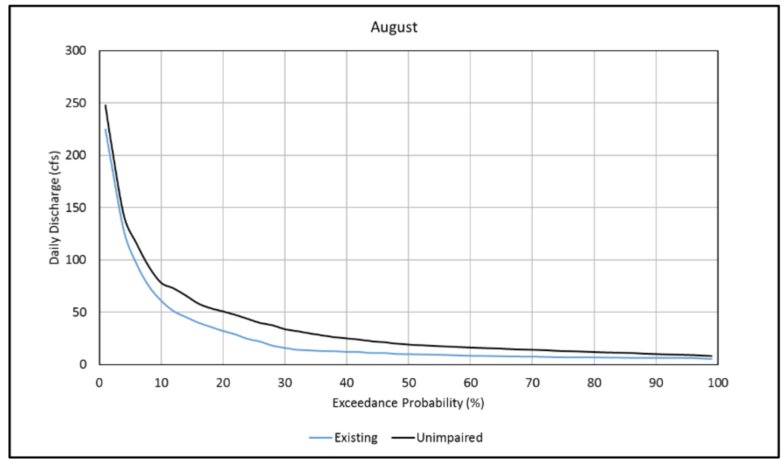


**Figure 7.7 E-4i.**

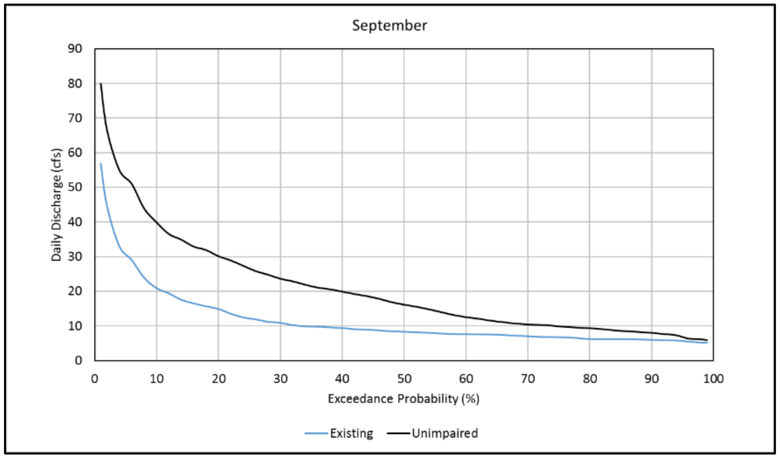



**Figure 7.7 E-4j.**

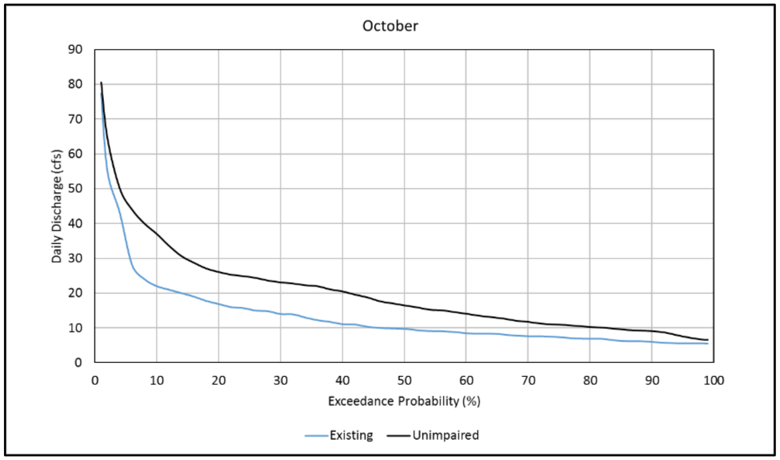



**Figure 7.7 E-4k.**

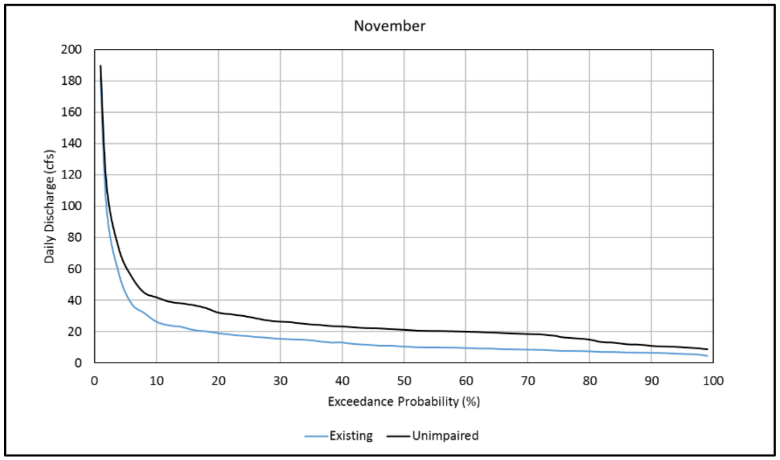
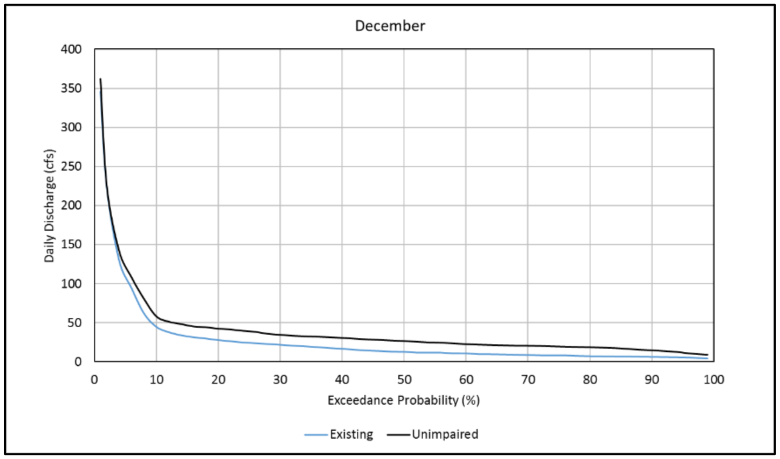



**Figure 7.7 E-4l.**



# APPENDIX 7.2-F

## Monthly Average Flows by Year in Bypass Reaches and Flowlines Associated with the Kaweah Project over the Available Flow Data Period of Record

This Page Intentionally Left Blank

**Table 7.2-F-1. Monthly Average Flows by Year in Bypass Reaches and Flowlines Associated with the Kaweah Project over the Available Flow Data Period of Record.[5]**

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| **Flow to Kaweah No. 3 Powerhouse (USGS Gage 11208565)** | | | | | | | | | | | | |
| 2002 | | | | | | | | | | 2.89 | 42.60 | 71.87 |
| 2003 | 85.61 | 85.43 | 87.03 | 87.87 | 88.87 | 89.60 | 76.39 | 43.97 | 13.47 | 6.15 | 19.27 | 53.32 |
| 2004 | 32.71 | 72.34 | 89.13 | 87.83 | 87.71 | 81.97 | 33.52 | 1.49 | 0.00 | 25.71 | 54.03 | 49.35 |
| 2005 | 74.81 | 87.86 | 89.74 | 89.57 | 88.19 | 89.77 | 89.61 | 60.52 | 27.60 | 17.88 | 19.37 | 64.48 |
| 2006 | 36.73 | 44.00 | 48.23 | 46.99 | 76.42 | 91.20 | 87.74 | 48.59 | 3.49 | 17.07 | 24.53 | 33.90 |
| 2007 | 32.29 | 54.82 | 86.23 | 90.17 | 90.61 | 62.27 | 10.10 | 0.07 | 0.0 | 0.0 | 0.18 | 0.0 |
| 2008 | 0.0 | 0.0 | 76.03 | 86.23 | 91.06 | 91.60 | 76.16 | 7.82 | 0.0 | 0.0 | 35.80 | 40.71 |
| 2009 | 67.68 | 89.29 | 91.29 | 82.60 | 71.29 | 71.43 | 57.45 | 5.85 | 0.0 | 25.87 | 31.40 | 60.39 |
| 2010 | 76.39 | 88.50 | 58.48 | 90.33 | 87.90 | 76.69 | 89.35 | 50.97 | 4.77 | 30.84 | 69.30 | 57.97 |
| 2011 | 24.78 | 0.0 | 67.77 | 22.63 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 | 0.17 | 0.0 |
| 2012 | 18.74 | 60.90 | 36.16 | 0.00 | 0.0 | 61.20 | 21.38 | 88.9 | 54.4 | 4.4 | 0.0 | 0.0 |
| 2013 | 0.0 | 0.0 | 72.00 | 89.93 | 88.94 | 54.43 | 4.45 | 88.9 | 51.2 | 2.8 | 0.0 | 0.0 |
| 2014 | 0.0 | 5.35 | 63.13 | 86.63 | 88.94 | 51.17 | 2.82 | 43.8 | 34.9 | 18.0 | 0.7 | 0.0 |
| 2015 | 0.0 | 0.0 | 15.5 | 12.9 | 43.1 | 63.1 | 41.3 | 88.3 | 74.9 | 42.7 | 1.0 | 0.0 |
| 2016 | 0.0 | 37.5 | 44.5 | 59.5 | 81.8 | 85.1 | 87.9 | 68.2 | 84.5 | 85.0 | 68.8 | 47.1 |
| 2017 | 0.0 | 0.2 | 10.4 | 17.6 | 22.5 | 58.9 | 64.0 | 82.9 | 56.2 | 0.1 | 0.0 | 0.0 |
| 2018 | 0.2 | 8.2 | 20.2 | 18.3 | 21.1 | 45.0 | 75.0 | 88.9 | 54.4 | 4.4 | 0.0 | 0.0 |
| **Calculated Unimpaired Flow Upstream of Kaweah No. 2 Diversion[1] (WY 1994 - 2018)** | | | | | | | | | | | | |
| 1994 | 31.4 | 30.8 | 46.6 | 44.6 | 86.4 | 188.2 | 329.6 | 531.6 | 323.9 | 55.5 | 20.8 | 19.7 |
| 1995 | 55.6 | 51.1 | 64.3 | 216.5 | 236.4 | 600.2 | 590.5 | 1038.0 | 1583.0 | 1220.4 | 334.1 | 94.2 |
| 1996 | 39.8 | 31.0 | 89.5 | 136.4 | 514.1 | 419.5 | 709.9 | 1123.9 | 782.5 | 243.6 | 60.7 | 29.0 |

[5] Note: See Tables 7.2-4 and 7.2-5 for data gaps/ time periods with missing data.

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 1997 | 28.3 | 197.8 | 347.4 | 1292.7 | 445.7 | 460.5 | 566.0 | 971.5 | 586.3 | 210.5 | 75.0 | 44.9 |
| 1998 | 37.2 | 56.8 | 94.5 | 155.8 | 352.6 | 411.1 | 643.1 | 923.4 | 2075.0 | 1647.5 | 334.2 | 161.8 |
| 1999 | 70.8 | 82.8 | 91.0 | 97.2 | 152.8 | 157.8 | 304.1 | 687.5 | 345.5 | 95.9 | 35.4 | 21.8 |
| 2000 | 20.6 | 33.3 | 25.0 | 73.6 | 221.1 | 300.3 | 547.6 | 1009.1 | 531.0 | 100.3 | 38.6 | 27.1 |
| 2001 | 50.5 | 64.4 | 42.8 | 51.2 | 100.9 | 251.0 | 424.5 | 917.5 | 227.8 | 76.1 | 25.6 | 16.7 |
| 2002 | 18.2 | 92.9 | 163.6 | 159.2 | 148.0 | 220.1 | 547.3 | 670.5 | 470.2 | 89.5 | 27.4 | 18.4 |
| 2003 | 19.8 | 377.4 | 104.8 | 145.8 | 156.2 | 283.6 | 380.5 | 892.5 | 711.8 | 152.6 | 67.8 | 27.7 |
| 2004 | 19.2 | 34.5 | 96.7 | 107.3 | 116.9 | 392.6 | 401.5 | 467.8 | 236.7 | 59.6 | 21.3 | 16.4 |
| 2005 | 49.9 | 77.2 | 72.4 | 252.1 | 184.9 | 341.5 | 475.5 | 1223.9 | 1159.7 | 523.5 | 96.2 | 40.6 |
| 2006 | 33.5 | 33.7 | 140.3 | 275.2 | 195.0 | 319.3 | 745.2 | 1413.0 | 1232.6 | 410.3 | 83.7 | 37.9 |
| 2007 | 31.9 | 38.4 | 52.6 | 59.4 | 90.4 | 228.8 | 329.8 | 440.0 | 138.1 | 34.0 | 18.0 | 15.8 |
| 2008 | 20.0 | 23.2 | 48.8 | 137.3 | 195.0 | 282.4 | 475.3 | 757.8 | 579.3 | 161.6 | 33.9 | 18.3 |
| 2009 | 24.1 | 118.5 | 62.8 | 157.1 | 184.8 | 256.7 | 474.7 | 936.8 | 358.0 | 115.1 | 32.5 | 18.6 |
| 2010 | 260.4 | 53.8 | 94.9 | 122.9 | 201.3 | 309.6 | 507.3 | 856.1 | 1494.9 | 474.0 | 82.4 | 34.6 |
| 2011 | 62.1 | 97.0 | 409.6 | 274.8 | 225.3 | 438.7 | 771.5 | 1056.1 | 1615.3 | 901.5 | 196.1 | 71.7 |
| 2012 | 149.9 | 89.5 | 53.8 | 94.4 | 98.3 | 177.0 | 550.6 | 561.9 | 167.5 | 48.5 | 27.2 | 17.3 |
| 2013 | 20.4 | 41.2 | 117.6 | 112.4 | 109.6 | 180.1 | 323.7 | 346.6 | 114.5 | 30.7 | 18.6 | 14.5 |
| 2014 | 16.4 | 20.6 | 24.2 | 18.9 | 57.5 | 109.6 | 273.5 | 345.6 | 114.0 | 24.6 | 19.2 | 11.3 |
| 2015 | 11.7 | 27.9 | 64.0 | 40.3 | 183.5 | 120.1 | 113.1 | 180.4 | 124.8 | 75.8 | 18.9 | 10.7 |
| 2016 | 17.8 | 56.2 | 74.2 | 126.1 | 207.1 | 326.4 | 468.1 | 620.0 | 545.5 | 83.7 | 23.1 | 14.3 |
| 2017 | 25.8 | 30.2 | 120.4 | 728.6 | 1004.4 | 703.2 | 1031.4 | 1603.4 | 1638.8 | 665.9 | 158.3 | 73.2 |
| 2018 | 35.6 | 67.3 | 46.9 | 82.0 | 56.5 | 309.8 | 743.8 | 517.8 | 262.1 | 70.6 | 27.0 | 16.2 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| **Kaweah No. 2 Flowline (USGS Gage No. 11208570 and SCE Gage 204a) (1994-2002 and 2002-2018)** | | | | | | | | | | | | |
| 1994 | 4.4 | 20.6 | 37.2 | 24.5 | 54.3 | 80.3 | 80.6 | 80.3 | 73.8 | 43.8 | 9.6 | 11.6 |
| 1995 | 42.6 | 45.4 | 58.4 | 75.3 | 81.6 | 79.0 | 83.0 | 82.1 | 82.9 | 89.7 | 82.1 | 68.0 |
| 1996 | 28.0 | 19.6 | 45.9 | 63.5 | 74.9 | 77.6 | 76.6 | 73.0 | 76.8 | 77.2 | 36.6 | 17.0 |
| 1997 | 16.2 | 45.4 | 75.9 | 42.4 | 81.6 | 72.4 | 82.3 | 76.0 | 75.9 | 77.3 | 40.2 | 28.8 |
| 1998 | 25.4 | 39.6 | 68.0 | 63.9 | 58.4 | 79.5 | 44.7 | 73.4 | 66.3 | 76.4 | 80.5 | 71.7 |
| 1999 | 8.7 | 66.1 | 42.8 | 48.1 | 65.1 | 76.6 | 74.4 | 82.9 | 83.1 | 62.1 | 12.6 | 3.7 |
| 2000 | 2.1 | 3.6 | 8.6 | 36.6 | 81.1 | 87.5 | 90.9 | 88.3 | 89.3 | 64.3 | 14.4 | 3.3 |
| 2001 | 2.0 | 29.9 | 24.7 | 23.9 | 68.8 | 79.3 | 83.2 | 83.8 | 77.8 | 42.5 | 4.6 | 3.5 |
| 2002 | 3.0 | 6.8 | 66.5 | 76.3 | 79.1 | 82.2 | 84.0 | 84.4 | 80.7 | 54.6 | 6.8 | 3.0 |
| 2003 | 3.0 | 42.6 | 75.8 | 78.4 | 75.4 | 75.3 | 75.6 | 79.9 | 79.1 | 78.6 | 39.6 | 13.3 |
| 2004 | 2.8 | 20.5 | 53.9 | 66.5 | 70.8 | 87.1 | 87.3 | 85.5 | 83.0 | 46.4 | 7.7 | 8.1 |
| 2005 | 25.5 | 65.8 | 56.9 | 69.8 | 83.1 | 84.3 | 84.6 | 86.4 | 86.8 | 86.6 | 63.1 | 27.5 |
| 2006 | 18.0 | 20.2 | 57.6 | 75.3 | 79.6 | 80.4 | 77.1 | 82.7 | 83.3 | 83.3 | 54.0 | 19.0 |
| 2007 | 6.3 | 13.2 | 36.3 | 35.6 | 54.8 | 83.8 | 84.4 | 82.4 | 65.7 | 17.9 | 5.6 | 5.2 |
| 2008 | 6.4 | 7.5 | 26.9 | 62.1 | 82.1 | 84.4 | 85.0 | 84.7 | 84.9 | 73.5 | 11.5 | 3.9 |
| 2009 | 8.6 | 62.2 | 37.2 | 62.0 | 82.7 | 85.3 | 86.1 | 83.6 | 84.0 | 64.3 | 9.3 | 4.1 |
| 2010 | 27.0 | 40.5 | 61.3 | 59.0 | 83.7 | 85.7 | 86.2 | 86.7 | 79.9 | 84.8 | 44.2 | 16.6 |
| 2011 | 26.6 | 71.0 | 59.8 | 82.5 | 81.9 | 81.1 | 77.1 | 65.4 | 82.8 | 84.1 | 83.2 | 25.1 |
| 2012 | 58.8 | 67.8 | 37.1 | 16.9 | 68.0 | 70.2 | 78.2 | 73.2 | 67.6 | 16.7 | 2.5 | 2.1 |
| 2013 | 1.9 | 1.7 | 8.2 | 47.0 | 69.4 | 65.9 | 71.9 | 72.4 | 49.8 | 11.3 | 1.9 | 1.8 |
| 2014 | 1.6 | 1.6 | 1.6 | 1.7 | 14.7 | 58.3 | 60.7 | 74.5 | 46.9 | 4.7 | 1.3 | 1.5 |
| 2015 | 1.5 | 1.5 | 11.4 | 27.2 | 56.1 | 30.7 | 62.9 | 72.9 | 51.8 | 27.4 | 4.6 | 2.4 |
| 2016 | 2.9 | 29.6 | 36.7 | 10.7 | 2.5 | 42.3 | 69.9 | 64.0 | 68.5 | 43.1 | 2.3 | 2.2 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 2017 | 2.4 | 2.4 | 24.6 | 6.3 | 2.2 | 3.3 | 53.9 | 68.1 | 60.8 | 69.7 | 68.2 | 49.9 |
| 2018 | 2.1 | 6.0 | 22.2 | 24.5 | 24.7 | 36.2 | 53.9 | 66.7 | 65.4 | 39.8 | 5.1 | 1.5 |
| **Kaweah River Downstream Kaweah No. 2 Diversion (USGS Gage No. 11208600) WY 1994-2018)** | | | | | | | | | | | | |
| 1994 | 27.0 | 10.2 | 9.4 | 20.1 | 32.1 | 107.9 | 249.0 | 451.3 | 250.1 | 11.7 | 11.2 | 8.0 |
| 1995 | 13.0 | 5.7 | 5.9 | 141.2 | 154.8 | 521.2 | 507.4 | 955.9 | 1500.1 | 1130.6 | 252.0 | 26.3 |
| 1996 | 11.8 | 11.4 | 43.6 | 72.9 | 439.2 | 341.9 | 633.3 | 1050.9 | 705.7 | 166.5 | 24.1 | 12.0 |
| 1997 | 12.1 | 152.4 | 271.5 | 1250.3 | 364.1 | 388.1 | 483.7 | 895.5 | 510.3 | 133.1 | 34.9 | 16.1 |
| 1998 | 11.8 | 17.2 | 26.4 | 91.8 | 294.1 | 331.5 | 598.4 | 850.0 | 2008.7 | 1571.1 | 253.6 | 90.1 |
| 1999 | 62.2 | 16.6 | 48.2 | 49.1 | 87.6 | 81.1 | 229.7 | 604.7 | 262.4 | 33.9 | 22.8 | 18.2 |
| 2000 | 18.5 | 29.7 | 16.4 | 37.0 | 140.0 | 212.7 | 456.7 | 920.9 | 441.7 | 36.0 | 24.2 | 23.8 |
| 2001 | 48.6 | 34.6 | 18.1 | 27.3 | 32.1 | 171.8 | 341.3 | 833.6 | 150.0 | 33.6 | 21.0 | 13.3 |
| 2002 | 15.2 | 86.1 | 97.1 | 82.9 | 68.9 | 137.8 | 463.3 | 586.1 | 389.5 | 34.9 | 20.5 | 15.3 |
| 2003 | 16.9 | 334.8 | 29.0 | 67.5 | 80.8 | 208.3 | 304.9 | 812.6 | 632.7 | 74.0 | 28.2 | 14.4 |
| 2004 | 16.4 | 14.0 | 42.8 | 40.7 | 46.2 | 305.5 | 314.2 | 382.4 | 153.6 | 13.3 | 13.6 | 8.3 |
| 2005 | 24.4 | 11.4 | 15.5 | 182.2 | 101.8 | 257.2 | 390.9 | 1137.5 | 1072.9 | 436.9 | 33.1 | 13.1 |
| 2006 | 15.5 | 13.4 | 82.7 | 199.9 | 115.4 | 238.9 | 668.3 | 1331.1 | 1149.8 | 326.8 | 29.7 | 19.0 |
| 2007 | 25.6 | 25.3 | 16.3 | 23.7 | 35.6 | 145.0 | 245.4 | 357.6 | 72.5 | 16.2 | 12.4 | 10.7 |
| 2008 | 13.6 | 15.7 | 22.0 | 75.1 | 112.8 | 198.0 | 390.3 | 673.0 | 494.4 | 88.1 | 22.4 | 14.5 |
| 2009 | 15.5 | 56.3 | 25.6 | 95.1 | 102.2 | 171.4 | 388.7 | 853.5 | 274.0 | 50.8 | 23.3 | 14.4 |
| 2010 | 233.5 | 13.3 | 33.6 | 63.9 | 117.6 | 223.9 | 421.1 | 769.4 | 1415.0 | 389.2 | 38.2 | 18.0 |
| 2011 | 35.5 | 26.0 | 349.7 | 192.3 | 143.4 | 357.6 | 694.4 | 990.7 | 1532.5 | 817.4 | 112.8 | 46.5 |
| 2012 | 91.2 | 21.7 | 16.7 | 77.5 | 30.4 | 106.8 | 472.4 | 488.7 | 100.0 | 31.8 | 24.8 | 15.3 |
| 2013 | 18.4 | 39.5 | 109.4 | 65.4 | 40.2 | 114.2 | 251.7 | 274.2 | 64.6 | 19.4 | 16.7 | 12.6 |
| 2014 | 14.8 | 19.0 | 22.6 | 17.2 | 42.8 | 51.3 | 212.9 | 271.0 | 67.0 | 19.8 | 17.9 | 9.8 |
| 2015 | 10.3 | 26.3 | 55.2 | 13.1 | 127.5 | 89.4 | 50.2 | 107.5 | 72.9 | 48.4 | 14.3 | 8.4 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 2016 | 14.8 | 26.7 | 37.5 | 115.4 | 204.6 | 284.1 | 398.2 | 556.0 | 477.0 | 40.6 | 20.9 | 12.1 |
| 2017 | 23.4 | 27.8 | 95.8 | 722.2 | 1002.2 | 700.0 | 977.5 | 1535.3 | 1578.0 | 596.2 | 90.1 | 23.3 |
| 2018 | 33.4 | 61.3 | 24.7 | 57.5 | 31.8 | 273.5 | 689.9 | 451.2 | 196.8 | 30.8 | 21.9 | 14.7 |
| **Flow to Kaweah No. 1 Powerhouse (USGS Gage No. 11208800)** | | | | | | | | | | | | |
| 2003 | 5.0 | 8.2 | 20.6 | 20.8 | 21.2 | 15.9 | 18.6 | 19.9 | 20.9 | 20.4 | 19.2 | 15.0 |
| 2004 | 6.1 | 11.9 | 15.9 | 18.1 | 20.1 | 20.0 | 21.7 | 21.1 | 21.3 | 13.9 | 3.6 | 0.0 |
| 2005 | 5.4 | 13.4 | 9.3 | 11.6 | 20.0 | 20.0 | 15.9 | 16.8 | 17.9 | 17.9 | 18.8 | 18.0 |
| 2006 | 11.3 | 0.0 | 11.2 | 17.2 | 19.9 | 19.0 | 12.8 | 15.0 | 14.7 | 12.0 | 18.5 | 13.0 |
| 2007 | 3.6 | 7.9 | 11.8 | 8.8 | 16.6 | 18.8 | 17.7 | 11.8 | 17.6 | 6.5 | 3.1 | 0.0 |
| 2008 | 0.0 | 0.0 | 6.0 | 14.4 | 17.8 | 18.2 | 13.7 | 17.1 | 12.6 | 16.1 | 9.3 | 0.0 |
| 2009 | 0.0 | 14.7 | 11.3 | 17.3 | 17.9 | 18.9 | 19.2 | 9.4 | 13.0 | 16.3 | 1.8 | 0.0 |
| 2010 | 0.0 | 0.0 | 2.1 | 14.1 | 0.1 | 0.0 | 10.7 | 18.2 | 16.5 | 17.9 | 13.8 | 16.8 |
| 2011 | 1.8 | 11.5 | 5.6 | 14.9 | 18.5 | 0.6 | 6.7 | 18.3 | 17.6 | 17.9 | 19.0 | 18.3 |
| 2012 | 14.7 | 18.6 | 9.0 | 11.9 | 17.4 | 13.9 | 18.3 | 18.0 | 17.9 | 13.0 | 10.5 | 0.6 |
| 2013 | 0.0 | 0.0 | 0.0 | 0.3 | 19.0 | 19.5 | 19.8 | 19.0 | 18.1 | 2.3 | 0.0 | 0.0 |
| 2014 | 0.0 | 0.0 | 0.0 | 0.2 | 6.3 | 11.3 | 18.6 | 18.3 | 2.5 | 0.0 | 0.0 | 0.0 |
| 2015 | 0.0 | 0.0 | 0.0 | 5.4 | 13.8 | 6.7 | 18.5 | 19.1 | 15.0 | 1.9 | 4.6 | 0.0 |
| 2016 | 0.0 | 9.8 | 11.1 | 15.3 | 17.7 | 18.3 | 18.4 | 15.9 | 11.1 | 11.4 | 2.2 | 0.0 |
| 2017 | 0.0 | 0.0 | 1.7 | 3.8 | 5.6 | 14.7 | 9.6 | 15.4 | 10.8 | 16.6 | 16.1 | 13.5 |
| 2018 | 0.1 | 3.2 | 10.9 | 14.5 | 11.2 | 8.2 | 12.5 | 13.1 | 12.7 | 0.1 | 0.0 | 0.0 |
| **Flow to Kaweah No. 2 Powerhouse (USGS Gage No. 11208818) (WY 2003 - 2018)** | | | | | | | | | | | | |
| 2003 | 0.0 | 40.7 | 68.7 | 74.0 | 72.8 | 75.3 | 74.1 | 75.5 | 75.5 | 68.8 | 34.5 | 9.1 |
| 2004 | 0.0 | 23.8 | 52.5 | 62.7 | 71.3 | 79.1 | 79.6 | 78.7 | 76.9 | 43.8 | 2.1 | 0.0 |
| 2005 | 19.7 | 64.3 | 55.4 | 65.3 | 79.2 | 79.9 | 79.0 | 78.6 | 78.9 | 78.6 | 60.0 | 28.7 |
| 2006 | 11.7 | 16.0 | 55.7 | 69.5 | 75.5 | 77.1 | 73.2 | 78.2 | 77.0 | 65.0 | 49.9 | 15.6 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 2007 | 0.0 | 0.3 | 33.8 | 33.5 | 50.7 | 75.1 | 77.5 | 74.2 | 58.7 | 8.5 | 0.0 | 0.0 |
| 2008 | 0.0 | 0.0 | 16.5 | 60.4 | 76.0 | 77.3 | 78.4 | 78.8 | 75.6 | 62.8 | 5.7 | 0.0 |
| 2009 | 0.0 | 55.5 | 34.3 | 60.2 | 78.1 | 79.0 | 79.5 | 78.0 | 78.3 | 58.7 | 2.7 | 0.0 |
| 2010 | 19.6 | 38.6 | 57.6 | 54.7 | 78.2 | 78.5 | 79.0 | 78.2 | 76.0 | 77.3 | 28.6 | 10.3 |
| 2011 | 11.1 | 68.2 | 71.6 | 77.2 | 77.9 | 77.7 | 74.0 | 70.3 | 76.0 | 77.9 | 74.7 | 19.0 |
| 2012 | 57.4 | 66.2 | 33.1 | 14.0 | 65.1 | 66.4 | 74.7 | 71.3 | 66.1 | 14.6 | 0.0 | 0.0 |
| 2013 | 0.0 | 0.0 | 0.0 | 40.7 | 68.9 | 65.4 | 71.5 | 71.4 | 47.8 | 7.2 | 0.0 | 0.0 |
| 2014 | 0.0 | 0.0 | 0.0 | 0.0 | 13.4 | 58.3 | 56.2 | 72.4 | 43.6 | 0.0 | 0.0 | 0.0 |
| 2015 | 0.0 | 0.0 | 5.9 | 26.2 | 53.0 | 27.2 | 61.4 | 65.6 | 44.4 | 23.3 | 1.6 | 0.0 |
| 2016 | 0.0 | 27.7 | 33.0 | 8.7 | 0.0 | 39.8 | 69.3 | 61.9 | 67.2 | 40.1 | 0.0 | 0.0 |
| 2017 | 0.0 | 0.0 | 22.4 | 4.2 | 0.0 | 0.6 | 52.2 | 66.6 | 59.0 | 68.3 | 64.3 | 47.2 |
| 2018 | 0.2 | 3.8 | 20.2 | 21.5 | 21.1 | 33.2 | 52.3 | 65.2 | 63.3 | 36.7 | 0.2 | 0.0 |
| **Calculated Unimpaired Flow Upstream of Kaweah No. 1 Diversion[2] (WY 1994 - 2018)** | | | | | | | | | | | | |
| 1994 | 20.4 | 33.1 | 58.7 | 113.8 | 216.8 | 131.0 | 26.9 | 10.8 | 10.2 | 15.0 | 18.8 | 22.2 |
| 1995 | 75.8 | 80.6 | 270.1 | 251.8 | 439.2 | 946.0 | 683.0 | 168.7 | 53.0 | 23.4 | 20.5 | 23.5 |
| 1996 | 54.0 | 202.8 | 189.6 | 311.8 | 554.6 | 339.8 | 89.4 | 31.0 | 21.0 | 28.3 | 21.7 | 37.9 |
| 1997 | 674.4 | 204.5 | 192.6 | 248.7 | 486.4 | 292.0 | 81.8 | 33.3 | 24.3 | 18.1 | 98.2 | 180.4 |
| 1998 | 72.0 | 161.7 | 159.0 | 247.8 | 366.1 | 1035.5 | 794.2 | 143.0 | 67.6 | 25.8 | 30.5 | 43.6 |
| 1999 | 44.6 | 58.7 | 52.1 | 111.2 | 298.7 | 160.9 | 51.1 | 22.1 | 20.8 | 41.2 | 42.0 | 38.8 |
| 2000 | 30.9 | 71.2 | 96.3 | 192.6 | 417.7 | 207.8 | 45.8 | 19.4 | 18.8 | 14.4 | 17.8 | 15.0 |
| 2001 | 22.8 | 37.5 | 89.5 | 164.1 | 362.9 | 106.8 | 34.5 | 13.1 | 13.8 | 23.3 | 24.8 | 20.3 |
| 2002 | 61.5 | 51.2 | 77.9 | 230.4 | 305.5 | 203.7 | 41.5 | 17.6 | 13.9 | 10.9 | 31.5 | 68.4 |
| 2003 | 55.7 | 65.1 | 102.6 | 162.9 | 448.2 | 359.1 | 69.8 | 41.9 | 25.1 | 11.7 | 158.7 | 50.7 |
| 2004 | 40.0 | 51.5 | 148.6 | 191.1 | 252.5 | 125.1 | 31.7 | 15.2 | 14.0 | 15.7 | 21.0 | 39.5 |
| 2005 | 88.4 | 60.3 | 119.8 | 203.8 | 666.1 | 623.1 | 227.6 | 56.4 | 28.3 | 18.4 | 24.2 | 26.5 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 2006 | 111.1 | 67.8 | 148.9 | 353.0 | 768.5 | 634.9 | 186.2 | 46.3 | 27.0 | 25.0 | 20.9 | 53.7 |
| 2007 | 25.9 | 36.0 | 78.5 | 137.6 | 213.8 | 63.9 | 20.0 | 12.4 | 10.8 | 23.3 | 22.4 | 25.5 |
| 2008 | 45.9 | 68.3 | 100.8 | 183.6 | 351.6 | 265.6 | 67.3 | 20.6 | 16.2 | 10.9 | 12.2 | 20.0 |
| 2009 | 47.8 | 60.4 | 84.0 | 186.5 | 393.3 | 143.4 | 44.3 | 16.1 | 10.4 | 12.8 | 32.3 | 23.8 |
| 2010 | 43.1 | 77.4 | 128.0 | 208.9 | 362.0 | 766.2 | 232.4 | 44.5 | 26.5 | 80.4 | 25.3 | 34.1 |
| 2011 | 103.7 | 88.1 | 205.1 | 331.4 | 427.3 | 831.5 | 343.1 | 83.5 | 36.6 | 27.2 | 32.7 | 151.2 |
| 2012 | 43.6 | 40.3 | 68.3 | 213.9 | 289.5 | 80.8 | 27.6 | 18.5 | 11.3 | 54.6 | 38.6 | 28.1 |
| 2013 | 39.7 | 37.1 | 59.6 | 134.5 | 164.1 | 51.4 | 19.2 | 11.2 | 7.2 | 12.4 | 17.5 | 38.3 |
| 2014 | 9.6 | 20.3 | 31.3 | 97.3 | 145.5 | 43.6 | 14.7 | 10.4 | 6.7 | 8.4 | 9.9 | 10.3 |
| 2015 | 13.7 | 45.3 | 35.3 | 37.6 | 50.0 | 44.3 | 44.1 | 12.6 | 8.2 | 6.7 | 10.3 | 18.6 |
| 2016 | 47.9 | 70.5 | 112.3 | 216.6 | 300.7 | 238.2 | 44.1 | 14.1 | 9.9 | 10.6 | 21.6 | 30.9 |
| 2017 | 249.0 | 375.0 | 278.5 | 394.1 | 822.3 | 810.7 | 244.5 | 62.5 | 33.3 | 11.3 | 12.5 | 45.0 |
| 2018 | 30.4 | 23.0 | 89.7 | 296.6 | 216.1 | 86.2 | 24.4 | 11.5 | 9.9 | 21.6 | 28.2 | 21.7 |
| **Kaweah No. 1 Flowline (USGS Gage No. 11208720 + SCE Gage 202)** | | | | | | | | | | | | |
| 1975 | 17.2 | 21.5 | 19.8 | 20.5 | 22.6 | 24.9 | 19.2 | 25.5 | 27.3 | 28.2 | 26.1 | 18.9 |
| 1976 | 23.4 | 24.7 | 24.3 | 18.0 | 23.3 | 23.5 | 21.0 | 25.3 | 26.1 | 18.2 | 15.6 | 19.8 |
| 1977 | 22.7 | 15.7 | 12.9 | 16.6 | 16.8 | 20.6 | 23.0 | 24.6 | 25.1 | 16.6 | 14.6 | 9.1 |
| 1978 | 7.8 | 11.2 | 15.8 | 26.6 | 22.8 | 23.2 | 24.0 | 24.7 | 25.6 | 26.0 | 25.9 | 25.6 |
| 1979-93 | no data | | | | | | | | | | | |
| 1994 | 0.2 | 12.0 | 17.2 | 14.7 | 19.6 | 23.0 | 22.9 | 22.8 | 22.9 | 14.3 | 4.3 | 3.4 |
| 1995 | 15.7 | 14.5 | 17.3 | 21.9 | 23.0 | 19.1 | 23.2 | 23.2 | 22.8 | 22.3 | 21.1 | 22.9 |
| 1996 | 19.4 | 15.2 | 17.7 | 22.4 | 21.1 | 23.1 | 23.4 | 20.5 | 9.8 | 19.2 | 18.9 | 13.8 |
| 1997 | 7.7 | 14.2 | 20.1 | 0.9 | 11.0 | 17.8 | 5.5 | 0.0 | 13.1 | 19.3 | 19.6 | 17.0 |
| 1998 | 15.4 | 15.4 | 19.5 | 20.7 | 17.8 | 22.3 | 22.5 | 22.4 | 17.9 | 19.2 | 20.6 | 22.6 |
| 1999 | 23.1 | 23.2 | 17.4 | 20.2 | 18.5 | 19.3 | 22.0 | 23.4 | 23.5 | 21.2 | 14.8 | 8.1 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 2000 | 1.8 | 9.5 | 7.9 | 10.9 | 15.4 | 22.8 | 23.7 | 23.9 | 23.9 | 19.3 | 10.5 | 10.8 |
| 2001 | 3.7 | 14.6 | 11.9 | 13.8 | 18.4 | 18.5 | 21.2 | 23.2 | 23.3 | 16.8 | 6.8 | 7.5 |
| 2002 | 2.3 | 9.4 | 20.2 | 20.6 | 21.3 | 21.6 | 23.5 | 23.9 | 23.6 | 19.7 | 10.8 | 7.5 |
| 2003 | 5.8 | 9.0 | 21.3 | 21.7 | 22.0 | 16.8 | 19.6 | 20.7 | 21.9 | 22.4 | 20.5 | 16.0 |
| 2004 | 7.9 | 13.1 | 16.7 | 19.9 | 21.3 | 21.1 | 22.5 | 22.2 | 22.1 | 15.3 | 7.6 | 5.2 |
| 2005 | 8.2 | 14.5 | 13.3 | 12.6 | 21.2 | 21.1 | 17.4 | 18.8 | 19.6 | 19.9 | 20.7 | 20.1 |
| 2006 | 14.1 | 4.3 | 13.8 | 17.9 | 21.2 | 20.4 | 16.0 | 18.1 | 16.7 | 14.1 | 20.0 | 16.5 |
| 2007 | 10.4 | 11.1 | 13.2 | 9.6 | 17.8 | 19.9 | 18.9 | 13.4 | 19.2 | 7.8 | 5.2 | 2.6 |
| 2008 | 3.1 | 3.1 | 8.3 | 15.5 | 18.2 | 19.8 | 17.1 | 18.4 | 13.9 | 17.9 | 12.7 | 3.9 |
| 2009 | 4.9 | 15.3 | 12.6 | 17.0 | 17.5 | 18.5 | 18.9 | 9.5 | 11.6 | 15.1 | 3.3 | 0.0 |
| 2010 | 1.0 | 2.8 | 6.2 | 13.8 | 0.4 | 0.1 | 10.7 | 17.8 | 16.7 | 17.5 | 15.6 | 17.4 |
| 2011 | 1.9 | 11.6 | 6.8 | 15.5 | 18.1 | 1.1 | 6.9 | 17.8 | 17.3 | 17.6 | 19.0 | 19.2 |
| 2012 | 15.6 | 19.0 | 15.4 | 13.3 | 18.9 | 16.0 | 18.5 | 19.0 | 19.2 | 14.1 | 10.9 | 3.1 |
| 2013 | 0.7 | 0.7 | 2.0 | 7.0 | 18.4 | 19.1 | 19.0 | 19.0 | 18.2 | 2.9 | 0.7 | 0.3 |
| 2014 | 0.2 | 0.3 | 0.2 | 0.9 | 6.4 | 11.3 | 18.5 | 17.7 | 2.5 | 0.6 | 0.7 | 0.7 |
| 2015 | 0.7 | 0.7 | 2.3 | 6.3 | 13.6 | 10.4 | 18.0 | 18.9 | 14.6 | 2.4 | 4.9 | 0.6 |
| 2016 | 1.2 | 9.9 | 11.9 | 14.9 | 17.3 | 17.7 | 17.5 | 15.4 | 10.8 | 11.5 | 2.7 | 0.6 |
| 2017 | 0.8 | 0.9 | 3.4 | 3.7 | 5.5 | 14.4 | 10.4 | 15.4 | 11.8 | 16.4 | 16.4 | 14.1 |
| 2018 | 4.2 | 5.8 | 11.3 | 14.7 | 11.6 | 8.5 | 13.9 | 14.0 | 13.4 | 0.6 | 0.5 | 0.6 |
| **East Fork Kaweah River below Kaweah No. 1 Diversion (USGS Gage No. 11208730)** | | | | | | | | | | | | |
| 1952 | | | | | | | | | 632.3 | 229.7 | 50.1 | 6.2 |
| 1953 | 1.5 | 3.7 | 9.7 | 33.1 | 19.4 | 28.6 | 130.8 | 177.2 | 323.9 | 87.1 | 4.9 | 0.2 |
| 1954 | 0.4 | 0.6 | 2.9 | 11.6 | 23.5 | 48.6 | 190.9 | 369.2 | 142.4 | 21.1 | 0.8 | 0.5 |
| 1955 | 0.9 | 2.6 | 2.5 | 5.2 | 30.3 | 29.8 | 68.8 | 232.5 | 209.9 | 27.0 | 0.3 | 0.3 |
| 1956-57 | no data | | | | | | | | | | | |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 1958 | 0.5 | 1.2 | 7.4 | 11.6 | 35.1 | 78.1 | 203.4 | 663.0 | 614.2 | 189.3 | 34.0 | 5.9 |
| 1959 | 0.3 | 7.6 | 0.2 | 1.2 | 16.7 | 26.5 | 79.2 | 84.9 | 38.4 | 0.8 | 0.6 | 0.7 |
| 1960 | 0.7 | 0.8 | 0.6 | 1.1 | 15.9 | 29.0 | 115.1 | 206.1 | 112.6 | 4.8 | 0.6 | 0.8 |
| 1961 | 0.8 | 1.4 | 2.0 | 0.5 | 0.4 | 6.8 | 62.2 | 119.2 | 48.2 | 0.9 | 4.8 | 1.0 |
| 1962 | 1.2 | 0.9 | 1.6 | 2.7 | 71.3 | 25.1 | 249.9 | 377.3 | 362.1 | 83.5 | 5.3 | 0.6 |
| 1963 | 1.4 | 0.5 | 0.4 | 59.3 | 169.4 | 46.3 | 122.4 | 411.6 | 415.6 | 115.3 | 16.5 | 5.5 |
| 1964 | 4.2 | 16.5 | 10.0 | 16.6 | 2.2 | 15.3 | 79.5 | 231.2 | 149.3 | 17.8 | 1.1 | 0.8 |
| 1965 | 3.5 | 5.2 | 109.9 | 68.6 | 41.0 | 45.0 | 151.4 | 342.8 | 420.6 | 147.1 | 55.4 | 9.9 |
| 1966 | 1.7 | 26.3 | 25.3 | 19.5 | 13.9 | 55.2 | 219.8 | 312.2 | 69.0 | 6.9 | 1.1 | 0.6 |
| 1967 | 0.5 | 13.6 | 593.9 | 114.4 | 103.6 | 131.3 | 157.1 | 582.1 | 820.1 | 552.4 | 148.3 | 48.6 |
| 1968 | 13.6 | 12.8 | 23.8 | 19.3 | 41.1 | 62.2 | 114.4 | 224.1 | 129.0 | 13.5 | 1.4 | 0.7 |
| 1969 | 2.9 | 5.2 | 20.0 | 358.6 | 219.1 | 160.4 | 350.1 | 943.8 | 965.7 | 451.3 | 96.5 | 22.8 |
| 1970 | 22.4 | 10.2 | 30.8 | 137.5 | 51.5 | 85.3 | 127.5 | 451.2 | 279.0 | 45.3 | 3.7 | 1.1 |
| 1971 | 1.0 | 12.7 | 17.4 | 30.1 | 31.6 | 54.8 | 120.1 | 255.6 | 338.0 | 64.7 | 8.4 | 2.5 |
| 1972 | 1.2 | 3.6 | 13.2 | 12.8 | 10.6 | 58.4 | 55.1 | 130.3 | 77.7 | 2.4 | 1.9 | 2.9 |
| 1973 | 0.8 | 4.6 | 17.6 | 80.9 | 50.4 | 78.7 | 181.5 | 662.9 | 654.1 | 138.6 | 25.0 | 1.9 |
| 1974 | 10.1 | 12.3 | 20.8 | 73.4 | 37.9 | 113.1 | 200.7 | 494.8 | 430.6 | 87.9 | 15.1 | 4.5 |
| 1975 | 2.3 | 2.6 | 8.6 | 7.0 | 22.9 | 52.0 | 72.9 | 404.3 | 472.2 | 80.3 | 7.1 | 3.2 |
| 1976 | 12.6 | 5.5 | 6.9 | 4.3 | 4.1 | 24.2 | 67.7 | 166.2 | 21.3 | 1.8 | 1.4 | 26.1 |
| 1977 | 12.6 | 4.0 | 1.3 | 1.9 | 2.1 | 2.3 | 45.2 | 54.8 | 60.9 | 2.0 | 2.1 | 2.0 |
| 1978 | 3.5 | 1.3 | 29.7 | 38.5 | 103.3 | 191.2 | 222.9 | 466.5 | 713.8 | 306.6 | 63.3 | 73.9 |
| 1979-93 | no data | | | | | | | | | | | |
| 1994 | 14.8 | 6.8 | 5.1 | 5.7 | 13.5 | 35.7 | 90.9 | 194.0 | 108.2 | 12.7 | 6.6 | 6.8 |
| 1995 | 7.7 | 6.0 | 6.2 | 53.9 | 57.7 | 251.0 | 228.6 | 415.9 | 923.2 | 660.7 | 147.7 | 30.1 |
| 1996 | 8.9 | 6.5 | 20.2 | 31.7 | 181.7 | 166.6 | 288.4 | 534.1 | 330.0 | 70.2 | 12.1 | 7.2 |

| Water Year and Location | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
| 1997 | 10.2 | 83.9 | 160.6 | 673.5 | 193.5 | 174.8 | 243.2 | 486.4 | 278.9 | 62.5 | 13.7 | 7.3 |
| 1998 | 10.4 | 15.1 | 24.0 | 51.1 | 144.0 | 136.7 | 225.3 | 343.6 | 1017.0 | 774.7 | 122.4 | 45.1 |
| 1999 | 18.3 | 19.1 | 21.4 | 24.3 | 40.2 | 32.9 | 89.2 | 275.3 | 137.6 | 30.0 | 7.3 | 12.9 |
| 2000 | 12.4 | 8.2 | 7.1 | 20.1 | 55.9 | 73.5 | 169.0 | 393.8 | 183.9 | 26.5 | 8.8 | 7.9 |
| 2001 | 19.5 | 10.1 | 8.4 | 9.0 | 19.1 | 71.1 | 142.9 | 339.7 | 83.5 | 17.6 | 6.4 | 6.3 |
| 2002 | 8.6 | 22.1 | 48.2 | 40.8 | 29.9 | 56.3 | 206.9 | 281.6 | 180.1 | 21.9 | 6.8 | 6.4 |
| 2003 | 5.9 | 149.7 | 29.4 | 34.1 | 43.2 | 85.8 | 143.4 | 427.5 | 337.2 | 47.4 | 21.4 | 9.1 |
| 2004 | 7.8 | 8.0 | 22.8 | 20.1 | 30.3 | 127.6 | 168.6 | 230.2 | 102.9 | 16.4 | 7.6 | 8.9 |
| 2005 | 10.2 | 9.7 | 13.1 | 75.9 | 39.1 | 98.9 | 186.4 | 647.6 | 603.3 | 207.8 | 35.7 | 14.1 |
| 2006 | 10.9 | 16.6 | 39.9 | 93.2 | 46.6 | 128.5 | 336.9 | 750.1 | 618.2 | 172.1 | 26.3 | 10.5 |
| 2007 | 12.9 | 11.3 | 12.4 | 16.3 | 18.2 | 58.6 | 118.6 | 200.5 | 44.7 | 12.0 | 7.3 | 8.1 |
| 2008 | 7.8 | 9.0 | 11.7 | 30.4 | 50.2 | 80.9 | 166.5 | 333.3 | 251.7 | 49.5 | 8.0 | 12.3 |
| 2009 | 7.9 | 17.0 | 11.3 | 30.7 | 42.8 | 65.6 | 167.6 | 383.8 | 131.8 | 29.2 | 12.7 | 10.4 |
| 2010 | 79.4 | 22.5 | 27.9 | 29.2 | 77.4 | 127.9 | 200.3 | 387.8 | 775.3 | 208.7 | 28.8 | 9.1 |
| 2011 | 25.4 | 21.2 | 144.4 | 88.2 | 70.0 | 204.0 | 324.5 | 409.4 | 814.3 | 325.4 | 64.5 | 17.4 |
| 2012 | 39.0 | 19.6 | 12.7 | 30.3 | 21.4 | 52.4 | 195.4 | 270.6 | 61.6 | 13.4 | 7.6 | 8.2 |
| 2013 | 11.6 | 16.8 | 36.3 | 32.7 | 18.7 | 40.5 | 115.6 | 145.1 | 33.2 | 16.3 | 10.4 | 6.9 |
| 2014 | 8.2 | 9.6 | 10.2 | 8.6 | 14.0 | 19.9 | 78.9 | 127.8 | 41.1 | 14.1 | 9.7 | 6.0 |
| 2015 | 6.0 | 9.6 | 16.3 | 7.5 | 31.7 | 24.9 | 19.6 | 31.1 | 29.7 | 41.7 | 7.7 | 7.6 |
| 2016 | 9.5 | 11.7 | 19.0 | 33.0 | 53.2 | 94.6 | 199.2 | 285.3 | 227.4 | 32.6 | 11.3 | 9.3 |
| 2017 | 10.5 | 11.7 | 41.6 | 245.2 | 369.5 | 264.1 | 383.7 | 806.9 | 798.9 | 228.1 | 46.1 | 19.2 |
| 2018 | 17.5 | 22.4 | 10.3 | 15.7 | 11.5 | 81.2 | 282.7 | 202.1 | 72.8 | 23.7 | 11.0 | 9.3 |

# APPENDIX 7.2-G

## Annual Maximum Instantaneous Peak Flows (cfs) for Bypass Reaches and Flowlines Associated with the Kaweah Project

This Page Intentionally Left Blank

**Table 7.2 G-1. Annual Maximum Instantaneous Peak Flows (cfs) for Waters Associated with the Kaweah Project.**

| | EF Kaweah River blw Diversion | | Kaweah River blw Diversion | |
|---|---|---|---|---|
| | USGS Gage 11208730 | | USGS Gage 11208600 | |
| Water Year | Flow (cfs) | Date | Flow (cfs) | Date |
| 1953 | 1050 | 4/27/53 | | |
| 1954 | 630 | 1/24/54 | | |
| 1955 | 1090 | 2/16/55 | | |
| 1956 | | | | |
| 1957 | | | | |
| 1958 | 1070 | 5/22/58 | | |
| 1959 | 541 | 2/16/59 | | |
| 1960 | 855 | 2/1/60 | | |
| 1961 | 231 | 5/17/61 | | |
| 1962 | 755 | 5/5/62 | | |
| 1963 | 2850 | 2/1/63 | | |
| 1964 | 480 | 5/20/64 | | |
| 1965 | 1510 | 12/23/64 | | |
| 1966 | 541 | 12/29/65 | | |
| 1967 | 13000 | 12/6/66 | | |
| 1968 | 424 | 5/29/68 | | |
| 1969 | 4700 | 1/25/69 | | |
| 1970 | 3220 | 1/16/70 | | |
| 1971 | 632 | 6/15/71 | | |
| 1972 | 428 | 6/8/72 | | |
| 1973 | 1220 | 5/28/73 | | |
| 1974 | 876 | 6/6/74 | | |
| 1975 | 1050 | 6/1/75 | | |
| 1976 | 522 | 9/11/76 | | |
| 1977 | 276 | 5/31/77 | | |
| 1978 | 1160 | 6/8/78 | | |
| 1979 | | | | |
| 1980 | | | | |
| 1981 | | | | |
| 1982 | | | | |
| 1983 | | | | |
| 1984 | | | | |
| 1985 | | | | |
| 1986 | | | | |
| 1987 | | | | |

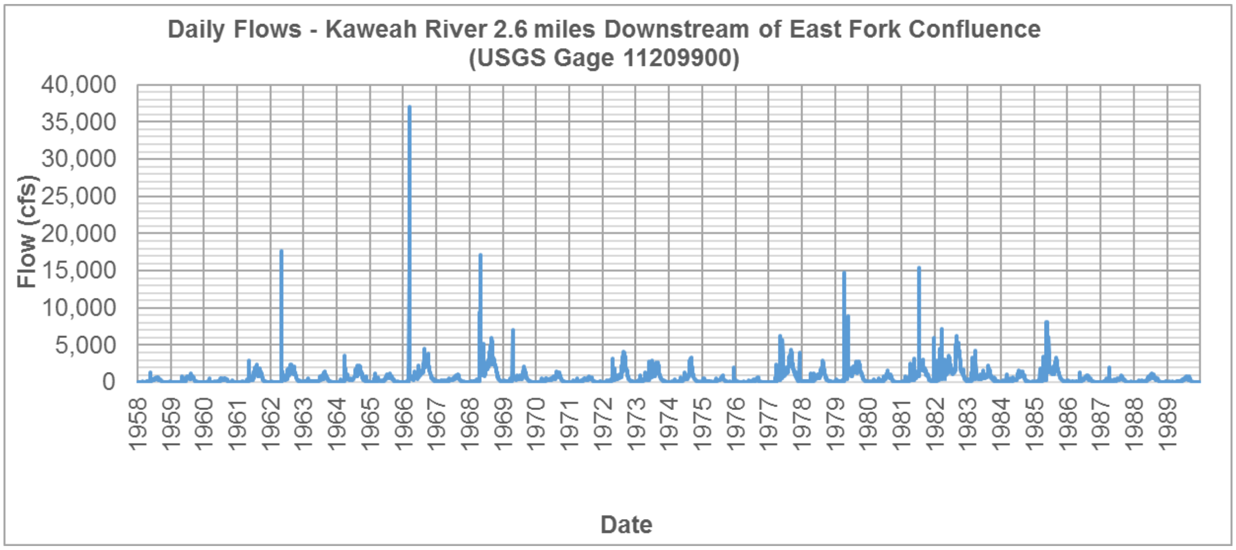
| Water Year | EF Kaweah River blw Diversion USGS Gage 11208730 | | Kaweah River blw Diversion USGS Gage 11208600 | |
|---|---|---|---|---|
| | Flow (cfs) | Date | Flow (cfs) | Date |
| 1988 | | | | |
| 1989 | | | | |
| 1990 | | | | |
| 1991 | | | | |
| 1992 | | | | |
| 1993 | | | | |
| 1994 | 427 | 5/14/94 | 1140 | 5/14/94 |
| 1995 | 1690 | 3/10/95 | 3000 | 4/30/95 |
| 1996 | 1700 | 2/19/96 | 3780 | 2/19/96 |
| 1997 | 11300 | 1/2/97 | 29000 | 1/2/97 |
| 1998 | 1530 | 7/1/98 | 3170 | 7/2/98 |
| 1999 | 466 | 5/25/99 | 1260 | 5/25/99 |
| 2000 | 910 | 2/14/00 | 1940 | 5/23/00 |
| 2001 | 544 | 5/10/01 | 1640 | 5/8/01 |
| 2002 | 1070 | 12/29/01 | 2330 | 11/24/01 |
| 2003 | 5680 | 11/8/02 | 15700 | 11/8/02 |
| 2004 | 476 | 12/24/03 | 1000 | 12/24/03 |
| 2005 | 1540 | 5/27/05 | 2440 | 5/16/05 |
| 2006 | 1500 | 6/4/06 | 2420 | 12/31/05 |
| 2007 | 318 | 5/12/07 | 783 | 4/29/07 |
| 2008 | 1250 | 1/5/08 | 2510 | 1/5/08 |
| 2009 | 687 | 5/11/09 | 1520 | 5/9/09 |
| 2010 | 2600 | 10/14/09 | 9000 | 10/14/09 |
| 2011 | 2250 | 12/19/10 | 5170 | 12/19/10 |
| 2012 | 878 | 10/5/11 | 1930 | 10/5/11 |
| 2013 | 331 | 4/29/13 | 889 | 12/2/12 |
| 2014 | 249 | 5/17/14 | 638 | 5/3/14 |
| 2015 | 1220 | 2/7/15 | 1880 | 2/7/15 |
| 2016 | 522 | 5/13/16 | 1480 | 5/13/16 |
| 2017 | 2240 | 2/7/17 | 4660 | 2/7/17 |
| 2018 | 2420 | 4/7/18 | 4820 | 4/7/18 |

# APPENDIX 7.2-H

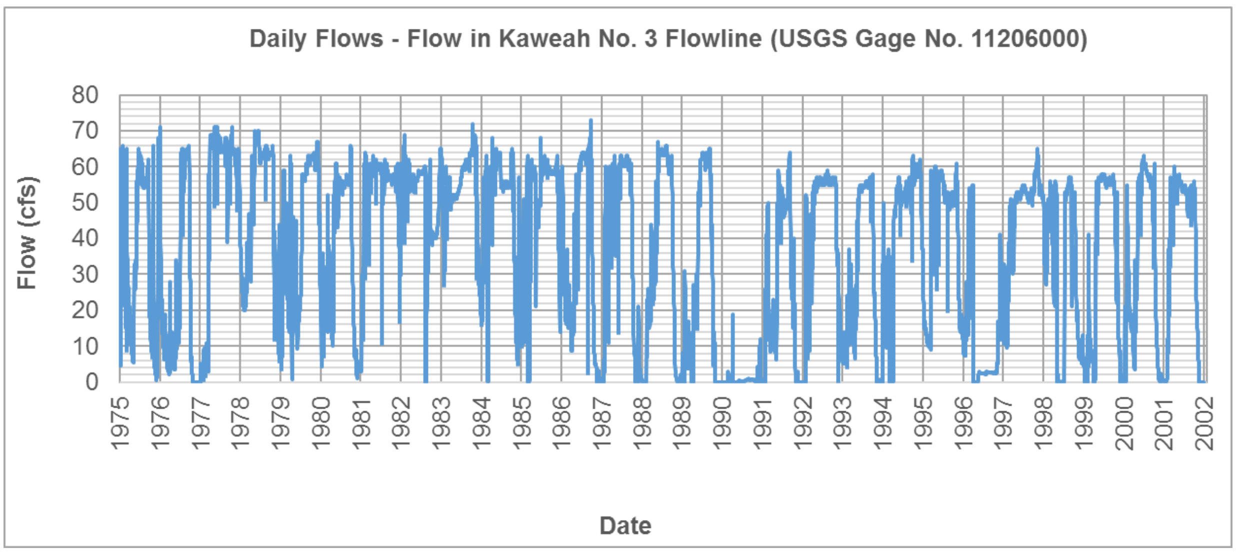
## Hydrology for Other River Reaches in the Watershed – Daily Flows and Annual Maximum Instantaneous Peak Flows

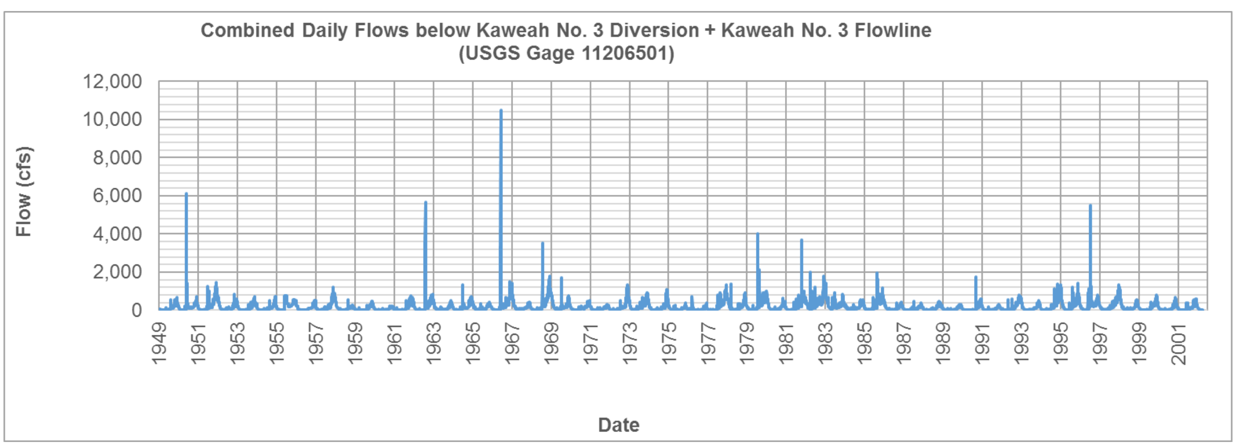
This Page Intentionally Left Blank

**Kaweah River – Downstream of the Kaweah River Bypass Reach**

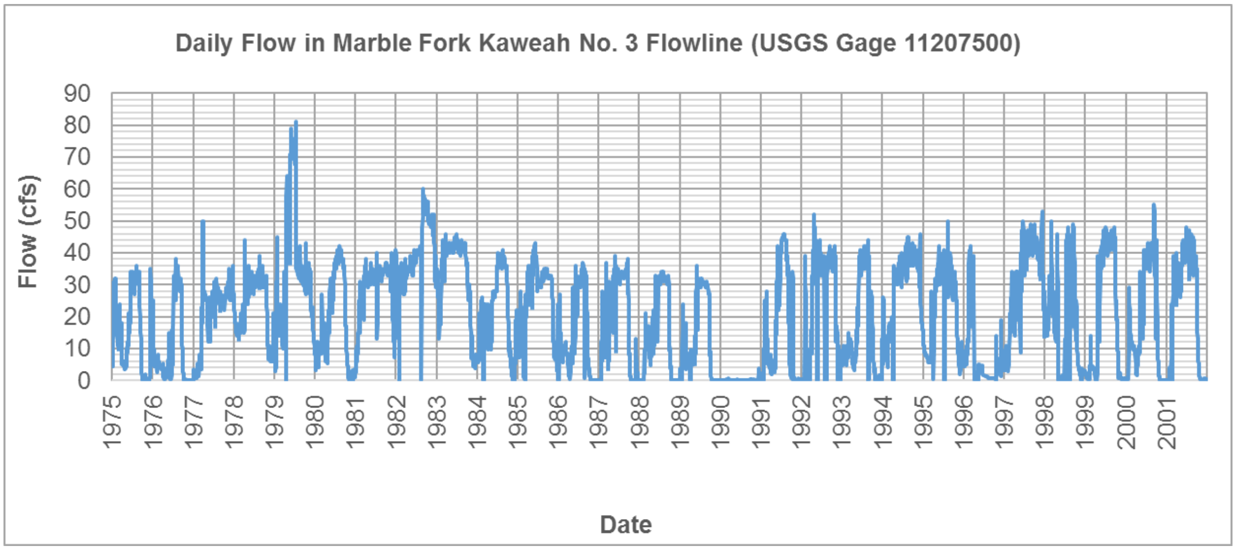


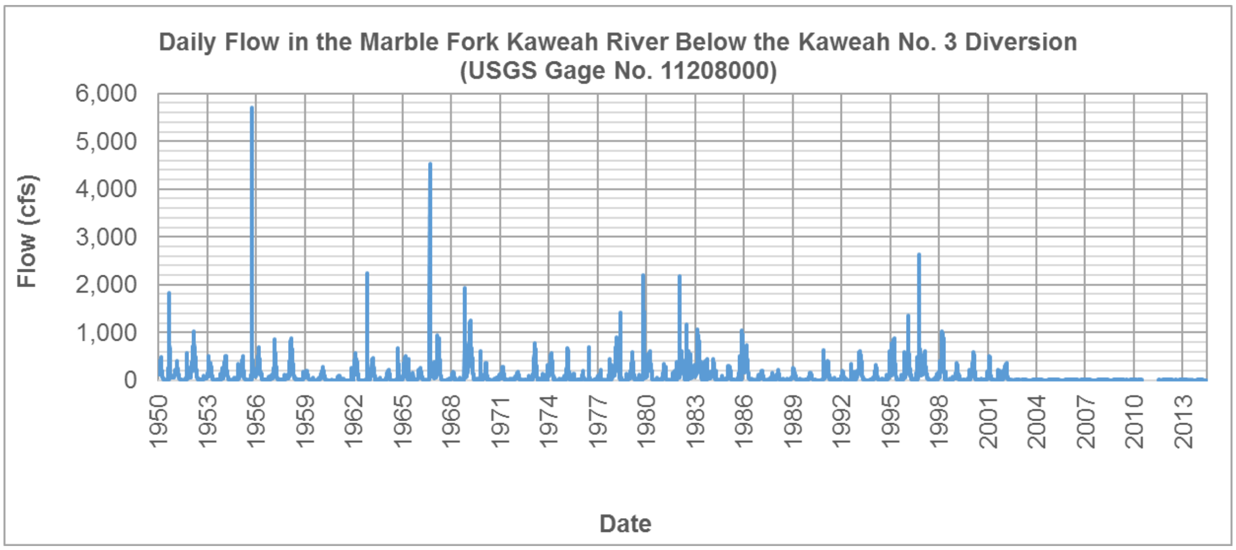

**Middle Fork Kaweah River upstream of the Bypass Reaches Associated with the Project**

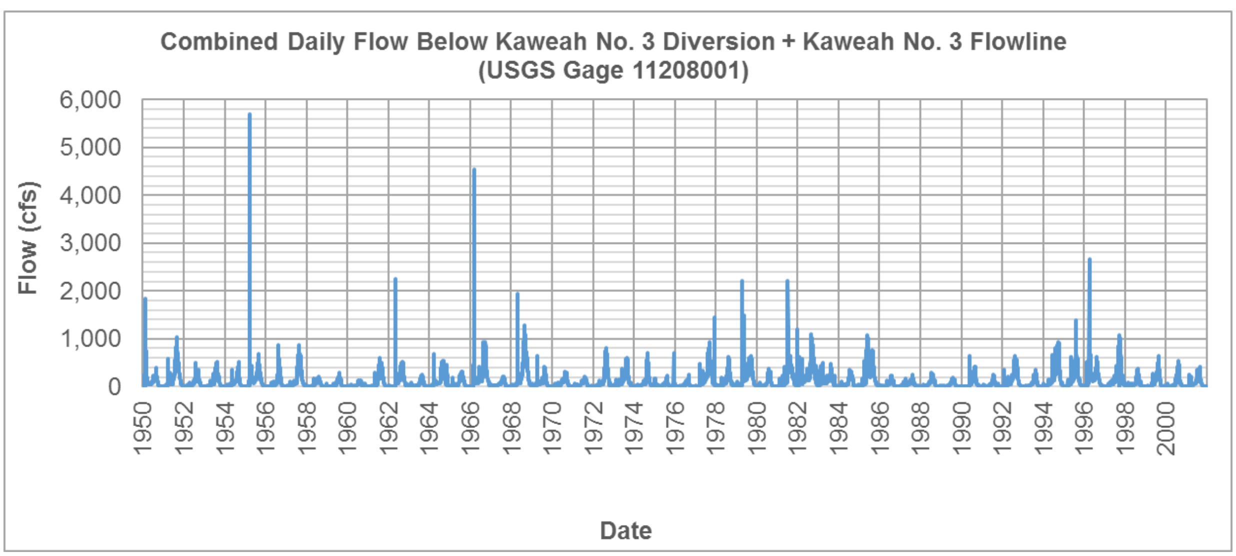


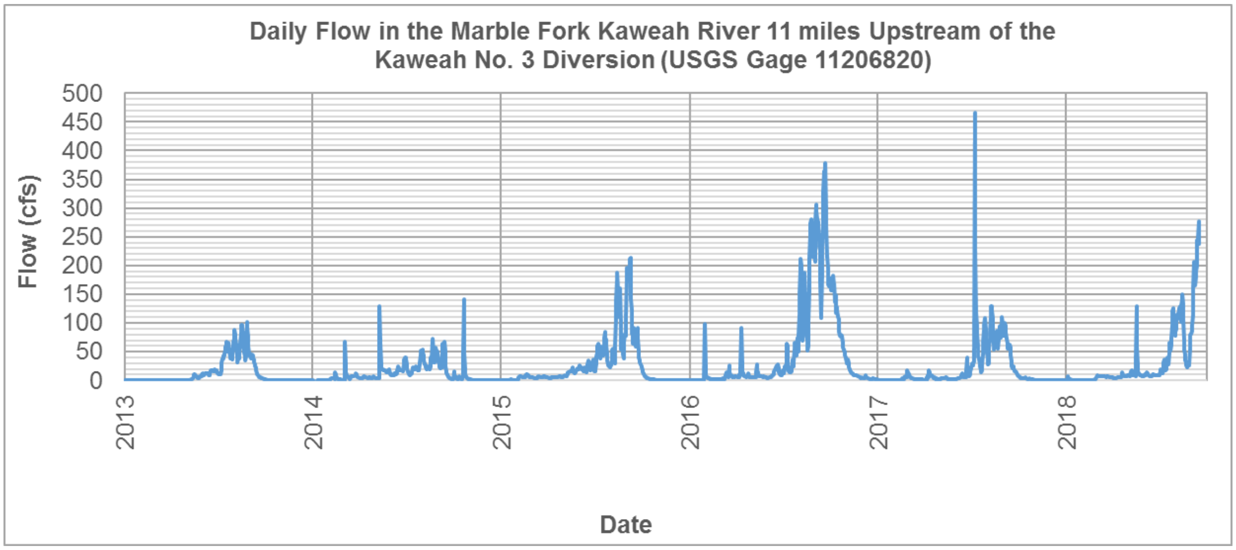
**Marble Fork Kaweah River upstream of the Bypass Reaches Associated with the Project**

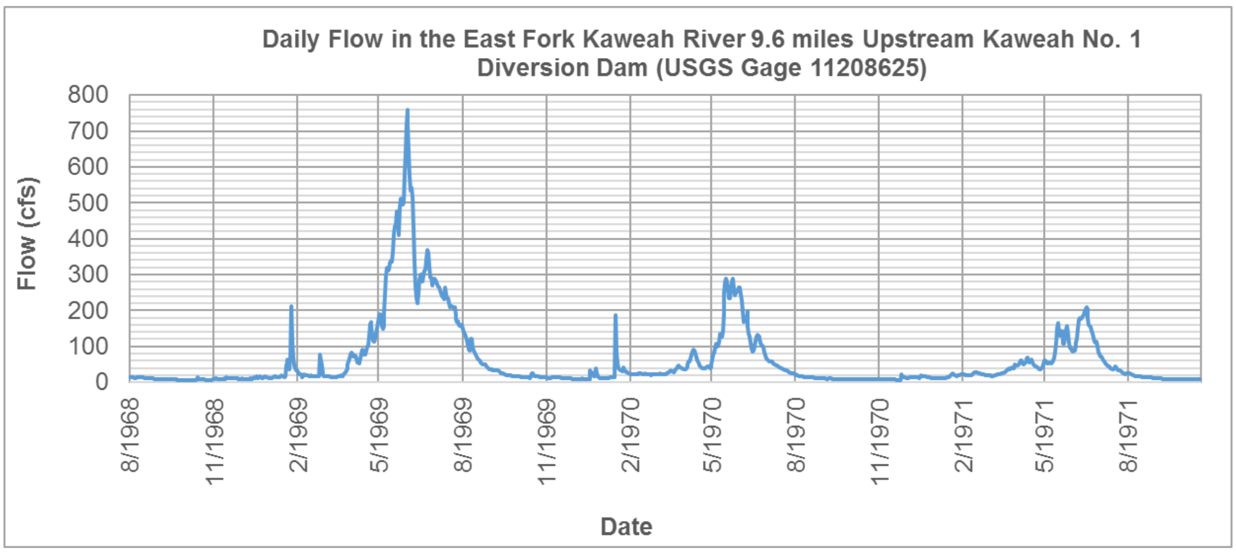


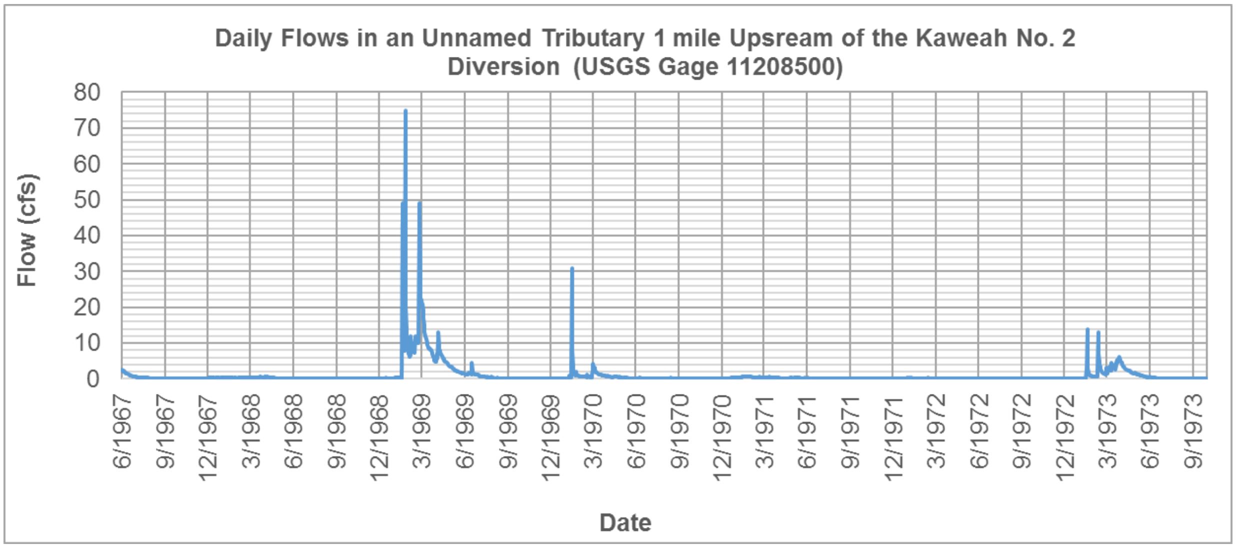



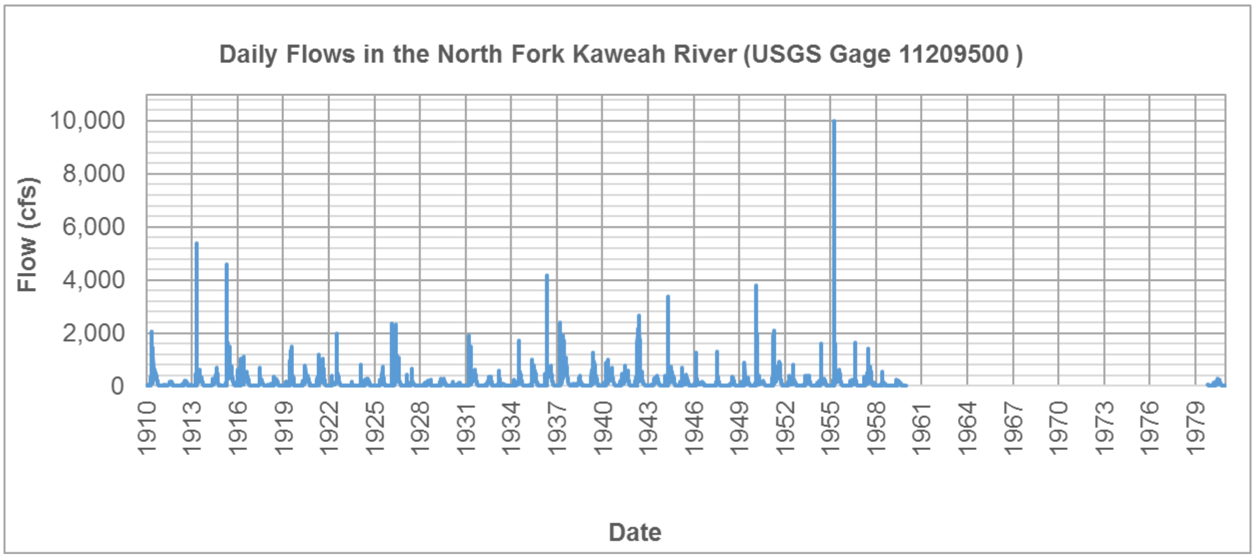
## East Fork Kaweah River upstream of Kaweah No. 1 Diversion Dam



### Tributaries to Kaweah River



**Annual Maximum Instantaneous Peak Flows (cfs) for Other Reaches in the Watershed.**

| Water Year | MF Kaweah Flow blw Diversion | | Marble Fork Kaweah River blw Diversion | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion | | North Fork Kaweah River | | Kaweah River 2.6 miles d/s from EF Confluence | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USGS Gage 11206500 | | USGS Gage 11208000 | | USGS Gage 11208625 | | USGS Gage 11208500 | | USGS Gage 11209500 | | USGS Gage 1209900 | |
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 1911 | | | | | | | | | 2710 | 1/31/11 | | |
| 1912 | | | | | | | | | 178 | 4/11/12 | | |
| 1913 | | | | | | | | | 196 | 4/1/13 | | |
| 1914 | | | | | | | | | 7400 | 1/25/14 | | |
| 1915 | | | | | | | | | 940 | 4/30/15 | | |
| 1916 | | | | | | | | | 5380 | 1/17/16 | | |
| 1917 | | | | | | | | | 3050 | 2/21/17 | | |
| 1918 | | | | | | | | | 900 | 3/18/18 | | |
| 1919 | | | | | | | | | 360 | 2/11/19 | | |
| 1920 | | | | | | | | | 1500 | 4/17/20 | | |
| 1921 | | | | | | | | | 1040 | 3/13/21 | | |
| 1922 | | | | | | | | | 1740 | 2/11/22 | | |
| 1923 | | | | | | | | | 2860 | 4/6/23 | | |
| 1924 | | | | | | | | | 182 | 4/11/24 | | |
| 1925 | | | | | | | | | 1080 | 11/9/24 | | |
| 1926 | | | | | | | | | 730 | 4/8/26 | | |
| 1927 | | | | | | | | | 4650 | 2/16/27 | | |
| 1928 | | | | | | | | | 915 | 3/27/28 | | |
| 1929 | | | | | | | | | 780 | 6/16/29 | | |

| Water Year | MF Kaweah Flow blw Diversion USGS Gage 11206500 | | Marble Fork Kaweah River blw Diversion USGS Gage 11208000 | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam USGS Gage 11208625 | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion USGS Gage 11208500 | | North Fork Kaweah River USGS Gage 11209500 | | Kaweah River 2.6 miles d/s from EF Confluence USGS Gage 1209900 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 1930 | | | | | | | | | 326 | 5/3/30 | | |
| 1931 | | | | | | | | | 250 | 11/17/30 | | |
| 1932 | | | | | | | | | 4200 | 12/28/31 | | |
| 1933 | | | | | | | | | 340 | 5/29/33 | | |
| 1934 | | | | | | | | | 1220 | 12/13/33 | | |
| 1935 | | | | | | | | | 3240 | 4/8/35 | | |
| 1936 | | | | | | | | | 2430 | 2/2/36 | | |
| 1937 | | | | | | | | | 6200 | 2/6/37 | | |
| 1938 | | | | | | | | | 11200 | 12/11/37 | | |
| 1939 | | | | | | | | | 700 | 4/2/39 | | |
| 1940 | | | | | | | | | 2550 | 2/26/40 | | |
| 1941 | | | | | | | | | 2260 | 2/11/41 | | |
| 1942 | | | | | | | | | 1580 | 4/4/42 | | |
| 1943 | | | | | | | | | 5870 | 1/21/43 | | |
| 1944 | | | | | | | | | 1220 | 3/4/44 | | |
| 1945 | | | | | | | | | 5550 | 2/1/45 | | |
| 1946 | | | | | | | | | 1070 | 12/22/45 | | |
| 1947 | | | | | | | | | 2680 | 11/23/46 | | |
| 1948 | | | | | | | | | 2460 | 4/10/48 | | |
| 1949 | | | | | | | | | 469 | 4/21/49 | | |

| Water Year | MF Kaweah Flow blw Diversion | | Marble Fork Kaweah River blw Diversion | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion | | North Fork Kaweah River | | Kaweah River 2.6 miles d/s from EF Confluence | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USGS Gage 11206500 | | USGS Gage 11208000 | | USGS Gage 11208625 | | USGS Gage 11208500 | | USGS Gage 11209500 | | USGS Gage 1209900 | |
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 1950 | 894 | 2/6/50 | 677 | 5/29/50 | | | | | 1670 | 2/6/50 | | |
| 1951 | 17500 | 11/19/50 | 4000 | 11/18/50 | | | | | 10800 | 11/19/50 | | |
| 1952 | 1680 | 12/29/51 | 1150 | 5/27/52 | | | | | 2890 | 1/25/52 | | |
| 1953 | 1500 | 4/27/53 | 1080 | 4/27/53 | | | | | 2490 | 4/27/53 | | |
| 1954 | 870 | 5/19/54 | 651 | 5/19/54 | | | | | 1430 | 1/24/54 | | |
| 1955 | 1160 | 2/16/55 | 715 | 6/7/55 | | | | | 2860 | 2/16/55 | | |
| 1956 | 46800 | 12/23/55 | 12500 | 12/23/55 | | | | | 21500 | 12/23/55 | 60000 | 12/23/55 |
| 1957 | | | 1900 | 5/19/57 | | | | | 3790 | 5/19/57 | | |
| 1958 | 1350 | 5/1958 | 1220 | 5/22/58 | | | | | 2160 | 4/3/58 | | |
| 1959 | 999 | 2/16/59 | 339 | 2/16/59 | | | | | 1280 | 2/16/59 | 3400 | 2/16/59 |
| 1960 | 1060 | 2/1/60 | 414 | 5/11/60 | | | 8.7 | 2/1/60 | 778 | 2/1/60 | 3030 | 2/1/60 |
| 1961 | 262 | 8/11/61 | 160 | 5/24/61 | | | 17 | 12/1/60 | | | 1160 | 12/2/60 |
| 1962 | 860 | 5/5/62 | 748 | 5/5/62 | | | | | | | 6180 | 2/9/62 |
| 1963 | 11800 | 2/1/63 | 3830 | 2/1/63 | | | 152 | 2/1/63 | | | 30900 | 2/1/63 |
| 1964 | 636 | 5/20/64 | 355 | 5/20/64 | | | | | | | 1970 | 5/20/64 |
| 1965 | 2370 | 12/23/64 | 2370 | 8/15/65 | | | 57 | 12/27/64 | | | 6050 | 12/23/64 |
| 1966 | 549 | 11/22/65 | 402 | 5/6/66 | | | 2.9 | 12/30/65 | | | 1680 | 11/23/65 |
| 1967 | 23300 | 12/6/66 | 6400 | 12/6/66 | | | 879 | 12/6/66 | 23900 | 12/6/66 | 73000 | 12/5/66 |
| 1968 | 610 | 5/28/68 | 278 | 5/28/68 | | | 0.9 | 3/16/68 | | | 1520 | 5/29/68 |
| 1969 | 6580 | 1/25/69 | 2610 | 1/25/69 | 934 | 5/31/69 | 203 | 1/25/69 | | | 24200 | 1/25/69 |

| Water Year | MF Kaweah Flow blw Diversion | | Marble Fork Kaweah River blw Diversion | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion | | North Fork Kaweah River | | Kaweah River 2.6 miles d/s from EF Confluence | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USGS Gage 11206500 | | USGS Gage 11208000 | | USGS Gage 11208625 | | USGS Gage 11208500 | | USGS Gage 11209500 | | USGS Gage 1209900 | |
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 1970 | 2890 | 1/16/70 | 1310 | 1/16/70 | 450 | 1/16/70 | 80 | 1/16/70 | | | 13400 | 1/16/70 |
| 1971 | 638 | 6/15/71 | 392 | 6/8/71 | 266 | 6/15/71 | 1.4 | 3/13/71 | | | 1830 | 5/16/71 |
| 1972 | 526 | 6/8/72 | 283 | 6/5/72 | 14.5 | 7/13/72 | 1.2 | 1/4/72 | | | 1120 | 6/8/72 |
| 1973 | 1550 | 5/28/73 | 1010 | 5/28/73 | | | 37 | 1/18/73 | | | 8070 | 1/18/73 |
| 1974 | 1200 | 4/1/74 | 797 | 5/27/74 | | | | | | | 6330 | 4/2/74 |
| 1975 | 1370 | 6/1/75 | 954 | 6/1/75 | | | | | | | 4250 | 6/1/75 |
| 1976 | 1220 | 9/11/76 | 1740 | 9/11/76 | | | | | | | 4400 | 9/11/76 |
| 1977 | 549 | 6/9/77 | 406 | 6/9/77 | | | | | | | 1240 | 6/9/77 |
| 1978 | 2030 | 9/5/78 | 2790 | 9/5/78 | | | | | | | 9460 | 3/4/78 |
| 1979 | 1120 | 5/21/79 | 806 | 5/21/79 | | | | | | | 3620 | 5/21/79 |
| 1980 | 7740 | 1/12/80 | 3040 | 1/13/80 | | | | | | | 23600 | 1/12/80 |
| 1981 | 711 | 5/1/1981 | 430 | 5/1/81 | | | | | 421 | 3/20/81 | 1970 | 5/2/81 |
| 1982 | 5610 | 4/11/82 | 3140 | 4/11/82 | | | | | | | 23700 | 4/11/82 |
| 1983 | 2290 | 10/26/82 | 1590 | 10/26/82 | | | | | | | 14300 | 12/22/82 |
| 1984 | 2700 | 11/24/83 | 1360 | 11/24/83 | | | | | | | 11500 | 11/24/83 |
| 1985 | 623 | 5/23/85 | 405 | 4/14/85 | | | | | | | 2030 | 11/28/84 |
| 1986 | 1910 | 2/19/86 | 1040 | 2/19/86 | | | | | | | 15800 | 2/13/86 |
| 1987 | 774 | 5/15/87 | 464 | 5/12/87 | | | | | | | 3220 | 2/13/87 |
| 1988 | 691 | 1/5/88 | 355 | 5/15/88 | | | | | | | 3530 | 1/5/88 |
| 1989 | 494 | 5/7/89 | 365 | 5/7/89 | | | | | | | 1420 | 4/11/89 |

| Water Year | MF Kaweah Flow blw Diversion | | Marble Fork Kaweah River blw Diversion | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion | | North Fork Kaweah River | | Kaweah River 2.6 miles d/s from EF Confluence | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | USGS Gage 11206500 | | USGS Gage 11208000 | | USGS Gage 11208625 | | USGS Gage 11208500 | | USGS Gage 11209500 | | USGS Gage 1209900 | |
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 1990 | 361 | 5/6/90 | 253 | 4/27/90 | | | | | | | 1010 | 5/7/90 |
| 1991 | 5110 | 3/4/91 | 1940 | 3/4/91 | | | | | | | | |
| 1992 | 625 | 10/26/91 | 310 | 4/29/92 | | | | | | | | |
| 1993 | 974 | 1/7/93 | 1710 | 10/30/92 | | | | | | | | |
| 1994 | 666 | 5/14/94 | 511 | 5/14/94 | | | | | | | | |
| 1995 | 1930 | 4/30/95 | 1410 | 7/8/95 | | | | | | | | |
| 1996 | 2460 | 2/5/96 | 2170 | 5/16/96 | | | | | | | | |
| 1997 | 18400 | 1/2/97 | 6760 | 1/2/97 | | | | | | | 54900 | 1/2/97 |
| 1998 | 1470 | 6/15/98 | 2100 | 9/3/98 | | | | | | | | |
| 1999 | 706 | 5/25/99 | 755 | 7/13/99 | | | | | | | | |
| 2000 | 983 | 5/23/00 | 869 | 5/23/00 | | | | | | | | |
| 2001 | 773 | 5/8/01 | 755 | 5/8/01 | | | | | | | | |
| 2002 | 1610 | 11/24/01 | | | | | | | | | | |
| 2003 | 10800 | 11/8/02 | | | | | | | | | | |
| 2004 | | | | | | | | | | | | |
| 2005 | | | | | | | | | | | | |
| 2006 | | | | | | | | | | | | |
| 2007 | | | | | | | | | | | | |
| 2008 | | | | | | | | | | | | |
| 2009 | | | | | | | | | | | | |

| Water Year | MF Kaweah Flow blw Diversion USGS Gage 11206500 | | Marble Fork Kaweah River blw Diversion USGS Gage 11208000 | | EF Kaweah River 9.6 miles u/s Kaweah No. 1 Diversion Dam USGS Gage 11208625 | | Kaweah River Unnamed Tributary 1 mile u/s Kaweah No. 2 Diversion USGS Gage 11208500 | | North Fork Kaweah River USGS Gage 11209500 | | Kaweah River 2.6 miles d/s from EF Confluence USGS Gage 1209900 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow (cfs) | Date | Flow (cfs) | Date | Flow (cfs) | Flow (cfs) | Date | Date | Flow (cfs) | Date | Flow (cfs) | Date |
| 2010 | | | | | | | | | | | | |
| 2011 | | | | | | | | | | | | |
| 2012 | | | | | | | | | | | | |
| 2013 | | | | | | | | | | | | |
| 2014 | | | | | | | | | | | | |

## TABLE OF CONTENTS



## LIST OF TABLES

## LIST OF MAPS



## LIST OF APPENDICES



## LIST OF ACRONYMS

| | |
|---|---|
| Basin Plan | Water Quality Control Plan for the Tulare Lake Basin |
| CEDEN | California Environmental Data Exchange Network |
| CTR | California Toxics Rule |
| DO | dissolved oxygen |
| DWR | California Department of Water Resources |
| *E. coli* | *Escherichia coli* |
| EPA | Environmental Protection Agency |
| NPS | National Park Service |
| PAD | Pre-Application Document |
| Project | Kaweah Project |
| STORET | EPA Storage and Retrieval |
| TRCSD | Three Rivers Community Service District |
| TSR | Technical Study Report |
| USGS | US Geological Survey |
| Watershed | Kaweah River Watershed |

## 7.3 WATER QUALITY AFFECTED ENVIRONMENT

This section describes the water quality in the vicinity of the Kaweah Project (Project), including an overview of applicable water quality standards and objectives, historical water quality data in the vicinity of the Project, and recent water quality data collected during Project relicensing studies. Water temperature and dissolved oxygen are discussed in Section 7.5 – Fish and Aquatics Resources. Hydrologic conditions associated with the Project are summarized in Section 7.2 – Water Use and Hydrology.

### 7.3.1 Information Sources

This section was prepared using the following information sources:

- Water quality standards
  - Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) (CRWQCB 2018).
  - Environmental Protection Agency (EPA) National Water Quality Criteria (EPA 1986, 2012, 2013, 2016, 2019).
  - California Toxics Rule (CTR) (65 Federal Register [FR] 31682).
- Historical study reports and data
  - The U.S. Geological Survey's (USGS) National Water Information System (USGS 2015) and EPA Storage and Retrieval (STORET) (EPA 2015) online databases provided water quality information that was collected by the USGS and other agencies (California Department of Water Resources [DWR], California Environmental Data Exchange Network [CEDEN], and the National Park Service [NPS]).
  - Three Rivers Community Services District (TRCSD) has bacteria test results for 2014 for total coliform and *Escherichia coli* (*E. coli*) at several locations along the Kaweah River[1] (TRCSD 2014).
- Recent reports and data
  - Pre-Application Document (PAD) for the Project (SCE 2016). The PAD includes a general description of water quality conditions within the vicinity of the Project, including historical water quality information.
  - AQ 6 – Water Quality Technical Study Report (SCE 2019) (AQ 6 – TSR), which is included in Supporting Document A (SD A).

[1] The TRCSD monitors surface water quality at various locations along the bypass reaches associated with the Project and in the surrounding watershed (RMA 2009, SSRWMG 2014).

### 7.3.2 Water Quality Standards

The State of California is responsible for maintaining water quality standards through implementation of the Federal Clean Water Act. The Central Valley Regional Water Quality Control Board has established water quality objectives for specific beneficial water uses in the Basin Plan. The water quality objectives include both numeric and narrative standards for surface water that are based on criteria that protect both human health and aquatic life. If water quality is maintained at levels consistent with these objectives, beneficial uses are considered to be protected. Applicable water quality objectives and standards in the Basin Plan are provided in Table 7.3-1.

The Basin Plan provides water quality objectives that are derived from various sources. These objectives include references to maximum contaminant levels that are provided in Title 22 of the California Code of Regulations which sets standards for waters designated for domestic or municipal use. Additional, and often more stringent, criteria are provided by the CTR (65 FR 31682) and by various EPA sources (EPA 1986, 2012, 2013, 2016, 2019) to protect aquatic life, and human health. The CTR and pertinent EPA standards are provided in Table 7.3-1.

### 7.3.3 Historical Water Quality Information

The USGS, CEDEN, DWR, NPS, and TRCSD water quality measurements are provided in Appendix 7.3-A. Historic water quality sampling locations are shown on Map 7.3-1 and Map 7.3-2. Map 7.3-1 shows the measurement locations in the Kaweah River Watershed (Watershed), including locations outside of the Project area. Map 7.3-2 shows the measurement locations in the vicinity of the Project (the locations on the bypass reaches and in the Watershed downstream of the bypass reaches).

Historical water quality data indicates that the physical and water chemistry conditions in the streams and rivers associated with the Project are of high quality and conform to regulatory water quality objectives and standards. No persistent, widespread water quality issues were found. There are no agriculture or water treatment plants that discharge into the bypass reaches. Several grazing allotments are present in the vicinity of the bypass reaches. Similarly, physical and water chemistry conditions in the Watershed upstream of the bypass reaches are of high quality.

Review of the water quality data from sample locations in the bypass reaches and on the Kaweah River downstream of the Project indicate that generally all of the constituents analyzed have complied with current regulatory standards, with the exception of two pH measurements in 2002 at the upstream end of the Kaweah River Bypass Reach downstream from the Kaweah No. 2 Diversion Dam and at the downstream end of the bypass reach immediately upstream of Kaweah No. 2 Powerhouse (Appendix 7.3-A, Table 2). In addition, surface water measurements by the TRCSD exceeded regulatory standards for fecal coliform in 2014 downstream of the Kaweah River Bypass Reach near the North Fork Kaweah River confluence (Appendix 7.3-A, Table 5).

