Kaweah Project, FERC Project No. 298

AQ 1 – Instream Flow
Final Technical Study Report

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List of Acronyms

A	habitat availability
ADCP	acoustic Doppler current profiler
CalVeg	California Vegetation
cfs	cubic feet/second
cm	centimeter(s)
CSI	Composite suitability index
DBH	diameter at breast height
FERC	Federal Energy Regulatory Commission
FYLF	Foothill yellow-legged frog
GIS	Geographic Information System
HSC	habitat suitability criteria
IFIM	Instream Flow Incremental Methodology
lbs	pounds
M	Medium-aged
MCV	Manual of California Vegetation
msl	mean sea level
O	Old/Mature
PAD	Pre-Application Document
PCWA	Placer County Water Agency
Project	Kaweah Project, FERC Project No. 298
Q1.5	Flow with annual recurrence interval of 1.5 years

Q10	Flow with annual recurrence interval of 10 years
Q2	Flow with annual recurrence interval of 2 years
Q25	Flow with annual recurrence interval of 25 years
Q5	Flow with annual recurrence interval of 5 years
RBT	Rainbow Trout
RSP	Revised Study Plan
SCE	Southern California Edison Company
TRPA	Thomas R. Payne & Associates
TSP	Technical Study Plan
TWG	Technical Working Group
U	habitat use
UARP	Upper American River Project
WSP	Water Surface Profile Instream Flow Model
WUA	weighted usable area
WY	water year
Y	Young

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1 INTRODUCTION

This report describes the AQ 1 – Instream Flow Technical Study conducted by the Southern California Edison Company (SCE) in accordance with the AQ 1 – Instream Flow Technical Study Plan (AQ 1 – TSP). The AQ 1 – TSP was included in SCE's Revised Study Plan (RSP)[1] (SCE 2017) and was approved by the Federal Energy Regulatory Commission (FERC) on October 24, 2017, as part of its Study Plan Determination for the Project (FERC 2017). Specifically, this report provides a description of the methods and results of AQ 1 –TSP completed in 2019.

2 STUDY OBJECTIVES

The specific AQ 1 – TSP study objectives include the following:

- Delineate the bypass rivers into segments with similar hydrology and channel characteristics (e.g., slope, channel dimensions, channel pattern);
- Map the mesohabitat types (e.g., pool, run, riffle) in the bypass river segments;
- Quantify the habitat versus flow relationships for fish, special-status amphibian, benthic macroinvertebrate, and riparian resources in the bypass river segments;
- Use the habitat versus flow relationships to develop a time series analysis of aquatic habitat under existing and unimpaired flow scenarios for the bypass river segments;
- Identify the time periods, flow conditions, and life stages when habitat may be a limiting factor for fish, benthic macroinvertebrate, special-status amphibian, and riparian populations for the existing and unimpaired scenarios; and
- Provide information necessary to quantify the potential effects of other alternative flow scenarios on aquatic and riparian habitat.

3 EXTENT OF STUDY AREA

The study area included the active channel and floodplain in the bypass river segments and selected riparian reference reaches outside the influence of the Project. The study area is identified in Table AQ 1-1 and Map AQ 1-1. Some portions of the study area in the East Fork of the Kaweah River were very difficult to access due to the rugged terrain and thus, field data were collected only in portions of the study area that were accessible and approved by the Aquatic TWG. The riparian reaches outside of the bypass river segments were used to interpret riparian vegetation versus flow relationships; therefore, data collection in these reaches was limited to that purpose.

1 SCE filed a Proposed Study Plan (PSP) on May 24, 2017 (SCE 2017b). Three comments were filed on the PSP; however, they did not result in revisions to any of the study plans. Therefore, SCE filed a Revised Study Plan (RSP) on September 19, 2017, which stated that the PSP, without revision, constituted its RSP. FERC subsequently issued a Study Plan Determination on October 24, 2017, approving all study plans for the Kaweah Project.

4 STUDY APPROACH

4.1 Target Species and Habitat Suitability Criteria

4.1.1 Species and Life Stages

The fish species and life stages included in the instream flow habitat modeling were selected in collaboration with the Aquatic TWG based on management importance and/or potential sensitivity to Project operations. The study plan also included modeling for foothill yellow-legged frog (FYLF) breeding and tadpole habitat, if FYLF were extant in the vicinity of the Project.

A life stage periodicity chart (or life history chronology chart by month) for each fish species and lifestage modeled in the study reaches was developed based on available literature (Moyle 2002)(Table AQ 1-2), discussion with qualified fisheries biologists, and review of the results of the AQ 2 – Fish Population TSR (AQ 2 – TSR) (SCE 2019a; SD A).

4.1.2 Habitat Suitability Criteria

Extensive development of habitat suitability criteria (HSC) for west-slope Sierra Nevada species/life stages (hardhead, Sacramento pikeminnow, Sacramento sucker, and rainbow trout) was recently conducted in collaboration with resource agencies for the Placer County Water Agency (PCWA) Middle Fork Project relicensing (PCWA 2011). These HSC were used for habitat modeling.

4.2 Stratification and Study Site Selection

Channel characteristics (slope, channel dimensions, channel pattern), hydrology, and mesohabitat (e.g., run, pool, and riffle) data were used to stratify the bypass and comparison reaches (Table AQ 1-3). Instream flow data were collected and analyzed within these strata. The largest strata, river segments (a specific bypass reach or comparison reach), were based on channel characteristics and hydrology. Within the bypass reaches, the river was stratified based on mesohabitat types. Each reach was mesohabitat mapped (typed), either by aerial photography or foot travel, using the most detailed level of mesohabitat typing outlined in McCain et al. (1990) (i.e., a potential of 22 mesohabitat types). In consultation with the Aquatic TWG, these habitat types were collapsed into five mesohabitat types for instream flow modeling (pool, run, low gradient riffle, high gradient riffle, and cascade).

Representative study sites were selected within each of the accessible bypass reaches to represent the entire reach. The representative study sites were at least 20 to 40^{+} channel widths in length and contained a full complement and similar proportion of mesohabitat types to those present within the larger geomorphic/hydrologic reach. The specific locations of the instream flow study sites were selected in the field during summer 2018, with concurrence of Aquatic TWG representatives.

4.3 Study Site Modeling

4.3.1 General Modeling

Instream flow modeling was accomplished by sampling/modeling representative mesohabitat units within each of the study sites using 1D hydrodynamics and habitat models. The results for each mesohabitat type were weighted and combined to develop a representation of hydrodynamics and habitat for the larger geomorphic/hydrologic reach. The weighting was based on the percentage of each mesohabitat type within the geomorphic/hydrologic reach. Cascades were not sampled due to the lack of habitat available in a cascade for the selected species and the inability of the hydraulic model to accurately represent the hydrodynamics in cascades.

The sampling effort within each study site was determined in collaboration with the Aquatic TWG. In general, mesohabitat types were sampled approximately in proportion to their abundance within the larger geomorphic/hydrologic study reach.

The representative study sites contained more mesohabitat units than were modeled/sampled. The specific mesohabitat units selected for modeling were those that were most representative of the mesohabitats in the geomorphic/hydrologic reach and provided river access.

Modeling cross-sections were visually placed within the mesohabitat units to best represent the habitat over a range of flows. Concurrence regarding cross-section placement within mesohabitat units was obtained from the Aquatic TWG during a field visit to each instream flow study site.

4.3.2 Hydrodynamics Modeling

PHABSIM 1D hydraulics modeling procedures (Milhous et al. 1989; Waddle 2001; TRPA 2009) were used for modeling depths, velocities, and substrate at the cross-sections in the study sites over a range of flows. Channel topography and calibration data (water surface elevations and velocity measurements) were collected so that the 1D models could simulate a wide range of discharges appropriate to the hydrology of each reach.

4.3.2.1 Channel Topography and Substrate

Channel topography, in the form of cross-sections for 1D modeling was collected at each study site. Cross-sections were marked with semi-permanent headpins and surveyed with a total station. Cross-section topography was surveyed with either a total station or laser level. The cross-sections extended into the floodplain to allow modeling at high flows. Substrate data were collected across each cross-section. The substrate data were collected using the substrate categories developed in consultation with the Aquatic TWG for the HSC criteria.

4.3.2.2 Water Surface Elevation

For water surface modeling calibration, empirical water surface elevations were measured (surveyed) during at least three calibration discharges (low, medium, and high flow) and for some sites four calibration discharges (low, medium, high, and high high flow). These measurements provided calibration data for the hydrodynamics models over the range of flows of interest. Targeted model data collection/calibration flows were determined in coordination with the Aquatic TWG (Table AQ 1-4).

Stage-discharge regressions, calibrated to measured stage-discharge data sets, were the preferred approach to model water surface elevations at all mesohabitat types except pools. Typically, pool water surface elevations were modeled with a step-backwater model, WSP (Waddle 2001).

4.3.2.3 Velocity

Empirical velocity data for velocity modeling were collected across each cross-section (e.g., 15 to 20 locations) at the middle calibration discharge. All velocities were collected with calibrated velocity meters. Discharges were measured using standard gaging techniques (Rantz 1982) and/or an acoustic Doppler current profiler (ADCP).

The IFG4 program (Waddle 2001) was used to model velocity at individual cells across cross-sections. When using the model, professional judgment was needed to modify the IFG4 Manning's N values at some cells to prevent unrealistic velocities on the edges of the channel (or at point locations in the channel) at high discharges. Specifically, professional judgment was used to cap the Manning's N values for cross-sections at an N minimum and N maximum value. Also, the Manning's N values for edge velocity cells that had very large, very small, or sometimes negative velocities were modified by either using an appropriate adjacent Manning's N value or using the Manning's N minimum or maximum values.

4.3.2.4 Special Purpose Riparian

Special purpose stage-discharge relationships for the riparian resources analysis were developed at the comparison reach riparian study sites (Map AQ 1-1; Table AQ 1-1). Target flows for data collection were similar to those for the instream flow modeling (Table AQ 1-4). Within the bypass reaches, stage-discharge relationships developed at the habitat modeling sites were used for the riparian modeling.

4.4 Habitat Modeling

Habitat modeling for the instream flow sites was consistent with the Instream Flow Incremental Methodology (IFIM) (Bovee et al. 1998).

4.4.1 Wetted Perimeter Versus Flow

The Average Parameter model (Waddle 2001) was used to estimate wetted perimeter (width of channel bed wetted) over the range of discharges modeled. Wetted perimeter was modeled for each cross-section at the study sites and combined into a reach-wide average wetted perimeter relationship for each reach.

4.4.2 Weighted Usable Area Habitat Area Versus Flow

Habitat area versus flow relationships were developed over a wide range of flows (low base flows up to approximately the 5-15% exceedance unimpaired flow). Standard weighted usable area (WUA) versus flow relationships were developed for all species and life stages using univariate HSC. WUA was derived by using a composite suitability index (CSI) multiplied by each cell area of potential habitat. The CSI was calculated by multiplying the individual HSC suitability for depth, velocity, and/or substrate together (Waddle 2001). Substrate suitability was used only for rainbow trout spawning. The results for each mesohabitat type at each study site were weighted to represent the proportion of mesohabitat types in the reach (Appendix A).

4.4.3 Time Series

The wetted perimeter and fish habitat versus flow relationships were combined with hydrology (existing and unimpaired daily mean flows) over the period of record (1994 to 2018) to create a wetted perimeter or habitat time series for hardhead (juvenile and adult), Sacramento pikeminnow (juvenile and adult), and rainbow trout (spawning, adult, juvenile, fry). Time series exceedance plots were used to compare the amount of wetted perimeter or habitat during different biologically significant time periods (reproduction, rearing) and identify potential habitat limiting factors and time periods. For this analysis, the spawning period for rainbow trout was March 1 through May 31 and for rainbow trout fry was May 1 through August 31 (Table AQ 1-2).

4.5 Evaluation of Riparian Conditions

The riparian study was conducted to characterize the riparian resources in relation to flow along the bypass and comparison river reaches (reaches unaffected by Project operations) (Table AQ 1-1; Map AQ-1).

4.5.1 Riparian Vegetation Processes Overview

Literature sources were reviewed and summarized to provide an overview of riparian vegetation processes along river corridors similar to the Kaweah River. The literature review focused on patterns of riparian vegetation establishment, including the role hydrological events (magnitude, frequency, timing, flow recession, inundation) in the establishment or scouring of riparian vegetation.

4.5.2 Life History Requirements of Dominant Woody Riparian Species

A literature review of the life history requirements of the dominant woody riparian species (Fremont cottonwood, white alder, willows, and California sycamore) present in the study area was conducted and summarized. The review focused on seed initiation (e.g., dispersal, germination, and initial seed/root growth); microsite characteristics necessary for germination (e.g., water table depth, substrate); establishment (survival and growth until maturity); and maturation (e.g., age of maturity, rooting depth, and tree height).

4.5.3 Riparian Community Characteristics

Distribution mapping of the riparian habitat upstream and downstream of the Project diversions was completed in 2015 and was included in SCE's PAD (SCE 2016). Field surveys were conducted in 2018 at selected representative riparian study sites within the bypass reaches and comparison reaches to provide a more detailed assessment of the riparian communities in relation to flow and geomorphic conditions. Field surveys were conducted at four study sites on the Kaweah River and East Fork Kaweah River bypass reaches and at three study sites on river segments upstream of Project diversions (East Fork Kaweah River and Kaweah River) and downstream of Project operations (Kaweah River below Kaweah Powerhouse No. 2) in September 2018.

Vegetation within the riparian corridor was mapped in the field within each study site on high-resolution aerial imagery. Vegetation that was compositionally and structurally homogeneous (e.g., similar species and age class mix with the area) was mapped as a polygon. The following summarizes the data collected within each polygon:

- **Community composition.** The percent cover of the polygon area of each dominant species and list of all sub-dominant species.
- **Woody riparian age class structure.** The age classes[2] of each dominant species and presence of seedlings by species.
- **Substrate.** Size classes of the substrate present (bedrock, boulder, cobble, gravel, sand, silt).

The species nomenclature followed Baldwin et al. (2012). Observations of activities that could potentially impact vegetation within the riparian corridor, such as grazing or recreation, were noted during the surveys at each study site.

To characterize riparian species composition and age structure at the study sites, the data were summarized by species and study site. The proportion of vegetation cover by each dominant species and age class of the dominant woody riparian species were calculated for each study site. These data were summarized in graphic and tabular formats.

The vegetation polygons were digitized in Geographic Information System (GIS) to create vegetation community maps for each study site. Based on the species observed within each polygon, the polygons were classified using *A Manual of California Vegetation* (MCV) (Sawyer et al. 2009) and mapped.

The vegetation mapping encompassed transects surveyed for the instream flow modeling. To illustrate the distributions of the vegetation communities across the floodplain in relation to the channel (distance and elevation), the locations of the vegetation were mapped along a representative subset of the elevation profiles surveyed within each study site for the instream flow modeling study[3]. Factors such as

[2] Age class structure was based on categories of shrub stem densities per individual and tree diameters, as follows: Young (Y): shrubs with less than 10 stems per individual or trees with diameters (diameter at breast height (DBH) less than 3 inches; Medium-aged (M): shrubs with between 10 and 60 stems per individual or trees with DBHs between 3 and 9 inches; and Old/Mature (O): shrubs with more than 60 stems per individual or trees with DBHs greater than 9 inches.

[3] Several elevation profiles were surveyed for the AQ 1 instream flow study. For the riparian study, three representative elevation profiles within each study site were selected.

the type of habitat unit, channel geometry, and location within the study site were used to select the representative elevation profile within each study site.

4.5.4 Riparian Resources and Hydrologic Regime Relationships

The relationship between the riparian vegetation and hydrologic regime at each of the bypass and comparison study sites was evaluated to identify the time periods and flow conditions that might be limiting to riparian vegetation in the Project bypass reaches. This evaluation included: (1) characterizing general impaired and unimpaired hydrology patterns at each site, and (2) evaluating vegetation and inundation relationships at the study sites.

4.5.4.1 Hydrology Patterns

Impaired and unimpaired daily flow data for the bypass reaches and the comparison reaches for water year (WY) 1994 through WY 2018 were used. For each study site, the following hydrology analyses were completed:

- **Annual Hydrology Patterns** – Annual hydrographs of the monthly average daily flows by water year type were developed;
- **Recurrence Intervals** – Flood frequency curves were developed for unimpaired and impaired flow conditions (SCE 2019) to compare the magnitude and frequency of peak high flow events;
- **Timing of High Flows** – The numbers of days that the impaired Q1.5 and Q2 flows were exceeded (1) by month, (2) by water year type and (3) all years combined were determined; and
- **Recession Rates (rate of change in stage over time [days])** – Recession rates of spring/ early summer flows during the time of spring seed release and seed setting (during the receding limb of the hydrograph) were evaluated for normal water years. Flows were converted to stage using the stage-discharge relationships developed for the instream flow modeling study.

4.5.4.2 Vegetation and Inundation Relationships

The vegetation mapping was also used in combination with the water surface elevation modeling to evaluate relationships between inundation characteristics (e.g., frequency, depth, and width of inundation) and the distributions of dominant riparian and upland species across the floodplain. Water surface elevation data (stage) were collected at elevation profile locations within each study site over a wide range of flows to develop stage-discharge relationships at each of the study sites. The frequency of inundation along the elevation profiles under impaired and unimpaired conditions was calculated and graphed with the vegetation community distribution along the elevation profile.

5 STUDY RESULTS

5.1 Target Species and Habitat Suitability Criteria

5.1.1 Species and Life Stages

Species distributions of fish, special-status amphibians and reptiles, and riparian resources within the bypass reaches associated with the Project were generated as part of the results of the AQ 2 – Fish Population Technical Study Report (AQ 2 – TSR) (SCE 2019a; SD A) and AQ 7 – Special-Status Amphibian and Aquatic Reptile Technical Study Report (AQ 7 – TSR) (SCE 2019b; SD A)).

The species and life stages selected for instream flow habitat modeling included hardhead (juvenile and adult rearing), Sacramento pikeminnow (juvenile and adult rearing), Sacramento sucker (juvenile and adult rearing), and rainbow trout (fry, juvenile rearing, adult rearing, and spawning). FYLF were not extant in the watershed (AQ 7 – Special-status Amphibians and Aquatic Reptiles TSR (AQ 7 – TSR) (SCE 2019b; SD A); therefore, instream flow modeling was not conducted for FYLF.

A fish life stage periodicity chart (life history chronology chart by month) for each fish species and lifestage modeled in the study reaches is shown in Table AQ 1-2. The periodicities were used for habitat time series modeling (see below).

5.1.2 Habitat Suitability Criteria

The HSC for each of the species and life stages are shown in Figures AQ 1-1 to AQ 1-4.

5.2 Stratification and Study Site Selection

The bypass reach and comparison reach river stratification (based on channel characteristics and hydrology) and the locations of the representative instream flow study sites within each reach are shown in Map AQ 1-1 and Table AQ 1-1. Four all-discipline instream flow study sites were selected. Three study sites were selected in the Kaweah River and one study site was selected in the East Fork Kaweah River where aquatic habitat, riparian habitat, and geomorphology were modeled. Additionally three riparian comparison study sites were selected for modeling. One bypass reach on the East Fork Kaweah River, downstream of Kaweah No. 1 Diversion, was not accessible (too steep and dangerous) and was not modeled. The short East Fork Kaweah River reach upstream of the confluence with the Kaweah River was modeled as a surrogate; however, it may not accurately represent the reach due to the steep confined nature of the channel below the Kaweah No. 1 Diversion compared to the lower gradient reach near the confluence.

The mesohabitat types used for mapping habitat within each reach and the subsequent combined (i.e., collapsed) mesohabitat types that were used for instream flow modeling are shown in Table AQ-3.

The length and percent of mapped mesohabitat types in each of the Project bypass reaches are shown in Table AQ 1-4. Detailed mesohabitat unit mapping data for the four instream flows sites are presented in Appendix A.

5.3 Study Site Modeling

5.3.1 General Modeling

Table AQ 1-5 shows the study sites, number of cross-sections sampled, and the mesohabitat unit types for the cross-sections. The mesohabitat weighting factors for weighting the cross-sections are provided in Table AQ 1-4.

5.3.2 Hydrodynamics Modeling

Table AQ 1-6 shows the target and actual discharges measured for each cross-section within each reach. The actual and target discharges for low flow were generally very similar. The actual discharges for the medium and high are larger than the target discharges. An extra high discharge was measured for the reaches on the mainstem Kaweah River. Table AQ 1-6 also shows the range of flows over which the instream flow hydraulics modeling is deemed most accurate.

5.3.2.1 Channel Topography and Substrate

Channel topography and substrate measurements collected as part of the instream flow study are provided in Appendix C for each study site and for each cross-section.

5.3.2.2 Water Surface Elevations

Water surface elevation modeling was successfully completed at all study sites over the range of modeling flows (Table AQ 1-6). Modeled and measured water surface elevation plots are provided in Appendix D.

5.3.2.3 Velocity

Velocity modeling was based on measured velocity data sets collected at discharges approximately two to five times greater than the existing minimum flows for each of the river reaches associated with the Project (Table AQ 1-6). This approach provided a reasonably accurate method for modeling velocity both below and above the existing minimum flows.

The study sites were modeled over the range of flows with only minor adjustments to the measured calibration velocity patterns. The Manning’s N (roughness) values on the margins of the channels were modified where extremely low or extremely high or negative velocities were measured. In addition, N maximum and N minimum values were used to facilitate velocity modeling at high discharges at each study site as discussed in the methods section (Section 4.3.2.3 Velocity).

5.3.2.4 Special Purpose Modeling

Special purpose stage-discharge relationships for analyses required for the riparian resources are provided in Appendix D, Attachment A. Attachment A includes the stage-discharge relationships for each riparian cross-section in the four instream flow study sites and in the three riparian comparison study sites (Map AQ 1-1; Table AQ 1-1; Table AQ 1-5).

5.4 Habitat Modeling

5.4.1 Wetted Perimeter Versus Flow

Average wetted perimeter plots for each of the bypass reaches are shown in Figure AQ 1-5. The wetted perimeter versus flow relationships for the study sites were relatively monotonic in their rate of increase in wetted perimeter with discharge. 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 exhibited only moderately distinct inflection points (distinct breaks) where an increase in flow exhibited an obvious change in the wetted perimeter relationship.

5.4.2 Weighted Usable Area Habitat Versus Flow

The habitat versus flow relationships, WUA and percent of maximum WUA versus flow, for hardhead (juvenile and adult) (including Sacramento pikeminnow), Sacramento sucker (juvenile and adult), and rainbow trout (spawning, adult, juvenile, fry) fish species in each bypass reach are presented in Figures AQ 1-6 to AQ 1-9. Tables of WUA and percent of maximum WUA are presented in Appendix E. Habitat versus flow relationships indicate 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 (Figures AQ 1-6 to AQ 1-9; Appendix E). The channels in the bypass reaches are relatively large, presumably because of frequent high magnitude winter and spring flow events. They are therefore capable of providing habitat for deep/fast water species/life stages at much higher flows than the natural summer/fall base flows that typically occur in these rivers, which are very low compared to the wetter times of the year. Table AQ 1-7 and Appendix G provide information on existing and unimpaired flows for the streams/rivers associated with the Project.

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 AQ 1-6 to AQ 1-9). 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 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 CONF). Upstream in the inaccessible bypass reach (EF DS K1 Div), the channel is much narrower and steeper and was too dangerous to measure. Presumably, in the upstream bypass reach (EF DS K1 Div), habitat would reach a maximum at a much lower flow than that which occurs at the wider, lower gradient EF US CONF site where the modeling was conducted.

5.4.3 Time Series Analysis

5.4.3.1 Wetted Perimeter

Wetted perimeter time series plots for existing conditions and for unimpaired hydrology for each month are shown Appendix F. Comparison plots of existing percent of unimpaired wetted perimeter are shown in Figures AQ 1-10 to AQ 1-13 for each reach in both dry and normal water year types. The plots also show the warm water temperature months (June to October) and the cooler water temperature months (November to May). In the Kaweah River each of the individual reaches (KR DS PH3, KR US PH1, KR US PH2) are shown separately (Figures AQ 1-10 to AQ 1-12). The bypass reaches on the Kaweah River have existing percent of unimpaired 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 percent of unimpaired exceedance plot between 70% and 80% of unimpaired (Figure AQ 1-13).

5.4.3.2 Weighted Usable Area

A time series analysis (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. Figures AQ 1-14 to AQ 1-18 show hardhead and Sacramento pikeminnow adult percent of unimpaired habitat exceedance plots by month and grouped by warm months and cool months. Weighted usable area time series and percent of unimpaired habitat exceedance plots for all species/life stages are provided in Appendix G. A summary of the results for all species and life stages is provided in Table AQ 1-8.

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 Appendix G for each bypass reach. A summary of the difference between the existing and unimpaired habitat each month is shown in Figures AQ 1-14 to AQ 1-17 (hardhead/pikeminnow adult) and Appendix G. In the lowest reach (KR US PH2), the existing habitat is approximately ≥80% of the unimpaired flow in all months, and in the two upper reaches (KR DS PH3 and KR US PH1) the existing habitat is approximately ≥70% of unimpaired flow in all months, and typically ≥80% in the upper two reaches (KR US PH1 and KR DS PH3). The months in which the lowest amount of habitat is available (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).

Adult rainbow trout habitat is similar to hardhead/pikeminnow and Sacramento sucker, but with slightly lower existing versus unimpaired habitat percentages. Typically, however, the water temperature is 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), in general, was higher under existing compared to unimpaired habitat (Appendix G).

East Fork Kaweah River

Lowest Reach (EF US CONF)

In the lower East Fork Kaweah River bypass reach (EF US CONF), adult hardhead/pikeminnow required the highest flow 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 Appendix G for each bypass reach. A summary of the difference between the existing and unimpaired habitat for all months month is shown in Figure AQ 1-18 (hardhead/pikeminnow adult) and Appendix G. Existing habitat in all months is ≥70% and typically ≥80% than unimpaired habitat 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. 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 CONF) 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 (Figures G-52, G-56, G-60). Juvenile WUA tends to have a maximum habitat at flows of 50 cfs. Once flow exceeds this threshold, the amount of habitat decreases. Habitat at lower flows (10 – 25 cfs) increases rapidly as flows increase. Consequently, if water is diverted at these lower flows the amount of available habitat can decrease quickly.

Rainbow trout spawning tends to decrease under existing conditions when compared to unimpaired. The spawning exceedance plots are derived from habitat versus flow relationships that have extremely low amounts of spawning habitat, literally a few cells on a few cross-sections provide spawning habitat. Spawning habitat patches were extremely low in abundance, scattered, and small. An extremely large number of cross-sections would need to be sampled to provide a reliable estimate of spawning habitat. The exceedance plots are not deemed accurate or representative of actual conditions due to the low reliability of the sampling of scarce and small spawning habitat patches.

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 habitat than in the downstream, wider channel bypass reach (EF US CONF).

5.5 Evaluation of Riparian Conditions

5.5.1 Riparian Vegetation Processes Overview

The patterns of riparian vegetation establishment and distribution along a river are created by the interaction of physical processes (e.g., flows of varying magnitudes, timing of flows, flow recession rates, flow and depth to water table variability, and sediment deposition) and the different life history characteristics of the dominant species (Stella et al. 2013; Merritt et al. 2009; Schmidt and Potyondy 2004; Mahoney and Rood 1998). The dominant woody riparian species present along the bypass and comparison river reaches have many life history adaptations that promote their success under dynamic and episodic, yet seasonally predictable, hydrologic conditions.

High magnitude, infrequent flow events (scouring flows) maintain the channel by scouring banks and the channel bed, and are important for maintaining channel complexity. These events create areas for new colonization by riparian species and maintain the compositional and structural diversity of the riparian community. The scouring flows are also important for limiting encroachment of riparian vegetation into the channel by scouring vegetation along the channel margins, which reduces the potential for berm development and channel narrowing. Riparian species can also readily reproduce vegetatively from downed or abraded limbs and trunks and root sprouts, as well as twig or root pieces deposited during a high flow event, which enables these species to rapidly re-establish following scouring flood events.

The magnitude, timing, and flow recession of spring flows (recruitment flows) are important determinants of successful regeneration and establishment of riparian species. For successful recruitment to occur, flows that coincide with the release of seeds with suitable recession rates are necessary in order to provide sufficient moisture to the seedlings and sprouts. This hydrology may occur in the same year as the scouring flow or may occur several years later (Stella et al. 2013; Merritt et al. 2009; Mahoney and Rood 1998; Karrenberg 2002; Dixon 2003). Willows and cottonwoods, dominant species along the bypass and comparison river reaches, release seeds in the spring, timed with the natural snowmelt hydrograph. These seeds are only viable for a short period of time (weeks), requiring suitable moisture and soil conditions to be present at the time of seed release. For seedlings to survive, the flow recession rates must be slow and groundwater must be available through the dry summer. Recession rates from the spring flows cannot exceed the root growth rates of the seedlings. Results from studies from the literature indicate that seedlings typically survive down ramping rates that range from 0.4 to 1.6 inches per day. Seedlings can survive down ramping rates of up to 3.9 inches per day, depending on various factors such as species, substrate characteristics, and other sources of water (e.g., seeps, hillslope runoff, precipitation) (Braatne et al. 1996; Amlin and Rood 2002; Shaforth et al. 2017). The maximum depth to groundwater is a strong determinant of riparian survival with results of studies in the literature indicating maximum groundwater depths between 6.5 and 8.5 feet (Braatne et al. 1996; Uchytil 1989; Shaforth et al. 2017). Seedlings that establish too close to the channel where late summer and fall water is available are more susceptible to scouring and uprooting by subsequent high winter or spring flows. As a result, riparian vegetation often establishes in elevation zones where water is available during the drier months, but not too close to the base flow (summer and fall) channel where it is susceptible to damage by higher flows.

A comprehensive plant list of all species encountered during the various surveys at each study site was developed, including any special-status plants and invasive weeds encountered during the surveys. The list is provided in Appendix B Attachment A.

5.5.2 Life History Requirements of Dominant Woody Riparian Species

Life history strategies of the common woody riparian species found along the bypass and comparison study reaches (willow, white alder, Fremont cottonwood, and California sycamore) are summarized in Table AQ 1-9. The timing of seed dispersal of these common species is summarized in Table AQ 1-10. Flowering and seed dispersal generally occurs in May and June for these species.

5.5.3 Riparian Community Characteristics

The confined valley walls and bedrock and/or coarse substrate that are characteristic of large sections of the bypass and comparison reaches considerably influence riparian abundance and distribution patterns. Riparian vegetation was either sparsely or discontinuously distributed along the East Fork Kaweah River and along the Kaweah River Bypass Reach from the Kaweah No. 3 Powerhouse to the Kaweah No. 1 Powerhouse. The width of the riparian corridor along these reaches varied depending on the availability of suitable substrate, summer water availability, and stage of the winter and spring flows. Downstream of the Kaweah No. 1 Powerhouse, the valley bottom widens, and the channel was lined with wide or narrow riparian corridors.

Characteristics of the riparian communities at the study sites on the bypass reaches (distribution, species composition, and age classes) were compared to those at suitable comparison study sites (Tables AQ 1-11 and AQ 1-12), and are summarized below. The mapped vegetation communities within each study site are shown on Map B-1. Table AQ 1-13 provides a crosswalk between the MCV communities and the CalVeg communities (USDA-FS 2015). Relationships between vegetation and inundation/hydrology and position along the elevation profile are discussed in Section 4.5. The majority of the species encountered in the surveys were native species (Appendix B Attachment A). Representative photographs of the riparian corridors at each study site are presented in Appendix B Attachment B.

5.5.3.1 Kaweah River Bypass Reach

Riparian vegetation was surveyed at three study sites along the Kaweah River Bypass Reach. One study site was located between the Kaweah No. 3 Powerhouse and the East Fork of the Kaweah River and two study sites were located between the East Fork Kaweah River confluence and the Kaweah No. 2 Tailrace.

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (RM 8.45 – RM 8.78)

This study site on the Kaweah River is relatively steep (3 percent gradient) with steep side slopes and limited geomorphic landform development. The study site is approximately 0.33 miles in length. The downstream end of the study site is located less than 0.10 miles upstream from the confluence with the East Fork Kaweah River at an elevation of approximately 1,313 feet above mean sea level (msl). The study site is adjacent to Highway 128, and recreation use within the site was observed. Minimal adverse impacts from recreationists to vegetation, streambanks, or debris within the study site was observed.

Within this study site, the channel has short alternating segments dominated by bedrock, step-pool formations, or boulder cascades. The channel substrate is primarily comprised of large and small boulders. The river is bordered by large granitic boulders and exposed bedrock with small patches of cobbles and gravels. Riparian vegetation was established in relatively short discontinuous narrow patches between the bedrock sections and among the boulders. In locations where vegetation was present, the riparian corridor along the riverbanks ranged from between 25 and 80 feet in width, depending on substrate and topography. Large portions of the right bank were bare outcrops of smooth and scoured granite.

The riparian corridor was dominated by the dusky willow riparian scrub community, with white-alder-California sycamore riparian forest, and Oregon ash woodland communities interspersed (Map B-1; Table AQ 1-12). Vegetation cover was relatively low, with homogenous stands having an average of 44 percent cover within the study site. Species occupying the canopy included California sycamore, a few Fremont cottonwood trees, white alder, interior live oak (*Quercus wislizeni*), and two willow tree species, red and Gooding's black willow (*Salix laevigata* and *Salix gooddingii*) (Figure AQ 1-19). Dusky willow (*Salix melanopsis*) and buttonbush (*Cephalanthus occidentalis*) were common throughout the reach, with patches of sandbar willow (*Salix exigua* var. *hindsiana*). The community was comprised of a mix of older and mature willow shrubs and white alder and California sycamore trees, with younger Fremont cottonwood individuals (Figure AQ 1-20). Young riparian trees and shrubs were observed on small gravel pockets among the boulders along the channel margins. Other common species included California brickelbush (*Brickellia californica*), tall flatsedge (*Cyperus eragrostis*), and western panic grass (*Panicum acuminatum*). A total of 31 plant species were documented within the site, and were primarily native species (81 percent). A large patch of invasive Spanish broom (*Acmispon americanus*) was also observed within the study site. The uplands surrounding the riparian zone were dominated by a low-density canopy of blue and canyon live oak (*Quercus douglasii* and *Quercus chrysolepis*), interspersed with California buckeye (*Aesculus californica*). Willows were primarily established along the low flow channel and lower bar surfaces, transitioning to California sycamore and white alder forest as elevations increased above the low flow channel. Upland species, including Oregon ash (*Fraxinus latifolia*) and oak trees were established on the hillslopes (Figure AQ 1-21).

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (RM 7.16 – RM 7.83)

Downstream of the confluence with the East Fork Kaweah River, the Kaweah River channel gradient is more moderate than the upstream study site, approximately 2 percent. The bypass channel is primarily comprised of pool-riffle and plane-bed segments interspersed with short bedrock segments.

The study site was approximately 0.67 mile in total length, and located approximately 0.5 mile downstream of the East Fork Kaweah River confluence. The study site included two stream segments, located about 0.26 mile apart. The channel flows through wide boulder-dominated and sparsely vegetated floodplains. The upstream segment, approximately 0.07 mile in length, was located at an elevation of approximately 1,205 feet, and the downstream segment, approximately 0.34 mile in length, was located at an elevation of approximately 1,160 feet. Where vegetation was present, the riparian corridor ranged from 20 to 80 feet in width along the riverbanks and on the floodplain.

The riparian corridor within the study site was dominated by the dusky willow riparian scrub community, with patches of white alder/dusky willow riparian forest (Map B-2; Table AQ 1-12). Fremont cottonwood, California sycamore, and Gooding's willow trees provided intermittent cover along the riverbanks with dusky willow; white alder and Oregon ash also present (Figure AQ 1-19). Where vegetation was present, vegetation cover within the study site averaged 71 percent. The community was comprised of a mix of older and younger willow shrubs, white alder and Fremont cottonwood trees, and had a canopy of older California sycamore trees (Figure AQ 1-20). Younger willow and cottonwood individuals and seedlings were observed among the boulders along the channel margins, and on finer substrate deposits. Two long cobble and sand islands hosted dusky willow, white alder, and a patch of broadleaf cattail (*Typha latifolia*). A total of 33 plant species were observed, with 76 percent native species. A dense patch of invasive Spanish broom was observed within the study site. The surrounding habitats were an open, dry woodland with a canopy of blue, canyon live and valley oaks (*Quercus lobate*). Willows were primarily established on the lower surfaces near the channel and sparsely vegetated on the bars, with white alder and Fremont cottonwood trees rooted higher on the banks (Figure AQ 1-21).

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (RM 5.01 – RM 6.46)

The study site is approximately 1.45 miles in total length. The study site was divided into two segments. The upstream segment, approximately 0.2 mile in length, was located at an elevation of approximately 1,075 feet. The 0.22-mile long downstream segment, located about one mile downstream, was located at an elevation of approximately 975 feet. The riparian corridor was confined along the right bank and extended approximately 275 feet onto a gravel bar and intermittently vegetated floodplain on the left bank where the valley bottom widened. The riparian corridor ranged in width from 40 to 80 feet where vegetation was present, depending on the substrate and topography. A public beach is located on the right bank that is accessed through SCE property within the study site.

The riparian corridor within the study site was dominated by dusky willow riparian scrub with patches of Fremont cottonwood forest and Fremont cottonwood/dusky willow riparian forest (Map B-1; Table AQ 1-12) with a canopy of Fremont cottonwood, California sycamore, valley oak and Goodding's black willow. Oregon ash, white alder, arroyo willow, and interior live oak were also common within the riparian corridor. The community was comprised of a mix of mature willows, white alders, and Fremont cottonwoods, with an overstory of old California sycamore trees (Figure AQ 1-19 and AQ 1-20). Young willows and willow seedlings were observed among the boulders along the channel margins and on finer substrate deposits. Invasive grasses, forbs, and Spanish broom were observed on the left bank. Where vegetation was present, vegetation within the study site averaged 56 percent. A total of 36 plant species were observed, with 70 percent native species. Habitats of open, dry woodland dominated by blue, interior live, and valley oaks surrounded the study site. Willow-dominated communities occurred adjacent to the low flow channel and sparsely vegetated on the bars, with white alder trees and California sycamore trees established at higher elevations on the floodplain. Vegetation was sparse or distributed in patches on the higher bar surfaces, which were 8 feet or higher than the low flow channel (Figure AQ 1-21).

5.5.3.2 East Fork Kaweah River Bypass Reach

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (RM 0.1 – RM 0.25)

The East Fork Kaweah River from Kaweah No. 1 Diversion Dam to the confluence with the Kaweah River flows through a sparsely vegetated steep and narrow canyon with steep side slopes. The channel contains more cobble and gravel-sized material in the 0.4-mile segment immediately upstream of the confluence with the Kaweah River, where the study site was located. The 0.24-mile long study site was located less than 0.10 miles upstream from the confluence with the Kaweah River at an elevation of 1,300 feet and approximately 4.7 miles downstream from the Kaweah No. 1 Diversion. Where vegetation was present, the riparian corridor ranged from 25 to 75 feet in width. The study site experiences some recreational use, and heavy use by cattle was observed along the riverbanks.

The riparian corridor within the study site was comprised of dusky willow riparian scrub with patches of California sycamore woodland and Oregon ash woodland (Map B-1; Table AQ 1-12). The river and riparian zone have intermittent cover provided by willow shrubs and mature trees including white alder, Fremont cottonwood, interior live and blue oak, red willow, and California sycamore (Figures AQ 1-19 and AQ 1-20). The willow- and alder-dominated communities occurred among boulders along the channel margins and along the banks at elevations where late summer and fall water is available, with young willow and alder individuals and seedlings observed on the finer substrate deposits (Figure AQ 1-21). The riparian communities quickly transition to California sycamores and communities dominated by upland species near the hillslopes. Clusters of buttonbush and dusky willow lined the active channel. Vining species such as white bark raspberry (*Rubus leucodermis*), wild grape (*Vitis californica*), and Himalayan blackberry (*Rubus armeniacus*) thread among the boulders and the other shrubs. A total of 26 plant species were identified, with 88 percent native species. The amount of cover in this reach is low, with homogeneous stands of vegetation having an average of 43 percent cover.

5.5.3.3 Comparison Study Sites

Three comparison study sites were surveyed to compare to the riparian vegetation characteristics along the bypass reaches.

Kaweah River Upstream of Kaweah No. 3 Powerhouse (RM 8.94 – RM 9.28)

The comparison study site upstream of the Kaweah No. 3 Powerhouse is located approximately 100 feet upstream of the Kaweah No. 2 Diversion. The study site was located at an elevation of approximately 1,380 feet. Upstream of the diversion, the river flows through a steep and narrow canyon with bedrock sections and large boulders. Riparian vegetation was sparsely distributed, and was established among the boulders and in patches in areas where smaller substrate had deposited. This study site is a comparison study site to the Kaweah River study site upstream of the East Fork Kaweah River confluence and the study site located between the East Fork Kaweah River confluence and Kaweah No. 1 Powerhouse. The comparison study site is approximately 0.34 miles in length. The width of the riparian corridor ranged from 25 to 70 feet where vegetation was present, depending on the substrate and topography.

The riparian corridor within the study site was comprised of communities dominated by white alder, California sycamore, red willow, and dusky willow (Map B-1; Table AQ 1-12; Figure AQ 1-19). Portions of the floodplain were boulder-dominated and primarily unvegetated, with patches of dusky willow. The riparian vegetation was a mix of mature willow shrubs with older white alder and California sycamore trees in the canopy. The species composition and distribution across the floodplain were similar to the bypass reaches, dominated by various willow species and white alder, with Fremont cottonwood and California sycamore in the canopy. Other species present in the floodplain canopy included interior live oak, Gooding’s black willow, red buckthorn (*Frangula rubra*), and ponderosa pine (*Pinus ponderosa*). The river margins support dense thickets of buttonbush with patches of deer grass (*Muhlenbergia rigens*), western panic grass (*Panicum acuminatum*), and a diversity of forbs. The uplands bordering the riparian zone consisted of a patchy oak and California buckeye forest, with outcrops of sparsely vegetated bedrock. A total of 35 plant species were identified, with 88 percent native species, similar to the bypass reaches. The amount of cover in this reach within homogeneous stands of vegetation had an average of 70 percent cover, similar to the study site downstream of the East Fork Kaweah River confluence. Cover was lower in the study site upstream of the East Fork Kaweah River confluence.

Kaweah River Downstream of Kaweah No. 2 Powerhouse (RM 3.07 - RM 3.15)

This comparison study site is located approximately 1.8 miles downstream from the Kaweah No. 2 Powerhouse at an elevation of approximately 825 feet. The river meanders through a wider river valley with wide sparely vegetated bars, with wider corridors of riparian vegetation lining the channel, ranging in width from 20 to 80 feet along the river banks. The study site was approximately 400 feet in length. This study site is a comparison to the study site on the Kaweah River between the Kaweah No. 1 and Kaweah No. 2 powerhouses.

The riparian corridor within the study site was comprised primarily of arroyo willow riparian scrub and white alter-red willow riparian forest (Map B-1; Table AQ 1-12). Dominant species within these communities included arroyo willow and white alder, with scattered California sycamore trees in the canopy (Figure AQ 1-19). The species composition and distribution were similar to that within the bypass reach, with willows and white alder established near the summer low flow channel and channel margins where late summer and early fall summer water would be available, transitioning to sparsely vegetated high bar surfaces. A large granite outcrop within the study site was devoid of vegetation. Aside from this outcrop, both banks were densely lined with a mix of mature and older willow shrubs and white alder trees (Figure AQ 1-20). The downriver end of the reach was a boulder-strewn riffle with small islands that supported deer grass. There were scattered patches of dusky and sandbar willows interspersed with buttonbush within the study site. An exotic southern catalpa tree was observed on the left bank. A total of 20 plant species were identified within the study site, lower than the bypass reach study site

(36 species). Of the species identified, 75 percent were native species. The amount of cover in this reach within homogeneous stands of vegetation was greater than bypass reach study site, with an average of 88 percent cover (compared to 56 percent cover in the bypass reach study site).

East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (RM 4.9 – RM 5.6)

The comparison study site for the East Fork Kaweah River Bypass Reach was located approximately one mile upstream of the Kaweah No. 1 Diversion Dam, at an elevation of approximately 2,820 feet. The river flows through a steep, narrow, and intermittently forested canyon. The 450-foot-long reach that was surveyed contains a series of large pools lined with bedrock topped over with sand, and more narrow sections of bedrock riffles and runs. A narrow floodplain occurred intermittently on the north side and there was one long, vegetated island. Where vegetation was present, the riparian corridor ranged from 30 to 80 feet in width along the river. On the date of the survey a 10-foot ladder had recently been left on the south bank of the river; no other impacts were observed from recreation or grazing.

The riparian corridor within the study site was comprised primarily of California sycamore woodland, white alder/dusky willow riparian forest, and white alder-Canyon live oak woodland communities, with the overstory canopy dominated by old white alder, California sycamore, and canyon live oak trees (*Quercus chrysolepis*) (Map B-1; Table AQ 1-12; Figures AQ 1-19 and AQ 1-20). The community composition and distribution across the channel and floodplain were similar to that observed in the bypass reach. White alder and California sycamore trees were established closer to the channel, with a mix of upland species near the hillslopes. The tree canopy lining the channel within the study site was denser than the study site along the bypass reach, providing 86 percent cover, on average, where vegetation was present along the river margins. The understory supported red and dusky willow, native and exotic blackberry, and wild grape. A total of 25 plant species were observed; with almost all native species (97 percent) (similar to the bypass reach study site [26 species identified, 88 percent native]).

5.5.4 Riparian Resources and Hydrologic Regime Relationships

5.5.4.1 Hydrology Patterns

Annual hydrology, including frequency and timing, and recession rates of high flow events for the bypass reaches under impaired and unimpaired flow conditions are summarized below.

General hydrologic patterns along the Kaweah River and East Fork Kaweah River bypass reaches (frequency and timing) were similar under impaired and unimpaired flows during both normal and dry year conditions (Figures AQ 1-22 and AQ 1-23). During the period of record, the hydrologic pattern generally followed a typical snowmelt hydrograph with higher flows during later spring and early summer (May to July). This pattern was punctuated with a few years with extremely high winter flow events (e.g., 1997, 2002, 2009, and 2010) and 5 consecutive years with very dry conditions (2012 to 2016) (Figure AQ 1-22).

The majority of the volume of high flows (scouring flows) on the bypass reaches was not captured by the diversion facilities and continued to flow downstream. There were minimal differences in the magnitudes and frequencies of the infrequent instantaneous peak flows (e.g., Q5, Q10, and Q25) that are important for channel geomorphic processes and resetting conditions for riparian vegetation under impaired and unimpaired flows (Figure AQ 1-24). The frequency of peak flows at the 1.5 (Q1.5) and 2 (Q2) recurrence intervals were also similar (Table B-1). Flows of this magnitude rarely occurred in dry years (once in the period of record). On the Kaweah River bypass reaches, the number of days when the flows equaled or exceeded the Q1.5 flow magnitude in years when high flow events occurred was on average 1 to 4 days less under impaired than unimpaired flow conditions. For Q2 flows, the frequencies of the flows were on average the same or 1 to 2 days less under impaired than unimpaired flow conditions. When an event occurred on the East Fork Kaweah River, the Q1.5 and Q2 flows occurred one day or less frequently per year, on average, under impaired than unimpaired flow conditions.

The magnitude, frequency, and rate of recession of flows that promote riparian recruitment were similar under impaired and unimpaired flow conditions. The number of days when the Q1.5 and Q2 flows occurred under impaired and unimpaired flow conditions were compared by month (Figure B-1). During May to June (months of seed setting for the dominant species), on average, the number of days the Q1.5 and Q2 flows were exceeded per year was 2 days or less on the Kaweah River and East Fork Kaweah rivers under both impaired and unimpaired flow conditions. Recession rates (change in stage over time) downstream from the Project diversions on the bypass reaches were faster under impaired conditions than unimpaired conditions during the time of spring seed release and seed setting (May to June) and generally were reduced to lower flow conditions earlier in the summer; but were within the range identified in the literature for seedling survival success (less than 3.9 inches per day). Recession rates were typically 1.6 inches or slower per day during the spring snowmelt recession under impaired and unimpaired flows. Figure B-2 shows a comparison on the recession rates for the unimpaired flows (top graph) and impaired flows (bottom graph) at three elevation profiles at the study sites on the Kaweah River and East Fork Kaweah River. The recession rates shown on the graphs illustrate the general trend in the rate of the receding limb during the snowmelt runoff; rates were faster in some years and slower in others. Variability among the recession rates among the elevation profiles at the same study site reflect the effects of topography on the stage-discharge relationship. The recession rate curves for the unimpaired flow conditions are also shown on the impaired graphs for comparison.

5.5.4.2 Vegetation and Inundation Relationships

The differences in inundation characteristics (e.g., inundation width, inundation frequency and duration, and water depths) between impaired and unimpaired flow conditions on the bypass and unimpaired comparison river reaches depended on the topographic characteristics of the study sites (e.g., steepness of river banks, confined valley walls, elevations of the bars).

At the study sites on the Kaweah River, the greatest change in width of inundation and depth (stage) occurred as flows increased from base flows up to approximately 500 cubic feet/second (cfs). At the study site between Kaweah No. 3 Powerhouse and the East Fork Kaweah River confluence, the wetted width increased between 40 and 50 feet and the depth increased between 2 and 4 feet as flows increased from base flow to 500 cfs, depending on the location (Figure B-3). As flows increased from 500 cfs to about 1,200 cfs (which occurred about 4 percent of the time (Table B-2), based on average daily flows), the wetted width and depth increased more slowly (up to 20 feet in total width and up to 2 feet in depth). For reference, 500 cfs is shown on the elevation profiles in Figure AQ 1-21. At this study site, flows of this magnitude overtop the riverbanks and extended to the valley walls or onto the higher bar surfaces. The frequency of inundation in lower elevation areas was greater under unimpaired conditions than impaired conditions (Figure AQ 1-21). At this study site, willows were primarily established along the channel and among the boulders bordering the channel. White alder and California sycamore trees were established on the higher surfaces that were less frequently inundated.

At the study site downstream of the confluence of the East Fork Kaweah River and upstream of Kaweah No. 1 Powerhouse, the wetted width increased between 40 and 70 feet and water depths increased between 2 and 3 feet as flows increased from base flow to approximately 500 cfs (Figure B-3). As flows increased from 500 cfs to about 1,700 cfs (which occurred about 4 percent of the time (Table B-2), based on average daily flows), the wetted width increased about 10 to 25 feet and water depth increased from 1.5 to 2 feet. Similar to the study site upstream, flows begin to overtop the riverbanks and enter into the floodplain or wide channel bars at approximately 500 cfs (Figure AQ 1-21). The frequency of inundation in lower elevation areas was greater under unimpaired conditions than impaired conditions (Figure AQ 1-21). This zone was fairly narrow in the more confined sections of the reach (e.g., elevation profile at Transect 9). Willows and white alders were established along the channel and lower elevations, with Fremont cottonwood and California sycamores established at higher elevations. The higher bar surfaces were sparsely vegetated.

At the study site between the Kaweah No. 1 and No. 2 powerhouses, the greatest change in inundation width and depth occurred as flows increased from base flows up to approximately 500 cfs, similar to the two study sites upstream. The wetted width increased between 40 and 60 feet and depth increased between 2 and 3 feet as flows increased from base flow to 500 cfs, depending on the location (Figure B-3). As flows increased from 500 cfs to about 1,900 cfs (which occurred about 4 percent of the time (Table B-2), based on average daily flows), the wetted width and depth increased more slowly (up to 20 feet in total width and up to 2 feet in depth). The frequency of inundation of lower elevation surfaces was greater under unimpaired conditions than impaired conditions (Figure AQ 1-21), although this area was fairly narrow through most of the reach (e.g., elevation profiles at transects 1, 5, and 9). The lowest elevations were vegetated primarily with willows; while communities comprised of a mix of Fremont cottonwood, California sycamore, white alder, and willows were found on less frequently inundated surfaces and extended farther from the channel.

On the East Fork Kaweah River, the greatest change in inundation width and depth occurred as flows increased from base flows up to approximately 100 cfs. The wetted width increased by 20 to 30 feet and depth increased from 1 to 2 feet, depending on the location. As flows increased from 100 cfs to 230 cfs (which occurred about 15 percent of the time (Table B-2), based on average daily flows), the wetted width increased by about 10 feet and water depth increased by about a foot. In the narrower sections of the study site confined by the valley walls, the width of inundation was fairly narrow under both impaired and unimpaired flow conditions (e.g., elevation profiles at Transects 1 and 9). In the sections of the study site with a wider channel bottom, the frequency, and duration of inundation adjacent to the channel was greater under unimpaired than impaired flow conditions (e.g., elevation profiles at Transect 14). Willows, white alder, and California sycamore were established between the channel and the valley walls, transitioning to upland communities or sparsely vegetated surfaces at higher elevations.

6 LITERATURE CITED

Amlin, N.M., and S.B. Rood. 2002. Comparative tolerances of riparian willows and cottonwoods to water table decline. Wetlands. 22: 338-346.

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken, editors. 2012. The Jepson manual: vascular plants of California, second edition. University of California Press, Berkeley.

Baltz, D.M. and B. Vondracek. 1985. Appendix 1-D Suitability and Microhabitat Preference Curves, in: Pit 3, 4, and 5 Project, Bald Eagle and Fish Study. Prepared by BioSystems Analysis, Inc., and U.C. Davis. Report for Pacific Gas and Electric Company.

Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.B. Stalnaker, J. Taylor, and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division Information and Technology Report USGS/BRD-1998-0004. 131 p.

Braatne J.H., S.B. Rood, and P.E. Heilman. 1996. Life history, ecology, and conservation of riparian cottonwoods in North America. *In:* Biology of *Populus* and its Implications for Management and Conservation. Eds. R.F. Stettler, H.D. Bradshaw, Jr., P.E. Heilman, and T.M. Hinkley. NRC Research Press, National Research Council of Canada, Ottawa, Ontario. Pp. 57-86.

Dixon, M.D. 2003. Effects of flow pattern on riparian seedling recruitment on sandbars in the Wisconsin River, Wisconsin. Wetlands. 23(1): 125-139.

FERC (Federal Energy Regulatory Commission). 2017. Study Plan Determination for the Kaweah Hydroelectric Project. October 24.

Hartman, G.F., and D.M. Galbraith. 1970. The reproductive environment of the gerrard stock rainbow trout. British Columbia Fish and Game Branch Management Publication 15: 51 p.

Karrenberg, S., P.J. Edwards, and J. Kollman. 2002. The life history of *Salicaceae* living in the active zone of floodplains. Freshwater Biology. 47:733-748.

Lind, A. 2009. Title, Company. Personal communication with S. Yarnell, Title, Company. November Day.

Mahoney, J.M. and S.B. Rood. 1998. Streamflow requirements for cottonwood seedlings recruitment – an integrative model. Wetlands. 18:634-645.

McCain, M., D. Fuller, L. Decker, and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHR Currents: R-5's fish habitat relationships technical bulletin. No. 1. U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Region, Arcata, California.

Meehan, W.R., and T.C. Bjornn. 1991. Salmonid distributions and life histories. Pp. 47–82 in W.R. Meehan, ed. Influences of Forest and Rangeland on Salmonid Fishes and Their Habitats. Special Publ. No. 19. American Fisheries Society. Bethesda, Maryland.

Merritt, D.M., M.L. Scott, N. Poff, G. Auble, and D. Lytle. 2009. Theory, methods and tools for determining environmental flows for riparian vegetation: riparian vegetation-flow response guilds. Freshwater Biology.

Milhous, R.T., M.A. Updike, and D.M. Schneider. 1989. Physical Habitat Simulation System Reference Manual – Version II. Washington, DC: U.S. Fish and Wildlife Service.

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

Orcutt, D.R., B.R. Pulliam, and A. Arp. 1968. Characteristics of Steelhead Trout Redds in Idaho Streams. Transactions of the American Fisheries Society 97:42–45.

Placer County Water Agency (PCWA). 2011. Application for New License. Middle Fork American River Project (FERC Project No. 2079). AQ 1 – Instream Flow Technical Study Report (2010). Exhibit E, Volume 3, Supporting Document B. Filed with FERC February 23, 2011.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. U.S. Fish and Wildlife Service, Division of Biological Services (FWS/OBS-82d/10.60). Washington, DC.

Rantz, S.E. 1982. Measurement and computation of streamflow: Volume 1. Measurements of stage and discharge. U.S. Geological Survey Water Supply Paper 2175. 284p.

Sawyer, J.O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation. Second Edition. California Native Plant Society Press. Sacramento, California.

Shafroth, P.B., K.J. Schlatter, M. Gomez-Sapiens, E. Lundgren, M.R. Grabau, J. Ramirez-Hernandez, J.E. Rodriquez-Burgueno, and K.W. Flessa. 2017. A large-scale environmental flow experiment for riparian restoration in the Colorado River Delta. Ecological Engineering. 106: 645-660. Shaforth et al. 2017

Schmidt, L.J., and J.P. Potyondy. 2004. Quantifying channel maintenance instream flows: an approach for gravel-bed streams in the Western United States. Gen. Tech. Rep. RMRS-GTR-128. Fort Collins, Colorado. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 33 p.

Smith G.E., and Aceituno M.E. 1987. Habitat preference criteria for brown, brook and rainbow trout in eastern Sierra Nevada streams. Final report, State of California, Department of Fish and Game.

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

SCE. 2017. Kaweah Project, Revised Study Plan. Filed with FERC on September 19.

SCE. 2019a. AQ 2 – Fish Population Technical Study Report. Available in SCE's Application for New License, Supporting Document A

SCE. 2019b. AQ 7 – SS Amphibians and Aquatic Reptiles Technical Study Report. Available in SCE's Application for New License, Supporting Document A

Stella, J.C., P.M. Rodriguez-Gonzalez, S. DuFour, and J. Bendix. 2013. Riparian vegetation research in Mediterranean-climate regions: common patterns, ecological processes, and considerations for management. Hydrobiolgia. 719: 291-315.

TRPA (Thomas R. Payne & Associates). Unpublished. Roaring River HSC Data. Arcata, California USA 95518. http://trpafishbiologists.com

TRPA. 1992. Instream flow study for the Middle Fork Stanislaus River, Spring Gap-Stanislaus Hydroelectric Project (FERC 2130). Document prepared for Pacific Gas and Electric Company, San Ramon, California.

TRPA. 2000. Determining appropriate HSC for use in the South Fork American River Basin. Testing the transferability of generic and California-specific HSC. Report submitted to El Dorado Irrigation District, Placerville, California. 100 pp.

TRPA. 2002a. Instream flow study for the Middle Fork Stanislaus River, Spring Gap-Stanislaus Hydroelectric Project (FERC 2130). Document prepared for Pacific Gas and Electric Company, San Ramon, California.

TRPA. 2002b. Habitat Suitability criteria for rainbow trout and Sacramento suckers in the Upper North Fork Feather River Project (FERC No.2105). Report prepared for Pacific Gas and Electric Company, San Ramon, California. 86 pp.

TRPA. 2004. Klamath Hydroelectric Project (FERC NO. 2082). Habitat suitability criteria. Report to PacifiCorp, Portland, Oregon. 64 pp. and appendices.

TRPA. 2009. RHABSIM (Riverine Habitat Simulation) Software Version 3.0. Thomas R. Payne and Associates. Arcata, California USA 95518. Available at: http://trpafishbiologists.com/rindex.html.

Uchytil, Ronald J. 1989. *Alnus rhombifolia*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available online at: http://www.fs.fed.us/database/feis/. Accessed August 13, 2007.

USDA-FS (U.S. Department of Agriculture-Forest Service). 2015. Pacific Southwest Region. Vegetation Classification & Mapping. CalVeg.

Waddle, T.J. (ed.). 2001. PHABSIM for Windows: user's manual and exercises: U.S. Geological Survey Open-File Report 01-340. 288 p.

TABLES

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Table AQ 1-1. Instream Flow Study Reaches and Study Sites.[1]

River Study Segments	Site ID	Bypass Reaches	Comparison Reaches (upstream or downstream of the Project)	Study Site Location River Miles
Kaweah River Upstream of Kaweah No. 3 Powerhouse	KR US PH3		●	RM 8.94 - RM 9.28
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence	KR DS PH3	●		RM 8.45 - RM 8.78
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse	KR US PH1	●		RM 7.16 - RM 7.5 RM 7.75 - RM 7.83
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse	KR US PH2	●		RM 5.01 - RM 5.23 RM 6.26 - RM 6.46
Kaweah River Downstream of Kaweah No. 2 Powerhouse	KR DS PH2		●	RM 3.07 - RM 3.15
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion	EF US K1 DIV		●	RM 4.9 - 5.6
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion	EF DS K1 DIV	●		
East Fork Kaweah River Upstream of Confluence with Kaweah River	EF US CONF	●		RM 0.1 - RM 0.25

[1] Study sites and modeling cross-sections were selected in the field in coordination with the Aquatic TWG in June 2019.

Table AQ 1-2. Periodicity Chart for Modeled Fish Species and Life Stages.

Month / Species and Life Stage	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												

Table AQ 1-3. Mesohabitat Types Mapped and Consolidated for Instream Flow Modeling.

Mesohabitat Types	Habitat Mapping	Instream Flow Modeling
Cascade (CAS)	CAS	CAS
High Gradient Riffle (HGR)	HGR	HGR
Low Gradient Riffle (LGR)	LGR	LGR
Main Channel Pool (MCP)	MCP	POOl
Step Pool (STP)	STP	
Run (RUN)	RUN	RUN
Step Run (SRN)	SRN	

Table AQ 1-4. Instream Flow Study Cross-section and Reach-Wide Mesohabitat Mapping.

Reach	Instream Flow Mesohabitat Units	Overall Reach			Instream Flow Site			
		Length ft	Length %	Length % w/o CAS	Number of Cross-sections	Cross-section %	Mesohabitat Units Used	Weighting Factor per Transect for Reach
Kaweah River								
KR DS PH3	CAS	222	7.0%	--	0	0.0%	0	--
	HGR	569	19.0%	20.4%	4	22.2%	3	5.10%
	LGR	200	7.0%	7.2%	2	11.1%	2	3.59%
	RUN	784	41.0%	28.1%	4	22.2%	3	7.03%
	POOL	1236	26.0%	44.3%	8	44.4%	4	5.54%
	Totals	3011	100.0%	100.0%	18	100.0%	12	--
KR US PH1	CAS	188	1.7%	--	0	0.0%	0	--
	HGR	1454	12.9%	13.1%	2	16.7%	2	6.54%
	LGR	5833	51.6%	52.5%	6	50.0%	2	8.74%
	RUN	1543	13.6%	13.9%	2	16.7%	1	6.94%
	POOL	2288	20.2%	20.6%	2	16.7%	1	10.29%
	Totals	11306	100.0%	100.0%	12	100.0%	6	--
KR US PH2	CAS	137	1.1%	--	0	0.0%	0	--
	HGR	3334	27.9%	28.3%	3	25.0%	2	9.42%
	LGR	4546	38.1%	38.5%	5	41.7%	5	7.71%
	RUN	1026	8.6%	8.7%	1	8.3%	1	8.70%
	POOL	2891	24.2%	24.5%	3	25.0%	1	8.17%
	Totals	11934	100.0%	100.0%	12	100.0%	9	--

Reach	Instream Flow Mesohabitat Units	Overall Reach			Instream Flow Site			
		Length ft	Length %	Length % w/o CAS	Number of Cross-sections	Cross-section %	Mesohabitat Units Used	Weighting Factor per Transect for Reach
East Fork Kaweah River								
EF US CONF KR	CAS	3587	14.4%	--	0	0.0%	0	--
	HGR	9010	36.2%	42.3%	8	42.1%	2	5.28%
	LGR	559	2.2%	2.6%	1	5.3%	1	2.62%
	RUN	3815	15.3%	17.9%	3	15.8%	2	5.96%
	POOL	7935	31.9%	37.2%	7	36.8%	2	5.32%
	Totals	24906	100.0%	100.0%	19	100.0%	7	--

CAS = Cascade

HGR = High Gradient Riffle

LGR = Low Gradient Riffle

Run = Run, Pool = Pool

Table AQ 1-5. Instream Flow Study Site Information.[1]

River Study Segments	Site Name	Number of Mesohabitats Sampled (Cross-sections)						Comments
		Total	HGR	LGR	RUN	POOL	Special Purpose Riparian	
Kaweah River								
Kaweah River Upstream of Kaweah No. 3 Powerhouse	KR US PH3	1					1	Riparian Site Only
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence	KR DS PH3	18	4	2	4	8	0	Instream Flow, Geomorphic, and Riparian Site
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse	KR US PH1	12	2	6	2	2	0	Instream Flow, Geomorphic, and Riparian Site
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse	KR US PH2	12	5	11	3	5	0	Instream Flow, Geomorphic, and Riparian Site
Kaweah River Downstream of Kaweah No. 2 Powerhouse	KR DS PH2	1					1	Riparian Site Only
East Fork Kaweah River								
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion	EF US K1 DIV	1					1	Riparian Site Only
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion[2]	EF DS K1 DIV	0	0	0	0	0	0	Instream Flow, Geomorphic, and Riparian Site
East Fork Kaweah River Upstream of the Confluence with the Kaweah River[3]	EF US CONF KR	19	8	1	3	7	0	Instream Flow, Geomorphic, and Riparian Site

[1] Study sites and modeling cross-sections were selected in the field in coordination with the Aquatic TWG in June 2019.

[2] This is the inaccessible section of the East Fork Kaweah River. This section of river was not modeled, it was inaccessible due to dangerous conditions.

[3] This is the accessible section of the East Fork Kaweah River. The section of river is short in length and may not be representative of the steeper and inaccessible EF DS K1 DIV reach.

Table AQ 1-6. Instream Flow Data Collection Discharges and Modeling Ranges for each Study Reach.

Instream Flow Study Reaches / Sites	Site Name	Model Calibration Discharges Measured and (Target)[1] (cfs)				Instream Flow Modeling Range (cfs)
		Low	Medium[2]	High	High High	
Kaweah River						
Kaweah River Upstream of Kaweah No. 3 Powerhouse	KR US PH3	15 (5-10)	120 (30-40)	200 (90-110)	438	6-1100
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence	KR DS PH3	16 (5-10)	52 (30-40)	272 (90-110)	497	7-1400
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse	KR US PH1	22-32 (5-10)	84 (30-40)	300-380 (90-110)	750-800	10-1900
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse	KR US PH2	25 (5-10)	120(30-40)	320-410 (90-110)	975	10-2000
Kaweah River Downstream of Kaweah No. 2 Powerhouse	KR DS PH2	37 (5-10)	154 (30-40)	425 (90-110)	908	15-2300
East Fork Kaweah River						
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion	EF US K1 DIV	8 (5-7)	34 (10-20)	72 (30-50)	-	4-180
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion[3]	EF DS K1 DIV	-	-	-	-	-
East Fork Kaweah River Upstream of Confluence with Kaweah River	EF US CONF KR	10 (5-7)	26 (10-20)	79 (30-50)	-	4-240

[1] These are target flows identified by the Aquatic TWG

[2] Flows for velocity data collection.

[3] This is the inaccessible section of the East Fork Kaweah River. This section of river was not modeled, it was inaccessible due to dangerous conditions.

Table AQ 1-7. Impaired and Unimpaired Hydrology Summary for each Instream Flow Study Reach.

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 cfs Wet: 11 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 cfs Wet: 11 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 cfs Wet: 11 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 cfs All the Time
	Unimpaired	6.0	336.3	194.0	44.8	18.8	12.5	

Table AQ 1-8. Existing Conditions (No-Action Alternative) Percent of Unimpaired Habitat Comparison for each Bypass Reach.

Month / Reach	Species / Life Stage							
	HHAD	HHJUV	SSAD	SSJUV	RBAD	RBJUV	RBFRY	RBSPAWN
Kaweah River Downstream of Powerhouse No. 3 (KR DS PH3)								
January	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
February	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
March	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%		≥80%
April	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%		≥80%
May	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%
June	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	
July	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
August	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
September	≥70%	≥80%	≥80%	≥80%	≥70%	≥80%		
October	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
November	≥70%	≥80%	≥80%	≥80%	≥60%	≥70%		
December	≥70%	≥80%	≥70%	≥80%	≥50%	≥70%		
Kaweah River Upstream of Powerhouse No. 1 (KR US PH1)								
January	≥70%	≥80%	≥70%	≥80%	≥50%	≥80%		
February	≥70%	≥80%	≥70%	≥80%	≥50%	≥80%		
March	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		≥80%
April	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		≥80%
May	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%
June	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	
July	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
August	≥70%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
September	≥70%	≥80%	≥70%	≥80%	≥60%	≥80%		
October	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
November	≥70%	≥80%	≥70%	≥80%	≥50%	≥70%		
December	≥60%	≥80%	≥70%	≥80%	≥50%	≥70%		
Kaweah River Upstream of Powerhouse No. 2 (KR US PH2)								
January	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
February	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
March	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%		≥80%
April	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%		≥80%
May	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥70%
June	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	
July	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
August	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	
September	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		

Month / Reach	Species / Life Stage							
	HHAD	HHJUV	SSAD	SSJUV	RBAD	RBJUV	RBFRY	RBSPAWN
October	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%		
November	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
December	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US CONFL KR)								
January	≥70%	≥80%	≥70%	≥80%	≥50%	≥70%		
February	≥70%	≥80%	≥70%	≥80%	≥60%	≥70%		
March	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		≥30%*
April	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		≥70%*
May	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥80%	≥70%*
June	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
July	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%	≥80%	
August	≥70%	≥80%	≥70%	≥80%	≥60%	≥80%	≥80%	
September	≥70%	≥80%	≥70%	≥80%	≥60%	≥80%		
October	≥80%	≥80%	≥80%	≥80%	≥70%	≥80%		
November	≥70%	≥80%	≥70%	≥80%	≥60%	≥70%		
December	≥70%	≥80%	≥70%	≥80%	≥50%	≥70%		

HHAD = Hardhead Adult
HHJUV = Hardhead Juvenile
RBAD = Rainbow Trout Adult
RBFRY = Rainbow Fry
RBJUV = Rainbow Trout Juvenile
RBSPAWN = Rainbow Trout Spawning
SSAD = Sacramento Sucker Adult
SSJUV = Sacramento Sucker Juvenile

* Generally greater than but at the 90% exceedance there is very little habitat, The exceedance plots are not deemed accurate or representative of actual conditions due to the low reliability of the sampling of scarce and small spawning habitat patches.

Table AQ 1-9. Life History Strategies of Dominant Woody Riparian Species Found in the Study Area.

Attribute		Species			
		Fremont Cottonwood	Willow	White Alder	California Sycamore
Initiation[1]					
Reproduction	Flowering Timing	Mar to June (Stella et al. 2006)	Apr to May; depends on location/ elevation and species (USDA-FS 2009; Zasada et al. 2009)	Mar (Harrington et al. 2009)	Feb to Apr (Baldwin et al. 2012)
	Seed Dispersal Timing	Seed Dispersal Timing is provided in Table AQ 1 D-3			
	Seed Dispersal Agent[2]	Hydrochoric and anemochoric		Primarily anemochoric, also hydrochoric and zoochoric	
	Asexual Traits	Crown breakage and flood-related disturbance (e.g. tree fall) (Braatne et al. 1996)	Root sprouts and sprouting of broken stem and root pieces transported during high flows, and layering of stems (Zasada et al. 2009)	Root or trunk resprouting; layering (Uchytil 1989a)	Can reproduce from root crown.
Germination and Establishment[3]	Seed Viability (in natural conditions)	1 to 3 weeks (as cited in Braatne et al. 1996)	A few days to a week, no more than 3 weeks (Anderson 2006)	Not a limiting factor (e.g. many months) (Harrington et al. 2009)	Not a limiting factor
	Germination	24 hours in moist, bare soil (Braatne et al. 1996)	12 to 24 hours (USDA-FS 2009; Karrenberg et al. 2002)	Can germinate immediately in favorable conditions (Uchytil 1989a and 1989b)	Germinates quickly in moist conditions.
	Seedling Root Growth Rate (and Recession Rate Associated with Establishment)	Seedling root growth rate: 4 to 12 mm/day (as cited in Braatne et al. 1996); can reach 40 cm length in 30 days (Braatne et al. 1996) Recession rate: 2.5 to 4 cm/day (up to 10 cm/day) (Mahoney and Rood 1998; Amlin and Rood 2002; Roberts et al. 2002; Stella et al. 2006)	Recession rate: 1 to 2.5 cm/day (Amlin and Rood 2002)	Rapid (similar to cottonwoods with water table declining rates of 1 to 3 cm/day); require continuously moist substrates to successfully establish (Uchytil 1989a and 1989b; USDA-NRCS 2009; as cited in Braatne et al. 1996)	Similar to cottonwoods
Dormant Season	Rooting Depth of Sapling, first growing season	75 to 150 cm (Braatne et al. 1996)	40 to 60 cm (Karrenberg et al. 2002)	Root growth rates similar to cottonwoods	Similar to cottonwoods

Attribute		Species			
		Fremont Cottonwood	Willow	White Alder	California Sycamore
Maturation[4]					
	Age at Reproductive Maturity	5 to 10 years (as cited in Braatne et al. 1996)	5 to 10 years (Zasada et al. 2009)	10 years, can be earlier (Harrington et al. 2009)	6 to 7 years
	Rooting Depth of Mature Stands/ Depth to Groundwater	3 to 5+ m (as cited in Braatne et al. 1996)	Less than 3 m	1 m (Uchytil 1989a, b)	Less than 1 m (USDA-NRCS 2019)
	Lifespan	130+ years (as cited in Braatne et al. 1996)	Varies depending on species. Stems survive 10 to 20 years (USDA-FS 2009)	100 years	200+ years
	Tree Height (mature tree)	12 to 35 m (USDA-NRCS 2008)	Variable, depends on species	15 to 24 m (Uchytil 1989a)	20 - 35 m (CNPS 2019)
	Diameter at Breast Height (mature tree)	30 to 150 cm USDA-NRCS 2008)	Variable, depends on species	28 to 60 cm (Uchytil 1989a)	up to 1 m (CNPS 2019)
Germination/Recruitment Microsite Characteristics					
	Depth to Water Table or Elevation above Baseflow	Elevation above baseflow: 1 to 3 m (Mahoney and Rood 1998; Roberts et al. 2002)	Elevation above baseflow: 0.6 to 3 m (Mahoney and Rood 1998; Jamison and Braatne 2001)	Elevation above baseflow: 0.4 m above baseflow (Lisle 1989)	Maximum depth to water table, 1.5 to 4.5 m (TNC 1998)
	Substrate	Bare, moist sandy, humous, or gravelly soils - with silts and clays.	Bare, moist sandy, humous, or gravelly soils - with silts and clays.	Sunny, wet mineral sites exposed from receding flood waters; cobbles, gravels and sands (Uchytil 1989a and 1989b)	Sunny, coarse, medium textured substrate near water (USDA-NRCS 2019)
	Location on Floodplain	Point bars, cut off channels, lower terraces	Point bars and cut off channels; water's edge	Sandbars or other fresh alluvium exposed by receding flood waters (Uchytil 1989a and 1989b)	Sand and gravel bars, alluvial surfaces near rivers and streams (USDA-NRCS 2019)

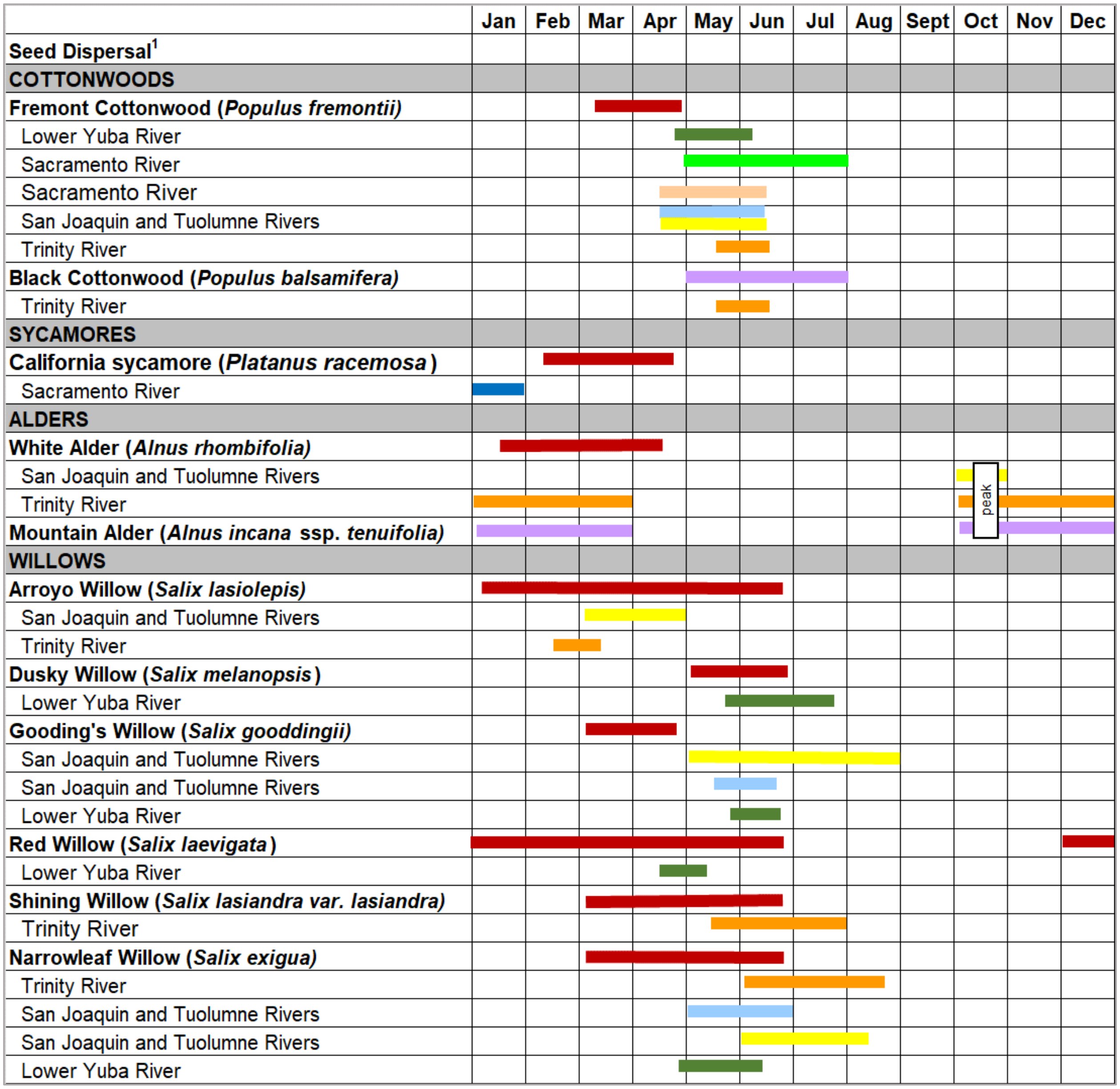
[1] Initiation refers to seed dispersal, germination, and initial seedling growth.

[2] Hydrochloric: water-dispersed; Anemochoric: wind-dispersed; Zoochoric: animal-dispersed.

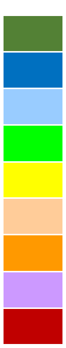
[3] Establishment refers to the continued survival and growth of seedlings and saplings over several years until the tree reaches maturity.

[4] Maturity (sexual) occurs once a tree begins to flower and produce seed.

Table AQ 1-10. Timing of Flowering and Seed Dispersal for Common Woody Riparian Species in the Study Area.



[1] References and elevation data for the different studies are:



Lower Yuba River (<300 feet elevation) (SYRCL 2016)
Sacramento River (TNC 1998)
San Joaquin River and Tuolumne River (< 650 feet elevation) (Stella et al 2006)
Sacramento River (< 300 feet elevation) (CALFED 1999)
San Joaquin River (< 600 feet elevation) (as reported in McBain and Trush 2002)
Sacramento River (< 300 feet elevation) (Roberts et al 2002 (TNC))
Trinity River (< ~1500 feet elevation) (McBain and Trush 1997)
General Source (Uchytil 1989b and as cited in Braatne et al 1996 for POBA)
General Source for flowers present (Baldwin et al 2012)

Table AQ 1-11. Summary of Riparian Vegetation Community Characteristics along the Project Bypass Reaches.

Riparian Corridor Width[1]	Riparian Corridor Substrate[2]	Vegetation Distribution and Community Composition[3]	Age Structure and Regeneration[1]	Vegetation Position and Recession Rates[1]
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence				
Ranging from 25 to 80 feet, where vegetation was present.	Stream banks and adjacent areas: Bedrock and boulder, with small patches of cobbles and gravels.	Distribution: Discontinuous narrow corridor (0.6 mi, 100% of the reach). Dominant Species: White alder and willows commonly associated with California sycamore trees and scattered Fremont cottonwood trees. Percent cover (44%) is fairly low, with homogenous stands of vegetation within the study site. Other common species included buttonbush, California brickelbush, tall flatsedge, and western panic grass. Community Composition: 31 plant species identified. Percent Native Species: 81%; Spanish broom was observed within the study site.	Age Class Structure: Mix of older and mature willows, alders, and California sycamore shrubs and trees, with younger Fremont cottonwood individuals. Regeneration: Young willows, white alders, and Fremont cottonwoods were observed on small gravel pockets among boulders along the channel.	At the study site, willow-dominated communities occurred along the channel margins. Communities with white alder, cottonwood, and/or California sycamore trees were typically established on higher, less frequently inundated surfaces. Higher floodplain and bar surfaces and bedrock sections were sparsely vegetated. Recession rates during spring runoff were typically slower than 1.6 inches per day.
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse				
Ranging from 20 to 80 feet, where vegetation was present.	Stream banks and adjacent areas: Boulder-dominated, with small gravel and cobble deposits along the channel margins.	Distribution: Discontinuous narrow corridor (1.85 mi, 100% of the reach). Dominant Species: White alder and willows, interspersed with Fremont cottonwood, California sycamore, and Oregon ash trees, with approximately 71% cover where vegetation was present. Other species present included buttonbush,	Age Class Structure: Mix of older and mature willow shrubs and white alder and Fremont cottonwood trees, with older California sycamore trees in the canopy. Regeneration: Younger willow and cottonwood individuals and seedlings were observed among the boulders along the channel	At the study site, willow-dominated communities occurred along the channel margins. Communities with white alder, cottonwood, and/or California sycamore trees were typically established on higher, less frequently inundated surfaces. Higher boulder-dominated floodplain and bar surfaces were sparsely vegetated. Recession rates

Riparian Corridor Width[1]	Riparian Corridor Substrate[2]	Vegetation Distribution and Community Composition[3]	Age Structure and Regeneration[1]	Vegetation Position and Recession Rates[1]
		California brickelbush, common spikerush, and smooth scouring rush. Community Composition: 33 plant species identified. Percent Native Species: 76%; Spanish broom was observed within the study site.	margins, and finer substrate deposits.	during spring runoff were typically slower than 1.6 inches per day.
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse				
Typically ranging from 40 to 80 feet, where vegetation was present; with wide corridors where the river bottom widens (greater than 250 feet in width).	Stream banks and adjacent areas: Gravel and cobble-dominated bars.	Distribution: Wide corridors (0.97 mi, 64% of the reach), with segments of narrow continuous (0.3 mi, 20% of the reach) and discontinuous (0.25 mi, 16% of the reach) corridors. Dominant Species: Willow and alder dominated, interspersed with cottonwood and California sycamore, with 56% cover where vegetation was present. Other common species observed included Oregon ash and buttonbush. Community Composition: 36 plant species identified. Percent Native Species: 70%.	Age Class Structure: Primarily mature willow, alder, and cottonwood trees, interspersed with older California sycamore trees. Regeneration: Younger willow and white alder individuals and seedlings were observed among the boulders along the channel margins, and finer substrate deposits.	At the study site, willow-dominated communities occurred along the active stream margins. Alder, cottonwood, and California sycamore communities, typically with willows, were established higher on the bank and bar surfaces. The high bar surfaces were sparsely vegetated. Recession rates during spring runoff were typically slower than 1.6 inches per day.

Riparian Corridor Width[1]	Riparian Corridor Substrate[2]	Vegetation Distribution and Community Composition[3]	Age Structure and Regeneration[1]	Vegetation Position and Recession Rates[1]
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion				
Ranging from 25 to 75 feet, where vegetation was present.	Stream banks and adjacent areas: Primarily boulder and bedrock, with small deposits of cobbles and gravels.	Distribution: Sparsely distributed (3.3 mi, 70% of the reach), with shorter segments with wide continuous (0.1 mi, 3% of the reach) or narrow discontinuous (1.2 mi, 27% of the reach) corridors. Dominant Species: Primarily willows and white alder, interspersed with California sycamore and cottonwood trees with intermittent cover along the channel (with 43% cover where vegetation was present). Other common species present included buttonbush, white bark raspberry, and Himalayan blackberry. Community Composition: 26 plant species identified. Percent Native Species: 88%.	Age Class Structure: Primarily mature willows, alder and cottonwoods, interspersed with older willows, and alder and California sycamore trees. Regeneration: Young willow and alder individuals and seedlings were observed on the finer substrate deposits.	At the study sites, there was a relatively narrow transition zone between the areas that were infrequently and frequently inundated along the stream channel. The riparian community was laterally distributed from the stream banks to the edge of the hillslopes. Recession rates during spring runoff were typically slower than 1.6 inches per day.

Notes:

1 At the study sites (AQ 1 - TSR) (SCE 2019a, SD A).

2 Also summarized in AQ 1 - TSR (SCE 2019a, SD A); AQ 5 - TSR (SCE 2019d); and SCE (2016).

3 Vegetation distribution information within the reach reported in SCE (2016) and dominant species, community composition, age class, and native species data at the study sites was reported in AQ 1 - TSR (SCE 2019a, SD A).

Table AQ 1-12. Summary of Vegetation Communities at the Study Sites.

Community Type[1]	Area (acres)	Proportion of Reach
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence		
Black willow riparian forest	0.05	1%
Broom patch (invasive, non-native)	0.07	2%
Buttonwillow scrub	0.11	3%
California sycamore woodland	0.03	1%
Dusky willow riparian scrub	1.26	37%
Edible fig (non-native)	0.01	0.2%
Fremont cottonwood forest	0.002	0.1%
Oregon ash woodland	0.47	14%
Red willow riparian forest	0.07	2%
Sandbar willow riparian scrub	0.15	4%
Sparsely vegetated	0.54	16%
White alder forest	0.11	3%
White alder-California sycamore riparian forest	0.51	15%
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse		
Black willow riparian forest	0.09	1%
Broom patch (invasive, non-native)	0.53	6%
California sycamore woodland	0.17	2%
Cattails	0.03	0.3%
Dusky willow riparian scrub	2.33	27%
Fremont cottonwood forest	0.32	4%
Fremont cottonwood/dusky willow riparian forest	0.26	3%
Sparsely vegetated	3.90	45%
White alder forest	0.39	4%
White alder/dusky willow riparian forest	0.65	7%
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse		
Black willow riparian forest	0.02	0.2%
California sycamore woodland	0.15	2%
California sycamore-Fremont cottonwood riparian forest	0.08	1%
Dusky willow riparian scrub	3.93	41%
Fremont cottonwood forest	1.63	17%
Fremont cottonwood/dusky willow riparian forest	1.73	18%
Interior live oak woodland	0.11	1%
Oregon ash woodland	0.01	0.2%
Sparsely vegetated	0.81	9%
White alder forest	0.46	5%

Community Type[1]	Area (acres)	Proportion of Reach
White alder-California sycamore riparian forest	0.55	6%
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion		
Blue oak woodland	0.13	12%
Buttonwillow scrub	0.001	0.1%
California sycamore woodland	0.14	13%
Dusky willow riparian scrub	0.38	35%
Fremont cottonwood forest	0.003	0.3%
Oregon ash woodland	0.17	16%
Red willow riparian forest	0.04	4%
Sparsely vegetated	0.11	11%
White alder forest	0.002	0.2%
White alder-California sycamore-Red willow riparian forest	0.05	5%
White alder-red willow riparian forest	0.04	4%
Kaweah River Upstream of Kaweah No. 3 Powerhouse (comparison)		
California sycamore woodland	0.09	3%
Dusky willow riparian scrub	0.22	7%
Interior live oak woodland	0.36	11%
Red willow riparian forest	0.02	1%
White alder forest	0.07	2%
White alder/dusky willow riparian forest	0.91	28%
White alder-California sycamore riparian forest	0.77	24%
White alder-California sycamore-Red willow riparian forest	0.47	15%
White alder-red willow riparian forest	0.31	10%
Kaweah River Downstream of Kaweah No. 2 Powerhouse (comparison)		
Arroyo willow riparian scrub	0.66	34%
California sycamore woodland	0.04	2%
Sparsely vegetated	0.76	40%
White alder forest	0.04	2%
White alder-California sycamore riparian forest	0.10	5%
White alder-red willow riparian forest	0.32	17%
East Fork Kaweah River Upstream of Kaweah Diversion No. 1 (comparison)		
California sycamore woodland	0.33	30%
Sparsely vegetated	0.03	2%
White alder/dusky willow riparian forest	0.30	26%
White alder-Canyon live oak woodland	0.47	42%

1. Vegetation communities are classified using A Manual of California (MCV) (Sawyer et al. 2009).

Table AQ 1-13. Cross-walk for MCV Alliance and Association with CalVeg Community Types Documented at the Riparian Study Sites.

MCV Alliance[1]	Association	CalVeg[1]	Map AQ 1 H-2 MCV Community Label
Alnus rhombifolia Alliance	Alnus rhombifolia	Riparian mixed shrub, White alder	White alder forest
Alnus rhombifolia Alliance	Alnus rhombifolia - Platanus racemosa	Riparian mixed shrub, White alder	White alder-California sycamore riparian forest
Alnus rhombifolia Alliance	Alnus rhombifolia - Platanus racemosa - Salix laevigata	Riparian mixed shrub, White alder	White alder-California sycamore-Red willow riparian forest
Alnus rhombifolia Alliance	Alnus rhombifolia - Quercus chrysolepis	Riparian mixed shrub, White alder	White alder-Canyon live oak woodland
Alnus rhombifolia Alliance	Alnus rhombifolia - Salix exigua	Riparian mixed shrub, White alder	White alder/dusky willow riparian forest
Alnus rhombifolia Alliance	Alnus rhombifolia - Salix laevigata	Riparian mixed shrub, White alder	White alder-red willow riparian forest
Broom (Cytisus scoparius and Others) Shrubland Semi-Natural Alliance	none	Non-native/ornamental shrub	Broom patch
Cephalanthus occidentalis Shrubland Alliance	Cephalanthus occidentalis	Willow (riparian scrub)	Button willow scrub
Fraxinus latifolia Forest Alliance	Fraxinus latifolia	Riparian mixed hardwood, White alder	Oregon ash woodland
Platanus racemosa Woodland Alliance	Platanus racemosa	California sycamore	California sycamore woodland
Platanus racemosa Woodland Alliance	Platanus racemosa - Populus fremontii	California sycamore	California sycamore-Fremont cottonwood riparian forest
Populus fremontii Forest Alliance	Populus fremontii	Fremont cottonwood	Fremont cottonwood forest
Populus fremontii Forest Alliance	Populus fremontii / Salix exigua	Fremont cottonwood	Fremont cottonwood/dusky willow riparian forest
Quercus douglasii Woodland Alliance	Quercus douglasii	Blue oak	Blue oak woodland
Quercus wislizeni (tree) Forest Alliance	Quercus wislizeni	Interior live oak	Interior live oak woodland
Rubus armeniacus - Sesbania punicea - Ficus carica Shrubland Semi-Natural Alliance	none	Non-native/ornamental shrub, Riparian mixed shrub	Edible fig
Salix exigua Shrubland Alliance	Salix exigua	Riparian mixed shrub, Willow (riparian scrub)	Sandbar willow riparian scrub
Salix exigua Shrubland Alliance	Salix exigua–Salix melanopsis	Riparian mixed shrub, Willow (riparian scrub)	Dusky willow riparian scrub
Salix gooddingii Woodland Alliance	Salix gooddingii	Willow, Willow-Alder	Black willow riparian forest

MCV Alliance[1]	Association	CalVeg[1]	Map AQ 1 H-2 MCV Community Label
Salix laevigata Woodland Alliance	Salix laevigata	Riparian mixed hardwood, Willow	Red willow riparian forest
Salix lasiolepis Shrubland Alliance	Salix laevigata - Salix lasiolepis	Riparian mixed shrub, Willow, Willow-Alder	Arroyo willow riparian scrub
Typha (angustifolia, domingensis, latifolia) Herbaceous Alliance	none	Tule-Cattail	Cattails

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FIGURES

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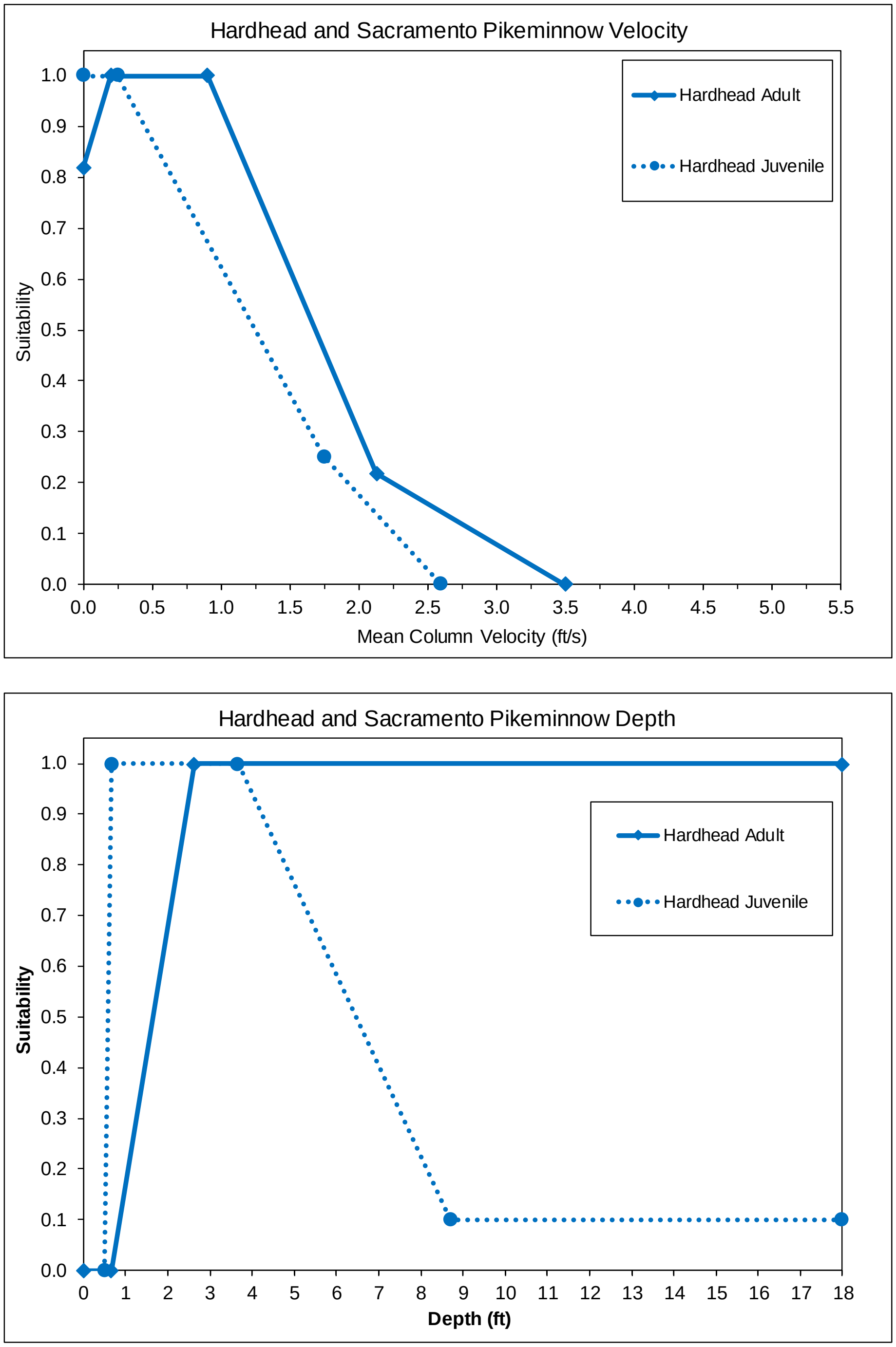


Figure AQ 1-1. Hardhead and Sacramento Pikeminnow Adult and Juvenile Habitat Suitability Criteria.

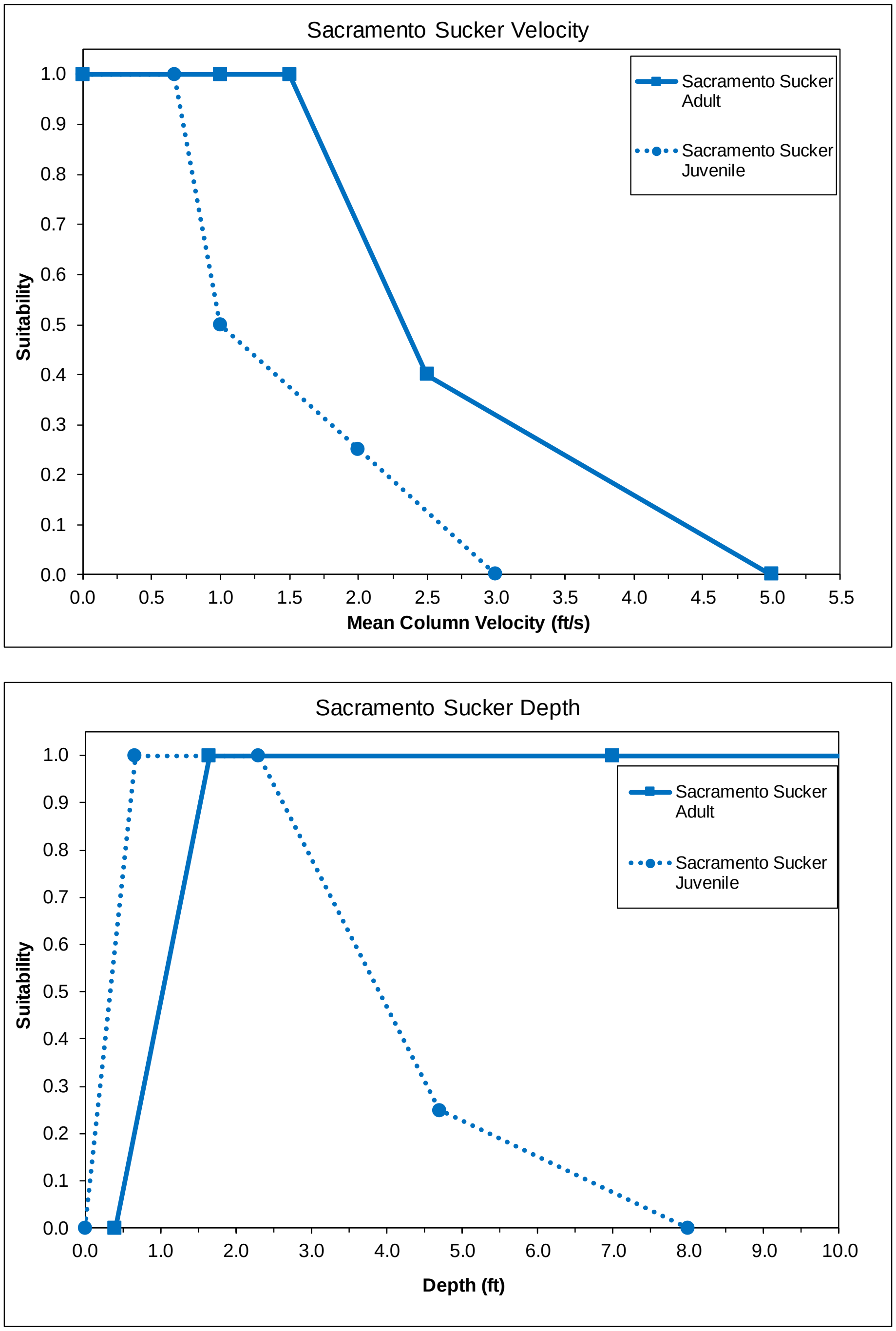
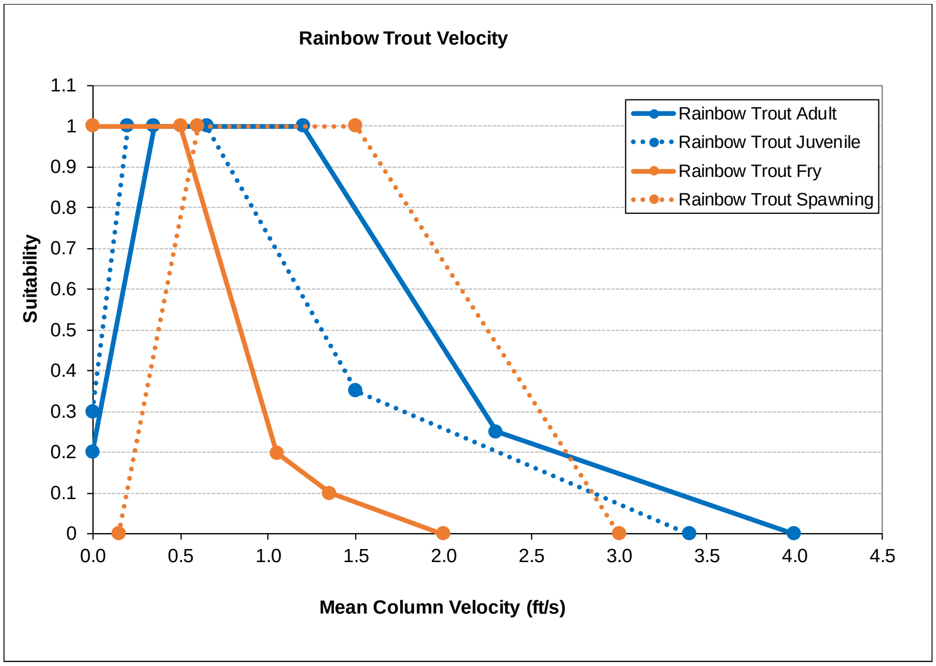


Figure AQ 1-2. Sacramento Sucker Adult and Juvenile Habitat Suitability Criteria.



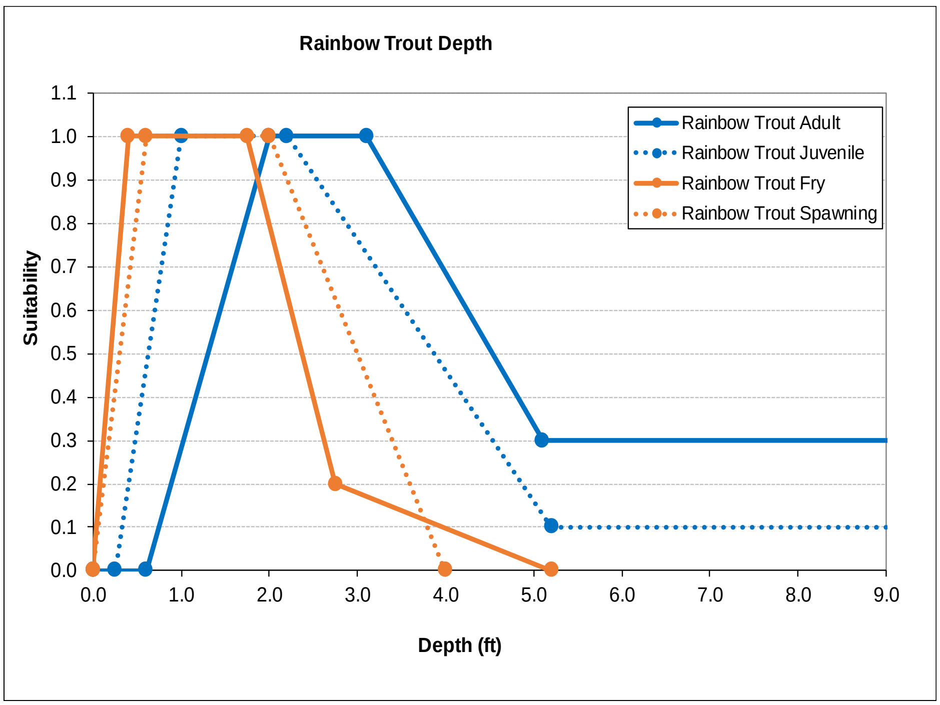


Figure AQ 1-3. Rainbow Trout Adult, Juvenile, Fry, and Spawning Habitat Suitability Criteria.

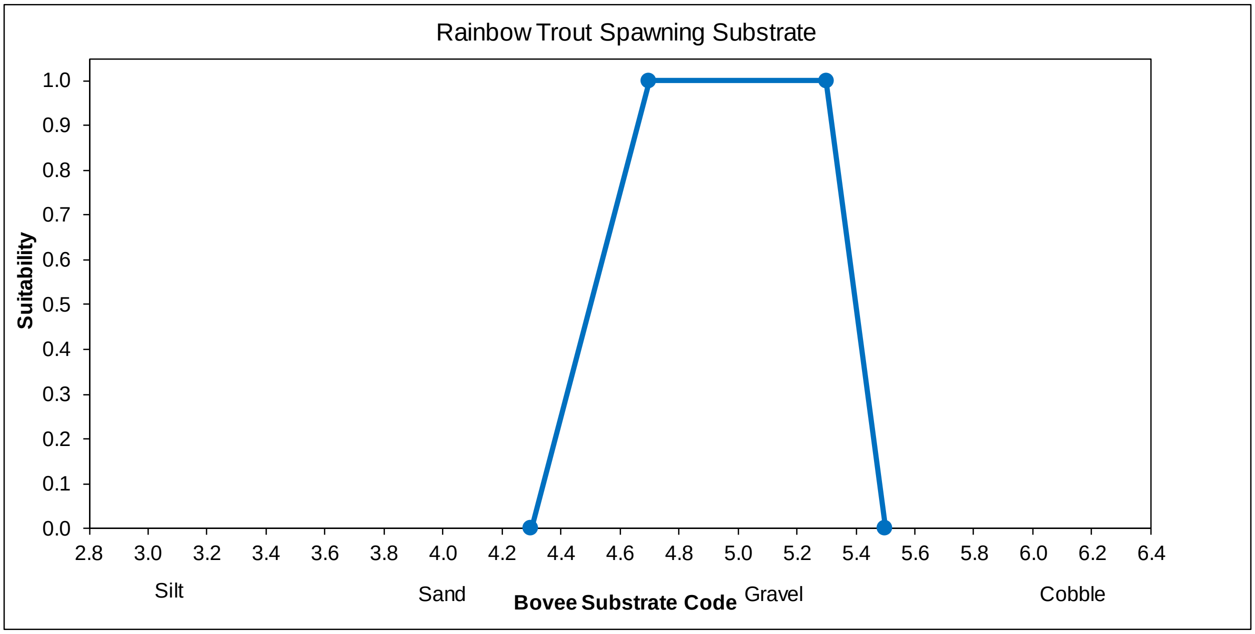


Figure AQ 1-4. Rainbow Trout Spawning Substrate Habitat Suitability Criteria.

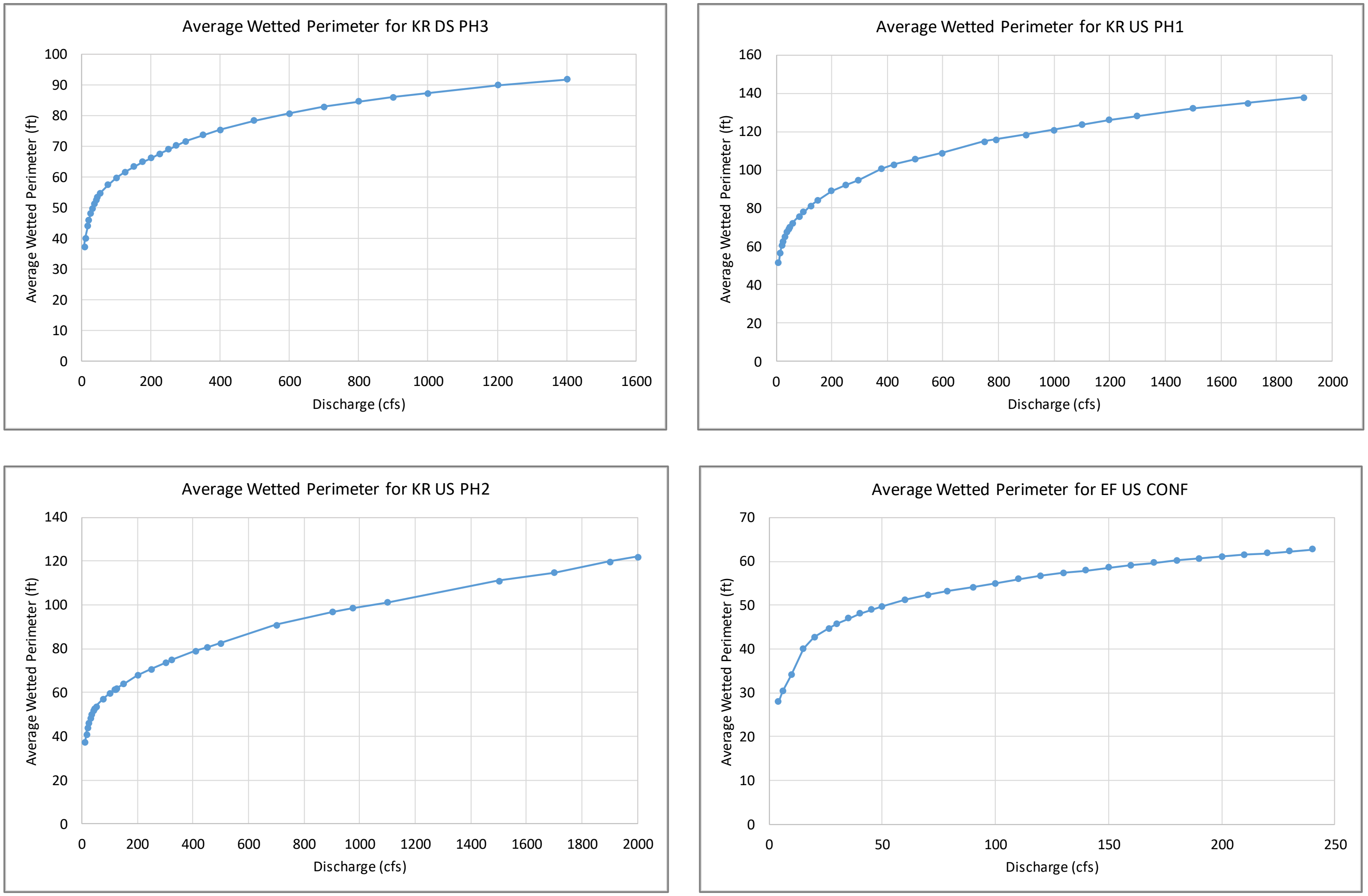
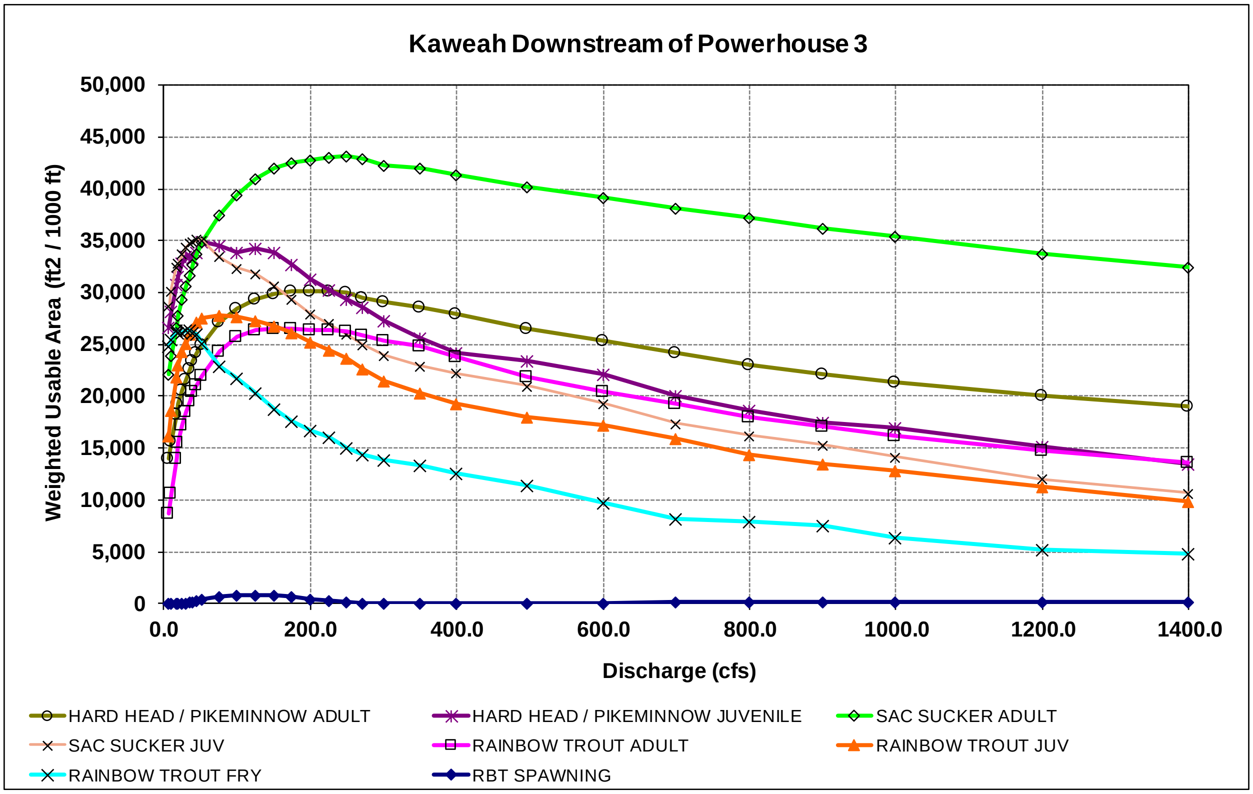


Figure AQ 1-5. Average Wetted Perimeter versus Discharge for each of the Bypass Reaches.



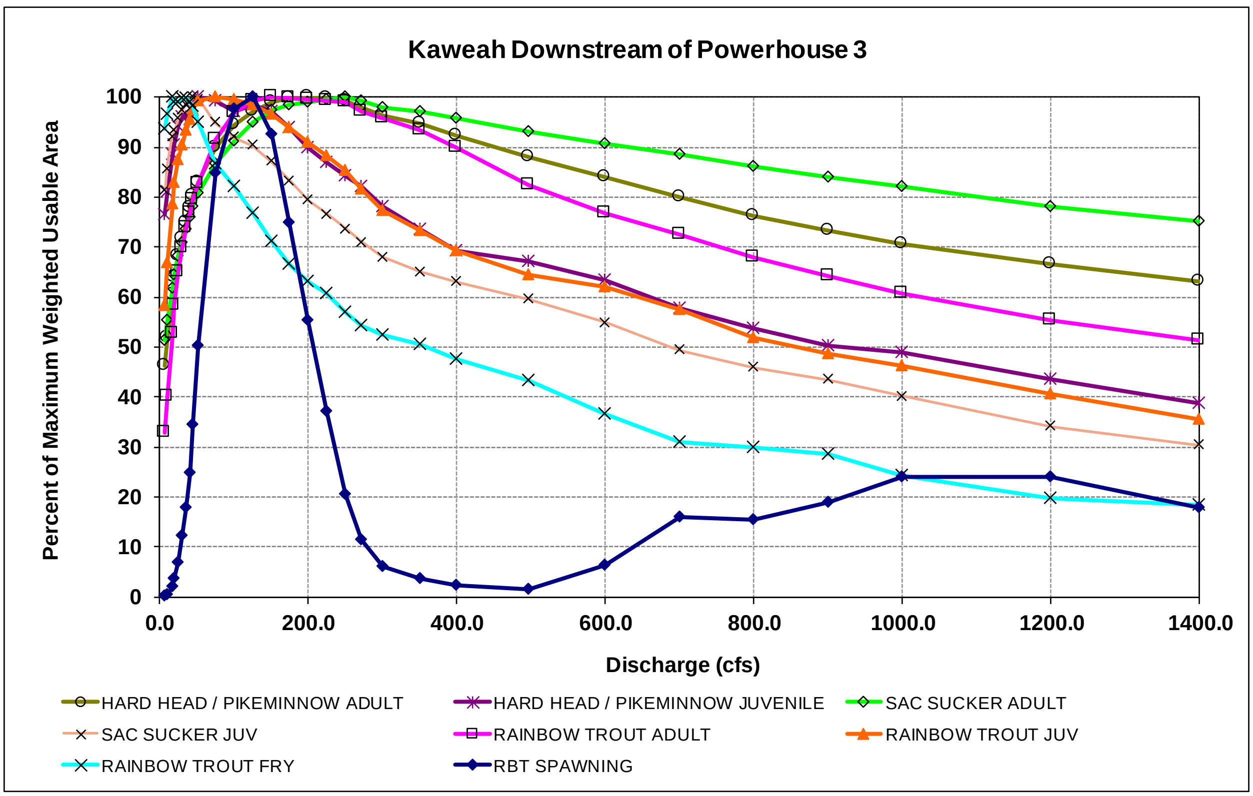
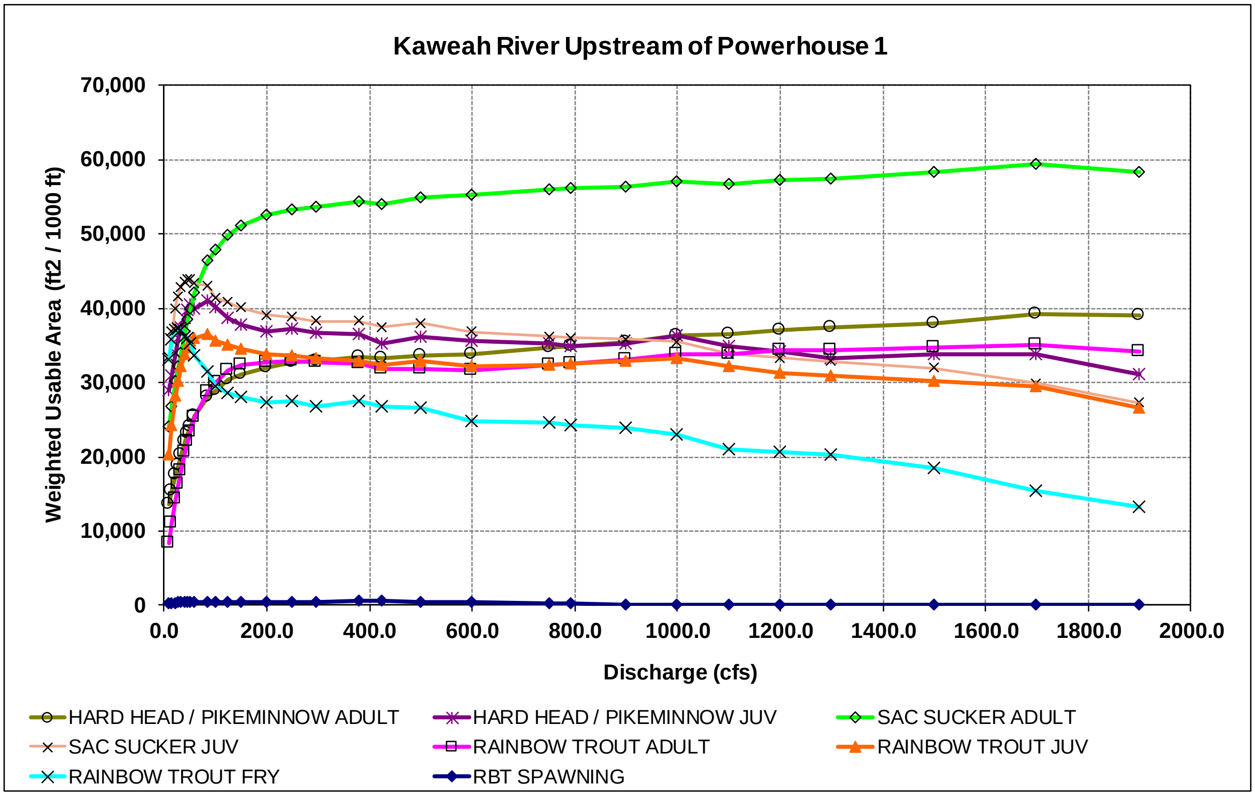


Figure AQ 1-6. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).



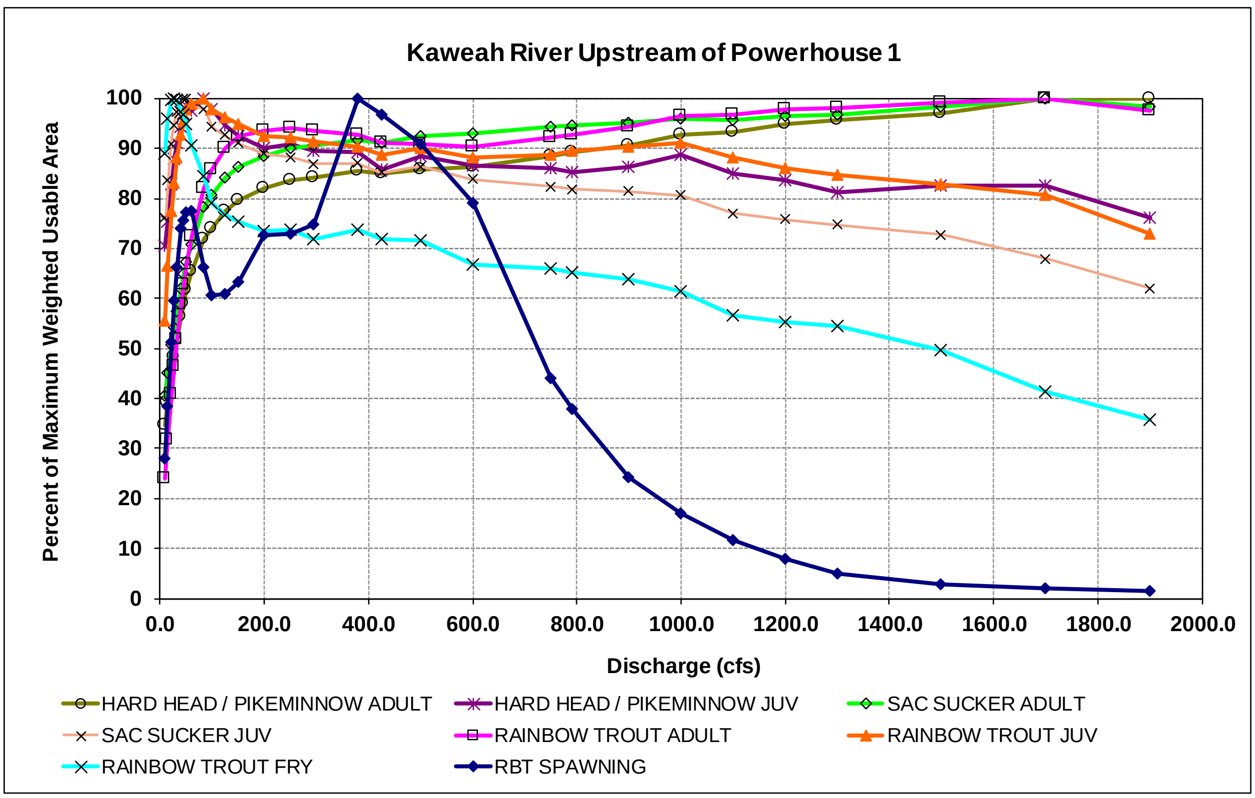
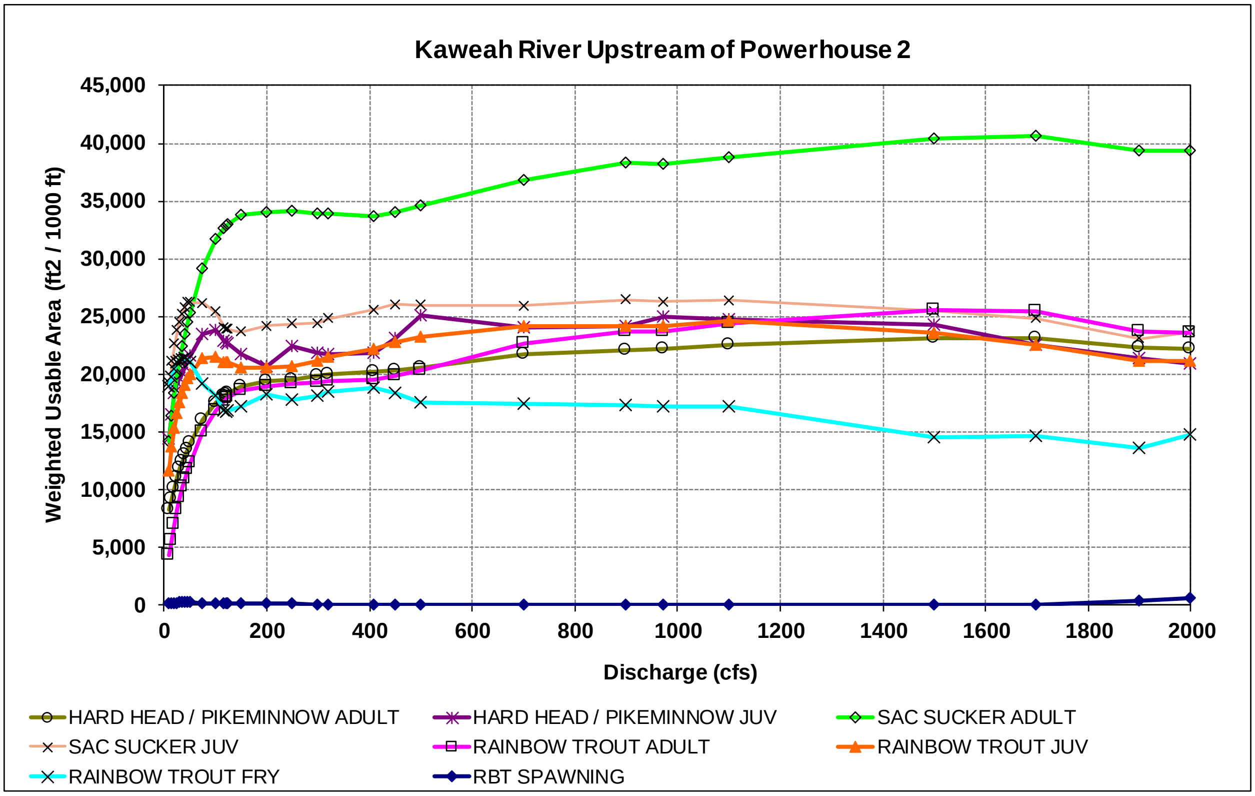


Figure AQ 1-7. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).