Water quality samples in the Watershed upstream of the Project and on other tributaries to the Kaweah River have also generally complied with current regulatory standards, based on data collected by the USGS, DWR, CEDEN, and NPS, with a few exceptions. Samples at several locations upstream of the Project or on tributaries to the Kaweah River have not complied with regulatory standards for pH, alkalinity, and fecal coliform in the 1980s and more recently in 2014 (Appendix 7.3-A, Tables 1 and 4). However, measurements of pH and alkalinity in the bypass reaches and overall Watershed, although not consistent with Basin Plan objectives, are typical of most west-slope Sierra Nevada streams and rivers.

### 7.3.4 Recent Water Quality Data Collected During Project Relicensing Studies

As part of the AQ 6 – TSR (SCE 2019), a comprehensive water quality monitoring program was conducted on the Kaweah River and East Fork Kaweah River in spring and summer 2018 (Table 7.3-2, Map 7.3-3). Sampling timing was designed to capture water quality during the spring runoff (May) and summer low-flow or base-flow period (August). Sixteen sites were sampled in the bypass river reaches associated with the Project and comparison river reaches upstream and downstream of the bypass reaches. A total of 33 parameters were measured, including a suite of *in-situ* field measurements, general parameters, dissolved metals, and total mercury. In addition, total coliform and *E. coli* sampling was conducted upstream and downstream of the river access area near Kaweah No. 2 Powerhouse (referred to by locals as “Edison Beach”) where contact recreation (e.g., swimming) occurs. Results of these sampling efforts are summarized below. A detailed description of the study methods and results are available in AQ 6 – TSR included in SD A (SCE 2019).

#### 7.3.4.1 *In-Situ* Field Measurements

*In-situ* water quality measurements consisted of water temperature, dissolved oxygen [DO], turbidity, conductivity, and pH. Water temperature, DO, turbidity, and conductivity measurements met the applicable water quality standards at all sampling sites (Table 7.3-3 and Table 7.3-4). A single pH measurement taken in the K2 Flowline in August exceeded the Basin Plan criterion, likely due to a combination of low flow, daytime photosynthesis by attached algae in the flowline, and the general low alkalinity in the Watershed.

#### 7.3.4.2 General Water Quality Sampling

Results of the general water quality sampling are presented in Table 7.3-5 for spring and in Table 7.3-6 for summer. Table 7.3-7 and Table 7.3-8 contain the calculated criteria and results for ammonia, which has criteria based on temperature and pH and therefore must be calculated on a location-by-location basis. Table 7.3-9 and Table 7.3-10 contain calculated criteria and results for cadmium, copper, lead, and nickel, which have hardness-based criteria. All general water quality sampling parameters were within the Basin Plan water quality objectives and the CTR and EPA national water quality criteria. Four of the 29 ammonia samples were greater than the Basin Plan ammonia “waste discharge” objective; however, Project operations do not produce any waste discharge.

Project operations only divert water from the river into the flowlines, then into powerhouses, and back into the river. There are no known Project-related activities, facilities, or operations that have the potential to affect ammonia concentrations. Ammonia can be produced from septic systems (decomposing organic matter) and there are many homes and the Sequoia National Park Visitor Center that are adjacent to the Kaweah River and could potentially be a source for ammonia. Nine of the 29 alkalinity samples were below the EPA total alkalinity criterion; however the EPA criterion also states that this minimum value does not apply "where alkalinity is naturally lower." Low alkalinity is a natural condition of the Watershed during spring high flow conditions when snowmelt and rainfall runoff have little opportunity to pick up calcium carbonate from the basin geology.

#### 7.3.4.3 Coliform Sampling

The results of the total coliform and *E. coli* analysis are presented in Table 7.3-11. The *E. coli* samples were less than the EPA criteria for human health risk for contact recreation. There is no contact recreation criteria for total coliform because much of total coliform can be from natural sources.

### 7.3.5 Literature Cited

65 FR 31682. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California. Federal Register. Vol. 65, No. 97. Thursday, May 18, 2000. Rules and Regulations.

CRWQCB (California Regional Water Quality Control Board) Central Valley Region. 2018. Water Quality Control Plan for the Tulare Lake Basin Second Edition. Revised May 2018. Available at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/tlbp_201805.pdf.

EPA (Environmental Protection Agency). 1986. Quality Criteria for Water.

EPA. 2012. Recreational Water Quality Criteria.

EPA. 2013. Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater. April.

EPA. 2015. USEPA Storage and Retrieval (STORET) online database. Available at: http://watersgeo.epa.gov/mwm/.

EPA. 2016. Definition and Procedure for the Determination of the Method Detection Limit, Revision 2. EPA 821-R-16-006. December.

EPA. 2019. National Recommended Water Quality Criteria – Aquatic Life Criteria Table. Retrieved January 8, 2019, from https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table.

RMA (Resource Management Agency). 2009. Draft Three Rivers Community Plan 2009 Draft. 89 pp.

SCE (Southern California Edison Company). 2016. Pre-Application Document (PAD) for the Kaweah Project.

SCE. 2019. AQ 6 – Water Quality Technical Study Report, Kaweah Project. July.

SSRWMG (Southern Sierra Regional Water Management Group). 2014. Southern Sierra Integrated Regional Water Management Plan. Prepared by Provost & Pritchard Consulting Group in cooperation with Sequoia Riverlands Trust, Kamansky's Ecological Consulting, and GEOS Institute. November 2014.

TRCSD (Three Rivers Community Services District). 2014. Kaweah River Testing – 2014 Bacteria Testing Results. Available at: http://www.3riverscsd.com/rivertest2014.php.

USGS (United States Geological Survey). 2015. National Water Information System: Web Interface. Available at: http://waterdata.usgs.gov/nwis/qw.

This Page Intentionally Left Blank

# TABLES

This Page Intentionally Left Blank

**Table 7.3-1. Summary of Water Quality Analytical Tests, Including Laboratory Methods and Detection Limits, and Chemical Water Quality Objectives.**

| Analyte | Units[1] | Analysis Method[2] | Method Detection Limit (MDL) | Practical Quantitation Limit (PQL)/ Method Reporting Limit (MRL) | Water Quality Criteria | | | Sample Container | Hold Time | Preservative/ Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Basin Plan[3] | CA Toxics Rule (CTR)[4] | EPA Criteria[5] | | | |
| ***In-Situ* Measurements** | | | | **PQL/MRL** | | | | | | |
| Water Temperature | Celsius (°C) | Water Quality Meter | Not Applicable | Not Applicable | ≤ +5°F[6] | NS | NS | Not Applicable | Not Applicable | None |
| Dissolved Oxygen (DO) | mg/L | Water Quality Meter | Not Applicable | Not Applicable | 5.0 - 7.0[7] | NS | 3.0 - 8.0[8] | Not Applicable | Not Applicable | None |
| Turbidity | NTU | Water Quality Meter | Not Applicable | Not Applicable | Depends on natural turbidity[9] | NS | NS | Not Applicable | Not Applicable | None |
| Conductivity | µS/cm at 25°C | Water Quality Meter | Not Applicable | Not Applicable | 175 | NS | NS | Not Applicable | Not Applicable | None |
| pH | unitless | Water Quality Meter | Not Applicable | Not Applicable | 6.5 – 8.3[10] | NS | 6.5 – 9.0 | Not Applicable | Not Applicable | None |
| **General Parameters** | | | | **PQL/MRL** | | | | | | |
| Calcium | µg/L | EPA 200.7 | 10.79 | 50.0 | NS | NS | NS | 500mL plastic | 180 days | $HNO_3$, maintain at ≤6°C |
| Chloride | mg/L | EPA 300.0 | 0.08 | 1.0 | 250[11] | NS | 230/860[12] | 250mL plastic | 28 days | Maintain at ≤6°C |
| Hardness (as $CaCO_3$) | mg/L | EPA 200.7/SM 2340B | 1.00 | 1.0 | NS | NS | NS | 500mL plastic | 180 days | $HNO_3$, maintain at ≤6°C |
| Magnesium | µg/L | EPA 200.7 | 3.48 | 25.0 | NS | NS | NS | 500mL plastic | 180 days | $HNO_3$, maintain at ≤6°C |
| Nitrate | mg/L | EPA 300.0 | 0.01 | 0.2 | 10 | NS | NS | 500mL plastic | 48 hours | $H_2SO_4$, maintain at ≤6°C |
| Nitrite | mg/L | EPA 300.0 | 0.01 | 0.1 | 1 | NS | NS | 500mL plastic | 48 hours | $H_2SO_4$, maintain at ≤6°C |
| Nitrate/Nitrite ($NO_3$) | mg/L | EPA 353.2 | 0.028 | 0.10 | 10 | NS | NS | 500mL plastic | 48 hours | $H_2SO_4$, maintain at ≤6°C |
| Ammonia as N | mg/L | EPA 350.1 | 0.012 | 0.5 | 0.025 | NS | Depends on pH & temperature | 500mL plastic | 28 days | $H_2SO_4$, maintain at ≤6°C |
| Total Kjeldahl Nitrogen (TKN) | mg/L | EPA 351.2 | 0.267 | 0.50 | NS | NS | NS | 500mL plastic | 28 days | $H_2SO_4$, maintain at ≤6°C |
| Total Phosphorus | µg/L | SM 4500 | 24.0 | 100 | NS | NS | NS | 500mL plastic | 28 days | $H_2SO_4$, maintain at ≤6°C |
| Ortho-phosphate | mg/L | SM 4500-P E | 0.016 | 0.05 | NS | NS | NS | 500mL amber glass | 48 hours | Maintain at ≤6°C |
| Potassium | µg/L | EPA 200.7 | 93.9 | 500 | NS | NS | NS | 500mL plastic | 180 days | $HNO_3$, maintain at ≤6°C |
| Sodium | µg/L | EPA 200.7 | 82.9 | 500 | NS | NS | NS | 500mL plastic | 180 days | $HNO_3$, maintain at ≤6°C |
| Sulfate ($SO_4$) | mg/L | EPA 300.0 | 0.09 | 1.0 | 250[11] | NS | NS | 250mL plastic | 180 days | Maintain at ≤6°C |
| Total Dissolved Solids | mg/L | SM 2540C | 4.4 | 10 | 500[11] | NS | NS | 500mL plastic | 7 days | Maintain at ≤6°C |
| Total Suspended Solids | mg/L | SM 2540D | 5.6 | 10 | NS | NS | NS | 500mL plastic | 7 days | Maintain at ≤6°C |
| Turbidity | NTU | EPA 180.1/SM 2130B | 0.035 | 0.10 | Depends on natural turbidity[9] | NS | NS | 1L amber glass | Not Applicable | Maintain at ≤6°C |
| Organic Carbon, Total (TOC) | mg/L | SM 5310C | Not Applicable | 0.2 | NS | NS | NS | 250mL amber glass | 28 days | $H_2SO_4$, maintain at ≤6°C |
| Total Alkalinity | mg/L | SM 2320B | 0.85 | 2.0 | NS | NS | >20[13] | 250mL plastic | 14 days | Maintain at ≤6°C |
| **Metals-Dissolved** | | | | **MRL** | | | | | | |
| Arsenic | µg/L | EPA 1638 | 0.056 | 0.204 | 10 | 150/340[12] | 150/340[12], 0.018[14], 0.14[15] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Cadmium | µg/L | EPA 1638 | 0.031 | 0.092 | 5 | 2.2/4.3[12, 16] | 0.72/1.8[12, 16] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Copper | µg/L | EPA 1638 | 0.112 | 0.337 | 1,000[11] | 9.0/13[12, 16], 1,300[14] | 9.0/13[12, 16, 17] | 125mL plastic | 48 hours | Maintain at ≤6°C |

| Analyte | Units[1] | Analysis Method[2] | Method Detection Limit (MDL) | Practical Quantitation Limit (PQL)/ Method Reporting Limit (MRL) | Water Quality Criteria | | | Sample Container | Hold Time | Preservative/ Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Basin Plan[3] | CA Toxics Rule (CTR)[4] | EPA Criteria[5] | | | |
| Iron | µg/L | EPA 1638 | 1.43 | 4.34 | 300[11] | NS | 1,000[18], 300[19] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Lead | µg/L | EPA 1638 | 0.026 | 0.077 | 15 | 2.5/65[12, 16] | 2.5/65[12, 16] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Manganese | µg/L | EPA 1638 | 0.107 | 0.321 | 50[11] | NS | 50[20] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Nickel | µg/L | EPA 1638 | 0.117 | 0.352 | 100 | 52/470[12, 16], 610[14], 4,600[15] | 52/470[12, 16], 610[14], 4,600[15] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| Chromium-Total | µg/L | EPA 1638 | 0.128 | 0.383 | 50 | NS | NS | 125mL plastic | 48 hours | Maintain at ≤6°C |
| **Metals-Total** | | | | **MRL** | | | | | | |
| Mercury | ng/L | EPA 1631E | 0.13 | 0.40 | 2,000 | 50[14], 51[15] | 770/1,400[12] | 125mL plastic | 48 hours | Maintain at ≤6°C |
| **Bacteria** | | | | **MRL** | | | | | | |
| Total Coliform | MPN/100 mL | EPA SM9223B | Not Applicable | 1 | NS | NS | NS | 100 mL plastic | 24 hours | Maintain at ≤6°C |
| *E. coli* | MPN/100 mL | EPA SM9223B | Not Applicable | 1 | NS | NS | 126 | 100 mL plastic | 24 hours | Maintain at ≤6°C |

Notes:

MDL - Method Detection Limit: The minimum measured concentration of a substance that can be reported with 99 percent confidence that the measured concentration is distinguishable from method blank results.

MPN - Most probable number of bacterial colonies per 100 mL of water.

MRL - Method Reporting Limit: The lowest concentration of a substance that can be reliably reported under current laboratory operating conditions.

NS - no standard available

PQL - Practical Quantitation Limit: The concentration that can be reliably measured within specified limits and accuracy during routine laboratory operating conditions.

Footnotes:

[1] Units follow listed criterion standards. If standards were not available, laboratory supplied units were used. (Note: µg/L-ppb and mg/L=ppm)

[2] Analysis methods are periodically updated by the EPA. The most recent methods available were used for the water quality analysis.

[3] The Water Quality Control Plan for the Tulare Lake Basin Second Edition relies on California primary and secondary Maximum Concentration Level objectives as criteria for water quality to be used as a municipal and domestic supply for human consumption.

[4] California Toxics Rule (CTR) criteria are based primarily on EPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the Integrated Risk Information System (IRIS) as of October 1, 1996.

[5] Federal water quality criteria are from the EPA's website unless otherwise noted in the footnotes.
Aquatic Life Criteria: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table#table
Human Health Criteria: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

[6] Elevated temperature wastes shall not cause the temperature of waters designated COLD or WARM to increase by more than 5°F above natural receiving water temperature.

[7] 5.0 mg/L for waters designated WARM, 7.0 mg/L for waters designated COLD or SPWN.

[8] The 1-day minimum warmwater criteria are 5.0 mg/L for early life stages, which includes all embryonic and larval stages and all juveniles forms to 30 days following hatching, and 3.0 mg/L for other life stages. The 1-day minimum coldwater criteria are 8.0 mg/L to achieve required intergravel DO concentrations for early life stages, 5.0 mg/L for early life stages exposed directly to the water column, and 4.0 mg/L for other life stages (EPA's 1986 'Gold Book').

[9] Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent. Where natural turbidity is equal to or between 50 and 100 NTUs, increases shall not exceed 10 NTUs. Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

[10] pH shall not be depressed below 6.5, raised above 8.3, or changed at any time more than 0.3 units from normal ambient pH.

[11] The criteria listed are secondary Maximum Concentration Levels for California drinking water quality objectives that do not necessarily indicate a toxic amount of contaminate. Rather these standards dictate water quality objectives designed to preserve taste, odor, or appearance of drinking water.

[12] Freshwater aquatic life protection, continuous concentration (4-day average)/maximum concentration (1-hour average).

[13] The CCC of 20 mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25 percent of the natural level.

[14] Human health criterion (30-day average) for drinking water sources (consumption of water and aquatic organisms).

[15] Human health criterion (30-day average) for other waters (consumption of aquatic organisms only).

[16] Criterion is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as $CaCO_3$) of the sample water. Values displayed above correspond to a total hardness of 100mg/L.

[17] Criteria values are from the EPA's 2004 National Recommended Water Quality Criteria.

[18] Criterion for freshwater aquatic life protection (EPA's 1986 'Gold Book').

[19] Criterion for domestic water supplies (EPA's 1986 'Gold Book').

**Table 7.3-2. Water Quality Monitoring and Sampling Locations.**

| Sampling Location | Sampling Location Description | Sample ID | GPS Coordinates | | Sampled in Spring? (May 7 – 31, 2018) | Sampled in Summer? (Aug 20 – 23, 2018) |
|---|---|---|---|---|---|---|
| | | | UTM11_ NAD 83 E | UTM11_ NAD 83 N | | |
| **Kaweah River** | | | | | | |
| K3 Flowline Above PH3 | Kaweah No. 3 Flowline Upstream of the Kaweah No. 3 Powerhouse | 6, 19 | 336315 | 4039197 | Y | N[1] |
| KR Upstream of PH3 | Kaweah River Upstream of the Kaweah No. 3 Powerhouse | 8, 25 | 335524 | 4039460 | Y | Y |
| K2 Flowline Below PH3 | Kaweah No. 2 Flowline Downstream of the Kaweah No. 3 Powerhouse | 9 | 335446 | 4039333 | Y | N[1] |
| KR Downstream of PH3 | Kaweah River Downstream of the Kaweah No. 3 Powerhouse | 7, 26 | 335549 | 4039215 | Y | Y |
| KR Upstream of the Conf. with EF | Kaweah River Upstream of the East Fork Kaweah River Confluence | 10, 27 | 335382 | 4038784 | Y | Y |
| KR Downstream of the Conf. with EF | Kaweah River Downstream of the East Fork Kaweah Confluence | 11, 32 | 335161 | 4038695 | Y | Y |
| KR Upstream of PH1 | Kaweah River Upstream of the Kaweah No. 1 Powerhouse | 14, 23, 34 | 333144 | 4037224 | Y | Y |
| K1 Flowline Above PH1 | Kaweah No. 1 Flowline Upstream of the Kaweah No. 1 Powerhouse | 12, 16 | 333867 | 4036565 | Y | N[2] |
| KR Downstream of PH1 | Kaweah River Downstream of the Kaweah No. 1 Powerhouse | 13, 22, 33 | 333049 | 4037206 | Y | Y |
| K2 Flowline Above PH2 | Kaweah No. 2 Flowline Upstream of the Kaweah No. 2 Powerhouse | 5, 18, 36 | 331832 | 4037037 | Y | Y |
| KR Upstream of PH2 | Kaweah River Downstream of the Kaweah No. 1 Powerhouse and Upstream of the Kaweah No. 2 Powerhouse | 4, 17, 35 | 331593 | 4036687 | Y | Y |
| KR Downstream of PH2 | Kaweah River Downstream of the Kaweah No. 2 Powerhouse | 15, 24, 37 | 331240 | 4036770 | Y | Y |
| **East Fork Kaweah River** | | | | | | |
| EF Upstream of K1 Div. | East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion | 2, 28 | 339661 | 4035539 | Y | Y |
| EF Downstream of K1 Div. | East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion | 3, 20, 29 | 339590 | 4035507 | Y | Y |
| K1 Flowline Below K1 Div. | Kaweah No. 1 Flowline Downstream of the Kaweah No. 1 Diversion | 1, 30 | 339450 | 4035266 | Y | Y |
| EF Upstream of the Conf. with KR | East Fork Kaweah River Upstream of the Confluence with Kaweah River | 21, 31 | 335383 | 4038647 | Y | Y |

Notes:

[1] The water level in the K3 Flowline above PH3 and the K2 Flowline below PH3 was so low during the summer sampling period that it could not be reached without entering the flowlines. Since entering the flowlines is prohibited, water quality samples could not be collected.

[2] The K1 Flowline above PH1 was dry during the summer sampling period and therefore water quality samples could not be collected.

This Page Intentionally Left Blank

**Table 7.3-3. Summary of *In-Situ* Water Quality Measurements, Spring 2018.**

| Sampling Location | Sample ID | Date | Time | Flow (cfs) | Water Temperature (°C) | Dissolved Oxygen (mg/L) | Turbidity (NTU) | Conductivity (µS/cm) | pH |
|---|---|---|---|---|---|---|---|---|---|
| K3 Flowline Above PH3 | 6 | 5/8/2018 | 825 | 90 | 10.82 | 9.33 | 3.7 | 15 | 7.32 |
| | 19 | 5/30/2018 | 1145 | 88 | 13.53 | 10.05 | 1.8 | 17 | 7.68 |
| KR Upstream of PH3 | 8 | 5/8/2018 | 1000 | 841 | 11.88 | 9.44 | 2.0 | 16 | 7.35 |
| K2 Flowline Below PH3 | 9 | 5/8/2018 | 1045 | 68 | 12.16 | 9.31 | 3.1 | 16 | 7.36 |
| KR Downstream of PH3 | 7 | 5/8/2018 | 930 | 773 | 11.75 | 9.46 | 2.2 | 15 | 7.35 |
| KR Upstream of the Conf. with EF | 10 | 5/8/2018 | 1200 | 773 | 12.75 | 9.1 | 2.3 | 16 | 7.4 |
| KR Downstream of the Conf. with EF | 11 | 5/8/2018 | 1310 | 1073 | 13.49 | 9.21 | 2.9 | 23 | 7.55 |
| KR Upstream of PH1 | 14 | 5/9/2018 | 1110 | 1088 | 12.1 | 9.48 | 3.6 | 22 | 7.51 |
| | 23 | 5/31/2018 | 845 | 531 | 13.56 | 9.77 | 0.9 | 28 | 7.64 |
| K1 Flowline Above PH1 | 12 | 5/9/2018 | 830 | 16 | 9.38 | 9.3 | 5.5 | 38 | 7.69 |
| | 16 | 5/30/2018 | 835 | 16 | 14.02 | 9.22 | 0.5 | 49 | 7.46 |
| KR Downstream of PH1 | 13 | 5/9/2018 | 1000 | 1104 | 12.05 | 9.26 | 3.9 | 23 | 7.5 |
| | 22 | 5/31/2018 | 820 | 547 | 13.51 | 10.04 | 0.1 | 29 | 7.51 |
| K2 Flowline Above PH2 | 5 | 5/7/2018 | 1405 | 65 | 14.78 | 9.35 | 1.7 | 19 | 7.75 |
| | 18 | 5/30/2018 | 1035 | 69 | 15.37 | 9.87 | 0.8 | 18 | 7.75 |
| KR Upstream of PH2 | 4 | 5/7/2018 | 1250 | 880 | 14.05 | 9.27 | 2.5 | 26 | 7.56 |
| | 17 | 5/30/2018 | 1015 | 627 | 15.37 | 9.55 | 1.1 | 27 | 7.6 |
| KR Downstream of PH2 | 15 | 5/9/2018 | 1150 | 1171 | 13.12 | 9.15 | 3.8 | 23 | 7.51 |
| | 24 | 5/31/2018 | 930 | 616 | 13.95 | 9.9 | 2.8 | 29 | 7.76 |
| EF Upstream of K1 Div. | 2 | 5/7/2018 | 1015 | 276 | 9.34 | 9.57 | 1.5 | 41 | 7.74 |
| EF Downstream of K1 Div. | 3 | 5/7/2018 | 1100 | 258 | 9.59 | 9.8 | 2.0 | 40 | 7.7 |
| | 20 | 5/30/2018 | 1300 | 158 | 13.63 | 9.39 | 0.8 | 50 | 7.88 |
| K1 Flowline Below K1 Div. | 1 | 5/7/2018 | 840 | 18 | 9.31 | 9.71 | 2.1 | 40 | 7.7 |
| EF Upstream of the Conf. with KR | 21 | 5/30/2018 | 1430 | 158 | 16.56 | 9.31 | 0.6 | 50 | 7.84 |

**Table 7.3-4. Summary of *In-Situ* Water Quality Measurements, Summer 2018.**

| Sampling Location | Sample ID | Date | Time | Flow (cfs) | Water Temperature (°C) | Dissolved Oxygen (mg/L) | Turbidity (NTU) | Conductivity (µS/cm) | pH |
|---|---|---|---|---|---|---|---|---|---|
| KR Upstream of PH3 | 25 | 8/20/2018 | 1100 | 23.6 | 23.07 | 8.51 | 4.0 | 93 | 7.86 |
| KR Downstream of PH3 | 26 | 8/20/2018 | 1315 | 21 | 24.03 | 8.43 | 3.5 | 92 | 8.07 |
| KR Upstream of the Conf. with EF | 27 | 8/20/2018 | 1400 | 21 | 25.03 | 8.44 | 2.5 | 92 | 8.16 |
| KR Downstream of the Conf. with EF | 32 | 8/23/2018 | 1031 | 29.2 | 21.93 | 8.9 | 2.2 | 110 | 8.04 |
| KR Upstream of PH1 | 34 | 8/23/2018 | 1155 | 29.2 | 23.03 | 8.9 | 2.4 | 110 | 8.14 |
| KR Downstream of PH1 | 33 | 8/23/2018 | 1123 | 29.68 | 22.42 | 8.71 | 2.3 | 110 | 8.12 |
| K2 Flowline Above PH2 | 36 | 8/23/2018 | 1254 | 2.6 | 26.9 | 9.61 | 2.1 | 95 | 8.57 |
| KR Upstream of PH2 | 35 | 8/23/2018 | 1325 | 29.68 | 23.8 | 8.3 | 1.3 | 113 | 8.21 |
| KR Downstream of PH2 | 37 | 8/23/2018 | 1400 | 32.28 | 24.64 | 8.69 | 1.2 | 113 | 8.17 |
| EF Downstream of K1 Div. | 29 | 8/22/2018 | 900 | 9.1 | 18.19 | 8.97 | 3.2 | 136 | 7.84 |
| EF Upstream of the Conf. with KR | 31 | 8/23/2018 | 938* | 9.2 | 21.04 | 8.85 | 1.9 | 139 | 7.82 |

Notes:

* *In-situ* water quality measurements were taken in the morning and water quality samples were collected in the afternoon.

**Table 7.3-5. Summary of Analytical Results for Water Quality Samples Collected during the Spring 2018 Sampling Event.**

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample ID | 6, 19 | 8 | 9 | 7 | 10 | 11 | 14, 23 | 12, 16 | 13, 22 | 5, 18 | 4, 17 | 15, 24 | 2 | 3, 20 | 1 | 21 |
| | | | | | Sample Location | K3 Flowline Above PH3 | KR Upstream of PH3 | K2 Flowline Below PH3 | KR Downstream of PH3 | KR Upstream of the Conf. with EF | KR Downstream of the Conf. with EF | KR Upstream of PH1 | K1 Flowline Above PH1 | KR Downstream of PH1 | K2 Flowline Above PH2 | KR Upstream of PH2 | KR Downstream of PH2 | EF Upstream of K1 Div. | EF Downstream of K1 Div. | K1 Flowline Below K1 Div. | EF Upstream of the Conf. with KR |
| | | | | | Date | 5/8/2018[1], 5/30/2018[1] | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/9/2018[1], 5/31/2018[1] | 5/9/2018[1], 5/30/2018[1] | 5/9/2018[1], 5/31/2018[1] | 5/7/2018[1], 5/30/2018[1] | 5/7/2018[1], 5/30/2018[1] | 5/9/2018[1], 5/31/2018[1] | 5/7/2018 | 5/7/2018[1], 5/30/2018[1] | 5/7/2018 | 5/30/2018 |
| | | | | | Time | 0825, 1145 | 1000 | 1045 | 0930 | 1200 | 1310 | 1110, 0845 | 0830, 0835 | 1000, 0820 | 1405, 1035 | 1250, 1015 | 1150, 0930 | 1015 | 1100, 1300 | 0840 | 1430 |
| **General Parameters** | **Units** | **MDL** | **PQL/MRL** | **WQ Criteria** | | | | | | | | | | | | | | | | | |
| Calcium | µg/L | 10.79 | 50.0 | NS | | 1740 | 2040 | 2010 | 1930 | 2040 | 3120 | 3300 | 6410 | 3260 | 2850 | 3660 | 3190 | 6660 | 6270 | 6590 | 7350 |
| Chloride | mg/L | 0.08 | 1.0 | 250[2] | | 0.6[J] | 0.7[J] | 0.7[J] | 0.7[J] | 0.7[J] | 0.7[J] | <MDL | 0.7[J] | <MDL | 0.7[J] | 0.8[J] | <MDL | 0.8[J] | 0.7[J] | 0.7[J] | 0.8[J] |
| Hardness (as $CaCO_3$) | mg/L | 1.00 | 1.0 | NS | | 5.4 | 6.4 | 6.4 | 6.1 | 6.3 | 9.2 | 9.7 | 17.9 | 9.6 | 8.6 | 10.8 | 9.4 | 18.6 | 17.5 | 18.5 | 20.5 |
| Magnesium | µg/L | 3.48 | 25.0 | NS | | 266 | 316 | 341 | 303 | 298 | 334 | 346 | 468 | 343 | 366 | 400 | 346 | 487 | 456 | 485 | 519 |
| Nitrate | mg/L | 0.01 | 0.2 | 10[2] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Nitrite | mg/L | 0.01 | 0.1 | 1[2] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Nitrate/Nitrite ($NO_3$) | mg/L | 0.028 | 0.10 | 10[2] | | <MDL | <MDL | <MDL | <MDL | <MDL | 0.16 | 0.34 | 0.36 | 0.24 | <MDL | <MDL | 0.08[J] | <MDL | <MDL | <MDL | 1.50 |
| Ammonia as N | mg/L | 0.012 | 0.5 | 0.025[3] | | <MDL | <MDL | **1.6** | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 0.267 | 0.50 | NS | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | 0.41[B,J] |
| Total Phosphorus | µg/L | 24.0 | 100 | NS | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | 39[J] | <MDL | <MDL | 49[J] | <MDL | <MDL | <MDL | <MDL | 53[J] | <MDL |
| Ortho-phosphate | mg/L | 0.016 | 0.05 | NS | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Potassium | µg/L | 93.9 | 500 | NS | | 370[J] | 413[J] | 418[J] | 401[J] | 401[J] | 420[J] | 415[J] | 493[J] | 434[J] | 419[J] | 463[J] | 408[J] | 504 | 468[J] | 484[J] | 473[J] |
| Sodium | µg/L | 82.9 | 500 | NS | | 884 | 1060 | 1020 | 999 | 1050 | 1120 | 1230 | 1420 | 1200 | 1220 | 1390 | 1200 | 1570 | 1490 | 1570 | 1740 |
| Sulfate ($SO_4$) | mg/L | 0.09 | 1.0 | 250[2] | | 0.7[J] | 0.7[J] | 0.8[J] | 0.7[J] | 0.8[J] | 1.0 | 1.1 | 1.7 | 1.1 | 0.8[J] | 1.1 | 1.1 | 1.9 | 1.8 | 1.8 | 2.0 |
| Total Dissolved Solids | mg/L | 4.4 | 10 | 500[2] | | 30 | 33 | 34 | 25 | 26 | 35 | 33 | 49 | 41 | 36 | 40 | 35 | 51 | 49 | 48 | 58 |
| Total Suspended Solids | mg/L | 5.6 | 10 | NS | | 9[J] | 11 | 10 | 14 | 11 | 10 | <MDL | <MDL | <MDL | 7[J] | 7[J] | <MDL | 11 | 8[J] | 16 | <MDL |
| Turbidity | NTU | 0.035 | 0.10 | Depends on natural turbidity[4] | | 1.30 | 1.40 | 1.40 | 1.10 | 0.80 | 1.00 | 2.10 | 2.70 | 2.10 | 0.42 | 0.60 | 1.40 | 1.10 | 0.77 | 0.72 | 0.61[H,T] |
| Organic Carbon, Total (TOC) | mg/L | Not Applicable | 0.2 | NS | | 1.6 | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 | 1.6 | 2.1 | 1.7 | 1.5[B] | 1.8[B] | 1.6 | 2.2[B] | 2.1[B] | 2.1[B] | 1.6 |
| Total Alkalinity | mg/L | 0.85 | 2.0 | >20[5] | | 5.9 | 6.6 | 1.0[J] | 6.5 | 2.8 | 369 | 9.4 | 22.4[B] | 11.6 | 7.8 | 20.3 | 9.7 | 23.6 | 23.7 | 24.1 | 20.4 |

| | | | | | Sample ID | 6, 19 | 8 | 9 | 7 | 10 | 11 | 14, 23 | 12, 16 | 13, 22 | 5, 18 | 4, 17 | 15, 24 | 2 | 3, 20 | 1 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample Location | K3 Flowline Above PH3 | KR Upstream of PH3 | K2 Flowline Below PH3 | KR Downstream of PH3 | KR Upstream of the Conf. with EF | KR Downstream of the Conf. with EF | KR Upstream of PH1 | K1 Flowline Above PH1 | KR Downstream of PH1 | K2 Flowline Above PH2 | KR Upstream of PH2 | KR Downstream of PH2 | EF Upstream of K1 Div. | EF Downstream of K1 Div. | K1 Flowline Below K1 Div. | EF Upstream of the Conf. with KR |
| | | | | | Date | 5/8/2018[1], 5/30/2018[1] | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/8/2018 | 5/9/2018[1], 5/31/2018[1] | 5/9/2018[1], 5/30/2018[1] | 5/9/2018[1], 5/31/2018[1] | 5/7/2018[1], 5/30/2018[1] | 5/7/2018[1], 5/30/2018[1] | 5/9/2018[1], 5/31/2018[1] | 5/7/2018 | 5/7/2018[1], 5/30/2018[1] | 5/7/2018 | 5/30/2018 |
| | | | | | Time | 0825, 1145 | 1000 | 1045 | 0930 | 1200 | 1310 | 1110, 0845 | 0830, 0835 | 1000, 0820 | 1405, 1035 | 1250, 1015 | 1150, 0930 | 1015 | 1100, 1300 | 0840 | 1430 |
| **Metals-Dissolved** | **Units** | **MDL** | **MRL** | **WQ Criteria** | | | | | | | | | | | | | | | | | |
| Arsenic | µg/L | 0.056 | 0.204 | 10[2] | | 0.124[J] | 0.223[J] | 0.210 | 0.215 | 0.233 | 0.435 | 0.564 | 1.250 | 0.589 | 0.269, 0.305 | 0.566 | 0.585 | 0.894 | 1.200 | 0.951 | 1.365 |
| Cadmium | µg/L | 0.031 | 0.092 | Hardness dependent[6] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Copper | µg/L | 0.112 | 0.337 | Hardness dependent[6] | | 0.239[J] | 0.261[J] | 0.290[J] | 0.299[J] | 0.283[J] | 0.383 | 0.260[J] | 0.573 | 0.228[J] | 0.268[J], 0.271[J] | 0.254[J] | 0.236[J] | 0.224[J] | 0.192[J] | 0.322[J] | 0.233[J] |
| Iron | µg/L | 1.43 | 4.34 | 300[2] | | 65.5 | 50.7 | 47.1 | 45.4 | 48.2 | 55.5 | 37.7 | 44.0 | 47.2 | 166.7, 29.3 | 48.1 | 38.6 | 40.1 | 47.3 | 38.4 | 71.1 |
| Lead | µg/L | 0.026 | 0.077 | Hardness dependent[6] | | 0.041[J] | 0.044[J] | 0.031[J] | 0.028[J] | 0.027[J] | 0.046[J] | <MDL | 0.032[J] | 0.029[J] | <MDL | 0.028[J] | <MDL | <MDL | 0.037[J] | <MDL | 0.062[J] |
| Manganese | µg/L | 0.107 | 0.321 | 50[2] | | 2.30 | 1.74 | 1.74 | 1.65 | 1.95 | 2.32 | 1.60 | 2.05 | 1.96 | 3.29, 1.19 | 2.06 | 1.80 | 1.57 | 2.21 | 1.65 | 3.21 |
| Nickel | µg/L | 0.117 | 0.352 | Hardness dependent[6] | | <MDL | <MDL | <MDL | <MDL | <MDL | 0.133[J] | <MDL | 0.120[J] | <MDL | <MDL, 0.236[J] | <MDL | <MDL | 0.206[J] | <MDL | 0.187[J] | <MDL |
| Chromium-Total | µg/L | 0.128 | 0.383 | 50[2] | | <MDL | 0.132[J] | <MDL | 0.134[J] | <MDL | 0.136[J] | <MDL | 0.151[J] | <MDL | <MDL, 0.464 | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| **Metals-Total** | **Units** | **MDL** | **MRL** | **WQ Criteria** | | | | | | | | | | | | | | | | | |
| Mercury | ng/L | 0.13 | 0.40 | 1,400[7] | | 0.66 | 0.97 | 1.12 | 1.04 | 0.94 | 0.94 | 0.65 | 0.81 | 0.70 | 0.84, 0.72 | 0.95 | 0.67 | 1.29 | 1.29 | 1.35 | 1.28 |

Note: Bold results do not meet the listed criteria

Acronyms

MRL (Method Reporting Limit): The lowest concentration of a substance that can be reliably reported under current laboratory operating conditions.

PQL (Practical Quantitation Limit): The concentration that can be reliably measured within specified limits and accuracy during routine laboratory operating conditions.

<MDL: Analyte was not detected above the method detection limit and is therefore considered a non-detect.

NS: No standard

Footnotes

[B] The analyte was found in a method blank, as well as in the sample.

[J] Detected by the instrument, the result is greater than the method detection limit but less than or equal to the method reporting limit. Result is reported and considered an estimate.

[H] Holding time exceeded. Due to equipment failure at the primary lab, the sample was subcontracted to another lab and the analysis was completed one day past holding time.

[T] Sample was received above the mandated temperature. Due to equipment failure at the primary lab, the sample was subcontracted to another lab and was received above the mandated temperature. The lab did not indicate by how much temperature was exceeded.

[1] Some locations were sampled twice because samples were missed or because holding times were exceeded during the first sampling effort. Sample results where holding times were exceeded were omitted from this results table except one instance (see "H" flag) where holding time was exceeded due to lab equipment failure.

[2] Water quality objective from the 2015 Water Quality Control Plan for the Tulare Lake Basin Second Edition.

[3] Basin Plan water quality objective is 0.025 mg/L. EPA criterion is pH, temperature, and life cycle dependent. See Table AQ 6-9 for EPA criteria and results.

[4] Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent. Where natural turbidity is equal to or between 50 and 100 NTUs, increases shall not exceed 10 NTUs. Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

[5] EPA criterion. The CCC of 20 mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25 percent of the natural level.

[6] Criterion is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criterion is calculated based on the hardness (as CaCO3) of the sample water. Refer to Table AQ 6-11 for sample site criteria and results.

[7] EPA maximum concentration (1-hour average) criterion for freshwater aquatic life protection. Basin Plan water quality objective is less stringent (2,000 ng/L).

**Table 7.3-6. Summary of Analytical Results for Water Quality Samples Collected during the Summer 2018 Sampling Event.**

| | | | | | Sample ID | 25 | 26 | 27 | 32 | 34 | 33 | 36 | 35 | 37 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sample Location | KR Upstream of PH3 | KR Downstream of PH3 | KR Upstream of the Conf. with EF | KR Downstream of the Conf. with EF | KR Upstream of PH1 | KR Downstream of PH1 | K2 Flowline Above PH2 | KR Upstream of PH2 | KR Downstream of PH2 | EF Upstream of K1 Div. | EF Downstream of K1 Div. | K1 Flowline Below K1 Div. | EF Upstream of the Conf. with KR |
| | | | | | Date | 8/20/2018 | 8/20/2018 | 8/23/2018 | 8/23/2018 | 8/23/2018 | 8/23/2018 | 8/23/2018 | 8/23/2018 | 8/23/2018 | 8/21/2018 | 8/21/2018 | 8/21/2018 | 8/23/2018 |
| | | | | | Time | 1100 | 1315 | 1400 | 1031 | 1155 | 1123 | 1254 | 1325 | 1400 | 1250 | 0900 | 1415 | 0938 |
| **General Parameters** | **Units** | **MDL** | **PQL** | **WQ Criteria** | | | | | | | | | | | | | | |
| Calcium | µg/L | 10.79 | 50.0 | NS | | 8350 | 8690 | 9670 | 13700 | 13100 | 14200 | 10000 | 14100 | 13500 | 21200 | 21000 | 20800 | 21100 |
| Chloride | mg/L | 0.08 | 1.0 | 250[1] | | 3.0 | 3.0 | 3.0 | 2.8 | 2.9 | 2.7 | 3.2 | 3.3 | 3.4 | 1.4 | 1.4 | 1.3 | 1.8 |
| Hardness (as $CaCO_3$) | mg/L | 1.00 | 1.0 | NS | | 26.7 | 27.9 | 31.0 | 41.2 | 39.3 | 42.6 | 32.0 | 42.2 | 40.7 | 59.2 | 58.9 | 58.2 | 59.5 |
| Magnesium | µg/L | 3.48 | 25.0 | NS | | 1430 | 1500 | 1670 | 1680 | 1620 | 1730 | 1690 | 1730 | 1680 | 1540 | 1540 | 1550 | 1650 |
| Nitrate | mg/L | 0.01 | 0.2 | 10[1] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Nitrite | mg/L | 0.01 | 0.1 | 1[1] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Nitrate/Nitrite ($NO_3$) | mg/L | 0.028 | 0.10 | 10[1] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Ammonia as N | mg/L | 0.012 | 0.5 | 0.025[2] | | <MDL | <MDL | <MDL | <MDL | **0.3[J]** | <MDL | <MDL | **0.1[J]** | **0.9** | <MDL | <MDL | <MDL | <MDL |
| Total Kjeldahl Nitrogen (TKN) | mg/L | 0.267 | 0.50 | NS | | <MDL | <MDL | <MDL | 0.50 | <MDL | 0.27[J] | 0.44[J] | 0.72 | <MDL | <MDL | <MDL | <MDL | <MDL |
| Total Phosphorus | µg/L | 24.0 | 100 | NS | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Ortho-phosphate | mg/L | 0.016 | 0.05 | NS | | <MDL | <MDL | 0.03[J] | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Potassium | µg/L | 93.9 | 500 | NS | | 1180 | 1210 | 1360 | 1320 | 1310 | 1430 | 1410 | 1470 | 1400 | 1230 | 1270 | 1270 | 1350 |
| Sodium | µg/L | 82.9 | 500 | NS | | 5340 | 5580 | 6160 | 6280 | 6030 | 6520 | 6400 | 6830 | 6650 | 5240 | 5200 | 5180 | 6220 |
| Sulfate ($SO_4$) | mg/L | 0.09 | 1.0 | 250[1] | | 2.0 | 2.0 | 2.0 | 3.0 | 3.0 | 3.0 | 2.1 | 2.9 | 2.9 | 4.6 | 4.7 | 4.6 | 4.7 |
| Total Dissolved Solids | mg/L | 4.4 | 10 | 500[1] | | 66 | 66 | 70 | 83 | 87 | 77 | 66 | 78 | 75 | 89 | 90 | 91 | 105 |
| Total Suspended Solids | mg/L | 5.6 | 10 | NS | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Turbidity | NTU | 0.035 | 0.10 | Depends on natural turbidity[3] | | 0.37 | 0.39 | 0.36 | 0.32 | 0.31 | 0.35 | 0.38 | 0.40 | 0.33 | 0.37 | 0.41 | 0.34 | 0.53 |
| Organic Carbon, Total (TOC) | mg/L | Not Applicable | 0.2 | NS | | 1.2 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.5 | 1.2 | 1.2 | 0.9[C] | 0.9 | 1.1 | 1.2 |
| Total Alkalinity | mg/L | 0.85 | 2.0 | >20[4] | | 38.8 | 40.5 | 41.0 | 49.4 | 49.1 | 49.6 | 39.2 | 49.2 | 48.8 | 645 | 62.9 | 63.2 | 63.5 |
| **Metals-Dissolved** | **Units** | **MDL** | **MRL** | **WQ Criteria** | | | | | | | | | | | | | | |
| Arsenic | µg/L | 0.056 | 0.204 | 10[1] | | 3.265 | 3.190 | 3.210 | 3.340 | 3.120 | 3.215 | 3.330 | 2.950 | 2.995 | 2.442 | 2.450 | 2.465 | 3.475 |
| Cadmium | µg/L | 0.031 | 0.092 | Hardness dependent[5] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Copper | µg/L | 0.112 | 0.337 | Hardness dependent[5] | | 0.150[J] | 0.174[J] | 0.182[J] | 0.171[J] | 0.280[J] | 0.154[J] | 0.208[J] | 0.141[J] | 0.137[J] | 0.120[J] | 0.125[J] | 0.125[J] | 0.137[J] |
| Iron | µg/L | 1.43 | 4.34 | 300[1] | | 26.7 | 27.2 | 28.1 | 35.1 | 36.0 | 37.0 | 35.7 | 47.4 | 48.8 | 30.2 | 33.5 | 30.7 | 40.7 |
| Lead | µg/L | 0.026 | 0.077 | Hardness dependent[5] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |

| | | | | | Sample ID | 25 | 26 | 27 | 32 | 34 | 33 | 36 | 35 | 37 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **Sample Location** | **KR Upstream of PH3** | **KR Downstream of PH3** | **KR Upstream of the Conf. with EF** | **KR Downstream of the Conf. with EF** | **KR Upstream of PH1** | **KR Downstream of PH1** | **K2 Flowline Above PH2** | **KR Upstream of PH2** | **KR Downstream of PH2** | **EF Upstream of K1 Div.** | **EF Downstream of K1 Div.** | **K1 Flowline Below K1 Div.** | **EF Upstream of the Conf. with KR** |
| | | | | | **Date** | **8/20/2018** | **8/20/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/21/2018** | **8/21/2018** | **8/21/2018** | **8/23/2018** |
| | | | | | **Time** | **1100** | **1315** | **1400** | **1031** | **1155** | **1123** | **1254** | **1325** | **1400** | **1250** | **0900** | **1415** | **0938** |
| Manganese | µg/L | 0.107 | 0.321 | 50[1] | | 1.34 | 1.2 | 1.10 | 1.82 | 1.51 | 1.55 | 1.36 | 2.245 | 2.25 | 3.415 | 3.75 | 3.26 | 2.92 |
| Nickel | µg/L | 0.117 | 0.352 | Hardness dependent[5] | | 0.140[J] | <MDL | 0.123[J] | 0.121[J] | 0.121[J] | <MDL | 0.120[J] | 0.121[J] | 0.119[J] | 0.122[J] | 0.138[J] | 0.142[J] | 0.124[J] |
| Chromium-Total | µg/L | 0.128 | 0.383 | 50[1] | | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| **Metals-Total** | **Units** | **MDL** | **MRL** | **WQ Criteria** | | | | | | | | | | | | | | |
| Mercury | ng/L | 0.13 | 0.40 | 1,400[6] | | 0.30[J] | 0.26[J] | 0.31[J] | 0.30[J] | 0.31[J] | 0.30[J] | 0.33[J] | 0.25[J] | 0.28[J] | 0.43 | 0.45 | 0.46 | 0.50 |

Notes: Bold results do not meet the listed criteria

Acronyms:

<MDL: Analyte was not detected above the method detection limit and is therefore considered a non-detect.

MRL (Method Reporting Limit): The lowest concentration of a substance that can be reliably reported under current laboratory operating conditions.

NS: No standard

PQL (Practical Quantitation Limit): The concentration that can be reliably measured within specified limits and accuracy during routine laboratory operating conditions.

Footnotes:

[C] Sample was received without chemical preservation.

[J] Detected by the instrument, the result is greater than the method detection limit but less than or equal to the method reporting limit. Result is reported and considered an estimate.

[1] Water quality objective from the 2015 Water Quality Control Plan for the Tulare Lake Basin Second Edition.

[2] Basin Plan water quality objective is 0.025 mg/L. EPA criterion is pH, temperature, and life cycle dependent. See Table AQ 6-10 for EPA criteria and results.

[3] Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent. Where natural turbidity is equal to or between 50 and 100 NTUs, increases shall not exceed 10 NTUs. Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

[4] EPA criterion. The CCC of 20 mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25 percent of the natural level.

[5] Criterion is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criterion is calculated based on the hardness (as $CaCO_3$) of the sample water. Refer to Table AQ 6-12 for sample site criteria and results.

[6] EPA maximum concentration (1-hour average) criterion for freshwater aquatic life protection. Basin Plan water quality objective is less stringent (2,000 ng/L).

**Table 7.3-7. Basin Plan Ammonia Waste Discharge Exceedance Criteria and Calculated Ammonia Concentration Criteria for the Spring 2018 Sampling Event.**

| Sample Site, Date, Time, and Parameters | | | | | | Basin Plan Waste Discharge Exceedance Criteria | EPA Ammonia Chronic Criteria[1] | EPA Ammonia Acute Criteria[1] | Ammonia Concentration |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Location Name | Date | Time | pH | Temperature (°C) | mg/L | mg/L | mg/L | mg/L |
| 6 | K3 Flowline Above PH3 | 5/08/2018 | 0825 | 7.3 | 10.82 | 0.025 | 2.89 | 17.07 | <MDL |
| 8 | KR Upstream of PH3 | 5/08/2018 | 1000 | 7.4 | 11.88 | 0.025 | 2.65 | 16.41 | <MDL |
| 9 | K2 Flowline Below PH3 | 5/08/2018 | 1045 | 7.4 | 12.16 | 0.025 | 2.58 | 16.20 | **1.6** |
| 7 | KR Downstream of PH3 | 5/08/2018 | 0930 | 7.4 | 11.75 | 0.025 | 2.67 | 16.41 | <MDL |
| 10 | KR Upstream of the Conf. with EF | 5/08/2018 | 1200 | 7.4 | 12.75 | 0.025 | 2.41 | 15.34 | <MDL |
| 11 | KR Downstream of the Conf. with EF | 5/08/2018 | 1310 | 7.6 | 13.49 | 0.025 | 2.03 | 12.31 | <MDL |
| 14 | KR Upstream of PH1 | 5/09/2018 | 1110 | 7.5 | 12.1 | 0.025 | 2.30 | 13.09 | <MDL |
| 12 | K1 Flowline Above PH1 | 5/09/2018 | 0830 | 7.7 | 9.38 | 0.025 | 2.29 | 9.81 | <MDL |
| 13 | KR Downstream of PH1 | 5/09/2018 | 1000 | 7.5 | 12.05 | 0.025 | 2.33 | 13.28 | <MDL |
| 5 | K2 Flowline Above PH2 | 5/07/2018 | 1405 | 7.8 | 14.78 | 0.025 | 1.51 | 8.85 | <MDL |
| 4 | KR Upstream of PH2 | 5/07/2018 | 1250 | 7.6 | 14.05 | 0.025 | 1.94 | 12.12 | <MDL |
| 15 | KR Downstream of PH2 | 5/09/2018 | 1150 | 7.5 | 13.12 | 0.025 | 2.15 | 13.09 | <MDL |
| 2 | EF Upstream of K1 Div. | 5/07/2018 | 1015 | 7.7 | 9.34 | 0.025 | 2.17 | 9.01 | <MDL |
| 3 | EF Downstream of K1 Div. | 5/07/2018 | 1100 | 7.7 | 9.59 | 0.025 | 2.24 | 9.64 | <MDL |
| 1 | K1 Flowline Below K1 Div. | 5/07/2018 | 0840 | 7.7 | 9.31 | 0.025 | 2.28 | 9.64 | <MDL |
| 21 | EF Upstream of the Conf. with KR | 5/30/2018 | 1430 | 7.8 | 16.56 | 0.025 | 1.21 | 6.98 | <MDL |

Notes: Bold results do not meet the listed criterion.

<MDL: Analyte was not detected above the method detection limit (MDL) and is therefore considered a non-detect. The MDL for ammonia is 0.012 mg/L.

[1] Ammonia criterion calculated using guidelines from the EPA's 2013 Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater, which is based on ambient pH and temperature conditions.

**Table 7.3-8. Basin Plan Ammonia Waste Discharge Exceedance Criteria and Calculated EPA Ammonia Concentration Criteria for the Summer 2018 Sampling Event.**

| Sample Site, Date, and Parameters | | | | | | Basin Plan Waste Discharge Exceedance Criteria mg/L | EPA Ammonia Chronic Criteria[1] mg/L | EPA Ammonia Acute Criteria[1] mg/L | Ammonia Concentration mg/L |
|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Location Name | Date | Time | pH | Temperature (°C) | | | | |
| 25 | KR Upstream of PH3 | 8/20/2018 | 1100 | 7.86 | 23.07 | 0.025 | 0.77 | 3.92 | <MDL |
| 26 | KR Downstream of PH3 | 8/20/2018 | 1315 | 8.07 | 24.03 | 0.025 | 0.54 | 2.45 | <MDL |
| 27 | KR Upstream of the Conf. with EF | 8/20/2018 | 1400 | 8.16 | 25.03 | 0.025 | 0.44 | 1.89 | <MDL |
| 32 | KR Downstream of the Conf. with EF | 8/23/2018 | 1031 | 8.04 | 21.93 | 0.025 | 0.65 | 3.08 | <MDL |
| 34 | KR Upstream of PH1 | 8/23/2018 | 1155 | 8.14 | 23.03 | 0.025 | 0.52 | 2.32 | 0.3[J] |
| 33 | KR Downstream of PH1 | 8/23/2018 | 1123 | 8.12 | 22.42 | 0.025 | 0.56 | 2.54 | <MDL |
| 36 | K2 Flowline Above PH2 | 8/23/2018 | 1254 | 8.57 | 26.9 | 0.025 | 0.20 | 0.74 | <MDL |
| 35 | KR Upstream of PH2 | 8/23/2018 | 1325 | 8.21 | 23.8 | 0.025 | 0.44 | 1.90 | 0.1[J] |
| 37 | KR Downstream of PH2 | 8/23/2018 | 1400 | 8.17 | 24.64 | 0.025 | 0.45 | 1.92 | **0.9** |
| 28 | EF Upstream of K1 Div. | 8/22/2018 | 0900 | 7.83[2] | 18.08[3] | 0.025 | 1.11 | 6.26 | <MDL |
| 29 | EF Downstream of K1 Div. | 8/22/2018 | 0900 | 7.84 | 18.19 | 0.025 | 1.09 | 6.10 | <MDL |
| 30 | K1 Flowline Below K1 Div. | 8/22/2018 | 0900 | 7.83[2] | 18.15[3] | 0.025 | 1.10 | 6.23 | <MDL |
| 31 | EF Upstream of the Conf. with KR | 8/23/2018 | 0938 | 7.82 | 21.04 | 0.025 | 0.93 | 4.99 | <MDL |

Notes: Bold results do not meet the listed criterion.

<MDL: Analyte was not detected above the method detection limit (MDL) and is therefore considered a non-detect. The MDL for ammonia is 0.012 mg/L.

[1] Ammonia criterion calculated using guidelines from the EPA's 2013 Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater, which is based on ambient pH and temperature conditions.

[2] pH was not measured at this site on this date. The pH value was estimated by averaging the pH values at the other sites on the East Fork Kaweah River (EF Downstream of K1 Div. and EF Upstream of the Conf with KR).

[3] Temperature was not measured with a YSI at this site on this date. Temperature values were obtained from the temperature logger reading at this site at 0900 on 8/22/2018.

[J] Detected by the instrument, the result is greater than the method detection limit but less than or equal to the reporting limit (RL). Result is reported and considered an estimate. The RL for ammonia is 0.5 mg/L.

**Table 7.3-9. Hardness-based Water Quality Criteria for Cadmium, Copper, Lead, and Nickel for the Spring 2018 Sampling Event.**

| Sample ID | 6, 19 | 8 | 9 | 7 | 10 | 11 | 14, 23 | 12, 16 | 13, 22 | 5, 18 | 4, 17 | 15, 24 | 2 | 3, 20 | 1 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Location** | **K3 Flowline Above PH3** | **KR Upstream of PH3** | **K2 Flowline Below PH3** | **KR Downstream of PH3** | **KR Upstream of the Conf. with EF** | **KR Downstream of the Conf. with EF** | **KR Upstream of PH1** | **K1 Flowline Above PH1** | **KR Downstream of PH1** | **K2 Flowline Above PH2** | **KR Upstream of PH2** | **KR Downstream of PH2** | **EF Upstream of K1 Div.** | **EF Downstream of K1 Div.** | **K1 Flowline Below K1 Div.** | **EF Upstream of the Conf. with KR** |
| **Date Sampled** | **5/08/2018 5/30/2018** | **5/08/2018** | **50/8/2018** | **5/08/2018** | **5/08/2018** | **5/08/2018** | **5/09/2018 5/31/2018** | **5/09/2018 5/30/2018** | **5/09/2018 5/31/2018** | **5/07/2018 5/30/2018** | **5/07/2018 5/30/2018** | **5/09/2018 5/31/2018** | **5/07/2018** | **5/07/2018 5/30/2018** | **5/07/2018** | **5/30/2018** |
| **Time Sampled** | **0825, 1145** | **1000** | **1045** | **0930** | **1200** | **1310** | **1110, 0845** | **0830, 0835** | **1000, 0820** | **1405, 1035** | **1250, 1015** | **1150, 0930** | **1015** | **1100, 1300** | **0840** | **1430** |
| **Hardness ($CaCO_3$) (mg/L)** | **5.4** | **6.4** | **6.4** | **6.1** | **6.3** | **9.2** | **9.7** | **17.9** | **9.6** | **8.6** | **10.8** | **9.4** | **18.6** | **17.5** | **18.5** | **20.5** |
| **Cadmium (Cd)** | | | | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Maximum Criterion (µg/L) | 0.12 | 0.14 | 0.14 | 0.13 | 0.13 | 0.19 | 0.20 | 0.36 | 0.20 | 0.18 | 0.22 | 0.20 | 0.37 | 0.35 | 0.37 | 0.41 |
| Continuous Criterion (µg/L) | 0.08 | 0.09 | 0.09 | 0.09 | 0.09 | 0.12 | 0.12 | 0.20 | 0.12 | 0.11 | 0.13 | 0.12 | 0.20 | 0.19 | 0.20 | 0.22 |
| **Copper (Cu)** | | | | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | 0.239[J] | 0.261[J] | 0.290[J] | 0.299[J] | 0.283[J] | 0.383 | 0.260[J] | 0.573 | 0.228[J] | 0.268[J], 0.271[J] | 0.254[J] | 0.236[J] | 0.224[J] | 0.192[J] | 0.322[J] | 0.233[J] |
| Maximum Criterion (µg/L) | 0.86 | 1.01 | 1.01 | 0.96 | 0.99 | 1.42 | 1.49 | 2.66 | 1.48 | 1.33 | 1.65 | 1.45 | 2.75 | 2.60 | 2.74 | 3.02 |
| Continuous Criterion (µg/L) | 0.74 | 0.86 | 0.86 | 0.82 | 0.84 | 1.17 | 1.22 | 2.06 | 1.21 | 1.10 | 1.34 | 1.19 | 2.13 | 2.02 | 2.12 | 2.31 |
| **Lead (Pb)** | | | | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | 0.041[J] | 0.044[J] | 0.031[J] | 0.028[J] | 0.027[J] | 0.046[J] | <MDL | 0.032[J] | 0.029[J] | <MDL | 0.028[J] | <MDL | <MDL | 0.037[J] | <MDL | 0.062[J] |
| Maximum Criterion (µg/L) | 2.42 | 2.94 | 2.94 | 2.78 | 2.89 | 4.46 | 4.74 | 9.52 | 4.68 | 4.13 | 5.36 | 4.57 | 9.94 | 9.28 | 9.88 | 11.10 |
| Continuous Criterion (µg/L) | 0.09 | 0.11 | 0.11 | 0.11 | 0.11 | 0.17 | 0.18 | 0.37 | 0.18 | 0.16 | 0.21 | 0.18 | 0.39 | 0.36 | 0.39 | 0.43 |
| **Nickel (Ni)** | | | | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | <MDL | <MDL | <MDL | <MDL | <MDL | 0.133[J] | <MDL | 0.120[J] | <MDL | <MDL, 0.236[J] | <MDL | <MDL | 0.206[J] | <MDL | 0.187[J] | <MDL |
| Maximum Criterion (µg/L) | 39.63 | 45.76 | 45.76 | 43.94 | 45.16 | 62.21 | 65.05 | 109.24 | 64.49 | 58.76 | 71.24 | 63.35 | 112.84 | 107.17 | 112.33 | 122.52 |
| Continuous Criterion (µg/L) | 4.40 | 5.08 | 5.08 | 4.88 | 5.02 | 6.91 | 7.23 | 12.13 | 7.16 | 6.53 | 7.91 | 7.04 | 12.53 | 11.90 | 12.48 | 13.61 |

Notes: Bold results do not meet the calculated criteria

<MDL: Analyte was not detected above the method detection limit (MDL) and is therefore considered a non-detect. The MDL for cadmium is 0.031 µg/L, the MDL for lead is 0.026 µg/L, and the MDL for nickel is 0.117 µg/L.

[J] Detected by the instrument, the result is greater than the MDL but less than or equal to the method reporting limit (MRL). Result is reported and considered an estimate. The MRL for copper is 0.337 µg/L, the MRL for lead is 0.077 µg/L, and the MRL for nickel is 0.352 µg/L.

California Toxics Rule (CTR) and EPA standard was used for Cu, Pb, and Ni. EPA standard was used for Cd as it is more stringent than the CTR standard.

Formulas used are provided in Appendix B.

This Page Intentionally Left Blank

**Table 7.3-10. Hardness-based Water Quality Criteria for Cadmium, Copper, Lead, and Nickel for the Summer 2018 Sampling Event.**

| **Sample ID** | **25** | **26** | **27** | **32** | **34** | **33** | **36** | **35** | **37** | **28** | **29** | **30** | **31** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample Location** | **KR Upstream of PH3** | **KR Downstream of PH3** | **KR Upstream of the Conf. with EF** | **KR Downstream of the Conf. with EF** | **KR Upstream of PH1** | **KR Downstream of PH1** | **K2 Flowline Above PH2** | **KR Upstream of PH2** | **KR Downstream of PH2** | **EF Upstream of K1 Div.** | **EF Downstream of K1 Div.** | **K1 Flowline Below K1 Div.** | **EF Upstream of the Conf. with KR** |
| **Date Sampled** | **8/20/2018** | **8/20/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/23/2018** | **8/21/2018** | **8/21/2018** | **8/21/2018** | **8/23/2018** |
| **Time Sampled** | **1100** | **1315** | **1400** | **1031** | **1155** | **1123** | **1254** | **1325** | **1400** | **1250** | **0900** | **1415** | **0938** |
| **Hardness (CaCO3) (mg/L)** | **26.7** | **27.9** | **31** | **41.2** | **39.3** | **42.6** | **32** | **42.2** | **40.7** | **59.2** | **58.9** | **58.2** | **59.5** |
| **Cadmium (Cd)** | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Maximum Criterion (µg/L) | 0.52 | 0.54 | 0.60 | 0.78 | 0.75 | 0.81 | 0.62 | 0.80 | 0.77 | 1.10 | 1.09 | 1.08 | 1.10 |
| Continuous Criterion (µg/L) | 0.27 | 0.27 | 0.30 | 0.37 | 0.36 | 0.38 | 0.30 | 0.38 | 0.37 | 0.48 | 0.48 | 0.48 | 0.49 |
| **Copper (Cu)** | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | 0.150[J] | 0.174[J] | 0.182[J] | 0.171[J] | 0.280[J] | 0.154[J] | 0.208[J] | 0.141[J] | 0.137[J] | 0.120[J] | 0.125[J] | 0.125[J] | 0.137[J] |
| Maximum Criterion (µg/L) | 3.87 | 4.04 | 4.46 | 5.83 | 5.57 | 6.01 | 4.59 | 5.96 | 5.76 | 8.20 | 8.16 | 8.07 | 8.24 |
| Continuous Criterion (µg/L) | 2.90 | 3.01 | 3.29 | 4.20 | 4.03 | 4.32 | 3.38 | 4.28 | 4.15 | 5.72 | 5.70 | 5.64 | 5.75 |
| **Lead (Pb)** | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Maximum Criterion (µg/L) | 14.95 | 15.71 | 17.68 | 24.30 | 23.05 | 25.22 | 18.32 | 24.96 | 23.97 | 36.33 | 36.13 | 35.66 | 36.54 |
| Continuous Criterion (µg/L) | 0.58 | 0.61 | 0.69 | 0.95 | 0.90 | 0.98 | 0.71 | 0.97 | 0.93 | 1.42 | 1.41 | 1.39 | 1.42 |
| **Nickel (Ni)** | | | | | | | | | | | | | |
| Laboratory Result (µg/L) | 0.140[J] | <MDL | 0.123[J] | 0.121[J] | 0.121[J] | <MDL | 0.120[J] | 0.121[J] | 0.119[J] | 0.122[J] | 0.138[J] | 0.142[J] | 0.124[J] |
| Maximum Criterion (µg/L) | 153.21 | 159.02 | 173.84 | 221.14 | 212.48 | 227.48 | 178.58 | 225.67 | 218.87 | 300.50 | 299.21 | 296.20 | 301.79 |
| Continuous Criterion (µg/L) | 17.02 | 17.66 | 19.31 | 24.56 | 23.60 | 25.27 | 19.83 | 25.07 | 24.31 | 33.38 | 33.23 | 32.90 | 33.52 |

Notes: Bold results do not meet the calculated criteria

<MDL: Analyte was not detected above the method detection limit (MDL) and is therefore considered a non-detect. The MDL for cadmium is 0.031 µg/L, the MDL for lead is 0.026 µg/L, and the MDL for nickel is 0.117 µg/L.

[J] Detected by the instrument, the result is greater than the MDL but less than or equal to the method reporting limit (MRL). Result is reported and considered an estimate. The MRL for copper is 0.337 µg/L and the MRL for nickel is 0.352 µg/L.

California Toxics Rule (CTR) and EPA standard was used for Cu, Pb, and Ni. EPA standard was used for Cd as it is more stringent than the CTR standard.

Formulas used are provided in Appendix B.

This Page Intentionally Left Blank

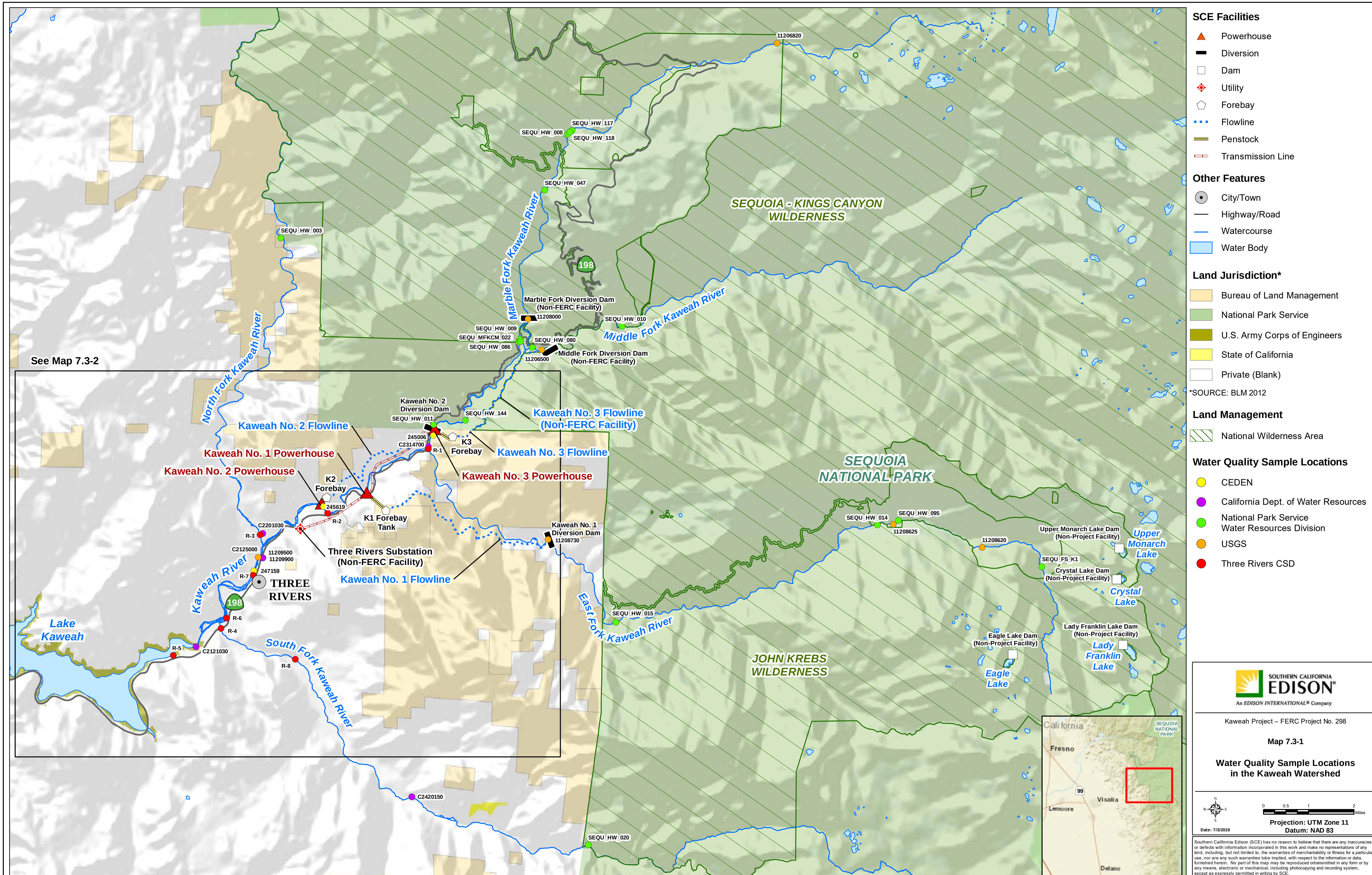
**Table 7.3-11. Edison Beach Coliform Sampling Upstream/Downstream Comparison.**

| Sample Location | Test | Sample Date | | | | |
|---|---|---|---|---|---|---|
| | | 7/05/2018 | 7/12/2018 | 7/19/2018 | 7/26/2018 | 7/31/2018 |
| Upstream of Edison Beach | Total Coliform (MPN/100mL) | >2419.6 | >2419.6 | >2419.6 | >2419.6 | >2419.6 |
| | *E. coli* (MPN/100mL) | 69.7 | 52.9 | 41.4 | 14.5 | 14.5 |
| Downstream of Edison Beach | Total Coliform (MPN/100mL) | >2419.6 | >2419.6 | >2419.6 | >2419.6 | >2419.6 |
| | *E. coli* (MPN/100mL) | 30.1 | 76.9 | 45.7 | 18.7 | 14.8 |

This Page Intentionally Left Blank

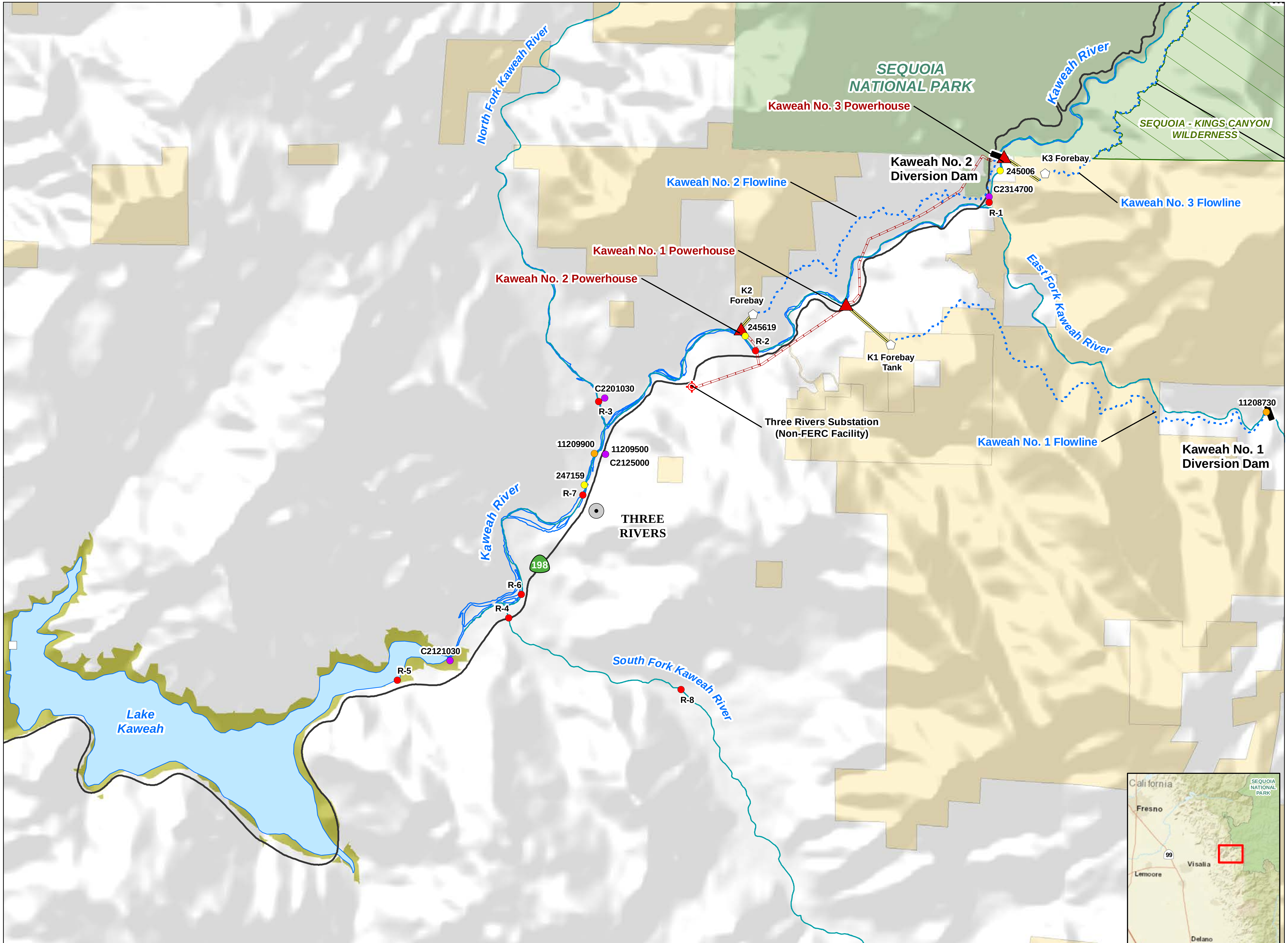
# MAPS

This Page Intentionally Left Blank




C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\SCE_Eastern_KAWEAH_WQ_SampleLocs_17i11i_01.mxd

This Page Intentionally Left Blank




**SCE Facilities**

- Powerhouse
- Diversion
- Dam
- Utility
- Forebay
- Flowline
- Penstock
- Transmission Line

**Other Features**

- City/Town
- Highway/Road
- Watercourse
- Water Body

**Land Jurisdiction***

- Bureau of Land Management
- National Park Service
- U.S. Army Corps of Engineers
- State of California
- Private (Blank)

*SOURCE: BLM 2012

**Land Management**

- National Wilderness Area

**Water Quality Sample Locations**

- CEDEN
- California Dept. of Water Resources
- National Park Service Water Resources Division
- USGS
- Three Rivers CSD

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Kaweah Project – FERC Project No. 298

**Map 7.3-2**

**Water Quality Sample Locations in the Vicinity of the Kaweah Project**

N S W E

0 0.5 1 Miles

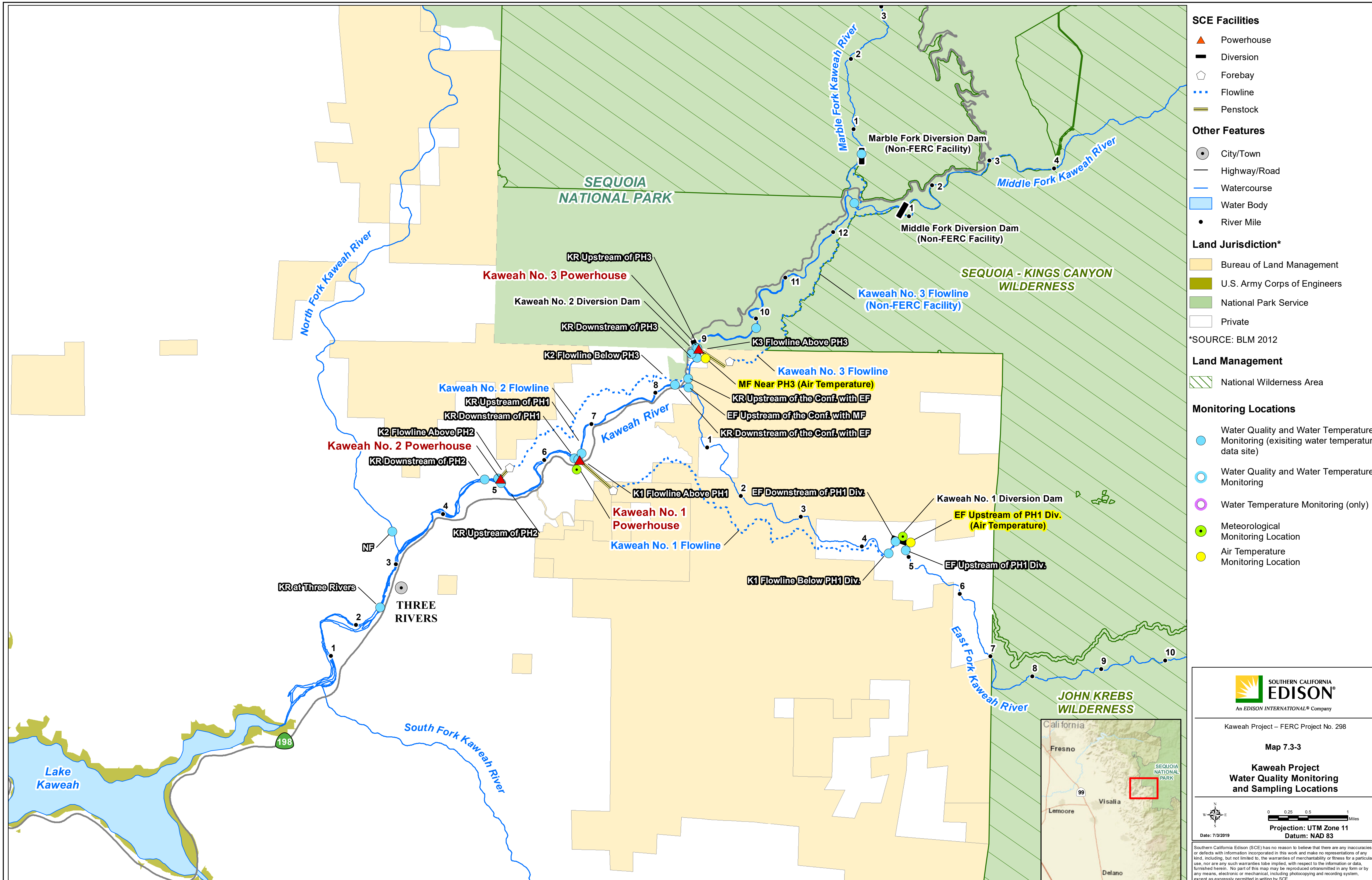
Date: 7/3/2019

**Projection: UTM Zone 11**
**Datum: NAD 83**



C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\SCE_Eastern_KAWEAH_WQ_SampleLocs_BelowK1_K2_17i11i_01.mxd

This Page Intentionally Left Blank




C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQTSPs_Locs_Monitoring_WQ_MET_17i11i_02.mxd

This Page Intentionally Left Blank

# APPENDIX 7.3-A

## Summary of Historical Water Quality Data

This Page Intentionally Left Blank

**Table 7.3-A1. USGS Water Quality Monitoring in the Vicinity of the Kaweah Project**

| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | General Parameters: Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Trace Elements: Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Bacteria: Total coliforms, M | Fecal coliforms, M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| ***Station 11208730 EF Kaweah R nr Three Rivers CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/25/1968 | 18 | 3.4 | 7.5 | 98 | 52 | 8.4 | 0 | 15 | 1 | 0.1 | 41 | 1 | 0.8 | 0.181 | 0 | | 1.1 | 12 | 3 | 5 | 65 | | | | 0 | 0 | | | |
| 8/2/1968 | 20.6 | 3.8 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 8/26/1968 | 27.2 | 0.4 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 8/26/1968 | 16 | 16 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 8/26/1968 | 16 | 16 | 7.7 | 111 | 60 | 8.9 | 1.2 | 17 | 0.7 | 0.1 | 48 | 1.2 | 0.2 | 0.045 | 0.03 | | 1.2 | 12 | 3.9 | 5 | 71 | | | | 60 | 10 | | 400 | |
| 9/30/1968 | 12.6 | 0.68 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 9/30/1968 | 15 | 10 | 7.5 | 121 | 66 | 9.9 | 0.01 | 18 | 1.3 | 0 | 50 | 1.3 | 0.7 | 0.158 | 0.07 | | 1.6 | 13 | 5 | 6 | 80 | | | | 0 | 0 | | 88 | |
| 10/31/1968 | 10 | 20 | 7.7 | 102 | 56 | 9 | | 14 | 1.5 | 0.1 | 40 | 1.3 | 0.3 | 0.068 | | | 1.1 | 15 | 4.7 | 3 | 69 | 2 | | | 0 | 10 | | 210 | |
| 12/11/1968 | 5 | 31 | | | | | | | | | | | | | | | | | | | | 9 | | | | | | | |
| 1/14/1969 | 6 | 88 | 7.3 | 58 | 32 | 12.2 | 0.01 | 7.3 | 0.6 | 0.2 | 20 | 0.5 | 0.1 | 0.023 | 0.07 | | 0.9 | 14 | 3.4 | 3 | 46 | 14 | | | 30 | 40 | | 14 | |
| 1/20/1969 | 6 | 433 | | | | | | | | | | | | | | | | | | | | 50 | | | | | | | |
| 5/1/1969 | 7 | 516 | | | | | | | | | | | | | | | | | | | | 24 | | | | | | | |
| 5/29/1969 | 10 | 1170 | 6.6 | 33 | 16 | 12.3 | 0 | 4.6 | 0.3 | 0 | 13 | 0.4 | 0.2 | 0.045 | 0.03 | | 0.6 | 7.7 | 1.3 | 2 | 25 | 83 | | | 40 | 20 | | | |
| 6/19/1969 | 12 | 745 | 6.8 | 35 | 17 | 11.5 | 0.03 | 4.5 | 0.5 | 0.1 | 12 | 0.4 | 0.1 | 0.023 | 0.04 | | 0.5 | 9.3 | 1.4 | 2 | 27 | 14 | | | 20 | 20 | | 14 | |
| 7/30/1969 | 18 | 266 | 6.5 | 46 | 24 | 10.2 | 0.04 | 6.5 | 0.4 | 0 | 18 | 0.5 | 0 | | 0 | | 0.6 | 9.1 | 1.2 | 1 | 31 | 2 | | | 0 | 30 | | 20 | |
| 8/26/1969 | 15 | 79 | 7.4 | 73 | 37 | 8.9 | 0.04 | 10 | 0.4 | 0 | 28 | 0.8 | 0.1 | 0.023 | 0.03 | | 0.8 | 13 | 2.6 | 3 | 49 | 2 | | | 0 | 10 | | 18 | |
| 10/15/1969 | 10 | 38 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 10/15/1969 | 8.5 | 38 | 7.8 | 90 | 48 | 11.9 | 0.03 | 12 | 1.3 | 0.1 | 34 | 1 | 0.1 | 0.023 | 0.07 | | 1 | 17 | 4 | 3 | 63 | | | | 0 | 20 | | | |
| 12/9/1969 | 3.5 | 28 | 7.5 | 93 | 47 | | 0 | 12 | 1.4 | 0.1 | 34 | 1.1 | 0.1 | 0.023 | 0.06 | | 1 | 18 | 4.9 | 3 | 65 | | | | 30 | 40 | | 17 | |
| 1/19/1970 | 6 | 181 | 6.9 | 54 | 28 | | 0.03 | 6.5 | 0.8 | 0.2 | 20 | 0.8 | 0.2 | 0.045 | 0.05 | | 0.9 | 15 | 3.2 | 2 | 43 | 6 | | | 0 | 40 | | 10 | |
| 3/10/1970 | 4 | 101 | 7.9 | 73 | 38 | 11.9 | 0 | 8.4 | 1.6 | 0 | 28 | 1.8 | 0 | | 0.08 | | 1 | 20 | 4.4 | 3 | 60 | 1 | | | 0 | 60 | | 14 | |
| 4/22/1970 | 3 | 104 | 7.5 | 67 | 34 | 12.7 | 0 | 9.4 | 0.6 | 0 | 26 | 0.7 | 0 | | 0.06 | | 0.7 | 14 | 3.1 | 2 | 48 | 3 | | | 0 | 10 | | 10 | |
| 5/18/1970 | 7 | 615 | | | | | | | | | | | | | | | | | | | | 19 | | | | | | | |
| 5/18/1970 | 9.5 | 532 | 6.6 | 38 | 18 | 10.5 | 0 | 5.8 | 0.4 | 0 | 16 | 0.3 | 0.2 | 0.045 | 0.06 | | 0.5 | 6.6 | 1.2 | 4 | 28 | | | | 70 | 0 | | 180 | |
| 7/1/1970 | 14 | 118 | 7.1 | 59 | 28 | | 0.04 | 8.7 | 0.4 | 0.2 | 24 | 0.5 | 0 | | 0.12 | | 0.6 | 8.7 | 2 | 3 | 38 | 1 | | | 0 | 40 | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 8/4/1970 | 19 | 33 | 7.1 | 91 | 46 | 8.7 | 0.04 | 13 | 0.7 | 0.2 | 36 | 0.9 | 0 | | 0.14 | | 1 | 12 | 3.2 | 4 | 58 | 2 | | | 80 | 0 | | | |
| 8/28/1970 | 19.5 | 21 | 7.2 | 111 | 59 | 9.2 | 0.04 | 16 | 1 | 0 | 45 | 1.2 | 0 | | 0 | | 1.1 | 13 | 4.5 | 3 | 69 | | | | 40 | 10 | | | |
| 8/28/1970 | 19.5 | 21 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 9/22/1970 | 14.5 | 15 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | 400 | |
| 9/22/1970 | 14 | 15 | 7.3 | 114 | 61 | 9.5 | 0.06 | 16 | 1.1 | 0.1 | 45 | 1.2 | 0.3 | 0.068 | 0.03 | | 1.3 | 12 | 4.5 | 5 | 71 | | | | 30 | 0 | | | |
| 11/2/1970 | 9 | 15 | 7.6 | 117 | 62 | 10.9 | 0 | 17 | 1.8 | 0.2 | 47 | 1.1 | 0 | 0 | 0.05 | | 1.2 | 16 | 5 | 4 | 77 | | | | 0 | 10 | | 88 | |
| 11/2/1970 | 9 | 16 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | 210 | |
| 12/14/1970 | 3 | 30 | 7.4 | 90 | 44 | 12.7 | 0.01 | 10 | 1.2 | 0.2 | 30 | 1.1 | 0.1 | 0.02 | 0.12 | | 1 | 17 | 4.4 | 3 | 60 | | | | 190 | 20 | | | |
| 12/14/1970 | 3 | 30 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | 14 | |
| 12/14/1970 | 3 | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12/18/1970 | 1.5 | 30 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 2/2/1971 | 4 | 53 | 7.4 | 79 | 40 | | 0.15 | 11 | 1 | 0.2 | 28 | | 0 | 0 | 0.01 | | 0.9 | 16 | 4.1 | 3 | 56 | 2 | | | 130 | 10 | | | |
| 3/17/1971 | 4 | 57 | 7.3 | 76 | 40 | 12 | 0.06 | 11 | 1.3 | 0 | 32 | 1 | 0 | | 0.03 | | 1.4 | 18 | 4.5 | 3.5 | 61 | | | | 130 | 30 | | 14 | |
| 3/17/1971 | 4 | 57 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 20 | |
| 5/3/1971 | 7 | 170 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 18 | |
| 5/4/1971 | 5.5 | 154 | 7.3 | 60 | 36 | 11.9 | 0.17 | 8.9 | 1.2 | 0 | 26 | 1 | | | 0 | | 0.7 | 13 | 2.5 | 2 | 48 | | | | 10 | 30 | | | |
| 6/22/1971 | 16 | 300 | 7.8 | | 27 | 9.6 | 0 | 6.1 | 2.5 | 0 | 17 | 0.4 | | | 0 | | 0.5 | 7.8 | 4.3 | 2.5 | 38 | | | | 10 | 60 | | | |
| 6/22/1971 | 16 | 300 | | | | | | | | | | | | | | | | | | | | 9 | | | | | | 17 | |
| 7/21/1971 | 18.5 | 65 | 8 | 70 | 44 | 8.5 | 0.1 | 11 | 0.4 | 0.2 | 30 | 0.7 | | | 0 | | 0.7 | 11 | 2.4 | 3 | 51 | | | | 0 | 10 | | 10 | |
| 7/21/1971 | 18.5 | 65 | | | | | | | | | | | | | | | | | | | | 5 | | | | | | 14 | |
| 9/22/1971 | 15.5 | 15 | 7.7 | 119 | 67 | 9.3 | 0.13 | 17 | 1.4 | 0.4 | 46 | 0.8 | | | 0.09 | | 1.2 | 14 | 4.5 | 3.5 | 76 | | | | 30 | 10 | | 10 | |
| 9/22/1971 | 14.5 | 15 | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | |
| ***Station 11209900 Kaweah R a Three Rivers CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11/4/1963 | | 81 | 7.8 | 121 | 63 | | | | 5.8 | | 47 | | | | | | | | 5.2 | | | | | | 0 | | | | |
| 8/10/1977 | 27 | 20 | 8 | 115 | | 8.4 | | | | | | | | | | | | | | | | | | | 0.57 | | | | |
| 9/27/1977 | 18 | 19 | 7.1 | 132 | | 9.5 | | | | | | | | | | | | | | | | | | | 0.54 | | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| ***Station 11208620 EF Kaweah R bl Mosquito C nr Hammond CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/26/1968 | 10 | 14 | 7.5 | 135 | 74 | 8.5 | 0.09 | 24 | 0.6 | 0.1 | 64 | 1.1 | 1 | 0.226 | 0.04 | | 0.5 | 7.3 | 1.6 | 7 | 79 | | | | 0 | 0 | | | |
| 8/2/1968 | 10 | 10 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 8/27/1968 | 12 | 9.6 | 7.7 | 152 | 80 | 7.9 | 0 | 27 | 0.8 | 0.1 | 73 | 1.3 | 0.1 | 0.023 | 0.01 | | 0.7 | 8.3 | 2.1 | 11 | 90 | 10 | | | 40 | 10 | | 24 | |
| 10/1/1968 | 7 | 4.4 | 7.8 | 182 | 104 | 9.8 | | 31 | 0.8 | 0.1 | 85 | 1.8 | 0.8 | 0.181 | | | 0.9 | 27 | 2.8 | 8 | 124 | 6 | | | 0 | 0 | | 4 | |
| 10/15/1968 | 8 | 8 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 10/29/1968 | 6 | 5.4 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 12/7/1968 | 2 | 7.4 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 1/18/1969 | 2 | 10 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 3/25/1969 | 4 | 17 | | | | | | | | | | | | | | | | | | | | 11 | | | | | | | |
| 4/22/1969 | 4 | 96 | | | | | | | | | | | | | | | | | | | | 24 | | | | | | | |
| 5/21/1969 | 5 | 280 | | | | | | | | | | | | | | | | | | | | 32 | | | | | | | |
| 6/18/1969 | 7 | 205 | | | | | | | | | | | | | | | | | | | | 9 | | | | | | | |
| 7/29/1969 | 10 | 116 | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | |
| 8/25/1969 | 15 | 41 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 10/14/1969 | 5 | 9.4 | 7.9 | 149 | 84 | 10.8 | 0.01 | 27 | 0.6 | 0.2 | 73 | 1.3 | 0 | | 0 | | 0.6 | 8.8 | 2 | 6 | 88 | 2 | | | 0 | 20 | | | |
| 12/8/1969 | 1 | 8.9 | 7.9 | 168 | 92 | | 0 | 30 | 0.8 | 0.1 | 82 | 1.6 | 0.1 | 0.023 | 0.04 | | 0.7 | 9.2 | 2.4 | 7 | 97 | 2 | | | 30 | 10 | | | |
| 1/20/1970 | 4 | 23 | 7.4 | 126 | 70 | | 0.09 | 22 | 0.5 | 0.2 | 60 | 1.2 | 0.5 | 0.113 | 0.02 | | 0.8 | 8 | 1.8 | 7 | 76 | 3 | | | 0 | 10 | | 5 | |
| 3/11/1970 | 2 | 12 | 7.7 | 145 | 78 | 10.3 | 0 | 25 | 1.2 | 0 | 68 | 1.3 | 0.1 | 0.023 | 0.06 | | 0.7 | 9.3 | 2.2 | 9 | 87 | 1 | | | 0 | 50 | | 2 | |
| 4/28/1970 | 1 | 31 | 7.9 | 123 | 68 | 10.9 | 0.01 | 22 | 0.4 | 0 | 59 | 1 | 0 | | 0.19 | | 0.5 | 7.9 | 1.8 | 5 | 72 | 2 | | | 0 | 10 | | 1 | |
| 5/20/1970 | 5 | 144 | 6.9 | 68 | 32 | 9.8 | 0 | 12 | 0.6 | 0 | 32 | 0.4 | 0.7 | 0.158 | 0.1 | | 0.4 | 5 | 1 | 5 | 41 | | | | 30 | 0 | | 2 | |
| 5/20/1970 | 5 | 140 | | | | | | | | | | | | | | | | | | | | 10 | | | | | | | |
| 6/30/1970 | 6 | 62 | 7.6 | 77 | 38 | | 0.04 | 13 | 0.4 | 0.2 | 35 | 0.6 | 0.2 | 0.045 | 0.07 | | 0.4 | 5 | 1.1 | 5 | 45 | | | | 0 | 20 | | 8 | 2 |
| 6/30/1970 | 6 | 60 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | | |
| 8/3/1970 | 13 | 18 | 7.2 | 124 | 65 | 8.6 | 0.01 | 21 | 0.3 | 0.2 | 56 | 1 | 0.1 | 0.023 | 0.01 | | 0.6 | 7.3 | 1.7 | 6 | 70 | 1 | | | 70 | 0 | | 56 | |
| 8/28/1970 | 12.5 | 9.9 | 7.4 | 150 | 83 | | | 26 | 0.6 | 0.1 | 70 | 1.3 | | | | | 0.7 | 9.6 | 2.2 | 5 | 87 | 1 | | | 90 | 10 | | | |
| 8/29/1970 | 12 | | | 150 | | | 0.01 | | | | | | 0.2 | 0.045 | 0 | | | | | | | | | | | | | 118 | 13 |

| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 8/29/1970 | 13 | | 8.3 | 152 | | | 0.22 | | | | | | 0.1 | 0.023 | 0 | | | | | | | | | | | | | 13 | 1 |
| 8/29/1970 | 14.5 | | 8 | 151 | | 7.8 | 0.18 | | | | | | 0 | | 0 | | | | | | | | | | | | | 111 | 3 |
| 8/30/1970 | 12.5 | | 8.3 | 154 | | 8.8 | 0 | | | | | | 0.2 | 0.045 | 0.12 | | | | | | | | | | | | | 107 | 10 |
| 8/30/1970 | 12.5 | | 8.3 | 152 | | 8.2 | 0 | | | | | | 0.1 | 0.023 | 0 | | | | | | | | | | | | | 50 | 1 |
| 8/30/1970 | 14.5 | | 8.3 | 156 | | 7.6 | 0 | | | | | | 0.8 | 0.181 | 0.17 | | | | | | | | | | | | | 73 | 1 |
| 8/31/1970 | 11.5 | | | 156 | | | 0 | | | | | | 0.2 | 0.045 | 1.3 | | | | | | | | | | | | | 98 | 9 |
| 8/31/1970 | 11.5 | | | 153 | | | 0 | | | | | | 0.2 | 0.045 | 0 | | | | | | | | | | | | | 121 | 3 |
| 9/21/1970 | 11 | 5.6 | 7.6 | 197 | 112 | 8.6 | 0 | 36 | 0.7 | 0.1 | 96 | 1.6 | 0.1 | 0.023 | 0.01 | | 0.8 | 7.5 | 2.4 | 8 | 112 | | | | 50 | 0 | | 140 | |
| 9/21/1970 | 11 | 5.6 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 11/2/1970 | 5.5 | 5.4 | 8 | 190 | 104 | 10.2 | 0.03 | 33 | 1 | 0 | 90 | 1.7 | 0.1 | 0.02 | 0.03 | | 0.8 | 9.7 | 2.8 | 8 | 108 | 0 | | | 0 | 0 | | 15 | |
| 12/29/1970 | 0.5 | 7.7 | 7.6 | 163 | 88 | 10.2 | 0 | 26 | 0.6 | 0.1 | 71 | 1.5 | 0.2 | 0.05 | 0.01 | | 0.7 | 8.7 | 2.5 | 8 | 91 | | | | 140 | 0 | | 6 | |
| 12/29/1970 | 0.5 | 7.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2/1/1971 | 4 | 13 | 7.7 | 141 | 72 | 11.2 | 0.13 | 25 | 0.8 | 0.1 | 62 | | 0.4 | 0.09 | 0.01 | | 0.6 | 8.2 | 2.6 | 7 | 79 | | | | 90 | 0 | | | |
| 2/1/1971 | 4 | 13 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 3/16/1971 | 5 | 22 | 7.6 | 133 | 68 | 9.7 | 0.15 | 25 | 0.7 | 0 | 68 | 1.4 | 0.885 | 0.2 | 0 | | 0.9 | 9.5 | 2.4 | 6.3 | 81 | | | | 0 | 20 | | 8 | |
| 3/16/1971 | 5.5 | 22 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 5/11/1971 | 7 | 43 | 8.3 | 116 | 70 | 9.6 | 0.17 | 20 | 0.9 | 0 | 56 | 1.5 | | | 0.03 | | 0.7 | 8.8 | 1.6 | 6 | 75 | | | | 0 | 20 | | 24 | |
| 5/11/1971 | 7 | 43 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 6/24/1971 | 8 | 86 | 7.8 | 65 | 31 | 9.6 | 0 | 11 | 2 | 0 | 30 | 0.5 | | | 0.03 | | 0.4 | 5.2 | 0.8 | 4.5 | 40 | | | | 10 | 10 | | | |
| 6/24/1971 | 8 | 86 | | | | | | | | | | | | | | | | | | | | 9 | | | | | | | |
| 7/7/1971 | 8 | | 7.2 | 85 | 39 | 9.1 | 0.08 | | | | 40 | | | | 0.03 | | | | | | | | | | | | | | |
| 8/9/1971 | 14.5 | | 6.7 | 135 | 58 | 8 | 0.14 | | | | 58 | | | | 0.15 | | | | | | | | | | | | | | |
| 9/7/1971 | 8 | | 7.1 | 130 | 76 | 9 | 0.01 | | | | 80 | | | | 0.06 | | | | | | | | | | | | | | |
| 9/21/1971 | 8 | 6.7 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 9/28/1971 | 4.5 | | 7.4 | 185 | 85 | 9.7 | 0.03 | | | | 90 | | | | 0.03 | | | | | | | | | | | | | | |
| 10/27/1971 | 5.5 | | 7 | 170 | 84 | 9.7 | | | | | 90 | | | | | | | | | | | | | | | | | | |
| 10/27/1971 | 5.5 | | | | | | 0.17 | | | | | | | | 0.15 | | | | | | | | | | | | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 1/5/1972 | 0 | | 7.4 | 175 | 80 | 11.2 | | | | | | | | | | | | | | | | | | | | | | | |
| 1/5/1972 | 0 | | | | | | 0.05 | | | | | | | | 0 | | | | | | | | | | | | | | |
| 3/1/1972 | 2 | | 7.4 | 150 | 72 | 11 | | | | | 72 | | | | | | | | | | | | | | | | | | |
| 3/1/1972 | 2 | | | | | | 0.1 | | | | | | | | 0.03 | | | | | | | | | | | | | | |
| 5/1/1972 | 7 | | 7.1 | 88 | 42 | 8.7 | | | | | 46 | | | | | | | | | | | | | | | | | | |
| 5/1/1972 | 7 | | | | | | 0.01 | | | | | | | | 0 | | | | | | | | | | | | | | |
| 6/21/1972 | 7.5 | 20 | 6.2 | 95 | 41 | 9.5 | | | | | 45 | | | | | | | | | | | | | | | | | | |
| 6/21/1972 | 7.5 | | 8.1 | 95 | 53 | | 0.13 | 16 | 0.4 | 0 | 43 | 0.8 | | | 0 | | 0.3 | 6 | 0.9 | 5.3 | 56 | | | | 20 | 30 | | | |
| 7/25/1972 | 15 | | 6.8 | 150 | 68 | 7.9 | | | | | 74 | | | | | | | | | | | | | | | | | | |
| 7/25/1972 | 15 | | | | | | 0.06 | | | | | | | | 0.03 | | | | | | | | | | | | | | |
| 9/6/1972 | 13 | | 8.2 | 125 | 64 | 8.6 | | | | | 62 | | | | | | | | | | | | | | | | | | |
| 9/6/1972 | 13 | | | | | | 1.7 | | | | | | | | 0.03 | | | | | | | | | | | | | | |
| 10/17/1972 | 7 | | 7.7 | 180 | 90 | 10 | | | | | 90 | | | | | | | | | | | | | | | | | | |
| 10/17/1972 | 7 | | | | | | 0.05 | | | | | | | | 0 | | | | | | | | | | | | | | |
| 5/8/1973 | 5 | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | |
| 6/19/1973 | | | | | | | | | | | | | | | 0 | | | | | | | | | | | | | | |
| 9/24/1973 | 10 | | | | | | | | | | | | | | 0.09 | | | | | | | | | | | | | | |
| ***Station 11208625 EF Kaweah R a Seq Natl P Bndry nr Hammond CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8/2/1968 | 14 | 10 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 8/27/1968 | 15 | 6.9 | 7.7 | 138 | 74 | 8.7 | 0 | 24 | 0.3 | 0.1 | 65 | 1.2 | 0.1 | 0.023 | 0 | | 0.7 | 9.5 | 2.4 | 7 | 81 | 1 | | | 40 | 10 | | 60 | |
| 10/1/1968 | 8 | 5.7 | 7.7 | 162 | 90 | 9.9 | 0 | 26 | 0.8 | 0.1 | 72 | 1.6 | 0.7 | 0.158 | 0.05 | | 1 | 11 | 3.3 | 7 | 96 | 2 | | | 20 | 0 | | 44 | |
| 10/29/1968 | 6 | 6.5 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 10/29/1968 | 6.2 | 6.4 | 7.9 | 169 | 98 | 10.7 | 0.02 | 30 | 0.8 | 0.1 | 82 | 1.6 | 0.3 | 0.068 | 0.08 | | 0.8 | 11 | 3.3 | 5 | 101 | | | | 0 | 0 | | 27 | |
| 3/26/1969 | 2 | 30 | | | | | | | | | | | | | | | | | | | | 14 | | | | | | | |
| 5/29/1969 | 9 | 528 | 6.8 | 49 | 23 | 11.4 | 0.05 | 8.2 | 0.3 | 0 | 22 | 0.4 | 0.4 | 0.09 | 0.03 | | 0.5 | 5.4 | 0.9 | 3 | 30 | 88 | | | 10 | 10 | | 1 | |
| 7/30/1969 | 10 | 155 | 6.5 | 56 | 28 | 10.8 | 0.04 | 9.1 | 0.2 | 0.1 | 24 | 0.5 | 0.1 | 0.023 | 0 | | 0.4 | 5.4 | 0.5 | 3 | 33 | 4 | | | 0 | 20 | | 7 | |
| 8/25/1969 | 13 | 39 | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 8/25/1969 | 13 | 40 | 7.5 | 85 | 44 | 9.9 | 0.04 | 14 | 0.2 | 0 | 38 | 0.8 | 0.1 | 0.023 | 0.04 | | 0.5 | 7.2 | 1.3 | 4 | 50 | | | | 0 | 0 | | 26 | |
| 10/15/1969 | 5 | 13 | 7.9 | 125 | 70 | 11.7 | 0.05 | 22 | 0.7 | 0.1 | 60 | 1.2 | 0.1 | 0.023 | 0.56 | | 0.7 | 10 | 2.3 | 5 | 76 | 2 | | | 0 | 20 | | | |
| 12/8/1969 | 1 | 9.2 | 7.6 | 138 | 74 | 12.5 | 0 | 23 | 0.8 | 0.1 | 64 | 1.4 | 0.1 | 0.023 | 0.05 | | 0.8 | 11 | 2.8 | 6 | 82 | 1 | | | 10 | 40 | | 2 | |
| 1/19/1970 | 3 | 39 | 7.1 | 86 | 43 | | | 14 | 1.8 | 0.2 | 38 | 0.9 | 0 | | | | 0.7 | 9.7 | 2 | 5 | 55 | 7 | | | 0 | 20 | | 7 | |
| 3/9/1970 | 2 | 22 | 7.5 | 112 | 62 | 11.1 | 0.18 | 19 | 1.2 | 0 | 52 | 1 | 0 | | 0.45 | | 0.8 | 11 | 2.4 | 6 | 73 | 1 | | | 0 | 40 | | 2 | |
| 4/21/1970 | 1 | 39 | 7.6 | 97 | 50 | | 0 | 16 | 0.4 | 0 | 44 | 0.8 | 0.3 | 0.068 | 0.02 | | 0.5 | 10 | 2 | 5 | 60 | 1 | | | 0 | 10 | | 1 | |
| 5/19/1970 | 8 | 232 | 6.8 | 57 | 26 | 10.2 | 0 | 9.9 | 0.3 | 0 | 26 | 0.4 | 0.5 | 0.113 | 0.05 | | 0.4 | 5.7 | 1 | 4 | 35 | 13 | | | 0 | 10 | | 3 | |
| 6/29/1970 | 11 | 69 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | | |
| 6/29/1970 | 11 | 67 | 7 | 69 | 34 | | 0.04 | 12 | 0.4 | 0.2 | 32 | 0.5 | 0.2 | 0.045 | 0.07 | | 0.4 | 6.2 | 1.2 | 4 | 42 | | | | 0 | 20 | | | |
| 8/4/1970 | 12 | 20 | 7.5 | 113 | 60 | | 0.01 | 19 | 0.4 | 0.1 | 52 | 1 | 0.2 | 0.045 | 0 | | 0.7 | 8.6 | 1.9 | 5 | 67 | 1 | | | 80 | 0 | | 74 | |
| 8/29/1970 | 12 | 12 | 7.1 | 135 | 74 | | 0.04 | 23 | 0.6 | 0.1 | 62 | 1.2 | 0 | | 0 | | 0.8 | 10 | 2.3 | 5 | 79 | 0 | | | 40 | 10 | | 22 | |
| 9/22/1970 | 8 | 7.2 | 7.9 | 147 | 82 | 10 | 0.03 | 25 | 0.7 | 0 | 68 | 1.4 | 0 | | 0.01 | | 0.8 | 8.3 | 2.7 | 6 | 85 | | | | 50 | 0 | | 100 | |
| 9/22/1970 | 8 | 9.2 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |
| 11/2/1970 | 5 | 7.4 | 7.8 | 164 | 88 | 10.9 | 0.06 | 28 | 1 | 0.2 | 76 | 1.5 | 0.1 | 0.02 | 0.03 | | 0.8 | 11 | 3 | 7 | 96 | 0 | | | 0 | 0 | | 13 | |
| 12/15/1970 | 1 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12/15/1970 | 1 | 12 | 7.5 | 136 | 72 | 12.2 | 0.04 | 21 | 0.6 | 0.1 | 58 | 1.3 | 0.3 | 0.07 | 0.01 | | 0.7 | 11 | 2.5 | 7 | 79 | | | | 120 | 20 | | 25 | |
| 12/15/1970 | 1 | 12 | | | | | | | | | | | | | | | | | | | | 0 | | | | | | | |
| 2/2/1971 | 2 | 22 | 7.5 | 109 | 56 | 13.1 | 0.13 | 19 | 0.8 | 0.2 | 48 | | 0.3 | 0.07 | 0.01 | | 0.8 | 10 | 2.6 | 5 | 66 | | | | 110 | 10 | | | |
| 2/2/1971 | 2 | 22 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 4/2/1971 | 3 | 45 | 7.8 | 100 | 56 | 11.9 | 0.1 | 17 | 0.8 | 0 | 46 | 0.9 | 0.885 | 0.2 | 0 | | 0.9 | 10 | 2.2 | 4.3 | 65 | 2 | | | 10 | 20 | | 2 | |
| 5/12/1971 | 5 | 60 | 7.7 | 90 | 51 | 10.9 | 0.23 | 15 | 1 | 0 | 42 | 1.2 | | | 0 | | 0.6 | 10 | 1.6 | 3.8 | 59 | 1 | | | 10 | 20 | | 16 | |
| 6/24/1971 | 14 | 118 | 8 | 60 | 31 | 9.3 | 0 | 9.3 | 1.5 | 0 | 26 | 0.7 | | | 0 | | 0.4 | 6 | 1 | 5.8 | 40 | | | | 0 | 20 | | 0 | |
| 6/24/1971 | 14 | 118 | | | | | | | | | | | | | | | | | | | | 8 | | | | | | | |
| 7/20/1971 | 13.5 | 36 | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | |
| 7/20/1971 | 13.5 | 36 | 8.4 | 84 | 53 | 8.9 | 0.06 | 14 | 0.9 | 0.3 | 38 | 0.7 | | | 0.03 | | 0.1 | 7.9 | 1.4 | 1.3 | 53 | | | | 10 | 10 | | 180 | |
| 9/21/1971 | 9 | 8.4 | 7.8 | 152 | 89 | 9.6 | 0.17 | 26 | 1.1 | 0.3 | 69 | 1 | | | 0.09 | | 0.7 | 11 | 2.7 | 5.5 | 93 | | | | 30 | 10 | | 4300 | |
| 9/21/1971 | 9 | 8.4 | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| Applicable Water Quality Objective or Standard | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| ***Station 11209500 NF Kaweah R a Kaweah CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6/12/1980 | 12.8 | | 7.2 | 46 | | 9.9 | | 6.2 | 0.5 | 0 | 19 | 0.9 | | | | 0.011 | 0.7 | 13 | 2.4 | 0.2 | 39 | | | | 0 | 30 | M | | |
| 7/10/1980 | 17 | | 7.6 | 89 | | 9 | | 13 | 1 | 0.2 | 39 | 1.7 | | | | 0.005 | 1 | 19 | 4 | 1.1 | 66 | | | | | 50 | M | | |
| 8/6/1980 | 23.5 | 37 | 8 | 121 | | 7.6 | | 16 | 1.5 | 0.2 | 49 | 2.1 | | | | 0.014 | 1.2 | 21 | 4.8 | 1.1 | 85 | | | | | 20 | M | | |
| 9/10/1980 | 23 | 27 | 8.1 | 157 | | 7.7 | | 19 | 3.4 | 0.1 | 58 | 2.5 | | | | 0.002 | 1.5 | 21 | 5.2 | 7.3 | 95 | | | | | 10 | M | | |
| 10/8/1980 | 20.9 | 14 | 8.1 | 151 | | 8.2 | | 22 | 2.8 | 0.1 | 68 | 3.1 | | | | 0.007 | 1.9 | 21 | 5.8 | 2.6 | 108 | | | | | 80 | M | | |
| ***Station 11206500 MF Kaweah R nr Potwish Camp (river flow only) CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6/12/1980 | 11.5 | 700 | 7.3 | 18 | | 10.6 | | 2.1 | 0.3 | 0 | 7 | 0.4 | | | | 0.01 | 0.4 | 6.2 | 1 | 0.5 | 16 | | | | M | 10 | M | | |
| 7/10/1980 | 12.5 | 435 | 7.3 | 19 | | 10 | | 2.1 | 0.2 | 0.1 | 7 | 0.4 | | | | 0.003 | 0.4 | 6.1 | 1.3 | 1.4 | 18 | | | | | 20 | M | | |
| 8/6/1980 | 17.5 | 155 | 7.1 | 23 | | 9 | | 2.4 | 0.3 | 0.3 | 7 | 0.3 | | | | 0.01 | 0.5 | 6.4 | 1.3 | 0.3 | 17 | | | | | < 10 | M | | |
| 9/11/1980 | 14 | 6.6 | 7 | 48 | | 8.9 | | 4.8 | 0.9 | 0.1 | 14 | 0.6 | | | | 0.001 | 1.1 | 12 | 2.7 | 6.1 | 38 | | | | | < 10 | M | | |
| 10/8/1980 | 13.6 | 28 | 7.1 | 60 | | 9.3 | | 6.4 | 1.5 | 0.1 | 20 | 1 | | | | 0 | 1.2 | 14 | 3.8 | 0.8 | 47 | | | | | 10 | M | | |
| ***Station 11206820 Marble Fork Kaweah R ab Horse C nr Lodgepole CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12/20/2012 | | | 6.9 | | | | | 1.17 | 0.35 | | 3.34 | 0.099 | | | | | 0.234 | 4.53 | 0.83 | 0.62 | 10 | | 1.33 | 3 | | | | | |
| 1/17/2013 | 1.7 | | 6.9 | | | | | 0.988 | 0.21 | | 2.81 | 0.084 | | | | | 0.194 | 4.43 | 0.86 | 0.58 | 9 | | 0.95 | 3 | | | | | |
| 2/14/2013 | 1.5 | | 6.8 | | | | | 0.926 | 0.15 | | 2.65 | 0.081 | | | | | 0.195 | 4.5 | 0.7 | 0.57 | 9 | | 1.05 | 3 | | | | | |
| 3/13/2013 | | | 6.8 | | | | | 0.772 | 0.11 | | 2.19 | 0.063 | | | | | 0.179 | 4.2 | 0.51 | 0.42 | 8 | | 1.45 | 2.7 | | | | | |
| 4/3/2013 | 5 | | 6.8 | | | | | 0.753 | 0.09 | | 2.14 | 0.063 | | | | | 0.167 | 3.89 | 0.54 | 0.34 | 8 | | 1.26 | 2.5 | | | | | |
| 4/18/2013 | 2 | | 6.7 | | | | | 0.698 | 0.08 | | 1.99 | 0.061 | | | | | 0.156 | 3.6 | 0.46 | 0.33 | 7 | | 1.23 | 2.4 | | | | | |
| 5/2/2013 | 9 | | 6.5 | | | | | 0.579 | 0.06 | | 1.66 | 0.051 | | | | | 0.14 | 2.74 | 0.37 | 0.25 | 6 | | 1.04 | 1.8 | | | | | |
| 5/9/2013 | 6 | | 6.6 | | | | | 0.666 | 0.08 | | 1.91 | 0.059 | | | | | 0.147 | 3.23 | 0.46 | 0.26 | 6 | | 1.28 | 2.3 | | | | | |
| 5/16/2013 | 3 | | 6.6 | | | | | 0.531 | 0.06 | | 1.52 | 0.048 | | | | | 0.124 | 2.55 | 0.36 | 0.24 | 5 | | 0.92 | 1.9 | | | | | |
| 5/22/2013 | | | 6.6 | | | | | 0.564 | 0.05 | | 1.61 | 0.05 | | | | | 0.124 | 2.72 | 0.35 | 0.23 | 5 | | 0.82 | 2 | | | | | |
| 6/6/2013 | 11 | | 6.6 | | | | | 0.647 | 0.04 | | 1.84 | 0.054 | | | | | 0.138 | 2.73 | 0.38 | 0.27 | 6 | | 0.69 | 2.5 | | | | | |
| 6/20/2013 | 12 | | 6.8 | | | | | 1.3 | 0.06 | | 3.81 | 0.139 | | | | | 0.186 | 3.76 | 0.68 | 0.39 | 9 | | 0.69 | 3.6 | | | | | |
| 7/11/2013 | | | 6.7 | | | | | 1.57 | 0.14 | | 4.45 | 0.13 | | | | | 0.277 | 5.27 | 1.04 | 0.49 | 13 | | 0.53 | 6 | | | | | |

| | | | | | | | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 7/29/2013 | 14.5 | | 7.1 | | | | | 1.83 | 0.17 | | 5.17 | 0.149 | | | | | 0.358 | 5.96 | 1.16 | 0.67 | 15 | | 0.59 | 6.9 | | | | | |
| 8/22/2013 | 12 | | 7.3 | | | | | 2.35 | 0.21 | | 6.64 | 0.19 | | | | | 0.454 | 6.88 | 1.7 | 0.84 | 18 | | 0.53 | 8.7 | | | | | |
| 9/10/2013 | 11 | | 7.2 | | | | | 2.29 | 0.2 | | 6.45 | 0.18 | | | | | 0.443 | 7.26 | 1.63 | 0.91 | 19 | | 0.58 | 9.3 | | | | | |
| 10/22/2013 | 4 | | 7.1 | | | | | 2.17 | 0.34 | | 6.12 | 0.174 | | | | | 0.449 | 6.66 | 1.58 | 0.87 | 18 | | 0.62 | 8.5 | | | | | |
| 11/19/2013 | 3 | | 6.9 | | | | | 2.23 | 0.48 | | 6.31 | 0.18 | | | | | 0.409 | 6.07 | 1.52 | 0.88 | 17 | | 0.23 | 7.4 | | | | | |
| 12/17/2013 | 5 | | 6.8 | | | | | 1.95 | 0.57 | | 5.52 | 0.158 | | | | | 0.376 | 5.14 | 1.3 | 0.89 | 16 | | 0.49 | 5.6 | | | | | |
| 1/16/2014 | | | 6.8 | | | | | 1.94 | 0.38 | | 5.51 | 0.162 | | | | | 0.329 | 6.02 | 1.45 | 0.91 | 16 | | 0.37 | 6.9 | | | | | |
| 2/11/2014 | 1 | | 6.5 | | | | | 1.18 | 0.32 | | 3.35 | 0.096 | | | | | 0.224 | 4.93 | 1.03 | 0.94 | 11 | | 1.3 | 2.6 | | | | | |
| 3/11/2014 | 8 | | 6.9 | | | | | 1 | 0.23 | | 2.82 | 0.077 | | | | | 0.23 | 5.02 | 0.81 | 0.61 | 10 | | 1.68 | 2.7 | | | | | |
| 4/1/2014 | 0 | | 6.1 | | | | | 0.782 | 0.16 | | 2.22 | 0.065 | | | | | 0.168 | 4.14 | 0.65 | 0.49 | 8 | | 1.41 | 2.5 | | | | | |
| 4/15/2014 | 6 | | 6.4 | | | | | 0.64 | 0.13 | | 1.8 | 0.049 | | | | | 0.175 | 3.46 | 0.48 | 0.37 | 7 | | 1.6 | 2 | | | | | |
| 5/1/2014 | 9 | | 6.6 | | | | | 0.576 | 0.09 | | 1.64 | 0.05 | | | | | 0.161 | 3.31 | 0.44 | 0.31 | 6 | | 1.39 | 2 | | | | | |
| 5/7/2014 | 5 | | 6.2 | | | | | 0.566 | 0.1 | | 1.62 | 0.051 | | | | | 0.136 | 3.06 | 0.4 | 0.3 | 6 | | 1.34 | 2 | | | | | |
| 5/13/2014 | 9 | | 6.3 | | | | | 0.531 | 0.12 | | 1.51 | 0.045 | | | | | 0.133 | 2.87 | 0.36 | 0.29 | 5 | | 1.31 | 1.6 | | | | | |
| 5/22/2014 | | | 6.8 | | | | | 0.562 | 0.1 | | 1.61 | 0.049 | | | | | 0.131 | 2.78 | 0.38 | 0.27 | 6 | | 1.61 | 2.2 | | | | | |
| 6/3/2014 | 9 | | 6.3 | | | | | 0.604 | 0.1 | | 1.71 | 0.049 | | | | | 0.136 | 2.54 | 0.37 | 0.26 | 5 | | 1.02 | 2.1 | | | | | |
| 6/23/2014 | 12 | | 6.4 | | | | | 1 | 0.13 | | 2.81 | 0.075 | | | | | 0.178 | 4.02 | 0.69 | 0.41 | 9 | | 0.52 | 3.7 | | | | | |
| 7/17/2014 | 15.5 | | 7.1 | | | | | 1.59 | 0.15 | | 4.47 | 0.123 | | | | | 0.314 | 5.25 | 1.06 | 0.66 | 13 | | 0.44 | 6.3 | | | | | |
| 7/29/2014 | 10 | | 6.9 | | | | | 1.86 | 0.19 | | 5.24 | 0.146 | | | | | 0.369 | 5.7 | 1.25 | 0.71 | 15 | | 0.46 | 7.1 | | | | | |
| 8/20/2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8/21/2014 | 12 | | 7.1 | | | | | 2.1 | 0.24 | | 5.92 | 0.164 | | | | | 0.36 | 5.37 | 1.43 | 0.74 | 15 | | 0.6 | 7.6 | | | | | |
| 9/10/2014 | 10 | | 7.1 | | | | | 2.41 | 0.27 | | 6.83 | 0.198 | | | | | 0.461 | 7.18 | 1.84 | 1 | 18 | | 0.63 | 7.2 | | | | | |
| 10/14/2014 | 7 | | | | | | | 2.36 | 0.33 | | 6.71 | 0.199 | | | | | 0.469 | 7.21 | 1.76 | 1.02 | | | 0.23 | | | | | | |
| 11/13/2014 | 6 | | | | | | | 1.7 | 0.45 | | 4.78 | 0.131 | | | | | 0.313 | 5.07 | 1.11 | 0.69 | | | 1.39 | | | | | | |
| 12/13/2014 | 0.5 | | | | | | | 1.05 | 0.41 | | 2.96 | 0.083 | | | | | 0.206 | 4.58 | 0.84 | 0.66 | | | 1.5 | | | | | | |
| 1/13/2015 | 1 | | | | | | | 1.08 | 0.24 | | 3.06 | 0.088 | | | | | 0.198 | 5.1 | 0.87 | 0.62 | | | 0.93 | | | | | | |
| 2/17/2015 | | | | | | | | | | | | | | | | | | | | | | | 1.52 | | | | | | |

| Sample Date | Temperature (deg C) | Discharge, cubic feet per second | pH, water, unfiltered, field, standard units | Specific conductance, water, unfiltered, microsiemens per | Bicarbonate, water, unfiltered, fixed endpoint (pH 4.5) titration, field, | Dissolved oxygen, water, unfiltered, milligrams per liter | General Parameters | | | | | | | | | | | | | | | | | | Trace Elements | | | Bacteria | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ammonia, water, filtered, milligrams per liter as NH4 | Calcium, water, filtered, milligrams per liter | Chloride, water, filtered, milligrams per liter | Fluoride, water, filtered, milligrams per liter | Hardness, water, milligrams per liter as calcium carbonate | Magnesium, water, filtered, milligrams per liter | Nitrate, water, filtered, milligrams per liter | Nitrite, water, filtered, milligrams per liter as nitrogen | Orthophosphate, water, filtered, milligrams per liter | Phosphorus, water, filtered, milligrams per liter as phosphorus | Potassium, water, filtered, milligrams per liter | Silica, water, filtered, milligrams per liter as SiO2 | Sodium, water, filtered, milligrams per liter | Sulfate, water, filtered, milligrams per liter | Dissolved solids, water, filtered, sum of constituents, milligrams per liter | Suspended sediment concentration, milligrams per liter | Organic carbon, water, filtered, milligrams per liter | Alkalinity, water, filtered, inflection, milligrams per liter as calcium carbonate | Boron, water, filtered, micrograms per liter | Iron, water, filtered, micrograms per liter | Manganese, water, filtered, micrograms per liter | Total coliforms, M | Fecal coliforms, M |
| **Applicable Water Quality Objective or Standard** | NS | NS | 6.5-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 1.5 | NS | 250 | 2 | NS | NS | 45 | 1 | NS | NS | NS | NS | NS | 250 | 500 | NS | NS | >20 | NS | 300 | 50 | NS | 200 |
| 3/17/2015 | 5 | | | | | | | 0.76 | 0.11 | | 2.14 | 0.059 | | | | | 0.153 | 3.93 | 0.72 | 0.35 | | | | | | | | | |
| 3/31/2015 | 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6/12/1980 | 10 | 445 | 7.2 | 15 | | 10.8 | | 2 | 0.7 | 0 | 7 | 0.4 | | | | 0.006 | 0.4 | 6.3 | 1.1 | 1 | 17 | | | | M | 20 | | | |
| ***Station 11208000 Marble F Kaweah R (R only) a Potwisha Camp CA*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7/10/1980 | 10.5 | 243 | 7.1 | 19 | | 10.1 | | 1.9 | 0.1 | 0.1 | 6 | 0.4 | | | | 0 | 0.3 | 5.7 | 1 | 0.9 | 16 | | | | | 20 | M | | |
| 8/6/1980 | 17 | 65 | 7.2 | 30 | | 8.6 | | 3.2 | 0.5 | 0.2 | 10 | 0.6 | | | | 0.01 | 0.4 | 6.6 | 1.1 | 2 | 20 | | | | | 10 | M | | |
| 9/10/1980 | 15 | 1.6 | 7.5 | 68 | | 9.1 | | 8.6 | 0.6 | 0.1 | 28 | 1.7 | | | | 0.001 | 1 | 14 | 2.4 | 3.3 | 47 | | | | | < 10 | M | | |
| 10/8/1980 | 15.2 | | 7.6 | 109 | | 9.3 | | 13 | 0.7 | 0 | 44 | 2.8 | | | | 0 | 1.2 | 17 | 3.2 | 0.8 | 71 | | | | | < 10 | M | | |

Measurements that exceed the applicable water quality objective or standard are highlighted in green.

This Page Intentionally Left Blank

**Table 7.3-A2. Water Quality Data Collected by the California Environmental Data Exchange Network (CEDEN) in the Vicinity of the Kaweah Project.**

| Station ID | Activity Start | Temperature, deg C | pH | Specific Conductance, uS/cm | Dissolved Oxygen, µg/l | General Parameters | | | Bacteria | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Ammonia as N, mg/l | Kjeldahl nitrogen, mg/L | Secchi Depth, m | E. coli, MPN/100ml | Fecal Coliform, MPN/100 ml | Total Coliform, MPN/100 ml |
| **Applicable Water Quality Objective or Standard** | | **NS** | **6.5-8.5** | **NS** | **Meet or exceed 5.0 for WARM; 7.0 for COLD** | **1.5** | **NS** | **NS** | **NS** | **100** | **NS** |
| **Kaweah River - Ash Mountain** | | | | | | | | | | | |
| 245006 | 4/16/2002 13:47 | 7.8 | | | | | | | 2 | 2 | 110 |
| 245006 | 6/11/2002 11:30 | 13.4 | 8.3 | 21.5 | 10.65 | | | | 8 | | 50 |
| 245006 | 9/9/2002 12:50 | 20.3 | 8.3 | 91.7 | 9.09 | 0.0234 | | | | | |
| 245006 | 12/17/2002 11:25 | 5.8 | 8.6 | 38.7 | 10.2 | ND | 0.17 | | | | |
| 245006 | 3/25/2003 12:00 | 9.6 | 8 | 43.3 | 11.28 | 0.0044 | 0.12 | | | | |
| **Kaweah River - Dinely Rd.** | | | | | | | | | | | |
| 245619 | 4/16/2002 13:19 | 8.3 | 7.8 | 35.9 | 11.4 | | | | 30 | 2 | |
| 245619 | 6/11/2002 12:00 | 15.2 | 8.3 | 31.5 | 10.6 | | | | 4 | 4 | 50 |
| 245619 | 9/9/2002 12:15 | 19.8 | 8.3 | 107.4 | 8.56 | 0.0052 | 0.15 | | | | |
| 245619 | 12/17/2002 12:00 | 7.5 | 8.6 | 46 | 10.09 | 0.0053 | 0.37 | | | | |
| 245619 | 3/25/2003 12:21 | 30 | 8.2 | 53 | 11.1 | 0.0096 | 0.11 | | | | |
| **Kaweah River - North Fork** | | | | | | | | | | | |
| 247159 | 4/16/2002 12:54 | 9.1 | 8 | 38 | 11.54 | | | | 23 | 23 | 70 |
| 247159 | 6/11/2002 12:25 | 16.2 | | 34.7 | 10.52 | | | | 4 | 4 | 22 |
| 247159 | 9/9/2002 11:50 | 20.6 | 8.3 | 112.1 | 9.25 | 0.0041 | 0.14 | | 4 | 13 | 30 |
| 247159 | 12/17/2002 13:00 | | | | | 0.011 | 0.3 | | | | |
| 247159 | 12/17/2002 13:00 | 12.9 | 8.3 | 58.7 | 10.7 | 0.0216 | 0.12 | | 13 | 50 | 80 |

NS: No standard; ND: no detection

Measurements that exceed the applicable water quality objective or standard are highlighted in green.

**Table 7.3-A3. Water Quality Data Collected by the Department of Water Resources in the Vicinity of the Kaweah Project.**

| Station ID | Activity Start | General Parameters | | |
|---|---|---|---|---|
| | | pH | Temperature, water, deg C | Specific conductance, µS/cm |
| Applicable Water Quality Objective or Standard | | 6.8-8.5 | NS | NS |
| **KAWEAH R A THREE RIVERS** | | | | |
| C2125000 | 5/6/1998 14:45 | 7.2 | 10 | 62 |
| C2125000 | 5/14/2003 10:30 | 7.3 | 12 | 47 |
| C2125000 | 10/22/2003 10:15 | 7.9 | 17 | 135 |
| **KAWEAH R AB LK KAWEAH** | | | | |
| C2121030 | 5/6/1998 12:00 | 7.5 | 18 | 105 |
| C2121030 | 5/14/2003 12:00 | 7.2 | 14 | 59 |
| C2121030 | 10/22/2003 14:15 | 8.1 | 20 | 143 |
| **KAWEAH R MF BL NO 2 IT NR THREE R** | | | | |
| C2314700 | 5/6/1998 14:00 | 7 | 10 | 53 |
| C2314700 | 5/13/2003 15:30 | 7.3 | 13 | 45 |
| C2314700 | 10/22/2003 8:15 | 7.5 | 16 | 117 |
| **KAWEAH R SF AB GROUSE C** | | | | |
| C2420150 | 5/6/1998 13:15 | 7.2 | 10 | 66 |
| C2420150 | 5/14/2003 9:00 | 7.3 | 9 | 52 |
| C2420150 | 10/22/2003 11:30 | 7.9 | 16 | 180 |
| **KAWEAH R,NF,NR MOUTH** | | | | |
| C2201030 | 5/6/1998 15:30 | 7.7 | 0.1 | 84 |
| C2201030 | 5/13/2003 16:30 | 7.6 | 16 | 71 |
| C2201030 | 10/22/2003 9:30 | 7.6 | 16 | 193 |

NS: No standard

Measurements that exceed the applicable water quality objective or standard are highlighted in green.

**Table 7.3-A4. Water Quality Data Collected by the National Park Service Water Resources Division in the Vicinity of the Kaweah Project and in the Kaweah Watershed.**

| | | | | | | | | General Parameters | | | | | | | | | | | | | | | | Trace Elements | | | | | | | | | | | | | | Bacteria | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station ID | Visit Start | Temperature, air,deg C | Temperature, water,deg C | pH | Specific conductance,umho/cm | Bicarbonate,mg/l | Dissolved oxygen (DO),mg/l | Ammonia as NH3 | Calcium,mg/l | Carbonate,mg/l | Chloride,mg/l | Fluoride,mg/l | Hardness, Ca + Mg,mg/l | Kjeldahl nitrogen,mg/l | Magnesium,mg/l | Nitrite as N,mg/l | Orthophosphate as PO4,mg/l | Potassium,mg/l | Silica,mg/l | Sodium,mg/l | Sulfur, sulfate (SO4) as SO4,mg/l | Turbidity,FTU | Alkalinity, Total (total hydroxide+carbonate+bicarbonate),mg/l | Aluminum,ug/l | Antimony,ug/l | Arsenic,ug/l | Beryllium,ug/l | Cadmium,ug/l | Chromium,ug/l | Copper,ug/l | Iron, mg/l | Lead,ug/l | Manganese,ug/l | Mercury,ug/l | Nickel,ug/l | Thallium,ug/l | Zinc,ug/l | Fecal Coliform,cfu/100ml | Fecal Streptococcus Group Bacteria,cfu/100ml | Total Coliform,cfu/100ml |
| Applicable Water Quality Objective or Standard | | NS | NS | 6.8-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 0.025 | NS | >20 | 250 | 2 | NS | NS | NS | 1 | NS | NS | NS | NS | 250 | Narr | >20 | 0.2 | 5.6 | 10 | 4 | 5 | 50 | 1 | 0.3 | 15 | 50 | 0.05 | 100 | 0.24 | 5 | 100 | NS | NS |
| **EAST FORK AT ATWELL TRAIL CROSSING** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 6/29/1981 0:00 | 22.6 | 13.9 | | 73 | | | | 38 | | ND | | 36 | | 0.84 | | ND | 0.52 | 8 | 1.44 | ND | ND | 38 | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 7/27/1981 0:00 | 27.7 | 15.2 | 8.13 | 92 | | | | 53.5 | | ND | | 57 | | 1.3 | | | 0.7 | | 2.15 | 4 | ND | 58 | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 8/11/1981 0:00 | 27 | 18.5 | 8.28 | 125 | | | | 72 | | ND | | 65 | | 1.52 | | 0.025 | 0.83 | 9.45 | 2.42 | 5 | ND | 67 | | | | | | | | 0.006 | | | | | | | | | |
| SEQU_HW_014 | 8/19/1981 0:00 | | | | 69 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 5/19/1982 12:00 | 13.5 | 4.9 | 8.4 | 43 | | | | 27 | | ND | | | | | | ND | | 8.6 | | 1 | 1 | 29 | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 6/26/1982 0:00 | 18.9 | 12.6 | 8.59 | 40 | | | | 18 | | 0.5 | | | | | | 0.008 | | | | ND | 1.2 | 31 | | | | | | | | | | | | | | | | | |
| SEQU_HW_014 | 7/20/1982 12:00 | 16.8 | 10.1 | 8.3 | 43 | | | | | | | | | | | | 0.013 | | | | | 0.62 | 20 | | | | | | | | | | | | | | | | 3 | 1 |
| SEQU_HW_014 | 8/19/1982 0:00 | | 10.9 | | 69 | | | | | | | | | | | | 0.017 | | | | | 1.15 | 40 | | | | | | | | | | | | | | | 40 | 6 | 0 |
| SEQU_HW_014 | 8/18/1983 12:00 | | 10 | | 41 | | | | | | | | | | | | 0.01 | | | | | 2.6 | | | | | | | | | | | | | | | | 50 | 0 | |
| SEQU_HW_014 | 10/11/1983 0:00 | | 5 | | 72 | | | | | | | | | | | | 0.017 | | | | | 0.72 | | | | | | | | | | | | | | | | 2 | 0 | |
| **EAST FORK AT KAWEAH HAN** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_095 | 6/28/1983 0:00 | | 7.8 | | 35 | | | | | | | | | | | | 0.008 | | | | | | 10.08 | | | | | | | | | | | | | | | 2 | 6 | |
| **EAST FORK KAWEAH AT BOUNDARY** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_015 | 6/29/1981 0:00 | 26.8 | 16.1 | 8.15 | 60 | | | | 25 | | ND | | 27 | | 0.77 | | ND | 0.65 | 10 | 2.24 | | ND | 32 | | | | | | | | | | | | | | | | | |
| SEQU_HW_015 | 7/27/1981 0:00 | 28.5 | | 8.14 | 92 | | | | 31 | | ND | | 37 | | 1.17 | | ND | 0.97 | | 3.18 | 1 | ND | 45.5 | | | | | | | | | | | | | | | | | |
| SEQU_HW_015 | 8/26/1981 0:00 | 23.9 | 18.3 | 8.21 | 108 | | | | 48 | | 0.5 | | | | 1.49 | | 0.017 | 1.13 | 16.4 | 3.63 | 1 | ND | 54.5 | | | | | | | | 0.018 | | | | | | | | | |
| SEQU_HW_015 | 5/19/1982 0:00 | 17.8 | 7.6 | 8.2 | 30 | | | | 19 | | ND | | | | | | ND | | | | 1 | 1 | 20 | | | | | | | | | | | | | | | | | |
| SEQU_HW_015 | 8/19/1982 0:00 | 14 | 14 | | 63 | | | | | | | | | | | | 0.023 | | | | | 0.52 | 34 | | | | | | | | | | | | | | | 170 | 27 | 0 |
| SEQU_HW_015 | 9/12/1985 0:00 | | 7 | 10.2 | 82 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_015 | 3/17/1987 0:00 | | 2.1 | | 50 | | | | | | | | | | | | ND | | | | | | 14.66 | | | | | | | | | | | | | | | 10 | | |
| SEQU_HW_015 | 5/27/1987 0:00 | | 8 | 7.9 | 47 | | | | 3.27 | | 0.845 | ND | | | 0.273 | | 0.021 | 0.5 | | 1.764 | 0.84 | | 8.88 | | | | | 0.2 | ND | ND | | 3 | | ND | | | | 1 | 16 | |
| SEQU_HW_015 | 7/15/1987 0:00 | | 16.8 | 8.23 | 73 | | | | | | | | | | | | 0.014 | | | | | | 15 | | | | | | | | | | | | | | | 14 | 23 | |
| SEQU_HW_015 | 8/17/1987 0:00 | | 15.4 | 8.29 | 99.5 | | | | 13.89 | | 1.089 | ND | | | 1.083 | | 0.03 | 1.2 | | 5.53 | 3.632 | | 21.04 | | | | | ND | ND | ND | | ND | | ND | | | | 24 | 42 | |
| SEQU_HW_015 | 10/29/1987 0:00 | | 11.6 | 8.1 | 93 | | | | | | | | | | | | 0.018 | | | | | | 19.24 | | | | | ND | ND | ND | | ND | | ND | | | | 20 | 1254 | |
| SEQU_HW_015 | 6/28/1988 0:00 | 15.4 | | 8.06 | 74 | | | | | | | | | | | | 0.017 | | | | | 0.4 | 11.7 | | | | | | | | | | | | | | | 5 | 121 | |
| SEQU_HW_015 | 7/25/1988 0:00 | 24.9 | | 8.41 | 97 | | | | | | | | | | | | 0.035 | | | | | 0.2 | 15.84 | | | | | | | | | | | | | | | 606 | 90 | |
| SEQU_HW_015 | 8/23/1988 0:00 | 17.9 | | 8.46 | 127 | | | | | | | | | | | | 0.017 | | | | | 0.2 | 20.2 | | | | | | | | | | | | | | | 18 | 55 | |
| **EAST FORK KAWEAH RIVER BELOW EAGLE CREEK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_FS_K1 | 10/27/1971 12:40 | | | | | | | 0.1606 | | | | | | 0.25 | | | 0.09 | | | | | 0.4 | | | | | | | | | | | | | | | | 0 | | 27 |
| SEQU_FS_K1 | 1/5/1972 9:45 | | | 7.5 | 180 | 72 | 10.9 | | | | | | 74 | | | | | | | | | 0.2 | | | | | | | | | | | | | | | | 0 | | 8 |
| SEQU_FS_K1 | 2/29/1972 14:00 | | | | | | | 0.36833 | | | | | | | | | 0 | | | | | | | | | | | | | | | | | | | | | 0 | | 1 |
| SEQU_FS_K1 | 5/1/1972 14:45 | | | 7 | 130 | 50 | 9 | | | | | | 54 | | | | | | | | | 0.3 | | | | | | | | | | | | | | | | 0 | | 16 |
| SEQU_FS_K1 | 6/20/1972 11:30 | | | | | 50 | 8.7 | | | | | | | | | | | | | | | 0.65 | | | | | | | | | | | | | | | | 0 | | 4 |
| SEQU_FS_K1 | 7/25/1972 15:30 | | | | | | | 0.00944 | | | | | | 0.09 | | | 0 | | | | | 0.3 | | | | | | | | | | | | | | | | 0 | | 16 |
| SEQU_FS_K1 | 9/5/1972 14:00 | | | 7.3 | 165 | 74 | 8.3 | | | | | | 74 | | | | | | | | | 0.4 | | | | | | | | | | | | | | | | 1 | | 120 |
| **MAIN FORK KAWEAH BELOW MARBLE FORK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_086 | 7/6/1983 0:00 | 25.8 | 14.8 | 6.75 | 14 | | | | | | | | | | | | ND | | | | | 8.4 | 4.98 | | | | | | | | | | | | | | | 43 | 38 | |
| **MAIN STEM KAWEAH AT BOUNDARY** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 6/11/1981 0:00 | 27.7 | 17.5 | 7.66 | 22 | | | | 13 | | 3 | | 9 | | | | ND | | 4.92 | | 1 | 1 | 10 | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 7/6/1981 0:00 | 36.2 | 25.6 | 8.26 | 81 | | | | 37 | | | | 26 | | 1.49 | | 0.006 | 1.16 | 10 | 3.79 | ND | | 29 | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 7/31/1981 12:00 | 38.7 | 24.1 | 8.77 | 95 | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 8/2/1981 0:00 | 33.9 | 23 | 8.53 | 90 | | | | 23 | | | | 27 | | 1.82 | | | 1.26 | 24 | 3.87 | ND | ND | 41 | | | | | | | | 0.012 | | | | | | | | | |

| Station ID | Visit Start | Temperature, air,deg C | Temperature, water,deg C | pH | Specific conductance,umho/cm | Bicarbonate,mg/l | Dissolved oxygen (DO),mg/l | Ammonia as NH3 | Calcium,mg/l | Carbonate,mg/l | Chloride,mg/l | Fluoride,mg/l | Hardness, Ca + Mg,mg/l | Kjeldahl nitrogen,mg/l | Magnesium,mg/l | Nitrite as N,mg/l | Orthophosphate as PO4,mg/l | Potassium,mg/l | Silica,mg/l | Sodium,mg/l | Sulfur, sulfate (SO4) as SO4,mg/l | Turbidity,FTU | Alkalinity, Total (total hydroxide+carbonate+bicarbonate),mg/l | Aluminum,ug/l | Antimony,ug/l | Arsenic,ug/l | Beryllium,ug/l | Cadmium,ug/l | Chromium,ug/l | Copper,ug/l | Iron, mg/l | Lead,ug/l | Manganese,ug/l | Mercury,ug/l | Nickel,ug/l | Thallium,ug/l | Zinc,ug/l | Fecal Coliform,cfu/100ml | Fecal Streptococcus Group Bacteria,cfu/100ml | Total Coliform,cfu/100ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | General Parameters | | | | | | | | | | | | | | | | Trace Elements | | | | | | | | | | | | | | Bacteria | | |
| Applicable Water Quality Objective or Standard | | NS | NS | 6.8-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 0.025 | NS | >20 | 250 | 2 | NS | NS | NS | 1 | NS | NS | NS | NS | 250 | Narr | >20 | 0.2 | 5.6 | 10 | 4 | 5 | 50 | 1 | 0.3 | 15 | 50 | 0.05 | 100 | 0.24 | 5 | 100 | NS | NS |
| SEQU_HW_011 | 10/17/1981 0:00 | 29.8 | 21.1 | 8.27 | 103 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 3/19/1982 12:00 | 9.5 | 10.2 | 7.7 | 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 4/11/1982 0:00 | | 2.9 | 8.8 | 30 | | | | | | | | | | | | | | | | | 90 | 41 | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 5/10/1982 12:00 | | 6.6 | 7.25 | 21 | | | | 11 | | 2 | | | | | | ND | | | | 1 | 2 | 14 | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 6/22/1982 0:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 0 | 10 |
| SEQU_HW_011 | 6/30/1982 12:00 | 25.2 | 10.1 | 7.82 | 19 | | | | | | | | | | | | 0.023 | 7.82 | | | | 1.2 | | | | | | | | | | | | | | | | | 2 | |
| SEQU_HW_011 | 7/28/1982 12:00 | 42 | 19.3 | 7.58 | 12 | | | | | | | | | | | | 0.007 | | | | | 0.44 | 11 | | | | | | | | | | | | | | | 1 | 3 | 100 |
| SEQU_HW_011 | 5/5/1983 0:00 | | 7 | 5.4 | 42 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 9 | |
| SEQU_HW_011 | 5/17/1983 0:00 | | | | | | | | | | | | | | | | | | | | | | 8.76 | | | | | | | | | | | | | | | 2 | 3 | |
| SEQU_HW_011 | 6/7/1983 0:00 | 26.5 | 10.7 | 7.02 | 13 | | | | | | | | | | | | 0.009 | | | | | 6 | 4.14 | | | | | | | | | | | | | | | 1 | 5 | |
| SEQU_HW_011 | 8/15/1983 0:00 | 31.5 | 17.4 | 6.87 | 21 | | | | | | | | | | | | 0.021 | | | | | 28 | | | | | | | | | | | | | | | | 75 | 25 | |
| SEQU_HW_011 | 10/4/1983 0:00 | | 13.4 | | 49 | | | | | | | | | | | | 0.018 | | | | | | | | | | | | | | | | | | | | | 9 | 0 | |
| SEQU_HW_011 | 7/18/1984 0:00 | | | | 22 | | | | | | | | | | | | ND | | | | | | 6.8 | | | | | | | | | | | | | | | 106 | 166 | |
| SEQU_HW_011 | 9/18/1984 0:00 | | | | | | | | | | | | | | | | 0.029 | | | | | | | | | | | | | | | | | | | | | 10 | 13 | |
| SEQU_HW_011 | 10/31/1984 0:00 | | 10 | | 71 | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | 3 | 168 | |
| SEQU_HW_011 | 7/31/1985 0:00 | | 23.1 | 8.2 | 116 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 9/9/1985 0:00 | | 18.8 | 9.4 | 110 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_011 | 11/4/1985 0:00 | | 12.9 | 7.2 | 93 | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | 9 | 4 | |
| SEQU_HW_011 | 3/17/1987 0:00 | | 12 | | 66 | | | | | | | | | | | | ND | | | | | | 11.46 | | | | | | | | | | | | | | | 8 | | |
| SEQU_HW_011 | 5/27/1987 0:00 | | 11.8 | 7.9 | 32 | | | | 8.3 | | 0.414 | ND | | | 0.26 | | 0.013 | 0.5 | | 1.974 | 1.705 | | 5.2 | | | | | 0.13 | ND | ND | | 8 | | ND | | | | 1 | 4 | |
| SEQU_HW_011 | 7/15/1987 0:00 | | 24.7 | 8.31 | 75 | | | | | | | | | | | | 0.018 | | | | | | 13.1 | | | | | | | | | | | | | | | 13 | 71 | |
| SEQU_HW_011 | 8/17/1987 0:00 | | 22.8 | 8.37 | 92 | | | | 9.1 | | 2.155 | ND | | | 9.531 | | 0.029 | 0.95 | | 3.84 | 1.837 | | 15.06 | | | | | | ND | ND | | ND | | ND | | | | 8 | 35 | |
| SEQU_HW_011 | 10/29/1987 0:00 | 16.8 | | 8 | 113 | | | | | | | | | | | | 0.022 | | | | | | 18.54 | | | | | ND | ND | ND | | ND | | ND | | | | 256 | 532 | |
| SEQU_HW_011 | 6/28/1988 0:00 | | 19.9 | 7.96 | 55 | | | | | | | | | | | | 0.017 | | | | | 0.3 | 7.22 | | | | | | | | | | | | | | | 3 | 53 | |
| SEQU_HW_011 | 7/25/1988 0:00 | | 25.8 | 8.45 | 80 | | | | | | | | | | | | 0.038 | | | | | 0.3 | 12.4 | | | | | | | | | | | | | | | 260 | 67 | |
| SEQU_HW_011 | 8/23/1988 0:00 | | 24.4 | 8.56 | 86 | | | | | | | | | | | | 0.014 | | | | | 0.2 | 15.9 | | | | | | | | | | | | | | | 3 | 120 | |
| **MAIN STEM KAWEAH BELOW HEADQUARTERS** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_144 | 7/30/1982 0:00 | | 19.9 | 7.91 | 21 | | | | | | | | | | | | 0.019 | | | | | 54 | | | | | | | | | | | | | | | | 92 | 37 | 0 |
| SEQU_HW_144 | 7/31/1982 0:00 | | 19.5 | 7.78 | 24 | | | | | | | | | | | | 0.008 | | | | | 0.54 | | | | | | | | | | | | | | | | 6 | 0 | 0 |
| SEQU_HW_119 | 10/16/1984 0:00 | | 9 | | 49 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_119 | 10/17/1984 0:00 | | | | | | | ND | | | | | | | | | 0.026 | | | | | | | | | | | | | | 0.055 | | | | | | | 253 | 608 | |
| **MARBLE FORK ABOVE HALSTEAD CREEK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_117 | 9/28/1983 0:00 | | 8.8 | | 30 | | | | | | | | | | | | 0.023 | | | | | | | | | | | | | | | | | | | | | 1 | 0 | |
| SEQU_HW_117 | 7/10/1984 0:00 | | | | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | |
| SEQU_HW_117 | 7/26/1984 0:00 | | | | 15 | | | | | | | | | | | | 0.01 | | | | | | | | | | | | | | | | | | | | | 5 | 10 | |
| SEQU_HW_117 | 9/27/1984 0:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 17 | |
| SEQU_HW_117 | 7/19/1988 0:00 | | 24.6 | 7.82 | 33 | | | | | | | | | | | | 0.029 | | | | | 0.1 | 3.74 | | | | | | | | | | | | | | | 17 | 95 | |
| **MARBLE FORK ABOVE SUWANNEE CREEK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_008 | 6/26/1981 0:00 | 23.7 | 14.7 | 7.48 | 15 | | | | 1.73 | | ND | | ND | | 0.22 | | | 0.47 | 14.5 | 1.34 | ND | ND | 7 | | | | | | | | | | | | | | | | | |
| SEQU_HW_008 | 7/22/1981 0:00 | 23.7 | 12.9 | 6.65 | 37 | | | | 8 | | ND | | 4 | | 0.6 | | 0.023 | 0.98 | | 4.15 | ND | ND | 18 | | | | | | | | 0.037 | | | | | | | | | |
| SEQU_HW_008 | 8/24/1981 0:00 | 23.2 | 17.1 | 7.58 | 35 | | | | 6 | | 2 | | | | 0.48 | | 0.015 | 0.96 | 14.9 | 3.09 | | ND | 18 | | | | | | | | | | | | | | | | | ND |
| SEQU_HW_008 | 6/23/1982 12:00 | 15.3 | 7.8 | 7.23 | 9 | | | | 3 | | 4 | | | | | | 0.011 | | | | ND | 0.52 | 13 | | | | | | | | | | | | | | | 16 | 0 | 26 |
| SEQU_HW_008 | 7/15/1982 0:00 | 10.8 | 9.3 | 7.3 | 9 | | | | | | | | | | | | | | | | | 0.48 | | | | | | | | | | | | | | | | 7 | 2 | 3 |
| SEQU_HW_008 | 8/17/1982 0:00 | | 11.5 | | 30 | | | | | | | | | | | | 0.025 | | | | | 2 | 21 | | | | | | | | | | | | | | | 5 | 38 | 0 |
| SEQU_HW_008 | 8/24/1982 0:00 | 33 | 14.9 | 6.92 | 22 | | | 0.017 | 3 | | 0.6 | | | | | | 0.029 | | | | | 0.42 | 14 | | | | | | | | | | | | | | | 79 | 3 | 1 |

| | | | | | | | | General Parameters | | | | | | | | | | | | | | | | Trace Elements | | | | | | | | | | | | | | Bacteria | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station ID | Visit Start | Temperature, air,deg C | Temperature, water,deg C | pH | Specific conductance,umho/cm | Bicarbonate,mg/l | Dissolved oxygen (DO),mg/l | Ammonia as NH3 | Calcium,mg/l | Carbonate,mg/l | Chloride,mg/l | Fluoride,mg/l | Hardness, Ca + Mg,mg/l | Kjeldahl nitrogen,mg/l | Magnesium,mg/l | Nitrite as N,mg/l | Orthophosphate as PO4,mg/l | Potassium,mg/l | Silica,mg/l | Sodium,mg/l | Sulfur, sulfate (SO4) as SO4,mg/l | Turbidity,FTU | Alkalinity, Total (total hydroxide+carbonate+bicarbonate),mg/l | Aluminum,ug/l | Antimony,ug/l | Arsenic,ug/l | Beryllium,ug/l | Cadmium,ug/l | Chromium,ug/l | Copper,ug/l | Iron, mg/l | Lead,ug/l | Manganese,ug/l | Mercury,ug/l | Nickel,ug/l | Thallium,ug/l | Zinc,ug/l | Fecal Coliform,cfu/100ml | Fecal Streptococcus Group Bacteria,cfu/100ml | Total Coliform,cfu/100ml |
| **Applicable Water Quality Objective or Standard** | | NS | NS | 6.8-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 0.025 | NS | >20 | 250 | 2 | NS | NS | NS | 1 | NS | NS | NS | NS | 250 | Narr | >20 | 0.2 | 5.6 | 10 | 4 | 5 | 50 | 1 | 0.3 | 15 | 50 | 0.05 | 100 | 0.24 | 5 | 100 | NS | NS |
| SEQU_HW_008 | 8/31/1982 12:00 | 10.4 | 10.1 | | 31 | | | 0.036 | 9 | | 5 | | | | | | 0.035 | | | | | 0.36 | 23 | | | | | | | | | | | | | | | 2 | 8 | 23 |
| SEQU_HW_008 | 8/1/1985 0:00 | | 17.2 | 7 | 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_008 | 9/10/1985 0:00 | | 8.4 | 9.5 | 34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **MARBLE FORK BELOW COMMISSARY CREEK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_047 | 9/20/1983 0:00 | | 12 | 6.91 | 16 | | | | | | | | | | | | 0.029 | | | | | | 3.7 | | | | | | | | | | | | | | | 12 | 1 | |
| SEQU_HW_047 | 10/19/1983 12:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | | |
| SEQU_HW_047 | 8/5/1987 0:00 | | 17.9 | 8 | 32 | | | | | | | | | | | | 0.035 | | | | | | 7.36 | | | | | | | | | | | | | | | 67 | 48 | |
| SEQU_HW_047 | 8/1/1988 0:00 | | 19.4 | 7.98 | 40 | | | | | | | | | | | | 0.031 | | | | | 0.2 | 5.08 | | | | | | | | | | | | | | | 5 | 112 | |
| **MARBLE FORK BELOW HALSTEAD CREEK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_118 | 9/28/1983 0:00 | | 8.8 | | 19 | | | | | | | | | | | | 0.053 | | | | | | | | | | | | | | | | | | | | | 2 | 0 | |
| SEQU_HW_118 | 7/10/1984 0:00 | | | | 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | |
| SEQU_HW_118 | 7/26/1984 0:00 | | | | 18 | | | | | | | | | | | | 0.013 | | | | | | | | | | | | | | | | | | | | | 10 | 20 | |
| SEQU_HW_118 | 9/27/1984 12:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 26 | |
| SEQU_HW_118 | 7/19/1988 0:00 | | 24.9 | 7.86 | 38 | | | | | | | | | | | | 0.037 | | | | | 0.1 | 4.36 | | | | | | | | | | | | | | | 8 | 126 | |
| **MARBLE FORK BELOW POTWISHA BRIDGE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 6/12/1981 0:00 | | 15.3 | 7.42 | 20 | | | | 5 | | ND | | 7 | | | | | | 5.24 | | ND | 2 | 10 | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 7/6/1981 0:00 | 31.8 | 21.8 | 8.05 | 71 | | | | 23 | | 4 | | 34 | | | | 0.01 | | 10.2 | | ND | 5 | 38 | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 7/7/1981 0:00 | | | | | | | | 8.64 | | | | | | 1.99 | | | 0.87 | | 2.32 | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 8/2/1981 0:00 | 34.5 | 20.2 | 8.48 | 109 | | | | 35 | | 1 | | 46 | | 2.55 | | ND | 1.16 | 34 | 3.09 | 1 | ND | 58 | | | | | | | | 0.007 | | | | | | | | | |
| SEQU_HW_009 | 5/24/1982 0:00 | 23.6 | 10.9 | 7.41 | 15 | | | | 4 | | 1 | | | | | | ND | | 6.4 | | 1 | 2 | 6 | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 6/22/1982 12:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | 0 | |
| SEQU_HW_009 | 6/23/1982 12:00 | 29.2 | 14 | 7.57 | 13 | | | | 4 | | 0.5 | | | | | | ND | | | | 1 | 1.12 | 22 | | | | | | | | | | | | | | | | | 0 |
| SEQU_HW_009 | 7/28/1982 12:00 | 24.3 | 17.7 | 7.68 | 10 | | | | | | | | | | | | 0.017 | | | | | 0.32 | 12 | | | | | | | | | | | | | | | 1 | 7 | 100 |
| SEQU_HW_009 | 8/24/1982 0:00 | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 9/26/1982 0:00 | | 11.9 | | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 5/5/1983 0:00 | 12 | 4.5 | 7.58 | 39 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | 26 | |
| SEQU_HW_009 | 6/7/1983 0:00 | 30 | 9.6 | 7.38 | 15 | | | | | | | | | | | | ND | | | | | 6.6 | 4.26 | | | | | | | | | | | | | | | 1 | 8 | |
| SEQU_HW_009 | 7/6/1983 0:00 | 30 | 15.3 | 6.52 | 14 | | | | | | | | | | | | ND | | | | | 6.6 | 4.06 | | | | | | | | | | | | | | | 2 | 0 | |
| SEQU_HW_009 | 8/15/1983 0:00 | 33 | 16.2 | 5.83 | 21 | | | | | | | | | | | | 0.015 | | | | | 2 | | | | | | | | | | | | | | | | 35 | 2 | |
| SEQU_HW_009 | 10/4/1983 0:00 | | 11.9 | | 32 | | | | | | | | | | | | 0.028 | | | | | | | | | | | | | | | | | | | | | 4 | 0 | |
| SEQU_HW_009 | 7/18/1984 0:00 | | | | 23 | | | | | | | | | | | | ND | | | | | | 4.3 | | | | | | | | | | | | | | | 158 | 198 | |
| SEQU_HW_009 | 9/18/1984 12:00 | | | | | | | | | | | | | | | | 0.044 | | | | | | | | | | | | | | | | | | | | | | 24 | |
| SEQU_HW_009 | 9/19/1984 12:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 13 | | |
| SEQU_HW_009 | 10/31/1984 0:00 | | 9 | | 85 | | | | | | | | | | | | 0.008 | | | | | | | | | | | | | | | | | | | | | 2 | 314 | |
| SEQU_HW_009 | 7/31/1985 0:00 | | 19.9 | 7.8 | 101 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 9/9/1985 0:00 | | 16.5 | 9.5 | 140 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_009 | 11/4/1985 0:00 | | | | | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | 1 | 8 | |
| SEQU_HW_009 | 5/19/1987 0:00 | | 10 | 7.6 | 18 | | | | | | | | | | | | 0.006 | | | | | | | | | | | | | | | | | | | | | 0 | 9 | |
| **MIDDLE FORK AT POTWISHA ABOVE CONTROL** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_082 | 3/19/1982 0:00 | | | | 37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_081 | 7/6/1983 0:00 | 23 | 15.3 | 6.49 | 14 | | | | | | | | | | | | | | | | | 5.4 | | | | | | | | | | | | | | | | 0 | 4 | |
| SEQU_HW_081 | 8/7/1983 0:00 | | | | 20 | | | | | | | | | | | | | | | | | 3.8 | | | | | | | | | | | | | | | | | | |
| SEQU_HW_080 | 8/11/1983 12:00 | | 14.5 | | 20 | | | | | | | | | | | | ND | | | | | 2.4 | | | | | | | | | | | | | | | | 3 | 0 | |
| SEQU_HW_080 | 9/22/1983 0:00 | | 17.2 | 7.03 | 36 | | | | | | | | | | | | 0.033 | | | | | 0.48 | | | | | | | | | | | | | | | | 7 | 0 | |

| | | | | | | | | General Parameters | | | | | | | | | | | | | | | | Trace Elements | | | | | | | | | | | | | | Bacteria | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station ID | Visit Start | Temperature, air,deg C | Temperature, water,deg C | pH | Specific conductance,umho/cm | Bicarbonate,mg/l | Dissolved oxygen (DO),mg/l | Ammonia as NH3 | Calcium,mg/l | Carbonate,mg/l | Chloride,mg/l | Fluoride,mg/l | Hardness, Ca + Mg,mg/l | Kjeldahl nitrogen,mg/l | Magnesium,mg/l | Nitrite as N,mg/l | Orthophosphate as PO4,mg/l | Potassium,mg/l | Silica,mg/l | Sodium,mg/l | Sulfur, sulfate (SO4) as SO4,mg/l | Turbidity,FTU | Alkalinity, Total (total hydroxide+carbonate+bicarbonate),mg/l | Aluminum,ug/l | Antimony,ug/l | Arsenic,ug/l | Beryllium,ug/l | Cadmium,ug/l | Chromium,ug/l | Copper,ug/l | Iron, mg/l | Lead,ug/l | Manganese,ug/l | Mercury,ug/l | Nickel,ug/l | Thallium,ug/l | Zinc,ug/l | Fecal Coliform,cfu/100ml | Fecal Streptococcus Group Bacteria,cfu/100ml | Total Coliform,cfu/100ml |
| **Applicable Water Quality Objective or Standard** | | NS | NS | 6.8-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 0.025 | NS | >20 | 250 | 2 | NS | NS | NS | 1 | NS | NS | NS | NS | 250 | Narr | >20 | 0.2 | 5.6 | 10 | 4 | 5 | 50 | 1 | 0.3 | 15 | 50 | 0.05 | 100 | 0.24 | 5 | 100 | NS | NS |
| **MIDDLE FORK KAWEAH ABOVE BUCKEYE BRIDGE** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 6/15/1981 0:00 | 24.9 | 12.6 | 7.45 | 21 | | | | 3 | | ND | | 5 | | | | ND | | 5.72 | | ND | 2 | 11 | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 7/6/1981 0:00 | 30.8 | 20 | 7.63 | 29 | | | | 17 | | 1 | | 9 | | ND | | ND | ND | 8 | 0.03 | 1 | 2 | ND | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 8/2/1981 0:00 | 27.4 | 18.5 | 8.06 | 38 | | | | 10 | | 2 | | 11 | | 0.68 | | ND | 0.9 | 34 | 2.88 | ND | ND | 18.5 | | | | | | | | 0.009 | | | | | | | | | |
| SEQU_HW_010 | 5/24/1982 12:00 | 23.8 | 23.8 | 7.49 | 13 | | 10 | | 4 | | ND | | | | | | ND | | 5.4 | | 1 | 4 | 6 | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 6/22/1982 12:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | 0 | |
| SEQU_HW_010 | 6/23/1982 12:00 | 23.2 | 13.6 | 7.66 | 12 | | | | 3 | | 0.7 | | | | | | ND | | | | 3 | | 17 | | | | | | | | | | | | | | | | | 1 |
| SEQU_HW_010 | 7/28/1982 12:00 | 29.6 | 15.6 | 7.42 | 18 | | | | | | | | | | | | 0.018 | | | | | 0.38 | 12 | | | | | | | | | | | | | | | 3 | 5 | 7 |
| SEQU_HW_010 | 9/26/1982 0:00 | | 11.2 | | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 5/5/1983 12:00 | | 4 | 7.35 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | 6 | |
| SEQU_HW_010 | 6/7/1983 0:00 | 24.2 | 9.3 | 7.21 | 12 | | | | | | | | | | | | ND | | | | | 6.6 | 3.46 | | | | | | | | | | | | | | | 3 | 0 | |
| SEQU_HW_010 | 7/6/1983 0:00 | 28.4 | 14 | 6.51 | 11 | | | | | | | | | | | | ND | | | | | 5.4 | 4.02 | | | | | | | | | | | | | | | 3 | 0 | |
| SEQU_HW_010 | 8/15/1983 0:00 | 26.9 | 14.9 | 7.12 | 15 | | | | | | | | | | | | 0.017 | | | | | 30 | 2.28 | | | | | | | | | | | | | | | 187 | 60 | |
| SEQU_HW_010 | 10/4/1983 0:00 | | 11.3 | | 28 | | | | | | | | | | | | 0.011 | | | | | | | | | | | | | | | | | | | | | 6 | 0 | |
| SEQU_HW_010 | 7/10/1984 0:00 | | | | 19 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 7/18/1984 0:00 | | | | | | | | | | | | | | | | ND | | | | | | 3.18 | | | | | | | | | | | | | | | 46 | 3 | |
| SEQU_HW_010 | 9/18/1984 0:00 | | | | | | | | | | | | | | | | 0.026 | | | | | | | | | | | | | | | | | | | | | | 48 | |
| SEQU_HW_010 | 10/31/1984 0:00 | | 7 | | 28 | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | | 46 | |
| SEQU_HW_010 | 7/31/1985 0:00 | | 18.5 | | 44 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 9/9/1985 0:00 | | 13.8 | 9.2 | 49 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_010 | 11/4/1985 0:00 | | 8.8 | 7.2 | 98 | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | 1 | 13 | |
| SEQU_HW_010 | 5/19/1987 0:00 | | 9.7 | 7.4 | 17 | | | | | | | | | | | | 0.009 | | | | | | | | | | | | | | | | | | | | | 0 | 3 | |
| **MOUTH OF MIDDLE FORK KAWEAH** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_MFKCM_022 | 9/21/1993 0:00 | 26 | 17.7 | 7.9 | 102 | 31 | 7.5 | | 6.9 | ND | ND | ND | 21 | | 0.9 | ND | | 1 | | | 2 | 0.22 | 26 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | | | |
| **N FRK KAWEAH AT PRK BNDRY ABV YUCCA CRK** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 6/25/1981 0:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 6/25/1981 0:00 | | 25.1 | 8.32 | 85 | | | | 85 | | 1 | | 37 | | | | | 1 | 18.2 | 3.37 | ND | 5 | 36 | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 7/15/1981 0:00 | 35.7 | 23.5 | 8.16 | 92 | | | | 33 | | 2 | | 39 | | 1.32 | | 0.008 | 1.15 | 14.5 | 3.67 | ND | 1 | 44 | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 8/4/1981 0:00 | 28.8 | 21.6 | 8.19 | 119 | | | | 39 | | 1 | | 48 | | 1.6 | | 0.042 | 1.36 | 28 | 3.74 | 1 | ND | 64 | | | | | | | | 0.022 | | | | | | | | | |
| SEQU_HW_003 | 5/17/1982 12:00 | 30 | 9.7 | 8.6 | 22 | | | | 14 | | 2 | | | | | | 0.024 | | 11.4 | | ND | 5 | 36 | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 6/7/1982 0:00 | 24.5 | 12.5 | 7.92 | 39 | | | | 14 | | 1 | | | | | | 0.017 | | 14.16 | | ND | 1.4 | 28 | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 7/13/1982 12:00 | 21.4 | 18.4 | 7.89 | 68 | | | | | | 1 | 0 | | | | | 0.024 | | | | | 48 | 41 | | | | | | | | | | | | | | | 10 | | 0 |
| SEQU_HW_003 | 8/6/1982 12:00 | 26.4 | 19 | 8.74 | 79 | | | | | | | | | | | | 0.017 | | | | | 0.42 | 42 | | | | | | | | | | | | | | | 7 | 67 | 100 |
| SEQU_HW_003 | 5/17/1983 0:00 | 18 | 7.6 | 7.53 | 76 | | | | | | | | | | | | 0.023 | | | | | | 17.02 | | | | | | | | | | | | | | | 36 | 4 | |
| SEQU_HW_003 | 6/7/1983 0:00 | 28 | 10 | 7.08 | 20 | | | | | | | | | | | | 0.006 | | | | | 4.2 | 5.5 | | | | | | | | | | | | | | | 7 | 0 | |
| SEQU_HW_003 | 8/18/1983 0:00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0 | |
| SEQU_HW_003 | 8/18/1983 0:00 | | 19 | | 72 | | | | | | | | | | | | | | | | | 10.4 | | | | | | | | | | | | | | | | 97 | 0 | |
| SEQU_HW_003 | 10/4/1983 0:00 | | 11.3 | | 58 | | | | | | | | | | | | 0.038 | | | | | | 25.14 | | | | | | | | | | | | | | | 28 | 0 | |
| SEQU_HW_003 | 9/18/1984 12:00 | | | | | | | | | | | | | | | | 0.043 | | | | | | | | | | | | | | | | | | | | | | 118 | |
| SEQU_HW_003 | 9/19/1984 12:00 | | | | | | | | | | | | | | | | 0.049 | | | | | | | | | | | | | | | | | | | | | 59 | | |
| SEQU_HW_003 | 10/30/1984 0:00 | | 10 | | 95 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 17 | 198 | |
| SEQU_HW_003 | 10/31/1984 12:00 | | | | | | | | | | | | | | | | 0.01 | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 7/31/1985 0:00 | | 23.1 | 8.2 | 116 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 9/9/1985 0:00 | | 17.9 | 10 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_003 | 3/17/1987 0:00 | | 8 | | 62 | | | | | | | | | | | | | | | | | | 14.76 | | | | | | | | | | | | | | | 15 | | |
| SEQU_HW_003 | 5/27/1987 0:00 | | 11.8 | 8.2 | 66 | | | | 10.21 | | 0.989 | | | | 0.395 | | 0.03 | 0.78 | | 3.337 | 0.865 | | 11.92 | | | | | 0.22 | ND | ND | | 9 | | ND | | | | 9 | 21 | |

| | | | | | | | | General Parameters | | | | | | | | | | | | | | | | Trace Elements | | | | | | | | | | | | | | Bacteria | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station ID | Visit Start | Temperature, air,deg C | Temperature, water,deg C | pH | Specific conductance,umho/cm | Bicarbonate,mg/l | Dissolved oxygen (DO),mg/l | Ammonia as NH3 | Calcium,mg/l | Carbonate,mg/l | Chloride,mg/l | Fluoride,mg/l | Hardness, Ca + Mg,mg/l | Kjeldahl nitrogen,mg/l | Magnesium,mg/l | Nitrite as N,mg/l | Orthophosphate as PO4,mg/l | Potassium,mg/l | Silica,mg/l | Sodium,mg/l | Sulfur, sulfate (SO4) as SO4,mg/l | Turbidity,FTU | Alkalinity, Total (total hydroxide+carbonate+bicarbonate),mg/l | Aluminum,ug/l | Antimony,ug/l | Arsenic,ug/l | Beryllium,ug/l | Cadmium,ug/l | Chromium,ug/l | Copper,ug/l | Iron, mg/l | Lead,ug/l | Manganese,ug/l | Mercury,ug/l | Nickel,ug/l | Thallium,ug/l | Zinc,ug/l | Fecal Coliform,cfu/100ml | Fecal Streptococcus Group Bacteria,cfu/100ml | Total Coliform,cfu/100ml |
| **Applicable Water Quality Objective or Standard** | | NS | NS | 6.8-8.5 | NS | NS | Meet or exceed 5.0 for WARM; 7.0 for COLD | 0.025 | NS | >20 | 250 | 2 | NS | NS | NS | 1 | NS | NS | NS | NS | 250 | Narr | >20 | 0.2 | 5.6 | 10 | 4 | 5 | 50 | 1 | 0.3 | 15 | 50 | 0.05 | 100 | 0.24 | 5 | 100 | NS | NS |
| SEQU_HW_003 | 7/15/1987 0:00 | | 26.9 | 8.4 | 128 | | | | | | | | | | | | 0.025 | | | | | | 22.48 | | | | | | | | | | | | | | | 4 | 18 | |
| SEQU_HW_003 | 8/17/1987 0:00 | | 22.9 | 8.4 | 142 | | | | 15.65 | | 1.595 | ND | | | 1.473 | | 0.043 | 1.43 | | 6.26 | 1.764 | | 27.5 | | | | | ND | ND | ND | | ND | | ND | | | | 10 | 22 | |
| SEQU_HW_003 | 10/29/1987 0:00 | | 16.3 | 8.2 | 111 | | | | | | | | | | | | | | | | | | 23.14 | | | | | ND | ND | ND | | ND | | ND | | | | 256 | 779 | |
| SEQU_HW_003 | 6/27/1988 0:00 | | 23.8 | 8.17 | 85 | | | | | | | | | | | | 0.027 | | | | | 0.4 | 15.28 | | | | | | | | | | | | | | | 7 | 608 | |
| SEQU_HW_003 | 7/25/1988 0:00 | | 28 | 8.63 | 114 | | | | | | | | | | | | 0.05 | | | | | 0.3 | 19.26 | | | | | | | | | | | | | | | 5 | 93 | |
| SEQU_HW_003 | 8/23/1988 0:00 | | 25.5 | 8.59 | 115 | | | | | | | | | | | | 0.021 | | | | | 0.4 | 23.64 | | | | | | | | | | | | | | | 2 | 32 | |
| **SOUTH FORK KAWEAH AT BOUNDARY** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 6/24/1981 0:00 | | 16.7 | 8.19 | 78 | | | | 21 | | ND | | 9 | | 1.22 | | ND | | 10.3 | 3.07 | 1 | 5 | 35 | | | | | | | | 0.023 | | | | | | | | | |
| SEQU_HW_020 | 7/26/1981 0:00 | 31.1 | 17.5 | 8.43 | 122 | | | | 51 | 49 | 0.5 | | 51 | | 2.19 | | 0.023 | 1.01 | 16.8 | 3.93 | ND | ND | 62 | | | | | | | | 0.008 | | | | | | | | | |
| SEQU_HW_020 | 8/26/1981 0:00 | 28.9 | | | 142 | | | | 50 | | ND | | | | 2.34 | | | 1.1 | | 3.88 | | ND | 77 | | | | | | | | 0.008 | | | | | | | | | |
| SEQU_HW_020 | 5/17/1982 0:00 | 19.8 | 6.1 | 8 | 20 | | | | 8 | | 1 | | | | | | ND | | 6.9 | | 1 | 5 | 31 | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 6/7/1982 0:00 | 18.5 | 6.4 | 7.38 | 18 | | | | 8 | | ND | | | | | | 0.011 | | Silica | | 1 | 0.52 | 13 | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 7/13/1982 0:00 | 20.4 | 11.3 | 7.49 | 40 | | | | | | 0.2 | | | | | | 0.032 | | | | | 0.52 | 44 | | | | | | | | | | | | | | | 14 | 0 | 5 |
| SEQU_HW_020 | 8/6/1982 12:00 | 21.8 | 15.2 | 8.2 | 89 | | | | | | | | | | | | | | | | | 0.26 | 60 | | | | | | | | | | | | | | | 2 | 2 | 0 |
| SEQU_HW_020 | 10/4/1983 0:00 | | 8.9 | | 60 | | | | | | | | | | | | 0.021 | | | | | | 16.84 | | | | | | | | | | | | | | | 2 | 0 | |
| SEQU_HW_020 | 9/18/1984 0:00 | | | | | | | | | | | | | | | | 0.017 | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 10/30/1984 0:00 | | 5 | | 61 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | 88 | |
| SEQU_HW_020 | 10/31/1984 12:00 | | | | | | | | | | | | | | | | ND | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 7/31/1985 0:00 | | 14.7 | 8.2 | 124 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 9/9/1985 0:00 | | 12.9 | 9.6 | 136 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SEQU_HW_020 | 3/17/1987 0:00 | | 4.6 | | 60 | | | | | | | | | | | | ND | | | | | | 16.6 | | | | | | | | | | | | | | | 17 | | |
| SEQU_HW_020 | 5/27/1987 0:00 | | 7.2 | 8 | 36 | | | | 5.1 | | 0.531 | ND | | | 0.345 | | 0.019 | 0.43 | | 2.003 | 0.534 | | 7.02 | | | | | 0.15 | ND | ND | | 4 | | ND | | | | 6 | 7 | |
| SEQU_HW_020 | 7/15/1987 0:00 | | 17.7 | 8.47 | 110 | | | | | | | | | | | | 0.019 | | | | | | 23.86 | | | | | | | | | | | | | | | 4 | 12 | |
| SEQU_HW_020 | 8/17/1987 0:00 | | 16.1 | 8.61 | 145 | | | | 16.32 | | 2.077 | ND | | | 2.074 | | 0.036 | 1.08 | | 6.12 | ND | | 30.08 | | | | | ND | ND | ND | | ND | | 0.3 | | | | 33 | 12 | |
| SEQU_HW_020 | 10/29/1987 0:00 | | 11.3 | 8.3 | 106 | | | | | | | | | | | | 0.021 | | | | | 0.3 | 22.96 | | | | | 2.4 | ND | ND | | ND | | ND | | | | 16 | 408 | |
| SEQU_HW_020 | 6/27/1988 0:00 | | 17.9 | 7.95 | 279 | | | | | | | | | | | | | | | | | | 14.46 | | | | | | | | | | | | | | | 3 | 16 | |
| SEQU_HW_020 | 7/25/1988 0:00 | | 19.4 | 8.41 | 126 | | | | | | | | | | | | 0.047 | | | | | 0.3 | 22.88 | | | | | | | | | | | | | | | 49 | | |
| SEQU_HW_020 | 8/23/1988 0:00 | | 17.5 | 8.53 | 138 | | | | | | | | | | | | 0.024 | | | | | 0.1 | 28.06 | | | | | | | | | | | | | | | 1 | 4 | |

NS: no standard; ND: no detection

Measurements that exceed the applicable water quality objective or standard are highlighted in green.

This Page Intentionally Left Blank

**Table 7.3-A5. Water Quality Data Collected by Three Rivers Community Services District in the Vicinity of the Kaweah Project.**

| Month | Date | Sampling Location and Parameter Sampled | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R1 - Buckeye/ Gateway | | R2 - Dinely Bridge | | R3 - North Fork (airport bridge) | | R4 - South Fork (198 bridge) | | R5 - Slick Rock | | R6 - Main Fork | | R7 - Hwy 198/ NF Bridge | | R8 - South Fork/District Boundary | |
| | | Total Coliform[1] | Fecal Coliform[1] | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform | Total Coliform | Fecal Coliform |
| Jan | 1/27/14 | >200.5 | <1.1 | >200.5 | 4.4 | >200.5 | 200.5 | >200.5 | 15.0 | >200.5 | 16.8 | >200.5 | 8.4 | >200.5 | 17.4 | >200.5 | 16.8 |
| Feb | 2/24/14 | >200.5 | 3.1 | >200.5 | 2.0 | >200.5 | 47.8 | >200.5 | 56.0 | >200.5 | 19.2 | >200.5 | 28.8 | >200.5 | 17.8 | >200.5 | 56.0 |
| Mar | 3/24/14 | 2.1 | 1.1 | 17.8 | 11.4 | 94.5 | 200.5 | 144.5 | 36.4 | 30.6 | 3.1 | >200.5 | 13.7 | >200.5 | 19.7 | >200.5 | 32.4 |
| Apr | 4/21/14 | 69.7 | 6.4 | >200.5 | 9.0 | >200.5 | 25.4 | >200.5 | 27.1 | >200.5 | 11.1 | >200.5 | 8.7 | >200.5 | 15.0 | >200.5 | 8.7 |
| May | 5/26/14 | >200.5 | 9.9 | >200.5 | 16.4 | >200.5 | 40.6 | >200.5 | 45.3 | >200.5 | 23.8 | >200.5 | 28.8 | >200.5 | 19.2 | >200.5 | 47.8 |
| Jun | 6/23/14 | 149.5 | 1.0 | 144.5 | 8.7 | >200.5 | 53.1 | >200.5 | 30.6 | >200.5 | 21.7 | >200.5 | 12.4 | >200.5 | 9.9 | >200.5 | 17.8 |
| Jul | 7/28/14 | >200.5 | 22.2 | >200.5 | 25.4 | >200.5 | 45.3 | >200.5 | 118.4 | >200.5 | 13.7 | >200.5 | 17.8 | >200.5 | 47.8 | >200.5 | 12.7 |
| Aug | 8/25/14 | 165.0 | 9.9 | >200.5 | 12.4 | >200.5 | 27.1 | >200.5 | 109.1 | >200.5 | 12.2 | >200.5 | 13.7 | >200.5 | 22.2 | >200.5 | 9.4 |
| Sept | 9/22/14 | >200.5 | 20.7 | >200.5 | 3.1 | >200.5 | 11.1 | >200.5 | 73.8 | >200.5 | 12.4 | >200.5 | 8.7 | >200.5 | 3.0 | >200.5 | 62.4 |
| Oct | 10/27/14 | >200.5 | 36.4 | >200.5 | 25.4 | >200.5 | 73.8 | >200.5 | 69.7 | >200.5 | 15.0 | >200.5 | 12.4 | >200.5 | 22.2 | >200.5 | 114.2 |
| Nov | 11/24/14 | >200.5 | 25.4 | >200.5 | 155.2 | >200.5 | 53.1 | >200.5 | 101.3 | >200.5 | 62.4 | >200.5 | 78.2 | >200.5 | 62.4 | >200.5 | 118.2 |
| Dec | 12/22/14 | 129.8 | 2.0 | >200.5 | 22.2 | >200.5 | 17.8 | >200.5 | 144.5 | >200.5 | 69.7 | >200.5 | 38.4 | >200.5 | 28.8 | >200.5 | 165.2 |

Applicable Water Quality Objective or Standard: Fecal coliform: 200 MPN/100 ml; Total coliform: no standard

Green shading indicates that the water quality objective is exceeded.

This Page Intentionally Left Blank

**TABLE OF CONTENTS**

Page

**LIST OF TABLES**

## List of Figures

## LIST OF MAPS

## LIST OF ACRONYMS

| | |
|---|---|
| BLM | Bureau of Land Management |
| BMI | Benthic Macroinvertebrate |
| CESA | California Endangered Species Act |
| CFP | California Fully Protected |
| CNDDB | California Natural Diversity Database |
| COLD | Cold Freshwater Habitat |
| CSC | California Species of Special Concern |
| CT | Candidate Threatened |
| CVRWQCB | Central Valley Regional Water Quality Control Board |
| DWR | Department of Water Resources |
| ESA | Endangered Species Act |
| FC | Federal candidate |
| FE | Federally endangered |
| FPD | Federally listed species proposed for delisting |
| FPE | Federally proposed endangered |
| FPT | Federally proposed threatened |
| FT | Federally threatened |
| FYLF | Foothill yellow-legged frog |
| HSC | Habitat suitability criteria |
| IBI | Index of Biotic Integrity |
| MVZ | Museum of Vertebrate Zoology |
| NPS | National Park Service |
| PAD | Pre-Application Document |
| PCB | Polychlorinated biphenyl |
| RARE | Rare, Threatened, or Endangered |
| SAFIT | Southwest Association of Freshwater Invertebrate Taxonomists |
| SCE | Southern California Edison Company |
| SE | State endangered |
| SNP | Sequoia National Park |
| SOP | Standard operating procedures |
| SPWN | Spawning, Reproduction and/or Early Development |
| ST | State threatened |
| SWAMP | Surface Water Ambient Monitoring Program |
| TSR | Technical Study Report |
| USGS | U.S. Geological Survey |
| W&SR | Wild and Scenic Rivers |
| WARM | Warm Freshwater Habitat |

| | |
|---|---|
| WPT | Western pond turtle |
| WUA | Weighted usable area |
| YOY | Young-of-year |

This Page Intentionally Left Blank

## 7.4 FISH AND AQUATICS RESOURCES AFFECTED ENVIRONMENT

This section describes the fish and aquatic resources in the vicinity of the Kaweah River Watershed (Watershed), including the river segments (bypass reaches) associated with the Kaweah Project (Project). Physical resource information pertinent to the discussion of fish and aquatic resources (hydrology, water quality, geomorphology, and riparian) is also summarized in this section. Detailed information on hydrology (Section 7.2), water quality (Section 7.3), geomorphology (Section 7.7), and riparian resources (Section 7.8) can be found in the respective sections for each of these topics.

The description of the fish and aquatic resources affected environment is organized based on the following categories:

- Information Sources
- Project Study Area Overview
- Fish and Special-Status Aquatic Species Overview
- Resource Management Objectives
- Riverine Physical Environment
    - Hydrology
    - Water Temperature and Water Quality
    - Channel Geomorphology and Sediment
    - Riparian Vegetation
- Instream Flow Habitat Modeling
- Riverine Aquatic Community
    - Benthic Algae
    - Benthic Macroinvertebrates
    - Wetted Perimeter Productivity
- Fish Passage Barriers
- Riverine Fish
    - Distribution and Diversity
    - Growth and Condition

  - Emergence/Spawning Timing
  - Abundance (Standing Crop)
  - Fish Stocking
  - Bypass Reach Habitat
- Foothill Yellow-legged Frogs and Western Pond Turtles
  - Distribution and Abundance
  - Habitat
- Fish Entrainment
- Special-status Species
  - Hardhead
  - Foothill Yellow-legged Frog
  - Western Pond Turtle

### 7.4.1 Information Sources

The aquatic resources information is based on a review of existing literature, agency, and stakeholder consultation, and studies conducted as part of the Kaweah relicensing process. A summary of agency and stakeholder consultation is provided in Section 14.0. The studies included early information gathering of water temperature data and nine aquatic technical studies that were developed in consultation with agencies and other interested relicensing participants. The studies were approved by the Federal Energy Regulatory Commission (FERC or Commission) and were completed in 2018 and 2019.

Key information sources are summarized below.

- Aquatic Species and Habitat Study (SCE 2007);
- Benthic Macroinvertebrates below Hydropower Dams (Rehn 2009);
- Bureau of Land Management (BLM) Designated Sensitive Species;
- California Department of Fish and Wildlife (CDFW) website (www.wildlife.ca.gov);
- CDFW California Wildlife website (www.dfg.ca.gov/biogeodata);
- CDFW California Natural Diversity Database (CNDDB) (CDFW 2019);
- Early Water Temperature Data Collection SCE 2014-2015 (SCE 2016);

- FERC website (www.ferc.gov);
- Fish Population and Water Temperature Studies – 1986 and 1987 (FERC 1991);
- Impact study of the Kaweah No. 3 Hydroelectric Facility on Sequoia National Park (Jordan/Avent et al. 1983, as cited in SCE 2007);
- Periodic point measurements of water temperature data at various locations available from Environmental Protection Agency STOrage and RETrieval (EPA STORET) on-line databases;
- Characterization of the hydrology in the study area in Section 7.2 Water Use and Hydrology:
- Quantification and evaluation of aquatic habitat as a function of flow. Identification of time periods, flow conditions, and life stages when habitat may be a limiting factor for aquatic species in AQ 1 – Instream Flow Technical Study Report (TSR) (SCE 2019a; SD A) (AQ 1 – TSR);
- Documentation of fish species composition, distribution, and abundance; and characterization of fish growth and population age structure in the bypass reaches (AQ 2 – Fish Population TSR [SCE 2019b; SD A]) (AQ 2 – TSR);
- Documentation of the BMI community in the bypass reaches (AQ 3 – Macroinvertebrate TSR [SCE2019c; SD A]) (AQ 3 – TSR);
- Characterization of the relationship between flow and water temperature in the bypass reaches using models supported by existing water temperature data (AQ 4 – Water Temperature TSR [SCE2019d; SD A]) (AQ 4 – TSR);
- Characterization of the river geomorphology physical environment and geology in in Section 7.6 Geology and Soils and Section 7.7 Geomorphology and AQ 5 – Geomorphology TSR (SCE 2019e; SD A) (AQ 5 – TSR), which is included in Supporting Document A (SD A);
- Characterization of physical, chemical, and bacterial water quality conditions in the bypass reaches (AQ 6 – Water Quality TSR [SCE 2019f; SD A]).
- Identification of foothill yellow-legged frog (FYLF) presence/absence and habitat in the bypass reaches and documentation of western pond turtle (WPT) habitat (AQ 7 – Special-status Amphibians and Aquatic Reptiles TSR [AQ 7 – TSR] [SCE 2019g; SD A]);
- Documentation of the location, nature, and characteristics of fish barriers in the bypass reaches (AQ 8 – Fish Passage TSR [SCE 2019h; SD A]) (AQ 8 – TSR);

- Evaluation of potential fish entrainment associated with flow diversion intake structures (AQ 9 – Entrainment TSR [SCE 2019i; SD A]) (AQ 9 – TSR);
- Characterization of riparian resources along the bypass reaches (Section 7.8 Riparian Resources); and
- Water quality objectives and water and standards in the Water Quality Control Plan for the Tulare Lake Basin (Basin Plan; CVRWQCB 2018).

### 7.4.2 Project Study Area Overview

Detailed descriptions of the Kaweah River Basin and the Kaweah Project Water Use and Hydrology are provided in Sections 7.1 and 7.2, respectively. The Project Study Area includes five river bypass reaches, two diversions, and three powerhouse inflows (Figure 7.4-1 and Map 7.4-1). Field studies to characterize aquatic resources were conducted in the five bypass reaches and in three nearby comparison reaches (Table 7.4-1). The comparison reaches were located upstream or downstream of the bypass reaches. The reaches (bypass and comparison) were delineated by selecting sections of river that were homogeneous with respect to geomorphology and hydrology (i.e., reaches that have similar channel types and flow regimes).

### 7.4.3 Fish and Special-Status Aquatic Species Overview

No anadromous, catadromous, or other migratory fish species are present in the vicinity of the Project. The study reaches associated with the Project are located within the Sacramento-San Joaquin Provence and the Central Valley subprovence (Moyle 2002). These river reaches support primarily warmwater fishes (pikeminnow-hardhead-sucker assemblage; Moyle 2002) with trout present in some areas. The warmwater fish assemblage is characteristic of lower elevation west slope Sierra Nevada river habitat that exhibits low summer/fall streamflows and high water temperatures. The AQ 2 – TSR (SCE 2019b; SD A) sampling confirmed that Sacramento sucker (*Catostomus occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), and hardhead (*Mylopharodon conocephalus*) (including young-of-year [YOY] mixed minnows), were the dominant fish species. Some rainbow trout were present (*Onchorynchus mykiss*) and other native species, Central California roach [*Lavinia symmetricus symmetricus*]) and sculpin (*Cottus* spp.). Non-native fish species observed were smallmouth bass (*Micropterus dolomieu*) and brown trout (*Salmo trutta*). Table 7.4-2 shows the fish species observed in the study reaches.