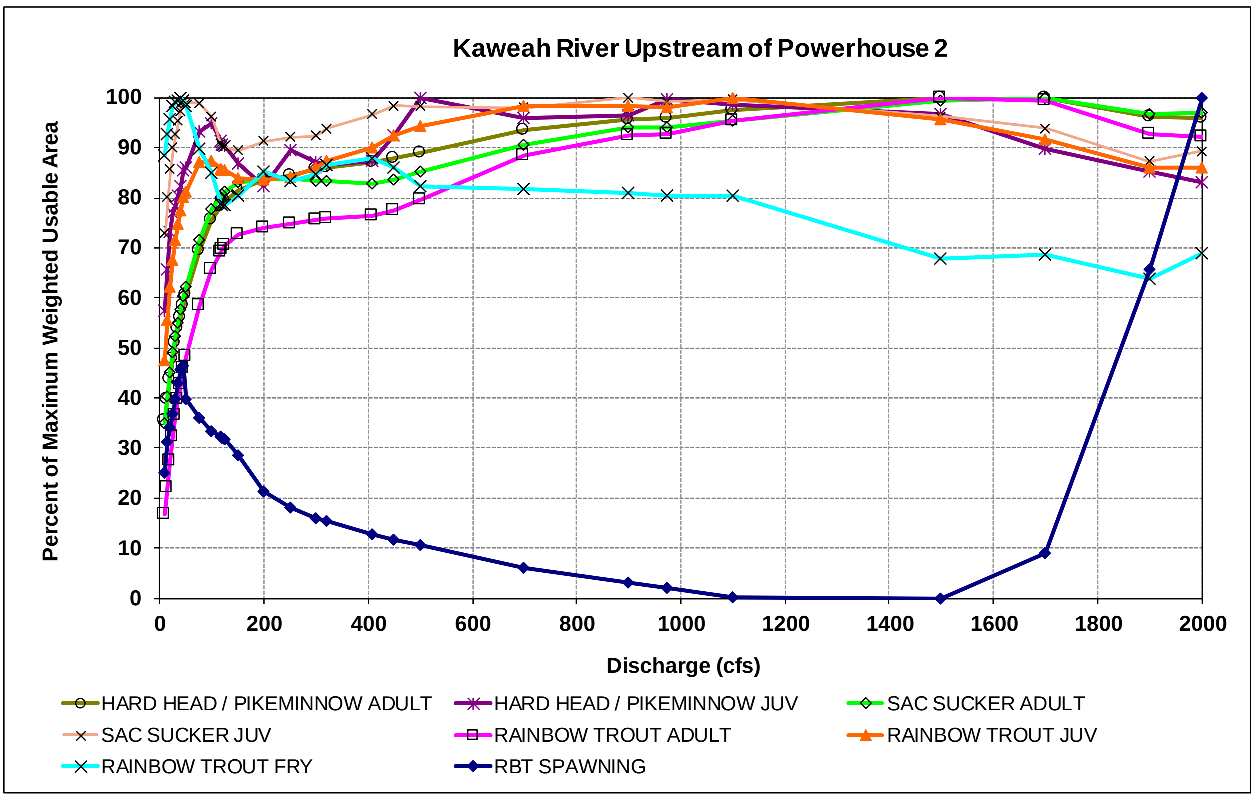
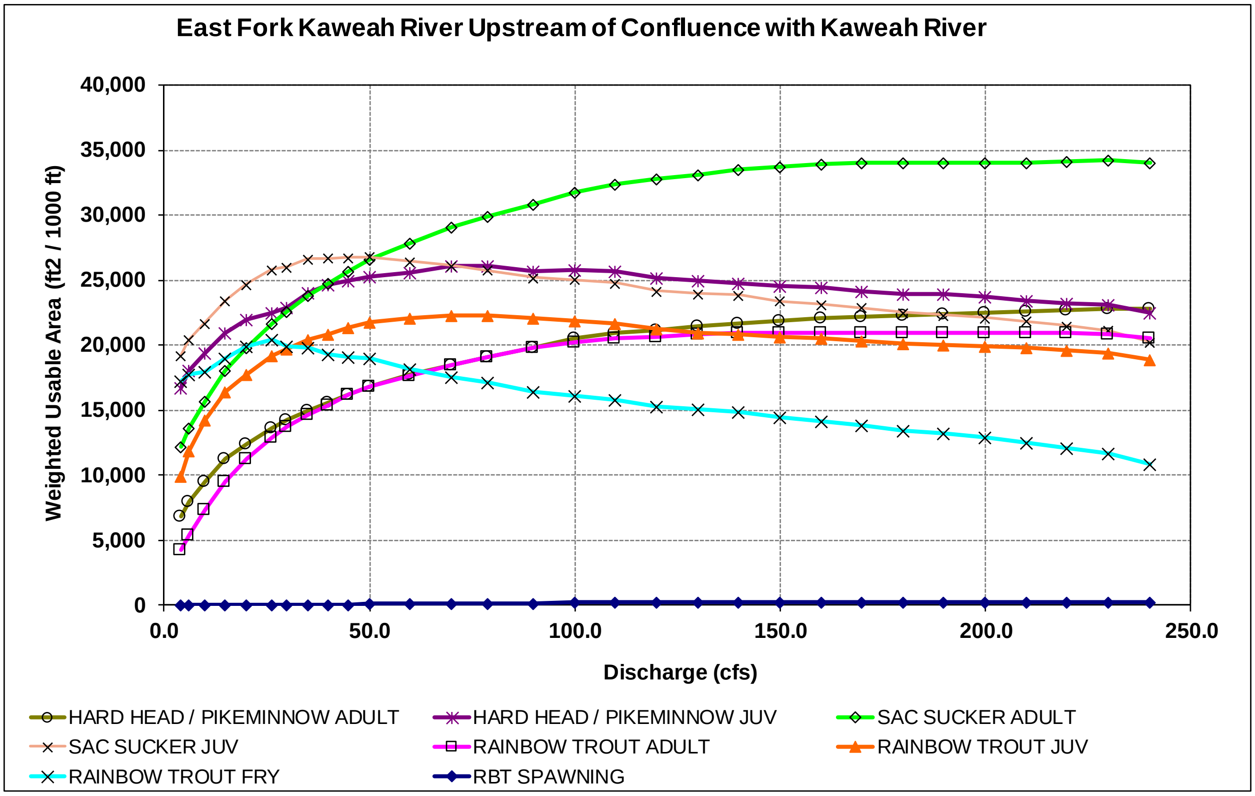


Figure AQ 1-8. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).



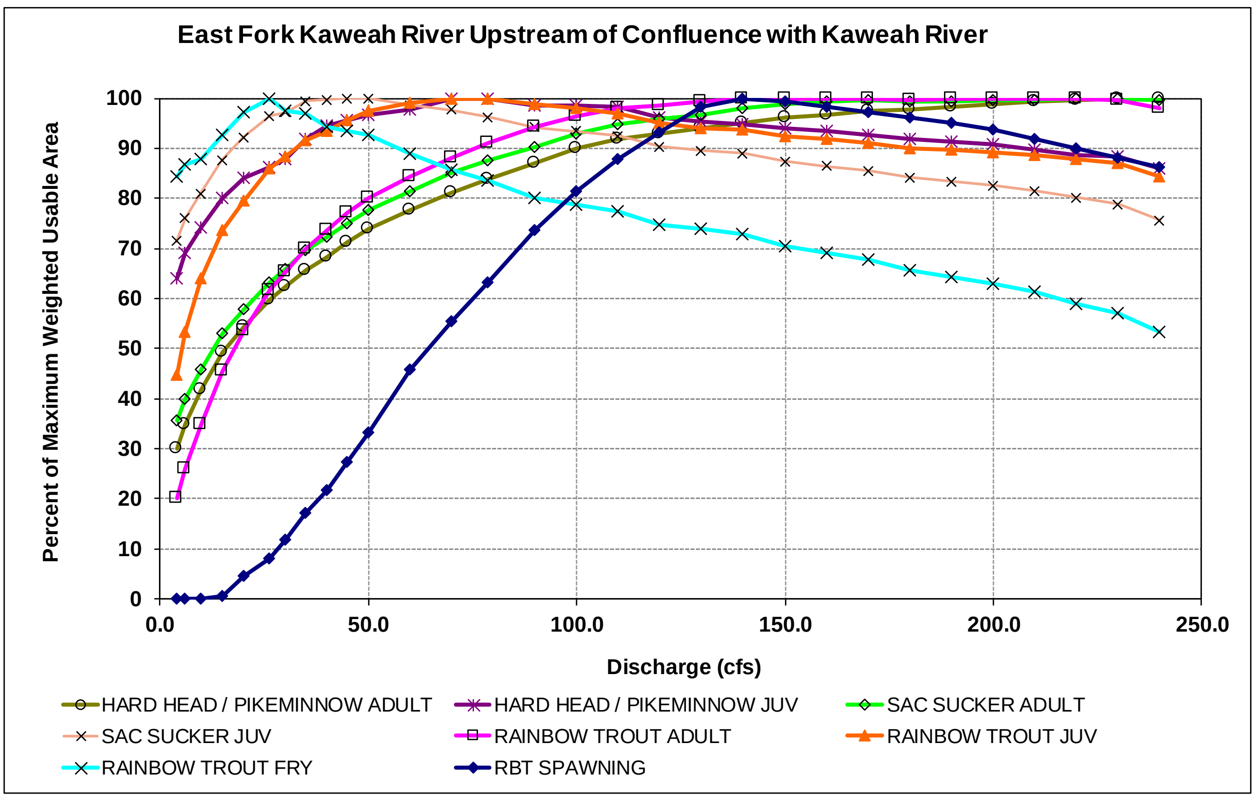
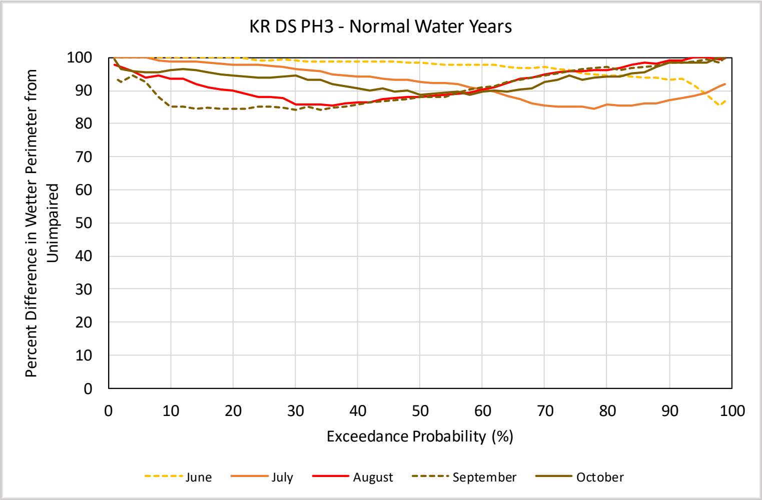
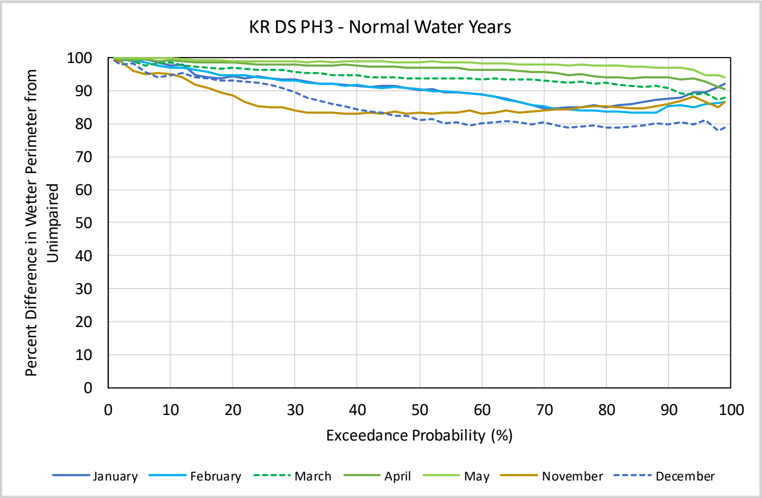
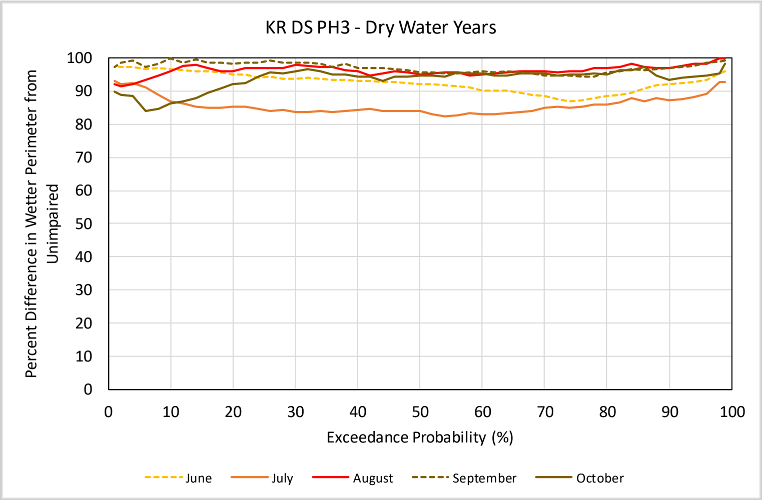


Figure AQ 1-9. East Fork Kaweah River Upstream of the Confluence with Kaweah River Weighted Usable Area (top) and Percent of Maximum Weighted Usable Area (bottom).







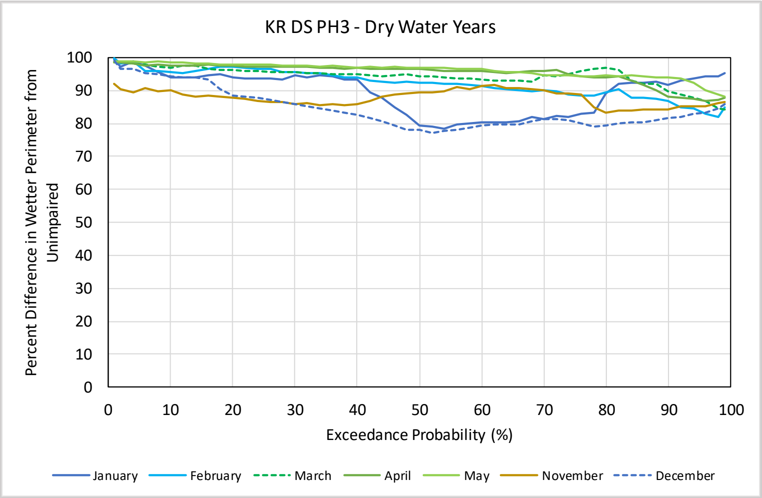


Figure AQ 1-10. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Wetted Perimeter Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

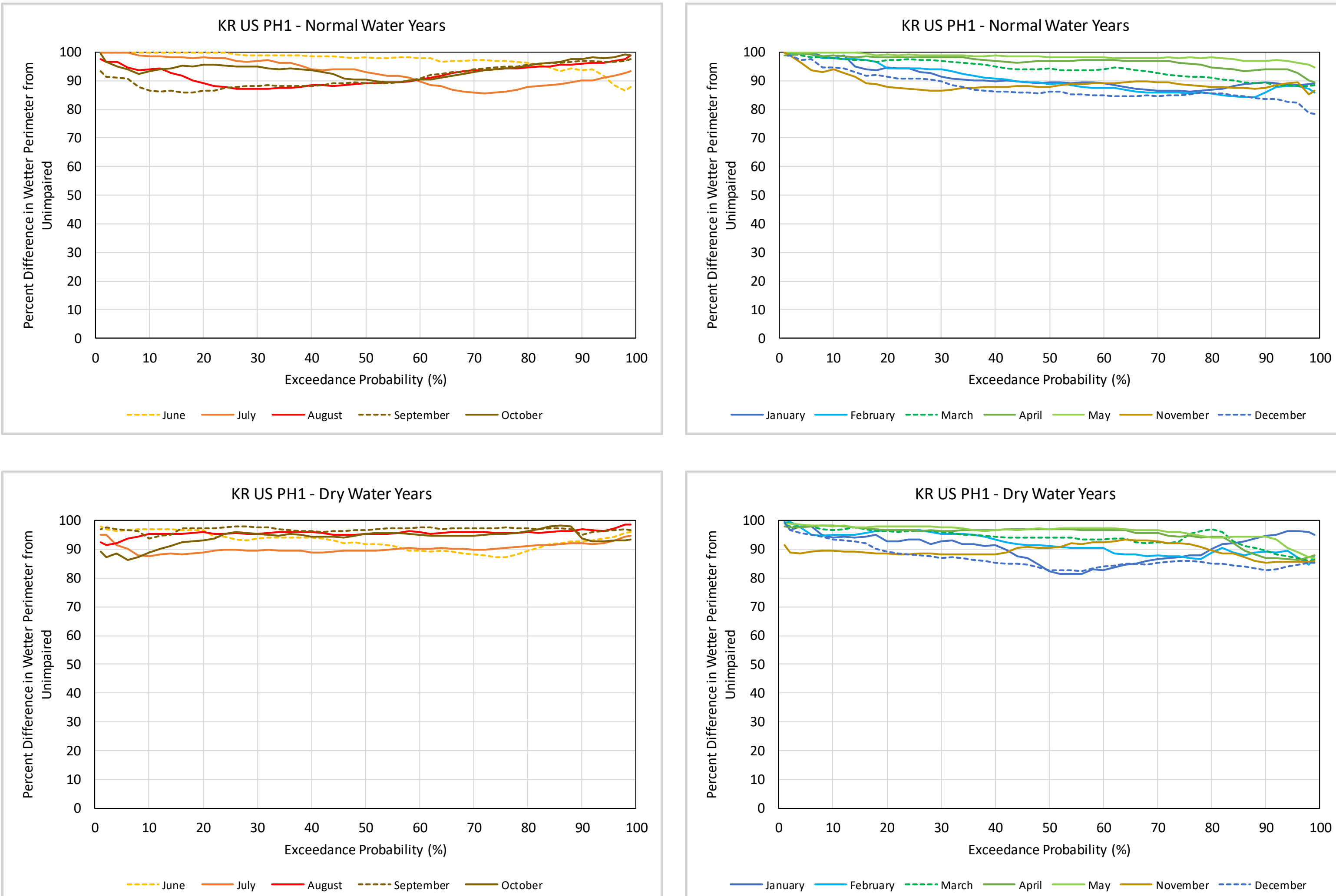


Figure AQ 1-11. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Wetted Perimeter Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

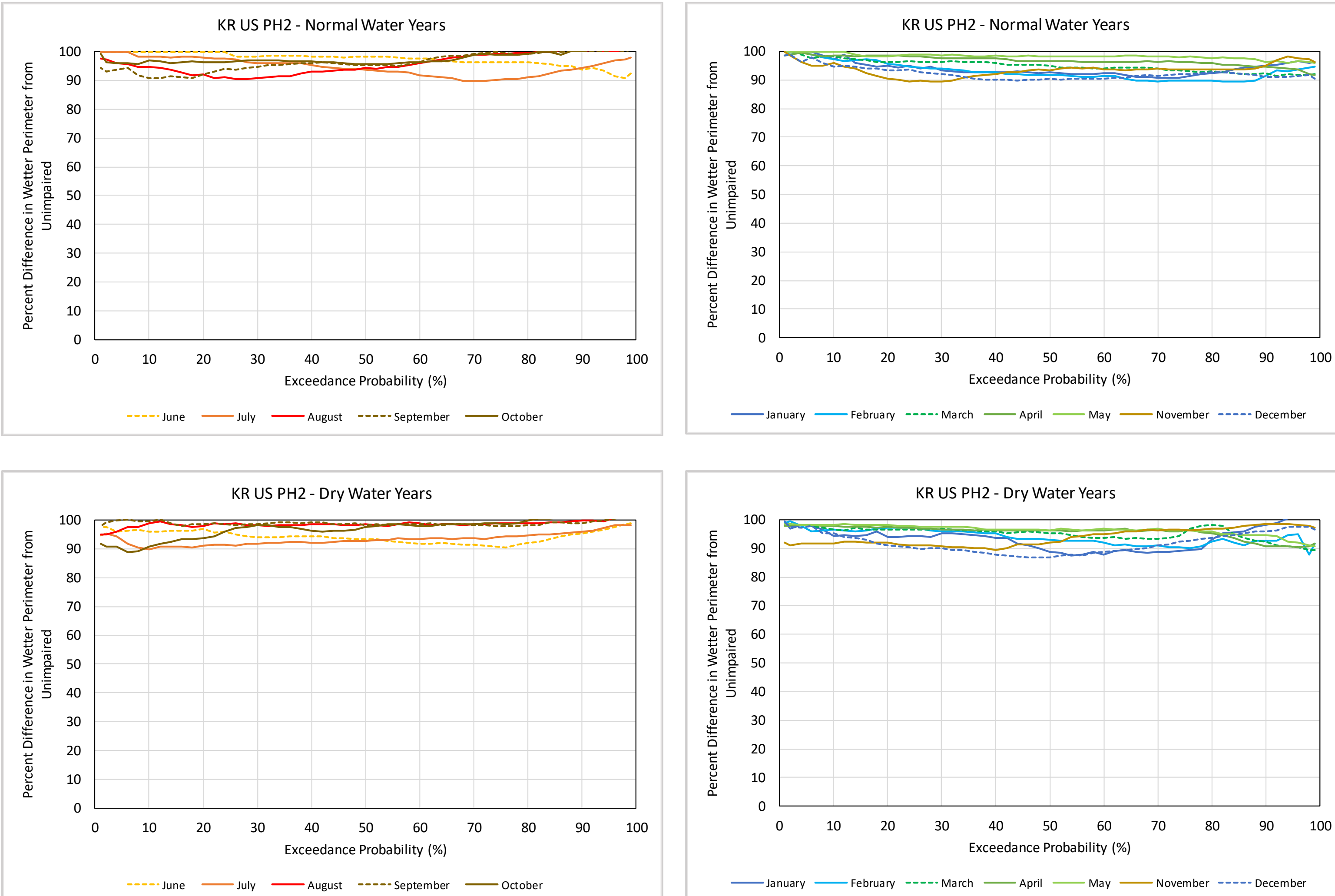


Figure AQ 1-12. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Wetter Perimeter Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

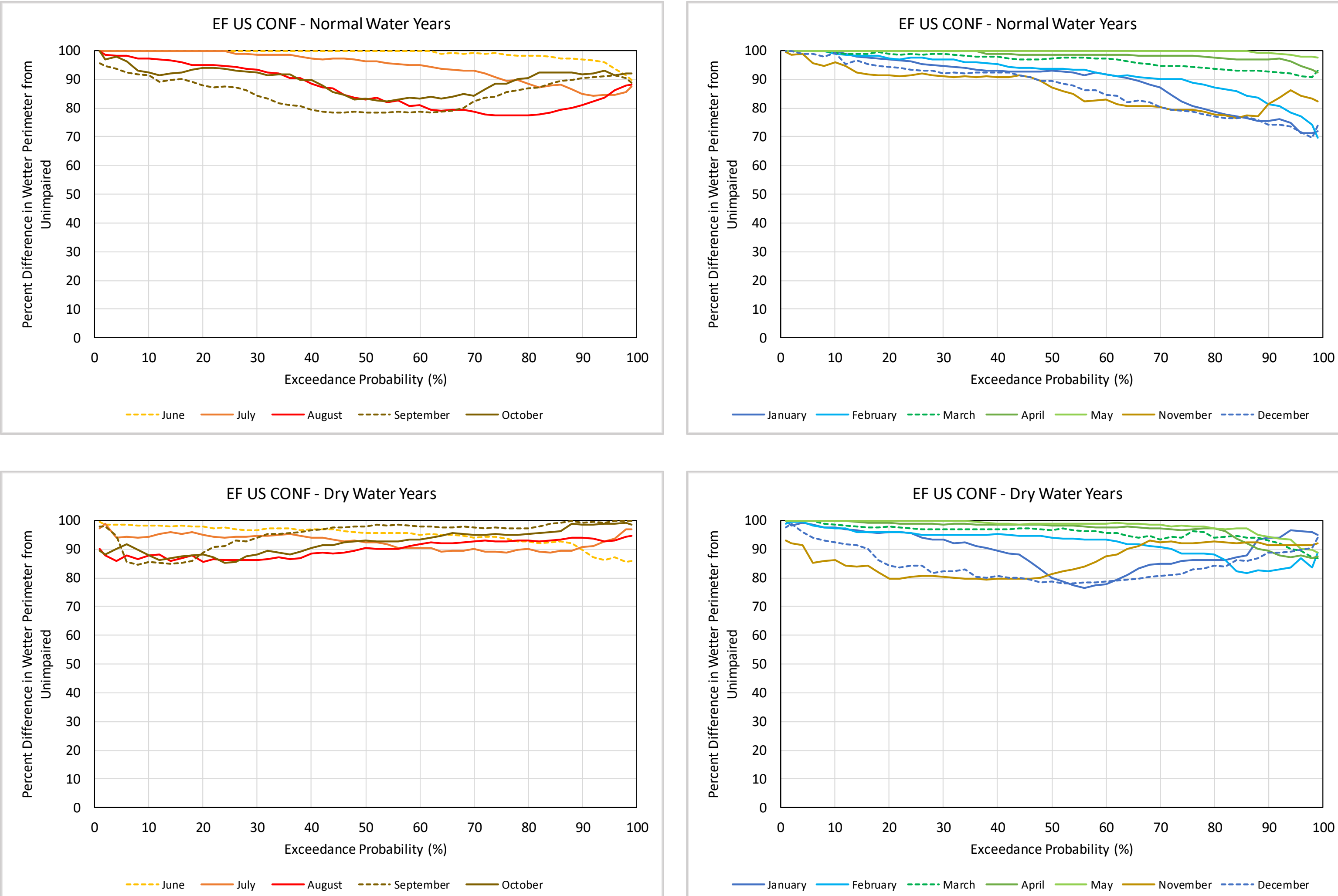


Figure AQ 1-13. East Fork Kaweah River Upstream of the Confluence with Kaweah River Wetted Perimeter Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

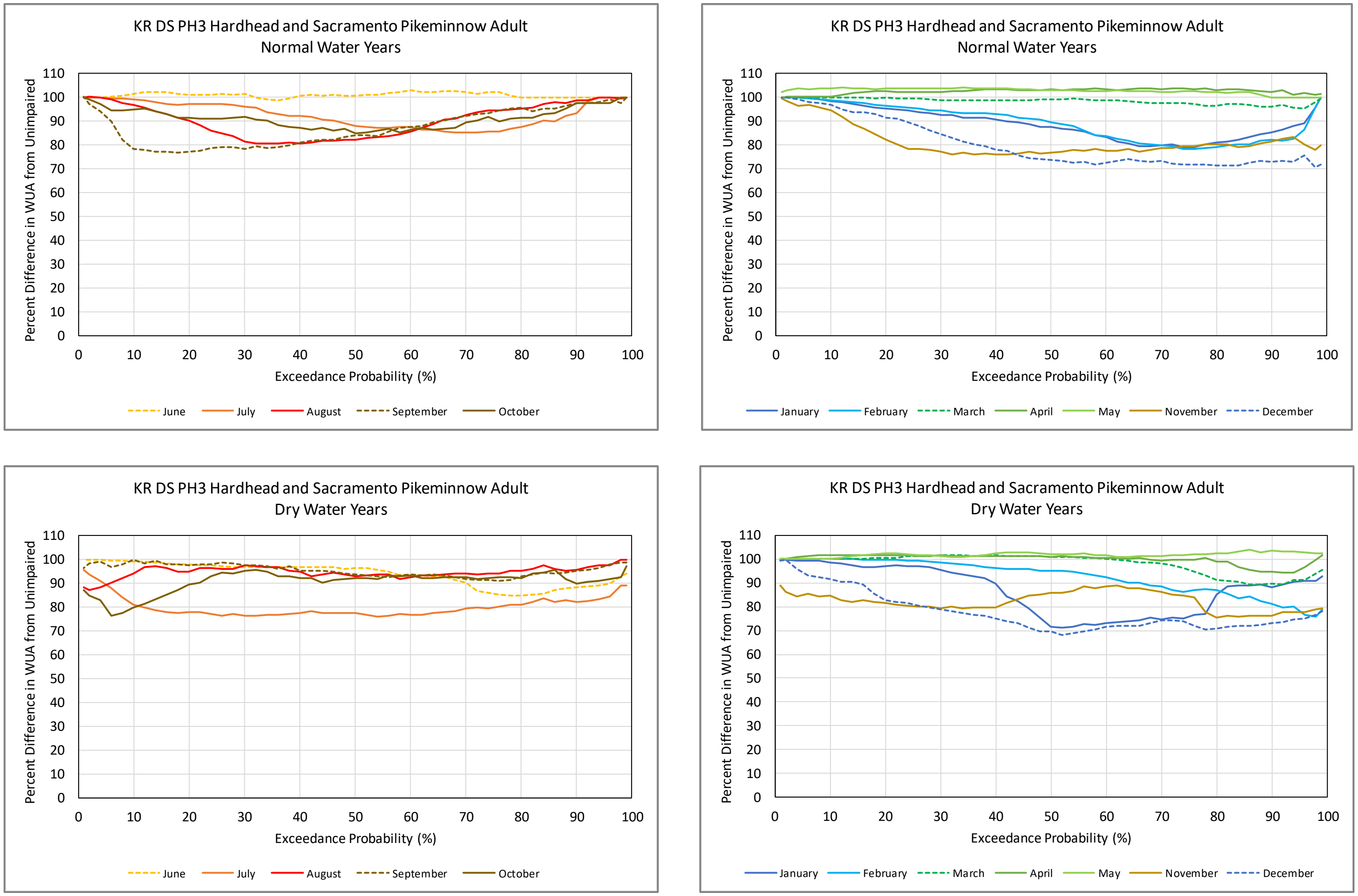


Figure AQ 1-14. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

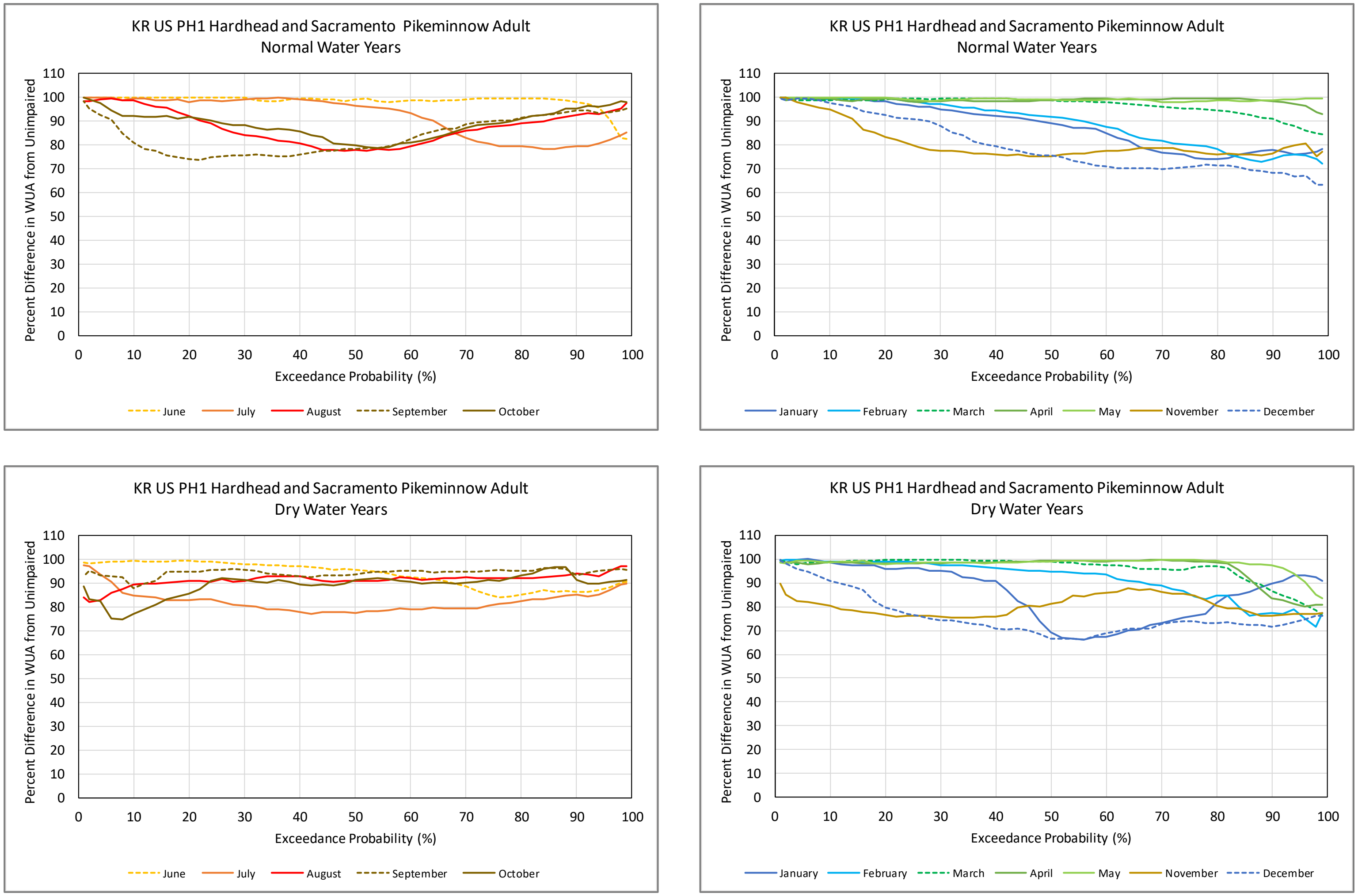


Figure AQ 1-15. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

Figure AQ 1-16. 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 for Normal and Dry Water Years.

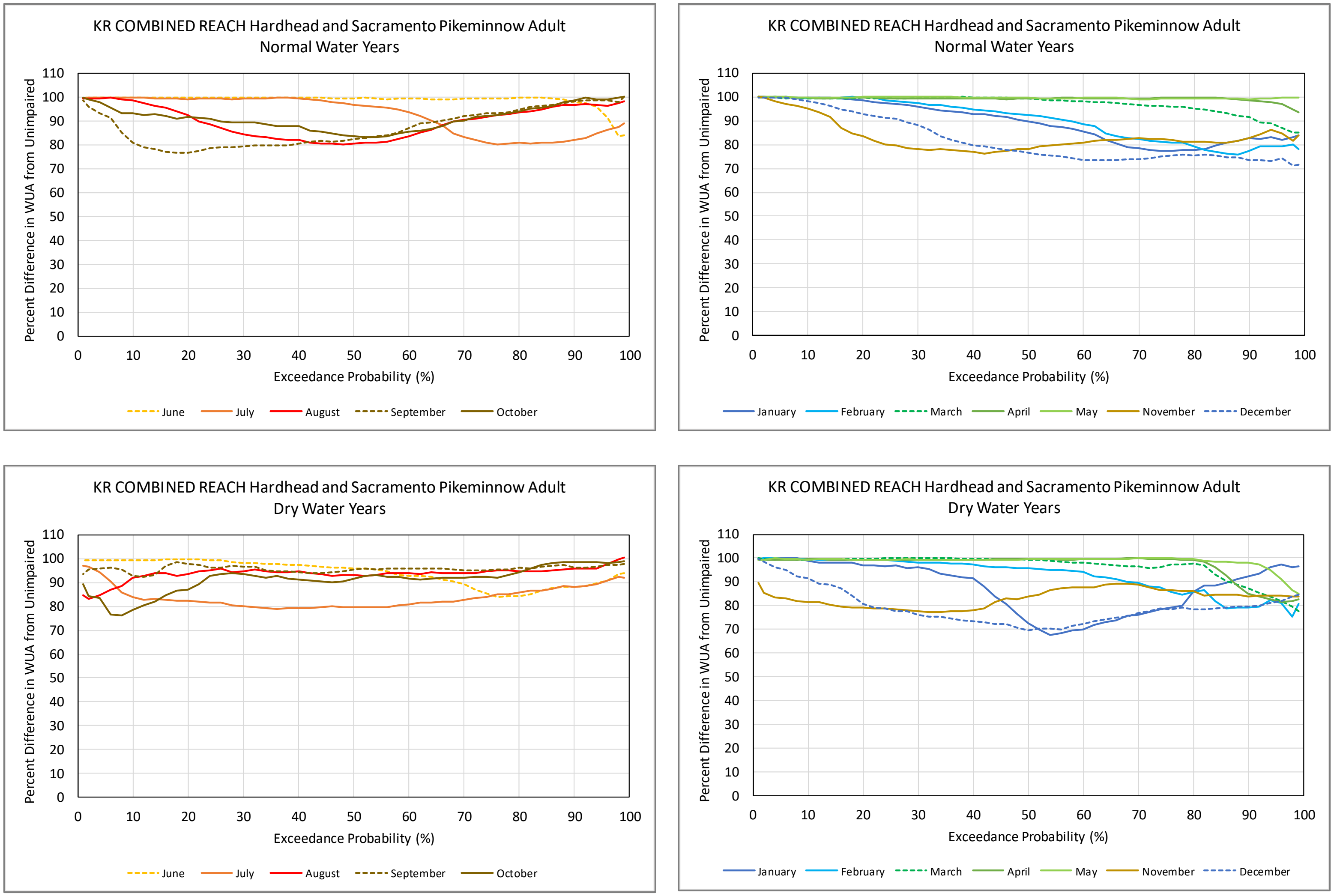


Figure AQ 1-17. Kaweah River Combined Reach Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years Water Years.

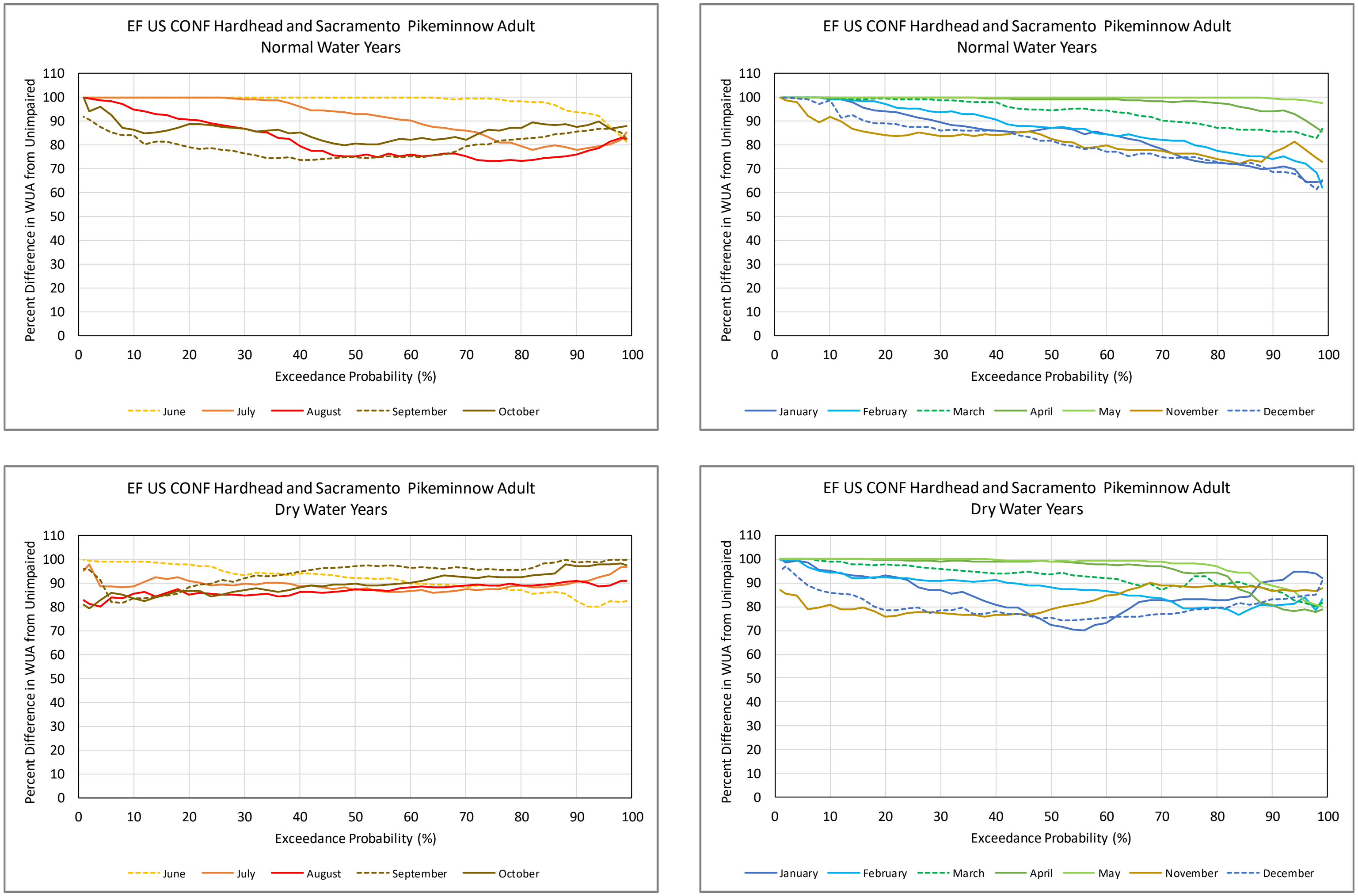
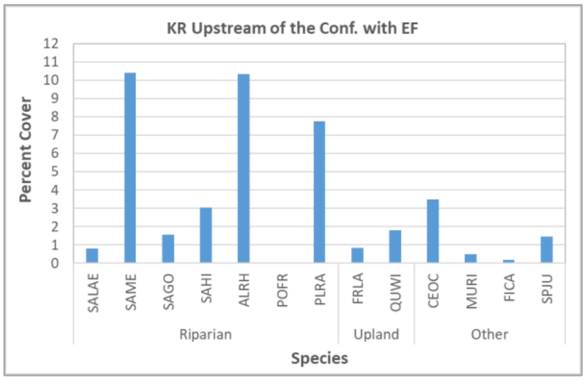
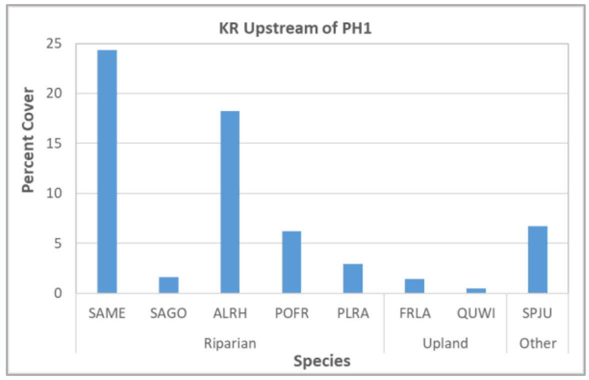
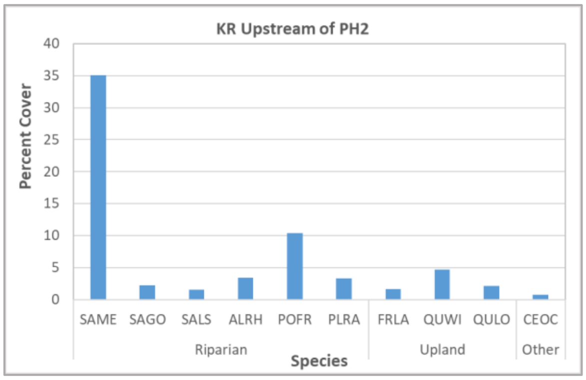


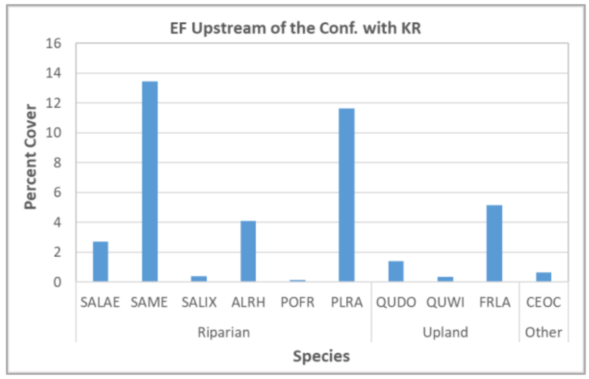
Figure AQ 1-18. East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.

Bypass Reach Study Sites

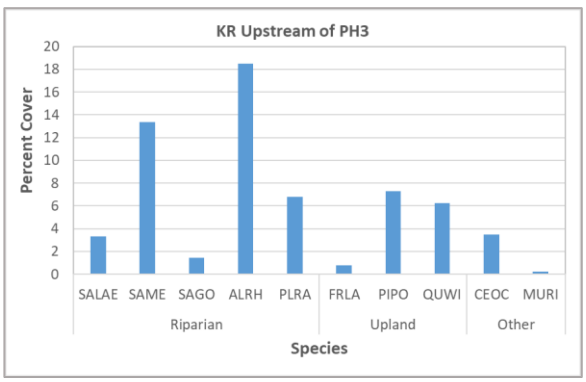


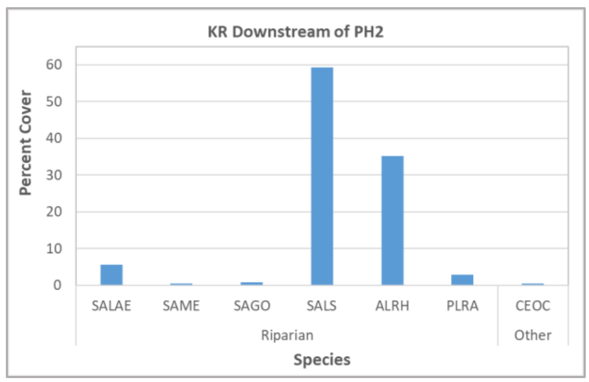


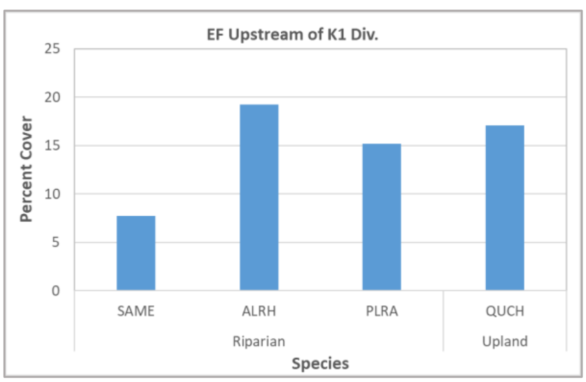




Comparison Reach Study Sites



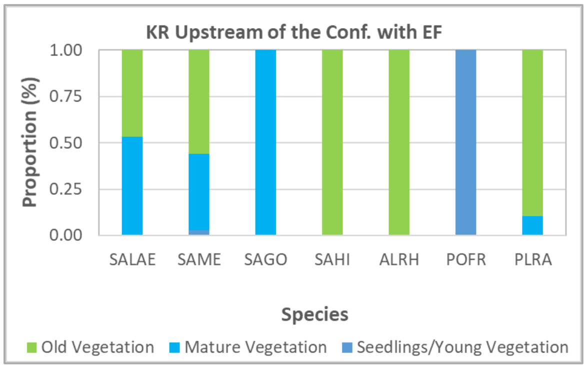


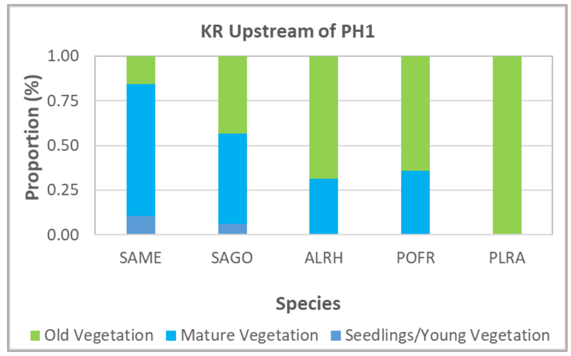


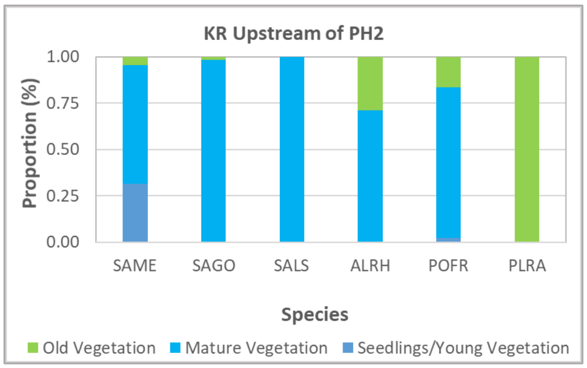
Note: Species 4-letter codes are provided in Appendix D Attachment A.

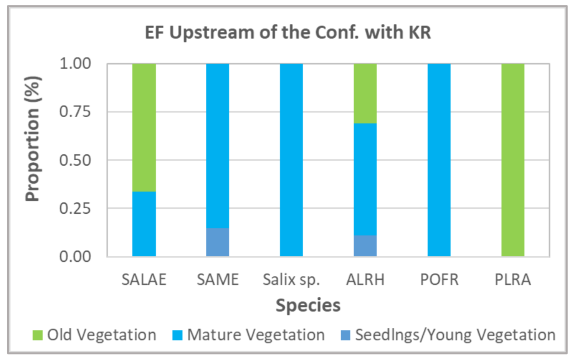
Figure AQ 1-19. Percent Cover of Dominant Riparian Species in the Bypass and Comparison Reach Study Sites.

Bypass Reach Study Sites

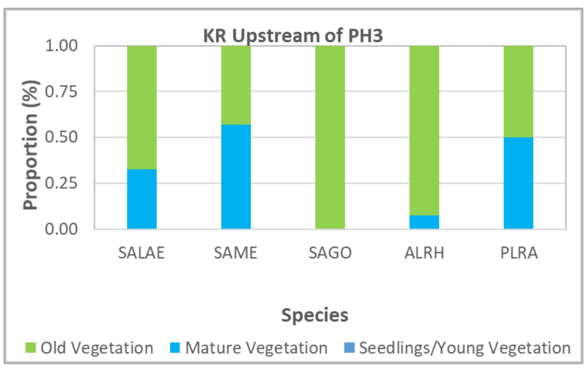


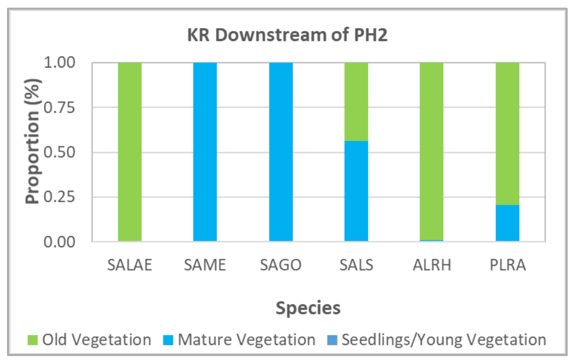


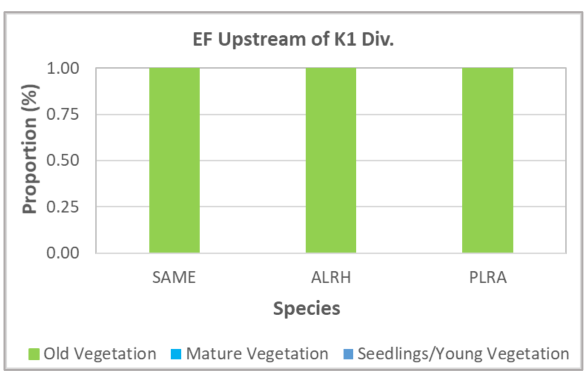




Comparison Reach Study Sites







Note: Species 4-letter codes are provided in Appendix D Attachment A.

Figure AQ 1-20. Summary of Riparian Vegetation Age Class Structure in the Bypass and Comparison Reach Study Sites.

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

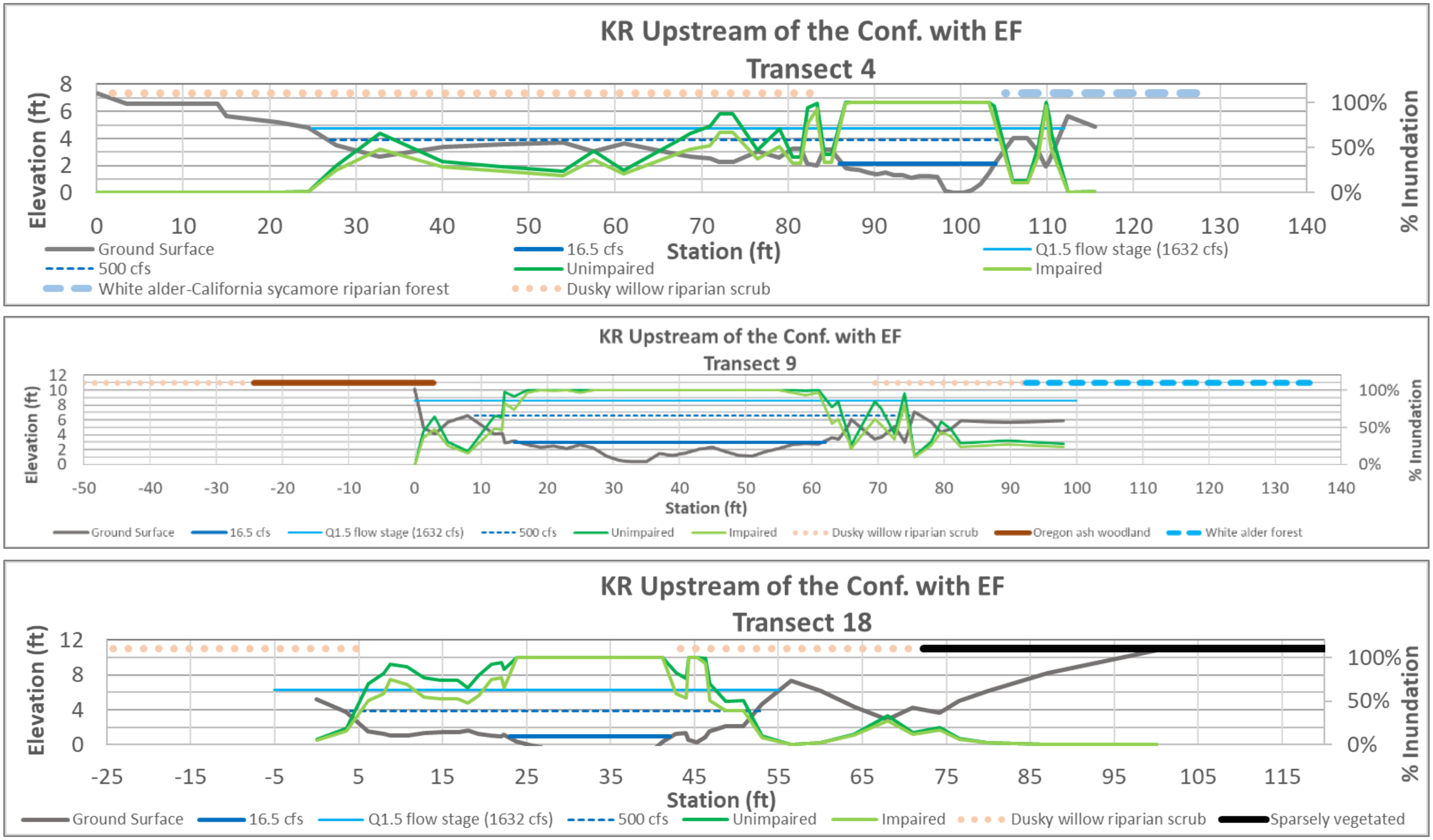


Figure AQ 1-21. Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[1]

[1] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

Kaweah River Upstream of Kaweah No. 3 Powerhouse (comparison)

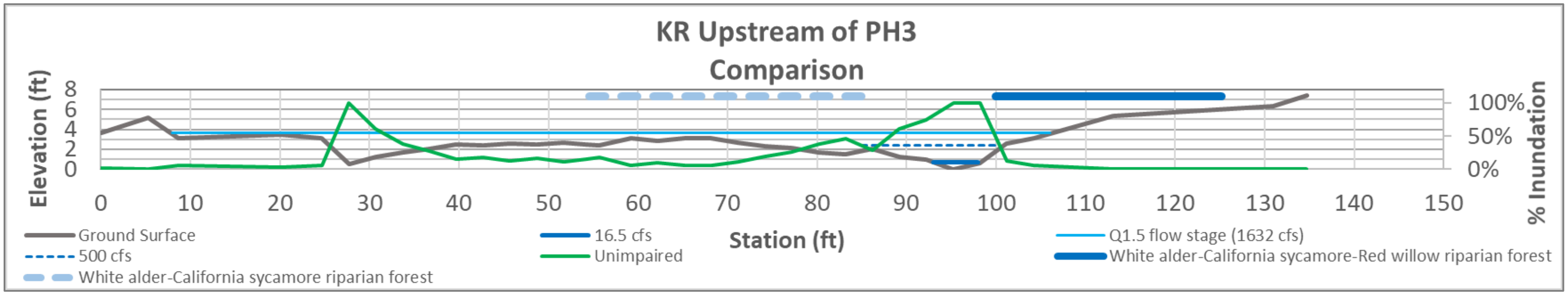


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[2]

[2] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

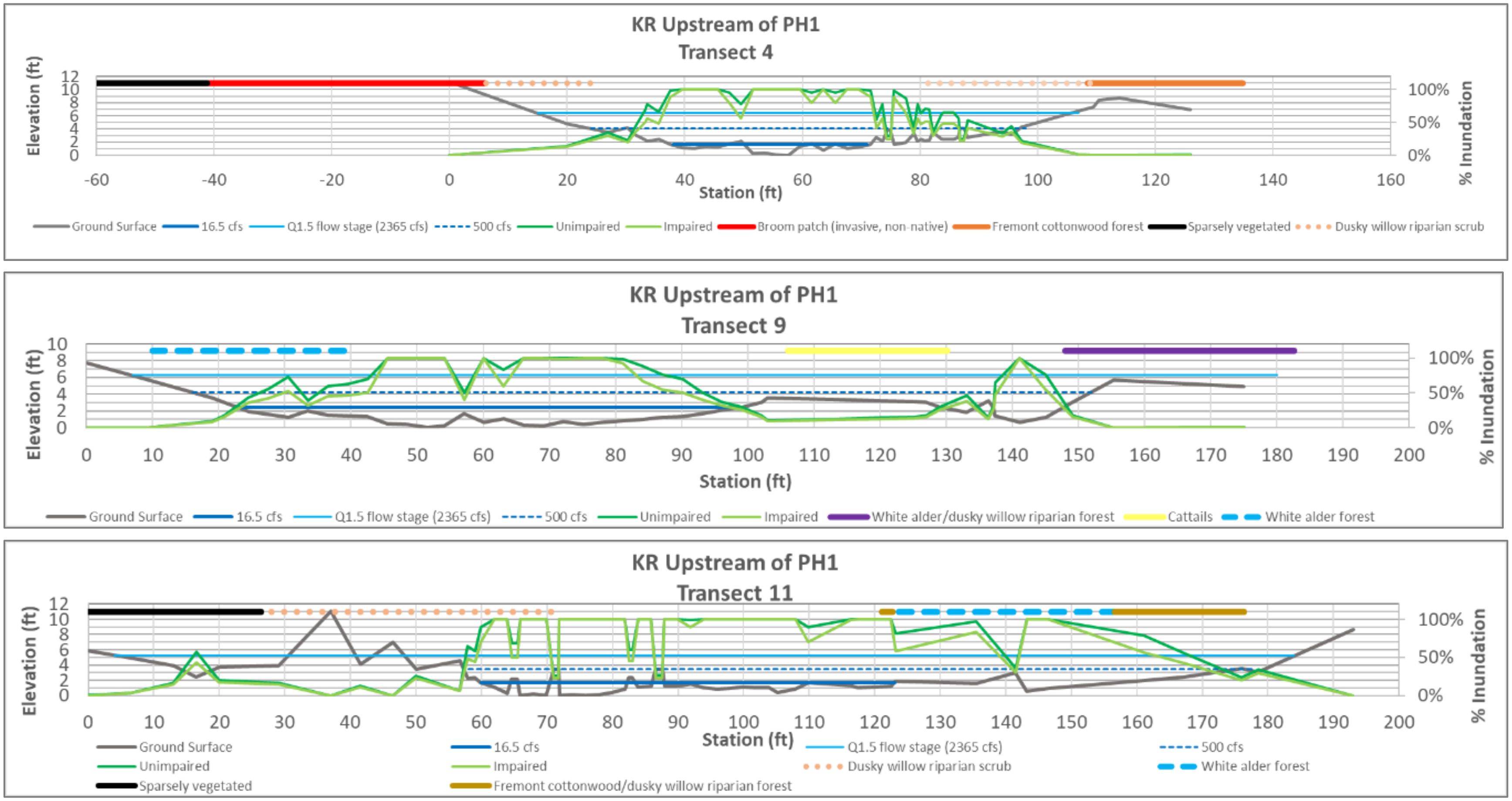


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[3]

[3] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

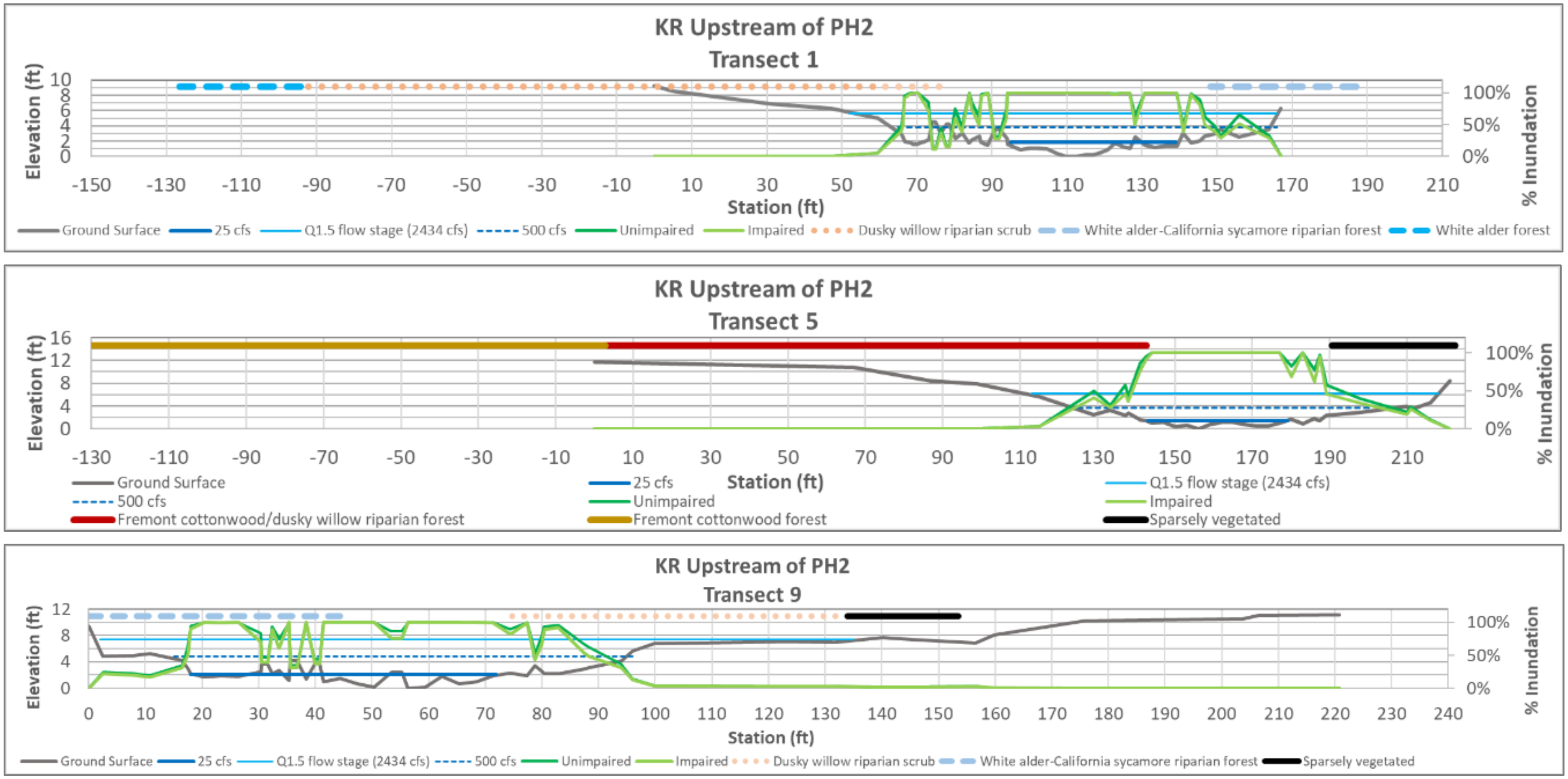


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[4]

[4] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

Kaweah River Downstream of Kaweah No. 2 Powerhouse (comparison)

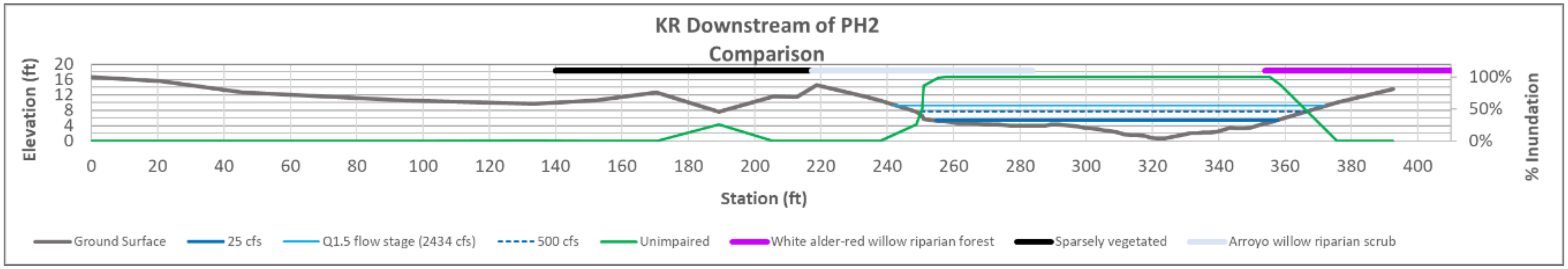


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[5]

[5] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion

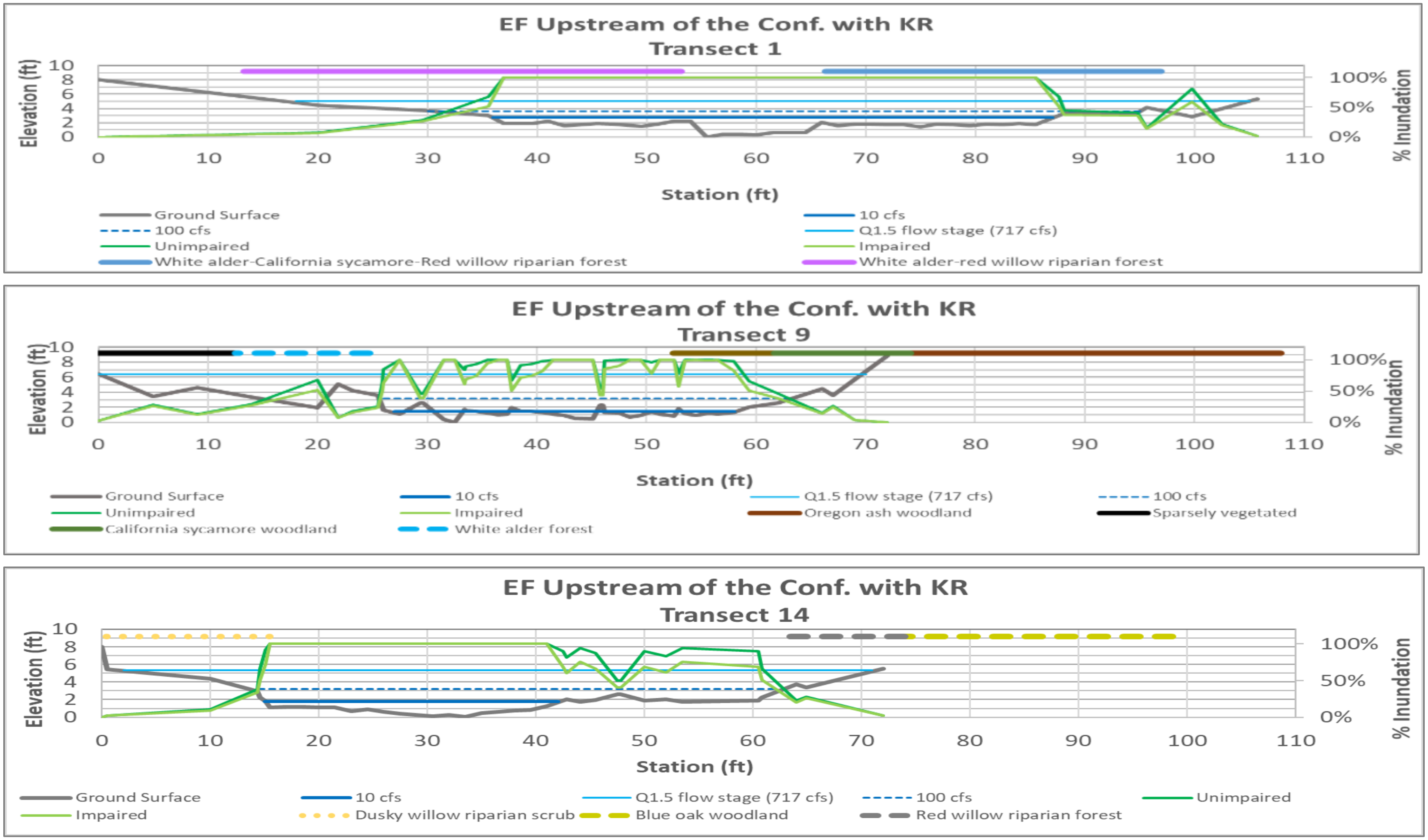


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[6]

[6] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (comparison)

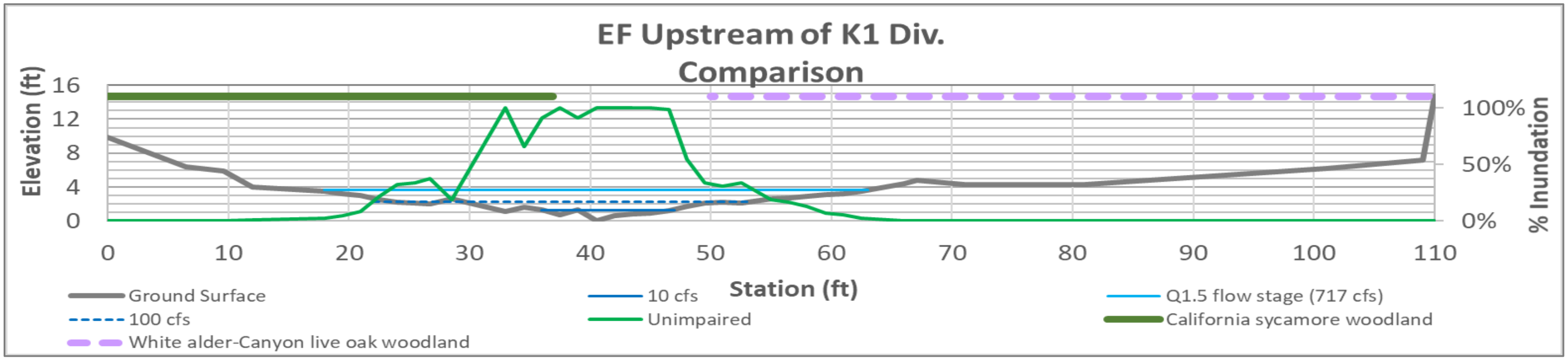


Figure AQ 1-21. (continued) Distribution of Vegetation at Representative Elevation Profiles in Relation to Flow and Inundation Frequency at the Study Sites.[7]

[7] Zero on the x-axis are the right bank, facing in the downstream direction; See Map AQ 1 H-1 for the locations of the transects and mapped vegetation communities within the study sites; Vegetation community colors are consistent with those shown the Map AQ 1 H-1 series of maps; The width of the elevation profiles (x-axis) and y-axes vary on the plots.

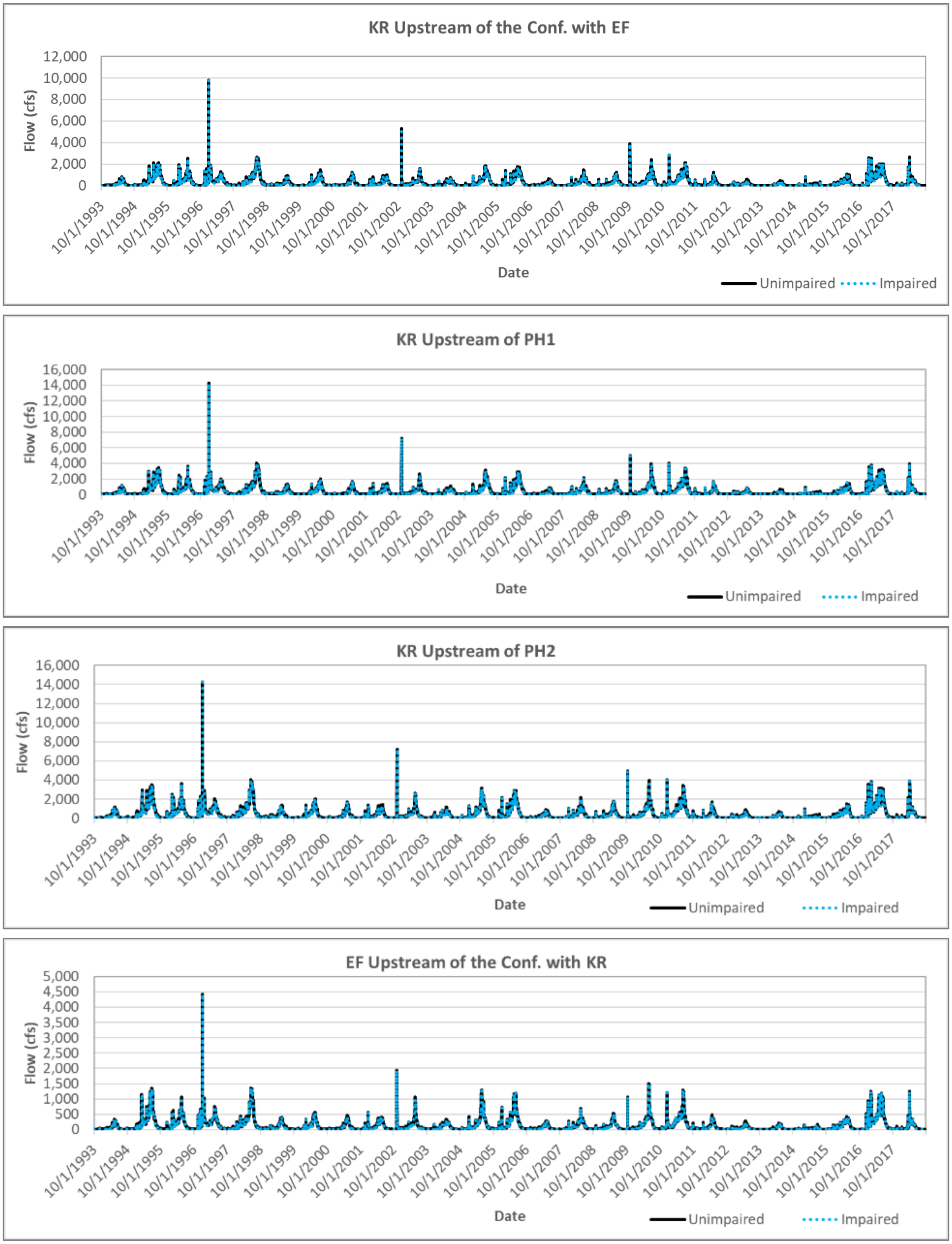


Figure AQ 1-22. Flows in the Project Bypass Reaches during the Period of Record (WY 1994 - 2018).

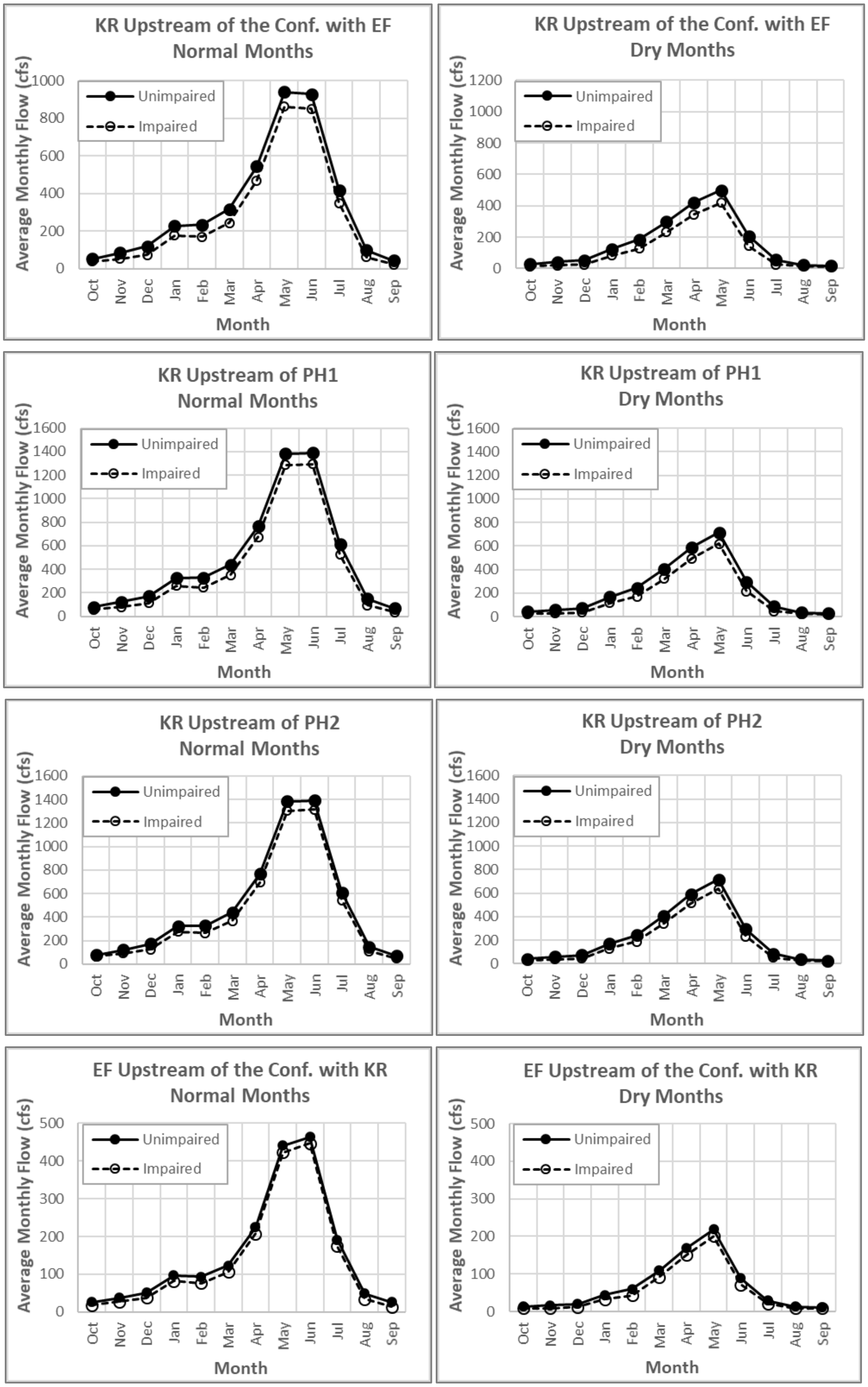
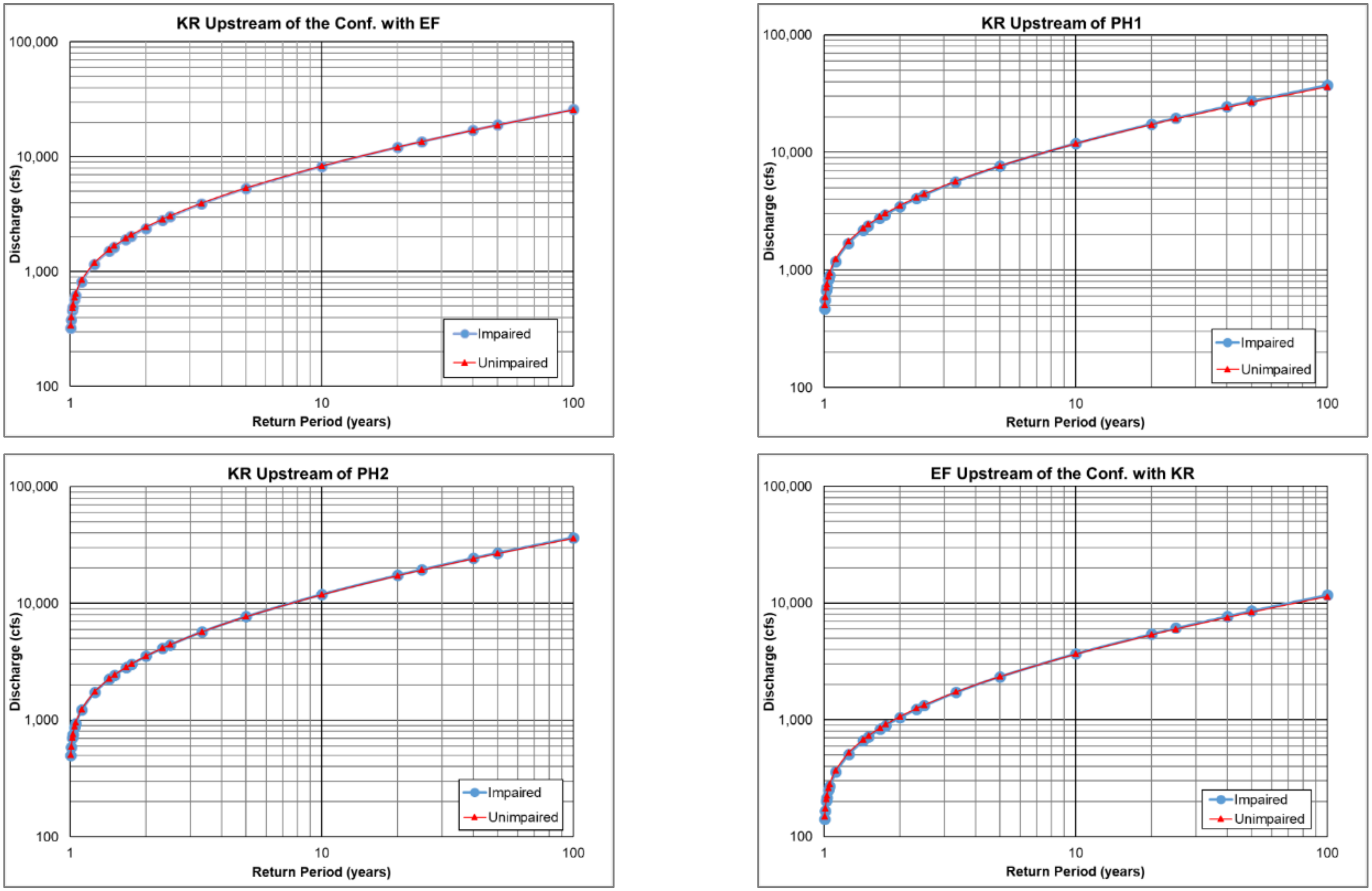


Figure AQ 1-23. Comparisons of Existing and Unimpaired Average Monthly Flows by Water Year Type (WY 1994 - 2018).



Refer to AQ 5 TSR (SCE 2019) for additional details on this analysis.

Figure AQ 1-24. Flood Frequency for Existing and Impaired Flows in the Kaweah River and East Fork Kaweah River Bypass Reaches.

MAPS

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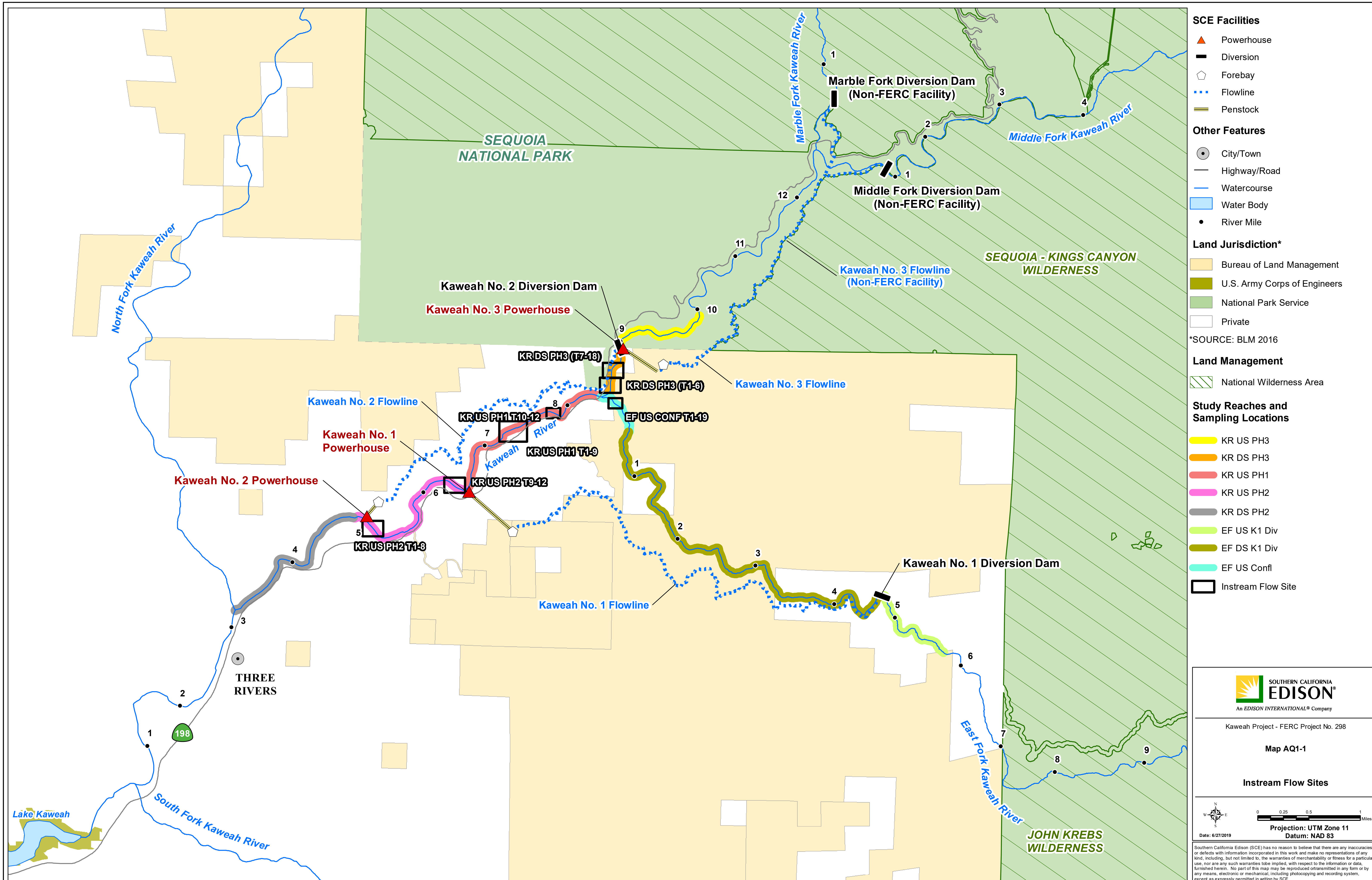

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APPENDIX A

Mesohabitat Mapping

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Appendix A Tables

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Table A-1. Middle/Main Fork Kaweah River Mesohabitat Unit Location and Type.

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
2.23-2.53	1576.09	RUN	Run
2.53-2.58	266.805	HGR	HGR
2.58-2.65	345.825	LGR	LGR
2.65-2.7	282.764	RUN	Run
2.7-2.73	172.013	RUN	Run
2.73-2.74	152.879	LGR	LGR
2.74-2.8	203.107	MCP	Pool
2.8-2.81	68.8862	CAS	CAS
2.81-2.83	99.0431	MCP	Pool
2.83-2.84	31.3511	CAS	CAS
2.84-2.91	378.2382	STP	Pool
2.91-2.93	115.024	CAS	CAS
2.93-2.95	100.972	LGR	LGR
2.95-3.07	614.534	LGR	LGR
3.07-3.09	104.882	MCP	Pool
3.09-3.14	272.74	MCP	Pool
3.14-3.17	197.295	RUN	Run
3.17-3.2	129.029	HGR	HGR
3.2-3.21	40.9869	HGR	HGR
3.21-3.28	382.861	LGR	LGR
3.28-3.64	1892.08	RUN	Run
3.64-3.72	433.304	MCP	Pool
3.72-3.75	137.866	HGR	HGR
3.75-3.77	107.475	MCP	Pool
3.77-3.79	92.2596	HGR	HGR
3.79-3.82	198.317	MCP	Pool
3.82-3.84	100.14	CAS	CAS
3.84-3.96	618.174	LGR	LGR
3.96-4.0	220.533	MCP	Pool
4.0-4.07	390.173	HGR	HGR
4.07-4.11	174.405	MCP	Pool
4.11-4.12	43.7014	CAS	CAS
4.12-4.18	325.143	MCP	Pool
4.18-4.2	122.575	HGR	HGR
4.2-4.26	315.114	MCP	Pool
4.26-4.35	471.392	HGR	HGR
4.35-4.4	269.491	RUN	Run
4.4-4.43	159.023	LGR	LGR
4.43-4.45	130.248	MCP	Pool
4.45-4.69	504.424	LGR	LGR
4.69-4.71	94.9346	MCP	Pool
4.71-4.75	209.842	LGR	LGR
4.75-4.8	250.172	MCP	Pool
4.8-4.83	149.902	LGR	LGR
4.83-4.86	181.993	RUN	Run
4.86-5.05	980.104	HGR	HGR
5.05-5.11	312.577	MCP	Pool
5.11-5.12	66.9316	LGR	LGR

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
5.12-5.14	86.8744	RUN	Run
5.14-5.21	360.447	LGR	LGR
5.21-5.27	349.72	STP	Pool
5.27-5.28	54.8538	CAS	CAS
5.28-5.42	750.286	LGR	LGR
5.42-5.46	199.956	MCP	Pool
5.46-5.47	22.4865	MCP	Pool
5.47-5.48	34.3115	HGR	HGR
5.48-5.5	145.55	MCP	Pool
5.5-5.56	318.612	HGR	HGR
5.56-5.57	62.0207	LGR	LGR
5.57-5.63	299.11	MCP	Pool
5.63-5.65	84.3364	LGR	LGR
5.65-5.68	205.812	HGR	HGR
5.68-5.71	128.032	RUN	Run
5.71-5.75	241.773	HGR	HGR
5.75-5.81	314.235	LGR	LGR
5.81-5.83	108.56	MCP	Pool
5.83-5.87	169.204	HGR	HGR
5.87-5.93	337.676	LGR	LGR
5.93-5.98	243.978	MCP	Pool
5.98-6.0	126.646	LGR	LGR
6.0-6.03	142.479	MCP	Pool
6.03-6.04	77.8762	HGR	HGR
6.04-6.06	103.791	MCP	Pool
6.06-6.19	656.638	HGR	HGR
6.19-6.26	393.814	HGR	HGR
6.26-6.38	614.217	LGR	LGR
6.38-6.4	123.18	MCP	Pool
6.4-6.41	25.976	MCP	Pool
6.41-6.42	96.3532	HGR	HGR
6.42-6.44	94.0706	RUN	Run
6.44-6.45	49.9479	HGR	HGR
6.45-6.47	88.6569	MCP	Pool
6.47-6.48	81.68	CAS	CAS
6.48-6.51	146.008	HGR	HGR
6.51-6.54	174.683	LGR	LGR
6.54-6.62	391.232	RUN	Run
6.62-6.64	107.514	MCP	Pool
6.64-6.65	53.0776	CAS	CAS
6.65-6.67	128.047	LGR	LGR
6.67-6.69	104.722	RUN	Run
6.69-6.71	106.805	LGR	LGR
6.71-6.74	137.776	RUN	Run
6.74-6.84	513.178	LGR	LGR
6.84-6.86	126.606	MCP	Pool
6.86-6.88	118.635	HGR	HGR
6.88-6.89	47.6695	MCP	Pool
6.89-6.9	47.3564	HGR	HGR

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
6.9-6.95	252.499	LGR	LGR
6.95-6.98	181.6456	RUN	Run
6.98-7.03	265.788	MCP	Pool
7.03-7.04	66.8177	HGR	HGR
7.04-7.08	178.489	MCP	Pool
7.08-7.17	457.037	LGR	LGR
7.17-7.23	317.45	MCP	Pool
7.23-7.46	1233.87	LGR	LGR
7.46-7.52	294.313	RUN	Run
7.52-7.64	685.343	LGR	LGR
7.64-7.69	214.92	MCP	Pool
7.69-7.72	181.319	SRN	Run
7.72-7.74	109.795	MCP	Pool
7.74-7.75	30.9539	CAS	CAS
7.75-7.78	201.238	HGR	HGR
7.78-7.82	207.966	LGR	LGR
7.82-7.89	323.903	MCP	Pool
7.89-7.93	225.637	LGR	LGR
7.93-7.97	246.644	HGR	HGR
7.97-8.01	183.883	RUN	Run
8.01-8.05	185.774	MCP	Pool
8.05-8.07	104.356	CAS	CAS
8.07-8.18	617.626	LGR	LGR
8.18-8.2	96.7171	MCP	Pool
8.2-8.26	313.436	MCP	Pool
8.26-8.35	496.892	HGR	HGR
8.35-8.39	192.525	SRN	Run
8.39-8.42	184.564	STP	Pool
8.42-8.43	48.4264	HGR	HGR
8.43-8.46	145.89	SRN	Run
8.46-8.47	53.8799	CAS	CAS
8.47-8.48	41.2481	HGR	HGR
8.48-8.49	33.8777	CAS	CAS
8.49-8.5025	73.2579	STP	Pool
8.5025-8.51	27.6493	STP	Pool
8.51-8.52	43.4518	HGR	HGR
8.52-8.53	60.896	RUN	Run
8.53-8.56	164.523	MCP	Pool
8.56-8.57	50.3733	CAS	CAS
8.57-8.59	93.4925	STP	Pool
8.59-8.61	109.832	HGR	HGR
8.61-8.64	84.3112	LGR	LGR
8.64-8.71	361.947	STP	Pool
8.71-8.74	134.527	HGR	HGR
8.74-8.76	91.9451	MCP	Pool
8.76-8.77	52.8881	RUN	Run
8.77-8.78	48.7228	CAS	CAS
8.78-8.81	182.6674	MCP	Pool
8.81-8.82	35.5015	CAS	CAS
8.82-8.84	126.694	SRN	Run
8.84-8.87	134.751	RUN	Run
8.87-8.905	191.073	HGR	HGR
8.905-8.915	62.5754	LGR	LGR
8.915-8.94	115.293	RUN	Run
8.94-8.95	53.2222	SRN	Run
8.95-8.96	72.216	LGR	LGR
8.96-9.03	309.063	MCP	Pool

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Table A-2. East Fork Kaweah River Mesohabitat Unit Location and Type

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
0-0.02	102.133	MCP	Pool
0.02-0.11	466.819	LGR	LGR
0.11-0.13	89.4607	MCP	Pool
0.13-0.14	73.6324	HGR	HGR
0.14-0.15	49.5889	MCP	Pool
0.15-0.17	91.7116	LGR	LGR
0.17-0.19	86.5467	CAS	CAS
0.19-0.195	20.0031	RUN	Run
0.195-0.24	305.855	RUN	Run
0.24-0.25	77.7888	CAS	CAS
0.25-0.32	325.7346	MCP	Pool
0.32-0.33	46.3473	HGR	HGR
0.33-0.35	130.253	MCP	Pool
0.35-0.37	92.2173	HGR	HGR
0.37-0.41	183.009	MCP	Pool
0.41-0.42	53.6743	CAS	CAS
0.42-0.44	125.588	MCP	Pool
0.44-0.47	157.45	CAS	CAS
0.47-0.51	227.785	MCP	Pool
0.51-0.52	58.062	HGR	HGR
0.52-0.53	64.5914	MCP	Pool
0.53-0.54	62.0568	HGR	HGR
0.54-0.56	117.591	MCP	Pool
0.56-0.62	290.078	HGR	HGR
0.62-0.65	169.339	MCP	Pool
0.65-0.67	94.1663	CAS	CAS
0.67-0.7	134.508	MCP	Pool
0.7-0.71	39.1308	CAS	CAS
0.71-0.74	153.229	MCP	Pool
0.74-0.77	190.557	CAS	CAS
0.77-0.78	45.5151	HGR	HGR
0.78-0.8	99.5673	MCP	Pool
0.8-0.81	32.1507	CAS	CAS
0.81-0.825	79.028	MCP	Pool
0.825-0.875	284.141	HGR	HGR
0.875-0.895	103.453	RUN	Run
0.895-0.92	125.934	CAS	CAS
0.92-0.945	131.2	MCP	Pool
0.945-0.95	32.3855	CAS	CAS
0.95-0.97	109.769	MCP	Pool
0.97-1.01	224.163	CAS	CAS
1.01-1.04	177.5512	MCP	Pool
1.04-1.11	388.2421	HGR	HGR
1.11-1.17	326.208	MCP	Pool
1.17-1.23	303.097	CAS	CAS
1.23-1.275	223.49	MCP	Pool
1.275-1.3	99.1822	CAS	CAS
1.3-1.33	140.653	RUN	Run

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
1.33-1.36	174.876	HGR	HGR
1.36-1.37	72.9275	MCP	Pool
1.37-1.44	376.421	SRN	Run
1.44-1.61	889.504	HGR	HGR
1.61-1.66	255.52	MCP	Pool
1.66-1.74	432.572	HGR	HGR
1.74-1.76	106.706	RUN	Run
1.76-1.85	480.423	HGR	HGR
1.85-1.9	238.391	MCP	Pool
1.9-1.91	69.4893	CAS	CAS
1.91-1.93	91.7433	RUN	Run
1.93-1.95	93.4788	CAS	CAS
1.95-2.02	392.017	SRN	Run
2.02-2.06	214.102	CAS	CAS
2.06-2.07	68.4823	RUN	Run
2.07-2.12	230.594	HGR	HGR
2.12-2.17	261.127	SRN	Run
2.17-2.26	486.827	HGR	HGR
2.26-2.29	145.237	MCP	Pool
2.29-2.3	58.8981	CAS	CAS
2.3-2.32	123.045	MCP	Pool
2.32-2.38	291.486	SRN	Run
2.38-2.39	43.7135	CAS	CAS
2.39-2.41	140.832	MCP	Pool
2.41-2.44	175.968	CAS	CAS
2.44-2.45	66.6333	MCP	Pool
2.45-2.64	954.282	HGR	HGR
2.64-2.65	53.09	MCP	Pool
2.65-2.67	106.678	HGR	HGR
2.67-2.69	109.894	MCP	Pool
2.69-2.72	143.792	CAS	CAS
2.72-2.78	322.088	STP	Pool
2.78-2.79	62.6166	CAS	CAS
2.79-2.87	442.807	STP	Pool
2.87-2.89	79.2405	CAS	CAS
2.89-2.92	159.253	STP	Pool
2.92-2.985	347.329	HGR	HGR
2.985-3.04	287.344	SRN	Run
3.04-3.055	82.5354	CAS	CAS
3.055-3.08	141.888	MCP	Pool
3.08-3.12	192.906	HGR	HGR
3.12-3.17	285.322	SRN	Run
3.17-3.2	139.2248	CAS	CAS
3.2-3.23	136.07	MCP	Pool
3.23-3.27	252.007	CAS	CAS
3.27-3.31	203.202	RUN	Run
3.31-3.39	428.712	HGR	HGR
3.39-3.43	179.435	SRN	Run
3.43-3.45	105.376	CAS	CAS

River Mile	Unit Length (ft)	McCain Channel Type	Instream Flow Habitat Type
3.45-3.5	279.195	STP	Pool
3.5-3.54	241.169	HGR	HGR
3.54-3.57	125.582	MCP	Pool
3.57-3.58	50.7097	HGR	HGR
3.58-3.59	59.6399	MCP	Pool
3.59-3.62	167.941	HGR	HGR
3.62-3.66	192.501	MCP	Pool
3.66-3.72	309.557	HGR	HGR
3.72-3.78	333.425	SRN	Run
3.78-3.83	278.736	STP	Pool
3.83-3.86	177.21	HGR	HGR
3.86-3.93	352.39	STP	Pool
3.93-3.95	105.629	CAS	CAS
3.95-3.98	132.471	MCP	Pool
3.98-4.04	294.075	HGR	HGR
4.04-4.1	346.957	CAS	CAS
4.1-4.12	62.0179	HGR	HGR
4.12-4.14	125.994	MCP	Pool
4.14-4.16	112.947	HGR	HGR
4.16-4.18	115.362	RUN	Run
4.18-4.22	226.925	HGR	HGR
4.22-4.25	169.668	RUN	Run
4.25-4.32	392.916	HGR	HGR
4.32-4.35	147.515	MCP	Pool
4.35-4.37	99.8569	HGR	HGR
4.37-4.43	306.596	STP	Pool
4.43-4.46	131.989	HGR	HGR
4.46-4.48	116.602	MCP	Pool
4.48-4.52	207.795	HGR	HGR
4.52-4.54	126.648	MCP	Pool
4.54-4.57	136.845	HGR	HGR
4.57-4.59	97.4545	CAS	CAS
4.59-4.605	82.9912	RUN	Run
4.605-4.625	125.567	HGR	HGR
4.625-4.64	86.3072	MCP	Pool
4.64-4.68	207.953	HGR	HGR
4.68-4.72	177.1833	STP	Pool

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APPENDIX B

Riparian Evaluation

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Appendix B Tables

Appendix B Figures

Appendix B Maps

Appendix B Attachments

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Table B-1. Number of Days and Average Number of Days per Year by Water Year Type that the Peak Q1.5 and Q2 Recurrence Interval Flow was Exceeded on the Project Bypass Reaches (WY 1994 - 2018).

Water Year	Water Year Type	KR Upstream of the Conf. with EF				KR Upstream of PH1				KR Upstream of PH2				East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion			
		Days Flows Exceed Q1.5		Days Flows Exceed Q2		Days Flows Exceed Q1.5		Days Flows Exceed Q2		Days Flows Exceed Q1.5		Days Flows Exceed Q2		Days Flows Exceed Q1.5		Days Flows Exceed Q2	
		1632 cfs		2385 cfs		2365 cfs		3453 cfs		2434 cfs		3530 cfs		717 cfs		1051 cfs	
		Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired
1994	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	Normal	21	26	0	0	29	31	0	1	28	31	0	0	34	35	21	23
1996	Normal	2	2	1	1	2	2	1	1	2	2	1	1	1	3	0	1
1997	Normal	5	6	2	2	5	5	3	3	5	5	3	3	8	8	3	3
1998	Normal	40	43	2	11	41	43	15	19	40	41	14	17	43	44	25	26
1999	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	Normal	2	2	1	1	5	6	1	1	4	5	1	1	11	11	1	2
2004	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	Normal	8	9	0	0	14	17	0	0	11	15	0	0	21	22	9	9
2006	Normal	3	12	0	0	15	17	0	0	14	15	0	0	24	27	10	11
2007	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010	Normal	8	9	1	2	9	10	5	5	9	10	4	4	11	12	8	8
2011	Normal	16	24	1	1	17	20	1	1	16	18	1	1	19	19	12	12
2012	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	Dry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	Normal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	Normal	39	43	2	2	36	40	2	2	36	37	2	2	37	41	15	17
2018	Dry	3	3	1	1	2	2	1	1	2	2	1	1	1	1	1	1
Average Per Year by Water Year Type																	
	Dry	0.4	0.4	0.1	0.1	0.3	0.3	0.1	0.1	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1
	Normal	8	10	1	1	10	11	2	2	10	11	2	2	12	13	6	7
Average Per Year in Years with Events																	
	Dry	3	3	1	1	2	2	1	1	2	2	1	1	1	1	1	1
	Normal	14	18	1	3	17	19	4	4	17	18	4	4	21	22	12	11
No. Years with Events																	
	Dry	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Normal	10	10	8	8	10	10	7	8	10	10	7	7	10	10	9	10

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Table B-2. Daily Exceedance Flows at the Study Sites (WY 1994 - 2018).

		Exceedance Flow (cfs)							
		KR Upstream of the Conf. with EF		KR Upstream of PH1		KR Upstream of PH2		EF Upstream of the Conf. with KR	
Percentile (%)	Exceedance (%)	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired
0.01	99	11	14	19	23	21	23	5	8
0.02	98	12	15	21	26	23	26	6	9
0.04	96	14	18	23	28	25	28	6	9
0.06	94	15	20	24	31	27	31	6	10
0.08	92	17	22	26	34	30	34	7	11
0.1	90	19	24	29	38	34	38	7	13
0.12	88	21	27	32	43	38	43	7	14
0.14	86	23	30	35	48	42	48	8	15
0.16	84	26	35	37	54	46	54	8	16
0.18	82	29	40	41	61	50	61	9	18
0.2	80	32	47	44	69	53	69	9	19
0.22	78	35	52	47	75	57	75	10	20
0.24	76	38	59	50	83	61	83	10	21
0.26	74	42	65	55	91	66	91	11	22
0.28	72	47	72	60	99	72	99	11	23
0.3	70	51	80	65	108	77	108	12	24
0.32	68	56	88	71	118	84	118	13	25
0.34	66	62	96	78	129	92	129	14	27
0.36	64	68	105	86	140	99	140	15	28
0.38	62	74	114	94	152	109	152	16	30
0.4	60	81	125	103	164	119	164	17	32
0.42	58	88	135	112	178	129	178	19	34
0.44	56	94	147	122	194	139	194	21	36

Percentile (%)	Exceedance (%)	Exceedance Flow (cfs)							
		KR Upstream of the Conf. with EF		KR Upstream of PH1		KR Upstream of PH2		EF Upstream of the Conf. with KR	
		Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired
0.46	54	100	160	134	209	150	209	23	39
0.48	52	107	171	144	225	162	225	25	42
0.5	50	113	180	156	239	171	239	28	45
0.52	48	120	190	168	253	185	253	31	48
0.54	46	129	201	185	269	202	269	33	52
0.56	44	142	212	202	288	220	288	36	55
0.58	42	156	226	220	310	239	310	40	59
0.6	40	172	242	244	334	263	334	46	64
0.62	38	191	260	272	362	290	362	52	71
0.64	36	209	280	303	393	321	393	60	80
0.66	34	230	302	338	429	357	429	70	88
0.68	32	260	333	377	465	395	465	81	99
0.7	30	288	359	421	508	434	508	92	110
0.72	28	317	390	460	546	476	546	107	125
0.74	26	352	424	502	595	519	595	123	141
0.76	24	383	460	547	637	565	637	141	158
0.78	22	418	494	596	691	616	691	160	176
0.8	20	458	534	664	750	682	750	177	194
0.82	18	510	585	724	811	741	811	197	215
0.84	16	564	635	791	884	809	884	225	242
0.86	14	621	695	876	969	892	969	256	271
0.88	12	686	759	969	1057	985	1057	287	304
0.9	10	772	847	1065	1156	1080	1156	319	336
0.92	8	881	959	1222	1314	1236	1314	353	368

Percentile (%)	Exceedance (%)	Exceedance Flow (cfs)							
		KR Upstream of the Conf. with EF		KR Upstream of PH1		KR Upstream of PH2		EF Upstream of the Conf. with KR	
		Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired	Impaired	Unimpaired
0.94	6	1043	1122	1397	1487	1414	1487	398	419
0.96	4	1245	1326	1640	1743	1662	1743	507	523
0.98	2	1583	1660	2212	2283	2224	2283	806	824
0.99	1	1941	2012	2787	2872	2805	2872	1088	1110

Refer to AQ 5 TSR (SCE 2019) for additional details on this analysis.

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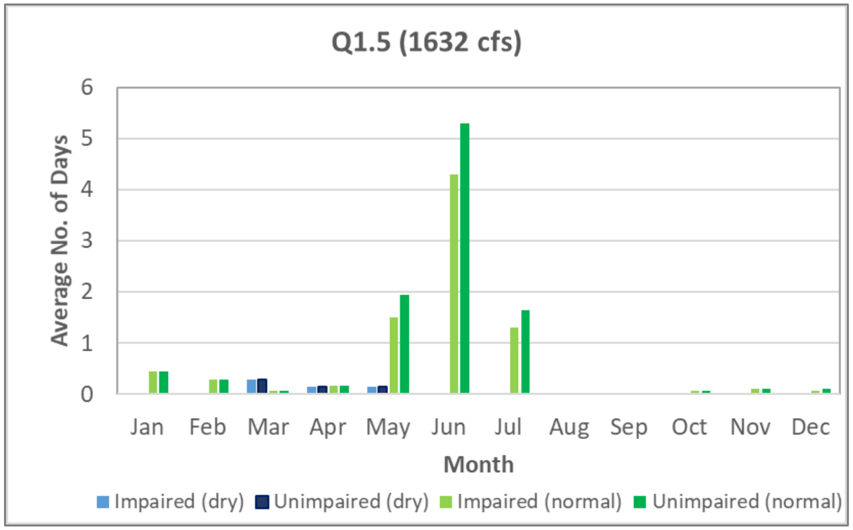
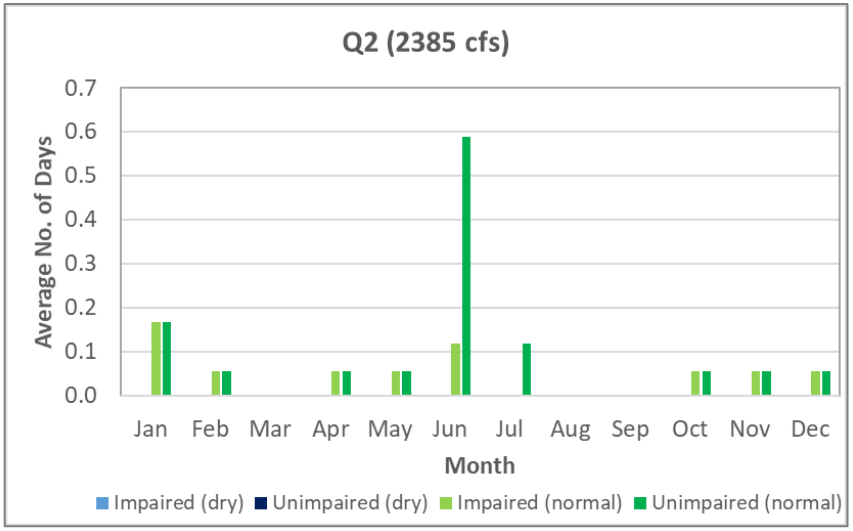
Figure B-1. Average Number of Days Q1.5 and Q2 Flows were Exceeded by Month and Water Year Type under Impaired and Unimpaired Flow Conditions (WY 1994 - 2018) on the Project Bypass Reaches.[1]

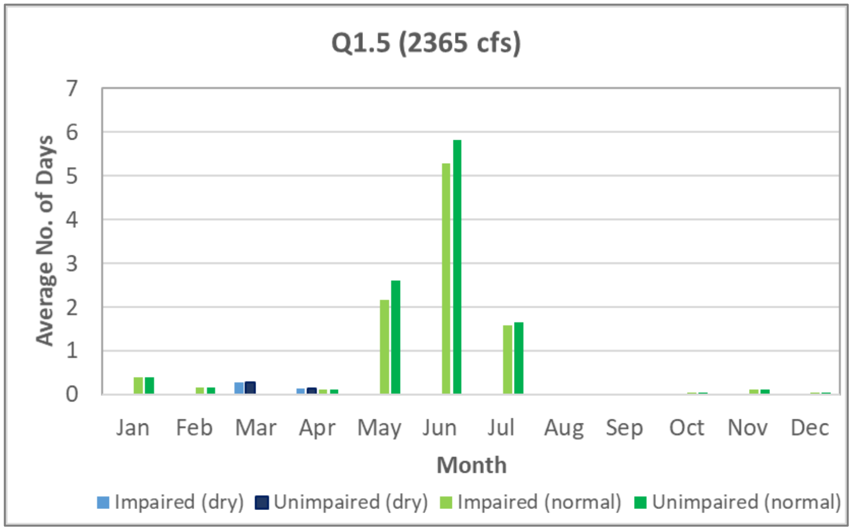
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

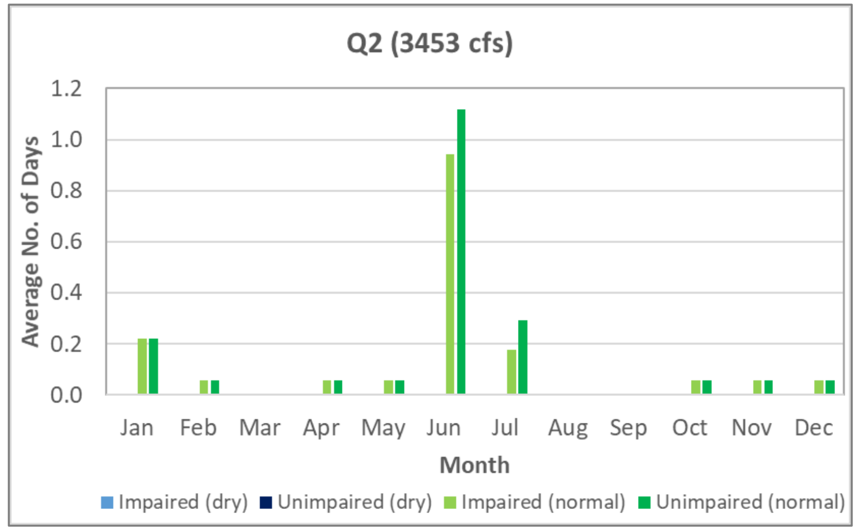




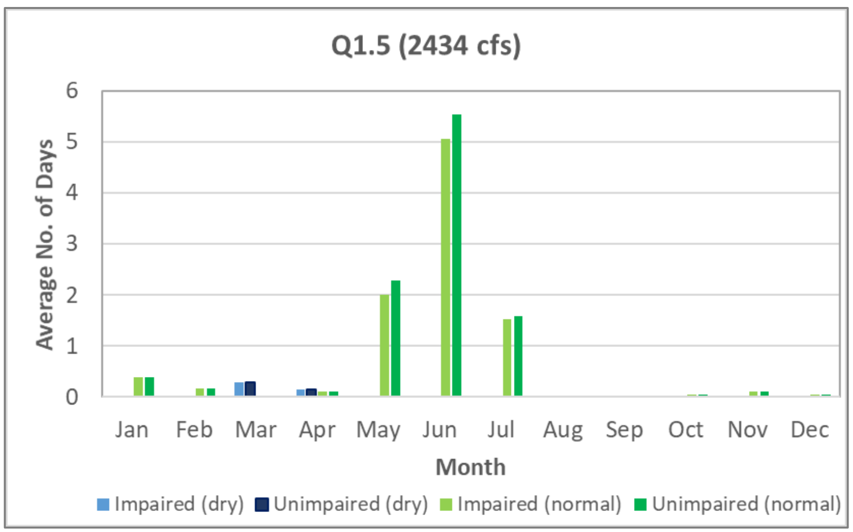
[1] Y-axis scales differ in the plots below.

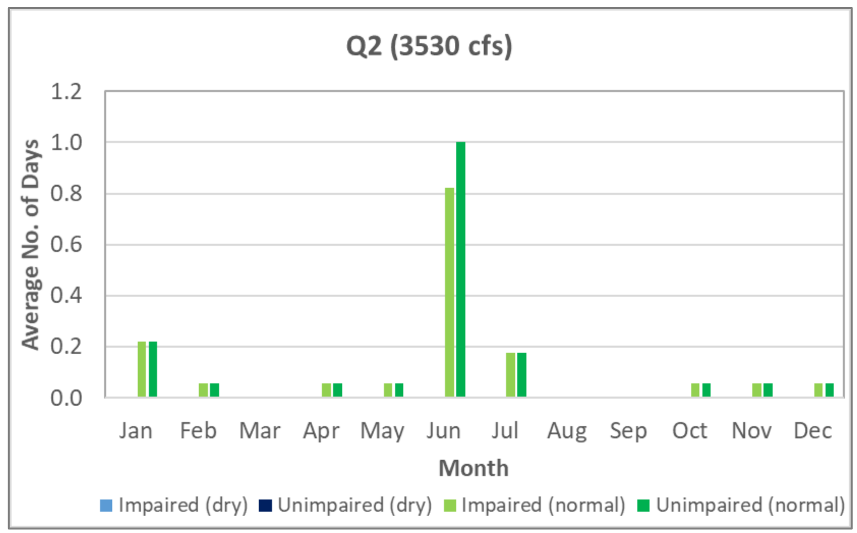
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse



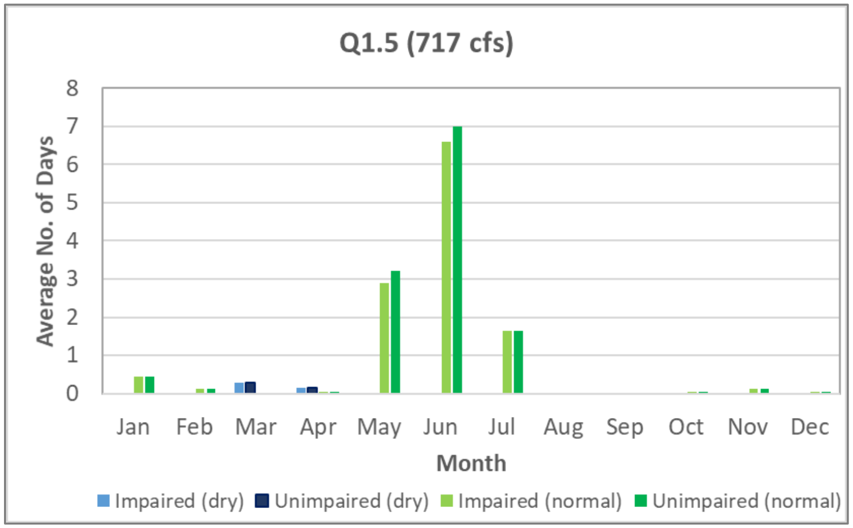


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse





East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion



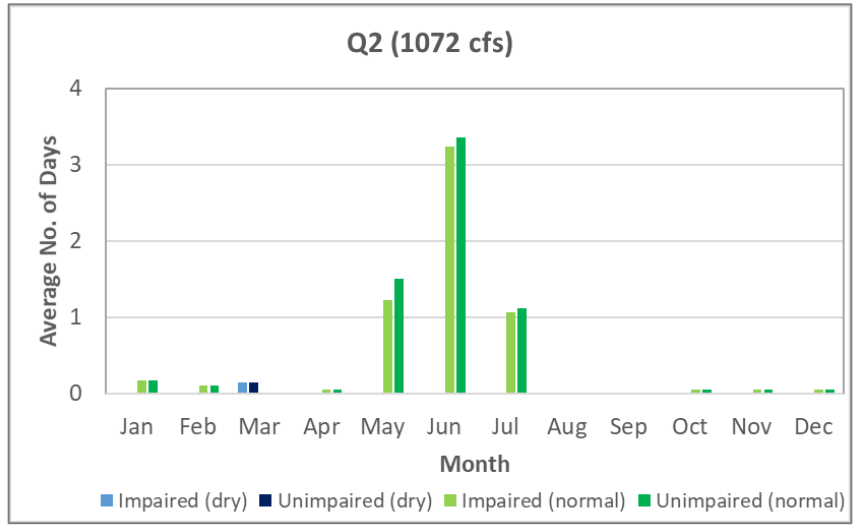


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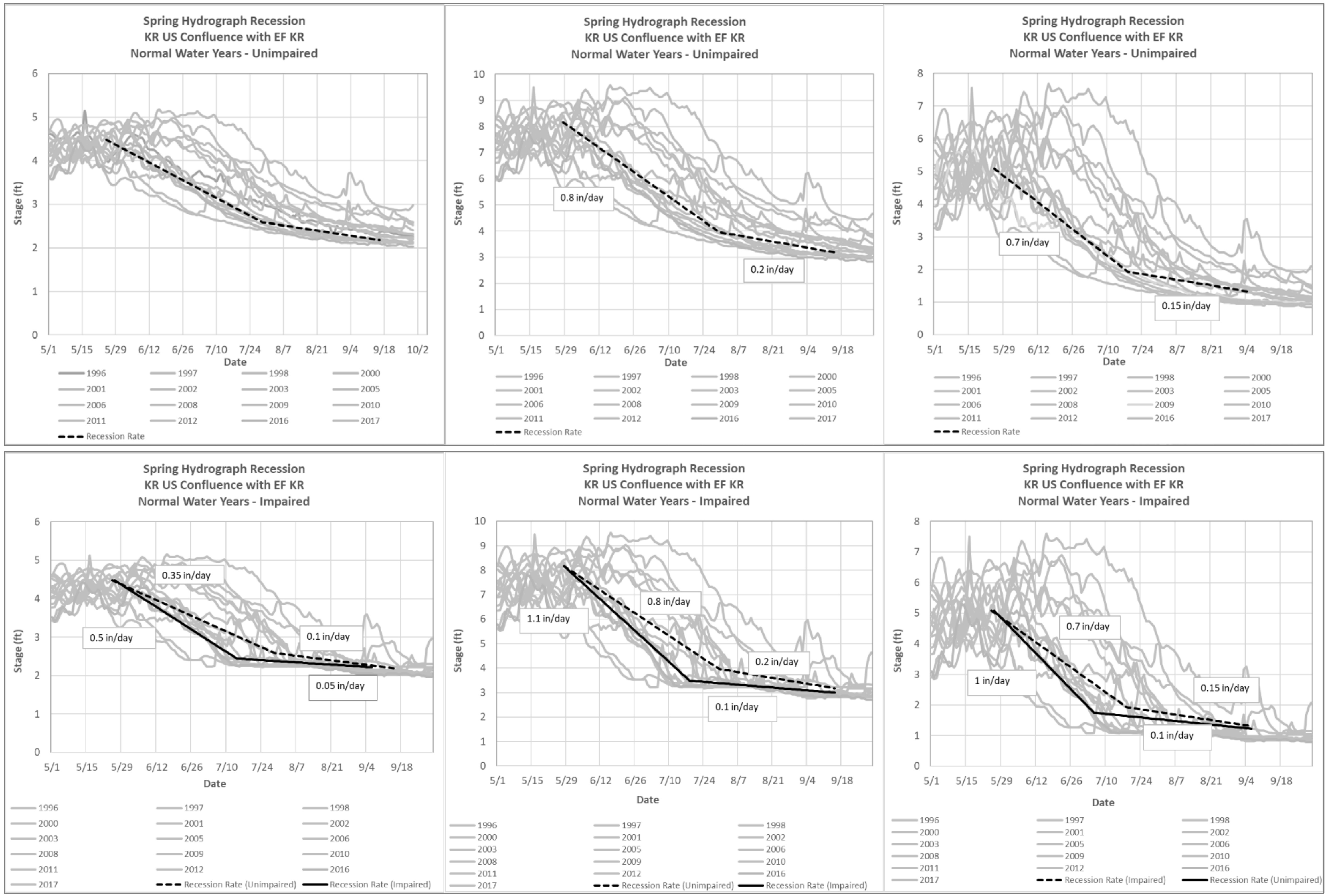
Figure B-2. Comparisons of Spring Runoff Recession Rates Under Unimpaired and Impaired Flows at the Three Representative Elevation Profiles at the Study Sites by Water Year Type (WY 1994 to 2018).