Special-status aquatic species are those granted status by federal and state agencies. Federally listed species under the Endangered Species Act (ESA) include federally threatened (FT), federally endangered (FE), federally proposed threatened (FPT), federally proposed endangered (FPE), federal candidate (FC), or federally listed species proposed for delisting (FPD). BLM also has a list of wildlife species that are not federally listed under the ESA, but are designated by the BLM State Director for special management consideration (BLMS). State-listed aquatic species, which are granted status by the CDFW under the California Endangered Species Act (CESA), include State threatened (ST), State endangered (SE), California Fully Protected Species (CFP), California Species of Special Concern (CSC), and Candidate Threatened (CT).

There are potentially three sensitive aquatic species in the vicinity of the Project including:

- Foothill yellow-legged frog (FYLF) (*Rana boylii*) – CSC, CT, BLMS
- Hardhead (*Mylopharadon conocephalus*) – CSC
- Western pond turtle (WPT) (*Actinemys marmorata*) – CSC

  where: CSC = CDFW Species of Special Concern; CT = CDFW Candidate Threatened; and BLMS = BLM Special Management Consideration.

Of these three species, FYLF were not found during surveys and are not known to be extant in the watershed; hardhead are common in select reaches associated with the Project; and WPT are known to be extant in the watershed, but no WPT were observed during aquatic studies in the Project study area.

### 7.4.4 Resource Management Objectives

For the Kaweah River and East Fork Kaweah River in the vicinity of the Project, resource management objectives focus on providing suitable habitat conditions to support warmwater (e.g., hardhead) and coldwater fish populations (rainbow trout) and other aquatic species. Management plans that apply to aquatic resources in the Project study area are listed below.

- California Department of Fish and Wildlife (CDFW) – No CDFW trout management plans/programs (e.g., stocking) apply specifically to the Kaweah River Project study area. None of the rivers in the Watershed are designated as Wild or Heritage Trout Waters. The Kaweah River from the Kaweah No. 1 Powerhouse to Lake Kaweah is designated as a Central Valley drainage hardhead/pikeminnow stream and a California Natural Diversity Database (CNDDB) rare natural community (CDFW 2019). Although this segment has been designated as a rare natural community, it is still under review by the state to be assigned a rank (S1-S3; status levels of imperilment). Hardhead have a global rank of G3 (at moderate risk of extinction due to a restricted range, relatively few populations [often 80 or fewer], recent and widespread declines, or other factors) and a state rank S3 (vulnerable in the state due to a restricted range, relatively few populations [often 80 or fewer], recent and widespread declines, or other factors making it vulnerable to extirpation from the state).

- State or Federal Wild and Scenic Rivers – None of the rivers in the Watershed are included in the California W&SR System and none of the rivers in the Watershed are designated as National Wild and Scenic Rivers.

- Bakersfield Office Resource Management Plan (US BLM) – The management plan provides broad-scale direction for the future management of BLM-administered public lands and resources including lands within the Kaweah Watershed.

- Water Quality Control Plan for the Tulare Lake Basin by the California Regional Water Quality Control Board Central Valley Region (CVRWQCB) includes the following beneficial uses for the Kaweah River and tributaries upstream of Lake Kaweah:

  - Warm Freshwater Habitat (WARM): Uses of water that support warm water ecosystems, including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates. WARM includes support for reproduction and early development of warm water fish.

  - Cold Freshwater Habitat (COLD): Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

  - Rare, Threatened, or Endangered Species (RARE): Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

  - Spawning, Reproduction and/or Early Development (SPWN): Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. SPWN shall be limited to cold water fisheries.

- National Park Service Nationwide Rivers Inventory (NPS) – The NPS lists two river segments upstream of the Project and within SNP, Marble Fork of the Kaweah River and Middle Fork of the Kaweah River, as recreationally important rivers with wild and scenic values.

- Final General Management Plan and Comprehensive River Management Plan / Environmental Impact Statement (NPS 2006) – The River Management Plan provides direction and overall guidance on the management of lands and uses within the river corridors in Sequoia National Park upstream of the Kaweah Project.

- No essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act is present in the vicinity of the Kaweah Project.

### 7.4.5 Riverine Physical Environment

The riverine physical environment associated with the Project is described below. The physical environment includes: (1) hydrology; (2) water temperature and water quality (3) channel geomorphology and sediment; and (4) riparian vegetation.

#### 7.4.5.1 Hydrology

A detailed description of Kaweah hydrology is included in Section 7.3. Overviews of FERC License minimum Instream flows/pre-1914 water rights and typical Project operations in the bypass reaches are discussed below.

**FERC License Minimum Instream Flows / Pre-1914 Water Delivery Requirements**

The minimum instream flow requirements for the Project are shown in Table 7.4-3. The existing minimum instream flows in the Kaweah River are based on dry and normal water year type designations. In the hydrologic period of record (1975–2018) 34% of the years were dry and the remainder were normal. In the Kaweah River minimum instream flows are lower in dry years and higher in normal years. In the East Fork Kaweah River the minimum instream flows are the same for both dry and normal years.

Local water user pre-1914 consumptive water rights exist on both the Kaweah No. 2 Flowline and the East Fork Kaweah No. 1 Flowline consequently SCE must maintain water in the flowlines to deliver water to local water users (see Section 3.5.2.2). Flows of 3 cfs in the Kaweah No. 2 Flowline and 1 cfs in the East Fork Kaweah No. 1 Flowline must be maintained for local water users.

Figures 7.2-1, 7.2-2 show both the minimum instream flows and the pre-1914 consumptive water rights requirements for normal and dry years overlaid with the unimpaired flows at the Kaweah River No. 2 Diversion and East Fork Kaweah No. 1 Diversion. With respect to the bypass reach flows downstream of the diversions, the minimum instream flows in practice are only approached during the dry season months (July to December; sometimes January and February). During the wetter season months (March through June), natural flow minus diverted flow is far in excess of the minimum flows and pre-1914 consumptive water rights requirements (Figures 7.2-1 and 7.2-2).

During dry years in the East Fork Kaweah River there are a few years when unimpaired inflows at the East Fork Kaweah No. 1 Diversion are barely equal to or greater than the required minimum flow combined with the pre-1914 consumptive water right diversion requirement. During both normal and dry years at Kaweah No. 2 Diversion, there are a number of years when unimpaired flows are less than the minimum instream flow and pre-1914 diversion requirement (Figure 7.2-2) (see Section 7.2.2.1)

**FERC Ramping Rate Requirements**

The existing FERC license for the Project requires the Licensee to operate such that flows below the Kaweah No. 1 and No. 2 diversion dams and Kaweah No. 1 and No. 2 powerhouses are not altered at a rate greater than 30 percent of the existing streamflow per hour. In the four bypass reaches this results in average stage changes as shown in Figures 7.4-2, 7.4-3, 7.4-4, and 7.4-5. The up-ramping rates are extremely conservative. Typically up-ramping rates are used to protect recreationists and often a 1.0 ft/hr ramping rate is used. Under the current FERC license the up-ramping rates are on the order of <0.1 to <0.3 ft/hr. The down-ramping rates are approximately <0.1 to 0.3 ft/hr in the range of flows that the project can operate (87 cfs at Kaweah No. 2 Diversion and 24 cfs at Kaweah No. 1 Diversion).

**Typical Project Operations in the Bypass Reaches**

In the river bypass reaches (Kaweah River and East Fork Kaweah River) flows are potentially altered year-round. Up to 87 cfs can be diverted at Kaweah No. 2 Diversion on the Kaweah River and up to 24 cfs can be diverted at the Kaweah No. 1 Diversion on the East Fork Kaweah River. These are run-of-river diversions that have minimum flow requirements downstream of the diversions (Section 7.4.5.1). Project operations and flows in the bypass reaches and diversions/flowlines are discussed in Section 7.2 Water Use. Figures 7.2-5a and b show that during the wetter months (April, May, June) the natural river flows are relatively large and the Project diversions have minimal effect on flows in the bypass reaches. During the drier months (August, September, October, November and sometimes December, January and February), the Project diversions can have a larger effect on flow in the bypass reaches. Figures 7.2 E1-4 in Section 7.2 Appendix E shows monthly flow exceedances for both existing and unimpaired flows. During drier water year types, diversions do not operate during many of the drier months.

The effects of flow diversion on flows in the bypass reaches are analyzed extensively in AQ 1 – TSR (SCE 2019a; SD A). The effects of flow reductions on wetted perimeter are shown below in Section 7.4.7.3 Wetted Perimeter / Productivity. The effects on fish habitat are shown below in Section 7.4.9.6 Bypass Reach Habitat Modeling

### 7.4.5.2 Water Temperature and Water Quality

The distribution of aquatic species is directly related to water temperature. Water temperature in the Kaweah River and in the East Fork Kaweah River varies with elevation and season. Water temperature is cooler in the upper elevation portions of the Watershed and transitions to warm, particularly in the summer, in the lower elevation portions of the Watershed where the Project is located.

The sources for water temperature data in the Watershed include periodic point measurement water temperature data at various locations recorded in the EPA STORET on-line databases; water temperature studies conducted in 1989 in the Kaweah River and East Fork Kaweah rivers in the vicinity of the Kaweah No. 1 and No. 2 diversions (FERC 1991); water temperature data loggers installed by SCE July 2014 to May 2015 at seven locations in the vicinity of the Project (Table 7.4-4; Map 7.4-2); and 13 water temperature loggers installed February 2018 to December 2018, including two air temperature stations, as part of the AQ 4 – TSR (SCE2019d; SD A) (Table 7.4-5; Map 7.4-3).

Water quality data (e.g., turbidity, dissolved oxygen) for the Project study area are discussed in AQ 6 – TSR (SCE 2019f; SD A) and Section 7.3 Water Quality and briefly summarized below.

### Kaweah River Water Temperature

Water temperature studies conducted in 1989 (in the vicinity of the Kaweah No. 1 and No. 2 diversions) (FERC 1991) found that water temperatures were relatively warm during the summer ≥70˚F (21˚C). The highest water temperatures were observed during the late summer low-flow period when air temperatures were warmest (FERC 1991). The warm temperatures occurred naturally during the late summer when water diversion for power generation was not occurring due to low inflows. As fall air temperatures cooled, river water temperatures also decreased.

Water temperature data collected in 2014/2015 (very dry years) and 2018 (dry year / normal year transition), in the vicinity of the Project show that at the upstream boundary of the Project, near river mile (RM) 8.8 (1,390 feet above mean sea level [msl]) monthly average water temperature in 2014 exceeded 70˚F during July, August, and September and in 2018 exceeded 70˚F during July and August (Figure 7.4-6). Farther downstream, average monthly water temperature exceeded approximately 75˚F in the Kaweah River bypass reaches in July and August and 70˚F in September. Summer 2018 was slightly cooler than 2014 (Figure 7.4-6). Figure 7.4-7 shows the 15-min diel and daily average temporal distribution, respectively, of water temperature at several sites between the periods of late July 2014 to April 2015 and February to December 2018. Water temperatures in the bypass reaches typically did not fall below 70°F from early July to early September. The warm summer temperature period (both 2014 and 2018) corresponded to a time when air temperatures were high, stream flows were very low, and no generation was occurring (see Figure 7.4-7). In 2018, for example, The Kaweah No. 2 Flowline was not diverting from early August to December and the Kaweah No. 3 Flowline (located upstream in SNP) was not diverting from late June through early December.

### East Fork Kaweah River Water Temperature

Water temperature data collected In 2014/2015 (very dry years) and 2018 (dry year / normal year transition), in the East Fork Kaweah River were slightly cooler than water temperature in the main stem Kaweah River due in part to the elevation and likely the orientation of the river with respect to solar shading. As shown in Figure 7.4-8, at the upstream temperature monitoring location above the Kaweah No.1 Diversion Dam (2,600 feet above msl), average monthly water temperature in 2014 was between about 65°F and 70°F during July, August, and September and in 2018 it was warmer in July (above 70°F) and cooler in September <65°F. However, the downstream sampling station (1,300 feet above msl), located near the confluence of the East Fork Kaweah River and Kaweah River, followed a warmer water temperature pattern similar to that in the Kaweah River in the vicinity of the confluence. Water temperatures were approximately 70°F, or greater, July, August, and September and did not fall below 70°F until late September in 2014. Figure 7.4-9 shows the daily average and 15 minute temperature data. In 2018, water temperature cooled to below 70°F in early September (Figure 7.4-9).

The warm summer temperature period in both 2014 and 2018 corresponded to a time when air temperatures were high, stream flows were very low, and no generation was occurring (see Figure 7.4-9). In 2018, for example, diversions at the East Fork Kaweah No. 1 Diversion ceased at the beginning of July through the remainder of the year, except for the 1 cfs pre-1914 consumptive water right delivery. The high temperatures observed in July, August, and September were a natural consequence of the watershed.

**Water Quality**

Historical water quality data and recent data collected in 2018 during the spring runoff (May) and during the summer low-flow period (August) (see Section 7.3 Water Quality) indicate that the physical and water chemistry conditions in the bypass reaches are of high quality and conform to regulatory water quality objectives and standards related to aquatic species. All in-situ measurements in the bypass reaches (dissolved oxygen, turbidity, conductivity, and pH) met applicable standards. General water quality parameters (e.g., metals, nutrients) were typically high quality. During the high flow season, several samples in the Kaweah River bypass reaches and comparison reaches exhibited low alkalinity (<20 mg/L). This appears to be a natural condition of the Watershed during spring high flow conditions when snowmelt and rainfall runoff have little opportunity to pick up calcium carbonate from the basin geology. Also, there were three ammonia samples in bypass reaches during the summer low-flow sampling that exceeded water quality criteria. Because the Project does not have operations that would typically affect ammonia, the source could potentially be septic systems from homes along the river (Section 7.3 Water Quality).

### 7.4.5.3 Channel Geomorphology and Sediment

Details of the Project study area geomorphology are included in Section 7.7 Geomorphology. Overviews of the river channels, fine sediment, spawning gravel abundance, and channel maintenance flows are discussed below.

**River Channels**

The Kaweah and East Fork Kaweah rivers in the Study Area are steep, coarse substrate rivers (e.g., abundant large cobbles, boulders, very large boulders, and bedrock) (Figure 7.4-1). Very little gravel exists in the system and finer substrate (sand/decomposed granite) exists in the pools or in the velocity shadow of large substrate. Sediment transport and deposition dynamics in boulder, bedrock-dominated system are mediated by the resistant channel boundary. The bypass reach downstream of the Kaweah No. 2 Diversion (KR DS PH3) has a 3.3% gradient and consists of boulder and cobble step pool sequences punctuated by bedrock pools. The bypass reaches in the Kaweah River downstream of the confluence with the East Fork River (KR US PH1 and KR US PH2) have a somewhat lower gradient (1.7% to 1.9%) and exhibit plane-bed and pool-riffle morphology with abundant large substrates. The bypass reach in the East Fork Kaweah downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) is predominately a steep (5.4% gradient) bedrock, plunge pool channel punctuated by coarse sediment aggregations in lower gradient sections. The exception is the lower 0.5

mile river reach (EF US Confl) stream near the confluence with the Middle Fork Kaweah (4.2% gradient), which includes large boulder substrates in combination with lower-gradient pools and runs with expansive sand deposits.

### Fine Sediment

Fine sediment in the Project study reaches primarily consisted of sand/decomposed granite and generally fine sediment abundance was low (local areas had higher fine sediment abundance). Fine sediment in pools was limited to a small proportion of the residual pool volume. In 48 of the 60 sampling sites, V* values were less than 0.10. Twelve sampling sites had V* values greater than 0.10, with the highest V* value being 0.18 (Section 7.7 Geomorphology; AQ 5 – Geomorphology TSR). Fine sediment within potential spawning gravels was generally within the criteria to support high reproductive success; however, spawning gravels were generally very limited in the river due to the high gradient of the rivers (Section 7.7 Geomorphology; AQ 5 – TSR [SCE 2019e; SD A]).

### Spawning Gravel Abundance

Spawning gravel is limited in the study area. Of the 61 instream flow transects in the four bypass reaches, only 18 included spawning gravels (typically a small amount). During selection of transects, transect placement emphasized locations with the most spawning gravel. In particular transects in pool tailouts and riffles were located where spawning gravel was present, if it was present in the channel (AQ 1 – Instream Flow TSR). For the 18 transects with spawning gravel, the average number of cells (substrate measurement locations) across each transect was 48 (range 35 to 62 cells) and the average number of cells with spawning gravel was 8 cells per transect (range 1 to 20 cells per transect). On average, 17% of substrate on the 18 “spawning” transects was spawning gravel.

### Channel Maintenance

Sediment/channel conditions in the bypass reaches are being maintained by the current flow regime. High flows continue to exist in each of the four bypass reaches. There was no berm development, channel narrowing, channelization, or aggradation / degradation observed in the bypass reaches (Section 7.7 Geomorphology and Section 7.8 Riparian Resources). The high flow events that move sediment and maintain the channels were relatively unchanged between existing and unimpaired flow regimes. Annual instantaneous peak flow exceedance plots for each bypass reach show that the existing and unimpaired instantaneous peak stream flows are similar. The peak flood frequency analysis for recurrence intervals from 1.005 year up to 100 years have been altered only 0.6% to 3.5% by Project operations in the bypass reaches (AQ 5 – TSP; SCE 2019e; SD A). The difference in the frequency (duration) of days when existing daily flows exceeded the 1.5-year unimpaired flow event was 87% to 93% of what would occur under unimpaired flows.

### 7.4.5.4 Riparian Vegetation

Details of the riparian resources are discussed in the Section 7.8 Riparian Resources. Riparian vegetation was sparse and patchily distributed along the majority of the four bypass reaches due to the confined valley walls and bedrock/coarse substrate. Riparian habitat occurred along approximately 3.5 linear miles or 51% of the total river miles along the bypass reaches, occurring primarily in discontinuous narrow corridors along the channel (2.7 miles) (Section 7.8 Riparian Resources). The remaining 49% of the bypass reaches were sparsely vegetated with scattered riparian trees and shrubs. Wide corridors of riparian vegetation were relatively uncommon.

The riparian community in the bypass reaches was primarily comprised of native species. The common woody riparian species included various willow species, white alder, cottonwoods, and California sycamores. Willows and alder were the dominant woody riparian species. Fremont cottonwood and California sycamore trees were common associates within the community. A diversity of age classes, including seedlings and young individuals, was present within the bypass reaches. In general, riparian vegetation distribution and abundance along the channel and community composition/age structure were similar between the bypass reaches and the appropriate comparison reaches (Section 7.8 Riparian Resources).

### 7.4.6 Instream Flow Habitat Modeling

Instream flow physical habitat modeling was conducted for each of the four bypass reaches in the Project Study Area using 1D hydraulics and habitat models (AQ 1 – TSR [SCE 2019a; SD A]) (Map 7.4-4). The modeling was used to develop wetted perimeter versus flow and habitat area versus flow relationships (weighted usable area [WUA] vs flow) and habitat time series habitat analyses (WUA each day).

The following habitat analyses were completed for the bypass reaches:

| Bypass Reach | Method | Species/Life Stage | Months |
|---|---|---|---|
| KR US CONF EF<br>KR US PH1<br>KR US PH2<br>EF US CONF KR | Habitat (WUA) vs. Flow and Habitat (WUA) Time Series (1994–2018) | Rainbow Trout | All |
| | | • Spawning | March-May |
| | | • Adult | All |
| | | • Juvenile | All |
| | | • Fry | May-Aug |
| | | Hardhead / Sacramento Pikeminnow | All |
| | | • Adult | All |
| | | • Juvenile | All |
| | | Sacramento Sucker | All |
| | | • Adult | All |
| | | • Juvenile | All |

The priority management species and life stages were selected in collaboration with the Aquatic TWG (AQ 1 – TSR [SCE 2019a; SD A]). The primary species and life stages selected for instream flow modeling included hardhead and Sacramento pikeminnow (juvenile and adult rearing), Sacramento Sucker (juvenile and adult rearing), and rainbow trout (adult, juvenile, and fry rearing and adult spawning). Habitat suitability criteria (HSC) were developed for these species and life stages (AQ 1 – TSR; SCE 2019a; SD A). A life-stage periodicity chart (i.e., season of occurrence) for the aquatic species in the study area (Figure 7.4.10) was developed from existing information (e.g., Moyle 2002) and biologist input.

Habitat versus flow relationships were modeled over a wide range of flows (low base flows up to approximately the 5-15% exceedance unimpaired flow). The habitat versus flow relationships were combined with hydrology (impaired and unimpaired daily mean flows) over the 1994–2018 period of record to create habitat time series and habitat exceedance plots. The habitat time series were used to compare the amount of habitat during the different biologically sensitive time periods (reproduction and rearing) and identify potential habitat limiting factors/time periods. Habitat exceedance plots were created for the two Project water year types (normal and dry).

The aquatic species habitat modeling analyses were applicable either to the summer/fall rearing period or spring spawning period. Habitat suitability criteria were not developed for the winter or early spring periods (cold water periods). Typically fish utilize comparatively low velocity water habitats during cold weather periods (Baltz et al. 1991; Vondracek et al. 1992). As a result, habitat modeling of winter habitat typically indicates that low flows provide suitable habitat.

The wetted perimeter versus flow results are provided in Section 7.4.7 – Riverine Aquatic Community and the modeling results for fish species are found in the Section 7.4.8 – Riverine Fish, below.

### 7.4.7 Riverine Aquatic Community

#### 7.4.7.1 Benthic Algae

Benthic algae sampling was conducted twice historically (Jordan/Avent et al. 1983; SCE 2007) in the vicinity of the Project and algae area coverage was sampled during the 2018 AQ 3 – TSR (SCE2019c; SD A) sampling. Jordan/Avent et al. (1983) sampled upstream of the Project in the Kaweah River, as well as in the Marble and Middle forks of the Kaweah river. At the time, high concentrations of algae were observed. The SCE (2007) study included sampling locations that overlapped the Jordan/Avent et al. (1983) sampling site and additional sampling near the Kaweah No. 2 Diversion. In the SCE (2007) study algae cover was light, typically less than 25%, in all sampling locations and there were no instances of “nuisance” algae in the sampling areas (dense growths). Didymo (*Didymosphenia geminata*), a well know nuisance algae, was not observed. Cladophora (sp.), which can produce heavy coverages of algae, was observed only at one sampling location and abundance was low at that location.

During the AQ 3 – TSR (SCE2019c; SD A) sampling in the bypass reaches in 2018, the percent coverage of macro algae ranged from 9% to 99% depending on the site location and dominate substrate present at the site. In general, algae abundance was moderate and nuisance algae were not observed (nor were high abundance algae locations observed). There was no obvious difference between algae coverage in the bypass reaches and the comparison reaches.

### 7.4.7.2 Benthic Macroinvertebrates

#### Drifting Macroinvertebrates

Macroinvertebrate drift sampling was conducted at eight sampling sites in August (summer) and October (fall) 2018 to document the seasonal density and size distribution of drifting macroinvertebrates in the bypass and comparison reaches of the Project (Table 7.4-6 and Map AQ 7.4-5) (AQ 3 – TSR; SCE2019c; SD A). General aquatic invertebrate length versus weight relationships (Cummins and Wuycheck 1971; Smock 1980) were used to convert macroinvertebrate drift to energy equivalents (joules/m3) for each size class (0-1, >1-3, >3-5, >5-7, and >7 mm) for potential use in bioenergetics analysis, if appropriate, to assist in the identification of limiting factors related to fish growth (food and water temperature) (AQ 3 – TSR; SCE2019c; SD A).

The average of the summer/fall drift density for all sites was 0.28 number/$m^3$ (range 0.18 to 0.41 number/$m^3$) (Table 7.4-7, Figure 7.4-11), which is on the low end of the typical drift density range reported by Allan (1987) of 0.01 to 5.0 number/$m^3$. This drift density was 19 to 30 percent of drift densities found in the American River watershed (PCWA 2011) and 18 percent of Klamath River drift densities (Addley 2005) (Table 7.4-8, Figure 7.4-12).

Average summer/fall drift densities were similar between comparison and bypass reaches (7.4-8, Figure 7.4-12). For Kaweah River comparison reaches, drift densities were 0.21 and 0.41 number/$m^3$. Kaweah River bypass reaches ranged from 0.18 to 0.30 number/$m^3$. The East Fork Kaweah River comparison reach had a drift density of 0.18 number/$m^3$ while bypass reaches had drift densities of 0.32 and 0.41 number/$m^3$.

Average summer/fall prey energy at all sites was 1.7 joules/$m^3$ and ranged from 0.4 joules/$m^3$ to 3.3 joules/$m^3$ (Table 7.4-9a and b, Figure 7.4-13). Average prey energy in the Kaweah River was 47 percent of the average prey energy calculated in the American River Watershed (North Fork and Middle Fork American Rivers and Rubicon River) in 2008 spring, summer, and fall sampling events (PCWA 2011).

#### Benthic Macroinvertebrates

Benthic macroinvertebrates were collected in the bypass and comparison reaches using the SWAMP RWB protocol (Ode 2016) (AQ 3 – TSR; SCE2019c; SD A). The samples collected from each sampling site were a composite of 11 sub-samples, each taken from one of 11 equally spaced transects. The transects were spaced 15 meters (m) apart, or 25 m if the wetted width of the channel was greater than 10 m wide. Sub-sampling alternated between left-center, center, and right-center locations on each sequential transect. Sampling sites for benthic macroinvertebrates are identified in Table 7.4-6 and Map 7.4-5.

Macroinvertebrate taxonomy was processed according to the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) level 2 (Richards and Rogers 2006). The processed 600 organism count data was used to calculate the hydropower Index of Biotic Integrity (IBI) metrics as outlined in Rehn et al. (2007).

Benthic Macroinvertebrate (BMI) sampling metric results and IBI scores are presented in Table 7.4-10. Physical habitat data from sampling reaches are presented in Table 7.4-11. Kaweah River comparison reaches had IBI scores of 35 and 37 and Kaweah River bypass reaches had similar scores that ranged from 31 to 40. The East Fork Kaweah River comparison reach had an IBI score of 36 and East Fork Kaweah River bypass reaches had similar IBI scores of 40 and 42.

A literature search for comparable BMI data and metrics found that one site sampled in 2007 (ENTRIX 2007) (site F2) was in a similar location to K9.5 sampled in 2018. Taxonomic richness was slightly higher in 2018 (IBI score of 36) compared to 2007 (IBI 31). EPT (Ephemeroptera, Plecoptera, and Trichoptera) taxa richness and percentage were lower in 2018 (13 and 37.5%, respectively) compared to 2007 (16 and 51.1%, respectively). The percent of intolerant individuals was lower in 2018 (2.7%) compared to 2007 (10%).

#### 7.4.7.3 Wetted Perimeter / Productivity

Wetted perimeter versus flow relationships for each of the four bypass reaches were modeled as part of the AQ 1 – TSR (SCE 2019a; SD A). Wetted perimeter versus flow relationships, useful for evaluating potential effects of flow regimes on wetted surface area and, therefore, productivity of algae and benthic macroinvertebrates, were relatively monotonic in their rate of increase in wetted perimeter with flow in the bypass reaches. The rate of increase in wetted perimeter with increased flow was greatest at the lowest flows and least at the highest flows. However, the relationships typically did not have distinct inflection points (distinct breaks) where an increase in flow exhibited an obvious change in the wetted perimeter relationship. Plots showing these relationships are shown in Figure 7.4-14 (also see AQ 1 – TSR (SCE 2019a; SD A).

Comparison of wetted perimeter under existing and unimpaired hydrology conditions show that, in general, the existing wetted perimeter is approximately ≥80% of the unimpaired wetted perimeter. Figures 7.4-15 to 7.4-18 show the existing wetted perimeter percent of unimpaired wetted perimeter for each month for both dry and normal water year types. The warm water temperature months (June-October) and cooler water temperature months ((all other months) are separated in the plots. The bypass reaches on the Kaweah River (Figures 7.4-1 to 7.4-17) have existing wetted perimeter exceedance values well above 80% except for parts of December and January in the farthest upstream reach, KR DS PH3, which are at or slightly below 80% during a small part of the exceedance. The East Fork Kaweah River is similar, except there are a few months in normal water years and dry water years (cooler months) that have a small part of the exceedance plot between 70% and 80% of unimpaired.

### 7.4.8 Fish Passage Barriers

Map 7.4-6 shows the barriers documented in the fish passage study (AQ 8 – TSR; SCE 2019h; SD A) and barriers that were previously documented upstream of Kaweah River Mile (RM) 9.5 in the SNP as part of another study (SCE 2007). Details and pictures of barriers surveyed in 2018 are summarized in Table 7.4-12 and AQ 8 – TSR Appendix C (SCE 2019h; SD A).

#### 7.4.8.1 Kaweah River

In the Kaweah River there were two Project-related barriers identified. These include the Kaweah No. 2 Diversion Dam (RM 8.9) and Kaweah No. 2 Diversion Dam Gage Pool Weir (RM 8.8). The Kaweah No. 2 Diversion Dam was identified as an impassable barrier and the Kaweah No. 2 Diversion Dam Gage Pool Weir was identified as a partial barrier to fish passage (Map 7.4-6; Table 7.4-12; AQ 8 – TSR Appendix C (SCE 2019h; SD A). Additionally, one natural partial barrier was documented on the Kaweah River below Kaweah No. 2 Powerhouse at RM 3.8, downstream of the bypass reaches, and an impassable natural barrier was identified upstream of the bypass reaches within the SNP at RM 9.5 approximately 0.6 mile upstream of the Kaweah No. 2 Diversion Dam.

The Kaweah No. 2 Diversion Dam at RM 8.9 precludes upstream fish passage into the river reach from RM 8.9 upstream to the impassable natural barrier at RM 9.5 (numerous partial and impassable barriers exist upstream of RM 9.5, both natural and manmade).

#### 7.4.8.2 East Fork Kaweah River

In the East Fork Kaweah River, there were two Project-related barriers, including the Kaweah No. 1 Diversion Dam and Kaweah No. 1 Diversion Dam Gage Pool Weir (Map 7.4-6; Table 7.4-12; AQ 8 – TSR Appendix C (SCE 2019h; SD A). Both structures create impassable fish barriers at approximately RM 4.7. Downstream of the Project-related barriers there were two natural barriers that were surveyed – an impassable natural barrier on the East Fork Kaweah River near the confluence at RM 0.2 and an impassable natural barrier at RM 4.4 below the Kaweah River Bridge. Analysis of aerial photographs of the river stretch between these natural barriers suggest the existence of many similar impassable natural barriers in this section of river, however, ground surveys were unsafe due to steep terrain.

### 7.4.9 Riverine Fish

Fish sampling was conducted in each of the five bypass reaches and three comparison reaches (Table 7.4-1) and is reported in the AQ 2 – TSR (SCE 2019b; SD A). The sampling was designed to identify the spatial distribution and the abundance of fish species in the Project Study Area. Quantitative sampling was conducted during the late summer/early fall base flow period using a combination of electrofishing (shallow water) and snorkeling (deep water) at each representative reach study site. At the snorkeling locations, juvenile hardhead and Sacramento pikeminnow less than approximately 3 inches were recorded as a single category, “unidentified juvenile mixed minnow”, due to the difficulty of distinguishing these two species during snorkeling.

Qualitative sampling using single pass electrofishing and/or seining gear was also used to collect seasonal information on emergence of fry. The purpose of this sampling was to identify the timing and abundance of fry in the vicinity of Project diversions (Kaweah No. 1 and Kaweah No. 2 diversions) and diversions within Sequoia National Park (SNP) (Marble Fork and Middle Fork diversions) with respect to potential entrainment into the diversions.

Information discussed below in relation to riverine fish includes: (1) distribution and diversity; (2) growth and condition; (3) emergence/spawning timing; (4) abundance (standing crop); (5) fish stocking; and (6) bypass reach habitat.

#### 7.4.9.1 Distribution and Diversity

The results of the quantitative and qualitative fish population sampling (AQ 2 – TSR; SCE 2019b; SD A) are summarized in a sampling site by species matrix, Table 7.4-1, to show the distribution and diversity of each fish species observed in the Kaweah River and in the East Fork Kaweah River. Hardhead and Sacramento pikeminnow were captured at all sampling sites in the Kaweah River and only the lowest elevation site on the East Fork Kaweah River. Sacramento suckers were found throughout the Kaweah and East Fork Kaweah River sampling sites. Rainbow trout were found in the upper three sampling sites on the Kaweah River, but not the lower two sites and at all of the East Fork Kaweah River study sites. Smallmouth bass were found in the lower three Kaweah River sites and lower East Fork Kaweah River. California roach were found at the two upper sites on the Kaweah River and the two lower sites on the East Fork Kaweah River.

#### 7.4.9.2 Growth and Condition

**Length Frequency Histograms and Age Structure**

Length frequency histograms were created for rainbow trout as well as for all other fish species captured during river sampling and special-purpose qualitative sampling at all of the fish sampling locations (Figure 7.4-19). Note that electrofishing and snorkeling data are presented in different size categories. In general, most of the fish captured or observed were YOY and juvenile, with some adults. Rainbow trout included juvenile fish up to about 100 mm (0+ and 1+) and adults from about 130–220 mm, with one adult observed greater than 260 mm (Figure 7.4-19; Figure 7.4-20; and AQ 2 – TSR Table B-2 Appendix B (SCE 2019b; SD A). The largest/oldest rainbow trout collected were 3+ years old (approximately 200+ mm) (Figure 7.4-20). Length frequency histograms for rainbow trout at each sampling site where they were observed are provided in AQ 2 – TSR Appendix C (SCE 2019b; SD A). A length versus weight relationship for rainbow trout is also provided in Figure 7.4-21. Pikeminnow, Sacramento sucker, and California roach were dominated by juvenile fish with a few larger adults captured/observed. Hardhead and smallmouth bass were an exception to the general pattern, with approximately equal numbers of juvenile and larger adult fish observed. Hardhead were particularly bimodal, with equal numbers of small (<80 mm) and larger (>260 mm) fish captured/observed (Figure 7.4-19).

### Condition Factor

Fulton's fish condition factor provides a relative index of the nutritional state (e.g., storage of muscle and lipids) of the fish, but the values of calculated condition factor that represent good or poor nutritional state vary by species, depending on their body shape, and can vary depending on the size (length) of fish within a species. The average condition factor of rainbow trout in the Project study area was 1.17 (Table 7.4-14). Condition factors for trout can range from <0.6 to >2.0 (Carlander 1969), where starving fish often have condition <0.7 (Reimers 1963; Carlander 1969) and exceptional fish have high condition factors (e.g., >1.5). The condition factor for rainbow trout in the Project area appears to be good, but is not exceptional. Similar rainbow trout condition factors to those observed in the Project vicinity were found in the Kings River downstream of Pine Flat Dam (Hanson and Bajjaliya 2005) and represent fish in good condition. Detailed information for condition factors at individual sampling locations and for rainbow trout YOY versus older fish is shown in Table 7.4-15. There were no remarkable differences between sampling sites or fish sizes. For all other fish species (hardhead, Sacramento pikeminnow, Sacramento sucker, sculpin, California roach, and smallmouth bass) average condition factors are shown in Table 7.4-14. Reference data for the condition factors for these species were not available.

### 7.4.9.3 Emergence/Spawning Timing

The total number of fry sampled or observed in the vicinity of each diversion during the June 13-14 and July 6-7, 2018, emergence sampling was relatively small. The results of the qualitative fry emergence surveys are shown in Table 7.4-16. Rainbow trout, brown trout, Sacramento pikeminnow, hardhead, unidentified juvenile mixed minnows, Sacramento sucker, and California roach were captured or observed during the sampling. No rainbow trout YOY were captured in the June 13-14 sampling. During the July 6-7 sampling, one rainbow trout was captured near the Middle Fork Diversion (total length [TL] = 46 mm) and eight rainbow/brown trout were captured or observed near the Marble Fork Diversion (RBT TL = 40 to 50 mm; BRT TL = 72 to 82 mm). Based on lack of rainbow trout fry observed in mid-June and the size of rainbow trout fry captured in early July (TL = 40 to 50 mm), rainbow trout emergence likely occurred sometime in early or mid-June. For example, emergence size for rainbow trout fry is approximately ≥26 mm (Reclamation 2010). Potential growth at 15°C to 20°C (59°F to 68°F) from early June to early July when rainbow trout fry were captured would be approximatel20 mm in length (calculated from observed laboratory growth rates in Hokanson et al. 1977); therefore, emergence of fry in early June would result in fry in the size range observed in early July (40 to 50 mm).

Minnow species and Sacramento sucker hatching also likely occurred sometime in mid to late June. The number and size of larval minnow species observed in mid-June was very small and more larval/fry minnows were observed in the early July sampling.

A fish life stage periodicity chart (or life history chronology chart by month) for each species in the study reaches was developed based on available literature (Moyle 2002), discussion with qualified fisheries biologists, and review of the results of the 2018 fish population sampling (backpack e-fishing, snorkeling, and YOY sampling; Table 7.4-17).

#### 7.4.9.4 Abundance (Standing Crop)

Sacramento pikeminnow, Hardhead (including young-of-year [YOY] mixed minnows), and Sacramento sucker were the dominant fish species in the study reaches (Tables 7.4-18 and 7.4-19). The study reaches on the Kaweah River and the lower East Fork Kaweah River are situated directly within the pikeminnow-hardhead-sucker assemblage elevation zone (100–1,500 feet [ft] mean sea level [msl]) of the Sacramento-San Joaquin Province / Sierra Nevada foothills (Moyle 2002). Along the Sierra Nevada mountain range, the foothill streams in this elevation band are dominated by pikeminnow-hardhead-sucker species, primarily due to water temperature. Figure 7.4-22 shows the elevation of the fish sampling locations. The only sampling locations that were above the 100 – 1,500 ft msl elevation band are two sites on the upper East Fork Kaweah River (>2,500 ft msl). Water temperature at the fish sampling locations generally ranged from 68–86°F (20–30°C) during the summer months (Figure 7.4-23).

Rainbow trout numbers in the reaches were relatively low, ranging from 0–707 fish/mile (25.6 lbs/mile), with the highest numbers in the upper East Fork Kaweah River where the water temperature was cooler (Table 7.4-19 and Figure 7.4-24). Conversely, smallmouth bass were present in the lower Kaweah River and lower East Fork Kaweah River (lowest elevation sites) where the warmest summer water temperature occurred (Table 7.4-18).

Fish densities by mesohabitat type within each sample reach are shown in Table 7.4-20 (fish/mile) and Table 7.4-21 (fish/acre) for all species captured. Rainbow trout biomass (lbs/mile and lbs/acre) for each mesohabitat type within each sample reach is shown in Table 7.4-22.

For comparison purposes, the rainbow trout fish density and biomass results from the sampling effort in the bypass reaches associated with the Kaweah Project were compared to density and biomass data from other Sierra Nevada stream systems in the same elevation range (Figure 7.4-25). Rainbow trout density and biomass in the bypass reaches and reference reaches upstream of the Project are lower than most of the Sierra Nevada fish density data in Figure 7.4-25. The Sierra Nevada fish density data were summarized from the Yuba and American Rivers (PCWA 2010) as well as the Middle Fork San Joaquin River, Clark Fork Stanislaus River, Clavey River, Merced River, Kings River, Kaweah River (1984 and 1985 surveys), and Tule River (CDFW 2017). The dataset was limited to elevations between 500 and 3,000 ft msl. Water temperature may be a confounding factor in the Sierra Nevada data sets as many of the data sets are derived from streams with colder water temperature downstream of reservoirs, whereas the bypass reach data sets are not influenced by cold/cool reservoir flow releases.

### 7.4.9.5 Fish Stocking

Fish species in the bypass and comparison reaches are naturally reproducing populations and no stocking currently occurs. Historically fish stocking of trout did occur in the Project Study Area.

### 7.4.9.6 Bypass Reach Habitat Modeling

The habitat versus flow relationships and habitat time series analyses for hardhead (juvenile and adult) (including Sacramento pikeminnow), Sacramento sucker (juvenile and adult), and rainbow trout (spawning, adult, juvenile, fry) and) fish species are summarized below. Tables of WUA and percent of maximum WUA are presented for each study site in AQ1 – TSR Appendix E SCE 2019a; SD A). Detailed presentation of the material is provided in the AQ 1 – TSR (SCE 2019a; SD A).

**Habitat versus Flow Modeling**

Habitat versus flow relationships in the bypass reaches indicated that relatively large flows (in comparison to the natural unimpaired summer flow) provide the maximum habitat for species and life stages that use deep and relatively faster water, such as adult hardhead/pikeminnow, adult Sacramento sucker, and adult rainbow trout. That is, the channels in the bypass reaches are relatively large, presumably because of frequent high magnitude winter and spring flow events, and are capable of providing habitat for deep/fast water species/life stages at much higher flows than the natural summer/fall base flows that occur in these rivers (very low summer/fall baseflows compared to other times of the year). Table 7.4-23 (also see AQ 1 – TSR [SCE 2019a; SD A]) provides information on existing and unimpaired flows for the streams/rivers associated with the Project. The existing flow exceedances are slightly lower than the unimpaired flow exceedances.

The hardhead/pikeminnow adult, Sacramento Sucker adult, and rainbow trout adult habitat versus flow relationships were very similar and typically reached a maximum at the highest discharges (approximately 150 cfs to 200 cfs in the Kaweah River and 100 cfs to 150 cfs in the East Fork Kaweah River) compared to other species/life stages (Figures 7.4-25 to 7.4-28). Juvenile and fry life stages reached a maximum habitat at much lower flows. The amount of rainbow trout spawning habitat in the bypass reaches was very low due to the very limited amount of spawning gravel.

In the East Fork Kaweah River, habitat versus flow relationships are typically only applicable to the accessible lower 0.5 miles of channel where the instream flow modeling was conducted (EF US Confl). Upstream in the inaccessible bypass reach (EF DS K1 Div), the channel is much narrower and steeper and too dangerous to measure/model. Presumably, in the upstream bypass reach (EF DS K1 Div), habitat would reach a maximum at a much lower flow than occurs at the wider, lower gradient EF US Confl site where the modeling was conducted.

### Habitat Time Series Modeling

A time series analyses (1994 to 2018) of existing and unimpaired flow conditions was used to provide an estimate of the difference between existing habitat and the natural habitat potential (unimpaired habitat) in the bypass reaches associated with the Project. The data and detailed discussion are presented in AQ 1 – TSR (SCE 2019a; SD A). A summary of the results is provided below.

*KAWEAH RIVER*

The lower Kaweah River from the Kaweah No. 1 Powerhouse to Lake Kaweah is designated as a Central Valley drainage hardhead/pikeminnow stream and a California Natural Diversity Database (CNDDB) rare natural community (CDFW 2019). In addition, adult hardhead/pikeminnow typically require some of the highest flow needed among fish species/life stages in the Kaweah River to achieve maximum habitat (similar to adult Sacramento sucker and adult rainbow trout). The individual monthly exceedance plots of existing and unimpaired habitat are shown in AQ1 – TSR Appendix G (SCE 2019a; SD A) for each bypass reach. A summary of the difference between the existing and unimpaired habitat each month is shown in Figures 7.4-29 to 7.4-32. Existing habitat is in all months is ≥80% of unimpaired habitat in the lowest reach, KR US PH2, and approximately ≥70% (typically ≥80%) in all months in the upper two reaches (KR US PH1 and KR DS PH3). The lowest months (months where part of the exceedance plot is <80%) are the drier months in the fall and early winter before snowmelt occurs (October, November, December, January and February). Figure 7.4-32 shows the existing percent of impaired for all three of the Kaweah River bypass reaches combined (weighted by length of the reaches).

Adult rainbow trout habitat is similar to the adult hardhead habitat, but with slightly lower existing percentages of unimpaired habitat (see AQ 1 – TSR (SCE 2019a; SD A). Typically, however, the water temperature in these reaches is naturally too high for quality rainbow trout habitat (e.g., > 70 F) and more conducive to hardhead, Sacramento pikeminnow, Sacramento sucker, and other warmer water species.

Juvenile habitat (hardhead/pikeminnow, Sacramento sucker, rainbow trout) and rainbow trout spawning habitat, in general, was higher under existing compared to unimpaired habitat (see AQ1 – TSR Appendix G SCE 2019a; SD A). This occurs because during many months unimpaired flow is too high to provide optimum habitat for juvenile life stages or spring spawning and the reduction of flows in the bypass reaches from the Project diversion actually enhances habitat.

*EAST FORK KAWEAH RIVER*

***LOWEST REACH (EF US CONFL)***

In the lower East Fork Kaweah River bypass reach (EF US Confl), adult hardhead/pikeminnow required some of the highest flow needed among fish species/life stages to achieve maximum habitat (similar to adult Sacramento sucker and adult rainbow trout). The individual monthly exceedance plots of existing and unimpaired habitat are shown in AQ1 – TSR Appendix G (SCE 2019a; SD A) for each bypass reach. A summary of the difference between the existing and unimpaired habitat each month is shown in Figure 7.4-33. Existing habitat in all months is ≥70% and typically ≥80% in the wetter months (March to July).

Adult rainbow trout habitat is similar to adult hardhead/pikeminnow habitat, but with slightly lower existing versus unimpaired habitat percentages (see AQ 1 – TSR (SCE 2019a; SD A). Typically, however, the water temperature is too high for quality rainbow trout summer rearing habitat (e.g., > 70 °F) in the lower reach (EF US Confl) and more conducive to hardhead, Sacramento pikeminnow, Sacramento sucker, and other warmer water species.

Juvenile habitat (hardhead/pikeminnow, Sacramento sucker, rainbow trout, in general, was lower under existing compared to unimpaired habitat (see AQ1 – TSR Appendix G SCE 2019a; SD A). Juvenile WUA tends to have a maximum habitat at flows of 50 cfs. Once flow exceed this the habitat decreases. Habitat at lower flows (10 – 25 cfs) increases rapidly as flow increase, as a result if water is diverted at these lower flows the habitat can decrease quickly. Rainbow trout spawning tends to decrease under existing conditions when compared to unimpaired.

***Upper Reach (EF DS K1 Div)***

The upper reach, EF DS K1 DIV, was not modeled due to the narrow, steep, and dangerous terrain. We assume that because of the narrower channel, diversion of flow from the bypass channel would have less negative impact on adult habitat than in the downstream, wider channel bypass reach (EF US Confl) (see discussion above) and more beneficial impacts on juvenile habitat and spring rainbow trout spawning habitat.

### 7.4.10 Foothill Yellow-Legged Frogs

#### 7.4.10.1 Distribution and Abundance

Surveys for FYLF were conducted in spring and/or late summer and early fall along the bypass and comparison reaches (and their tributaries) to document the distribution and abundance of FYLF (Map 7.4-7; Figure 7.4-33). The surveys followed the Visual Encounter Protocol described in Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians (Heyer et. al. 1994). The study sites and survey methods are described in the AQ 7 –TSR (SCE 2019g; SD A).

FYLF were not observed in the surveyed reaches. In the reaches where FYLF might have been expected to be present based on physical habitat, bullfrogs were found (competitors/predators of FYLF). It is highly unlikely that FYLF persist in the study area, given the dominance of bullfrogs in the lower elevation reaches, the absence of permanently flowing tributaries in the higher elevation study reaches, and the position of the Watershed downwind of areas in the Central Valley where pesticide use is heavy (Davidson et al. 2004, Sparling et al. 2015). Pacific treefrogs in the area have long shown the negative effects of pesticides (Datta et al. 1998) and FYLF is particularly sensitive to contaminant exposure (Sparling and Fellers 2015, Kerby and Sih 2015).

The possibility that a small remnant FYLF population may exist somewhere in the greater Kaweah Watershed cannot be completely ruled out because frog populations that have gone undetected for decades are occasionally re-discovered (Backlin et al. 2018). However, there are no recent observations of FYLF in the Kaweah River Watershed. The most recent records date back to 1970, almost 50 years ago (Moyle 1973). At that point in time, FYLF were already uncommon in the region according to the Conservation Assessment for FYLF (Hayes et al. 2016). No collections or sightings of FYLF exist from Sequoia National Park in the interval from 1980 to present.

The only other relatively recent (i.e., within the last few decades) sightings in the vicinity, were outside the watershed, in two unnamed tributaries of the North Fork Kern River in Sequoia National Forest (Lind et al. 2003). The creeks were surveyed multiple times from 1998 to 2002. The last observation of FYLF from one creek was of three adults found by Patrick Kleeman of the U.S. Geological Survey (USGS) on September 12, 1998 (Lind et al. 2003). No frogs were observed at that locality during three subsequent surveys conducted 2002–2003. At least two adult FYLF were observed per survey at the other creek between 1998 and 2002 (Lind et al. 2003).

#### 7.4.10.2 Habitat

Based on longitudinal profile, topography, and geomorphology, the sections of river with the greatest proportion of wide channel cross sections, low gradients, and close proximity to tributaries should offer the best habitat for FYLF (Kupferberg 1996, Rice 2017). Upstream of the Project (KR US PH3 and EF US K1 DIV), there was little indication of habitat suitable for FYLF. There were only small isolated locations in the river channels with slow velocity habitat and the off-channel tributaries were ephemeral. Similarly, the bypass study reaches in the upstream portion of the Study Area (KR US CONF EF, EF DS K1 DIV) provided limited FYLF habitat. The channels are generally narrow and steep gradient with limited depositional area suitable for breeding and perennial off-channel tributaries are not present. The lower portion of the Kaweah River study area (KR US PH1, KR US PH2, and KR DS PH2), provides pockets of suitable FYLF breeding habitat, including side channels, however, the presence of abundant bullfrogs and other predators such as signal crayfish, likely precludes the possibility of FYLF occupying the habitat.

### 7.4.11 Fish Entrainment

The Project locations where fish entrainment could result in fish translocation or mortality (e.g., into flowlines or through Project powerhouses) include: (1) Kaweah No. 1 Diversion, flowline, forebay, and powerhouse (2) the Kaweah No. 2 diversion, flowline, forebay, and powerhouse and (3) the Kaweah No. 3 flowline, forebay, and powerhouse. The timing of YOY fish emergence, abundance of fish in the river reaches upstream of the Project diversions, empirical fish entrainment sampling, and diversion/powerhouse characteristics related to fish translocation or mortality are discussed below.

### 7.4.11.1 Emergence Timing

The timing of emergence in river reaches upstream of Project diversions, could influence the entrainment of YOY fishes. The AQ 9 – TSR (SCE 2019h; SD A) included emergence sampling near diversions and emergence sampling is also discussed in Section 7.4.9.3. The number of fry sampled or observed in the vicinity of each diversion during the June 13-14 and July 6-7, 2018, emergence sampling was relatively small. In total, at the four upstream of diversion sampling sites (Marble Fork Diversion, Middle Fork Diversion, Kaweah No. 2 Diversion, Kaweah No. 1 Diversion), there were only 45 YOY and 139 YOY fish captured, June and July, respectively. Rainbow trout, brown trout, Sacramento pikeminnow, hardhead, unidentified juvenile mixed minnows, Sacramento sucker, and California roach were captured during the sampling. Based on lack of rainbow trout fry observed in mid-June and the size of rainbow trout fry captured in early July (TL = 40 to 50 mm), rainbow trout emergence likely occurred sometime in early or mid-June. Minnow species and Sacramento sucker hatching also likely occurred sometime in June. The number and size of larval minnow species observed in mid-June was very small and more larval/fry minnows were observed in the early July sampling. The data suggest that hatching was occurring primarily in June.

Section 7.2.3.3 shows the hydrology related to each individual diversion. During the driest years the diversions quit diverting flow in late June or early July and, therefore, the diversion pattern would minimize the potential for YOY entrainment. During wetter years, the diversions continue to divert later into the summer and/or fall and there would be more opportunity for YOY entrainment.

### 7.4.11.2 Fish Abundance

Entrainment potential is likely related to fish abundance in the river reaches upstream of the Project diversions. Section 7.4.9.4 discusses fish abundance in the bypass and comparison reaches. Sacramento sucker, Sacramento pikeminnow, and hardhead (including young-of-year [YOY] mixed minnows), in general, were the dominant fish species in the study reaches, with California roach being relatively abundant in the upper reaches of both the Kaweah River and East Fork Kaweah River (KR US PH3, KR DS PH3, EF US Confl). Rainbow trout numbers in the reaches were relatively low compared to other Sierra Nevada trout rivers, ranging from 0–707 fish/mile (25.6 lbs/mile), with the highest numbers in the upper East Fork Kaweah River where the water temperature was cooler.

### 7.4.11.3 Entrainment Sampling

Entrainment sampling (fyke net and drift net) is being conducted as part of the revised AQ 9 – Entrainment Technical Study Plan filed with FERC on December 11, 2018[1]. Table 7.4-24 shows the sampling that has occurred and the draft schedule for future sampling (2019 and 2020). Both drift net sampling and fyke net sampling are being conducted for a three day/night period during four seasons. Due to dangers of overtopping the Kaweah No. 3 Flowline, only drift sampling is proposed, not fyke net

1 FERC Accession No.: 20181212-5130; Available online at: https://www.ferc.gov/docs-filing/elibrary.asp.

sampling. The revised study plan proposes to use fyke net entrainment monitoring in the Kaweah No. 1 and 2 flowlines to approximate entrainment in Kaweah No. 3 Flowline. The revised study plan also allows for additional entrainment sampling based on consultation with agency biologists/staff.

To date, only the Kaweah No. 2 Flowline has been sampled with fyke and drift nets (May 6-10, 2019). During the three days of sampling (three 4 hour periods each day), only one fish was captured in the fyke net (200 mm Sacramento pikeminnow) and no fry were captured in the drift nets. The Kaweah No. 3 Flowline has been sampled once with drift nets (May 20-24, 2019). No fry were captured during the sampling.

### 7.4.11.4 Diversion/Powerhouse Characteristics

#### Kaweah No. 1 Diversion, Flowline, Forebay, and Powerhouse

Any potential entrainment of fish at the Kaweah No. 1 Diversion would result in translocation of fish into the Kaweah No. 1 flowline, forebay tank, and powerhouse. The annual number of fish that potentially are entrained into the Kaweah No. 1 Diversion/Flowline is currently unknown. Incidental observations by maintenance workers and field biologists suggest the number may be low. Presently the Kaweah No. 1 Flowline is out of service due to a rockslide. When the flowline is back in service, entrainment sampling will be conducted (see Section 7.4.11.3 above).

Generally, fish entrained into the flowline would have high survival, until at some point the flowline was dewatered or the fish were entrained into the powerhouse. The Kaweah No. 1 Powerhouse is an implulse turbine with 1,260 feet of head and a capacity of 24 cfs. It is assumed that entrained fish passing through an impulse turbine will sustain high mortality (nearly 100%). Translocation of fish from the diversion, into the flowline, into the powerhouse and back into the Kaweah River below the powerhouse would be associated with a high percentage mortality risk.

#### Kaweah No. 2 Diversion, Flowline, Forebay, and Powerhouse

Any potential entrainment of fish at the Kaweah No. 2 Diversion would result in translocation of fish into the Kaweah No. 2 flowline, forebay, and powerhouse. The annual number of fish that potentially are entrained into the Kaweah No. 2 Diversion/Flowline is currently unknown. Incidental observations by maintenance workers and field biologists suggest the number may be low. The initial entrainment sampling for three days May 6-10, 2019 (fyke and drift nets) captured only one fish (200 mm Sacramento pikeminnow). Three additional entrainment sampling time periods are scheduled (see Section 7.4.11.3 above).

Generally, fish entrained into the flowline would experience high survival, until at some point the flowline was dewatered or the fish were entrained into the powerhouse. Typically the flowline maintains a few cfs of flow to provide consumptive water-rights conveyance and fish may not experience complete dewatering very frequently. The Kaweah No. 2 Powerhouse is a Francis-type turbine with 344 feet of head and a capacity of 82 cfs. Francis-type turbines typically have moderate to high survival rates for fish passing through them (Winchell et al. 2000). Survival depends on the size of the fish, the peripheral runner velocity, and blade and or wicket spacing/clearance. The details of the Kaweah No. 2 Powerhouse are being investigated and will be available in the final AQ 9 – TSR (SCE 2019h; SD A). Translocation of fish from the diversion, into the flowline/forebay, into the powerhouse, and back into the Kaweah River below the powerhouse would likely be associated with a low to moderate percentage mortality risk.

**Kaweah No. 3 Flowline, Forebay, and Powerhouse**

Any potential entrainment of fish at the Kaweah No. 3 diversions (Marble Fork and Middle Fork Kaweah River) would result in translocation of fish into the Kaweah No. 3 flowline, forebay, and powerhouse. The annual number of fish that potentially are entrained into the Kaweah No. 3 Diversion/Flowline is currently unknown. Incidental observations by maintenance workers during maintenance outages and draining of the Kaweah No. 3 Forebay, suggest the number may be relatively low. Fishermen have been observed fishing in the forebay, the maintenance workers suggest that during the most recent draining of the forebay, there was a fish kill of <100 fish. Drift net entrainment sampling was conducted May 20-24, 2019 (see Section 7.4.11.3 above). No fry were captured in the drift nets. Additional sampling is scheduled for three more time periods in the future.

Generally, fish entrained into the flowline would experience high survival in the flowline and/or the forebay, until at some point the flowline/forebay was dewatered or the fish were entrained into the powerhouse. The Kaweah No. 3 Powerhouse is an impulse turbine with 750 feet of head and a capacity of 92 cfs. It is assumed that entrained fish that pass through an impulse turbine will sustain high mortality (nearly 100%). Translocation of fish from the diversion, into the flowline, into the powerhouse and back into the Kaweah River below the powerhouse would be associated with a high percentage mortality risk.

### 7.4.12 Special-Status Species

Table 7.4-25 provides a list of special-status species identified by resources agencies as potentially occurring in the Project area. Of these, only three--hardhead, foothill yellow-legged frog, and western pond turtle, may potentially occur in the study area. This species are discussed below.

#### 7.4.12.1 Hardhead

Hardhead distribution and abundance in the Project study area was discussed above in Sections 7.4.9.1 and 7.4.9.4, respectively. Hardhead, were present in low to moderate abundance in all of the bypass and comparison reaches on the Kaweah River (KR US PH3, KR DS PH3, KR US PH1, KR US PH2, KR DS PH2) and in the lowest reach of the East Fork Kaweah River (EF US Confl). Hardhead were not found in the upper reaches of the East Fork Kaweah River (EF DS K1 Div or EF US K1 Div) likely due to the extensive number of natural upstream migration barriers in the narrow, steep, confined channel. It is unlikely hardhead have ever existed in these reaches. A total of 36 hardhead were captured or observed during the AQ 2 – TSR (SCE 2019b; SD A) sampling. The hardhead size distribution was bimodal with approximately half of the fish being juvenile fish and half being adult fish. A large number of mixed minnows were observed during the snorkel sampling in the Kaweah River study reaches and it is unknown how many of these were hardhead (AQ 2 – TSR [SCE 2019b; SD A]).

#### 7.4.12.2 Foothill Yellow-legged Frog

Historical data and extensive FYLF sampling as part of AQ 7 – TSR (SCE 2019g; SD A) are discussed in Section 7.4.10. FYLF were not observed during the surveys conducted in the Project study area. In the reaches where FYLF might have been expected to be present based on physical habitat, bullfrogs were found (competitors/predators of FYLF). It is highly unlikely that FYLF persist in the study area, given the dominance of bullfrogs in the lower elevation reaches, the absence of permanently flowing tributaries in the higher elevation study reaches, and the position of the Watershed downwind of areas in the Central Valley where pesticide use is heavy (Davidson et al. 2004, Sparling et al. 2015). Pacific treefrogs in the area have long shown the negative effects of pesticides (Datta et al. 1998) and FYLF is particularly sensitive to contaminant exposure (Sparling and Fellers 2015, Kerby and Sih 2015).

The possibility that a small remnant FYLF population may exist somewhere in the greater Kaweah Watershed cannot be completely ruled out because frog populations that have gone undetected for decades are occasionally re-discovered (Backlin et al. 2018). However, there are no recent observations of FYLF in the Kaweah River Watershed. The most recent records date back to 1970, almost 50 years ago (Moyle 1973). At that point in time, FYLF were already uncommon in the region according to the Conservation Assessment for FYLF (Hayes et al. 2016). No collections or sightings of FYLF exist from Sequoia National Park in the interval from 1980 to present.

The only other relatively recent (i.e., within the last few decades) sightings in the vicinity, were outside the watershed, in two unnamed tributaries of the North Fork Kern River in Sequoia National Forest (Lind et al. 2003). The creeks were surveyed multiple times from 1998 to 2002. The last observation of FYLF from one creek was of three adults found by Patrick Kleeman of the U.S. Geological Survey (USGS) on September 12, 1998 (Lind et al. 2003). No frogs were observed at that locality during three subsequent surveys conducted 2002–2003. At least two adult FYLF were observed per survey at the other creek between 1998 and 2002 (Lind et al. 2003).

#### 7.4.12.3 Western Pond Turtle

The FYLF study sites (AQ 7 – TSR [SCE 2019g; SD A]) and Section 7.4.10 were surveyed for WPT during the FYLF surveys. In particular, surveyors visually inspected pools and backwaters for WPT at each study site during the FYLF surveys. Additionally, potential sightings of WPT during implementation of other aquatic technical studies were recorded, if they occurred. In particular, these included the AQ 1 – Instream Flow Study mesohabitat mapping and field data collection (SCE 2019a; SD A), the AQ 2 – Fish Population study (SCE 2019b; SD A), and the AQ 3 – Benthic Macroinvertebrate study (SCE2019c; SD A).

No WPT were encountered either in the water or on land during the three surveys conducted by the amphibian / reptile surveyors. No incidental observations of WPT occurred during the other aquatic studies. There was one incidental observation of an unidentified turtle on July 25, 2018 in the KR US PH2 reach (i.e., Downstream of Kaweah No.1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse); however, the unidentified turtle was in the in the vicinity (200 m and 380 m east-southeast) of a pair of ponds where we observed many bullfrogs, known predators of hatchling WPT (Jancowski and Orchard 2013), and there is a high potential that non-native turtles could be present and the observed turtle; therefore, may have been non-native.

Similar to the findings for FYLF, the upstream survey reaches in both the Kaweah and the East Fork Kaweah River where cascades and narrow bedrock canyons were common, provide limited instream habitat for turtles and no large woody debris for basking. Side pools and side channels in the downstream lower gradient reaches (KR US PH1, KR US PH2, KR DS PH2) would provide refuge during high flows for WPT, but again, most suitable habitat was occupied by bullfrogs.

There are recent observations of WPT near the study area from two locations in Sequoia National Park that have been the focus of either population monitoring (Jeffcoach 2014), thermal behavior research (Ruso et al. 2017) or ecotoxicological studies (Datta et al. 1998; Meyer et al. 2013, 2014, 2016). One population occupies pools in the permanently flowing reaches of the North Fork Kaweah near the confluence with Yucca Creek approximately 12 kilometers (km) upstream of the study area. The other is in Sycamore Creek, an intermittent tributary of the Middle Fork Kaweah approximately 1 km from the Study Area (see Map 7.4-7). These sites have long histories of being occupied by WPT as there are collections records from the University of California's Museum of Vertebrate Zoology (MVZ) for both of these sites dating from 1935 (record Nos. MVZ: Herp:19334, 18277, 21910). Turtles in the Kaweah Watershed show evidence of high loads of agricultural pesticides and immunological impairment due to windborne contaminants that drift into the study area from the Central Valley (Datta et al. 1998; Meyer et al. 2013, 2014, 2016).

GIS analysis indicates that potential nesting habitat exists in a narrow patchy corridor along the Kaweah River and East Fork Kaweah River corridors and along some of the small tributaries / ponds that may maintain permanent water (Map 7.4-8). During field work we found no evidence of nesting activity in the Project area. During reconnaissance surveys at potential nesting locations identified in the GIS map near project facilities (e.g., powerhouses, diversion pools, and Project roads), we found that a large amount of the GIS identified habitat included substrate (e.g., large cobble/boulders, roadways) and/or dense vegetation that was not suitable for nesting. We did identify potential nesting habitat with suitable substrate on the North side of the river upstream of the Kaweah No. 2 Diversion structure. There is also potential nesting habitat with suitable substrate on the north side of the river near the Kaweah No. 2 Powerhouse. Unnecessary disturbance to these areas should be avoided during Project maintenance.

### 7.4.13 Literature Cited

Addley, R.C., B. Bradford, and J. Ludlow. 2005. Klamath River bioenergetics report. Institute for Natural Systems Engineering, Utah Water Research Lab, Utah State University. Logan, UT.

Allan, D. 1995. Stream Ecology. Chapman and Hall, Oxford London. 387p.

Backlin, A.R., J.Q. Richmond, E.A. Gallegos, C.K. Christensen, and R.N. Fisher. 2018. An extirpated lineage of a threatened frog species resurfaces in southern California. Oryx 52:718–722.

Baltz, D. M., B. Vondracek, L. R. Brown, P. Moyle. 1991. Seasonal changes in microhabitat selection by rainbow trout in a small stream. Transactions of the American Fisheries Society 120:166-176.

CDFW (California Department of Fish and Wildlife) Wild Trout Data, unpublished data. 2017.

____. 2019. California Natural Diversity Database. Accessed 2019. https://www.wildlife.ca.gov/Data/CNDDB

Carlander, K.D. 1969. Handbook of Freshwater Fishery Biology, Volume 1. Iowa State University Press. Pg. 752.

Cummins, K.W., and Wuycheck, J.C. 1971. Caloric equivalents for investigations in ecological energetics. Mitt. int. Ver. Limnol. 18: 1-58.

CVRWQCB (California Regional Water Quality Control Board) Central Valley Region. 2018. Water Quality Control Plan for the Tulare Lake Basin Second Edition. Revised May 2018. Available at: https://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/tlbp_201805.pdf.

Datta, S., L. Hansen, L. McConnell, J. Baker, J. LeNoir, and J.N. Seiber. 1998. Pesticides and PCB contaminants in fish and tadpoles from the Kaweah River Basin, California. Bulletin of Environmental Contamination and Toxicology 60:829–836.

Davidson, C. 2004. Declining downwind: amphibian population declines in California and historical pesticide use. Ecological Applications 14:1892–1902

ENTRIX. 2007. Aquatic Studies Report for the Kaweah No. 3 Hydroelectric Project. Prepared in Suppoort of Southern California Edison Company Application for Renewal of Special Use Permit No. PWFA-SEKI-6000-095 to Continue Operation of the Kaweah No. 3 Hydroelectric Project. Prepared for Sequoia National Park Ash Mountain Headquarters by ENTRIX, Inc. 590 Ygnacio Valley Road, Suite 200, Walnut Creek, CA 94960.

FERC (Federal Energy Regulatory Commission). 1991. Environmental Assessment Federal Energy Regulatory Commission, Office of Hydropower Licensing, Division of Project Review Kaweah Project, FERC Project No. 298-000 – California. August 16, 1991.

Hanson, C.H., and F. Bajjaliya. 2005. Analysis of the Condition of Rainbow Trout Collected from the Kings River Downstream of Pine Flat Dam 1983-2005. Hanson Environmental, Inc.

Hayes, M.P., C.A. Wheeler, A.J. Lind, G.A. Green, and D.C. Macfarlane. 2016. Foothill Yellow-legged Frog conservation assessment in California. Gen. Tech. Rep. PSW-GTR-248. Albany, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 193 p.

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster, eds. 1994. Measuring and monitoring biological diversity: Standard methods for amphibians. Biological Diversity Handbook Series. Washington D.C., Smithsonian Institution Press.

Hokanson, K.E.F., C.F. Kleiner, and T.W. Thorslund. 1977. Effects of constant temperatures and diel temperature fluctuation on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri.* J. Fish. Res. Board Can. 34:639-648.

Jancowski, K., and S. Orchard. 2013. Stomach contents from invasive American bullfrogs Rana catesbeiana (= Lithobates catesbeianus) on southern Vancouver Island, British Columbia, Canada. “NeoBiota” 16:17–37.

Jeffcoach, D. 2014. Monitoring anthropogenic contaminants and their effects on wildlife in Sequoia National Park. MS Thesis, California State University, Fresno.

Jordan/Avent & Associates, Jones & Stokes Associates, and D. Abell. 1983. A study to evaluate the impacts of the Kaweah No. 3 hydroelectric facility on the resources of Sequoia National Park. 171 pp + bibliography and appendices.

Kerby, J.L., and A. Sih. 2015. Effects of carbaryl on species interactions of the Foothill Yellow-legged Frog (Rana boylii) and the Pacific treefrog (Pseudacris regilla). Hydrobiologia 746:255–269.

Kupferberg, S.J. 1996. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (Rana boylii). Ecological Applications 6:1332–1344.

Lind, A.J., L. Conway, H.E Sanders, P. Strand, and T. Tharalson. 2003. Distribution, relative abundance, and habitat of foothill yellow-legged frogs (Rana boylii) on national forests in the Southern Sierra Nevada Mountains of California. Vallejo, California: U.S. Department of Agriculture, Forest Service, Pacific Southwest Region. 30 p.

Meyer, E., D. Sparling, and S. Blumenshine. 2013. Regional inhibition of cholinesterase in free-ranging western pond turtles (Emys marmorata) occupying California mountain streams. Environmental toxicology and chemistry. 32:692–698.

Meyer, E., C.A. Eagles-Smith, D. Sparling, and S. Blumenshine. 2014. Mercury exposure associated with altered plasma thyroid hormones in the declining Western Pond Turtle (Emys marmorata) from California mountain streams. Environmental Science and Technology 48:2989–2996.

Meyer, E., E.A. Eskew, L. Chibwe, J. Schrlau, S.L.M. Simonich, and B.D. Todd. 2016. Organic contaminants in western pond turtles in remote habitat in California. Chemosphere 154:326–334.

Moyle, P.B. 2002. Inland Fishes of California. Berkeley: University of California Press. Pp. 502.

Moyle, P.B. 1973. Effects of introduced Bullfrogs, Rana catesbeiana, on the native frogs of the San Joaquin Valley, California. Copeia 1973:18–22.

NPS (National Park Service, U.S. Department of the Interior) . 2006. Final General Management Plan and Comprehensive River Management Plan, Sequoia and Kings Canyon National Parks, Middle and South Forks of the Kings River and North Fork of the Kern River. November 2006. Available at: http://parkplanning.nps.gov/document.cfm?parkID=342&projectID=11110&documentID=17344.

Ode, P.R., A.E. Fetscher, and L.B. Busse. 2016. SWAMP bioassessment procedures: standard operating procedures (SOP) for the collecting of field data for bioassessments of California wadeable streams: benthic macroinvertebrates, algae, and physical habitat.

PCWA (Placer County Water Agency). 2010. Middle Fork Project Relicensing AQ 2 – Fish Population Technical Study Report 2007-2009. Middle Fork Project (FERC Project No. 2079).

PCWA. 2011. Middle Fork Project Relicensing AQ 5 – Bioenergetics Technical Study Report 2011. Middle Fork Project (FERC Project No. 2079).

Reclamation (U.S. Bureau of Reclamation). 2010. Fishes of the Sacramento-San Joaquin River delta and adjacent waters, California: a guide to early life histories. Vol 44 Special Publication, December 2010.

Rehn, A.C., N. Ellenrieder, and P.R. Ode. 2007. Assessment of Ecological Impacts of Hydropower Projects on Benthic Macroinvertebrate Assemblages: A Review of Existing Data Collected for FERC Relicensing Studies. California Energy Commission, contract #500-03-017.

Rehn, A.C. 2009. Benthic macroinvertebrates as indicators of biological condition below hydropower dams on west slope Sierra Nevada streams, California, USA; River Research and Applications. Vol 25 (2); pg 208-228.

Reimers, N. 1963. Body Condition, Water Temperature, and Over-winter Survival of Hatchery-reared Trout in Convict Creek, California. Trans. Am. Fish. Society 92(1):39-46.

Rice, S.P. 2017. Tributary connectivity, confluence aggradation, and network biodiversity. Geomorphology 277:6–16.

Richards, A.B., and D.C. Rogers. 2006. List of Freshwater Macroinvertebrate Taxa from California and Adjacent States including Standard Taxonomic Effort Levels. Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT). 215 pp.

Ruso, G.E., E. Meyer, and A.J. Das. 2017. Seasonal and diel environmental conditions predict Western Pond Turtle (Emys marmorata) behavior at a perennial and an ephemeral stream in Sequoia National Park, California. Chelonian Conservation and Biology 16:20–28.

SCE (Southern California Edison Company). 2007. Aquatic Studies Report for the Kaweah No. 3. Hydroelectric Project. Prepared for Sequoia National Park Ash Mountain Headquarters. Prepared in Support of Southern California Edison Company Application for Renewal of Special Use Permit No. PWFA-SEKI-6000-095 to Continue Operation of the Kaweah No. 3 Hydroelectric Project. Prepared by ENTRIX, Inc.

SCE. 2016. Section 3.5 Fish and Aquatic Resources; Pre-Application Document (PAD) for the Kaweah Project. December.

SCE. 2019a. AQ 1 – Instream Flow Technical Study Report. Available in Supporting Document A.

SCE. 2019b. AQ 2 – Fish Population Technical Study Report. Available in Supporting Document A.

SCE. 2019c. AQ 3 – Macroinvertebrate Technical Study Report. Available in Supporting Document A.

SCE. 2019d. AQ 4 – Water Temperature Technical Study Report. Available in Supporting Document A.

SCE. 2019e. AQ 5 – Geomorphology Technical Study Report. Available in Supporting Document A.

SCE. 2019f. AQ 6 – Water Quality Technical Study Report. Available in Supporting Document A.

SCE. 2019g. AQ 7 – Special-status Amphibians and Aquatic Reptiles Technical Study Report. Available in Supporting Document A.

SCE. 2019h. AQ 8 – Fish Passage Technical Study Report. Available in Supporting Document A.

SCE. 2019i. AQ 9 – Entrainment Technical Study Report. Available in Supporting Document A.

Smock, L.A. 1980. Relationships between body size and biomass of aquatic insects. Freshwater Biol. 10: 375-83.

Sparling, D.W., J. Bickham, D. Cowman, G.M. Fellers, T. Lacher, C.W. Matson, and L. McConnell. 2015. In-situ effects of pesticides on amphibians in the Sierra Nevada. Ecotoxicology 24:262–278.

Vondracek, B.B. Spence, D.R. Longanecker. 1992. Seasonal Habitat Selection of Rainbow Trout. Pacific Gas and Electric Company. San Ramon, California.

Winchell, F., S. Amaral, and D. Dixon. 2000. Hydroelectric Turbine Entrainment and Survival Database: An Alternative to Field Studies. Paper presented at Hydrovision 2000.

This Page Intentionally Left Blank

# TABLES

This Page Intentionally Left Blank

## Table 7.4-1. Bypass and Comparison Reaches in the Project Study Area.

| Study Reach | Site ID | Bypass Reaches | Comparison Reaches[1] |
|---|---|---|---|
| Kaweah River Upstream of Kaweah No. 3 Powerhouse | KR US PH3 | | X |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence | KR DS PH3 | X | |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse | KR US PH1 | X | |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse | KR US PH2 | X | |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse | KR DS PH2 | | X |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion | EF US K1 Div | | X |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion | EF DS K1 Div | X | |
| East Fork Kaweah River Upstream of Confluence with Kaweah River | EF US Confl | X | |

[1] upstream or downstream of the Project

## Table 7.4-2. Summary of Fish Species Observed in the Kaweah River and East Fork Kaweah River Study Reaches during 2018 Quantitative Sampling.

| Study Site | Date | Fish Species[1] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | RBT | BNT | HH | SPM | MXD | SS | SC | CAR | SMB |
| **Kaweah River** | | | | | | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse (KR US PH3) | 10/02/2018<br>10/18/2018 | • | •[2] | •[3] | •[3] | • | • | | • | |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (KR DS PH3) | 10/01/2018<br>10/06/2018 | • | | • | • | • | • | | • | |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (KR US PH1) | 10/01/2018<br>10/17/2018<br>10/19/2018 | • | | • | • | | • | | | • |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (KR US PH2) | 10/01/2018<br>10/08/2018 | | | • | • | • | • | • | | • |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse (KR DS PH2) | 10/01/2018<br>10/03/2018<br>10/19/2018 | | | • | • | | • | • | | • |
| **East Fork Kaweah River** | | | | | | | | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div) | 10/02/2018<br>10/05/2018 | • | | | | | • | | | |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) | 10/02/2018 | • | | | | | • | | • | |
| East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) | 10/02/2018<br>10/09/2018<br>10/19/2018 | • | | • | • | • | • | | • | • |

Notes:

1 Species: RBT = Rainbow Trout; BNT = Brown Trout; HH = Hardhead; SPM = Sacramento Pikeminnow; MXD = Unidentified Juvenile Mixed Minnow; SS = Sacramento Sucker; SC = Sculpin spp.; CAR = California Roach; SMB = Smallmouth Bass

2 Brown trout were only captured during qualitative sampling upstream of the Middle Fork Kaweah Diversion within Sequoia National Park.

3 Hardhead and Sacramento Pikeminnow were captured during the qualitative sampling but not during the quantitative sampling.

## Table 7.4-3. Minimum Instream Flow Requirements for the Bypass Reaches Associated with the Kaweah Project.[1,2]

| Month | Kaweah No. 1 Diversion | | Kaweah No. 2 Diversion | |
|---|---|---|---|---|
| | Normal Year (cfs) | Dry Year (cfs) | Normal Year (cfs) | Dry Year (cfs) |
| October | 5 | 5 | 11 | 5 |
| November | 5 | 5 | 11 | 5 |
| December | 5 | 5 | 11 | 5 |
| January | 5 | 5 | 20 | 10 |
| February | 5 | 5 | 20 | 10 |
| March | 10 | 10 | 30 | 20 |
| April | 10 | 10 | 30 | 30 |
| May | 10 | 10 | 30 | 30 |
| June | 10 | 10 | 30 | 30 |
| July | 10 | 10 | 20 | 10 |
| August | 5 | 5 | 20 | 10 |
| September | 5 | 5 | 11 | 5 |

Source: FERC License Article 405, as amended on April 20, 1994.

[1] Runoff of Kaweah River at Terminus Reservoir for April 1 through July 31, for the current year, as estimated by the California Department of Water Resources (DWR) on or about May 1 of each such calendar year shall be used to distinguish between a normal water year and a dry water year for the purpose of this article. A "Normal Year" is defined as a forecasted runoff of 172,000 acre-feet or more. A "Dry Year" is defined as a forecasted runoff is equal to or less than 172,000 acre-feet. The determination of either a normal water year or a dry water year shall then be used in maintaining the appropriate minimum flow release for the period May 10 of each calendar year through May 9 of the succeeding calendar year.

[2] This flow schedule may be temporarily modified if required by operating emergencies beyond the control of the licensee or for short periods on mutual agreement between the licensee, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. If the flow is so modified, the licensee shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

### Table 7.4-4. Water Temperature Monitoring Locations 2014-2015.

| Temperature Monitoring Location | River Mile |
|---|---|
| **Kaweah River** | |
| Three Rivers | 2.4 |
| Downstream of Kaweah No. 2 PH | 4.8 |
| Downstream of Kaweah No. 1 PH | 6.5 |
| Downstream of the Conf. with East Fork Kaweah River | 8.3 |
| Near Kaweah No. 3 PH | 8.8 |
| **East Fork Kaweah River** | |
| Upstream of the Conf. with Kaweah River | 0.1 |
| Upstream of Kaweah No. 1 Diversion | 4.8 |

## Table 7.4-5. Water Temperature Monitoring Locations 2018.

| Monitoring Sites | Site ID | Sampling Location | | Bypass or Comparison Reach (B or C) |
|---|---|---|---|---|
| | | River Mile | GPS Location | |
| **Water Temperature Monitoring Sites** | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse | KR US PH3 | 8.96 | 36.48635136, -118.8361886 | C |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse | KR DS PH3 | 8.79 8.82 | 36.48439526, -118.8357774 36.48405746, -118.8359942 | B |
| Kaweah No. 3 Powerhouse Tailrace | No. 3 Flowline | 8.95 | 36.48620181, -118.8357265 | B |
| Kaweah River Upstream of the Confluence with East Fork Kaweah River | KR US Conf EF | 8.44 | 36.47956494, -118.8380172 | B |
| Kaweah River Downstream of the Confluence with East Fork Kaweah River | KR DS Conf EF | 8.3 | 36.4794382, -118.8402536 | X |
| Kaweah River Upstream of Kaweah No. 1 Powerhouse | KR US PH1 | 6.51 6.52 | 36.46579943, -118.862146 36.46593544, -118.8620571 | X |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse | KR DS PH1 | 6.45 | 36.46562639, -118.863133 | X |
| Kaweah No. 1 Powerhouse Tailrace | No. 1 Flowline | 6.49 | 36.4653658, -118.8620713 | X |
| Kaweah River Upstream of Kaweah No. 2 Powerhouse | KR US PH2 | 5.04 | 36.46071055, -118.8796395 | X |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse | KR DS PH2 | 4.81 | 36.4613941, -118.8834057 | C |
| Kaweah No. 2 Powerhouse Tailrace | No. 2 Flowline | 4.95 | 36.46186337, -118.8806466 | X |
| **East Fork Kaweah River** | | | | |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion Dam | EF DS K1 Div | 4.68 | 36.45138042, -118.7899557 | X |
| East Fork Kaweah River Upstream of the Confluence with Kaweah River | EF US Conf KR | 0.09 | 36.47896325, -118.8374857 | X |
| **Air Temperature Monitoring Sites** | | | | |
| Kaweah No. 3 Powerhouse Air Temp | NA | 8.93 | 36.48592359, -118.8364717 | NA |
| Kaweah No. 1 Diversion Dam Air Temp | NA | 4.48 | 36.44906467, -118.7916033 | NA |
| **Weather Station Monitoring Sites** | | | | |
| Kaweah No. 1 Powerhouse Weather Station | NA | 6.49 | 36.465126, -118.861466 | NA |

## Table 7.4-6. Macroinvertebrate River Sampling Reaches.

| Study Reach | Site ID | Bypass Reaches | Reaches Upstream of Project Facilities or Comparison Reaches | Number of SWAMP Benthic Macroinvertebrate Sample Locations | Number of Drift Macroinvertebrate Sample Locations |
|---|---|---|---|---|---|
| **Kaweah River** | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse | US PH3 (K9.5) | | X | 1 | 1 |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence | DS PH3 (K8.7) | X | | 1 | 1 |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse | US PH1 (K7.3) | X | | 1 | 1 |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse | US PH2 (K6.9) | X | | 1 | 1 |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse | DS PH2 (K4.3) | | X | 1 | 1 |
| **East Fork Kaweah River** | | | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion | EF Ref (EFK5.2) | | X | 1 | 1 |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion | EF DS K1 (EFK3.8) | X | | 1 | 1 |
| East Fork Kaweah River Upstream of Confluence with Kaweah River | EF US Confl (EFK0.7) | X | | 1 | 1 |

**Table 7.4-7. Average Macroinvertebrate Drift Density (Summer and Fall) by Site (number/m$^3$).**

| Length (mm) | Site | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|
| | K9.5 | K8.7 | K7.3 | K6.9 | K4.3 | EFK5.2 | EFK3.8 | EFK0.7 | |
| 0-1 | 0.018 | 0.017 | 0.013 | 0.008 | 0.018 | 0.009 | 0.015 | 0.027 | 0.016 |
| >1-3 | 0.132 | 0.095 | 0.136 | 0.113 | 0.168 | 0.083 | 0.160 | 0.189 | 0.135 |
| >3-5 | 0.050 | 0.050 | 0.096 | 0.091 | 0.144 | 0.063 | 0.105 | 0.133 | 0.092 |
| >5-7 | 0.007 | 0.012 | 0.035 | 0.030 | 0.049 | 0.019 | 0.033 | 0.038 | 0.028 |
| >7 | 0.004 | 0.008 | 0.017 | 0.013 | 0.026 | 0.004 | 0.009 | 0.018 | 0.012 |
| **Total** | 0.211 | 0.182 | 0.296 | 0.256 | 0.405 | 0.178 | 0.323 | 0.406 | 0.282 |

## Table 7.4-8. Average Macroinvertebrate Drift Density (Summer and Fall) at the Kaweah River Study Locations and Comparison Locations.

| River/ Site | Comparison Type | Location | Elevation (ft) | Season | Avg. Drift Density (number/m³) |
|---|---|---|---|---|---|
| **Kaweah Project Study Reaches** | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse | Kaweah River Comparison Reach | California | 1,380 | Summer/Fall | 0.21 |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence | Bypass Reach | California | 1,320 | Summer/Fall | 0.18 |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse | Bypass Reach | California | 1,160 | Summer/Fall | 0.30 |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse | Bypass Reach | California | 1,135 | Summer/Fall | 0.26 |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse | Kaweah River Comparison Reach | California | 910 | Summer/Fall | 0.41 |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion | East Fork Kaweah River Comparison Reach | California | 2,574 | Summer/Fall | 0.18 |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion | Bypass Reach | California | 2,600 | Summer/Fall | 0.32 |
| East Fork Kaweah River Upstream of Confluence with Kaweah River | Bypass Reach | California | 1,420 | Summer/Fall | 0.41 |
| **Comparison River Sites** | | | | | |
| American River (MF) | Literature Reference (Cardno 2011) | California | 1,200 | Summer/Fall | 0.82 |
| American River (NF) | Literature Reference (Cardno 2011) | California | 800 | Summer/Fall | 1.19 |
| American River (NFMF) | Literature Reference (Cardno 2011) | California | 1,200 | Summer/Fall | 1.06 |
| Rubicon River | Literature Reference (Cardno 2011) | California | 3,800 | Summer/Fall | 0.77 |
| Klamath River | Literature Reference (Addley 2005) | Oregon | 3,415 | Summer/Fall | 1.52 |

**Table 7.4-9a. Average Macroinvertebrate Drift Total Prey Energy (Summer and Fall) (joules/m$^3$).**

| Length (mm) | Site | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|
| | K9.5 | K8.7 | K7.3 | K6.9 | K4.3 | EFK5.2 | EFK3.8 | EFK0.7 | |
| 0-1 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| >1-3 | 0.278 | 0.273 | 0.702 | 0.363 | 0.687 | 0.152 | 0.464 | 0.877 | 0.474 |
| >3-5 | 0.140 | 0.305 | 1.278 | 0.859 | 1.914 | 0.316 | 0.807 | 1.534 | 0.894 |
| >5-7 | 0.006 | 0.035 | 0.379 | 0.207 | 0.459 | 0.064 | 0.175 | 0.293 | 0.202 |
| >7 | 0.004 | 0.037 | 0.233 | 0.092 | 0.278 | 0.007 | 0.028 | 0.172 | 0.106 |
| **Total** | **0.429** | **0.651** | **2.592** | **1.521** | **3.339** | **0.538** | **1.474** | **2.878** | **1.678** |

**Table 7.4-9b. Average Macroinvertebrate Drift Total Prey Energy Percent by Size (Summer and Fall) (joules/m$^3$).**

| Length (mm) | Site | | | | | | | | Average |
|---|---|---|---|---|---|---|---|---|---|
| | K9.5 | K8.7 | K7.3 | K6.9 | K4.3 | EFK5.2 | EFK3.8 | EFK0.7 | |
| 0-1 | 8.8% | 8.7% | 4.2% | 3.4% | 4.4% | 5.3% | 4.8% | 6.4% | 5.8% |
| >1-3 | 62.5% | 51.3% | 45.9% | 44.6% | 41.7% | 47.0% | 50.8% | 46.2% | 48.7% |
| >3-5 | 23.7% | 29.2% | 32.5% | 34.7% | 34.9% | 34.7% | 31.5% | 33.4% | 31.8% |
| >5-7 | 3.2% | 6.6% | 11.8% | 11.9% | 12.3% | 10.6% | 10.0% | 9.7% | 9.5% |
| >7 | 1.9% | 4.2% | 5.6% | 5.5% | 6.7% | 2.3% | 2.9% | 4.3% | 4.2% |

## Table 7.4-10. Benthic Macroinvertebrate SWAMP Sampling Results.

| Metric / IBI Score Components | Kaweah River Site | | | | | | | | | | East Fork Kaweah River Site | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | K9.5 Comparison Reach | | K8.7 Bypass Reach | | K7.3 Bypass Reach | | K6.9 Bypass Reach | | K4.3 Comparison Reach | | EFK5.2 Comparison Reach | | EFK3.8 Bypass Reach | | EFK0.7 Bypass Reach | |
| | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score | # / % | IBI Score |
| ET Taxa | 12 | 5 | 13 | 5 | 13 | 5 | 17 | 7 | 18 | 8 | 12 | 5 | 15 | 6 | 17 | 7 |
| Percent Non-Insect Taxa | 19 | 6 | 15 | 8 | 16 | 7 | 18 | 6 | 20 | 6 | 19 | 6 | 15 | 8 | 20 | 6 |
| Percent Intolerant Individuals (0-2) | 1 | 0 | 6 | 1 | 4 | 0 | 8 | 1 | 9 | 1 | 17 | 3 | 20 | 4 | 8 | 1 |
| Percent Tolerant Individuals (8-10) | 3 | 7 | 4 | 6 | 8 | 2 | 4 | 6 | 9 | 1 | 5 | 5 | 1 | 9 | 4 | 6 |
| Percent Predator Individuals | 22 | 10 | 17 | 10 | 18 | 10 | 12 | 6 | 20 | 10 | 21 | 10 | 8 | 2 | 16 | 10 |
| Percent Scraper Individuals | 28 | 7 | 28 | 7 | 13 | 3 | 28 | 7 | 19 | 4 | 21 | 5 | 35 | 8 | 29 | 7 |
| Shannon Diversity | 2.23 | 0 | 2.61 | 3 | 2.83 | 4 | 3.00 | 6 | 3.11 | 7 | 2.56 | 2 | 2.70 | 3 | 2.92 | 5 |
| IBI Score* | | 35 | | 40 | | 31 | | 39 | | 37 | | 36 | | 40 | | 42 |

* IBI Score is the sum of all IBI Components

**Table 7.4-11. SWAMP Physical Habitat Data.**

| Site ID | Date | Water Temp (°F) | Average Velocity (ft/sec) | Average Width (ft) | Average Depth (in) | Dominant Substrate | Subdominant Substrate | Average Cobble % Embeddedness | % with CPOM | Predominate Microalgae Thickness | % Attached Macroalgae | % Unattached Macroalgae | % Macrophytes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K9.5 | 8/20/18 | 73.5 | 1.8 | 59.4 | 15.9 | Boulder, Small | Boulder, Large | 48% | 31% | >20mm | 99% | 21% | 88% |
| K8.7 | 8/20/18 | 73.4 | 6.8 | 25.2 | 16.0 | Bedrock, Smooth | Cobble | 32% | 87% | >20mm | 85% | 0% | 0% |
| K7.3 | 8/22/18 | 76.4 | 1.8 | 52.6 | 18.1 | Cobble | Boulder, Small | 55% | 5% | >20mm | 99% | 30% | 0% |
| K6.9 | 8/21/18 | 75.2 | 1.4 | 63.3 | 8.9 | Cobble | Sand | 37% | 63% | <1mm | 47% | 0% | 0% |
| K4.3 | 8/21/18 | 76.5 | 0.6 | 51.9 | 12.2 | Cobble | Sand | 47% | 76% | <1mm | 9% | 0% | 0% |
| EFK5.2 | 8/21/18 | 70.5 | 1.9 | 27.6 | 21.1 | Boulder, Small | Boulder, Large | 29% | 4% | Not Present | 66% | 5% | 0% |
| EFK3.8 | 8/22/18 | 64.7 | 1.2 | 39.4 | 15.6 | Cobble; Bedrock, Smooth | Sand | 50% | 61% | Not Present | 29% | - | - |
| EFK0.7 | 8/21/18 | 72.9 | 3.3 | 27.7 | 13.3 | Boulder, Small | Cobble | 46% | 8% | >20mm | 88% | 2% | 4% |

This Page Intentionally Left Blank

**Table 7.4-12. Potential Fish Passage Barriers.**

| ` | River Mile | Barrier Type | Barrier Class | Physical Characteristics: Height of Barrier (ft) | Horizontal Distance or Length (ft) (Measured or Calculated)[2] | Plunge Pool / Chute Depth (ft) | Water Velocity[3] (ft/s) | Flow at Visit (cfs) | Passable at Low / High Flows: Trout | Minnows[4] | Barrier Limitation |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Kaweah River** | | | | | | | | | | | |
| Downstream of National Park Foothills Visitor Center | 9.5 | Natural | Falls | 10.0[1] | 12.0[1] | - | - | - | NO / NO | NO / NO | Fall Height |
| Kaweah No. 2 Diversion Dam | 8.9 | Project | Falls | 9.2 | 16.0 | 5.0 | 2.2 | 338 | NO / NO | NO / NO | Fall Height |
| Kaweah No. 2 Diversion Dam Gage Pool Weir | 8.8 | Project | Falls | 1.0 | 3.0 | 5.2 | 2.2 | 315 | NO[5] / YES | NO[5] / YES | Fall Height |
| Downstream of Kaweah No. 2 Powerhouse | 3.8 | Natural | Falls | 1.8 | 20.0 | 2.3 | 0.6 | 169 | NO / YES | NO / YES | Fall Height |
| **East Fork Kaweah River** | | | | | | | | | | | |
| Kaweah No. 1 Diversion Dam | 4.7 | Project | Falls | 11.5 | 15.0 | 8.0 | 2.5 | 188 | NO / NO | NO / NO | Fall Height |
| Kaweah No. 1 Diversion Dam Gage Pool Weir | 4.7 | Project | Falls/ Chute | 7.2 | 11.2 / 17.0 | 2.5/0.5 | 3 / >12 | 122 | NO / NO | NO / NO | Fall Height, Chute Velocity, and Length |
| East Fork Kaweah Downstream of Kaweah River Bridge | 4.4 | Natural | Falls | 9.0 | 20.0 | 6.0 | 4.0 | 195 | NO / NO | NO / NO | Fall Height |
| East Fork Kaweah above Confluence with Kaweah River | 0.2 | Natural | Falls/ Chute | 5.7/9.7 | 15.0 / 35.8 | 4.0/0.5 | 3.8 / 12.2 | 47 | NO / NO | NO / NO | Fall Height, Chute Velocity, and Length |

1 Measurement estimated from online kayaker video.
2 Horizontal leap distance required to clear falls and/or swimming length of chutes.
3 Velocity at crest of falls / Velocity in chute.
4 "Minnows" include hardhead, Sacramento pikeminnow, and Sacramento sucker.
5 Passable at measured flow, but not at low flow.

This Page Intentionally Left Blank

## Table 7.4-13. Summary of Fish Species Observed in the Kaweah River and East Fork Kaweah River Study Reaches during 2018 Quantitative Sampling.

| Study Site | Date | Fish Species[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | RBT | HH | SPM | MXD | SS | SC | CAR | SMB |
| **Kaweah River** | | | | | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3) | 10/02/2018<br>10/18/2018 | ● | ●[2] | ●[2] | ● | ● | | ● | |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3) | 10/01/2018<br>10/06/2018 | ● | ● | ● | ● | ● | | ● | |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1) | 10/01/2018<br>10/17/2018<br>10/19/2018 | ● | ● | ● | | ● | | | ● |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2) | 10/01/2018<br>10/08/2018 | | ● | ● | ● | ● | ● | | ● |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2) | 10/01/2018<br>10/03/2018<br>10/19/2018 | | ● | ● | | ● | ● | | ● |
| **East Fork Kaweah River** | | | | | | | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div) | 10/02/2018<br>10/05/2018 | ● | | | | ● | | | |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) | 10/02/2018 | ● | | | | ● | | ● | |
| East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) | 10/02/2018<br>10/09/2018<br>10/19/2018 | ● | ● | ● | ● | ● | | ● | ● |

Notes:

[1] Species: RBT = Rainbow Trout; BNT = Brown Trout; HH = Hardhead; SPM = Sacramento Pikeminnow; MXD = Unidentified Juvenile Mixed Minnow; SS = Sacramento Sucker; SC = Sculpin spp.; CAR = California Roach; SMB = Smallmouth Bass

[2] Hardhead and Sacramento Pikeminnow were captured during the qualitative sampling but not during the quantitative sampling.

**Table 7.4-14. Average Condition Factors, Standard Deviation, and Sample Size by Species Collected during Electrofishing in the Study Area in 2018.**

| Species | Average Condition Factor | Standard Deviation | Sample Size |
|---|---|---|---|
| Rainbow Trout | 1.17 | 0.17 | 68 |
| Hardhead | 1.15 | 0.31 | 5 |
| Sacramento Pikeminnow | 0.81 | 0.21 | 135 |
| Sacramento Sucker | 1.14 | 0.24 | 117 |
| Sculpin | 1.30 | 0.21 | 12 |
| California Roach | 1.10 | 0.28 | 160 |
| Smallmouth Bass | 1.37 | 0.15 | 73 |

**Table 7.4-15. Rainbow Trout Condition Factors by Site.**

| Study Reach | Age Class | Average Condition Factor | n |
|---|---|---|---|
| **Kaweah River** | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3) | YOY | 1.23 | 4 |
| | 1+ | 1.14 | 6 |
| | COMBINED | 1.18 | 10 |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3) | YOY | 1.22 | 5 |
| | 1+ | 1.04 | 1 |
| | COMBINED | 1.19 | 6 |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1) | YOY | 1.1 | 1 |
| | 1+ | 1.06 | 1 |
| | COMBINED | 1.08 | 2 |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2) | YOY | -- | Not Observed |
| | 1+ | -- | Not Observed |
| | COMBINED | -- | Not Observed |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2) | YOY | -- | Not Observed |
| | 1+ | -- | Not Observed |
| | COMBINED | -- | Not Observed |
| **East Fork Kaweah River** | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div) | YOY | 1.18 | 29 |
| | 1+ | 1.14 | 6 |
| | COMBINED | 1.17 | 35 |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) | YOY | 1.18 | 4 |
| | 1+ | 1.27 | 4 |
| | COMBINED | 1.22 | 8 |
| East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) | YOY | 1.12 | 4 |
| | 1+ | 1.2 | 3 |
| | COMBINED | 1.15 | 7 |

## Table 7.4-16. Qualitative Fry Sampling in the Vicinity of the Project Diversions and the Sequoia National Park Diversions. (note: sampling generally consisted of 0.5 to 2.5 hours of sampling with seines and/or electrofishing gear).

| Sample Location | Type of Observation | June 13-14 Sampling[1] | | | | | July 6-7 Sampling[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RBT | SPM | MXD | SS | CAR | RBT | BRT | HH | SPM | MXD | SS | CAR |
| **Project Diversions** | | | | | | | | | | | | | |
| Kaweah No. 1 Diversion | Captured (size mm) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 (larval) | 0 | 0 |
| | Visually Observed | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Kaweah No. 2 Diversion | Captured (size mm) | 0 | 1 (24) | 1 (20) | 1 (no size) | 1 (80) | 0 | 0 | 6 ( 26, 35, 39, 42, 42, 46) | 3 (36, 42, 51) | 32 (larval) | 20 (25, 25, 26, 26, 27, 27 27, 27, 28, 29, 29, 30, 30, 31, 32, 32, 32, 33, 34, 35) | 1 (75) |
| | Visually Observed (size) | -- | >20 (larval) | > 100 (larval) | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| **Sequoia National Park Diversions** | | | | | | | | | | | | | |
| Middle Fork Diversion | Captured (size mm) | 0 | 0 | 1 (15) | 0 | 0 | 1 (46) | 0 | 0 | 0 | 40 (larval) | 0 | 0 |
| | Visually Observed | -- | -- | 40 (larval) | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Marble Fork Diversion | Captured (size mm) | 0 | 0 | 0 | 0 | 0 | 2 (42, 50) | 2 (75, 82) | 0 | 0 | 0 | 2 (51, 57) | 0 |
| | Visually Observed | -- | -- | -- | -- | -- | 4 (40-50 mm)[2] | -- | -- | -- | -- | -- | -- |

[1]Species: RBT = Rainbow Trout; BRT = Brown Trout; HH = Hardhead; SPM = Sacramento Pikeminnow; MXD = Unidentified Juvenile Mixed Minnow; SS = Sacramento Sucker; CAR = California Roach

[2] Unidentified salmonids (i.e. Brown Trout or Rainbow Trout).

**Table 7.4-17. Fish Species Life Stage Periodicity.**

| Month | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rainbow Trout** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Incubation | | | | | | | | | | | | |
| Fry | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Brown Trout** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Incubation | | | | | | | | | | | | |
| Fry | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Sacramento Pikeminnow** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Larval | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Hardhead** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Larval | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **California Roach** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Larval | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Sacramento Sucker** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Larval | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Smallmouth Bass** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Incubation | | | | | | | | | | | | |
| Fry | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |

## Table 7.4-18. Summary of Reach Density for All Captured Species excluding Rainbow Trout.

| Study Reach | Species[1] Reach Density (Fish per Mile) | | | | | | | Species[1] Reach Density (Fish per Acre) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HH | SPM | MXD | SS | SC | CAR | SMB | HH | SPM | MXD | SS | SC | CAR | SMB |
| **Kaweah River** | | | | | | | | | | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3) | 0 | 0 | 15389 | 5345 | 0 | 1993 | 0 | 0 | 0 | 1414 | 532 | 0 | 419 | 0 |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3) | 26 | 3400 | 12645 | 2079 | 0 | 850 | 0 | 5 | 652 | 2192 | 373 | 0 | 171 | 0 |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1) | 6 | 104 | 0 | 684 | 0 | 0 | 611 | 1 | 14 | 0 | 140 | 0 | 0 | 95 |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2) | 19 | 2 | 5 | 237 | 54 | 0 | 622 | 2 | 0 | 1 | 42 | 10 | 0 | 109 |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2) | 116 | 45 | 0 | 299 | 209 | 0 | 644 | 15 | 5 | 0 | 36 | 22 | 0 | 73 |

| Study Reach | Species[1] Reach Density (Fish per Mile) | | | | | | | Species[1] Reach Density (Fish per Acre) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HH | SPM | MXD | SS | SC | CAR | SMB | HH | SPM | MXD | SS | SC | CAR | SMB |
| **East Fork Kaweah River** | | | | | | | | | | | | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div) | 0 | 0 | 0 | 1725 | 0 | 0 | 0 | 0 | 0 | 0 | 360 | 0 | 0 | 0 |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) | 0 | 0 | 0 | 2486 | 0 | 13 | 0 | 0 | 0 | 0 | 627 | 0 | 3 | 0 |
| East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) | 26 | 377 | 1341 | 255 | 0 | 409 | 137 | 4 | 107 | 217 | 86 | 0 | 120 | 33 |

Notes:

[1] Species: RBT = Rainbow Trout; HH = Hardhead; SPM = Sacramento Pikeminnow; MXD = Unidentified Juvenile Mixed Minnow; SS = Sacramento Sucker; SC = Sculpin spp.; CAR = California Roach; SMB = Smallmouth Bass

## Table 7.4-19. Reach Density and Reach Biomass of Rainbow Trout.

| Study Reach | Reach Density (Adult; YOY) | | Reach Biomass | |
|---|---|---|---|---|
| | Fish per Mile | Fish per Acre | Pounds per Mile | Pounds per Acre |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3) | 102 (61; 41) | 17 (10; 7) | 11.3 | 1.8 |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3) | 142 (24; 118) | 26 (4; 22) | 0.8 | 0.2 |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1) | 84 (42; 42) | 19 (9.3; 9.3) | 0.8 | 0.2 |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2) | 0 | 0 | 0.0 | 0.0 |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2) | 0 | 0 | 0.0 | 0.0 |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div) | 707 (120; 587) | 184 (31; 153) | 25.6 | 6.7 |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div) | 196 (98; 98) | 37 (18.5; 18.5) | 20.6 | 4.2 |
| East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) | 177 (76; 101) | 72 (31; 41) | 4.9 | 2.1 |

### Table 7.4-20. Density of Species, Fish per Mile and Percent of Young-of-Year, at Quantitative Sampling Sites.

| Study Site | Species Density (fish per mile) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RBT (% YOY) | HH | SPM | MXD | SS | SC | CAR | SMB |
| **Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)** | | | | | | | | |
| HGR | 271 (40%) | 0 | 0 | 0 | 1489 | 0 | 3790 | 0 |
| LGR | 770 (40%) | 0 | 0 | 0 | 550 | 0 | 6050 | 0 |
| RUN | 127 (40%) | 0 | 0 | 0 | 1143 | 0 | 16644 | 0 |
| MCP[1] | 0 | 0 | 0 | 24046 | 7565 | 0 | 108 | 0 |
| **Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)** | | | | | | | | |
| HGR | 230 (83%) | 0 | 5518 | 0 | 613 | 0 | 0 | 0 |
| LGR | 284 (83%) | 189 | 4165 | 0 | 852 | 0 | 2083 | 0 |
| RUN | 0 | 0 | 6008 | 0 | 1073 | 0 | 2468 | 0 |
| MCP[1] | 176 (83%) | 35 | 458 | 11158 | 1901 | 0 | 0 | 0 |
| RUN[1] | 0 | 0 | 143 | 26450 | 2569 | 0 | 48 | 0 |
| **Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)** | | | | | | | | |
| HGR | 0 | 0 | 703 | 0 | 938 | 0 | 0 | 2814 |
| LGR | 176 (50%) | 0 | 0 | 0 | 1144 | 0 | 0 | 352 |
| MCP[1] | 0 | 26 | 35 | 0 | 52 | 0 | 0 | 250 |
| RUN[1] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)** | | | | | | | | |
| LGR | 0 | 0 | 0 | 0 | 671 | 168 | 0 | 1676 |
| MCP[1] | 0 | 72 | 9 | 18 | 81 | 0 | 0 | 316 |
| **Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)** | | | | | | | | |
| HGR | 0 | 153 | 153 | 0 | 307 | 460 | 0 | 307 |
| LGR | 0 | 147 | 73 | 0 | 733 | 440 | 0 | 1026 |
| RUN | 0 | 0 | 0 | 0 | 62 | 62 | 0 | 928 |
| MCP[1] | 0 | 187 | 0 | 0 | 150 | 0 | 0 | 212 |
| RUN[1] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Study Site | Species Density (fish per mile) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RBT (% YOY) | HH | SPM | MXD | SS | SC | CAR | SMB |
| **East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)** | | | | | | | | |
| HGR | 1863 (83%) | 0 | 0 | 0 | 254 | 0 | 0 | 0 |
| RUN | 1101 (83%) | 0 | 0 | 0 | 2372 | 0 | 0 | 0 |
| MCP[1] | 0 | 0 | 0 | 0 | 2624 | 0 | 0 | 0 |
| **East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)** | | | | | | | | |
| HGR | 268 (50%) | 0 | 0 | 0 | 358 | 0 | 0 | 0 |
| RUN | 367 (50%) | 0 | 0 | 0 | 1026 | 0 | 73 | 0 |
| MCP[1] | 18 (50%) | 0 | 0 | 0 | 5920 | 0 | 0 | 0 |
| **East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)** | | | | | | | | |
| HGR | 1173 (57%) | 0 | 0 | 0 | 978 | 0 | 0 | 391 |
| LGR | 220 (57%) | 0 | 1319 | 0 | 440 | 0 | 1539 | 0 |
| MCP[1] | 0 | 47 | 47 | 2134 | 62 | 0 | 0 | 171 |
| RUN[1] | 0 | 0 | 0 | 1998 | 57 | 0 | 0 | 29 |

Notes:

CAR = California Roach
HGR = high gradient riffle
HH = Hardhead
LGR = low gradient riffle
MCP = mid-channel pool
MXD = Unidentified Juvenile Mixed Minnow
RBT = Rainbow Trout
SC = Sculpin spp.
SMB = Smallmouth Bass
SPM = Sacramento Pikeminnow
SS = Sacramento Sucker
YOY = young-of-year

[1] These sites were sampled by snorkeling. All other sites were sampled by electrofishing.

## Table 7.4-21. Density of Species, Fish per Acre and Percent of Young-of-Year, at Quantitative Sampling Sites.

| Study Site | Species Density (fish per acre) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | RBT (% YOY) | HH | SPM | MXD | SS | SC | CAR | SMB |
| **Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)** | | | | | | | | |
| HGR | 43 (40%) | 0 | 0 | 0 | 236 | 0 | 601 | 0 |
| LGR | 144 (40%) | 0 | 0 | 0 | 103 | 0 | 1134 | 0 |
| RUN | 40 (40%) | 0 | 0 | 0 | 359 | 0 | 5232 | 0 |
| MCP[1] | 0 | 0 | 0 | 2210 | 695 | 0 | 11 | 0 |
| **Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)** | | | | | | | | |
| HGR | 41 (83%) | 0 | 991 | 0 | 110 | 0 | 0 | 0 |
| LGR | 74 (83%) | 49 | 1084 | 0 | 222 | 0 | 542 | 0 |
| RUN | 0 | 0 | 1162 | 0 | 208 | 0 | 477 | 0 |
| MCP[1] | 31 (83%) | 6 | 80 | 1959 | 334 | 0 | 0 | 0 |
| RUN[1] | 0 | 0 | 25 | 4546 | 442 | 0 | 8 | 0 |
| **Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)** | | | | | | | | |
| HGR | 0 | 0 | 92 | 0 | 123 | 0 | 0 | 369 |
| LGR | 39 (50%) | 0 | 0 | 0 | 255 | 0 | 0 | 78 |
| MCP[1] | 0 | 3 | 5 | 0 | 7 | 0 | 0 | 34 |
| RUN[1] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)** | | | | | | | | |
| LGR | 0 | 0 | 0 | 0 | 123 | 31 | 0 | 307 |
| MCP[1] | 0 | 8 | 1 | 2 | 9 | 0 | 0 | 37 |
| **Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)** | | | | | | | | |
| HGR | 0 | 13 | 13 | 0 | 26 | 39 | 0 | 26 |
| LGR | 0 | 18 | 9 | 0 | 92 | 55 | 0 | 128 |
| RUN | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 91 |
| MCP[1] | 0 | 29 | 0 | 0 | 23 | 0 | 0 | 33 |
| RUN[1] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Study Site | Species Density (fish per acre) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **RBT (% YOY)** | **HH** | **SPM** | **MXD** | **SS** | **SC** | **CAR** | **SMB** |
| **East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)** | | | | | | | | |
| HGR | 485 (83%) | 0 | 0 | 0 | 66 | 0 | 0 | 0 |
| RUN | 396 (83%) | 0 | 0 | 0 | 852 | 0 | 0 | 0 |
| MCP[1] | 0 | 0 | 0 | 0 | 540 | 0 | 0 | 0 |
| **East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)** | | | | | | | | |
| HGR | 46 (50%) | 0 | 0 | 0 | 62 | 0 | 0 | 0 |
| RUN | 78 (50%) | 0 | 0 | 0 | 217 | 0 | 16 | 0 |
| MCP[1] | 5 (50%) | 0 | 0 | 0 | 1550 | 0 | 0 | 0 |
| **East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)** | | | | | | | | |
| HGR | 538 (57%) | 0 | 0 | 0 | 448 | 0 | 0 | 179 |
| LGR | 65 (57%) | 0 | 389 | 0 | 130 | 0 | 453 | 0 |
| MCP[1] | 0 | 7 | 7 | 327 | 10 | 0 | 0 | 26 |
| RUN[1] | 0 | 0 | 0 | 466 | 13 | 0 | 0 | 7 |

Notes:

CAR = California Roach
HGR = high gradient riffle
HH = Hardhead
LGR = low gradient riffle
MCP = mid-channel pool
MXD = Unidentified Juvenile Mixed Minnow
RBT = Rainbow Trout
SC = Sculpin spp.
SMB = Smallmouth Bass
SPM = Sacramento Pikeminnow
SS = Sacramento Sucker
YOY = young-of-year

[1] These sites were sampled by snorkeling. All other sites were sampled by electrofishing.

## Table 7.4-22. Rainbow Trout Biomass at the Quantitative Sampling Sites.

| Study Site | Pounds per Mile | Pounds per Acre |
|---|---|---|
| **Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)** | | |
| HGR | 35.2 | 5.6 |
| LGR | 30.4 | 5.7 |
| RUN | 2.5 | 0.8 |
| MCP[1] | 0 | 0 |
| **Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)** | | |
| HGR | 2.5 | 0.4 |
| LGR | 3.2 | 0.8 |
| RUN | 0 | 0 |
| MCP[1] | 0.2 | 0.04 |
| RUN[1] | 0 | 0 |
| **Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)** | | |
| HGR | 0 | 0 |
| LGR | 1.6 | 0.4 |
| MCP[1] | 0 | 0 |
| RUN[1] | 0 | 0 |
| **Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)** | | |
| LGR | 0 | 0 |
| MCP[1] | 0 | 0 |
| **Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)** | | |
| HGR | 0 | 0 |
| LGR | 0 | 0 |
| RUN | 0 | 0 |
| MCP[1] | 0 | 0 |
| RUN[1] | 0 | 0 |
| **East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)** | | |
| HGR | 67.5 | 17.6 |
| RUN | 12.5 | 4.5 |
| MCP[1] | 0 | 0 |
| **East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)** | | |
| HGR | 30.3 | 5.2 |
| RUN | 6.0 | 1.3 |
| MCP[1] | 15.5 | 4.3 |

| Study Site | Pounds per Mile | Pounds per Acre |
|---|---|---|
| **East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)** | | |
| HGR | 40.3 | 18.5 |
| LGR | 3.2 | 0.9 |
| MCP[1] | 0 | 0 |
| RUN[1] | 0 | 0 |

Notes:

HGR = high gradient riffle

LGR = low gradient riffle

MCP = mid-channel pool

[1] These sites were sampled by snorkeling. All other sites were sampled by electrofishing.

**Table 7.4-23. Impaired and Unimpaired Hydrology Summary for each Instream Flow Study Site.**

| Instream Flow Study Reaches | Impaired or Unimpaired | Minimum Flow (cfs) | Exceedance Flows (cfs) | | | | | Current FERC License Instream Flow Requirement |
|---|---|---|---|---|---|---|---|---|
| | | | 10% | 20% | 50% | 80% | 90% | |
| **Kaweah River** | | | | | | | | |
| Kaweah River Upstream of Kaweah No. 3 Powerhouse | Impaired | 0.8 | 775.9 | 471.0 | 113.0 | 33.1 | 21.0 | |
| | Unimpaired | 9.5 | 847.0 | 534.0 | 179.5 | 46.7 | 23.9 | |
| Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence | Impaired | 5.5 | 772.0 | 458.0 | 112.5 | 32.0 | 19.2 | Dry: 5 – 30 cfs<br>Wet: 11 – 30 cfs |
| | Unimpaired | 9.5 | 847.0 | 534.0 | 179.5 | 46.7 | 23.9 | |
| Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse | Impaired | 10.9 | 1065.0 | 664.0 | 156.0 | 43.7 | 28.7 | Dry: 5 – 30 cfs*<br>Wet: 11 – 30 cfs* |
| | Unimpaired | 15.6 | 1156.0 | 749.5 | 239.0 | 68.5 | 37.6 | |
| Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse | Impaired | 13.6 | 1080.3 | 682.0 | 171.4 | 53.3 | 33.9 | Dry: 5 – 30 cfs*<br>Wet: 11 – 30 cfs* |
| | Unimpaired | 15.6 | 1156.0 | 749.5 | 239.0 | 68.5 | 37.6 | |
| Kaweah River Downstream of Kaweah No. 2 Powerhouse | Impaired | 15.6 | 1156.0 | 749.5 | 239.0 | 68.5 | 37.6 | |
| | Unimpaired | 15.6 | 1156.0 | 749.5 | 239.0 | 68.5 | 37.6 | |
| **East Fork Kaweah River** | | | | | | | | |
| East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion | Impaired | 6.0 | 336.3 | 194.0 | 44.8 | 18.8 | 12.5 | |
| | Unimpaired | 6.0 | 336.3 | 194.0 | 44.8 | 18.8 | 12.5 | |
| East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion | Impaired | 2.7 | 319.4 | 176.8 | 28.0 | 9.1 | 7.0 | 5 – 10 cfs All Water Year Types |
| | Unimpaired | 6.0 | 336.3 | 194.0 | 44.8 | 18.8 | 12.5 | |

* Note: Minimum flow requirements are implemented at a compliance location upstream.

## Table 7.4-24. Entrainment Sampling Schedule.

| Sampling Period | Kaweah No. 1 Flowline | | Kaweah No. 2 Flowline | | Kaweah No. 3 Flowline | |
|---|---|---|---|---|---|---|
| | Drift Net | Fyke Net | Drift Net | Fyke Net | Drift Net | Fyke Net |
| May 2019 | Pending Repairs on the No. 1 Flowline | | X | X | X | NA* |
| July 2019 | | | X | -- | -- | NA* |
| January/February 2020 | | | -- | -- | -- | NA* |
| March/April 2020 | | | -- | -- | -- | NA* |

--- = Pending

X = Completed

* Due to high risk at the Kaweah No. 3 Flowline, the revised study plan proposes to use entrainment monitoring in the Kaweah No. 1 and 2 flowlines to approximate entrainment in Kaweah No. 3 Flowline. The revised study plan allows for additional entrainment sampling based on consultation with agency biologists/staff.

## Table 7.4-25. Special-Status Aquatic Species Known to Occur or Potentially Occurring in the Study Area

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| **Known to Occur in the Study Area** | | | | |
| **Fish** | | | | |
| *Mylopharodon conocephalus*<br>hardhead | — | SSC | Undisturbed larger middle- and low-elevation streams with summer temperatures in excess of 20°C at elevations ranging from 30 to 4,750 feet. Most commonly found in clear, deep (>3 feet) pools with sand-gravel-boulder substrates and slow water velocities (<0.8 feet per second). | • Known to occur in the study area.<br>• Observed in low to moderate abundance in the bypass and comparison reaches on the Kaweah River, and in the lowest reach of the East Fork Kaweah River.<br>• Refer to AQ 2 - TSR for more detailed information about occurrence of this species. |
| **May Potentially Occur in the Study Area** | | | | |
| **Amphibians** | | | | |
| *Rana boylii*<br>foothill yellow-legged frog | BLMS | SCT, SSC | Perennial rocky (pebble or cobble) streams with cool, clear water in a variety of habitats from valley and foothill oak woodland, riparian forest, ponderosa pine, mixed conifer, coastal scrub, and mixed chaparral at elevations ranging from 0 to 6,370 feet. | • This species is not known to be extant in the Kaweah River watershed. This species was not observed during extensive surveys conducted in support of relicensing (AQ 7 – TSR).<br>• The most recent observations in the Kaweah River watershed date to 1970..<br>• Refer to AQ 7 - TSR for more detailed information about occurrence of this species. |
| **Reptiles** | | | | |
| *Actinemys marmorata*<br>western pond turtle | | SSC | Perennial wetlands and slow-moving creeks and ponds, from sea level to 6,000 ft in elevation, with overhanging vegetation and suitable basking sites such as logs and rocks above the waterline. | • May potentially occur in appropriate habitat and is known to be present in the Kaweah watershed; however, this species was not observed during surveys conducted in support of relicensing.<br>• Refer to AQ 7 - TSR for more detailed information about occurrence of this species. |
| **Unlikely to Occur in the Study Area** | | | | |
| **Fish** | | | | |
| *Entosphenus tridentatus*<br>Pacific lamprey | BLMS | SSC | An anadromous fish requiring stream and river reaches with natural flow regimes, deep pools with adequate cover, low velocity rearing areas with fine sand or silt, and silt-free cobble areas upstream of rearing areas. Temperatures must not exceed 20°C. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Oncorhynchus mykiss whitei*<br>Little Kern golden trout | FT | — | Known only from the Little Kern River and tributaries in Tulare County, mostly within Sequoia National Forest and Sequoia National Park. High altitude freshwater lakes and river from elevations ranging from 9,000 to 12,000 feet. | • Unlikely to occur.<br>• The study area is outside the elevation and geographic range of this species. |
| *Hypomesus transpacficus*<br>delta smelt | FT | SE | Tidally influenced backwater sloughs and channel edgewaters of brackish and freshwater marshes. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species and does not contain suitable habitat. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Siphateles bicolor snyderi*<br>Owens tui chub | FE | SE | Standing waters and low gradient reaches of the Owens River and larger tributaries. Found in springs, ponds, lakes, large sluggish streams, and shelter of small swiftwater streams. Prefers reaches with abundant aquatic vegetation and summer temperatures in excess of 20°C. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Gasterosteus aculeatus williamsoni*<br>unarmored threespine stickleback | FE | SE | Slow, continuous flows of water in isolated headwater streams that experience intermittent flows to the ocean and lack turbidity. Restricted to the Santa Clara River watershed in Los Angeles County. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |

Sources:

1. Bureau of Land Management (BLMS). 2014. BLMS Species Status Animal Species by Field Office, Bakersfield Office.
2. California Natural Diversity Database (CNDDB). 2018. Rare Find 5.0. California Department of Fish and Wildlife, Habitat Planning and Conservation Branch. Accessed August 2018. Electronic Database.
3. U.S. Fish and Wildlife Service (USFWS). 1994. Endangered and Threatened Wildlife and Plants; Critical Habitat Determination for the Delta Smelt. Federal Register, Vol. 59, No. 242.
4. USFWS. 2018. Information for Planning and Consultation (IPaC) – Powered by the Environmental Conservation Online System (ECOS). Accessed August 2018. Electronic Database.

**LEGEND:**

Federal Status

BCC = Birds of Conservation Concern
BLMS = Bureau of Land Management Sensitive (Bakersfield Office)
FC = Federal Candidate
FD = Delisted Species
FE = Federal Endangered
FPD = Federal Proposed for Delisting
FT = Federal Threatened

State Status

CFP = State of California Fully Protected
SCT = State Candidate Threatened
SCE = State Candidate Endangered
SD = State Delisted
SE = State Endangered
SSC = State Species of Special Concern
ST = State Threatened
WL = Watch List

# FIGURES

This Page Intentionally Left Blank

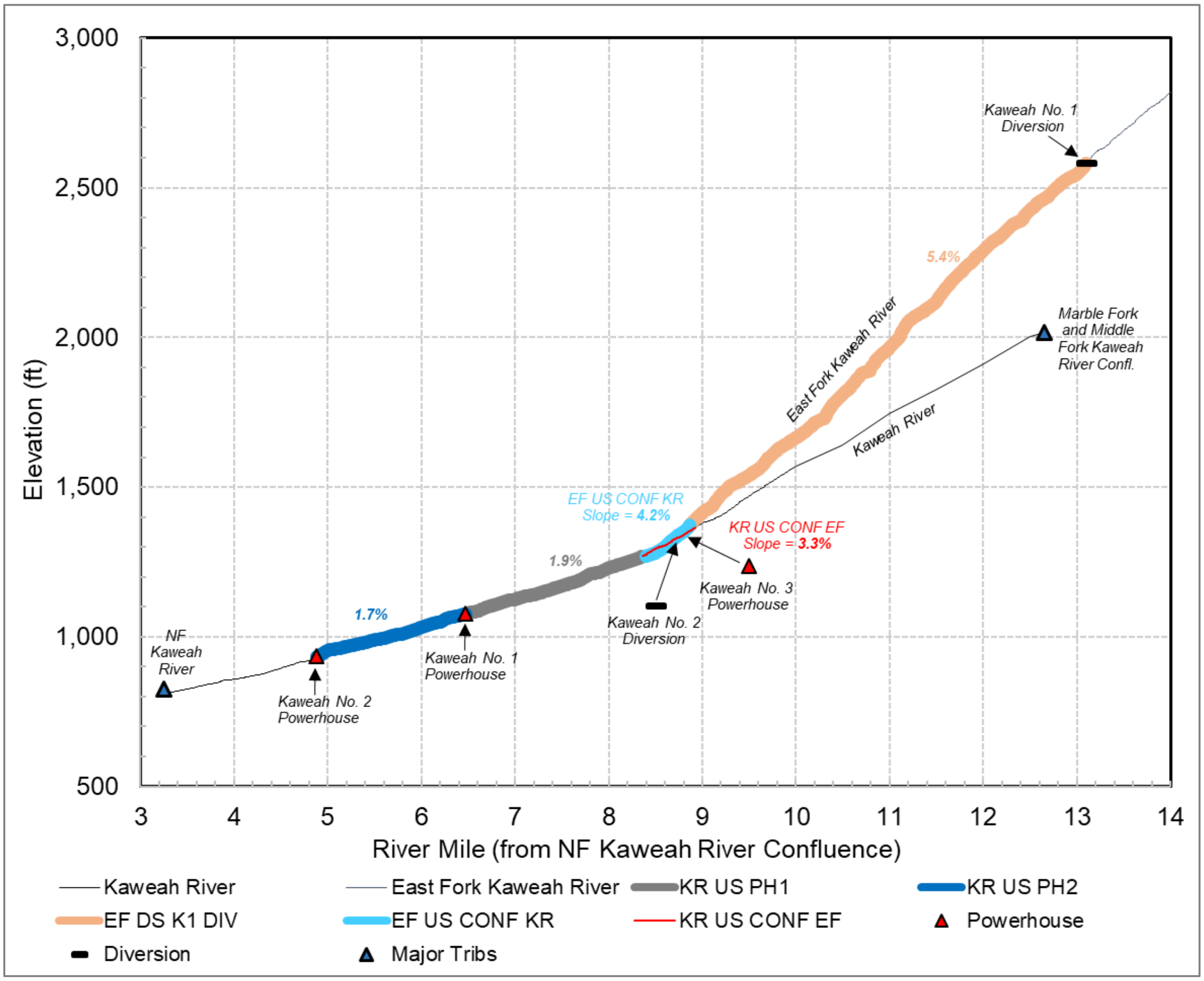



**Figure 7.4-1. Gradient map of the Kaweah River and East Fork Kaweah River Showing Project Diversions and Powerhouses.**

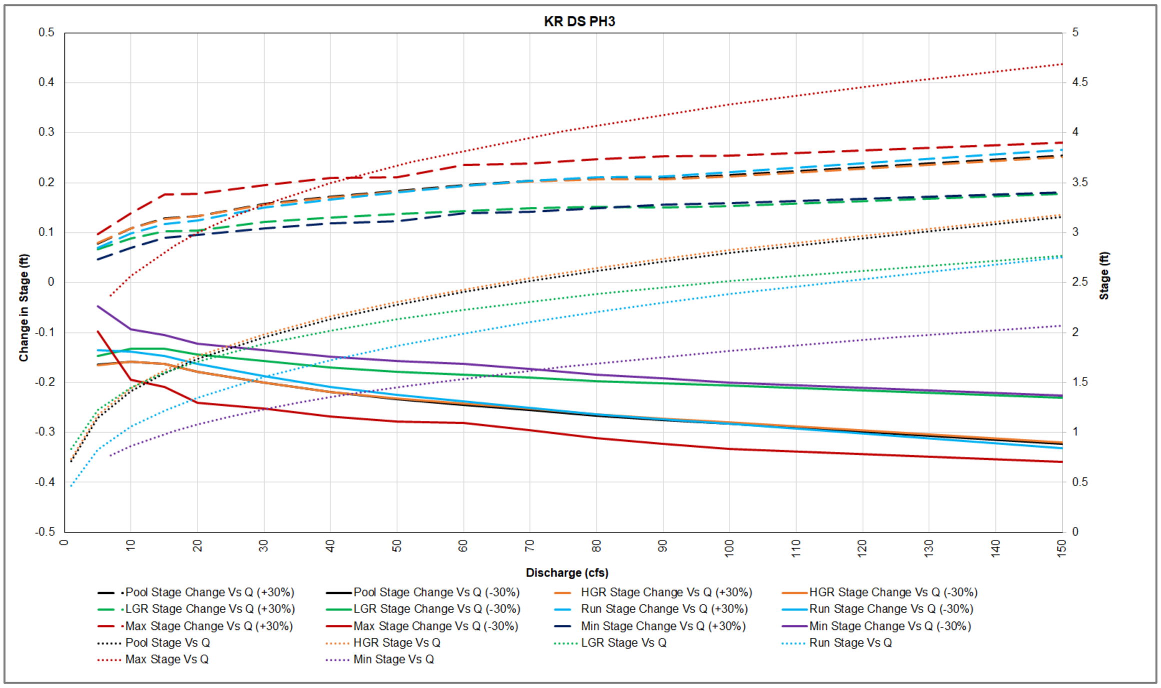



**Figure 7.4-2. Stage Changes in the Kaweah River Downstream of Powerhouse No. 3 (KR DS PH3) Bypass Reach Based on a 30% of Existing Streamflow up or Down Ramp per Hour.**

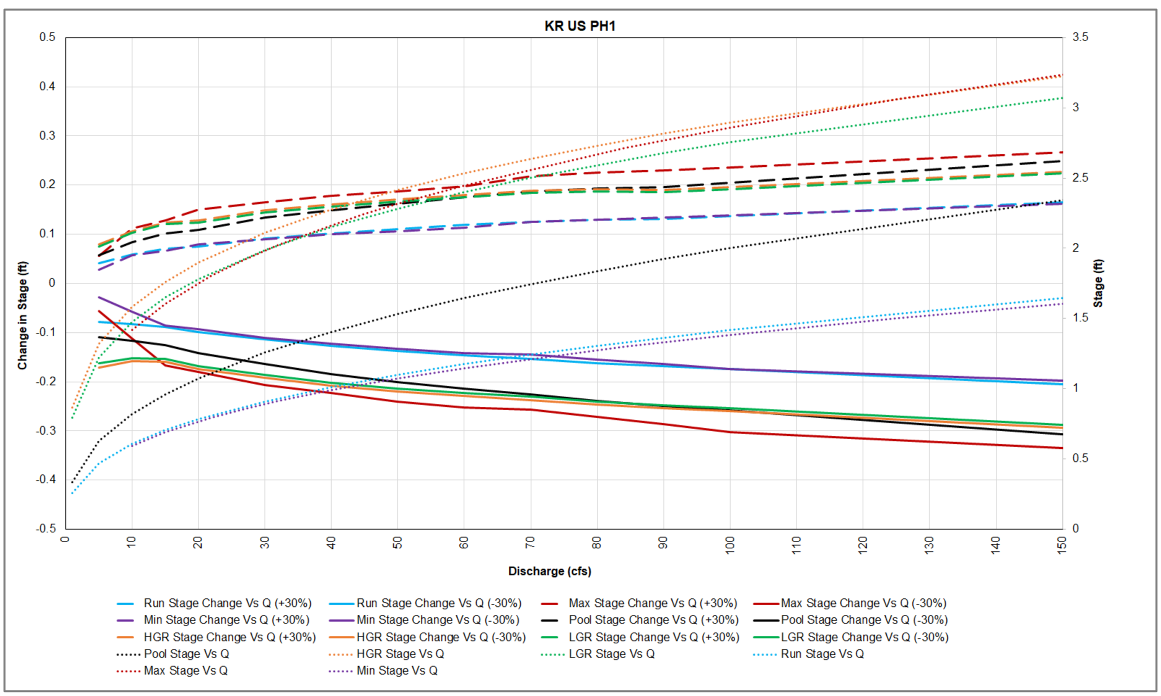



**Figure 7.4-3. Stage Changes in the Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (KR US PH1) Bypass Reach Based on a 30% of Existing Streamflow up or Down Ramp per Hour.**

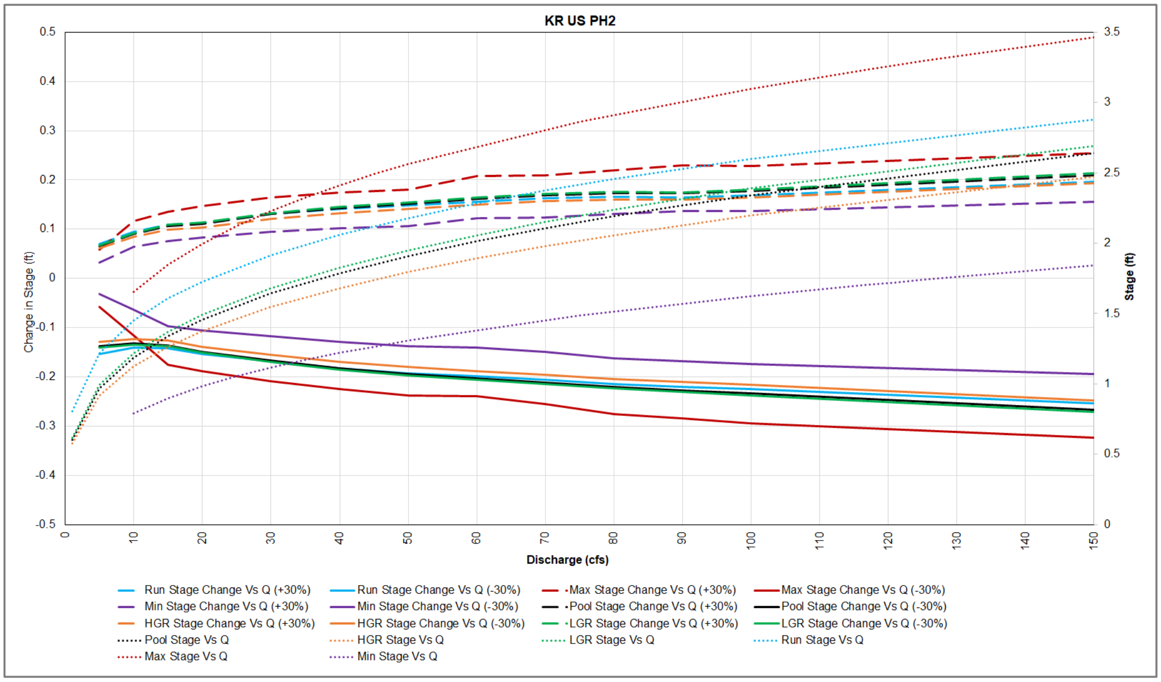



**Figure 7.4-4. Stage changes in the Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (KR US PH2) Bypass Reach Based on a 30% of Existing Streamflow up or Down Ramp per Hour.**

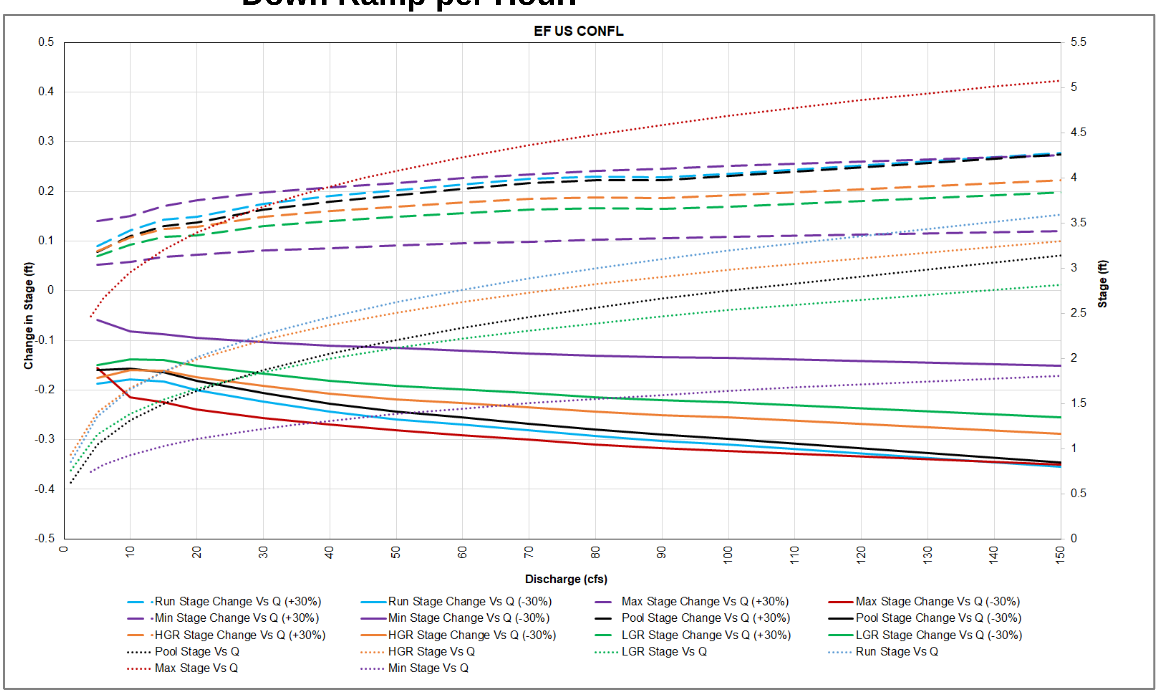
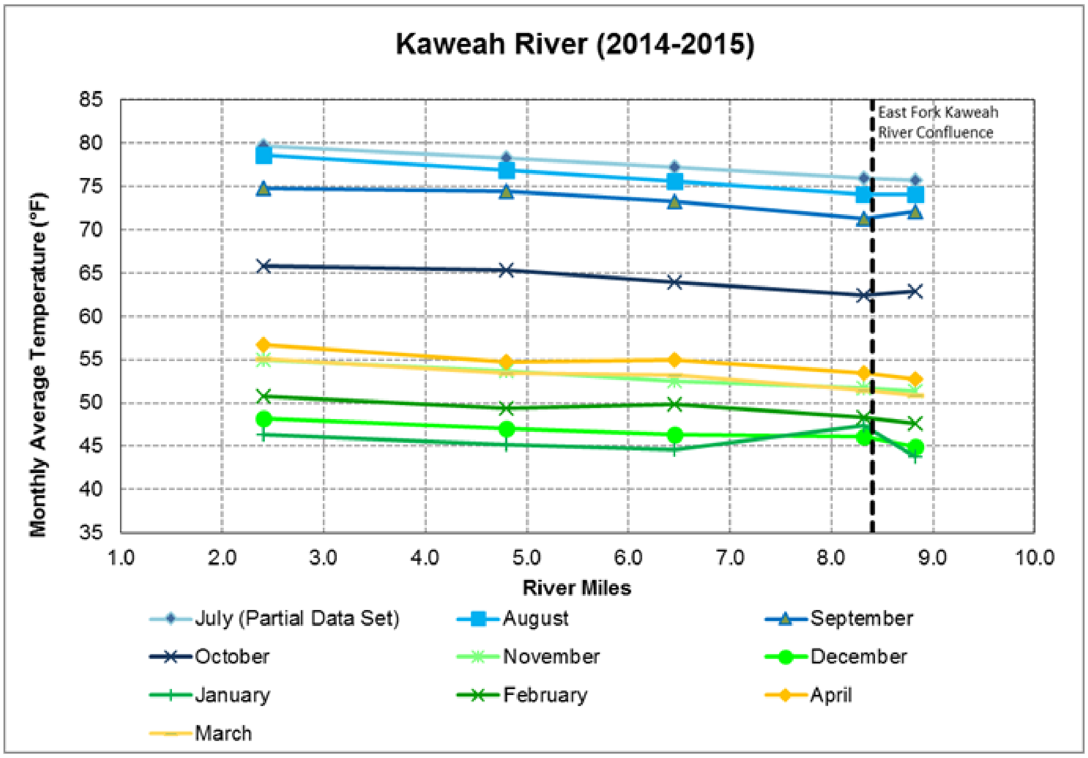



**Figure 7.4-5. Stage Changes in the East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl) Bypass Reach Based on a 30% of Existing Streamflow up or Down Ramp per Hour.**



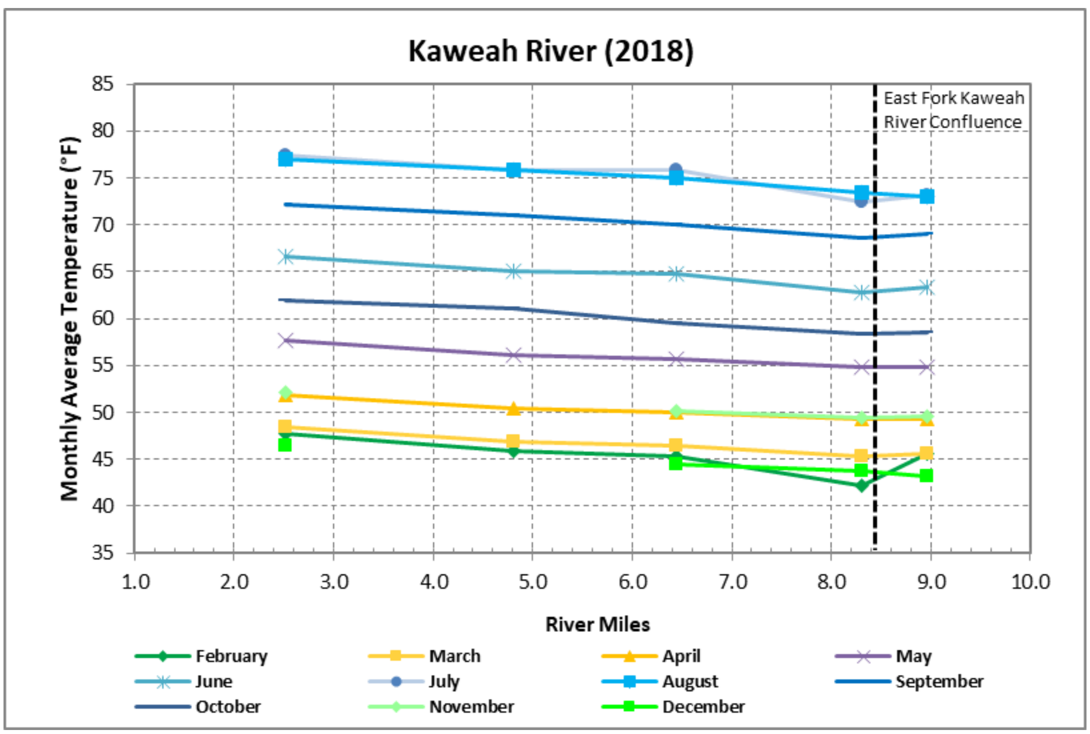




**Figure 7.4-6. Longitudinal trends in Average Monthly Water Temperature along the Kaweah River July 2014 through April 2015 (top) and 2018 (bottom).**

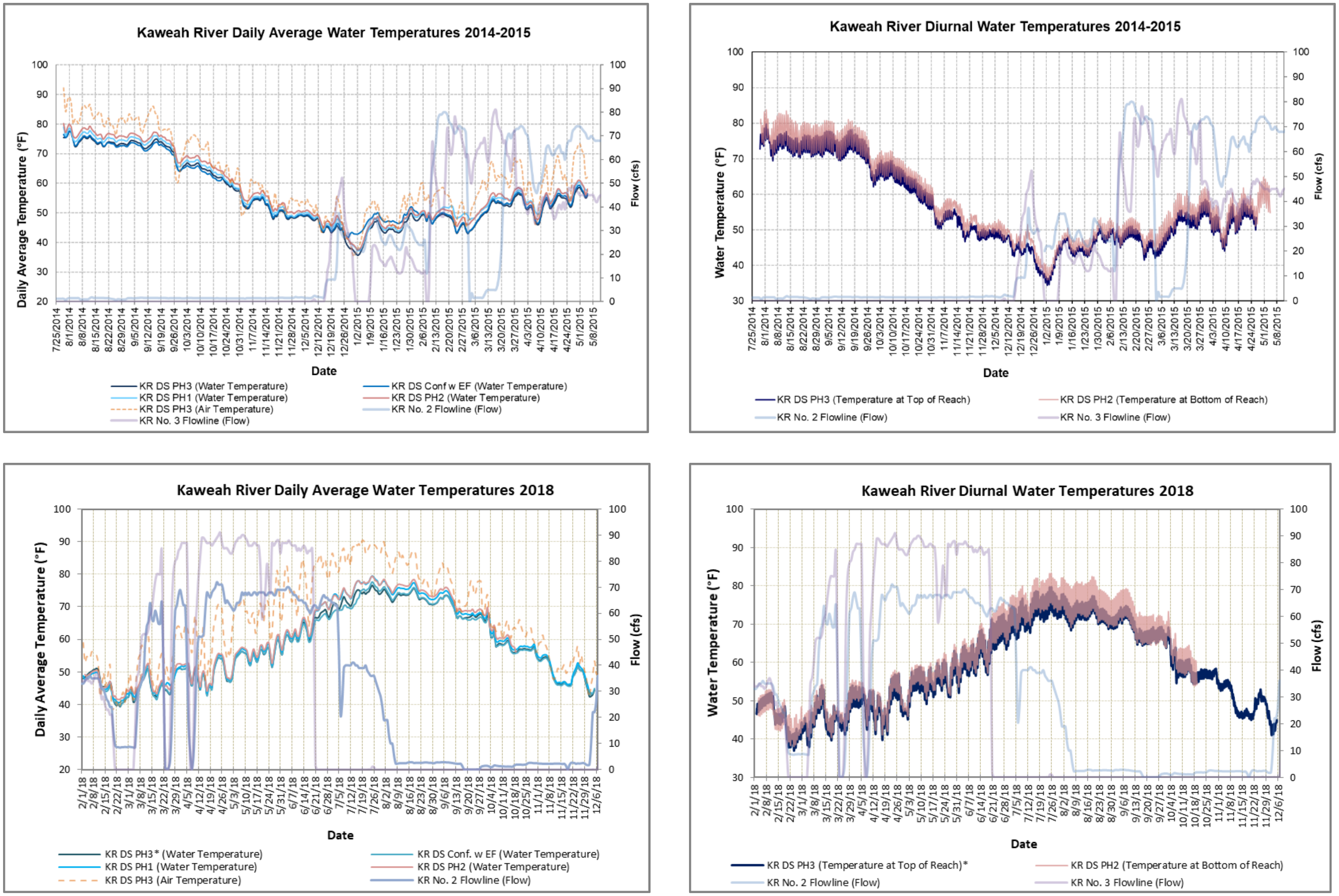
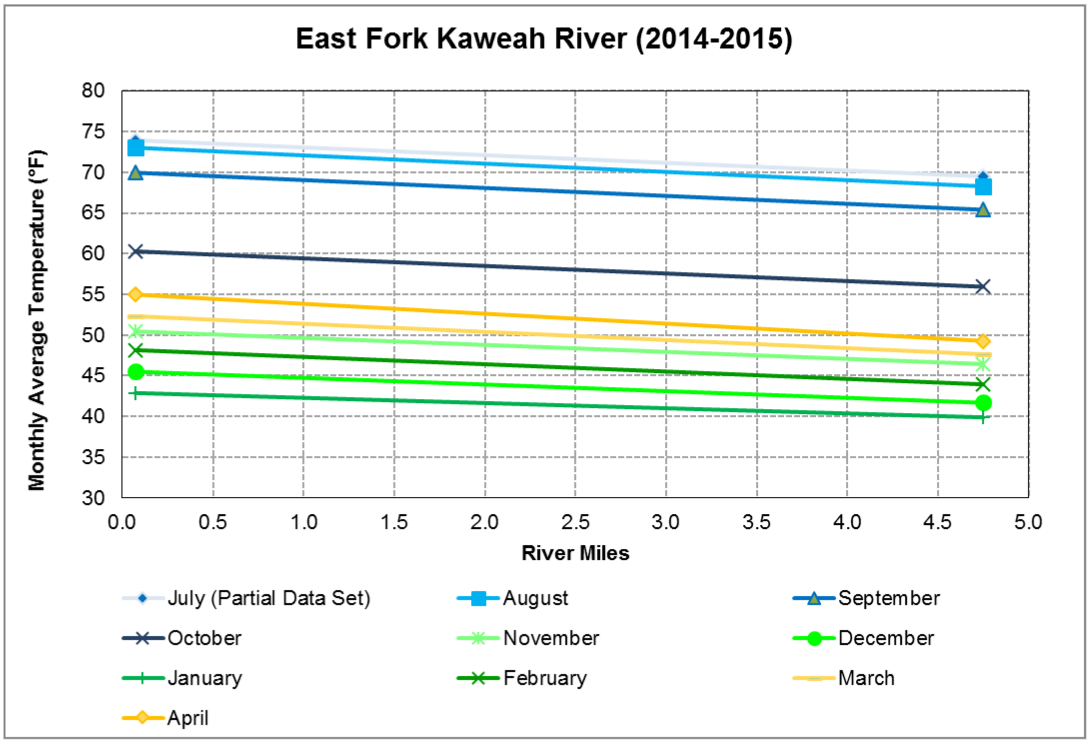



**Figure 7.4-7. Kaweah River Average Daily and 15-min Water Temperature July 2014 through April 2015 (top) and 2018 (bottom).**



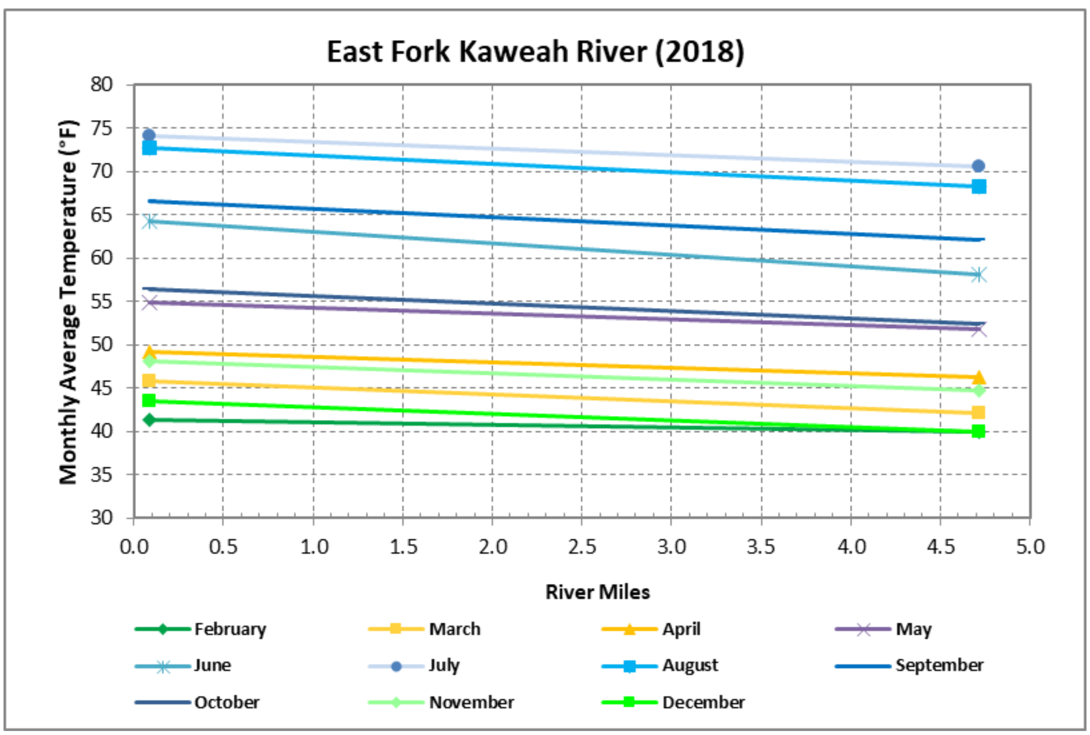




**Figure 7.4-8. Longitudinal Trends in Average Monthly Water Temperature along the East Fork Kaweah River July 2014 through April 2015 (top) and 2018 (bottom).**

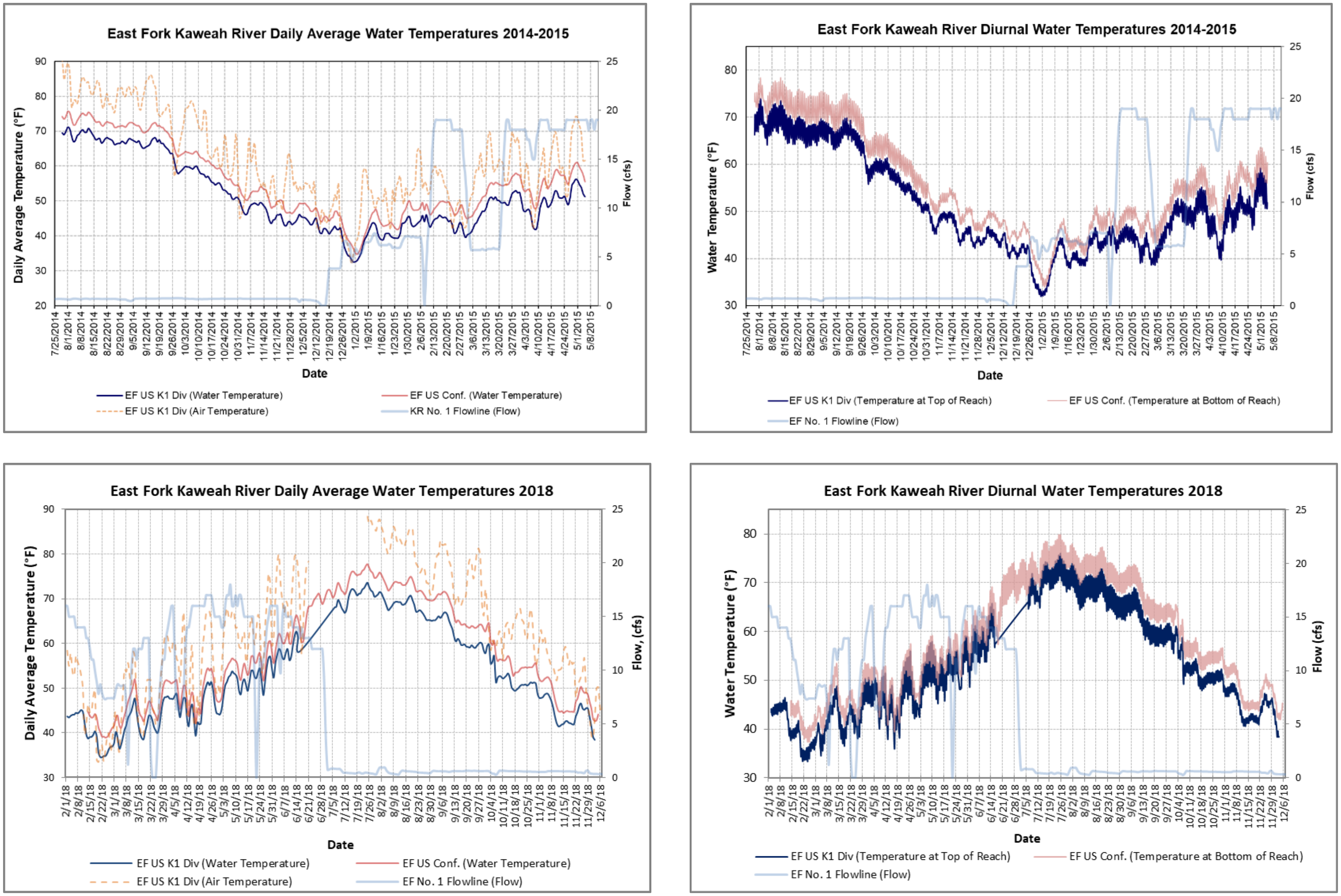



**Figure 7.4-9. East Fork Kaweah River Average Daily and 15-min Water Temperature July 2014 through April 2015 (top) and 2018 (bottom).**

| Month | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Hardhead** | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Sacramento Pikeminnow** | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Sacramento Sucker** | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |
| **Rainbow Trout** | | | | | | | | | | | | |
| Spawning | | | | | | | | | | | | |
| Fry | | | | | | | | | | | | |
| Juvenile | | | | | | | | | | | | |
| Adult | | | | | | | | | | | | |

**Figure 7.4-10. Periodicity Chart for Modeled Fish Species and Life Stages in the Kaweah Project.**

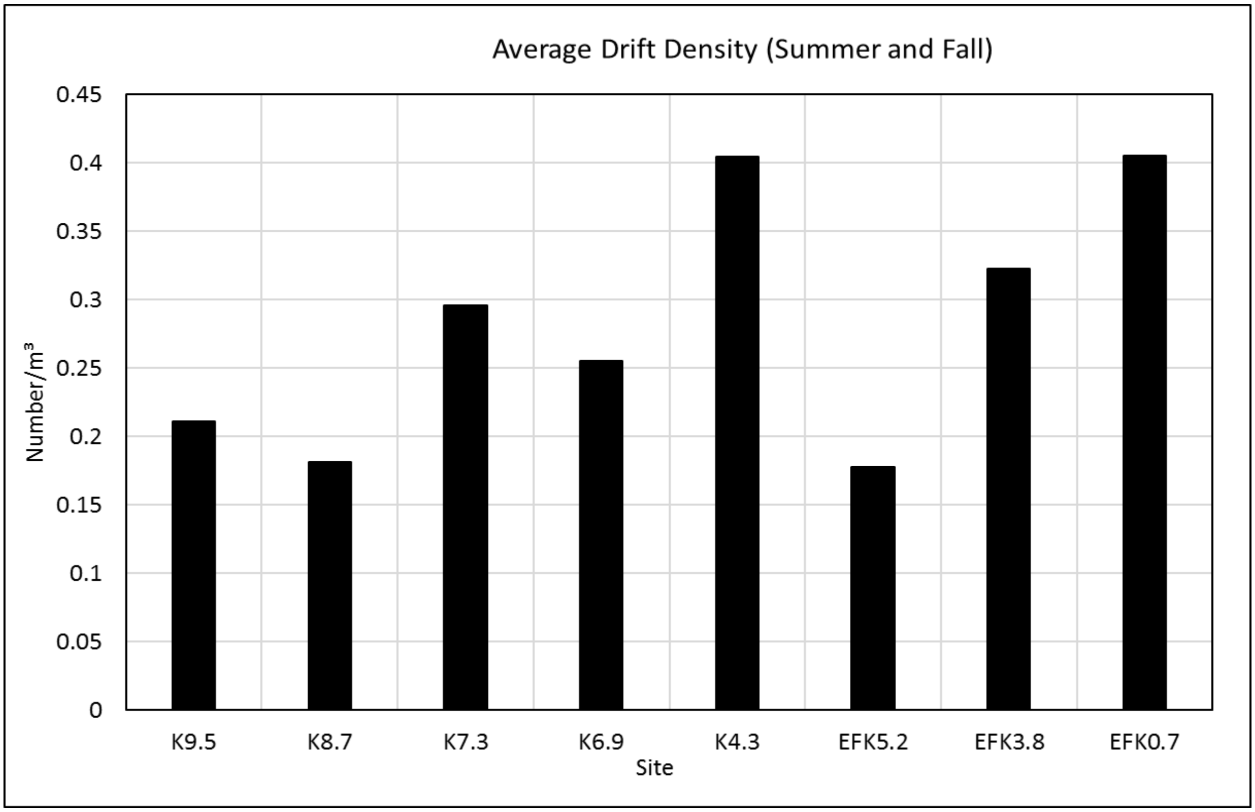



**Figure 7.4-11. Average Macroinvertebrate Drift Density (Summer and Fall) (number/m$^3$) by Location.**

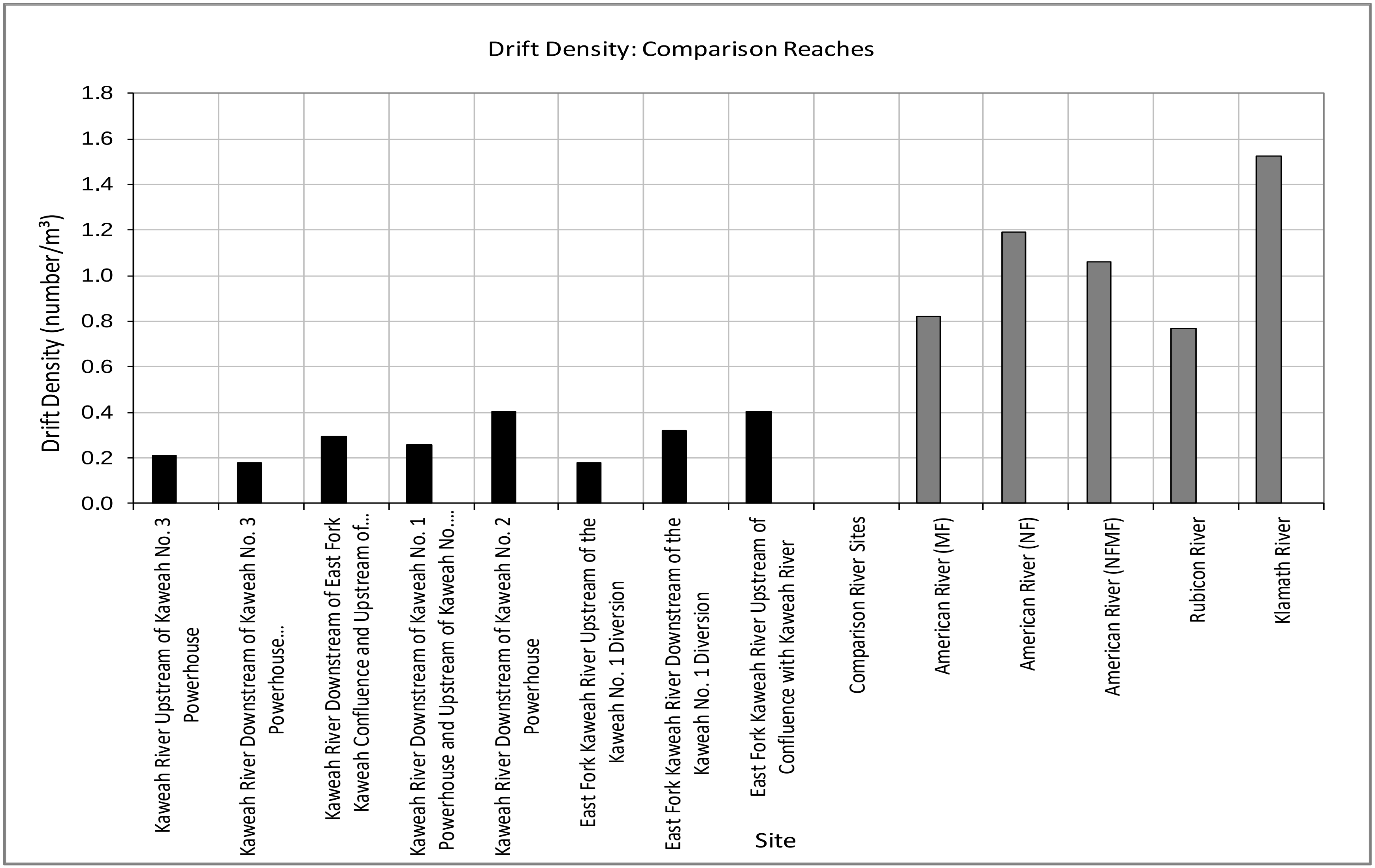



**Figure 7.4-12. Average Drift Density (Summer and Fall) at Kaweah River Study Locations (black) and Comparable Locations (grey).**

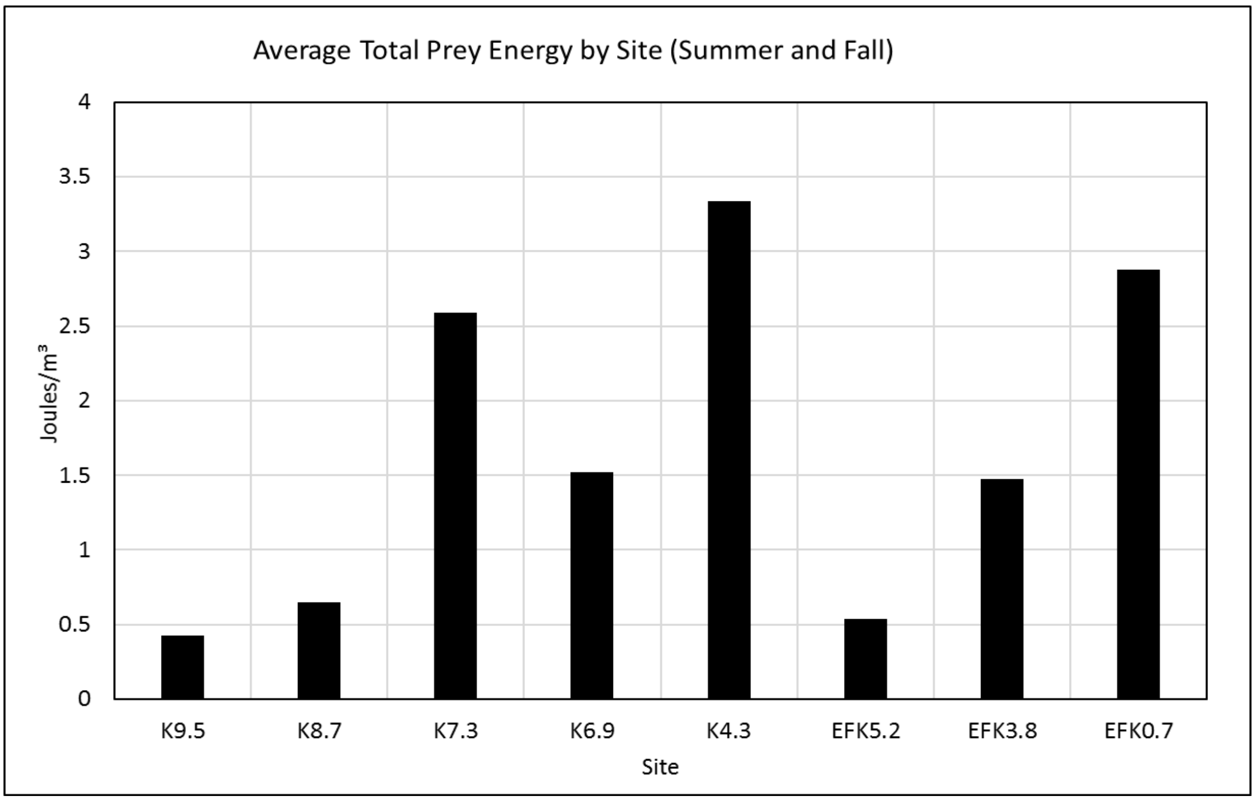
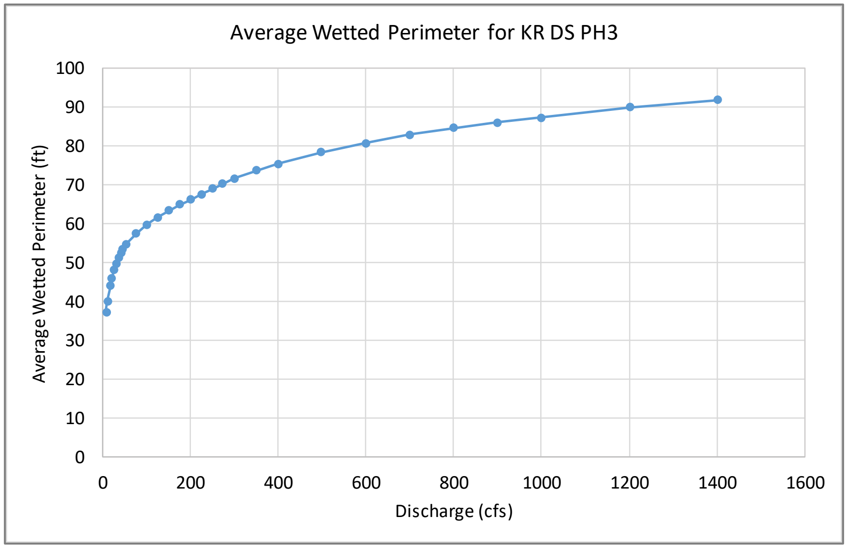
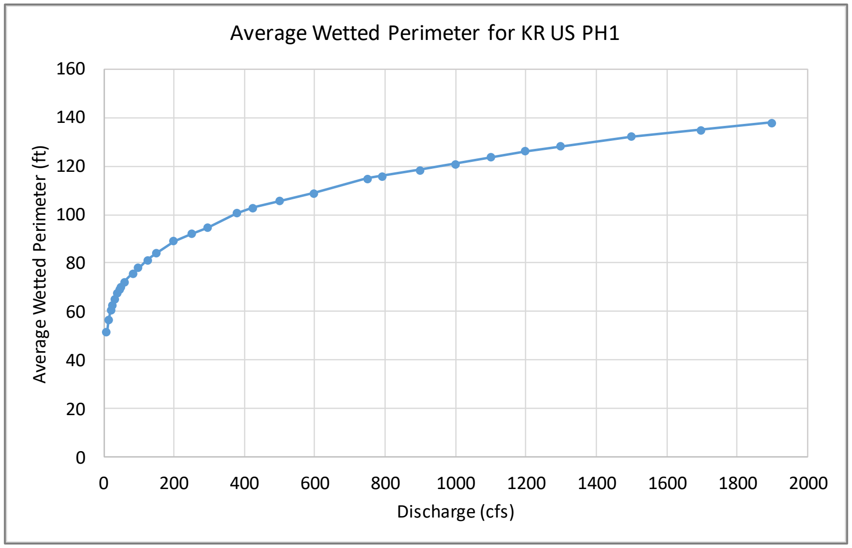
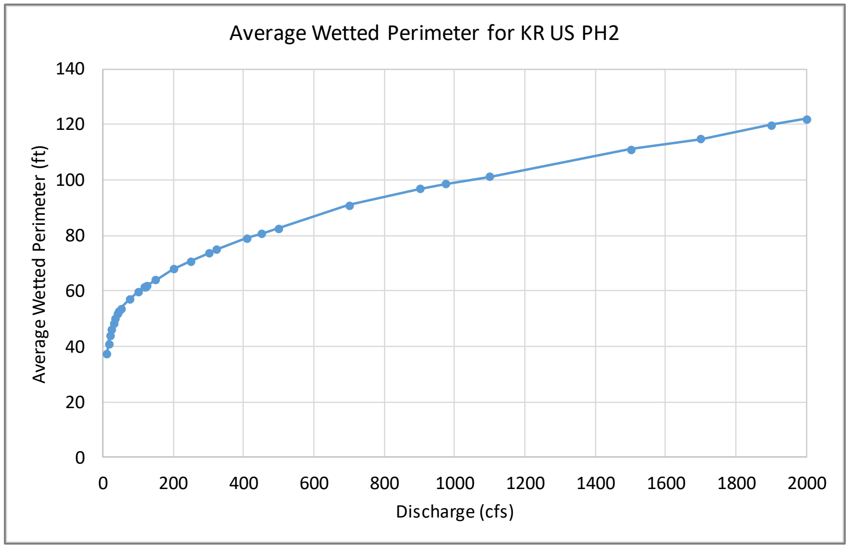



**Figure 7.4-13. Average Total Prey Energy (Summer and Fall) by Site.**



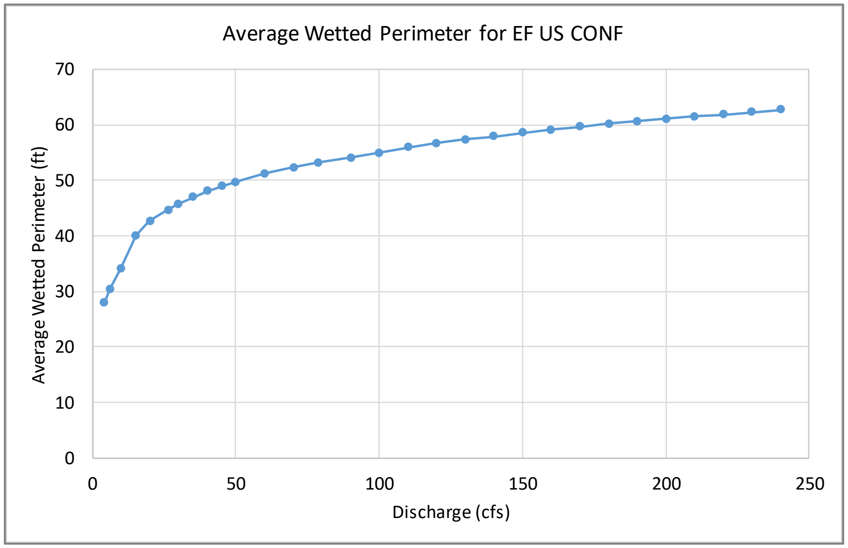




**Figure 7.4-14. Wetted Perimeter Versus Flow in each Bypass Reach.**

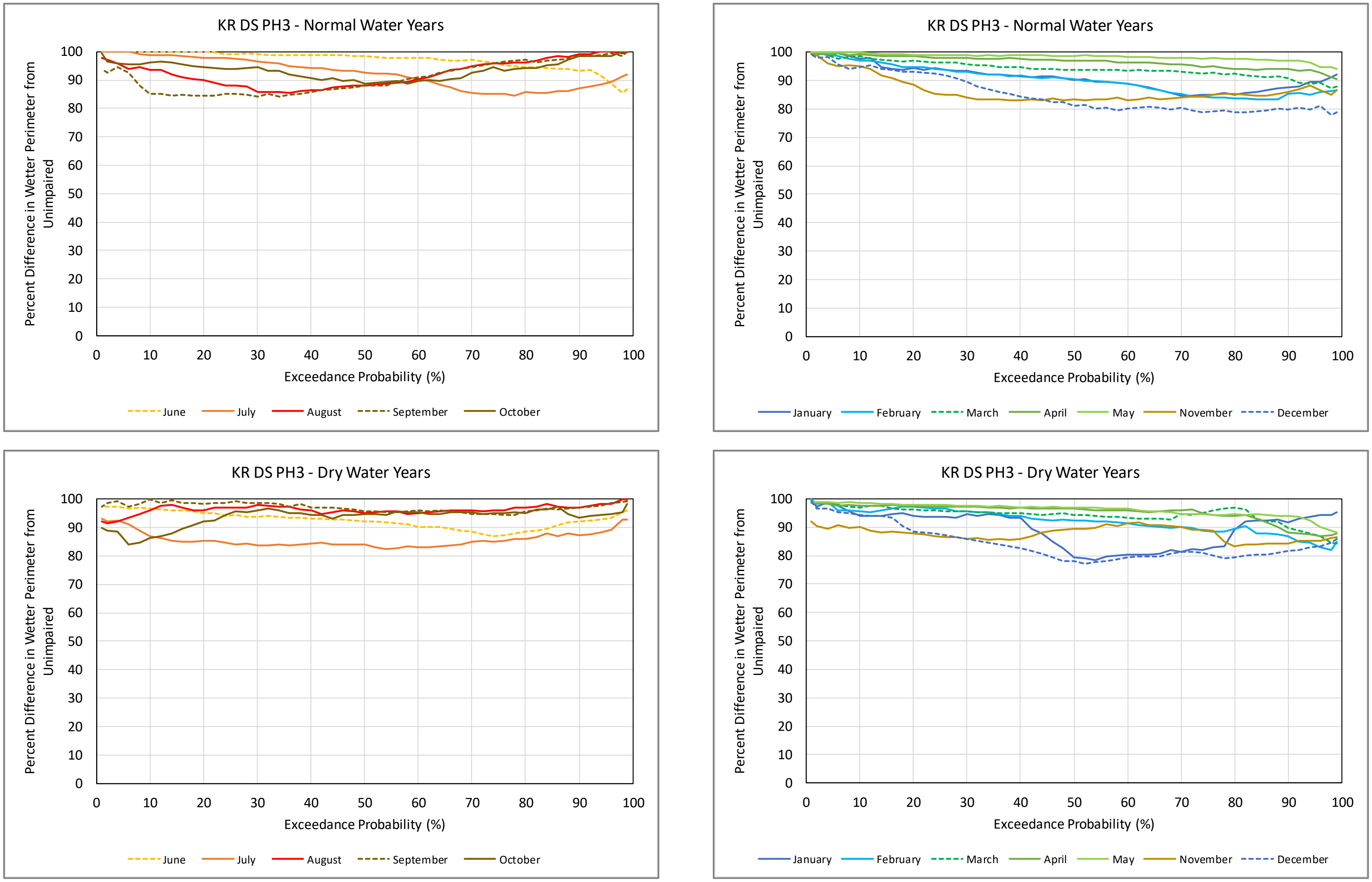



**Figure 7.4-15. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Wetted Perimeter Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**


**Figure 7.4-16. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Wetted Perimeter Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

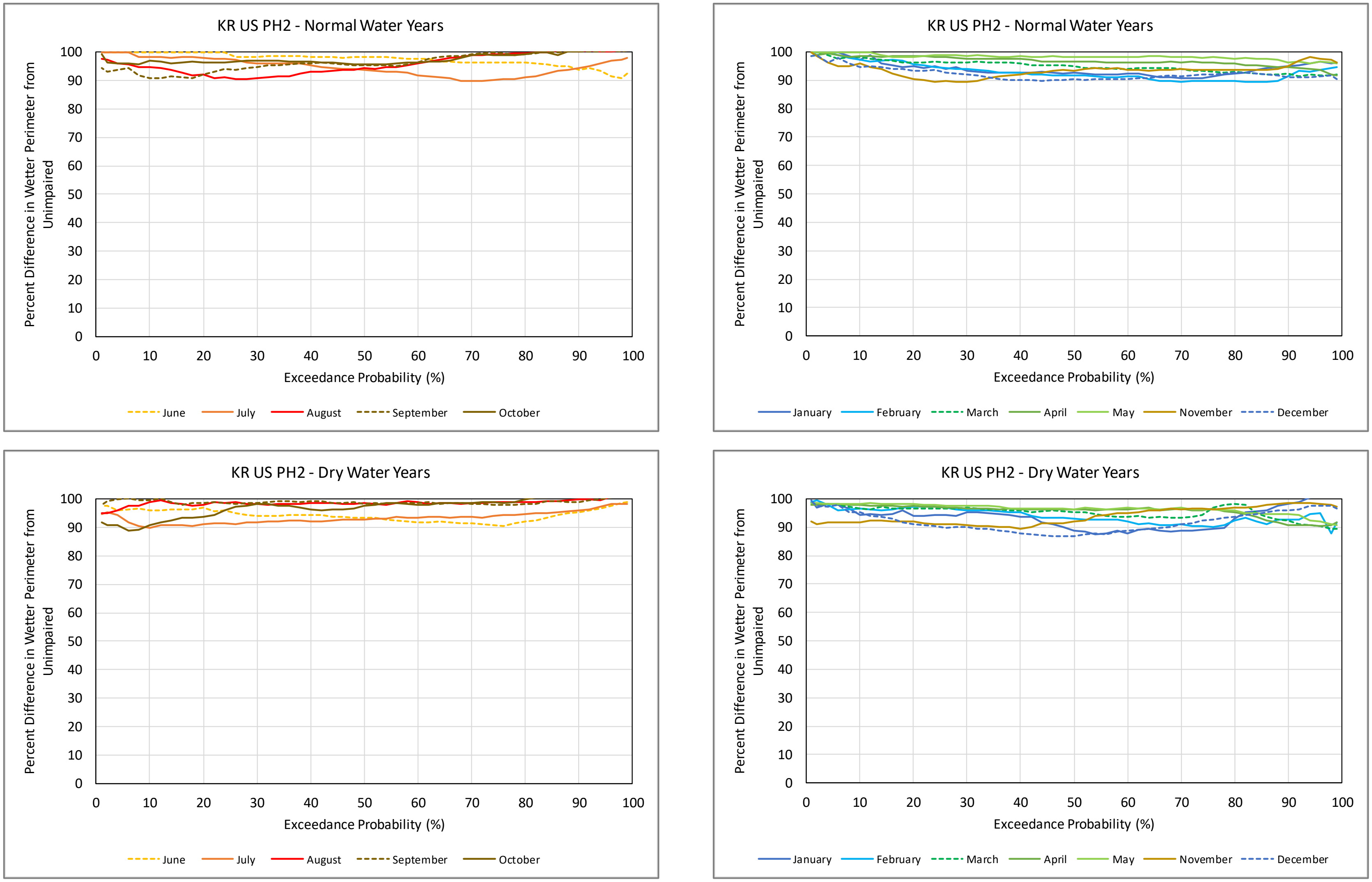



**Figure 7.4-17. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Wetted Perimeter Habitat Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

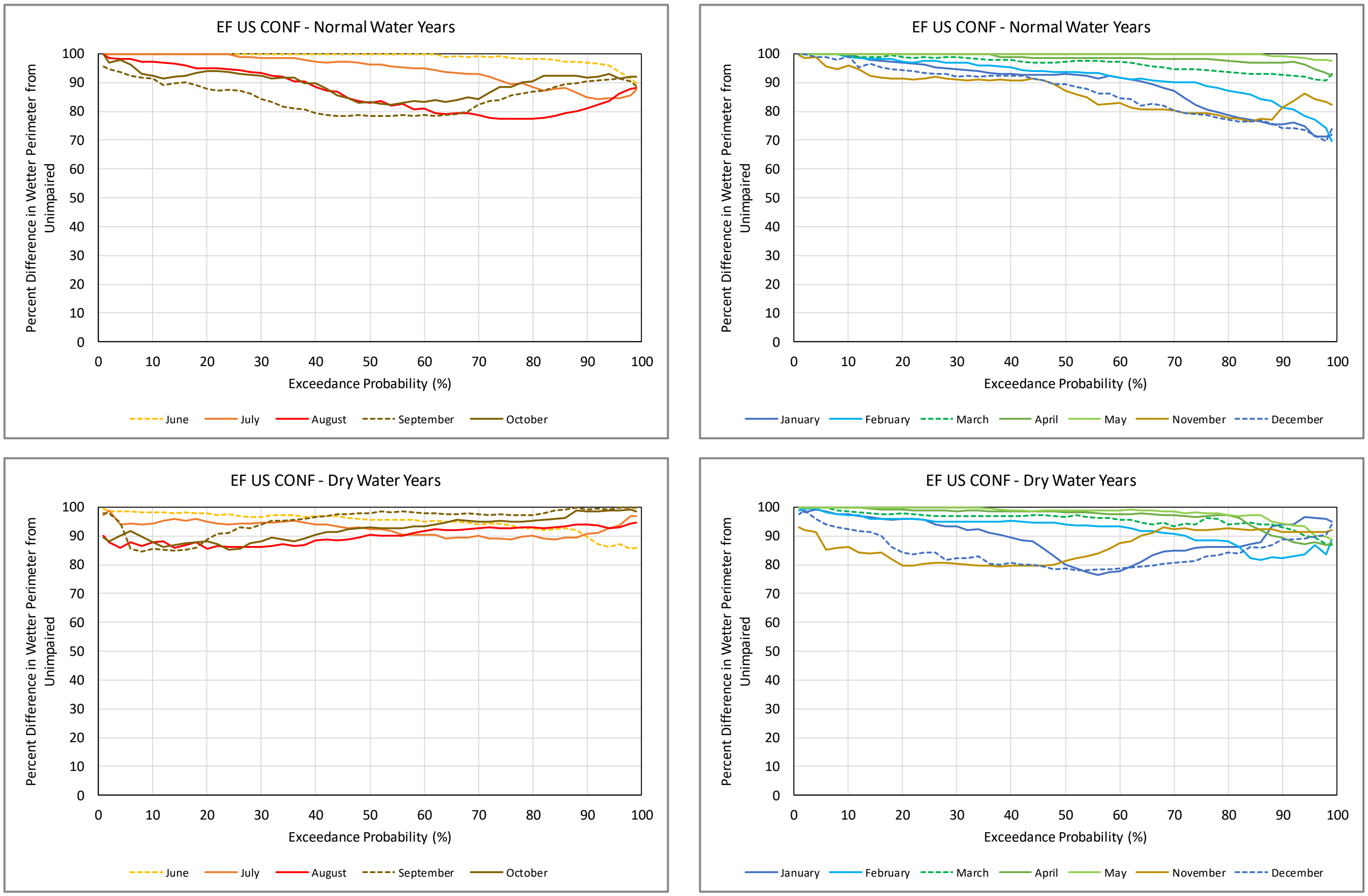



**Figure 7.4-18. East Fork Kaweah River Upstream of the Confluence with Kaweah River Wetted Perimeter Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

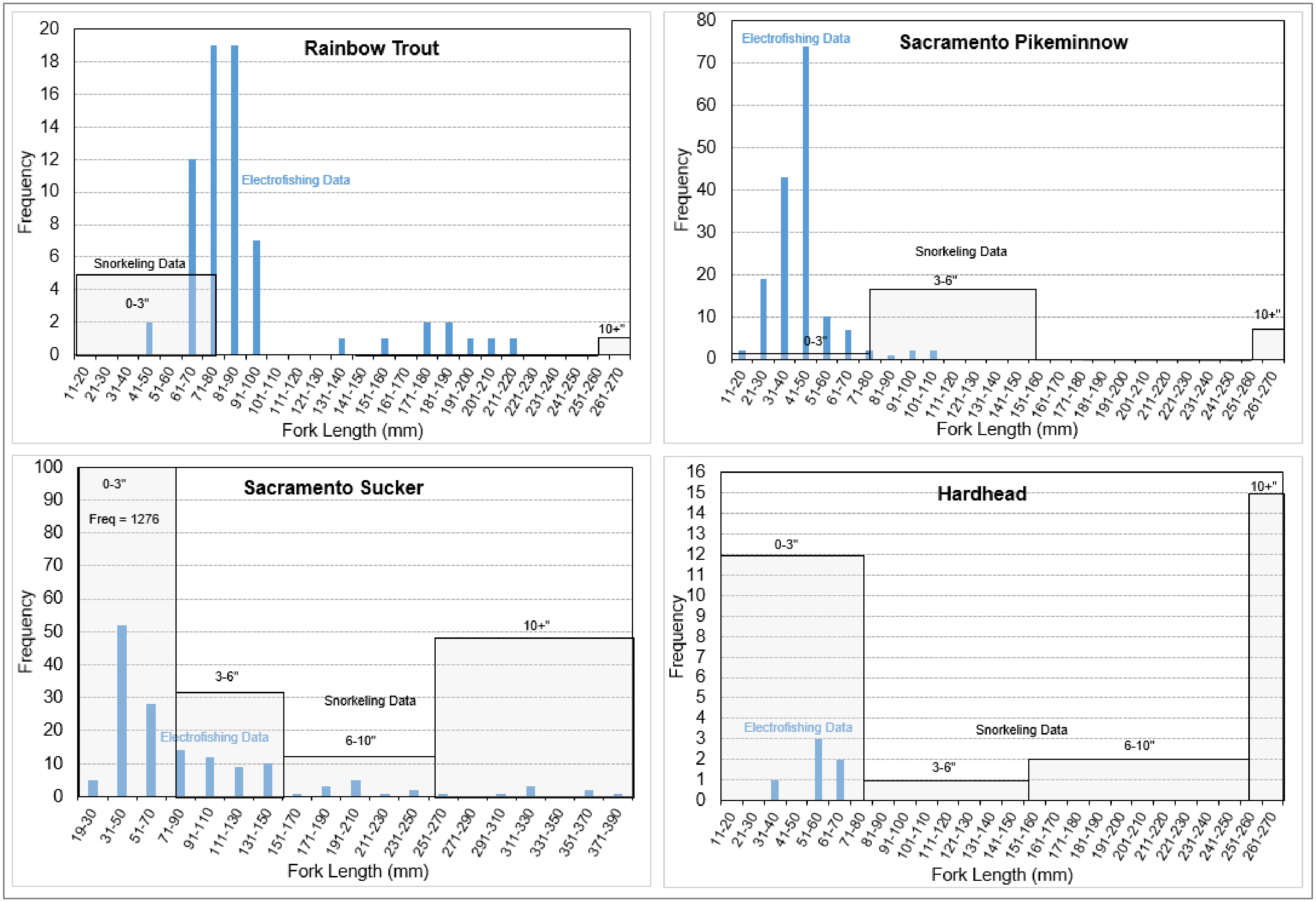



**Figure 7.4-19. Length Frequency Histograms for Each Fish Species Captured at All Sites.**

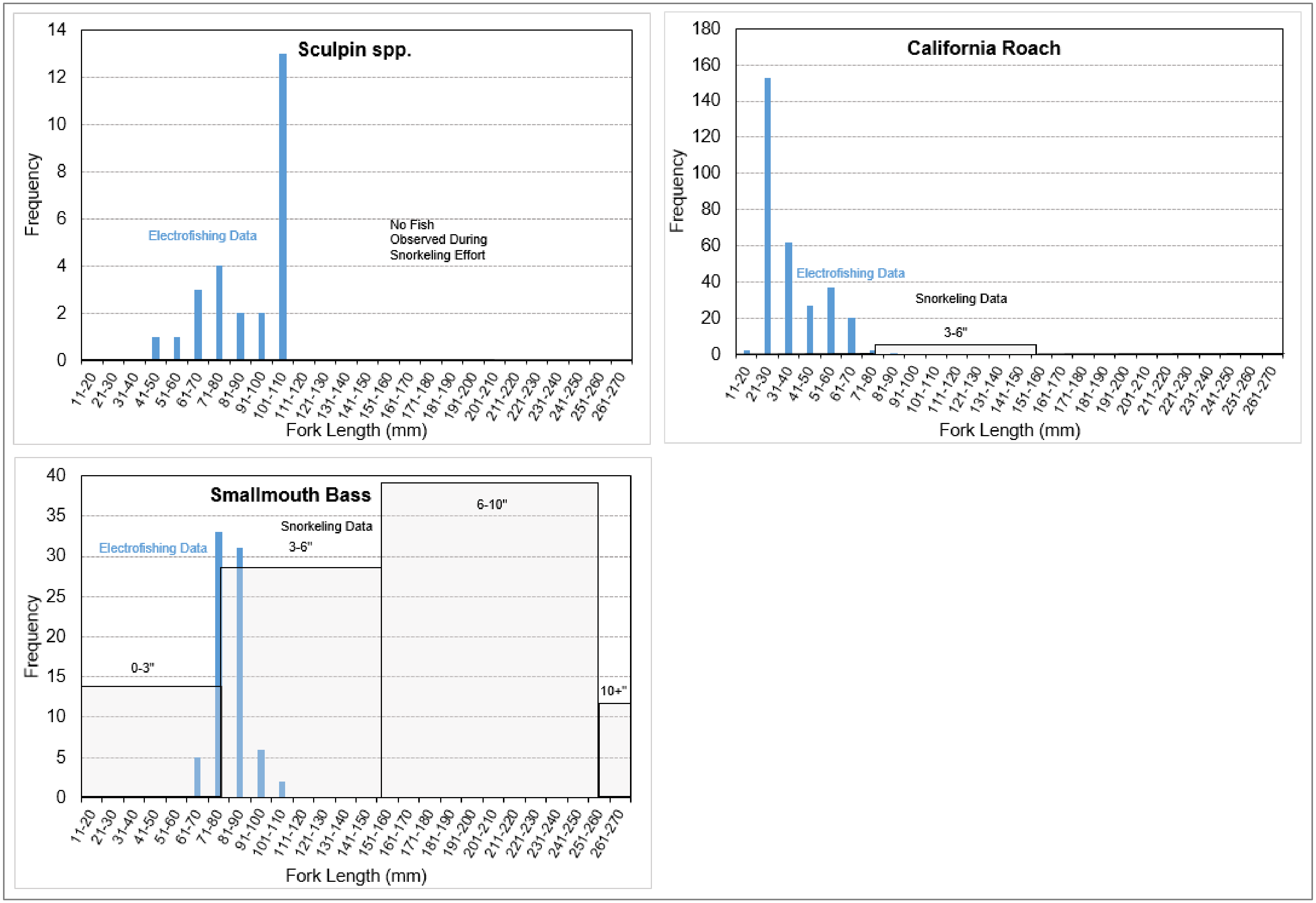



**Figure 7.4-19. (cont'd) Length Frequency Histograms for Each Fish Species Captured Across All Sites.**

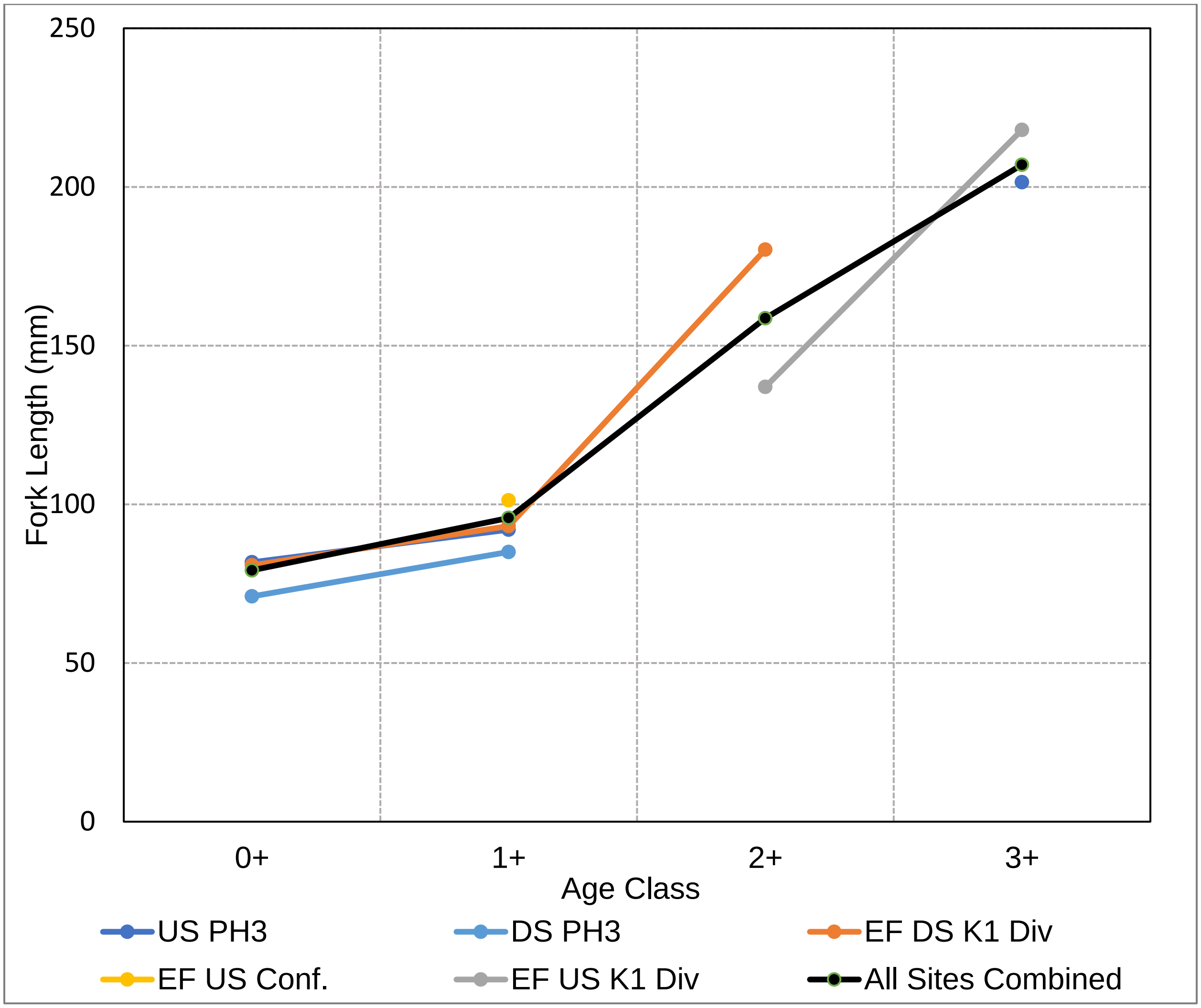



**Figure 7.4-20. 2018 Age and Growth Rates of Rainbow Trout for All Study Sites Combined Based on Scale Analysis (n=30).**