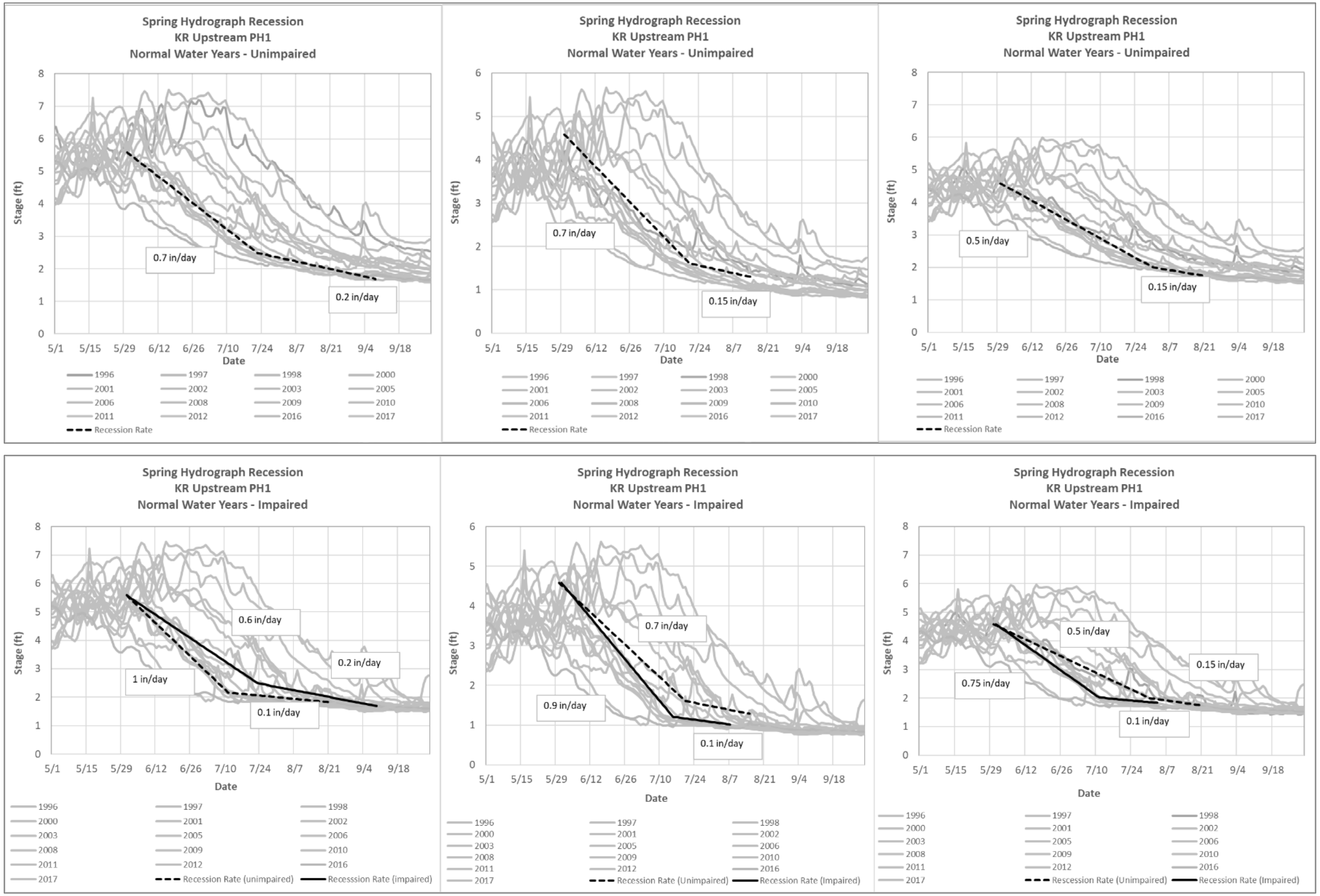
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

T4 T9 T18



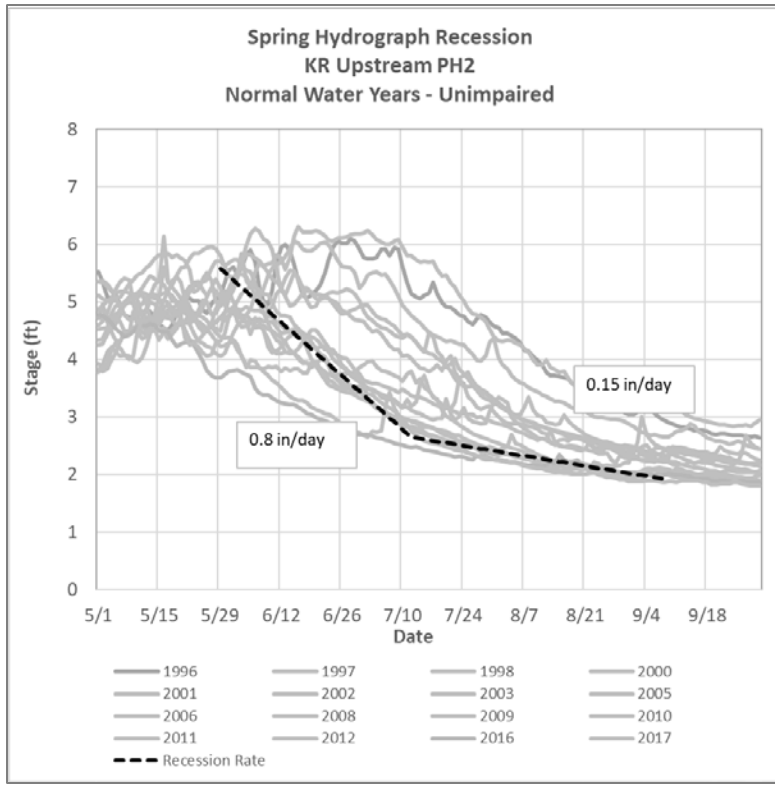
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

T4 T9 T11

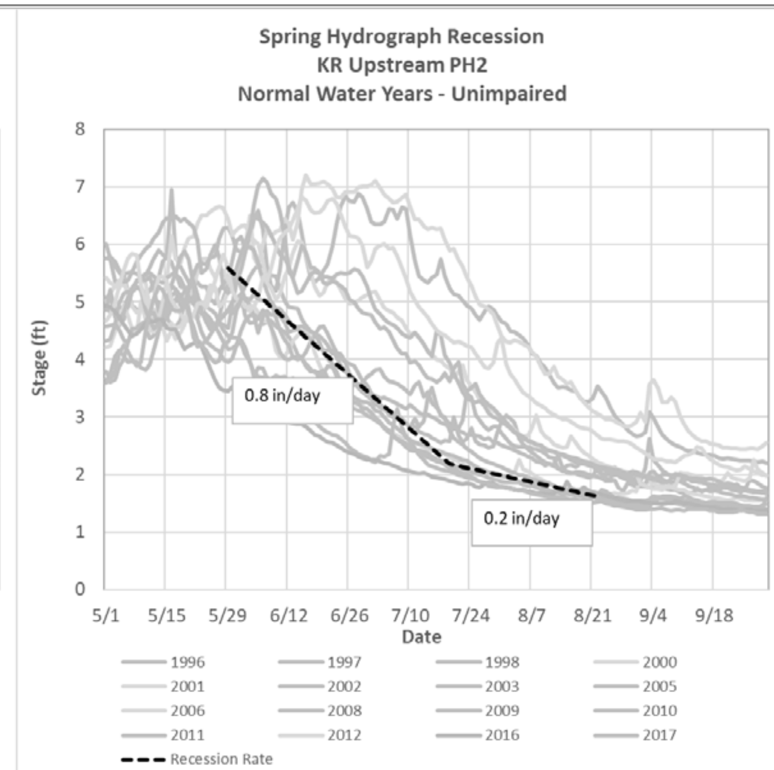


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

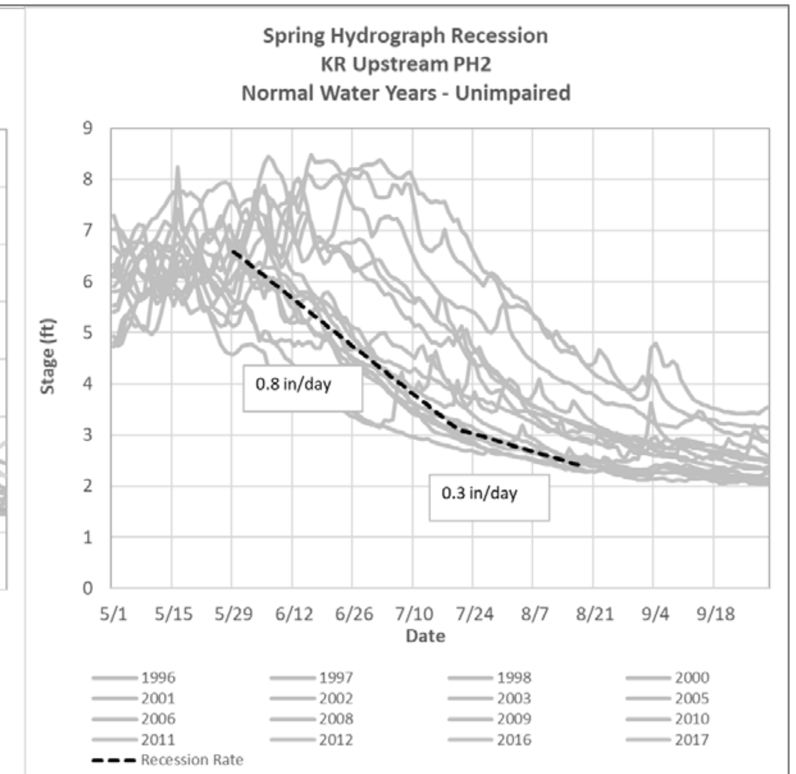
T1

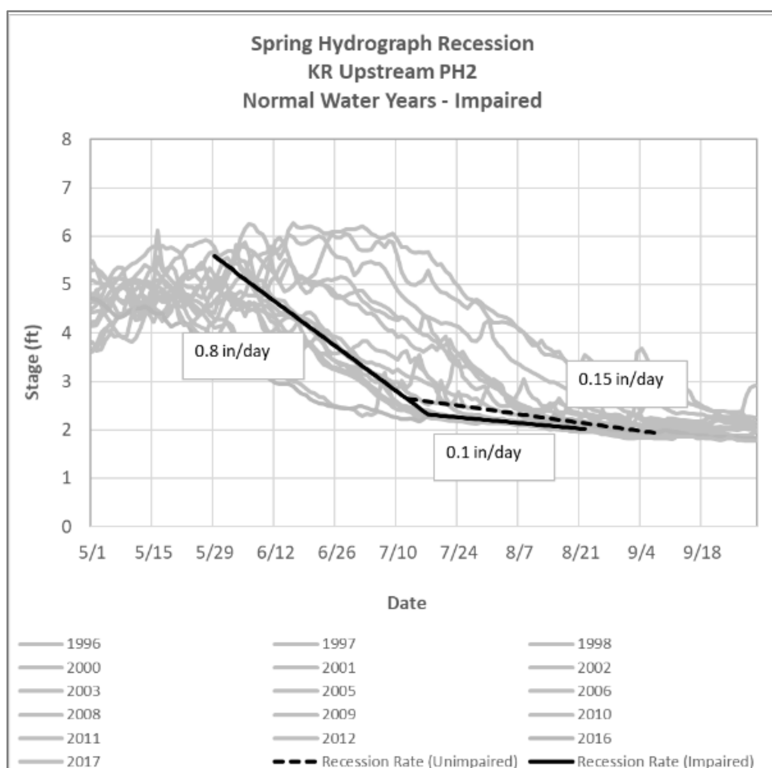


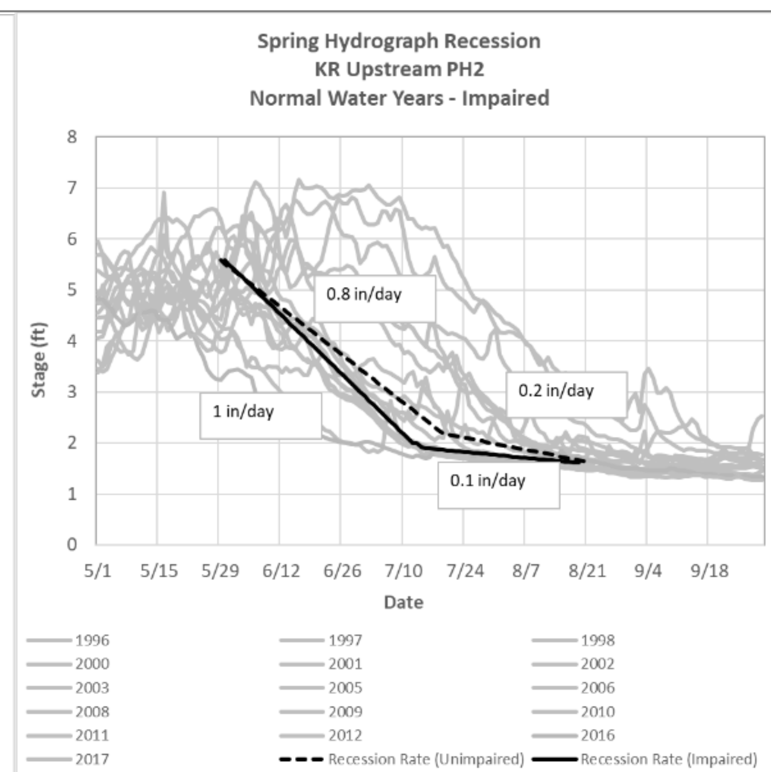
T5

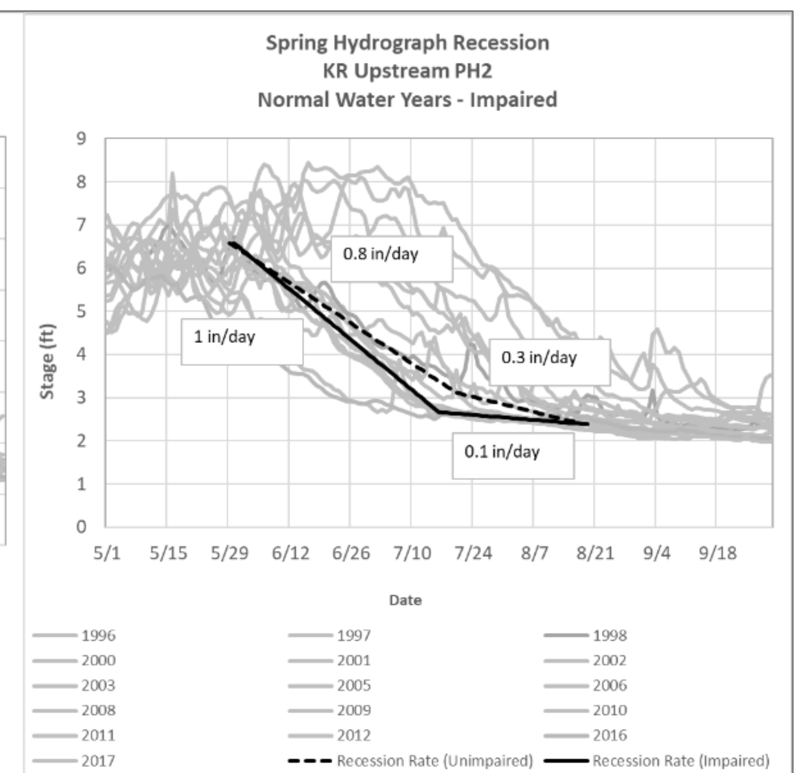


T9



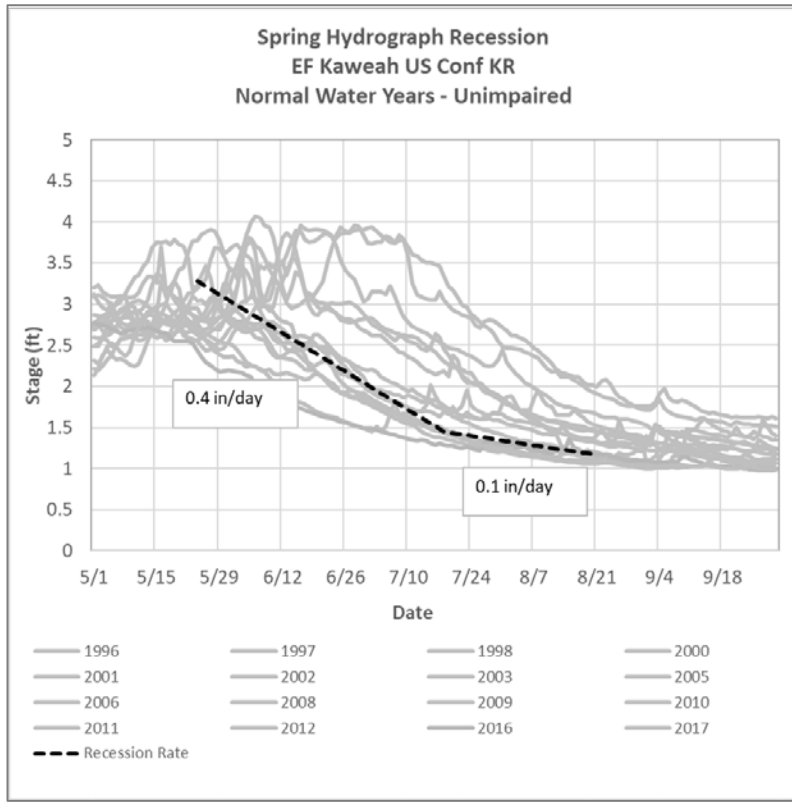


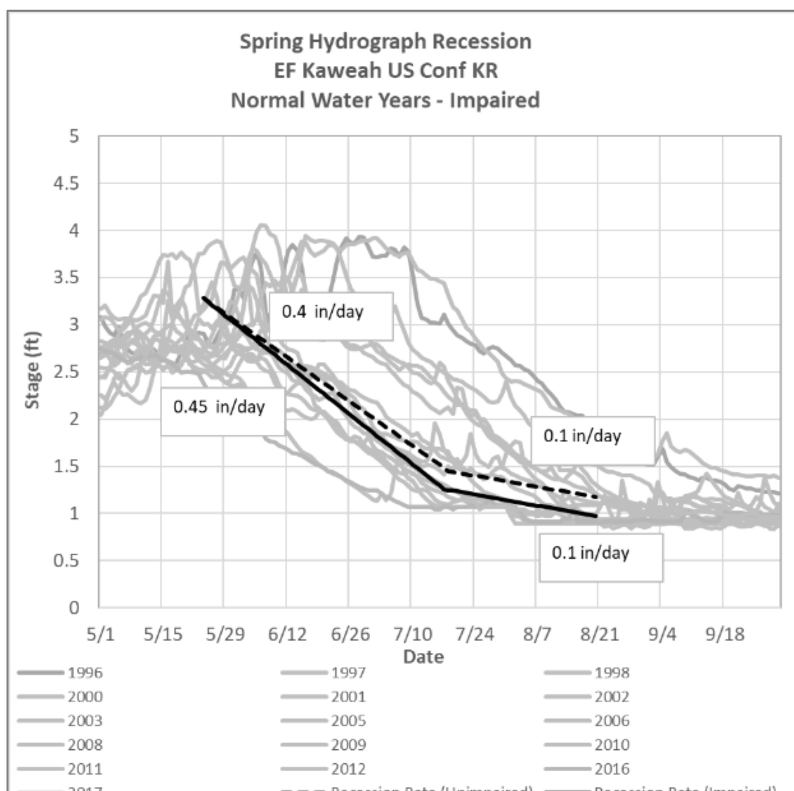




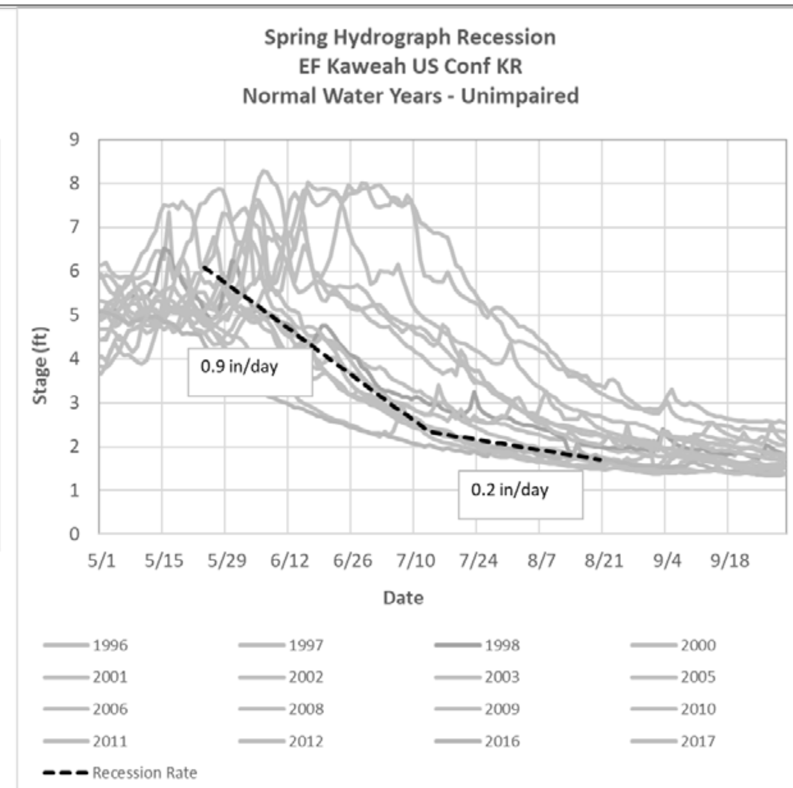
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion

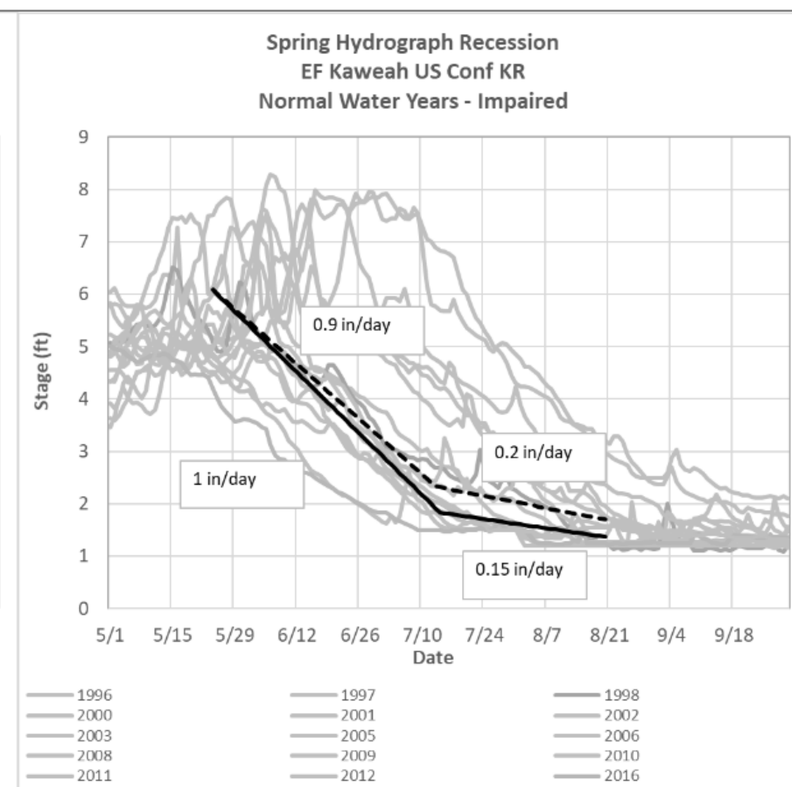
T1



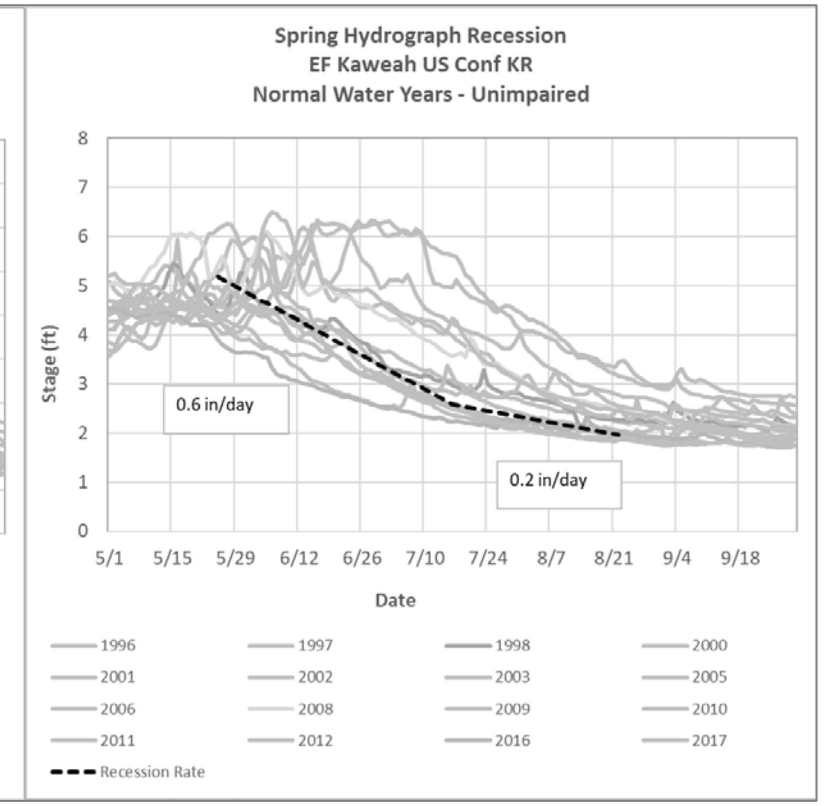


T9





T14



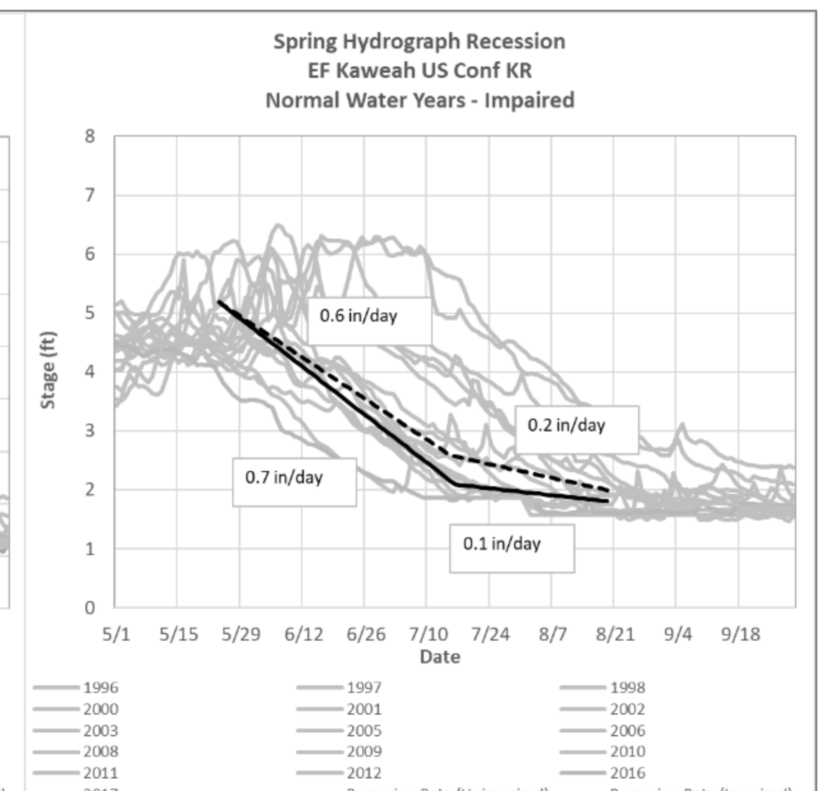
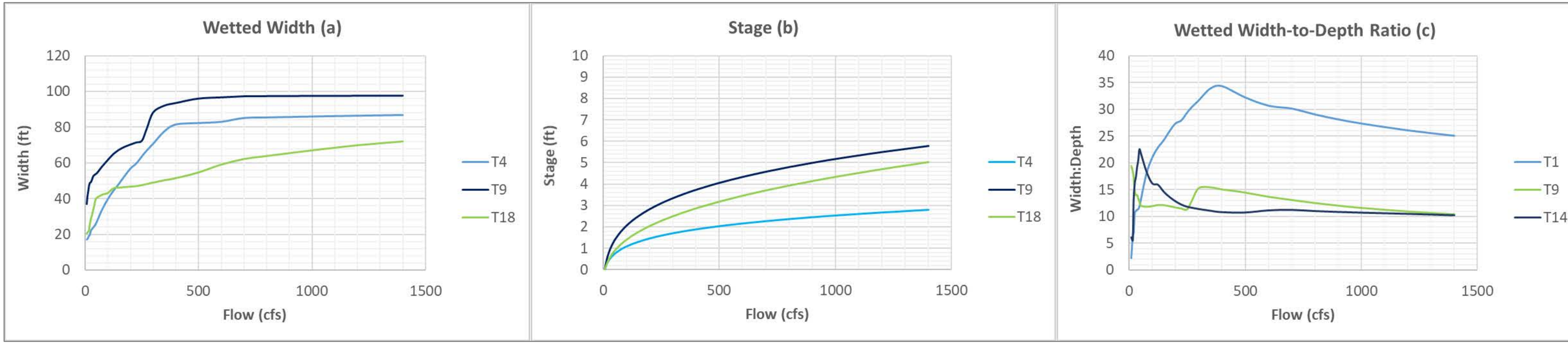
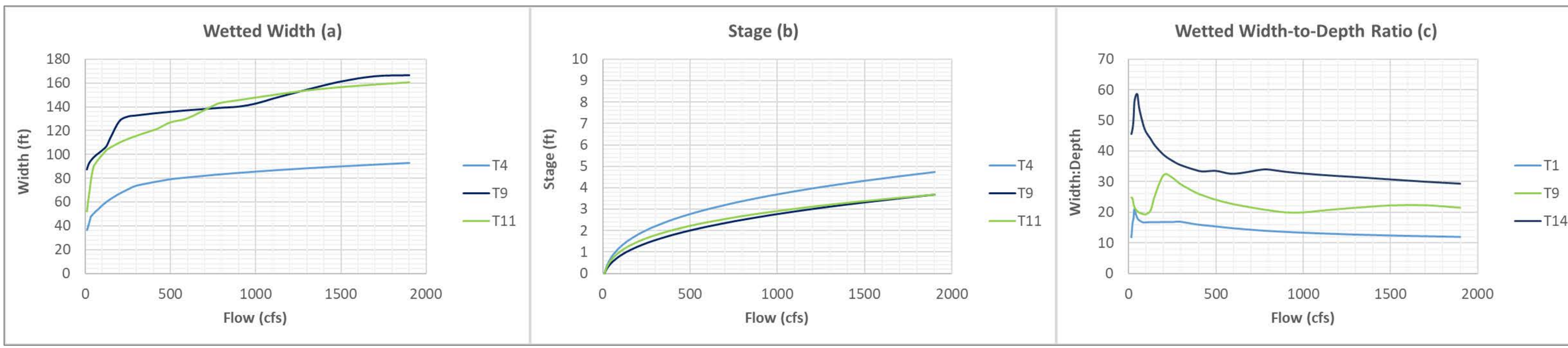


Figure B-3. Change in Wetted Width (a), Stage (b), and Wetted Width-to-Depth Ratio with Increased Flow at the Study Sites.

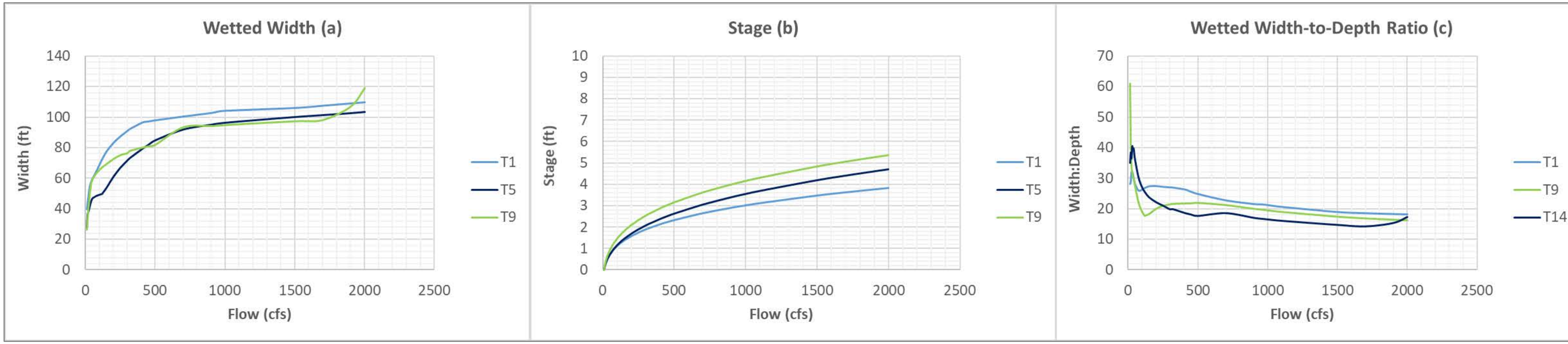
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence



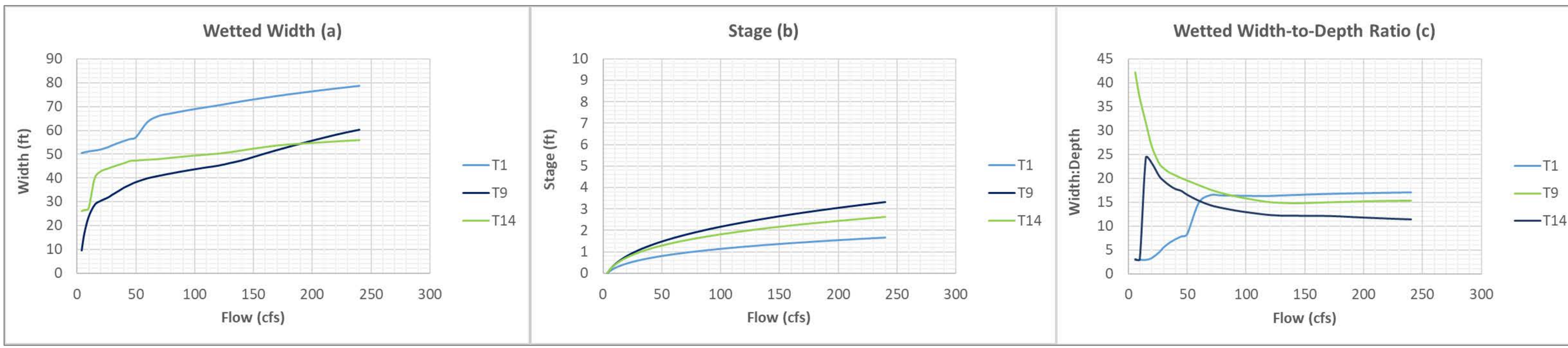
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

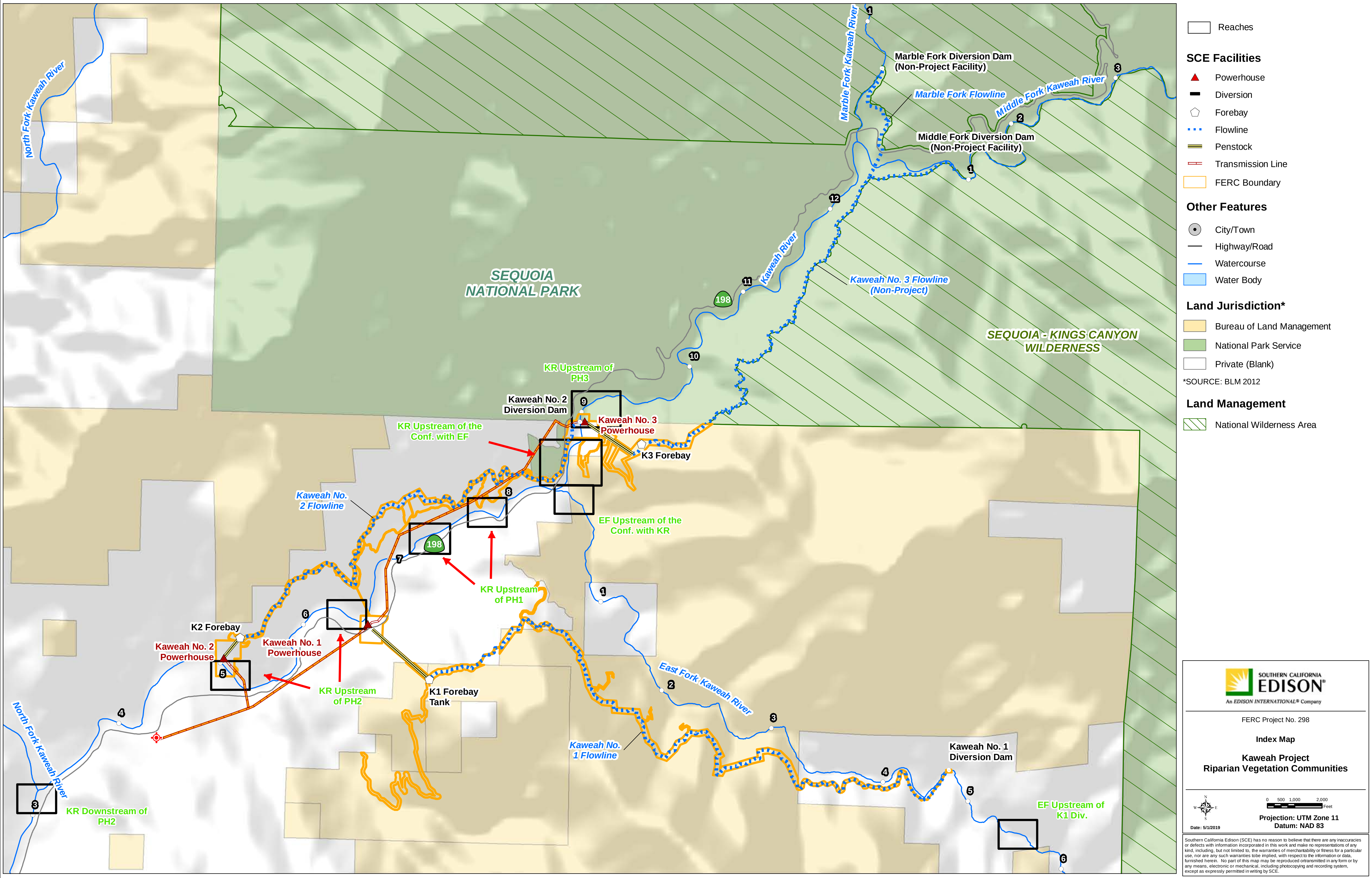


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse



East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion





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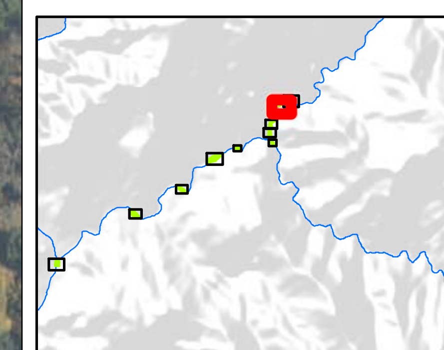
Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
- White alder/dusky willow riparian forest
- Arroyo willow riparian scrub
- Black willow riparian forest
- Dusky willow riparian scrub
- Red willow riparian forest
- Sandbar willow riparian scrub
- Fremont cottonwood forest
- Fremont cottonwood/dusky willow riparian forest
- California sycamore-Fremont cottonwood riparian forest
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ-1 T1)

Aerial Imagery Source: Hexagon Imagery 2016
(Imagery Date 7-1-2016; Flow: 198 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1A

Riparian Vegetation Communities

Kaweah River Upstream of Kaweah No. 3 Powerhouse

0 25 50 100 Feet

N S W E

Date: 5/1/2019

Projection: UTM Zone 11
Datum: NAD 83

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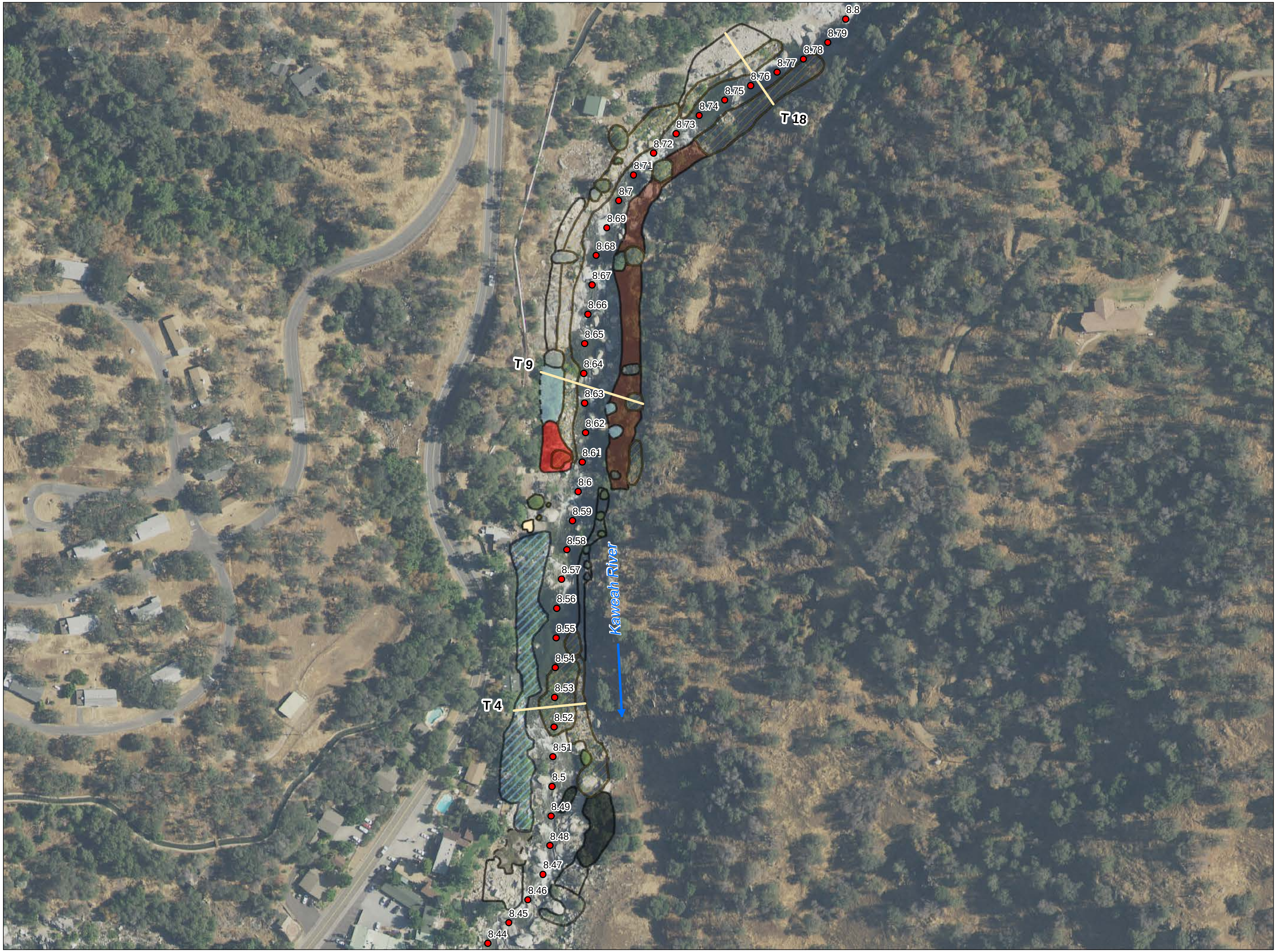

Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
- White alder/dusky willow riparian forest
- Arroyo willow riparian scrub
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- Red willow riparian forest
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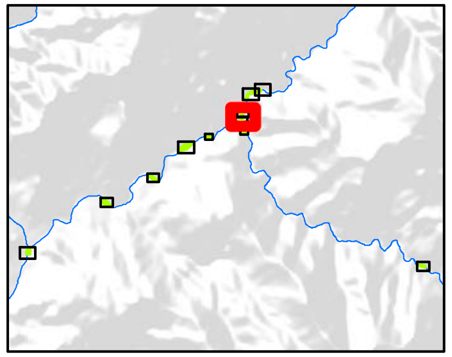
- California sycamore-Fremont cottonwood riparian forest
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ-1 T4, T9, T18)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 128 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1B

Riparian Vegetation Communities

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

0 25 50 100 Feet

Projection: UTM Zone 11
Datum: NAD 83

Date: 5/1/2019

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
- White alder/dusky willow riparian forest
- Arroyo willow riparian scrub
- Black willow riparian forest
- Dusky willow riparian scrub
- Red willow riparian forest
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- Fremont cottonwood forest
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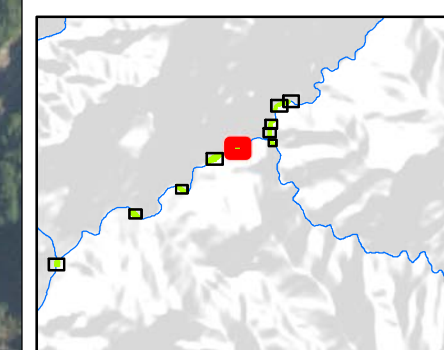
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ-1 T11)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 209 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1C

Riparian Vegetation Communities

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

0 25 50 100 Feet

Date: 5/1/2019

Projection: UTM Zone 11
Datum: NAD 83

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
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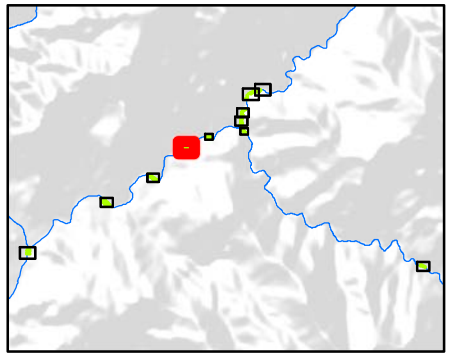
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T4, T9)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 1209 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1D

Riparian Vegetation Communities

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

0 25 50 100 Feet

Projection: UTM Zone 11
Datum: NAD 83

Date: 5/1/2019

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
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- Red willow riparian forest
- Sandbar willow riparian scrub
- Fremont cottonwood forest
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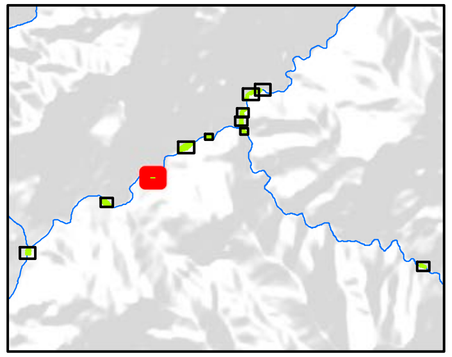
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T9)

Aerial Imagery Source: Hexagon Imagery 2016
(Imagery Date 7-1-2016; Flow: 221 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1E

Riparian Vegetation Communities

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

0 25 50 100 Feet

Projection: UTM Zone 11
Datum: NAD 83

Date: 5/1/2019

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
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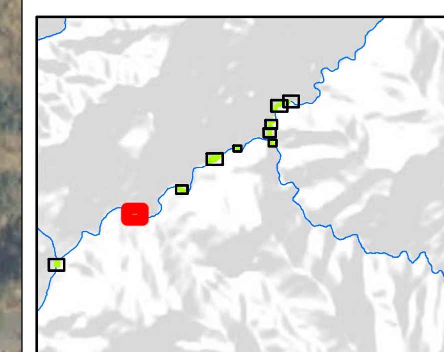
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T1, T5)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 221 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1F

Riparian Vegetation Communities

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

0 25 50 100 Feet

Projection: UTM Zone 11
Datum: NAD 83

Date: 5/1/2019

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
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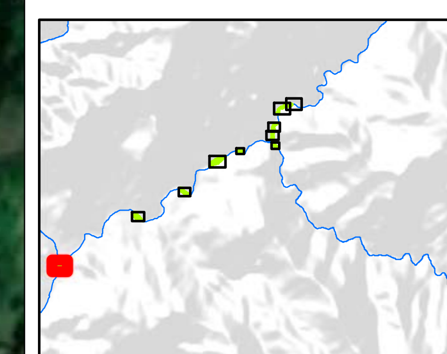
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T1)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 291 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1G

Riparian Vegetation Communities

Kaweah River Downstream of Kaweah No. 2 Powerhouse

0 25 50 100 Feet

Date: 5/1/2019

Projection: UTM Zone 11
Datum: NAD 83

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
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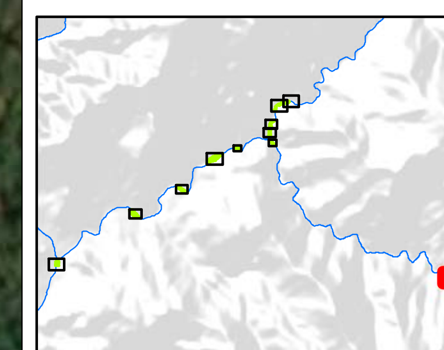
- Arroyo willow riparian scrub
- Black willow riparian forest
- Dusky willow riparian scrub
- Red willow riparian forest
- Sandbar willow riparian scrub
- Fremont cottonwood forest
- Fremont cottonwood/dusky willow riparian forest
- California sycamore-Fremont cottonwood riparian forest
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T1)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 93 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1H

Riparian Vegetation Communities

East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion

0 25 50 100 Feet

Date: 5/1/2019

Projection: UTM Zone 11
Datum: NAD 83

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Plant Communities

- White alder forest
- White alder-California sycamore riparian forest
- White alder-California sycamore-Red willow riparian forest
- White alder-Canyon live oak woodland
- White alder-red willow riparian forest
- White alder/dusky willow riparian forest
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- Black willow riparian forest
- Dusky willow riparian scrub
- Red willow riparian forest
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- Fremont cottonwood/dusky willow riparian forest
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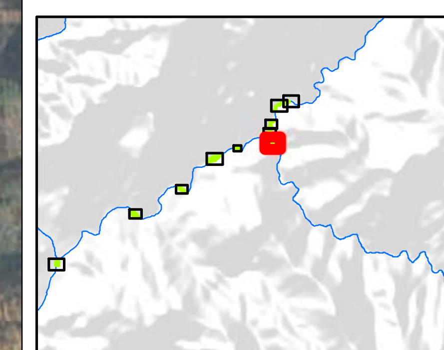
- California sycamore woodland
- Blue oak woodland
- Interior live oak woodland
- Oregon ash woodland
- Buttonwillow scrub
- Cattails
- Edible fig (non-native)
- Broom patch (invasive, non-native)
- Sparsely vegetated

River miles

Transects (AQ1 T1, T9, T14)

Aerial Imagery Source: Hexagon Imagery 2016 (Imagery Date 7-1-2016; Flow: 81 cfs)



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Kaweah Project - FERC Project No. 298

Maps AQ1 - B - 1I

Riparian Vegetation Communities

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion

0 25 50 100 Feet

Date: 5/1/2019

Projection: UTM Zone 11
Datum: NAD 83

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Attachment A

Dominant and Sub-dominant Species Observed during Riparian Survey at Each Study Site

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Dominant and Sub-dominant Species Observed during Riparian Survey at Each Study Site.

Common Name	Taxon Name	Code	Rarity	Study Site						
				EF Upstream of K1 Div.	EF Upstream of the Conf. with KR	KR Upstream of PH3	KR Upstream of the Conf. with EF	KR Upstream of PH1	KR Upstream of PH2	KR Downstream of PH2
Spanish lotus	*Acmispon americanus*	ACAM	native			s	s		s	
buckeye	*Aesculus californica*	AECA	native			s				
white alder	*Alnus rhombifolia*	ALRH	native	D	D/s	D/s	D/s	D/s	D/s	D/s
Western ragweed	*Ambrosia psilostachya*	AMPS	native						s	
California mugwort	*Artemisia douglasiana*	ARDO	native	s	s	s	s	s	s	s
narrow leaf milkweed	*Asclepias fascicularis*	ASFA	native		s	s	s			
California brickelbush	*Brickellia californica*	BRCA	native			s	s	s		
ripgut brome	*Bromus diandrus*	BRDI	invasive non-native						s	
incense cedar	*Calocedrus decurrens*	CADE	native	s						
spicebush	*Calycanthus occidentalis*	CAOC	native	s				s		
southern catalpa	*Catalpa sp.*	Catalpa sp.	exotic							s
tocalote	*Centaurea melitensis*	CEME	exotic					s		
buttonbush	*Cephalanthus occidentalis*	CEOC	native		D/s	D/s	D/s	s	D/s	D
western red bud	*Cercis occidentalis*	CEROCC	native	s		s	s	s		
creek dogwood	*Cornus sericea*	COSE	native	s						
Bermuda grass	*Cynodon dactylon*	CYDA	exotic						s	

Common Name	Taxon Name	Code	Rarity	Study Site						
				EF Upstream of K1 Div.	EF Upstream of the Conf. with KR	KR Upstream of PH3	KR Upstream of the Conf. with EF	KR Upstream of PH1	KR Upstream of PH2	KR Downstream of PH2
tall flatsedge	*Cyperus eragrostis*	CYER	native		s	s	s	s	s	s
yellow nutsedge	*Cyperus esculentus*	CYES	exotic					s	s	s
toluaca	*Datura wrightii*	DAWR	native						s	
crabgrass	*Digitaria sanguinalis*	DISA	exotic					s		s
wood fern	*Dryopteris arguta*	DRAR	native	s						
common spikerush	*Eleocharis macrostachya*	ELMA	native					s		
California fuchsia	*Epilobium canum ssp. canum*	EPCA	native					s		
smooth scouring rush	*Equisetum laevigatum*	EQLA	native	s	s	s	s	s		
California yerba santa	*Eriodictyon californicum*	ERCA	native			s				
Contura creek spurge	*Euphorbia ocellata*	EUOC	native		s	s		s		
Italian rye grass	*Festuca perennis*	FEPE	exotic			s			s	
common fig	*Ficus carica*	FICA	exotic		s		D			
hoary coffeeberry	*Frangula californica ssp. tomentella*	FRTO	native					s	s	
red buckthorn	*Frangula rubra*	FRRU	native	s			s			
Oregon ash	*Fraxinus latifolia*	FRLA	native	s	D/s	D	D	D/s	D/s	
walnut	*Juglans sp.*	Juglans sp.	native						s	
southern honeysuckle	*Lonicera subspicata*	LOSU	native	s	s	s				

Common Name	Taxon Name	Code	Rarity	Study Site						
				EF Upstream of K1 Div.	EF Upstream of the Conf. with KR	KR Upstream of PH3	KR Upstream of the Conf. with EF	KR Upstream of PH1	KR Upstream of PH2	KR Downstream of PH2
silver bush lupine	*Lupinus albifrons*	LUAL	native			s			s	
pennyroyal	*Mentha pulegium*	MEPU	exotic		s			s		
many flowered monkey flower	*Mimulus floribundus (Erythranthe floribunda)*	MIFL	native			s	s			
deergrass	*Muhlenbergia rigens*	MURI	native			D/s	D/s	s	s	s
western panic grass	*Panicum acuminatum*	PAAC	native	s	s	s	s	s	s	
woodbine	*Parthenocissus inserta*	PAIN	exotic				s		s	
dallis grass	*Paspalum dilatatum*	PADI	exotic				s	s		s
dotted smartweed	*Persicaria punctata*	PEPU	native							s
windmill pink	*Petrorhagia dubia*	PEDU	exotic					s	s	
caterpillar phacelia	*Phacelia cicutaria*	PHCI	native			s			s	
ponderosa pine	*Pinus ponderosa*	PIPO	native	s		D				
California sycamore	*Platanus racemosa*	PLRA	native	D	D/s	D/s	D	D/s	D/s	D/s
rabbitsfoot grass	*Polypogon monspeliensis*	POMO	exotic						s	
Fremont's cottonwood	*Populus fremontii*	POFR	native		D	s	D	D/s	D	
black cottonwood	*Populus trichocarpa*	POTR	native	s						

Common Name	Taxon Name	Code	Rarity	Study Site						
				EF Upstream of K1 Div.	EF Upstream of the Conf. with KR	KR Upstream of PH3	KR Upstream of the Conf. with EF	KR Upstream of PH1	KR Upstream of PH2	KR Downstream of PH2
Jersey cudweed	*Pseudognaphalium luteoalbum*	PSLU	exotic				s			
canyon live oak	*Quercus chrysolepis*	QUCH	native	D						
blue oak	*Quercus douglasii*	QUDO	native		D		s			
valley oak	*Quercus lobata*	QULO	native					s	D/s	
interior live oak	*Quercus wislizeni*	QUWI	native	s	D/s	D/s	D/s	D/s	D/s	
evergreen buckthorn	*Rhamnus ilicifolia*	RHIL	native	s						
California wild rose	*Rosa californica*	ROCA	native			s				
Himalayan blackberry	*Rubus armeniacus*	RUAR	exotic	s	s	s	s	s	s	s
white bark raspberry	*Rubus leucodermis*	RULE	native	s	s					
California blackberry	*Rubus ursinus*	RUUR	native		s	s		s	s	
sandbar willow	*Salix exigua var. hindsiana*	SAHI	native				D			s
Goodding's black willow	*Salix gooddingii*	SAGO	native		s	D	D	D/s	D/s	D
red willow	*Salix laevigata*	SALAE	native	s	D	D/s	D			D
arroyo willow	*Salix lasiolepis*	SALS	native						D	D
dusky willow	*Salix melanopsis*	SAME	native	D/s	D/s	D/s	D/s	D/s	D/s	D
Spanish broom	*Spartium junceum*	SPJU	invasive non-native			s	D/s	D/s	s	
hedge parsley	*Torilis arvensis*	TOAR	exotic		s				s	

Common Name	Taxon Name	Code	Rarity	Study Site						
				EF Upstream of K1 Div.	EF Upstream of the Conf. with KR	KR Upstream of PH3	KR Upstream of the Conf. with EF	KR Upstream of PH1	KR Upstream of PH2	KR Downstream of PH2
pacific poison oak	*Toxicodendron diversilobum*	TODI	native	s	s	s	s	s		
broadleaf cattail	*Typha latifolia*	TYLA	native		s	s		D/s	s	
California bay	*Umbellularia californica*	UMCA	native	s						
periwinkle	*Vinca major*	VIMA	exotic			s			s	
California wild grape	*Vitis californica*	VICA	native	s	s	s	s		s	s
cocklebur	*Xanthium strumarium*	XAST	native				s	s	s	s

Notes:

D = Dominant species

S = sub-dominant species

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Attachment B

Representative Photographs of Riparian Vegetation at Each Study Site

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Kaweah River

Kaweah River Upstream of Kaweah No. 3 Powerhouse

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

Kaweah River Downstream of Kaweah No. 2 Powerhouse

East Fork Kaweah River

East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion

East Fork Kaweah River Upstream of the Confluence with the Kaweah River

APPENDIX C

Channel Topography and Substrate

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Table C-1. East Fork Kaweah River Upstream of the Confluence with Kaweah River, Study Site Topography, Substrate, and Velocity Data.

Transect 1

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
13.3	85.14	0.00	45.7	50	sand	25	LG	15	LB	10	SB
16.5	83.75	0.00	45.7	50	sand	25	LG	15	LB	10	SB
19.2	82.70	0.00	45.7	50	sand	25	LG	15	LB	10	SB
23.4	83.97	0.00	45.7	50	sand	25	LG	15	LB	10	SB
24.2	83.18	0.00	44.9	100	sand						
30.9	83.12	0.00	44.9	100	sand						
31.4	82.81	0.00	44.9	100	sand						
33.5	81.56	-0.22	46.6	60	sand	30	LC	10	MC		
35	81.71	-0.06	46.6	60	sand	30	LC	10	MC		
36.5	81.51	0.58	46.6	60	sand	30	LC	10	MC		
38	81.61	1.27	46.6	60	sand	30	LC	10	MC		
39.5	81.41	0.58	46.6	60	sand	30	LC	10	MC		
41	81.51	-0.02	46.6	60	sand	30	LC	10	MC		
42.5	81.61	-0.08	46.6	60	sand	30	LC	10	MC		
44	81.21	-0.09	46.6	60	sand	30	LC	10	MC		
45.5	81.51	-0.03	46.6	60	sand	30	LC	10	MC		
47	81.56	0.10	46.6	60	sand	30	LC	10	MC		
48.5	81.61	0.13	46.6	60	sand	30	LC	10	MC		
50	81.61	-0.07	46.6	60	sand	30	LC	10	MC		
51.5	81.41	-0.09	46.6	60	sand	30	LC	10	MC		
53	81.86	0.27	46.6	60	sand	30	LC	10	MC		
54.5	80.46	-0.04	46.7	50	sand	25	SB	25	LC		
56	80.41	0.03	46.7	50	sand	25	SB	25	LC		
57.5	80.41	0.35	46.7	50	sand	25	SB	25	LC		
59	80.11	-0.18	46.7	50	sand	25	SB	25	LC		
60.5	80.21	-0.07	46.7	50	sand	25	SB	25	LC		
62	80.16	0.00	46.7	50	sand	25	SB	25	LC		
63.5	79.81	0.78	46.7	50	sand	25	SB	25	LC		
65	82.06	1.14	64.5	45	LC	40	sand	10	LB	5	SB
66.5	82.01	1.04	64.5	45	LC	40	sand	10	LB	5	SB
68	81.66	0.98	64.5	45	LC	40	sand	10	LB	5	SB
69.5	81.31	0.88	64.5	45	LC	40	sand	10	LB	5	SB
72	81.66	0.06	64.5	45	LC	40	sand	10	LB	5	SB
73.5	81.71	0.83	64.5	45	LC	40	sand	10	LB	5	SB
75	81.56	0.80	64.5	45	LC	40	sand	10	LB	5	SB
76.5	81.41	0.21	64.5	45	LC	40	sand	10	LB	5	SB
78	82.01	0.36	64.5	45	LC	40	sand	10	LB	5	SB
79.5	81.71	0.62	64.5	45	LC	40	sand	10	LB	5	SB
82	81.71	0.19	64.5	45	LC	40	sand	10	LB	5	SB
83.4	82.81	0.00	64.5	45	LC	40	sand	10	LB	5	SB
89.5	83.51	0.00	45.9	85	sand	10	LG	5	LC		
99	84.27	0.00	45.9	85	sand	10	LG	5	LC		
119	87.79	0.00	45.9	85	sand	10	LG	5	LC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 2

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
2	94.06	0.00	47.5	50	sand	50	LB				
2.4	85.56	0.00	47.5	50	sand	50	LB				
8.7	84.56	0.00	47.5	50	sand	50	LB				
10.5	82.89	0.00	47.5	50	sand	50	LB				
11.6	81.79	-0.08	44.9	100	sand						
12.6	81.64	-0.12	44.9	100	sand						
13.6	81.49	-0.13	44.9	100	sand						
14.6	81.34	-0.04	44.9	100	sand						
15.6	81.34	-0.09	44.9	100	sand						
16.6	81.39	-0.11	44.9	100	sand						
17.6	81.24	-0.10	44.9	100	sand						
18.6	81.14	-0.12	44.9	100	sand						
19.6	80.79	-0.12	44.9	100	sand						
20.6	80.64	-0.07	44.9	100	sand						
21.6	80.29	-0.08	44.9	100	sand						
23.6	81.07	0.44	44.9	100	sand						
25.1	80.89	0.29	44.9	100	sand						
26.6	80.31	0.36	44.9	100	sand						
28.1	80.06	0.46	44.9	100	sand						
29.6	79.95	0.53	44.9	100	sand						
31.1	79.99	0.52	44.9	100	sand						
32.6	79.99	0.46	44.9	100	sand						
34.1	79.84	0.38	44.9	100	sand						
35.6	79.74	0.31	44.9	100	sand						
37.1	79.74	0.45	44.9	100	sand						
38.6	79.65	0.54	44.9	100	sand						
40.1	79.65	0.42	44.9	100	sand						
41.6	79.52	0.33	44.9	100	sand						
43.1	79.48	0.31	44.9	100	sand						
44.6	79.76	0.28	44.9	100	sand						
46.1	80.14	0.22	44.9	100	sand						
47.6	80.46	0.17	44.9	100	sand						
48.6	80.60	0.19	44.9	100	sand						
50.1	81.39	0.42	44.9	100	sand						
51.1	81.74	0.23	44.9	100	sand						
52.1	81.89	0.24	44.9	100	sand						
53.1	81.89	0.11	44.9	100	sand						
54.1	81.89	0.04	44.9	100	sand						
55.1	81.79	-0.01	44.9	100	sand						
56.1	81.69	-0.05	44.9	100	sand						
57.1	81.59	-0.05	44.9	100	sand						
58.1	82.89	0.00	77.9	100	BR						
58.4	82.99	0.00	77.9	100	BR						
62.5	83.99	0.00	77.9	100	BR						
63.4	84.71	0.00	77.9	100	BR						
71	84.93	0.00	77.9	100	BR						
81	86.63	0.00	47.9	85	sand	15	OM				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 3

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-7.3	91.26	0.00	47.6	50	sand	25	LB	15	LC	10	SB
2.3	89.64	0.00	47.6	50	sand	25	LB	15	LC	10	SB
4.3	86.35	0.00	47.6	50	sand	25	LB	15	LC	10	SB
5.5	82.89	0.00	47.6	50	sand	25	LB	15	LC	10	SB
6	81.11	0.42	47.6	50	sand	25	LB	15	LC	10	SB
7.5	80.85	0.16	47.6	50	sand	25	LB	15	LC	10	SB
9	80.75	0.36	47.6	50	sand	25	LB	15	LC	10	SB
10.5	80.46	0.42	47.6	50	sand	25	LB	15	LC	10	SB
12	79.95	0.82	47.6	50	sand	25	LB	15	LC	10	SB
13.5	79.61	1.12	47.6	50	sand	25	LB	15	LC	10	SB
15	79.45	0.43	47.6	50	sand	25	LB	15	LC	10	SB
16.5	79.23	0.31	47.6	50	sand	25	LB	15	LC	10	SB
18	78.66	0.28	47.6	50	sand	25	LB	15	LC	10	SB
19.5	78.42	0.21	47.6	50	sand	25	LB	15	LC	10	SB
21	78.56	0.24	47.6	50	sand	25	LB	15	LC	10	SB
22.5	79.25	0.22	47.6	50	sand	25	LB	15	LC	10	SB
24	79.36	0.21	47.6	50	sand	25	LB	15	LC	10	SB
25.5	79.44	0.25	47.6	50	sand	25	LB	15	LC	10	SB
27	79.72	0.20	47.6	50	sand	25	LB	15	LC	10	SB
28.5	80.34	0.09	47.6	50	sand	25	LB	15	LC	10	SB
30	80.19	0.08	47.9	90	sand	10	LB				
31	82.39	-0.15	47.9	90	sand	10	LB				
32	81.19	-0.17	47.9	90	sand	10	LB				
33	81.19	-0.14	47.9	90	sand	10	LB				
34	81.19	-0.13	47.9	90	sand	10	LB				
35	81.29	0.02	47.9	90	sand	10	LB				
36	82.04	0.04	47.9	90	sand	10	LB				
37	82.39	-0.32	47.9	90	sand	10	LB				
38	82.39	0.09	47.9	90	sand	10	LB				
39	82.79	-0.22	00.4	70	SB	15	sand	10	LC	5	WD
40	82.89	0.00	00.4	70	SB	15	sand	10	LC	5	WD
44.2	85.22	0.00	00.4	70	SB	15	sand	10	LC	5	WD
49	86.32	0.00	00.4	80	LB	10	OM	10	LC		
52	88.53	0.00	76.9	80	LB	10	OM	10	LC		
55.4	86.01	0.00	76.9	80	LB	10	OM	10	LC		
59	86.64	0.00	74.7	50	OM	30	sand	20	WD		
71.4	88.46	0.00	74.7	50	OM	30	sand	20	WD		
73.7	89.54	0.00	74.7	50	OM	30	sand	20	WD		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 4

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
0	88.00	0.00	74.7	40	LB	30	SB	25	sand	5	WD
8.6	84.76	0.00	74.7	40	LB	30	SB	25	sand	5	WD
10.6	84.39	0.00	74.7	40	LB	30	SB	25	sand	5	WD
11.05	83.64	0.00	74.7	40	LB	30	SB	25	sand	5	WD
11.2	83.31	0.00	74.7	40	LB	30	SB	25	sand	5	WD
11.6	83.14	1.02	74.7	40	LB	30	SB	25	sand	5	WD
12.5	83.29	0.71	74.7	40	LB	30	SB	25	sand	5	WD
13.6	82.54	-0.17	74.7	40	LB	30	SB	25	sand	5	WD
14.4	82.04	-0.17	74.7	40	LB	30	SB	25	sand	5	WD
15.6	82.79	0.42	74.7	40	LB	30	SB	25	sand	5	WD
16.4	82.94	0.24	74.7	40	LB	30	SB	25	sand	5	WD
16.5	83.62	0.00	74.7	40	LB	30	SB	25	sand	5	WD
16.6	83.62	0.00	74.7	40	LB	30	SB	25	sand	5	WD
17.5	82.84	0.08	74.7	40	LB	30	SB	25	sand	5	WD
18.4	83.92	0.00	74.7	40	LB	30	SB	25	sand	5	WD
18.6	83.92	0.00	74.7	40	LB	30	SB	25	sand	5	WD
19.6	81.84	0.08	67.5	50	LB	50	LC				
20.6	83.04	1.19	67.5	50	LB	50	LC				
21.6	83.09	1.05	67.5	50	LB	50	LC				
21.7	83.43	0.00	67.5	50	LB	50	LC				
22.6	82.84	0.62	67.5	50	LB	50	LC				
23.6	82.94	1.12	67.5	50	LB	50	LC				
24.1	82.84	1.17	67.5	50	LB	50	LC				
24.6	83.14	1.07	67.5	50	LB	50	LC				
25.1	82.99	1.01	67.5	50	LB	50	LC				
25.6	82.49	1.00	67.5	50	LB	50	LC				
26.1	82.29	0.47	67.5	50	LB	50	LC				
26.6	82.74	1.49	67.5	50	LB	50	LC				
27.6	82.74	2.12	67.5	50	LB	50	LC				
28.6	82.84	1.36	67.5	50	LB	50	LC				
29.3	82.94	0.39	67.5	50	LB	50	LC				
30.7	84.48	0.00	67.5	50	LB	50	LC				
31	84.48	0.00	67.5	50	LB	50	LC				
31.6	83.64	0.00	67.5	50	LB	50	LC				
32.6	83.64	0.00	67.5	50	LB	50	LC				
33.6	81.94	0.54	77.9	100	LB						
34.6	82.54	3.38	77.9	100	LB						
35.6	81.94	3.00	77.9	100	LB						
36.6	82.94	2.34	77.9	100	LB						
37.6	83.10	0.00	77.9	100	LB						
39.7	84.47	0.00	77.9	100	LB						
40	84.47	0.00	77.9	100	LB						
41.6	83.44	0.00	77.9	100	LB						
41.7	84.50	0.00	76.6	40	LB	30	LC	25	SB	5	MC
41.8	84.50	0.00	76.6	40	LB	30	LC	25	SB	5	MC
42.6	83.64	0.00	76.6	40	LB	30	LC	25	SB	5	MC
43.4	83.23	0.00	76.6	40	LB	30	LC	25	SB	5	MC
48	85.55	0.00	76.6	40	LB	30	LC	25	SB	5	MC
51	87.12	0.00	76.6	40	LB	30	LC	25	SB	5	MC
54.7	85.40	0.00	76.6	40	LB	30	LC	25	SB	5	MC
57.8	86.23	0.00	56.5	45	LC	45	LG	10	WD		
68.5	86.95	0.00	77.9	90	LB	5	WD	5	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 5

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
4	85.11	0.00	76.7	50	BR	25	LC	20	SB	5	OM
13.2	88.95	0.00	76.7	50	BR	25	LC	20	SB	5	OM
14.6	88.06	0.00	46.7	50	sand	25	SB	25	LC		
14.95	83.87	0.00	46.7	50	sand	25	SB	25	LC		
16.2	84.19	0.00	46.7	50	sand	25	SB	25	LC		
16.25	83.32	0.34	46.7	50	sand	25	SB	25	LC		
19.2	83.61	0.00	46.7	50	sand	25	SB	25	LC		
21.25	82.97	0.21	46.7	50	sand	25	SB	25	LC		
22.25	82.87	1.42	46.7	50	sand	25	SB	25	LC		
23.75	82.87	0.61	46.7	50	sand	25	SB	25	LC		
25.25	83.57	1.69	46.7	50	sand	25	SB	25	LC		
26.75	83.37	0.77	46.7	50	sand	25	SB	25	LC		
28.25	82.67	-0.13	46.7	50	sand	25	SB	25	LC		
29.75	83.27	0.40	67.8	75	LC	20	SB	5	sand		
30.75	83.47	1.68	67.8	75	LC	20	SB	5	sand		
32.75	82.42	-0.13	67.8	75	LC	20	SB	5	sand		
34.25	82.67	0.81	67.8	75	LC	20	SB	5	sand		
35.75	83.52	2.00	67.8	75	LC	20	SB	5	sand		
37	83.23	0.00	67.8	75	LC	20	SB	5	sand		
37.25	83.37	1.54	67.8	75	LC	20	SB	5	sand		
38.75	83.27	3.16	67.8	75	LC	20	SB	5	sand		
39.3	83.07	0.00	67.8	75	LC	20	SB	5	sand		
40.25	82.57	0.43	67.6	50	LC	20	sand	20	LB	10	SB
41.75	82.47	-0.18	67.6	50	LC	20	sand	20	LB	10	SB
43.25	83.22	0.16	67.6	50	LC	20	sand	20	LB	10	SB
44.75	83.02	0.65	67.6	50	LC	20	sand	20	LB	10	SB
46.25	81.92	0.44	67.6	50	LC	20	sand	20	LB	10	SB
47.75	83.07	0.62	67.6	50	LC	20	sand	20	LB	10	SB
49.25	82.67	0.65	67.6	50	LC	20	sand	20	LB	10	SB
50.75	82.72	0.00	67.6	50	LC	20	sand	20	LB	10	SB
52.25	82.77	1.02	67.6	50	LC	20	sand	20	LB	10	SB
53.75	82.77	0.97	67.6	50	LC	20	sand	20	LB	10	SB
54	86.50	0.00	67.6	50	LC	20	sand	20	LB	10	SB
54.3	86.77	0.00	67.6	50	LC	20	sand	20	LB	10	SB
54.6	86.50	0.00	67.6	50	LC	20	sand	20	LB	10	SB
55.3	83.13	0.00	76.6	55	LB	40	LC	5	WD		
55.95	83.87	0.00	76.6	55	LB	40	LC	5	WD		
57.75	84.62	0.00	76.6	55	LB	40	LC	5	WD		
61.5	84.12	0.00	77.9	100	LB						
65	88.10	0.00	77.9	100	LB						
69	86.38	0.00	67.6	60	LC	35	SB	5	WD		
78	86.66	0.00	74.9	85	LB	10	sand	5	WD		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 6

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
4.5	92.55	0.00	77.9	100	LB						
11.3	86.93	0.00	77.9	100	LB						
12.7	83.72	2.43	77.9	100	LB						
14.2	84.22	3.17	77.9	100	LB						
16.2	84.02	1.29	67.9	90	LC	10	SB				
17.7	84.42	0.23	67.9	90	LC	10	SB				
17.8	85.01	0.00	67.9	90	LC	10	SB				
18.2	84.80	0.00	67.9	90	LC	10	SB				
19.2	84.02	0.22	67.9	90	LC	10	SB				
20.7	83.82	0.78	67.9	90	LC	10	SB				
22.2	84.02	0.04	67.9	90	LC	10	SB				
23.8	85.72	0.00	77.9	70	LB	30	SB				
26.2	84.62	0.00	77.9	70	LB	30	SB				
27.7	82.72	1.58	77.9	70	LB	30	SB				
29.2	83.42	2.12	77.9	70	LB	30	SB				
30.2	83.62	2.76	77.9	70	LB	30	SB				
33.2	83.02	0.07	77.9	70	LB	30	SB				
34.7	83.12	-0.08	77.9	70	LB	30	SB				
35.8	84.73	0.00	77.9	70	LB	30	SB				
36.2	82.92	0.00	77.9	70	LB	30	SB				
37.7	82.37	0.03	77.9	70	LB	30	SB				
39.2	84.02	0.64	77.9	70	LB	30	SB				
40.7	82.82	0.80	77.9	70	LB	30	SB				
42.2	82.02	0.25	77.9	70	LB	30	SB				
43.7	81.92	0.08	77.9	70	LB	30	SB				
45.2	82.22	0.06	77.9	100	SB						
46.7	83.42	0.15	77.9	100	SB						
48.2	84.02	0.93	77.9	100	SB						
49.7	84.32	0.77	77.9	100	SB						
50.1	83.88	0.00	77.9	100	SB						
51.2	84.62	0.00	77.9	100	SB						
52.7	84.47	0.00	77.9	100	SB						
53	84.65	0.00	77.9	100	SB						
54.2	84.45	0.00	00.4	40	LB	30	sand	10	MG		
55.7	84.62	0.00	00.4	40	LB	30	sand	10	MG		
59	86.32	0.00	00.4	40	LB	30	sand	10	MG		
61.5	84.54	0.00	00.4	40	LB	30	sand	10	MG		
72.7	91.65	0.00	77.9	100	SB						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 7

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
5.9	94.27	0.00	74.7	30	LB	30	sand	25	SB	15	OM
10.2	92.05	0.00	74.7	30	LB	30	sand	25	SB	15	OM
11.9	91.20	0.00	74.7	30	LB	30	sand	25	SB	15	OM
15.1	92.09	0.00	74.7	30	LB	30	sand	25	SB	15	OM
18.7	91.33	0.00	74.7	30	LB	30	sand	25	SB	15	OM
28.2	88.56	0.00	76.5	40	SB	40	LC	15	LG	5	OM
32.9	87.16	0.00	74.9	55	LB	30	SB	10	sand	5	WD
33.5	86.74	0.00	74.9	55	LB	30	SB	10	sand	5	WD
34.7	86.41	-0.06	74.9	55	LB	30	SB	10	sand	5	WD
35.5	86.80	0.00	74.9	55	LB	30	SB	10	sand	5	WD
36.3	85.97	0.00	74.9	55	LB	30	SB	10	sand	5	WD
37.2	86.31	1.07	74.9	55	LB	30	SB	10	sand	5	WD
38.2	86.36	1.78	74.9	55	LB	30	SB	10	sand	5	WD
39.2	86.36	0.94	74.9	55	LB	30	SB	10	sand	5	WD
41.5	87.69	0.00	74.9	55	LB	30	SB	10	sand	5	WD
43.7	85.56	0.00	74.9	85	SB	5	sand	5	WD	5	LC
45.7	86.06	0.00	74.9	85	SB	5	sand	5	WD	5	LC
47.7	86.31	0.00	74.9	85	SB	5	sand	5	WD	5	LC
49.7	86.46	0.00	74.9	85	SB	5	sand	5	WD	5	LC
51.7	85.91	-0.33	74.9	85	SB	5	sand	5	WD	5	LC
53.7	85.31	0.32	74.9	85	SB	5	sand	5	WD	5	LC
55.2	85.81	0.65	74.9	85	SB	5	sand	5	WD	5	LC
55.9	85.36	0.98	74.9	85	SB	5	sand	5	WD	5	LC
58.2	84.81	0.69	00.4	100	LB						
59.7	85.91	0.71	00.4	100	LB						
60.4	87.03	0.00	00.4	100	LB						
60.7	86.66	0.05	00.4	100	LB						
61.7	86.31	0.59	00.4	100	LB						
62.7	86.26	1.01	00.4	100	LB						
63.7	86.26	0.60	00.4	100	LB						
64.7	86.01	0.41	00.4	100	LB						
65.7	87.16	0.00	00.4	100	LB						
66.4	87.09	0.00	00.4	100	LB						
66.7	86.91	0.50	00.4	100	LB						
67.7	86.81	3.30	00.4	100	LB						
68.7	86.46	2.20	00.4	100	LB						
70.7	87.16	0.00	00.4	100	LB						
71.7	87.16	0.00	00.4	100	LB						
72.7	86.16	-0.17	00.4	100	LB						
73.7	85.71	0.15	00.4	100	LB						
74.7	86.06	0.12	47.5	50	LB	50	sand				
75.7	86.16	-0.10	47.5	50	LB	50	sand				
76.7	86.46	0.24	47.5	50	LB	50	sand				
77.7	86.31	1.71	47.5	50	LB	50	sand				
78.8	87.11	0.00	47.5	50	LB	50	sand				
79.7	87.16	0.00	46.6	50	sand	40	LC	10	LB		
81.15	89.39	0.00	46.6	50	sand	40	LC	10	LB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 8

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-5	95.44	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
0	92.07	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
5	92.20	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
21.5	88.59	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
22.6	88.40	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
24.3	89.09	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
25.6	88.05	0.57	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
27.6	88.10	0.69	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
29.6	88.10	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
31	88.49	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
31.4	88.20	0.00	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
31.6	87.65	-0.17	67.5	37.5	LC	25	LG	31.25	SB	6.25	OM
33.1	87.90	0.93	77.9	70	SB	30	LB				
33.3	88.58	0.00	77.9	70	SB	30	LB				
35	88.15	0.00	77.9	70	SB	30	LB				
35.6	87.10	0.52	77.9	70	SB	30	LB				
37.6	87.40	0.63	77.9	70	SB	30	LB				
38	89.00	0.00	77.9	70	SB	30	LB				
38.4	89.70	0.00	77.9	70	SB	30	LB				
39.6	87.70	0.00	77.9	70	SB	30	LB				
40.3	89.11	0.00	77.9	70	SB	30	LB				
41	88.50	0.00	77.9	70	SB	30	LB				
41.6	87.70	0.00	77.9	70	SB	30	LB				
43.6	87.60	-0.48	77.9	70	SB	30	LB				
45.4	89.21	0.00	77.9	70	SB	30	LB				
47	87.00	0.00	77.9	70	SB	30	LB				
49.6	86.00	0.50	77.9	100	LB						
50.8	89.28	0.00	77.9	100	LB						
51.4	89.00	0.00	77.9	100	LB						
51.6	85.00	0.62	77.9	100	LB						
53.6	85.40	0.33	77.9	100	LB						
55.6	84.90	0.07	77.9	100	LB						
57.6	85.20	-0.28	46.8	60	sand	20	LB	20	LC		
59.6	85.50	-0.30	46.8	60	sand	20	LB	20	LC		
61.6	85.80	-0.10	46.8	60	sand	20	LB	20	LC		
63.6	86.00	0.00	46.8	60	sand	20	LB	20	LC		
65.6	86.10	0.23	46.8	60	sand	20	LB	20	LC		
67.6	86.60	0.57	46.8	60	sand	20	LB	20	LC		
69.6	86.90	0.39	64.7	60	LC	30	sand	10	SB		
71.6	86.90	0.09	64.7	60	LC	30	sand	10	SB		
73.6	86.70	0.47	64.7	60	LC	30	sand	10	SB		
75	88.80	0.00	64.7	60	LC	30	sand	10	SB		
75.6	88.80	0.00	64.7	60	LC	30	sand	10	SB		
76.6	86.90	0.15	47.9	90	sand	10	LB				
78.6	86.50	0.43	47.9	90	sand	10	LB				
80.6	86.60	0.27	47.9	90	sand	10	LB				
82.8	86.00	0.11	47.9	90	sand	10	LB				
88.8	87.59	0.00	77.9	100	SB						
90.1	88.40	0.00	77.9	100	SB						
91.8	89.13	0.00	77.9	100	SB						
93.5	98.46	0.00	77.9	100	SB						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 9

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
3	96.46	0.00	76.9	80	LB	10	MC	5	OM	5	WD
6	93.34	0.00	76.9	80	LB	10	MC	5	OM	5	WD
8	91.20	0.00	76.9	80	LB	10	MC	5	OM	5	WD
9	92.07	0.00	76.7	40	SB	30	LC	20	BR	10	OM
13	90.16	0.00	76.7	40	SB	30	LC	20	BR	10	OM
15.6	89.62	0.00	76.7	40	SB	30	LC	20	BR	10	OM
17	88.95	0.00	76.7	40	SB	30	LC	20	BR	10	OM
18.5	88.72	0.45	74.8	70	SB	20	sand	10	LC		
18.9	88.76	0.00	74.8	70	SB	20	sand	10	LC		
19.5	88.77	-0.01	74.8	70	SB	20	sand	10	LC		
20.5	88.52	-0.01	74.8	70	SB	20	sand	10	LC		
21.5	88.77	0.00	74.8	70	SB	20	sand	10	LC		
22.1	89.40	0.00	74.8	70	SB	20	sand	10	LC		
22.5	88.47	-0.04	74.8	70	SB	20	sand	10	LC		
23.8	88.72	0.14	74.8	70	SB	20	sand	10	LC		
24.5	89.02	0.13	74.8	70	SB	20	sand	10	LC		
25.5	88.52	1.17	74.8	70	SB	20	sand	10	LC		
26.5	88.32	1.29	74.8	70	SB	20	sand	10	LC		
27.5	88.87	2.48	74.8	70	SB	20	sand	10	LC		
28.8	88.92	0.00	76.9	80	LB	15	SB	5	LC		
29	89.89	0.00	76.9	80	LB	15	SB	5	LC		
29.2	89.89	0.00	76.9	80	LB	15	SB	5	LC		
29.9	88.07	0.69	76.9	80	LB	15	SB	5	LC		
31.5	88.17	2.49	76.9	80	LB	15	SB	5	LC		
32.5	88.57	2.50	76.9	80	LB	15	SB	5	LC		
33.5	88.72	2.32	76.9	80	LB	15	SB	5	LC		
34.5	88.97	2.52	76.9	80	LB	15	SB	5	LC		
35.5	89.07	1.37	76.9	80	LB	15	SB	5	LC		
36.5	89.12	0.61	76.9	80	LB	15	SB	5	LC		
37.3	89.60	0.00	76.9	80	LB	15	SB	5	LC		
37.7	88.67	0.64	76.9	80	LB	15	SB	5	LC		
38.5	88.62	1.29	76.9	80	LB	15	SB	5	LC		
39.5	88.82	0.44	76.9	80	LB	15	SB	5	LC		
40.5	89.07	0.11	76.9	80	LB	15	SB	5	LC		
41.5	89.17	-0.31	76.9	80	LB	15	SB	5	LC		
41.6	89.31	0.00	76.9	80	LB	15	SB	5	LC		
42.5	87.62	0.18	76.9	80	LB	15	SB	5	LC		
43.5	88.02	1.21	67.5	50	LC	25	LB	20	SB	5	WD
45.4	90.15	0.00	67.5	50	LC	25	LB	20	SB	5	WD
45.6	90.15	0.00	67.5	50	LC	25	LB	20	SB	5	WD
47.5	88.72	-0.06	67.5	50	LC	25	LB	20	SB	5	WD
49	89.28	0.00	67.5	50	LC	25	LB	20	SB	5	WD
49.1	89.62	0.00	67.5	50	LC	25	LB	20	SB	5	WD
49.5	91.24	0.00	67.5	50	LC	25	LB	20	SB	5	WD
51.8	91.86	0.00	67.5	50	LC	25	LB	20	SB	5	WD
53.1	92.68	0.00	67.5	50	LC	25	LB	20	SB	5	WD
55	89.58	0.00	67.5	50	LC	25	LB	20	SB	5	WD
61	90.98	0.00	76.9	90	BR	5	LC	5	OM		
66	92.21	0.00	76.9	90	BR	5	LC	5	OM		
70	91.03	0.00	76.9	90	BR	5	LC	5	OM		
75	94.00	0.00	76.9	90	BR	5	LC	5	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 10

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
10	101.71	0.00	77.9	90	BR	10	WD				
13.5	103.73	0.00	77.9	90	BR	10	WD				
16	103.27	0.00	77.9	90	BR	10	WD				
17.7	97.73	0.00	76.7	50	BR	30	LC	10	SB	10	LB
18.8	96.84	0.92	76.7	50	BR	30	LC	10	SB	10	LB
19	96.75	0.00	76.7	50	BR	30	LC	10	SB	10	LB
19.8	96.84	1.22	76.7	50	BR	30	LC	10	SB	10	LB
20.2	96.74	0.52	76.7	50	BR	30	LC	10	SB	10	LB
20.4	96.94	0.00	76.7	50	BR	30	LC	10	SB	10	LB
22.1	95.84	2.60	76.7	50	BR	30	LC	10	SB	10	LB
22.6	95.89	1.80	76.7	50	BR	30	LC	10	SB	10	LB
23.1	95.89	1.07	76.7	50	BR	30	LC	10	SB	10	LB
23.6	95.84	1.01	76.7	50	BR	30	LC	10	SB	10	LB
24.1	95.74	0.40	76.7	50	BR	30	LC	10	SB	10	LB
24.6	95.84	0.16	76.7	50	BR	30	LC	10	SB	10	LB
25.1	95.79	0.04	76.7	50	BR	30	LC	10	SB	10	LB
25.6	95.64	0.65	76.7	50	BR	30	LC	10	SB	10	LB
26.1	95.54	0.89	76.7	50	BR	30	LC	10	SB	10	LB
26.6	96.04	2.67	76.7	50	BR	30	LC	10	SB	10	LB
27.1	96.09	4.06	76.7	50	BR	30	LC	10	SB	10	LB
27.6	96.29	4.43	76.7	50	BR	30	LC	10	SB	10	LB
28.1	96.34	4.63	76.7	50	BR	30	LC	10	SB	10	LB
28.6	96.54	3.19	76.7	50	BR	30	LC	10	SB	10	LB
29.3	96.44	1.21	76.7	50	BR	30	LC	10	SB	10	LB
29.8	96.44	1.61	76.7	50	BR	30	LC	10	SB	10	LB
30.3	96.49	0.64	76.7	50	BR	30	LC	10	SB	10	LB
30.4	97.10	0.00	76.7	50	BR	30	LC	10	SB	10	LB
30.6	97.10	0.00	76.7	50	BR	30	LC	10	SB	10	LB
30.8	96.54	0.01	76.7	50	BR	30	LC	10	SB	10	LB
31.3	96.34	0.28	76.7	50	BR	30	LC	10	SB	10	LB
31.8	96.44	0.01	76.7	50	BR	30	LC	10	SB	10	LB
32.3	96.09	1.94	76.7	50	BR	30	LC	10	SB	10	LB
33.6	96.59	-0.48	76.7	50	BR	30	LC	10	SB	10	LB
34.6	95.69	1.83	76.7	50	BR	30	LC	10	SB	10	LB
35.6	96.09	1.34	76.7	50	BR	30	LC	10	SB	10	LB
36.6	96.49	2.43	76.7	50	BR	30	LC	10	SB	10	LB
37.6	96.24	3.57	76.7	50	BR	30	LC	10	SB	10	LB
38.6	96.04	1.94	76.7	50	BR	30	LC	10	SB	10	LB
39.6	96.04	1.56	76.7	50	BR	30	LC	10	SB	10	LB
40.2	96.71	0.00	76.7	50	BR	30	LC	10	SB	10	LB
40.7	97.01	0.00	77.9	80	SB	15	LB	5	WD	5	OM
41.7	96.69	1.23	77.9	80	SB	15	LB	5	WD	5	OM
42.7	98.01	0.00	77.9	80	SB	15	LB	5	WD	5	OM
43	98.01	0.00	77.9	80	SB	15	LB	5	WD	5	OM
44.5	97.04	0.00	77.9	80	SB	15	LB	5	WD	5	OM
46.5	99.76	0.00	77.9	80	SB	15	LB	5	WD	5	OM
53.3	100.61	0.00	77.9	80	SB	15	LB	5	WD	5	OM
58	101.13	0.00	77.9	80	SB	15	LB	5	WD	5	OM
62.7	99.48	0.00	46.7	50	sand	20	SB	20	LC	10	
64.7	97.04	0.00	46.7	50	sand	20	SB	20	LC	10	
66.3	96.79	0.00	46.7	50	sand	20	SB	20	LC	10	
70	100.80	0.00	46.7	50	sand	20	SB	20	LC	10	
70.6	100.80	0.00	46.7	50	sand	20	SB	20	LC	10	
75	99.10	0.00	46.7	50	sand	20	SB	20	LC	10	
80.1	96.49	0.36	46.7	50	sand	20	SB	20	LC	10	
81	98.33	0.00	46.7	50	sand	20	SB	20	LC	10	
83.25	97.04	0.00	46.7	50	sand	20	SB	20	LC	10	
84	100.15	0.00	46.7	50	sand	20	SB	20	LC	10	
90	103.00	0.00	46.7	50	sand	20	SB	20	LC	10	

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 11

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7	101.44	0.00	00.4	60.00	BR	30	sand	10	WD		
12.75	102.42	0.00	00.4	60.00	BR	30	sand	10	WD		
13.75	102.17	0.00	00.4	60.00	BR	30	sand	10	WD		
14.75	97.16	0.00	76.8	75.00	BR	15	MC	10	sand		
15.65	96.51	-0.24	76.8	75.00	BR	15	MC	10	sand		
16.15	96.46	0.40	76.8	75.00	BR	15	MC	10	sand		
16.65	95.66	0.92	76.8	75.00	BR	15.00	MC	10.00	sand		
17.15	96.16	2.73	76.8	75.00	BR	15.00	MC	10.00	sand		
17.65	95.66	1.84	76.8	75.00	BR	15.00	MC	10.00	sand		
18.15	95.81	1.37	76.8	75.00	BR	15.00	MC	10.00	sand		
18.65	95.86	1.16	76.8	75.00	BR	15.00	MC	10.00	sand		
19.15	95.71	0.55	76.8	75.00	BR	15.00	MC	10.00	sand		
19.65	95.96	-0.02	76.8	75.00	BR	15.00	MC	10.00	sand		
20.15	95.66	-0.11	76.8	75.00	BR	15.00	MC	10.00	sand		
20.65	95.76	-0.41	76.8	75.00	BR	15.00	MC	10.00	sand		
21.05	95.86	-0.11	76.8	75.00	BR	15.00	MC	10.00	sand		
22.65	96.46	-0.14	76.8	75.00	BR	15.00	MC	10.00	sand		
23.35	96.46	2.73	76.8	75.00	BR	15.00	MC	10.00	sand		
23.85	95.96	0.14	76.8	75.00	BR	15.00	MC	10.00	sand		
25.42	97.66	0.00	76.8	75.00	BR	15.00	MC	10.00	sand		
26.15	96.41	3.72	76.8	75.00	BR	15.00	MC	10.00	sand		
26.65	96.36	2.73	76.8	75.00	BR	15.00	MC	10.00	sand		
27.15	96.41	3.34	76.8	75.00	BR	15	MC	10	sand		
27.65	96.51	4.57	76.8	75.00	BR	15	MC	10	sand		
28.15	96.41	4.30	76.8	75.00	BR	15	MC	10	sand		
28.65	96.41	4.39	76.8	75.00	BR	15	MC	10	sand		
29.15	96.11	4.94	76.8	75.00	BR	15	MC	10	sand		
29.65	95.96	2.91	76.8	75.00	BR	15.00	MC	10.00	sand		
30.5	98.12	0.00	76.8	40.00	SB	40.00	LB	20.00	MC		
31.85	96.36	3.20	76.8	40.00	SB	40.00	LB	20.00	MC		
32.65	96.81	-3.78	76.8	40.00	SB	40.00	LB	20.00	MC		
33.66	97.77	0.00	76.8	40.00	SB	40.00	LB	20.00	MC		
34.15	95.86	2.43	76.8	40.00	SB	40.00	LB	20.00	MC		
34.65	96.06	2.21	76.8	40.00	SB	40.00	LB	20.00	MC		
35.65	96.21	1.63	76.8	40.00	SB	40.00	LB	20.00	MC		
36.15	96.46	2.12	76.8	40.00	SB	40.00	LB	20.00	MC		
37.33	97.09	0.00	76.8	40.00	SB	40.00	LB	20.00	MC		
38	97.42	0.00	76.8	40.00	SB	40	LB	20	MC		
38.95	96.86	0.17	76.8	40.00	SB	40	LB	20	MC		
39.65	97.16	0.00	76.8	40.00	SB	40	LB	20	MC		
42	100.26	0.00	76.8	40.00	SB	40	LB	20	MC		
43.58	100.26	0.00	76.8	40.00	SB	40	LB	20	MC		
46	98.69	0.00	77.9	90.00	SB	5	OM	5	WD		
47.42	100.33	0.00	77.9	90.00	SB	5	OM	5	WD		
49	100.33	0.00	77.9	90.00	SB	5	OM	5	WD		
50.66	98.88	0.00	77.9	90.00	SB	5	OM	5	WD		
63.58	100.31	0.00	45.5	25.00	sand	25	SC	25	LG	25	SB
70	100.24	0.00	45.5	25.00	sand	25	SC	25	LG	25	SB
73	99.14	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
73.05	97.06	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
77.25	97.01	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
78.85	96.86	0.46	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
81.75	97.16	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
82.9	99.88	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB
85	102.00	0.00	45.5	25.00	sand	25.00	SC	25.00	LG	25	SB

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 12

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
5	100.01	0.00	76.7	37.5	BR	25	SB	25	LC	12.5	LG
9.66	98.35	0.00	76.7	37.5	BR	25	SB	25	LC	12.5	LG
11.8	97.42	0.00	76.7	37.5	BR	25	SB	25	LC	12.5	LG
12.6	97.02	-0.01	76.7	37.5	BR	25	SB	25	LC	12.5	LG
12.75	97.54	0.00	76.7	37.5	BR	25	SB	25	LC	12.5	LG
13.58	96.98	0.00	76.9	85	SB	10	LC	5	sand		
13.8	96.82	0.05	76.9	85	SB	10	LC	5	sand		
14.3	96.92	0.11	76.9	85	SB	10	LC	5	sand		
14.8	96.82	0.42	76.9	85	SB	10	LC	5	sand		
16.3	96.42	0.59	76.9	85	SB	10	LC	5	sand		
16.8	96.52	0.63	76.9	85	SB	10	LC	5	sand		
17.3	96.52	0.61	76.9	85	SB	10	LC	5	sand		
17.8	97.02	0.82	76.9	85	SB	10	LC	5	sand		
18.3	96.72	0.20	76.9	85	SB	10	LC	5	sand		
18.8	96.72	0.25	76.9	85	SB	10	LC	5	sand		
19.3	96.62	0.41	76.9	85	SB	10	LC	5	sand		
19.8	96.42	0.56	76.9	85	SB	10	LC	5	sand		
20.3	96.82	0.72	76.9	85	SB	10	LC	5	sand		
20.8	95.72	0.25	76.9	85	SB	10	LC	5	sand		
21.3	96.42	0.61	76.9	85	SB	10	LC	5	sand		
21.8	95.42	0.49	76.9	85	SB	10	LC	5	sand		
22.3	95.32	0.67	76.9	85	SB	10	LC	5	sand		
22.8	95.42	0.71	76.9	85	SB	10	LC	5	sand		
23.3	95.22	0.62	76.9	85	SB	10	LC	5	sand		
23.8	96.12	0.60	76.9	85	SB	10	LC	5	sand		
24.3	95.82	0.57	76.9	85	SB	10	LC	5	sand		
24.8	95.22	0.42	76.9	85	SB	10	LC	5	sand		
25.3	95.32	0.45	76.9	85	SB	10	LC	5	sand		
25.8	95.12	0.37	76.9	85	SB	10	LC	5	sand		
26.3	95.82	0.53	76.9	85	SB	10	LC	5	sand		
26.8	95.92	0.52	76.9	85	SB	10	LC	5	sand		
27.3	96.02	0.47	76.9	85	SB	10	LC	5	sand		
28.3	95.72	0.12	76.9	85	SB	10	LC	5	sand		
29.58	97.12	0.00	76.9	85	SB	10	LC	5	sand		
30.25	97.65	0.00	77.9	55	LB	40	SB	5	WD		
31.2	97.42	0.00	77.9	55	LB	40	SB	5	WD		
33	98.11	0.00	77.9	55	LB	40	SB	5	WD		
39.17	100.66	0.00	77.9	55	LB	40	SB	5	WD		
44	100.90	0.00	77.9	100	LB						
50	101.20	0.00	77.9	100	LB						
59.75	99.62	0.00	45.5	25	LG	25	sand	25	SC	25	SB
67	99.04	0.00	45.5	25	LG	25	sand	25	SC	25	SB
70.58	99.76	0.00	45.5	25	LG	25	sand	25	SC	25	SB
72.58	100.62	0.00	45.5	25	LG	25	sand	25	SC	25	SB

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 13

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
11.5	103.62	0.00	74.9	40	LB	40	SB	10	sand	10	WD
20.4	104.01	0.00	74.9	40	LB	40	SB	10	sand	10	WD
21	101.33	0.00	74.9	40	LB	40	SB	10	sand	10	WD
25.3	101.60	0.00	74.9	40	LB	40	SB	10	sand	10	WD
27.5	103.64	0.00	74.9	40	LB	40	SB	10	sand	10	WD
29.5	102.52	0.00	74.9	40	LB	40	SB	10	sand	10	WD
31.45	99.56	0.00	74.9	40	LB	40	SB	10	sand	10	WD
31.9	99.28	0.00	74.9	40	LB	40	SB	10	sand	10	WD
36.15	99.41	0.00	64.6	50	LC	40	sand	10	OM		
37.9	99.39	0.00	64.6	50	LC	40	sand	10	OM		
44.4	99.37	0.00	64.6	50	LC	40	sand	10	OM		
55.05	99.36	0.65	64.6	50	LC	40	sand	10	OM		
56.05	99.56	0.38	64.6	50	LC	40	sand	10	OM		
57.05	99.46	-0.16	64.6	50	LC	40	sand	10	OM		
58.05	99.51	0.37	64.6	50	LC	40	sand	10	OM		
59.05	99.46	0.31	46.6	50	sand	40	LC	10	SB		
59.85	99.51	0.60	46.6	50	sand	40	LC	10	SB		
61.05	99.46	0.30	46.6	50	sand	40	LC	10	SB		
62.05	99.06	0.68	46.6	50	sand	40	LC	10	SB		
63.05	99.41	0.86	46.6	50	sand	40	LC	10	SB		
64.05	98.71	-0.06	46.6	50	sand	40	LC	10	SB		
65.05	98.01	1.02	46.6	50	sand	40	LC	10	SB		
66.05	98.31	1.59	46.6	50	sand	40	LC	10	SB		
67.05	98.31	1.52	46.6	50	sand	40	LC	10	SB		
68.05	98.01	1.38	46.6	50	sand	40	LC	10	SB		
69.05	98.06	1.17	46.6	50	sand	40	LC	10	SB		
70.05	98.26	0.91	46.6	50	sand	40	LC	10	SB		
71.05	98.26	1.34	46.6	50	sand	40	LC	10	SB		
71.85	98.36	1.40	46.6	50	sand	40	LC	10	SB		
73.05	97.76	0.93	46.6	50	sand	40	LC	10	SB		
74.05	98.86	0.58	46.6	50	sand	40	LC	10	SB		
75.05	98.76	0.77	46.6	40	sand	30	LC	20	LB	10	SB
76.05	98.41	1.04	46.6	40	sand	30	LC	20	LB	10	SB
77.05	97.86	0.27	46.6	40	sand	30	LC	20	LB	10	SB
78.05	98.06	0.64	46.6	40	sand	30	LC	20	LB	10	SB
79.05	97.76	0.38	46.6	40	sand	30	LC	20	LB	10	SB
80.05	98.21	0.23	46.6	40	sand	30	LC	20	LB	10	SB
80.95	98.21	-0.07	46.6	40	sand	30	LC	20	LB	10	SB
81.4	99.33	0.00	46.6	40	sand	30	LC	20	LB	10	SB
81.6	99.78	0.00	46.6	40	sand	30	LC	20	LB	10	SB
87.1	100.00	0.00	46.6	40	sand	30	LC	20	LB	10	SB
90.2	99.38	0.00	46.6	40	sand	30	LC	20	LB	10	SB
95.2	99.54	0.00	46.5	50	sand	30	MC	20	LC		
102.8	101.45	0.00	46.5	50	sand	30	MC	20	LC		
112.3	102.48	0.00	47.9	85	sand	10	OM	5	SB		
116.9	103.92	0.00	47.9	85	sand	10	OM	5	SB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 14

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
8.5	103.04	0.00	00.4	100	BR						
15.6	100.91	0.00	00.4	100	BR						
16.5	101.21	0.00	00.4	100	BR						
19.7	99.78	0.00	00.4	100	BR						
20	99.38	-0.03	00.4	100	BR						
27	99.28	-0.13	00.4	100	BR						
28.5	99.53	-0.01	00.4	100	BR						
30.5	99.38	-0.01	00.4	100	BR						
32.7	100.11	0.00	00.4	100	BR						
33	100.11	0.00	00.4	100	BR						
35	99.43	1.02	00.4	100	BR						
36.4	99.28	1.14	00.4	100	BR						
37.7	99.56	0.00	00.4	100	BR						
38	99.38	0.46	77.9	100	BR						
39.5	98.78	0.57	77.9	100	BR						
41	98.33	0.52	77.9	100	BR						
42.5	98.23	0.65	77.9	100	BR						
44	98.13	1.04	77.9	100	BR						
45.5	97.98	1.27	77.9	100	BR						
47	97.53	1.55	77.9	100	BR						
48.5	97.78	0.46	77.9	100	BR						
50	97.58	-0.18	77.9	100	BR						
53	97.88	-0.15	46.8	80	sand	10	MC	5	SB	5	LC
54.5	98.08	-1.05	46.8	80	sand	10	MC	5	SB	5	LC
56	98.38	-0.10	46.8	80	sand	10	MC	5	SB	5	LC
57.5	98.18	-0.65	46.8	80	sand	10	MC	5	SB	5	LC
59	98.63	1.46	46.8	80	sand	10	MC	5	SB	5	LC
60.5	98.58	1.81	46.8	80	sand	10	MC	5	SB	5	LC
62	98.68	1.49	46.8	80	sand	10	MC	5	SB	5	LC
63.5	98.68	1.14	46.8	80	sand	10	MC	5	SB	5	LC
65	98.58	-0.01	46.6	40	sand	30	LC	20	SB	10	OM
65.4	99.34	0.00	46.6	40	sand	30	LC	20	SB	10	OM
65.9	99.78	0.00	46.6	40	sand	30	LC	20	SB	10	OM
66.2	100.45	0.00	46.6	40	sand	30	LC	20	SB	10	OM
70.5	101.89	0.00	46.6	40	sand	30	LC	20	SB	10	OM
80	102.91	0.00	46.6	40	sand	30	LC	20	SB	10	OM
80.5	105.51	0.00	46.6	40	sand	30	LC	20	SB	10	OM

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 15

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7	103.29	0.00	77.9	90	SB	10	OM				
12.5	102.89	0.00	77.9	90	BR	10	OM				
22.1	100.20	0.00	77.9	91	BR	11	OM				
23.1	100.00	-0.01	67.5	50	SB	30	LC	20	MC		
25.1	100.05	0.00	67.5	50	SB	30	LC	20	MC		
27.1	99.35	0.80	67.5	50	SB	30	LC	20	MC		
27.1	99.89	0.00	67.5	50	SB	30	LC	20	MC		
27.6	99.50	0.73	67.5	50	SB	30	LC	20	MC		
28.1	99.20	0.62	67.5	50	SB	30	LC	20	MC		
28.6	99.80	1.77	67.5	50	SB	30	LC	20	MC		
29.1	99.70	2.26	67.5	50	SB	30	LC	20	MC		
29.2	100.77	0.00	67.5	50	SB	30	LC	20	MC		
29.4	100.77	0.00	67.5	50	SB	30	LC	20	MC		
29.6	99.30	0.44	67.5	50	SB	30	LC	20	MC		
30.1	99.20	0.05	67.5	50	SB	30	LC	20	MC		
30.6	99.70	2.42	67.5	50	SB	30	LC	20	MC		
31.1	99.50	2.47	67.5	50	SB	30	LC	20	MC		
31.6	99.15	2.70	67.5	50	SB	30	LC	20	MC		
32.1	98.90	0.93	67.5	50	SB	30	LC	20	MC		
32.6	98.75	0.02	67.5	50	SB	30	LC	20	MC		
33.1	98.80	1.42	67.5	50	SB	30	LC	20	MC		
33.6	99.00	2.84	67.5	50	SB	30	LC	20	MC		
34.1	98.80	1.25	67.5	50	SB	30	LC	20	MC		
34.6	98.50	0.36	67.5	50	SB	30	LC	20	MC		
35.1	98.80	2.87	67.5	50	SB	30	LC	20	MC		
35.6	99.00	3.95	67.5	50	SB	30	LC	20	MC		
36.1	98.70	1.43	67.5	50	SB	30	LC	20	MC		
36.6	98.90	2.80	67.5	50	SB	30	LC	20	MC		
37.1	98.70	4.18	67.5	50	SB	30	LC	20	MC		
37.6	99.00	3.94	67.5	50	SB	30	LC	20	MC		
38.1	99.10	2.73	67.5	50	SB	30	LC	20	MC		
38.6	99.40	1.57	67.5	50	SB	30	LC	20	MC		
41.1	101.00	0.00	00.4	100	LB						
43	101.00	0.00	00.4	100	LB						
45.6	99.98	0.00	00.4	100	LB						
47.8	100.08	0.00	76.8	70	LB	15	LC	5	MG	10	sand
48.9	101.62	0.00	76.8	70	LB	15	LC	5	MG	10	sand
56	102.81	0.00	76.8	70	LB	15	LC	5	MG	10	sand
56.9	102.67	0.00	76.8	70	LB	15	LC	5	MG	10	sand
58.6	99.80	0.25	00.4	30	SB	30	WD	30	LC	10	OM
60.1	99.80	0.16	00.4	30	SB	30	WD	30	LC	10	OM
62.4	100.20	0.00	00.4	30	SB	30	WD	30	LC	10	OM
62.5	100.86	0.00	00.4	30	SB	30	WD	30	LC	10	OM
69.2	101.91	0.00	00.4	30	SB	30	WD	30	LC	10	OM
71	103.31	0.00	00.4	30	SB	30	WD	30	LC	10	OM
82	103.56	0.00	00.4	75	BR	15	sand	10	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 16

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
0	103.18	0.00	77.9	100	LB						
4.7	103.50	0.00	77.9	100	LB						
8	101.51	0.00	77.9	100	LB						
12.35	100.66	0.00	46.5	50	sand	50	LC				
14.15	100.36	0.00	46.5	50	sand	50	LC				
15.15	100.36	0.07	46.5	50	sand	50	LC				
15.85	100.36	0.25	46.5	50	sand	50	LC				
16.85	100.16	0.64	46.5	50	sand	50	LC				
17.95	100.41	0.60	46.5	50	sand	50	LC				
18.85	100.16	1.33	46.5	50	sand	50	LC				
19.5	100.32	0.00	46.5	50	sand	50	LC				
19.85	100.06	0.61	46.5	50	sand	50	LC				
20	100.03	0.00	46.5	50	sand	50	LC				
20.85	99.66	0.52	46.5	50	sand	50	LC				
21.85	99.31	0.55	46.5	50	sand	50	LC				
22.85	99.31	0.23	46.5	50	sand	50	LC				
23.85	99.61	0.01	46.5	50	sand	50	LC				
26.2	100.34	0.00	46.5	50	sand	50	LC				
27.15	100.06	0.56	46.5	50	sand	50	LC				
29.85	99.46	1.01	46.5	50	sand	50	LC				
32.15	98.91	0.10	46.5	50	sand	50	LC				
33.25	98.46	0.07	46.5	50	sand	50	LC				
34.15	98.36	0.40	46.5	50	sand	50	LC				
35.15	98.36	0.85	46.5	50	sand	50	LC				
35.65	97.76	0.96	46.5	50	sand	50	LC				
36.15	97.81	1.08	46.5	50	sand	50	LC				
36.65	97.91	1.14	46.5	50	sand	50	LC				
37.15	97.86	1.17	46.5	50	sand	50	LC				
37.65	97.86	1.04	46.5	50	sand	50	LC				
38.15	97.71	1.09	46.5	50	sand	50	LC				
39.15	99.56	0.96	46.5	50	sand	50	LC				
41.15	100.16	0.16	74.8	70	LB	20	sand	10	LC		
43.15	100.41	-0.05	74.8	70	LB	20	sand	10	LC		
45.3	100.69	0.00	74.8	70	LB	20	sand	10	LC		
45.85	100.01	0.13	74.8	70	LB	20	sand	10	LC		
48.85	99.31	0.09	74.8	70	LB	20	sand	10	LC		
50.7	100.03	0.00	74.8	70	LB	20	sand	10	LC		
51.25	100.66	0.00	74.8	70	LB	20	sand	10	LC		
51.9	101.07	0.00	74.8	70	LB	20	sand	10	LC		
54	101.47	0.00	74.8	70	LB	20	sand	10	LC		
63	101.60	0.00	74.8	70	LB	20	sand	10	LC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 17

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
10.6	105.27	0.00	47.9	95	sand	5	OM				
11.6	104.03	0.00	47.9	95	sand	5	OM				
19.0	103.60	0.00	47.9	95	sand	5	OM				
22.0	102.20	0.00	47.9	95	sand	5	OM				
25.3	101.46	0.00	47.9	95	sand	5	OM				
26.8	100.66	0.00	47.9	95	sand	5	OM				
28.0	100.06	0.00	47.9	95	sand	5	OM				
28.1	99.96	-0.06	47.9	95	sand	5	OM				
29.6	99.66	-0.11	46.6	60	sand	40	LC				
31.1	99.16	-0.13	46.6	60	sand	40	LC				
32.6	98.71	-0.16	46.6	60	sand	40	LC				
34.1	97.96	0.08	46.6	60	sand	40	LC				
35.6	97.81	1.18	46.6	60	sand	40	LC				
37.1	97.61	0.31	46.6	60	sand	40	LC				
38.6	98.71	0.62	46.6	60	sand	40	LC				
40.1	98.01	0.12	46.6	60	sand	40	LC				
41.6	97.66	0.21	46.6	60	sand	40	LC				
43.1	98.41	0.11	46.6	60	sand	40	LC				
44.6	97.51	0.18	46.6	60	sand	40	LC				
46.1	97.76	0.22	46.6	60	sand	40	LC				
47.6	98.26	0.25	46.6	60	sand	40	LC				
49.1	98.26	0.26	46.6	60	sand	40	LC				
50.6	99.66	0.14	74.9	80	LB	10	sand	10	LC		
52.1	100.06	0.11	74.9	80	LB	10	sand	10	LC		
53.6	100.36	0.01	74.9	80	LB	10	sand	10	LC		
54.0	101.87	0.00	74.9	80	LB	10	sand	10	LC		
55.0	101.87	0.00	74.9	80	LB	10	sand	10	LC		
55.1	100.66	0.00	74.9	80	LB	10	sand	10	LC		
56.1	100.46	0.00	74.9	80	LB	10	sand	10	LC		
57.6	99.81	0.24	74.9	80	LB	10	sand	10	LC		
59.1	98.61	0.41	74.9	80	LB	10	sand	10	LC		
60.6	98.66	0.28	74.9	80	LB	10	sand	10	LC		
62.1	98.66	0.22	74.9	80	LB	10	sand	10	LC		
63.6	98.81	0.17	74.9	80	LB	10	sand	10	LC		
65.1	98.91	0.03	74.9	80	LB	10	sand	10	LC		
66.6	96.71	0.29	47.8	80	sand	20	LB				
68.1	96.46	0.35	47.8	80	sand	20	LB				
69.6	96.86	0.47	47.8	80	sand	20	LB				
71.1	96.76	0.39	47.8	80	sand	20	LB				
72.6	97.21	0.18	47.8	80	sand	20	LB				
74.1	97.21	0.26	47.8	80	sand	20	LB				
75.6	97.51	-0.03	47.8	80	sand	20	LB				
77.1	97.86	-0.01	47.8	80	sand	20	LB				
78.6	99.81	0.02	47.8	80	sand	20	LB				
79.6	100.06	0.00	47.8	80	sand	20	LB				
80.1	100.11	-0.10	47.8	80	sand	20	LB				
81.7	100.66	0.00	47.8	80	sand	20	LB				
84.5	101.62	0.00	47.8	80	sand	20	LB				
90.0	103.15	0.00	46.8	80	sand	10	MC	10	SC		
101.0	104.97	0.00	46.8	80	sand	10	MC	10	SC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 18

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
4	102.20	0.00	47.9	98	sand	2	OM				
9	101.85	0.00	47.9	98	sand	2	OM				
10	101.62	0.00	47.9	98	sand	2	OM				
13	100.66	0.00	47.9	98	sand	2	OM				
14	100.07	0.00	47.9	98	sand	2	OM				
14.5	99.86	-0.06	44.9	100	sand						
15.5	99.46	-0.06	44.9	100	sand						
16.5	99.06	-0.14	44.9	100	sand						
17.5	98.56	-0.04	44.9	100	sand						
18.5	98.06	-0.04	44.9	100	sand						
19.5	99.86	-0.06	44.9	100	sand						
20	97.66	-0.03	44.9	100	sand						
21.5	97.76	-0.03	47.6	50	sand	30	LB	20	LC		
23	97.91	0.06	47.6	50	sand	30	LB	20	LC		
24.5	97.66	0.06	47.6	50	sand	30	LB	20	LC		
26.5	96.16	0.10	47.6	50	sand	30	LB	20	LC		
28	96.76	0.11	47.6	50	sand	30	LB	20	LC		
29.5	97.01	0.23	47.6	50	sand	30	LB	20	LC		
31	96.86	0.40	47.6	50	sand	30	LB	20	LC		
32.5	96.96	0.24	47.6	50	sand	30	LB	20	LC		
34	96.86	0.21	47.6	50	sand	30	LB	20	LC		
35.5	97.16	0.19	47.6	50	sand	30	LB	20	LC		
37	98.89	0.00	47.6	50	sand	30	LB	20	LC		
39	101.20	0.00	47.6	50	sand	30	LB	20	LC		
40	102.35	0.00	77.9	100	LB						
42	102.12	0.00	77.9	100	LB						
44	101.89	0.00	77.9	100	LB						
46	101.66	0.00	77.9	100	LB						
48	101.42	0.00	77.9	100	LB						
49	101.31	0.00	77.9	100	LB						
50	95.66	0.45	47.7	70	sand	30	LB				
51.5	96.96	0.51	47.7	70	sand	30	LB				
53	97.56	0.36	47.7	70	sand	30	LB				
54.5	97.16	0.44	47.7	70	sand	30	LB				
56	97.26	0.22	47.7	70	sand	30	LB				
57.5	97.86	0.23	47.7	70	sand	30	LB				
58	101.67	0.00	47.7	70	sand	30	LB				
58.5	101.67	0.00	47.7	70	sand	30	LB				
59	100.16	0.18	47.7	70	sand	30	LB				
60.5	99.66	-0.21	47.7	70	sand	30	LB				
61.1	100.09	0.00	47.9	90	sand	10	SB				
61.7	100.66	0.00	47.9	90	sand	10	SB				
63.5	101.37	0.00	47.9	90	sand	10	SB				
64.9	101.90	0.00	47.9	90	sand	10	SB				
68	102.34	0.00	47.9	90	sand	10	SB				
73	103.91	0.00	47.9	90	sand	10	SB				
83	105.02	0.00	47.9	90	sand	10	SB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 19

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-8	103.00	0.00	47.5	50	sand	50	BR				
5	100.79	0.00	47.5	50	sand	50	BR				
6.8	101.52	0.00	47.5	50	sand	50	BR				
7.2	100.68	0.00	47.5	50	sand	50	BR				
7.7	99.48	0.00	47.5	50	sand	50	BR				
8.2	98.78	-0.02	47.5	50	sand	50	BR				
10.7	98.28	0.34	47.5	50	sand	50	BR				
11.2	97.48	0.41	47.5	50	sand	50	BR				
12.7	96.28	0.49	47.5	50	sand	50	BR				
14.2	94.88	0.43	47.5	50	sand	50	BR				
15.7	94.88	0.34	47.5	50	sand	50	BR				
17.2	95.18	0.24	77.9	100	LB						
18.7	98.28	0.31	77.9	100	LB						
20.2	98.58	0.02	77.9	100	LB						
21.7	98.68	0.02	77.9	100	LB						
23.2	99.38	-0.01	77.9	100	LB						
24.7	96.48	0.05	77.9	100	LB						
26.2	96.08	0.16	47.6	50	sand	40	SB	10	LC		
27.7	98.78	0.37	47.6	50	sand	40	SB	10	LC		
29.2	98.28	0.34	74.8	80	LB	20	sand				
30.7	98.18	0.38	74.8	80	LB	20	sand				
32.2	97.08	0.23	74.8	80	LB	20	sand				
33.7	97.58	0.25	74.8	80	LB	20	sand				
35.2	97.88	0.18	74.8	80	LB	20	sand				
36.7	100.48	0.40	74.8	80	LB	20	sand				
38.2	100.38	0.25	74.8	80	LB	20	sand				
39.7	99.08	0.85	74.8	80	LB	20	sand				
41.2	98.98	0.99	74.8	80	LB	20	sand				
41.5	100.68	0.00	74.8	80	LB	20	sand				
43.3	100.86	0.00	74.8	80	LB	20	sand				
67	105.37	0.00	44.9	100	sand						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-2. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Study Site Topography, Substrate, and Velocity Data.

Transect 1

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7.3	51.39	0.00	77.9	100	LB						
14.3	53.84	0.00	77.9	100	LB						
17.5	50.77	0.00	77.9	100	LB						
25.5	49.33	0.00	64.9	60	LC	20	MC	10	LG	10	sand
26.5	49.25	0.00	64.9	60	LC	20	MC	10	LG	10	sand
28.2	48.79	0.00	64.6	30	sand	30	SB	30	LC	10	MC
29.7	47.95	-0.05	64.6	30	sand	30	SB	30	LC	10	MC
32.7	48.00	0.16	64.6	30	sand	30	SB	30	LC	10	MC
35.7	47.75	0.19	64.6	30	sand	30	SB	30	LC	10	MC
38.7	47.85	0.16	64.6	30	sand	30	SB	30	LC	10	MC
41.7	47.50	0.03	64.6	30	sand	30	SB	30	LC	10	MC
44.7	47.55	0.45	64.6	30	sand	30	SB	30	LC	10	MC
47.7	47.50	0.44	64.6	30	sand	30	SB	30	LC	10	MC
50.7	48.25	1.10	64.6	30	sand	30	SB	30	LC	10	MC
53.7	48.45	0.85	45.6	40	sand	30	MG	20	MC	10	LC
56.6	49.57	0.00	45.6	40	sand	30	MG	20	MC	10	LC
57.2	48.65	1.56	45.6	40	sand	30	MG	20	MC	10	LC
59.5	49.36	0.00	45.6	40	sand	30	MG	20	MC	10	LC
59.7	48.35	0.53	45.6	40	sand	30	MG	20	MC	10	LC
62.7	48.15	0.12	45.6	40	sand	30	MG	20	MC	10	LC
65.7	47.55	0.25	67.5	45	LC	40	SB	10	sand	5	LG
68.7	47.25	0.39	67.5	45	LC	40	SB	10	sand	5	LG
71.7	46.45	0.00	67.5	45	LC	40	SB	10	sand	5	LG
74.7	46.40	0.00	67.5	45	LC	40	SB	10	sand	5	LG
77.7	46.75	0.00	67.5	45	LC	40	SB	10	sand	5	LG
80.7	46.60	1.68	74.9	50	LB	30	SB	10	sand	10	LC
83.7	48.65	1.04	74.9	50	LB	30	SB	10	sand	10	LC
85	48.96	0.00	74.9	50	LB	30	SB	10	sand	10	LC
86.7	47.05	0.31	74.9	50	LB	30	SB	10	sand	10	LC
88.5	49.08	0.00	74.9	50	LB	30	SB	10	sand	10	LC
89.7	48.60	-0.19	74.9	50	LB	30	SB	10	sand	10	LC
90.6	48.64	0.00	74.9	50	LB	30	SB	10	sand	10	LC
93	47.75	-0.29	74.9	50	LB	30	SB	10	sand	10	LC
95	49.00	0.00	74.9	50	LB	30	SB	10	sand	10	LC
95.8	49.25	0.00	74.9	50	LB	30	SB	10	sand	10	LC
96.9	50.17	0.00	77.9	50	LB	50	SB				
99	54.59	0.00	77.9	50	LB	50	SB				
103	59.59	0.00	77.9	50	LB	50	SB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 2

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-5	67.59	0.00	00.4	20	LB	30	SB	20	sand	30	SC
0	66.22	0.00	00.4	20	LB	30	SB	20	sand	30	SC
3	62.22	0.00	00.4	20	LB	30	SB	20	sand	30	SC
18	59.98	0.00	00.4	20	LB	30	SB	20	sand	30	SC
28.8	57.39	0.00	76.9	70	LB	20	SB	10	LC		
35	57.79	0.00	76.9	70	LB	20	SB	10	LC		
38	61.19	0.00	76.9	70	LB	20	SB	10	LC		
40	60.27	0.00	76.9	70	LB	20	SB	10	LC		
44.2	57.20	0.00	66.9	90	LC	10	MC				
44.3	56.77	0.00	66.9	90	LC	10	MC				
46.2	56.20	0.42	66.9	90	LC	10	MC				
48.2	55.70	0.83	66.9	90	LC	10	MC				
50.2	55.40	1.91	66.9	90	LC	10	MC				
52.2	54.80	1.57	66.9	90	LC	10	MC				
54.2	54.70	0.61	66.9	90	LC	10	MC				
56.2	54.10	0.52	66.9	90	LC	10	MC				
58.2	53.80	0.85	66.9	90	LC	10	MC				
59.2	54.40	0.77	66.9	90	LC	10	MC				
60.2	54.40	0.65	66.9	90	LC	10	MC				
61.2	54.20	0.76	66.9	90	LC	10	MC				
62.2	54.90	0.80	66.9	90	LC	10	MC				
63.2	54.40	0.77	66.9	90	LC	10	MC				
65.2	54.90	0.85	76.8	80	LB	20	LC				
66.2	54.00	0.72	76.8	80	LB	20	LC				
67.2	54.80	0.87	76.8	80	LB	20	LC				
68.2	56.20	0.84	76.8	80	LB	20	LC				
69.2	56.40	1.05	76.8	80	LB	20	LC				
70.2	56.40	1.00	76.8	80	LB	20	LC				
71.2	55.50	0.37	76.8	80	LB	20	LC				
72.2	55.50	0.09	76.8	80	LB	20	LC				
73.2	55.30	-0.05	76.8	80	LB	20	LC				
74.2	56.70	0.50	76.8	80	LB	20	LC				
75.2	56.60	-0.01	76.8	80	LB	20	LC				
75.5	57.10	0.00	76.8	80	LB	20	LC				
77.5	57.20	0.00	00.4	30	SB	30	MC	30	LC	10	SC
84.3	59.03	0.00	00.4	30	SB	30	MC	30	LC	10	SC
89	59.87	0.00	00.4	30	SB	30	MC	30	LC	10	SC
103.6	62.24	0.00	00.4	30	SB	30	MC	30	LC	10	SC
117.5	65.07	0.00	67.9	40	LC	40	MC	10	SC	10	SB

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 3

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-5	76.36	0.00	00.4	90	LB	5	SC	5	sand		
0	66.36	0.00	00.4	90	LB	5	SC	5	sand		
4	64.27	0.00	00.4	90	LB	5	SC	5	sand		
10.5	64.14	0.00	00.4	90	LB	5	SC	5	sand		
11.6	63.41	0.00	00.4	90	LB	5	SC	5	sand		
12.3	62.91	0.00	00.4	90	LB	5	SC	5	sand		
13.6	62.21	1.06	67.7	70	LC	20	SB	10	LB		
14.6	62.41	1.40	67.7	70	LC	20	SB	10	LB		
15.6	62.31	1.32	67.7	70	LC	20	SB	10	LB		
16.6	62.41	1.09	67.7	70	LC	20	SB	10	LB		
17.6	62.61	0.63	67.7	70	LC	20	SB	10	LB		
18.6	62.71	0.91	67.7	70	LC	20	SB	10	LB		
19.6	63.01	0.22	67.7	70	LC	20	SB	10	LB		
20.6	62.41	0.45	67.7	70	LC	20	SB	10	LB		
21.6	62.71	1.02	67.7	70	LC	20	SB	10	LB		
21.7	63.03	0.00	67.7	70	LC	20	SB	10	LB		
24.3	63.22	0.00	67.7	70	LC	20	SB	10	LB		
25.6	61.91	-0.05	67.7	70	LC	20	SB	10	LB		
26.6	62.11	0.73	67.7	70	LC	20	SB	10	LB		
27.6	62.21	0.94	67.7	70	LC	20	SB	10	LB		
28.6	62.41	1.33	67.7	70	LC	20	SB	10	LB		
29.6	62.41	0.59	67.7	70	LC	20	SB	10	LB		
30.6	62.91	0.12	67.7	70	LC	20	SB	10	LB		
31.6	62.61	-0.23	67.7	70	LC	20	SB	10	LB		
32.6	63.01	-0.38	67.6	60	LC	30	SB	10	LB		
33.6	62.81	0.53	67.6	60	LC	30	SB	10	LB		
34.6	62.11	1.82	67.6	60	LC	30	SB	10	LB		
35.6	62.21	4.14	67.6	60	LC	30	SB	10	LB		
36.6	62.81	1.29	67.6	60	LC	30	SB	10	LB		
37.6	62.11	2.15	67.6	60	LC	30	SB	10	LB		
38.6	62.31	4.89	67.6	60	LC	30	SB	10	LB		
39.6	61.81	2.81	67.6	60	LC	30	SB	10	LB		
40.6	61.91	3.83	67.6	60	LC	30	SB	10	LB		
41.5	63.54	0.00	67.6	60	LC	30	SB	10	LB		
42.6	62.41	2.95	67.6	60	LC	30	SB	10	LB		
43.6	62.61	3.83	67.6	60	LC	30	SB	10	LB		
44.6	62.41	3.53	67.6	60	LC	30	SB	10	LB		
45.6	62.81	0.69	67.6	60	LC	30	SB	10	LB		
46.6	62.41	-0.29	67.6	60	LC	30	SB	10	LB		
47.6	62.51	0.84	67.6	60	LC	30	SB	10	LB		
48.6	62.21	0.30	67.6	60	LC	30	SB	10	LB		
49.6	62.71	2.69	67.6	60	LC	30	SB	10	LB		
50.6	62.81	0.91	67.6	60	LC	30	SB	10	LB		
51.6	62.71	0.578	67.6	60	LC	30	SB	10	LB		
52.6	63.41	0	67.6	60	LC	30	SB	10	LB		
61	63.852	0	00.4	30	SB	30	LC	20	MC	20	SC
71	64.307	0	00.4	30	SB	30	LC	20	MC	20	SC
74.2	65.772	0	00.4	30	SB	30	LC	20	MC	20	SC
78	64.79	0.00	00.4	30	SB	30	LC	20	MC	20	SC
84	64.75	0.00	00.4	30	SB	30	LC	20	MC	20	SC
100	66.18	0.00	47.5	40	SB	40	sand	10	LC	5	SC
110	66.34	0.00	47.5	40	SB	40	sand	10	LC	5	SC
124	69.30	0.00	47.5	40	SB	40	sand	10	LC	5	SC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 4

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
6.5	66.76	0.00	00.4	80	LB	20	SB				
9.6	67.55	0.00	00.4	80	LB	20	SB				
11.55	64.57	0.00	00.4	80	LB	20	SB				
11.75	64.27	1.69	00.4	80	LB	20	SB				
12.15	63.87	2.08	00.4	80	LB	20	SB				
13	64.86	0.00	00.4	80	LB	20	SB				
14.3	65.94	0.00	00.4	80	LB	20	SB				
16	65.94	0.00	00.4	80	LB	20	SB				
18.1	64.03	0.00	00.4	80	LB	20	SB				
18.75	63.37	1.04	00.4	80	LB	20	SB				
19.75	62.57	1.40	67.9	70	LC	20	MC	10	SB		
20.75	62.07	1.46	67.9	70	LC	20	MC	10	SB		
21.75	61.87	1.51	67.9	70	LC	20	MC	10	SB		
22.75	61.92	1.75	67.9	70	LC	20	MC	10	SB		
23.75	62.02	2.27	67.9	70	LC	20	MC	10	SB		
24.75	63.07	2.73	67.9	70	LC	20	MC	10	SB		
25.75	63.12	3.24	67.9	70	LC	20	MC	10	SB		
26.75	63.12	1.98	67.9	70	LC	20	MC	10	SB		
27.75	62.97	1.50	67.9	70	LC	20	MC	10	SB		
28.65	63.22	2.07	67.9	70	LC	20	MC	10	SB		
29.75	63.22	2.26	67.9	70	LC	20	MC	10	SB		
30.75	63.42	1.54	67.9	70	LC	20	MC	10	SB		
31.75	63.27	1.31	67.9	70	LC	20	MC	10	SB		
32.75	63.37	0.95	67.9	70	LC	20	MC	10	SB		
33.75	63.57	0.55	67.9	70	LC	20	MC	10	SB		
34.75	63.62	0.27	67.9	70	LC	20	MC	10	SB		
35.35	63.72	0.69	67.9	70	LC	20	MC	10	SB		
37	65.09	0.00	67.9	70	LC	20	MC	10	SB		
37.8	65.09	0.00	67.9	70	LC	20	MC	10	SB		
38.6	64.01	0.00	00.4	50	LC	25	MC	15	SC	10	SB
38.65	63.92	0.90	00.4	50	LC	25	MC	15	SC	10	SB
39.75	64.07	-0.05	00.4	50	LC	25	MC	15	SC	10	SB
40.5	65.15	0.00	00.4	50	LC	25	MC	15	SC	10	SB
41.5	65.15	0.00	00.4	50	LC	25	MC	15	SC	10	SB
43	64.48	0.00	00.4	50	LC	25	MC	15	SC	10	SB
45.5	64.95	0.00	00.4	50	LC	25	MC	15	SC	10	SB
48.35	64.17	0.07	00.4	50	LC	25	MC	15	SC	10	SB
49.95	64.17	0.24	00.4	50	LC	25	MC	15	SC	10	SB
51	64.43	0.00	00.4	50	LC	25	MC	15	SC	10	SB
53.25	64.57	0.00	00.4	50	LC	25	MC	15	SC	10	SB
54.5	64.71	0.00	00.4	50	LC	25	MC	15	SC	10	SB
61	65.55	0.00	00.4	50	LC	25	MC	15	SC	10	SB
64.5	64.97	0.00	00.4	50	LC	25	MC	15	SC	10	SB
68	65.60	0.00	00.4	50	LC	25	MC	15	SC	10	SB
75	65.46	0.00	00.4	50	LC	25	MC	15	SC	10	SB
82	65.27	0.00	00.4	50	LC	25	MC	15	SC	10	SB
89.25	64.57	0.00	00.4	50	LC	25	MC	15	SC	10	SB
94.3	65.42	0.00	46.5	45	sand	20	LC	20	SC	15	SB
97.5	66.69	0.00	46.5	45	sand	20	LC	20	SC	15	SB
101	67.11	0.00	46.5	45	sand	20	LC	20	SC	15	SB
107	67.54	0.00	46.5	45	sand	20	LC	20	SC	15	SB
108	68.45	0.00	46.5	45	sand	20	LC	20	SC	15	SB
118.5	68.45	0.00	46.5	45	sand	20	LC	20	SC	15	SB
122	69.24	0.00	46.5	45	sand	20	LC	20	SC	15	SB

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 5

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-10	77.83	0.00	00.4	60	SB	30	sand	10	LB		
0	67.83	0.00	00.4	60	SB	30	sand	10	LB		
3.6	65.16	0.00	00.4	60	SB	30	sand	10	LB		
6.6	62.86	0.04	00.4	60	SB	30	sand	10	LB		
9.6	62.56	0.44	00.4	60	SB	30	sand	10	LB		
12.6	62.81	0.56	00.4	60	SB	30	sand	10	LB		
15.6	62.66	0.72	64.9	45	LC	45	MC	10	sand		
18.6	62.46	0.86	64.9	45	LC	45	MC	10	sand		
21.6	62.76	0.86	64.9	45	LC	45	MC	10	sand		
24.6	62.66	0.78	64.9	45	LC	45	MC	10	sand		
27.6	63.36	0.37	64.9	45	LC	45	MC	10	sand		
30.6	64.06	0.84	64.9	45	LC	45	MC	10	sand		
33.6	64.46	1.22	64.9	45	LC	45	MC	10	sand		
36.6	64.06	0.81	64.9	45	LC	45	MC	10	sand		
39.6	64.36	0.74	64.9	45	LC	45	MC	10	sand		
42.6	64.16	0.27	64.9	45	LC	45	MC	10	sand		
45.6	64.56	0.54	64.9	45	LC	45	MC	10	sand		
48.6	64.51	0.22	64.9	45	LC	45	MC	10	sand		
51.6	64.66	0.18	64.9	45	LC	45	MC	10	sand		
56.6	64.56	-0.04	46.8	80	sand	10	LC	10	MC		
62.6	64.26	0.07	46.8	80	sand	10	LC	10	MC		
67.6	64.21	0.04	46.8	80	sand	10	LC	10	MC		
72.6	64.41	-0.08	46.8	80	sand	10	LC	10	MC		
74	65.16	0.00	46.8	80	sand	10	LC	10	MC		
76.44	64.45	0.00	46.8	80	sand	10	LC	10	MC		
84.81	65.13	0.00	46.8	80	sand	10	LC	10	MC		
86.45	69.39	0.00	46.8	80	sand	10	LC	10	MC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 6

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
2.5	71.40	0.00	00.4	40	SB	30	SB	30	OM		
3.6	69.60	0.00	00.4	40	SB	30	SB	30	OM		
6.3	69.70	0.00	00.4	40	SB	30	SB	30	OM		
8.7	68.33	0.00	00.4	40	SB	30	SB	30	OM		
12.1	66.75	0.00	00.4	50	SB	45	sand	5	OM		
17.3	66.20	0.00	00.4	50	SB	45	sand	5	OM		
18.2	67.10	0.00	00.4	50	SB	45	sand	5	OM		
20.7	65.79	0.00	00.4	50	SB	45	sand	5	OM		
22.2	64.80	0.00	00.4	50	SB	45	sand	5	OM		
23	65.17	0.00	00.4	50	SB	45	sand	5	OM		
25.4	64.37	-0.01	00.4	50	SB	45	sand	5	OM		
26.4	64.57	-0.09	00.4	50	SB	45	sand	5	OM		
27.4	64.07	-0.30	00.4	50	SB	45	sand	5	OM		
28.4	63.77	-0.14	64.6	40	LC	30	sand	30	SB		
29.4	64.47	-0.03	64.6	40	LC	30	sand	30	SB		
30.4	64.47	0.15	64.6	40	LC	30	sand	30	SB		
31.4	63.37	-0.02	64.6	40	LC	30	sand	30	SB		
32.4	63.47	0.37	64.6	40	LC	30	sand	30	SB		
33.4	62.57	0.46	64.6	40	LC	30	sand	30	SB		
34.4	62.37	0.82	64.6	40	LC	30	sand	30	SB		
35.4	61.70	0.71	64.6	40	LC	30	sand	30	SB		
37.4	61.55	0.52	64.6	40	LC	30	sand	30	SB		
39.4	61.12	0.26	64.6	40	LC	30	sand	30	SB		
41.4	60.75	0.30	64.6	40	LC	30	sand	30	SB		
43.4	60.57	0.19	64.6	40	LC	30	sand	30	SB		
45.4	60.39	0.15	64.6	40	LC	30	sand	30	SB		
47.4	60.13	0.15	64.6	40	LC	30	sand	30	SB		
49.4	59.80	0.11	64.6	40	LC	30	sand	30	SB		
51.4	59.47	0.05	64.6	40	LC	30	sand	30	SB		
53.4	59.24	0.04	64.6	40	LC	30	sand	30	SB		
55.4	59.58	0.09	64.6	40	LC	30	sand	30	SB		
57.4	59.97	0.05	64.6	40	LC	30	sand	30	SB		
59.4	60.16	0.08	64.6	40	LC	30	sand	30	SB		
61.4	60.31	0.09	64.6	40	LC	30	sand	30	SB		
63.4	60.49	0.09	64.6	40	LC	30	sand	30	SB		
65.4	60.67	0.08	64.6	40	LC	30	sand	30	SB		
67.4	60.91	0.15	64.6	40	LC	30	sand	30	SB		
69.4	60.89	0.25	64.6	40	LC	30	sand	30	SB		
71.4	60.82	0.24	64.6	40	LC	30	sand	30	SB		
73.4	60.72	0.19	64.6	40	LC	30	sand	30	SB		
75.4	60.65	0.12	64.6	40	LC	30	sand	30	SB		
77.4	60.69	0.20	64.6	40	LC	30	sand	30	SB		
79.4	60.77	0.24	64.6	40	LC	30	sand	30	SB		
81.4	61.18	0.45	64.6	40	LC	30	sand	30	SB		
83.4	61.69	0.50	64.6	40	LC	30	sand	30	SB		
85.4	62.03	0.52	64.6	40	LC	30	sand	30	SB		
87.4	62.33	0.51	47.8	80	sand	20	LB				
89.4	62.43	0.49	47.8	80	sand	20	LB				
91.4	62.70	0.23	47.8	80	sand	20	LB				
93.4	63.04	0.16	47.8	80	sand	20	LB				
95.4	63.39	0.10	47.8	80	sand	20	LB				
97.4	63.67	0.10	47.8	80	sand	20	LB				
99.4	63.60	0.15	47.8	80	sand	20	LB				
101.4	63.57	0.23	47.8	80	sand	20	LB				
103.4	63.60	0.28	47.8	80	sand	20	LB				
105.4	63.68	0.30	47.8	80	sand	20	LB				
107.4	63.68	0.31	47.8	80	sand	20	LB				
109.4	63.58	0.32	47.8	80	sand	20	LB				
111.4	63.43	0.33	47.8	80	sand	20	LB				
113.4	63.23	0.37	47.8	80	sand	20	LB				
114	64.66	0.00	47.8	80	sand	20	LB				
115	65.35	0.00	47.8	80	sand	20	LB				
115.8	65.17	0.00	47.8	80	sand	20	LB				
119	65.96	0.00	47.8	80	sand	20	LB				
120	70.00	0.00	77.9	100	LB						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 7

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
5	75.81	0.00	00.4	45	LC	45	SB	5	sand	5	WD
7.4	75.71	0.00	00.4	45	LC	45	SB	5	sand	5	WD
10	76.16	0.00	00.4	45	LC	45	SB	5	sand	5	WD
11.3	76.54	0.00	00.4	45	LC	45	SB	5	sand	5	WD
12.9	75.77	0.00	00.4	45	LC	45	SB	5	sand	5	WD
14.4	77.41	0.00	00.4	50	LB	25	sand	20	SB	5	LC
16.6	77.80	0.00	00.4	50	LB	25	sand	20	SB	5	LC
18.1	76.54	0.00	00.4	50	LB	25	sand	20	SB	5	LC
21	77.31	0.00	00.4	50	LB	25	sand	20	SB	5	LC
23.5	76.55	0.00	00.4	50	LB	25	sand	20	SB	5	LC
24.2	74.45	0.00	00.4	50	LB	25	sand	20	SB	5	LC
25.6	74.30	0.00	67.6	40	SB	30	MC	30	LC		
27.95	72.56	0.00	67.6	40	SB	30	MC	30	LC		
30.3	72.21	0.00	67.6	40	SB	30	MC	30	LC		
33.4	71.96	0.00	67.6	40	SB	30	MC	30	LC		
33.75	72.29	0.42	67.6	40	SB	30	MC	30	LC		
34.65	72.04	1.30	67.6	40	SB	30	MC	30	LC		
36	73.40	0.00	67.6	40	SB	30	MC	30	LC		
36.8	73.40	0.00	67.6	40	SB	30	MC	30	LC		
38.5	72.23	0.00	75.9	90	SB	10	LG				
38.55	71.96	0.28	75.9	90	SB	10	LG				
39.75	71.86	0.06	75.9	90	SB	10	LG				
40.3	71.86	0.00	75.9	90	SB	10	LG				
41.05	71.26	0.13	75.9	90	SB	10	LG				
41.75	71.66	1.85	75.9	90	SB	10	LG				
41.8	72.22	0.00	75.9	90	SB	10	LG				
42.75	71.26	2.30	75.9	90	SB	10	LG				
43.75	71.46	3.50	75.9	90	SB	10	LG				
44.65	71.21	4.31	75.9	90	SB	10	LG				
45.75	71.46	4.16	75.9	90	SB	10	LG				
46.3	73.17	0.00	75.9	90	SB	10	LG				
47	73.17	0.00	75.9	90	SB	10	LG				
47.05	71.36	0.00	67.5	50	LB	40	LC	10	MC		
47.3	71.44	0.28	67.5	50	LB	40	LC	10	MC		
47.75	70.66	0.38	67.5	50	LB	40	LC	10	MC		
48.75	70.86	0.00	67.5	50	LB	40	LC	10	MC		
49.25	73.42	0.00	67.5	50	LB	40	LC	10	MC		
50.25	73.42	-0.45	67.5	50	LB	40	LC	10	MC		
51.15	71.86	0.18	67.5	50	LB	40	LC	10	MC		
51.95	71.36	0.21	67.5	50	LB	40	LC	10	MC		
52.75	71.26	1.35	67.5	50	LB	40	LC	10	MC		
53.95	70.76	4.45	67.5	50	LB	40	LC	10	MC		
54.75	71.06	5.43	67.5	50	LB	40	LC	10	MC		
55.75	70.91	1.18	67.5	50	LB	40	LC	10	MC		
56.45	71.06	0.00	67.5	50	LB	40	LC	10	MC		
58	72.57	1.98	67.5	50	LB	40	LC	10	MC		
60.35	71.41	1.07	67.5	50	LB	40	LC	10	MC		
61.25	71.41	1.72	00.4	40	SB	30	MC	30	LC		
62.25	71.96	0.00	00.4	40	SB	30	MC	30	LC		
63.8	72.16	1.16	00.4	40	SB	30	MC	30	LC		
64.05	72.16	-0.26	00.4	40	SB	30	MC	30	LC		
65.15	72.24	0.00	00.4	40	SB	30	MC	30	LC		
66	72.34	0.67	00.4	40	SB	30	MC	30	LC		
67.55	71.96	0.35	00.4	40	SB	30	MC	30	LC		
68.25	72.06	0.00	00.4	40	SB	30	MC	30	LC		
70	72.77	0.00	00.4	40	SB	30	MC	30	LC		
70.85	72.56	0.00	00.4	90	BR	5	MC	5	SB		
77.1	73.73	0.00	00.4	90	BR	5	MC	5	SB		
79.8	74.77	0.00	00.4	90	BR	5	MC	5	SB		
84	73.71	0.00	00.4	90	BR	5	MC	5	SB		
86	73.67	0.00	00.4	90	BR	5	MC	5	SB		
87.5	76.08	0.00	00.4	90	BR	5	MC	5	SB		
92	76.91	0.00	00.4	90	BR	5	MC	5	SB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 8

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
12	75.74	0.00	00.4	60	SB	20	LC	10	SC	10	sand
16.2	77.16	0.00	00.4	60	SB	20	LC	10	SC	10	sand
18	76.20	0.00	00.4	60	SB	20	LC	10	SC	10	sand
19.5	78.72	0.00	00.4	60	SB	20	LC	10	SC	10	sand
22.5	77.29	0.00	00.4	60	SB	20	LC	10	SC	10	sand
25	75.37	0.00	00.4	60	SB	20	LC	10	SC	10	sand
27.2	75.61	0.00	00.4	60	SB	20	LC	10	SC	10	sand
30.2	74.78	0.00	00.4	60	SB	20	LC	10	SC	10	sand
33.3	72.84	0.00	00.4	60	SB	20	LC	10	SC	10	sand
33.7	72.75	0.00	00.4	60	SB	20	LC	10	SC	10	sand
36.1	72.24	0.08	00.4	60	SB	20	LC	10	SC	10	sand
37.4	72.02	0.00	00.4	60	SB	20	LC	10	SC	10	sand
37.7	72.24	-0.01	00.4	60	SB	20	LC	10	SC	10	sand
39.1	72.34	0.16	00.4	60	SB	20	LC	10	SC	10	sand
41	72.23	0.00	00.4	60	SB	20	LC	10	SC	10	sand
42.7	72.44	0.08	00.4	60	SB	20	LC	10	SC	10	sand
43.2	72.10	0.00	00.4	60	SB	20	LC	10	SC	10	sand
44.1	72.04	0.18	00.4	60	SB	20	LC	10	SC	10	sand
44.8	72.30	0.00	00.4	60	SB	20	LC	10	SC	10	sand
45.6	72.19	0.27	00.4	60	SB	20	LC	10	SC	10	sand
47.1	71.94	1.35	00.4	60	SB	20	LC	10	SC	10	sand
48.2	72.55	0.00	00.4	60	SB	20	LC	10	SC	10	sand
49.8	70.79	1.65	00.4	60	SB	20	LC	10	SC	10	sand
51.1	70.54	1.52	67.7	40	LC	30	SB	30	MC		
52.6	70.64	2.62	67.7	40	LC	30	SB	30	MC		
54.1	71.04	1.70	67.7	40	LC	30	SB	30	MC		
55.6	70.94	1.70	67.7	40	LC	30	SB	30	MC		
57.1	71.34	-0.02	67.7	40	LC	30	SB	30	MC		
58.6	71.79	0.32	67.7	40	LC	30	SB	30	MC		
61.1	71.59	0.27	67.7	40	LC	30	SB	30	MC		
62.6	71.89	1.36	67.7	40	LC	30	SB	30	MC		
63	72.25	0.00	67.7	40	LC	30	SB	30	MC		
64.1	72.19	2.93	67.7	40	LC	30	SB	30	MC		
65.6	71.84	1.28	67.7	40	LC	30	SB	30	MC		
66.7	72.45	0.00	67.7	40	LC	30	SB	30	MC		
67.1	71.74	1.35	67.7	40	LC	30	SB	30	MC		
68.6	71.64	1.42	67.7	40	LC	30	SB	30	MC		
70.1	71.84	2.02	67.7	40	LC	30	SB	30	MC		
71.6	71.59	1.24	67.7	40	LC	30	SB	30	MC		
74.1	72.54	0.58	00.4	50	SC	25	LC	15	LB	15	SB
74.8	72.14	0.00	00.4	50	SC	25	LC	15	LB	15	SB
75.6	72.64	0.07	00.4	50	SC	25	LC	15	LB	15	SB
76	72.44	0.00	00.4	50	SC	25	LC	15	LB	15	SB
82	72.59	-0.02	00.4	50	SC	25	LC	15	LB	15	SB
83	72.54	0.00	00.4	50	SC	25	LC	15	LB	15	SB
83.7	72.84	0.00	00.4	50	SC	25	LC	15	LB	15	SB
85	74.00	0.00	00.4	90	BR	10	sand				
91	74.40	0.00	00.4	90	BR	10	sand				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 9

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
9	75.90	0.00	64.6	40	sand	40	LC	20	MC		
17.5	75.62	0.00	64.6	40	sand	40	LC	20	MC		
24.5	75.86	0.00	64.6	40	sand	40	LC	20	MC		
26	74.74	0.00	64.6	40	sand	40	LC	20	MC		
27.5	74.39	0.00	64.6	40	sand	40	LC	20	MC		
29	75.74	0.00	64.6	40	sand	40	LC	20	MC		
31.5	77.11	0.00	77.9	60	LB	40	SB				
33	73.01	0.00	77.9	60	LB	40	SB				
34.5	75.10	0.00	77.9	60	LB	40	SB				
36.5	73.66	0.00	77.9	60	LB	40	SB				
37.5	73.39	0.00	77.9	60	LB	40	SB				
41.1	76.04	0.00	77.9	60	LB	40	SB				
41.4	75.26	0.00	77.9	60	LB	40	SB				
42.3	74.15	0.00	77.9	60	LB	40	SB				
43	73.39	0.00	77.9	60	LB	40	SB				
44	73.60	-0.14	77.9	60	LB	40	SB				
46	72.70	-0.13	77.9	60	LB	40	SB				
48	72.80	-0.09	45.8	80	sand	20	MG				
50	72.65	-0.20	45.8	80	sand	20	MG				
52	72.15	0.01	45.8	80	sand	20	MG				
54	71.75	0.51	75.9	90	LB	10	LG				
56	71.15	1.31	75.9	90	LB	10	LG				
58	71.25	1.51	75.9	90	LB	10	LG				
60	71.70	1.03	75.9	90	LB	10	LG				
62	72.35	1.70	75.9	90	LB	10	LG				
64	72.05	1.36	75.9	90	LB	10	LG				
66	71.55	0.40	64.9	90	LC	10	sand				
68	71.20	0.94	64.9	90	LC	10	sand				
70	71.45	0.88	64.9	90	LC	10	sand				
72	70.40	0.65	64.9	90	LC	10	sand				
74	70.35	0.56	64.9	90	LC	10	sand				
76	70.55	0.25	64.9	90	LC	10	sand				
78	71.15	0.47	64.9	90	LC	10	sand				
80	72.20	0.13	64.9	90	LC	10	sand				
82	72.65	0.11	74.6	50	LB	40	sand	10	LC		
84	72.15	-0.19	74.6	50	LB	40	sand	10	LC		
86	72.45	-0.30	74.6	50	LB	40	sand	10	LC		
88	72.35	-0.23	74.6	50	LB	40	sand	10	LC		
90	72.65	-0.06	74.6	50	LB	40	sand	10	LC		
92	73.15	-0.12	74.6	50	LB	40	sand	10	LC		
93.4	72.95	0.00	47.8	80	sand	10	OM	10	WD		
93.8	74.15	0.00	47.8	80	sand	10	OM	10	WD		
95	74.06	0.00	47.8	80	sand	10	OM	10	WD		
99	76.56	0.00	47.8	80	sand	10	OM	10	WD		
102	75.75	0.00	74.8	60	LB	20	sand	20	SB		
104	74.10	0.00	74.8	60	LB	20	sand	20	SB		
105.7	74.99	0.00	74.8	60	LB	20	sand	20	SB		
107	80.10	0.00	74.8	60	LB	20	sand	20	SB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 10

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-3	79.94	0.00	00.4	70	BR	20	sand	10	LG		
0	76.94	0.00	00.4	70	BR	20	sand	10	LG		
10.5	75.94	0.00	00.4	70	BR	20	sand	10	LG		
13.2	75.18	0.00	00.4	70	BR	20	sand	10	LG		
14.4	75.10	0.00	00.4	70	BR	20	sand	10	LG		
16.1	74.40	-0.05	00.4	70	BR	20	sand	10	LG		
17.5	73.98	0.00	00.4	70	BR	20	sand	10	LG		
18.1	73.60	-0.09	00.4	70	BR	20	sand	10	LG		
19.9	73.51	0.00	47.5	50	SB	50	sand				
20.1	73.60	-0.21	47.5	50	SB	50	sand				
22.1	73.60	-0.14	47.5	50	SB	50	sand				
24.1	72.80	-0.22	47.5	50	SB	50	sand				
26.1	72.90	-0.23	47.5	50	SB	50	sand				
28.1	72.70	-0.26	47.5	50	SB	50	sand				
30.1	72.80	-0.22	47.5	50	SB	50	sand				
32.1	73.00	-0.20	47.5	50	SB	50	sand				
34.1	72.30	-0.14	47.5	50	SB	50	sand				
36	71.79	0.12	47.5	50	SB	50	sand				
38	71.95	0.09	47.5	50	SB	50	sand				
40	71.55	0.07	47.5	50	SB	50	sand				
42	71.07	0.24	47.5	50	SB	50	sand				
44	70.66	0.09	47.5	50	SB	50	sand				
46	70.48	0.15	47.5	50	SB	50	sand				
48	70.71	0.33	47.5	50	SB	50	sand				
50	70.96	0.31	47.5	50	SB	50	sand				
52	71.54	0.45	64.9	90	LC	10	sand				
54	72.16	0.22	64.9	90	LC	10	sand				
56	72.57	0.49	64.9	90	LC	10	sand				
58	72.57	0.50	64.9	90	LC	10	sand				
60	72.50	0.60	64.9	90	LC	10	sand				
62	72.30	0.98	64.9	90	LC	10	sand				
64	72.08	1.10	64.9	90	LC	10	sand				
66	71.86	0.67	64.9	90	LC	10	sand				
68	71.52	0.40	64.9	90	LC	10	sand				
70	71.60	0.44	64.9	90	LC	10	sand				
72	71.42	0.17	64.9	90	LC	10	sand				
74	71.25	0.22	64.9	90	LC	10	sand				
76	71.30	0.17	64.9	90	LC	10	sand				
78	71.48	0.15	44.9	100	sand						
80	71.71	0.28	44.9	100	sand						
82	71.84	0.22	44.9	100	sand						
84	72.18	0.18	44.9	100	sand						
86	72.28	0.15	44.9	100	sand						
91.5	73.63	0.00	77.9	100	BR						
98.9	76.48	0.00	77.9	100	BR						
101	76.24	0.00	77.9	100	BR						
107	81.46	0.00	77.9	100	BR						
109	77.33	0.00	77.9	100	BR						
120	78.87	0.00	77.9	100	BR						
125	80.38	0.00	77.9	100	BR						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 11

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-6	81.96	0.00	74.8	80.00	BR	20	sand				
-2	81.18	0.00	74.8	80.00	BR	20	sand				
1.3	76.65	0.00	74.8	80.00	BR	20	sand				
3.3	75.46	0.00	74.8	80.00	BR	20	sand				
5.3	75.17	0.00	74.8	80.00	BR	20	sand				
6.3	74.37	0.00	74.8	80.00	BR	20	sand				
10.3	73.87	-0.10	74.8	80.00	BR	20.00	sand				
15.3	73.37	-0.03	74.8	80.00	BR	20.00	sand				
20.3	73.47	-0.07	74.8	80.00	BR	20.00	sand				
25.3	74.37	-0.06	74.8	80.00	BR	20.00	sand				
30.3	73.97	0.36	74.8	80.00	BR	20.00	sand				
31.3	72.23	2.13	74.8	80.00	BR	20.00	sand				
32.3	71.63	2.20	74.8	80.00	BR	20.00	sand				
33.3	71.43	2.18	74.8	80.00	BR	20.00	sand				
34.3	71.33	1.61	74.8	80.00	BR	20.00	sand				
35.3	71.38	1.09	64.8	70.00	LC	20.00	sand	10.00	LB		
36.3	71.63	0.68	64.8	70.00	LC	20.00	sand	10.00	LB		
37.3	71.69	0.49	64.8	70.00	LC	20.00	sand	10.00	LB		
38.3	71.86	0.36	64.8	70.00	LC	20.00	sand	10.00	LB		
39.3	71.78	0.22	64.8	70.00	LC	20.00	sand	10.00	LB		
40.3	71.77	0.20	64.8	70.00	LC	20.00	sand	10.00	LB		
41.3	71.66	0.21	64.8	70.00	LC	20.00	sand	10.00	LB		
42.3	71.64	0.13	64.8	70.00	LC	20	sand	10	LB		
43.3	71.60	0.17	64.8	70.00	LC	20	sand	10	LB		
44.3	71.51	0.25	64.8	70.00	LC	20	sand	10	LB		
45.3	71.43	0.29	64.8	70.00	LC	20	sand	10	LB		
46.3	71.45	0.26	64.8	70.00	LC	20	sand	10	LB		
47.3	71.45	0.32	64.8	70.00	LC	20.00	sand	10.00	LB		
48.3	71.49	0.35	64.8	70.00	LC	20.00	sand	10.00	LB		
49.3	71.55	0.39	64.8	70.00	LC	20.00	sand	10.00	LB		
50.3	71.44	0.37	64.8	70.00	LC	20.00	sand	10.00	LB		
51.3	71.28	0.32	64.8	70.00	LC	20.00	sand	10.00	LB		
52.3	71.53	0.43	64.8	70.00	LC	20.00	sand	10.00	LB		
53.3	71.85	0.57	64.8	70.00	LC	20.00	sand	10.00	LB		
54.3	75.17	0.00	64.8	70.00	LC	20.00	sand	10.00	LB		
59.1	77.11	0.00	77.9	100.00	LB						
61	78.25	0.00	77.9	100.00	LB						
66	77.71	0.00	77.9	100.00	LB						
72	79.33	0.00	77.9	100.00	LB						
76.3	77.21	0.00	77.9	100.00	LB						
86	79.25	0.00	00.4	40.00	LC	30	MC	20	SC	10	LG
92	79.30	0.00	00.4	40.00	LC	30	MC	20	SC	10	LG
97	81.33	0.00	00.4	40.00	LC	30	MC	20	SC	10	LG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 12

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7	89.48	0.00	76.9	50	WD	40	BR	10	LC		
11	87.98	0.00	76.9	50	WD	40	BR	10	LC		
17	86.68	0.00	76.9	50	WD	40	BR	10	LC		
22	85.38	0.00	76.9	50	WD	40	BR	10	LC		
26.3	83.13	0.00	76.9	50	WD	40	BR	10	LC		
29.4	81.67	0.00	76.9	50	WD	40	BR	10	LC		
36	82.43	0.00	45.5	30	sand	25	LG	25	LC	20	SB
38.7	83.09	0.00	45.5	30	sand	25	LG	25	LC	20	SB
44	82.00	0.00	77.9	100	BR						
46	85.52	0.00	77.9	100	BR						
51	87.66	0.00	77.9	100	BR						
56	85.96	0.00	77.9	100	BR						
61	81.78	0.00	77.9	100	BR						
62.4	79.71	0.00	77.9	100	BR						
63	81.15	0.00	77.9	100	BR						
64.8	80.86	0.00	77.9	100	BR						
65.8	80.19	0.00	77.9	100	BR						
67	79.99	-0.06	77.9	100	BR						
69.3	78.69	0.65	77.9	100	BR						
71.9	78.19	1.10	77.9	100	BR						
72.3	77.97	1.03	77.9	100	BR						
73.3	77.27	0.92	77.9	100	BR						
74.3	76.48	0.78	67.7	70	LC	30	SB				
75.3	76.14	0.73	67.7	70	LC	30	SB				
76.3	76.20	1.02	67.7	70	LC	30	SB				
77.3	76.27	0.98	67.7	70	LC	30	SB				
78.3	76.55	1.14	67.7	70	LC	30	SB				
79.3	76.74	0.74	67.7	70	LC	30	SB				
80.3	76.98	0.54	67.7	70	LC	30	SB				
81.3	77.28	0.59	67.7	70	LC	30	SB				
82.3	77.59	0.68	67.7	70	LC	30	SB				
83.3	77.54	0.61	67.7	70	LC	30	SB				
84.3	77.59	0.56	67.7	70	LC	30	SB				
86.3	77.79	0.74	67.7	70	LC	30	SB				
88.3	78.19	0.54	67.7	70	LC	30	SB				
90.3	78.19	0.62	67.7	70	LC	30	SB				
92.3	78.49	0.71	67.7	70	LC	30	SB				
93.8	78.59	0.56	67.7	70	LC	30	SB				
96.3	79.19	0.32	67.7	70	LC	30	SB				
98.1	79.68	0.00	76.7	30	LB	25	SB	25	LC	10	MG
99.3	80.19	0.00	76.7	30	LB	25	SB	25	LC	10	MG
100	80.19	0.00	76.7	30	LB	25	SB	25	LC	10	MG
103	81.01	0.00	76.7	30	LB	25	SB	25	LC	10	MG
103.4	82.14	0.00	76.7	30	LB	25	SB	25	LC	10	MG
106	81.94	0.00	76.7	30	LB	25	SB	25	LC	10	MG
109	82.97	0.00	76.7	30	LB	25	SB	25	LC	10	MG
114	84.03	0.00	76.7	30	LB	25	SB	25	LC	10	MG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 13

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
13	88.91	0.00	77.9	90	BR	10	WD			10	WD
17.7	87.36	0.00	77.9	90	BR	10	WD			10	WD
26	86.22	0.00	77.9	90	BR	10	WD			10	WD
34.8	83.63	0.00	77.9	90	BR	10	WD			10	WD
39.5	81.49	0.00	77.9	90	BR	10	WD			10	WD
43.5	80.25	0.00	77.9	90	BR	10	WD			10	WD
44.5	80.05	0.04	77.9	90	BR	10	WD			10	WD
45.5	79.75	0.04	77.9	90	BR	10	WD			10	WD
46.5	79.75	-0.02	77.9	90	BR	10	WD				
47.5	79.75	-0.45	77.9	90	BR	10	WD				
48.5	79.25	-0.59	77.9	90	BR	10	WD				
49.5	79.10	-0.27	77.9	90	BR	10	WD				
50.5	79.10	-0.24	77.9	90	BR	10	WD				
51.5	79.00	-0.68	77.9	90	BR	10	WD				
52.5	78.75	-0.26	77.9	90	BR	10	WD				
53.5	78.15	-0.19	77.9	90	BR	10	WD				
54	77.99	0.38	77.9	90	BR	10	WD				
56	77.47	0.70	77.9	90	BR	10	WD				
58	76.39	0.91	76.6	60	LB	40	LC				
60	76.08	0.69	76.6	60	LB	40	LC				
62	75.65	0.41	76.6	60	LB	40	LC				
64	76.15	0.46	76.6	60	LB	40	LC				
66	76.60	0.79	76.6	60	LB	40	LC				
68	76.35	0.77	76.6	60	LB	40	LC				
70	76.48	0.38	76.6	60	LB	40	LC				
72	77.63	0.43	76.6	60	LB	40	LC				
74	77.81	0.46	76.6	60	LB	40	LC				
76	76.63	0.67	76.6	60	LB	40	LC				
78	76.16	0.46	76.6	60	LB	40	LC				
80	75.91	0.33	76.6	60	LB	40	LC				
82	75.17	0.17	76.6	60	LB	40	LC				
84	76.85	0.41	76.6	60	LB	40	LC				
86	77.60	0.44	76.6	60	LB	40	LC				
88	78.00	0.38	76.6	60	LB	40	LC				
90	78.08	0.34	76.6	60	LB	40	LC				
92	78.49	0.14	76.6	60	LB	40	LC				
93	78.90	0.13	76.6	60	LB	40	LC				
97.8	77.25	0.05	76.6	60	LB	40	LC				
99	77.95	0.05	76.6	60	LB	40	LC				
102	79.25	-0.01	76.6	60	LB	40	LC				
104.7	80.25	0.00	76.6	60	LB	40	LC				
106.5	81.66	0.00	57.6	50	MG	30	SB	20	LC		
107.5	81.81	0.00	57.6	50	MG	30	SB	20	LC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 14

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
12	98.74	0.00	77.9	100	LB						
14	89.79	0.00	77.9	100	LB						
15.5	89.10	0.00	77.9	100	LB						
16.8	88.66	0.00	64.7	60	LC	20	sand	20	SB		
16.9	91.00	0.00	64.7	60	LC	20	sand	20	SB		
17	93.71	0.00	64.7	60	LC	20	sand	20	SB		
17.2	93.71	0.00	64.7	60	LC	20	sand	20	SB		
17.5	88.90	0.00	64.7	60	LC	20	sand	20	SB		
18.5	88.90	-0.03	64.7	60	LC	20	sand	20	SB		
18.8	95.96	0.00	64.7	60	LC	20	sand	20	SB		
19	95.96	0.00	64.7	60	LC	20	sand	20	SB		
19.2	94.50	0.00	64.7	60	LC	20	sand	20	SB		
20	88.54	-0.01	64.7	60	LC	20	sand	20	SB		
21.5	88.45	-0.07	64.7	60	LC	20	sand	20	SB		
21.9	88.85	0.00	64.7	60	LC	20	sand	20	SB		
22	92.04	0.00	64.7	60	LC	20	sand	20	SB		
22.3	92.04	0.00	64.7	60	LC	20	sand	20	SB		
23	87.90	-0.02	64.7	60	LC	20	sand	20	SB		
24.5	88.20	2.55	64.7	60	LC	20	sand	20	SB		
26	87.50	1.59	64.7	60	LC	20	sand	20	SB		
27.5	88.20	1.44	74.9	80	SB	10	sand	10	LC		
29	87.60	0.61	74.9	80	SB	10	sand	10	LC		
30.5	87.50	0.67	74.9	80	SB	10	sand	10	LC		
32	87.10	-0.05	74.9	80	SB	10	sand	10	LC		
33.5	88.10	-0.40	74.9	80	SB	10	sand	10	LC		
35	87.80	0.60	74.9	80	SB	10	sand	10	LC		
36.5	87.10	2.77	74.9	80	SB	10	sand	10	LC		
38	87.40	4.39	74.9	80	SB	10	sand	10	LC		
38.5	88.70	0.00	74.9	80	SB	10	sand	10	LC		
39	95.25	0.00	74.9	80	SB	10	sand	10	LC		
39.4	95.25	0.00	74.9	80	SB	10	sand	10	LC		
40.5	88.00	2.02	74.9	80	SB	10	sand	10	LC		
42	88.20	1.12	74.9	80	SB	10	sand	10	LC		
43.5	88.30	1.66	74.9	80	SB	10	sand	10	LC		
45	87.30	0.55	77.9	100	BR						
46.5	87.00	0.32	77.9	100	BR						
48	87.10	-0.13	77.9	100	BR						
49.5	87.30	0.30	77.9	100	BR						
51	87.50	0.51	77.9	100	BR						
52.5	87.60	0.14	77.9	100	BR						
54	88.00	0.15	75.9	75	LB	10	SB	5	LC	5	LG
54.3	89.81	0.00	75.9	75	LB	10	SB	5	LC	5	LG
55.4	88.55	0.00	75.9	75	LB	10	SB	5	LC	5	LG
56.4	89.10	0.00	75.9	75	LB	10	SB	5	LC	5	LG
58.8	91.05	0.00	75.9	75	LB	10	SB	5	LC	5	LG
61.5	92.65	0.00	75.9	75	LB	10	SB	5	LC	5	LG
66	94.66	0.00	75.9	75	LB	10	SB	5	LC	5	LG
72	96.76	0.00	75.9	75	LB	10	SB	5	LC	5	LG
77.7	97.61	0.00	75.9	75	LB	10	SB	5	LC	5	LG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 15

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
11	96.07	0.00	67.9	40	LC	35	MC	15	LB	10	SC
15.8	96.62	0.00	67.9	40	LC	35	MC	15	LB	10	SC
18	94.05	0.00	67.9	40	LC	35	MC	15	LB	10	SC
26	93.70	0.00	74.6	50	SB	40	sand	10	LB		
31	91.80	0.00	75.7	50	LB	25	SC	25	LG		
35.6	90.36	0.00	75.7	50	LB	25	SC	25	LG		
36.8	91.24	0.00	75.7	50	LB	25	SC	25	LG		
37.9	89.96	0.00	75.7	50	LB	25	SC	25	LG		
38.9	89.30	0.00	75.7	50	LB	25	SC	25	LG		
39.6	88.06	-0.20	75.7	50	LB	25	SC	25	LG		
40.9	88.96	0.83	77.9	100	BR						
42.9	87.76	-0.46	77.9	100	BR						
44.9	87.56	0.38	77.9	100	BR						
46.4	87.26	3.08	77.9	100	BR						
48.4	86.46	2.60	67.5	50	LC	25	LB	25	SB		
50.4	86.66	0.84	67.5	50	LC	25	LB	25	SB		
51.9	86.76	0.77	67.5	50	LC	25	LB	25	SB		
53.4	89.96	0.00	67.5	50	LC	25	LB	25	SB		
54	89.41	0.00	67.5	50	LC	25	LB	25	SB		
54.9	88.66	0.92	67.5	50	LC	25	LB	25	SB		
56.4	88.46	0.75	67.5	50	LC	25	LB	25	SB		
58.4	89.56	0.33	67.5	50	LC	25	LB	25	SB		
60.4	89.46	0.35	67.5	50	LC	25	LB	25	SB		
62.4	89.26	0.59	67.5	50	LC	25	LB	25	SB		
64.4	89.06	0.76	67.5	50	LC	25	LB	25	SB		
66.4	88.56	0.37	67.5	50	LC	25	LB	25	SB		
68.4	88.56	0.16	67.5	50	LC	25	LB	25	SB		
69.9	88.46	0.04	67.5	50	LC	25	LB	25	SB		
71.4	89.46	-0.06	67.5	50	LC	25	LB	25	SB		
72.9	89.46	-0.06	67.5	50	LC	25	LB	25	SB		
74.4	89.66	-0.24	67.5	50	LC	25	LB	25	SB		
75.4	89.96	0.00	67.5	50	LC	25	LB	25	SB		
76.9	89.46	0.07	67.5	50	LC	25	LB	25	SB		
78.9	89.36	-0.14	67.5	50	LC	25	LB	25	SB		
79.5	89.74	0.00	67.5	50	LC	25	LB	25	SB		
80.3	89.96	0.00	76.7	70	LB	15	SC	15	LC		
83.5	93.18	0.00	76.7	70	LB	15	SC	15	LC		
84.7	92.59	0.00	76.7	70	LB	15	SC	15	LC		
91	93.98	0.00	76.7	70	LB	15	SC	15	LC		
97	97.61	0.00	76.7	70	LB	15	SC	15	LC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 16

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type	Additional
10	99.36	0.00	65.8	60	LC	10	MC	10	LG	10	MG	10%Sand
30	93.03	0.00	46.6	50	sand	40	LC	10	LB			
33.8	91.66	0.00	64.9	80	LC	10	LB	10	sand			
34.9	91.12	0.00	64.9	80	LC	10	LB	10	sand			
35.8	89.86	0.02	64.9	80	LC	10	LB	10	sand			
37.8	89.46	-0.03	64.9	80	LC	10	LB	10	sand			
39.8	88.86	0.35	64.9	80	LC	10	LB	10	sand			
41.8	89.56	0.40	64.9	80	LC	10	LB	10	sand			
43.8	88.76	0.41	64.9	80	LC	10	LB	10	sand			
45.8	88.56	0.39	64.9	80	LC	10	LB	10	sand			
47.8	88.76	0.44	64.9	80	LC	10	LB	10	sand			
49.8	88.36	0.53	64.9	80	LC	10	LB	10	sand			
51.8	88.76	0.51	64.9	80	LC	10	LB	10	sand			
53.8	89.06	0.21	64.9	80	LC	10	LB	10	sand			
55.8	90.06	0.69	64.9	80	LC	10	LB	10	sand			
57.8	89.06	0.59	64.9	80	LC	10	LB	10	sand			
59.8	88.66	0.49	64.9	80	LC	10	LB	10	sand			
61.8	89.16	0.54	64.9	80	LC	10	LB	10	sand			
63.8	89.06	0.55	64.9	80	LC	10	LB	10	sand			
65.8	89.56	0.58	64.9	80	LC	10	LB	10	sand			
67.8	89.56	0.54	64.9	80	LC	10	LB	10	sand			
69.8	90.06	0.60	64.9	80	LC	10	LB	10	sand			
71.8	90.26	0.53	64.9	80	LC	10	LB	10	sand			
73.8	90.56	0.48	64.9	80	LC	10	LB	10	sand			
75.8	90.66	0.49	64.9	80	LC	10	LB	10	sand			
77.8	91.06	0.35	47.9	95	sand	5	SB					
79	91.08	0.00	47.9	95	sand	5	SB					
79.8	91.26	0.09	47.9	95	sand	5	SB					
81.8	91.36	0.91	47.9	95	sand	5	SB					
83.4	91.42	0.00	47.9	95	sand	5	SB					
83.8	91.66	0.00	47.9	95	sand	5	SB					
91	92.92	0.00	47.9	95	sand	5	SB					
92	94.12	0.00	47.9	95	sand	5	SB					
98.9	100.21	0.00	47.9	95	sand	5	SB					

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 17

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-8.2	98.40	0.00	77.9	100	BR						
2.2	100.24	0.00	77.9	100	BR						
7.2	94.00	0.00	77.9	100	BR						
10.9	92.45	0.00	77.9	100	BR						
11.7	91.66	0.00	77.9	100	BR						
13.2	91.26	-0.10	77.9	100	BR						
14.2	89.76	0.00	77.9	100	BR						
15.2	89.46	-0.04	77.9	100	BR						
16.2	89.36	-0.06	77.9	100	BR						
17.2	89.06	-0.11	77.9	100	BR						
18.2	88.54	0.19	77.9	100	BR						
19.2	88.24	0.38	76.9	95	BR	5	LC				
20.2	87.81	0.23	76.9	95	BR	5	LC				
21.2	87.56	0.23	76.9	95	BR	5	LC				
22.2	87.61	0.21	76.9	95	BR	5	LC				
23.2	87.75	0.28	76.9	95	BR	5	LC				
24.2	87.77	0.25	76.9	95	BR	5	LC				
25.2	87.77	0.12	76.9	95	BR	5	LC				
26.2	88.02	0.12	76.9	95	BR	5	LC				
27.2	88.02	0.31	76.9	95	BR	5	LC				
28.2	87.69	0.60	76.9	95	BR	5	LC				
29.2	87.49	0.72	76.9	95	BR	5	LC				
30.2	86.83	0.67	76.9	95	BR	5	LC				
31.2	86.74	0.66	76.9	95	BR	5	LC				
32.2	86.91	0.36	76.9	95	BR	5	LC				
33.2	86.84	0.38	76.9	95	BR	5	LC				
34.2	86.86	0.57	76.9	95	BR	5	LC				
35.2	86.87	0.77	76.9	95	BR	5	LC				
36.2	86.91	0.79	76.9	95	BR	5	LC				
37.2	87.03	1.08	76.9	95	BR	5	LC				
38.2	87.29	1.38	76.9	95	BR	5	LC				
39.2	87.53	1.45	76.9	95	BR	5	LC				
40.2	87.45	0.74	76.9	95	BR	5	LC				
41.2	87.87	1.18	76.9	95	BR	5	LC				
42.2	88.56	0.93	76.9	95	BR	5	LC				
43.2	89.33	0.53	76.9	95	BR	5	LC				
44.7	91.66	0.00	76.9	95	BR	5	LC				
46.5	93.61	0.00	77.9	100	BR						
48.3	93.97	0.00	77.9	100	BR						
50.2	94.65	0.00	77.9	100	BR						
58.7	93.54	0.00	77.9	100	BR						
60.3	92.29	0.00	77.9	100	BR						
69.9	93.64	0.00	67.5	40	SB	20	LC	20	MC	20	LG
76.8	100.31	0.00	67.5	40	SB	20	LC	20	MC	20	LG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 18

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
10	101.10	0.00	65.9	40	LC	30	MC	20	SC	10	LG
23	98.44	0.00	65.9	40	LC	30	MC	20	SC	10	LG
30	96.43	0.00	65.9	40	LC	30	MC	20	SC	10	LG
33.5	95.24	0.00	65.9	40	LC	30	MC	20	SC	10	LG
35.8	93.97	0.00	74.9	95	SB	5	sand				
39	94.52	0.00	74.9	95	SB	5	sand				
42	93.14	0.00	74.9	95	SB	5	sand				
46	94.65	0.00	74.9	95	SB	5	sand				
50	96.41	0.00	74.9	95	SB	5	sand				
53.5	97.65	0.00	74.9	95	SB	5	sand				
57	94.91	0.00	74.9	95	SB	5	sand				
59.2	92.34	0.00	74.9	95	SB	5	sand				
61.3	92.38	0.00	74.9	95	SB	5	sand				
63.2	91.78	0.00	74.9	95	SB	5	sand				
63.7	91.08	2.88	74.9	95	SB	5	sand				
64.7	90.53	0.48	74.9	95	SB	5	sand				
65.7	90.83	0.94	74.9	95	SB	5	sand				
66	91.61	0.00	74.9	95	SB	5	sand				
67.2	91.48	1.51	74.9	95	SB	5	sand				
68.8	90.63	0.79	74.9	95	SB	5	sand				
70.2	89.53	1.45	74.9	95	SB	5	sand				
71.2	88.38	1.86	74.9	95	SB	5	sand				
72.7	87.98	1.90	74.9	95	SB	5	sand				
74.2	88.38	1.58	74.9	95	SB	5	sand				
75.7	88.58	1.33	64.7	60	LC	20	sand	20	LB		
77.2	88.48	0.41	64.7	60	LC	20	sand	20	LB		
78.7	88.58	0.57	64.7	60	LC	20	sand	20	LB		
80.2	89.38	0.22	64.7	60	LC	20	sand	20	LB		
81.8	89.08	0.12	64.7	60	LC	20	sand	20	LB		
83.2	89.98	0.00	64.7	60	LC	20	sand	20	LB		
84.7	90.28	0.00	64.7	60	LC	20	sand	20	LB		
86.2	90.63	0.00	64.7	60	LC	20	sand	20	LB		
87.7	91.38	-0.41	64.7	60	LC	20	sand	20	LB		
88	91.25	0.00	64.7	60	LC	20	sand	20	LB		
89.2	91.28	-0.68	54.6	40	sand	20	SC	20	LG	30	MG
90.7	91.53	-0.37	54.6	40	sand	20	SC	20	LG	30	MG
92	91.91	0.00	54.6	40	sand	20	SC	20	LG	30	MG
93.2	91.68	0.00	54.6	40	sand	20	SC	20	LG	30	MG
95.2	91.68	0.00	54.6	40	sand	20	SC	20	LG	30	MG
97.2	91.58	0.00	54.6	40	sand	20	SC	20	LG	30	MG
99.2	91.33	0.00	54.6	40	sand	20	SC	20	LG	30	MG
101.2	91.28	0.00	54.6	40	sand	20	SC	20	LG	30	MG
102	91.50	0.00	54.6	40	sand	20	SC	20	LG	30	MG
103.9	91.78	0.00	77.9	70	SB	30	OM				
106.5	94.04	0.00	77.9	70	SB	30	OM				
110	95.45	0.00	77.9	70	SB	30	OM				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-3. Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Study Site Topography, Substrate, and Velocity Data.

Transect 1

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
2	87.76	0.00	64.9	50	SC	30	MC	10	SG	10	sand
6	86.86	0.00	64.9	50	SC	30	MC	10	SG	10	sand
12.8	86.76	0.00	64.9	50	SC	30	MC	10	SG	10	sand
31	88.06	0.00	56.5	30	MC	30	SG	20	LB	10	sand
38	89.71	0.00	00.4	50	sand	40	OM	10	MC		
43	90.42	0.00	00.4	50	sand	40	OM	10	MC		
54.8	90.52	0.00	46.8	80	sand	20	SC				
70.4	89.38	0.00	00.4	40	SB	30	MC	20	SC	10	LB
77	88.70	0.00	00.4	30	MC	30	SC	20	SG	20	silt
89	88.49	0.00	64.7	40	SC	30	sand	20	LC	10	SG
102	87.23	0.00	67.7	40	SC	30	MC	20	SB	10	LB
111.5	87.11	0.00	67.7	40	SC	30	MC	20	SB	10	LB
113.4	86.69	0.00	67.6	40	SB	40	LC	20	MC		
117.5	85.99	0.16	67.6	40	SB	40	LC	20	MC		
119	86.09	0.43	67.6	40	SB	40	LC	20	MC		
120.5	85.94	0.34	67.6	40	SB	40	LC	20	MC		
122	85.79	0.15	66.9	90	MC	10	SC				
123.5	85.69	0.74	66.9	90	MC	10	SC				
125	85.34	0.61	66.9	90	MC	10	SC				
126.5	85.49	0.85	64.7	50	MC	30	sand	10	SC	10	LC
128	84.59	0.58	64.7	50	MC	30	sand	10	SC	10	LC
129.5	84.39	1.02	64.7	50	MC	30	sand	10	SC	10	LC
131	84.59	1.27	64.7	50	MC	30	sand	10	SC	10	LC
132.5	83.99	1.11	64.7	50	MC	30	sand	10	SC	10	LC
134.5	84.24	1.33	46.6	50	sand	20	SG	20	MC	10	SC
136	83.99	1.21	46.6	50	sand	20	SG	20	MC	10	SC
137.5	83.89	1.16	46.6	50	sand	20	SG	20	MC	10	SC
139	83.74	1.15	46.6	50	sand	20	SG	20	MC	10	SC
140.5	83.69	1.03	46.6	50	sand	20	SG	20	MC	10	SC
142	83.49	1.11	46.7	60	sand	20	SC	10	MC	10	SG
143.5	83.89	1.17	46.7	60	sand	20	SC	10	MC	10	SG
145	83.74	1.06	46.7	60	sand	20	SC	10	MC	10	SG
146.5	83.99	1.00	46.7	60	sand	20	SC	10	MC	10	SG
148	84.34	0.58	46.7	60	sand	20	SC	10	MC	10	SG
149.5	83.99	0.77	45.5	30	SG	30	sand	20	LB	20	MC
151	84.29	0.80	45.5	30	SG	30	sand	20	LB	20	MC
152.1	84.69	1.02	45.5	30	SG	30	sand	20	LB	20	MC
154	83.54	0.48	67.6	60	LC	40	SB				
155.5	85.09	0.56	67.6	60	LC	40	SB				
157.1	85.69	0.03	67.6	60	LC	40	SB				
158.5	85.29	0.07	67.6	60	LC	40	SB				
160	85.44	0.33	67.6	60	LC	40	SB				
160.6	85.91	0.00	67.6	60	LC	40	SB				
161.2	86.69	0.00	76.7	70	SB	30	LC				
162.3	87.93	0.00	76.7	70	SB	30	LC				
166.7	87.59	0.00	76.7	70	SB	30	LC				
173	89.38	0.00	74.8	70	SB	20	sand	10	LC		
180	91.04	0.00	47.9	90	sand	10	LB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 2

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-3	93.96	0.00	77.9	100	BR						
1	87.52	0.00	77.9	100	BR						
6	89.49	0.00	47.9	90	sand	10	RB				
7.5	88.46	0.00	47.8	80	sand	10	OM	10	BR		
17.7	87.94	0.00	47.8	80	sand	10	OM	10	BR		
18.9	86.73	0.00	47.8	80	sand	10	OM	10	BR		
22	82.25	0.13	44.9	100	sand						
23.5	81.90	0.10	44.9	100	sand						
25	81.56	0.06	44.9	100	sand						
26.5	81.33	0.05	44.9	100	sand						
28	81.13	0.11	44.9	100	sand						
29.5	80.96	0.09	44.9	100	sand						
31	80.90	0.12	44.9	100	sand						
32.5	80.57	0.18	44.9	100	sand						
34	79.80	0.17	44.9	100	sand						
35.5	79.50	0.18	44.9	100	sand						
37	79.39	0.22	44.9	100	sand						
38.5	79.41	0.13	44.9	100	sand						
40	79.41	0.06	44.9	100	sand						
41.5	79.44	0.04	44.9	100	sand						
43	79.60	0.08	44.9	100	sand						
44.5	79.69	0.06	44.9	100	sand						
46	79.54	0.15	44.9	100	sand						
47.5	79.31	0.11	44.9	100	sand						
49	78.98	0.03	44.9	100	sand						
50.5	78.75	0.08	44.9	100	sand						
52	78.58	0.05	44.9	100	sand						
53.5	78.53	0.10	44.9	100	sand						
55	78.37	0.24	44.9	100	sand						
56.5	78.08	0.39	44.9	100	sand						
58	77.74	0.38	44.9	100	sand						
59.5	77.42	0.26	44.9	100	sand						
61	77.47	0.32	44.9	100	sand						
62.5	77.62	0.44	44.9	100	sand						
64	77.64	0.39	44.9	100	sand						
65.5	77.75	0.35	44.9	100	sand						
67	77.99	0.25	44.9	100	sand						
68.5	78.76	0.24	44.9	100	sand						
70	79.32	0.28	44.9	100	sand						
71.5	79.80	0.28	44.9	100	sand						
73	80.12	0.27	44.9	100	sand						
74.5	80.80	0.23	44.9	100	sand						
76	80.78	0.27	44.9	100	sand						
77.5	81.03	0.24	44.9	100	sand						
79	81.56	0.20	44.9	100	sand						
80.5	81.98	0.20	44.9	100	sand						
82	82.38	0.15	44.9	100	sand						
83.5	82.61	0.15	44.9	100	sand						
85	82.76	0.28	44.9	100	sand						
86.5	82.81	0.32	44.9	100	sand						
88	82.80	0.35	44.9	100	sand						
89.5	82.87	0.26	44.9	100	sand						
91	82.98	0.27	44.9	100	sand						
92.5	83.18	0.31	46.6	60	sand	20	MC	20	LC		
94	83.38	0.39	46.6	60	sand	20	MC	20	LC		
95.5	83.61	0.49	46.6	60	sand	20	MC	20	LC		
97	83.81	0.54	46.6	60	sand	20	MC	20	LC		
98.5	84.01	0.47	46.6	60	sand	20	MC	20	LC		
100	84.06	0.36	46.6	60	sand	20	MC	20	LC		
101.5	83.98	0.44	46.6	60	sand	20	MC	20	LC		
103	83.79	0.40	46.6	60	sand	20	MC	20	LC		
104.5	83.74	0.34	46.6	60	sand	20	MC	20	LC		
106	83.82	0.40	46.6	60	sand	20	MC	20	LC		
107.5	84.22	0.35	46.6	60	sand	20	MC	20	LC		
108	84.03	0.36	46.6	60	sand	20	MC	20	LC		
109.5	84.73	0.33	46.6	60	sand	20	MC	20	LC		
110	84.93	0.40	46.6	60	sand	20	MC	20	LC		
111.5	85.43	0.07	46.6	60	sand	20	MC	20	LC		
113.1	86.73	0.00	67.7	35	LC	25	MC	25	SB	15	sand
113.8	87.29	0.00	67.7	35	LC	25	MC	25	SB	15	sand
125	92.15	0.00	67.7	35	LC	25	MC	25	SB	15	sand
130.8	93.13	0.00	47.8	80	sand	15	LB	5	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 3

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
4	98.47	0.00	77.9	95	BR	5	WD				
6	96.30	0.00	77.9	95	BR	5	WD				
9	94.61	0.00	77.9	95	BR	5	WD				
11	93.40	0.00	77.9	95	BR	5	WD				
15	92.38	0.00	00.4	50	silt	40	SB	10	LG		
15.7	91.55	0.00	00.4	50	silt	40	SB	10	LG		
17	91.12	0.00	00.4	50	silt	40	SB	10	LG		
17.6	91.15	0.25	00.4	50	silt	40	SB	10	LG		
19.5	90.25	0.00	00.4	50	silt	40	SB	10	LG		
20.2	89.95	0.82	46.6	40	sand	30	LB	30	LC		
21.6	90.20	0.22	46.6	40	sand	30	LB	30	LC		
23.6	90.50	1.39	46.6	40	sand	30	LB	30	LC		
25.6	90.45	1.30	46.6	40	sand	30	LB	30	LC		
27.6	90.25	1.16	46.6	40	sand	30	LB	30	LC		
29.6	90.35	1.04	46.6	40	sand	30	LB	30	LC		
31.6	90.10	0.03	46.6	40	sand	30	LB	30	LC		
31.9	91.40	0.00	46.6	40	sand	30	LB	30	LC		
33	91.40	0.00	54.6	30	sand	20	LG	30	LC	20	SG
34.1	89.45	0.83	54.6	30	sand	20	LG	30	LC	20	SG
35.2	91.29	0.00	54.6	30	sand	20	LG	30	LC	20	SG
35.5	91.29	0.00	54.6	30	sand	20	LG	30	LC	20	SG
35.8	90.15	0.40	54.6	30	sand	20	LG	30	LC	20	SG
38.3	89.80	1.07	77.9	100	SB						
41.6	89.25	0.76	67.9	60	SC	30	LC	10	LB		
43.1	89.55	1.93	67.9	60	SC	30	LC	10	LB		
45.1	90.35	2.50	67.9	60	SC	30	LC	10	LB		
47.1	89.75	2.62	67.9	60	SC	30	LC	10	LB		
49.1	89.85	1.98	77.9	100	LB						
51.1	90.55	2.56	77.9	100	LB						
52.9	89.80	1.76	77.9	100	LB						
55.1	89.35	1.66	46.7	65	sand	35	SC				
57.1	89.55	1.33	46.7	65	sand	35	SC				
59.1	89.95	1.11	66.9	80	LC	20	LC				
61.1	90.10	0.11	66.9	80	LC	20	LC				
63.1	90.40	-0.17	66.9	80	LC	20	LC				
65.1	90.35	-0.14	66.9	80	LC	20	LC				
67.1	90.35	1.65	67.6	40	SC	20	LB	20	SB	15	LC
69.1	90.60	1.93	67.6	40	SC	20	LB	20	SB	15	LC
70	92.14	0.00	67.6	40	SC	20	LB	20	SB	15	LC
71.7	92.14	0.00	67.6	40	SC	20	LB	20	SB	15	LC
73.1	91.05	2.47	67.6	40	SC	20	LB	20	SB	15	LC
74.8	91.60	0.00	67.6	40	SC	20	LB	20	SB	15	LC
75.1	90.85	0.14	67.6	40	SC	20	LB	20	SB	15	LC
77.1	90.745	1.656	67.6	40	SC	20	LB	20	SB	15	LC
79.1	90.445	0.493	67.6	40	SC	20	LB	20	SB	15	LC
81.1	90.345	1.618	67.6	40	SC	20	LB	20	SB	15	LC
82.1	90.945	0	67.6	40	SC	20	LB	20	SB	15	LC
83.1	91.545	0	00.4	40	SB	20	SC	20	sand	20	SG
90.8	92.80	0.00	00.4	40	SB	20	SC	20	sand	20	SG
97.6	94.19	0.00	00.4	40	SB	20	SC	20	sand	20	SG
99.3	94.45	0.00	00.4	40	SB	20	SC	20	sand	20	SG
115	95.90	0.00	00.4	60	sand	40	SB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 4

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type	
-21	96.98	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
-9	97.99	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
-5.5	97.74	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
-4.5	96.60	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
-2	96.10	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
7.7	93.56	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
9.4	92.41	0.00	0.00	77.9	60	LB	40	SB				
11	92.90	0.00	0.00	77.9	60	LB	40	SB				
16.9	92.07	0.00	0.00	77.9	60	LB	40	SB				
17.5	93.37	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
18.2	93.37	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
18.4	92.01	-0.07	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
19.3	91.72	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
21	91.72	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
21.4	91.81	0.01	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
22.8	92.84	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
23.4	91.61	-0.04	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
24.1	91.58	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
24.8	91.76	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
25.4	91.41	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
26	92.60	0.00	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
27.4	91.21	-0.05	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
29.4	90.91	-0.04	0.00	76.9	90	LB	10	LC				
30	93.13	0.00	0.00	76.9	90	LB	10	LC				
30.6	93.13	0.00	0.00	76.9	90	LB	10	LC				
31.4	91.41	-0.01	0.00	76.9	90	LB	10	LC				
32.4	92.06	0.00	0.00	76.9	90	LB	10	LC				
33.4	90.91	0.56	0.00	76.9	90	LB	10	LC				
35.4	90.51	1.06	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
37.4	90.31	0.92	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
39.4	91.01	1.35	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
41.4	90.11	0.52	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
43.4	91.01	1.28	0.00	76.7	40	SB	30	LB	20	LC	10.00	MC
45.4	90.61	0.81	0.00	76.7	40	SB	30	LB	20	LC	10.00	MC
47.4	89.31	0.37	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
49.4	89.41	1.27	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
51.4	89.71	1.75	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
53.4	89.61	2.04	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
55.4	91.41	2.00	0.00	76.7	70	LB	20	MC	10	SC		
57.4	91.01	2.37	0.00	76.7	70	LB	20	MC	10	SC		
59.4	90.51	1.65	0.00	76.7	70	LB	20	MC	10	SC		
61.4	90.61	2.00	0.00	64.9	60	MC	20	LC	10	SG	10	sand
63.4	90.31	1.74	0.00	56.5	40	SG	30	SC	20	sand	10	MC
65.4	90.41	0.72	0.00	45.8	80	sand	20	SG				
67.4	90.91	-0.01	0.00	45.8	80	sand	20	SG				
69.4	91.71	-0.38	0.00	45.8	80	sand	20	SG				
71.4	91.41	-0.38	0.00	45.8	80	sand	20	SG				
71.7	91.63	0.00	0.00	45.8	80	sand	20	SG				
73.4	92.41	0.00	0.00	74.7	70	LB	30	sand				
74.7	93.50	0.00	0.00	74.7	70	LB	30	sand				
78	92.83	0.00	0.00	74.7	70	LB	30	sand				
85	94.06	0.00	0.00	74.7	70	LB	30	sand				
105	100.51	0.00	0.00	77.9	90	LB	10	SB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Substrate Type	Field Abbrev.	Size Range (in)
Permanent Vegetation (alders, willows, upland trees)		
silt and sand		<0.1 - 0.2
small, medium, large gravel	SG, MG, LG	0.2-3
small, medium, large cobble	SC, MC, LC	3-12
Other - organic material - leaf/detritus	OM	
(large) woody debris	LWD or WD	
small, large boulder	SB, LB	
rough bedrock (cobble/boulder consistency)	RB	
smooth bedrock	SmBr	

Substrate Type	Size Range (in)
Organic material - leaf/detritus	
Clay or silt	< 0.1
sand	0.1 - 0.2
small gravel	0.2 - 1.0
medium gravel	1 - 2
large gravel	2 - 3
small cobble	3 - 6
medium cobble	6 - 9
large cobble	9 - 12
small boulder	12 - 40
large boulder	> 40
smooth bedrock	
rough bedrock	

Transect 5

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-1	107.05	0.00	66.9	80	LC	20	MC				
19.5	100.34	0.00	66.9	80	LC	20	MC				
24.7	97.62	0.00	67.6	60	LC	40	SB				
26.3	95.46	0.00	66.9	60	MC	40	SC				
28.5	95.06	0.86	66.9	60	MC	40	SC				
30	94.76	0.00	66.9	60	MC	40	SC				
31	95.01	0.72	46.8	80	sand	20	MC				
31.8	95.68	0.00	46.8	80	sand	20	MC				
32.5	94.58	0.00	46.8	75	sand	25	MC				
33	94.36	0.97	46.8	75	sand	25	MC				
35	94.06	1.16	46.8	75	sand	25	MC				
37	93.51	1.51	46.8	75	sand	25	MC				
39	93.06	1.66	46.8	75	sand	25	MC				
40.5	93.36	1.99	46.8	75	sand	25	MC				
42.5	94.21	1.97	46.8	75	sand	25	MC				
45	93.16	0.52	46.8	75	sand	25	MC				
47	94.11	1.06	46.8	75	sand	25	MC				
49	94.16	1.19	46.8	75	sand	25	MC				
51	94.06	0.81	46.8	75	sand	25	MC				
53	93.81	0.91	46.8	75	sand	25	MC				
55	95.16	2.34	46.8	75	sand	25	MC				
57	95.21	1.39	67.5	50	SB	30	MC	20	SC		
58.3	93.71	0.60	67.5	50	SB	30	MC	20	SC		
62.5	95.38	0.00	76.6	60	SB	40	LC				
63	94.76	1.91	76.6	60	SB	40	LC				
64.7	94.46	2.37	76.6	60	SB	40	LC				
66.6	93.51	1.22	66.9	70	MC	30	SC				
67.7	95.16	0.00	66.9	70	MC	30	SC				
68.1	95.16	0.00	66.9	70	MC	30	SC				
68.8	92.76	0.56	66.9	70	MC	30	SC				
70.7	93.41	1.40	66.9	70	MC	30	SC				
72.7	93.41	1.04	66.9	70	MC	30	SC				
74.7	93.46	1.20	66.9	70	MC	30	SC				
76.6	93.86	0.49	66.9	70	MC	30	SC				
78.8	93.86	0.46	66.9	70	MC	30	SC				
80.7	94.16	0.19	66.9	70	MC	30	SC				
82.7	93.76	0.24	66.9	70	MC	30	SC				
84.7	93.81	0.01	66.9	70	MC	30	SC				
86.7	94.26	-0.03	66.9	70	MC	30	SC				
89.2	94.79	0.00	66.9	70	MC	30	SC				
90	96.19	0.00	47.6	60	sand	40	SB				
91.6	95.46	0.00	46.6	40	sand	30	LB	30	MC		
93.7	95.50	0.00	46.6	40	sand	30	LB	30	MC		
94.9	96.28	0.00	47.6	60	sand	40	SB				
108	97.78	0.00	66.9	50	MC	50	SC				
113.5	98.28	0.00	66.9	50	MC	50	SC				
114	99.28	0.00	66.9	50	LC	50	MC				
115.5	98.78	0.00	76.7	70	SB	30	MC				
123	99.78	0.00	66.9	60	LC	40	MC				
127	100.28	0.00	74.9	80	SB	20 LB					
133	102.28	0.00	77.9	100	LB						
138	102.78	0.00	44.9	100	sand						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 6

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
0	111.54	0.00	65.9	65	LC	15	MC	10	SC	10	MG
3	110.64	0.00	65.9	65	LC	15	MC	10	SC	10	MG
10.4	108.41	0.00	65.9	65	LC	15	MC	10	SC	10	MG
12.4	108.24	0.00	65.9	65	LC	15	MC	10	SC	10	MG
13	107.48	0.00	65.9	65	LC	15	MC	10	SC	10	MG
24	101.76	0.00	65.9	65	LC	15	MC	10	SC	10	MG
24.4	101.04	0.00	65.9	65	LC	15	MC	10	SC	10	MG
27.3	99.86	0.00	65.9	65	LC	15	MC	10	SC	10	MG
28.7	99.83	0.00	65.9	65	LC	15	MC	10	SC	10	MG
29.4	98.98	0.00	65.9	65	LC	15	MC	10	SC	10	MG
29.7	98.98	0.21	65.9	65	LC	15	MC	10	SC	10	MG
30.4	99.87	0.00	76.8	50	LB	30	SB	15	LC	5	sand
32	98.73	0.31	76.8	50	LB	30	SB	15	LC	5	sand
34	98.68	0.26	76.8	50	LB	30	SB	15	LC	5	sand
36	98.83	0.53	76.8	50	LB	30	SB	15	LC	5	sand
38	98.33	0.15	76.8	50	LB	30	SB	15	LC	5	sand
40	97.48	0.49	76.8	50	LB	30	SB	15	LC	5	sand
42	96.63	0.56	76.8	50	LB	30	SB	15	LC	5	sand
44.4	97.13	0.78	76.8	50	LB	30	SB	15	LC	5	sand
46.1	98.13	0.86	76.8	50	LB	30	SB	15	LC	5	sand
47.9	97.98	1.27	76.8	50	LB	30	SB	15	LC	5	sand
50	96.33	0.62	76.8	50	LB	30	SB	15	LC	5	sand
52	96.83	0.34	76.8	50	LB	30	SB	15	LC	5	sand
54	97.28	0.12	76.8	50	LB	30	SB	15	LC	5	sand
56	96.48	0.09	76.8	50	LB	30	SB	15	LC	5	sand
58.5	97.33	0.65	76.9	70	LB	15	SB	10	LC	5	sand
60	97.03	0.87	76.9	70	LB	15	SB	10	LC	5	sand
62	96.93	1.31	76.9	70	LB	15	SB	10	LC	5	sand
64	97.83	2.33	76.9	70	LB	15	SB	10	LC	5	sand
66	97.23	1.22	76.9	70	LB	15	SB	10	LC	5	sand
68	98.28	1.38	76.9	70	LB	15	SB	10	LC	5	sand
70	97.48	1.71	76.9	70	LB	15	SB	10	LC	5	sand
72	97.13	2.25	76.9	70	LB	15	SB	10	LC	5	sand
73	99.30	0.00	76.9	70	LB	15	SB	10	LC	5	sand
74	99.23	2.56	76.9	70	LB	15	SB	10	LC	5	sand
75.9	98.03	1.47	76.9	70	LB	15	SB	10	LC	5	sand
80.3	99.75	0.00	74.9	75	BR	10	sand	10	MG	5	SC
82.2	99.28	0.60	74.9	75	BR	10	sand	10	MG	5	SC
84	98.88	-0.11	74.9	75	BR	10	sand	10	MG	5	SC
84.7	99.09	0.00	74.9	75	BR	10	sand	10	MG	5	SC
85.4	99.14	0.00	74.9	75	BR	10	sand	10	MG	5	SC
86	99.23	-0.11	74.9	75	BR	10	sand	10	MG	5	SC
88	99.38	-0.08	74.9	75	BR	10	sand	10	MG	5	SC
91.6	99.33	-0.08	47.7	60	sand	15	SB	15	LB	10	SC
93	99.52	0.00	47.7	60	sand	15	SB	15	LB	10	SC
93.9	99.83	0.00	47.7	60	sand	15	SB	15	LB	10	SC
99.8	100.67	0.00	47.7	60	sand	15	SB	15	LB	10	SC
101.8	102.64	0.00	47.7	60	sand	15	SB	15	LB	10	SC
103.5	101.88	0.00	46.8	80	sand	15	SC	5	MG	5	LG
116.4	102.33	0.00	46.8	80	sand	15	SC	5	MG	5	LG
125.7	103.68	0.00	64.6	40	LC	30	sand	20	LG	10	OM
136.7	104.95	0.00	74.6	40	sand	35	SB	25	OM		
140.7	104.99	0.00	74.6	40	sand	35	SB	25	OM		
143.5	105.92	0.00	74.6	40	sand	35	SB	25	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 7

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7	110.66	0.00	64.6	30	sand	35	LC	20	SB	15	SC
15.7	109.69	0.00	64.6	30	sand	35	LC	20	SB	15	SC
22.5	107.37	0.00	00.4	40	SB	35	OM	20	LC	5	MC
25	104.52	0.00	76.6	50	SB	25	LC	10	LG	15	SC
34.5	102.98	0.00	76.6	50	SB	25	LC	10	LG	15	SC
36.5	102.76	0.00	76.6	50	SB	25	LC	10	LG	15	SC
42.5	101.22	0.00	76.6	50	SB	25	LC	10	LG	15	SC
43.5	100.20	0.00	76.6	50	SB	25	LC	10	LG	15	SC
46.5	101.64	0.00	74.9	50	LB	40	SB	5	MG	5	sand
47	101.64	0.00	74.9	50	LB	40	SB	5	MG	5	sand
48.1	98.20	0.60	74.9	50	LB	40	SB	5	MG	5	sand
49.1	98.10	0.84	74.9	50	LB	40	SB	5	MG	5	sand
50.1	97.20	0.92	74.9	50	LB	40	SB	5	MG	5	sand
51.1	97.40	1.62	74.9	50	LB	40	SB	5	MG	5	sand
52.1	97.60	2.46	74.9	50	LB	40	SB	5	MG	5	sand
53.1	97.90	2.01	74.9	50	LB	40	SB	5	MG	5	sand
54.1	97.80	1.64	74.9	50	LB	40	SB	5	MG	5	sand
55.1	97.50	1.51	74.9	50	LB	40	SB	5	MG	5	sand
56.1	97.60	0.68	74.9	50	LB	40	SB	5	MG	5	sand
57.1	97.90	0.43	74.9	50	LB	40	SB	5	MG	5	sand
58.1	97.20	1.71	74.9	50	LB	40	SB	5	MG	5	sand
59.1	98.40	1.30	67.6	30	SB	30	LC	30	MC	10	LB
60	100.47	0.00	67.6	30	SB	30	LC	30	MC	10	LB
62.1	98.20	1.99	67.6	30	SB	30	LC	30	MC	10	LB
63.1	98.20	1.18	67.6	30	SB	30	LC	30	MC	10	LB
64.1	98.60	2.25	67.6	30	SB	30	LC	30	MC	10	LB
65.1	98.20	1.72	67.6	30	SB	30	LC	30	MC	10	LB
66.1	98.10	-0.12	67.6	30	SB	30	LC	30	MC	10	LB
67.1	98.80	-0.30	67.6	30	SB	30	LC	30	MC	10	LB
68.1	98.40	0.02	67.6	30	SB	30	LC	30	MC	10	LB
69.1	98.70	2.76	67.6	30	SB	30	LC	30	MC	10	LB
70.1	98.60	3.00	67.6	30	SB	30	LC	30	MC	10	LB
71.1	98.30	3.60	67.6	30	SB	30	LC	30	MC	10	LB
72.1	98.60	4.92	67.6	30	SB	30	LC	30	MC	10	LB
73.1	99.00	-0.62	67.6	30	SB	30	LC	30	MC	10	LB
74.1	98.90	0.84	67.6	30	SB	30	LC	30	MC	10	LB
76	100.17	0.00	67.6	30	SB	30	LC	30	MC	10	LB
77.1	99.00	0.30	67.6	30	SB	30	LC	30	MC	10	LB
78.1	99.00	0.49	67.6	30	SB	30	LC	30	MC	10	LB
79.4	100.45	0.00	76.5	50	SB	25	LC	20	SC	5	MG
81.1	99.60	2.95	76.5	50	SB	25	LC	20	SC	5	MG
82.1	99.30	2.67	76.5	50	SB	25	LC	20	SC	5	MG
82.4	99.30	0.00	76.5	50	SB	25	LC	20	SC	5	MG
83.1	98.60	-0.09	76.5	50	SB	25	LC	20	SC	5	MG
84.1	98.90	0.92	76.5	50	SB	25	LC	20	SC	5	MG
85.1	98.60	0.30	76.5	50	SB	25	LC	20	SC	5	MG
87.8	100.44	0.00	76.5	50	SB	25	LC	20	SC	5	MG
89.1	99.60	-0.06	76.5	50	SB	25	LC	20	SC	5	MG
90.1	99.70	0.05	76.5	50	SB	25	LC	20	SC	5	MG
91.7	101.55	0.00	76.5	50	SB	25	LC	20	SC	5	MG
92.8	100.69	0.00	76.5	50	SB	25	LC	20	SC	5	MG
93.1	99.70	1.26	76.5	50	SB	25	LC	20	SC	5	MG
94.6	100.20	0.00	00.4	70	LB	20	SB	10	LC		
96	101.71	0.00	00.4	70	LB	20	SB	10	LC		
102	102.66	0.00	00.4	70	LB	20	SB	10	LC		
104	100.88	0.00	00.4	70	LB	20	SB	10	LC		
107.8	102.55	0.00	67.6	25	SC	25	LC	35	SB	15	MG
112.7	101.95	0.00	67.6	25	SC	25	LC	35	SB	15	MG
114	102.56	0.00	67.6	25	SC	25	LC	35	SB	15	MG
117	104.31	0.00	67.6	25	SC	25	LC	35	SB	15	MG
120.5	102.94	0.00	67.6	25	SC	25	LC	35	SB	15	MG
124.4	104.03	0.00	67.6	25	SC	25	LC	35	SB	15	MG
133	108.03	0.00	67.6	25	SC	25	LC	35	SB	15	MG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 8

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
0.6	99.22	0.00	00.4	90	sand	10	OM				
4.6	97.87	0.00	00.4	90	sand	10	OM				
6.5	97.00	0.00	00.4	90	sand	10	OM				
7.7	96.31	0.00	00.4	90	sand	10	OM				
9.5	95.56	0.00	00.4	90	sand	10	OM				
13.6	95.66	0.48	46.9	80	sand	5	LG	10	SC	5	SB
18.8	96.75	0.00	46.9	80	sand	5	LG	10	SC	5	SB
19.1	95.41	0.25	46.9	80	sand	5	LG	10	SC	5	SB
23.5	96.25	0.00	46.9	80	sand	5	LG	10	SC	5	SB
25.1	95.81	0.36	46.9	80	sand	5	LG	10	SC	5	SB
31.1	94.61	0.57	46.9	90	sand	10	LC				
34.8	95.01	0.03	46.9	90	sand	10	LC				
36.6	95.50	0.00	46.9	90	sand	10	LC				
38	97.08	0.00	00.4	60	sand	20	WD	10	LC	10	SB
50	97.11	0.00	00.4	60	sand	20	WD	10	LC	10	SB
56.1	96.31	0.00	00.4	60	sand	20	WD	10	LC	10	SB
59.7	96.79	0.00	00.4	60	sand	20	WD	10	LC	10	SB
61.1	95.66	-0.04	00.4	60	sand	20	WD	10	LC	10	SB
64.1	95.41	0.00	64.6	40	LC	30	SB	30	sand		
67.4	95.31	0.59	64.6	40	LC	30	SB	30	sand		
70.6	95.21	0.61	64.6	40	LC	30	SB	30	sand		
73.4	95.06	0.95	64.6	40	LC	30	SB	30	sand		
76.4	95.41	0.72	64.6	40	LC	30	SB	30	sand		
79.4	94.86	0.49	64.6	40	LC	30	SB	30	sand		
82.4	94.91	0.92	64.6	40	LC	30	SB	30	sand		
85.4	94.91	0.31	64.6	55	LC	40	sand	5	SB		
88.4	94.71	0.70	64.6	55	LC	40	sand	5	SB		
91.4	94.71	0.44	64.6	55	LC	40	sand	5	SB		
94.4	94.76	0.56	64.6	55	LC	40	sand	5	SB		
98	94.31	0.85	64.6	55	LC	40	sand	5	SB		
101	94.81	1.38	64.6	55	LC	40	sand	5	SB		
104	94.31	0.91	64.6	55	LC	40	sand	5	SB		
107	94.01	0.46	64.6	55	LC	40	sand	5	SB		
110	94.01	0.27	64.6	55	LC	40	sand	5	SB		
113	94.11	1.49	64.6	55	LC	40	sand	5	SB		
116	94.31	1.38	64.6	55	LC	40	sand	5	SB		
119	95.51	-0.23	74.9	80	SB	10	LC	10	sand		
122	95.01	0.78	74.9	80	SB	10	LC	10	sand		
125	94.91	0.28	74.9	80	SB	10	LC	10	sand		
128	94.81	0.93	74.9	80	SB	10	LC	10	sand		
131	95.31	1.17	74.9	80	SB	10	LC	10	sand		
134	95.71	0.54	74.9	80	SB	10	LC	10	sand		
135.5	96.60	0.00	74.9	80	SB	10	LC	10	sand		
136.4	96.60	0.00	76.9	45	LB	45	SB	5	OM	5	LC
137	95.51	0.25	76.9	45	LB	45	SB	5	OM	5	LC
139	97.06	0.00	76.9	45	LB	45	SB	5	OM	5	LC
140.5	97.06	0.00	76.9	45	LB	45	SB	5	OM	5	LC
143	95.61	0.71	76.9	45	LB	45	SB	5	OM	5	LC
146	95.61	-0.04	76.9	45	LB	45	SB	5	OM	5	LC
147	96.43	0.00	76.9	45	LB	45	SB	5	OM	5	LC
149	96.31	0.00	47.7	50	sand	20	LC	25	LB	5	LG
151	97.75	0.00	47.7	50	sand	20	LC	25	LB	5	LG
157.4	97.69	0.00	47.7	50	sand	20	LC	25	LB	5	LG
166.5	99.33	0.00	46.9	90	sand	10	LC				
174.3	100.63	0.00	46.9	90	sand	10	LC				
178	101.35	0.00	46.9	90	sand	10	LC				
182	102.05	0.00	46.9	90	sand	10	LC				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 9

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-7	98.33	0.00	44.9	100	sand						
12.7	99.06	0.00	00.4	100	sand						
18.9	96.41	0.00	00.4	100	sand						
22.9	94.61	0.54	45.6	40	sand	30	LC	30	SG		
26.9	94.01	0.59	45.6	40	sand	30	LC	30	SG		
30.6	94.81	0.43	45.6	40	sand	30	LC	30	SG		
30.8	95.73	0.00	45.6	40	sand	30	LC	30	SG		
31.6	96.62	0.00	45.6	40	sand	30	LC	30	SG		
34.9	95.21	0.19	45.6	40	sand	30	LC	30	SG		
38.9	95.81	0.02	45.6	50	sand	30	SG	20	LB		
41	96.41	0.00	47.9	90	sand	10	OM				
42.8	96.56	0.00	47.9	90	sand	10	OM				
48	96.65	0.00	47.9	90	sand	10	OM				
55	96.76	0.00	47.6	60	sand	40	SB				
60	96.84	0.00	47.6	60	sand	40	SB				
65	96.92	0.00	00.4	80	sand	20	LB				
65.9	96.41	0.00	00.4	80	sand	20	LB				
68.9	95.81	-0.02	47.7	70	sand	30	SB				
71.9	95.51	0.09	47.7	70	sand	30	SB				
74.9	95.11	0.02	47.7	70	sand	30	SB				
77.9	94.71	0.30	47.8	80	sand	20	SB				
80.9	94.61	0.50	47.8	80	sand	20	SB				
83.9	94.41	0.39	47.8	80	sand	20	SB				
86.9	94.21	0.48	47.7	70	sand	30	SB				
89.9	94.01	0.42	64.7	30	sand	30	SC	30	MC	10	
92.9	93.81	0.41	64.7	30	sand	30	SC	30	MC	10	
95.9	94.11	0.44	64.7	30	sand	30	SC	30	MC	10	
98.9	93.61	0.45	64.7	30	sand	30	SC	30	MC	10	
101.9	93.71	0.71	64.7	30	sand	30	SC	30	MC	10	
104.9	94.51	0.83	64.7	30	sand	30	SC	30	MC	10	
107.9	94.01	0.87	64.7	30	sand	30	SC	30	MC	10	
110.9	95.11	0.71	64.7	30	sand	30	SC	30	MC	10	
113.9	93.61	0.71	76.9	90	LB	5	MC	5	SC		
116.5	93.41	0.69	64.8	60	SC	20	sand	20	MC		
119.5	93.81	0.77	64.8	60	SC	20	sand	20	MC		
122.5	93.91	0.60	64.8	60	SC	20	sand	20	MC		
125.5	94.71	-0.08	64.8	60	SC	20	sand	20	MC		
128.5	94.86	0.13	46.8	80	sand	10	MC	10	SC		
131.5	94.91	0.37	46.8	80	sand	10	MC	10	SC		
134.5	95.46	0.62	46.8	80	sand	10	MC	10	SC		
137.5	94.66	0.48	46.8	80	sand	10	MC	10	SC		
140.5	95.01	0.63	47.5	40	LB	40	sand	20	MC		
143.5	95.31	0.41	47.5	40	LB	40	sand	20	MC		
147.2	96.41	0.00	47.5	40	LB	40	sand	20	MC		
149	96.98	0.00	47.5	40	LB	40	sand	20	MC		
158.9	99.20	0.00	47.5	40	LB	40	sand	20	MC		
168	101.12	0.00	47.5	40	LB	40	sand	20	MC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 10

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
10	95.17	0.00	77.9	100	BR						
20	95.56	0.00	77.9	100	BR						
28	94.78	0.00	77.9	100	BR						
32.1	92.67	0.00	77.9	100	BR						
40	91.80	0.00	64.8	40	MC	30	SC	20	sand	10	OM
52	91.11	0.00	67.8	50	LC	20	SB	20	MC	10	SG
54.6	90.96	0.00	67.8	50	LC	20	SB	20	MC	10	SG
57	89.80	0.00	65.6	30	SB	30	SG	20	MC	20	LC
58.7	89.27	0.00	65.6	30	SB	30	SG	20	MC	20	LC
59.4	89.18	0.00	65.6	30	SB	30	SG	20	MC	20	LC
61.7	89.02	0.00	65.6	30	SB	30	SG	20	MC	20	LC
63.2	88.92	0.60	65.6	30	SB	30	SG	20	MC	20	LC
64.7	88.57	0.03	65.8	40	SC	30	MC	20	SG	10	sand
68.9	88.37	0.00	67.6	30	SC	30	MC	20	SB	20	LB
69.7	88.12	0.28	45.8	80	sand	15	SG	5	MC		
71.2	87.67	1.04	45.8	80	sand	15	SG	5	MC		
72.7	87.57	0.46	45.8	80	sand	15	SG	5	MC		
74.2	88.32	0.41	64.6	40	sand	20	LC	20	SC	20	MC
75.7	87.52	1.15	64.6	40	sand	20	LC	20	SC	20	MC
77.2	87.82	2.11	64.6	40	sand	20	LC	20	SC	20	MC
78.7	87.57	2.27	64.6	40	sand	20	LC	20	SC	20	MC
80.2	86.97	1.22	64.6	40	sand	20	LC	20	SC	20	MC
81.9	88.37	1.46	64.6	40	sand	20	LC	20	SC	20	MC
83.2	88.42	1.66	67.6	40	SB	30	LC	20	MC	10	SC
84.6	86.62	1.94	67.6	40	SB	30	LC	20	MC	10	SC
85.7	86.87	4.35	67.6	40	SB	30	LC	20	MC	10	SC
87.2	87.87	4.73	67.6	40	SB	30	LC	20	MC	10	SC
88.7	88.57	4.22	67.6	40	SB	30	LC	20	MC	10	SC
90.2	86.82	3.04	76.8	80	SB	20	LC				
91.7	87.27	1.86	76.8	80	SB	20	LC				
93.2	87.02	1.19	76.8	80	SB	20	LC				
94.7	87.72	1.90	76.8	80	SB	20	LC				
96.2	87.92	1.04	76.8	80	SB	20	LC				
97.4	87.77	0.47	76.8	80	SB	20	LC				
99.2	88.32	0.86	76.8	80	SB	20	LC				
101.3	89.80	0.00	76.8	80	SB	20	LC				
102.3	89.80	0.00	76.8	80	SB	20	LC				
103.9	88.92	3.83	76.8	80	SB	20	LC				
104.9	88.97	2.93	76.8	80	SB	20	LC				
106	89.18	0.00	76.8	80	SB	20	LC				
109	91.85	0.00	76.8	80	SB	20	LC				
115.6	92.71	0.00	77.9	100	RB						
116.9	88.98	0.00	77.9	100	RB						
117.5	88.82	0.58	77.9	100	RB						
119.9	89.27	0.00	54.7	30	LG	30	SG	20	MC	20	sand
123.3	91.56	0.00	77.9	100	RB						
125	90.02	0.00	67.7	30	SB	30	SC	20	LC	20	MC
127.5	90.02	0.00	67.7	30	SB	30	SC	20	LC	20	MC
130.7	92.04	0.00	67.7	30	SB	30	SC	20	LC	20	MC
132	92.04	0.00	67.7	30	SB	30	SC	20	LC	20	MC
135.2	90.19	0.00	64.8	40	SC	30	MC	20	sand	10	LG
136.5	90.19	0.00	64.8	40	SC	30	MC	20	sand	10	LG
138.2	91.87	0.00	64.8	40	SC	30	MC	20	sand	10	LG
144.7	92.16	0.00	64.8	40	SC	30	MC	20	sand	10	LC
150	93.65	0.00	64.8	40	SC	30	MC	20	sand	10	LC
157	95.15	0.00	64.8	40	SC	30	MC	20	sand	10	LC
163	97.09	0.00	76.6	60	SB	30	LC	10	SC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 11

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-10	100.00	0.00	00.4	30.00	SB	30	LB	20	LC	20	OM
4.5	94.45	0.00	00.4	30.00	SB	30	LB	20	LC	20	OM
7	94.90	0.00	00.4	30.00	SB	30	LB	20	LC	20	OM
15.8	93.80	0.00	00.4	30.00	SB	30	LB	20	LC	20	OM
21.9	93.30	0.00	00.4	30.00	SB	30	LB	20	LC	20	OM
36.5	92.30	0.00	00.4	60.00	sand	40	LB				
39.8	91.90	0.00	00.4	60.00	sand	40.00	LB				
41.5	94.37	0.00	00.4	60.00	sand	40.00	LB				
47.5	92.94	0.00	74.9	90.00	LB	10.00	sand				
59.8	93.25	0.00	47.5	50.00	LB	50.00	sand				
60.5	92.60	0.00	47.5	50.00	LB	50.00	sand				
65.6	92.37	0.22	76.8	80.00	SB	20.00	LC				
66.7	92.67	0.54	76.8	80.00	SB	20.00	LC				
73.1	93.07	-0.32	76.8	80.00	SB	20.00	LC				
75.1	92.17	1.16	76.8	80.00	SB	20.00	LC				
77.8	91.77	1.00	76.8	80.00	SB	20.00	LC				
79.1	92.37	1.46	76.8	80.00	SB	20.00	LC				
81.1	92.37	1.47	76.8	80.00	SB	20.00	LC				
83.1	92.47	3.06	76.8	80.00	SB	15.00	LC	5.00	WD		
85.1	92.27	2.78	76.8	80.00	SB	15.00	LC	5.00	WD		
87.1	92.17	1.56	76.8	80.00	SB	15.00	LC	5.00	WD		
89.1	92.37	1.40	76.8	80.00	SB	15.00	LC	5.00	WD		
91.1	92.87	2.11	76.8	80.00	SB	15	LC	5	WD		
93.1	92.57	1.97	76.8	80.00	SB	15	LC	5	WD		
95.1	92.57	1.11	76.8	80.00	SB	15	LC	5	WD		
95.4	94.79	0.00	76.8	80.00	SB	15	LC	5	WD		
96.4	94.79	0.00	76.8	80.00	SB	15	LC	5	WD		
97.1	92.57	2.16	76.8	80.00	SB	15.00	LC	5.00	WD		
99.1	92.47	3.37	76.8	80.00	SB	15.00	LC	5.00	WD		
100	93.70	0.00	76.8	80.00	SB	15.00	LC	5.00	WD		
100.5	93.70	0.00	76.8	80.00	SB	15.00	LC	5.00	WD		
101.1	92.17	3.74	76.8	80.00	SB	15.00	LC	5.00	WD		
103.1	91.77	2.13	76.8	80.00	SB	15.00	LC	5.00	WD		
105.1	91.47	1.82	76.8	80.00	SB	15.00	LC	5.00	WD		
107.1	91.37	-0.09	76.8	80.00	SB	15.00	LC	5.00	WD		
109.1	91.47	1.07	77.9	70.00	LB	30.00	SB				
111.1	91.37	1.94	77.9	70.00	LB	30.00	SB				
111.2	94.80	0.00	77.9	70.00	LB	30	SB				
112	94.80	0.00	77.9	70.00	LB	30	SB				
113.1	91.37	2.20	77.9	70.00	LB	30	SB				
115.1	91.57	1.43	77.9	70.00	LB	30	SB				
117.1	91.37	1.11	77.9	70.00	LB	30	SB				
117.5	93.49	0.00	77.9	70.00	LB	30	SB				
118.4	93.49	0.00	77.9	70.00	LB	30	SB				
119.1	91.67	1.62	74.8	40.00	SB	30	LB	15	sand	15	LC
121.1	92.47	1.28	74.8	40.00	SB	30	LB	15	sand	15	LC
123.1	93.07	0.23	74.8	40.00	SB	30	LB	15	sand	15	LC
124	93.73	0.00	74.8	40.00	SB	30	LB	15	sand	15	LC
125.1	93.57	0.00	74.8	40.00	SB	30.00	LB	15.00	sand	15	LC
126.3	95.90	0.00	74.8	40.00	SB	30.00	LB	15.00	sand	15	LC
133	94.80	0.00	74.8	40.00	SB	30.00	LB	15.00	sand	15	LC
136.5	98.38	0.00	76.9	95.00	LB	3.00	SB	2.00	LC		
141.5	95.48	0.00	76.9	95.00	LB	3.00	SB	2.00	LC		
146	102.45	0.00	76.9	95.00	LB	3.00	SB	2.00	LC		
153.9	95.26	0.00	74.6	30.00	LB	30.00	sand	20.00	SB	20	LC
163	95.06	0.00	74.6	30.00	LB	30.00	sand	20.00	SB	20	LC
166.5	93.76	0.00	74.6	30.00	LB	30.00	sand	20.00	SB	20	LC
170	95.26	0.00	74.6	30.00	LB	30	sand	20	SB	20	LC
176.5	96.26	0.00	74.6	30.00	LB	30	sand	20	SB	20	LC
183	97.26	0.00	74.6	30.00	LB	30	sand	20	SB	20	LC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 12

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
14.8	99.04	0.00	47.8	80	sand	10	SB	10	LB		
23	97.97	0.00	47.8	80	sand	10	SB	10	LB		
33.7	96.38	0.00	65.6	30	LC	30	LG	30	MC	10	SG
41.4	94.90	0.00	65.6	30	LC	30	LG	30	MC	10	SG
55.9	95.27	0.00	77.9	60	LB	40	SB				
59	94.67	0.00	56.8	60	LG	20	SC	10	SG	10	LB
61.6	96.20	0.00	76.6	60	SB	20	MC	10	LC	10	SC
64.2	93.77	0.00	64.9	50	LC	30	MC	10	sand	10	SC
68.5	92.77	1.62	64.9	50	LC	30	MC	10	sand	10	SC
70.5	92.97	0.85	64.9	50	LC	30	MC	10	sand	10	SC
72.5	93.07	2.92	64.9	50	LC	30	MC	10	sand	10	SC
74.5	92.57	2.02	66.9	80	MC	10	SC	10	LC		
76.5	92.67	2.79	66.9	80	MC	10	SC	10	LC		
78.5	92.87	4.61	66.9	80	MC	10	SC	10	LC		
80.5	92.57	3.08	64.7	50	MC	30	sand	20	SC		
82.5	92.27	0.47	64.7	50	MC	30	sand	20	SC		
84.5	92.87	0.28	64.7	50	MC	30	sand	20	SC		
86.5	92.57	0.91	64.7	30	sand	30	SC	30	MC	10	SG
88.5	92.97	0.03	67.8	50	MC	20	SC	20	SB	10	sand
91.8	94.25	0.00	67.8	50	MC	20	SC	20	SB	10	sand
92.5	93.77	0.00	66.9	50	MC	20	LC	30	SC		
94.5	93.07	1.33	66.9	50	MC	20	LC	30	SC		
96.5	92.97	1.51	66.9	50	MC	20	LC	30	SC		
98.5	93.27	2.21	66.9	50	MC	20	LC	30	SC		
99.2	93.30	0.00	66.9	50	MC	20	LC	30	SC		
99.7	94.68	0.00	66.9	50	MC	20	LC	30	SC		
100	93.30	0.00	66.9	50	MC	20	LC	30	SC		
100.5	93.07	2.44	64.9	40	SC	40	MC	10	LC	10	sand
102.5	93.17	1.72	64.9	40	SC	40	MC	10	LC	10	sand
104.5	92.87	1.94	67.7	70	MC	30	SB				
106.5	92.87	0.18	67.7	70	MC	30	SB				
108.5	92.57	0.96	67.7	70	MC	30	SB				
110.5	92.27	1.42	67.7	70	MC	30	SB				
112.5	91.87	2.70	67.7	70	MC	30	SB				
114.5	91.77	2.97	67.7	70	MC	30	SB				
116.5	92.37	5.98	66.9	70	MC	20	SC	10	LC		
118.5	91.47	1.46	66.9	70	MC	20	SC	10	LC		
120.5	91.47	0.91	66.9	70	MC	20	SC	10	LC		
122.5	92.17	0.14	66.9	70	MC	20	SC	10	LC		
124.5	92.97	-0.23	77.9	100	RB						
125.3	93.30	0.00	77.9	100	RB						
127.7	96.57	0.00	77.9	100	RB						
133.5	98.59	0.00	76.8	80	SB	20	MC				
137	95.38	0.00	76.8	80	SB	20	MC				
141.4	96.90	0.00	66.9	50	MC	25	SC	25	LC		
145.3	96.05	0.00	00.4	40	sand	40	SC	10	MC	10	SG
154.5	94.79	0.00	00.4	100	LB						
157.1	95.67	0.00	67.9	60	MC	20	SC	10	LC	10	SB
159.5	98.16	0.00	67.9	60	MC	20	SC	10	LC	10	SB
161.5	95.95	0.00	47.9	90	sand	10	BR				
165.6	95.87	0.00	47.9	90	sand	10	BR				
171.2	97.05	0.00	00.4	90	sand	10	BR				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-4. Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Study Site Topography, Substrate, and Velocity Data.