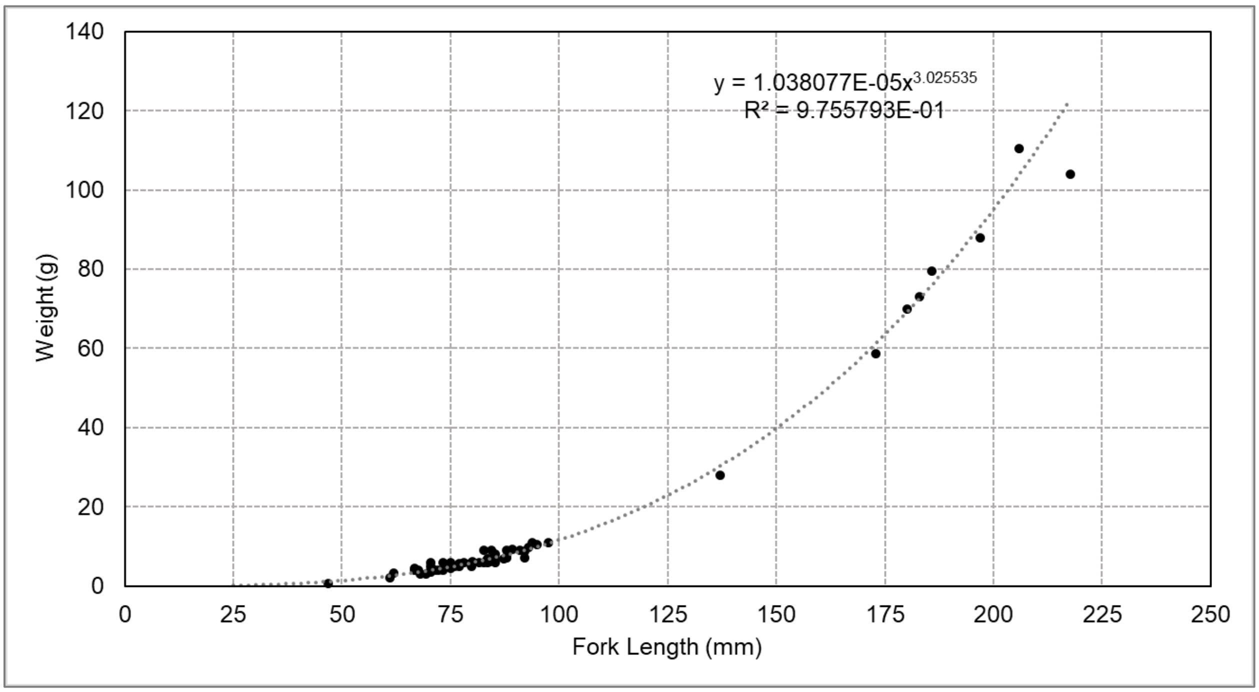



**Figure 7.4-21. Length and Weight Relationship for Rainbow Trout for All Study Sites Combined.**

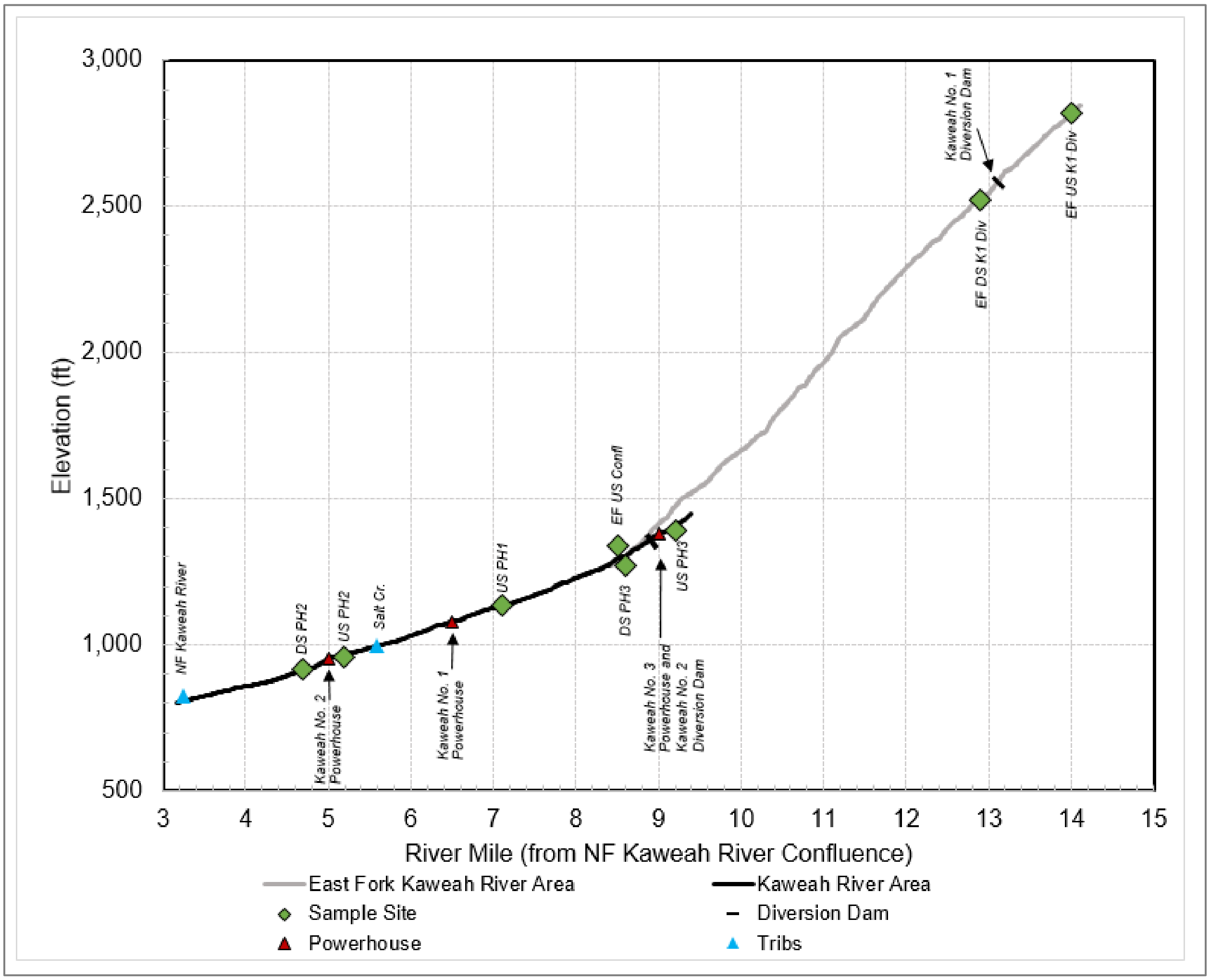



**Figure 7.4-22. Elevation of Fish Sampling Sites on the Kaweah River and East Fork Kaweah River.**

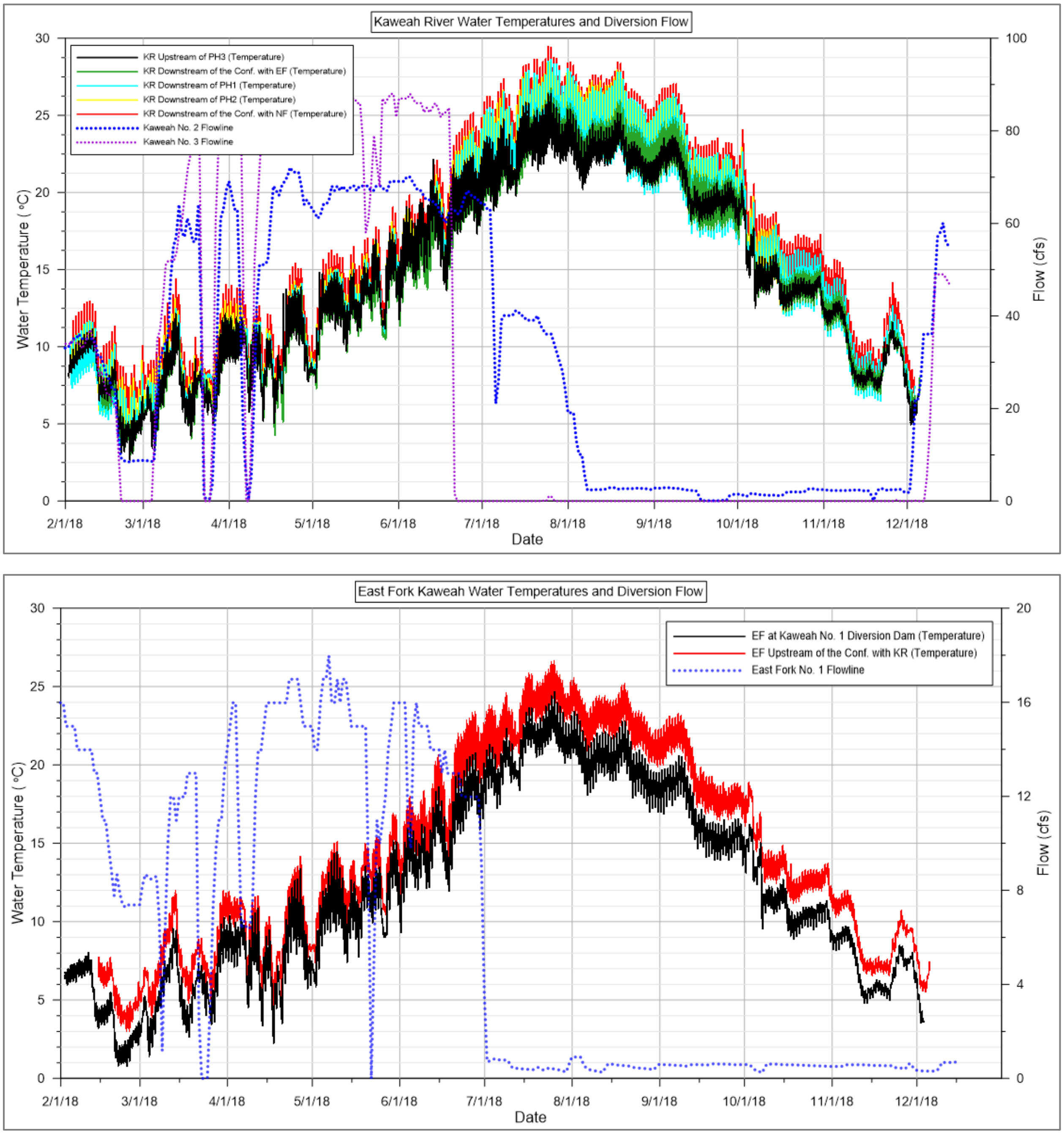



**Figure 7.4-23. Water Temperature (2018) in the Vicinity of the Kaweah River and East Fork Kaweah River Fish Sampling Sites.**

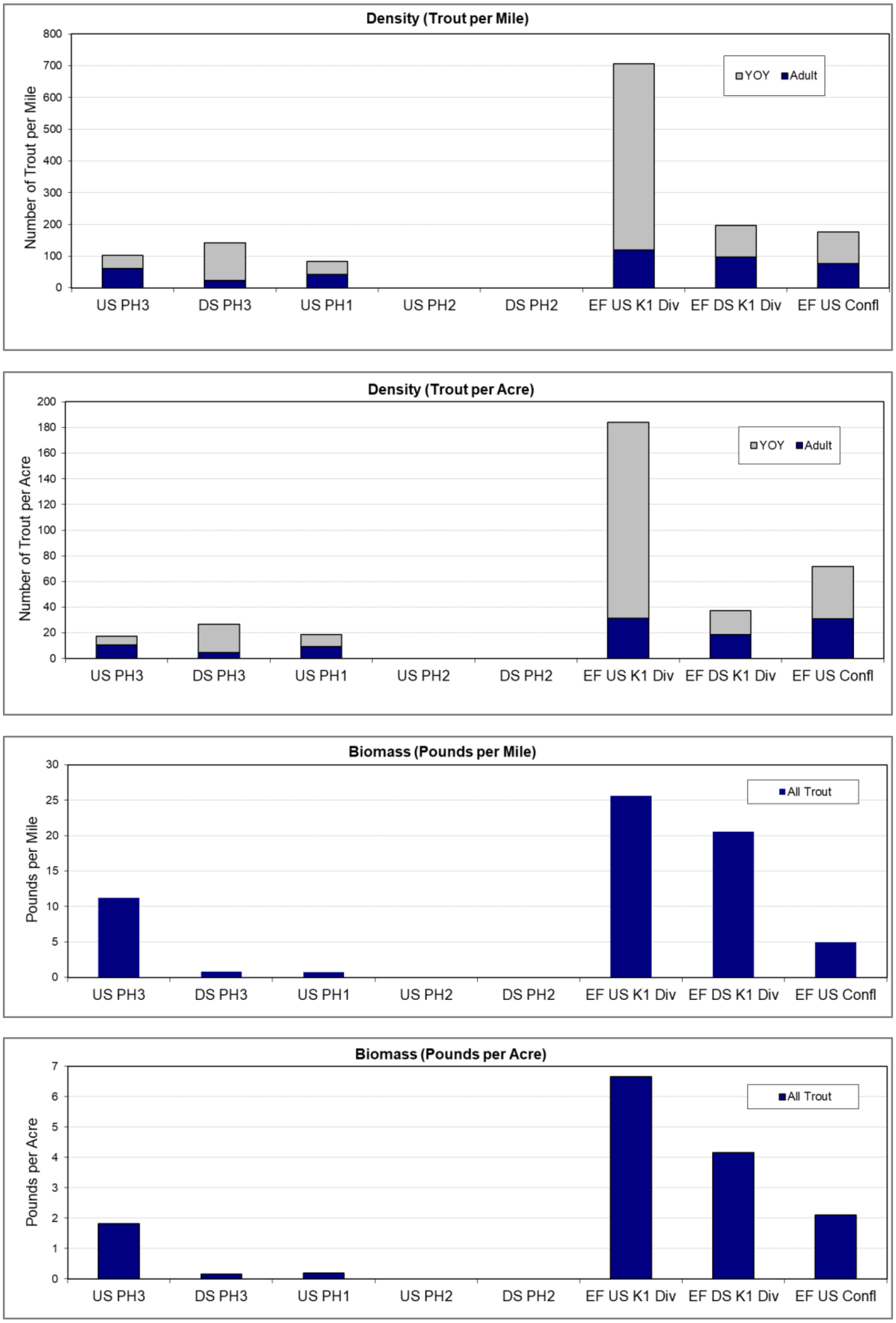



**Figure 7.4-24. The Density and Biomass of Rainbow Trout in Study Reaches.**

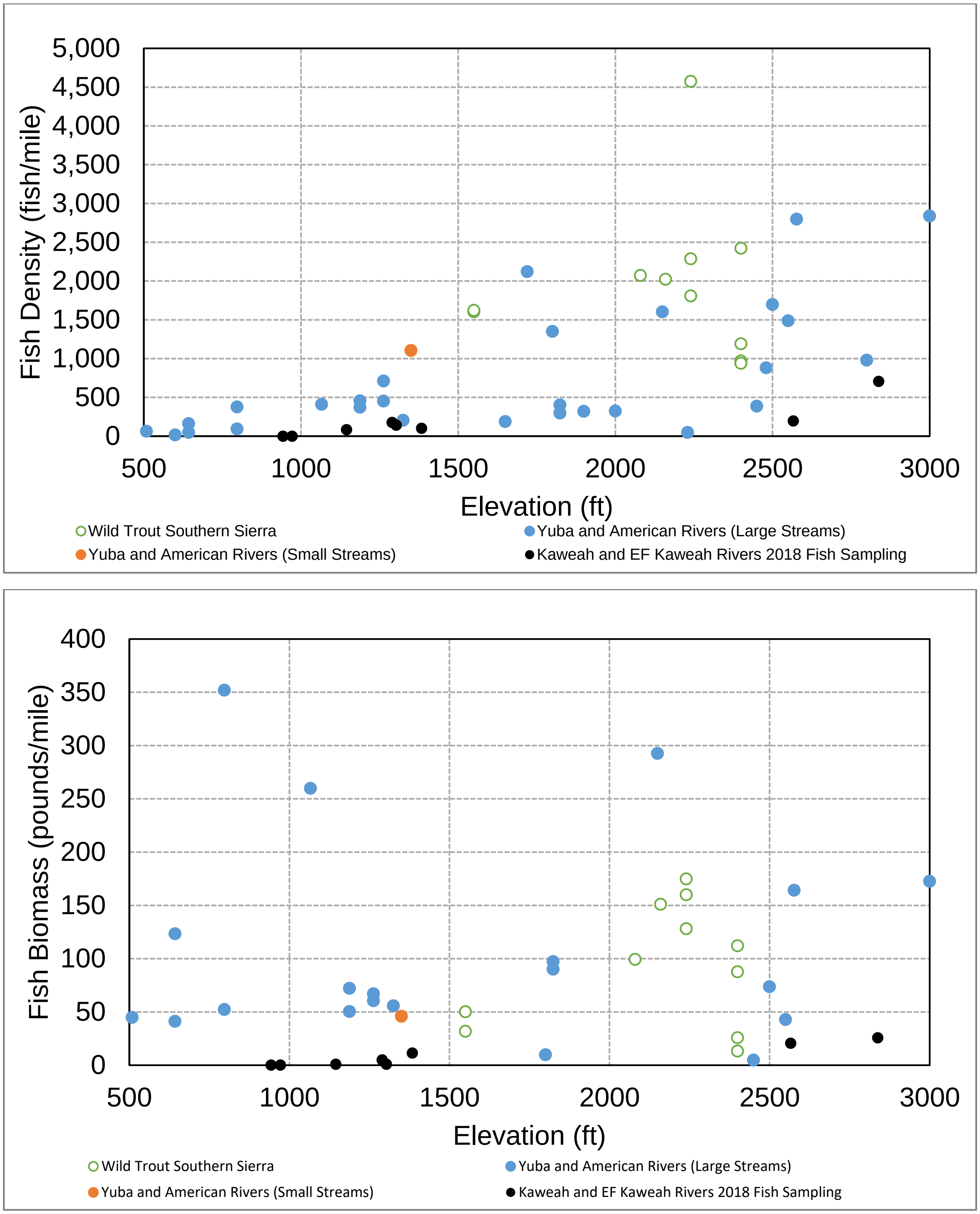
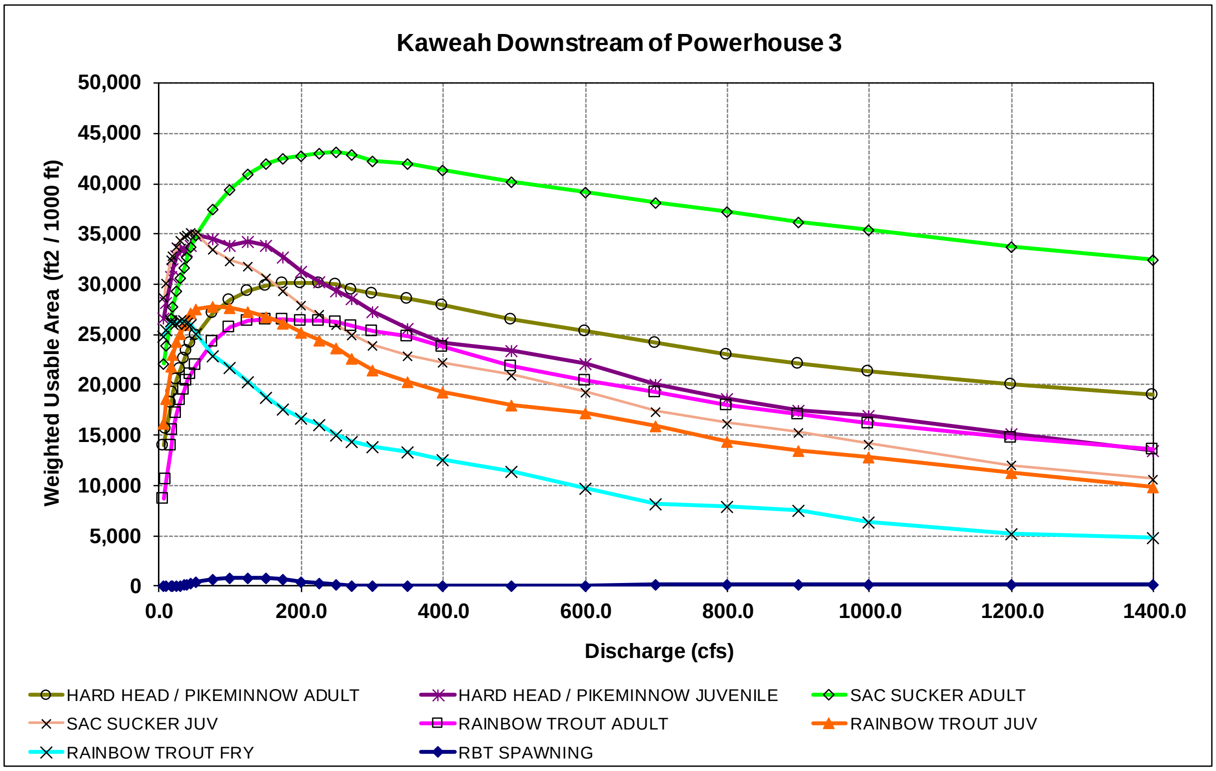



**Figure 7.4-25. Rainbow Trout - Elevation vs. Fish per Mile (top) and Elevation vs. Pounds per Mile (bottom).**



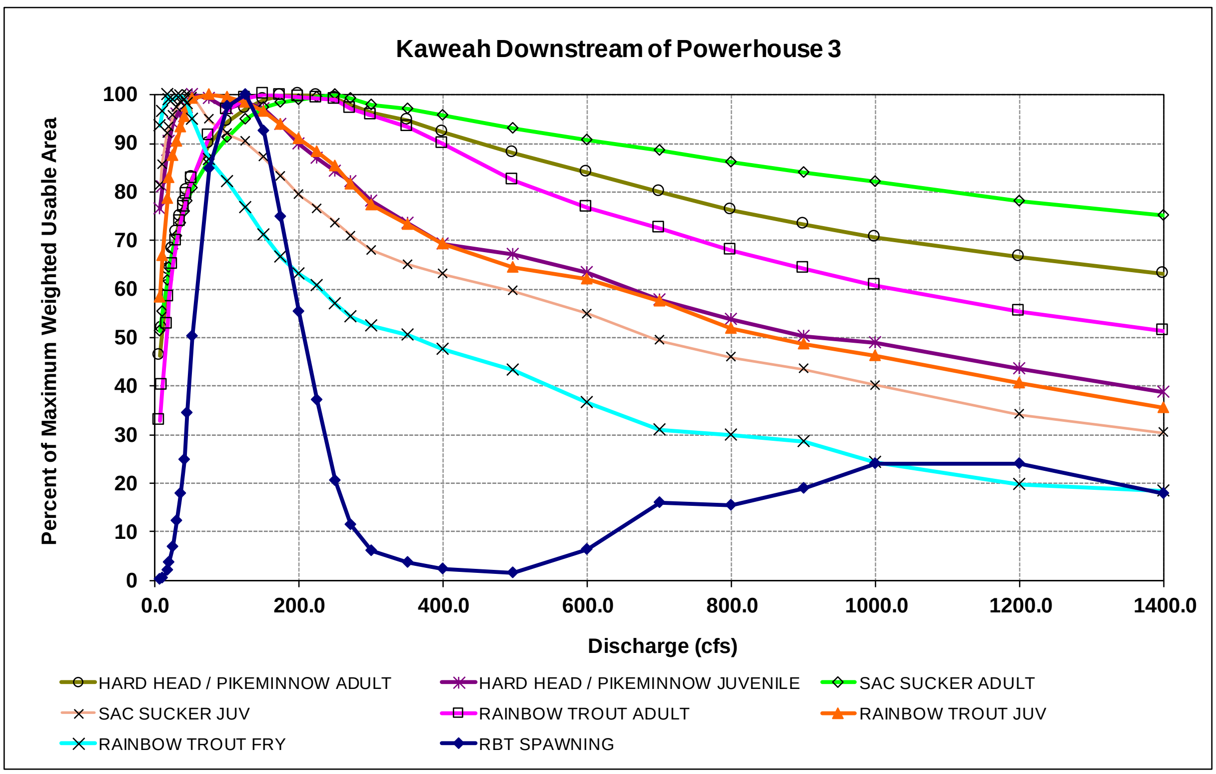




**Figure 7.4-26. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).**

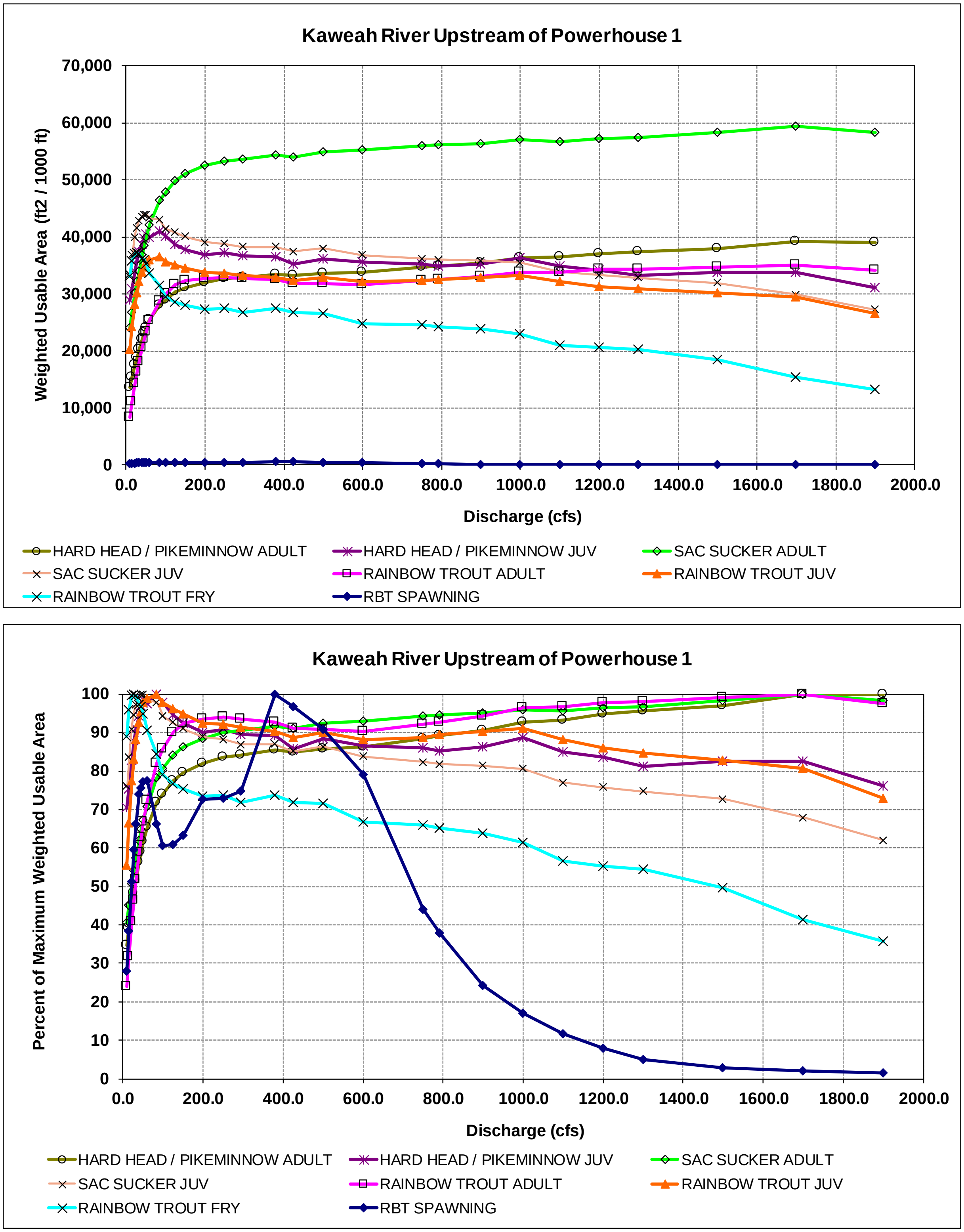
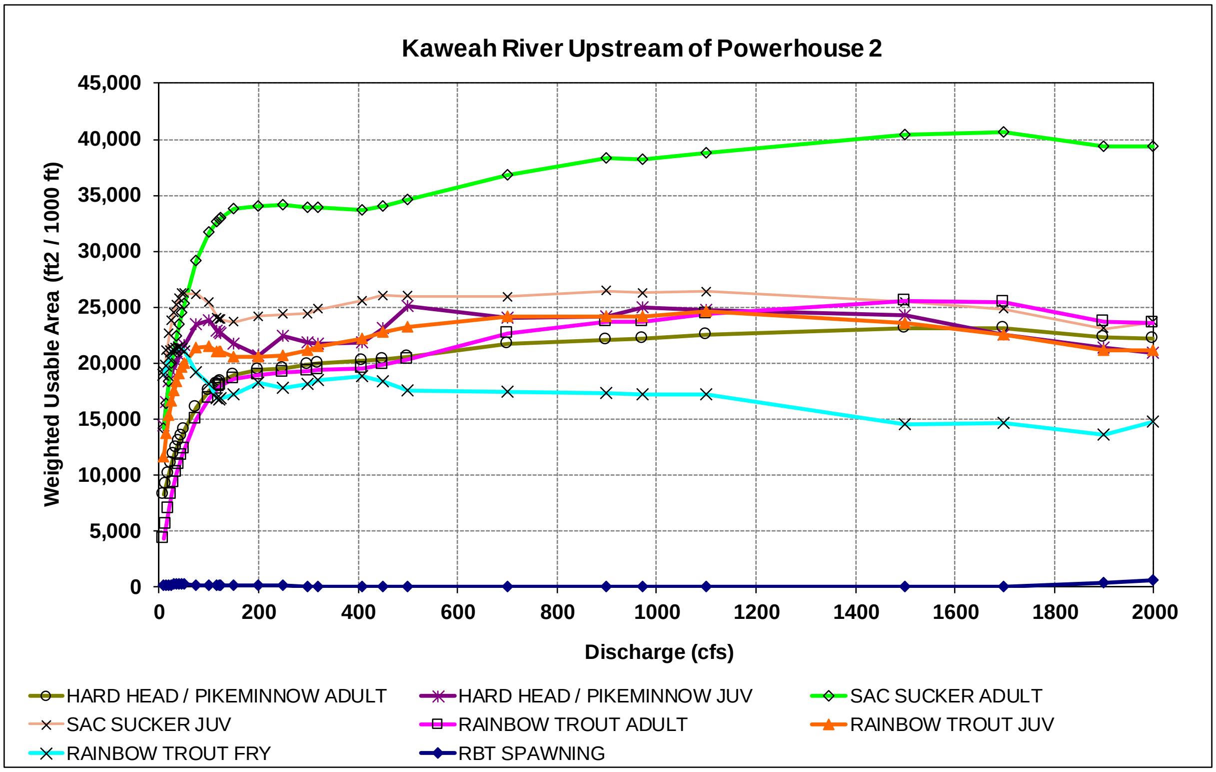



**Figure 7.4-27. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).**



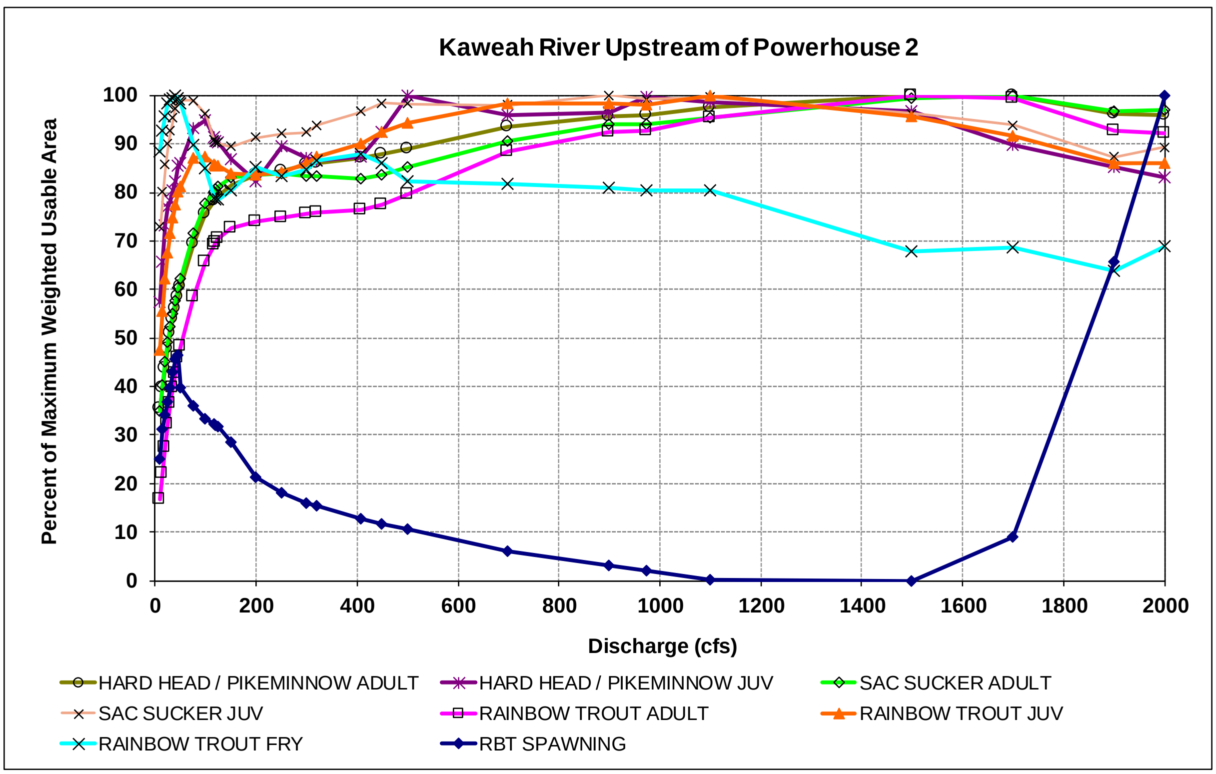
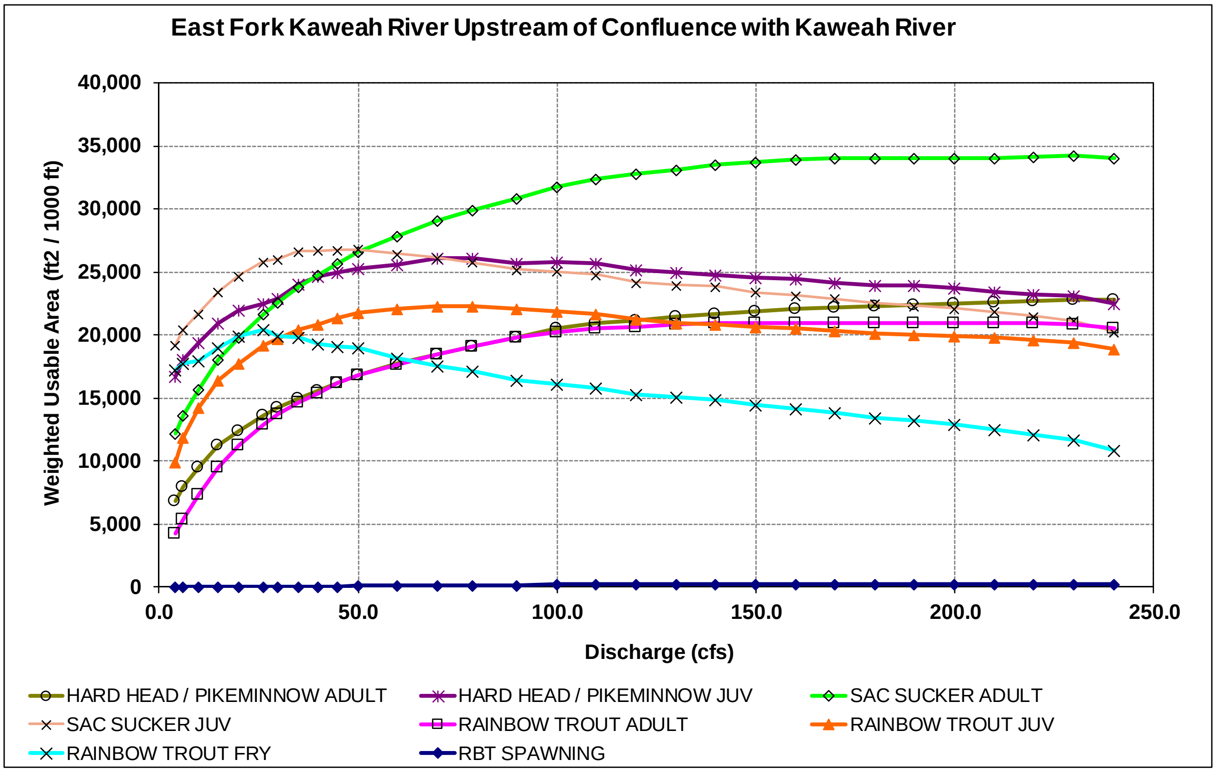




**Figure 7.4-28. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).**



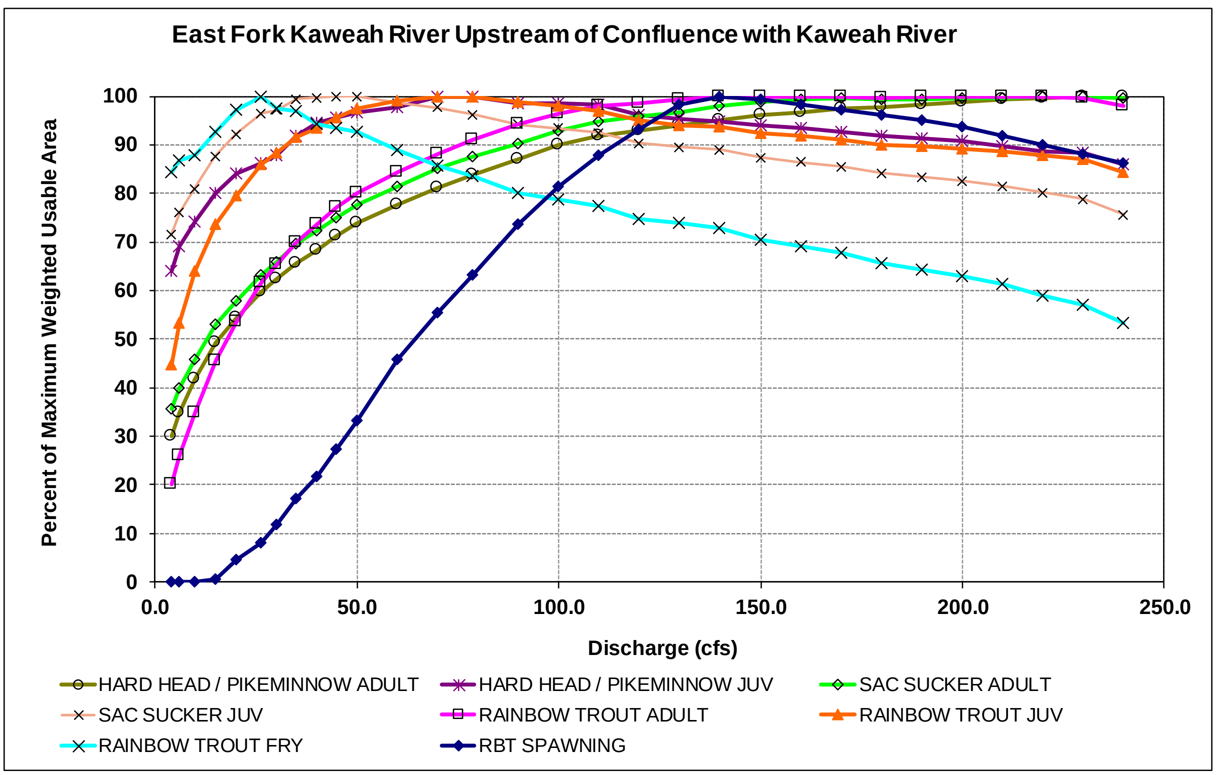




**Figure 7.4-29. East Fork Kaweah River Upstream of the Confluence with Kaweah River Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).**

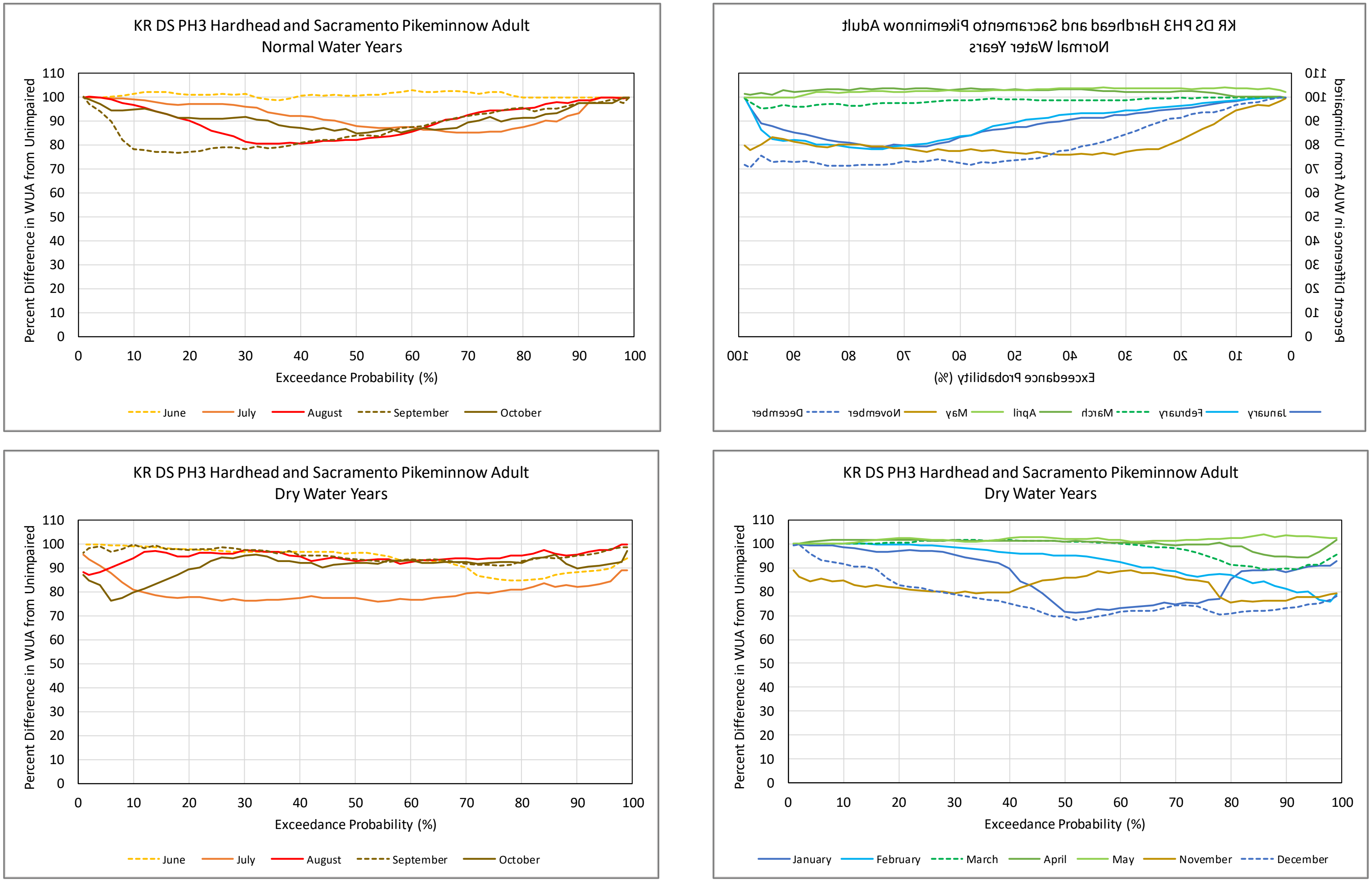



**Figure 7.4-30. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Habitat Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**


**Figure 7.4-31. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**


**Figure 7.4-32. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

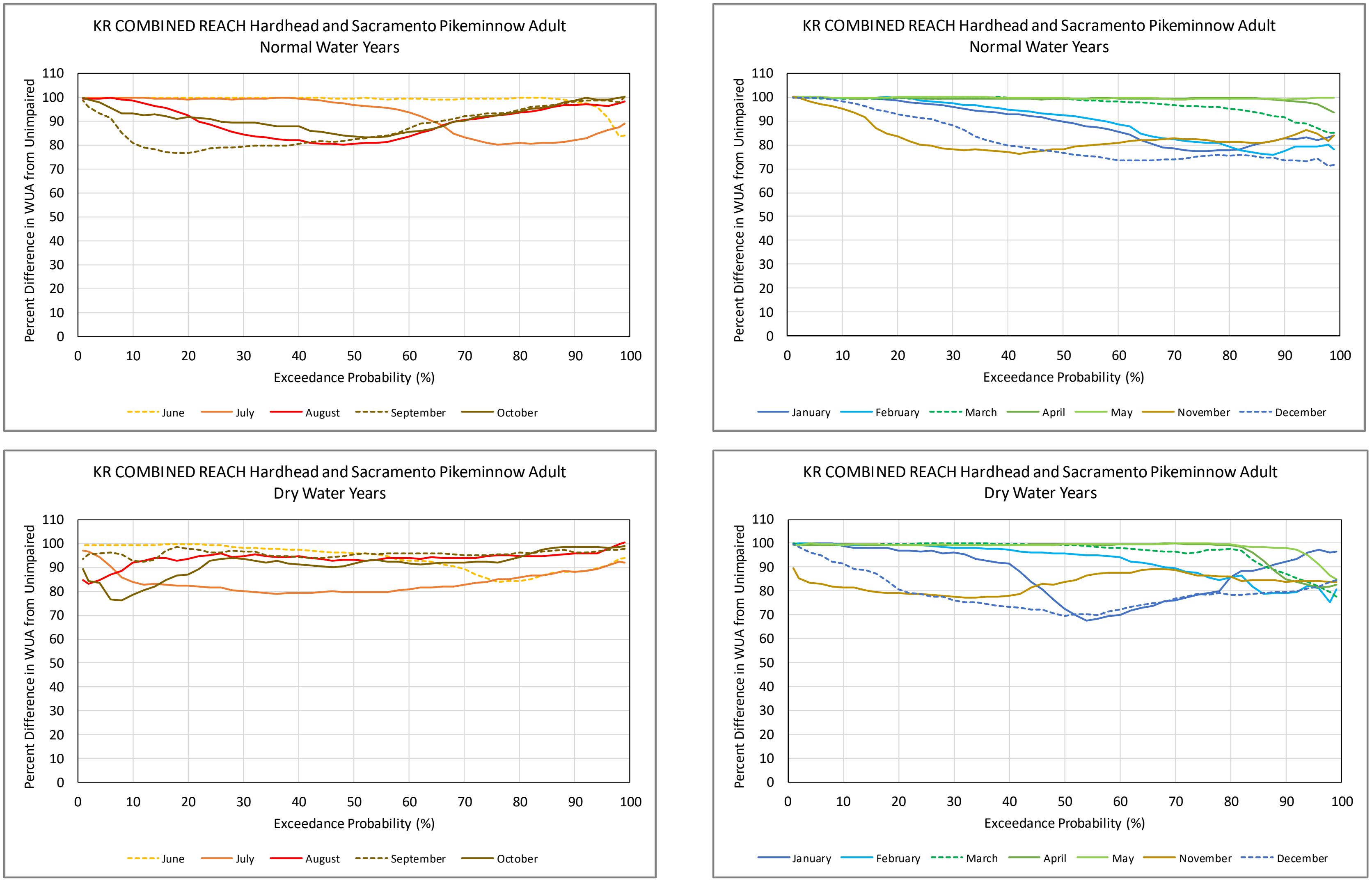



**Figure 7.4-33. Kaweah River Combined Reaches Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

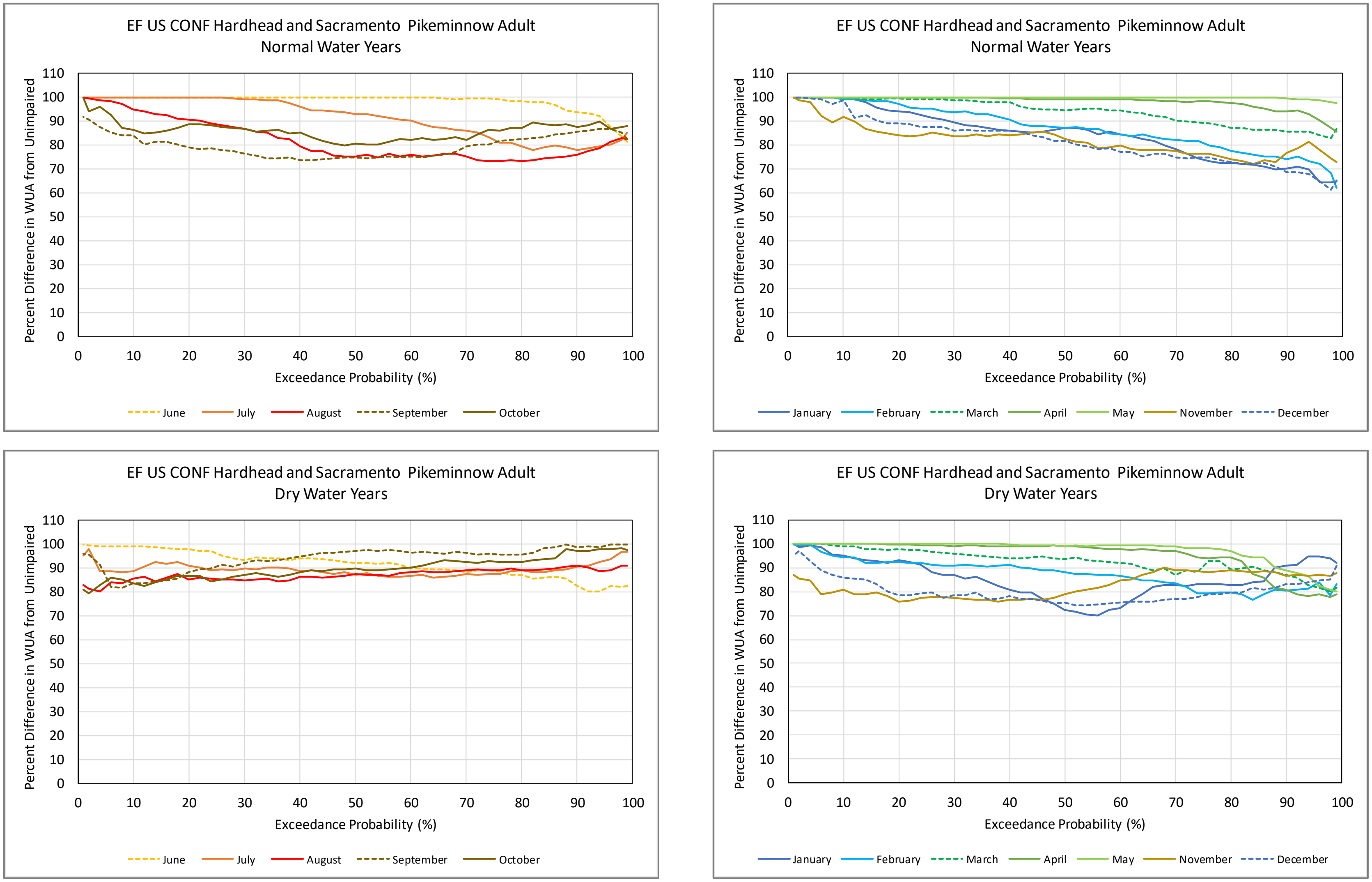



**Figure 7.4-34. East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots (1994-2018) for Normal (top) and Dry Water Year Types (bottom) (warm water temperature months, left, cool water temperature months, right).**

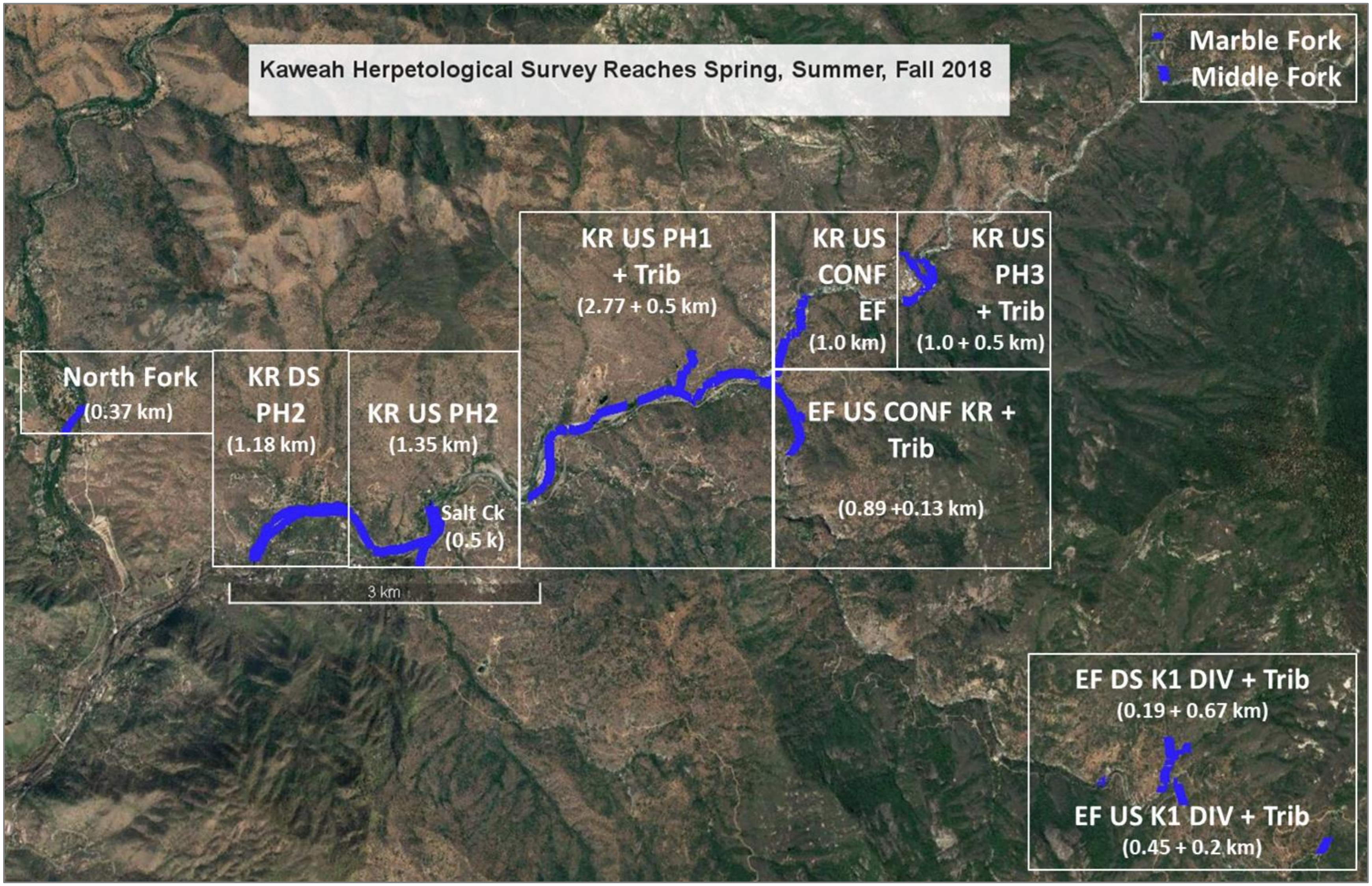
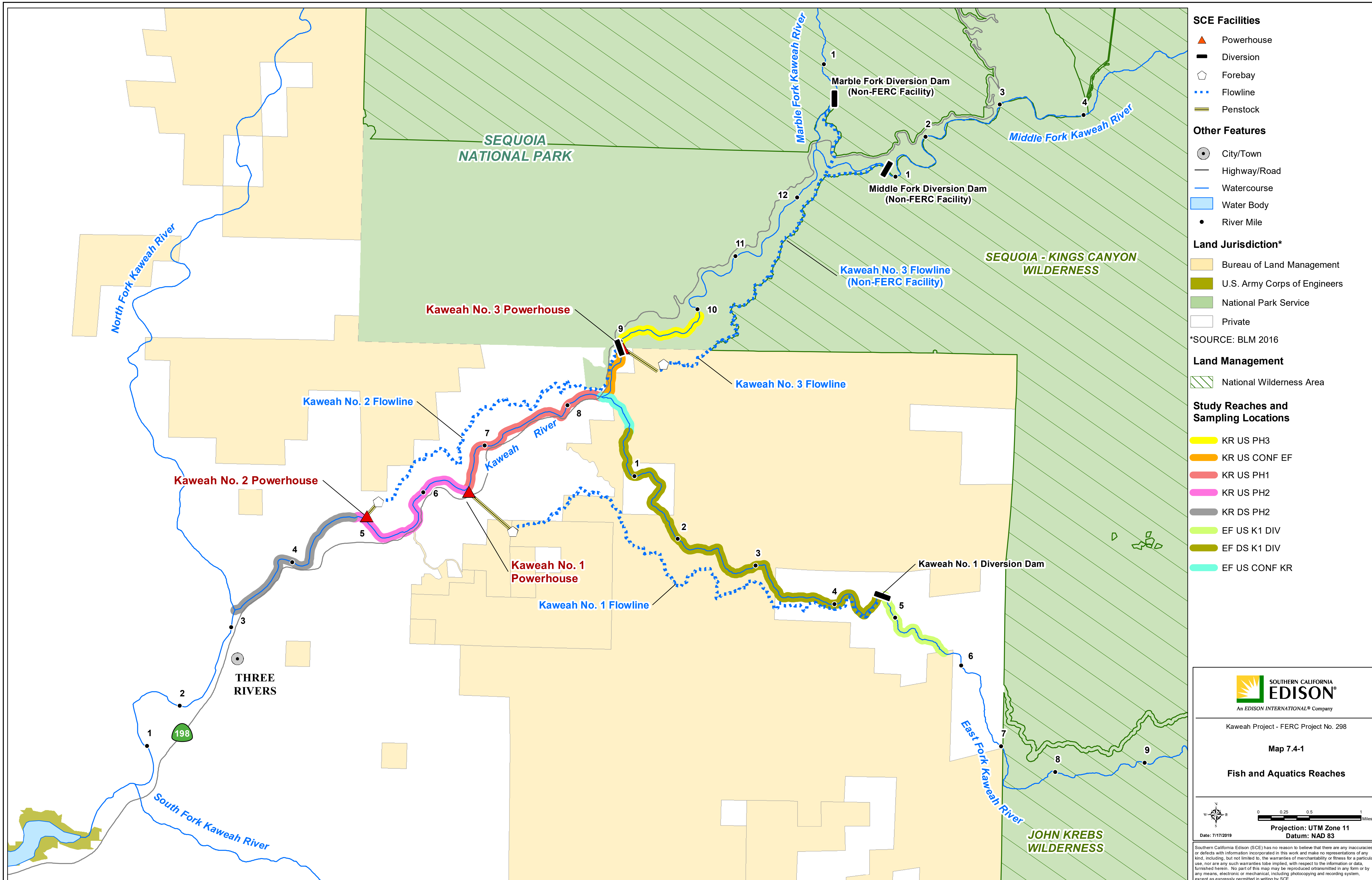



**Figure 7.4-35. 2018 Survey Reaches for Amphibians, Reptiles, and Other Aquatic Species (Blue Lines=Field Survey Locations).**

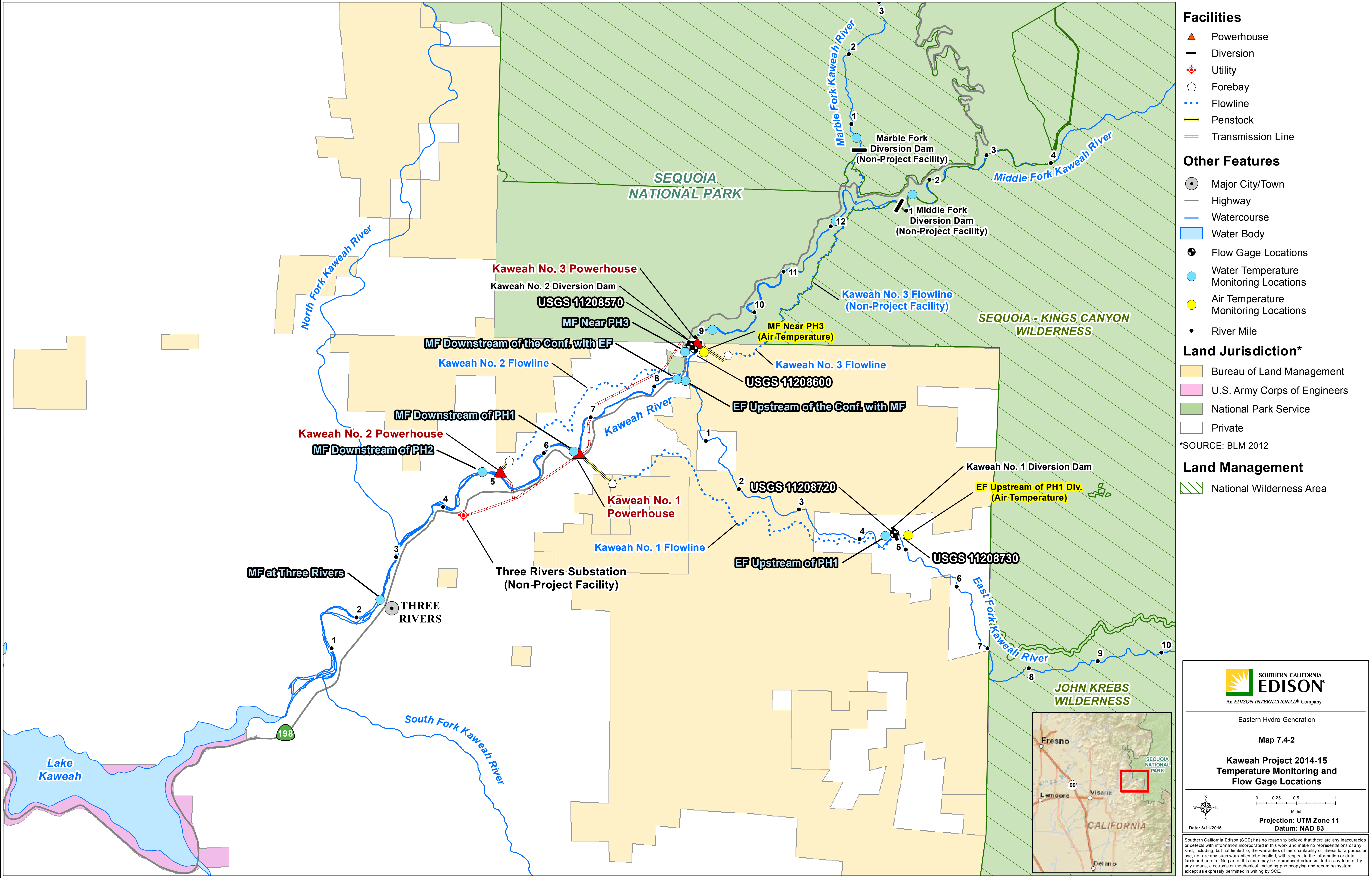
# MAPS

This Page Intentionally Left Blank



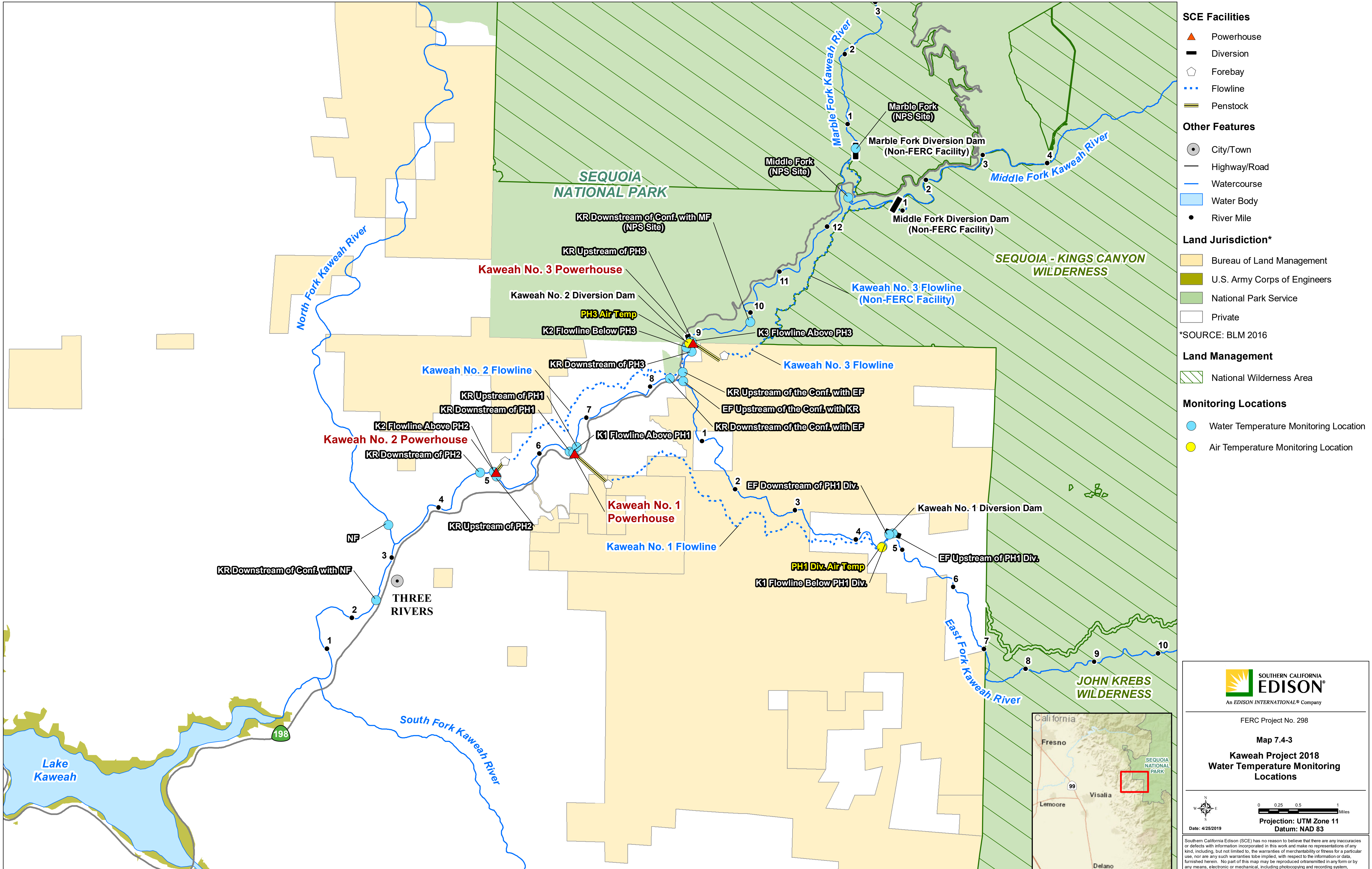

C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_FishAquatics_AffectedEnviro_17i11i_01.mxd

This Page Intentionally Left Blank




C:\GIS\ENTRIX\30735240_SCE_EasternHydro\map\Kaweah\SCE_Eastern_KAWEAH_Gages_All_17i11i_01.mxd

This Page Intentionally Left Blank




SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

FERC Project No. 298

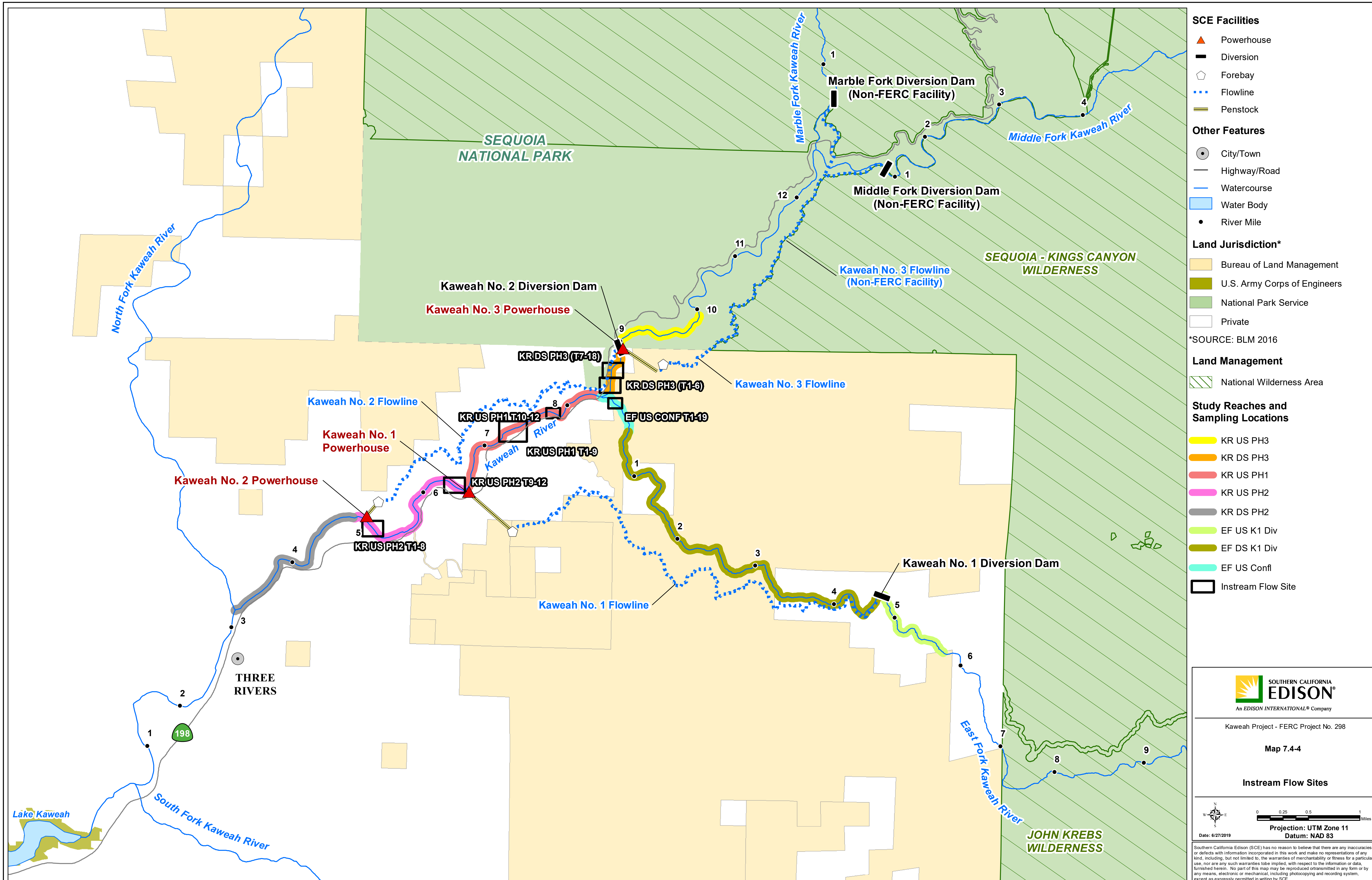
Map 7.4-3
Kaweah Project 2018
Water Temperature Monitoring Locations

Date: 4/25/2019
Projection: UTM Zone 11
Datum: NAD 83



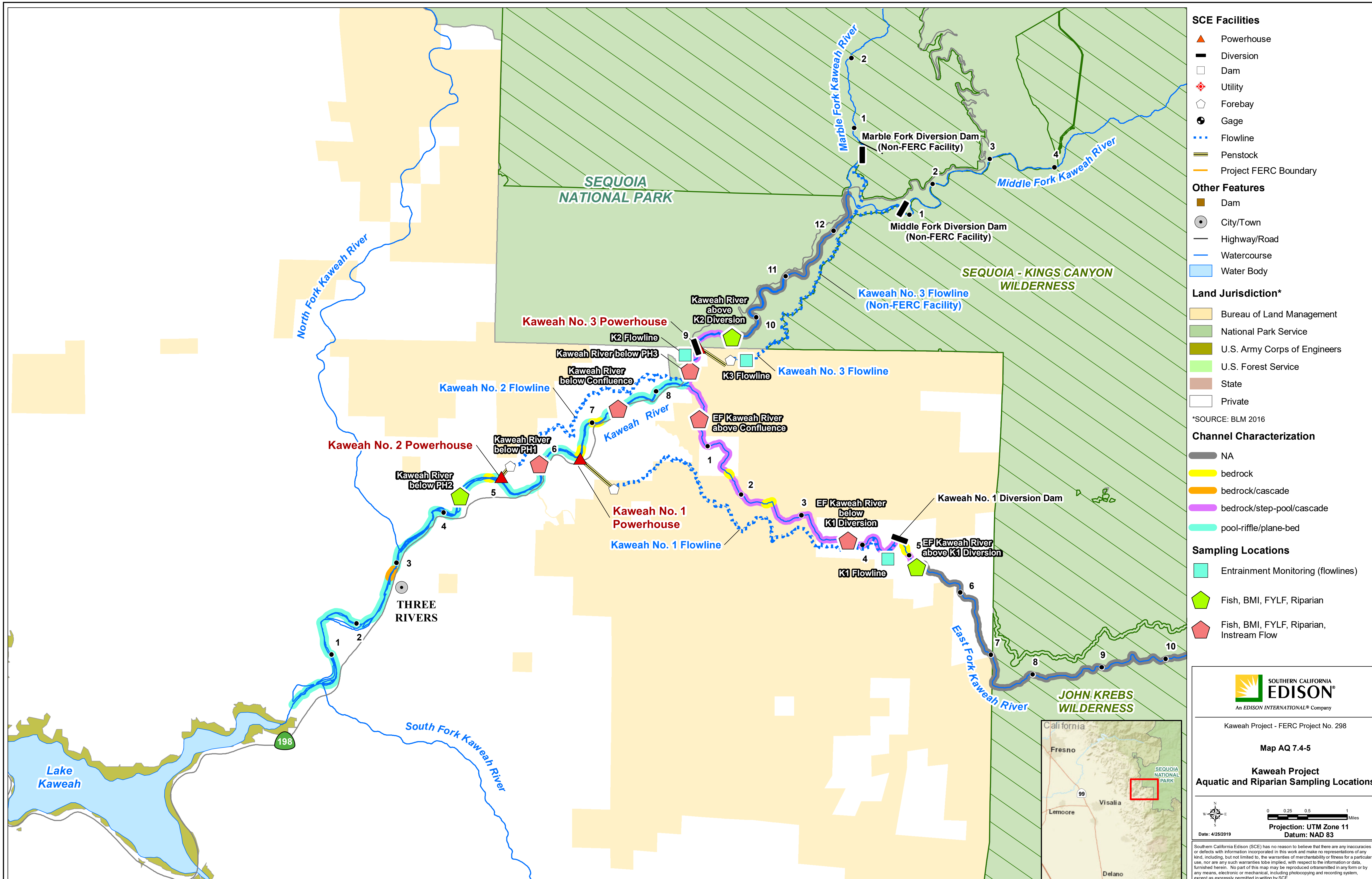
Z:\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQ4_WaterTemp_17i11i_01.mxd

This Page Intentionally Left Blank



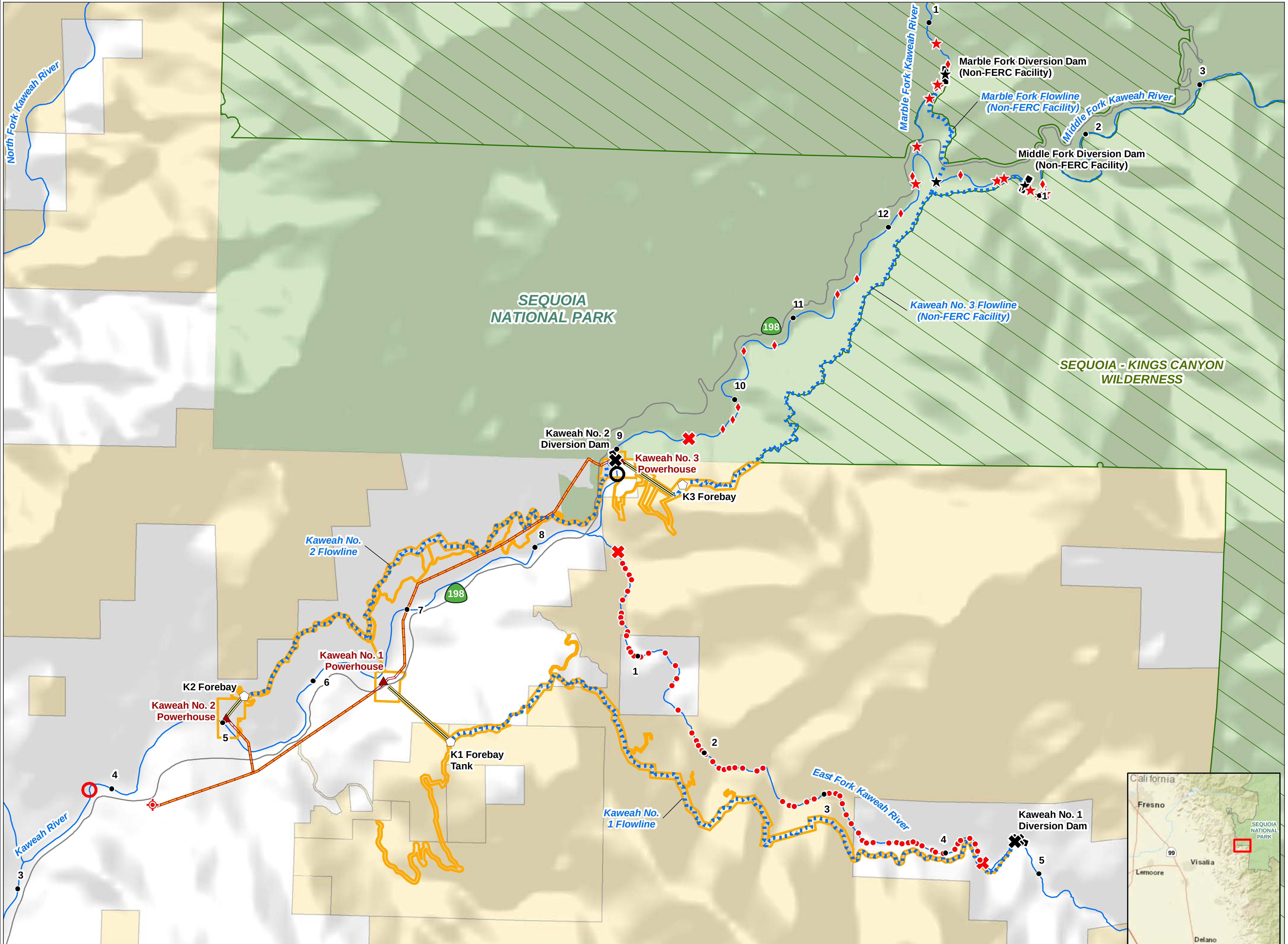

C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQ1_InstrmFlowSites_17i11i_01.mxd

This Page Intentionally Left Blank




Z:\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQTSPs_Locs_Sampling_AQ_RIP_17i11i_01.mxd

This Page Intentionally Left Blank




**SCE Facilities**
- Powerhouse
- Diversion
- Forebay
- Flowline
- Penstock
- Transmission Line
- FERC Boundary

**Other Features**
- Highway/Road
- Watercourse
- Water Body
- River Mile

**Land Jurisdiction***
- Bureau of Land Management
- National Park Service
- Private (Blank)

*SOURCE: BLM 2016

**Land Management**
- National Wilderness Area

**2018 Fish Passage Barriers**
- Impassable Project Barrier
- Impassable Natural Barrier
- Partial Project Barrier
- Partial Natural Barrier
- Potential Impassable Barriers [1]

[1] Not visited due to inaccessibility

**2007 Fish Passage Barriers [2]**
- Impassable Man-made Barrier
- Impassable Natural Barrier
- Partial Natural Barrier

[2] Barriers from SCE 2007 Report

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

FERC Project No. 298

**Map 7.4-6**

**Kaweah Project**
**Fish Passage Barrier**
**Locations and Category**

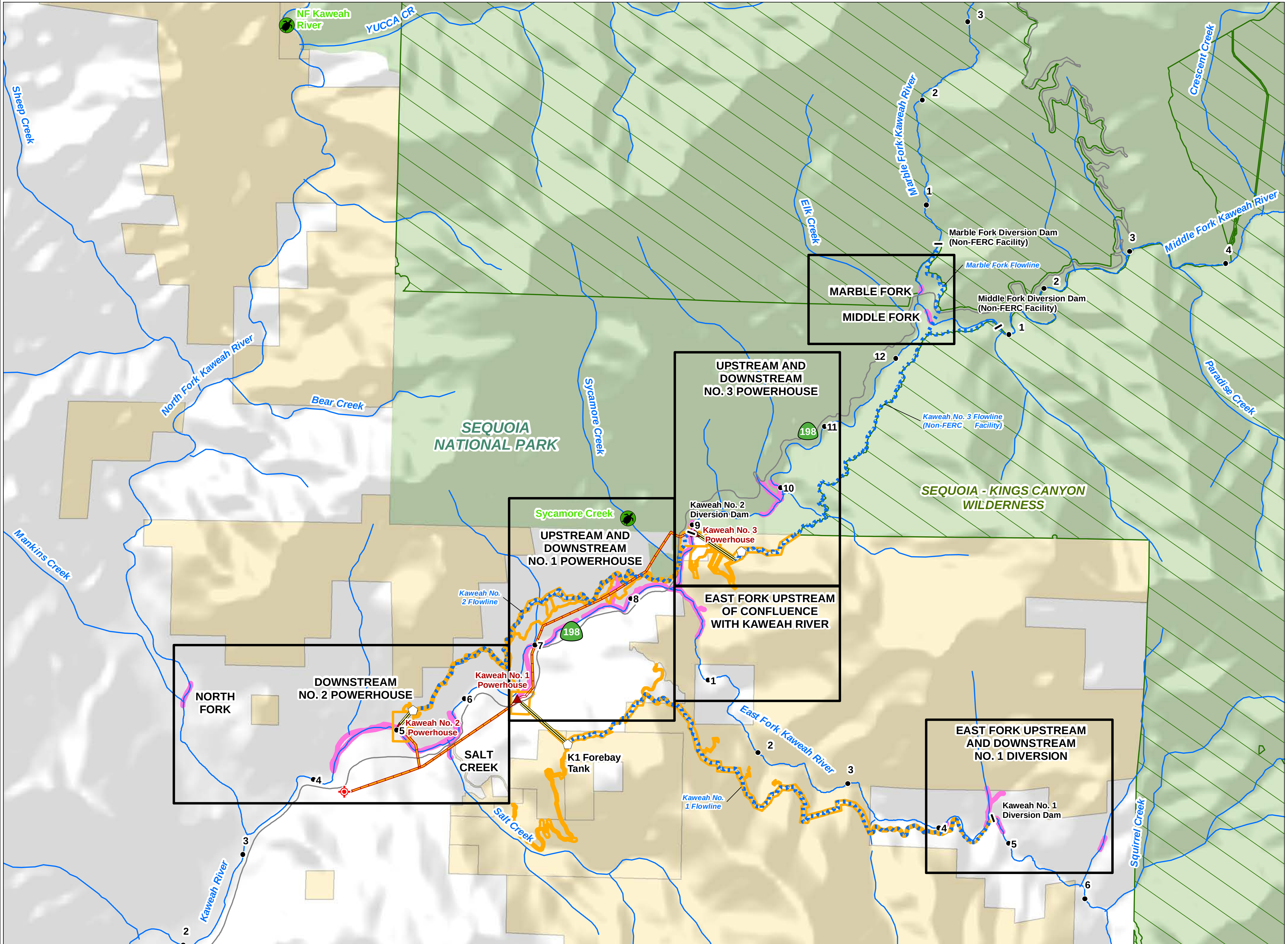
N W E S

0 500 1,000 2,000 Feet

**Date: 4/25/2019**

**Projection: UTM Zone 11**
**Datum: NAD 83**

This Page Intentionally Left Blank




**SCE Facilities**

- Powerhouse
- Diversion
- Forebay
- Flowline
- Penstock
- Transmission Line
- FERC Boundary

**Other Features**

- Highway/Road
- Watercourse
- Water Body
- River Mile

**Land Jurisdiction***

- Bureau of Land Management
- National Park Service
- Private (Blank)

*SOURCE: BLM 2016

**Land Management**

- National Wilderness Area

**Western Pond Turtle Data**

- FYLF (No Known Locations)
- Western Pond Turtle**

** SOURCE: Ruso et al. 2017

**AQ7 Survey**

- Herpetological Survey Reaches

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

FERC Project No. 298

**Map 7.4-7**

**Kaweah Project**
**Herpetological Survey Reaches**
**Spring, Summer, Fall 2018**

N W E S
0 0.5 1 Miles

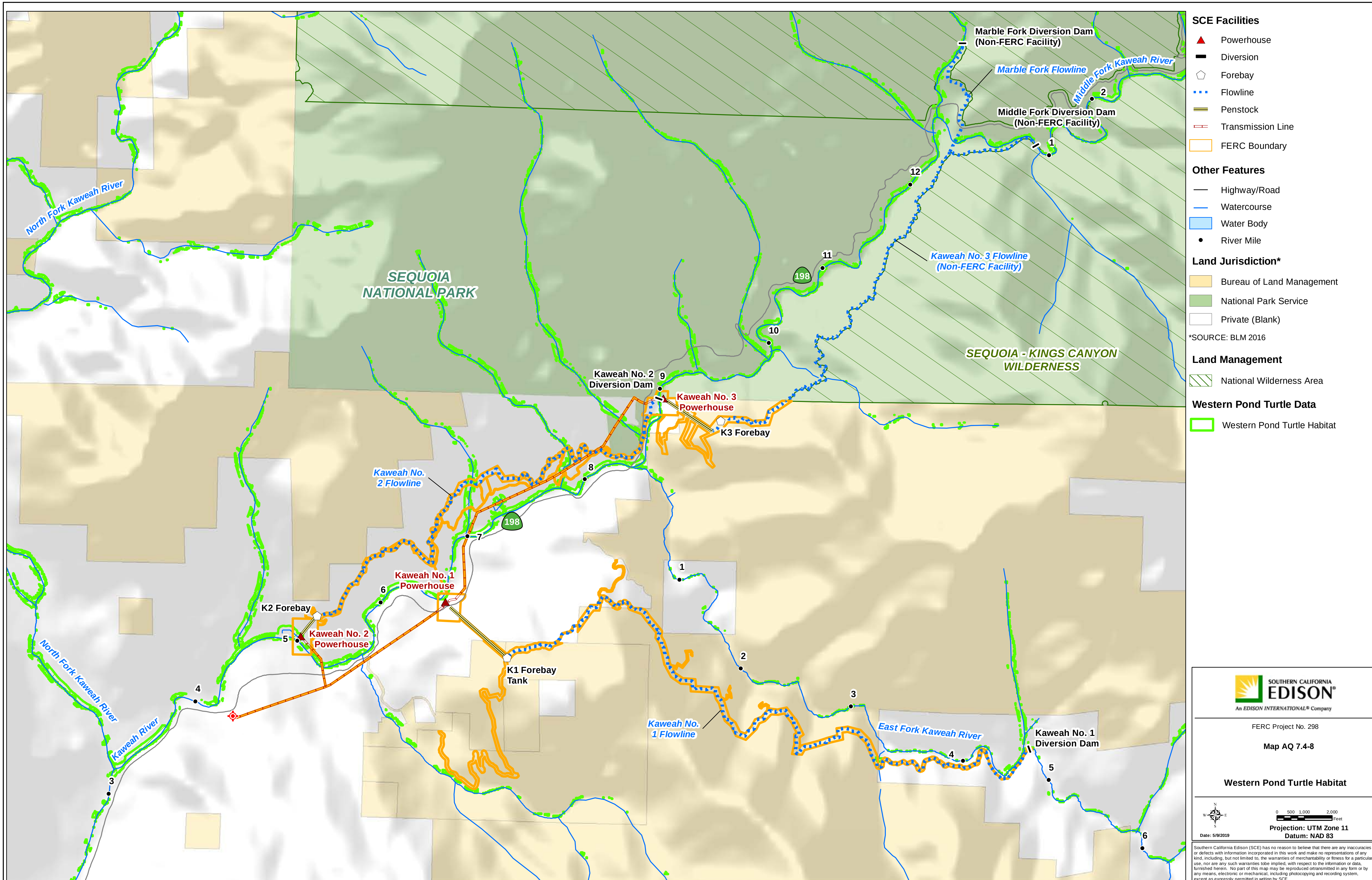
**Date: 4/22/2019**

**Projection: UTM Zone 11**
**Datum: NAD 83**



Z:\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQ7_SurvReaches_2018_17i11i_02.mxd

This Page Intentionally Left Blank




Z:\30735240_SCE_EasternHydro\map\Kaweah\AquaticMaps\SCE_Eastern_KAWEAH_AQ7_WPTHabitat_Overview_17i11i_01.mxd

This Page Intentionally Left Blank

## TABLE OF CONTENTS

Page

## List of Tables



## List of Figures



## List of Maps

## LIST OF ACRONYMS

| | |
|---|---|
| APLIC | Avian Power Line Interaction Committee |
| BCC | Birds of Conservation Concern |
| BLM | Bureau of Land Management |
| BLMS | Bureau of Land Management Sensitive Species |
| CALVEG | Classification and Assessment with LANDSAT of Visible Ecological Groupings |
| CDFA | California Department of Food and Agriculture |
| CDFW | California Department of Fish and Wildlife |
| CEQA | California Environmental Quality Act |
| CESA | California Endangered Species Act |
| CFP | California Fully Protected |
| CNPS | California Native Plant Society |
| CRPR | California Rare Plant Rank |
| CWHR | California Wildlife Habitat Relationships |
| ESA | Endangered Species Act |
| FC | Federal Candidate for Listing |
| FE | Federal Endangered |
| FERC or Commission | Federal Energy Regulatory Commission |
| FPD | Federal Proposed Delisted |
| FPE | Federal Proposed Endangered |
| FPT | Federal Proposed Threatened |
| FT | Federal Threatened |
| NNIP | Non-native Invasive Plant |
| PAD | Pre-Application Document |
| Project | Kaweah Project |
| SCE | Southern California Edison Company |
| SE | State Endangered |
| SR | State Rare |
| SSC | Species of Special Concern |
| ST | State Threatened |
| TSR | Technical Study Report |
| USDA-FS | US Department of Agriculture – Forest Service |
| USFWS | US Fish and Wildlife Service |
| WL | Watch List |

This Page Intentionally Left Blank

## 7.5 BOTANICAL AND WILDLIFE RESOURCES AFFECTED ENVIRONMENT

This section describes botanical and wildlife resources in the vicinity of the Kaweah Project (Project), including identification of vegetation alliances and wildlife habitats; federally listed rare, threatened, and endangered plant or wildlife species; other special-status plants and wildlife; non-native invasive plants (NNIPs); game species; wildlife use of wildlife bridges; and wildlife mortality in flowlines. Information on special-status aquatic species is included in Section 7.4 – Fish and Aquatic Resources.