Transect 1

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-12	96.00	0.00	00.4	75	sand	15	OM	5	SG	5	SB
-8.9	93.20	0.00	00.4	75	sand	15	OM	5	SG	5	SB
-0.9	92.20	0.00	00.4	75	sand	15	OM	5	SG	5	SB
4.1	93.20	0.00	00.4	75	sand	15	OM	5	SG	5	SB
5.7	92.63	0.00	74.6	50	SB	40	sand	10	OM		
8.2	92.28	0.00	74.6	50	SB	40	sand	10	OM		
9.5	91.70	0.00	74.6	50	SB	40	sand	10	OM		
11.9	91.48	0.00	67.5	50	MC	30	SB	15	OM	5	SG
14	92.71	0.00	67.5	50	MC	30	SB	15	OM	5	SG
15.7	91.07	0.51	67.8	80	MC	15	SB	5	SG		
18.7	91.07	1.12	67.8	80	MC	15	SB	5	SG		
21.7	90.88	1.49	67.8	80	MC	15	SB	5	SG		
24.2	91.18	1.14	67.8	80	MC	15	SB	5	SG		
26.8	92.24	0.00	76.6	60	SB	20	LC	20	MC		
28.2	90.78	1.74	76.6	60	SB	20	LC	20	MC		
30.2	90.93	0.75	76.6	60	SB	20	LC	20	MC		
32.2	91.48	2.29	76.6	60	SB	20	LC	20	MC		
34.2	90.57	1.29	67.8	40	MC	30	SC	20	LB	10	SG
36.2	90.18	2.25	67.8	40	MC	30	SC	20	LB	10	SG
38.2	89.82	1.15	67.8	40	MC	30	SC	20	LB	10	SG
40.2	89.88	1.58	67.8	40	MC	30	SC	20	LB	10	SG
42.7	89.68	1.42	67.8	40	MC	30	SC	20	LB	10	SG
45.2	89.68	1.61	67.8	40	MC	30	SC	20	LB	10	SG
47.7	90.03	1.36	65.8	40	LC	30	MC	20	SG	10	sand
50.2	90.68	1.35	65.8	40	LC	30	MC	20	SG	10	sand
52.8	90.78	0.39	65.8	40	LC	30	MC	20	SG	10	sand
55	90.73	0.30	65.8	40	LC	30	MC	20	SG	10	sand
57.5	90.53	1.52	65.8	40	LC	30	MC	20	SG	10	sand
60.8	91.23	0.68	65.8	40	LC	30	MC	20	SG	10	sand
61	91.98	0.00	65.8	40	LC	30	MC	20	SG	10	sand
63	93.25	0.00	65.8	40	LC	30	MC	20	SG	10	sand
64.2	93.25	0.00	65.8	40	LC	30	MC	20	SG	10	sand
66.1	91.18	2.63	76.6	50	SB	30	MC	20	SG		
67.9	91.53	0.26	76.6	50	SB	30	MC	20	SG		
68.4	92.30	0.00	76.6	50	SB	30	MC	20	SG		
70.4	91.78	0.00	76.6	50	SB	30	MC	20	SG		
71.1	91.43	1.70	76.6	50	SB	30	MC	20	SG		
73	92.69	0.00	76.9	95	LB	5	LC				
74.8	92.00	0.00	76.9	95	LB	5	LC				
76.4	93.93	0.00	76.9	95	LB	5	LC				
77.1	93.93	0.00	76.9	95	LB	5	LC				
78.6	92.76	0.00	76.9	95	LB	5	LC				
80	94.17	0.00	76.9	95	LB	5	LC				
80.8	94.17	0.00	76.9	95	LB	5	LC				
81.9	91.80	0.00	76.9	95	LB	5	LC				
84.7	91.32	-0.02	56.5	50	SG	30	LC	20	MC		
85.8	91.28	0.15	56.5	50	SG	30	LC	20	MC		
86.7	91.43	-0.16	56.5	50	SG	30	LC	20	MC		
88.3	91.58	0.00	56.5	50	SG	30	LC	20	MC		
88.8	92.28	0.00	76.6	60	SB	40	LC				
89.2	92.64	0.00	76.6	60	SB	40	LC				
95.4	94.69	0.00	64.6	50	LC	20	sand	20	silt	10	OM
108	95.96	0.00	46.5	50	sand	30	MC	20	LC		
124	96.58	0.00	44.9	100	sand						
150	98.22	0.00	44.9	100	sand						
155	98.97	0.00	47.5	50	sand	30	WD	20	SB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 2

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-2.3	95.45	0.00	45.9	90	sand	5	LB	5	LG		
8.3	94.18	0.00	45.9	90	sand	5	LB	5	LG		
11.7	93.33	0.00	45.9	90	sand	5	LB	5	LG		
16.9	92.54	0.00	46.9	80	sand	10	SB	10	SC		
18.3	92.18	0.00	46.9	80	sand	10	SB	10	SC		
19.2	92.14	0.15	46.9	80	sand	10	SB	10	SC		
20.7	91.78	0.00	46.9	80	sand	10	SB	10	SC		
22.2	91.74	1.22	64.9	65	MC	25	LC	10	sand		
25.2	91.34	1.45	64.9	65	MC	25	LC	10	sand		
28.2	91.54	1.50	64.9	65	MC	25	LC	10	sand		
31.2	91.24	1.41	64.9	65	MC	25	LC	10	sand		
34.2	90.94	0.70	64.9	65	MC	25	LC	10	sand		
37.2	91.04	1.17	64.9	65	MC	25	LC	10	sand		
40.2	90.54	0.21	64.9	65	MC	25	LC	10	sand		
43.2	90.44	1.37	64.9	65	MC	25	LC	10	sand		
46.2	90.34	1.03	64.9	65	MC	25	LC	10	sand		
49.2	89.94	1.11	64.9	65	MC	25	LC	10	sand		
52.2	90.54	0.17	64.9	65	MC	25	LC	10	sand		
55.2	89.84	0.78	77.9	100	LB						
58.2	90.84	0.97	64.7	70	LC	30	sand				
61.2	90.04	0.69	77.9	100	LB						
64.2	90.54	0.89	64.7	60	LC	30	sand	10	SB		
67.2	89.94	0.78	64.7	60	LC	30	sand	10	SB		
70.2	90.04	0.67	64.7	60	LC	30	sand	10	SB		
73.2	91.14	0.95	77.9	100	SB						
76.2	90.54	0.12	77.9	100	SB						
79.2	90.74	0.55	67.8	80	MC	20	SB				
82.2	91.24	0.30	77.9	100	SB						
85.2	91.14	0.31	66.9	60	LC	40	MC				
87.2	91.78	0.00	66.9	60	LC	40	MC				
87.6	92.21	0.00	47.9	85	sand	10	SB	5	LC		
88.2	92.54	0.00	47.9	85	sand	10	SB	5	LC		
88.6	92.58	0.00	47.9	85	sand	10	SB	5	LC		
90.6	93.17	0.00	47.9	85	sand	10	SB	5	LC		
109	95.34	0.00	74.8	60	SB	20	OM	15	sand	5	LWD
124	98.34	0.00	74.8	60	SB	20	OM	15	sand	5	LWD
145	98.50	0.00	47.6	50	sand	20	SB	20	LWD	10	LC
164	98.41	0.00	47.6	50	sand	20	SB	20	LWD	10	LC
169	98.63	0.00	47.6	50	sand	20	SB	20	LWD	10	LC
189	95.34	0.00	47.6	50	sand	20	SB	20	LWD	10	LC
212	97.44	0.00	47.6	50	sand	20	SB	20	LWD	10	LC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 3

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-17	110.66	0.00	74.7	70	SB	30	sand				
-3.2	100.56	0.00	74.7	70	SB	30	sand				
7.5	96.36	0.00	44.9	100	sand						
12.4	94.50	0.00	44.9	100	sand						
22.9	93.26	0.00	44.9	100	sand						
26.9	91.77	0.00	44.9	100	sand						
30.5	92.58	0.00	44.9	100	sand						
31.5	91.68	-0.05	44.9	100	sand						
34.5	91.58	-0.03	44.9	100	sand						
37.5	91.58	0.13	44.9	100	sand						
40.5	91.28	-0.06	44.9	100	sand						
43.5	90.98	-0.08	44.9	100	sand						
44.5	90.95	0.13	44.9	100	sand						
47.5	90.48	0.11	47.6	60	sand	40	LB				
50.5	89.76	0.07	47.6	60	sand	40	LB				
53.5	88.84	0.09	47.6	60	sand	40	LB				
56.5	87.83	0.08	47.6	60	sand	40	LB				
59.5	86.73	0.07	47.6	60	sand	40	LB				
62.5	85.45	0.07	64.6	40	sand	30	SC	30	MC		
65.5	84.29	0.14	64.6	40	sand	30	SC	30	MC		
68.5	83.23	0.29	64.6	40	sand	30	SC	30	MC		
71.5	82.32	0.22	64.6	40	sand	30	SC	30	MC		
74.5	81.56	0.40	64.7	60	MC	20	sand	20	SB		
77.5	81.07	0.43	64.7	60	MC	20	sand	20	SB		
80.5	81.11	0.34	64.7	60	MC	20	sand	20	SB		
83.5	81.10	0.43	64.7	60	MC	20	sand	20	SB		
86.5	81.75	0.42	67.6	50	MC	30	SB	20	sand		
89.5	82.53	0.27	67.6	50	MC	30	SB	20	sand		
92.5	83.22	0.20	67.6	50	MC	30	SB	20	sand		
95.5	83.92	0.14	47.5	40	SB	40	sand	20	MC		
98.5	84.46	0.14	64.9	60	MC	30	LC	10	sand		
101.5	87.22	0.16	64.9	60	MC	30	LC	10	sand		
104.5	88.23	0.18	64.9	60	MC	30	LC	10	sand		
107.5	88.94	0.04	76.6	50	LB	30	MC	10	sand	10	SC
108.8	90.58	0.00	76.6	50	LB	30	MC	10	sand	10	SC
111.8	91.88	-0.02	76.6	50	LB	30	MC	10	sand	10	SC
112.5	92.58	0.00	76.6	50	LB	30	MC	10	sand	10	SC
120.5	98.54	0.00	76.6	50	LB	30	MC	10	sand	10	SC
123	100.26	0.00	76.8	80	LB	20	LC				
126.8	99.43	0.00	76.8	80	LB	20	LC				
137.5	99.83	0.00	46.8	80	sand	20	LC				
147.4	99.70	0.00	46.9	90	sand	10	LC				
155.8	100.36	0.00	76.7	50	SB	30	LC	20	WD		
174.4	100.496	0	76.7	50	SB	30	LC	20	WD		
177.3	100.406	0	76.7	50	SB	30	LC	20	WD		
178.5	99.116	0	47.8	75	sand	25	OM				
191	99.076	0	47.8	75	sand	25	OM				
195	99.486	0	47.8	75	sand	25	OM				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 4

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate								
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type	
-13.5	99.38	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
2	95.01	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
10.4	96.13	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
15	95.80	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
29.2	93.26	0.00	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
29.55	92.18	-0.04	0.00	67.9	40	MC	30	SC	20	LC	10.00	SB
33	92.60	0.00	0.00	77.9	60	LB	40	SB				
36.2	91.77	0.00	0.00	77.9	60	LB	40	SB				
37.05	91.58	-0.11	0.00	77.9	60	LB	40	SB				
37.55	90.29	0.13	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
37.85	89.34	0.12	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
39.55	86.06	0.21	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
41.05	83.48	0.28	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
42.55	80.92	0.44	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
44.05	80.48	0.51	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
45.55	80.08	0.56	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
47.05	79.89	0.51	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
48.55	80.15	0.51	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
50.05	80.55	0.54	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
51.55	80.92	0.61	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
53.05	81.32	0.60	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
54.55	81.79	0.53	0.00	76.7	40	LB	30	SB	15	LC	15.00	SC
56.05	82.50	0.43	0.00	76.9	90	LB	10	LC				
57.55	83.23	0.29	0.00	76.9	90	LB	10	LC				
59.05	83.87	0.23	0.00	76.9	90	LB	10	LC				
60.55	85.20	0.21	0.00	76.9	90	LB	10	LC				
62.05	86.63	0.15	0.00	76.9	90	LB	10	LC				
63.55	88.07	0.10	0.00	76.9	90	LB	10	LC				
65.05	89.06	-0.06	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
65.65	89.95	-0.15	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
65.75	90.18	-0.25	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
66.25	90.88	-0.26	0.00	65.6	40	SG	30	LC	20	MC	10.00	SC
66.75	90.78	-0.31	0.00	76.7	40	SB	30	LB	20	LC	10.00	MC
67.25	90.78	-0.31	0.00	76.7	40	SB	30	LB	20	LC	10.00	MC
67.75	90.78	-0.24	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
68.2	91.69	0.00	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
70.45	92.58	0.00	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
79.4	95.01	0.00	0.00	46.6	60	sand	30	LC	5	SC	5.00	SB
103	98.64	0.00	0.00	76.7	70	LB	20	MC	10	SC		
120	100.48	0.00	0.00	76.7	70	LB	20	MC	10	SC		
129	100.85	0.00	0.00	76.7	70	LB	20	MC	10	SC		
140	101.53	0.00	0.00	64.9	60	MC	20	LC	10	SG	10	sand
149.5	101.73	0.00	0.00	56.5	40	SG	30	SC	20	sand	10	MC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Substrate Type	Field Abbrev.	Size Range (in)
Permanent Vegetation (alders, willows, upland trees)		
silt and sand		<0.1 - 0.2
small, medium, large gravel	SG, MG, LG	0.2-3
small, medium, large cobble	SC, MC, LC	3-12
Other - organic material - leaf/detritus	OM	
(large) woody debris	LWD or WD	
small, large boulder	SB, LB	
rough bedrock (cobble/boulder consistency)	RB	
smooth bedrock	SmBr	

Substrate Type	Size Range (in)
Organic material - leaf/detritus	
Clay or silt	< 0.1
sand	0.1 - 0.2
small gravel	0.2 - 1.0
medium gravel	1 - 2
large gravel	2 - 3
small cobble	3 - 6
medium cobble	6 - 9
large cobble	9 - 12
small boulder	12 - 40
large boulder	> 40
smooth bedrock	
rough bedrock	

Transect 5

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-10	100.00	0.00	46.8	80	sand	10	SC	5	SB	5	MC
-5	96.17	0.00	46.8	80	sand	10	SC	5	SB	5	MC
0	95.09	0.00	46.8	80	sand	10	SC	5	SB	5	MC
1	95.51	0.00	46.8	80	sand	10	SC	5	SB	5	MC
13.2	94.55	0.00	46.8	80	sand	10	SC	5	SB	5	MC
21.9	93.94	0.00	46.8	80	sand	10	SC	5	SB	5	MC
23.6	93.00	0.00	46.8	80	sand	10	SC	5	SB	5	MC
24.9	93.44	-0.06	45.6	40	sand	30	SB	20	LG	10	MG
27.9	92.54	-0.32	45.6	40	sand	30	SB	20	LG	10	MG
30.9	93.34	0.16	45.6	40	sand	30	SB	20	LG	10	MG
33.9	92.64	1.82	45.6	40	sand	30	SB	20	LG	10	MG
36.9	92.14	2.37	45.6	40	sand	30	SB	20	LG	10	MG
39.9	92.14	2.94	77.9	100	LB						
42.9	92.44	1.65	77.9	100	LB						
45.9	92.74	0.23	77.9	100	LB						
48.9	92.74	3.10	57.5	40	LB	30	LG	10	SG		
51.9	92.34	2.93	57.5	40	LB	30	LG	10	SG		
54.9	91.64	2.38	76.6	60	SB	40	LC				
57.9	92.24	2.26	76.6	60	SB	40	LC				
60.9	92.04	1.43	76.6	60	SB	40	LC				
63.9	92.74	1.13	76.7	60	LB	20	LC	10	SC	10	SG
66.9	92.64	1.16	76.7	60	LB	20	LC	10	SC	10	SG
68.4	93.06	0.00	76.7	60	LB	20	LC	10	SC	10	SG
69.9	93.24	0.15	67.6	30	SB	40	MC	15	MG	15	sand
73	94.42	0.00	67.6	30	SB	40	MC	15	MG	15	sand
73.8	93.94	0.00	67.6	30	SB	40	MC	15	MG	15	sand
77.7	94.97	0.00	67.6	30	SB	40	MC	15	MG	15	sand
82	94.17	0.00	67.6	30	SB	40	MC	15	MG	15	sand
96	97.24	0.00	76.6	50	SB	30	LC	15	sand	5	WD
112	99.54	0.00	76.6	50	SB	30	LC	15	sand	5	WD
124	100.11	0.00	76.6	50	SB	30	LC	15	sand	5	WD
144	102.45	0.00	76.6	50	SB	30	LC	15	sand	5	WD
211	103.34	0.00	47.7	65	sand	15	OM	10	WD	5	MC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 6

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
4.5	101.77	0.00	44.9	100	sand						
5.5	101.66	0.00	44.9	100	sand						
13	100.99	0.00	76.7	70	SB	20	SC	10	MC		
21.1	97.95	0.00	66.9	50	LC	50	MC				
23.8	97.01	0.00	66.9	60	LC	40	MC				
24.9	96.41	0.00	66.9	60	LC	40	MC				
27	95.79	0.00	76.7	70	SB	30	MC				
27.2	96.21	0.95	76.7	70	SB	30	MC				
28.4	95.86	0.42	76.7	70	SB	30	MC				
30.7	95.81	1.54	76.7	70	SB	30	MC				
32.2	95.69	0.00	66.9	75	LC	25	MC				
33.6	95.76	2.91	66.9	75	LC	25	MC				
35.4	94.86	2.45	66.9	75	LC	25	MC				
36.7	94.71	1.06	66.9	75	LC	25	MC				
37.9	95.26	0.97	66.9	75	LC	25	MC				
38.9	94.96	1.72	66.9	75	LC	25	MC				
39.9	94.81	4.01	66.9	75	LC	25	MC				
42.4	95.31	3.22	66.9	75	LC	25	MC				
43.9	94.91	3.47	66.9	75	LC	25	MC				
45.4	94.81	4.39	66.9	75	LC	25	MC				
46.9	94.21	3.74	66.9	75	LC	25	MC				
48.4	94.41	3.75	66.9	75	LC	25	MC				
49.9	94.51	3.36	66.9	75	LC	25	MC				
52.4	94.86	2.14	66.9	75	LC	25	MC				
53.9	95.01	3.11	66.9	75	LC	25	MC				
55.4	95.16	5.00	66.9	75	LC	25	MC				
56.7	94.76	1.73	66.9	75	LC	25	MC				
58.4	94.96	1.42	66.9	75	LC	25	MC				
59.9	95.21	0.99	66.9	75	LC	25	MC				
61.4	94.96	2.76	66.9	75	LC	25	MC				
62.9	95.81	0.16	66.9	75	LC	25	MC				
64.4	95.61	0.55	66.9	75	LC	25	MC				
66.1	96.01	1.17	66.9	75	LC	25	MC				
66.4	95.68	0.00	65.7	30	MC	30	SG	20	SC	20	LC
67.4	96.21	1.08	65.7	30	MC	30	SG	20	SC	20	LC
68.2	96.16	0.00	67.7	40	LC	30	MC	30	SB		
69.2	96.41	0.00	67.7	40	LC	30	MC	30	SB		
75.1	97.12	0.00	66.9	60	MC	20	LC	20	SC		
85.3	97.83	0.00	65.8	50	SC	30	LC	20	SG		
98	99.44	0.00	76.6	50	SB	30	MC	20	SG		
111	100.53	0.00	67.7	40	LC	30	MC	30	SB		
139.4	102.24	0.00	76.7	60	SB	30	MC	10	sand		
142.5	104.39	0.00	76.9	90	LB	10	MC				
152.2	103.31	0.00	66.9	60	LC	40	MC				
169.5	104.81	0.00	46.6	60	sand	30	MC	10	LC		
191	105.24	0.00	47.9	90	sand	10	OM				
208.3	104.70	0.00	47.8	80	sand	20	LB				
224	104.70	0.00	64.9	60	MC	30	SC	10	sand		
236.3	105.90	0.00	64.9	60	MC	30	SC	10	sand		
238.8	107.20	0.00	66.9	60	LC	40	MC				
240.6	107.53	0.00	67.5	50	LB	40	LC	10	MC		
250	107.86	0.00	64.6	60	LC	40	sand				
254.8	109.36	0.00	46.6	60	sand	40	LC				
257	111.36	0.00	67.7	70	LC	30	SB				
257.9	109.36	0.00	67.5	50	SB	50	LC				
260.5	108.86	0.00	76.6	60	LB	40	MC				
265.1	108.36	0.00	77.9	100	LB						
265.2	108.86	0.00	77.9	100	LB						
267.7	109.61	0.00	47.5	50	LB	25	sand	25	silt		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 7

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
6	104.05	0.00	64.8	50	LC	20	MC	15	sand	15	MG
6.4	105.04	0.00	64.8	50	LC	20	MC	15	sand	15	MG
15	102.91	0.00	64.8	50	LC	20	MC	15	sand	15	MG
29.8	99.56	0.00	64.8	50	LC	20	MC	15	sand	15	MG
30.8	99.53	0.00	64.8	50	LC	20	MC	15	sand	15	MG
32	101.90	0.00	64.8	50	LC	20	MC	15	sand	15	MG
33.3	100.37	0.00	64.8	50	LC	20	MC	15	sand	15	MG
35.8	99.35	0.00	64.8	50	LC	20	MC	15	sand	15	MG
37.4	98.46	0.56	64.8	50	LC	20	MC	15	sand	15	MG
40	98.66	0.00	64.8	50	LC	20	MC	15	sand	15	MG
40.4	98.26	2.66	67.6	40	SB	30	LC	25	MC	5	sand
43.4	98.16	2.55	67.6	40	SB	30	LC	25	MC	5	sand
46.4	97.96	2.60	67.6	40	SB	30	LC	25	MC	5	sand
49.4	98.56	3.44	67.6	40	SB	30	LC	25	MC	5	sand
52.4	98.36	1.12	67.6	40	SB	30	LC	25	MC	5	sand
53.3	99.72	0.00	67.6	40	SB	30	LC	25	MC	5	sand
54.3	99.72	0.00	67.6	40	SB	30	LC	25	MC	5	sand
55.4	97.86	1.96	67.6	40	SB	30	LC	25	MC	5	sand
58.4	97.76	4.13	67.6	40	SB	30	LC	25	MC	5	sand
61.4	97.76	1.92	67.6	40	SB	30	LC	25	MC	5	sand
62.5	99.41	0.00	67.6	40	SB	30	LC	25	MC	5	sand
63.5	99.41	0.00	67.6	40	SB	30	LC	25	MC	5	sand
64.4	97.66	1.81	67.6	40	SB	30	LC	25	MC	5	sand
67.4	97.56	2.46	67.6	40	SB	30	LC	25	MC	5	sand
70.4	97.86	0.17	67.6	40	SB	30	LC	25	MC	5	sand
73.4	97.96	3.65	67.6	40	SB	30	LC	25	MC	5	sand
76.4	98.36	2.11	67.6	40	SB	30	LC	25	MC	5	sand
76.8	99.40	0.00	67.6	40	SB	30	LC	25	MC	5	sand
77.8	99.40	0.00	67.6	40	SB	30	LC	25	MC	5	sand
79.4	97.76	1.38	67.6	40	SB	30	LC	25	MC	5	sand
82.4	98.26	0.85	67.6	40	SB	30	LC	25	MC	5	sand
84.1	99.06	-0.14	67.6	40	SB	30	LC	25	MC	5	sand
88.4	99.26	0.00	75.7	65	SB	15	SG	10	sand	10	LG
89.7	100.62	0.00	75.7	65	SB	15	SG	10	sand	10	LG
96.7	99.38	0.00	75.7	65	SB	15	SG	10	sand	10	LG
112.8	101.99	0.00	67.5	40	SB	20	LC	20	sand	20	SC
123.2	101.16	0.00	67.5	40	SB	20	LC	20	sand	20	SC
128.7	101.27	0.00	67.5	40	SB	20	LC	20	sand	20	SC
152	102.80	0.00	67.7	30	SB	30	MC	30	LC	10	SC
163.8	103.65	0.00	67.7	30	SB	30	MC	30	LC	10	SC
165.7	105.13	0.00	67.7	30	SB	30	MC	30	LC	10	SC
196	105.01	0.00	46.9	80	sand	10	LC	10	SB		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 8

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
0	109.91	0.00	47.7	60	sand	30	OM	10	MC		
5	106.91	0.00	47.7	60	sand	30	OM	10	MC		
11	106.66	0.00	47.7	60	sand	30	OM	10	MC		
24	105.36	0.00	45.6	40	sand	30	MC	30	SG		
29	104.65	0.00	46.5	40	sand	40	SC	20	SG		
34	104.88	0.00	66.9	50	SC	50	MC				
41	103.38	0.00	66.9	60	SC	40	MC				
54.4	101.95	0.00	76.6	60	SB	30	LC	10	MC		
65.7	103.30	0.00	76.7	70	LB	30	LC				
66	102.38	0.00	76.6	60	SB	40	LC				
74.2	101.86	0.00	67.8	60	LC	20	SB	20	MC		
78.5	101.38	0.00	67.8	60	LC	20	SB	20	MC		
79.4	101.03	-0.16	67.8	60	LC	20	SB	20	MC		
80.5	100.69	0.00	67.7	40	LC	30	SC	30	SB		
80.7	100.43	0.48	67.7	40	LC	30	SC	30	SB		
82	100.78	0.33	67.7	40	LC	30	SC	30	SB		
84.5	99.53	1.23	67.7	40	LC	30	SC	30	SB		
86.5	99.48	3.60	67.7	40	LC	30	SC	30	SB		
88	100.18	4.16	67.7	40	LC	30	SC	30	SB		
90	99.58	0.37	67.7	40	LC	30	SC	30	SB		
92	99.68	0.79	67.7	40	LC	30	SC	30	SB		
93.6	99.83	1.79	67.7	40	LC	30	SC	30	SB		
95.2	99.68	2.12	67.7	40	LC	30	SC	30	SB		
97	100.68	3.09	67.7	40	LC	30	SC	30	SB		
99	100.03	2.26	67.7	40	LC	30	SC	30	SB		
101	99.88	2.44	67.7	40	LC	30	SC	30	SB		
102.3	100.13	1.70	67.6	60	MC	40	SB				
103.5	101.25	0.00	76.9	90	LB	10	MC				
105	100.18	3.10	76.9	90	LB	10	MC				
107.4	100.13	2.52	76.9	90	LB	10	MC				
109.2	100.23	3.75	76.9	90	LB	10	MC				
111.6	100.08	3.71	76.9	90	LB	10	MC				
113.7	100.08	3.35	76.9	90	LB	10	MC				
115.5	100.23	2.07	76.9	90	LB	10	MC				
117.6	100.38	3.80	77.9	100	LB						
119.4	101.47	0.00	77.9	100	LB						
121.5	100.38	2.70	67.6	60	MC	40	SB				
123.4	100.48	0.92	67.8	40	LC	40	MC	20	SB		
123.5	100.61	0.00	65.8	60	MC	20	SC	15	LG	5	SG
126	101.08	0.24	65.8	60	MC	20	SC	15	LG	5	SG
127.5	101.38	0.00	65.8	60	MC	20	SC	15	LG	5	SG
129.5	101.63	0.00	65.8	60	MC	20	SC	15	LG	5	SG
135.2	102.87	0.00	65.8	60	MC	20	SC	15	LG	5	SG
135.3	102.86	0.00	65.8	60	MC	20	SC	15	LG	5	SG
142.5	103.07	0.00	65.8	60	MC	20	SC	15	LG	5	SG
149.2	103.07	0.00	65.8	60	MC	20	SC	15	LG	5	SG
158	103.79	0.00	00.4	80	SB	20	LC				
168	103.11	0.00	46.8	80	sand	10	SC	10	LC		
179.5	104.29	0.00	64.6	40	sand	25	LC	25	MC	10	SC
196.4	104.57	0.00	64.6	40	sand	25	LC	25	MC	10	SC
217	104.74	0.00	64.6	40	sand	25	LC	25	MC	10	SC

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 9

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
8	96.55	0.00	47.5	50	silt	50	OM				
22.4	96.44	0.00	67.5	50	LC	50	OM				
25	95.96	0.00	46.5	50	sand	50	MC				
53	95.67	0.00	47.5	50	sand	50	OM				
69	93.54	0.00	46.7	50	sand	25	SB	25	LC		
72.2	92.32	0.00	44.9	100	sand						
83.3	92.78	0.00	66.9	65	MC	35	LC				
88.6	93.07	0.00	44.9	100	sand						
97	92.38	0.00	44.9	100	sand						
105.5	92.50	0.00	66.9	60	SC	40	MC				
129	92.20	0.00	46.5	50	sand	50	LC				
132.8	91.00	0.00	77.9	100	LB						
134.8	89.53	0.00	66.9	50	MC	50	LC				
140.5	88.49	0.00	66.9	50	MC	50	LC				
141.4	88.30	0.00	66.9	50	MC	50	LC				
145.9	87.54	0.00	67.6	40	LC	30	SB	15	MC	15	sand
148.4	87.59	0.13	67.6	40	LC	30	SB	15	MC	15	sand
148.8	87.96	0.00	67.6	40	LC	30	SB	15	MC	15	sand
150	88.79	0.00	67.6	40	LC	30	SB	15	MC	15	sand
151.4	87.29	1.03	67.6	40	LC	30	SB	15	MC	15	sand
154.4	87.69	0.94	67.6	40	LC	30	SB	15	MC	15	sand
157.4	87.29	0.22	67.6	40	LC	30	SB	15	MC	15	sand
160.4	86.39	1.13	76.9	50	LB	45	SB	5	LC		
163.4	86.09	1.34	76.9	50	LB	45	SB	5	LC		
166.4	87.19	3.05	76.9	50	LB	45	SB	5	LC		
169.4	85.59	3.31	76.9	50	LB	45	SB	5	LC		
172.4	85.39	0.10	76.9	50	LB	45	SB	5	LC		
173.5	87.79	0.00	76.9	50	LB	45	SB	5	LC		
175.4	87.79	-0.37	67.7	55	LC	30	SB	15	MC		
178.4	85.59	0.38	67.7	55	LC	30	SB	15	MC		
181.4	86.09	2.07	67.7	55	LC	30	SB	15	MC		
184.4	86.89	3.55	67.7	55	LC	30	SB	15	MC		
187.4	86.39	1.57	76.7	45	LB	30	SB	20	LC	5	MC
188	89.15	0.00	76.7	45	LB	30	SB	20	LC	5	MC
188.9	89.15	0.00	76.7	45	LB	30	SB	20	LC	5	MC
190.4	86.79	1.58	76.7	45	LB	30	SB	20	LC	5	MC
192	89.59	0.00	76.7	45	LB	30	SB	20	LC	5	MC
193.2	89.59	0.00	76.7	45	LB	30	SB	20	LC	5	MC
193.4	86.59	-0.04	76.7	45	LB	30	SB	20	LC	5	MC
195.2	88.08	0.00	76.7	45	LB	30	SB	20	LC	5	MC
196.4	87.59	0.11	76.7	45	LB	30	SB	20	LC	5	MC
197.2	89.02	0.00	76.7	45	LB	30	SB	20	LC	5	MC
198.2	89.02	0.00	76.7	45	LB	30	SB	20	LC	5	MC
198.4	87.89	0.71	76.7	45	LB	30	SB	20	LC	5	MC
202.4	87.19	0.00	76.7	45	LB	30	SB	20	LC	5	MC
205.4	87.29	0.45	76.7	45	LB	30	SB	20	LC	5	MC
208.4	87.09	0.48	76.7	45	LB	30	SB	20	LC	5	MC
210.8	87.57	0.00	75.9	50	LB	30	SB	10	LG		
211.3	88.43	0.00	75.9	50	LB	30	SB	10	LG		
211.4	88.49	0.00	75.9	50	LB	30	SB	10	LG		
212.3	89.60	0.00	75.9	50	LB	30	SB	10	LG		
218	90.60	0.00	75.9	50	LB	30	SB	10	LG		
221	90.35	0.00	75.9	50	LB	30	SB	10	LG		
226.3	90.23	0.00	75.9	50	LB	30	SB	10	LG		
228.8	94.78	0.00	75.9	50	LB	30	SB	10	LG		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 10

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-32.5	96.88	0.00	00.4	100	sand						
-24.5	95.47	0.00	00.4	100	sand						
-22	98.58	0.00	00.4	100	LB						
-20	96.13	0.00	00.4	100	sand						
-20	95.58	0.00	00.4	100	sand						
-3	95.64	0.00	00.4	40	SG	40	SC	20	sand		
15	95.08	0.00	00.4	40	SG	40	SC	20	sand		
38.5	94.06	0.00	00.4	75	LC	25	MC				
53.8	93.81	0.00	00.4	75	LC	25	MC				
62.1	92.37	0.00	46.5	50	MC	50	sand				
63.6	91.10	0.00	46.5	50	MC	50	sand				
64	91.05	0.05	66.9	100	LC						
65	90.95	0.45	66.9	100	LC						
65.7	91.10	1.41	66.9	100	LC						
67.2	90.95	2.32	66.9	100	LC						
68	90.00	1.71	66.9	100	LC						
69	90.35	2.77	66.9	100	LC						
70	90.05	3.24	66.9	100	LC						
71	90.35	2.98	66.9	100	LC						
72	90.15	3.13	66.9	100	LC						
73	89.85	3.83	66.9	100	LC						
74	90.35	2.57	66.9	100	LC						
75	89.80	3.24	66.9	100	LC						
76	91.25	1.04	66.9	100	LC						
77	91.40	1.37	66.9	100	LC						
78	91.15	2.84	66.9	100	LC						
79	90.20	4.27	66.9	100	LC						
80	89.80	3.08	66.9	100	LC						
81	90.35	3.65	66.9	100	LC						
82	89.45	4.38	66.9	100	LC						
83	90.10	2.87	66.9	100	LC						
84	90.25	3.61	66.9	100	LC						
85	89.30	1.85	66.9	100	LC						
86	90.80	3.20	66.9	100	LC						
87	90.50	1.40	66.9	100	LC						
87.9	90.40	1.13	66.9	100	LC						
89.1	91.05	0.27	66.9	100	LC						
90.1	91.00	1.10	66.9	100	LC						
91.5	91.43	0.00	66.9	100	LC						
92	91.25	3.06	66.9	100	LC						
92.3	91.00	0.00	66.9	100	LC						
93.6	91.88	0.00	67.8	40	MC	35	LC	25	SB		
94	91.35	1.46	67.8	40	MC	35	LC	25	SB		
94.9	91.30	2.07	77.9	100	LB						
96.6	92.05	0.00	77.9	100	LB						
98	92.81	0.00	77.9	100	LB						
100	93.52	0.00	77.9	100	LB						
106.5	91.32	0.00	77.9	100	LB						
108.8	93.48	0.00	77.9	100	LB						
111.7	94.48	0.00	77.9	100	LB						
114	94.47	0.00	77.9	100	LB						
118	100.61	0.00	77.9	100	LB						

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 11

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-24	95.89	0.00	00.4	100.00	sand						
-20	96.89	0.00	00.4	40.00	SC	30	MC	30	sand		
-18	97.72	0.00	00.4	100.00	LB						
-17	97.07	0.00	76.9	90.00	LB	10	SC				
-12	96.45	0.00	46.8	80.00	sand	20	MC				
3	96.47	0.00	65.8	40.00	MC	30	SC	20	SG	10	sand
28	95.66	0.00	64.7	30.00	MC	30.00	SC	30.00	sand	10	LC
65.6	94.15	0.00	66.9	80.00	LC	20.00	MC				
70.3	93.27	0.00	66.9	80.00	LC	20.00	MC				
74.4	92.43	0.00	46.5	50.00	sand	50.00	MC				
74.6	92.32	0.00	66.9	100.00	MC						
76.3	92.88	0.00	66.9	50.00	LC	50.00	MC				
76.9	92.27	0.98	66.9	55.00	LC	45.00	MC				
78.9	92.67	1.75	66.9	55.00	LC	45.00	MC				
80.9	91.77	2.93	66.9	55.00	LC	45.00	MC				
82.9	91.57	0.94	66.9	55.00	LC	45.00	MC				
84.9	91.77	0.31	66.9	55.00	LC	45.00	MC				
86.9	91.37	2.42	66.9	55.00	LC	45.00	MC				
88.9	91.27	2.59	66.9	55.00	LC	45.00	MC				
90.9	90.97	2.60	66.9	55.00	LC	45.00	MC				
92.9	90.77	3.06	66.9	55.00	LC	45.00	MC				
94.9	90.27	3.35	66.9	55.00	LC	45.00	MC				
96.9	92.17	1.98	66.9	55.00	LC	45	MC				
98.9	91.47	2.91	66.9	55.00	LC	45	MC				
100.9	91.37	2.22	66.9	55.00	LC	45	MC				
102.9	91.67	0.83	66.9	55.00	LC	45	MC				
104.8	92.49	0.00	66.9	55.00	LC	45	MC				
106.9	93.27	0.00	76.8	80.00	SB	20.00	LC				
111	93.74	0.00	76.8	80.00	SB	20.00	LC				
114.4	94.31	0.00	74.9	90.00	SB	10.00	sand				
115	95.12	0.00	66.9	80.00	LC	20.00	MC				
121	94.89	0.00	46.8	80.00	sand	20.00	MC				
127.4	96.45	0.00	77.9	75.00	SB	25.00	LB				
128.4	103.15	0.00	77.9	75.00	SB	25.00	LB				

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Transect 12

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
7	102.23	0.00	47.8	65	sand	20	SB	10	LC	10	LG
12	100.90	0.00	47.8	65	sand	20	SB	10	LC	10	LG
19	99.97	0.00	47.8	65	sand	20	SB	10	LC	10	LG
25	99.54	0.00	47.8	65	sand	20	SB	10	LC	10	LG
34	100.67	0.00	47.8	65	sand	20	SB	10	LC	10	LG
40	101.08	0.00	00.4	70	SC	15	LC	15	LG		
49	98.38	0.00	65.8	65	SC	5	SG	15	LG	15	SB
56.5	98.22	0.00	65.8	65	SC	5	SG	15	LG	15	SB
60	97.53	0.00	65.8	65	SC	5	SG	15	LG	15	SB
64.51	97.00	0.00	65.8	65	SC	5	SG	15	LG	15	SB
67.25	96.75	0.05	65.8	65	SC	5	SG	15	LG	15	SB
67.5	96.74	0.00	65.8	65	SC	5	SG	15	LG	15	SB
69.25	96.15	0.14	65.8	65	SC	5	SG	15	LG	15	SB
70	96.21	0.00	65.8	65	SC	5	SG	15	LG	15	SB
71.75	95.80	0.17	76.7	50	SB	30	LC	20	LB		
74.25	96.00	0.41	76.7	50	SB	30	LC	20	LB		
76.75	96.50	0.68	76.7	50	SB	30	LC	20	LB		
77.3	96.88	0.00	76.7	50	SB	30	LC	20	LB		
78.25	96.80	1.30	76.7	50	SB	30	LC	20	LB		
80.75	95.90	1.46	76.7	50	SB	30	LC	20	LB		
83.25	94.65	1.32	76.7	50	SB	30	LC	20	LB		
85.75	94.20	1.33	76.7	50	SB	30	LC	20	LB		
88.25	94.60	0.98	76.7	50	SB	30	LC	20	LB		
91.9	94.50	1.40	76.7	50	SB	30	LC	20	LB		
93.25	95.00	1.27	76.7	50	SB	30	LC	20	LB		
95.75	94.40	0.59	76.7	50	SB	30	LC	20	LB		
98.85	95.50	0.82	76.7	50	SB	30	LC	20	LB		
100.75	95.85	1.61	76.6	60	SB	40	MC				
101	96.49	0.00	76.6	60	SB	40	MC				
103.25	95.70	1.68	76.6	60	SB	40	MC				
105.75	95.50	1.52	76.6	60	SB	40	MC				
108.45	95.40	1.28	76.6	60	SB	40	MC				
111.25	95.10	1.91	66.9	50	SC	45	MC	5	LC		
113.75	94.50	2.03	66.9	50	SC	45	MC	5	LC		
116.85	94.50	1.76	45.5	50	sand	50	SG				
119.25	95.30	1.07	77.9	100	LB						
119.7	97.32	0.00	77.9	100	LB						
120.4	97.32	0.00	77.9	100	LB						
121.75	96.15	-0.07	77.9	100	LB						
123.8	96.45	0.00	74.7	60	SB	30	sand	10	SC		
124.25	96.05	0.28	74.7	60	SB	30	sand	10	SC		
125.5	96.77	0.00	74.7	60	SB	30	sand	10	SC		
126.75	96.15	0.18	74.7	60	SB	30	sand	10	SC		
127	96.21	0.00	74.7	60	SB	30	sand	10	SC		
129.25	96.75	0.21	00.4	40	sand	30	SC	20	SG	10	LG
131.85	97.00	0.00	00.4	40	sand	30	SC	20	SG	10	LG
136	97.43	0.00	00.4	40	sand	30	SC	20	SG	10	LG
143.4	98.25	0.00	00.4	40	sand	30	SC	20	SG	10	LG
152	99.49	0.00	54.7	20	LB	40	SG	20	sand	20	LG
160.5	100.03	0.00	74.9	90	LB	5	sand	5	LC		
188.9	103.78	0.00	74.9	90	LB	5	sand	5	LC		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-5. East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion, Reference Study Site Topography, Substrate, and Velocity Data.

Transect 1

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
-35	109.85	0.00	44.9	100	sand						
-34	102.39	0.00	44.9	100	sand						
-26	101.39	0.00	77.9	100	SB						
-6	99.43	0.00	47.9	90	sand	5	LB	5	WD		
4	99.47	0.00	00.4	90	sand	5	LB	5	WD		
7.9	100.01	0.00	00.4	90	sand	5	LB	5	WD		
9	99.55	0.00	47.9	90	sand	5	LB	5	WD		
12.5	98.72	0.00	00.4	90	sand	5	LB	5	WD		
14	98.37	0.07	00.4	85	SB	10	sand	5	LWD		
15.5	98.27	0.07	74.9	85	SB	10	sand	5	LWD		
17	98.07	0.12	74.9	85	SB	10	sand	5	LWD		
18.5	97.92	0.33	74.9	85	SB	10	sand	5	LWD		
20	97.82	0.17	74.9	85	SB	10	sand	5	LWD		
21	97.62	0.33	74.9	85	SB	10	sand	5	LWD		
22.5	97.32	0.28	74.9	85	SB	10	sand	5	LWD		
24	97.42	0.66	74.9	85	SB	10	sand	5	LWD		
25.5	97.32	0.69	74.9	85	SB	10	sand	5	LWD		
27	96.92	0.25	74.9	85	SB	10	sand	5	LWD		
28.5	96.37	0.63	74.9	85	SB	10	sand	5	LWD		
30	96.12	0.71	74.9	85	SB	10	sand	5	LWD		
31.5	96.02	0.53	64.7	40	LC	25	sand	25	SG	10	SC
33	95.77	0.64	64.7	40	LC	25	sand	25	SG	10	SC
34.5	95.17	0.44	64.7	40	LC	25	sand	25	SG	10	SC
36	96.47	0.48	64.7	40	LC	25	sand	25	SG	10	SC
37.5	95.87	0.42	45.9	85	sand	10	SG	5	MC		
39	96.47	0.62	45.9	85	sand	10	SG	5	MC		
40.5	96.77	0.54	45.9	85	sand	10	SG	5	MC		
42	96.27	0.56	46.6	50	sand	30	LC	20	MG		
46.5	97.82	0.54	54.6	40	sand	25	LG	25	SG	10	SC
48.3	97.22	0.59	54.6	40	sand	25	LG	25	SG	10	SC
49.5	97.32	0.49	54.6	40	sand	25	LG	25	SG	10	SC
51	97.37	0.56	74.9	95	SB	5	sand				
52.5	97.72	0.41	74.9	95	SB	5	sand				
54	98.22	0.44	77.9	100	SB						
55.5	98.42	0.21	77.9	100	SB						
57	98.72	0.00	54.6	40	sand	20	MG	20	SG	20	LG
63	99.18	0.00	54.7	25	LG	25	sand	25	SC	25	SG
65.4	101.05	0.00	54.7	25	LG	25	sand	25	SC	25	SG
68.5	101.60	0.00	54.7	25	LG	25	sand	25	SC	25	SG
75	105.00	0.00	54.7	25	LG	25	sand	25	SC	25	SG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-6 Kaweah River Upstream of Kaweah No. 3 Powerhouse, Reference Study Site Topography, Substrate, and Velocity Data.

Transect 2

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate							
				Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
5.2	99.93	0.00	67.6	60	LC	20	OM	20	WD		
22	96.50	0.00	47.8	80	sand	10	OM	10	WD		
39	92.15	0.00	46.8	60	sand	20	SB	20	LC		
42.2	91.38	0.43	46.8	60	sand	20	SB	20	LC		
44.2	90.90	0.48	46.8	60	sand	20	SB	20	LC		
46.2	90.40	0.42	46.8	60	sand	20	SB	20	LC		
48.2	89.89	0.40	46.8	60	sand	20	SB	20	LC		
50.2	89.72	0.43	46.8	60	sand	20	SB	20	LC		
52.2	89.72	0.42	46.8	60	sand	20	SB	20	LC		
54.2	89.85	0.43	46.8	60	sand	20	SB	20	LC		
56.2	89.46	0.41	46.8	60	sand	20	SB	20	LC		
58.2	88.94	0.42	46.8	60	sand	20	SB	20	LC		
60.2	88.69	0.38	46.8	60	sand	20	SB	20	LC		
62.2	88.62	0.35	46.8	60	sand	20	SB	20	LC		
64.2	88.57	0.42	46.8	60	sand	20	SB	20	LC		
66.2	88.43	0.46	46.8	60	sand	20	SB	20	LC		
68.2	88.14	0.50	46.8	60	sand	20	SB	20	LC		
70.2	87.78	0.58	46.8	60	sand	20	SB	20	LC		
72.2	87.43	0.59	46.8	60	sand	20	SB	20	LC		
74.2	87.17	0.64	46.8	60	sand	20	SB	20	LC		
76.2	87.11	0.60	46.8	60	sand	20	SB	20	LC		
78.2	87.36	0.51	46.8	60	sand	20	SB	20	LC		
80.2	87.76	0.55	46.8	60	sand	20	SB	20	LC		
82.2	88.01	0.60	46.8	60	sand	20	SB	20	LC		
84.2	88.03	0.61	46.8	60	sand	20	SB	20	LC		
86.2	88.13	0.52	46.8	60	sand	20	SB	20	LC		
88.2	88.60	0.67	46.8	60	sand	20	SB	20	LC		
90.2	88.95	0.65	46.8	60	sand	20	SB	20	LC		
92.2	89.23	0.63	46.8	60	sand	20	SB	20	LC		
94.2	89.55	0.63	46.8	60	sand	20	SB	20	LC		
96.2	89.69	0.50	46.8	60	sand	20	SB	20	LC		
98.2	89.94	0.48	46.8	60	sand	20	SB	20	LC		
100.2	90.26	0.48	46.8	60	sand	20	SB	20	LC		
102.2	90.45	0.46	46.8	60	sand	20	SB	20	LC		
104.2	90.57	0.44	46.8	60	sand	20	SB	20	LC		
106.2	90.82	0.42	46.8	60	sand	20	SB	20	LC		
108.2	90.76	0.45	46.8	60	sand	20	SB	20	LC		
110.2	90.39	0.50	46.8	60	sand	20	SB	20	LC		
112.2	90.36	0.54	46.8	60	sand	20	SB	20	LC		
114.2	90.41	0.52	46.8	60	sand	20	SB	20	LC		
116.2	90.39	0.50	46.8	60	sand	20	SB	20	LC		
118.2	90.43	0.46	46.8	60	sand	20	SB	20	LC		
120.2	90.47	0.40	46.8	60	sand	20	SB	20	LC		
122.2	90.54	0.42	46.8	60	sand	20	SB	20	LC		
124.2	90.72	0.55	46.8	60	sand	20	SB	20	LC		
126.2	90.83	0.47	46.8	60	sand	20	SB	20	LC		
128.2	90.83	0.31	46.8	60	sand	20	SB	20	LC		
130.2	90.97	0.28	46.8	60	sand	20	SB	20	LC		
132.2	91.10	0.27	46.8	60	sand	20	SB	20	LC		
134.2	91.08	0.20	46.8	60	sand	20	SB	20	LC		
136.2	91.09	0.18	46.8	60	sand	20	SB	20	LC		
138.2	91.33	0.15	46.8	60	sand	20	SB	20	LC		
140.2	91.57	0.12	46.8	60	sand	20	SB	20	LC		
142.2	91.70	0.11	46.8	60	sand	20	SB	20	LC		
146.8	92.17	0.00	46.8	60	sand	20	SB	20	LC		
147.2	93.12	0.00	47.7	70	sand	30	WD				
149	94.11	0.00	47.7	71	sand	31	WD				
160	97.00	0.00	47.7	72	sand	32	WD				
164.5	98.11	0.00	47.7	73	sand	33	WD				
179	101.11	0.00	47.7	74	sand	34	WD				
185	98.00	0.00	47.7	75	sand	35	WD				
191.99	98.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
208.39	94.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
227.24	99.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
245.73	97.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
264.22	96.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
303.14	97.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
351.96	99.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
376.98	102.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG
397.7	103.11	0.00	67.7	30	LC	30	SB	30	MC	10	LG

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

Table C-7. Kaweah River Downstream of Kaweah No. 2 Powerhouse, Reference Study Site Topography, Substrate, and Velocity Data.

Transcect 3

Station (ft)	Elevation (ft)	Mid Vel. Cal. (ft/s)	Spawning Substrate Code	Field Measured Substrate: Dominant %	Dominant Type	Subdominant %	Subdominant Type	Residual %	Residual Type	Residual %	Residual Type
9	100.59	0.00	47.5	50	sand	30	OM	20	LB		
12.7	99.56	0.00	47.5	50	sand	30	OM	20	LB		
30.6	98.53	0.00	47.5	50	sand	30	OM	20	LB		
39.5	96.33	0.00	74.9	30	SB	30	LB	20	OM	10	sand
42.5	95.83	1.33	00.4	30	SB	30	LB	20	OM	10	sand
45.5	93.83	2.48	00.4	90	LB	10	sand				
48.5	93.23	2.07	00.4	60	LC	30	SC	10	sand		
51.5	94.23	2.65	00.4	60	LC	30	SC	10	sand		
54.5	94.43	1.55	00.4	60	LC	30	SC	10	sand		
57.5	95.23	0.59	64.9	60	LC	30	SC	10	sand		
60.5	94.73	1.34	64.9	60	LC	30	SC	10	sand		
63.5	94.93	0.38	64.9	60	LC	30	SC	10	sand		
66.5	95.33	1.16	64.9	60	LC	30	SC	10	sand		
69.5	95.53	1.69	64.9	60	LC	30	SC	10	sand		
72.5	95.93	1.64	64.9	60	LC	30	SC	10	sand		
75.5	96.33	0.00	67.9	40	LC	30	SC	20	MC	10	SB
78.5	96.33	0.67	67.9	40	LC	30	SC	20	MC	10	SB
81.5	96.03	0.00	67.9	40	LC	30	SC	20	MC	10	SB
84.5	96.33	0.00	67.9	40	LC	30	SC	20	MC	10	SB
88	95.63	0.10	67.9	40	LC	30	SC	20	MC	10	SB
89.5	95.73	1.53	67.9	40	LC	30	SC	20	MC	10	SB
92	95.93	0.90	67.9	40	LC	30	SC	20	MC	10	SB
95	95.68	0.86	67.9	40	LC	30	SC	20	MC	10	SB
98	95.83	0.30	67.9	40	LC	30	SC	20	MC	10	SB
101	95.63	1.87	67.9	40	LC	30	SC	20	MC	10	SB
104	95.73	1.71	67.9	40	LC	30	SC	20	MC	10	SB
107	95.28	1.62	66.9	50	LC	50	MC				
110	94.93	1.87	66.9	50	LC	50	MC				
113	94.43	1.73	66.9	50	LC	50	MC				
116	93.73	0.68	66.9	50	LC	50	MC				
119	96.33	0.00	66.9	50	LC	50	MC				
123.6	96.71	0.00	77.9	100	LB						
135	96.34	0.00	74.7	60	LB	30	sand	10	OM		
138.4	98.37	0.00	74.7	60	LB	30	sand	10	OM		
143.7	96.86	0.00	74.7	60	LB	30	sand	10	OM		

Trout Spawning Substrate Code

ab.c a=Dominant, b=Subdominant, c=% Dominant

Code	Substrate Type	Field Abbrev.	Size Range (in)
00.4	Permanent Vegetation (alders, willows, upland trees)		
4	silt and sand		<0.1 - 0.2
5	small, medium, large gravel	SG, MG, LG	0.2-3
6	small, medium, large cobble	SC, MC, LC	3-12
7	Other - organic material - leaf/detritus	OM	
	(large) woody debris	LWD or WD	
	small, large boulder	SB, LB	
	rough bedrock (cobble/boulder consistency)	RB	
	smooth bedrock	SmBr	

Field Data Collection Code

Field Abbrev	Substrate Type	Size Range (in)
OM	Organic material - leaf/detritus	
clay/silt	Clay or silt	< 0.1
SAND	sand	0.1 - 0.2
SG	small gravel	0.2 - 1.0
MG	medium gravel	1 - 2
LG	large gravel	2 - 3
SC	small cobble	3 - 6
MC	medium cobble	6 - 9
LC	large cobble	9 - 12
SB	small boulder	12 - 40
LB	large boulder	> 40
SmBr	smooth bedrock	
RB	rough bedrock	

APPENDIX D

Water Surface and Velocity Calibration Results

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Attachment A: Stage Discharge Calibration Report

Attachment B: Water Surface Elevation Calibration Report

Attachment C: Velocity Calibration Report

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Attachment A

Stage Discharge Calibration Report

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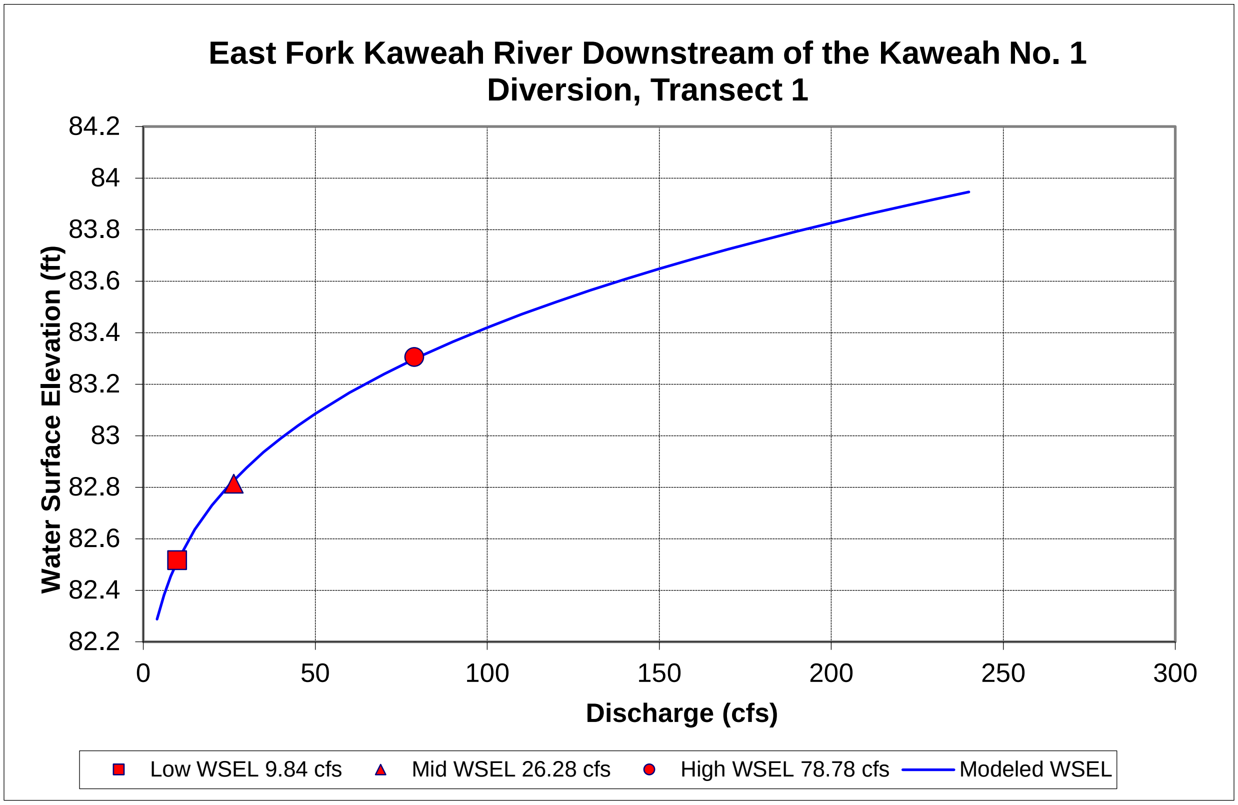
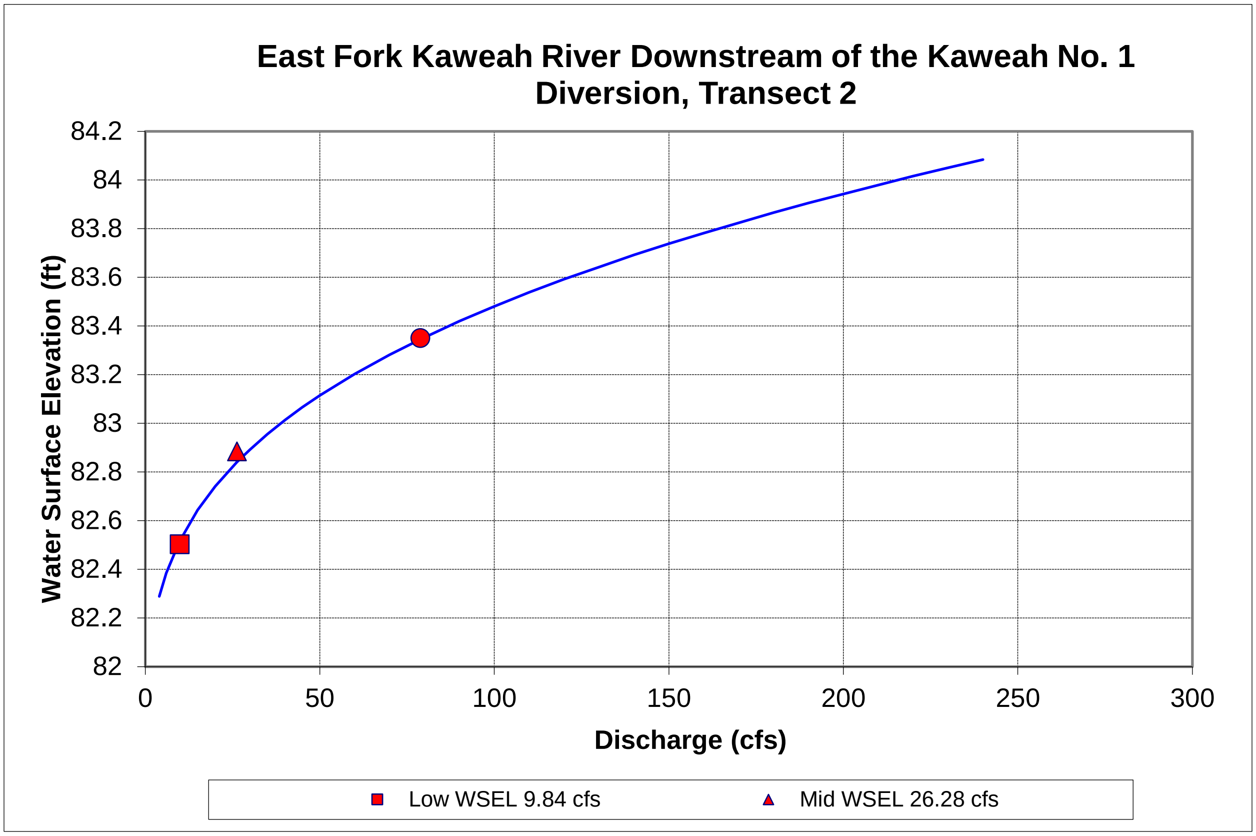
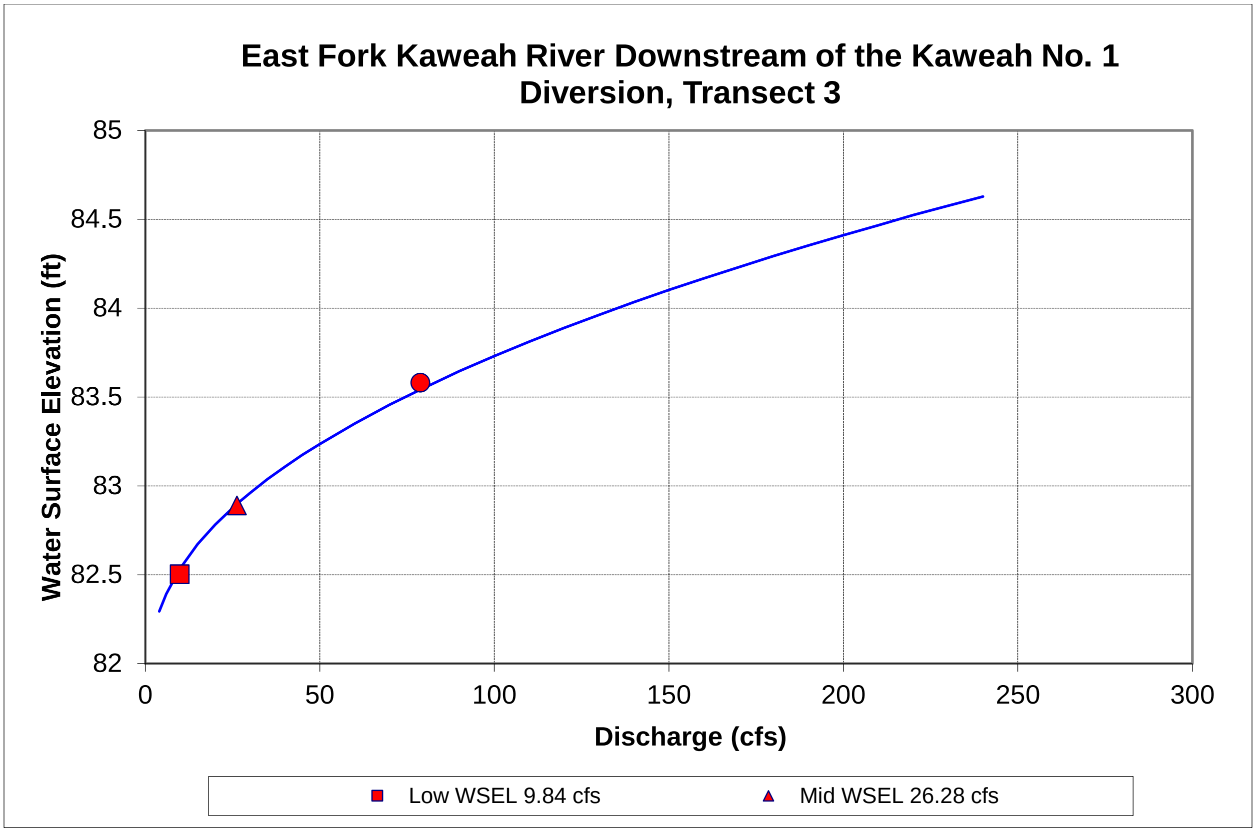
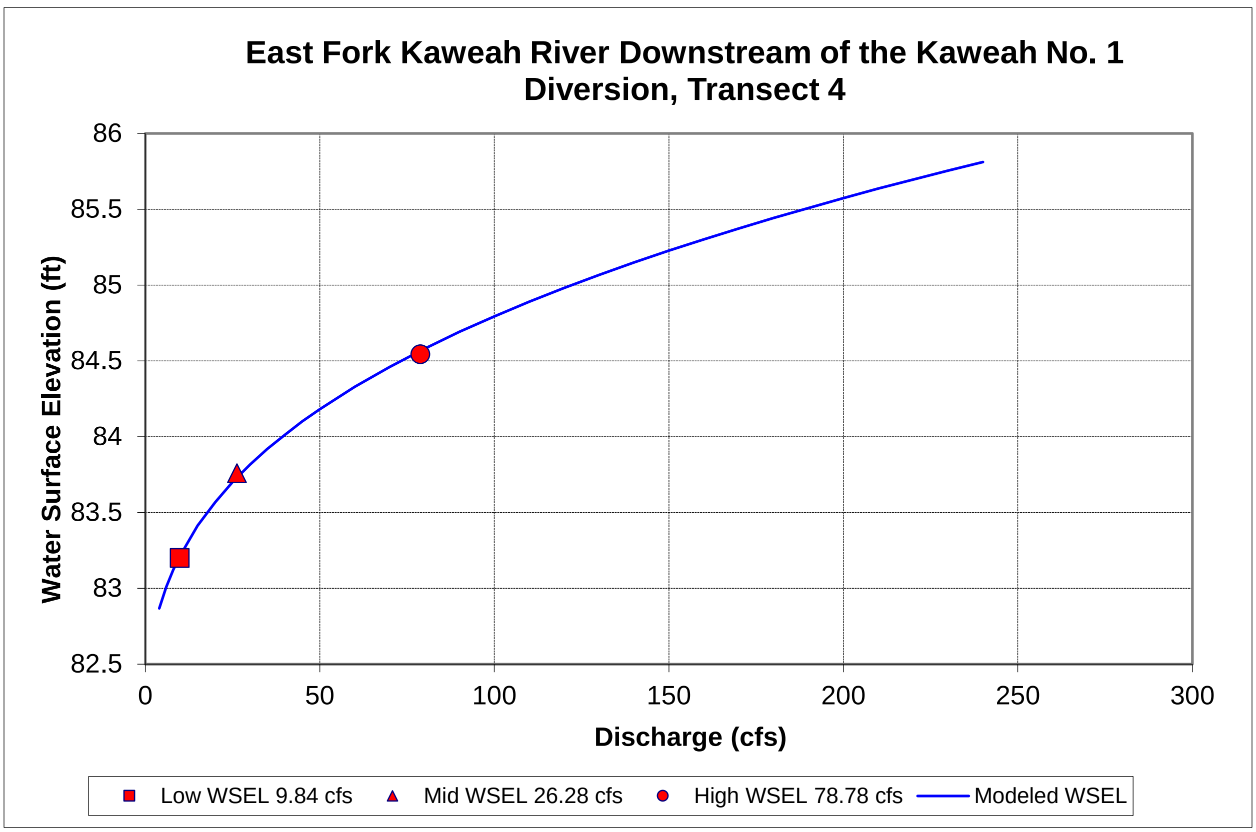
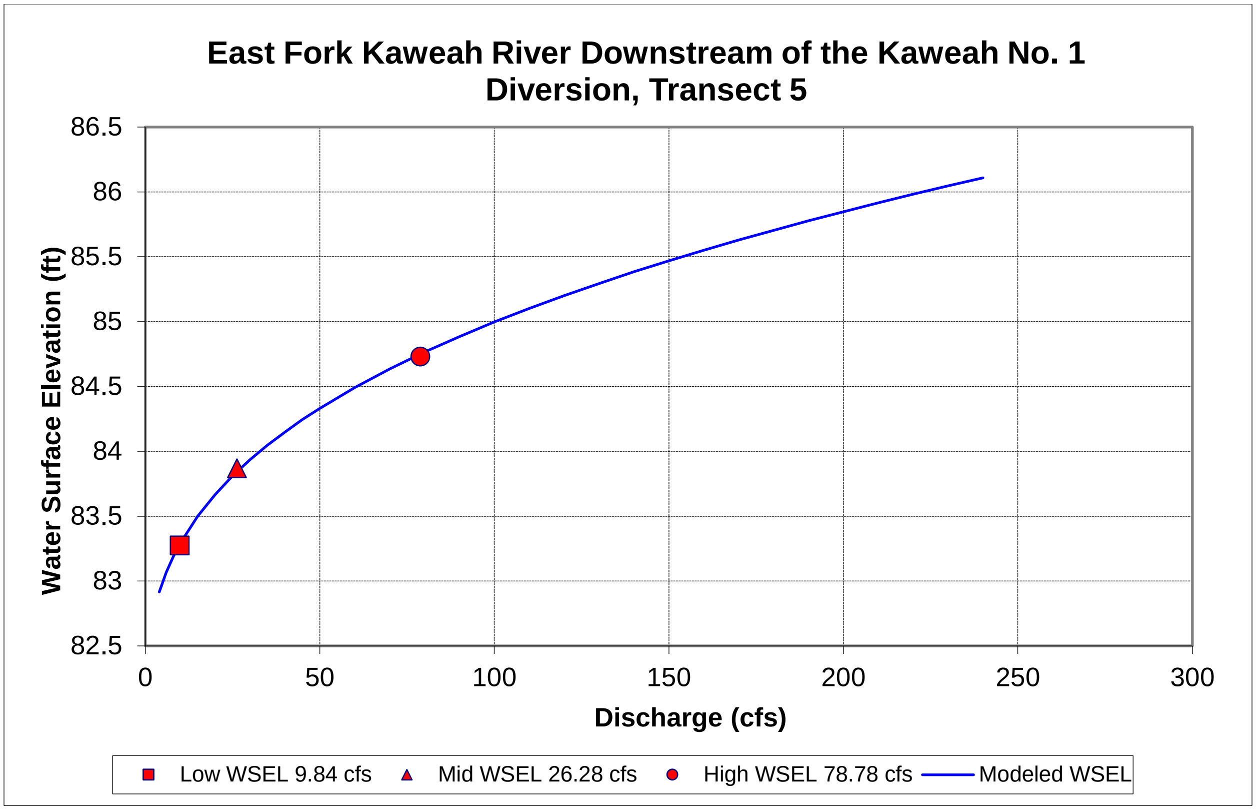
Figure D.A-1. East Fork Kaweah River Upstream of the Confluence with Kaweah River Stage Discharge Calibration Report.

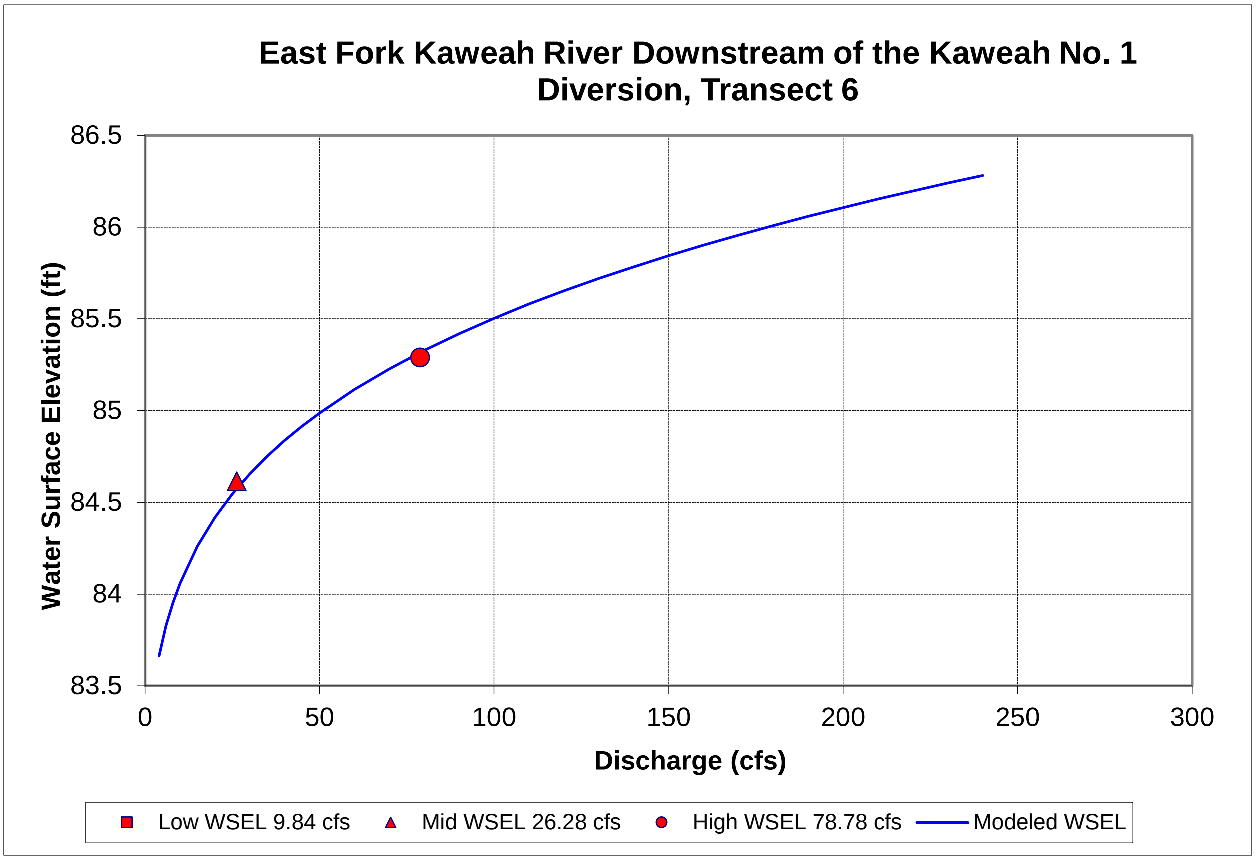


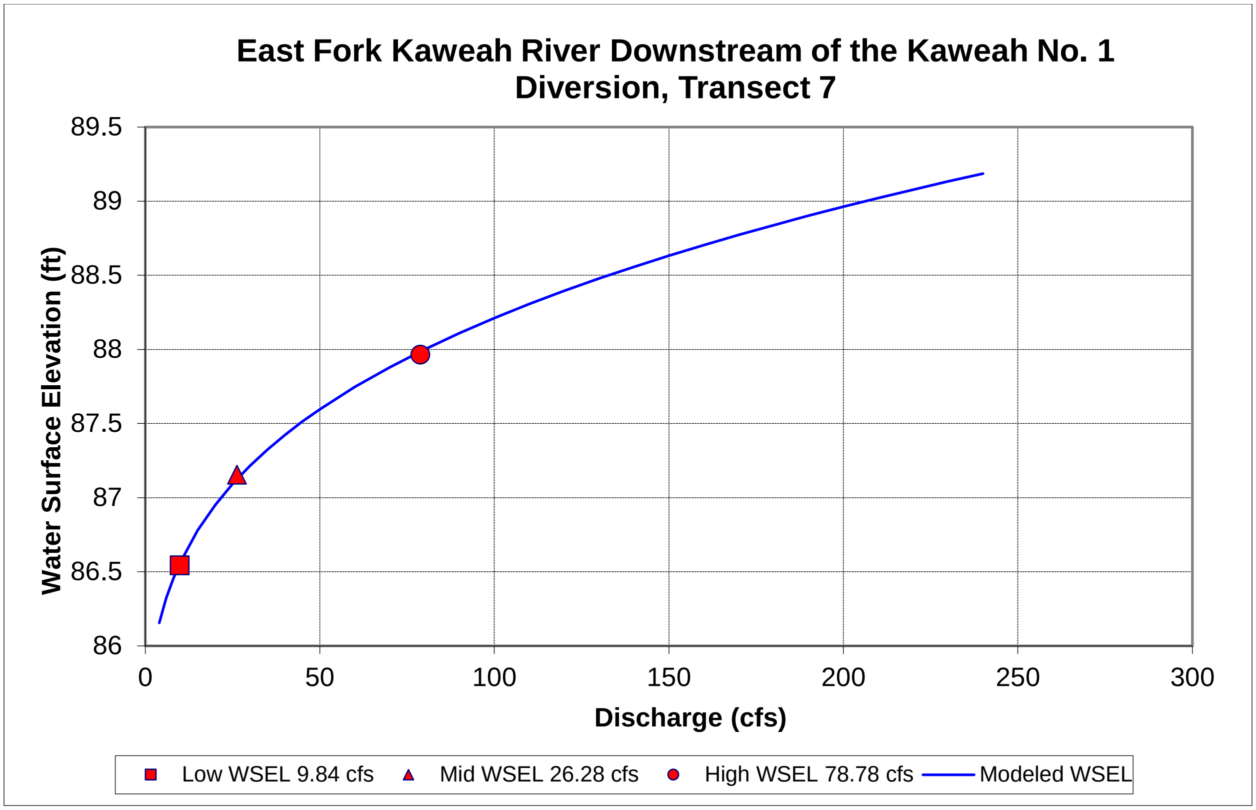


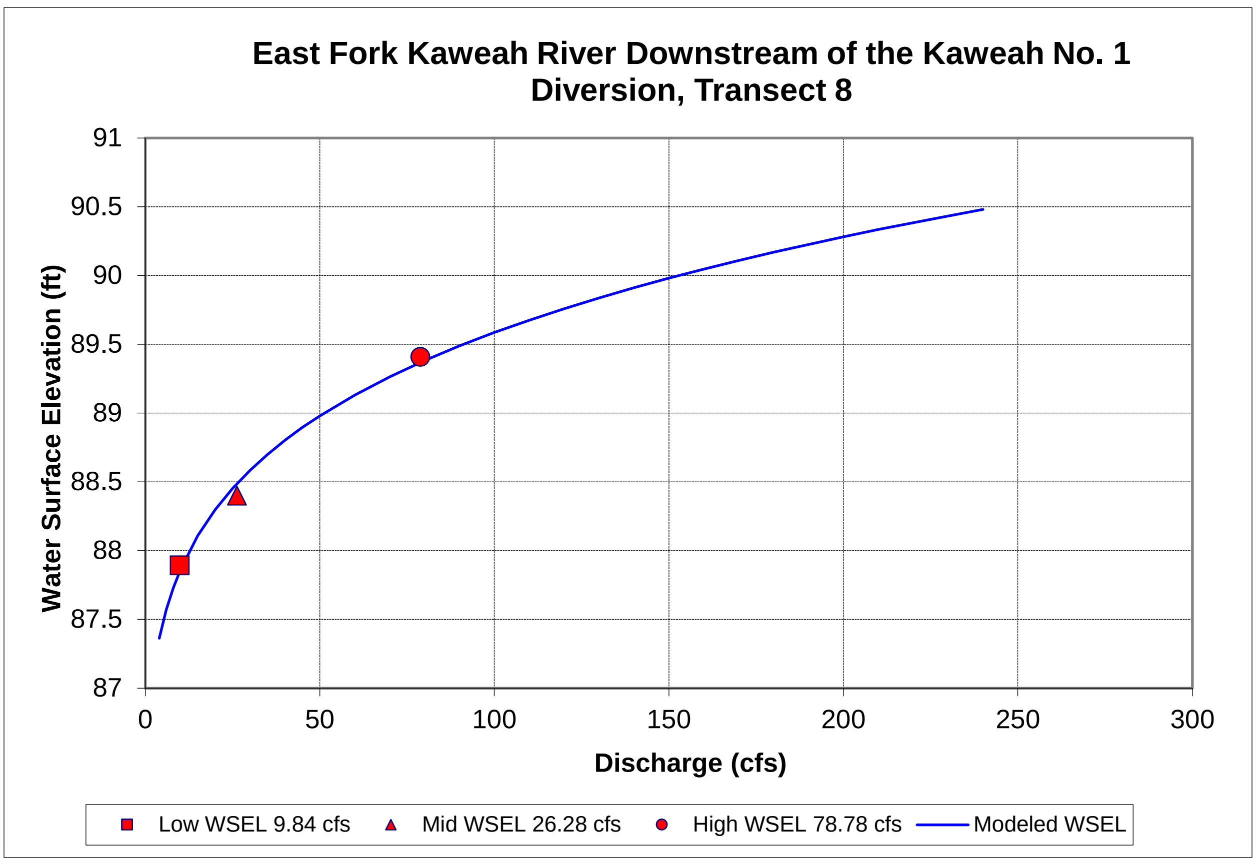

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 3
Water Surface Elevation (ft)
85
84.5
84
83.5
83
82.5
82
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs

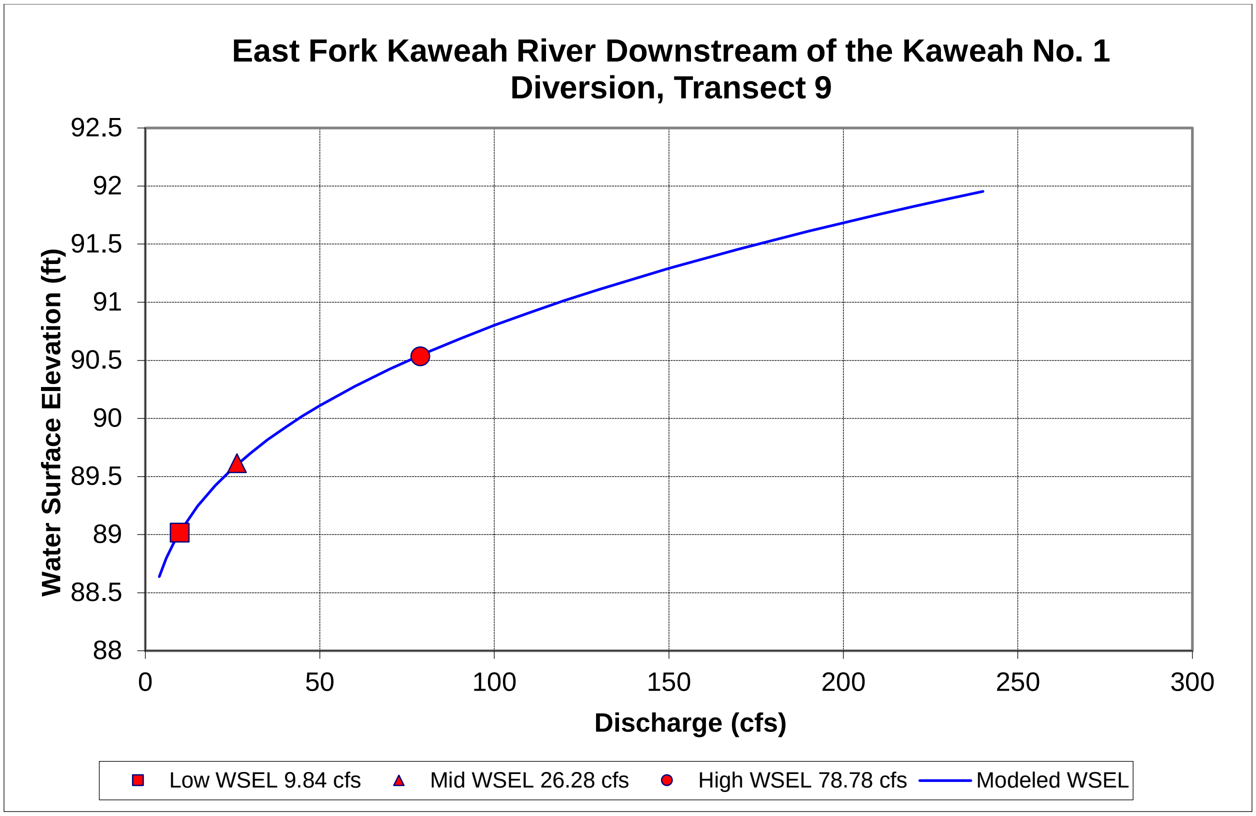

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 4
Water Surface Elevation (ft)
86
85.5
85
84.5
84
83.5
83
82.5
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

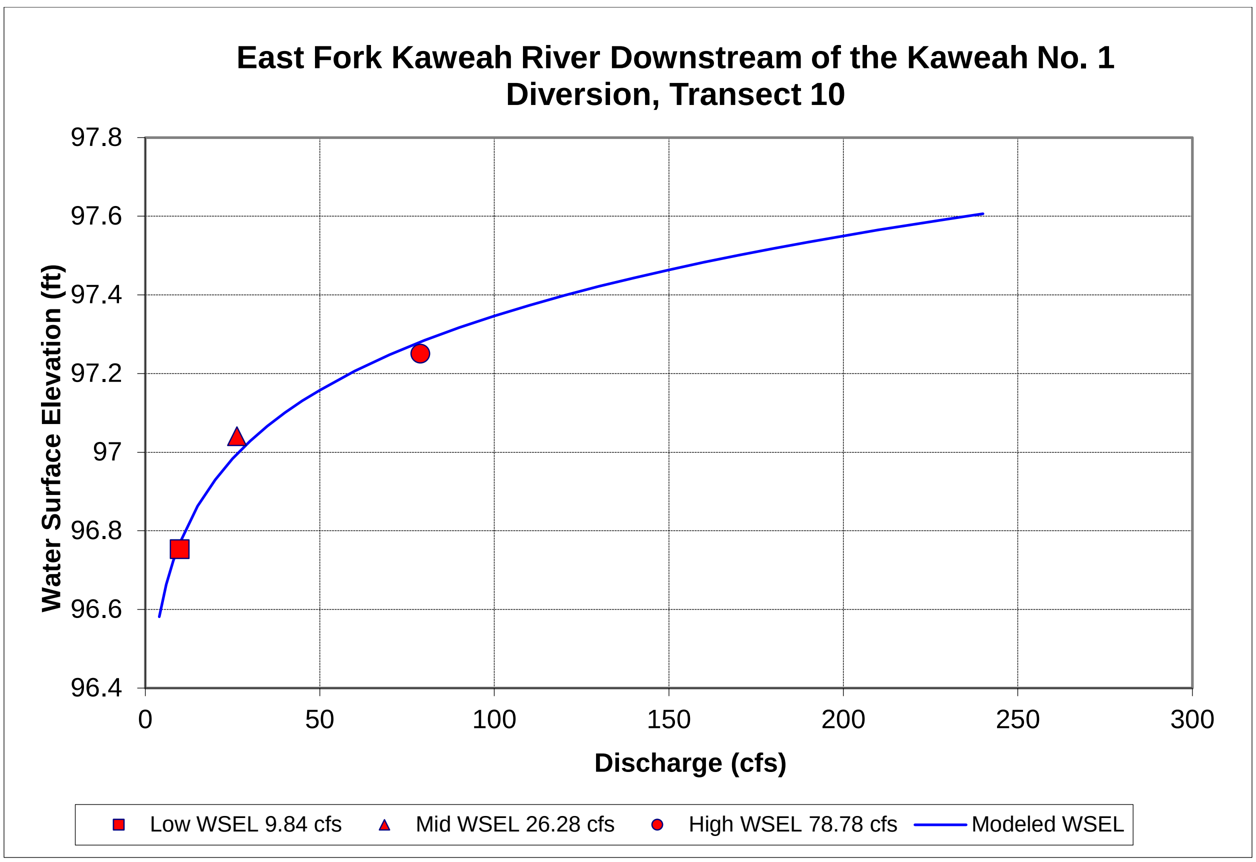

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 5
Water Surface Elevation (ft)
86.5
86
85.5
85
84.5
84
83.5
83
82.5
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

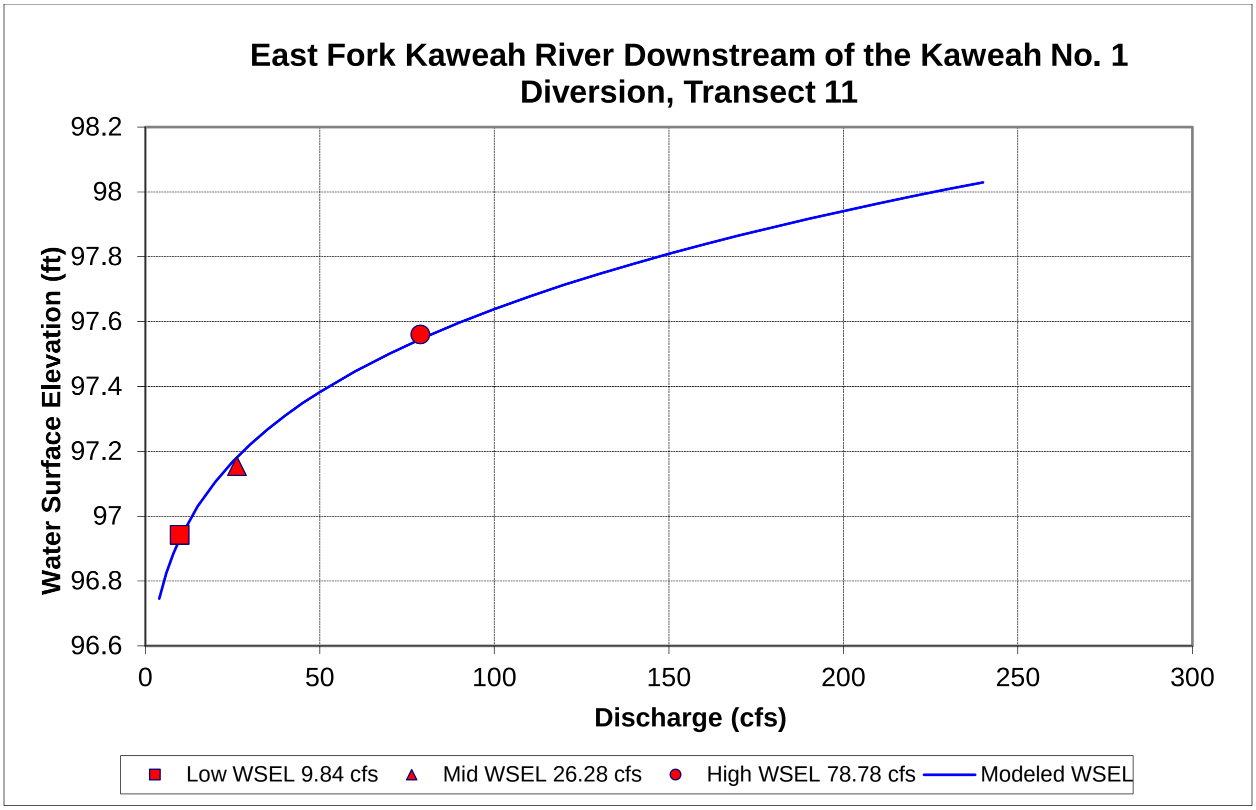

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 6
Water Surface Elevation (ft)
86.5
86
85.5
85
84.5
84
83.5
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

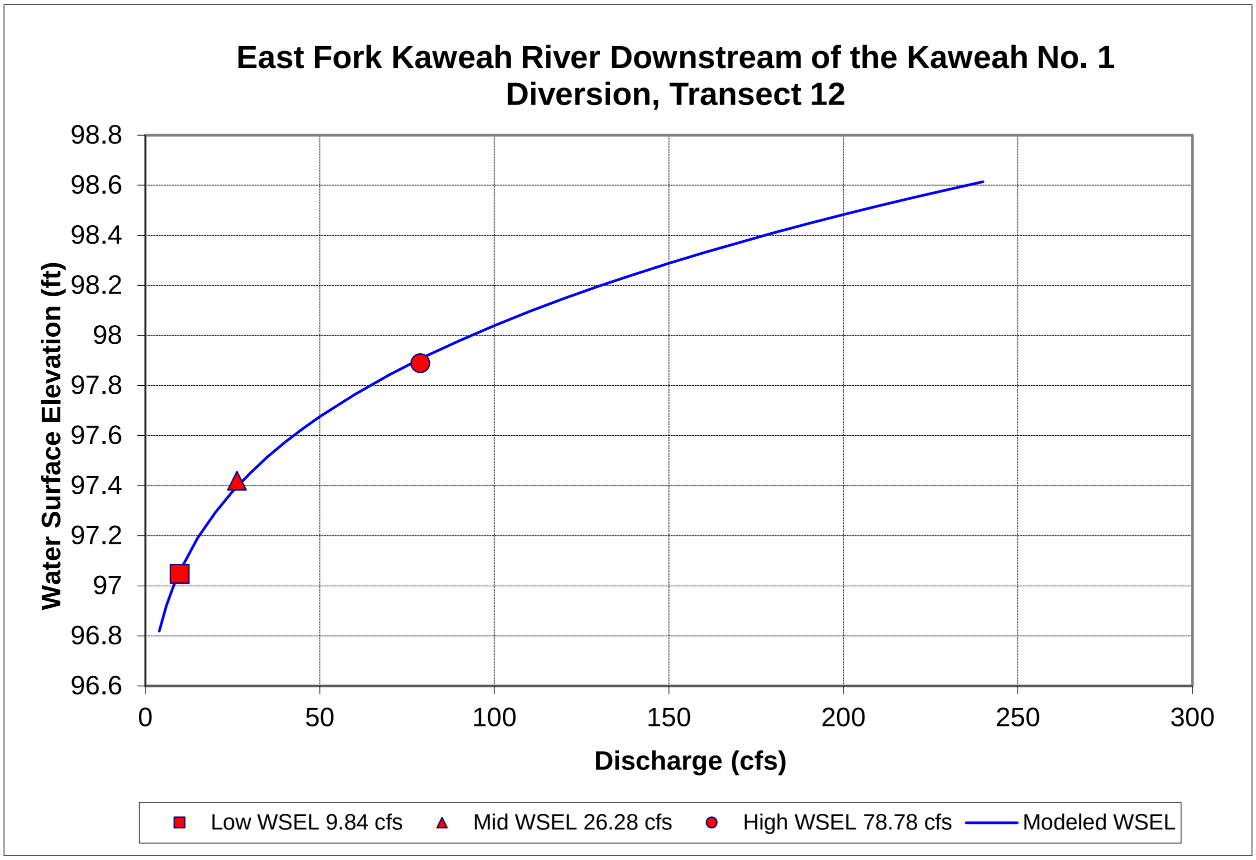

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 7
Water Surface Elevation (ft)
89.5
89
88.5
88
87.5
87
86.5
86
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

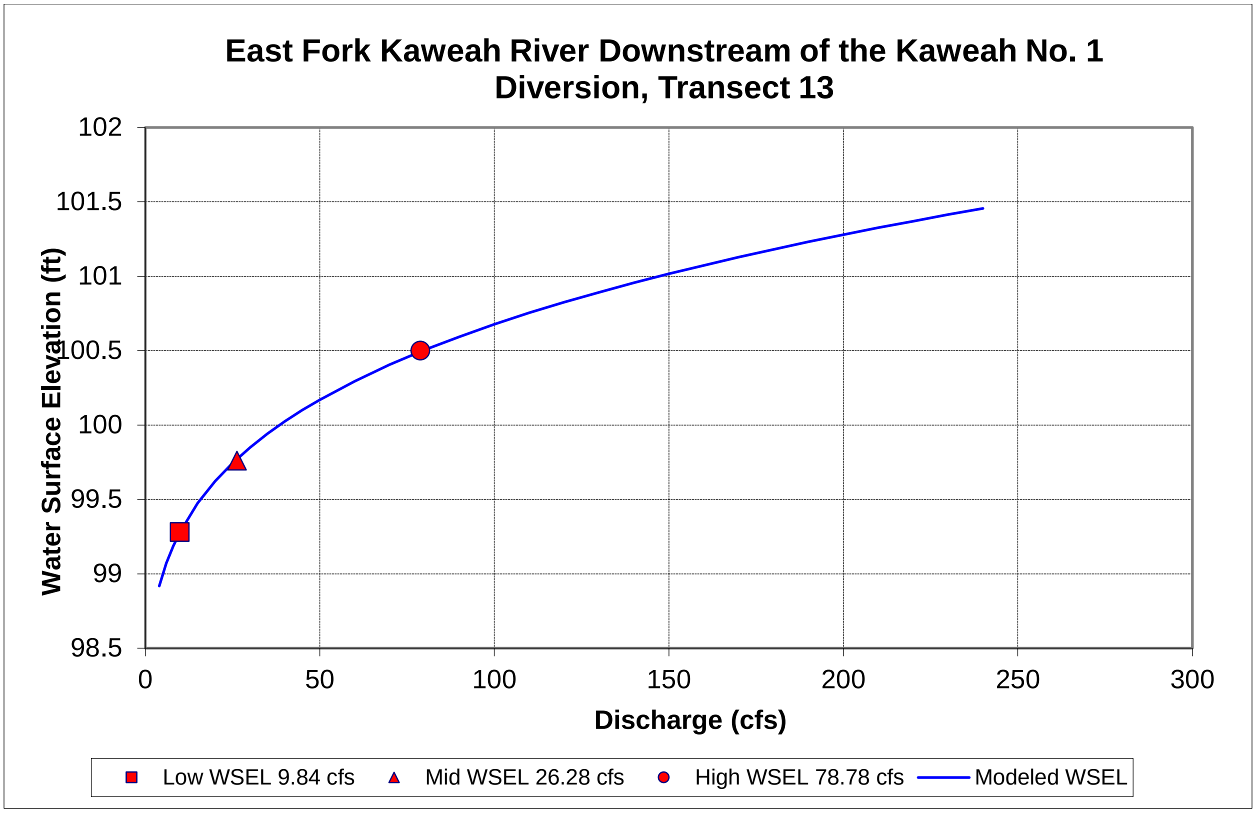

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 8
Water Surface Elevation (ft)
91
90.5
90
89.5
89
88.5
88
87.5
87
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

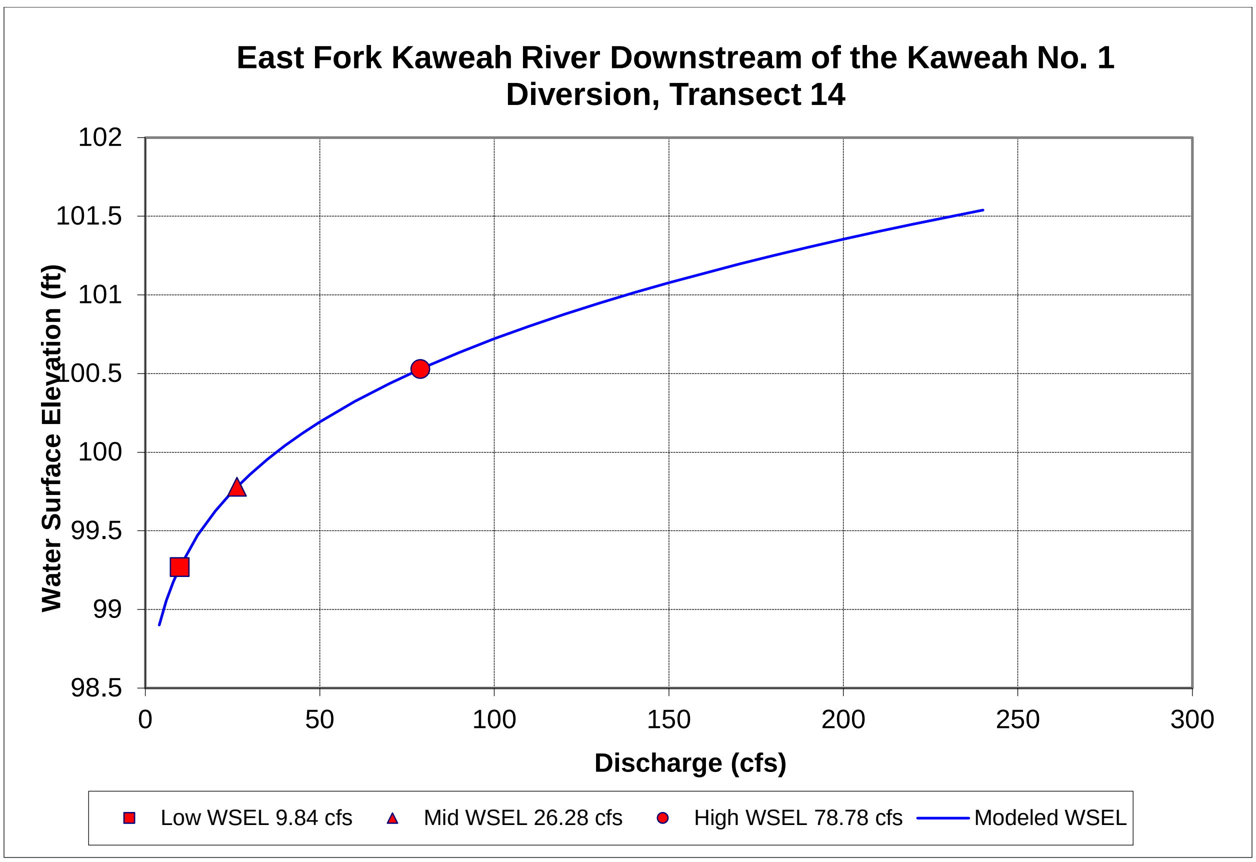

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 9
Water Surface Elevation (ft)
92.5
92
91.5
91
90.5
90
89.5
89
88.5
88
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

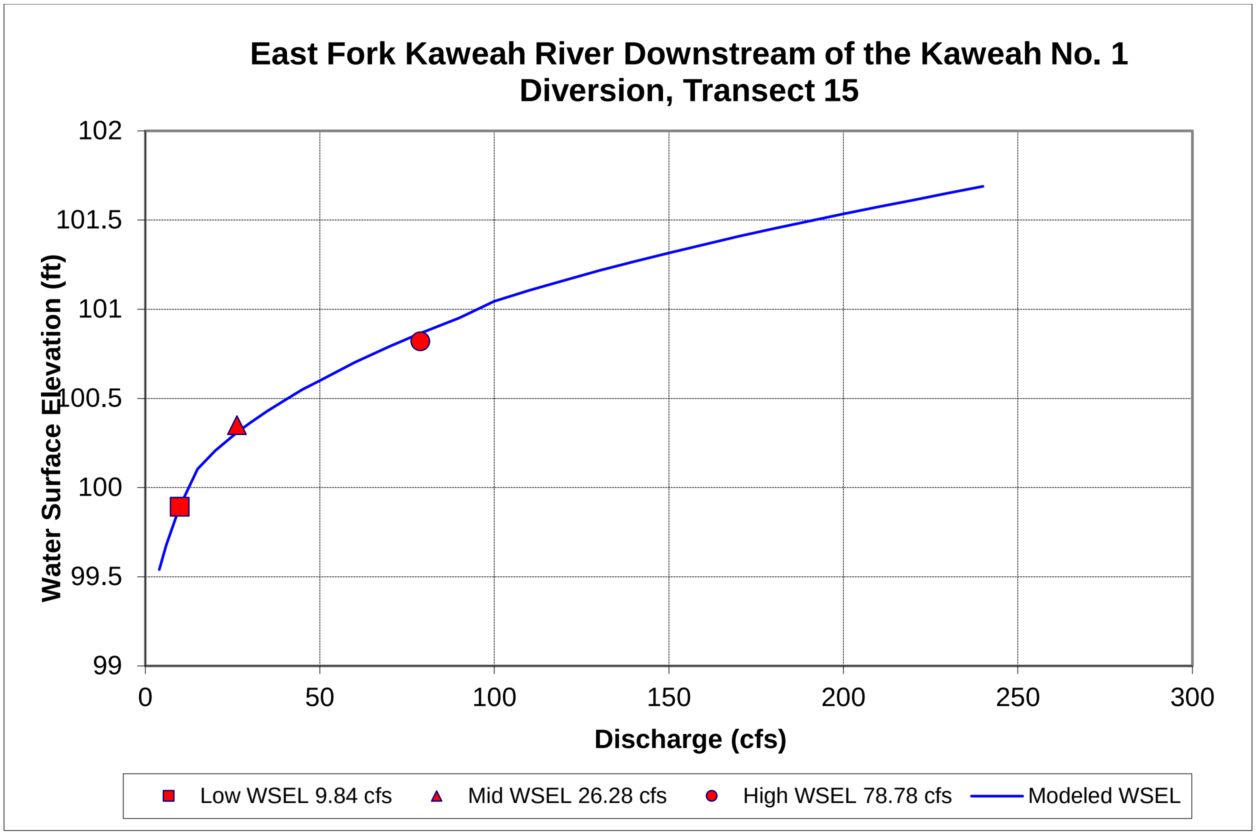

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 10
Water Surface Elevation (ft)
97.8
97.6
97.4
97.2
97
96.8
96.6
96.4
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

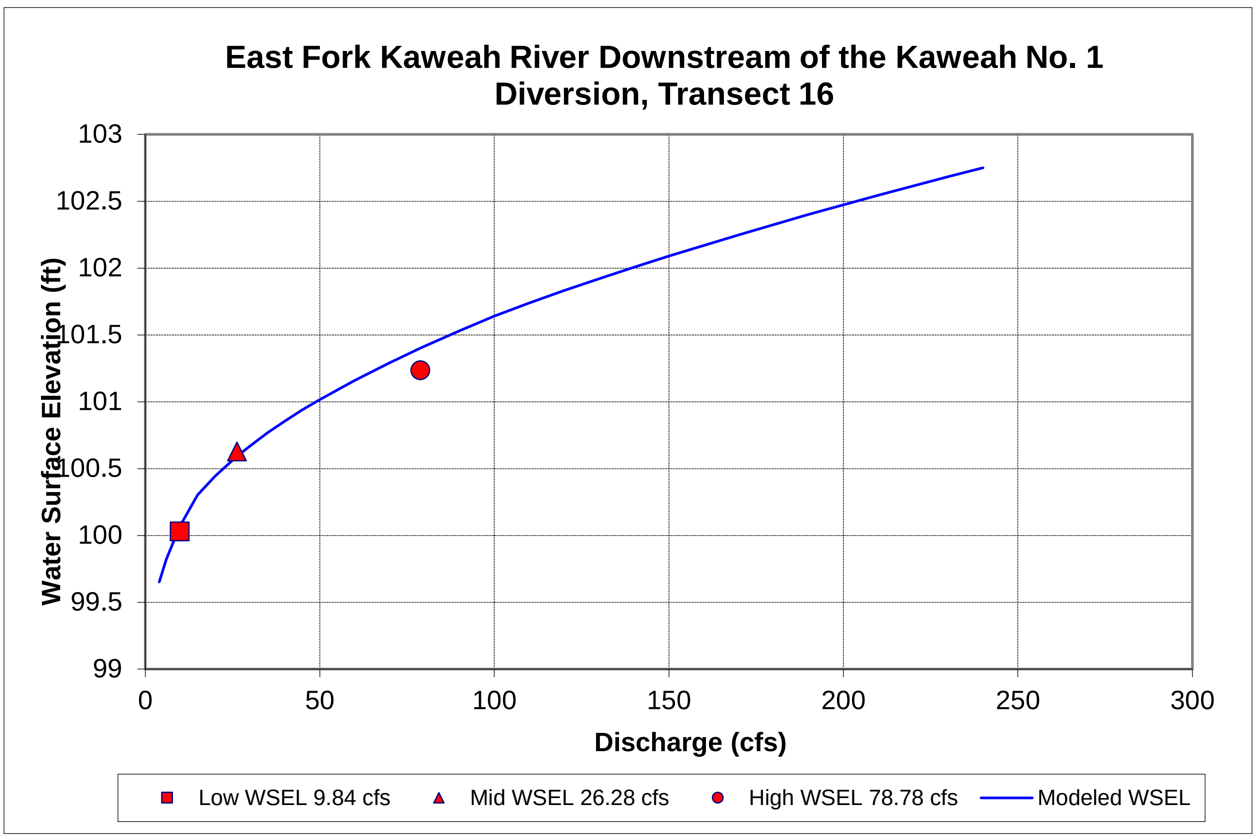

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 11
Water Surface Elevation (ft)
98.2
98
97.8
97.6
97.4
97.2
97
96.8
96.6
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

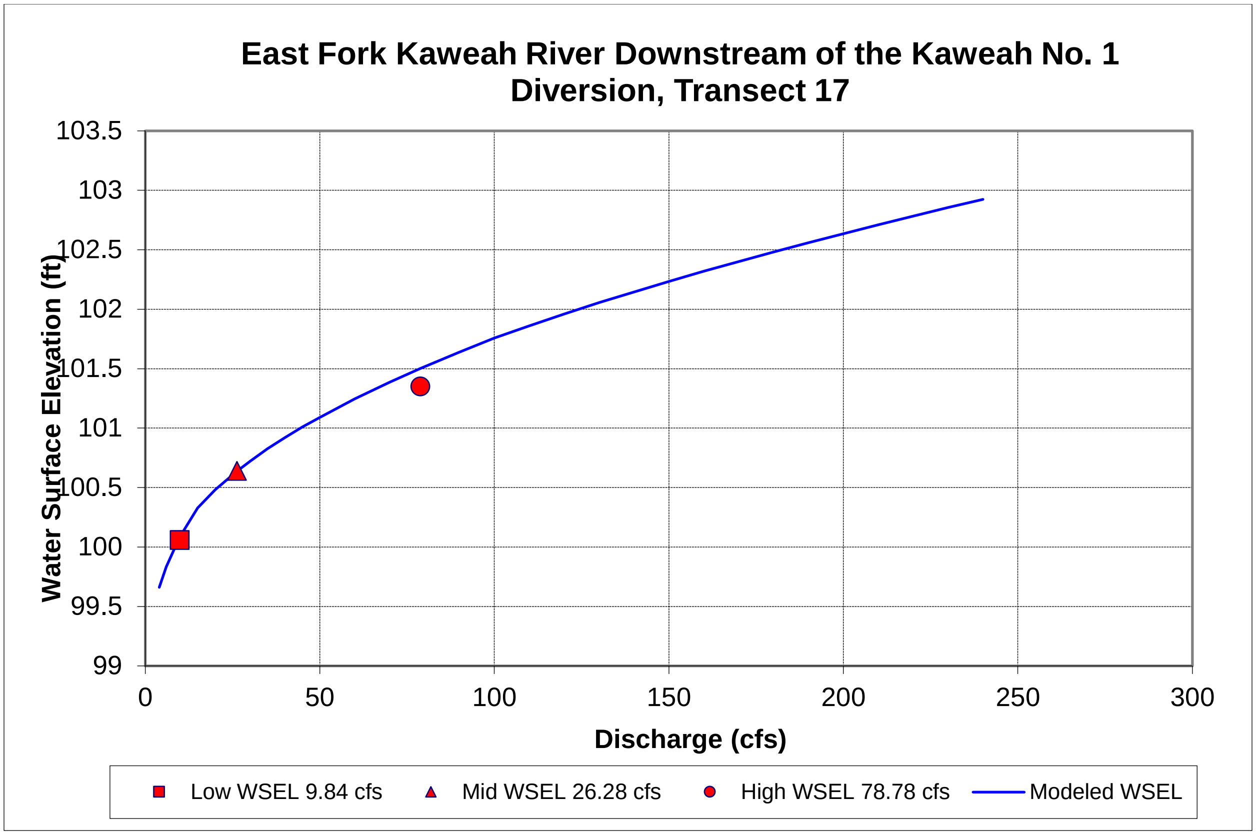

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 12
Water Surface Elevation (ft)
98.8
98.6
98.4
98.2
98
97.8
97.6
97.4
97.2
97
96.8
96.6
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

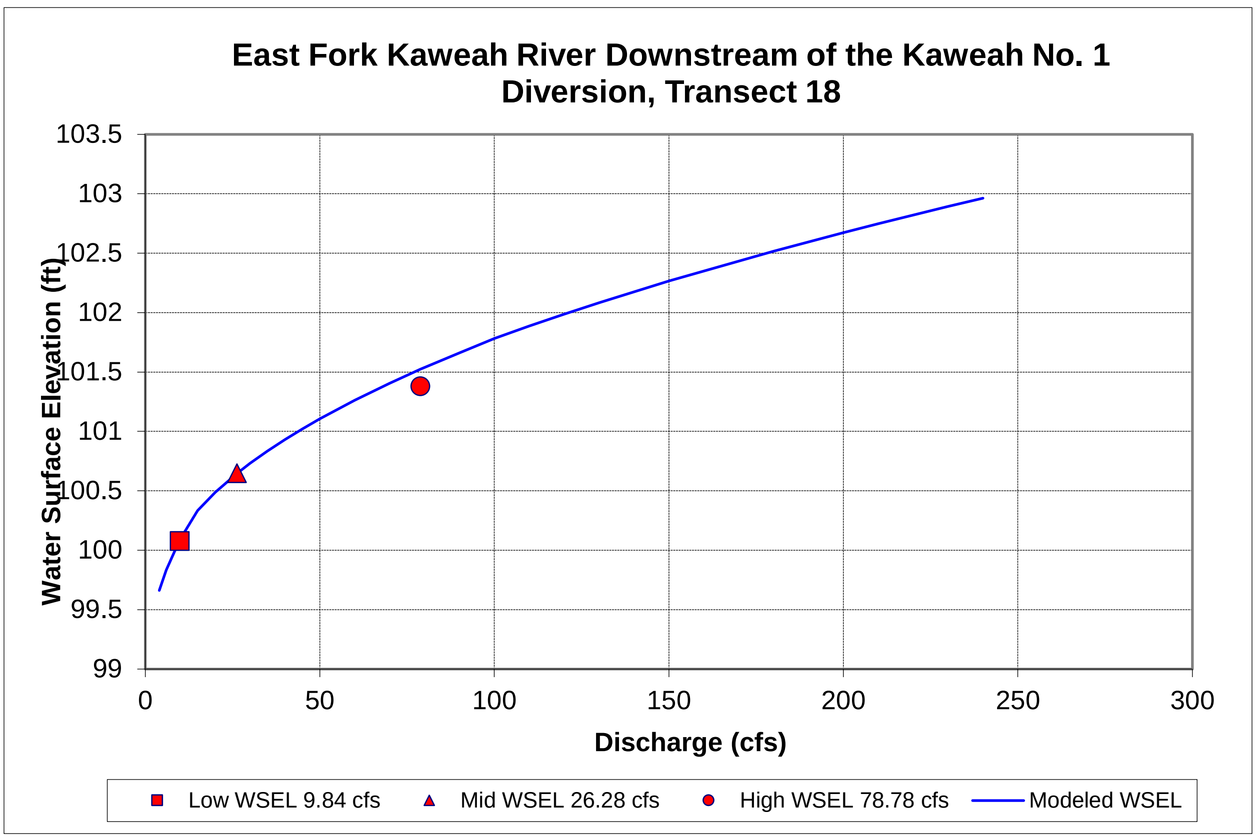

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 13
Water Surface Elevation (ft)
102
101.5
101
100.5
100
99.5
99
98.5
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 14
Water Surface Elevation (ft)
102
101.5
101
100.5
100
99.5
99
98.5
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 15
Water Surface Elevation (ft)
102
101.5
101
100.5
100
99.5
99
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 16
Water Surface Elevation (ft)
103
102.5
102
101.5
101
100.5
100
99.5
99
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 17
Water Surface Elevation (ft)
103.5
103
102.5
102
101.5
101
100.5
100
99.5
99
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 18
Water Surface Elevation (ft)
103.5
103
102.5
102
101.5
101
100.5
100
99.5
99
0
50
100
150
200
250
300
Discharge (cfs)
Low WSEL 9.84 cfs
Mid WSEL 26.28 cfs
High WSEL 78.78 cfs
Modeled WSEL

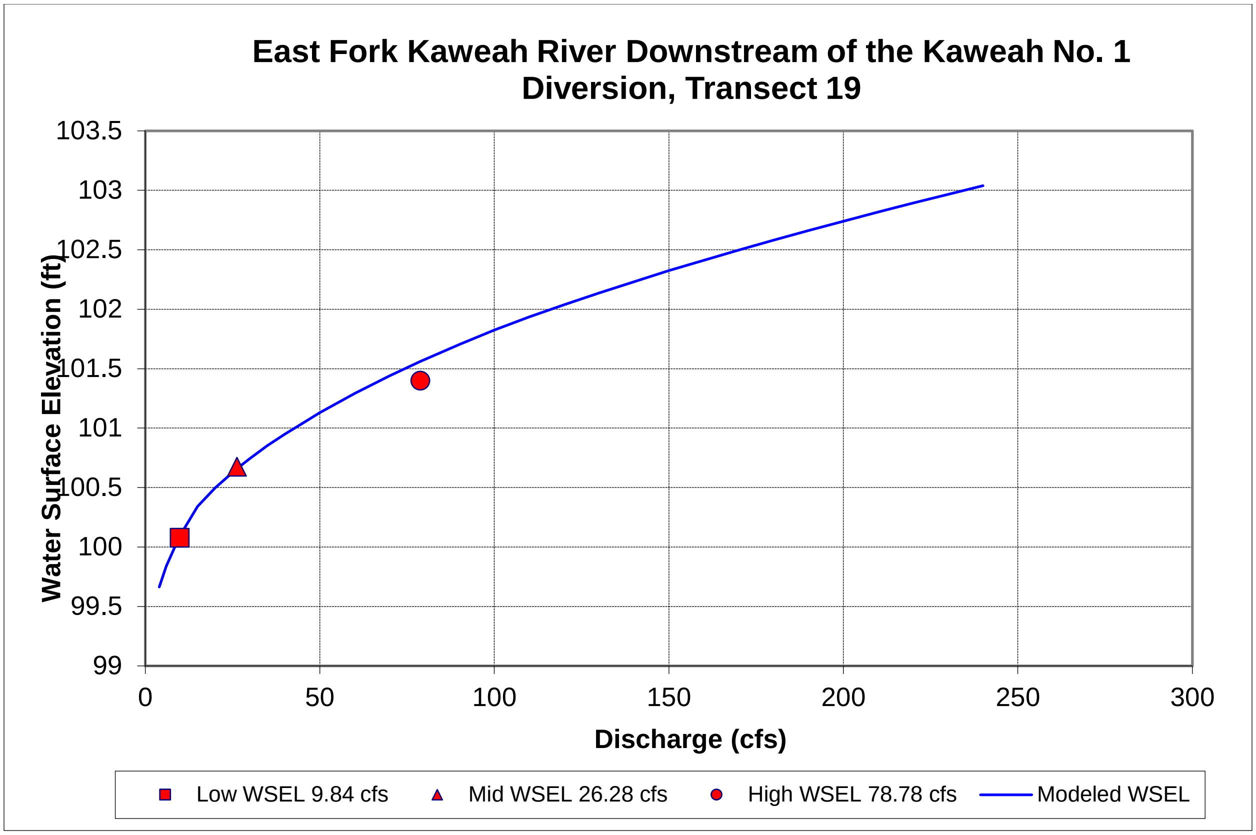
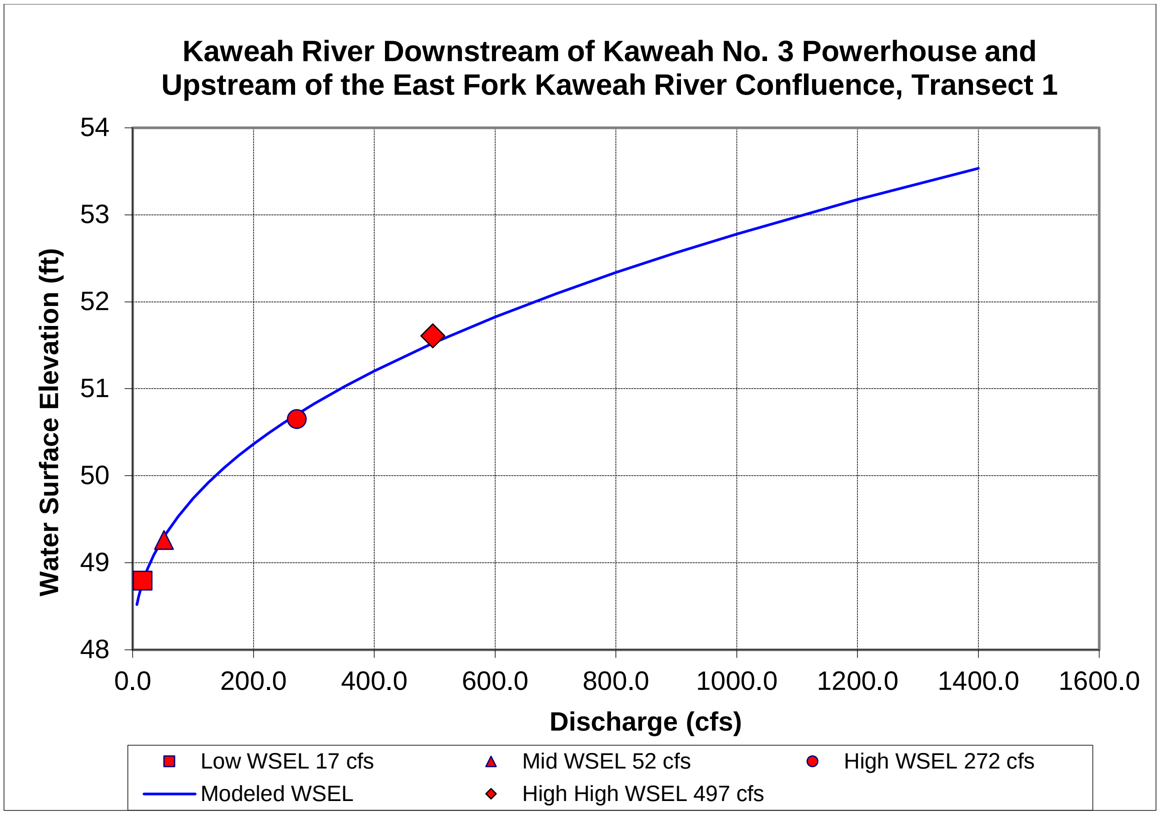
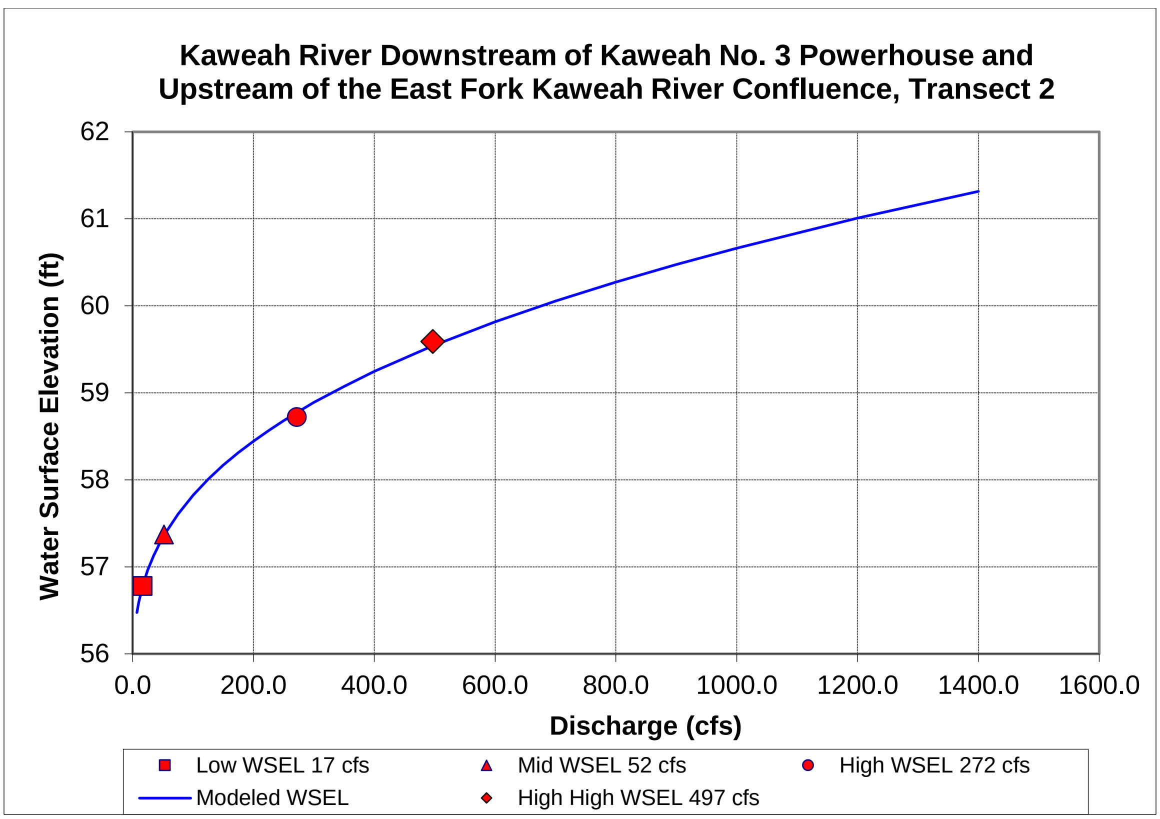
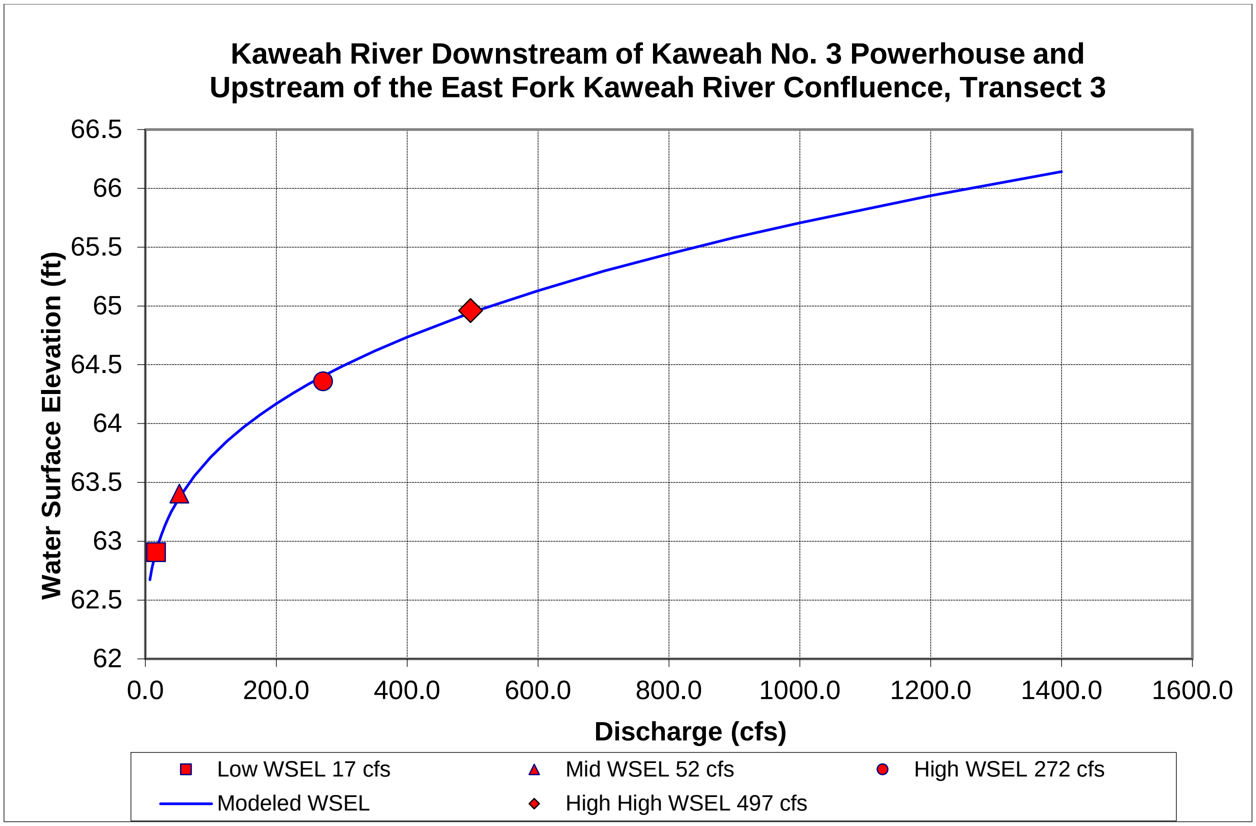
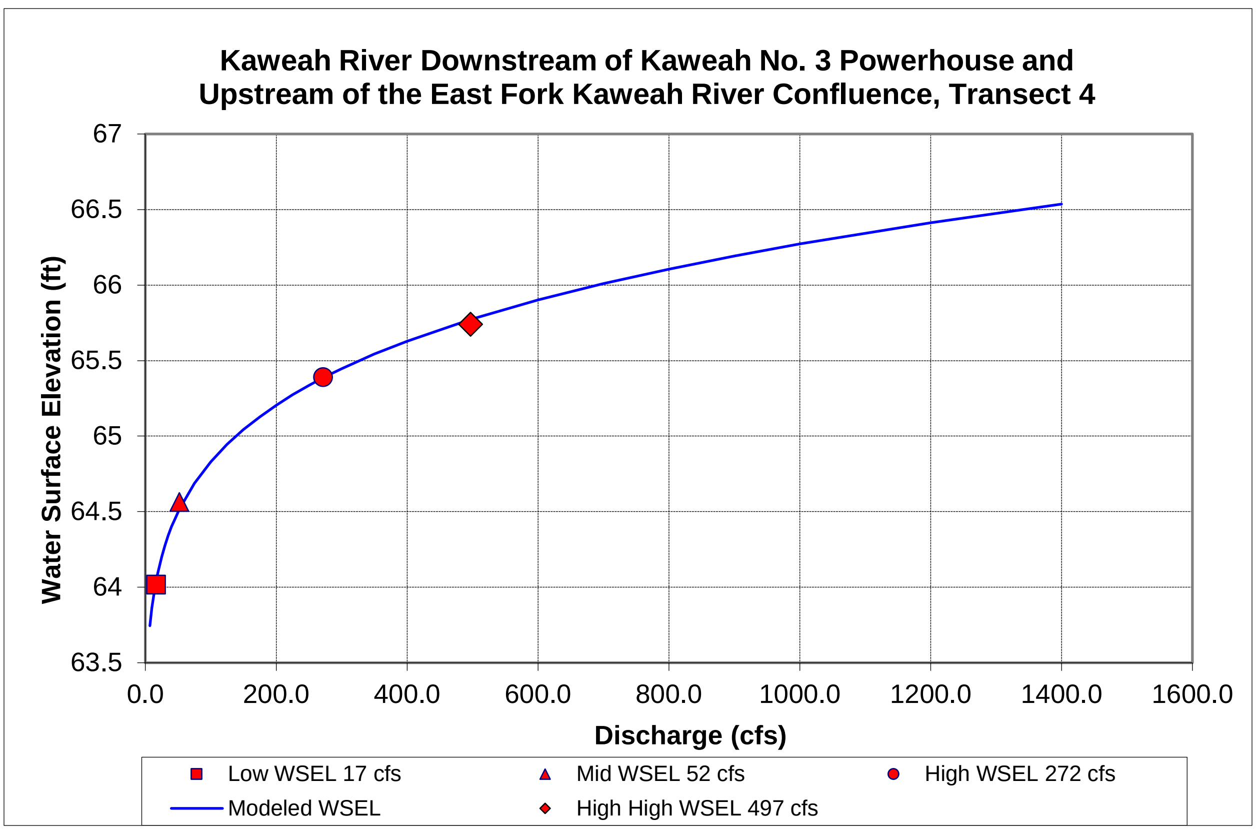


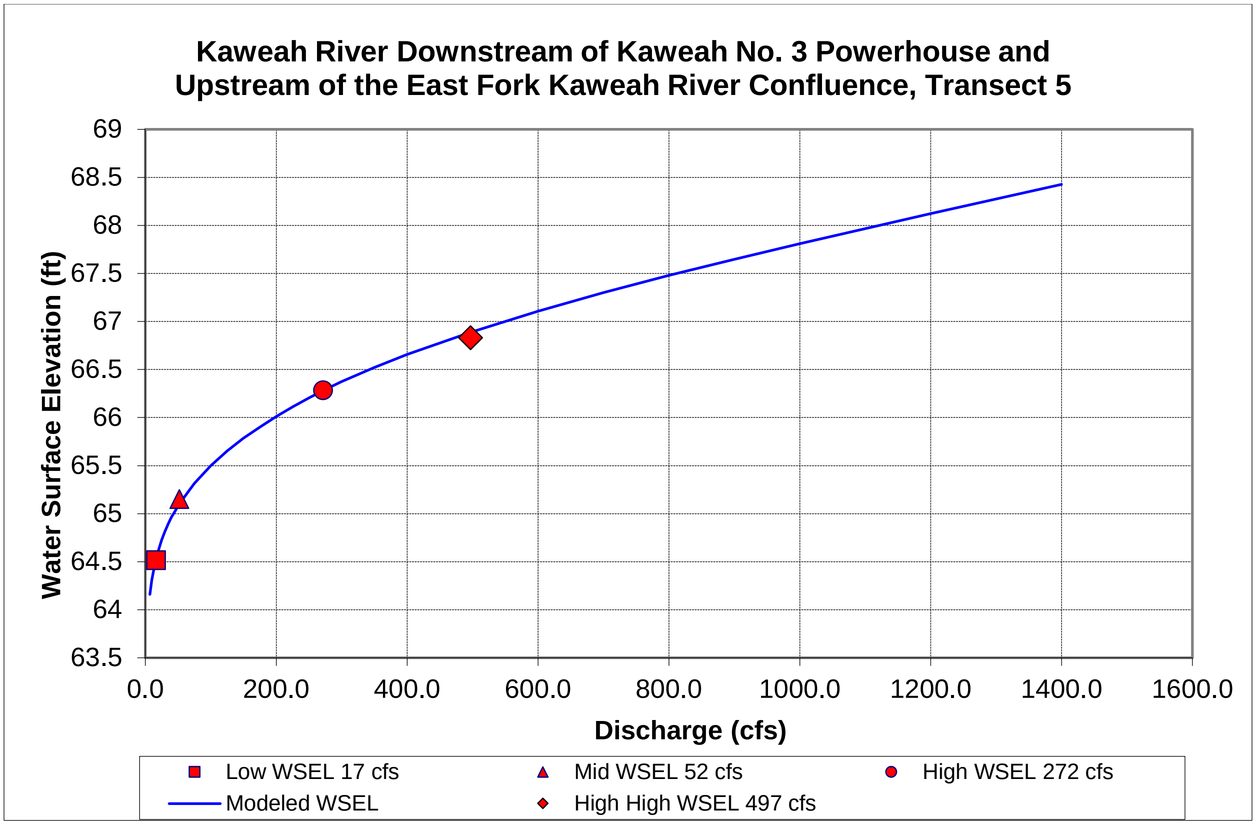
Figure D.A-2. **Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Stage Discharge Calibration Report.**

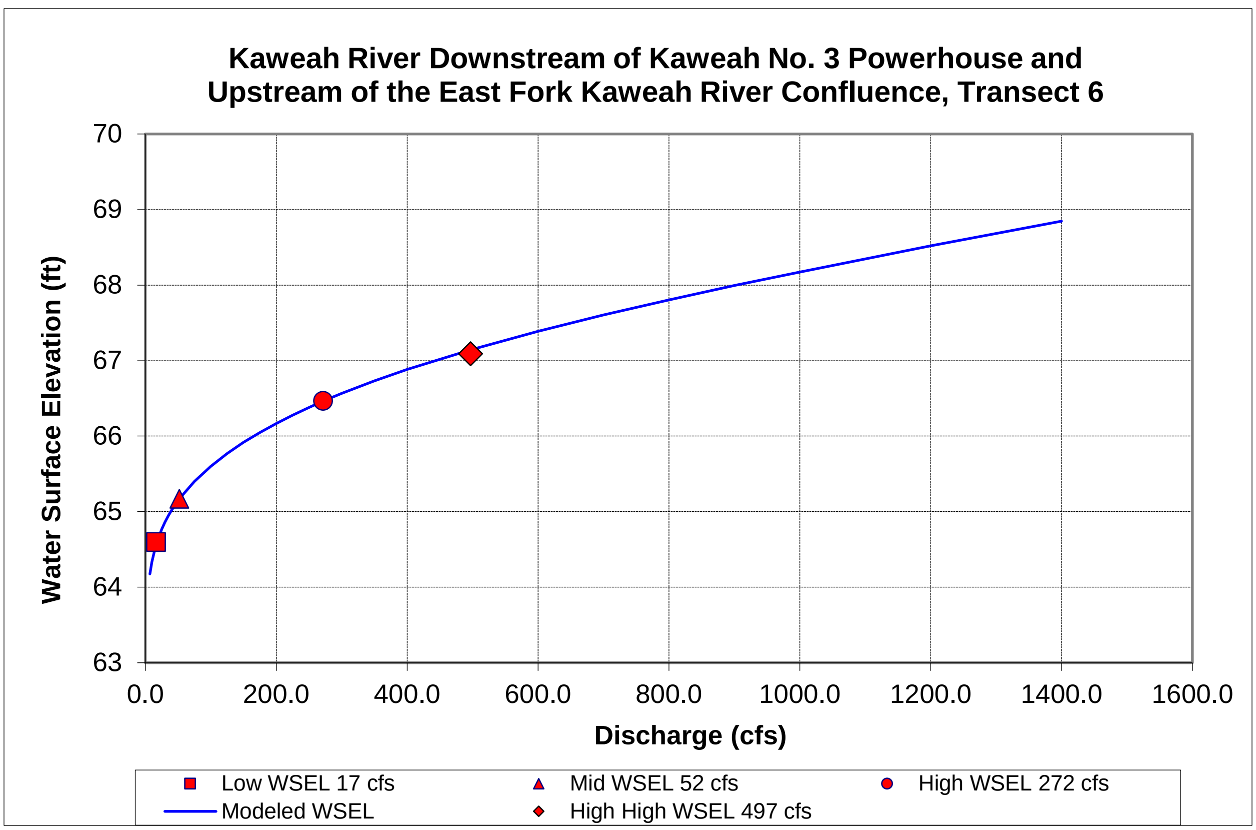

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 1
Water Surface Elevation (ft)
54
53
52
51
50
49
48
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

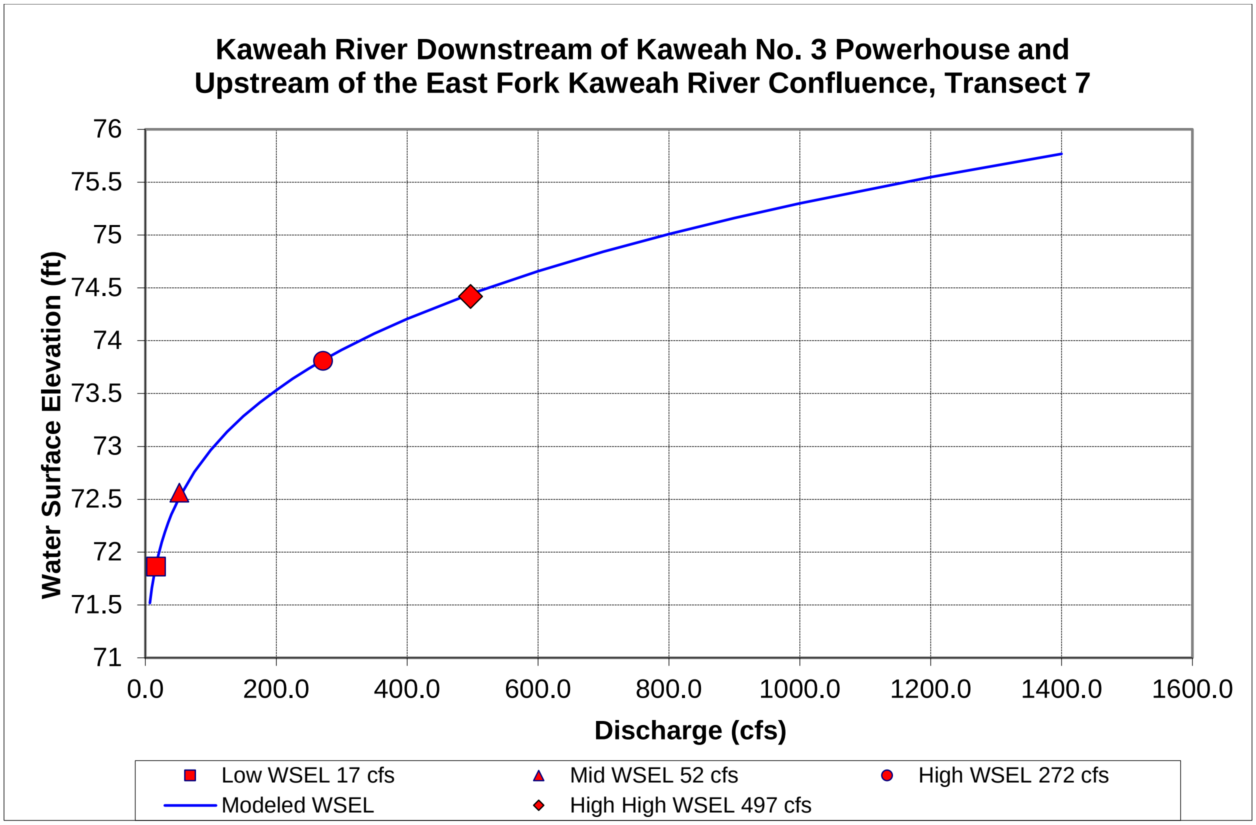

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 2
Water Surface Elevation (ft)
62
61
60
59
58
57
56
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

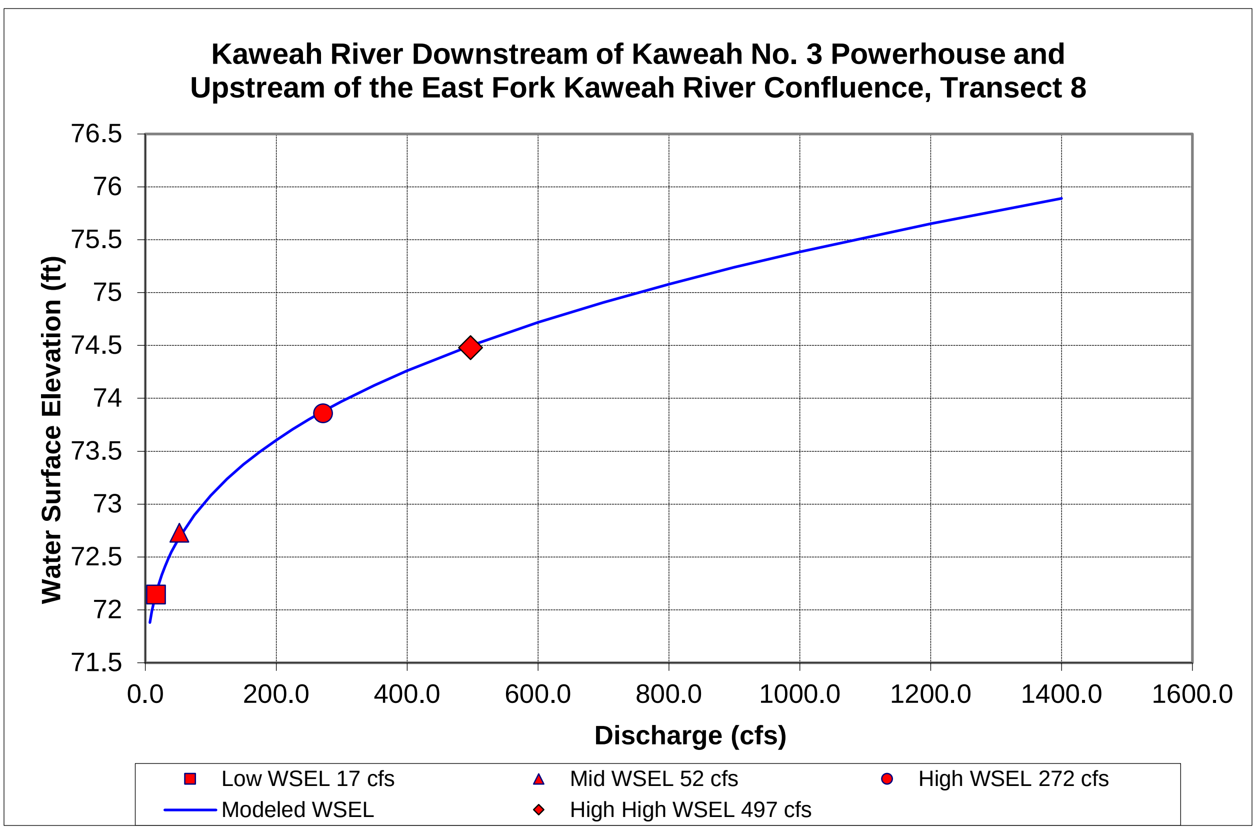

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 3
Water Surface Elevation (ft)
66.5
66
65.5
65
64.5
64
63.5
63
62.5
62
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

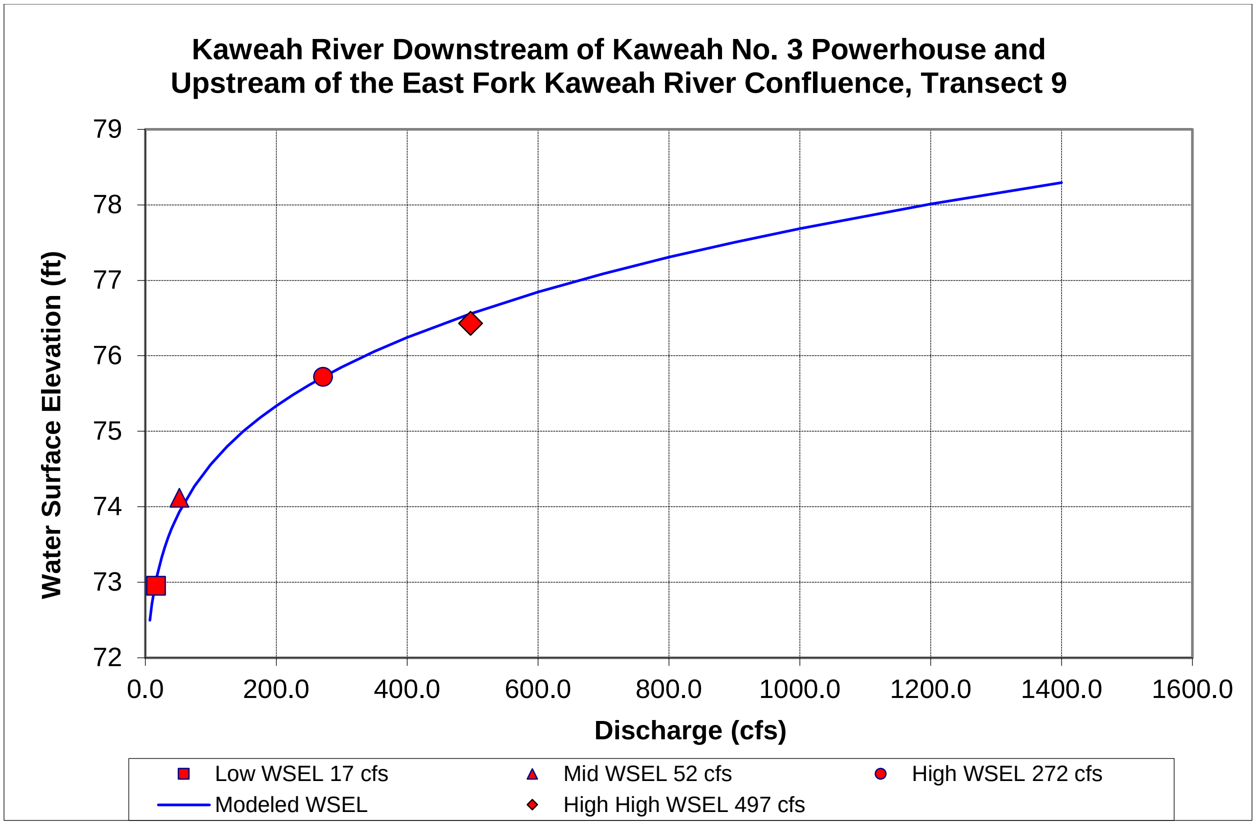

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 4
Water Surface Elevation (ft)
67
66.5
66
65.5
65
64.5
64
63.5
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

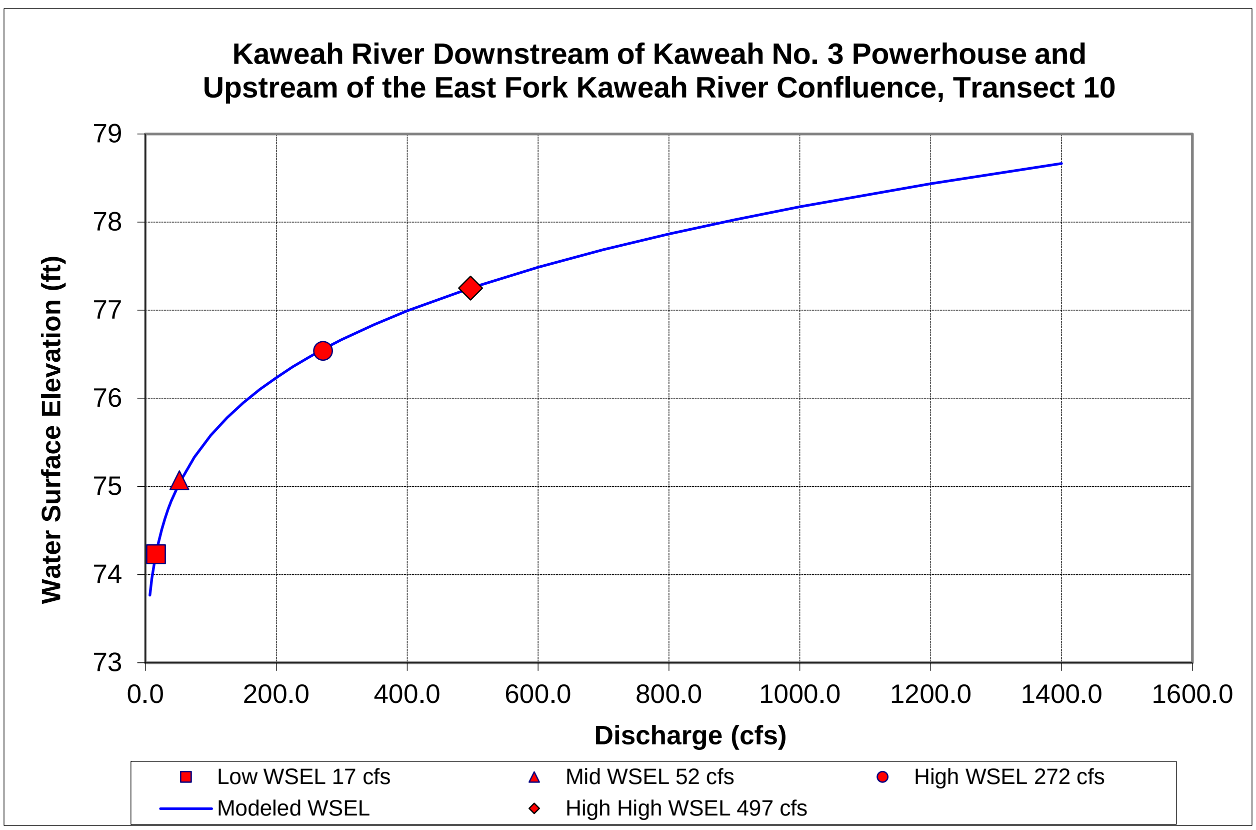

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 5
Water Surface Elevation (ft)
69
68.5
68
67.5
67
66.5
66
65.5
65
64.5
64
63.5
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

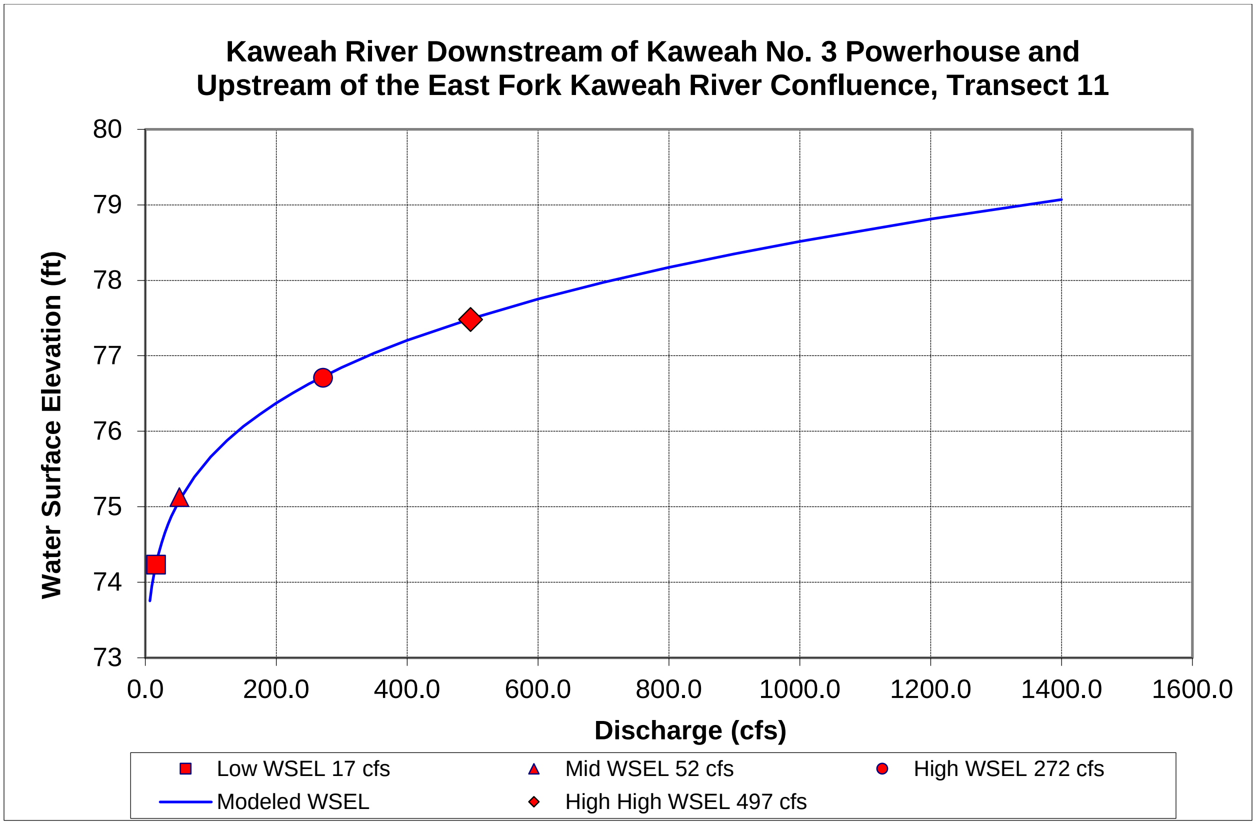

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 6
Water Surface Elevation (ft)
70
69
68
67
66
65
64
63
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

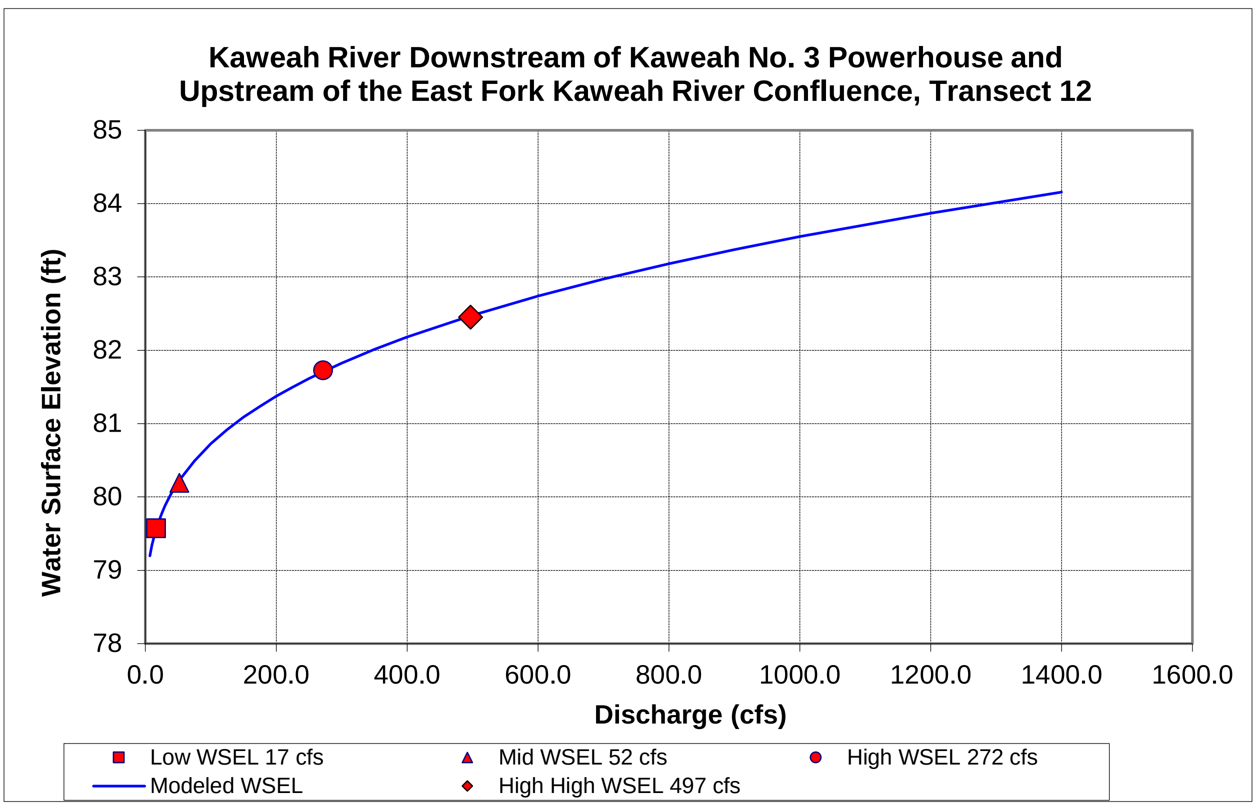

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 7
Water Surface Elevation (ft)
76
75.5
75
74.5
74
73.5
73
72.5
72
71.5
71
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

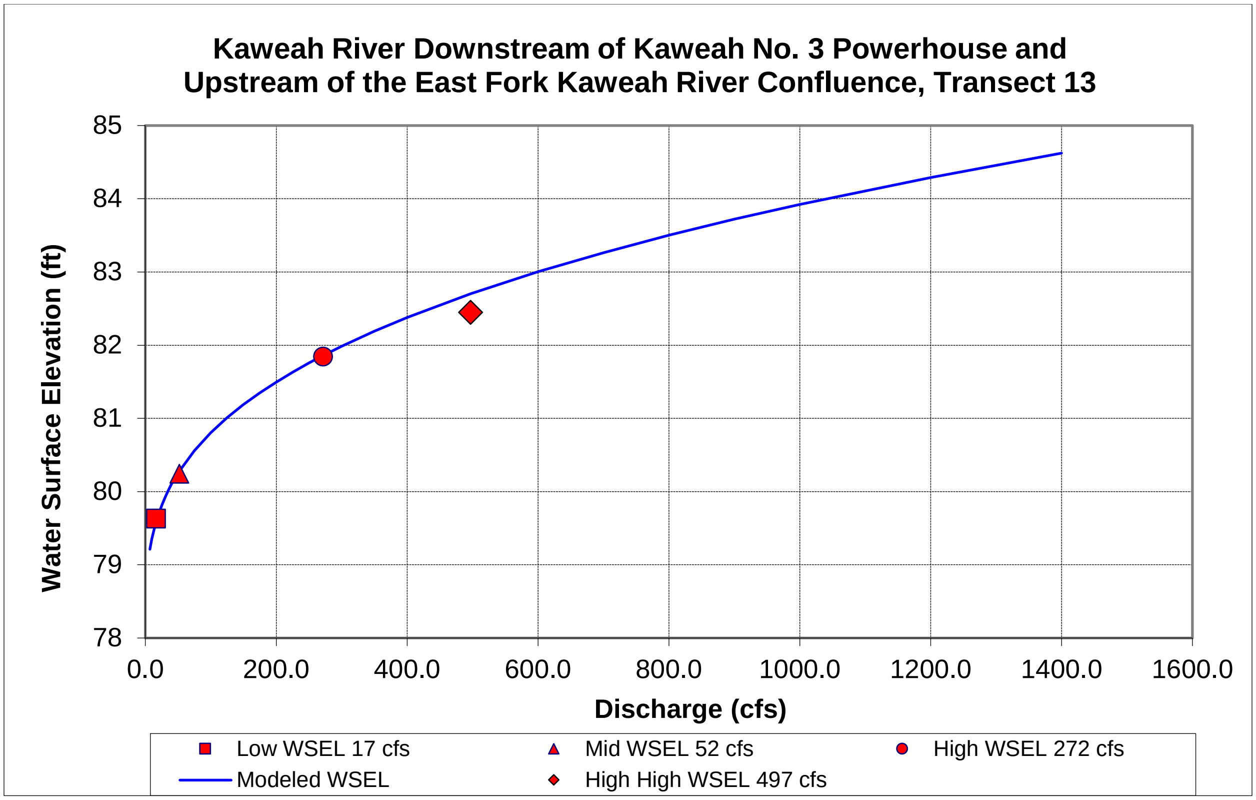

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 8
Water Surface Elevation (ft)
76.5
76
75.5
75
74.5
74
73.5
73
72.5
72
71.5
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

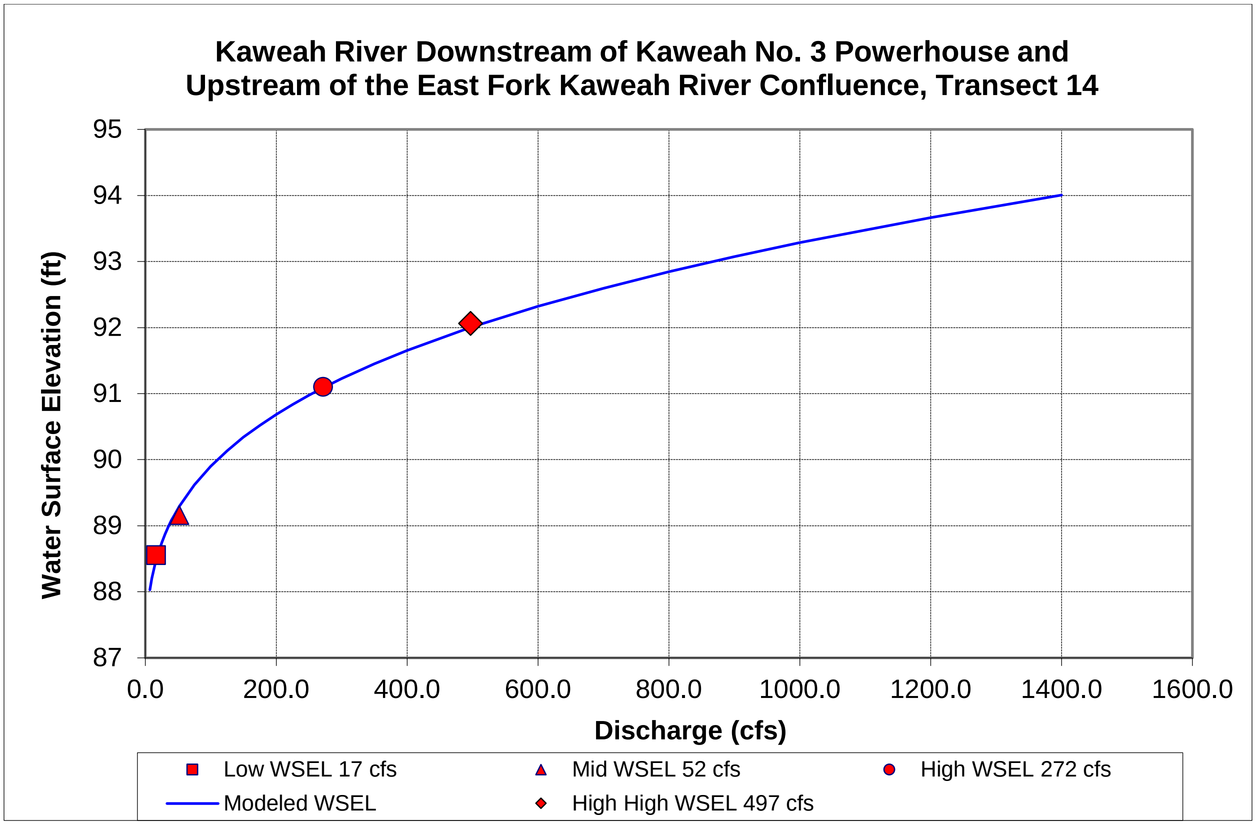

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 9
Water Surface Elevation (ft)
79
78
77
76
75
74
73
72
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

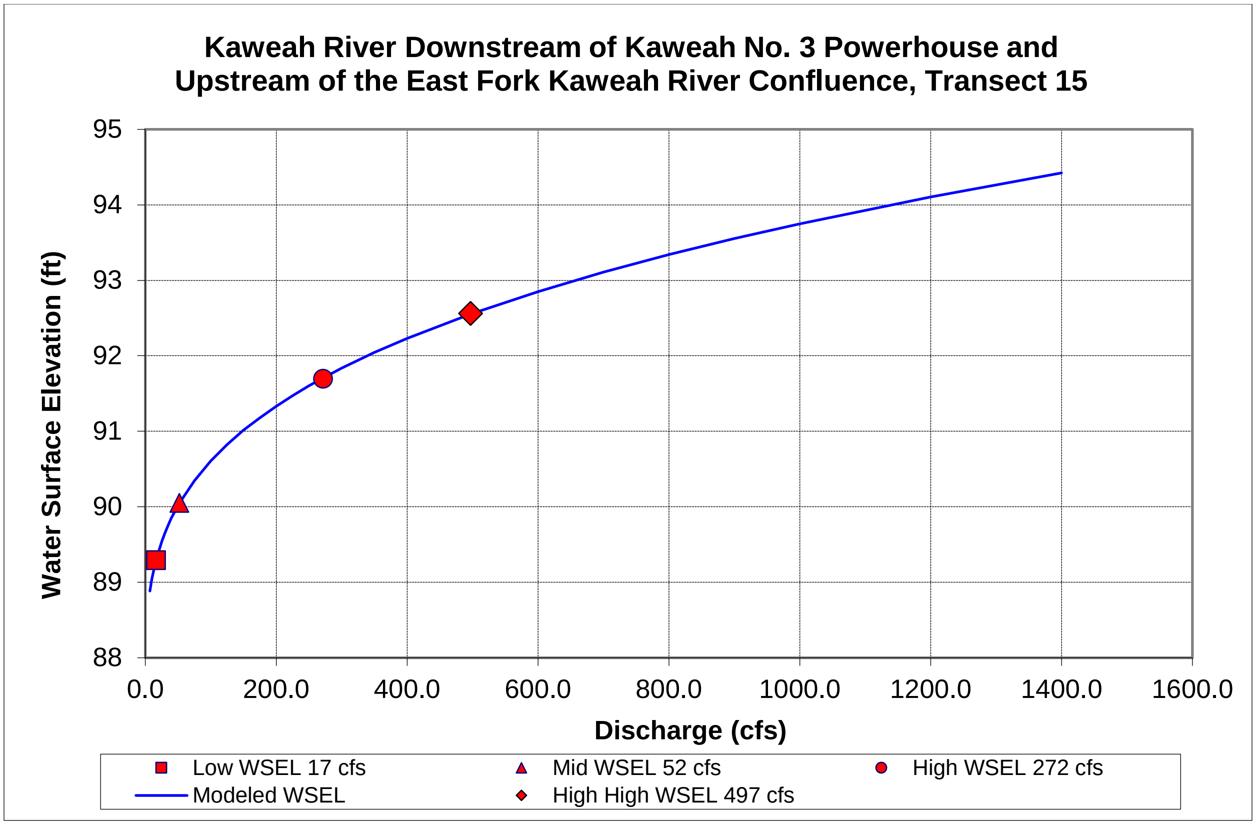

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 10
Water Surface Elevation (ft)
79
78
77
76
75
74
73
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

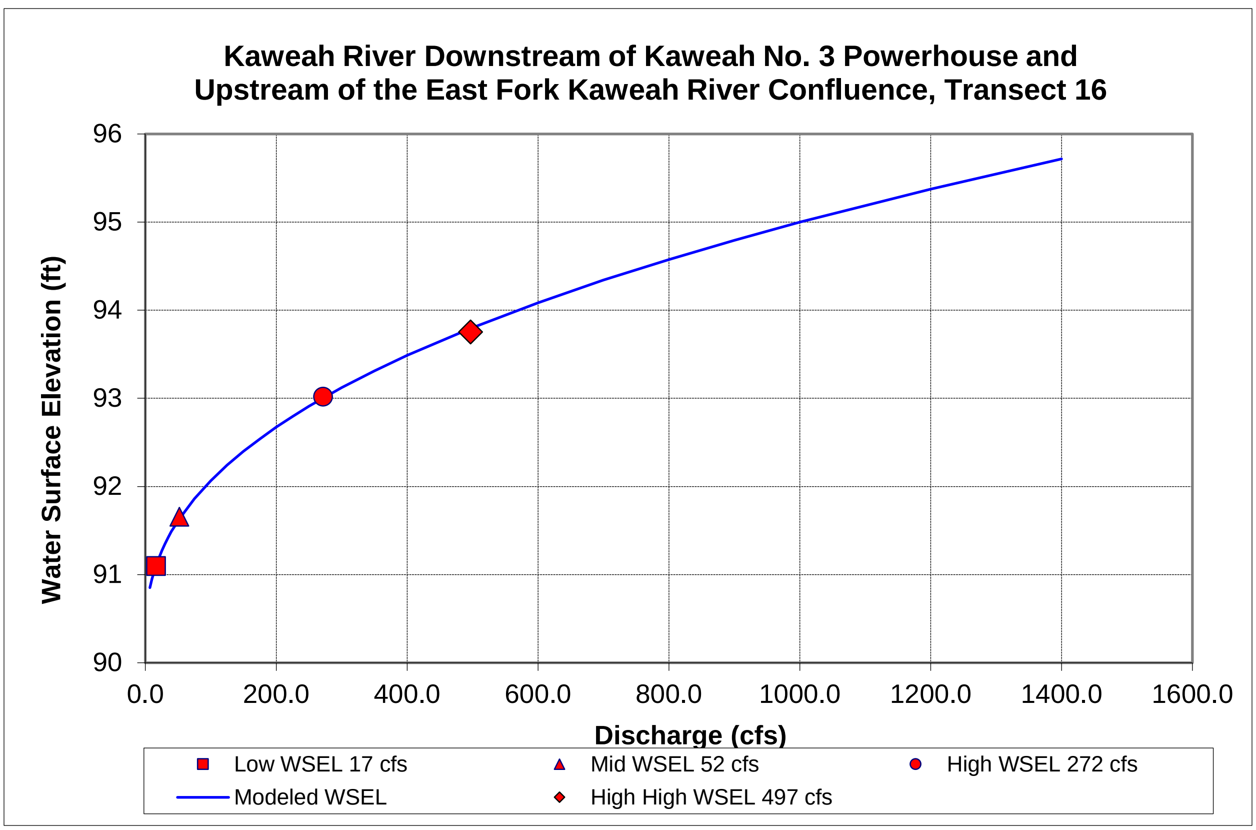

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 11
Water Surface Elevation (ft)
80
79
78
77
76
75
74
73
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

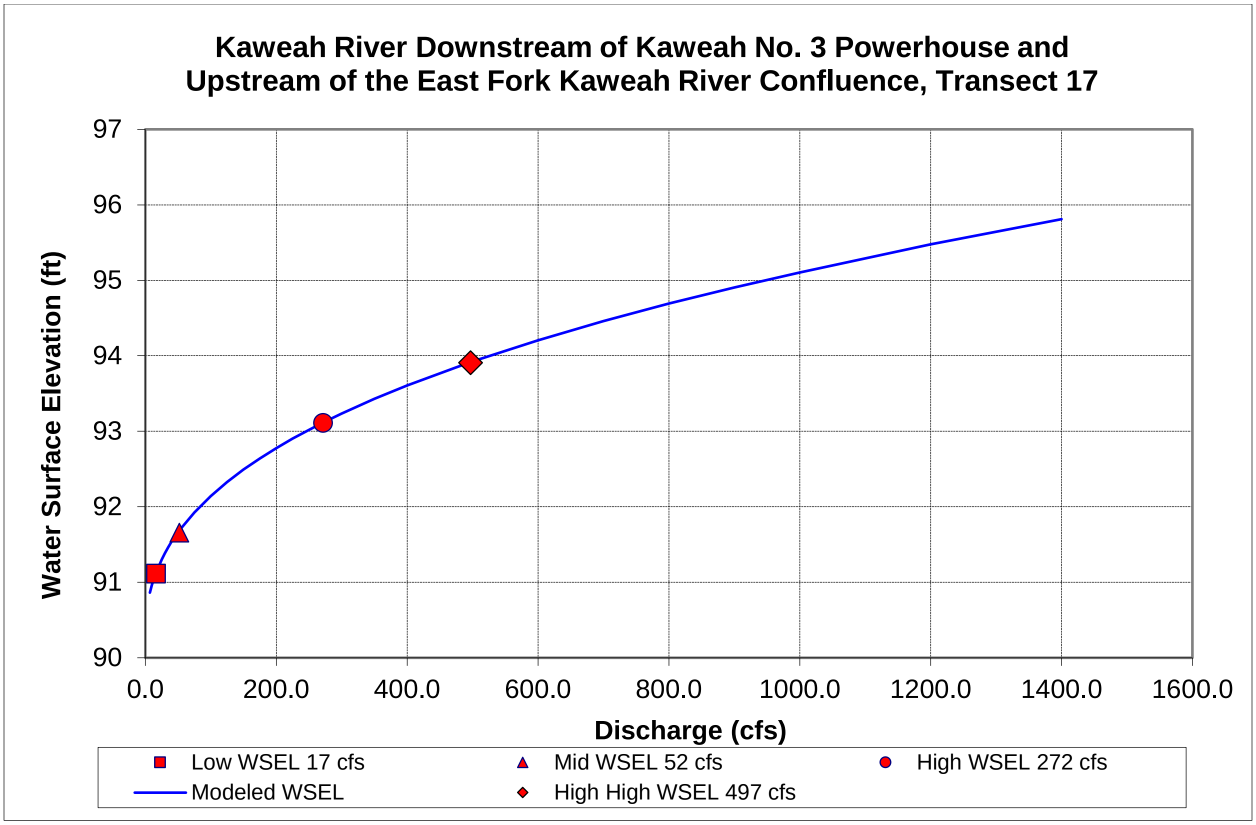

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 12
Water Surface Elevation (ft)
85
84
83
82
81
80
79
78
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 13
Water Surface Elevation (ft)
85
84
83
82
81
80
79
78
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 14
Water Surface Elevation (ft)
95
94
93
92
91
90
89
88
87
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 15
Water Surface Elevation (ft)
95
94
93
92
91
90
89
88
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 16
Water Surface Elevation (ft)
96
95
94
93
92
91
90
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 17
Water Surface Elevation (ft)
97
96
95
94
93
92
91
90
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

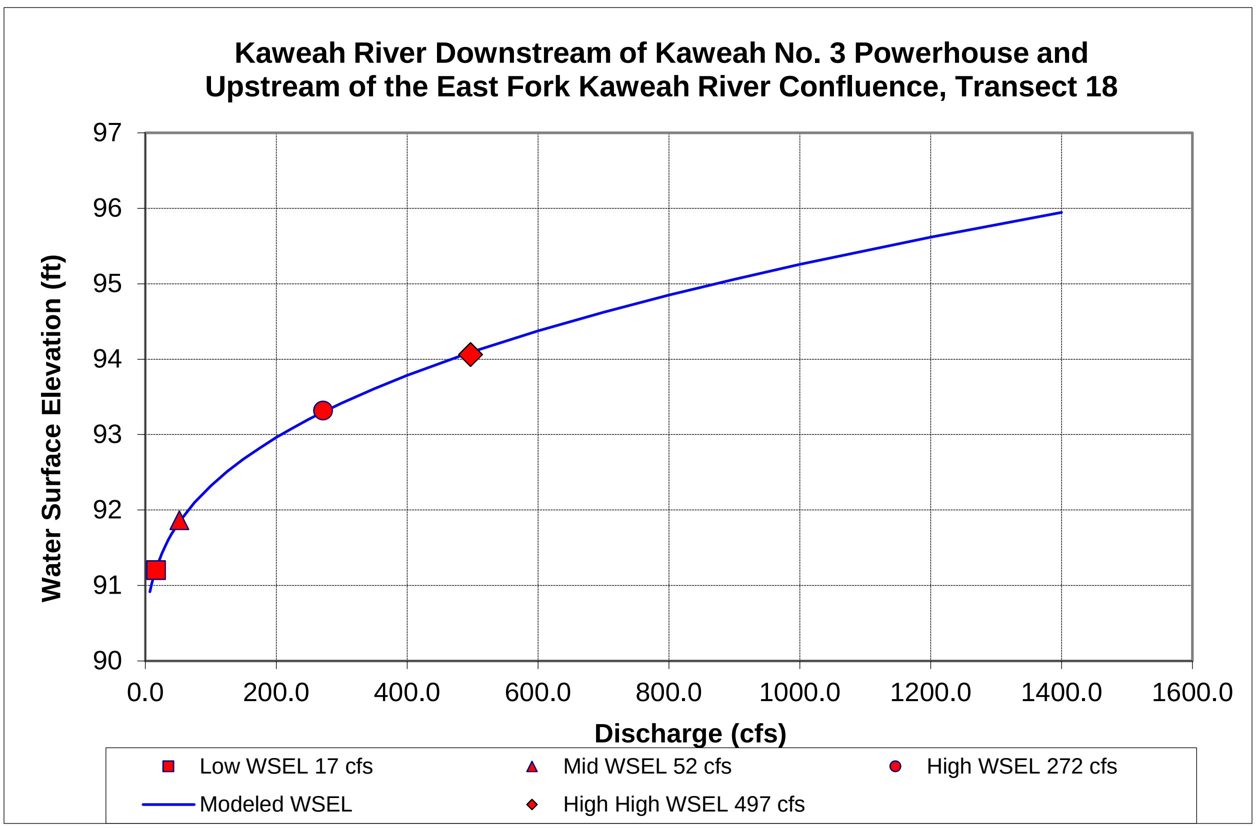
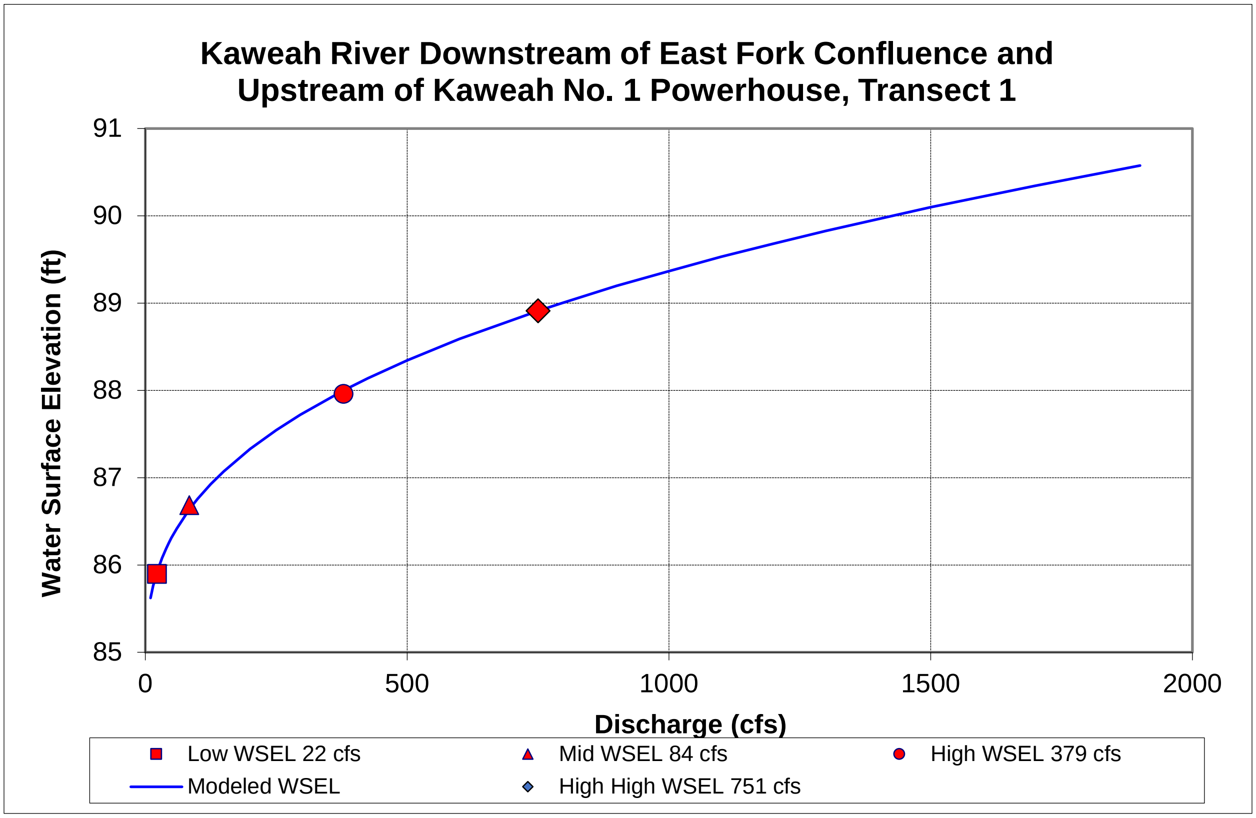
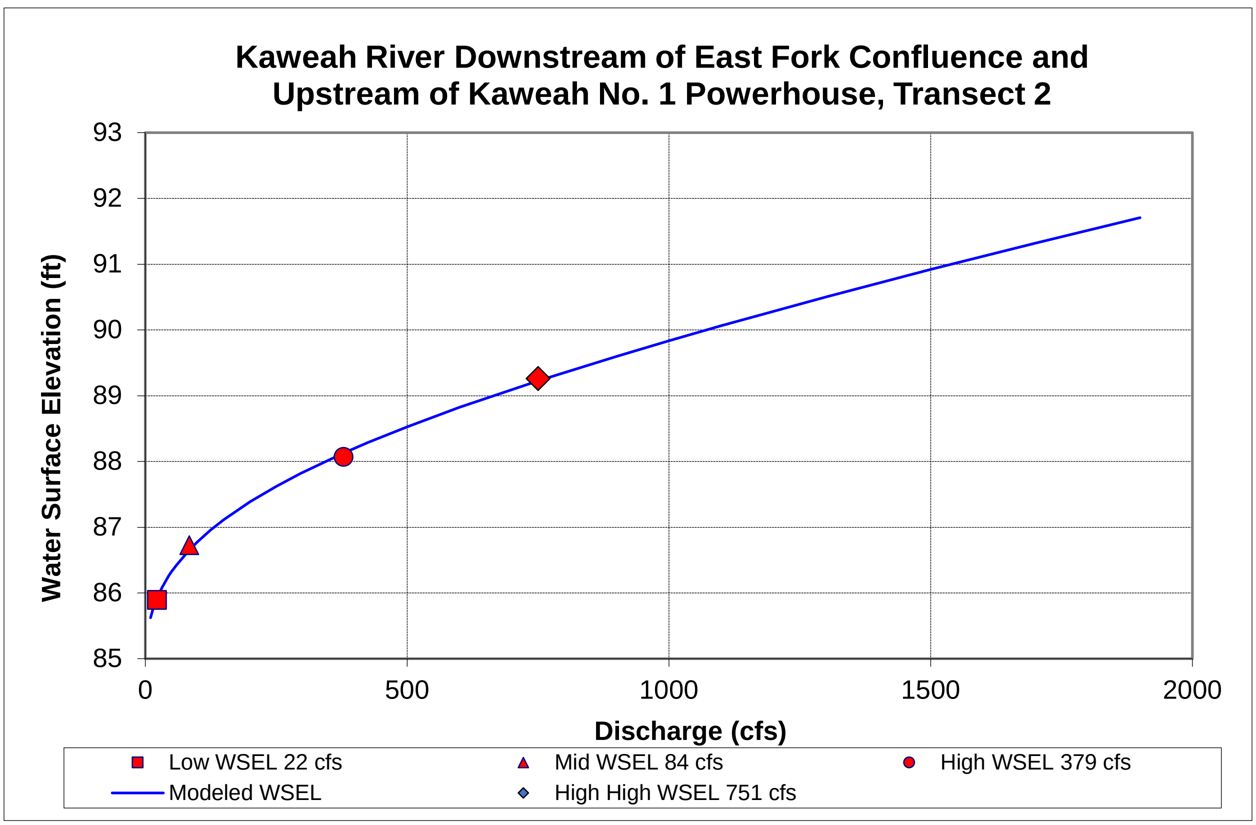
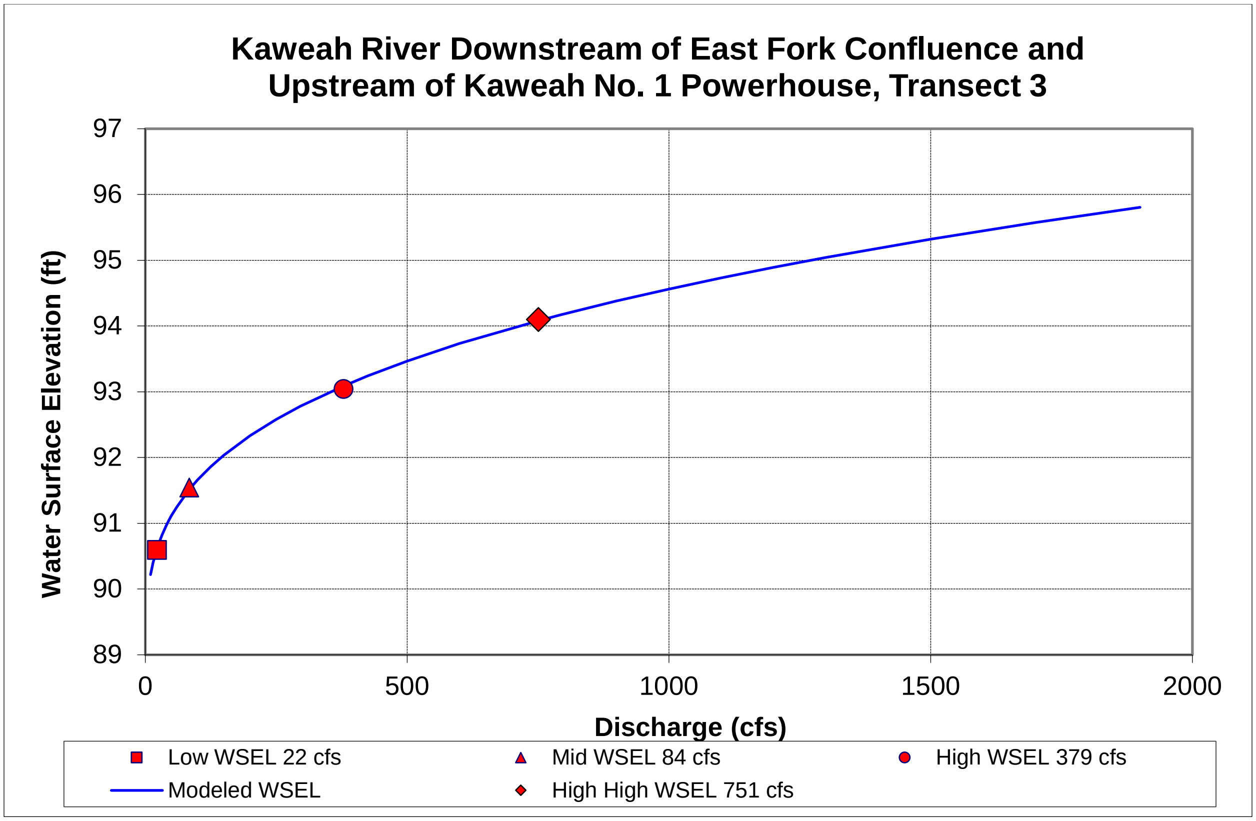
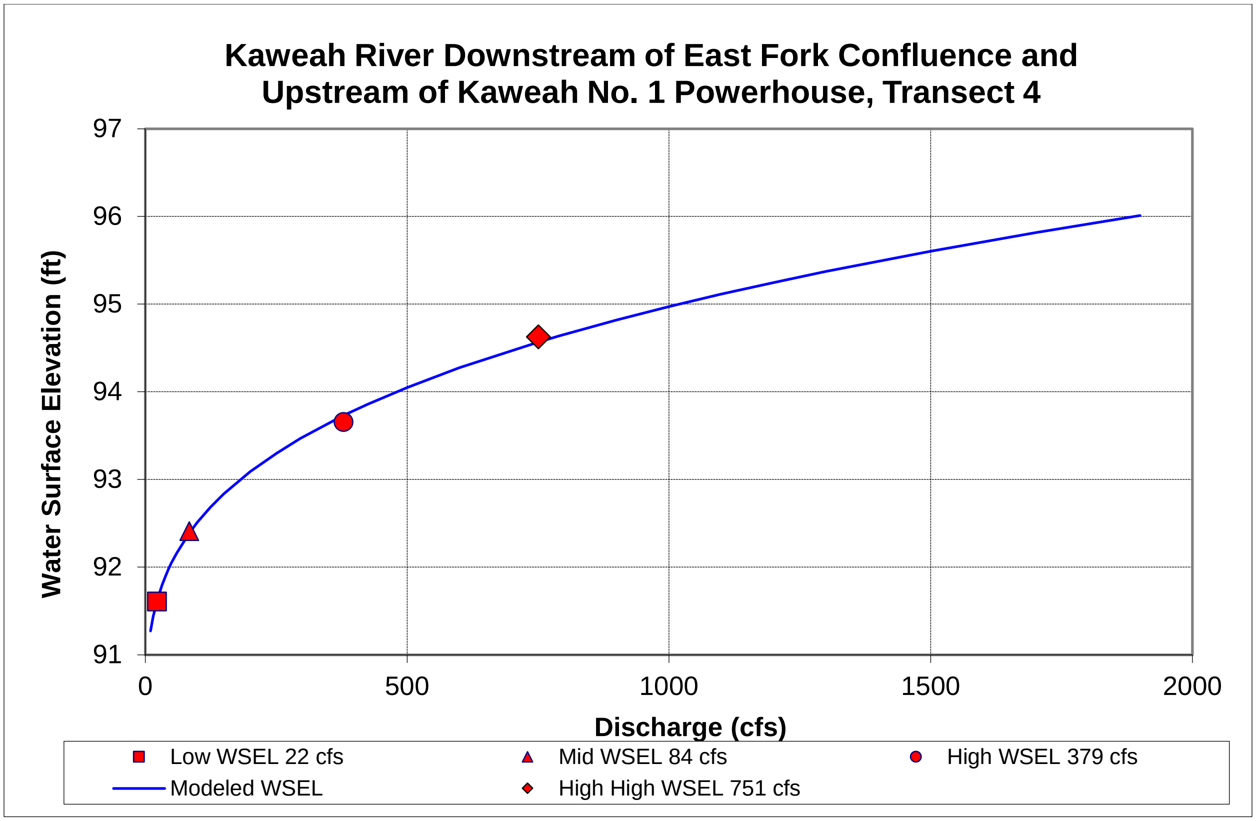

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 18
Water Surface Elevation (ft)
97
96
95
94
93
92
91
90
0.0
200.0
400.0
600.0
800.0
1000.0
1200.0
1400.0
1600.0
Discharge (cfs)
Low WSEL 17 cfs
Mid WSEL 52 cfs
High WSEL 272 cfs
Modeled WSEL
High High WSEL 497 cfs

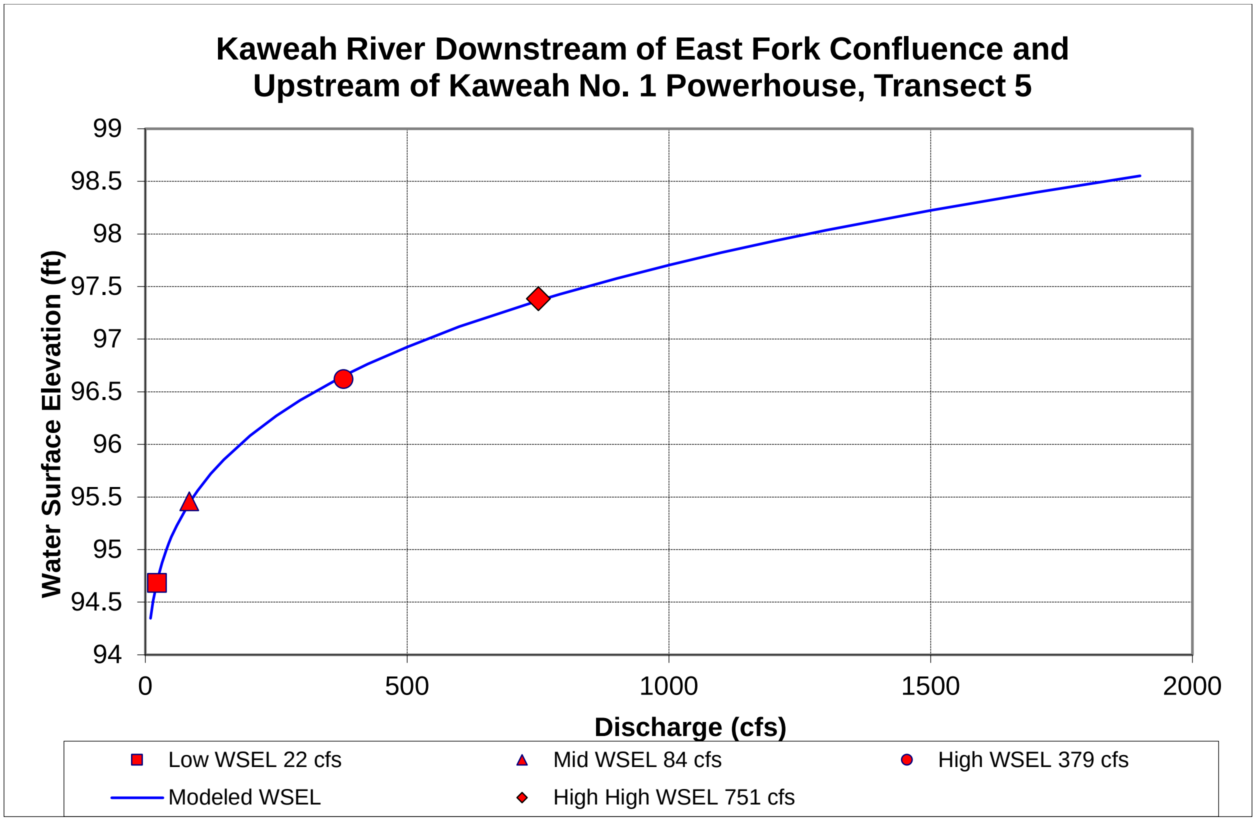
Figure D.A-3. Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse Stage Discharge Calibration Report.

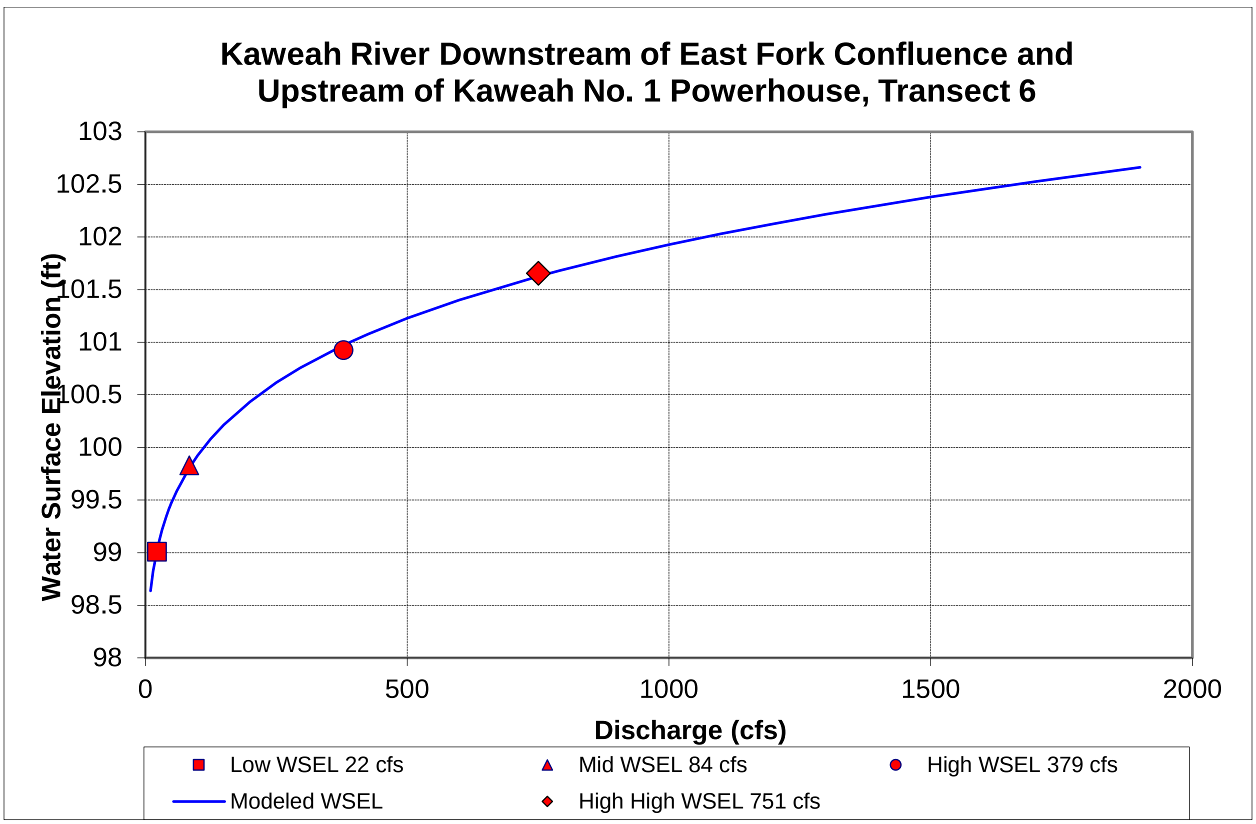


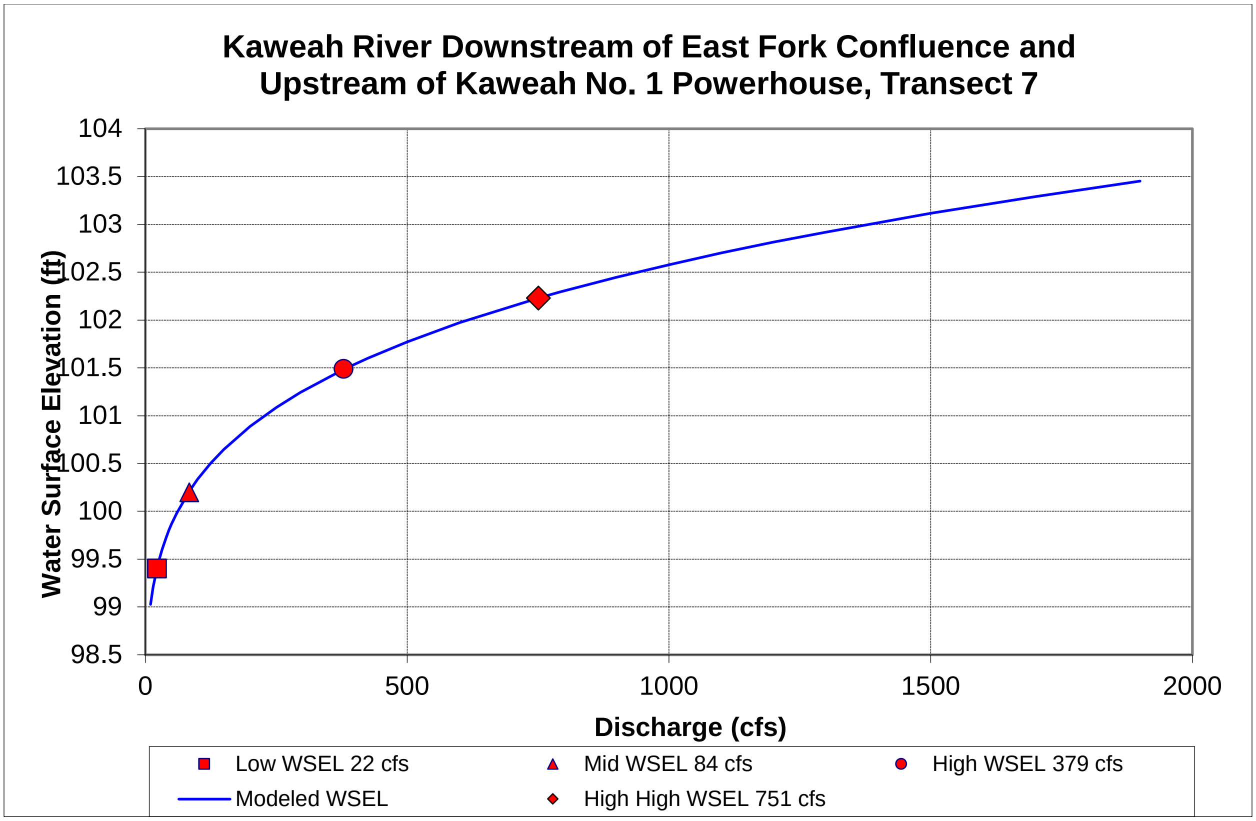


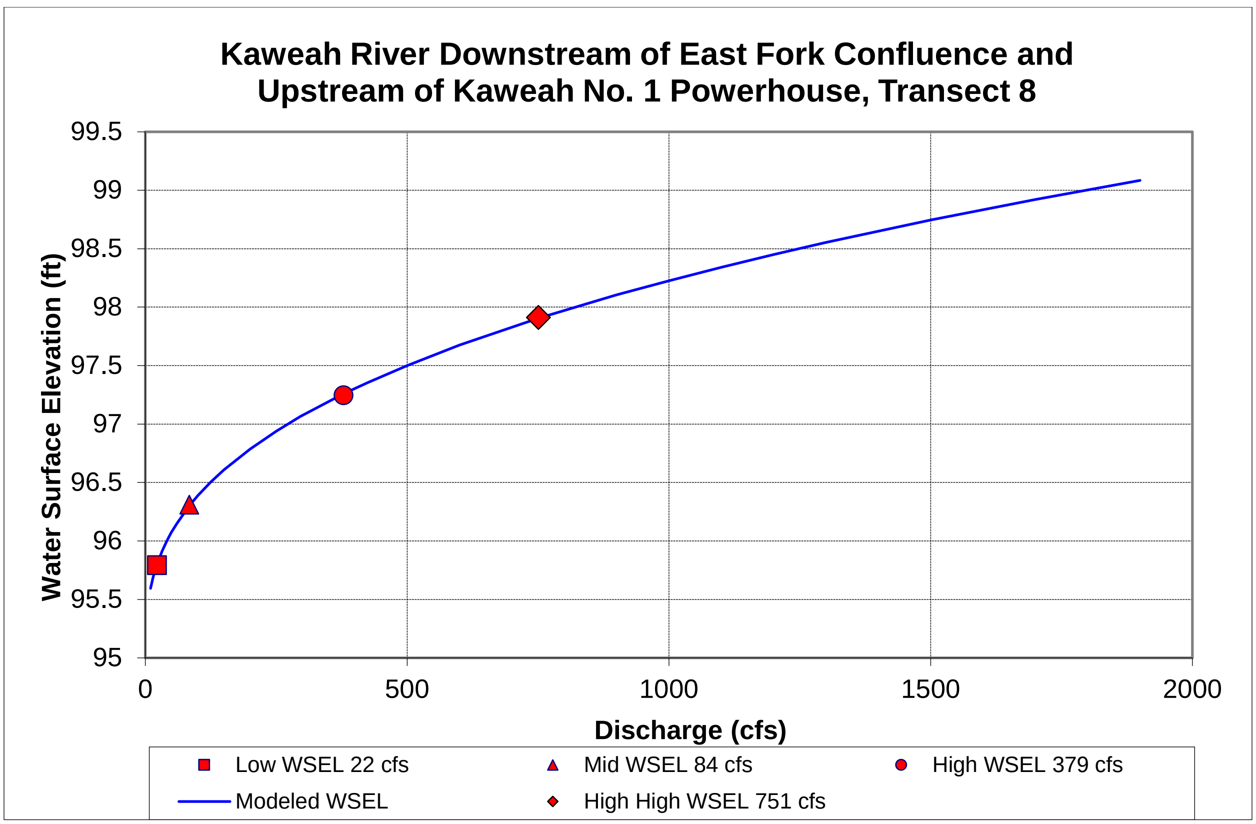

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 3
Water Surface Elevation (ft)
97
96
95
94
93
92
91
90
89
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs

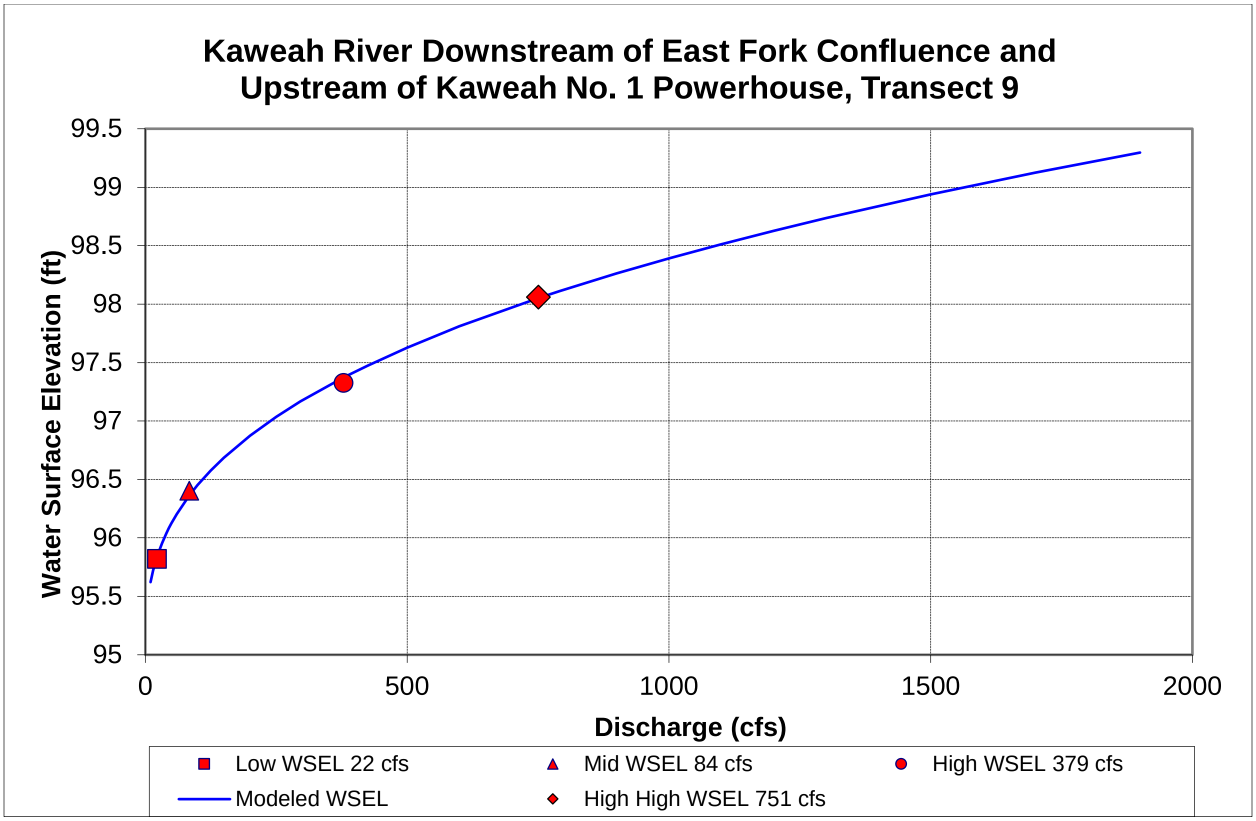

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 4
Water Surface Elevation (ft)
97
96
95
94
93
92
91
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs

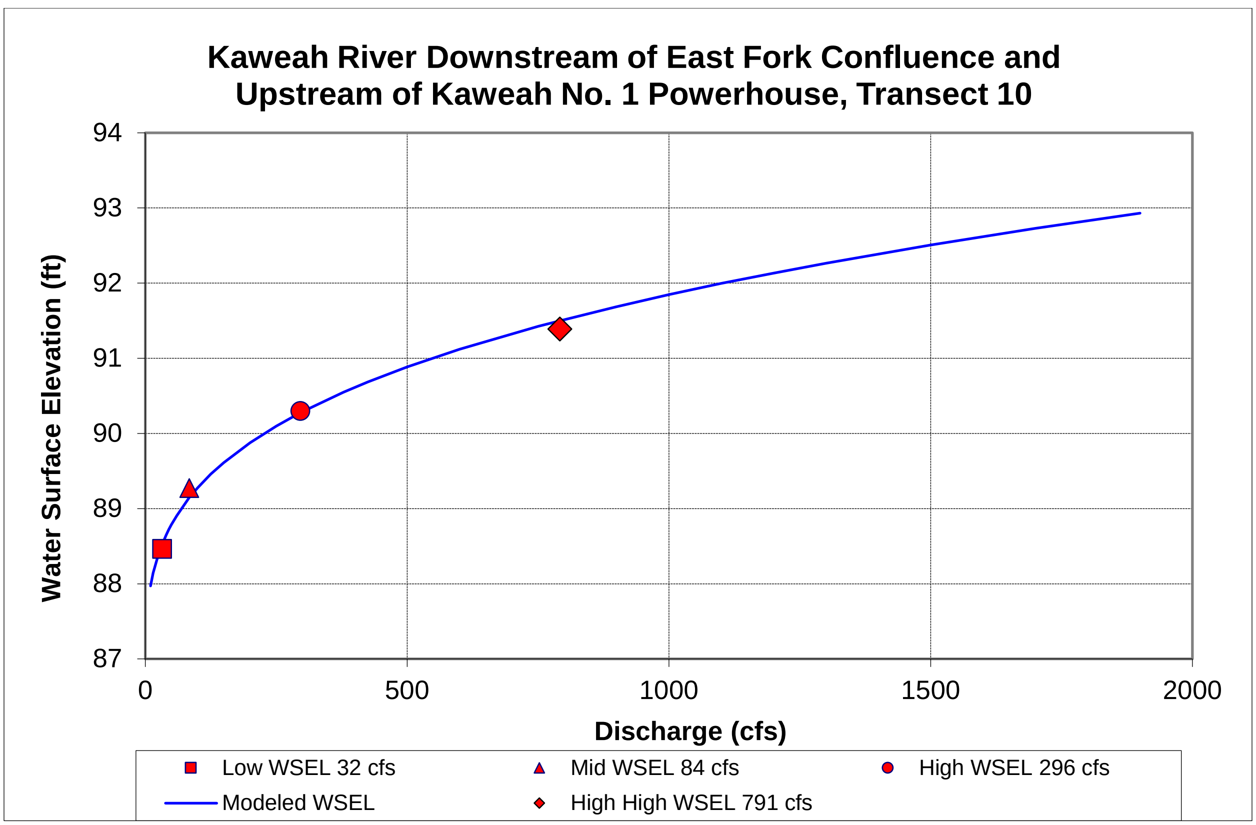

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 5
Water Surface Elevation (ft)
99
98.5
98
97.5
97
96.5
96
95.5
95
94.5
94
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs

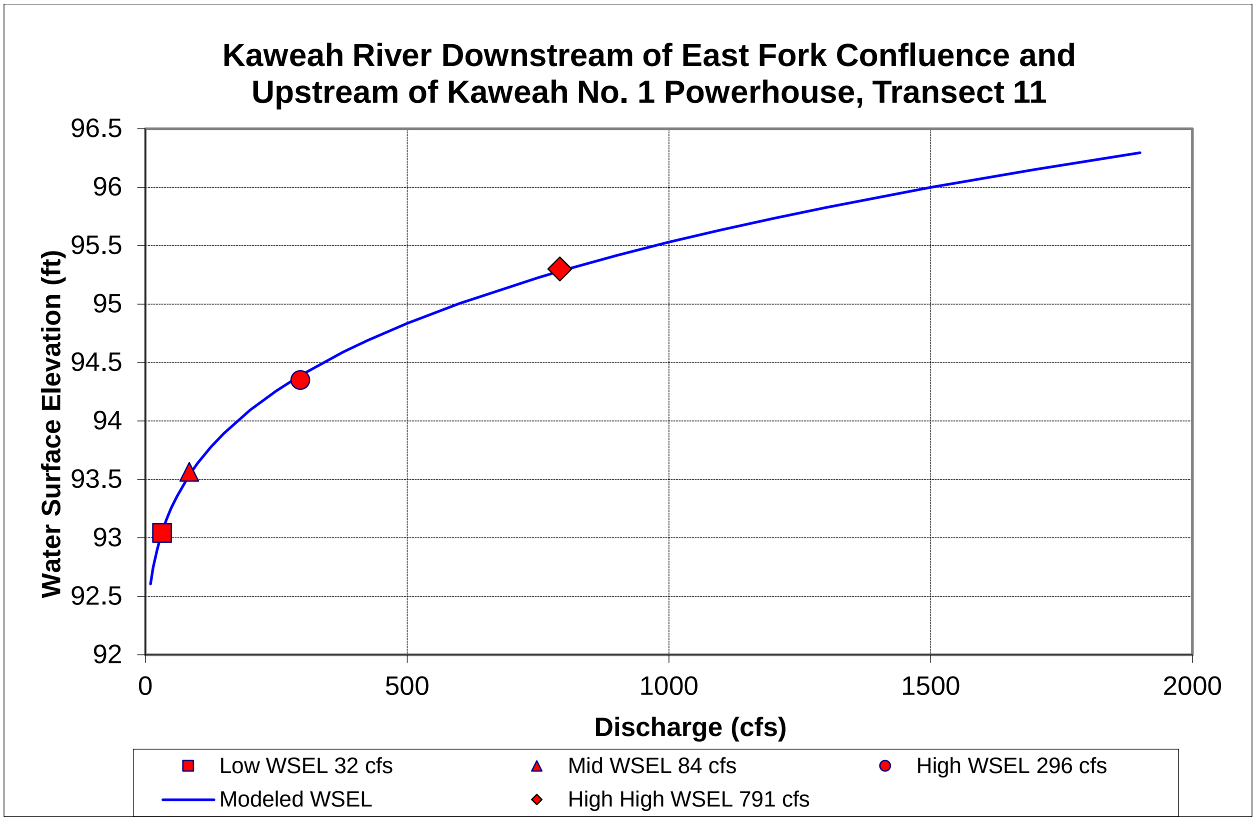

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 6
Water Surface Elevation (ft)
103
102.5
102
101.5
101
100.5
100
99.5
99
98.5
98
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 7
Water Surface Elevation (ft)
104
103.5
103
102.5
102
101.5
101
100.5
100
99.5
99
98.5
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 8
Water Surface Elevation (ft)
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 9
Water Surface Elevation (ft)
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 22 cfs
Mid WSEL 84 cfs
High WSEL 379 cfs
Modeled WSEL
High High WSEL 751 cfs


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 10
Water Surface Elevation (ft)
94
93
92
91
90
89
88
87
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 32 cfs
Mid WSEL 84 cfs
High WSEL 296 cfs
Modeled WSEL
High High WSEL 791 cfs


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 11
Water Surface Elevation (ft)
96.5
96
95.5
95
94.5
94
93.5
93
92.5
92
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 32 cfs
Mid WSEL 84 cfs
High WSEL 296 cfs
Modeled WSEL
High High WSEL 791 cfs

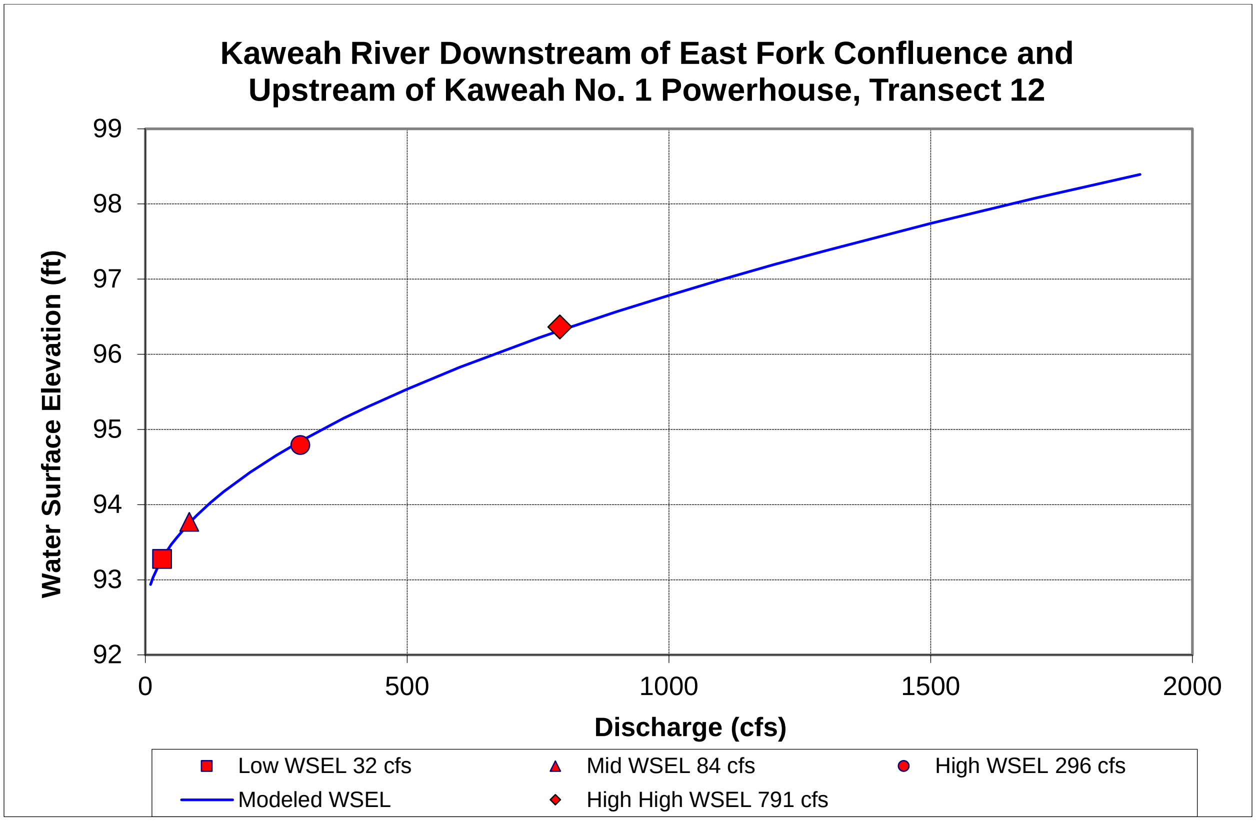
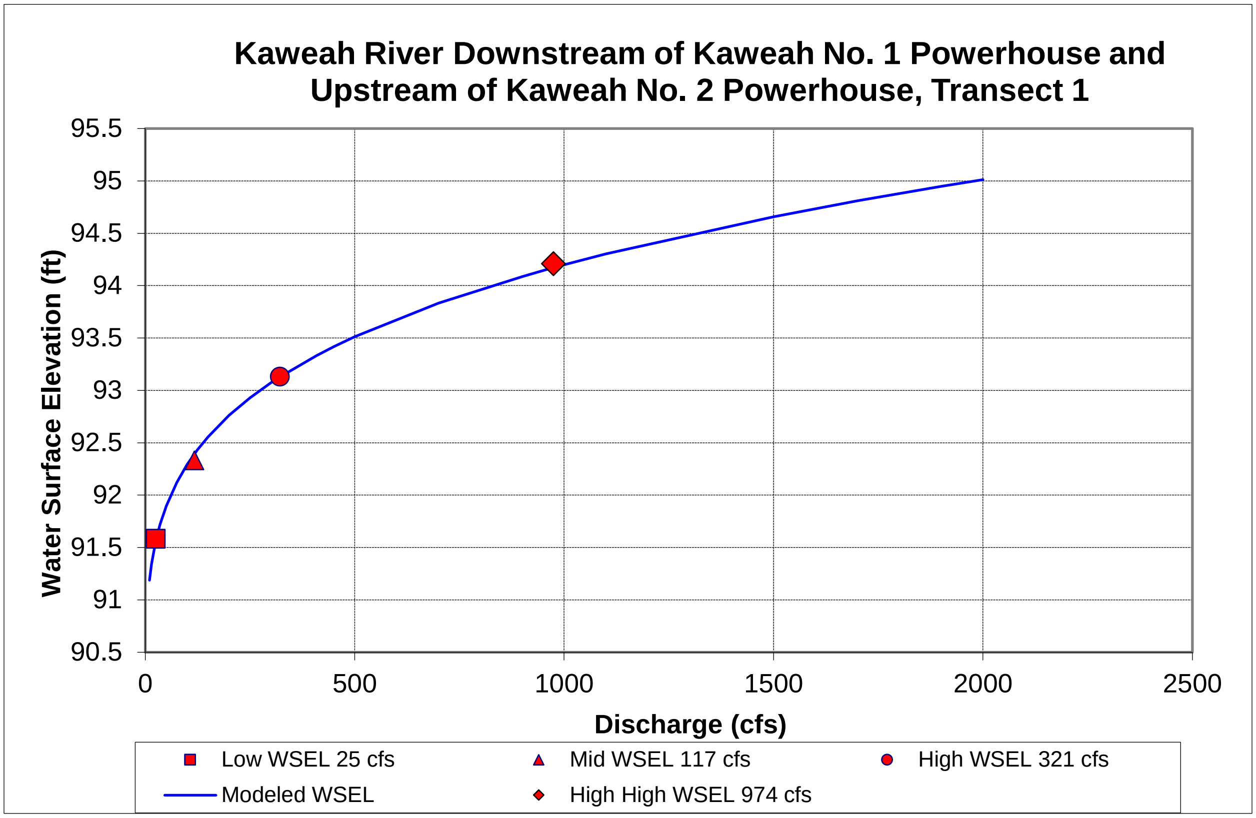
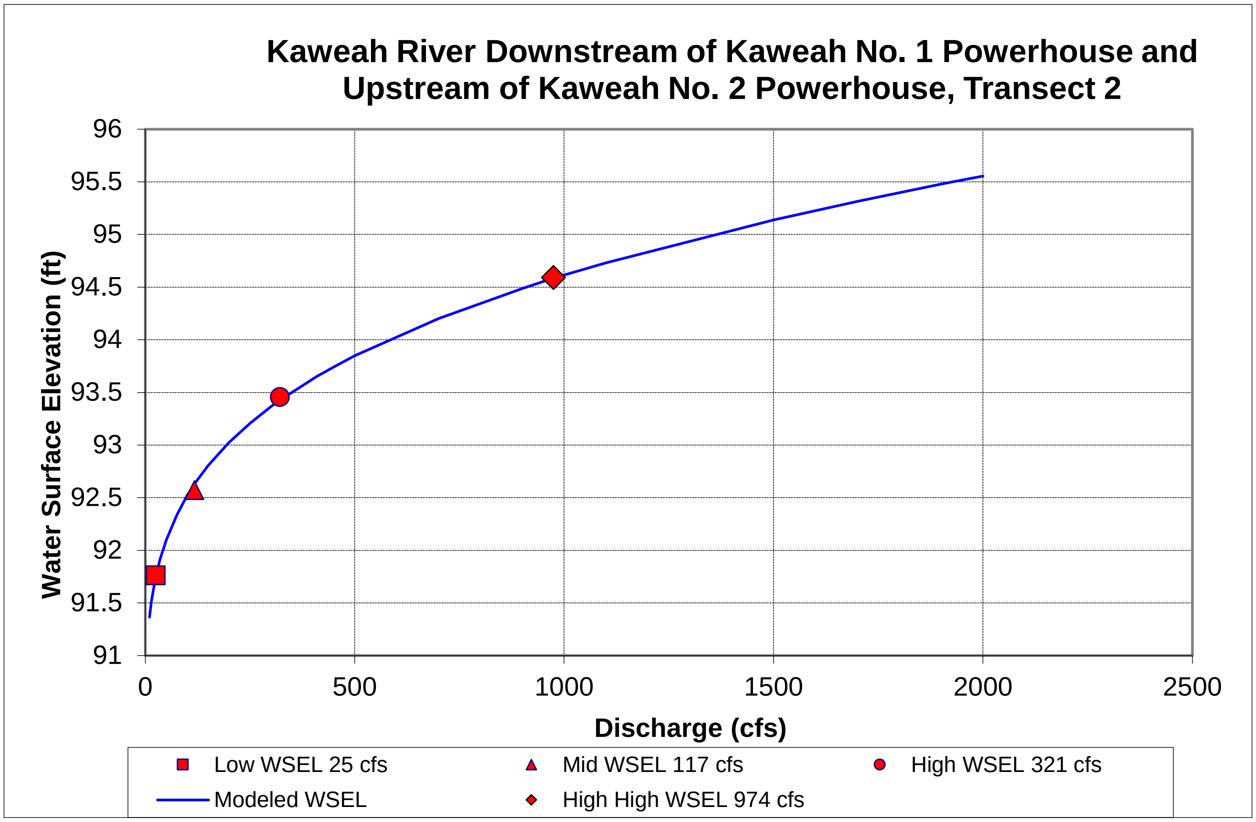
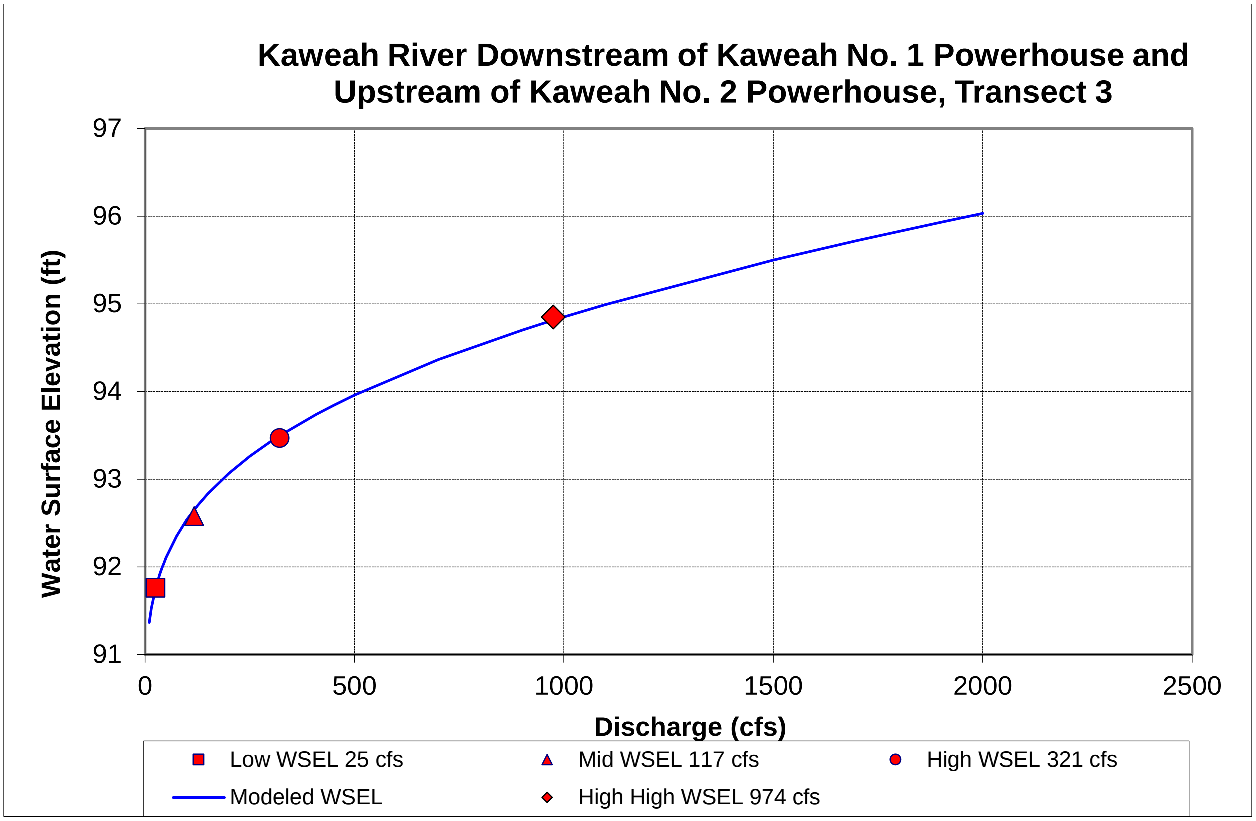
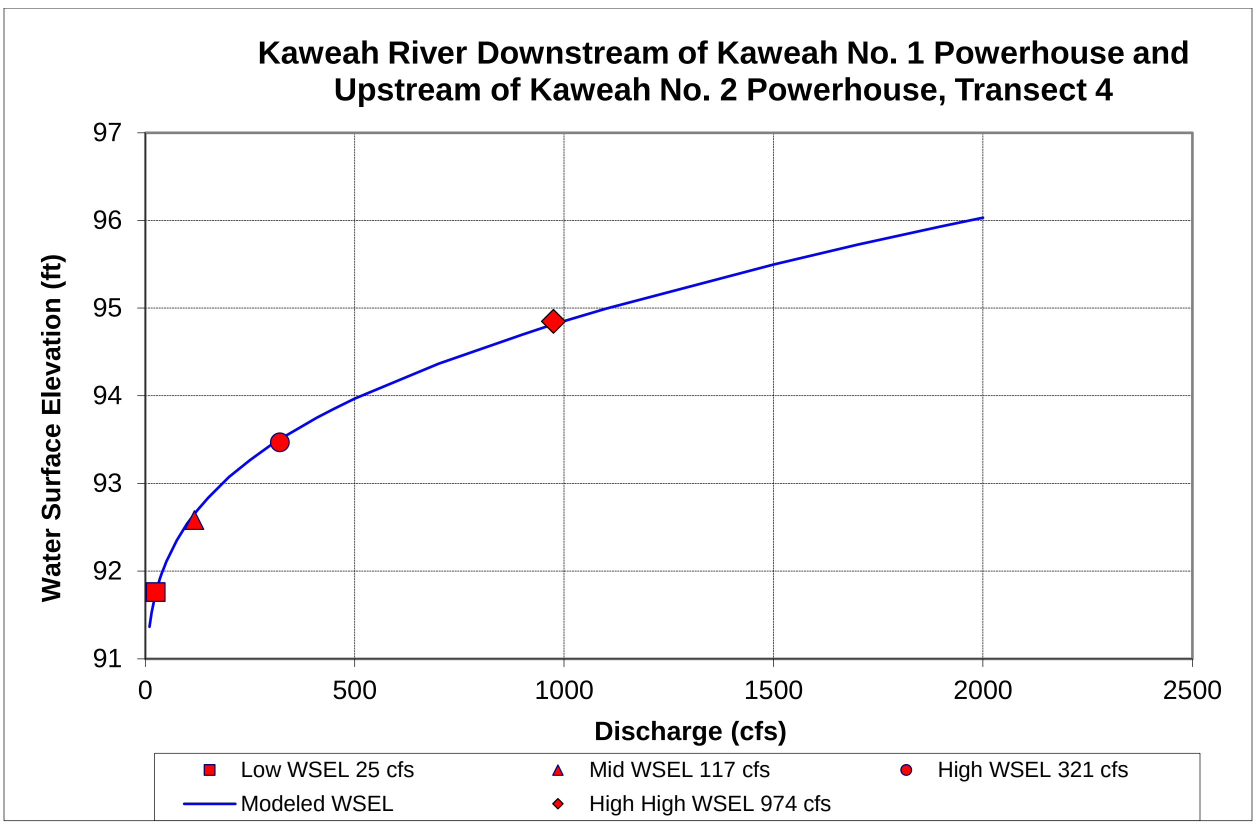

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 12
Water Surface Elevation (ft)
99
98
97
96
95
94
93
92
0
500
1000
1500
2000
Discharge (cfs)
Low WSEL 32 cfs
Mid WSEL 84 cfs
High WSEL 296 cfs
Modeled WSEL
High High WSEL 791 cfs

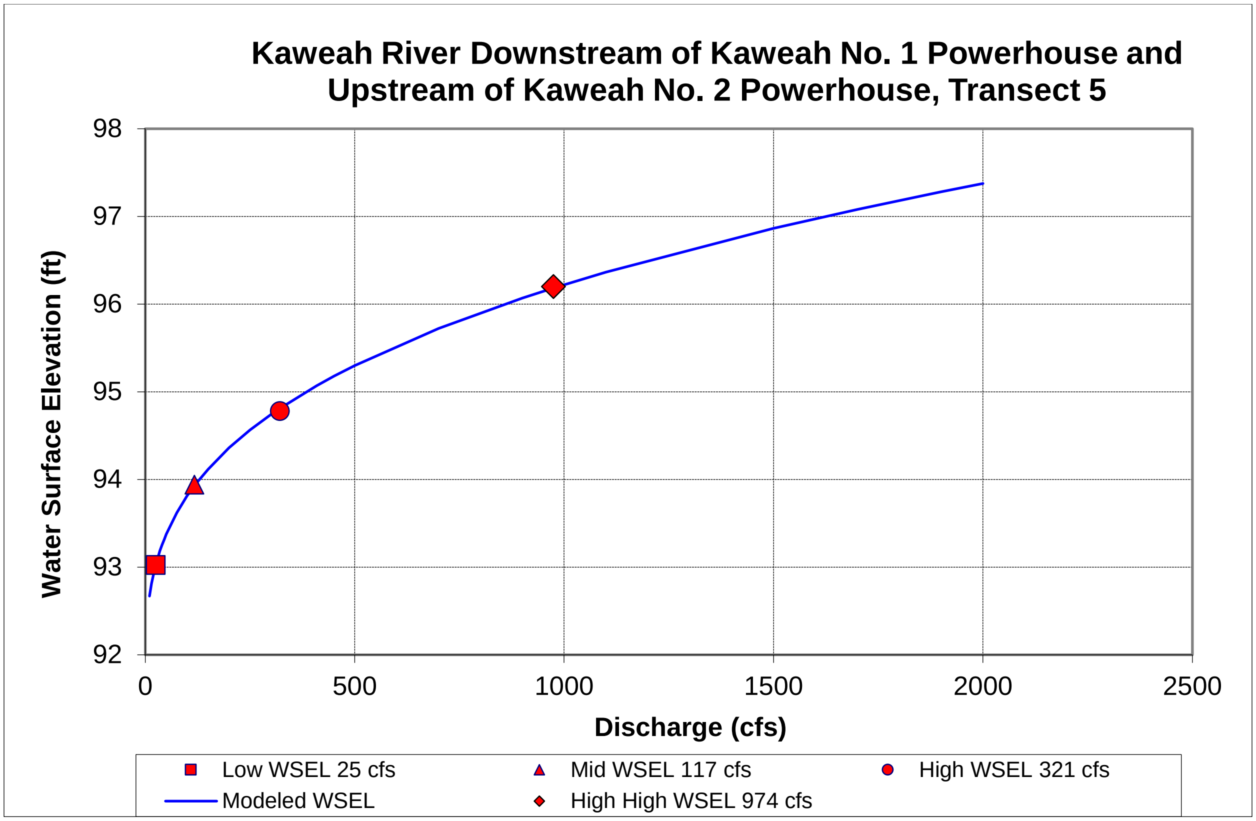
Figure D.A-4. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Stage Discharge Calibration Reports.

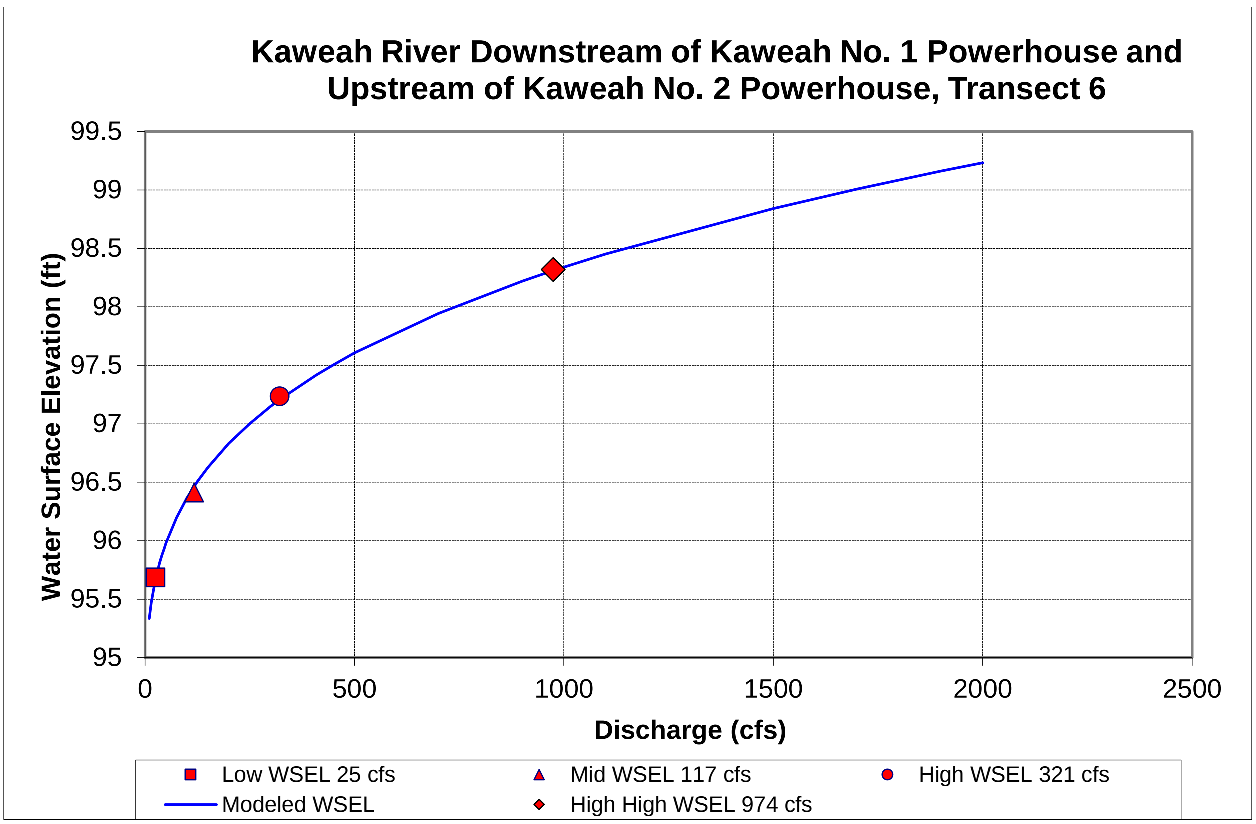


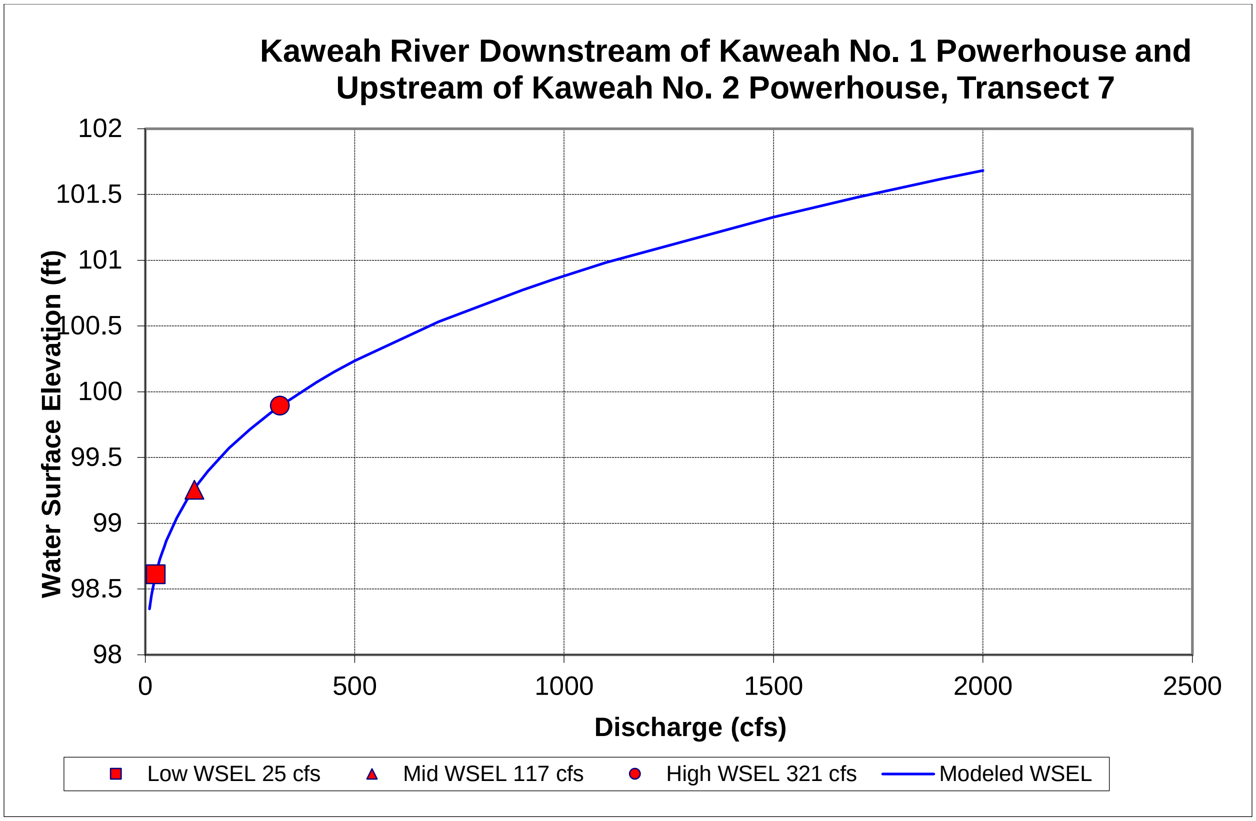


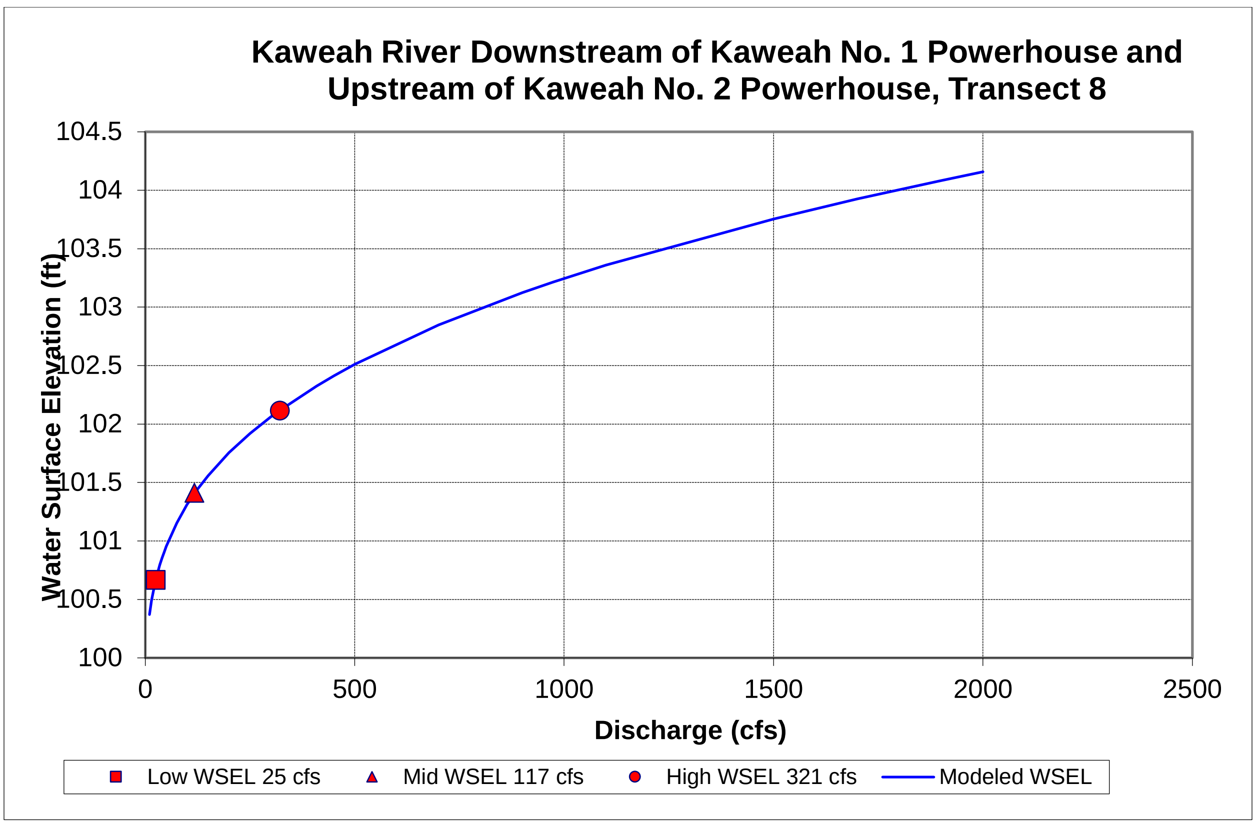

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 3
Water Surface Elevation (ft)
97
96
95
94
93
92
91
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL
High High WSEL 974 cfs

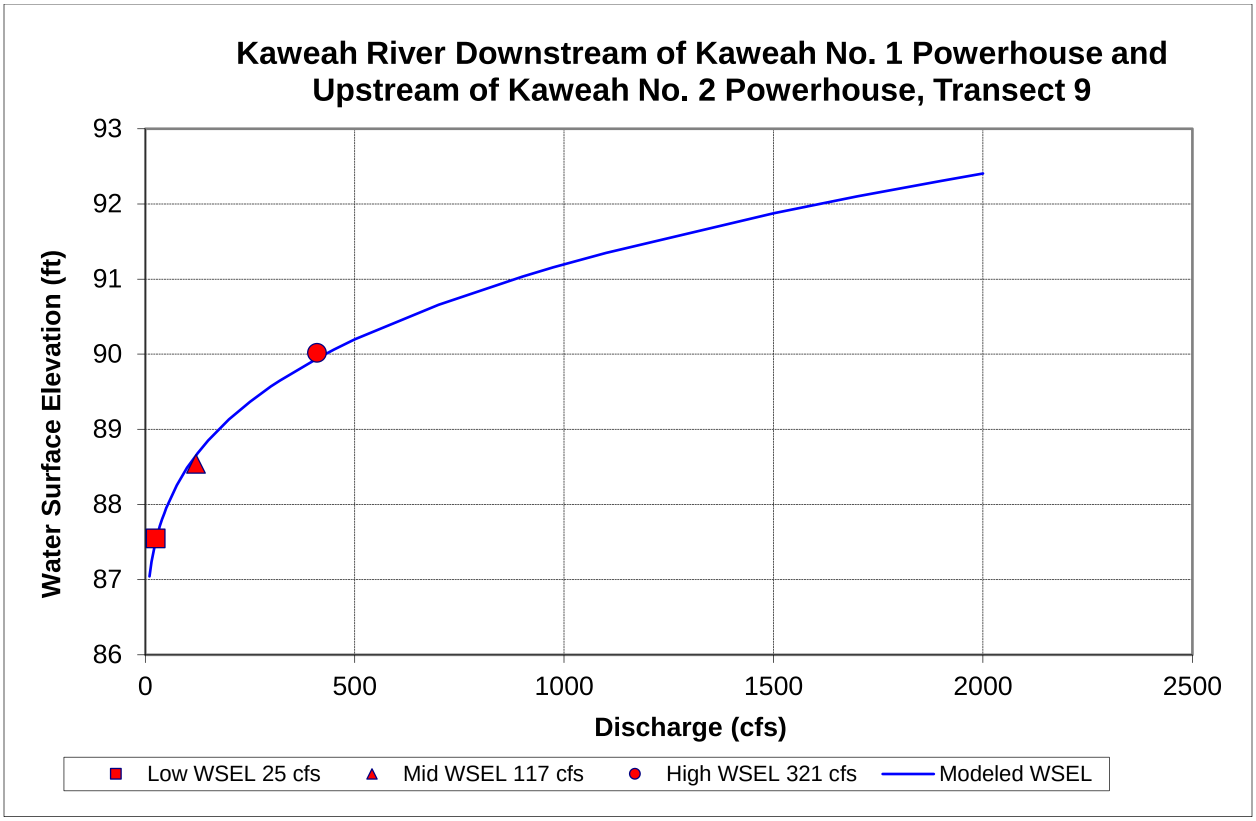

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 4
Water Surface Elevation (ft)
97
96
95
94
93
92
91
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL
High High WSEL 974 cfs

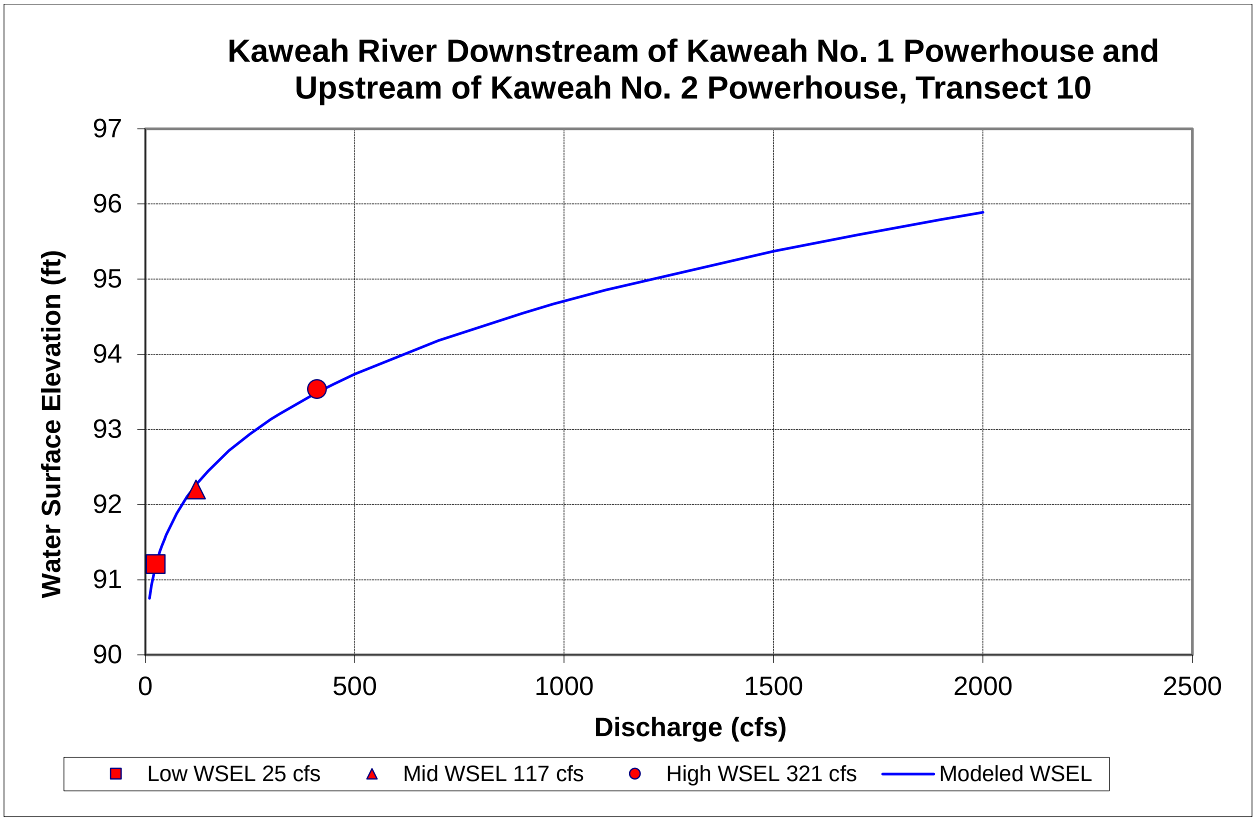

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 5
Water Surface Elevation (ft)
98
97
96
95
94
93
92
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL
High High WSEL 974 cfs

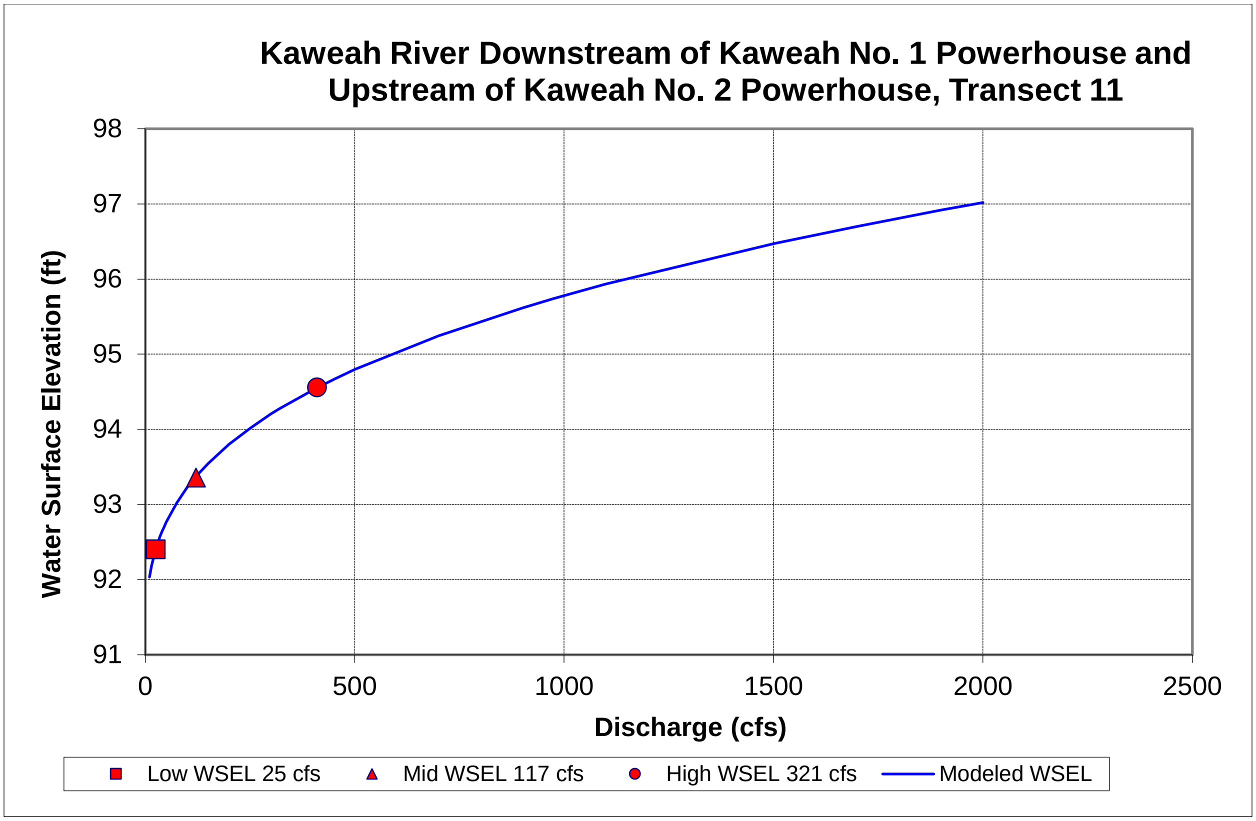

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 6
Water Surface Elevation (ft)
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL
High High WSEL 974 cfs


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 7
Water Surface Elevation (ft)
102
101.5
101
100.5
100
99.5
99
98.5
98
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 8
Water Surface Elevation (ft)
104.5
104
103.5
103
102.5
102
101.5
101
100.5
100
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL


Kaweah River Downstream of Kaweah No. 1 Powerhouse and
Upstream of Kaweah No. 2 Powerhouse, Transect 9
Water Surface Elevation (ft)
93
92
91
90
89
88
87
86
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL


Kaweah River Downstream of Kaweah No. 1 Powerhouse and
Upstream of Kaweah No. 2 Powerhouse, Transect 10
Water Surface Elevation (ft)
97
96
95
94
93
92
91
90
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 11
Water Surface Elevation (ft)
98
97
96
95
94
93
92
91
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL

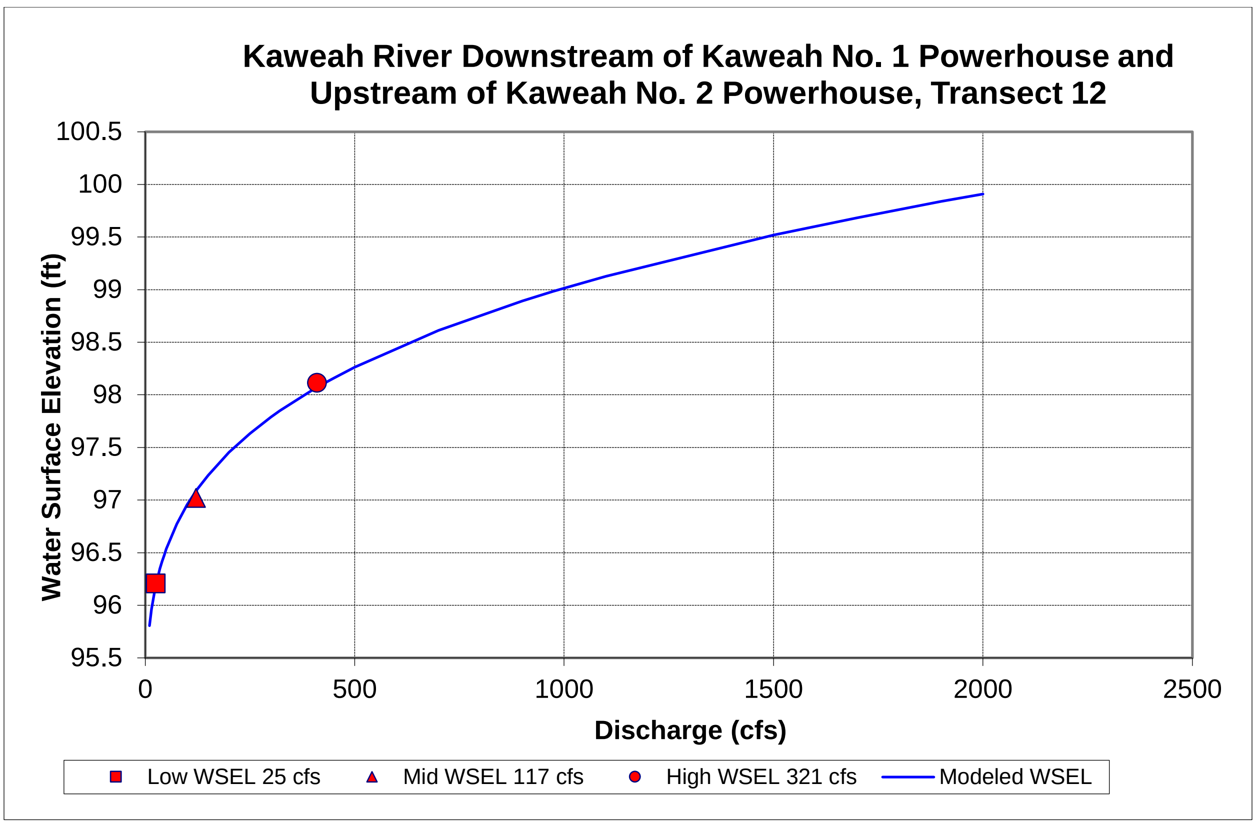

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 12
Water Surface Elevation (ft)
100.5
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
0
500
1000
1500
2000
2500
Discharge (cfs)
Low WSEL 25 cfs
Mid WSEL 117 cfs
High WSEL 321 cfs
Modeled WSEL

Figure D.A-5. East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion, Stage Discharge Calibration Report.

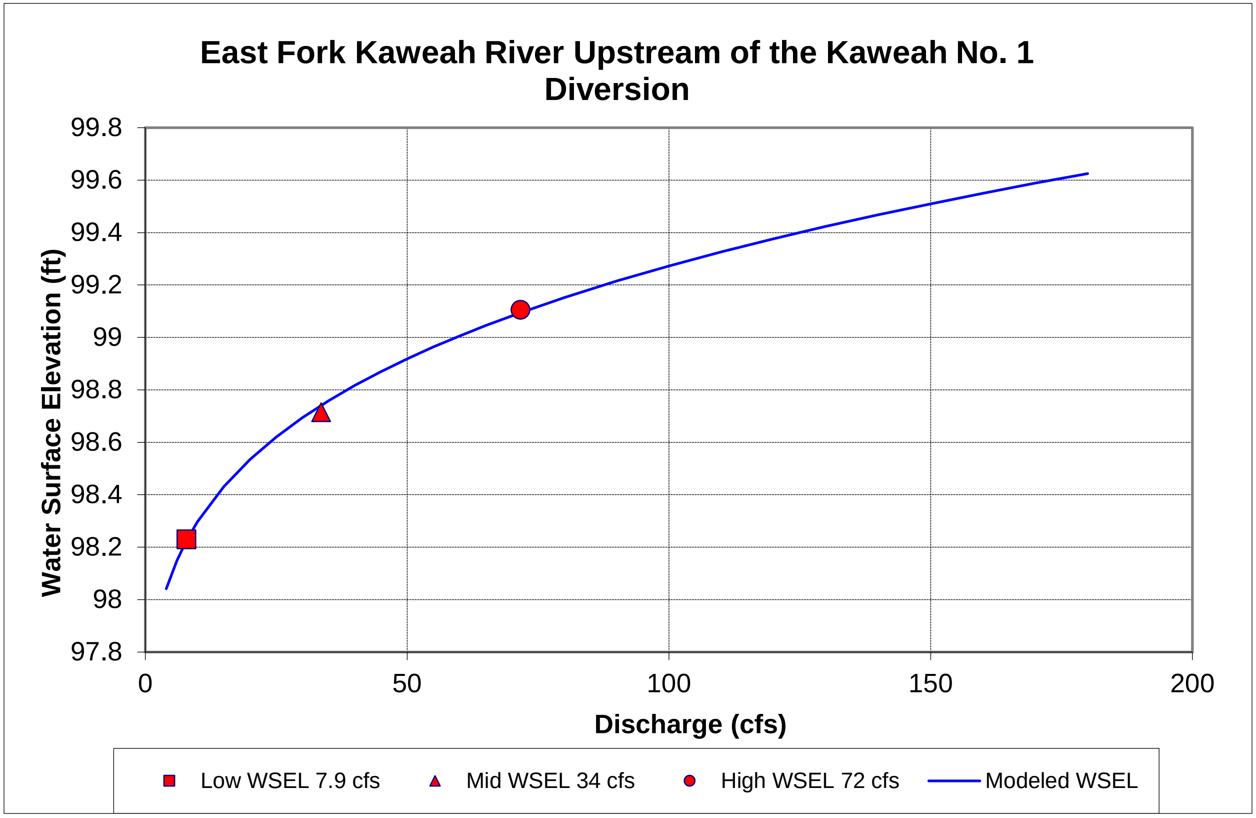


Figure D.A-6. Kaweah River Upstream of Kaweah No. 3 Powerhouse, Stage Discharge Calibration Report.

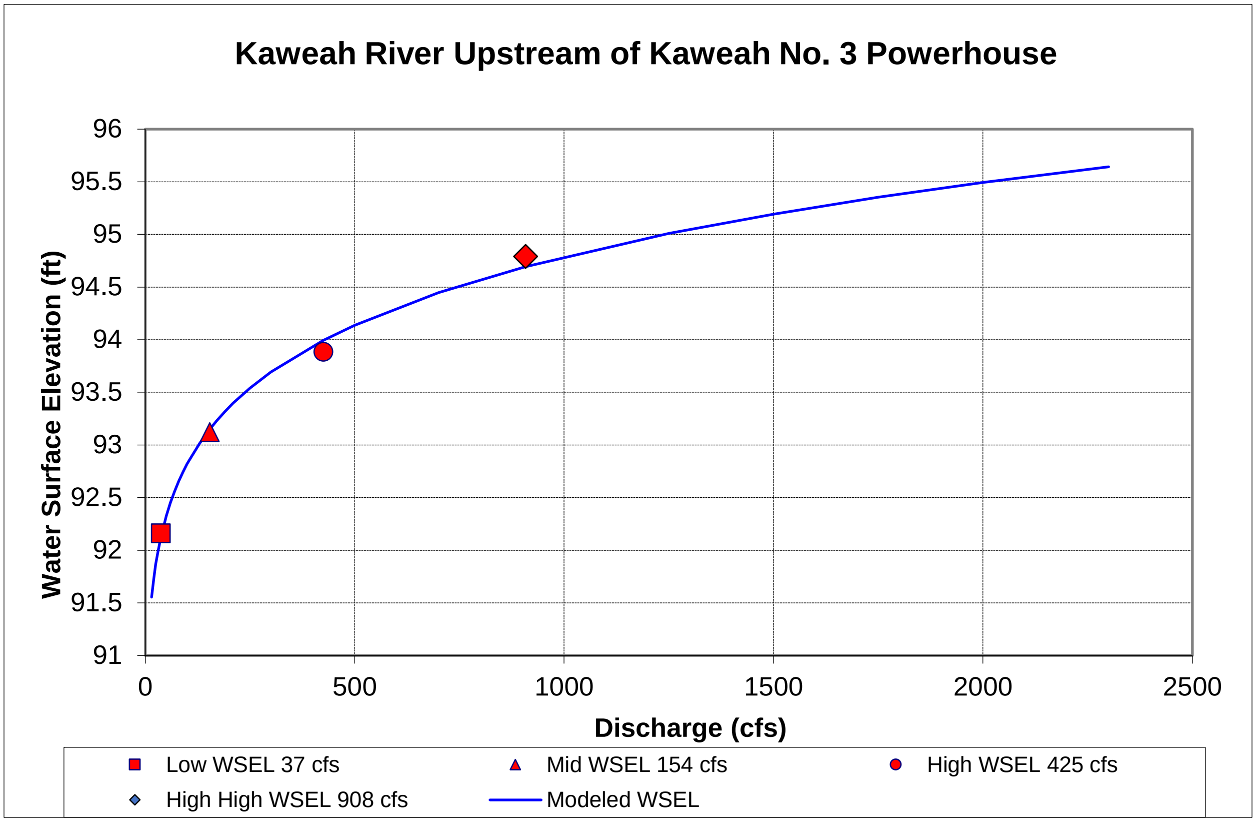
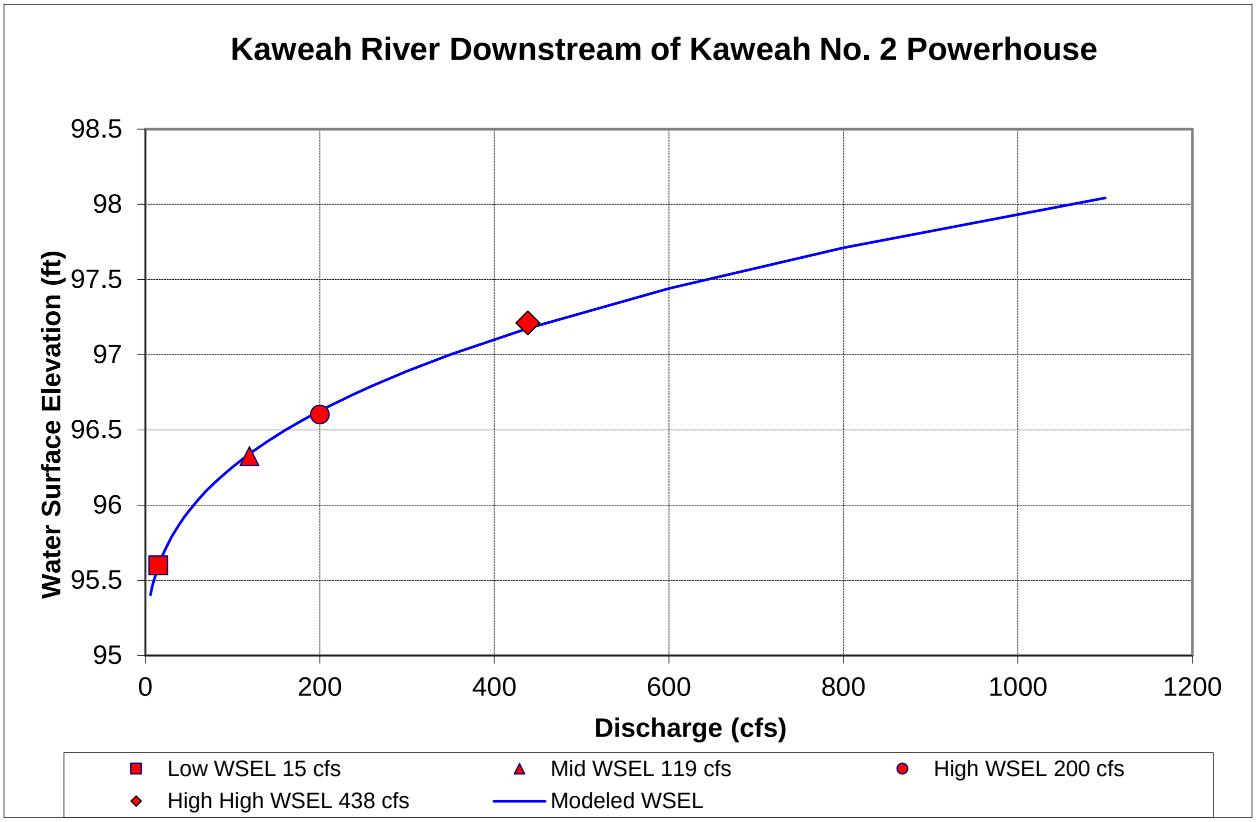


Figure D.A-7. Kaweah River Downstream of Kaweah No. 2 Powerhouse, Stage Discharge Calibration Report.