### 7.5.1 Information Sources

Information on botanical and wildlife resources is based on data from resource agency files and reports; Southern California Edison Company's (SCE) Pre-Application Document (PAD); and botanical and wildlife resources technical studies completed in 2018 for the Kaweah Project relicensing. A summary of agency and stakeholder consultation is provided in Section 14.0 – Consultation Documentation. Detailed descriptions of the study methods and results are provided in the following Technical Study Reports (TSR):

- TERR 1 – Botanical Resources TSR (TERR 1 – TSR) (SCE 2019a)
- TERR 2 – Wildlife Resources TSR (TERR 2 – TSR) (SCE 2019b)

Extensive field surveys were conducted as part of the TERR 1 and TERR 2 – TSRs to document the location of botanical and wildlife resources and their habitats in the vicinity of the Project. Field surveys included:

- Vegetation Alliances and Wildlife Habitat Mapping;
- Special-status Plant Surveys;
- NNIP Surveys;
- Wildlife Reconnaissance Surveys;
- Evaluation of Transmission and Power Lines for Consistency with Avian Power Line Interaction Committee (APLIC) Guidelines;
- Special-status Bat Reproductive and Seasonal Use Surveys;
- Evaluation of Wildlife Use of Wildlife Bridges; and
- Evaluation of Wildlife Mortality in Project Flowlines.

Information on the relationship between flow and riparian vegetation in the bypass reaches associated with the Project is provided in AQ 1 – Instream Flow TSR (AQ 1 – TSR).

### 7.5.2 Botanical Resources

This section describes botanical resources including vegetation alliances; special-status plants; and NNIPs.

#### 7.5.2.1 Vegetation Alliances

The study area for vegetation alliances includes areas within 1 mile of the Federal Energy Regulatory Commission (FERC or Commission) Project boundary. Vegetation alliances are classified based on the Classification and Assessment with LANDSAT of Visible Ecological Groupings (CALVEG) mapping and vegetation alliance descriptions developed by the United States Department of Agriculture – Forest Service (USDA-FS) Region 5 (USDA-FS 2014).

Twenty-five vegetation alliances are present within the study area. Vegetation alliances in the study area vary with increases in elevation. The higher elevations of the Project along the East Fork Kaweah River are composed primarily of chamise (*Adenostoma fasciculatum*), lower montane mixed chaparral and interior mixed hardwood alliances, while the lower elevations near the Kaweah River are composed primarily of blue oak (*Quercus douglasii)*, annual grasses/forbs, and riparian mixed hardwood alliances. Refer to Table 7.5-1 for a complete list of vegetation alliances present within the study area. Detailed information and vegetation alliance maps are provided in TERR 1 – TSR (SCE 2019a). Additional information on the location of riparian habitat is described in Section 7.8 – Riparian Resources.

#### 7.5.2.2 Upland Special-Status Plants

For the purposes of this document, special-status plants are defined as any plant granted protection by a federal, state, or local agency, including:

- Federally listed plant species granted status by the United States Fish and Wildlife Service (USFWS) under the Federal Endangered Species Act (ESA) include threatened (FT), endangered (FE), proposed threatened or endangered (FPT, FPE), candidate (FC), or listed species proposed for delisting (FPD).

- State of California listed plant species granted status by the California Department of Fish and Wildlife (CDFW) under the California Endangered Species Act (CESA) include state threatened (ST), endangered (SE), rare (SR), and California Species of Special Concern (SSC).

- California Native Plant Society (CNPS) listed plant species, which uses the California Rare Plant Rank (CRPR) system for rare, threatened, or endangered plants in California. Under the California Environmental Quality Act (CEQA), special-status plants include the following CRPR:

    - 1A (presumed extirpated in California and either rare or extinct elsewhere);

    - 1B (rare, threatened, or endangered in California and elsewhere);

- 2A (presumed extirpated in California, but common elsewhere); and
- 2B (rare, threatened, or endangered in California, but common elsewhere).

- Bureau of Land Management (BLM) list of sensitive plant species, which are designated by the BLM State Director for special management consideration. In California, this includes all plants on BLM lands that are listed as FC, ST, SE, and SR; all plants that have a CRPR of 1B, and any other plants that the State Director has determined to warrant status.

The study area for special-status plants is defined to include public lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer. Refer to Table 7.5-2 for the survey area by facility type. Based on database queries and literature searches conducted for the TERR 1 – TSR, 28 upland special-status plant and moss species were determined to have the potential to occur within the study area. Refer to Table 7.5-3 for the status of each species, a summary of life history requirements, and information on their presence in the study area.

One special-status plant species, Munz's iris (*Iris munzii* [BLMS, CRPR 1B.3]) was observed during botanical surveys (a total of 29 populations) in the vicinity of the Kaweah No. 1 Flowline and associated access roads. No other special-status plants were observed. Refer to Map 7.5-1 (a–t) (CONFIDENTIAL) for the location of these plants in the study area. Refer to Table 7.5-4 for a list of each Munz's iris population identified in the study area and the estimated size and number of individuals in each population.

### 7.5.2.3 Riparian Associated Special-Status Plants

Three special-status plants and mosses may potentially occur in riparian habitats along bypass reaches associated with the Project. Refer to Table 7.5-3 for the status of each species, a summary of life history requirements, and information on their presence in the study area. The special-status plants and mosses include:

- Watershield (*Brasenia schreberi* [CRPR 2B.3]);
- American manna grass (*Glyceria glandis* [CRPR 2B.3]); and
- Holzinger's orthotrichum moss (*Orthotrichum holzingeri* [CRPR 1B.3]).

Portions of riparian habitats along bypass reaches associated with the Project were surveyed as part of the AQ 1 – TSR. No special-status riparian plants were observed during these surveys.

### 7.5.2.4 Non-native Invasive Plants

The study area for NNIPs is defined to include public lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer. Refer to Table 7.5-2 for the survey area by facility type. A list of target NNIPs in the study area was developed in consultation with BLM and includes species from the California Department of Food and Agriculture's (CDFA) list, edited to include only those found in Tulare County (Arbogast, pers. comm., 2018). Five NNIP species were identified during botanical surveys, including:

- Two populations of tree-of-heaven (*Ailanthus altissima*);
- Seventy-three populations of tocalote (also known as Malta starthistle) (*Centaurea melitensis*);
- One population of bull thistle (*Cirsium vulgare*);
- One population of French broom (*Genista monspessulana*); and
- Twenty-five populations of puncture vine (*Tribulus terrestris*).

Refer to Table 7.5-5 for a summary of each NNIP population and to Map 7.5-1 (a–t) (CONFIDENTIAL) for the location of these populations in the study area. The full extent of each population was mapped, with the exception of tocalote. This species was widespread in grasslands and woodlands throughout the study area; therefore, with the exception of five populations, mapping for this species was not extended beyond the study area.

### 7.5.3 Wildlife Resources

This section describes wildlife resources in the Project vicinity, including wildlife habitats and common wildlife species; special-status wildlife; and game species.

#### 7.5.3.1 Wildlife Habitats

The study area for wildlife habitats includes areas within 1 mile of the FERC Project boundary. Information on wildlife habitats was obtained to characterize habitat conditions and identify common wildlife species in the study area. Vegetation alliances described in Section 7.5.2.1 were cross-walked with the California Wildlife Habitat Relationships (CWHR) habitats using a CALVEG–CWHR Crosswalk for California (USDA-FS 2004). This crosswalk was developed by USDA-FS and CDFW as a method to determine which wildlife habitats are likely to be present based on existing vegetation alliances and forest structural characteristics.

Fourteen wildlife habitats were identified in study area. Dominant habitats in the study area include montane hardwood and chamise-redshank chaparral at higher elevations along the East Fork Kaweah River, and blue oak woodland, valley oak woodland, and annual grassland at lower elevations along the Kaweah River. Refer to Table 7.5-1 for a list of the wildlife habitats that occur within 1 mile of the Project. Detailed maps and descriptions of wildlife habitats are provided in TERR 2 – TSR (SCE 2019b). Additional information on the location of riparian habitat is described in Section 7.8 – Riparian Resources.

### 7.5.3.2 Special-Status Wildlife

This section describes special-status wildlife that occur or may potentially occur in the study area. This section addresses only special-status terrestrial wildlife species. Aquatic species, including fish, amphibians, and aquatic reptiles, are addressed in Section 7.4 – Fish and Aquatic Resources.

For the purposes of this document, a special-status wildlife species is defined as any animal species that is granted status by a federal, state, or local agency, including:

- Federally listed species granted status by USFWS under the ESA include FT, FE, FPT, FPE, FC, or FPD. Also included are those species listed by USFWS as Birds of Conservation Concern (BCC) which include "species, subspecies, and populations of all migratory nongame birds that, without additional conservation action, are likely to become candidates for listing under the ESA of 1973" (USFWS 2008).

- State of California listed wildlife species that are granted status by the CDFW under the CESA include ST, SE, Fully Protected species (CFP), and CSC.

- BLM list of wildlife species that are not federally listed under the ESA, but are designated by the BLM State Director for special management consideration.

- One additional species, the osprey (*Pandion haliaetus* [CDFW Watch List (WL)]), although not a special-status species, is included in this analysis because it is commonly associated with hydroelectric facilities in the state of California.

The study area for special-status wildlife (excluding bats) includes public lands within the FERC Project boundary where operations and/or maintenance activities are conducted, plus a protective buffer. Refer to Table 7.5-2 for the survey area by facility type. The study area for special-status bats includes facilities listed on Table 7.5-6.

Thirteen special-status wildlife species were observed in the study area during reconnaissance surveys conducted as part of the TERR 2 – TSR or observed incidentally during other studies. Twenty additional special-status wildlife may potentially occur in the study area based on a literature and data review. Refer to Table 7.5-7 and Map 7.5-2 for a comprehensive list of special-status wildlife species evaluated for their potential to occur in the study area, including the status of each species, a summary of life history requirements, and information on their presence in the study area. Detailed information is provided in the TERR 2 – TSR (SCE 2019b).

#### Special-Status Terrestrial Reptile Species

Three terrestrial reptiles may potentially occur in the study area: coast horned lizard (*Phrynosoma blainvillii* [BLMS, SSC]), northern California legless lizard (*Anniella pulchra* [SSC]), and California mountain kingsnake (*Lampropeltis zonata* [BLMS, WL]). Refer to Table 7.5-7 for a summary of each species' status, habitat requirements, and potential for occurrence in the study area.

## Special-Status Bird Species

*RAPTORS*

Special-status raptors known to occur in the study area include golden eagle (*Aquila chrysaetos* [BLMS, BCC, CFP, WL]) and osprey. Refer to the TERR 2 – TSR for detailed survey methods and results.

An adult golden eagle was observed in flight over the Kaweah No. 1 Flowline near the Summit Access Road during reconnaissance surveys conducted as part of the TERR 2 – TSR. Large cliffs and rocky structures in the study area provide suitable golden eagle nesting habitat, though no suitable nesting habitat is present within the study area. Suitable grassland foraging habitat is present in the study area.

An adult osprey was observed in flight over a small pond adjacent to the Kaweah No. 2 Flowline Access Road – Canal 5. There is no suitable nesting habitat within the study area, though osprey may forage along riverine and lacustrine habitats in the study area.

Ten additional special-status raptor species may potentially occur in the study area. These include seven diurnal raptors—California condor (*Gymnogyps californianus* [FE, SE, CFP]); northern goshawk (*Accipiter gentilis* [BLMS, SSC]); Swainson's hawk (*Buteo swainsoni* [BLMS, BCC, ST]); northern harrier (*Circus cyaneus* [SSC]); white-tailed kite (*Elanus leucurus* [BLMS, CFP]); bald eagle (*Haliaeetus leucocephalus* [FD, BCC, BLMS, SE, CFP]); and American peregrine falcon (*Falco peregrinus anatum* [FD, BCC, SD, CFP])—and three owl species—short-eared owl (*Asio flammeus* [SSC]); burrowing owl (*Athene cunicularia* [BLMS, BCC, SSC]); and California spotted owl (*Strix occidentalis occidentalis* [BCC, SSC]). Refer to Table 7.5-7 for a summary of each species' status, habitat requirements, and potential for occurrence in the study area.

*OTHER BIRDS*

One special-status songbird, the yellow warbler (*Dendroica petechia* [BCC, SSC]) is known to occur in the study area. An adult male was observed singing in riparian vegetation between the Kaweah No. 1 Flowline and the East Fork Kaweah River during reconnaissance surveys. Suitable breeding habitat for this species occurs along the East Fork Kaweah River and Kaweah River in brushy valley and montane riparian woodlands. Refer to TERR 2 – TSR for detailed information on survey methods and results.

Four additional non-raptorial special-status bird species may potentially occur in the study area, including black swift (*Cypseloides niger* [BCC, SSC]); Lewis' woodpecker (*Melanerpes lewis* [BCC]); willow flycatcher (*Empidonax traillii* [BCC, SE]); and southwestern willow flycatcher (*Empidonax traillii extimus* [FE, SE]). Refer to Table 7.5-7 for a summary of each species' status habitat requirements, and potential for occurrence in the study area.

### Special-Status Mammal Species

*BATS*

Nine special-status bat species were detected during surveys conducted for TERR 2 – TSR (SCE 2019b). These include:

- Pallid bat (*Antrozous pallidus* [BLMS, SSC]);
- Townsend's big-eared bat (*Corynorhinus townsendii* [BLMS, SSC]);
- Spotted bat (*Euderma maculatum* [BLMS, SSC]);
- Western red bat (*Lasiurus blossevillii* [SSC]);
- Western small-footed myotis (*Myotis ciliolabrum* [BLMS]);
- Long-eared myotis (*Myotis evotis* [BLMS]);
- Fringed myotis (*Myotis thysanodes* [BLMS]);
- Yuma myotis (*Myotis yumanensis* [BLMS]); and
- Western mastiff bat (*Eumops perotis californicus* [BLMS, SSC]).

Pallid bats, spotted bats, and western mastiff bats roost primarily in cliffs, caves, and rock crevices. Western red bats roost solitarily under tree foliage. Townsend's big-eared bats prefer man-made structures, such as mines and buildings. Western small-footed myotis, fringed myotis, long-eared myotis, and Yuma myotis roost in buildings, mines, caves, crevices, and underneath bark. The fringed myotis is commonly associated with ponderosa pine (*Pinus ponderosa*) snags and live trees with extensive shingle bark.

Yuma myotis were detected roosting inside the Kaweah No. 2 Powerhouse and on the exterior of a maintenance building near the Kaweah No. 3 Powerhouse. No other special-status bat species were confirmed roosting on Project facilities.

Open water habitats in the study area (i.e., forebays, diversion pools, and river reaches) provide aquatic foraging habitat and a drinking resource for special-status bat species. Grassland and oak woodland habitats provide additional open foraging habitat for special-status bats in the study area. Foraging special-status bats were detected during acoustic sampling and mist net sampling conducted for the TERR 2 – TSR. Refer to TERR 2 – TSR for more detailed information on the location, season, and number of bats detected in the study area.

Refer to Table 7.5-8 for a detailed list of each special-status bat species known to occur in the study area and the facilities where they were detected.

*OTHER MAMMALS*

One special-status mammal, ringtail (*Bassariscus astutus* [CFP]), is known to occur in the study area. Ringtail sign (i.e., scat and pawprints) was observed near the Kaweah No. 1 Diversion Dam and Pool and near the Kaweah No. 3 Powerhouse and Switchyard during reconnaissance surveys. Refer to TERR 2 – TSR for more detailed information on the location of these observations. Suitable habitat for ringtail occurs near rocky outcrops along the Kaweah No. 1 Flowline and the riparian corridors along the Kaweah River.

Two additional special-status species, the fisher (*Pekania pennanti* [FPT, BLMS, ST, SSC]) and American badger (*Taxidea taxus* [SSC]), may potentially occur in the study area. Fisher may occur in montane hardwood or riparian habitats within the study area. American badger may occur in open habitats within the study area where there are dry, friable soils for burrowing.

### 7.5.3.3 Game Species

A game species is an animal that is hunted for sport. Information on game species known to occur or potentially present in the study area is provided in this section because of their commercial and recreational value. Game species are regulated by CDFW and are defined under the California Fish and Game Code as follows:

- Resident and migratory game birds are defined in California Fish and Game Code §3500.
- Game mammals are defined in California Fish and Game Code §3950.
- Furbearing mammals are defined in California Fish and Game Code §4000.

Game species described in the California Fish and Game Code were evaluated for their likelihood to occur based on the geographic and elevation range of the Project and wildlife habitats present. Fourteen species of game were observed during wildlife reconnaissance surveys in the study area. Table 7.5-9 lists the resident and migratory game birds and game mammals that are known or have the potential to occur in the study area, including their habitat requirements and a summary of state hunting regulations for each species. Hunting of game species is permitted during seasons regulated by the CDFW.

A brief summary of the game species known to occur in the study area, including resident game birds, migratory game birds, and game mammals, is provided below.

#### Resident and Migratory Game Birds

Eight species of game birds were observed in the study area during reconnaissance surveys. Upland birds known to occur in the study area that meet the definition of resident game birds include: wild turkey (*Meleagris gallopavo*), mountain quail (*Oreotyx pictus*), and California quail (*Callipepla californica*). Birds that meet the definition of migratory game birds include mallard (*Anas platyrhynchos*), common merganser (*Mergus* *merganser*), American coot (*Fulica americana*), mourning dove (*Zenaida macroura*), and Eurasian-collared dove (*Streptopelia decaocto*).

Four species of game birds were identified as potentially occurring in the study area, including ring-necked pheasant (*Phasianus colchicus*), sooty grouse (*Dendragapus fuliginosus*), common snipe (*Gallinago gallinago*), and band-tailed pigeon (*Columba fasciata*).

## Game Mammals

A summary of game mammals known to occur in the study area is provided below. Table 7.5-9 provides the status, habitat requirements, and a summary of state hunting regulations for each of these species.

### *Mule Deer*

Mule deer (*Odocoileus hemionus*) are among the most visible and widespread wildlife species in California. The study area is within Deer Management Unit 460 and Deer Hunt Zone D8 (CDFW 2018). Deer hunting is regulated by California state law through CDFW. A hunting license and a hunting tag are required to take mule deer, and only bucks with antlers with demonstrable forks (or greater) may be taken, except during special hunts.

Two herds, the Kaweah Herd and the Southern Sierra Foothill Herd are present in the study area (CDFW 2018). The Kaweah Herd is migratory, spending the majority of the year in higher-elevation areas within the Sequoia National Park. Winter conditions drive the deer into lower elevation areas. Map 7.5-3 provides the location of the Kaweah mule deer herd key areas, winter range, and migratory routes. The Southern Sierra Foothill Herd is a resident, non-migratory herd that occupies the western Sierra Nevada foothills across multiple Deer Management Units. The populations of these herds are stable to declining, although there is an overall decline in population numbers in California (CDFW 2018). Survival rates of fawns have been low in the past few years, which can be attributed to weather conditions that affect forage production (CDFW 2018).

### *Other Game Mammals*

In addition, to mule deer, five game species were detected in the study area, including the small game mammals desert cottontail (*Sylvilagus audubonii*) and western gray squirrel (*Sciurus griseus*); the furbearers gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and raccoon (*Procyon lotor*); and large game mammal: black bear (*Ursus americanus*).

One other furbearer, American mink (*Mustela vison*), may potentially occur in the study area. In addition, one large game mammal, wild pig (*Sus scrofa*), may also potentially occur in the study area.

### 7.5.3.4 Wildlife Bridges

Wildlife drownings, primarily of mule deer, were identified by agencies as a resource issue during the previous relicensing for the Kaweah Project (SCE 1989, FERC 1991). The current FERC license included measures (Articles 408 and 409) to minimize wildlife drowning in the Kaweah No. 2 and Kaweah No. 3 flowlines[1]. The measures included modification, relocation, and/or rebuilding of existing foot and wildlife bridges, constructing new wildlife bridges, and installation of hazers and flashers at existing escape ramps. These improvements were implemented between 1994 and 1996.

Monitoring of wildlife bridges along the Kaweah No.2 and Kaweah No. 3 was conducted in the spring and fall of 2018 to evaluate whether mule deer and other species were successfully using the wildlife bridges. Refer to Table 7.5-10 for a list of all species and the number observed during flowline monitoring.

Out of 299 total mule deer observations, 254 were observed making a complete crossing of the wildlife bridges. Seven other species were also observed crossing wildlife bridges, including bobcat, coyote (*Canis latrans*), gray fox, black bear, striped skunk (*Mephitis mephitis*), western spotted skunk (*Spilogale gracilis*), and raccoon. No special-status wildlife species were observed during monitoring.

Refer to the TERR 2 – TSR for more detailed information on wildlife species observed during monitoring of wildlife bridges (SCE 2019b).

### 7.5.3.5 Wildlife Mortality in Flowlines

The current FERC license includes a measure (Article 410) for annual monitoring of wildlife mortality in the Kaweah No. 2 and Kaweah No. 3 flowlines.[1] Since 1991, there have been a total of 52 wildlife mortalities in these flowlines. The majority of these mortalities have been mule deer (41 observations), but seven foxes, a coyote, a black bear, a golden eagle, and an unknown owl species were also recorded.

Since implementation of the measures in Articles 408 and 409 (described in the previous section) there has been a decline in wildlife mortality in the flowlines, particularly in the last 10 years of monitoring (refer to Figure 7.5-1). Refer to the TERR 2 – TSR for more detailed information on wildlife mortalities in Project flowlines (SCE 2019b).

[1] Monitoring of wildlife bridges and documentation of mortalities was not conducted for the Kaweah No. 1 Flowline because wildlife drownings in flowline are rare. The structure is an elevated flume along its entire length, rather than a canal, and is covered by a planked walkway that prevents large wildlife from accessing the water.

### 7.5.4 Literature Cited

Argobast, T. 2018. E-mail from Tiera Arbogast at Bureau of Land Management, regarding NNIPs in the study area. February 5, 2018.

CDFW (California Department of Fish and Wildlife). 2018. 2018 Deer Zone Information; General Deer Hunting Information for Zone D-8. Deer Management Program. Sacramento, California.

SCE (Southern California Edison Company). 2019a. TERR 1 – Botanical Resources Technical Study Report.

SCE. 2019b. TERR 2 – Wildlife Resources Technical Study Report.

USDA-FS (United States Department of Agriculture–Forest Service). 2004. The Classification and Assessment with LANDSAT of Visible Ecological Groupings (CALVEG) crosswalk to the California Wildlife Habitat Relationships System (CWHR).

USDA-FS. 2014. GIS data and vegetation descriptions. South Sierran Ecological Province. Available at: https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192

USFWS (United States Fish and Wildlife Service). 2008. Birds of Conservation Concern 2008. USFWS Division of Migratory Bird Management. Arlington, Virginia.

This Page Intentionally Left Blank

# TABLES

This Page Intentionally Left Blank

### Table 7.5-1. Vegetation Alliances and Wildlife Habitats Within 1 Mile of the FERC Project Boundary

| Vegetation Community[1] | Wildlife Habitat[2] | Acreage of Wildlife Habitat within 1 Mile of the Kaweah Project |
|---|---|---|
| Annual Grasses/Forbs | Annual Grassland | 985 |
| Barren | Barren | 172 |
| Blue Oak | Blue Oak Woodland | 3,469 |
| Chamise | Chamise-Redshank Chaparral | 2,387 |
| Water | Lacustrine | 40 |
| Birchleaf Mountain Mahogany | Mixed Chaparral | 780 |
| Ceanothus Chaparral | | |
| Chaparral Yucca | | |
| Lower Montane Mixed Chaparral | | |
| Wedgeleaf Ceanothus | | |
| Whiteleaf Manzanita | | |
| Ceanothus Chaparral | Montane Chaparral | 23 |
| Upper Montane Mixed Chaparral | | |
| Wedgeleaf Ceanothus | | |
| Whiteleaf Manzanita | | |
| Black Oak | Montane Hardwood | 2,458 |
| California Buckeye | | |
| Canyon Live Oak | | |
| Interior Live Oak | | |
| Interior Mixed Hardwood | | |
| Riparian Mixed Hardwood | Montane Riparian | 363 |
| Shrub Willow | | |
| White Alder | | |
| Perennial Grasses/Forbs | Perennial Grassland | 2 |
| Incense Cedar | Sierran Mixed Conifer | 2 |
| Mixed Conifer-Pine | | |
| Urban/Developed | Urban | 32 |
| California Sycamore | Valley Foothill Riparian | 103 |
| Riparian Mixed Hardwood | | |
| Interior Live Oak | Valley Oak Woodland | 4,314 |
| | **TOTAL ACREAGE** | **15,130** |

[1] Vegetation alliance classification is based on the Classification and Assessment with LANDSAT of Visible Ecological Groupings (CALVEG) (USDA-FS 2014).

[2] Wildlife habitat classification is based on California Wildlife Habitat Relationships (CWHR) (CDFW 2018).

## Table 7.5-2. Survey Area for Special-Status Plants, Non-Native Invasive Plants, and Wildlife Reconnaissance, by Facility Type

| Project Facility | Survey Area[1] |
|---|---|
| Diversion Dams and Pools | 15 feet around the perimeter |
| Flowlines[2] | 20 feet on either side |
| Forebays/Forebay Tank | 20 feet around the perimeter |
| Penstocks | 15 feet on either side |
| Powerhouses and Switchyards | Within and up to 15 feet around the perimeter fence |
| Transmission, Power, and Communication Lines | 25 feet on either side |
| Gages | 10 feet around gages |
| Project Access Roads | 20 feet on either side |
| Project Trails | 15 feet on either side |
| Kaweah No. 1 Powerhouse Campus | Within the developed campus |
| Repeaters and Solar Panels | 15 feet around the perimeter |
| River Access Parking | 10 feet around parking area and beach |

[1] Survey areas represent locations where potential operation and maintenance activities occur.

[2] Footbridges, wildlife bridges, and wildlife escape ramps are located on Project flowlines and will be surveyed concurrently with the flowlines.

**Table 7.5-3. Special-Status Plant Species Known to Occur or Potentially Occurring in the Study Area**

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| ***Known to Occur in the Study Area*** | | | | | |
| *Iris munzii*<br>Munz's iris | BLMS | CRPR 1B.3 | April | Wet, grassy sites, open to part shade in foothill woodland habitat from 1,000 to 2,700 feet. | • Observed in 2018 during special-status plant surveys conducted as part of relicensing. Twenty-nine populations were observed along the Kaweah No. 1 Flowline and associated access roads.<br>• SCE notes in their 1989 report that the population along the Kaweah No. 1 flowline responds favorably to SCE maintenance (periodically clearing away woody species near plants) (SCE 1989). |
| ***May Potentially Occur in the Study Area*** | | | | | |
| *Astragalus hornii* var. *hornii*<br>Horn's milk-vetch | BLMS | CRPR 1B.1 | May – Oct | Lake margins, with alkaline substrate including meadows and seeps, and playas. 196 to 2,888 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Atriplex cordulata* var. *cordulata*<br>heart-leaved saltbush | BLMS | CRPR 1B.2 | April – Oct | Chenopod scrub, meadows and seeps, and valley and foothill grassland with sandy, aline, or alkaline substrate. Up to 1,837 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Atriplex coronata* var. *vallicola*<br>Lost Hills crownscale | BLMS | CRPR 1B.2 | April – Aug | Chenopod scrub, valley and foothill grassland, and vernal pools with alkaline substrate. 164 to 2,083 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Brasenia schreberi*<br>watershield | – | CRPR 2B.3 | June – Sept | Ponds and slow streams below 7,200 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Brodiaea insignis*<br>Kaweah brodiaea | BLMS | SE, CRPR 1B.2 | April – June | Known only from blue oak woodlands in the Kaweah and Tule River drainages in Tulare County (approx. 400 to 5,000 feet). Associated with reddish-brown clay loam soils underlain by granitic rock substrates. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Calochortus striatus*<br>alkali mariposa lily | BLMS | CRPR 1B.2 | April – June | Chaparral, chenopod scrub, mojavean desert scrub, and meadows and seeps with alkaline and mesic substrate. 229 to 5,232 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Carex praticola*<br>northern meadow sedge | – | CRPR 2B.2 | May – July | Perennial herb. Meadows and seeps. To 10,500 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *California macrophylla*<br>round-leaved filaree | BLMS | CRPR 1B.1.2 | Mach – May | Open sites, grassland, scrub, vertic clay, occasionally serpentine. 50 to 3,935 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| *Caulanthus californicus*<br>California jewelflower | FE | SE, CRPR 1B.1 | Feb – May | Grasslands in the southern San Joaquin valley. 250 to 3,300 feet. USFWS has not designated critical habitat for this species. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Clarkia springvillensis*<br>Springville clarkia | FT, BLMS | SE, CRPR 1B.2 | May – July | Chaparral, grasslands, and woodlands from 800 to 4,000 feet. USFWS has not designated critical habitat for this species. Known only from the Tulare River Drainage. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Deinandra mohavensis*<br>Mojave tarplant | BLMS | SE, CRPR 1B.3 | (May)Jun – Oct(Jan) | Chaparral, Coastal and Riparian scrub with mesic substrate. 2,100 to 5,250 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Delphinium purpusii*<br>rose-flowered larkspur/ Kern County larkspur | BLMS | CRPR 1B.3 | March – May | Talus areas and cliffs among chaparral, foothill woodland, and pinyon-juniper woodland 900 to 4,400 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Delphinium recurvatum*<br>recurved larkspur | BLMS | CRPR 1B.2 | March – June | Poorly drained, fine, alkaline soils in grassland scrub, and foothill woodland below 2,600 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Eremalche (=Malvastrum) kernensis*<br>Kern mallow | FE, BLMS | CRPR 1B.1 | March – May | Found on dry, open sandy to clay soils, often at the edge of balds. In valley and foothill grasslands. USFWS has not designated critical habitat for this species. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Eriogonum nudum* var. *murinum*<br>mouse buckwheat | BLMS | CRPR 1B.2 | June – Nov | Sandy soils in chaparral, grassland, or foothill woodland 1,100 to 3,800 feet. Known only from the Kaweah River drainage. Restricted to marble outcrops, although it may colonize disturbed sites. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Eryngium spinosepalum*<br>spiny-sepaled button-celery | – | CRPR 1B.2 | April – June | Vernal pools, swales, and roadside ditches in lower foothills and grasslands of Fresno, Stanislaus, and Tulare counties from 200 to 2,100 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Mimulus norrisii/Erythranthe norrisii*<br>Kaweah monkeyflower | BLMS | CRPR 1B.3 | March – May | Marble crevices in chaparral and cismontane woodlands. Known only from the Kaweah and Kings River drainages. 1,100 to 4,300 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Fritillaria striata*<br>striped adobe-lily | BLMS | ST, CRPR 1B.1 | Feb – April | Clay soil in valley grassland and foothill woodland below 3,300 feet. Known to occur at one remaining site in Tulare County (Lewis Hill east of Porterville). | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Glyceria grandis*<br>American manna grass | – | CRPR 2B.3 | June – Aug | Freshwater emergent wetlands, streambanks, and lake margins below 6,500 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| *Helianthus winteri*<br>Winter's sunflower | BLMS | CRPR 1B.2 | Jan – Dec | Cismontane woodland and valley and foothill grassland. Grows in openings on relatively steep south-facing slopes, with granitic and often rocky substrate, often roadsides. 410 to 1,510 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Hesperocyparis nevadensis*<br>Piute cypress | BLMS | CRPR 1B.2 | – | Closed-cone coniferous forest, chaparral, and cismontane, pinyon, and juniper woodland. 2,360 to 6,005 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Leptosiphon serrulatus*<br>Madera leptosiphon | – | CRPR 1B.2 | April – May | Dry slopes in cismontane oak woodland and lower montane coniferous forest. Usually in decomposed granite, one instance on serpentine. 900 to 4,300 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Mimulus pictus/Diplacus pictus*<br>calico monkeyflower | BLMS | CRPR 1B.2 | March – May | Bare, sunny, shrubby areas, around granite outcrops. 443 to 4,101 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Monolopia congdonii*<br>San Joaquin woollythreads | FE | CRPR 1B.2 | Feb – May | Chenopod scrub and valley and foothill grassland. 190 to 2,625 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Navarretia setiloba*<br>Piute Mountains navarretia | BLMS | CRPR 1B.1 | April – July | Cismontane, pinyon, and juniper woodland and valley and foothill grassland with clay or gravelly loam substrate. 935 to 6,890 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Orthotrichum holzingeri*<br>Holzinger's orthotrichum moss | – | CRPR 1B.3 | N/A | Periodically inundated rock surfaces near streams in dry, montane forests from 2,300 to 5,900 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Phacelia nashiana*<br>Charlotte's phacelia | BLMS | CRPR 1B.2 | March – June | Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland with usually granitic and sandy substrate. 1,960 to 7, 220 feet elevation. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Pseudobahia peirsonii*<br>San Joaquin adobe sunburst/ Tulare Pseudobahia | FT | SE, CRPR 1B.1 | Feb – April | Clay (Cibo, Porterville, or Centerville) soils in grassland and foothill woodland from 200 to 2,700 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Ribes menziesii* var. *ixoderme*<br>aromatic canyon gooseberry | – | CRPR 1B.2 | April | Chaparral and montane woodlands to 3,900 feet. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |
| *Sidalcea keckii*<br>Keck's checker-mallow/ Keck's checkerbloom | FE | CRPR 1B.1 | April – May | Cismontane woodland and valley and foothill grassland with serpentinite and clay substrates from 300 to 2,200 feet. USFWS has designated critical habitat for this species. | • The study area is within the known geographic and elevation range of this species.<br>• This species was not observed during the TERR 1 special-status plant surveys. |

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| ***Unlikely to Occur in the Study Area*** | | | | | |
| *Agrostis humilis*<br>mountain bent grass | – | CRPR 2B.3 | July – Sept | Grows in moist to dry locations in subalpine to alpine meadows or slopes at elevations from 8,700 to 10,500 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Allium abramsii*<br>Abram's onion | – | CRPR 1B.2 | May – July | Granitic sand in lower and upper montane coniferous forest. 2,900 to 10,100 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Asplenium septentrionale*<br>northern spleenwort | – | CRPR 2B.3 | N/A | Crevices in granite within chaparral or conifer forests from 5,200 to 11,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Astragalus lentiginosus* var. *kernensis*<br>Kern Plateau milk-vetch | – | CRPR 1B.2 | June – July | Sandy areas and meadows in subalpine forests 7,300 to 9,100 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Astragalus shevockii*<br>Shevock's milk-vetch | BLMS | CRPR 1B.3 | June – July | Upper montane coniferous forest with granitic and sandy substrates. 6,200 to 6,446 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Atriplex cordulata* var. *erecticaulis*<br>Earlimart orache | BLMS | CRPR 1B.2 | Aug – Sept (Nov) | Valley and foothill grassland. 130 to 330 feet elevation. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| Atriplex subtilis<br>subtle orache | BLMS | CRPR 1B.2 | June, Aug, Sept, (Oct) | Valley and foothill grassland with alkaline substrate. 131 to 328 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Boechera tularensis*<br>Tulare rockcress | – | CRPR 1B.3 | June – July | Rocky slopes in montane, subalpine habitats. 5,900 to 11,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Botrychium minganense*<br>Mingan moonwort | – | CRPR 2B.2 | July – Sept | Meadows, marshes, bogs, and fens in lower and upper montane conifer forest. 4,500 to 7,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Calochortus westonii*<br>Shirley Meadows star-tulip | BLMS | CRPR 1B.2 | May – June | Meadows and open areas among conifer woodlands above 4,900 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Calyptridium pygmaeum*<br>pygmy pussypaws | – | CRPR 1B.2 | June – Aug | Lodgepole, subalpine coniferous forest, and upper montane coniferous forest, in sandy or gravelly soils. 6,400 to 11,500 feet in elevation. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Carlquistia muirii*<br>Muir's tarplant (=Muir’s raillardella) | BLMS | CRPR 1B.3 | July – Aug | Chaparral (montane), lower montane coniferous forest, upper montane coniferous forest. Northern distributional limit is in the vicinity of the Wishon Reservoir in the Kings River drainage. 3,000 to 8,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Cinna bolanderi*<br>Bolander's woodreed | – | CRPR 1B.2 | July – Sept | Meadows and seeps and along stream banks in upper montane coniferous forests. 5,400 to 8,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Cryptantha circumscissa* var. *rosulata*<br>rosette cushion cryptantha | – | CRPR 1B.2 | July – Aug | Barren areas of decomposed granite at elevations from 9,600 to 12,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Cuscuta jepsonii*<br>Jepson's dodder | – | CRPR 1B.2 | July – Sept | Possibly extinct, grows on *Ceanothus diversifolius* and *C. prostratus* from 3,900 to 7,600 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Draba cruciata*<br>Mineral King draba | – | CRPR 1B.3 | June – Aug | Gravelly soils in subalpine areas from 8,200 to 11,000 feet. Known primarily from the slopes surrounding Mineral King Valley. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Dudleya cymosa* ssp. *costatifolia*<br>Pierpoint Springs dudleya | – | CRPR 1B.2 | May – July | Limestone outcrops from 4,700 to 5,300 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Erigeron aequifolius*<br>Hall's daisy | BLMS | CRPR 1B.3 | June – Aug | Broad-leaved upland forest, lower and upper montane coniferous forest, pinyon-juniper woodland, rocky soils. 4,900 to 8,100 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| *Erigeron multiceps*<br>Kern River daisy | BLMS | CRPR 1B.2 | June – Sept | Meadows, riverbanks, sandy flats, and openings in Joshua tree or aspen woodlands and conifer forest from 4,900 to 8,300 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Erythronium pusaterii*<br>Kaweah fawn lily | – | CRPR 1B.3 | May – July | Meadows and rocky ledges from 6,800 to 9,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Galium angustifolium* subsp. *onycense*<br>Onyx Peak bedstraw | BLMS | CRPR 1B.3 | April – July | Cismontane, Pinyon and juniper woodland with granitic and rocky substrate. 2,820 to 7,545 feet elevation. | • The study area is outside the elevation range of and does not support appropriate habitat for this species. Known to occur on BLM lands managed by the Bakersfield field office. |
| *Hosackia oblongifolia* var. *cuprea*<br>copper-flowered bird's-foot trefoil | – | CRPR 1B.3 | June – Aug | Meadows and openings in conifer woodlands from 7,800 to 9,100 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Hulsea vestita* ssp. *pygmaea*<br>pygmy hulsea | – | CRPR 1B.3 | June – Oct | Gravel soils in alpine barrens and open slopes within subalpine forest from 9,300 to 13,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Ivesia campestris*<br>field ivesia | – | CRPR 1B.2 | May – Aug | Meadow edges from 6,400 to 11,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Lasthenia glabrata* subsp. *coulteri*<br>Coulter's goldfields | BLMS | CRPR 1B.1 | Feb – June | Marshes and swamps (coastal salt), playas, and vernal pools. 3 to 4,005 feet elevation. | • Unlikely to occur. The study area does not support appropriate habitat for this species. |
| *Lupinus lepidus* var. *culbertsonii*<br>Hockett Meadows lupine | – | CRPR 1B.3 | July – Aug | Meadows and rocky slopes among conifer forests from 8,000 to 9,900 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Mimulus shevockii*<br>Kelso Creek monkeyflower | BLMS | CRPR 1B.2 | March – May | Alluvial fans, dry streamlets, generally granitic soils. 2,953 to 4,265 feet elevation. | • Unlikely to occur. The study area is outside the elevation range of this species. |
| *Minuartia stricta*<br>bog sandwort | – | CRPR 2B.3 | July – Sept | Wet areas of decomposed granite or sandy soils in meadows or alpine areas from 8,000 to 13,000 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Myurella julacea*<br>small mousetail moss | – | CRPR 2B.3 | N/A | Rich soil among rocks or in crevices from 8,800 to 9,900 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Nemacladus twisselmannii*<br>Twisselmann's nemacladus | BLMS | SR, CRPR 1B.2 | July | Upper montane coniferous forest. 7,350 to 8,040 feet elevation. | • The study area is outside the elevation range of and does not support appropriate habitat for this species. Suspected to occur on BLM lands managed by the Bakersfield field office. |
| *Oreonana purpurascens*<br>purple mountain-parsley | – | CRPR 1B.2 | May – June | Ridgetops, usually metamorphic rocks in conifer forests from 7,800 to 9,400 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Orcuttia inaequalis*<br>San Joaquin Valley Orcutt grass | FT | SE, CRPR 1B.1 | April – Sept | Vernal pools. Below 2,700 feet. USFWS has designated critical habitat for this species. | • Unlikely to occur. The study area does not support vernal pool habitat. |
| *Petrophytum caespitosum ssp. acuminatum*<br>marble rockmat | – | CRPR 1B.3 | Aug – Sept | Limestone cliffs from 3,900 to 7,600 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Phacelia novenmillensis*<br>Nine Mile Canyon phacelia | BLMS | CRPR 1B.2 | (Feb) May – June | Broadleafed upland forest, cismontane, pinyon, and juniper woodland, and upper montane coniferous forest with sandy or gravelly substrate. Often in leaf litter under canyon live oak (Quercus chrysolepsis). 5,390 to 8,665 feet elevation. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Phacelia orogenes*<br>mountain phacelia | – | CRPR 4.3 | June – Aug | Rock moist slopes in subalpine forests from 9,250 to 9,400 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Ribes tularense*<br>Sequoia gooseberry | BLMS | CRPR 1B.3 | May | Conifer forests from 5,400 to 5,800 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Sidalcea multifida*<br>cut-leaf checkerbloom | – | CRPR 2B.3 | May – Sept | Dry areas among sagebrush scrub and conifer forest from 5,700 to 9,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |

| Scientific/Common Name | Federal Status | State Status and CRPR Rank | Blooming Period/Fertile | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|---|
| *Streptanthus gracilis*<br>alpine jewelflower | – | CRPR 1B.3 | July – Aug | Rocky slopes in subalpine conifer forests from 9,100 to 11,500 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Trifolium kingii subsp. dedeckerae*<br>DeDecker's clover | BLMS | CRPR 1B.3 | May – July | Lower montane coniferous forest, pinyon and juniper woodland, and Subalpine and upper montane coniferous forest with granitic or rocky substrate. 6,890 to 11,485 feet elevation. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Triglochin palustris*<br>marsh arrow-grass | – | CRPR 2B.3 | July – Aug | Wet areas in subalpine to alpine habitats from 7,400 to 12,200 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Tuctoria (=Orcuttia) greenei*<br>Greene's tuctoria | FE | SR, CRPR 1B.1 | May – July | Vernal pools below 3,600 feet. | • Unlikely to occur. The study area does not support vernal pool habitat. |
| *Utricularia intermedia*<br>flat-leaved bladderwort | – | CRPR 2B.2 | July – Aug | Annual aquatic herb. Shallow waters within bogs, fens, swamps, and wet meadows. 3,900 to 8,900 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |
| *Viola pinetorum* var. *grisea*<br>grey-leaved violet | – | CRPR 1B.3 | April – July | Dry peaks and slopes in subalpine conifer forest and upper montane conifer forest. 4,500 to 12,100 feet. | • Unlikely to occur. The study area is outside the elevation range of and does not support appropriate habitat for this species. |

LEGEND:

<u>Federal Status</u>

FT = Federal Threatened

FE = Federal Endangered

BLMS = BLM Sensitive

<u>State Status</u>

ST = California Threatened

SE = California Endangered

SR = California Rare

CRPR = California Native Plant Society Rare Plant Rank

CRPR 1B = rare, threatened or endangered in California and elsewhere

CRPR 2B = rare in California but more common elsewhere

3 = need more information

4 = plants of limited distribution; a watch list

_.1 = Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)

_.2 = Moderately threatened in California (20–80% occurrences threatened)

_.3 = Not very threatened in California (<20% of occurrences threatened or no current threats known)

## Table 7.5-4. Munz's Iris Populations Identified in the Study Area

| Scientific Name | Common Name | Unique Population/ Map ID[1] | Facility | Total # of Individuals | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Iris munzii | Munz's iris | IRMU001 | Kaweah No. 1 Flowline | 3 | 135 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU002 | Kaweah No. 1 Flowline | 7 | 2,177 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU003 | Kaweah No. 1 Flowline | 7 | 7,925 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU004 | Kaweah No. 1 Flowline | 45 | 16,413 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU005 | Kaweah No. 1 Flowline Access Road – Slick Rock | 1 | 3 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU006 | Kaweah No. 1 Flowline | 2 | 10 | 6/17/2018 |
| Iris munzii | Munz's iris | IRMU007 | Kaweah No. 1 Flowline | 2 | 150 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU008 | Kaweah No. 1 Flowline | 58 | 8,258 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU009 | Kaweah No. 1 Flowline | 21 | 17,829 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU010 | Kaweah No. 1 Flowline | 1 | 4 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU011 | Kaweah No. 1 Flowline | 1 | 4 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU012 | Kaweah No. 1 Flowline | 14 | 3,285 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU013 | Kaweah No. 1 Flowline | 29 | 9,479 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU014 | Kaweah No. 1 Flowline | 94 | 21,828 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU015 | Kaweah No. 1 Flowline | 10 | 1,873 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU016 | Kaweah No. 1 Flowline | 2 | 471 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU017 | Kaweah No. 1 Flowline | 2 | 503 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU018 | Kaweah No. 1 Flowline | 4 | 1,396 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU019 | Kaweah No. 1 Flowline | 1 | 36 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU020 | Kaweah No. 1 Flowline | 3 | 412 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU021 | Kaweah No. 1 Flowline | 5 | 932 | 6/18/2018 |
| Iris munzii | Munz's iris | IRMU022 | Kaweah No. 1 Flowline | 4 | 2,474 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU023 | Kaweah No. 1 Flowline | 1 | 9 | 6/19/2018 |

| Scientific Name | Common Name | Unique Population/ Map ID[1] | Facility | Total # of Individuals | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Iris munzii | Munz's iris | IRMU024 | Kaweah No. 1 Flowline | 4 | 5,889 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU025 | Kaweah No. 1 Flowline | 11 | 12,512 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU026 | Kaweah No. 1 Flowline | 5 | 7,761 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU027 | Kaweah No. 1 Flowline | 1 | 8 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU028 | Kaweah No. 1 Flowline | 6 | 4,159 | 6/19/2018 |
| Iris munzii | Munz's iris | IRMU029 | Kaweah No. 1 Flowline | 2 | 4,264 | 6/19/2018 |

[1]Refer to Map 7.5-1 (a–t) (CONFIDENTIAL) for the location of each individual/population in the Study area.

## Table 7.5-5. Non-Native Invasive Plant Populations Identified in the Study Area

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Ailanthus altissima | Tree-of-Heaven | AIAL001 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | MOD | 8,752 | 6/23/2018 |
| Ailanthus altissima | Tree of Heaven | AIAL002 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | HIGH | 16,718 | 4/26/2018 |
| Centaurea melitensis | Tocalote | CEME001[3] | Kaweah No. 3 Forebay Road | LOW | 6,836 | 6/14/2018 |
| Centaurea melitensis | Tocalote | CEME002 | Kaweah No. 3 Forebay Road | LOW | 129,704 | 6/14/2018 |
| Centaurea melitensis | Tocalote | CEME003 | Kaweah No. 3 Forebay Road, Kaweah No. 3 Penstock | LOW | 200,760 | 6/14/2018, 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME004 | Kaweah No. 3 Powerhouse and Switchyard | MOD | 4 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME005 | Kaweah No. 3 Powerhouse Road | LOW | 320 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME006 | Kaweah No. 3 Powerhouse Road | LOW | 1,730 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME007 | Kaweah No. 2 Intake Road | LOW | 25 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME008 | Kaweah No. 2 Intake Road | MOD | 100 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME009 | Kaweah No. 2 Intake Road | LOW | 100 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME010 | Kaweah No. 2 Flowline Access Road - Open Siphon Grids, Kaweah No. 2 Flowline | LOW | 18,756 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME011 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 30,994 | 4/27/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Centaurea melitensis | Tocalote | CEME012 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 13,540 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME013 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 4,799 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME014 | Kaweah No. 2 Flowline (Canal 2 to Forebay) | LOW | 980,963 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME015 | Kaweah No. 2 Flowline East Access Road | LOW | 212,577 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME016 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 67,108 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME017 | Kaweah No. 2 Flowline Access Trail - Canal 4 West, Kaweah No. 2 Flowline Access Road - Canal 4 East | LOW | 19,558 | 6/15/2018 |
| Centaurea melitensis | Tocalote | CEME018 | Kaweah No. 2 Flowline Access Road - Canal 4 West | LOW | 31,371 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME019 | Kaweah No. 2 Flowline Access Road - Canal 5 | LOW | 38,427 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME020 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 12,245 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME021 | Kaweah No. 2 Flowline Access Road - Canal 6 East | LOW | 12,981 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME022 | Kaweah No. 2 Flowline Access Road - Canal 6 West | LOW | 5,968 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME023 | Kaweah No. 2 Flowline East Access Road | LOW | 29,603 | 6/16/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Centaurea melitensis | Tocalote | CEME024 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 400 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME025 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 12,163 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME026 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 900 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME027 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | HIGH | 15,273 | 6/16/2018 |
| Centaurea melitensis | Tocalote | CEME028 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | MOD | 900 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME029[3] | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | MOD | 3,001 | 4/27/2018 |
| Centaurea melitensis | Tocalote | CEME030 | Kaweah No. 2 Flowline Access Road - Flume 8 | LOW | 43,422 | 6/21/2018 |
| Centaurea melitensis | Tocalote | CEME031 | Kaweah No. 2 Flowline Center Access Road | LOW | 212,844 | 6/21/2018 |
| Centaurea melitensis | Tocalote | CEME032 | Kaweah No. 2 Flowline West Access Road | LOW | 226,414 | 6/21/2018 |
| Centaurea melitensis | Tocalote | CEME033 | Kaweah No. 2 Spillways | LOW | 14,505 | 6/21/2018 |
| Centaurea melitensis | Tocalote | CEME034 | Kaweah No. 2 Forebay Road | LOW | 87,801 | 6/21/2018 |
| Centaurea melitensis | Tocalote | CEME035 | Kaweah No. 2 Penstock | LOW | 88,032 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME036 | Kaweah No. 2 Penstock Road | LOW | 96,300 | 6/22/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Centaurea melitensis | Tocalote | CEME037 | Kaweah No. 2 Powerhouse Transmission Tap Line | LOW | 29,897 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME038 | Kaweah No. 2 Powerhouse Transmission Tap Line | LOW | 300 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME039 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 35,389 | 6/24/2018 |
| Centaurea melitensis | Tocalote | CEME040 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 13,197 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME041 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 9,146 | 6/24/2018 |
| Centaurea melitensis | Tocalote | CEME042[3] | Kaweah No. 1 Penstock | LOW | 10,170 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME043 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 72,630 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME044 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 6,791 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME045 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 25 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME046 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 5,524 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME047 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 3,929 | 4/26/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Centaurea melitensis | Tocalote | CEME048 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 5,069 | 4/26/2018 |
| Centaurea melitensis | Tocalote | CEME049 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | LOW | 400 | 6/23/2018 |
| Centaurea melitensis | Tocalote | CEME050 | Kaweah No. 1 Solar Yard Satellite Repeater | HIGH | 2,807 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME051 | Kaweah No. 1 Solar Yard Satellite Repeater | LOW | 8,479 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME052 | Kaweah No. 1 Intake Road | LOW | 40,782 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME053 | Kaweah No. 1 Flowline | LOW | 36,632 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME054 | Kaweah No. 1 Flowline | LOW | 3,998 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME055 | Kaweah No. 1 Flowline | LOW | 44,893 | 6/17/2018 |
| Centaurea melitensis | Tocalote | CEME056 | Kaweah No. 1 Access Road - Lumberyard | MOD | 3,293 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME057 | Kaweah No. 1 Flowline | LOW | 28,067 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME058 | Kaweah No. 1 Flowline | LOW | 21,880 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME059[3] | Kaweah No. 1 Access Road - Upper Pine | LOW | 40,693 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME060 | Kaweah No. 1 Flowline | LOW | 2,370 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME061 | Kaweah No. 1 Flowline | LOW | 33,653 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME062 | Kaweah No. 1 Flowline Access Road - Lower Pine | LOW | 32,447 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME063 | Kaweah No. 1 Flowline | LOW | 8,126 | 6/18/2018 |
| Centaurea melitensis | Tocalote | CEME064 | Kaweah No. 1 Flowline | LOW | 15,948 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME065 | Kaweah No. 1 Flowline Access Road - Grapevine | LOW | 39,555 | 6/19/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Centaurea melitensis | Tocalote | CEME066 | Kaweah No. 1 Flowline | LOW | 13,736 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME067 | Kaweah No. 1 Flowline | LOW | 2,691 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME068 | Kaweah No. 1 Flowline | LOW | 19,794 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME069 | Kaweah No. 1 Flowline Access Road - Summit | MOD | 2,430 | 6/22/2018 |
| Centaurea melitensis | Tocalote | CEME070[3] | Kaweah No. 1 Forebay Tank and Spillway Channel | LOW | 1,048 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME071 | Kaweah No. 1 Forebay Road | LOW | 91,443 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME072 | Kaweah No. 1 Forebay Road | LOW | 66,683 | 6/19/2018 |
| Centaurea melitensis | Tocalote | CEME073 | Kaweah No. 1 Forebay Road | LOW/MOD/HIGH | 23,390 | 6/19/2018 |
| Cirsium vulgare | Bull thistle | CIVU001 | Kaweah No. 2 Flowline at Flume 4 | LOW | 150 | 6/16/2018 |
| Genista monspessulana | French broom | GEMO001 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | HIGH | 2,042 | 4/26/2018 |
| Tribulus terrestris | Puncture vine | TRTE001 | Kaweah No. 3 Forebay and Spillway Channel | LOW | 14,766 | 6/14/2018 |
| Tribulus terrestris | Puncture vine | TRTE002 | Kaweah No. 3 Powerhouse and Switchyard | LOW | 954 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE003 | Kaweah No. 3 Powerhouse and Switchyard | LOW | 20 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE004 | Kaweah No. 3 Powerhouse and Switchyard | LOW | 3,319 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE005[4] | Kaweah No. 3 Powerhouse and Switchyard | LOW | 100 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE006 | Kaweah No. 3 Powerhouse Road | LOW | 2,815 | 6/15/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Tribulus terrestris | Puncture vine | TRTE007 | Kaweah No. 3 Powerhouse Road | LOW | 1,227 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE008 | Kaweah No. 3 Powerhouse Road | LOW | 9,193 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE009 | Kaweah No. 2 Intake Road | LOW | 19,590 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE010 | Kaweah No. 2 Intake Road, Kaweah No. 2 Flowline Access Road - Open Siphon Grids | LOW | 28,862 | 6/15/2018 |
| Tribulus terrestris | Puncture vine | TRTE011 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | MOD | 225 | 6/16/2018 |
| Tribulus terrestris | Puncture vine | TRTE012 | Kaweah No. 2 Access Road - Red Barn | LOW | 30,828 | 6/21/2018 |
| Tribulus terrestris | Puncture vine | TRTE013 | Kaweah No. 2 Flowline West Access Road | MOD | 16 | 6/21/2018 |
| Tribulus terrestris | Puncture vine | TRTE014 | Kaweah No. 2 Flowline Access Trail - Canal 15 | LOW | 1,062 | 6/21/2018 |
| Tribulus terrestris | Puncture vine | TRTE015 | Kaweah No. 2 Flowline Access Trail - Canal 15 | LOW | 587 | 6/21/2018 |
| Tribulus terrestris | Puncture vine | TRTE016 | Kaweah No. 2 Forebay Road | LOW | 73,683 | 6/22/2018 |
| Tribulus terrestris | Puncture vine | TRTE017 | Kaweah No. 2 Powerhouse Road, Kaweah River Drive, Kaweah No. 2 Powerhouse | MOD | 3,352 | 6/22/2018 |
| Tribulus terrestris | Puncture vine | TRTE018 | Kaweah No. 2 Powerhouse Road, Kaweah River Drive, Kaweah No. 2 Switchyard | LOW | 10,207 | 6/22/2018 |

| Scientific Name | Common Name | Unique Population/Map ID[1] | Facility | Level of Infestation[2] | Population Size (Square Feet) | Survey Date |
|---|---|---|---|---|---|---|
| Tribulus terrestris | Puncture vine | TRTE019 | Kaweah No. 2 Powerhouse Road, Kaweah River Drive, Kaweah No. 2 Powerhouse | LOW | 10,102 | 6/22/2018 |
| Tribulus terrestris | Puncture vine | TRTE020 | Kaweah No. 2 Powerhouse Transmission Tap Line | LOW | 4 | 6/22/2018 |
| Tribulus terrestris | Puncture vine | TRTE021 | Kaweah No. 2 Powerhouse Transmission Tap Line | LOW | 300 | 6/22/2018 |
| Tribulus terrestris | Puncture vine | TRTE022 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line, Kaweah No. 1 Powerhouse Campus | LOW/MOD | 32,905 | 6/18/2018 |
| Tribulus terrestris | Puncture vine | TRTE023 | Kaweah No. 1 Powerhouse Campus | LOW | 2,198 | 6/18/2018 |
| Tribulus terrestris | Puncture vine | TRTE024 | Kaweah No. 1 Penstock | LOW | 23,005 | 6/18/2018 |
| Tribulus terrestris | Puncture vine | TRTE025 | Kaweah No. 3 Powerhouse to Three Rivers Substation Transmission Line | MOD | 400 | 6/23/2018 |

Notes:

LOW = <5% cover

MOD = 6–25% cover

HIGH = >25% cover

[1] Refer to Map 7.5-1 (a–t) (CONFIDENTIAL) for the location of each individual/population in the Study Area.

[2] Level of Infestation.

[3] Tocalote is widespread in the Study area. Therefore, with the exception of populations CEME001, CEME029, CEME042, CEME059, and CEME070, the full extent of tocalote populations were not fully mapped and extend beyond the study area boundaries.

[4] After review, TRTE005 was removed from the map because it falls outside of the Project boundary. It is included in this table for reference.

## Table 7.5-6. Survey Locations for Special-Status Bats

| |
|---|
| **Diversion Dams and Pools** |
| • Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) [1,2] |
| • Kaweah No. 2 Diversion Dam and Pool (Kaweah River) [1] |
| **Flowlines** |
| • Kaweah No. 1 Flowline (flume section only) [1] |
| • Kaweah No. 2 Flowline (flume section only) [1] |
| **Powerhouses and Switchyards** |
| • Kaweah No. 1 Powerhouse and Switchyard[1,2] |
| • Kaweah No. 2 Powerhouse and Switchyard[1,2] |
| • Kaweah No. 3 Powerhouse and Switchyard[1,2] |
| **Stream Gages** |
| • East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) [1] |
| • East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) [1] |
| • Kaweah No. 1 Minimum Instream Flow Release (SCE Gage No. 201a) [1] |
| • East Fork Kaweah River Conduit 1 near Three Rivers CA (SCE Gage No. 202) [1] |
| • Kaweah River below Conduit No. 2 near Hammond CA (USGS Gage No. 11208600) (SCE Gage No. 203) [1] |
| • Kaweah River Conduit No. 2 near Hammond CA (SCE Gage No. 204a) [1] |
| • Kaweah River Conduit No. 2 at Power Plant near Hammond CA (USGS Gage No. 11208818) (SCE Gage No. 205a) [1] |
| • Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) [1] |
| **Ancillary and Support Facilities** |
| • Kaweah No. 1 Powerhouse Campus[1] |
| • Kaweah No. 2 Wildlife Bridges [1] |
| • Kaweah No. 2 Wildlife Escape Ramps [1] |
| • Kaweah No. 2 Footbridges [1] |
| • Kaweah No. 3 Wildlife Bridges[1] |
| • Kaweah No. 3 Wildlife Escape Ramps[1] |
| • Kaweah No. 3 Footbridges [1] |

[1]Bat roost and reproductive survey location

[2]Acoustic and mist nest survey location

This Page Intentionally Left Blank

**Table 7.5-7. Special-Status Wildlife Species Known to Occur or Potentially Occurring in the Study Area**

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| **Known to Occur in the Study Area** | | | | |
| ***Birds*** | | | | |
| *Pandion haliaetus*<br>osprey | — | WL | Uncommon migratory raptor that builds large perennial nests in dead trees or other prominent supports near open water. Foraging areas include regulated and unregulated rivers, reservoirs, lakes, estuaries, and coastal marine ecosystems. | • Known to occur in the study area.<br>• An individual was observed April 2018 foraging in a pond adjacent to the Kaweah No. 2 Flowline Access Trail – Canal 5 during technical studies conducted in 2018. However, there is no appropriate breeding habitat within the FERC Project boundary.<br>• Refer to TERR 2 – TSR for more detailed information about occurrence of this species. |
| *Aquila chrysaetos*<br>golden eagle | Eagle Act, BLMS, BCC | CFP, WL (nesting and wintering) | Forages in grasslands and early successional stages of forest and shrub habitats at elevations up to 11,500 feet. Nests on secluded cliffs with overhanging ledges or large trees in open areas with unobstructed view. | • Known to occur in the study area.<br>• A mortality was recorded by SCE in the Kaweah No. 2 Forebay in 1994.<br>• An individual was observed flying over Kaweah No. 1 Flowline during reconnaissance surveys conducted in May 2018.<br>• Refer to TERR 2 – TSR for more detailed information about occurrence of this species. |
| *Dendroica petechia*<br>yellow warbler | BCC | SSC (nesting) | Breeds in riparian woodlands from coastal and desert lowlands at elevations up to 8,000 feet in the Sierra Nevada. Also breeds in montane chaparral, open ponderosa pine, and mixed conifer habitats with substantial amounts of brush. | • Known to occur in the study area.<br>• One singing male was observed near the Kaweah No. 1 Flowline just downstream of the Kaweah No. 1 Diversion Dam during reconnaissance surveys conducted in May 2018.<br>• Refer to TERR 2 – TSR for more detailed information about occurrence of this species. |
| ***Mammals*** | | | | |
| *Antrozous pallidus*<br>pallid bat | BLMS | SSC | Occurs in grasslands, shrublands, woodlands, and forests from sea level to 10,000 feet in elevation. Typically roosts in caves, crevices, or mines. Requires open habitat for foraging. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Corynorhinus townsendii*<br>Townsend's big-eared bat | BLMS | SSC | Found in all but alpine and subalpine habitats; most abundant in mesic habitats up to 6,000 feet in elevation. Requires caves, mines, tunnels, buildings, or other man-made structures for roosting. Extremely sensitive to disturbance and may abandon a roost if disturbed. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed.<br>• The CNDDB query yielded one record for this species 2.5 miles northeast of Sycamore Drive at Generals Highway (HWY 198). |
| *Euderma maculatum*<br>spotted bat | BLMS | SSC | Ranges from arid deserts and grasslands through mixed conifer forests up to elevations of 10,600 feet in southern California. Prefers sites with adequate roosting habitat, such as cliffs. Often limited by the availability of cliff habitat. Feeds over water and along marshes. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Lasiurus blossevillii*<br>western red bat | — | SSC | Roosts in forests and woodlands from sea level up through mixed mesic conifer forests in coastal ranges and the Sierra Nevada. Forages in a variety of habitats including croplands, grasslands, shrublands, and open woodlands and forests. Prefers solitary roosts in trees and occasionally shrubs. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Myotis ciliolabrum*<br>western small-footed myotis | BLMS | — | Found in a wide variety of habitats, primarily in relatively arid wooded and brushy uplands near water. Elevation range is from 0 to 8,900 feet. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Myotis evotis*<br>long-eared myotis | BLMS | — | Found predominantly in coniferous forests, typically only at higher elevations in southern areas (between 7,000 and 8,500 feet). They roost in tree cavities and beneath exfoliating bark in both living trees and dead snags. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Myotis thysanodes* fringed myotis | BLMS | — | Optimal habitats are pinyon-juniper, valley foothill hardwood, and hardwood-conifer, generally at 4,000 to 7,000 feet. Roosts in caves, mines, buildings, and crevices. Separate day and night roosts may be used. Uses open habitats, early successional stages, streams, lakes, and ponds as foraging areas. This species is migratory, making relatively short, local movements to suitable hibernacula. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Myotis yumanensis* Yuma myotis | BLMS | — | Occasionally roosting in mines or caves, these bats are most often found in buildings or bridges. Bachelors also sometimes roost in abandoned cliff swallow nests, but tree cavities are probably the original sites for most nursery roosts. These bats typically forage over water in forested areas. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed. |
| *Eumops perotis californicus* western mastiff bat | BLMS | SSC | Found in variety of habitats including desert scrub, chaparral, oak woodland, ponderosa pine, meadows, and mixed conifer forests up to 4,600 feet in elevation. Distribution is likely limited by availability of significant rock features offering suitable roosting habitat. | • Known to occur in the study area.<br>• Observed during bat surveys conducted for relicensing studies in 2018. Refer to Table TERR 2-8 in the TERR 2 – TSR for specific facilities where this species was observed.<br>• The CNDDB query yielded two records for this species adjacent to Project facilities:<br>• A 1994 detection approximately 0.5 mile to the north of the Kaweah No. 3 Powerhouse and Switchyard;<br>• A 1994 detection approximately 0.5 mile to the south of the Kaweah No. 3 Powerhouse and Switchyard. |
| *Bassariscus astutus* ringtail | — | CFP | Found in most forest and shrub habitats in close association with rocky and/or riparian areas, usually not more than 0.6 miles from water. Dens in hollow trees, snags, or other cavities. | • Known to occur in the study area.<br>• Sign was observed incidentally during surveys conducted for relicensing studies in October 2018:<br>• Scat found at the Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River);<br>• Tracks found by the river behind the Kaweah No. 3 Powerhouse and Switchyard.<br>• Refer to TERR 2 – TSR for more detailed information about occurrence of this species. |
| **May Potentially Occur in the Study Area** | | | | |
| ***Reptiles*** | | | | |
| *Phrynosoma blainvillii* coast horned lizard | BLMS | SSC | Occurs in valley foothill hardwood, conifer and riparian habitats, as well as in pine-cypress, juniper, and annual grassland habitats. The elevational range extends up to 4,000 feet in the Sierra Nevada foothills and up to 6,000 feet in the mountains of southern California. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Anniella pulchra* northern California legless lizard | — | SSC | Occurs in moist warm loose soil with plant cover. Moisture is essential. Occurs in sparsely vegetated areas of beach dunes, chaparral, pine-oak woodlands, desert scrub, sandy washes, and stream terraces with sycamores, cottonwoods, or oaks. Often can be found under surface objects such as rocks, boards, driftwood, leaf litter, and logs. Elevation range is from sea level to 5,900 feet. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing.<br>• The CNDDB query yielded one record for this species from 1907 with the general location as Kaweah. |
| *Lampropeltis zonata* California mountain kingsnake | BLMS | WL | A habitat generalist, found in diverse habitats including coniferous forest, oak-pine woodlands, riparian woodland, chaparral, manzanita, and coastal sage scrub. Wooded areas near a stream with rock outcrops, talus, or rotting logs that are exposed to the sun are good places to find this snake. Elevation range is from 1,500 to 8,000 feet. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| ***Birds*** | | | | |
| *Gymnogyps californianus* California condor | FE | SE, CFP | Found mostly below 9,000 feet in open rangelands in the mountain ranges surrounding the southern San Joaquin Valley. Nests in caves, crevices, or sandstone ledges, typically at elevations below 6,500 feet. USFWS has designated critical habitat for this species. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing.<br>• The CNDDB query yielded one record outside the Study area, which documents a condor roosting area located at Blue Ridge, approximately 4.5 miles to the southwest of the Kaweah No. 2 Powerhouse. Condors typically roost here between April and September.<br>• The closest critical habitat is located along the Kaweah River downstream of the study area, including a portion of Kaweah Lake. |
| *Accipiter gentilis* northern goshawk | BLMS | SSC (nesting) | Forages and nests in middle to high elevation, mature, dense conifer forests. Wintering habitat includes foothills, northern deserts in pinyon-juniper woodland, and low elevation riparian habitats. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Buteo swainsoni* Swainson's hawk | BLMS, BCC | ST (nesting) | Uncommon breeding resident and migrant in the Central Valley, Klamath Basin, Northeastern Plateau, Lassen County, and Mojave Desert. Nests in riparian woodlands, juniper-sage flats, and oak woodlands. Forages in grasslands and agricultural areas. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Circus cyaneus* northern harrier | — | SSC (nesting) | Occurs in a variety of habitats at elevations up to 10,000 feet. Forages in open areas such as meadows, wetlands, and grasslands. Breeding habitat is up to 5,700 feet in the Sierra Nevada, in areas with shrubby vegetation near foraging habitat. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Elanus leucurus* white-tailed kite | BLMS | CFP | Prefers coastal and lowland valleys; often associated with farmlands, meadows with emergent vegetation, and grasslands. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Haliaeetus leucocephalus* bald eagle | FD (Former FT, delisted on 7/09/07), Eagle Act, BCC, BLMS | SE, CFP | Year-round resident in ice-free regions of California. Foraging areas include regulated and unregulated rivers, reservoirs, lakes, estuaries, and coastal marine ecosystems. The majority of bald eagles in California breed near reservoirs and nests are usually located within 1 mile of foraging habitat. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing.<br>• This species could potentially forage along the Kaweah River. There is no appropriate breeding habitat within the FERC Project boundary. |
| *Falco peregrinus anatum* American peregrine falcon | FD (Former FE, delisted on 8/25/99) (nesting), BCC | SD (Former SE, delisted on 8/6/09), CFP | Very uncommon breeding resident and uncommon as a migrant. Breeds in woodlands, forests, coastal habitats, and riparian areas near wetlands, lakes, rivers, or other water on high cliffs, banks, dunes, or mounds. Active nesting sites are known along the coast, in the Sierra Nevada, and in the mountains of northern California. Migrants occur along the coast and the western Sierra Nevada in spring and fall. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Asio flammeus* short-eared owl | — | SSC (nesting) | Open areas with few trees, such as annual and perennial grasslands, prairies, dunes, meadows, irrigated lands, saline and fresh emergent wetlands. Needs elevated sites for perching and dense vegetation for roosting. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Athene cunicularia* burrowing owl | BLMS, BCC | SSC | Suitable habitat throughout their breeding range typically includes open, treeless areas within grassland, steppe, and desert biomes. They generally inhabit gently-sloping areas, characterized by low, sparse vegetation. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Strix occidentalis occidentalis* California spotted owl | BLMS, BCC | SSC | Nests and forages in dense, old growth, multi-layered mixed conifer, redwood, Douglas-fir, and oak woodland habitats, from sea level to elevations of approximately 7,600 feet. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| *Cypseloides niger* black swift | BCC | SSC (nesting) | Nests in moist crevices or caves, or on cliffs near waterfalls in deep canyons at elevations ranging from 6,000 to 11,000 feet. Forages widely over many habitats; seems to avoid arid regions. Known from the high elevations of the Sierra National Forest. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. The CNDDB query yielded one historic (1935) record for this species outside the Study area along the Marble Fork, approximately 3 miles upstream of the Kaweah No. 3 Powerhouse. |
| *Melanerpes lewis* Lewis' woodpecker | BCC | — | Breeds east of the Sierra Nevada crest in cavities excavated in sycamore, cottonwood, oak, or conifer trees. Winter resident in open oak savannas, broken deciduous, and coniferous habitats with a sufficient supply of acorns and insects. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |

| Scientific/<br>Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Empidonax traillii*<br>willow flycatcher | BCC | SE | Summer resident in wet meadow and montane riparian habitats at 2,000 to 8,000 feet in the Sierra Nevada. Most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing.<br>• The Kaweah Project is located outside the breeding range for this species. However, individuals may be present during the non-breeding season. |
| *Empidonax traillii extimus*<br>southwestern willow flycatcher | FE | SE (nesting) | Wet meadow and montane riparian habitats at elevations ranging from 2,000 to 8,500 feet in elevation. Most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows. USFWS has designated critical habitat for this species. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing.<br>• The Kaweah Project is located outside the breeding range for this species. However, individuals may be present during the non-breeding season. The closest designated critical habitat is in Kern County. |
| ***Mammals*** | | | | |
| *Pekania pennanti*<br>fisher – West Coast DPS | FPT, BLMS | ST, SSC | Found in large areas of mature, dense forest red fir, lodgepole pine, ponderosa pine, mixed conifer, and Jeffery pine forests with snags and greater than 50% canopy closure. Historically known from elevations of sea level to 8,000 feet. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing and suitable habitat is limited in the study area.<br>• The CNDDB query yielded three historical records for this species in the study area:<br>• A 1937 circular (non-specific) record in the mountains between the Kaweah River and East Fork Kaweah River, approximately 3.5 miles east of the Kaweah No. 3 Powerhouse;<br>• A record from 1968 and is a circular (non-specific) record which covers the Kaweah No. 2 facilities including the powerhouse and the diversion;<br>• A 2003 detection at a mesocarnivore photo station, 1 mile south of Oak Grove and the East Fork Kaweah River (approximately 1 mile south of the Kaweah No. 1 diversion).<br>• There are seven other CNDDB records within 5 miles of the study area. |
| *Taxidea taxus*<br>American badger | — | SSC | Occurs throughout most of the state in areas with dry, friable soils. It is most abundant in drier open stages of most shrub, forest, and herbaceous habitats up to 12,000 feet in elevation. | • May potentially occur in appropriate habitat; however, this species was not observed during surveys conducted in support of relicensing. |
| **Unlikely to Occur in the Study Area** | | | | |
| ***Invertebrates*** | | | | |
| *Coelus gracilis*<br>San Joaquin dune beetle | BLMS | — | This beetle inhabits inland sand dunes along the western edge of the San Joaquin Valley. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Desmocerus californicus dimorphus*<br>valley elderberry longhorn beetle | FT | — | Central valley riparian forests and adjacent upland vegetation along river corridors, in close association with elderberry (Sambucus ssp.) plants. | • Unlikely to occur.<br>• Two CNDDB records exist within the Study Area.<br>• However, the study area is outside the geographic range of this species. In 2014, the USFWS revised their description of the life history, population distribution, range, and occupancy. As part of the revised range, several counties were removed from the species' range. The study area is located within Tulare County, which is no longer within the species' range. |
| ***Amphibians*** | | | | |
| *Ambystoma californiense*<br>California tiger salamander | FT | ST, WL | Found in grassland, oak savanna, edges of mixed woodland, and lower elevation coniferous forest. The USFWS has designated critical habitat for this species. Critical habitat consists of vernal pools, permanent or ephemeral standing water bodies, as well as upland habitat with small mammal burrows adjacent to the water bodies. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. The closest critical habitat in Tulare County is northeast of Visalia in the Central Valley. The study area does not meet the Primary Constituent Elements (PCEs) of critical habitat. |
| *Batrachoseps stebbinsi*<br>Tehachapi slender salamander | BLMS | ST | Inhabits north-facing moist canyons and ravines in oak and mixed woodlands in arid to semi-arid locations. Found under rocks, logs, bark, and other debris in moist areas, especially in areas with a lot of leaf litter, often near talus slopes. Only recorded from the Tehachapi mountains in Kern County. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Ensatina eschscholtzii croceator* yellow-blotched salamander | BLMS | WL | Found in evergreen and deciduous forests, under rocks, logs, and other surface debris, especially bark that has peeled off and fallen beside decaying logs. Shaded north-facing areas seem to be favored, especially near creeks or streams. Subspecies and intergrades only recorded from Kern County. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| ***Reptiles*** | | | | |
| *Gambelia (=Crotaphytus) sila* blunt-nosed leopard lizard | FE | SE, CFP | Found in sparsely vegetated alkali scrub and desert habitats below 2,400 feet in the San Joaquin Valley and adjacent foothills. USFWS has not designated critical habitat for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Thamnophis gigas* giant garter snake | FT | ST | Uses a wide variety of habitats including forests, mixed woodlands, grasslands, chaparral, and agricultural lands in the Central and San Joaquin Valleys. The species often occurs near aquatic habitat including ponds, marshes, and streams where it freely enters and retreats to when alarmed. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Thamnophis hammondii* two-striped garter snake | BLMS | SSC | Associated with permanent or semi-permanent bodies of water in rocky areas, woodland, shrubland, and coniferous forest from sea level to 8,000 feet. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| ***Birds*** | | | | |
| Pelecanus occidentalis californicus California brown pelican | FD, BLMS | SD, CFP | Brown Pelicans live year-round in estuaries and coastal marine habitats along both the east and west coasts. On the west coast they breed on dry, rocky offshore islands. When not feeding or nesting, they rest on sandbars, pilings, jetties, breakwaters, mangrove islets, and offshore rocks. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Charadrius montanus* mountain plover | BLMS | SSC | Breeds on open plains at moderate elevations in the Intermountain West. Winters in short-grass plains and fields, plowed fields, and sandy deserts in the western United States. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Laterallus jamaicensis coturniculus* California black rail | BLMS, BCC | ST, CFP | Year-round resident of the western slope foothills of the Sierra Nevada range in California. Nests in high portions of salt marshes, shallow freshwater marshes, wet meadows, and flooded grassy vegetation. | • Unlikely to occur.<br>• Study area lacks large freshwater marshes or wet meadow required by this species. |
| *Coccyzus americanus occidentalis* western yellow-billed cuckoo | FT, BLMS | SE | Breeds and forages in riparian areas with low woody vegetation in lowland California, especially willow-cottonwood habitat. Critical habitat has been proposed for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. The closest population is located Southwest of the study area near the town of Lindsay. |
| *Otus flammeolus* flammulated owl | BCC | — | Summer resident in coniferous habitats from ponderosa pine to red fir forests from 6,000 to 10,000 feet in elevation; prefers low to intermediate canopy closure. Breeds in the North Coast and Klamath Ranges, Sierra Nevada, and in suitable habitats in mountains of southern California. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Strix nebulosa* great gray owl | — | SE (nesting) | Nests in old-growth coniferous forests and forages in montane meadows. Distribution includes high elevations of the Sierra Nevada and Cascade ranges, from 4,500 to 7,500 feet in elevation. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Stellula calliope* calliope hummingbird | BCC | — | Prefers coniferous forests and mountain meadow habitats for breeding. In the Sierra Nevada, it typically nests above 4,000 feet in elevation. Nests almost always in a lodgepole pine or aspen, immediately beneath live branches, and typically in riparian areas. Migrates and spends winter in central and southern Mexico. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Sphyrapicus thyroideus* Williamson's sapsucker | BCC | — | Uncommon to fairly common summer resident in coniferous forests from approximately 5,500 to 9,500 feet in elevation throughout California. Preferred nesting habitat is lodgepole pine forests. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Contopus borealis* olive-sided flycatcher | BCC | SSC (nesting) | Uncommon to common summer resident in a wide variety of forest and woodland habitats. Nesting habitats include mixed conifer, montane hardwood-conifer, Douglas-fir, redwood, red fir, and lodgepole pine forests from 3,000 to 7,000 feet in elevation. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Vireo bellii pusillus* least Bell's vireo | FE | SE | Breeds in riparian habitats (typically in dense willows) in the southwestern U. S. Winters in Baja California. Its distribution includes cismontane southern California (most breeding pairs occur in San Diego county) extending north up to the Owens Valley and east into Death Valley National Park. USFWS has designated critical habitat for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of the species, and outside of designated critical habitat for this species. |
| *Vireo vicinior* gray vireo | BLMS, BCC | SSC | Found in hot, arid mountains and high plains scrubland habitats, including desert scrub, mixed juniper or pinyon pine and oak scrub associations, and chaparral. Found in desert habitats on the eastern slope of the Sierra Nevada and eastern slopes of San Bernardino mountains. | • Unlikely to occur.<br>• The study area is outside of the geographic range for this species. |
| *Riparia riparia* bank swallow | BLMS | ST | Nests in riparian, lacustrine, and coastal areas with vertical banks, bluffs and cliffs with sandy soils; found in open country near water during migration. | • Unlikely to occur.<br>• The study area is outside of the geographic range for this species. |
| *Toxostoma lecontei macmillanorum* San Joaquin Le Conte's thrasher | BLMS | SSC | Le Conte's thrashers are generally found in open desert scrub, alkali desert scrub, and desert succulent scrub. In the San Joaquin Valley, the species is found primarily in habitats dominated by saltbush, and often frequents desert washes and flats with scattered saltbush. Elevation range is between sea level and 3,800 feet. | • Unlikely to occur.<br>• The study area is outside the geographic range of the species. |
| *Agelaius tricolor* tricolored blackbird | BLMS, BCC | SCE, SSC (Nesting colony) | Nests near fresh water, emergent wetland with cattails or tules, and Himalayan blackberry; forages in grasslands, woodland, and agriculture in the Central Valley and coastal ranges. | • Unlikely to occur.<br>• Suitable habitat for this species is not abundant within the study area and the study area is higher in elevation than preferred valley habitats. |
| *Carpodacus cassinii* Cassin's finch | BCC | — | A common montane resident from 4,200 to 8,000 feet in elevation. Prefers tall, open coniferous forests, in lodgepole pine, red fir, and subalpine conifer habitats, especially for breeding. Most numerous near wet meadows and grassy openings; also frequents semi-arid forests. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| ***Mammals*** | | | | |
| *Macrotus californicus* California leaf-nosed bat | BLMS | SSC | Occupied habitats include desert riparian, desert wash, desert scrub, desert succulent shrub, and alkali desert scrub. Their preferred roosting habitats are caves, mines, and rock shelters near palm oases. In California, they are generally recorded below 2,000 feet. | • Unlikely to occur.<br>• The study area is outside the geographic range of the species, and the study area does not contain appropriate habitat. |
| *Aplodontia rufa* Sierra Nevada mountain beaver | — | SSC | Dense riparian and open brushy stages of most forest types at elevations ranging from 3,900 to 10,100 feet in elevation. Deep, friable soils are required for burrowing along cool, moist microclimates. Burrows are typically located in or near deep soils near streams and springs. Found in Sierra montane riparian habitats. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Ammospermophilus nelson* Nelson's antelope squirrel | BLMS | ST | Habitat consists of dry, flat, or rolling terrain with grassy, sparsely shrubby ground; requires soils with sandy or gravelly texture, or fine-grained soils that are nearly brick-hard when dry. They also occur in areas lacking shrubs where giant kangaroo rats are present. The range of this species is restricted to the central and western San Joaquin Valley and neighboring areas to the west in the inner Coast Ranges of California. Elevation range is between 165 to 3,610 feet. | • Unlikely to occur,<br>• The study area is outside of the geographic range for this species. |
| *Dipodomys ingens* giant kangaroo rat | FE | SE | Large (6-inch) kangaroo rat that lives in dry, sandy grasslands. It currently is found only in isolated areas west of the San Joaquin Valley, including the Carrizo Plain, Elkhorn Plain, and Kettleman Hills. No critical habitat rules have been published for this species. | • Unlikely to occur.<br>• The study area is outside the known geographic range of the species. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Dipodomys nitratoides brevinasus* short-nosed kangaroo rat | BLMS | SSC | Short-nosed kangaroo rats generally occupy grassland with scattered shrubs and desert-shrub associations on friable soils. Historically this species occurred on the western, southern, and extreme southeastern side of the San Joaquin Valley. Museum records for this species range from 148-2,411 feet. The current range is approximately 1.5-3.7% of the historic range. Restricted and disjunct populations are known to occur or potentially occur in the following areas (listed from north to south): Panoche and San Joaquin valleys, Kettleman Hills, Antelope and Carrizo plains, and Cuyama Valley. | • Unlikely to occur.<br>• The study area is outside of the geographic range for this species. |
| *Dipodomys nitratoides exilis* Fresno kangaroo rat | FE | SE | The range of this species encompasses arid grasslands (with friable, sandy soils) in the San Joaquin and adjacent valleys, from the valley floor in Merced County, south of the Merced and San Joaquin rivers, to the southern edge of the valley, and the Panoche Valley (eastern San Benito County), the Carrizo Plain (San Luis Obispo County), and the upper Cuyama Valley (San Luis Obispo and Santa Barbara counties), at elevations of 100 to 2,700 feet. USFWS has designated critical habitat for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of the species. The closest critical habitat designated for this species is in western Fresno County. |
| *Dodomys nitratoides nitratoides* Tipton kangaroo rat | FE | SE | Tipton kangaroo rats are limited to arid-land communities occupying the Valley floor of the Tulare Basin in level or nearly level terrain. They are currently found in scattered, isolated areas clustered in low elevation valleys of Tulare and Kern County. USFWS has not designated critical habitat for this species. | • Unlikely to occur.<br>• The study area is (just) outside the geographic range of the species. |
| *Microtus californicus vallicola* Owens Valley vole | BLMS | SSC | Occurs in mesic habitats including riparian corridors and montane riparian, meadows, dense annual grassland, and agricultural lands. This species is limited to the Owen's Valley of California. | • Unlikely to occur.<br>• The study area is outside the geographic range for this species. |
| *Onychomys torridus tularensis* Tulare grasshopper mouse | BLMS | SSC | Habitats include compact soils with a sparse growth of perennial grasses; blue oak savannas; desert scrub associations composed of grasses and shrubs; valley sink and saltbush scrub communities on the valley floor; and valley grassland. The historic range of the Tulare grasshopper mouse extended along the foothills and floor of the southern San Joaquin Valley from western Merced and eastern San Benito counties, east to Madera County, and south to the foothills of the Tehachapi and San Emigdio mountains. It also occurs on the Carrizo Plain in eastern San Luis Obispo County, Cuyama Valley, Caliente Creek Wash in southern Kern County,<br>Weldon and Kelso Valley in northeastern Kern County, the Tulare Basin, and the Panoche Valley. Elevation range is between 279 to 2,650 feet. | • Unlikely to occur.<br>• The study area is outside of the geographic range for this species. |
| *Perognathus inornatus* San Joaquin pocket mouse | BLMS | — | Occurs in dry, open grasslands with fine-textured soils in the Central and Salinas Valleys from elevation 1,000 to 2,000 feet. | • Unlikely to occur.<br>• The study area is outside of the geographic range for this species. |
| *Perognathus xanthonotus* yellow-eared pocket mouse | BLMS | — | The species is found in Joshua tree woodland, desert scrub, pinyon-juniper, mixed and montane chaparral, sagebrush and bunchgrass habitats. Occurs primarily in sandy soils with sparse to moderate shrub cover. Elevations of known localities range between 3,380 and 5,300 feet. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Vulpes macrotis mutica* San Joaquin kit fox | FE | ST | Grasslands and shrubland areas in the San Joaquin Valley with friable soils for building underground dens. Denning begins around September, mating occurs from December to March, and pups are born February through April. No critical habitat rules have been published for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species. |
| *Vulpes vulpes necator* Sierra Nevada red fox | FC | ST | Occurs throughout the Sierra Nevada in forests interspersed with meadows or alpine forests at elevations above 7,000 feet. Open areas are used for hunting, forested habitats for cover and reproduction. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |

| Scientific/ Common Name | Federal Status | State Status | Habitat | Likelihood for Occurrence/Occurrence Notes |
|---|---|---|---|---|
| *Gulo gulo luscus* California wolverine | FPT | ST, CFP | Mixed conifer, red fir, and lodgepole habitats, and probably subalpine conifer, alpine dwarf shrub, wet meadow, and montane riparian habitats. Occurs in Sierra Nevada at elevations ranging from 4,300 to 10,800 feet. Majority of recorded sightings are found above 8,000 feet in elevation. | • Unlikely to occur.<br>• The study area is outside the elevation range of this species. |
| *Ovis canadensis sierrae* Sierra Nevada bighorn sheep | FE | SE, CFP | Lives on steep, rugged slopes in the high Sierra Nevada and Great Basin in shrub, grassland, montane chaparral, subalpine conifer, or riparian habitats. The USFWS has designated critical habitat for this species. | • Unlikely to occur.<br>• The study area is outside the geographic range of this species, and outside the designated critical habitat for this species. |

**LEGEND:**

Federal Status
BCC = Birds of Conservation Concern
BLMS = Bureau of Land Management Sensitive (Bakersfield Office)
FC = Federal Candidate
FD = Delisted Species
FE = Federal Endangered
FPD = Federal Proposed for Delisting
FT = Federal Threatened

State Status
CFP = State of California Fully Protected
SCT = State Candidate Threatened
SCE = State Candidate Endangered
SD = State Delisted
SE = State Endangered
SSC = State Species of Special Concern
ST = State Threatened
WL = Watch List

## Table 7.5-8. Special-Status Bat Species Known to Occur in the Study Area

| Common Name | Scientific Name | Status | Facility Where Bat was Detected[1] |
|---|---|---|---|
| pallid bat | *Antrozous pallidus* | BLMS, SSC | Kaweah No. 1 Flowline |
| | | | Kaweah No. 1 Powerhouse and Switchyard |
| | | | Kaweah No. 1 Powerhouse Campus |
| | | | East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) |
| | | | Kaweah No. 2 Powerhouse and Switchyard |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |
| Townsend's big-eared bat | *Corynorhinus townsendii* | BLMS, SSC | Kaweah No. 1 Flowline |
| | | | Kaweah No. 1 Powerhouse and Switchyard |
| | | | Kaweah No. 1 Powerhouse Campus |
| | | | East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) |
| | | | Kaweah No. 2 Powerhouse and Switchyard |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |

| Common Name | Scientific Name | Status | Facility Where Bat was Detected[1] |
|---|---|---|---|
| spotted bat | *Euderma maculatum* | BLMS, SSC | Kaweah No. 1 Flowline |
| | | | Kaweah No. 1 Powerhouse and Switchyard |
| | | | Kaweah No. 1 Powerhouse Campus |
| | | | East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) |
| | | | Kaweah No. 2 Powerhouse and Switchyard |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| western red bat | *Lasiurus blossevillii* | SSC | Kaweah No. 1 Flowline |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| western small-footed myotis | *Myotis ciliolabrum* | BLMS | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| long-eared myotis | *Myotis evotis* | BLMS | Kaweah No. 1 Flowline |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |
| fringed myotis | *Myotis thysanodes* | BLMS | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |

| Common Name | Scientific Name | Status | Facility Where Bat was Detected[1] |
|---|---|---|---|
| Yuma Myotis | *Myotis yumanensis* | BLMS | Kaweah No. 1 Flowline |
| | | | Kaweah No. 1 Powerhouse and Switchyard |
| | | | Kaweah No. 1 Powerhouse Campus |
| | | | East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) |
| | | | Kaweah No. 2 Powerhouse and Switchyard* |
| | | | Kaweah No. 3 Powerhouse and Switchyard* |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |
| western mastiff bat | *Eumops perotis* | BLMS, SSC | Kaweah No. 1 Flowline |
| | | | Kaweah No. 1 Powerhouse and Switchyard |
| | | | Kaweah No. 1 Powerhouse Campus |
| | | | East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a) |
| | | | Kaweah No. 2 Powerhouse and Switchyard |
| | | | Kaweah No. 3 Powerhouse and Switchyard |
| | | | Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a) |
| | | | Kaweah No. 1 Diversion Dam and Pool (East Fork Kaweah River) |
| | | | East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201) |

| Common Name | Scientific Name | Status | Facility Where Bat was Detected[1] |
|---|---|---|---|
| **Bat Groups** | | | |
| California myotis/western small-footed myotis[2] | *Myotis californicus/ Myotis ciliolabrum* | BLMS | Kaweah No. 1 Powerhouse Campus* |
| | | | Kaweah No. 2 Powerhouse and Switchyard* |

[1] Some facilities are geographically co-located and therefore acoustic and mist net surveys covered both facility types. The following facilities are geographically co-located:
Kaweah No. 1 Powerhouse and Switchyard, Kaweah No. 1 Powerhouse Campus, and East Fork Kaweah River Conduit 1 at Power Plant near Hammond CA (USGS Gage No. 11208800) (SCE Gage No. 200a);
Kaweah No. 3 Powerhouse and Switchyard and Middle Fork Kaweah River Conduit No. 3 at Power Plant near Hammond CA (USGS Gage No. 11208565) (SCE Gage No. 206a);
Kaweah No. 1 Diversion Dam and Pool and East Fork Kaweah River near Three Rivers CA (USGS Gage No. 11208730) (SCE Gage No. 201).

[2] Currently, there are no unique genetic markers that can distinguish California myotis/western small-footed myotis species from guano samples. Therefore, these roosts could consist of either or both species.

* Indicates that roost for this species was detected at this location.

**Table 7.5-9. Game Species Known to Occur or Potentially Occurring in the Study Area**

| Species | Habitat | General Season | Bag Limit | Possession Limit | Hunting Restrictions |
|---|---|---|---|---|---|
| ***Resident Game Birds*** | | | | | |
| wild turkey (*Meleagris gallopavo*) | • Found mostly in deciduous riparian, oak, and conifer-oak woodlands. Prefers rugged, hilly terrain with low to intermediate canopy, interspersed with numerous grass/forb openings, near water. | • Fall Season – November 8 – December 7<br>• Spring Season – the last Saturday in March extending for 37 consecutive days | • Fall Season: 1 either-sex turkey per day.<br>• Spring Season: 1 bearded turkey per day | • Fall Season: 2 per season<br>• Spring Season: 3 per season | • Hunting license is required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than No. 2.<br>• On July 1, 2019 nonlead ammunition required. |
| mountain quail (*Oreotyx pictus*) | • Common to uncommon resident, found typically in most major montane habitats of the state. Found seasonally in open, brushy stands of conifer and deciduous forest, woodland, and chaparral. | • Zones Q1 and Q3: October 18 – January 25 | • 10 per day | • Triple the daily bag limit | • Hunting license is required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| California quail (*Callipepla californica*) | • Common, permanent resident of low and middle elevations. Found in shrub, scrub, and brush, open stages of conifer and deciduous habitats, and margins of grasslands and croplands. | | | | |
| ring-necked pheasant (*Phasianus colchicus*) | • Common to uncommon introduced species. Occurs in scattered locations throughout the state, centered in the Central Valley. Dependent on croplands with adjacent herbaceous and woody cover; also in perennial grasslands with sufficient cover. | • November 8 – December 21 | • 2 males per day for first two days of the season; 3 males per day after the first two days of the season | • Triple the daily bag limit | • Hunting license is required.<br>• On July 1, 2019 nonlead ammunition required. |
| sooty grouse (*Dendragapus fuliginosus*) | • Uncommon to common permanent resident at middle to high elevations. Occurs in open, medium to mature aged stands of fir, Douglas-fir, and other conifer habitats, interspersed with medium to large openings, and available water. | • The second Saturday in September extending for 31 consecutive days | • 2 sooty grouse per day | • Triple the daily bag limit | • Hunting license is required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| ***Migratory Game Birds*** | | | | | |
| mallard (*Anas platyrhynchos*) | • Common resident and migrant, found throughout the state in fresh emergent wetlands, estuarine, lacustrine, and riverine habitats, ponds, pastures, croplands, and urban parks. | • South San Joaquin Valley Zone:<br>• October 20 – January 27 | • 7 per day, not more than 2 females | • Triple the daily bag limit | • Hunting license and state duck tag are required. Must use ten-gauge shotgun or smaller, and shot must be nonlead and non-toxic. Electronically-operated calling or sound-reproducing devices are prohibited. No use of practice dogs on birds outside of season. No take of nests or eggs.<br>• On July 1, 2019 nonlead ammunition required. |
| common merganser (*Mergus merganser*) | • Uncommon to locally common resident and migrant on lakes, ponds, and large streams of the Coast, Klamath, Cascade, and Sierra Nevada Ranges. | | • 7 per day | | |
| American coot (*Fulica americana*) | • Common resident throughout most of the state below 7,000 feet in elevation. Found in fresh and saline emergent wetlands, wet grasslands, pastures, lacustrine, estuarine, cropland, and urban habitats. | | • 25 per day | | |

| Species | Habitat | General Season | Bag Limit | Possession Limit | Hunting Restrictions |
|---|---|---|---|---|---|
| common snipe<br>(*Gallinago gallinago*) | • Fairly common winter visitor from October to April on wet meadow and short, emergent wetland habitats throughout much of California. | • The third Saturday in October extending for 107 days | • 8 per day | • Triple the daily bag limit | • Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| band-tailed pigeon<br>(*Columba fasciata*) | • Common resident in hardwood and hardwood-conifer habitats. Inhabits lower slopes of major mountain ranges of the state. | • The third Saturday in December extending for 9 consecutive days | • 2 per day | • Triple the daily bag limit | • Hunting license and state duck tag are required. No use of motor vehicles to drive birds toward target. No use of mammal (or imitation) as blind. No take of nests or eggs. No use of practice dogs on birds outside of season. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| mourning dove<br>(*Zenaida macroura)* | • Open woodlands, grasslands, croplands, open hardwood, hardwood-conifer, riparian, low elevation conifer, and deserts all provide adequate habitat. Requires and nearby water source. | • September 1-15 and from the second Saturday in November extending for an additional 45 days | • 15 doves, up to 10 may be white winged | • Triple the daily bag limit | • On July 1, 2019 nonlead ammunition required. |
| Eurasian-collared Dove<br>(*Streptopelia decaocto*) | • Introduced species to California. Found throughout California in urban and suburban settings with access to bird feeders or other seed sources. In agricultural areas they seek open sites where grain is available, including farmyards, fields, and areas around silos. | • All year | • no limit | • no limit | |
| ***Mammals*** | | | | | |
| desert cottontail<br>(*Sylvilagus audubonii*) | • This species is considered resident small game under the California Fish and Wildlife Code.<br>• Commonly found in grasslands, open forests, and desert-shrub habitats of southern deserts, Central Valley, and surrounding foothills. | • July 1 – January 27<br>• Falconry only (January 28-March 17) | • 5 per day | • 10 in possession | • Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| western gray squirrel<br>(*Sciurus griseus*) | • This species is considered resident small game under the California Fish and Wildlife Code.<br>• Fairy common locally in mature stands of most conifer, hardwood, and mixed hardwood-conifer habitats in the Klamath, Cascade, Transverse, Peninsular, and Sierra Nevada Ranges. Dependent upon mature stands of mixed conifer and oak habitats. Closely associated with oaks. Requires large trees, mast, and snags. | • The second Saturday in September through the last Sunday in January. | • 4 per day | • 4 in possession | • Hunting license is required. Must use ten-gauge shotgun or smaller, and no shot size larger than BB.<br>• On July 1, 2019 nonlead ammunition required. |
| gray fox<br>(*Urocyon cinereoargenteus*) | • This species is considered a furbearing mammal under the California Fish and Wildlife Code.<br>• Uncommon to common permanent resident of low to middle elevations throughout most of the state. Frequents most shrublands, valley foothill riparian, montane riparian, and brush stages of many deciduous and conifer forest and woodland habitats. Also found in meadows and cropland areas. Suitable habitat consists of shrublands, brushy and open-canopied forests, interspersed with riparian areas, providing water. | • November 24 – the last day of February | • no limit | • no limit | • Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted.<br>• On July 1, 2019 nonlead ammunition required. |

| Species | Habitat | General Season | Bag Limit | Possession Limit | Hunting Restrictions |
|---|---|---|---|---|---|
| black bear<br>(*Ursus americanus*) | • This species is considered a big game mammal under the California Fish and Wildlife Code.<br>• Widespread, common to uncommon resident occurring from sea level to high mountain regions. Occurs in fairly dense, mature stands of many forest habitats, and feeds in a variety of habitats including brushy stands of forest, valley foothill riparian, and wet meadow. | • Opening day of deer season through the last Sunday in December. | • 1 adult/season/tag | • 1 adult/season/tag | • Requires hunting license and hunting tags. May use approved rifles, bow and arrow, and approved shotguns. Cubs and females accompanied by cubs may not be taken.<br>• On July 1, 2019 nonlead ammunition required. |
| American mink<br>(*Mustela vison*) | • This species is considered a furbearing mammal under the California Fish and Wildlife Code.<br>• Uncommon permanent resident, generally occurring in the northern half of the state. Semiaquatic, inhabiting most aquatic habitats, including some coastal areas. Occurs at elevation up to about 9,000 feet. | • November 16 – March 31 | • no limit | • no limit | • Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted.<br>• On July 1, 2019 nonlead ammunition required. |
| Raccoon<br>(*Procyon lotor*) | • This species is considered a furbearing mammal under the California Fish and Wildlife Code.<br>• Widespread, common to uncommon permanent resident throughout most of the state. Occurs in a ll habitats except alpine and desert types without water; marginal in Great Basin shrub types. Most abundant in riparian and wetland areas at low to middle elevations. | • November 16 – March 31 | • no limit | • no limit | • Hunting license is required. May use firearms, bow and arrow, poison under special permit, and approved traps with trapping permit. Dogs permitted. When taking raccoon after dark, pistols and rifles not large than.22 caliber rimfire and shotguns using shot no larger than BB may be used.<br>• On July 1, 2019 nonlead ammunition required. |
| Bobcat<br>(*Lynx rufus*) | • Common throughout the state, except at higher elevations. Abundant at lower elevations in herbaceous and desert-shrub areas and open, early stages of forest and chaparral habitats. | • October 15 – February 28 | • 5 bobcats per season | • 5 bobcats per season | • Hunting license is required. Bobcat Hunting Tags also required. Dogs are not permitted.<br>• It is unlawful to trap any bobcat, or attempt to do so, or sell or export any bobcat from the State of California.<br>• Any holder of a trapping license who traps a bobcat shall immediately release the bobcat to the wild unharmed. |
| Mule deer<br>(*Odocoileus hemionus*) | • This species is considered a big game mammal under the California Fish and Wildlife Code. | • The season in Zone D-8 shall open on the fourth Saturday in September and extend for 30 consecutive days. | • 1 buck/tag | • 1 buck/tag | • Requires hunting license and hunting tags. May use approved rifles, bow and arrow, approved shotguns, and crossbows. Only bucks with antlers with demonstrable forks (or greater) may be taken.<br>• On July 1, 2019 nonlead ammunition required. |
| Wild pig<br>(*Sus scrofa*) | • This species is considered a big game mammal under the California Fish and Wildlife Code.<br>• Wild pigs currently exist in 56 of the state's 58 counties and can be found in a variety of habitats ranging from woodland, chaparral, meadow and grasslands. Wild pigs are omnivorous, consuming both plant and animal matter. In general, wild pigs feed on: grasses and forbs in the spring; mast and fruits in the summer and fall; and roots, tubers and invertebrates throughout the year. | • All Year | • no limit | • no limit | • Requires a hunting license and a wild pig tag.<br>• On July 1, 2019 nonlead ammunition required.<br>• Dogs permitted, but only 3 dogs per hunter are allowed. |

This Page Intentionally Left Blank

**Table 7.5-10. Species Observed Using Wildlife Bridges and Escape Ramps During 2018 Monitoring**

| Species[1] | Number of Observations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Spring | | | | Fall | | | | Total No. Observations |
| | Kaweah No. 2 Flowline | | Kaweah No. 3 Flowline | | Kaweah No. 2 Flowline | | Kaweah No. 3 Flowline | | |
| | Wildlife Bridges | Escape Ramps | Wildlife Bridges | Escape Ramps | Wildlife Bridges | Escape Ramps | Wildlife Bridges | Escape Ramps | |
| mule deer (*Odocoileus hemionus*) | 93 | 0 | 1 | 0 | 203 | 0 | 2 | 0 | 299 |
| gray fox (*Urocyon cinereoargenteus*) | 42 | 0 | 0 | 0 | 55 | 0 | 26 | 0 | 123 |
| bobcat (*Lynx rufus*) | 48 | 0 | 7 | 0 | 30 | 0 | 7 | 0 | 92 |
| coyote (*Canis latrans*) | 17 | 0 | 0 | 0 | 65 | 0 | 1 | 0 | 83 |
| striped skunk (*Mephitis mephitis*) | 5 | 0 | 0 | 0 | 2 | 0 | 12 | 0 | 19 |
| cow (*Bos taurus*) | 0 | 0 | 3 | 0 | 0 | 0 | 11 | 0 | 14 |
| raccoon (*Procyon lotor*) | 7 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 11 |
| black bear (*Ursus americanus*) | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 4 |
| mountain lion (*Puma concolor*) | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| western spotted skunk (*Spilogale gracilis*) | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 |
| Virginia opossum (*Didelphis virginiana*) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

[1] Species are listed in order of most commonly observed to least commonly observed species.

This Page Intentionally Left Blank

# FIGURES

This Page Intentionally Left Blank

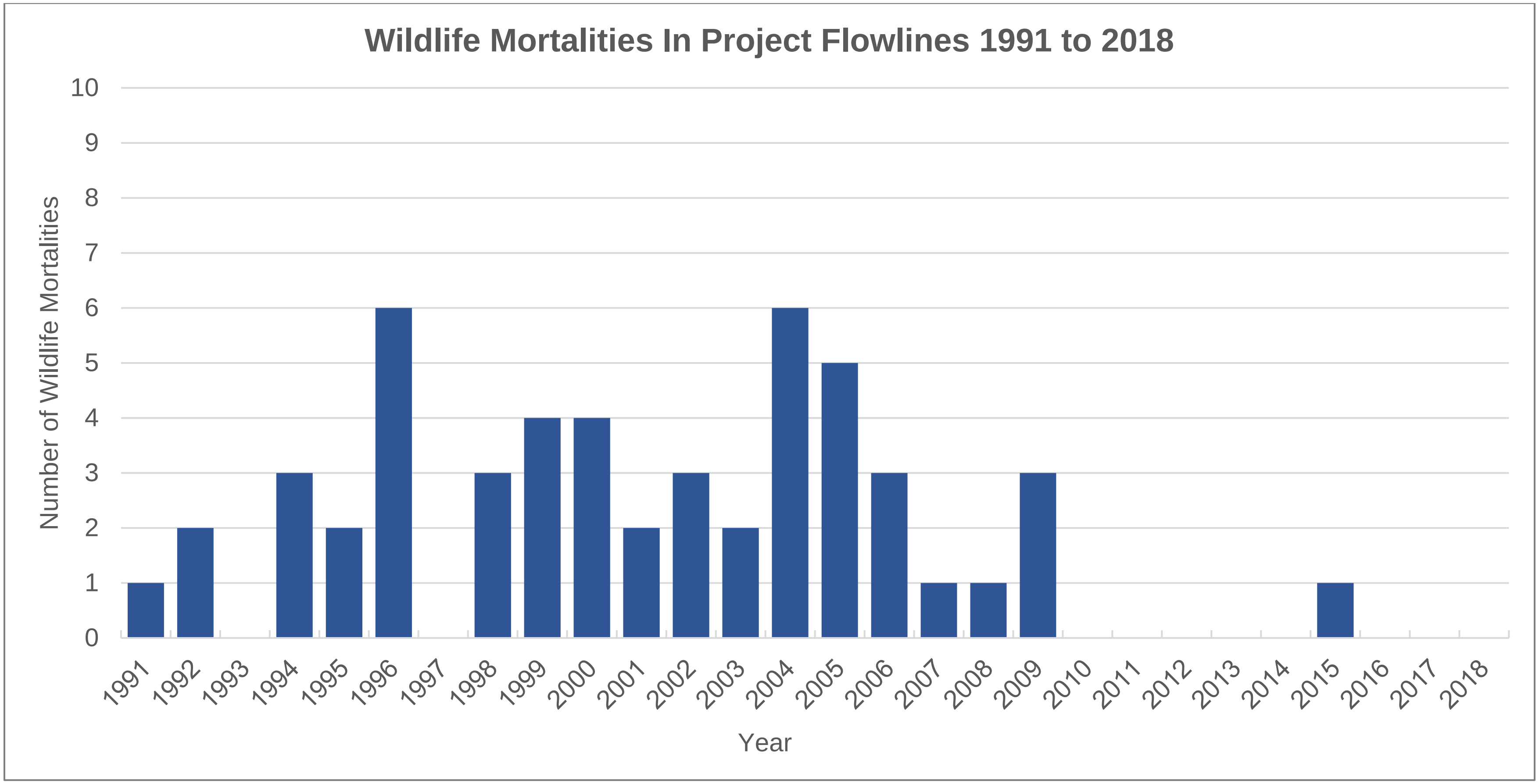



**Figure 7.5-1. Wildlife Mortalities in Project Flowlines 1991 to 2018**

This Page Intentionally Left Blank

# MAPS

This Page Intentionally Left Blank

# CONFIDENTIAL

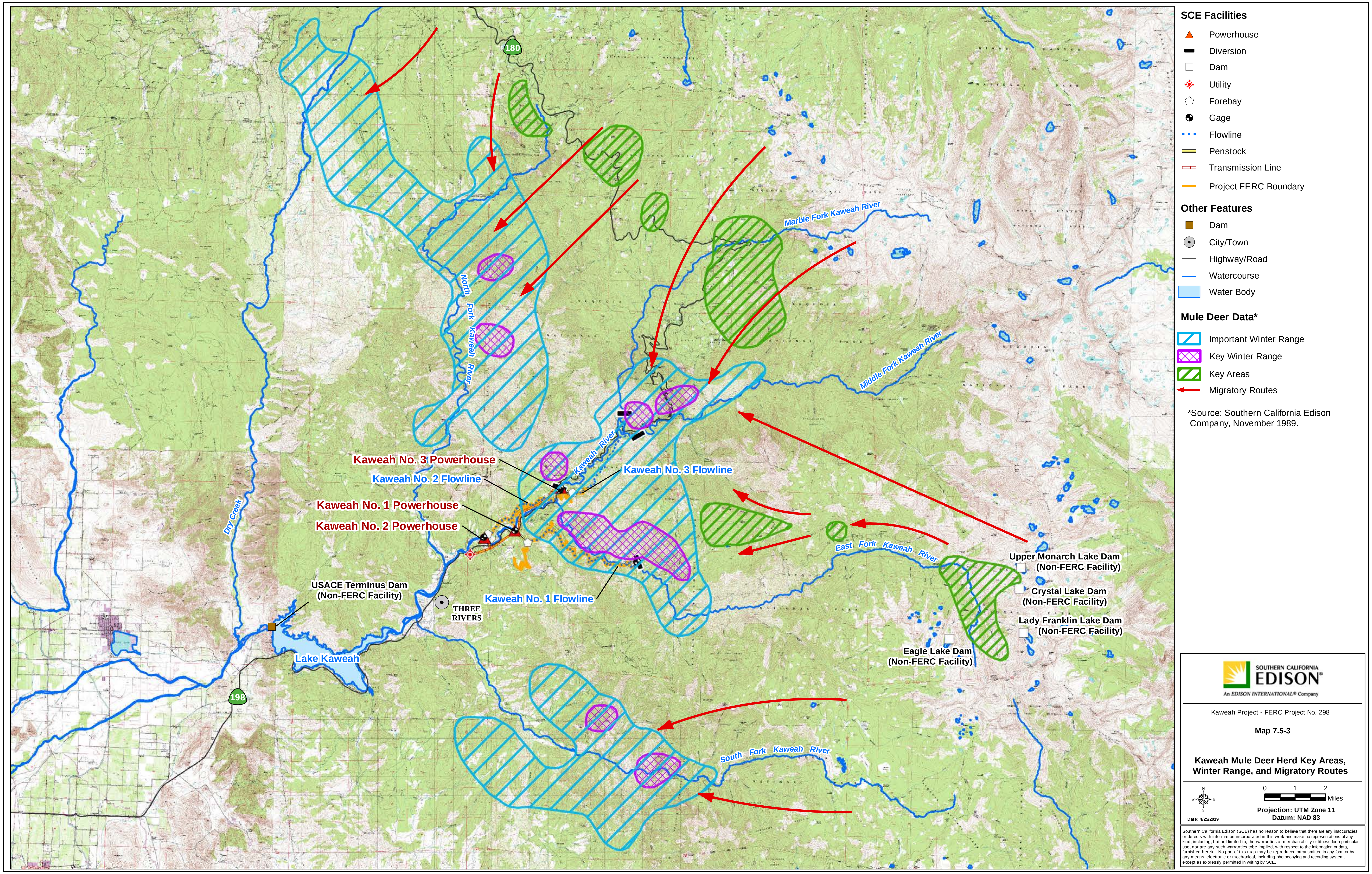
The following maps is being withheld from public disclosure in accordance with applicable regulations. These maps contains details on the locations of special-status biological resources and qualifies as Confidential Information [18 CFR §385.1112]. Disclosure of such information could be harmful to these resources. To further understand FERC's regulations regarding confidential filings visit https://www.ferc.gov/legal/ceii-foia/foia.asp

**Map 7.5-1 (a–t).** **CONFIDENTIAL Location of Munz's Iris and Non-native Invasive Plant in the Study Area**

**Map 7.5-2.** **CONFIDENTIAL Location of Special-Status Wildlife in the Study Area**

These maps will not be distributed to the general public. Documents containing Confidential Information may be requested by entities and organizations with jurisdiction over these resources. To request copies, please contact David Moore, SCE Relicensing Project Manager at (626) 302-9494, or david.moore@sce.com.

This Page Intentionally Left Blank


SCE Facilities
Powerhouse
Diversion
Dam
Utility
Forebay
Gage
Flowline
Penstock
Transmission Line
Project FERC Boundary
Other Features
Dam
City/Town
Highway/Road
Watercourse
Water Body
Mule Deer Data*
Important Winter Range
Key Winter Range
Key Areas
Migratory Routes
*Source: Southern California Edison Company, November 1989.
180
198
Marble Fork Kaweah River
Middle Fork Kaweah River
North Fork Kaweah River
Kaweah River
East Fork Kaweah River
South Fork Kaweah River
Dry Creek
Kaweah No. 3 Powerhouse
Kaweah No. 2 Flowline
Kaweah No. 3 Flowline
Kaweah No. 1 Powerhouse
Kaweah No. 2 Powerhouse
Kaweah No. 1 Flowline
USACE Terminus Dam (Non-FERC Facility)
THREE RIVERS
Lake Kaweah
Upper Monarch Lake Dam (Non-FERC Facility)
Crystal Lake Dam (Non-FERC Facility)
Lady Franklin Lake Dam (Non-FERC Facility)
Eagle Lake Dam (Non-FERC Facility)
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company
Kaweah Project - FERC Project No. 298
Map 7.5-3
Kaweah Mule Deer Herd Key Areas, Winter Range, and Migratory Routes
N
W
E
S
0
1
2
Miles
Projection: UTM Zone 11
Datum: NAD 83
Date: 4/25/2019
Southern California Edison (SCE) has no reason to believe that there are any inaccuracies or defects with information incorporated in this work and make no representations of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties tobe implied, with respect to the information or data, furnished herein. No part of this map may be reproduced ortransmitted in any form or by any means, electronic or mechanical, including photocopying and recording system, except as expressly permitted in writing by SCE.

This Page Intentionally Left Blank

## TABLE OF CONTENTS

Page



## LIST OF TABLES



## LIST OF FIGURES

## LIST OF MAPS



## LIST OF ACRONYMS

| | |
|---|---|
| ac-ft | acre-foot/feet |
| BLM | Bureau of Land Management |
| CDC | California Department of Conservation |
| cfs | cubic feet per second |
| Commission | Federal Energy Regulatory Commission |
| FERC | Federal Energy Regulatory Commission |
| msl | mean sea level |
| NRCS | Natural Resource Conservation Service |
| PAD | Pre-Application Document |
| Project | Kaweah Project |
| SCE | Southern California Edison Company |
| SD | Scoping Document |
| SNP | Sequoia National Park |
| TSR | Technical Study Report |
| USACE | U.S. Army Corps of Engineers |
| Watershed | Kaweah River Watershed |

## 7.6 GEOLOGY AND SOILS

This section describes the geology and soils in the vicinity of the Kaweah Project (Project). Specifically, this section describes: (1) the geologic setting in the vicinity of the Project, including the bedrock lithology, seismicity, structural features, glacial features, unconsolidated sediments, and mineral resources; (2) the soils in the vicinity of the Project, including factors pertaining to soil movement and erodibility; (3) the shorelines associated with the Project; (4) potential erosion associated with Project operations or maintenance activities, including Southern California Edison Company's (SCE) current Erosion Protection and Remediation Plan; and (5) sediment management practices at Project diversions, flowlines, and forebays. Additional information related to stream condition in the bypass reaches is included in Section 7.7 – Geomorphology.

### 7.6.1 Information Sources

This section was prepared utilizing existing information available in the following maps and documents:

- Environmental Assessment, Kaweah Project Federal Energy Regulatory Commission (FERC) Project No. 298-000 (FERC 1991);
- Evaluation of Geologic and Soils Conditions, Kaweah Hydroelectric Project, (Sholes 1989);
- Fault Activity Map of California, California Department of Conservation (CDC) (CDC 2010a);
- Geology of California (Norris R. and Webb, R. 1990);
- Geologic Map of California (CDC 2010b);
- Glacial Reconnaissance of Sequoia National Park (SNP) California (Matthes 1959);
- Limits of Tahoe glaciation in Sequoia and Kings Canyon National Parks, California (Moore and Mack 2008);
- Pre-Application Document (PAD) for the Kaweah Project (SCE 2016);
- Terminus Reservoir Geology, Paleontology, Flora & Fauna, Archaeology, History (Berryman, et al. 1966);
- U.S. Department of Agriculture – Natural Resource Conservation Service (NRCS) for soils information (NRCS 2019);
- U.S. Army Corps of Engineers (USACE) Kaweah River Investigation (USACE 1996);

- AQ 5 – Geomorphology Technical Study Report (TSR) (SCE 2019a) (AQ 5 – TSR), which is included in Supporting Document A (SD A); and

- LAND 1 – Transportation TSR (SCE 2019b) (LAND 1 – TSR), which is included in SD A.

### 7.6.2 Geologic Setting

The Project is situated along the western slope of the Sierra Nevada, at elevations ranging from about 2,585 feet above mean sea level (msl) at the Kaweah No. 1 Diversion Dam to 921 feet above msl at the Kaweah No. 2 Powerhouse. The upper Kaweah River Watershed (Watershed) is characterized by steep canyons with narrow "V-shaped" valley bottoms and steep, deeply-incised channels. The lower Watershed is characterized by rolling foothills with wider "U-shaped" valley bottoms and lower gradient and wider channels (floodplains). Topography in the Watershed is shown on Map 7.6-1.

#### 7.6.2.1 Bedrock Lithology

The Watershed primarily consists of mixed Cretaceous (Upper Mesozoic) granites and granodiorites of the Sierra Nevada batholith that intruded coherent older masses of Mesozoic metasedimentary and metavolcanic rocks. Quaternary till and talus and recent alluvium are the principal surficial deposits. A basic geologic time scale is provided in Table 7.6-1 for reference.

As shown on Map 7.6-2, the Cretaceous granites underlying the Project facilities primarily consist of granodiorite. Small bodies of mafic intrusive igneous rocks, mainly gabbro, are also present. The Mesozoic metasedimentary and metavolcanic rocks are expressed as large generally elongated roof pendants, mapped as perodotite. Contacts between the granitic and metamorphic rocks are deeply dipping. The roof pendants trend northwest, reflecting the orientation of bedding and foliation within the metamorphic bodies (Sholes 1989).

The Project facilities are situated on granitic rock. Bedrock outcrops occur in scattered locations; in a few areas, outcrops comprise up to 50% or more of the ground surface. Weathering of the granitic rock is variable; in some areas, the bedrock is completely decomposed to depths of 20 feet or more (FERC 1991).

#### 7.6.2.2 Seismicity

The Project is situated in an area with low historic seismicity. There are no known active faults[1] or fault zones in the immediate vicinity of the Project. In addition, there are no Alquist-Priolo Earthquake Fault Zones[2] identified in the Project vicinity (CDC 2015).

---

[1] The California Department of Conservation (CDC) defines an "Active Fault Zone" as an area of related faults that have exhibited surface displacement within the last 11,000 years.

[2] The Alquist-Priolo Earthquake Fault Zoning Act was passed into law following the 1971 San Fernando earthquake. The intent of the Act is to ensure public safety by prohibiting the siting of most structures for

The nearest known active fault is the Kern Canyon Fault, a northeast-southwest trending fault that extends from the mouth of the Kern River Canyon, through Lake Isabella and Kernville, through the SNP, terminating near Harrison Pass, approximately 32 miles east of the community of Three Rivers. Recent USACE field studies determined that the Kern Canyon Fault is active and capable of producing a 7.5-magnitude earthquake. The last movement on the Kern Canyon Fault appears to have occurred during the past 2,500 to 4,000 years, with an average interval between large earthquakes of about 3,200 years (USACE 2012). A moderate to large earthquake on this fault would likely produce ground shaking in the Project vicinity.

#### 7.6.2.3 Structural Features

There are very few structural features in the vicinity of the Project, primarily because the area is relatively inactive. The most prominent structural features are the roof pendants that occur in the Watershed. These features consist of older rocks stratigraphically positioned on top of younger intrusive rocks.

Massive, rounded, granitic domes that are typical of the Sierra Nevada occur in the Watershed. The most prominent of these is Moro Rock, which is located in the SNP between the Marble and Middle forks of the Kaweah River.

At least four caverns have been formed in the marble and limestone deposits in the Watershed. None are large, but all contain limestone cave features such as stalactites, stalagmites, and pillars (Norris and Webb 1990). The largest and most popular is Crystal Cove near the Giant Forest in the SNP.

#### 7.6.2.4 Glacial Features

The Sierra Nevada was glaciated several times during the Pleistocene Period. Glacial events modified the topography of the Watershed by forming wider, U-shaped valleys, particularly in the upper portions of the Watershed. Glaciers in the Kaweah Watershed were not extensive and terminated at approximately 6,100 feet, 5,100 feet, and 6,200 feet in the Marble, Middle, and East forks of the Kaweah River, respectively (Moore and Mack 2008).

Glacial deposits (moraines and till) have been mapped in the upper portions of the Watershed. The most prominent glacial deposit is located on the Marble Fork Kaweah River upstream of the Marble Fork Diversion Dam, where Highway 198 crosses the river (Map 7.6-2). Erosion of glacial deposits, such as till and moraines tend to contribute gravel-sized sediment to the streambeds downstream.

human occupancy across traces of active faults that constitute a potential hazard to structures from surface faulting or fault creep.

### 7.6.2.5 Unconsolidated Sediments

Aside from glacial deposits, unconsolidated sediments in the Watershed are generally limited to surface soils, and recent alluvium deposited in the stream and river courses and associated terraces. As shown on Map 7.6-2, a relatively large deposit of unconsolidated and semi-consolidated Quaternary alluvium is present in the vicinity of Three Rivers, extending along the North Fork Kaweah River and the Kaweah River to the upper end of Lake Kaweah.

### 7.6.2.6 Mineral Resources

Historic and current mining activity in the Watershed is shown on Map 7.6-3. As indicated, with the exception of one uranium prospect located near the Kaweah No. 1 Diversion Dam, there are no known historic or active mines located within the FERC Project boundary or the immediate vicinity. The only active mine in the vicinity of the Project is a crushed stone mining operation located due south of the community of Three Rivers (Map 7.6-3).

As indicated by the absence of productive mines, mineral resources in the Watershed are relatively limited, which is typical in areas dominated by granitic rock. As shown on Map 7.6-3, a variety of minerals have been identified in the Watershed, but only a few deposits have produced active mines. Deposits of lead were identified on the divide between the North Fork Kaweah River and the Middle Fork Kaweah River, but not in concentrations that could be economically mined. Tungsten was historically mined along the North Fork Kaweah River and the South Fork Kaweah River, southeast of Three Rivers. These northwest-southeast trending lead deposits appear to occur along or near the contact between the younger granitic and older metamorphic rocks (Map 7.6-2).

Silver and galena (a lead ore) were historically mined in the Mineral King Valley, which is located in the SNP at the headwaters of the East Fork Kaweah River, approximately 20 miles southeast of the community of Three Rivers. Silver was first discovered in the Mineral King Valley in 1872. Mining continued between 1873 and 1882, but these operations ceased when the ore was found to be difficult to smelt profitably (SCE 1992a).

Extensive deposits of limestone occur near Three Rivers along the South Fork Kaweah River, and on the Middle, Marble and East forks of the Kaweah River in the SNP. These deposits were mined historically but are not currently active.

## 7.6.3 Soils

Soils found within 0.5 mile of Project facilities and bypass reaches are shown on Map 7.6-4. Descriptions of each soil shown on the map, including taxonomy, parent rock, vegetation and erodibility (K Factor) are summarized in Table 7.6-2. Table 7.6-3 summarizes the soil types that underlie each Project facility, organized by development. The information is based entirely on detailed soil information developed by the NRCS (NRCS 2015).

In general, the soils shown on Map 7.6-4 can be classified into two categories as follows, based primarily on factors that pertain to the parent material from which the soil is derived:

- Soils formed on granitic bedrock are moderately deep and moderately coarse-grained. These soils are subject to erosion, particularly when devoid of vegetated cover (USACE 1996).

- Soils formed on metamorphic and volcanic bedrock are shallow, well drained, slightly acidic, rocky, and medium-textured. These soils are relatively stable and well vegetated.

As indicated on the map and tables, most of soils within 0.5 mile of the East Fork Kaweah River and within 0.5 mile of the Kaweah River, including the soils underlying the Project facilities, were formed on granitic bedrock, meaning they are moderately deep and moderately coarse-grained and are subject to erosion, particularly when devoid of vegetated cover. The excessively well-drained nature of the soils can make revegetation difficult, especially on steeper slopes. Soils derived from metasedimentary rocks do not occur in the immediate vicinity of the Project or within 0.5 mile of a Project facility, but they do occur downstream near Three Rivers. Minor deposits of alluvium (stream deposits) and colluvium (material moved by gravity) occur at scattered locations throughout the area, primarily within the active stream channels and terraces.

One of the parameters used by the NRCS in assessing the susceptibility of a soil to erosion is the K factor. This factor assesses the susceptibility of the soil to sheet and rill erosion and is dependent upon the percentages of clay, silt, sand, and organic matter in the soil. In general, soils with low K factors are less susceptible to erosion and soils with high K factors are more susceptible to erosion. The K factor for each of the soil types in the vicinity of the Project are provided on Tables 7.6-2 and 7.6-3. As indicated, K values for the soils underlying Project facilities range from 0.15 to 0.37, meaning they have low to moderate susceptibility to erosion when there is minimal vegetative cover. Areas with good vegetative cover would have a lower overall potential for erosion.

### 7.6.4 Shorelines

This section describes the shorelines associated with the Project, including potential erosion issues. A description of the streambank/channel conditions in the river reaches downstream of the Project diversion dams (bypass reaches) is provided in Section 7.7 – Geomorphology.

The Project under FERC jurisdiction does not have any impoundments/reservoirs. The Project is operated in a run-of-river mode with water diverted from the Kaweah River and East Fork Kaweah River at the Kaweah No. 2 Diversion Dam/Pool and the Kaweah No. 1 Diversion Dam/Pool, respectively. The Kaweah No. 1 Diversion Dam is a 6-foot high overflow concrete gravity dam, with a crest length of 20 feet at an elevation of 2,583 feet. The Kaweah No. 1 Diversion Pool has a design and current capacity of approximately 0.03 acre-feet (ac-ft). The Kaweah No. 2 Diversion Dam is a 7-foot high masonry overflow gravity dam, with an overall crest length of 161 feet at an elevation of 1,365 feet. The

Kaweah No. 2 Diversion Pool has a design capacity of approximately 1–2 ac-ft. Over time, this diversion pool has filled in with sediment and it currently has a capacity of approximately 0.2 ac-ft.

The Kaweah No. 1 and Kaweah No. 2 diversion dams/pools are situated in granitic bedrock. Therefore, there is very minimal potential for erosion in the immediate vicinity of the dams or along the perimeters of small pools formed behind the diversion pools. In addition, the bedrock/large boulder channels upstream of the diversion pools have little potential for erosion. The Project also includes three small concrete-lined forebays which are not subject to erosion. A description of each forebay is provided in in Section 3.2.3.

### 7.6.5 Potential Erosion Associated with Project Operation and Maintenance Activities

The Project facilities are well-maintained and the surrounding landscape is relatively stable. Minimal erosion is present on the slopes surrounding the Project facilities. As discussed in the following subsections, potential erosion issues are primarily limited to: (1) operation and maintenance of the Project flowlines and forebays; and (2) use and maintenance of the Project access roads and trails.

#### 7.6.5.1 Flowlines

The flowlines are narrow and contour the hillsides, so there are limited areas of cut and fill that could be subject to erosion or slope instability (FERC 1991). Runoff from the slopes above the flowlines is directed through culverts and overflow chutes, which helps minimize erosion.

Breaks in the flowlines could potentially cause erosion. Historically, these breaks caused substantial erosion, creating gullies and channels up to 40 feet wide and 10 to 15 feet deep. These channels have since been revegetated by native grasses and scattered brush. In accordance with License Article 401, SCE prepared an Erosion Protection and Remediation Plan in 1992 to address Project-related erosion, including potential erosion from flowline breaks. The plan was subsequently revised and FERC approved the revised plan in an Order issued January 29, 1993. In addition to addressing specific erosion issues that were identified during the previous relicensing effort, the plan includes erosion protection measures that SCE is required to implement in the event of a future flowline break. The plan specified actions that were to be implemented in the event of a break, including shutting off the flow within two hours (Sholes 1989; SCE 1992b). Implementation of the measures outlined in this plan has substantially reduced the potential for erosion and other forms of instability associated with the Project.

#### 7.6.5.2 Forebays

In the event of an unplanned powerhouse outage (i.e., unit trips), water in the flowlines continues to flow (drain) into the forebays until the diversion is turned out (closed). Water entering the forebay can either be: (1) passed through the generating units at the powerhouse (if operational); (2) released through the powerhouse bypass value (if present); or (3) released from each forebay/tank via Project spillways/spillway chutes that direct the overflow into natural drainage channels for conveyance to the Kaweah River.

Periodic spills from the forebays (due to powerhouse outages) have occurred into natural drainages via the spillways/spillway chutes for decades. These spills generally last for less than a day. A description and the location of the forebay spillways/spillway chutes and associated natural drainage channels are described below and shown on Maps 7.6-5 through 7.6-7.

**Kaweah No. 1 Forebay Tank Spillway Flume and Natural Drainage Channel**

The Kaweah No. 1 Forebay consists of a 24-foot diameter steel tank with a capacity of 0.18 ac-ft. Overflow from the Kaweah No. 1 Forebay Tank is directed through a spill flume into a natural drainage channel located adjacent to the penstock (Map 7.6-5). There is also a drain and pipe from the bottom of the tank directed approximately 50 feet downslope adjacent to the penstock. Once in the natural channel, the water travels approximately 0.72 mile downslope before flowing into the Kaweah River just south of the Kaweah No. 1 Powerhouse Campus. This drainage channel is very steep and heavily vegetated. In aerial photographs of the area there is extensive bedrock in the vicinity of the channel and there is no evidence of extensive erosion, rather the channel appears similar to adjacent natural drainage channels on the hillside. Field verification of the upper portion of the channel has not been attempted due to safety concerns. The bottom 0.25 mile of channel, near the river, is dominated by coarse boulders, cobbles and bedrock and there is no evidence of excessive erosion due spills (Figure 7.6-1a-c).

**Kaweah No. 2 Forebay Spillways and Natural Drainage Channels**

The Kaweah No. 2 Forebay is an enlargement of the Kaweah No. 2 Flowline that extends approximately 180 feet and has a cross section 13-feet wide by 14-feet deep and a capacity of 0.75 ac-ft. At the Kaweah No. 2 Forebay, up to 87 cubic feet per second (cfs) can spill into three concrete-lined spillway chutes, which discharge into natural drainage channels (Map 7.6-6). The primary spillway drainage channel is located adjacent to the forebay and receives spill flows up to 40 cfs. The drainage channel is approximately 0.23-mile long and flows into the Kaweah No. 2 Tailrace. The two smaller drainages converge approximately 220 feet downslope and then continue downslope to the Kaweah River, discharging approximately 0.16 mile upstream of the Kaweah No. 2 Powerhouse. The upper sections of the three spillway drainage channels are very steep, with slopes exceeding 50%. Figure 7.6-2a shows the primary drainage channel with approximately 10 cfs of water.

The three spillway drainage channels show evidence of historical incision through the decomposed granite to the underlying granitic bedrock (Figure 7.6-2b). Most of the vertical erosion occurred several decades ago based on the size of the trees currently established along the channel margins. The side slopes of the upper sections of the drainages are generally comprised of bedrock or coarse boulders or decomposed granite, with relatively minimal vegetative cover. Some ongoing instability occurs in the upper portion of the primary channel where the decomposed granite/soil horizon overlays the bedrock (Figure 7.6-2c). The other bedrock or large boulder sections are stable (Figure 7.6-2d). The lower portions of the drainage channels are lower gradient and well vegetated, which reduces the erosion potential.

**Kaweah No. 3 Forebay Spillway Chute and Natural Drainage Channels**

The Kaweah No. 3 Forebay is an embankment concrete forebay with a capacity of approximately 11 ac-ft. At Kaweah No. 3 Forebay, up to 97 cfs of flow can spill into an approximate 75-foot long concrete-lined spillway chute that begins at the upstream end of the forebay (Map 7.6-7). The chute discharges into an adjacent natural drainage channel that flows approximately 0.3 mile downslope into the Kaweah River. Spills occur periodically and generally last for less than a day. The drainage is very narrow and steep (approximately 38% gradient), and is primarily comprised of large boulders and bedrock and is well vegetated (Figure 7.6-3a-d). The large substrate / bedrock acts as rip-rap and well-vegetated side slopes limit the potential for down cutting and erosion of the side slopes. At the confluence with the Kaweah River, the drainage is vegetated, with no large sediment deposits at the margins of the channel. There is no evidence of excessive erosion due spills (Figure 7.6-3e).

A forebay drainage channel exists on the downstream side of the forebay. During sediment removal activities (see below), or other activities where the forebay is drained, water is released from the low-level outlet and enters a short concrete chute. The chute discharges into a natural drainage channel that flows approximately 0.5 mile downslope into the Kaweah River within the SNP (Map 7.6-7). From aerial photographs, the drainage is very narrow and steep, well vegetated, and appears to be primarily comprised of large boulders and bedrock. There is no evidence of excessive erosion due spills.

### 7.6.5.3 Project Roads and Trails

The Project includes various Project roads and trails that are used to access the Project facilities for operation and maintenance purposes. A list of the Project access roads and trails is provided in the Table 3-5.

A detailed assessment of the Project roads and trails, and all associated drainage and erosion control features (e.g., culverts, water bars, and drainage channels) was conducted in 2018 using the methods identified in the LAND 1 – Transportation System TSP. The assessment results are documented in the LAND 1 – TSR, included in SD-A. A characterization of each Project road and trail, including overall length, width, surface treatment and overall condition is provided in Table LAND 1-3 (included in the LAND 1 – TSR). In addition, detailed descriptions of all of the features that occur along the Project roads and trails, including erosion control features, are provided in Appendix C of the LAND 1 – TSR.

All of the Project trails and most of the Project roads are unpaved and therefore susceptible to erosion. Erosion of the roads and trails is controlled by directing runoff along the road through drainage features such as ditches or water bars, or under the road via culverts and downdrains. However, erosion of the trail or road surface can occur when the amount of runoff exceeds the capacity of the erosion control features, or when these features are damaged or blocked by debris. In addition, erosion can occur where concentrated runoff has been directed down natural slopes.

To minimize the potential for erosion, SCE regularly inspects the Project access roads and trails, including erosion control features, during normal Project activities, and makes repairs, as necessary. Minor repairs are conducted on an as-needed basis and major repairs are implemented annually in consultation with the appropriate resource agencies. In general, SCE regrades the Project roads and maintains the adjacent ditches annually (FERC 1991).

During the previous relicensing effort, active erosion was identified along specific sections of the Mineral King Road that had the potential to undercut the support legs of the adjacent Kaweah No. 1 Flowline (SCE 1992b; FERC 1999). SCE has since addressed this issue as outlined in the Erosion Protection and Remediation Plan and associated monitoring, which are required by License Articles 401 and 402, respectively (refer to Section 7.6.5.1).

### 7.6.6 Sediment Management

SCE conducts routine sediment management activities at the following locations:

- Kaweah No. 1 Intake Structure
    - The low-level outlet at the sandbox is routinely opened during high flows to flush sand and gravel into the active stream channel. If larger substrate becomes trapped in the sandbox, it is typically removed by hand and placed back into the active channel during the fall maintenance outage.
- Kaweah No. 1 Forebay Tank
    - A low-level outlet in the forebay tank is routinely opened during normal operations to flush sand and fine sediment from the bottom of the tank into an adjacent natural drainage channel. Any large material remaining in the bottom of the tank is removed by hand during the fall maintenance outage.
- Kaweah No. 2 Diversion Pool/Intake
    - The Kaweah No. 2 Diversion Pool has a design capacity of approximately 1–2 ac-ft. Over time, the diversion pool has filled in with sediment and it currently has a capacity of approximately 0.2 ac-ft. No sediment management activities have occurred since issuance of the current license other than removal of a small amount of sediment blocking the intake structure.
- Kaweah No. 2 Forebay
    - The forebay has several low-level outlets which are routinely opened during normal operations to flush small accumulation of sand and fine sediment from

the bottom of the forebay into natural drainages. Any large build-up of material is removed by hand during the fall maintenance outage.

- Kaweah No. 3 Forebay
    - Active sediment removal in the forebay occurs approximately every five years. Heavy equipment is used to remove the sediment. The majority of the sediment removed is composed of sand. Prior to sediment removal, water in the forebay is lowered, first by passing water via the penstock through the Kaweah No. 3 Powerhouse. As the forebay water level approaches the elevation of the intake structure, diversion through the powerhouse is discontinued and the remainder of the water is released through the forebay's low-level outlet. Water released from the low-level outlet enters a short concrete chute. The chute discharges into a natural drainage channel that flows approximately 0.5 mile downslope into the Kaweah River within the SNP (Map 7.6-7). Sediment removal with heavy equipment occurs once the sediment in the bottom of the forebay dries. Most recently, in the summer of 2018, approximately 2,500 cubic yards of sediment was removed from the forebay. The forebay is located on lands managed by the U.S. Bureau of Land Management (BLM). SCE consults with BLM on the disposition of the material prior to initiation of sediment removal activities.

### 7.6.7 Literature Cited

Berryman, Lorin E., and Dr. Albert B. Elasser. 1966. Terminus Reservoir: Geology, Paleontology, Flora & Fauna, Archaeology, History. U.S. Army Corps of Engineers, Sacramento District.

CDC (California Department of Conservation). 2010a. Geologic Map of California – 2010. California Geological Survey Geologic Data Map No. 2. Available at: https://www.conservation.ca.gov/cgs/maps-data/rgm.

CDC. 2010b. Fault Activity Map of California – 2010. California Geological Survey Geologic Data Map No. 6. Available at: http://maps.conservation.ca.gov/cgs/fam/.

CDC. 2015. The Alquist-Priolo Earthquake Zoning Act. Available at: https://www.conservation.ca.gov/cgs/alquist-priolo.

FERC (Federal Energy Regulatory Commission). 1991. Environmental Assessment Federal Energy Regulatory Commission, Office of Hydropower Licensing, Division of Project Review Kaweah Project, FERC Project No. 298-000 – California. August 16.

FERC. 1999. FERC Approval Erosion Monitoring Filing. Dated August 13, 1999.

Matthes, F.E. 1959. Glacial Reconnaissance of Sequoia National Park California. Prepared posthumously by F. Fryxell. U.S. Department of the Interior. Geological Survey Professional Paper 504-A. Available at: http://npshistory.com/publications/geology/pp/504-A/.

Moore, J.G., and Gregory S. Mack. 2008. Map showing limits of Tahoe glaciation in Sequoia and Kings Canyon National Parks, California. 2008. U.S. Geological Survey Scientific Investigations Map 2945, scale 1:125,000 Available at: http://pubs.usgs.gov/sim/2945/.

Norris, Robert M., and Robert W. Webb. 1990. Geology of California. Second Edition.

Sholes, R.C. 1989. Southern California Edison Company (SCE) Geotechnical Group. Evaluation of Geologic and Soils Conditions, Kaweah Hydroelectric Project, Tulare County, California. August.

SCE (Southern California Edison Company). 1992a. Cultural Resources Management Plan for Southern California Edison Company's Kaweah Hydroelectric Project Tulare County, California, FERC Project No. 298. November 1992.

SCE. 1992b. Final Erosion Protection and Remediation Plan. Kaweah Hydroelectric Project. Tulare County, California. November.

SCE. 2016. Pre-Application Document (PAD) for the Kaweah Project.

SCE. 2019a. AQ 5 – Geomorphology Technical Study Report (TSR). Available in Supporting Document A.

SCE. 2019b. LAND 1 – Transportation TSR. Available in Supporting Document A.

NRCS (U.S. Department of Agriculture – Natural Resources Conservation Service). 2019. Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

UCMP (University of California Museum of Paleontology). Geologic Time Scale. Available at: http://www.ucmp.berkeley.edu/help/timeform.php.

USACE (U.S. Army Corps of Engineers). 1996. Kaweah River Investigation, California, Final Feasibility Report. U.S. Department of the Army, South Pacific Division, Sacramento District. September. Available at: http://elibrary.ferc.gov/idmws/File_list.asp?document_id=13759225.

USACE. 2012. Isabella Lake Dam Safety Modification Project Environmental Impact Statement, Draft. March 2012. Available at: http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/ISABELLA_DSM_DEIS_Volume_I_13MAR12.pdf.

This Page Intentionally Left Blank

# TABLES

This Page Intentionally Left Blank

## Table 7.6-1. Simplified Geologic Time Scale

| Eon | Era | Period | Years Before Present (MYA = Million Years Ago) |
|---|---|---|---|
| Phanerozoic (542.0 mya to present) | Cenozoic (65.5 mya to present) | Quaternary | 2.6 mya to present |
| | | Holocene | 11,700 yrs to present |
| | | Pleistocene | 2.588 mya to 11,700 yrs |
| | | Tertiary | 65.5 to 2.6 mya |
| | Mesozoic (251.0 to 65.5 mya) | Cretaceous | 145.5 to 65.5 mya |
| | | Jurassic | 199.6 to 145.5 mya |
| | | Triassic | 251.0 to 199.6 mya |
| | Paleozoic (542.0 to 251.0 mya) | Permian | 299.0 to 251.0 mya |
| | | Carboniferous | 359.2 to 299.0 mya |
| | | Devonian | 416.0 to 359.2 mya |
| | | Silurian | 443.7 to 416.0 mya |
| | | Ordovician | 488.3 to 443.7 mya |
| | | Cambrian | 542.0 to 488.3 mya |
| | Precambrian | | |

Source: Adapted from Geologic Time Scale, University of California Museum of Paleontology (http://www.ucmp.berkeley.edu/help/timeform.php).

This Page Intentionally Left Blank

## Table 7.6-2. Description of Soils Within 0.5 Mile of the Kaweah Project Facilities, Organized by Soil Code

| Code (Corresponds to Map 7.6-4) | Association | Soil Description | Slope | Taxonomy | Parent Rock | Erosion K Factor[1] | Vegetation |
|---|---|---|---|---|---|---|---|
| 102 | Auberry sandy loam | deep, well drained soils that formed in material weathered from intrusive, acid igneous rocks | 15 to 30% slope | Fine-loamy, mixed, semiactive, thermic Ultic Haploxeralfs | intrusive acid igneous rocks, principally quartz diorite or grandiorite | 0.24 | woodland grass, annual grasses and forbes, and brush |
| 103 | Auberry sandy loam | deep, well drained soils that formed in material weathered from intrusive, acid igneous rocks | 30 to 50% slope | Fine-loamy, mixed, semiactive, thermic Ultic Haploxeralfs | intrusive acid igneous rocks, principally quartz diorite or grandiorite | 0.24 | woodland grass, annual grasses and forbes, and brush |
| 105 | Blasingame sandy loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 9 to 15% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| 106 | Blasingame sandy loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 15 to 30% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| 107 | Blasingame sandy loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| 108 | Blasingame rock outcrop complex | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 9 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| 116 | Cieneba-Rock | very shallow and shallow, somewhat excessively drained soils that formed in material weathered from granitic rock | 15 to 75% slope | Loamy, mixed, superactive, nonacid, thermic, shallow Typic Xerorthents | granite and other rocks of similar texture and composition | 0.24 | chaparral and chemise with widely spread foothill pine or oak tree, small area of thin annual grasses and weeds |
| 118 | Coarsegold loam | moderately deep, well drained soils that formed from weathered schist | 15 to 30% slope | Fine-loamy, mixed, superactive, thermic Mollic Haploxeralfs | metasedimentary rocks of mica schist, quartz, gneiss or quartzite | 0.28 | chaparral composed of chamise, scrub oak, birchleaf mountain mahogany, eastern manzanita, cupleaf ceanothus, and yucca<br>Open Area: ground cover of cheatgrass, wild oats and other annual grasses and weeds |
| 119 | Coarsegold loam | moderately deep, well drained soils that formed from weathered schist | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Mollic Haploxeralfs | metasedimentary rocks of mica schist, quartz, gneiss or quartzite | 0.28 | chaparral composed of chamise, scrub oak, birchleaf mountain mahogany, eastern manzanita, cupleaf ceanothus, and yucca<br>Open Area: ground cover of cheatgrass, wild oats and other annual grasses and weeds |
| 123 | Crouch-Rock outcrop complex | deep, well drained soils that formed in material weathered from granitic rock | 15 to 50% slope | Coarse-loamy, mixed, superactive, mesic Ultic Haploxerolls | igneous (granitic) rocks | - | annual grasses and forbs with open stands of timber at higher elevations |
| 128 | Fallbrook sandy loam | deep, well drained soils that formed in material weathered from granitic rocks | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | material weathered from granite and closely related granitic rocks | 0.28 | annual grasses and forbs with considerable chaparral, chamise, flattop buckwheat and other shrubs |
| 130 | Friant-Rock outcrop complex | shallow, well drained soils that formed in material weathered from mica schist, quartz schist and gneiss | 15 to 75% slope | Loamy, mixed, superactive, thermic Lithic Haploxerolls | residuum weathered from mica schist, quartz schist, and gneiss | 0.28 | buckwheat, chaparral, and naturalized grasses and forbs |

| Code (Corresponds to Map 7.6-4) | Association | Soil Description | Slope | Taxonomy | Parent Rock | Erosion K Factor[1] | Vegetation |
|---|---|---|---|---|---|---|---|
| 136 | Holland loam | very deep, well drained soils that formed in material weathered from granitic rock | 15 to 30% slope | Fine-loamy, mixed, semiactive, mesic Ultic Haploxeralfs | granitic rocks | 0.24 | semi-dense stands of ponderosa pine and incense cedar with some white fir, sugar pine, black or canyon live oak with an understory of bear clover and manzanita |
| 137 | Holland loam | very deep, well drained soils that formed in material weathered from granitic rock | 30 to 50% slope | Fine-loamy, mixed, semiactive, mesic Ultic Haploxeralfs | granitic rocks | 0.24 | semi-dense stands of ponderosa pine and incense cedar with some white fir, sugar pine, black or canyon live oak with an understory of bear clover and manzanita |
| 138 | Holland-Rock outcrop complex | very deep, well drained soils that formed in material weathered from granitic rock | 15 to 50% slope | Fine-loamy, mixed, semiactive, mesic Ultic Haploxeralfs | granitic rocks | | semi-dense stands of ponderosa pine and incense cedar with some white fir, sugar pine, black or canyon live oak with an understory of bear clover and manzanita |
| 140 | Honcut sandy loam | very deep, well drained soils that formed in moderately coarse textured alluvium from basic igneous and granitic rocks | 2 to 5% slope | Coarse-loamy, mixed, superactive, nonacid, thermic Typic Xerorthents | alluvium dominantly from basic rocks but are derived from acid igneous rocks in some places | 0.2 | open parklike areas of annual grasses, herbs and scattered oaks |
| 142 | Las Posas loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 15 to 30% slope | Fine, smectitic, thermic Typic Rhodoxeralfs | material weathered from basic igneous rocks | 0.37 | annual grasses, forbs, and broadleaf chaparral |
| 143 | Las Posas loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 30 to 50% slope | Fine, smectitic, thermic Typic Rhodoxeralfs | material weathered from basic igneous rocks | 0.37 | annual grasses, forbs, and broadleaf chaparral |
| 151 | Riverwash | - | - | - | - | - | - |
| 152 | Rock outcrop | - | - | - | - | - | - |
| 160 | Sheephead-Rock outcrop complex | shallow, somewhat excessively drained soils that formed in material weathered from mica, schist, gneiss, or granite | 15 to 75% slope | Loamy, mixed, superactive, mesic, shallow Entic Ultic Haploxerolls | material weathered from granitic rocks | 0.17 | mainly chaparral but in the lower rainfall area it is scrub oak, pinyon pine, and digger pine |
| 164 | Tujunga sand | very deep, somewhat excessively drained soils that formed in alluvium from granitic sources | | Mixed, thermic Typic Xeropsamments | alluvium weathered from granitic sources or similar | 0.02 | Uncultivated areas have a cover of shrubs, annual grasses, and forbs. In urban areas ornamentals and turf-grass are common |
| 165 | Vista coarse sandy loam | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 9 to 15% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| 166 | Vista coarse sandy loam | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 15 to 30% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| 167 | Vista coarse sandy loam | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 30 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |

| Code (Corresponds to Map 7.6-4) | Association | Soil Description | Slope | Taxonomy | Parent Rock | Erosion K Factor[1] | Vegetation |
|---|---|---|---|---|---|---|---|
| 168 | Vista-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks, 9 to 15% slope | 9 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| 169 | Walong sandy loam | moderately deep, well drained soils that formed in material weathered from granitic rocks | 15 to 30% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls | material weathered from granite | 0.2 | annual grasses, blue oaks, and live oaks |
| 171 | Walong-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from granitic rocks | 15 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls | material weathered from granite | 0.15 | annual grasses, blue oaks, and live oaks |
| 173 | Wyman loam | deep, well drained soils that formed in alluvium from andesitic and basaltic rocks | 2 to 5% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | alluvium originating from andesitic and basaltic rocks | 0.37 | annual grasses and herbs with a few scattered oaks |
| 175 | Xerofluvents | - | - | - | - | - | - |
| 178 | Water | - | - | - | - | - | - |

Source: USDA NRCS Official Soil Series Descriptions (OSDs) (NRCS 2019)

[1] The K factor assesses the susceptibility of soil to sheet and rill erosion and is dependent upon the percentages of clay, silt, sand, and organic matter in the soil. In general, soils with low K factors are less susceptible to erosion and soils with high K factors are more susceptible to erosion.

This Page Intentionally Left Blank

**Table 7.6-3. Description of Soils Underlying the Kaweah Project Facilities, Organized by Development**

| Project Facility | Code (Corresponds to Map 7.6-4) | Association | Soil Description | Slope | Taxonomy | Parent Rock | Erosion K Factor[1] | Vegetation |
|---|---|---|---|---|---|---|---|---|
| **Kaweah No. 1 Development** | | | | | | | | |
| Kaweah No 1 Diversion Dam<br>Kaweah No. 1 Flowline | 128 | Fallbrook sandy loam | deep, well drained soils that formed in material weathered from granitic rocks | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | material weathered from granite and closely related granitic rocks | 0.28 | annual grasses and forbs with considerable chaparral, chamise, flattop buckwheat and other shrubs |
| Kaweah No. 1 Flowline | 152 | Rock outcrop | - | - | - | - | - | - |
| Kaweah No. 1 Flowline<br>Kaweah No. 1 Forebay Tank<br>Kaweah No. 1 Penstock<br>Kaweah No. 1 Powerhouse | 171 | Walong-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from granitic rocks | 15 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls | material weathered from granite | 0.15 | annual grasses, blue oaks, and live oaks |
| **Kaweah No. 2 Development** | | | | | | | | |
| Kaweah No. 2 Diversion Dam | 107 | Blasingame sandy loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| Kaweah No. 2 Powerhouse | 108 | Blasingame rock outcrop complex | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 9 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| Kaweah No. 2 Flowline | 116 | Cieneba-Rock | very shallow and shallow, somewhat excessively drained soils that formed in material weathered from granitic rock | 15 to 75% slope | Loamy, mixed, superactive, nonacid, thermic, shallow Typic Xerorthents | granite and other rocks of similar texture and composition | 0.24 | chaparral and chemise with widely spread foothill pine or oak tree, small area of thin annual grasses and weeds |
| Kaweah No. 2 Flowline | 166 | Vista coarse sandy loam | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 15 to 30% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| Kaweah No. 2 Flowline<br>Kaweah No. 2 Forebay<br>Kaweah No. 2 Powerhouse | 168 | Vista-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 9 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| **Kaweah No. 3 Development** | | | | | | | | |
| Kaweah No. 3 Flowline<br>Kaweah No. 3 Forebay | 160 | Sheephead-Rock outcrop complex | shallow, somewhat excessively drained soils that formed in material weathered from mica, schist, gneiss, or granite | 15 to 75% slope | Loamy, mixed, superactive, mesic, shallow Entic Ultic Haploxerolls | material weathered from granitic rocks | 0.17 | mainly chaparral but in the lower rainfall area it is scrub oak, pinyon pine, and digger pine |
| Kaweah No. 3 Powerhouse | 107 | Blasingame sandy loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 30 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |

| Project Facility | Code (Corresponds to Map 7.6-4) | Association | Soil Description | Slope | Taxonomy | Parent Rock | Erosion K Factor[1] | Vegetation |
|---|---|---|---|---|---|---|---|---|
| **Transmission Line** | | | | | | | | |
| Transmission Line | 108 | Blasingame rock outcrop complex | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 9 to 50% slope | Fine-loamy, mixed, superactive, thermic Typic Haploxeralfs | gabbrodiorite and other basic igneous rocks | 0.24 | annual grasses and forbs with some shrubs and blue oak trees |
| Transmission Line | 116 | Cieneba-Rock | very shallow and shallow, somewhat excessively drained soils that formed in material weathered from granitic rock | 15 to 75% slope | Loamy, mixed, superactive, nonacid, thermic, shallow Typic Xerorthents | granite and other rocks of similar texture and composition | 0.24 | chaparral and chemise with widely spread foothill pine or oak tree, small area of thin annual grasses and weeds |
| Transmission Line | 143 | Las Posas loam | moderately deep, well drained soils that formed in material weathered from basic igneous rocks | 30 to 50% slope | Fine, smectitic, thermic Typic Rhodoxeralfs | material weathered from basic igneous rocks | 0.37 | annual grasses, forbs, and broadleaf chaparral |
| Transmission Line | 166 | Vista coarse sandy loam | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 15 to 30% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| Transmission Line | 168 | Vista-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from decomposed granitic rocks | 9 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerepts | material weathered from decomposed granite and other closely related rocks | 0.15 | annual grasses and forbs and such shrubs as California sagebrush, scrub oak, lilac, chamise, sumac, and flattop buckwheat |
| Transmission Line | 171 | Walong-Rock outcrop complex | moderately deep, well drained soils that formed in material weathered from granitic rock | 15 to 50% slope | Coarse-loamy, mixed, superactive, thermic Typic Haploxerolls | material weathered from granite | 0.2 | annual grasses, blue oaks, and live oaks |

Source: USDA NRCS Official Soil Series Descriptions (OSDs) (NRCS 2019)

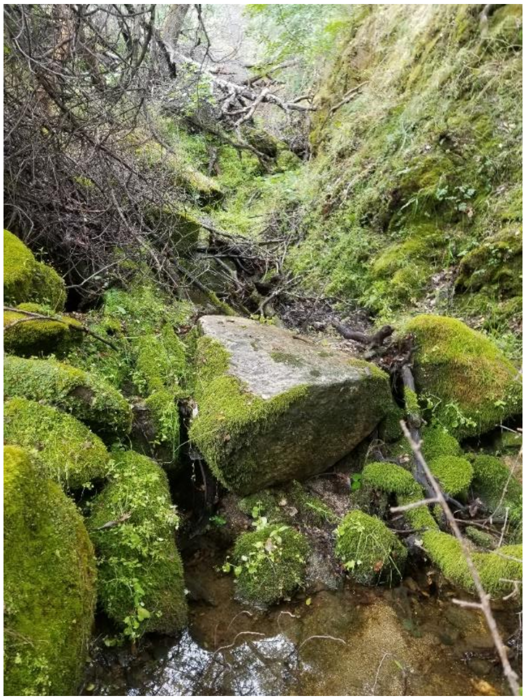
[1] The K factor assesses the susceptibility of soil to sheet and rill erosion and is dependent upon the percentages of clay, silt, sand, and organic matter in the soil. In general, soils with low K factors are less susceptible to erosion and soils with high K factors are more susceptible to erosion.

# FIGURES

This Page Intentionally Left Blank

**Figure 7.6-1a-c. Representative Photographs of the Natural Drainage Channels Associated with the Kaweah No. 1 Forebay**

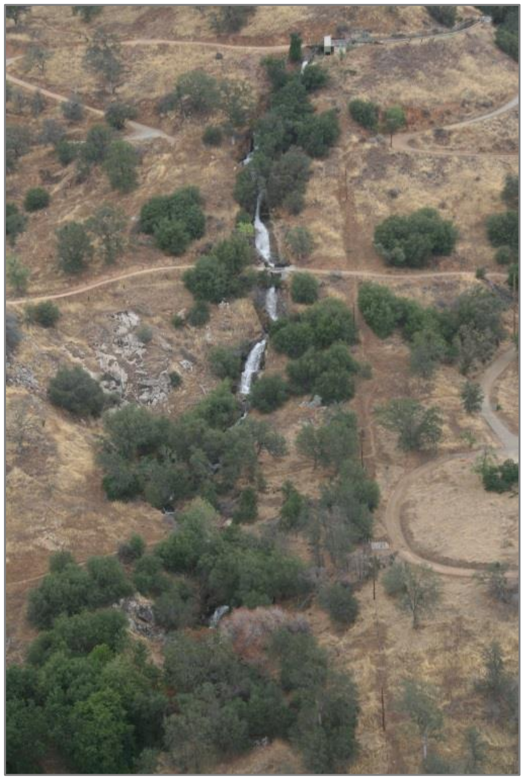
(a) Representative photograph of the portion of the Kaweah No. 1 natural drainage channel upstream of the Kaweah No. 1 Powerhouse



(b) Representative section of the Kaweah No. 1 natural drainage channel, illustrating the steep, bedrock/boulder nature of this drainage

(c) Representative section of the Kaweah No. 1 natural drainage channel just west of the Kaweah No. 1 Powerhouse and immediately upstream of its confluence with the Kaweah River

**Figure 7.6-2a-d. Representative Photographs of the Natural Drainage Channels Associated with the Kaweah No. 2 Forebay**



(a) View of the Kaweah No. 2 spillway and natural drainage channel (#1, primary) (flow is approximately 10 cfs).

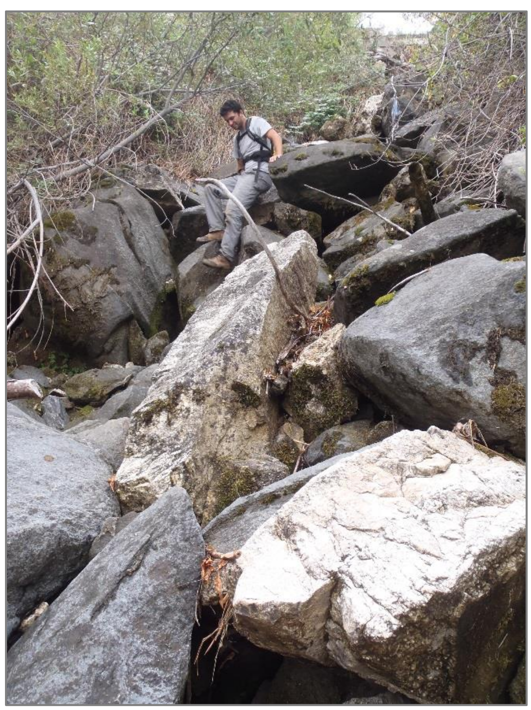
(b) Representative photograph of a down cut section in the Kaweah No. 2 natural drainage channel (#1, primary).

(c) Recent erosion on the side slope of the Kaweah No. 2 natural drainage channel (#1, primary), near the top of the drainage.

(d) Representative photograph of a stable section of the Kaweah No. 2 natural drainage channel (#2).

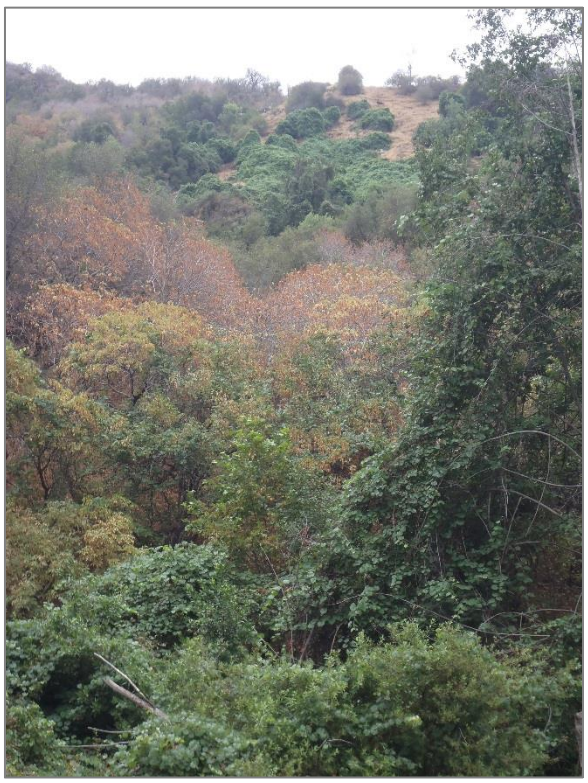
**Figure 7.6-3a-e. Representative Photographs of the Natural Drainage Channels Associated with the Kaweah No. 3 Forebay**


(a) Representative photograph of the upper portion of the Kaweah No. 3 natural drainage channel, showing the end of the spill chute.



(b) Representative section of the Kaweah No. 3 natural drainage channel, illustrating the steep, bedrock/boulder nature of this drainage.

(c) Representative section of the Kaweah No. 3 natural drainage channel showing boulders along the side slopes of the drainage.



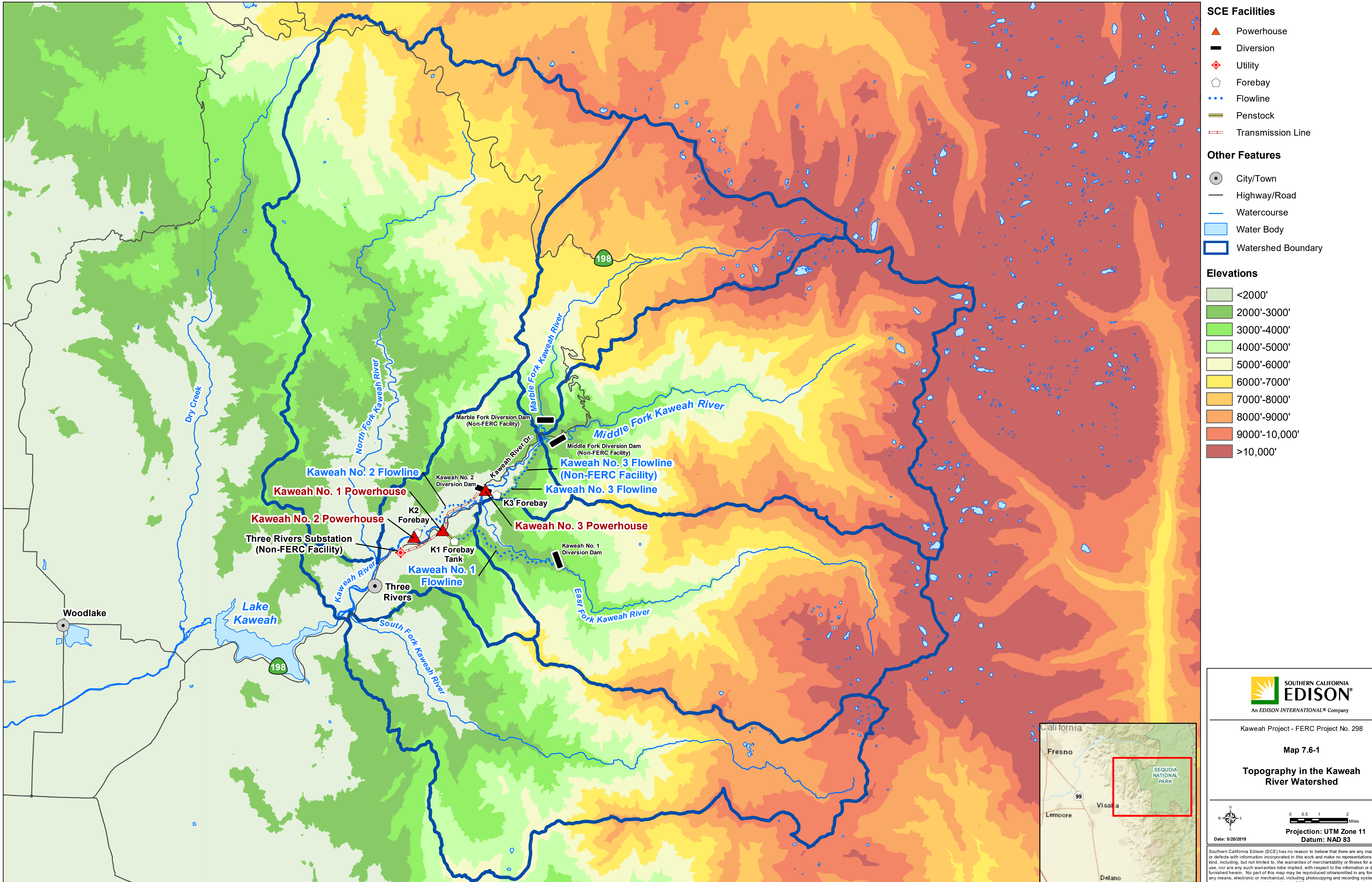
(d) View of the Kaweah No. 3 natural drainage channel from the bottom.


(e) Outlet of the Kaweah No. 3 natural drainage channel at the Kaweah River.

This Page Intentionally Left Blank

# MAPS

This Page Intentionally Left Blank




SOUTHERN CALIFORNIA EDISON®

An *EDISON INTERNATIONAL*® Company

Kaweah Project - FERC Project No. 298

**Map 7.6-1**

**Topography in the Kaweah River Watershed**

N W E S

0 0.5 1 2 Miles

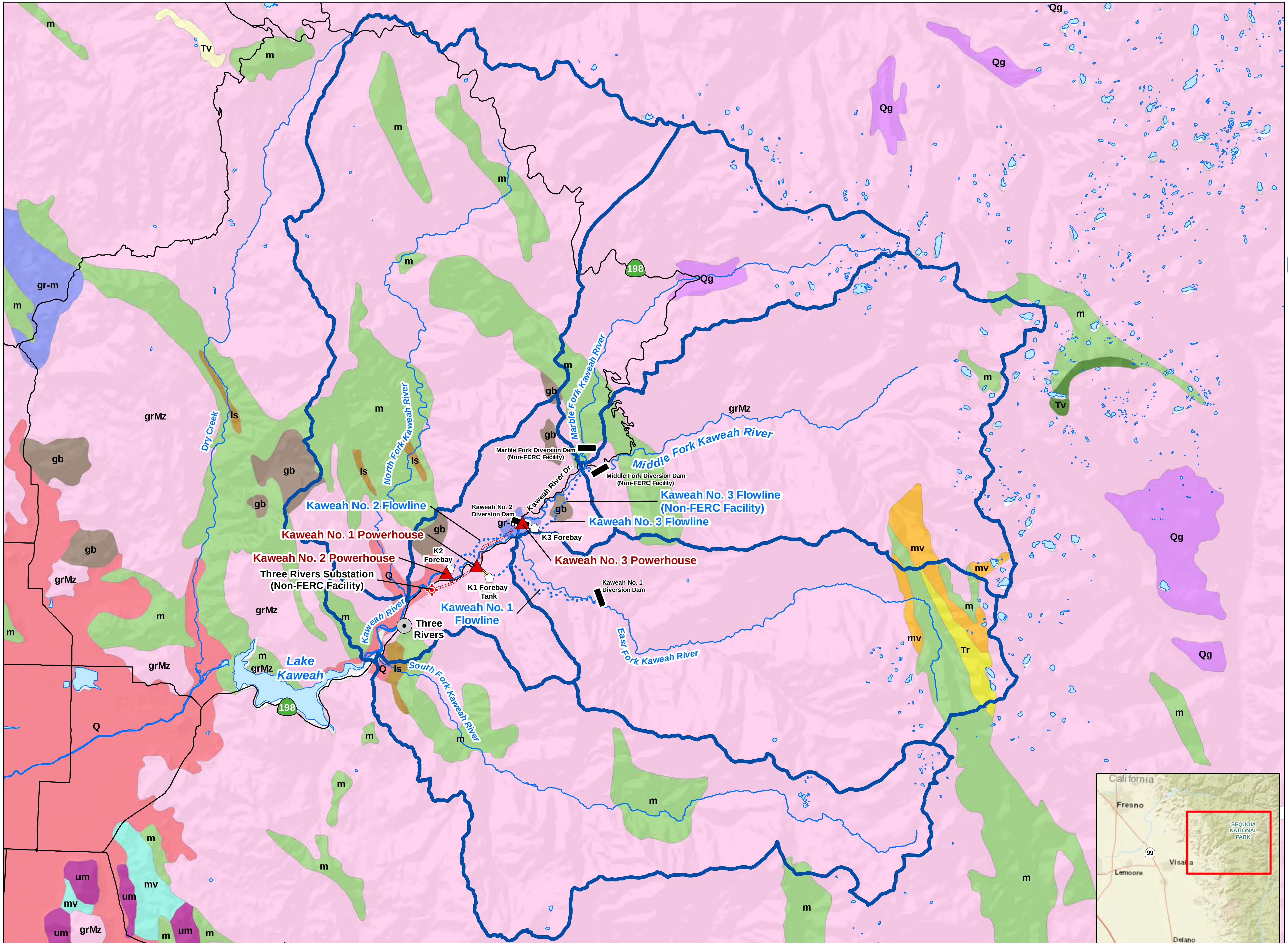
**Date: 5/20/2019**

**Projection: UTM Zone 11**
**Datum: NAD 83**



C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\SCE_Eastern_KAWEAH_Topo_17i11i_02.mxd

This Page Intentionally Left Blank




## SCE Facilities

- Powerhouse
- Diversion
- Utility
- Forebay
- Flowline
- Penstock
- Transmission Line

## Other Features

- City/Town
- Highway/Road
- Watercourse
- Water Body
- Watershed Boundary

## Geologic Rock Types*

### Cenozoic

- Q alluvium
- Qg glacial drift
- Tr sandstone
- Tv rhyolite
- Tv tephrite (basanite)

### Mesozoic

- grMz granodiorite
- gb gabbro
- gr-m plutonic rock (phaneritic)
- ls limestone
- m peridotite

### Paleozoic

- mv schist
- mv basalt
- um intermediate volcanic rock

*Source: California Geologic Survey Data, 2005

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

Kaweah Project - FERC Project No. 298

**Map 7.6-2**

**Geologic Formations in the Kaweah River Watershed**

0 0.5 1 2 Miles

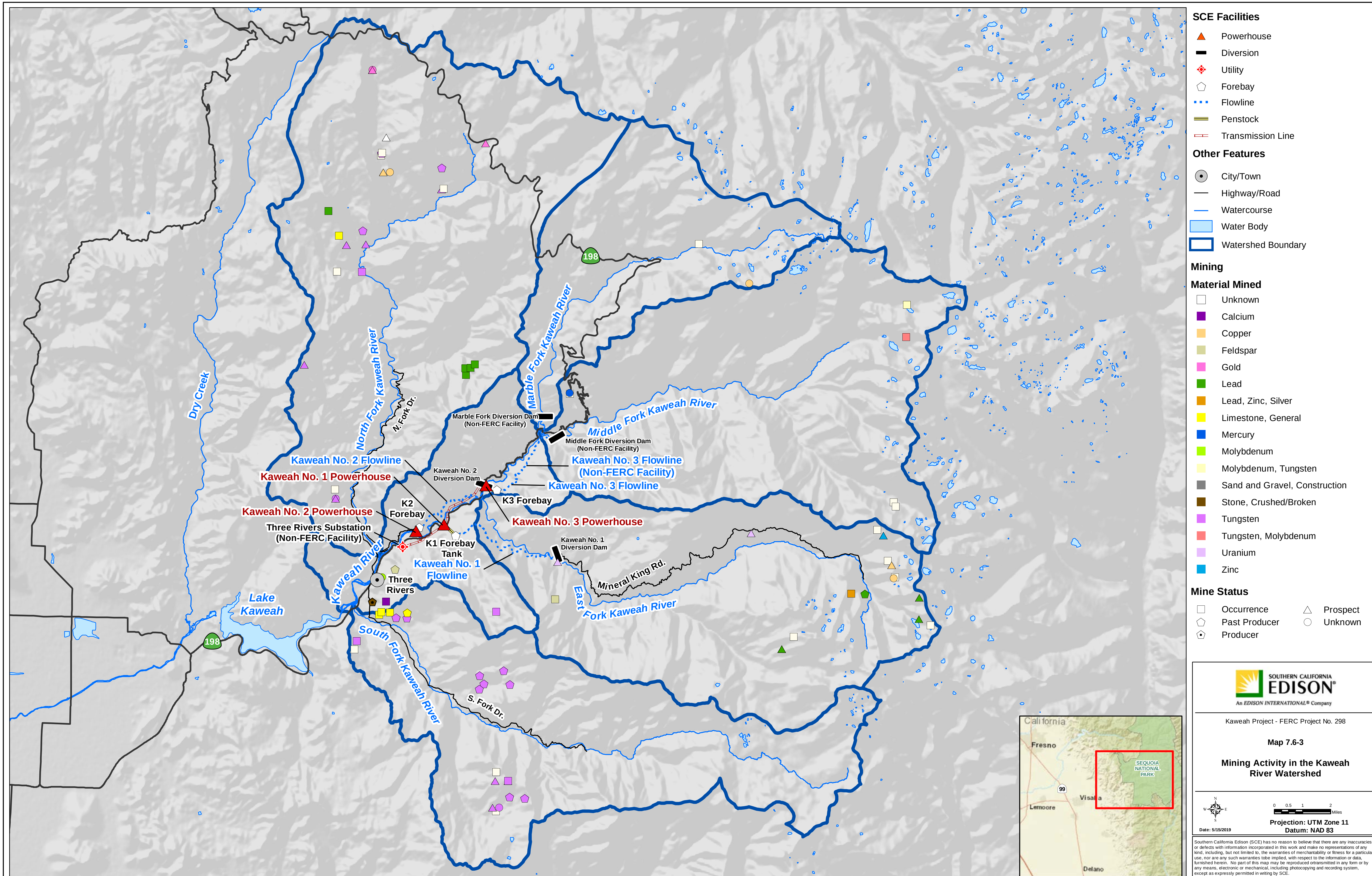
Date: 5/15/2019

Projection: UTM Zone 11
Datum: NAD 83



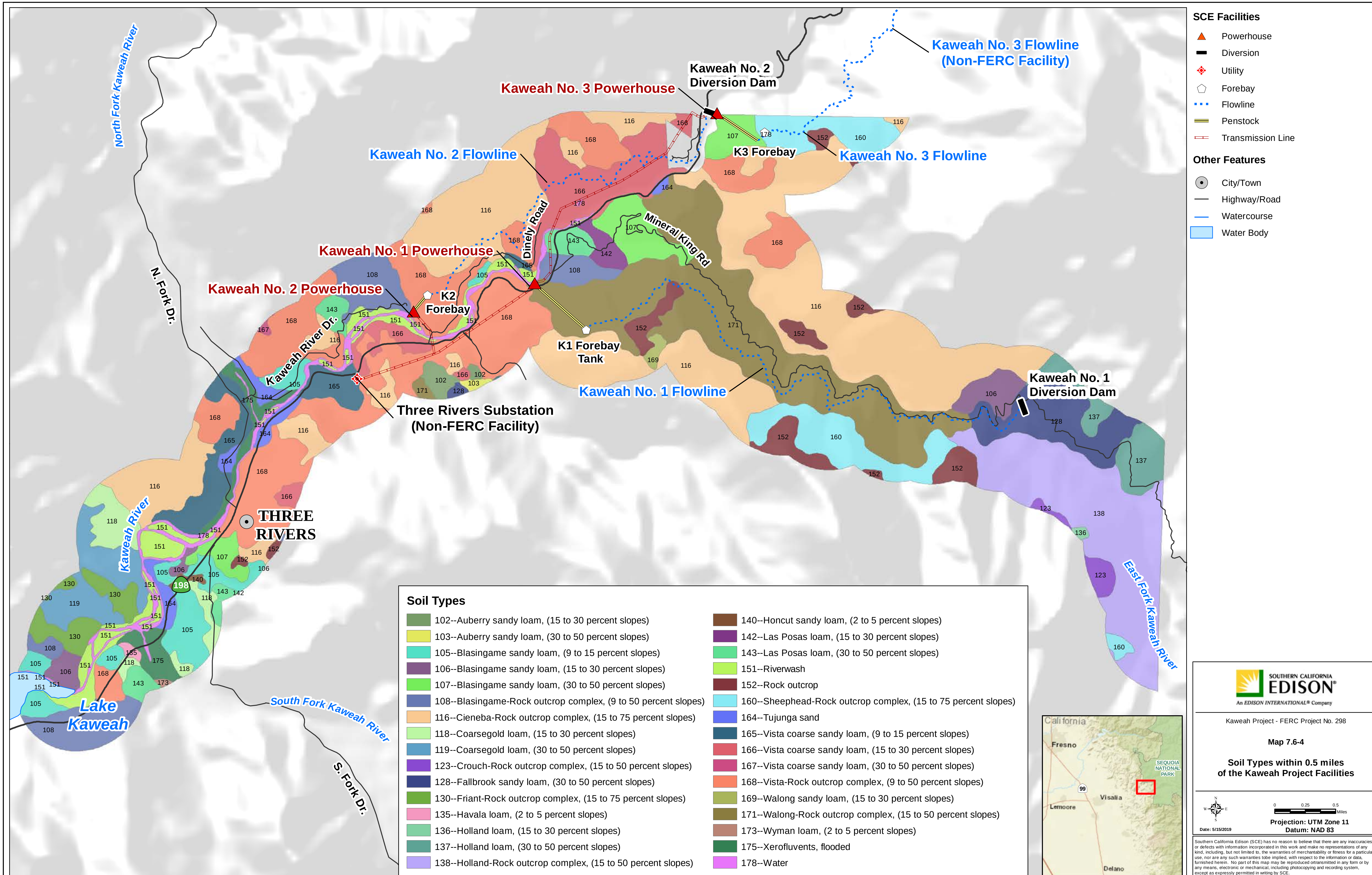
C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\GeoMaps\SCE_Eastern_KAWEAH_Geology_17i11i_01.mxd

This Page Intentionally Left Blank




C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\GeoMaps\SCE_Eastern_KAWEAH_Mining_17i11i_01.mxd

This Page Intentionally Left Blank




C:\GIS\Cardno\30735240_SCE_EasternHydro\map\Kaweah\GeoMaps\SCE_Eastern_KAWEAH_Soils_17i11i_01.mxd

This Page Intentionally Left Blank


**SCE Facilities**

- Powerhouse
- Diversion
- Utility
- Forebay
- Flowline
- Penstock
- Transmission Line

**Other Features**

- Project Road
- Non-Project General Access Road
- River/Stream

**Survey Features**

- K1 Forebay Tank Spill Drainage*

*NOTE: Location of natural drainage channels are approximate based on topography

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL® Company

Kaweah Project - FERC Project No. 298

Map 7.6-5

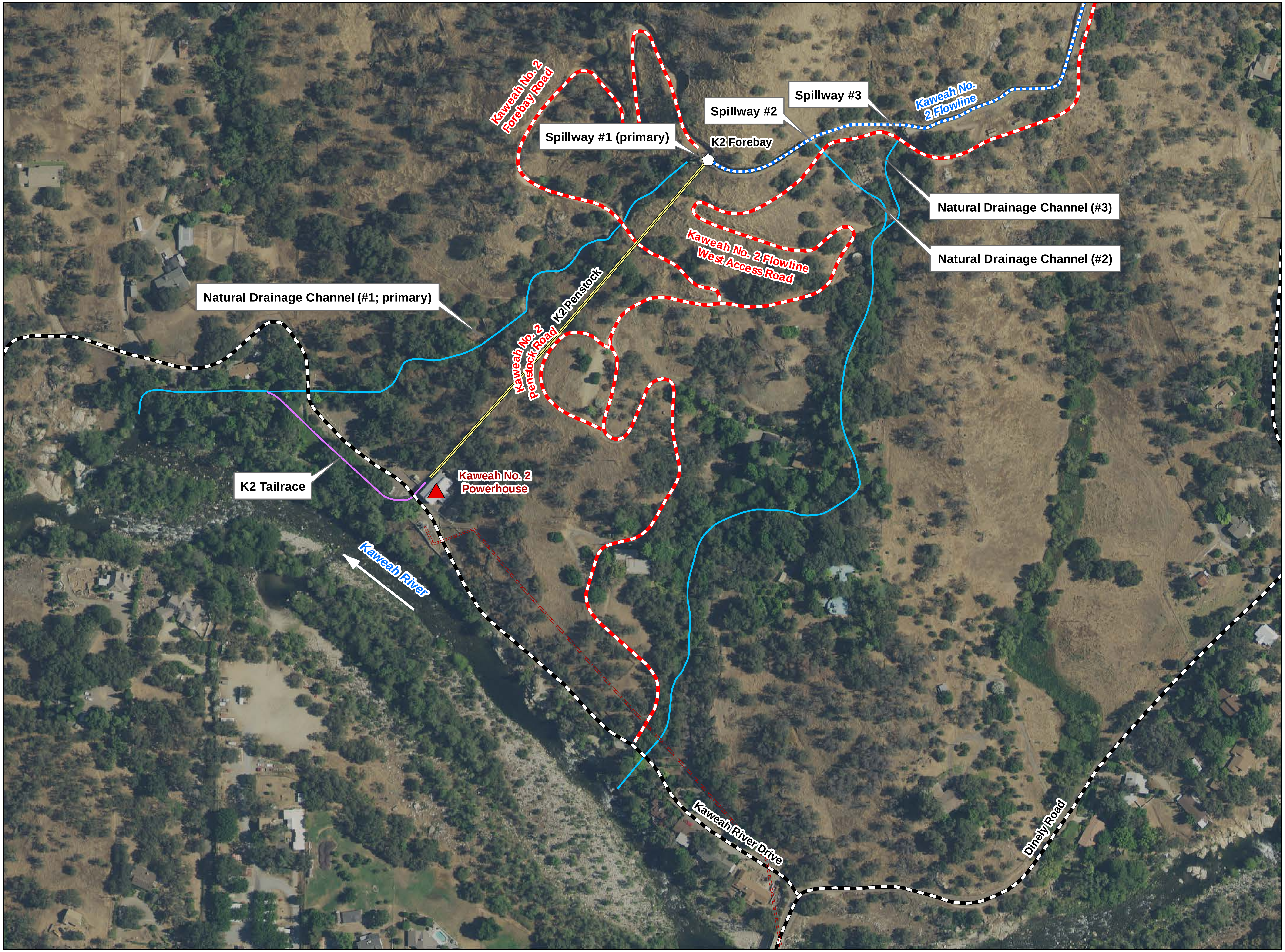
**Kaweah No. 1 Forebay Tank and Associated Natural Drainage Channels**

Date: 5/30/2019

0 50 100 200 Feet

**Projection: UTM Zone 11**
**Datum: NAD 83**

This Page Intentionally Left Blank




**SCE Facilities**

- Powerhouse
- Diversion
- Utility
- Forebay
- Flowline
- Tailrace
- Penstock
- Transmission Line

**Other Features**

- Project Road
- Non-Project General Access Road
- River/Stream

**Survey Features**

- K2 Forebay Spill Drainage*

*NOTE: Location of natural drainage channels are approximate based on topography

Southern California EDISON
An EDISON INTERNATIONAL® Company

Kaweah Project - FERC Project No. 298

**Map 7.6-6**

**Kaweah No. 2 Forebay and Associated Natural Drainage Channels**

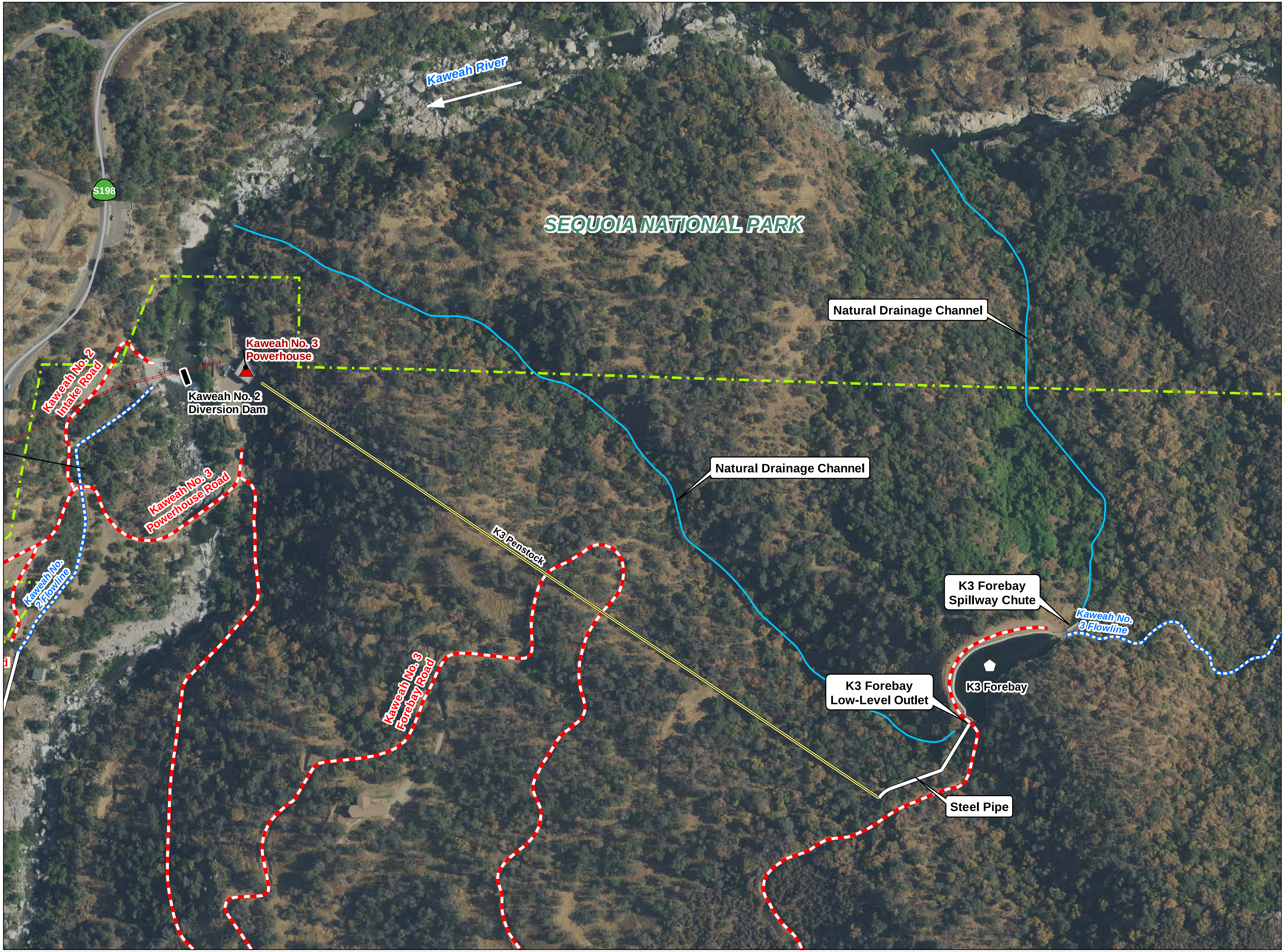
N S W E

0 50 100 200 Feet

**Projection: UTM Zone 11**
**Datum: NAD 83**

**Date: 5/30/2019**

This Page Intentionally Left Blank




**SCE Facilities**

- Powerhouse
- Diversion
- Utility
- Forebay
- Flowline
- Steel Pipe
- Penstock
- Transmission Line

**Other Features**

- Project Road
- Non-Project General Access Road
- River/Stream

**Survey Features**

- K3 Forebay Spill Drainage*

*NOTE: Location of natural drainage channels are approximate based on topography

**Land Jurisdiction**

- National Park Service Boundary

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Kaweah Project - FERC Project No. 298

Map 7.6-7

**Kaweah No. 3 Forebay and Associated Natural Drainage Channels**

0 50 100 200 Feet

Date: 5/30/2019

Projection: UTM Zone 11
Datum: NAD 83

This Page Intentionally Left Blank