Attachment B

Water Surface Elevation Calibration Report

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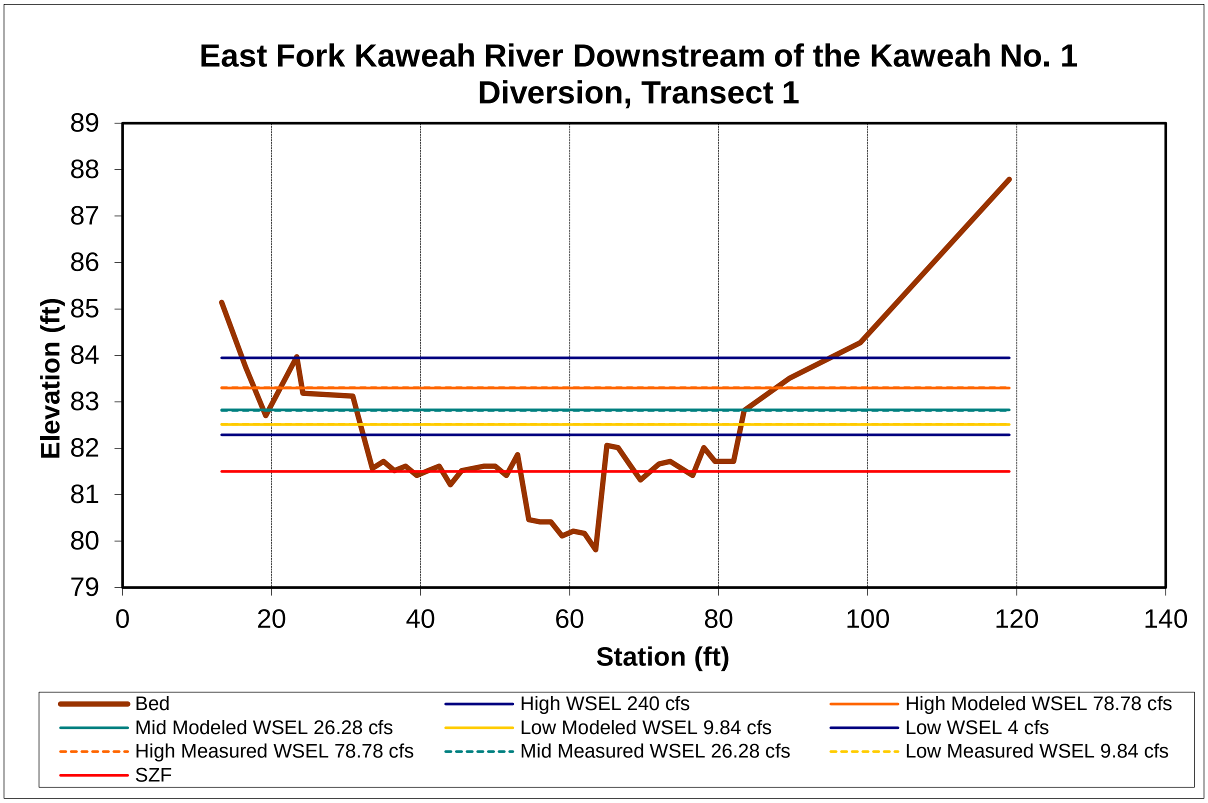
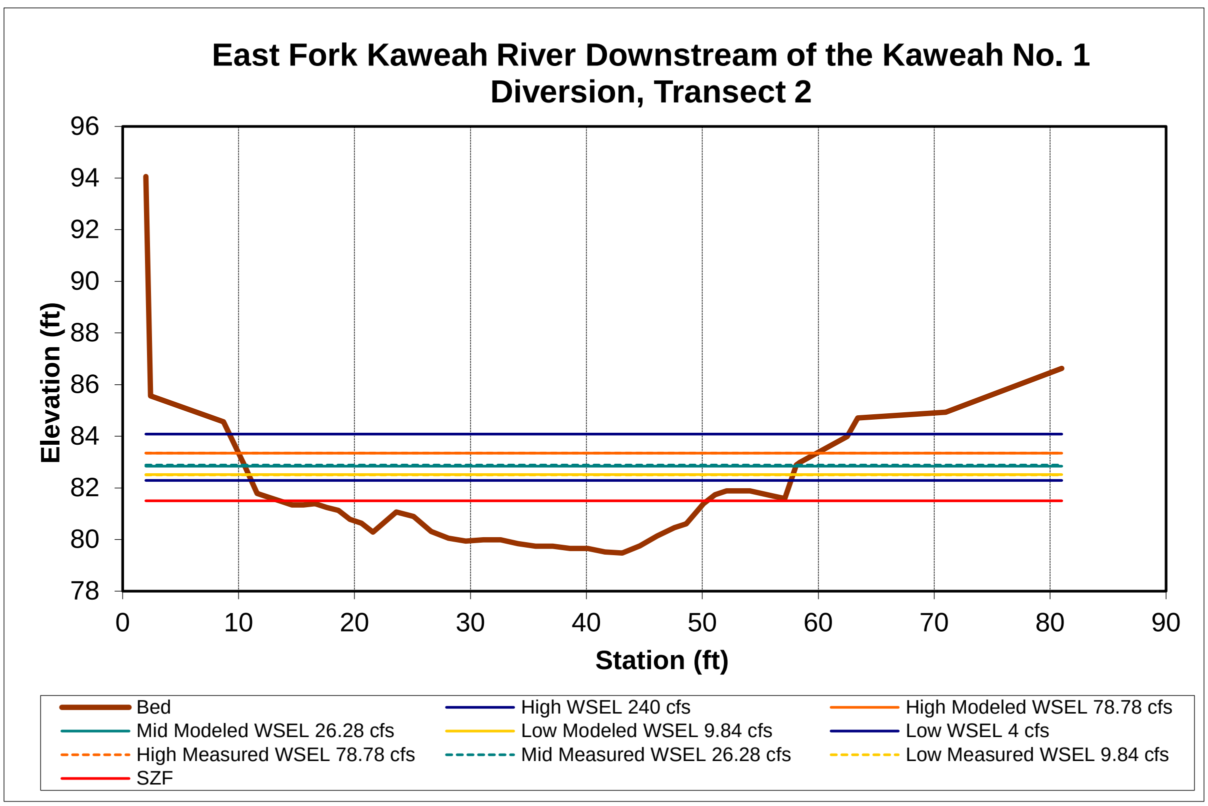
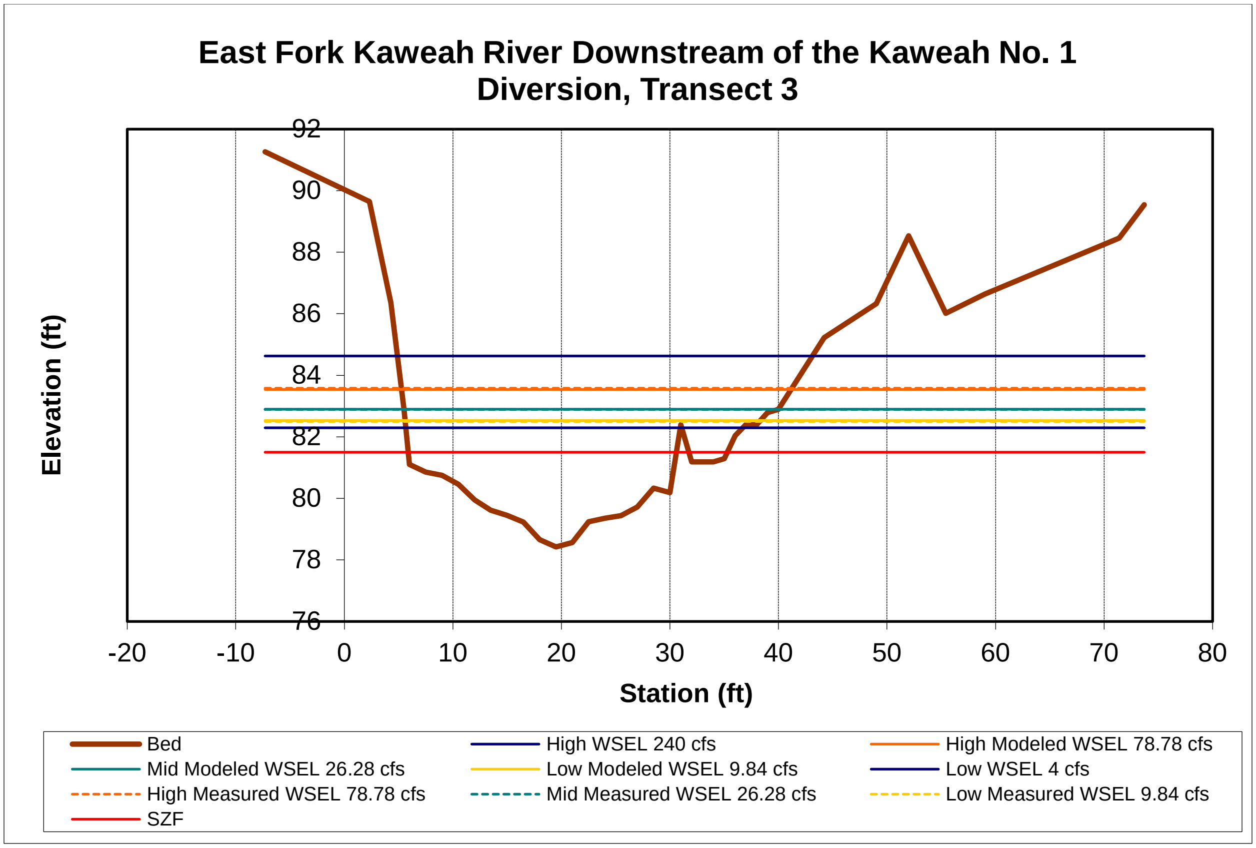
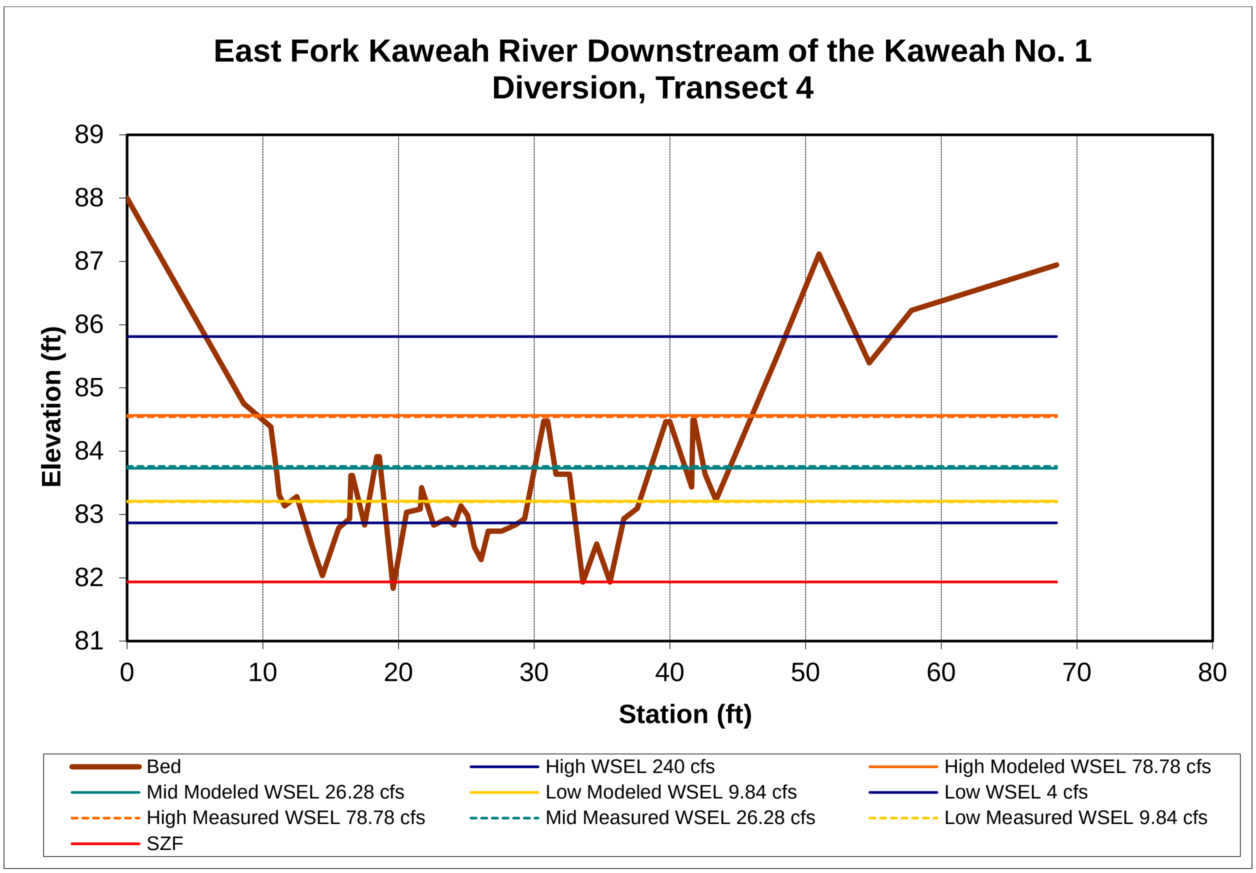
Figure D.B-1. East Fork Kaweah River Upstream of the Confluence with Kaweah River Water Surface Elevation Calibration Report.



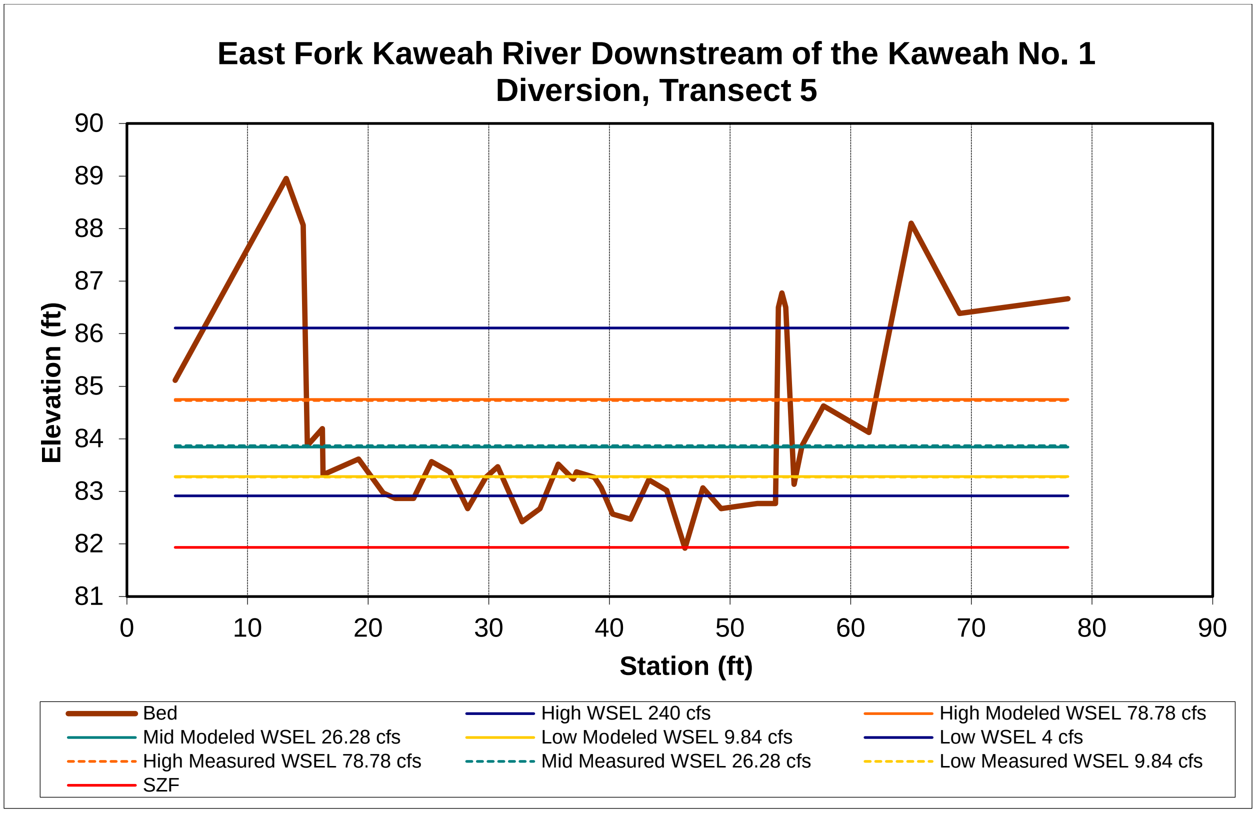


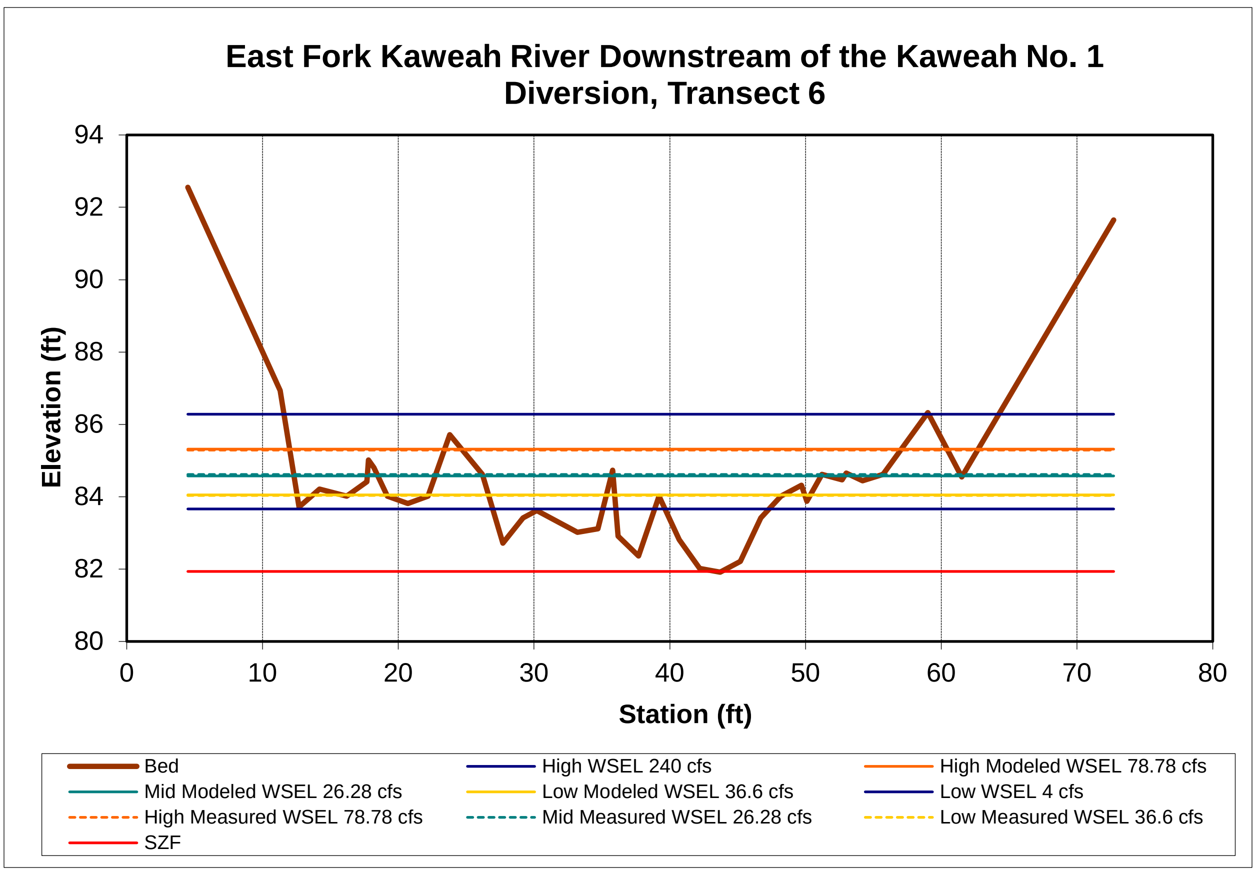


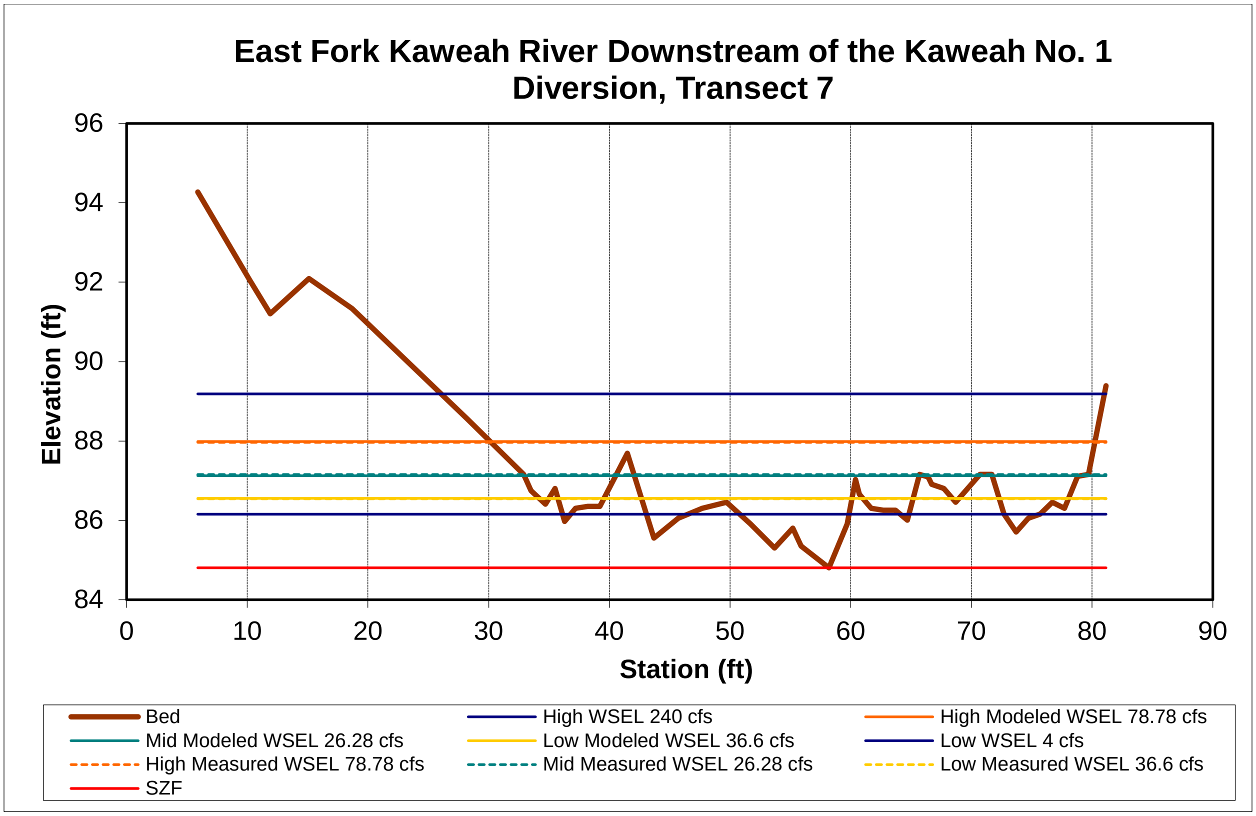
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 3
Elevation (ft)
92
90
88
86
84
82
80
78
76
-20
-10
0
10
20
30
40
50
60
70
80
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

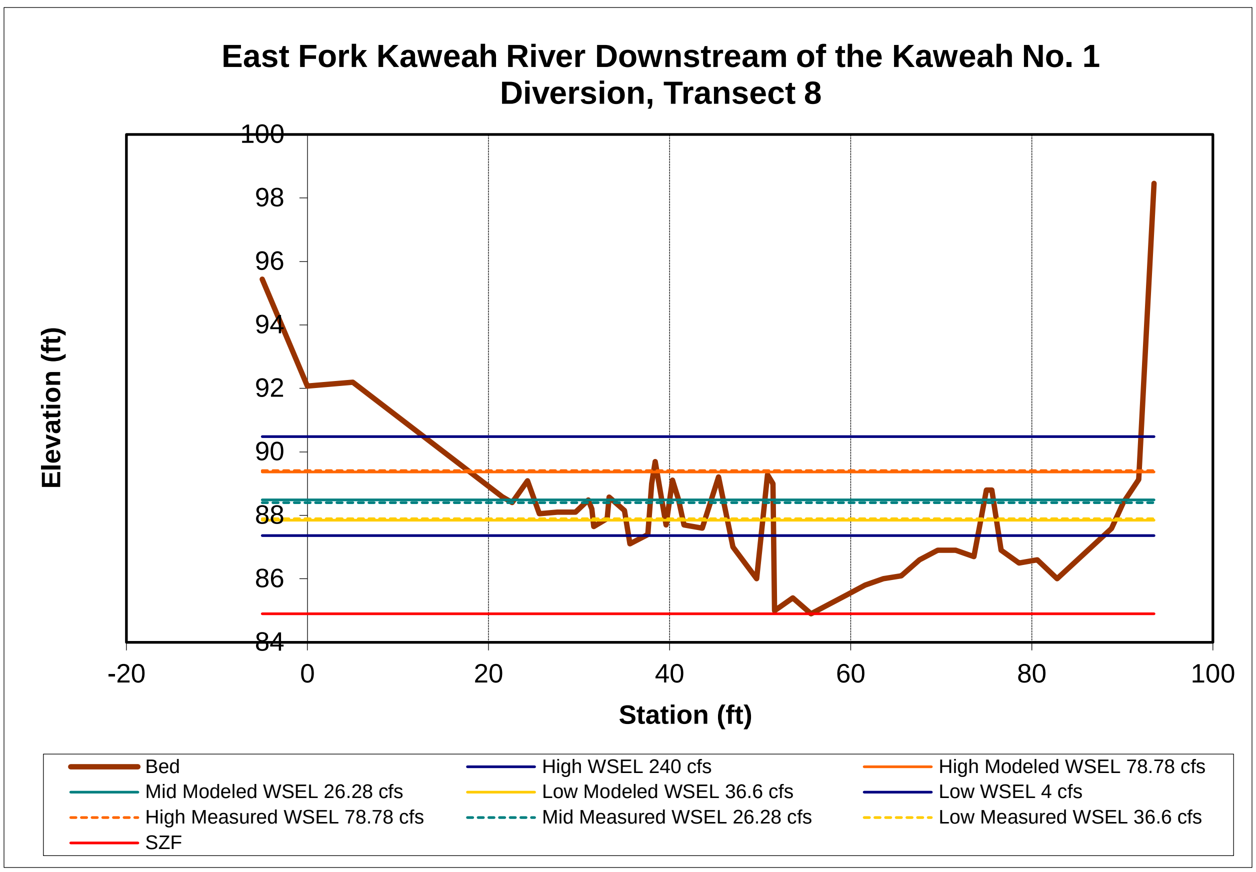


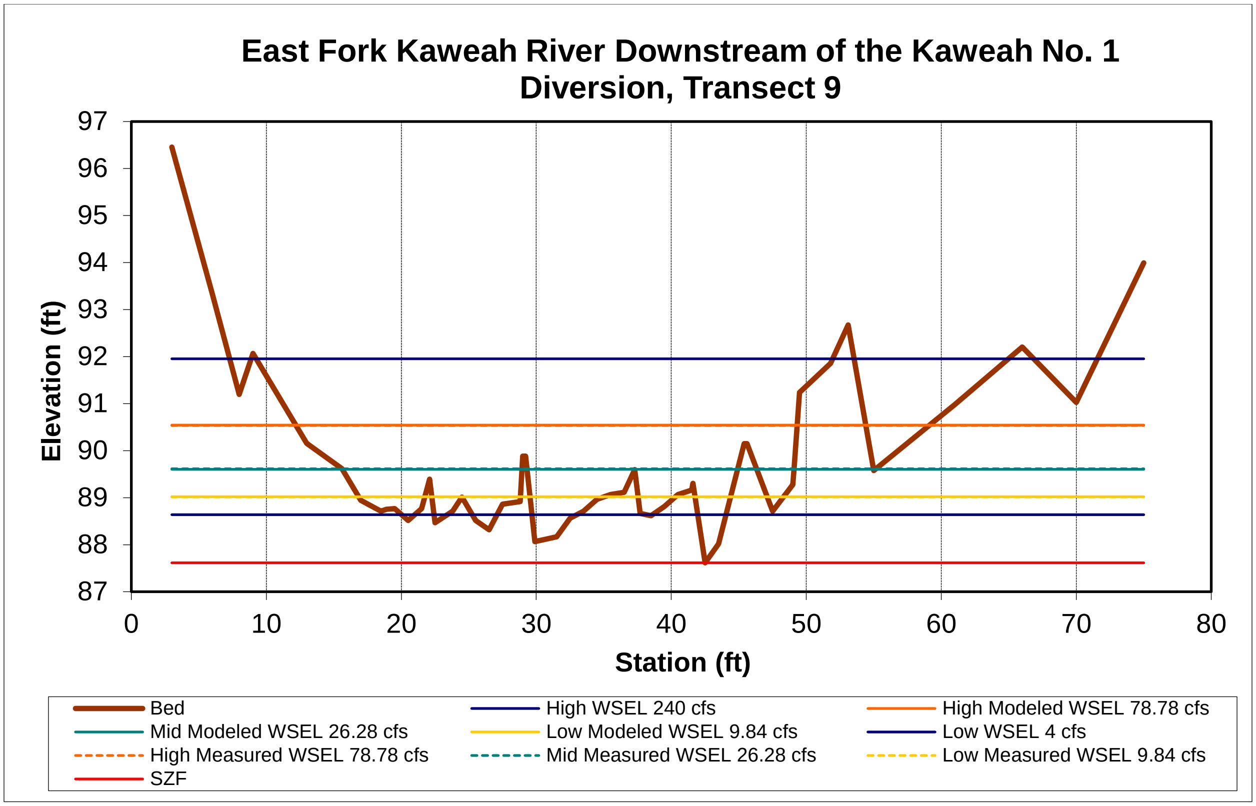
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 4
Elevation (ft)
89
88
87
86
85
84
83
82
81
0
10
20
30
40
50
60
70
80
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

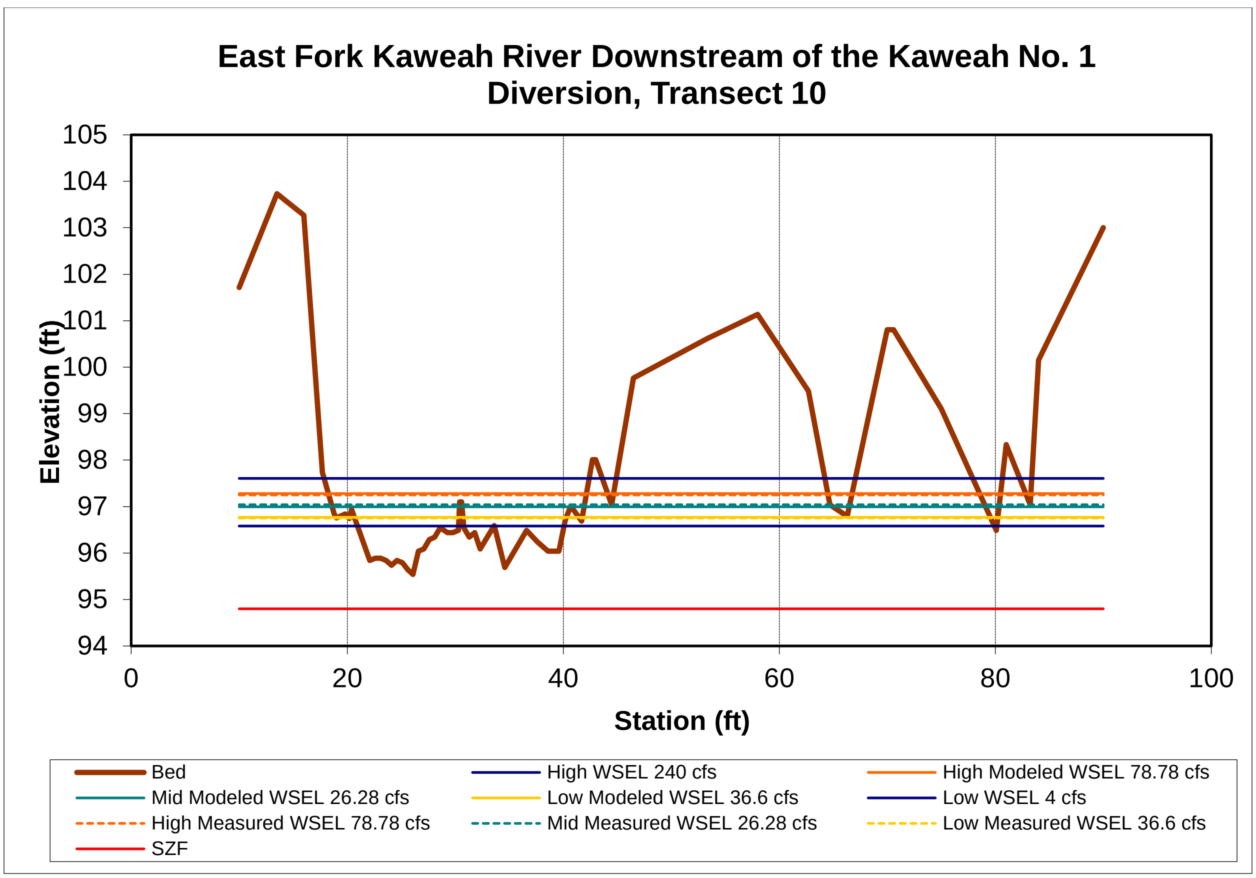

East Fork Kaweah River Downstream of the Kaweah No. 1
Diversion, Transect 5
Elevation (ft)
Station (ft)
90
89
88
87
86
85
84
83
82
81
0
10
20
30
40
50
60
70
80
90
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

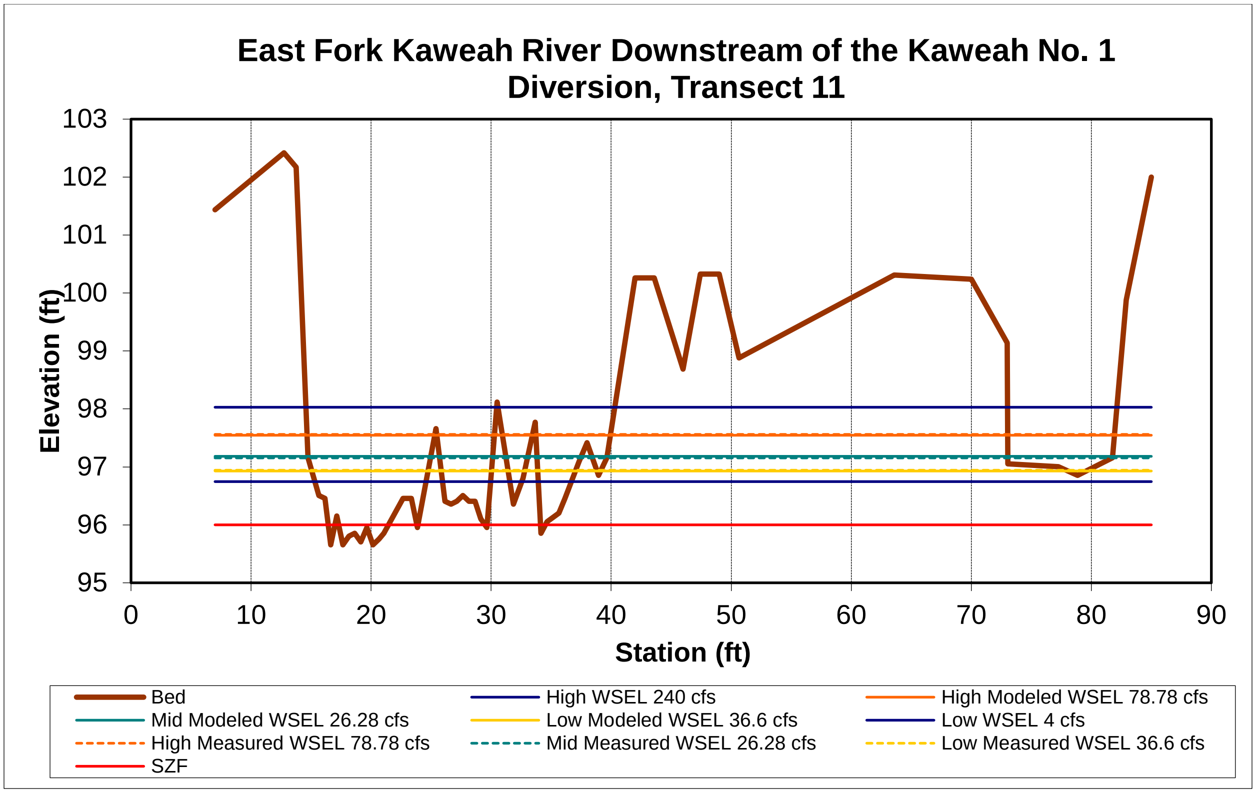

East Fork Kaweah River Downstream of the Kaweah No. 1
Diversion, Transect 6
Elevation (ft)
Station (ft)
94
92
90
88
86
84
82
80
0
10
20
30
40
50
60
70
80
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

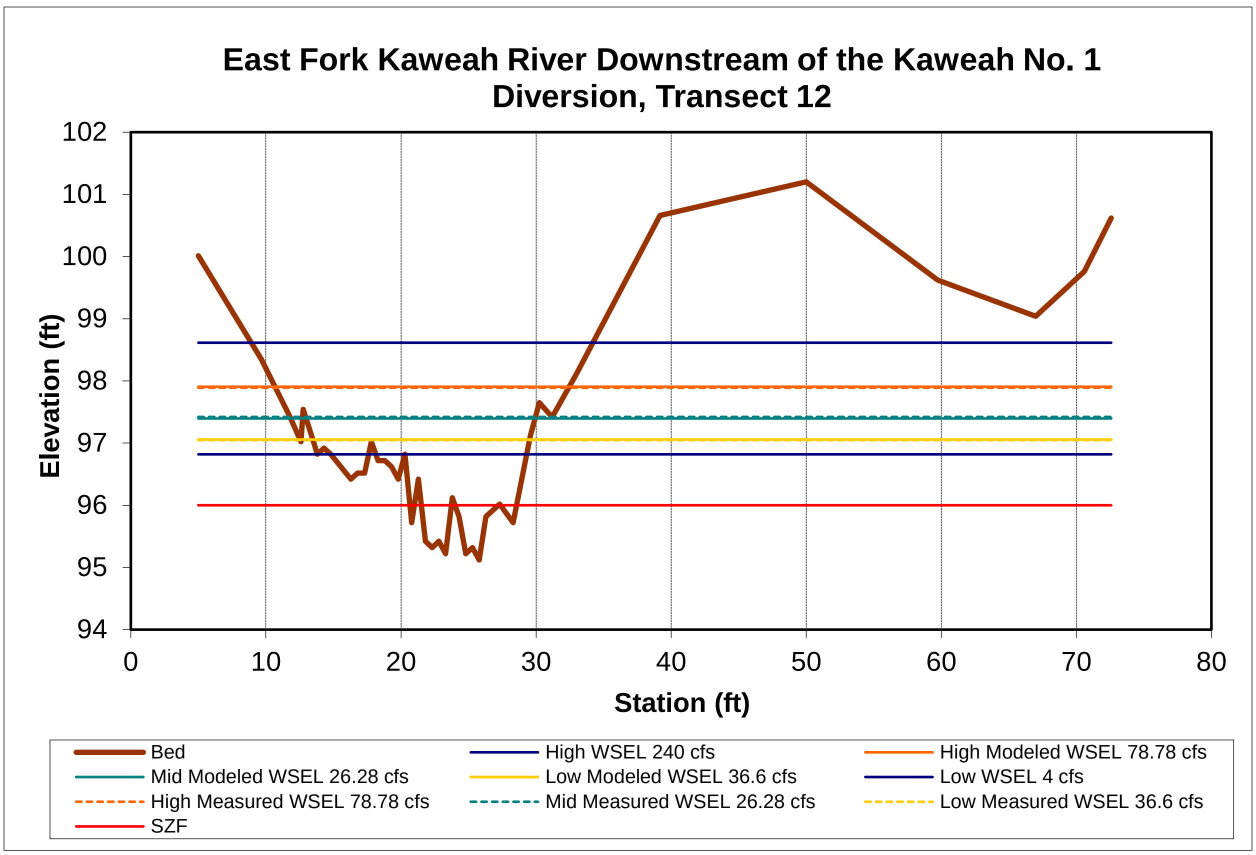

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 7
Elevation (ft)
96
94
92
90
88
86
84
0
10
20
30
40
50
60
70
80
90
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

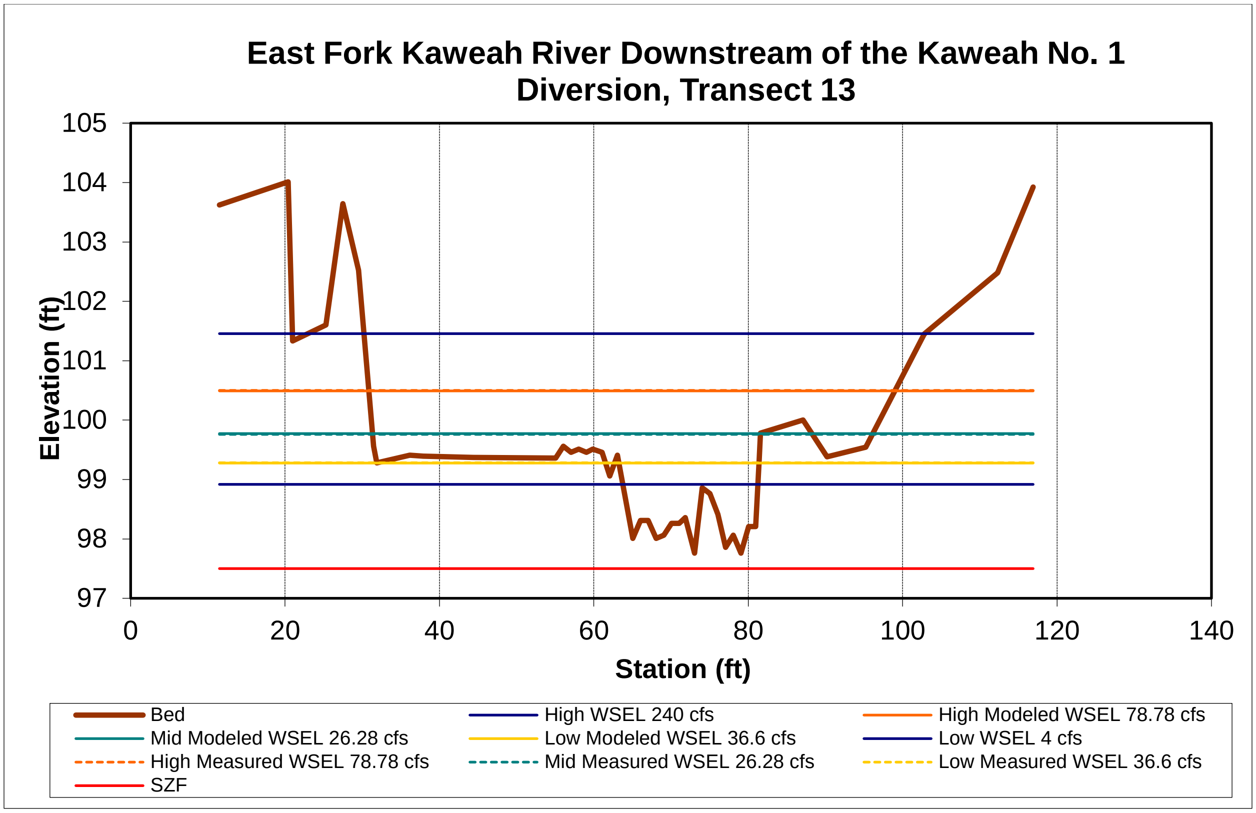

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 8
Elevation (ft)
100
98
96
94
92
90
88
86
84
-20
0
20
40
60
80
100
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

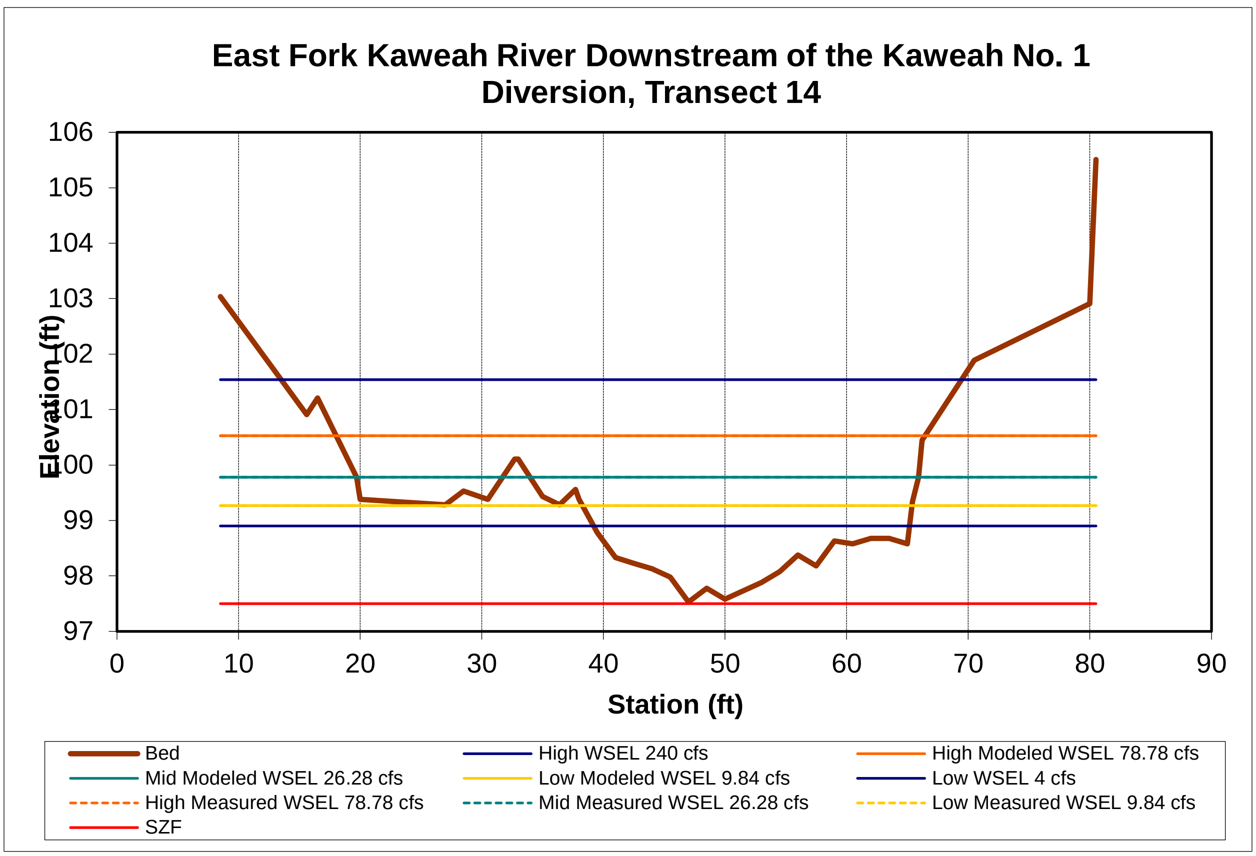

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 9
Elevation (ft)
Station (ft)
97
96
95
94
93
92
91
90
89
88
87
0
10
20
30
40
50
60
70
80
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

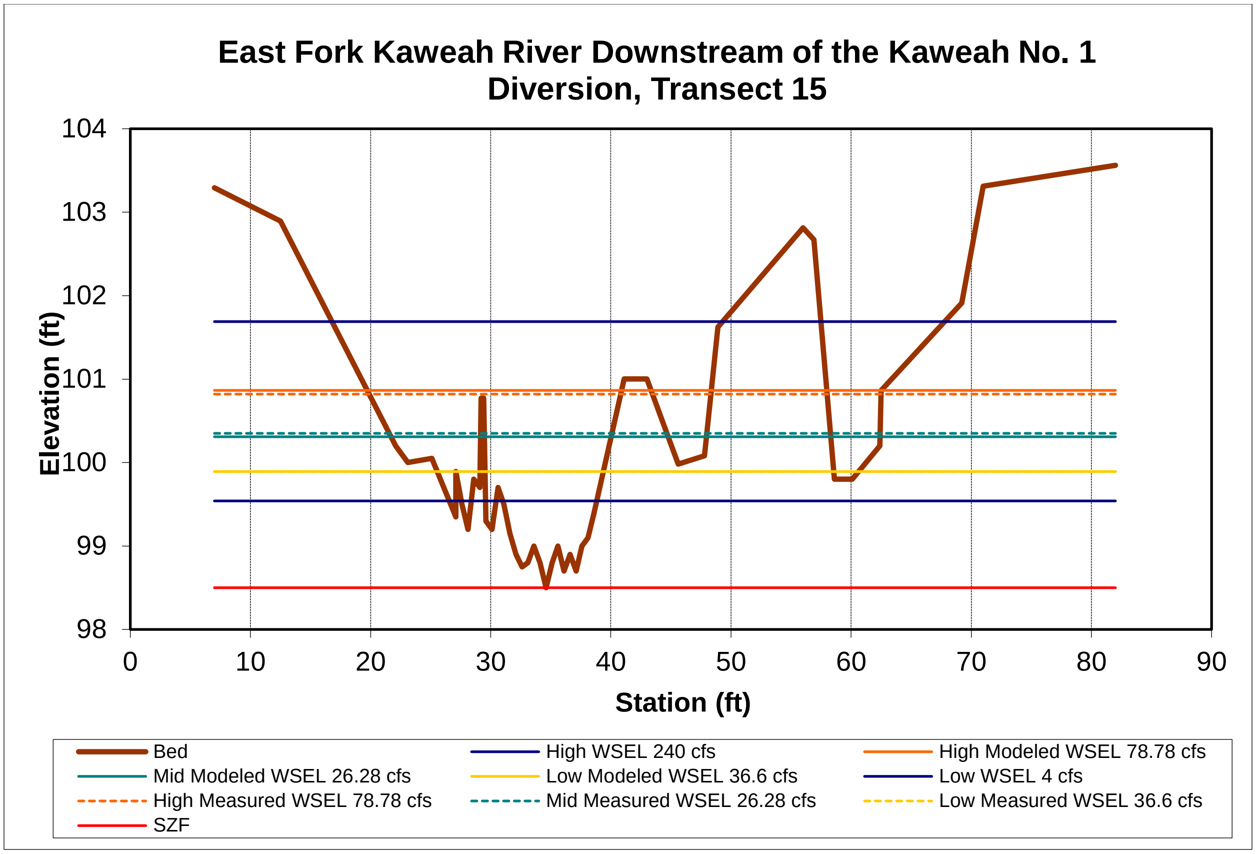

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 10
Elevation (ft)
Station (ft)
105
104
103
102
101
100
99
98
97
96
95
94
0
20
40
60
80
100
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

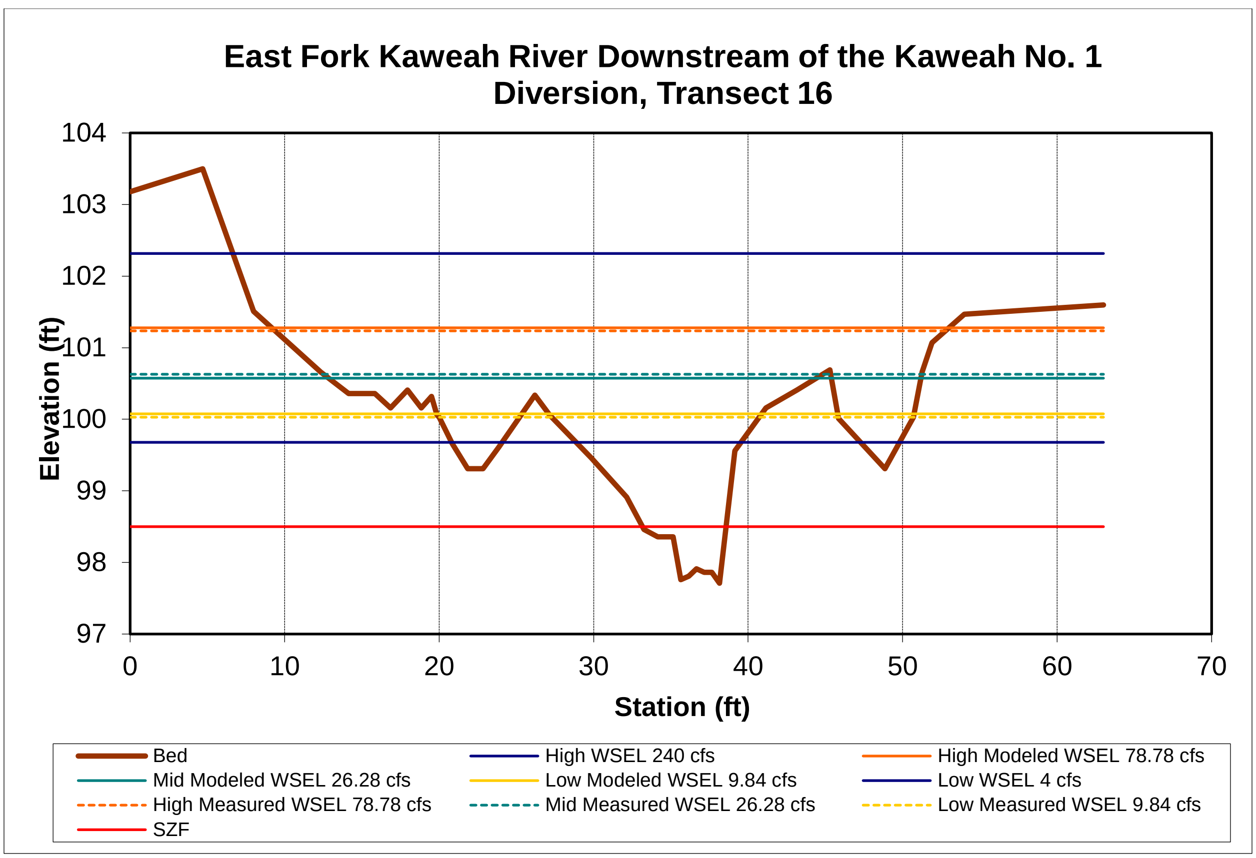

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 11
Elevation (ft)
103
102
101
100
99
98
97
96
95
0
10
20
30
40
50
60
70
80
90
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

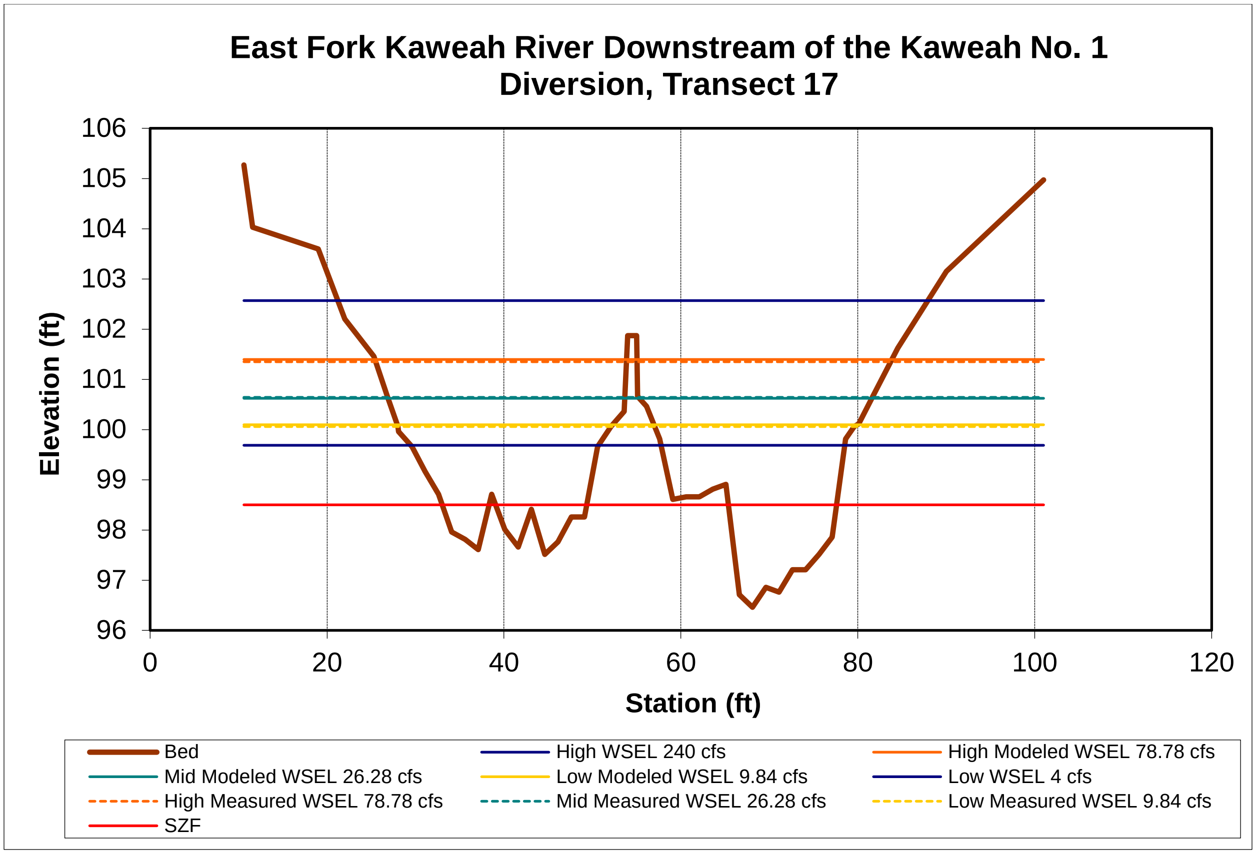

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 12
Elevation (ft)
102
101
100
99
98
97
96
95
94
0
10
20
30
40
50
60
70
80
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF

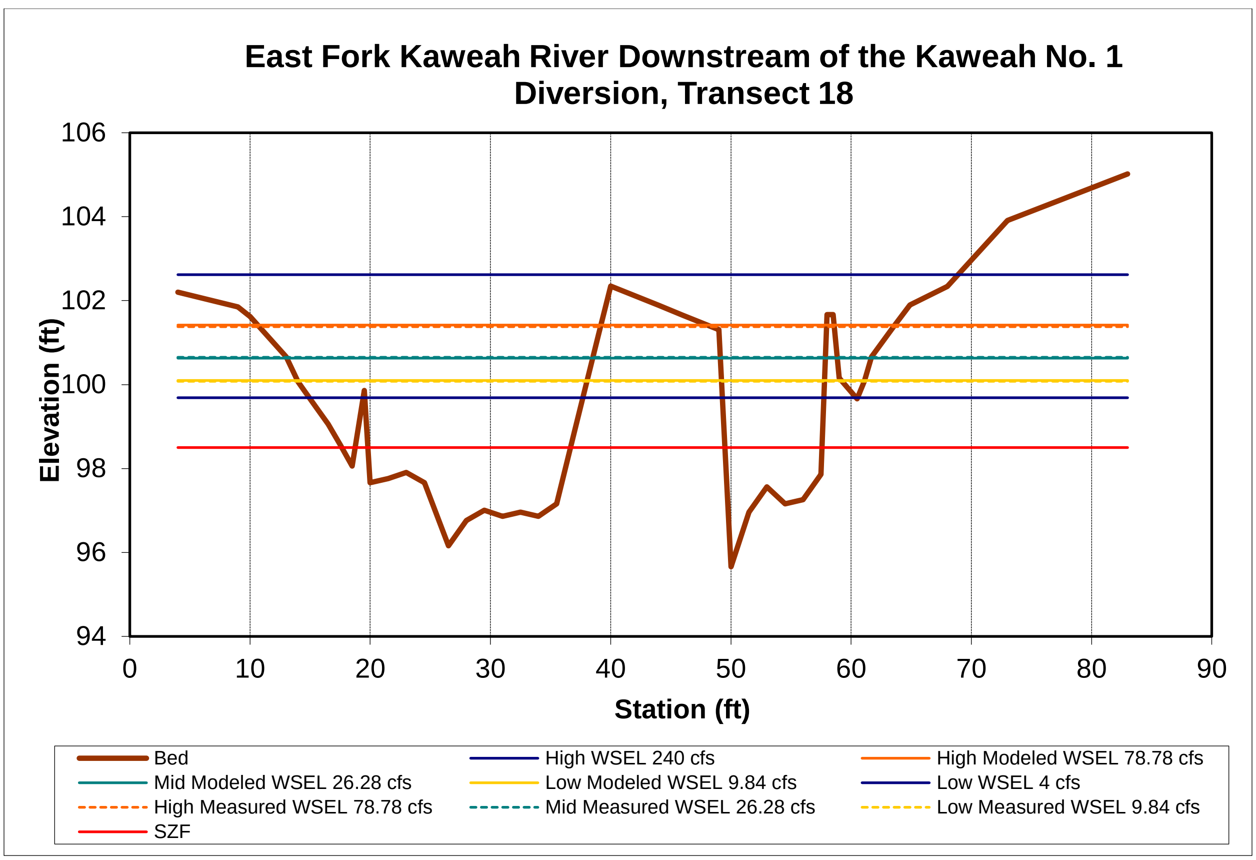

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 13
Elevation (ft)
105
104
103
102
101
100
99
98
97
0
20
40
60
80
100
120
140
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 14
Elevation (ft)
106
105
104
103
102
101
100
99
98
97
0
10
20
30
40
50
60
70
80
90
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 15
Elevation (ft)
104
103
102
101
100
99
98
Station (ft)
0
10
20
30
40
50
60
70
80
90
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 36.6 cfs
SZF


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 16
Elevation (ft)
104
103
102
101
100
99
98
97
Station (ft)
0
10
20
30
40
50
60
70
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 17
Elevation (ft)
106
105
104
103
102
101
100
99
98
97
96
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 18
Elevation (ft)
106
104
102
100
98
96
94
0
10
20
30
40
50
60
70
80
90
Station (ft)
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

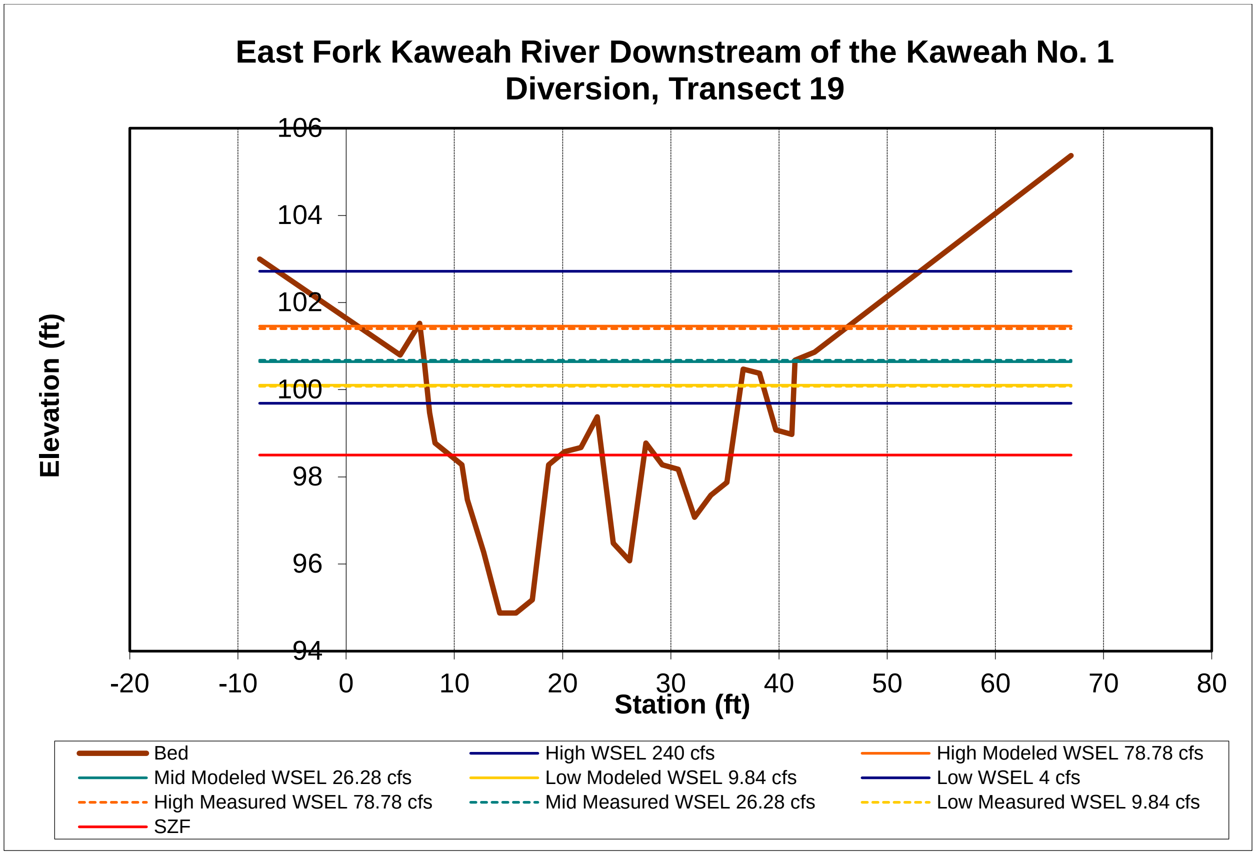
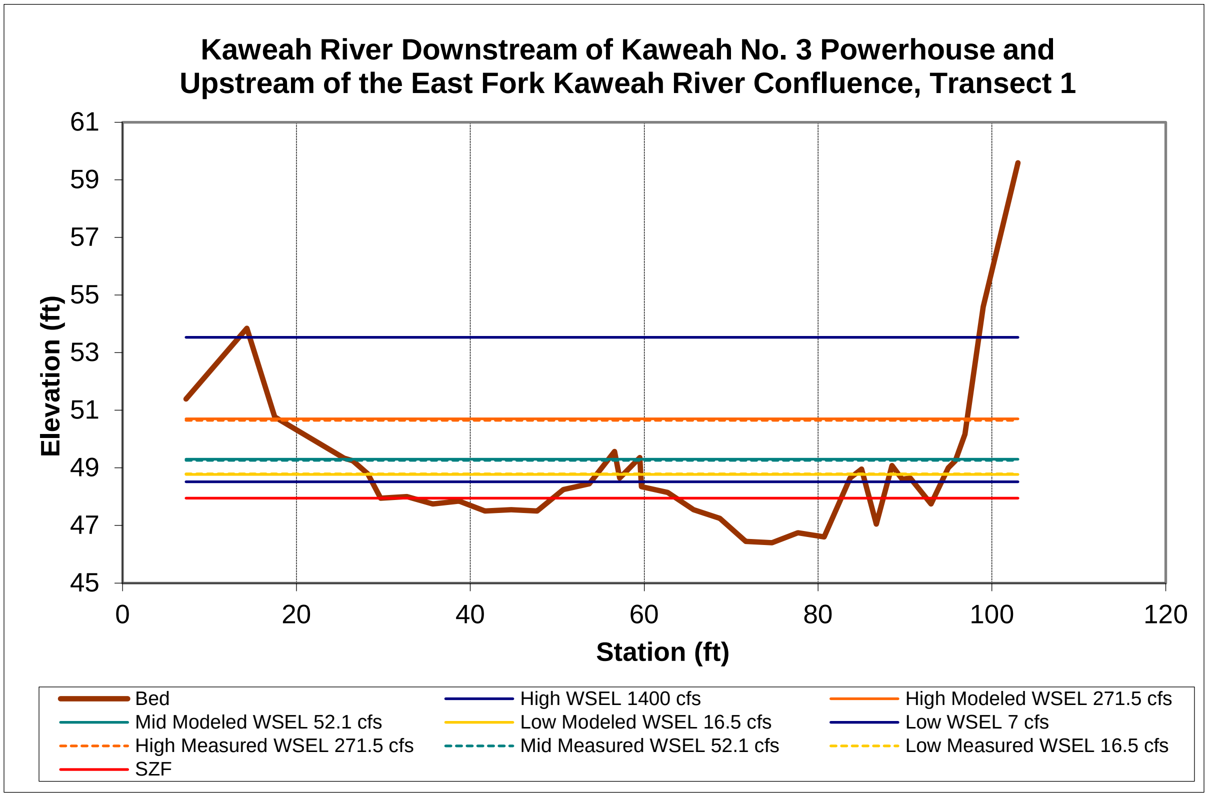
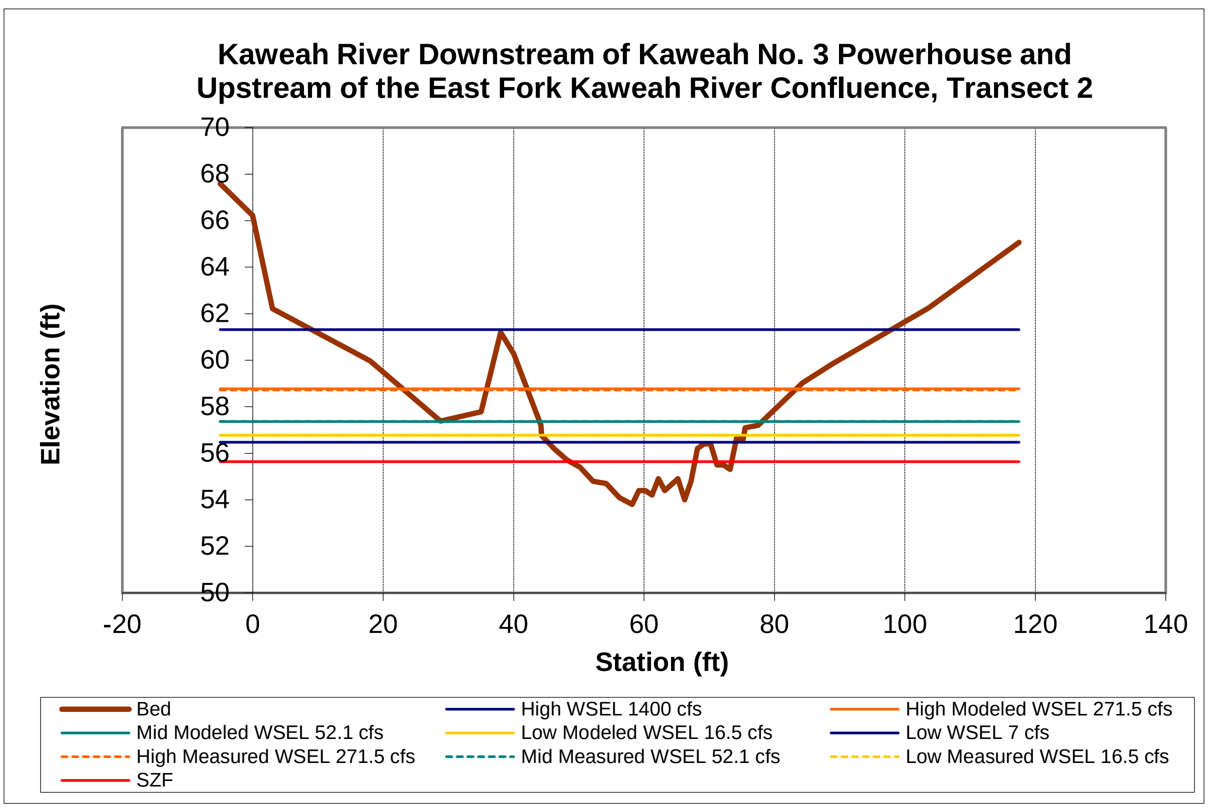
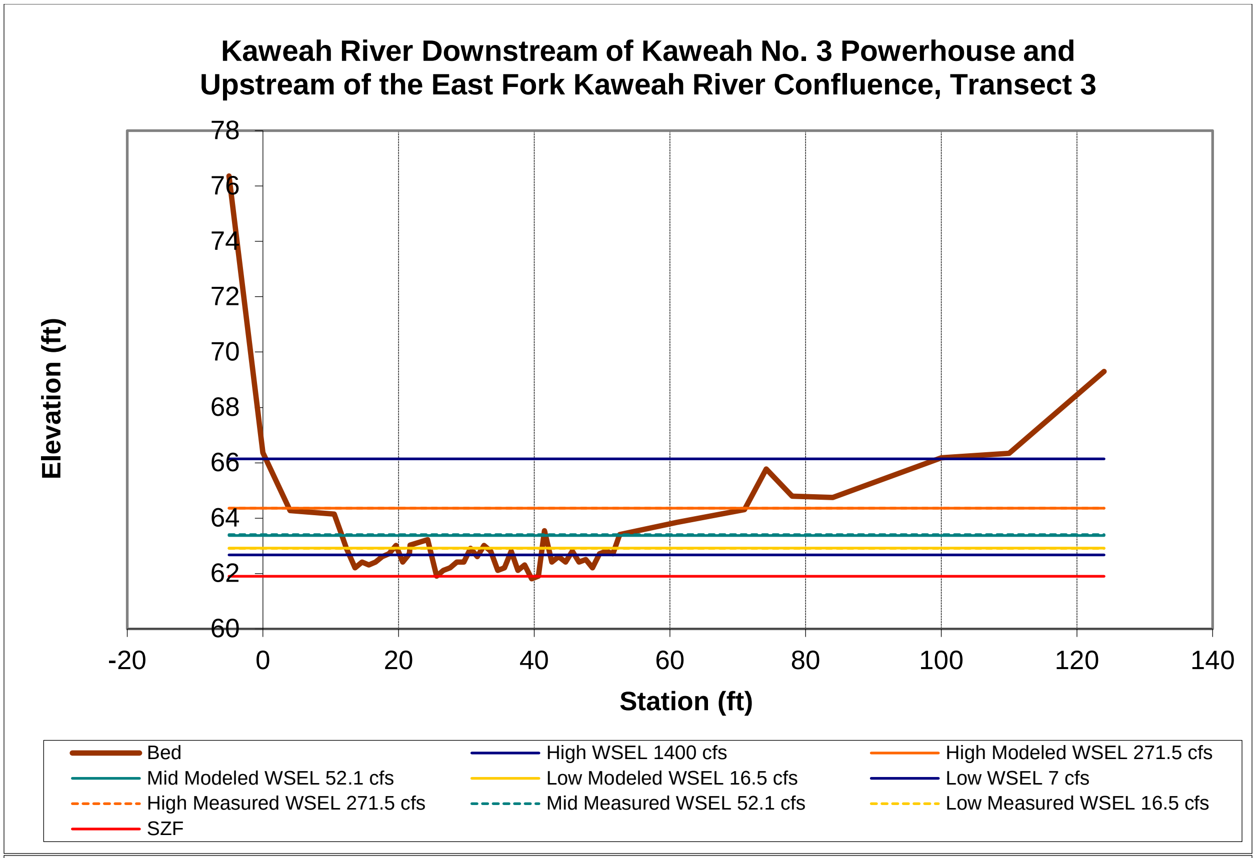
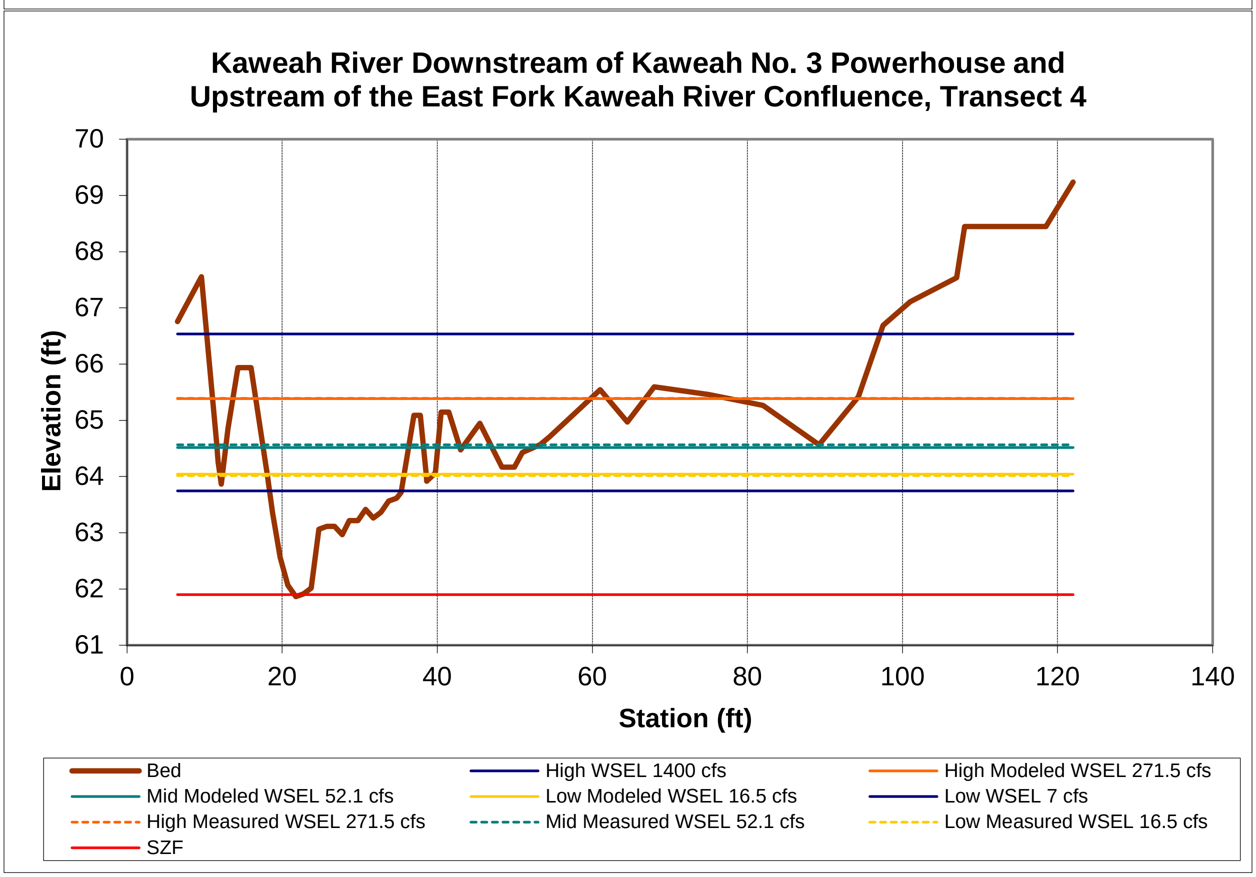

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 19
Elevation (ft)
Station (ft)
106
104
102
100
98
96
94
-20
-10
0
10
20
30
40
50
60
70
80
Bed
High WSEL 240 cfs
High Modeled WSEL 78.78 cfs
Mid Modeled WSEL 26.28 cfs
Low Modeled WSEL 9.84 cfs
Low WSEL 4 cfs
High Measured WSEL 78.78 cfs
Mid Measured WSEL 26.28 cfs
Low Measured WSEL 9.84 cfs
SZF

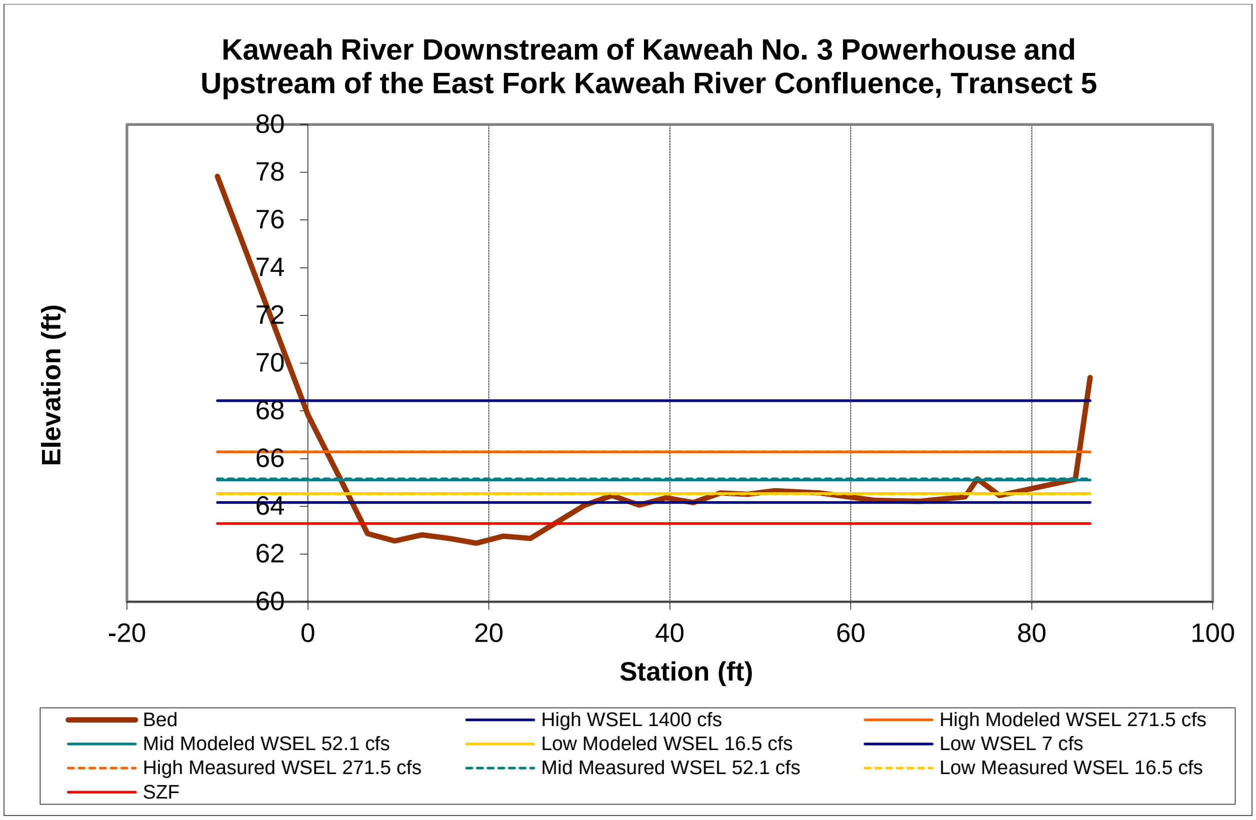
Figure D.B-2. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Water Surface Elevation Calibration Report.

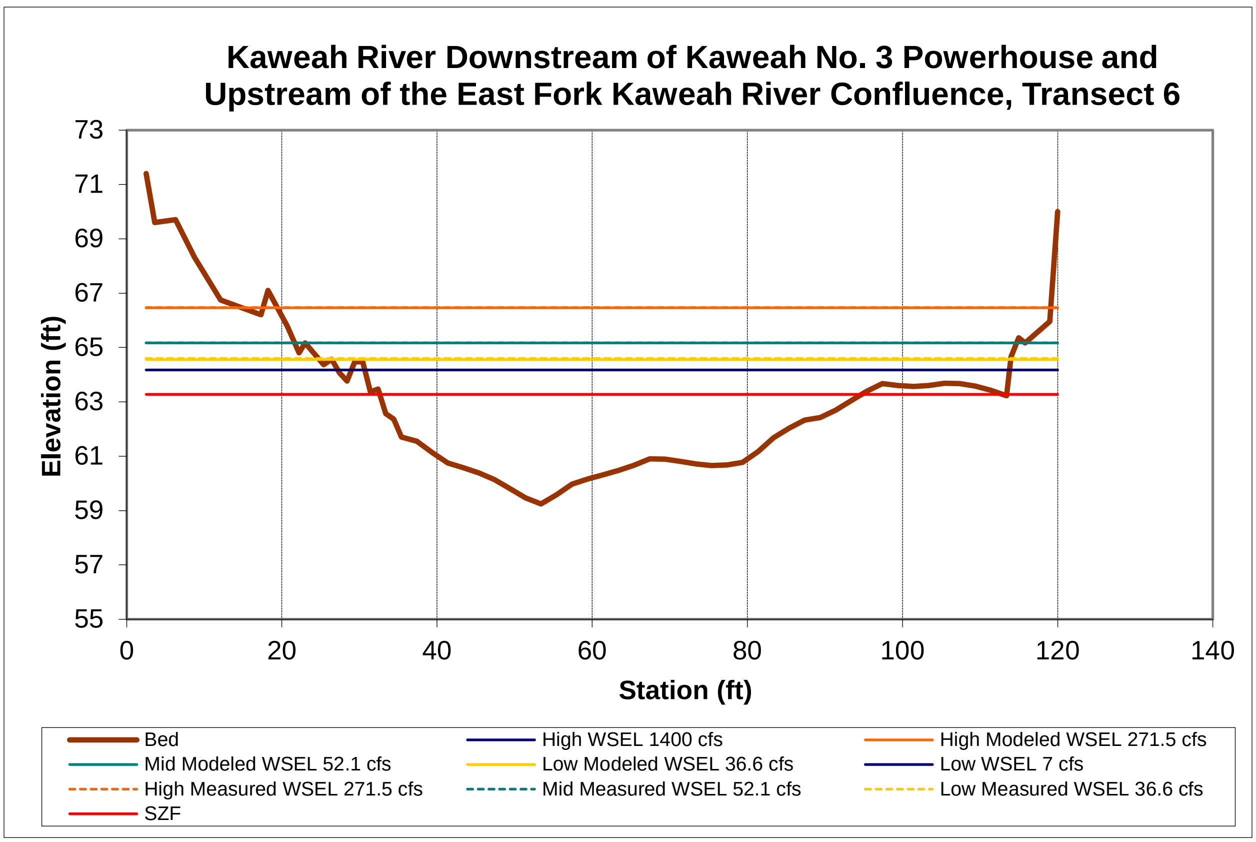


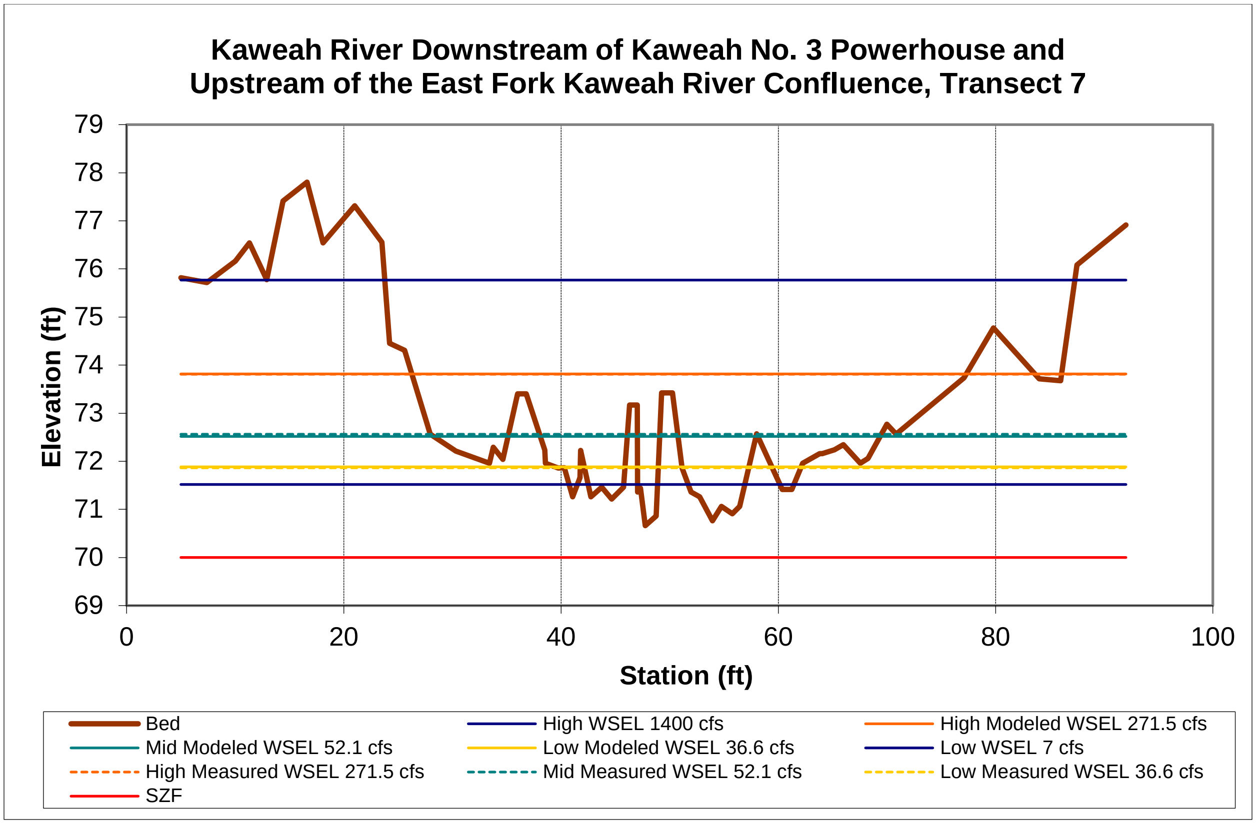


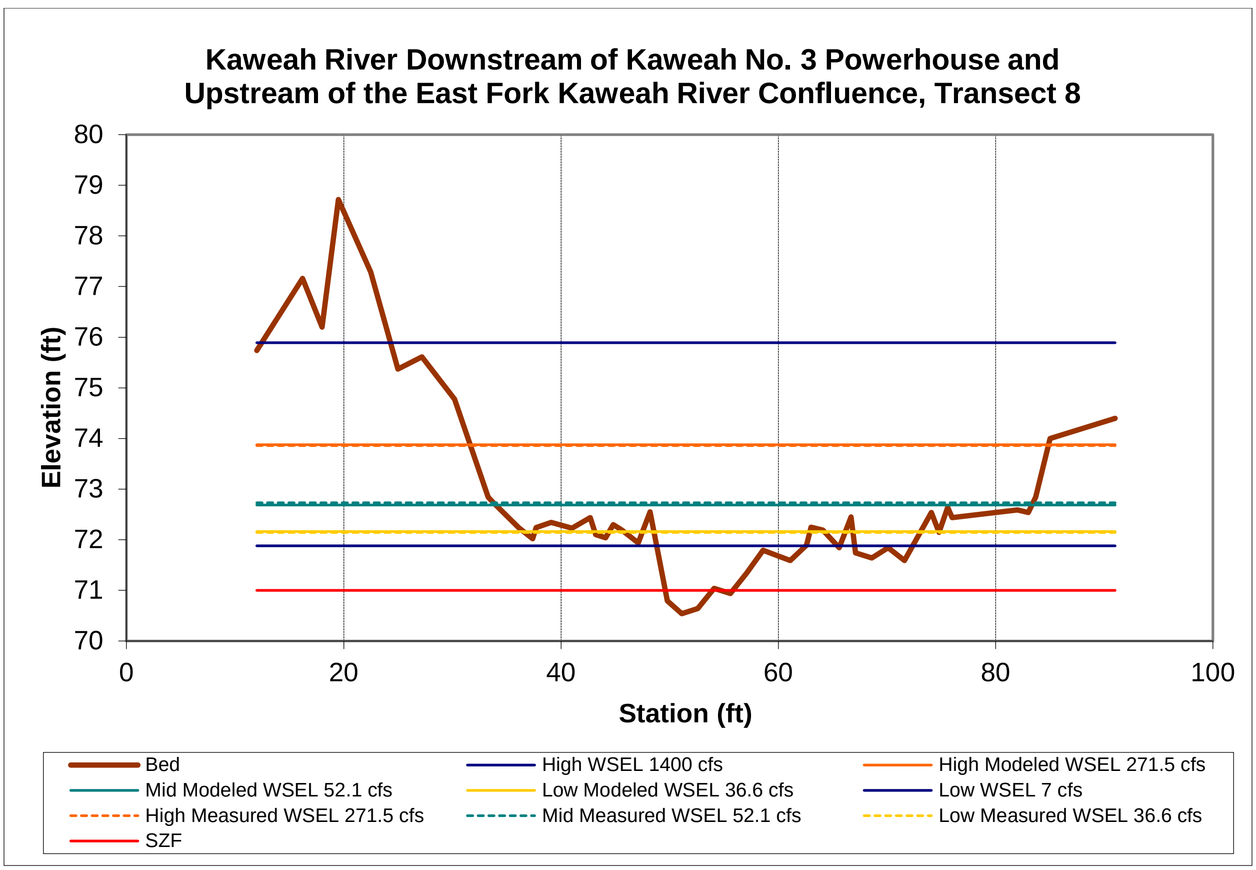

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 3
Elevation (ft)
78
76
74
72
70
68
66
64
62
60
-20
0
20
40
60
80
100
120
140
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

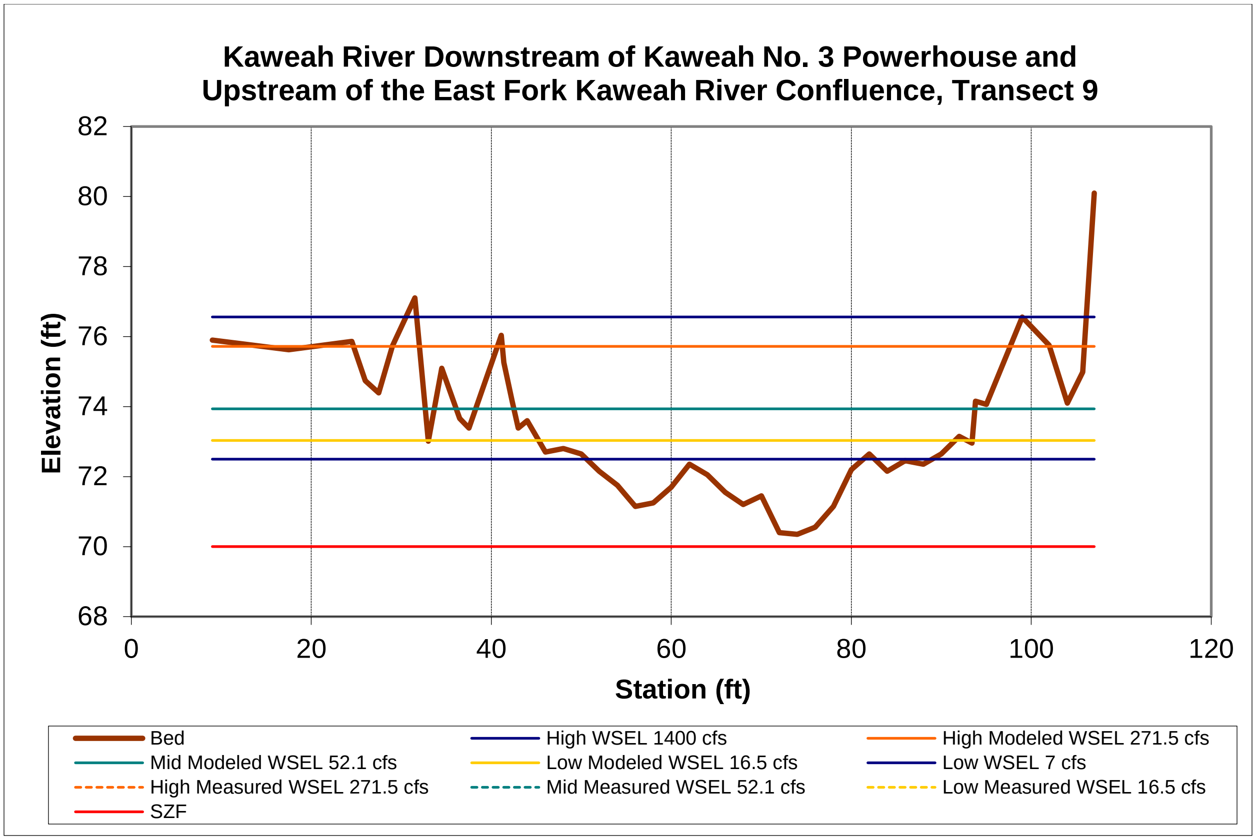

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 4
Elevation (ft)
70
69
68
67
66
65
64
63
62
61
0
20
40
60
80
100
120
140
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

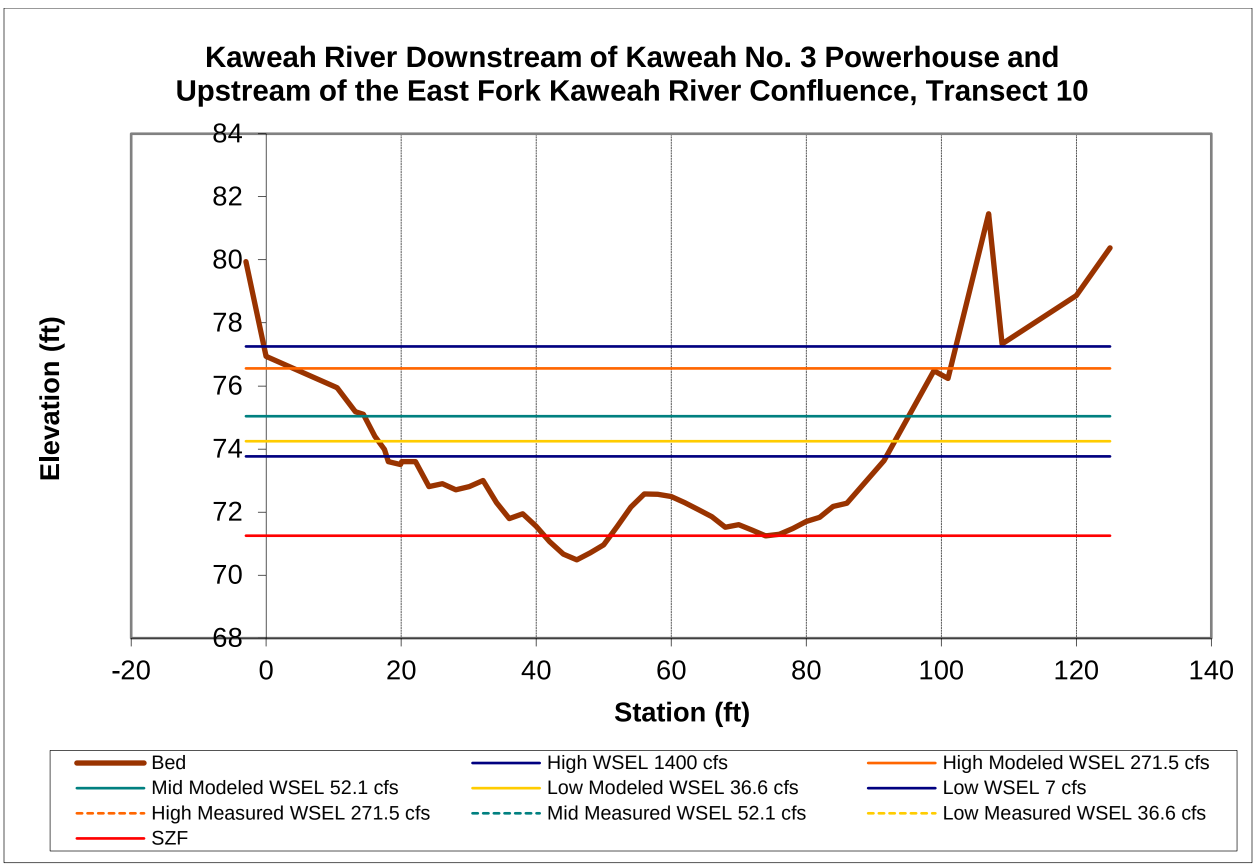

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 5
Elevation (ft)
Station (ft)
80
78
76
74
72
70
68
66
64
62
60
-20
0
20
40
60
80
100
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

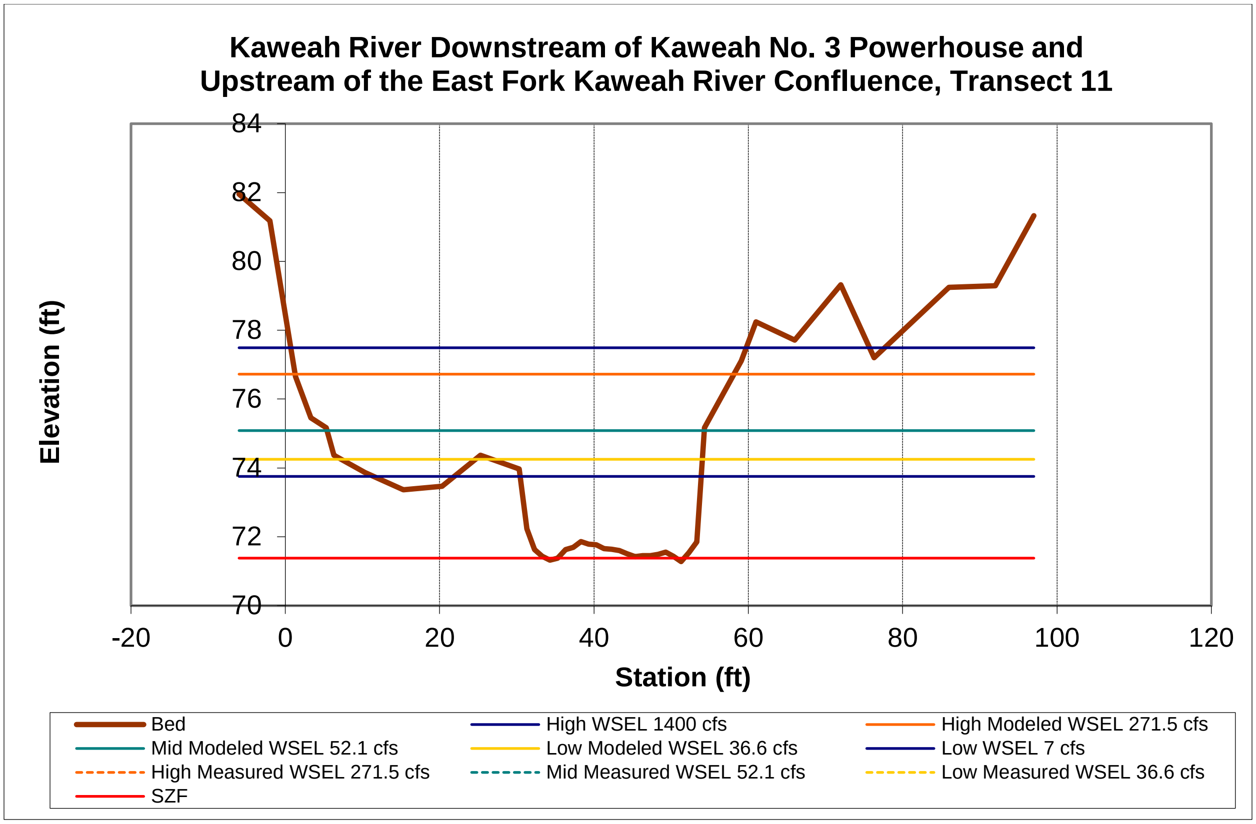

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 6
Elevation (ft)
Station (ft)
73
71
69
67
65
63
61
59
57
55
0
20
40
60
80
100
120
140
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF

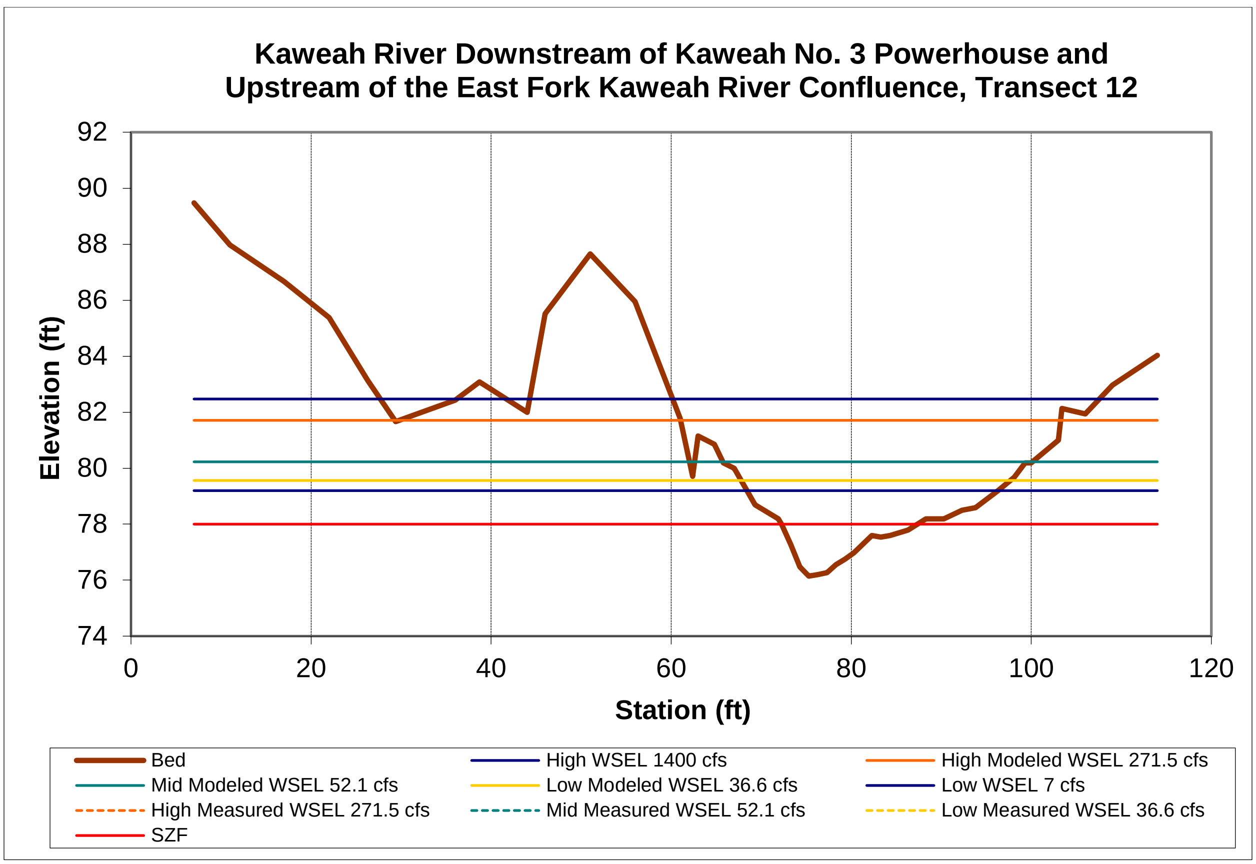

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 7
Elevation (ft)
79
78
77
76
75
74
73
72
71
70
69
0
20
40
60
80
100
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF

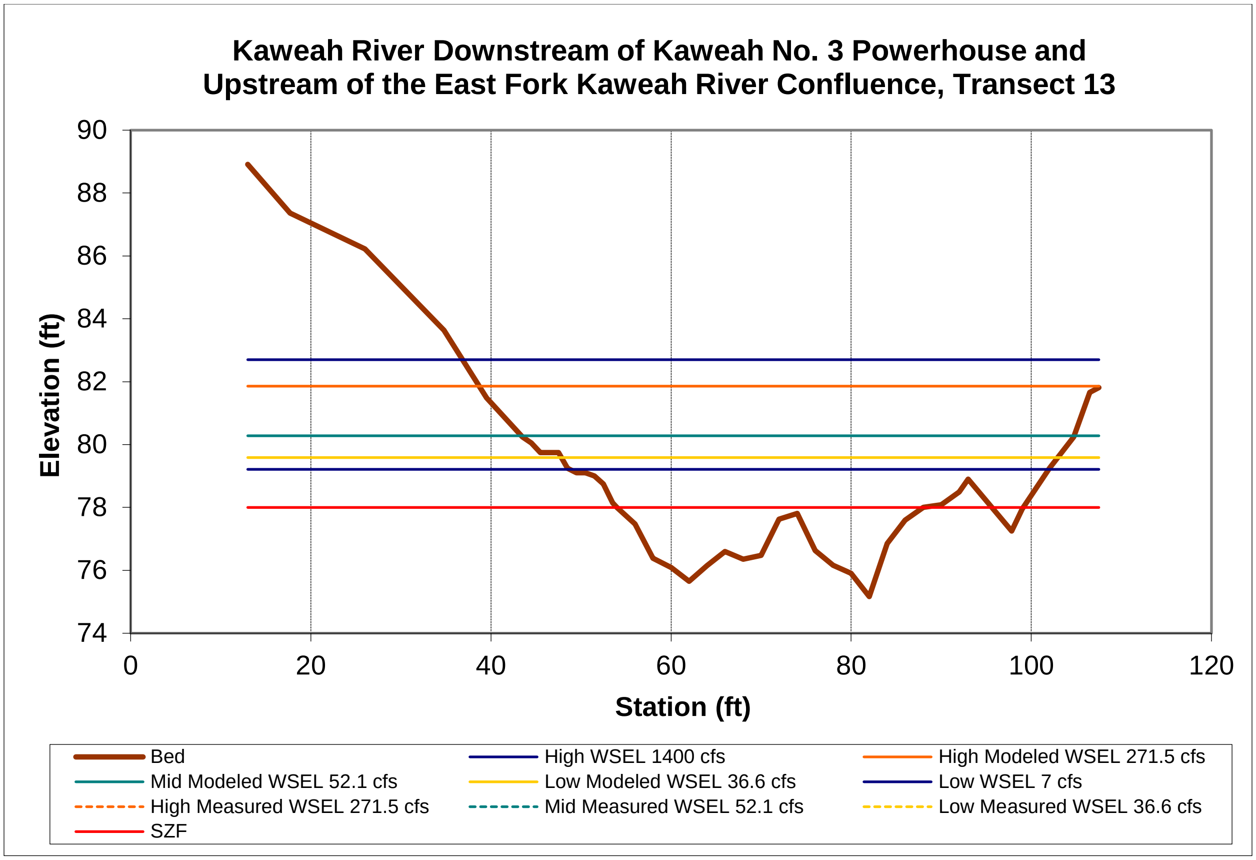

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 8
Elevation (ft)
80
79
78
77
76
75
74
73
72
71
70
0
20
40
60
80
100
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF

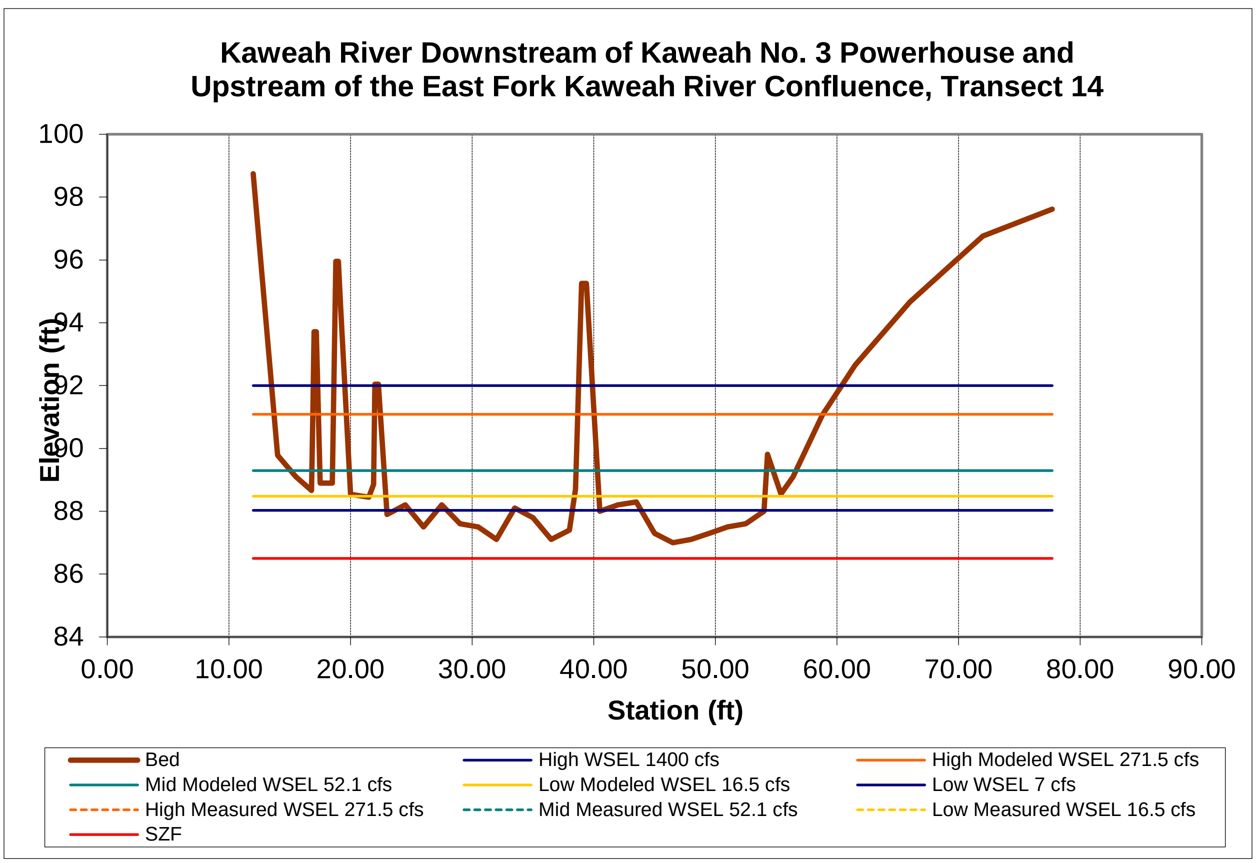

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 9
Elevation (ft)
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

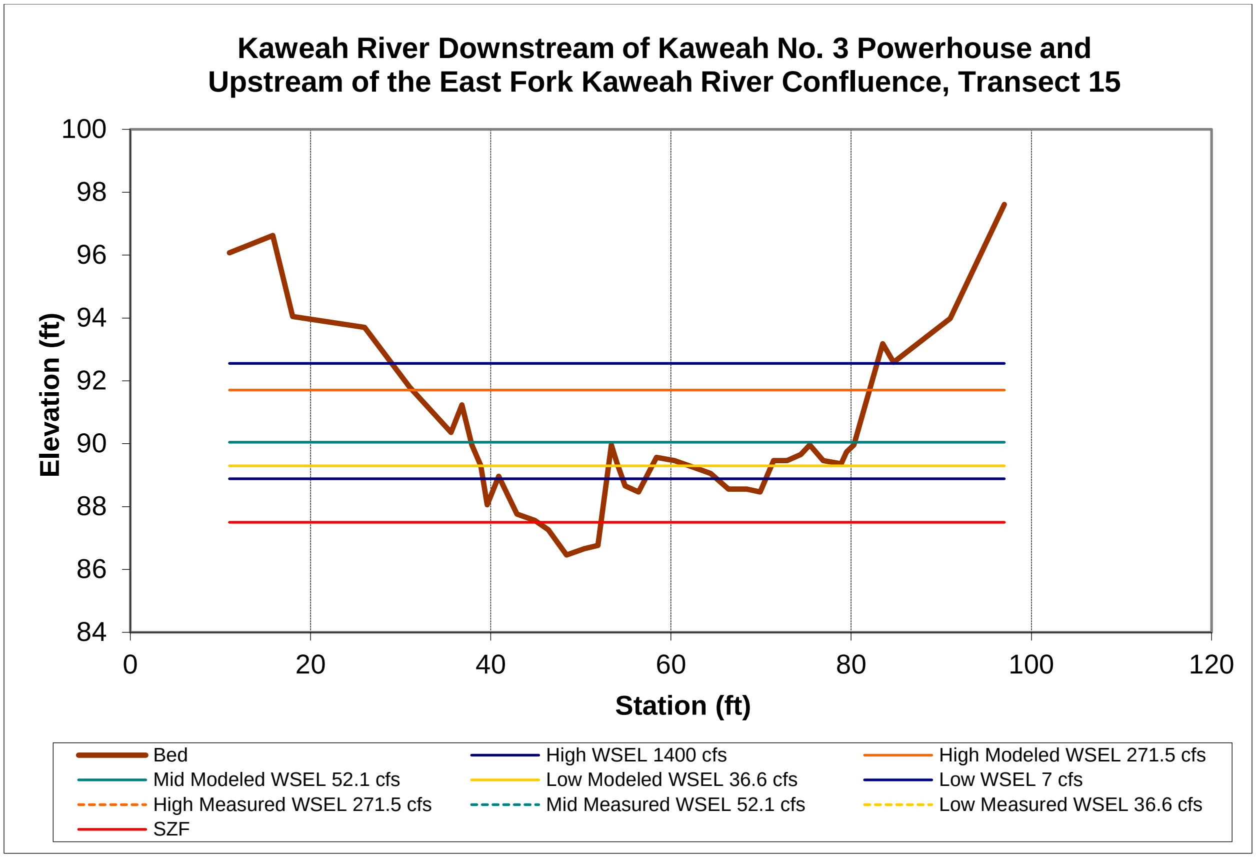

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 10
Elevation (ft)
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF

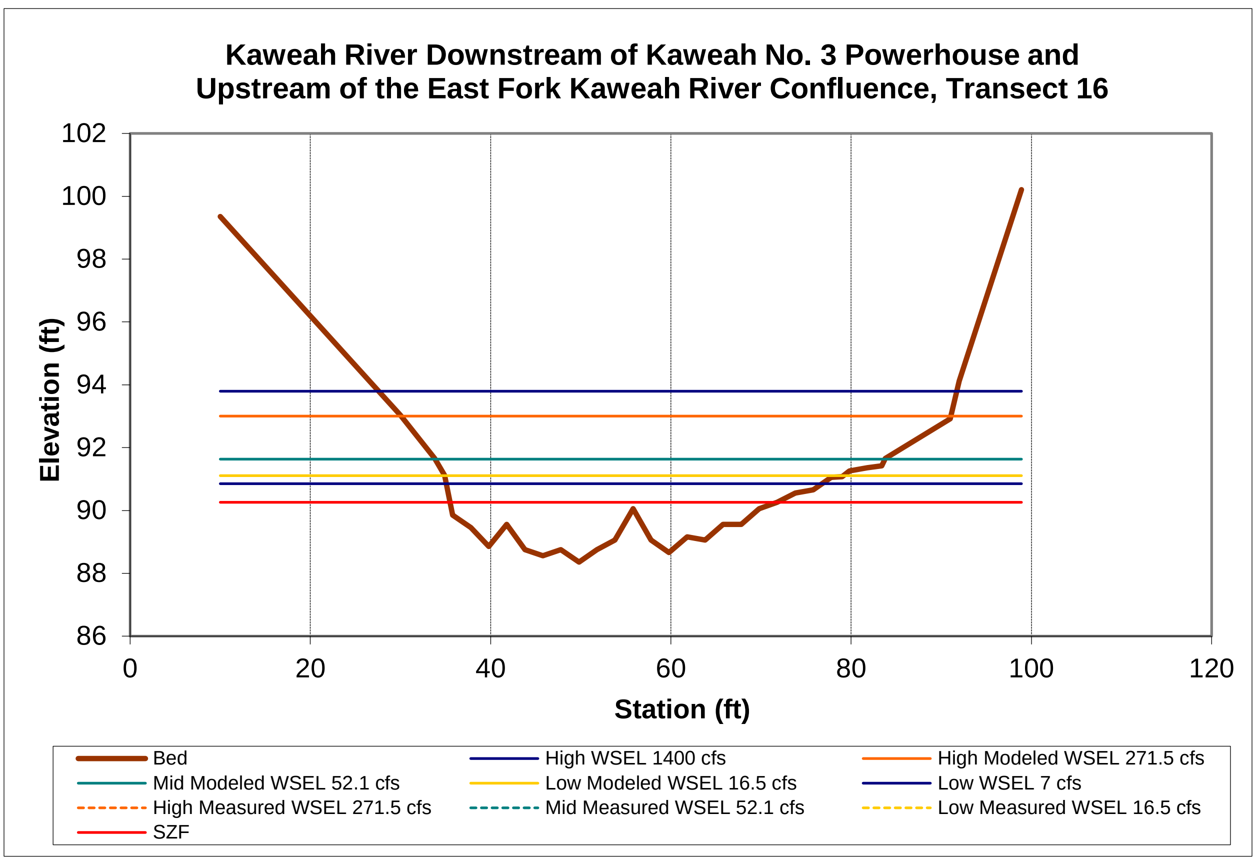

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 11
Elevation (ft)
84
82
80
78
76
74
72
70
-20
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF

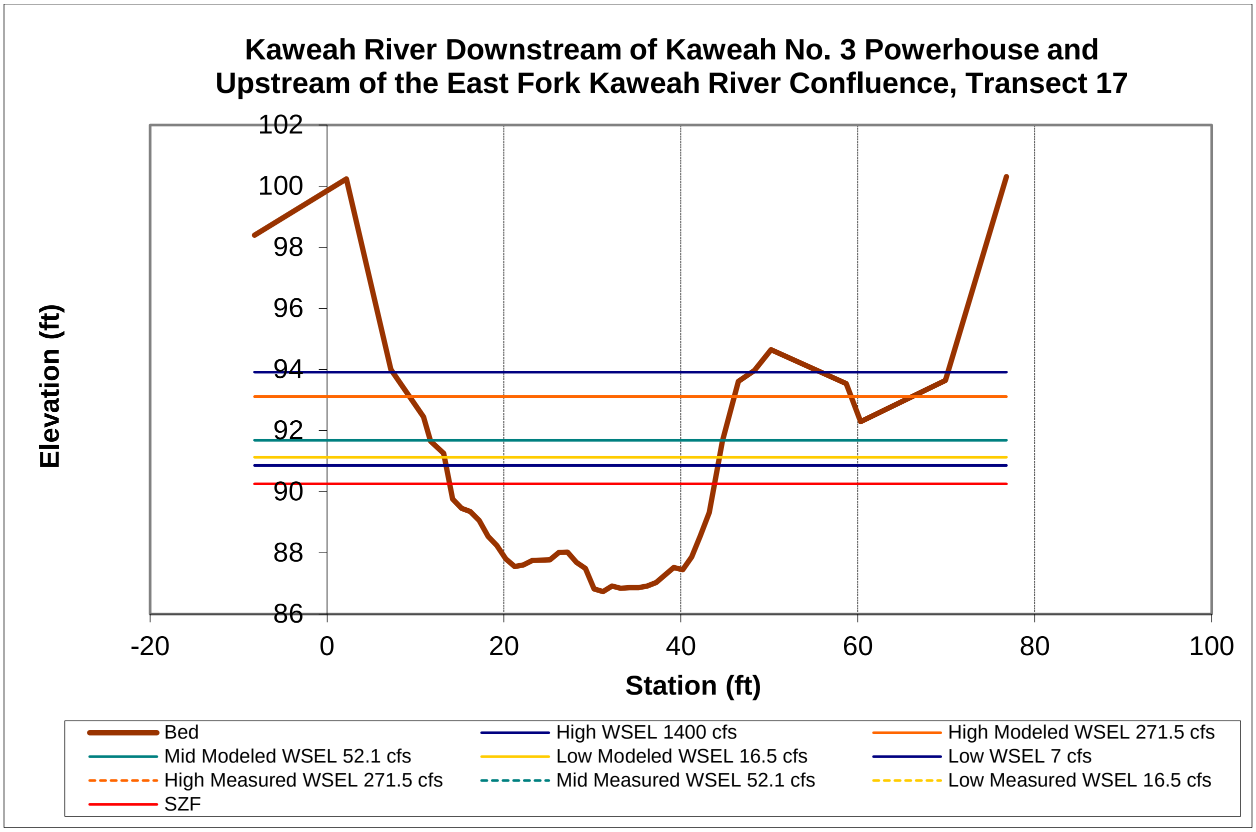

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 12
Elevation (ft)
92
90
88
86
84
82
80
78
76
74
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 13
Elevation (ft)
90
88
86
84
82
80
78
76
74
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 14
Elevation (ft)
100
98
96
94
92
90
88
86
84
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 15
Elevation (ft)
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 16
Elevation (ft)
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 17
Elevation (ft)
102
100
98
96
94
92
90
88
86
-20
0
20
40
60
80
100
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

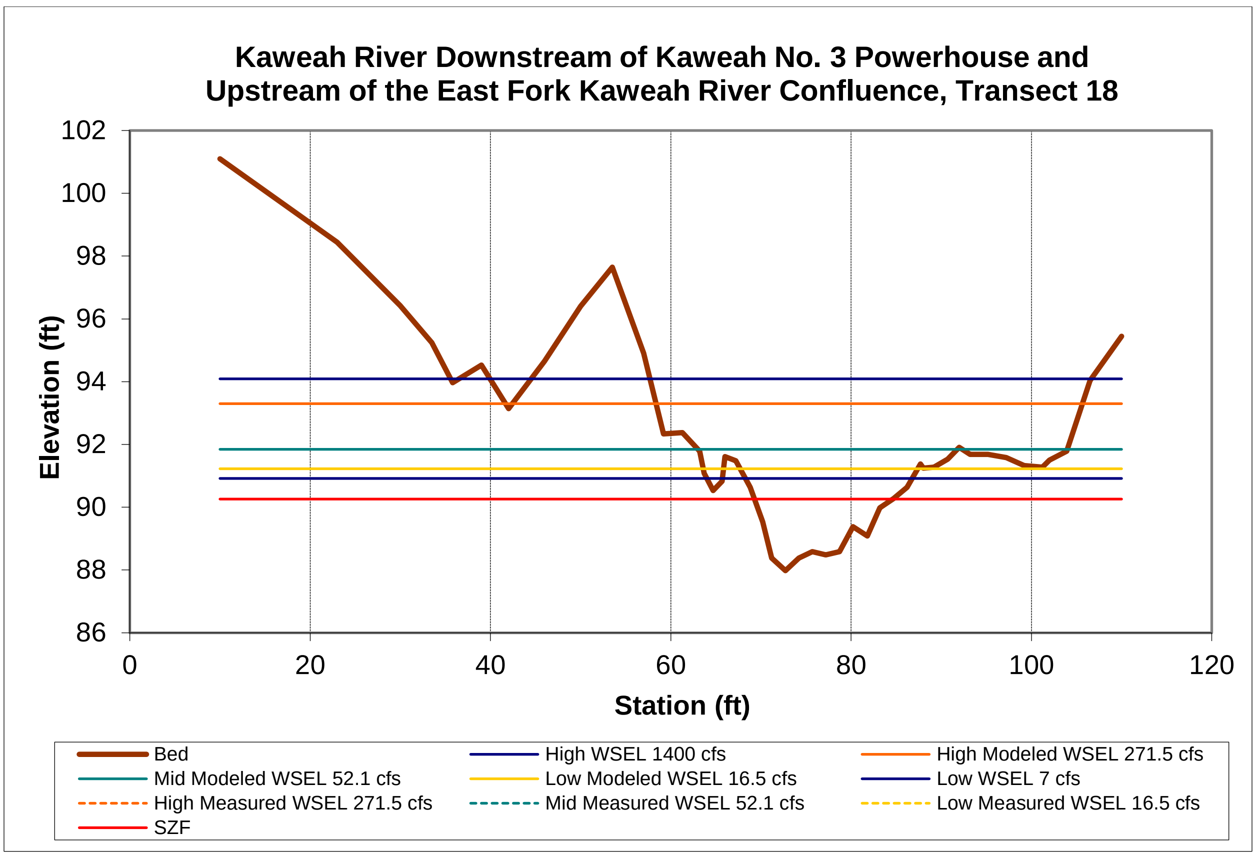
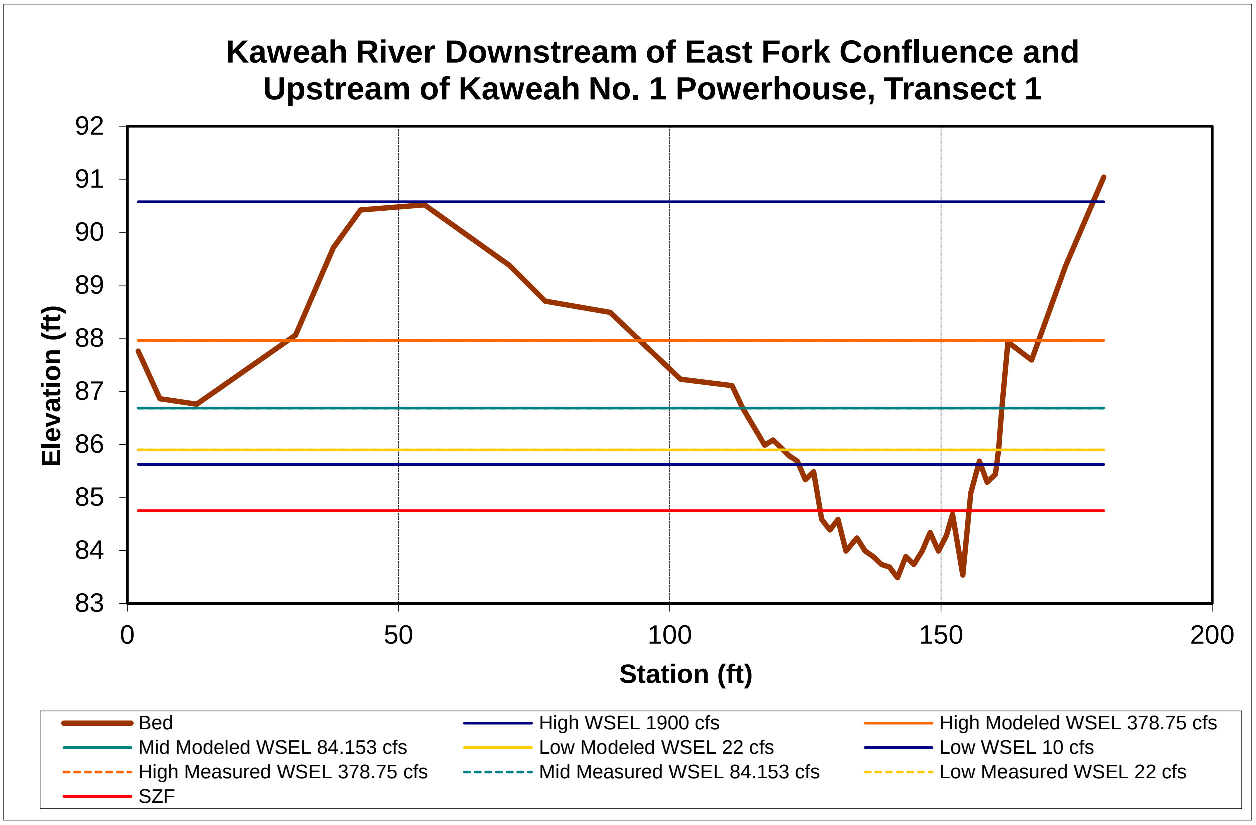
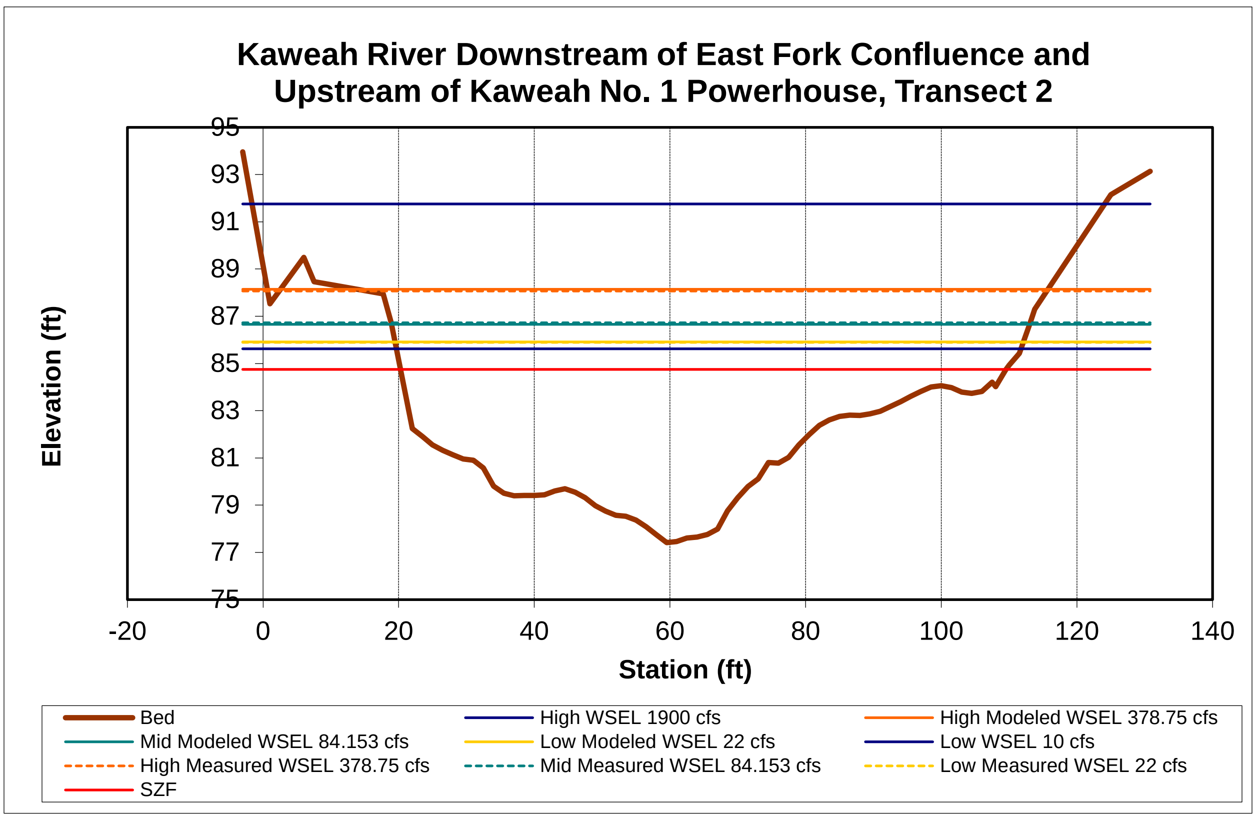
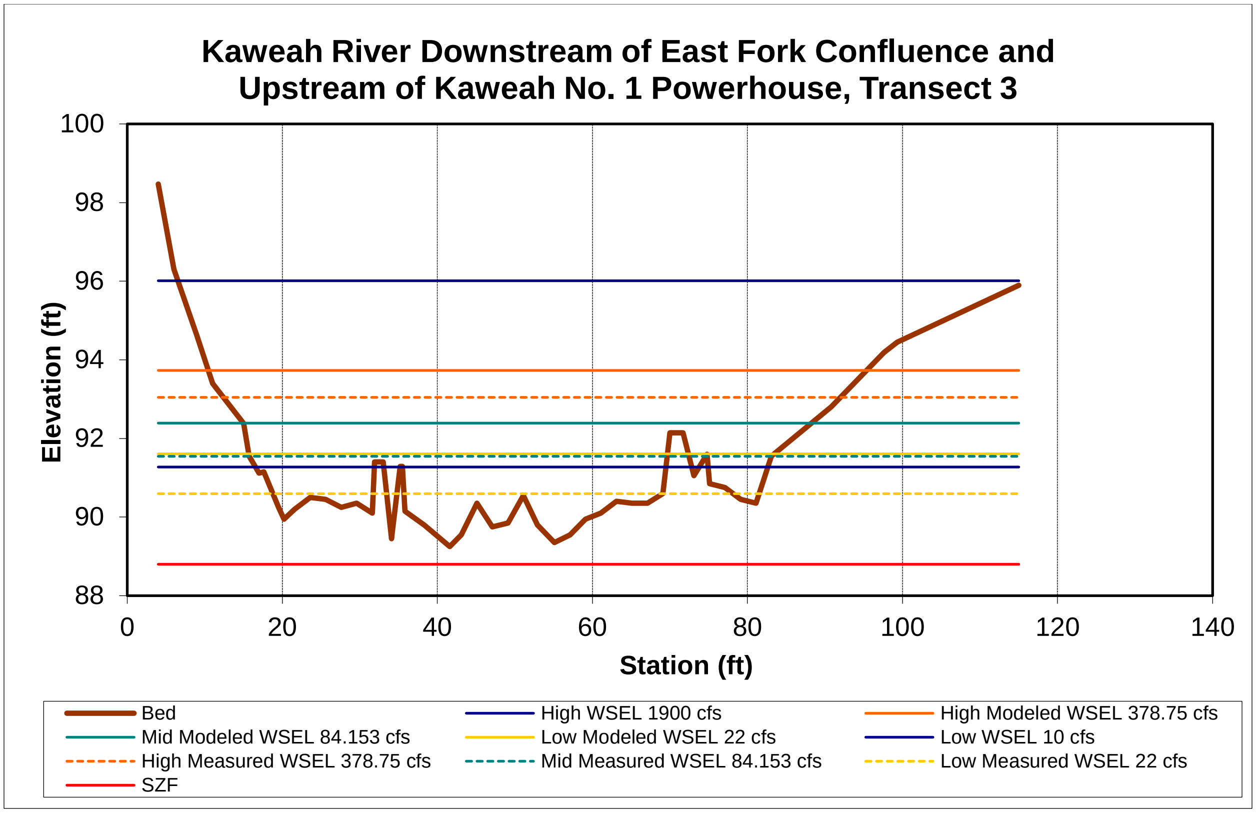
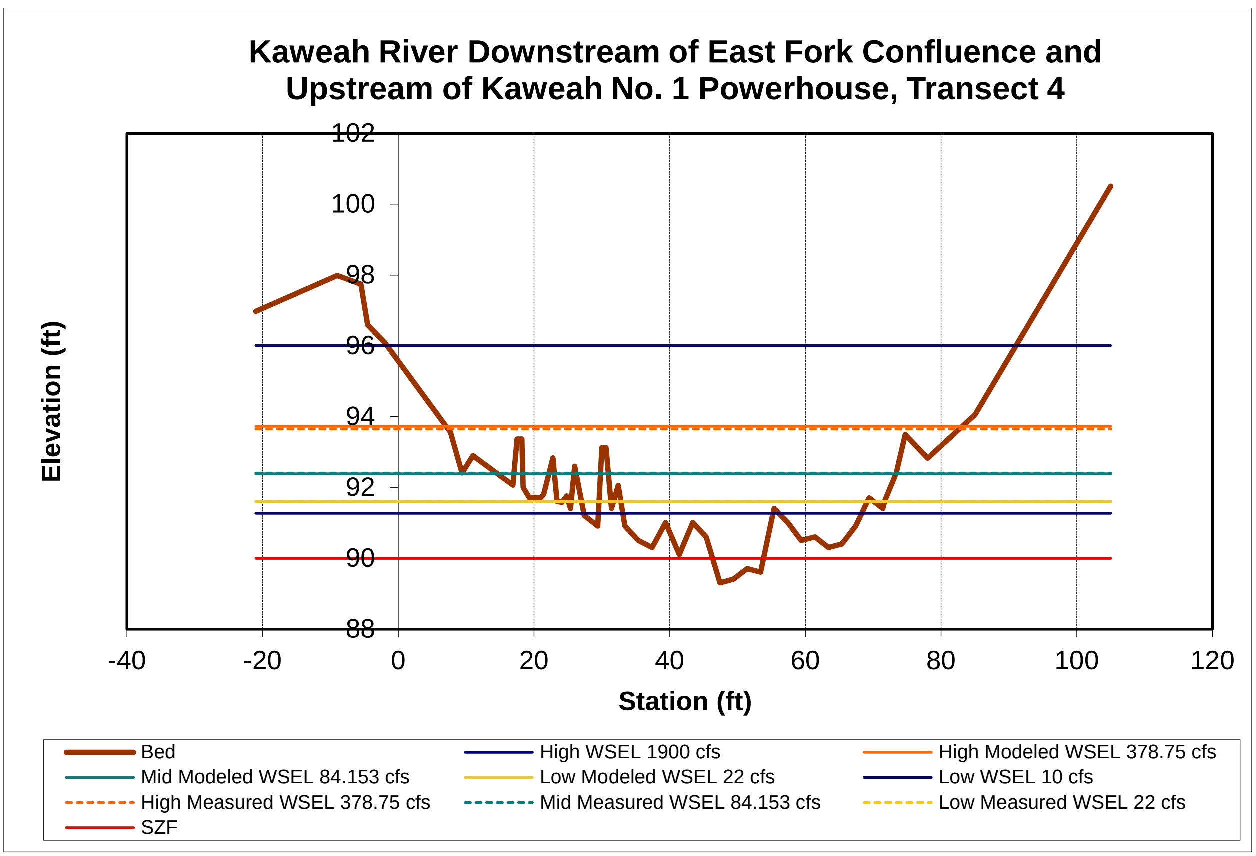

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 18
Elevation (ft)
102
100
98
96
94
92
90
88
86
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 1400 cfs
High Modeled WSEL 271.5 cfs
Mid Modeled WSEL 52.1 cfs
Low Modeled WSEL 16.5 cfs
Low WSEL 7 cfs
High Measured WSEL 271.5 cfs
Mid Measured WSEL 52.1 cfs
Low Measured WSEL 16.5 cfs
SZF

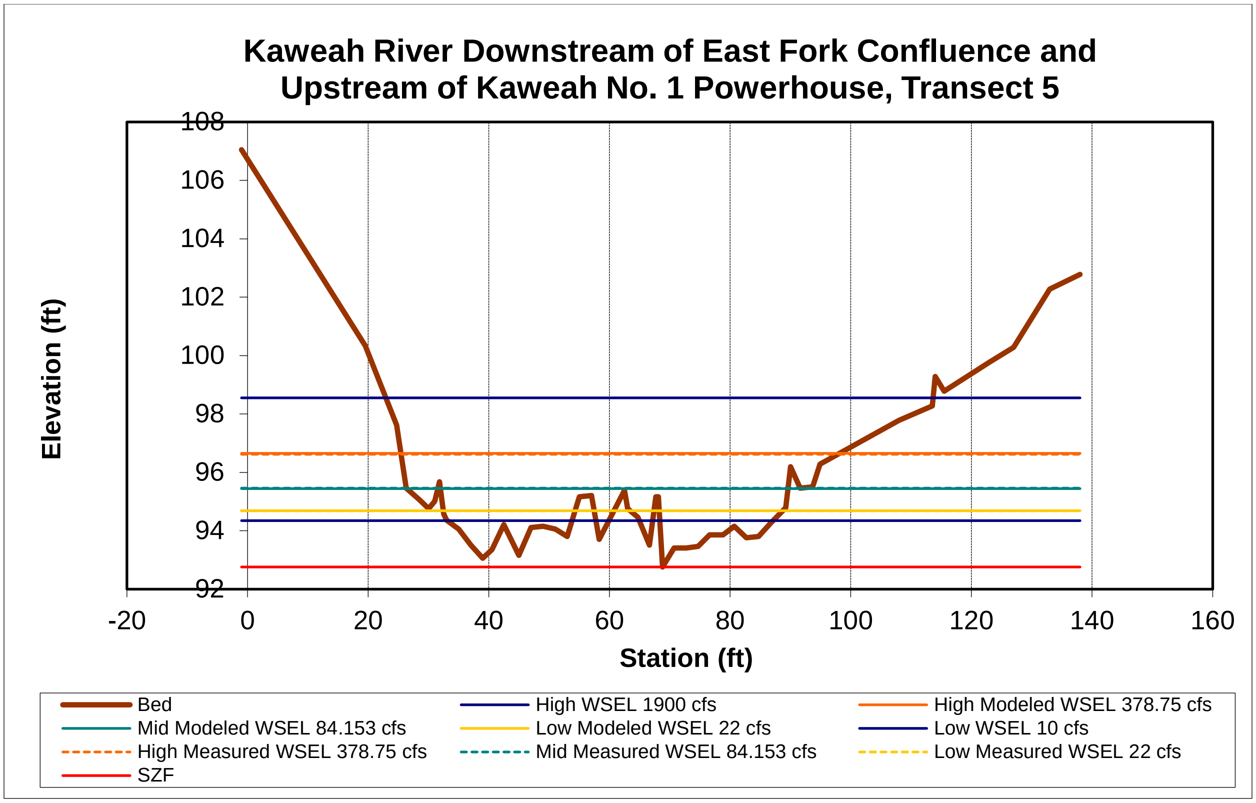
Figure D.B-3. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Water Surface Elevation Calibration Report.

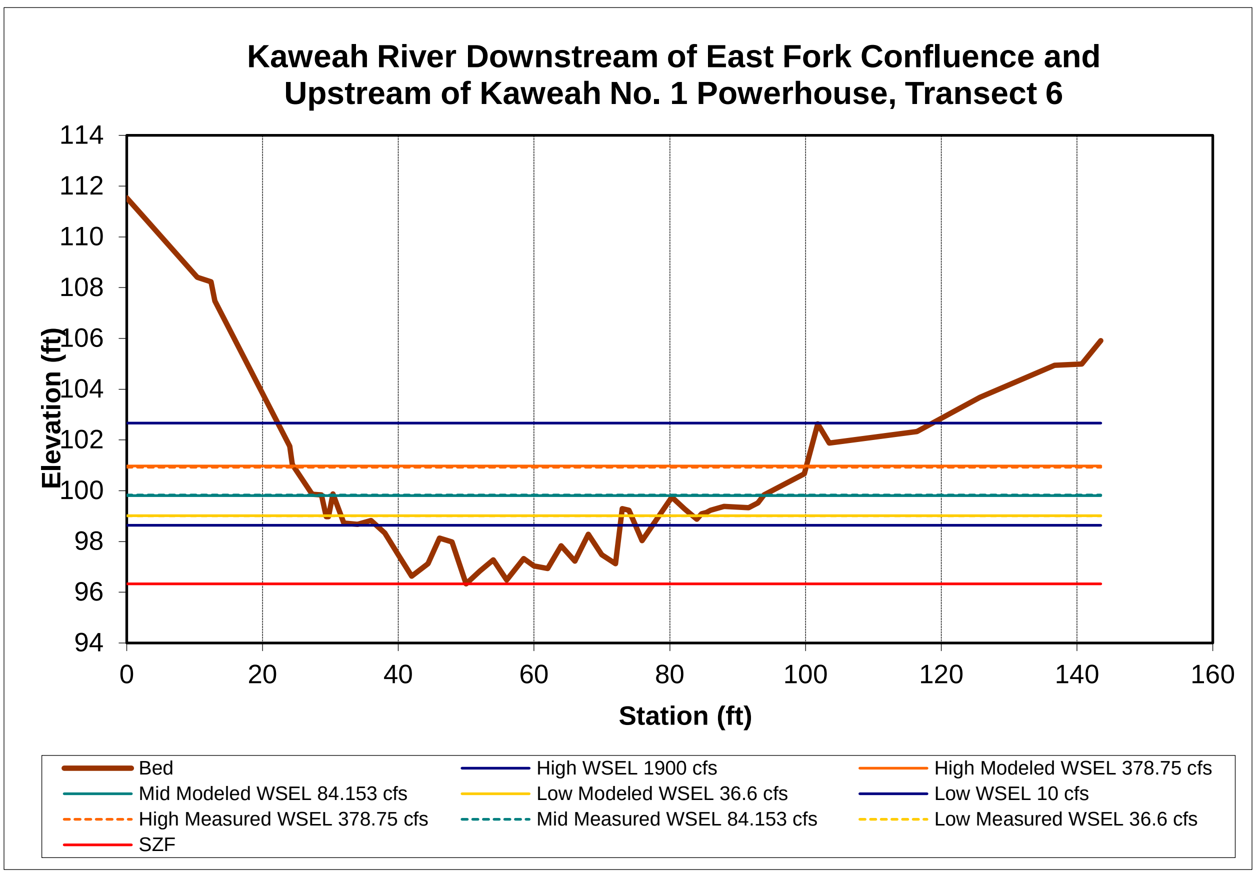


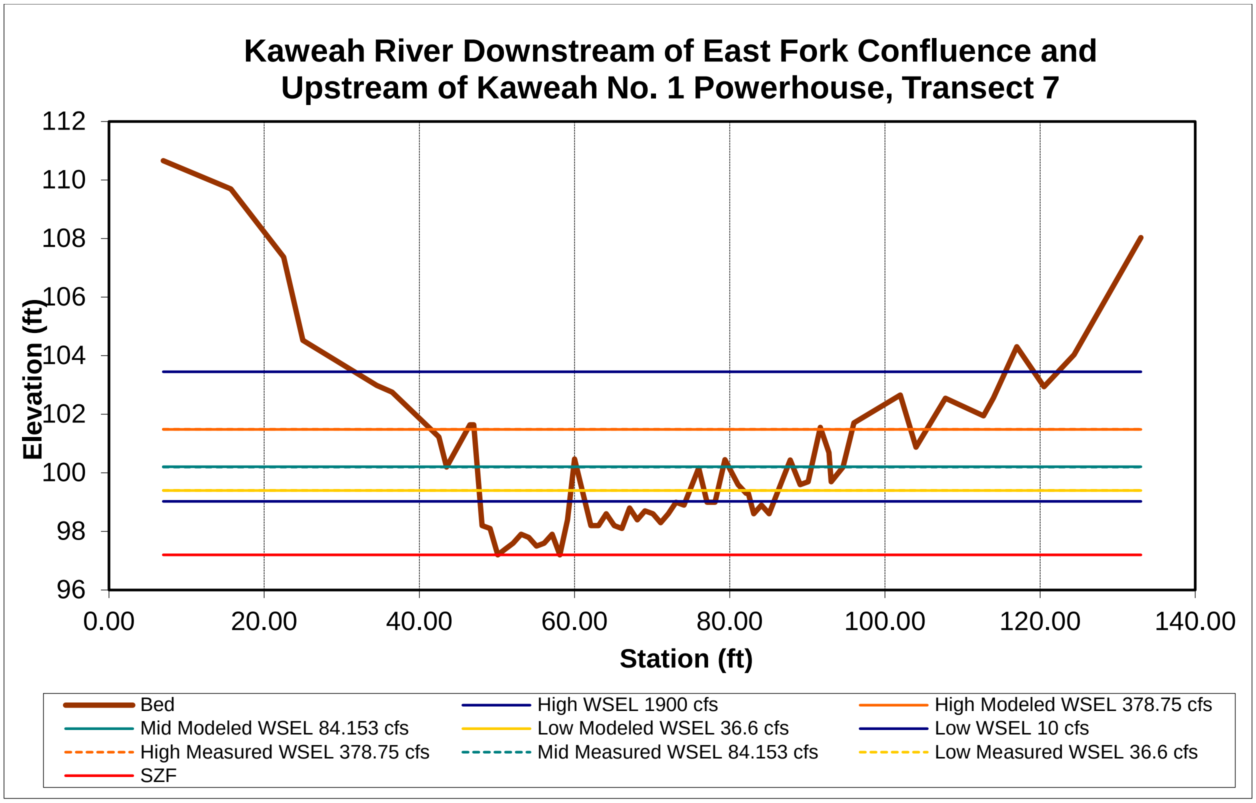


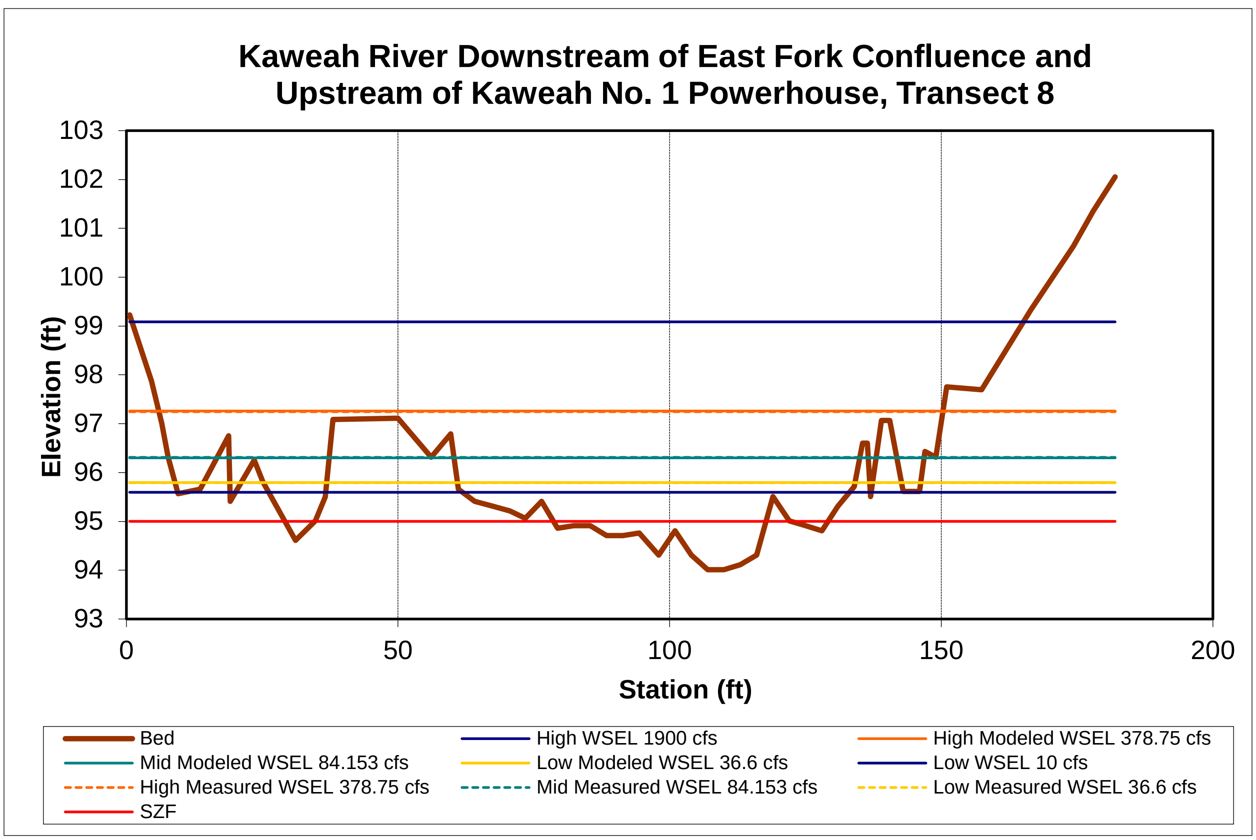

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 3
Elevation (ft)
100
98
96
94
92
90
88
0
20
40
60
80
100
120
140
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 22 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 22 cfs
SZF

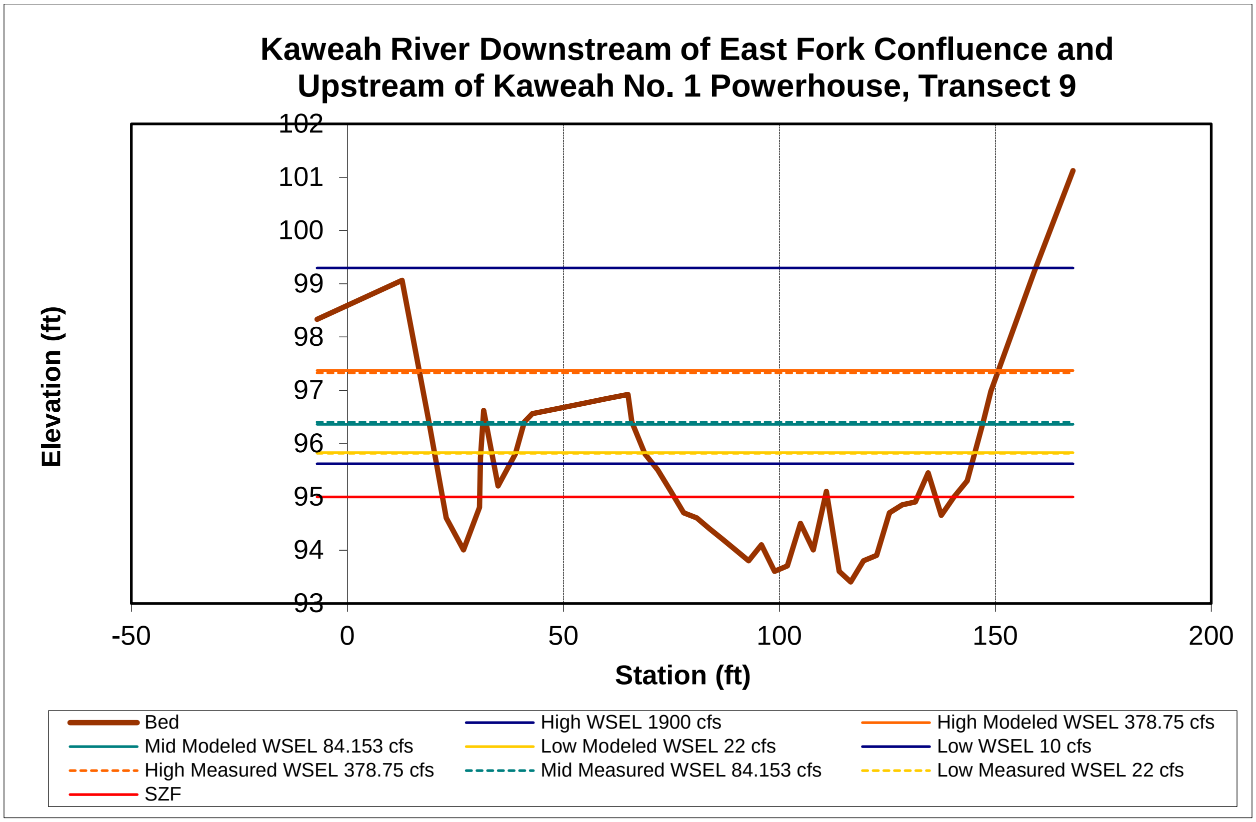

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 4
Elevation (ft)
102
100
98
96
94
92
90
88
-40
-20
0
20
40
60
80
100
120
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 22 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 22 cfs
SZF

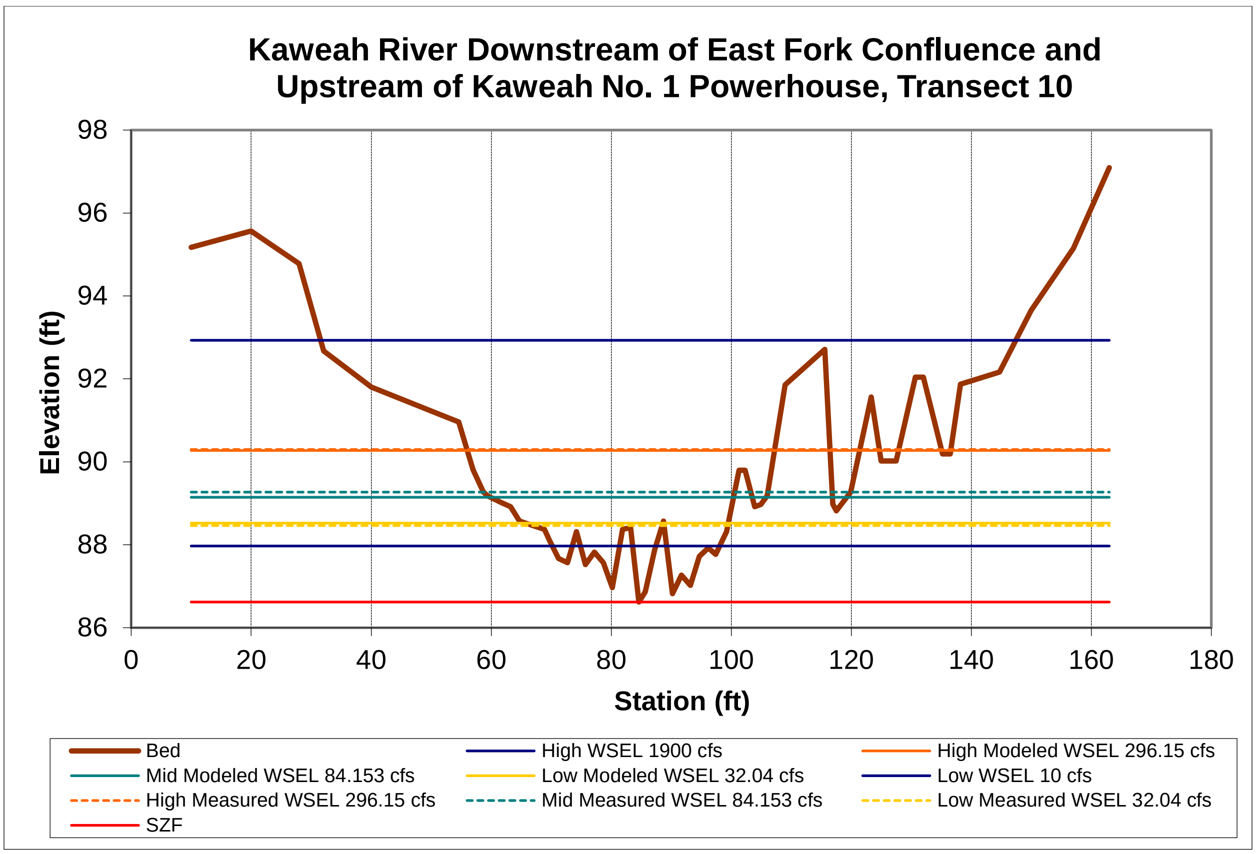

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 5
Elevation (ft)
108
106
104
102
100
98
96
94
92
-20
0
20
40
60
80
100
120
140
160
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 22 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 22 cfs
SZF

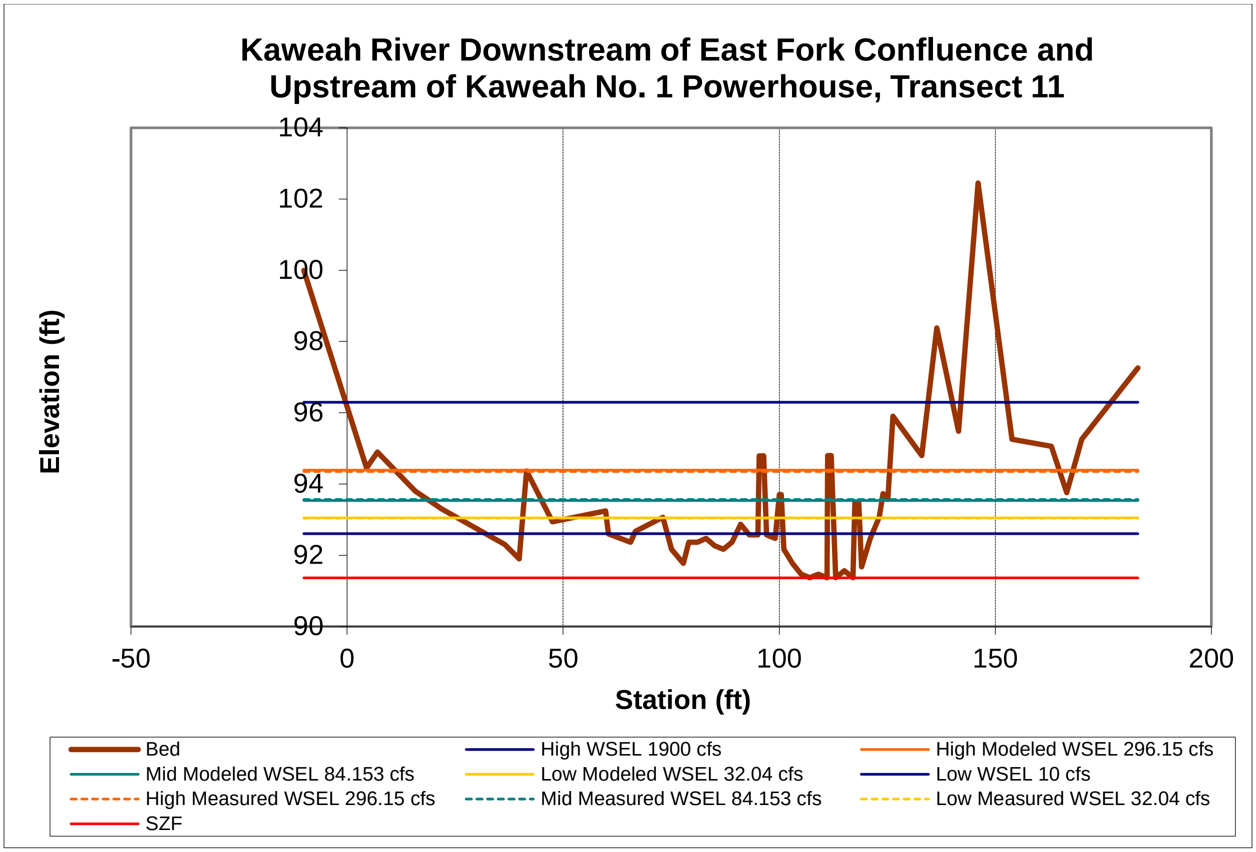

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 6
Elevation (ft)
114
112
110
108
106
104
102
100
98
96
94
0
20
40
60
80
100
120
140
160
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 7
112
110
108
106
104
102
100
98
96
Elevation (ft)
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 8
103
102
101
100
99
98
97
96
95
94
93
Elevation (ft)
0
50
100
150
200
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 9
Elevation (ft)
102
101
100
99
98
97
96
95
94
93
-50
0
50
100
150
200
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 378.75 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 22 cfs
Low WSEL 10 cfs
High Measured WSEL 378.75 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 22 cfs
SZF


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 10
Elevation (ft)
98
96
94
92
90
88
86
0
20
40
60
80
100
120
140
160
180
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 296.15 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 32.04 cfs
Low WSEL 10 cfs
High Measured WSEL 296.15 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 32.04 cfs
SZF


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 11
Elevation (ft)
104
102
100
98
96
94
92
90
-50
0
50
100
150
200
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 296.15 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 32.04 cfs
Low WSEL 10 cfs
High Measured WSEL 296.15 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 32.04 cfs
SZF

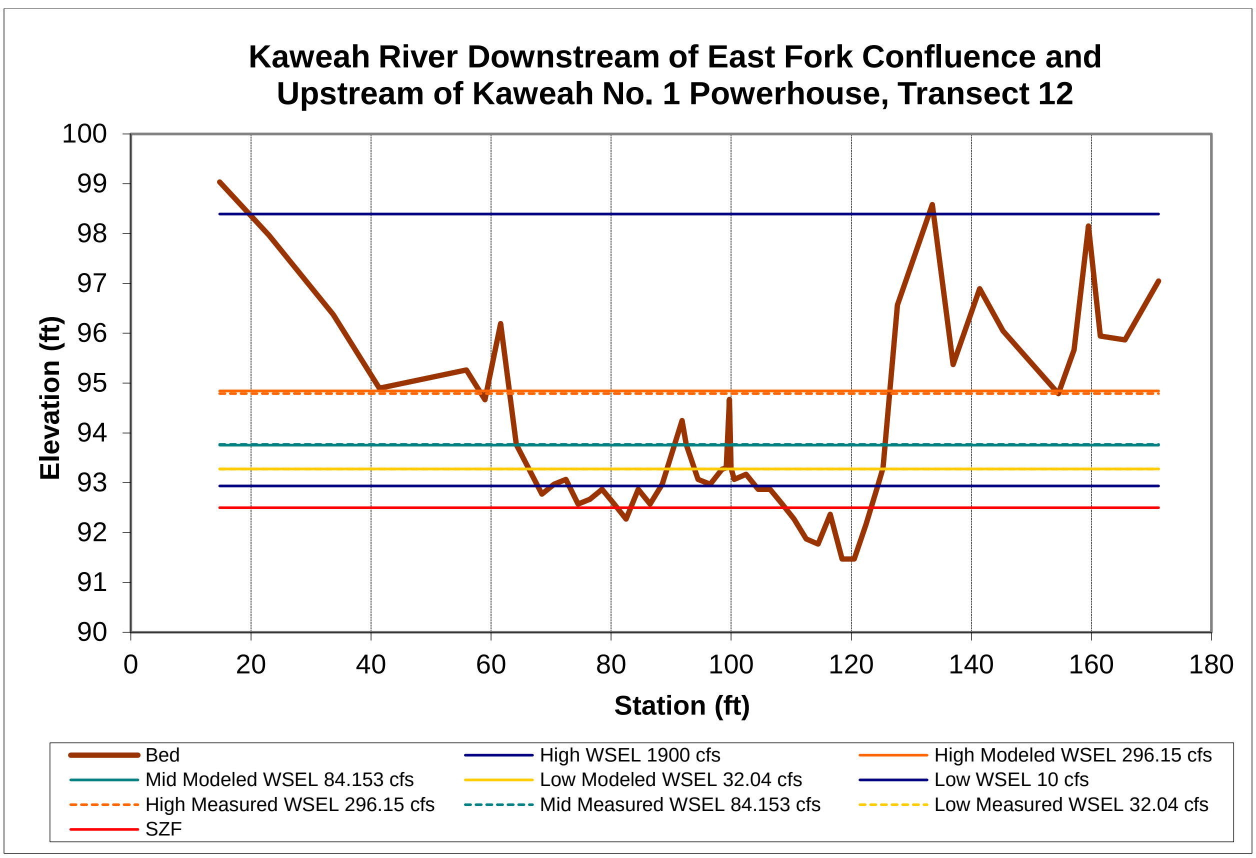
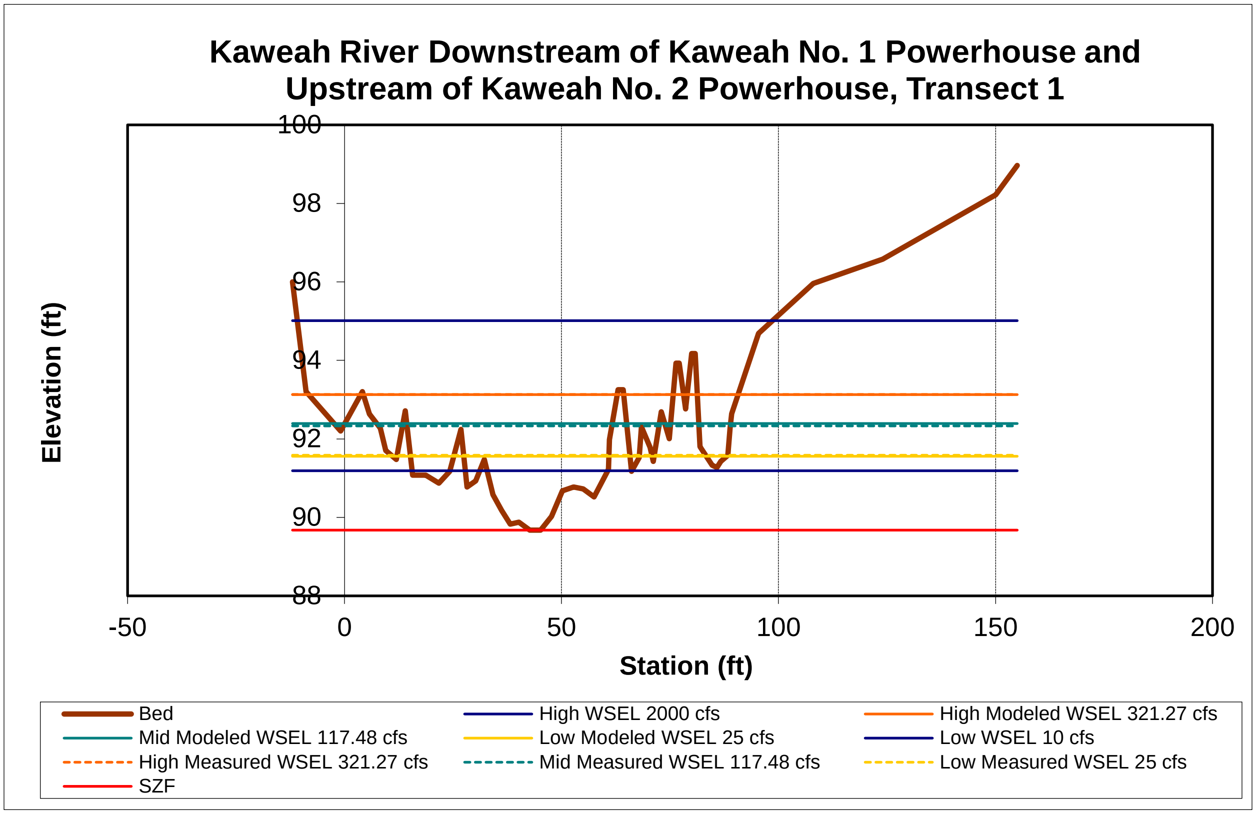
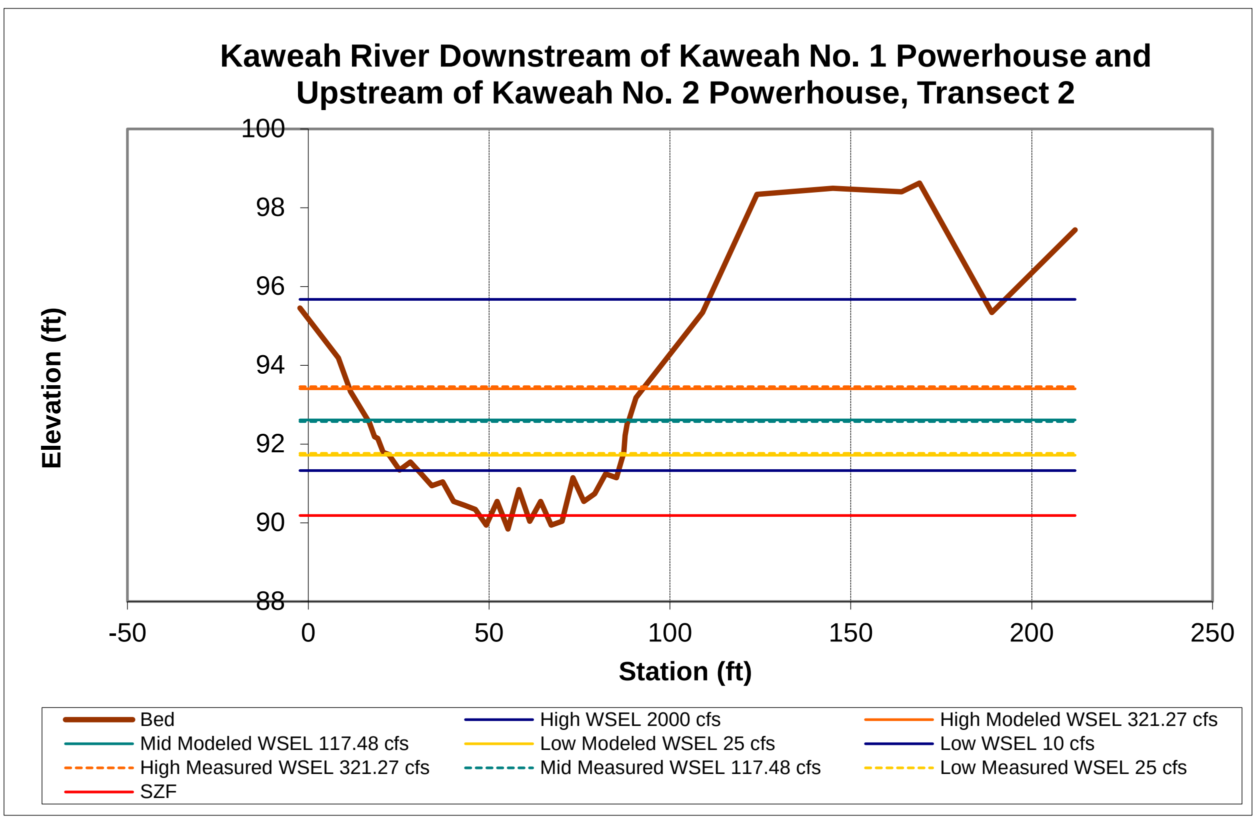
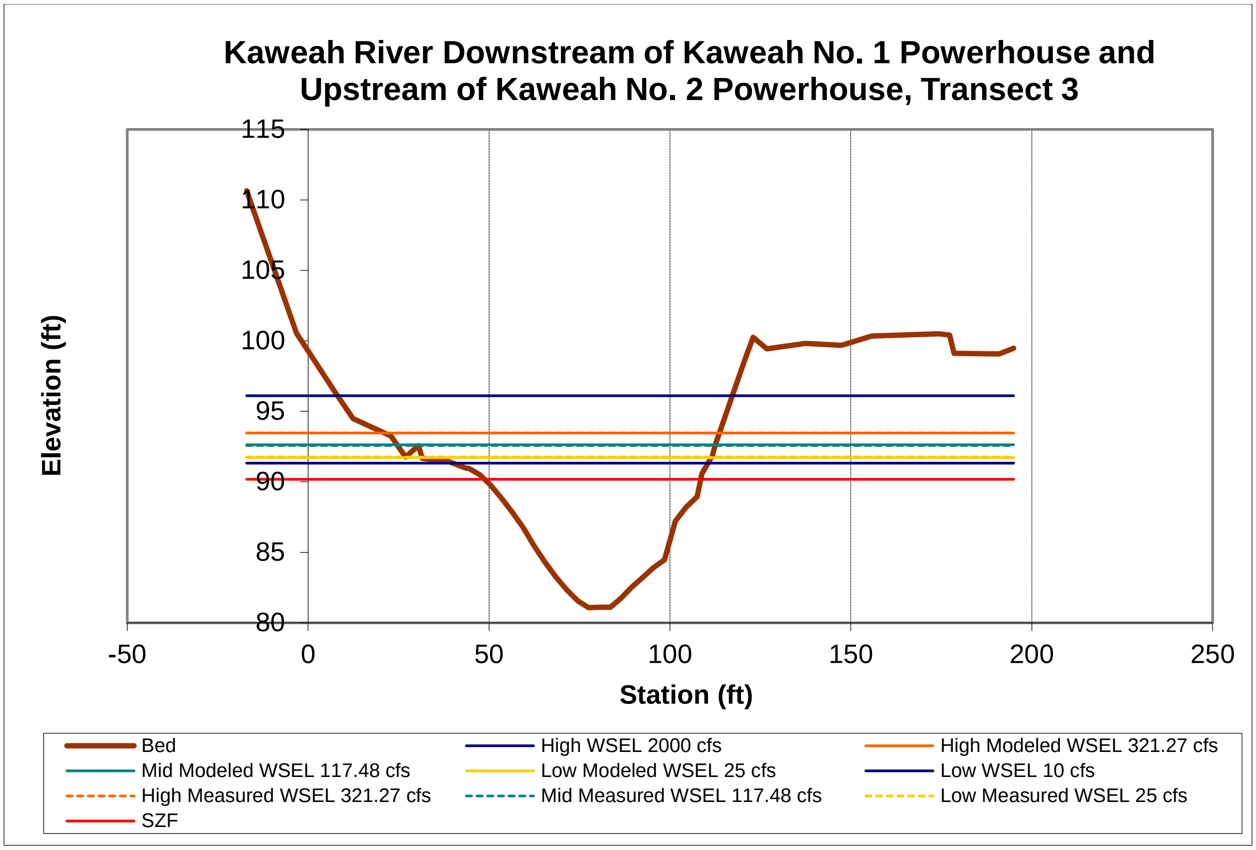

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 12
Elevation (ft)
100
99
98
97
96
95
94
93
92
91
90
0
20
40
60
80
100
120
140
160
180
Station (ft)
Bed
High WSEL 1900 cfs
High Modeled WSEL 296.15 cfs
Mid Modeled WSEL 84.153 cfs
Low Modeled WSEL 32.04 cfs
Low WSEL 10 cfs
High Measured WSEL 296.15 cfs
Mid Measured WSEL 84.153 cfs
Low Measured WSEL 32.04 cfs
SZF

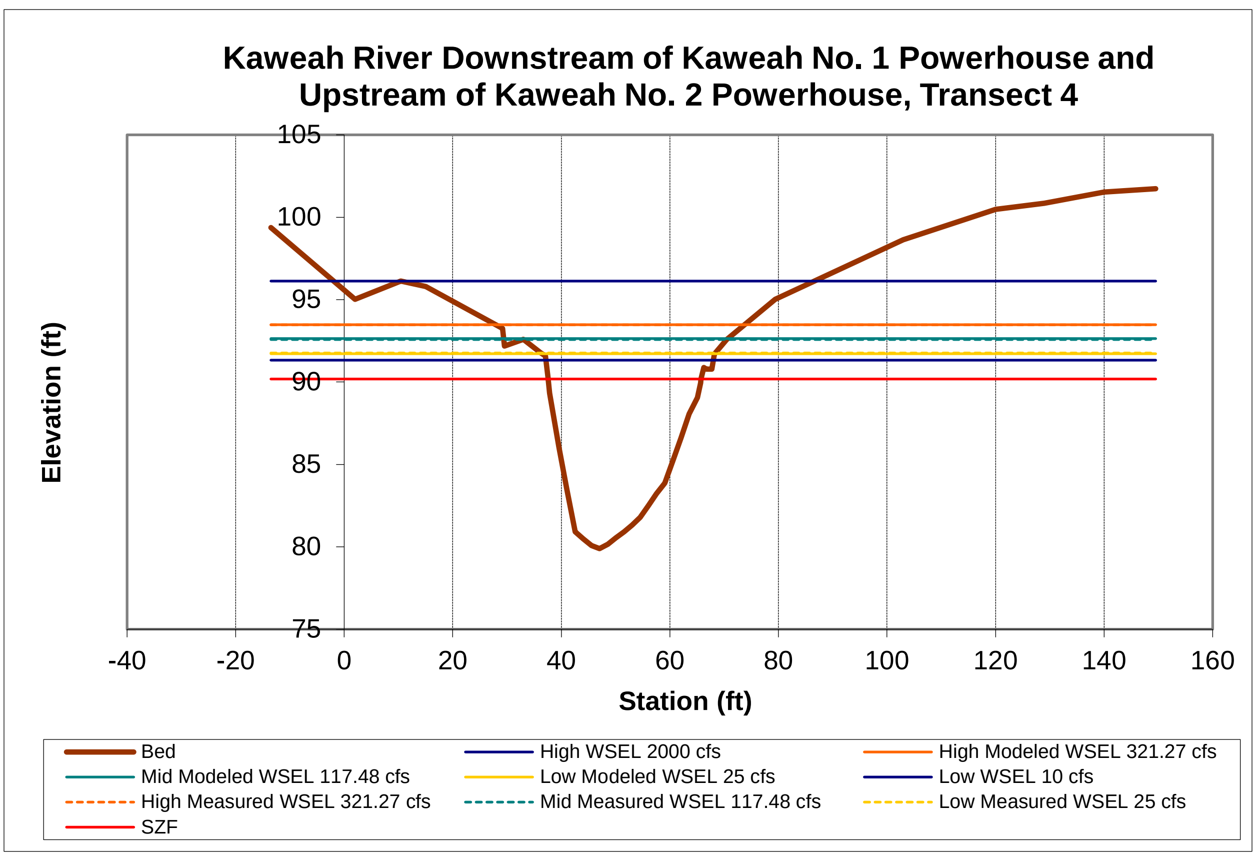
Figure D.B-4. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Water Surface Elevation Calibration Report.



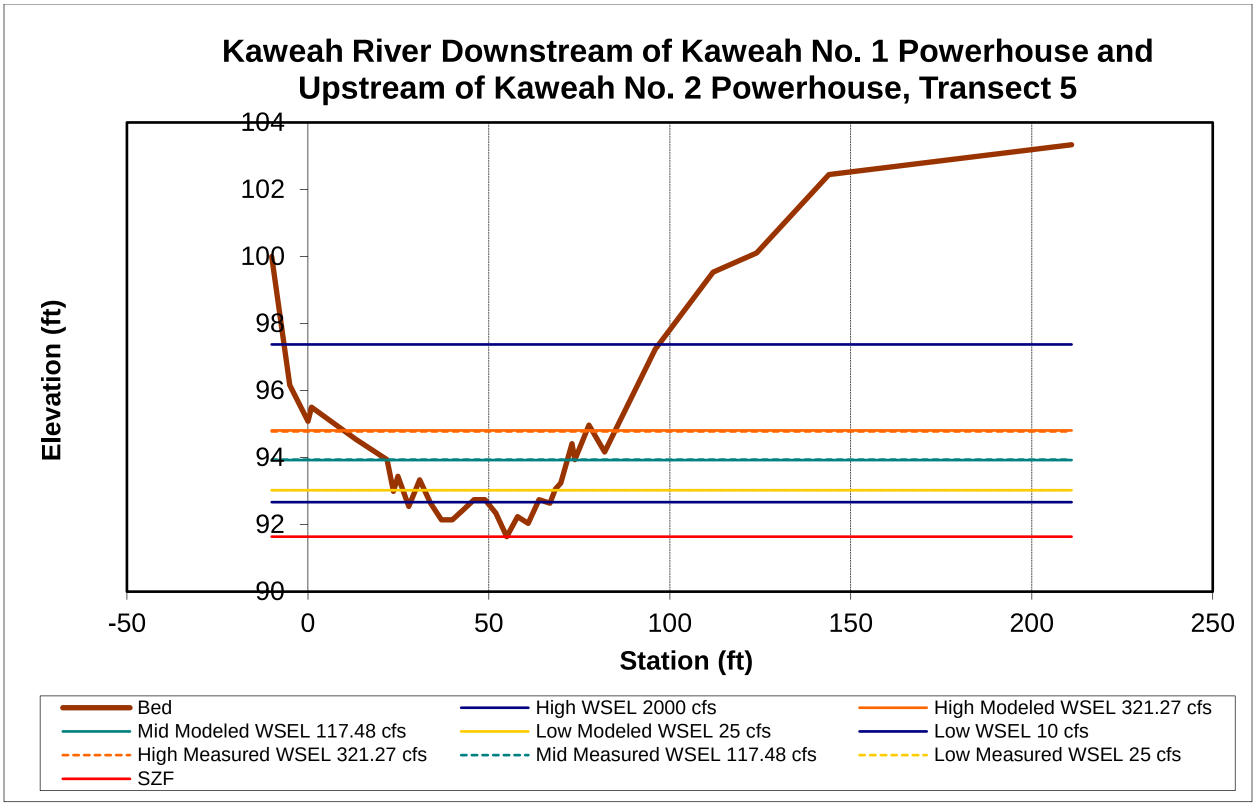


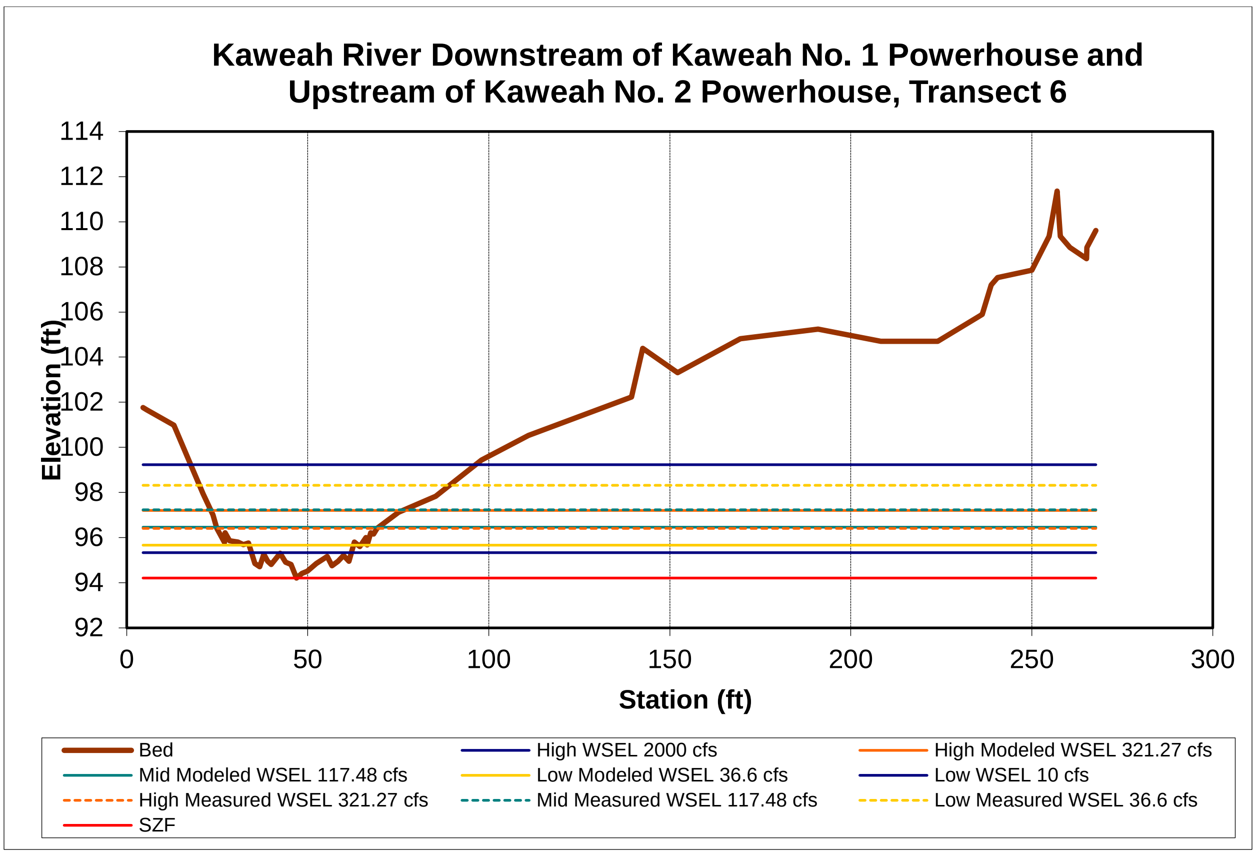


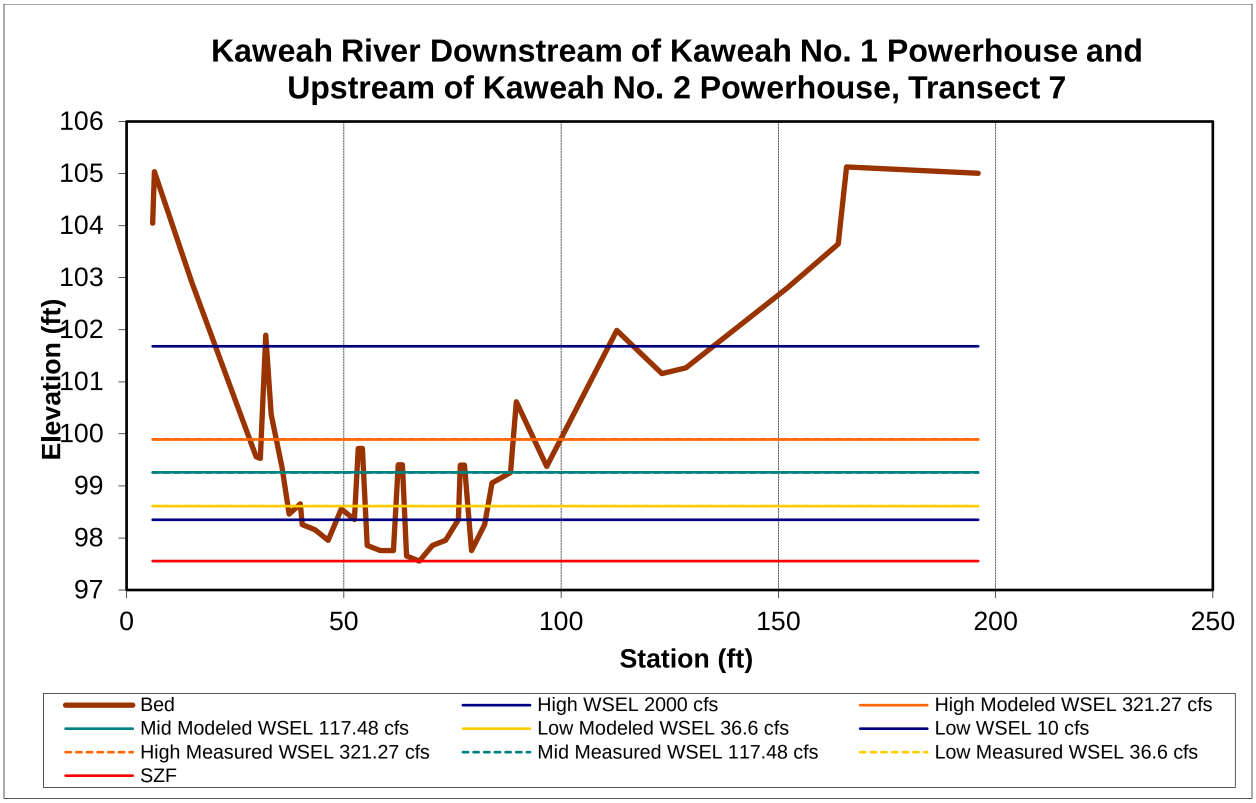
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 3
Elevation (ft)
115
110
105
100
95
90
85
80
-50
0
50
100
150
200
250
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 25 cfs
SZF

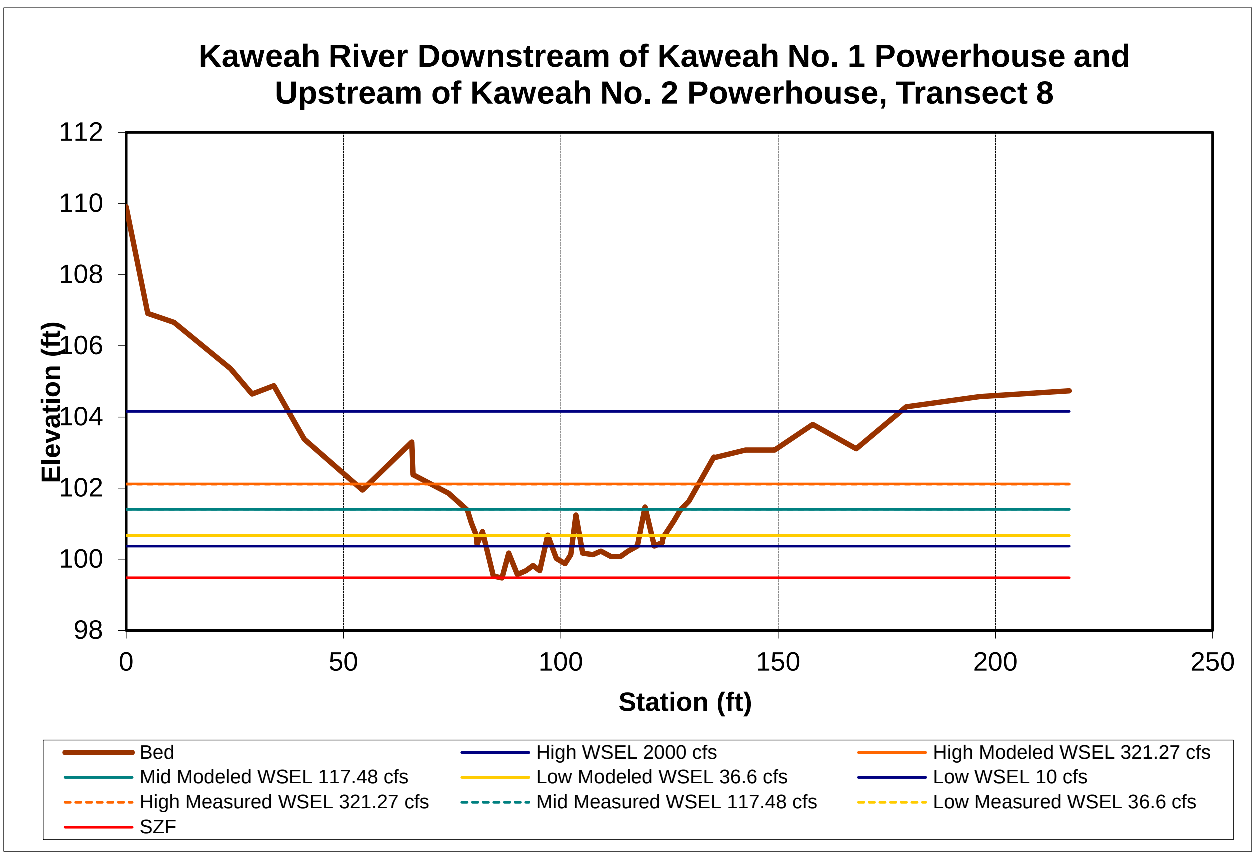


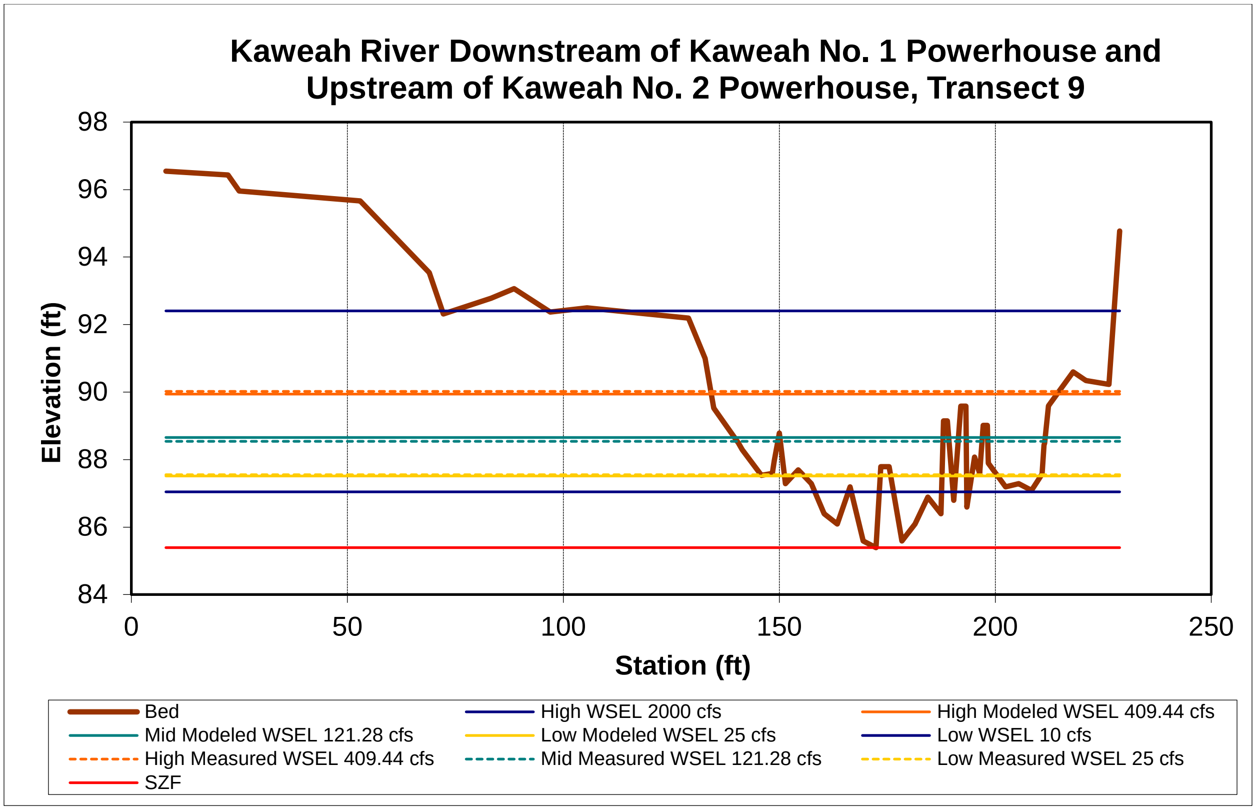
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 4
Elevation (ft)
105
100
95
90
85
80
75
-40
-20
0
20
40
60
80
100
120
140
160
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 25 cfs
SZF

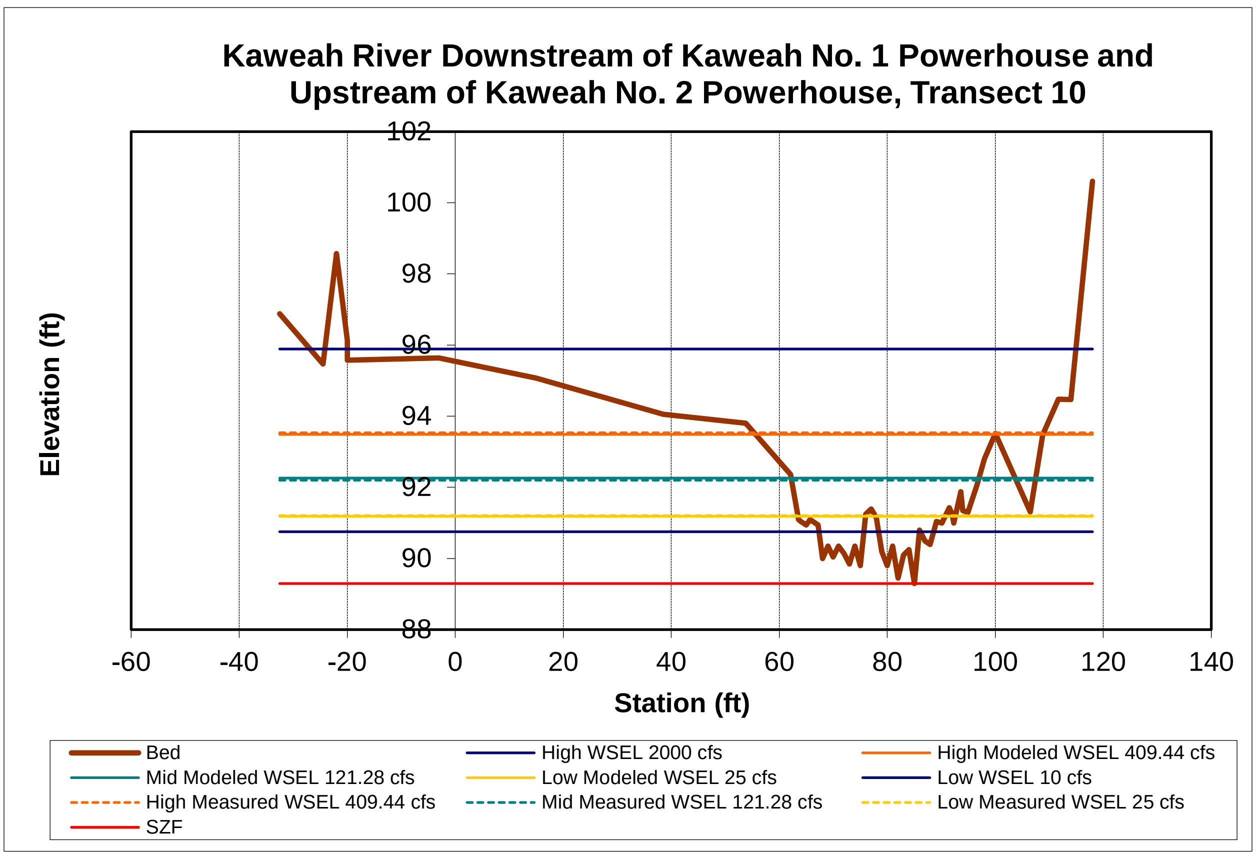

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 5
Elevation (ft)
104
102
100
98
96
94
92
90
-50
0
50
100
150
200
250
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 25 cfs
SZF

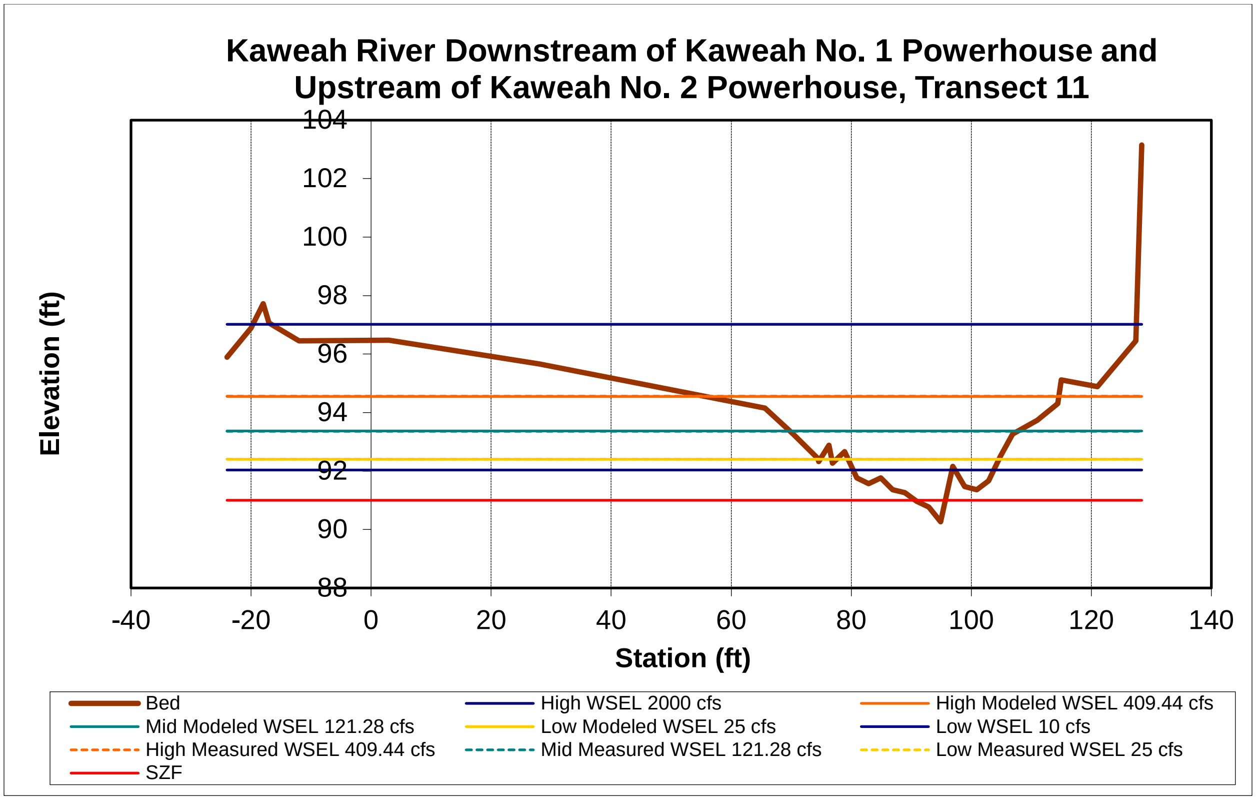

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 6
Elevation (ft)
114
112
110
108
106
104
102
100
98
96
94
92
0
50
100
150
200
250
300
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 7
Elevation (ft)
106
105
104
103
102
101
100
99
98
97
0
50
100
150
200
250
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 8
Elevation (ft)
112
110
108
106
104
102
100
98
0
50
100
150
200
250
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 321.27 cfs
Mid Modeled WSEL 117.48 cfs
Low Modeled WSEL 36.6 cfs
Low WSEL 10 cfs
High Measured WSEL 321.27 cfs
Mid Measured WSEL 117.48 cfs
Low Measured WSEL 36.6 cfs
SZF


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 9
98
96
94
92
90
88
86
84
Elevation (ft)
0
50
100
150
200
250
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 409.44 cfs
Mid Modeled WSEL 121.28 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 409.44 cfs
Mid Measured WSEL 121.28 cfs
Low Measured WSEL 25 cfs
SZF


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 10
102
100
98
96
94
92
90
88
Elevation (ft)
-60
-40
-20
0
20
40
60
80
100
120
140
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 409.44 cfs
Mid Modeled WSEL 121.28 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 409.44 cfs
Mid Measured WSEL 121.28 cfs
Low Measured WSEL 25 cfs
SZF


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 11
Elevation (ft)
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 409.44 cfs
Mid Modeled WSEL 121.28 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 409.44 cfs
Mid Measured WSEL 121.28 cfs
Low Measured WSEL 25 cfs
SZF

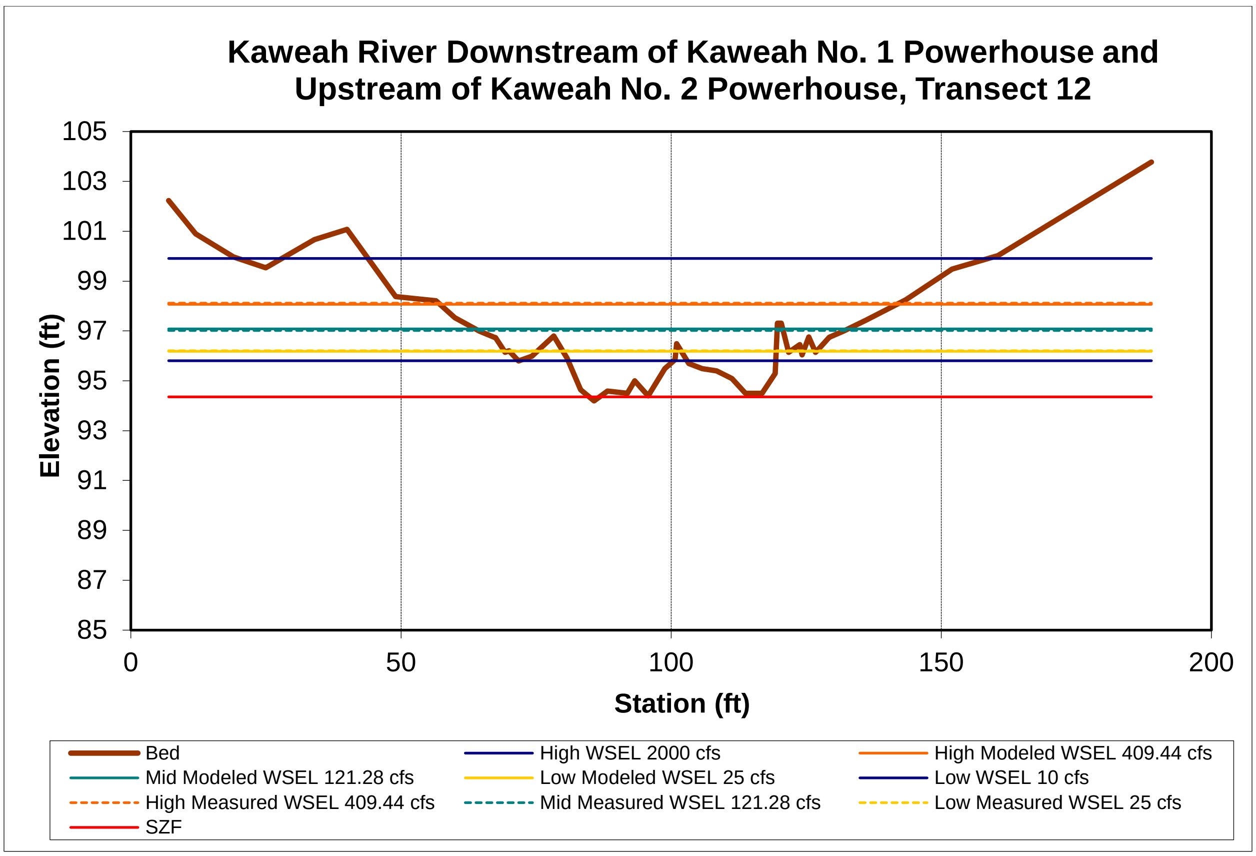

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 12
Elevation (ft)
Station (ft)
Bed
High WSEL 2000 cfs
High Modeled WSEL 409.44 cfs
Mid Modeled WSEL 121.28 cfs
Low Modeled WSEL 25 cfs
Low WSEL 10 cfs
High Measured WSEL 409.44 cfs
Mid Measured WSEL 121.28 cfs
Low Measured WSEL 25 cfs
SZF

Figure D.B-5. East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion Water Surface Elevation Calibration Report.

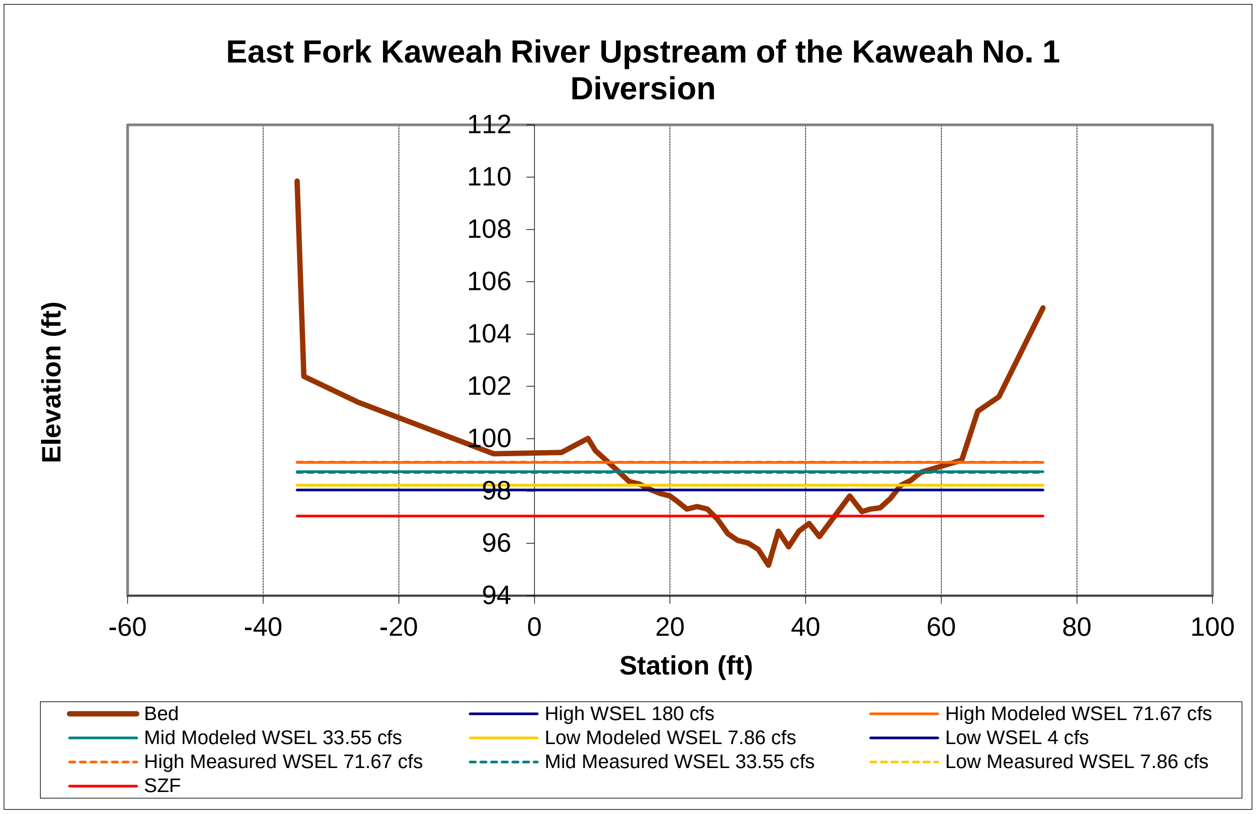


Figure D.B-6. Kaweah River Upstream of Kaweah No. 3 Powerhouse Water Surface Elevation Calibration Report.

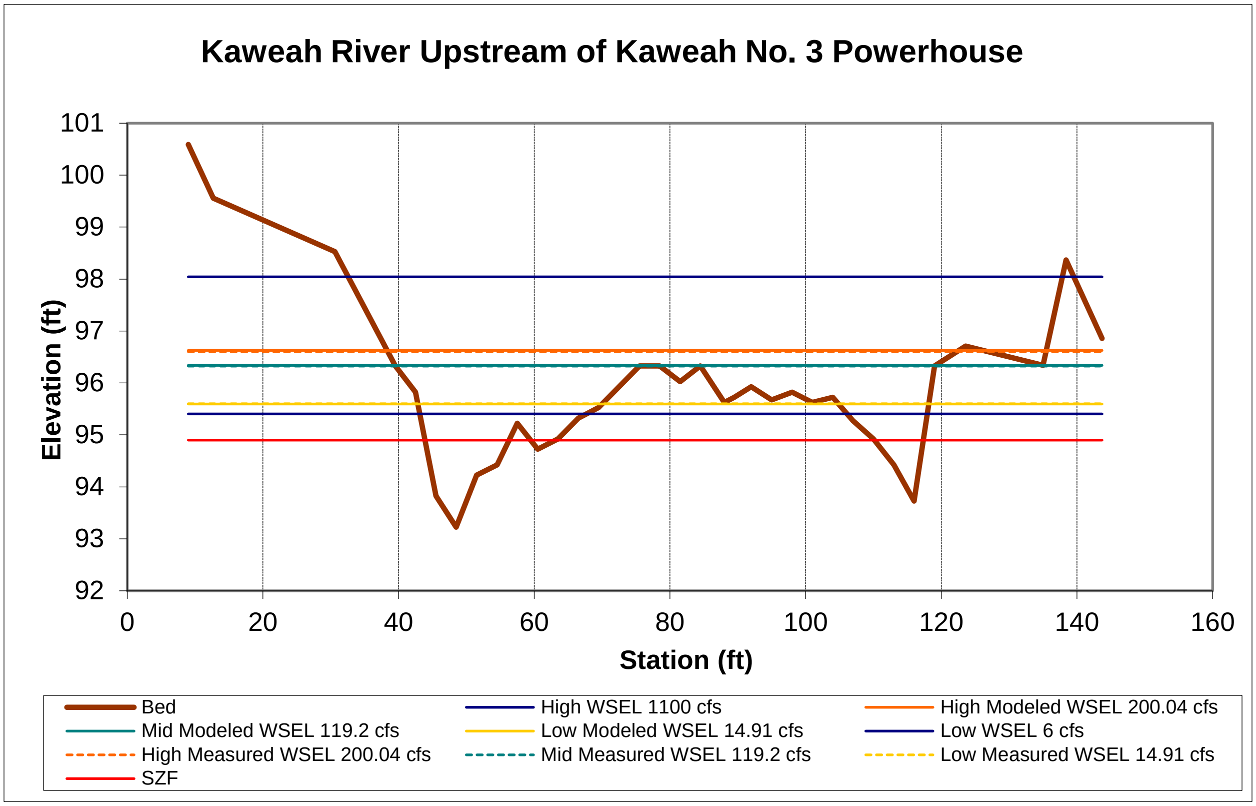
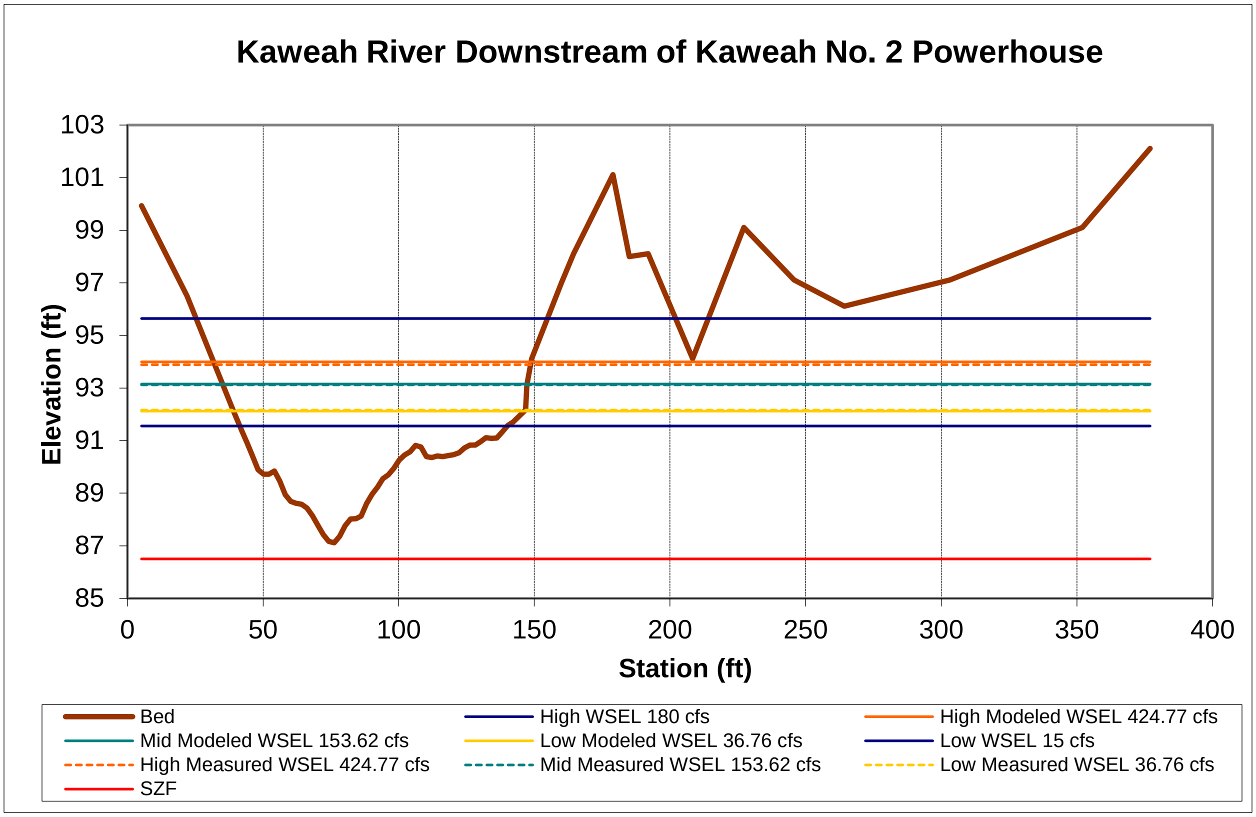


Figure D.B-7. Kaweah River Downstream of Kaweah No. 2 Powerhouse Water Surface Elevation Calibration Report.



Attachment C

Velocity Calibration Report

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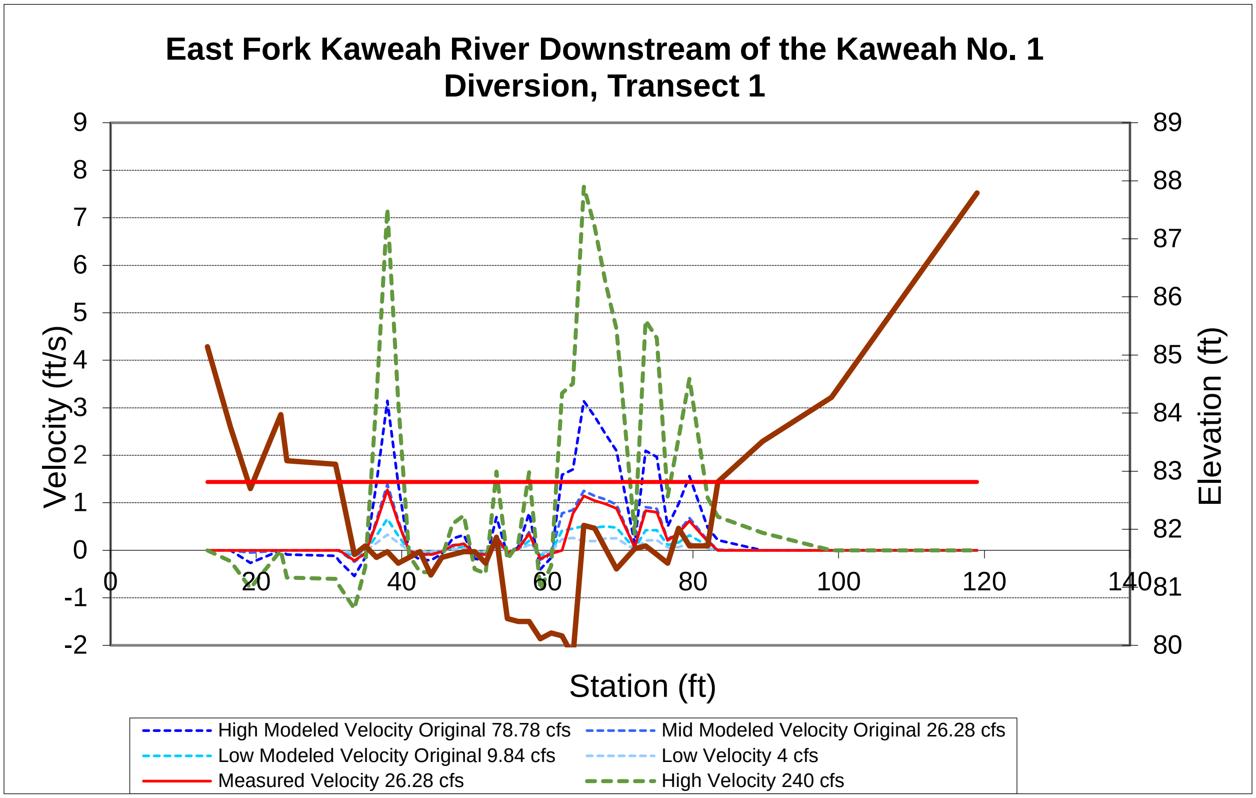
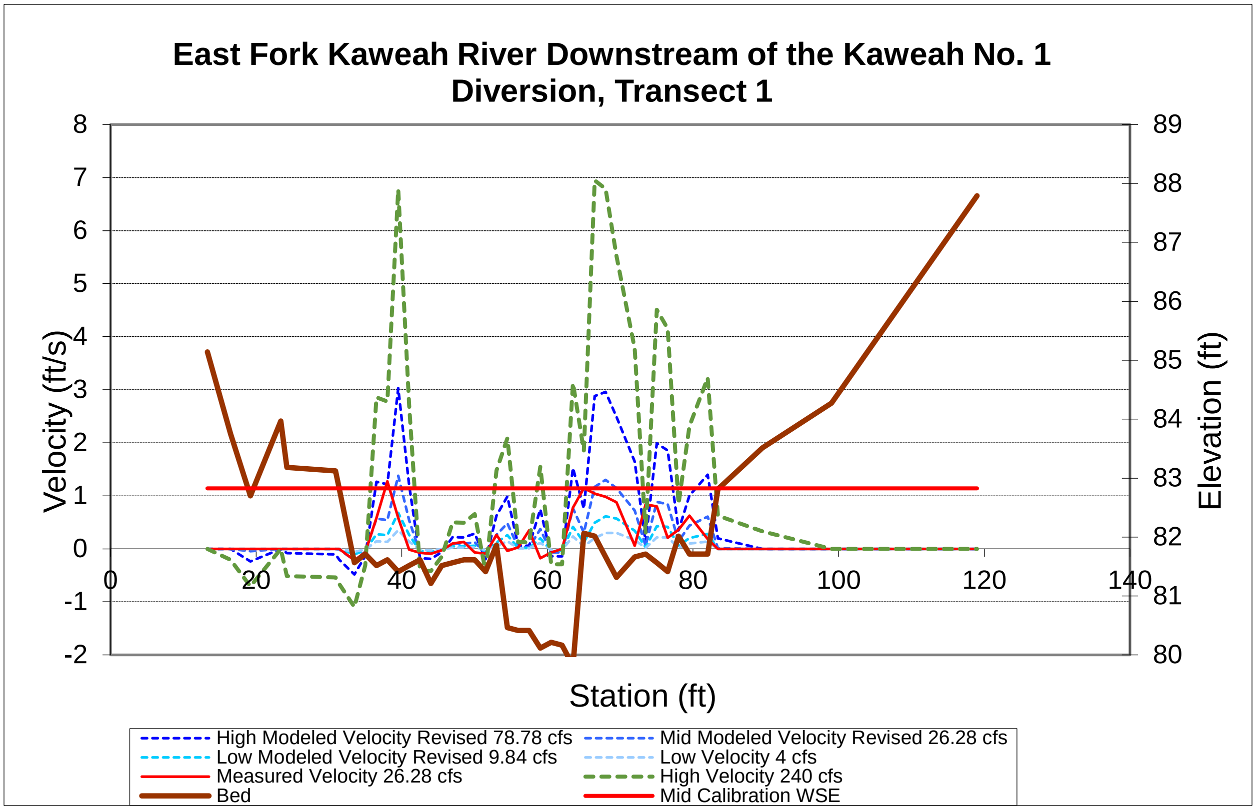
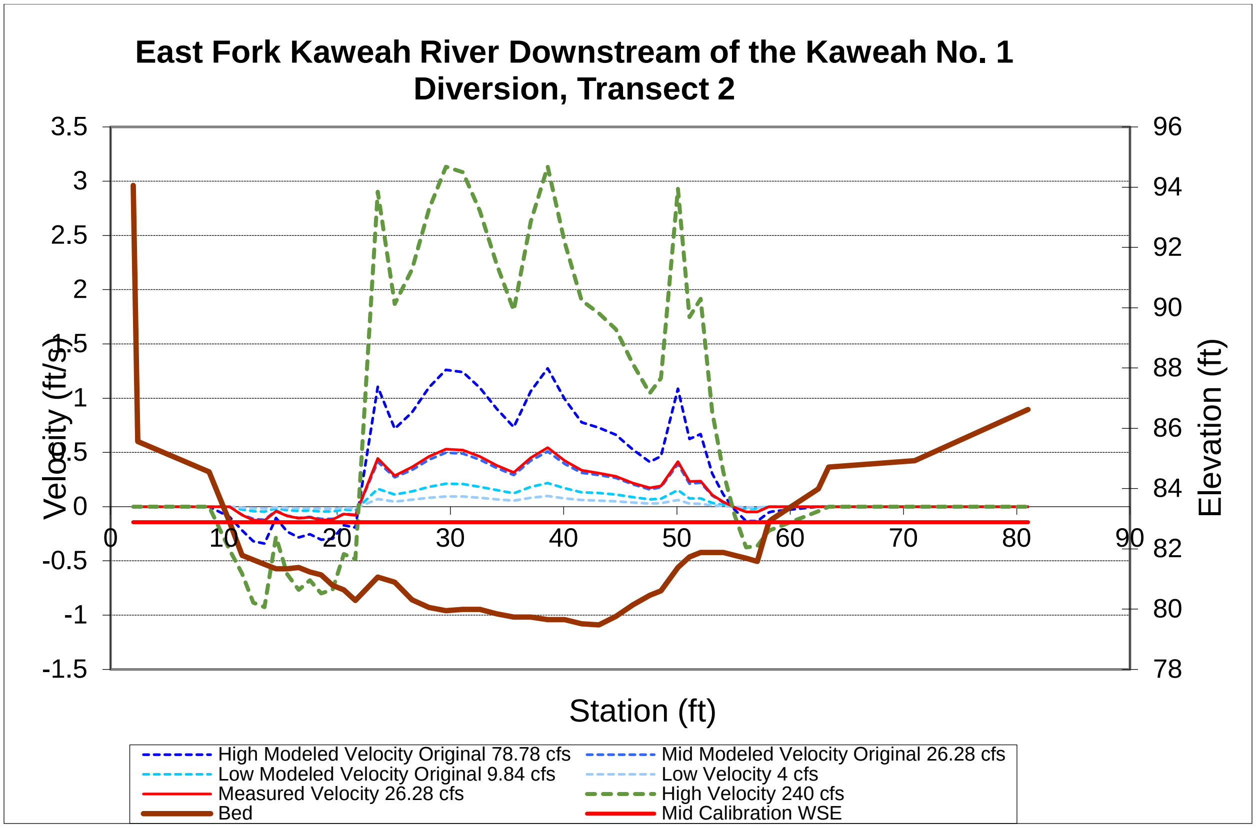
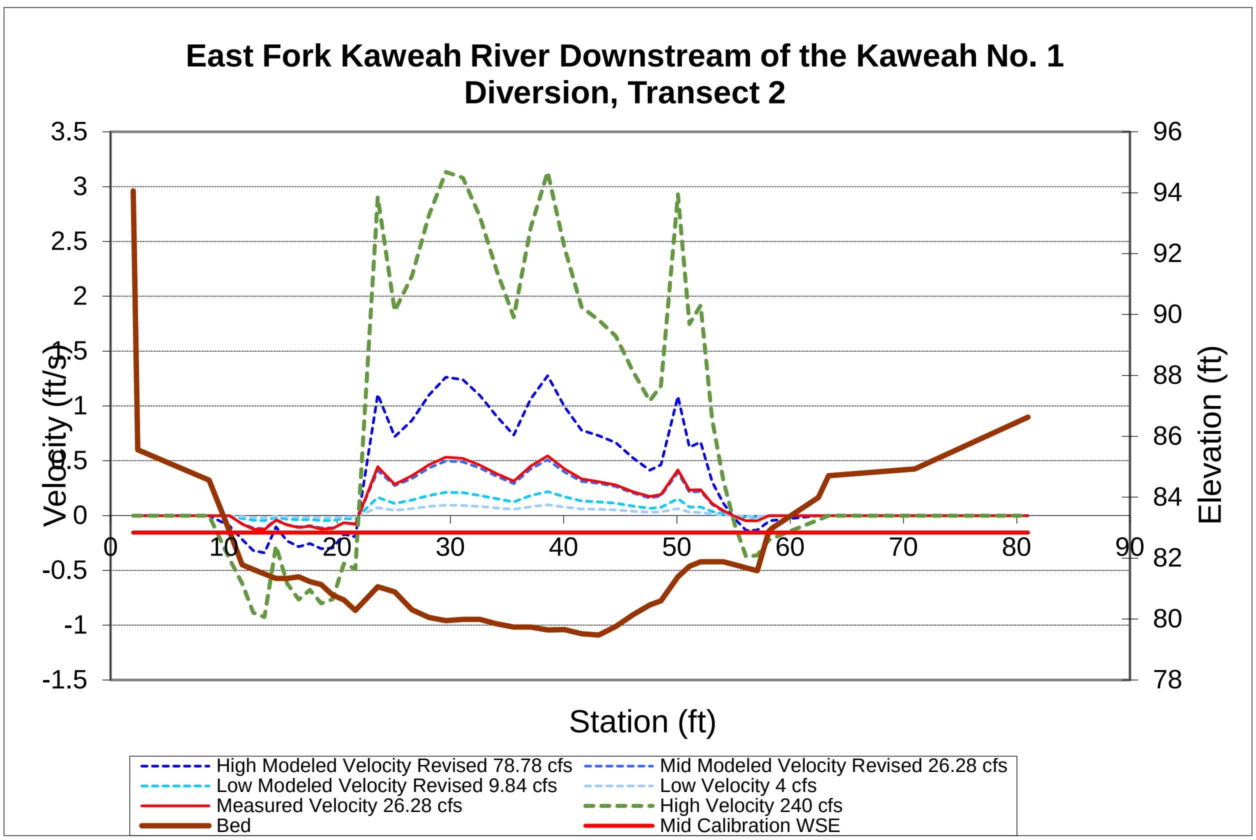
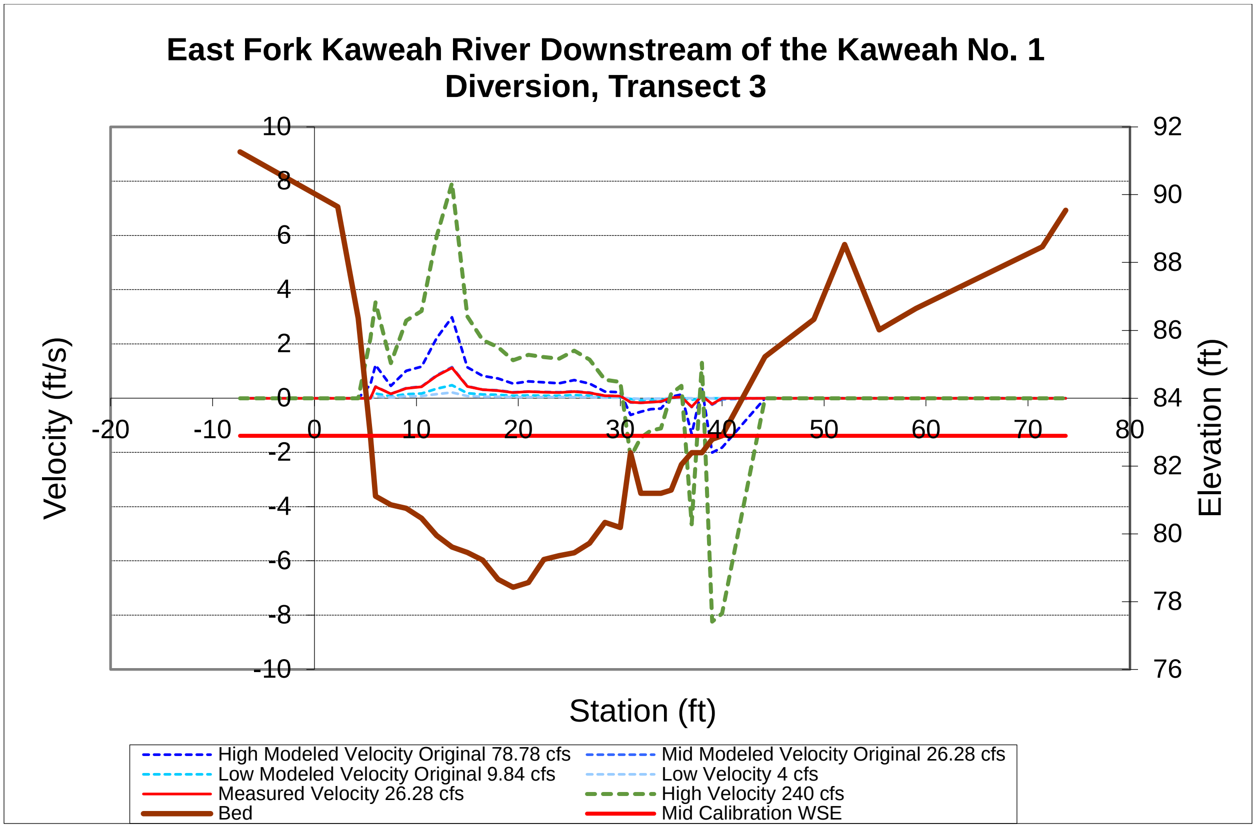
Figure D.C-1. East Fork Kaweah River Upstream of the Confluence with Kaweah River, Velocity Calibration Report (Original on top Revised on bottom).

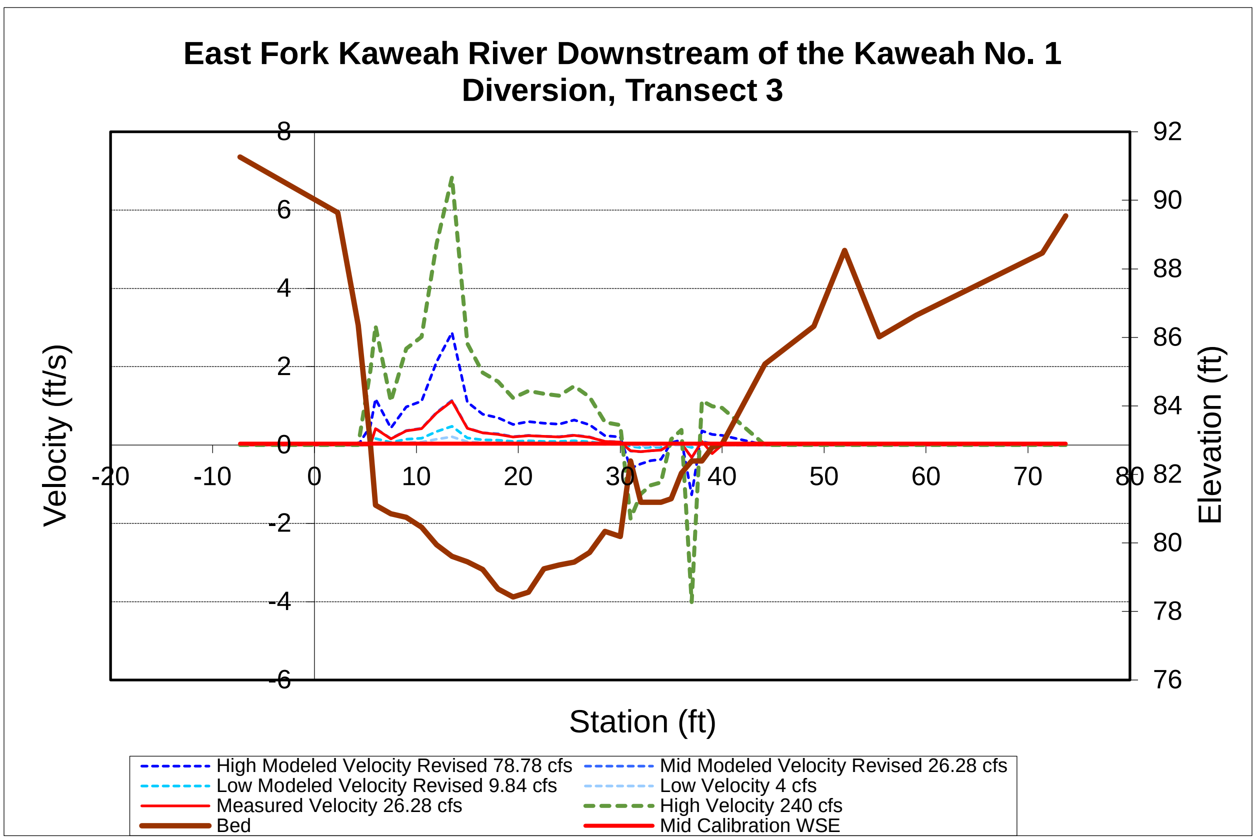


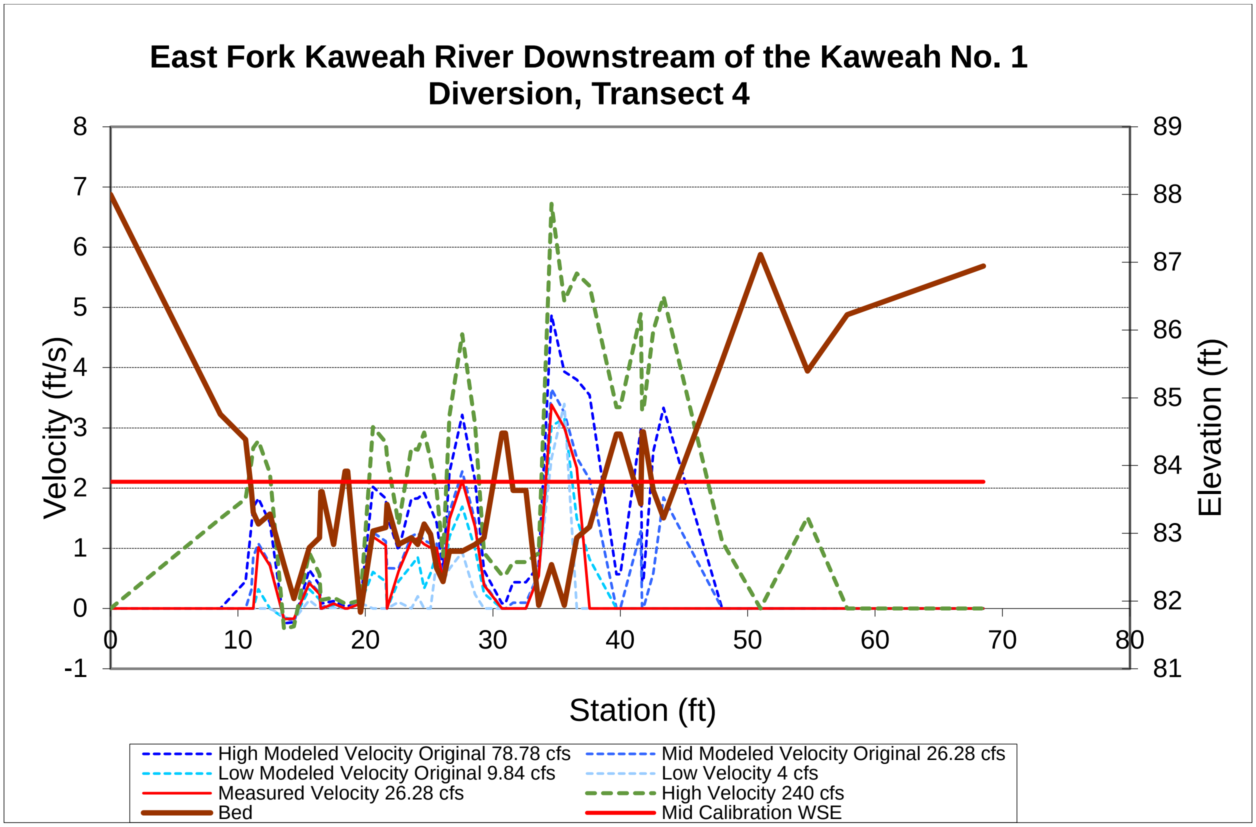


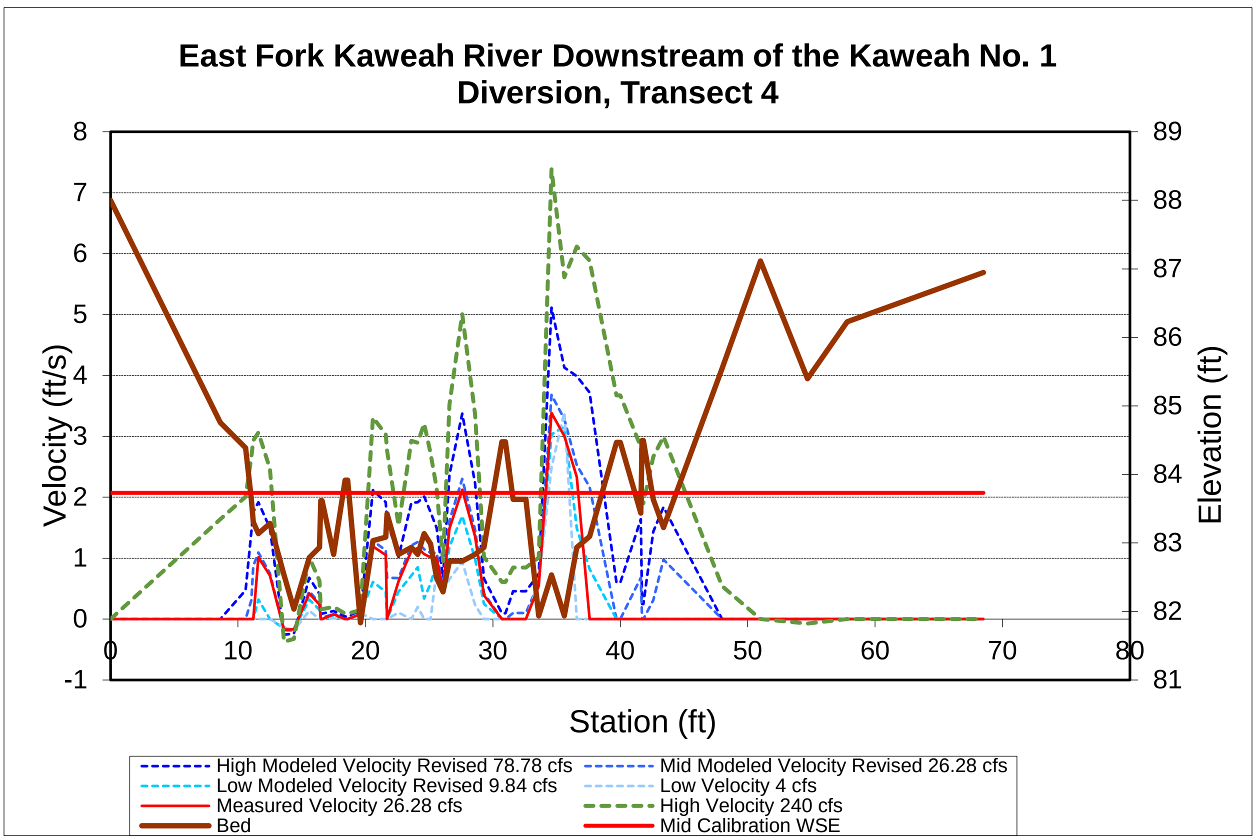

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

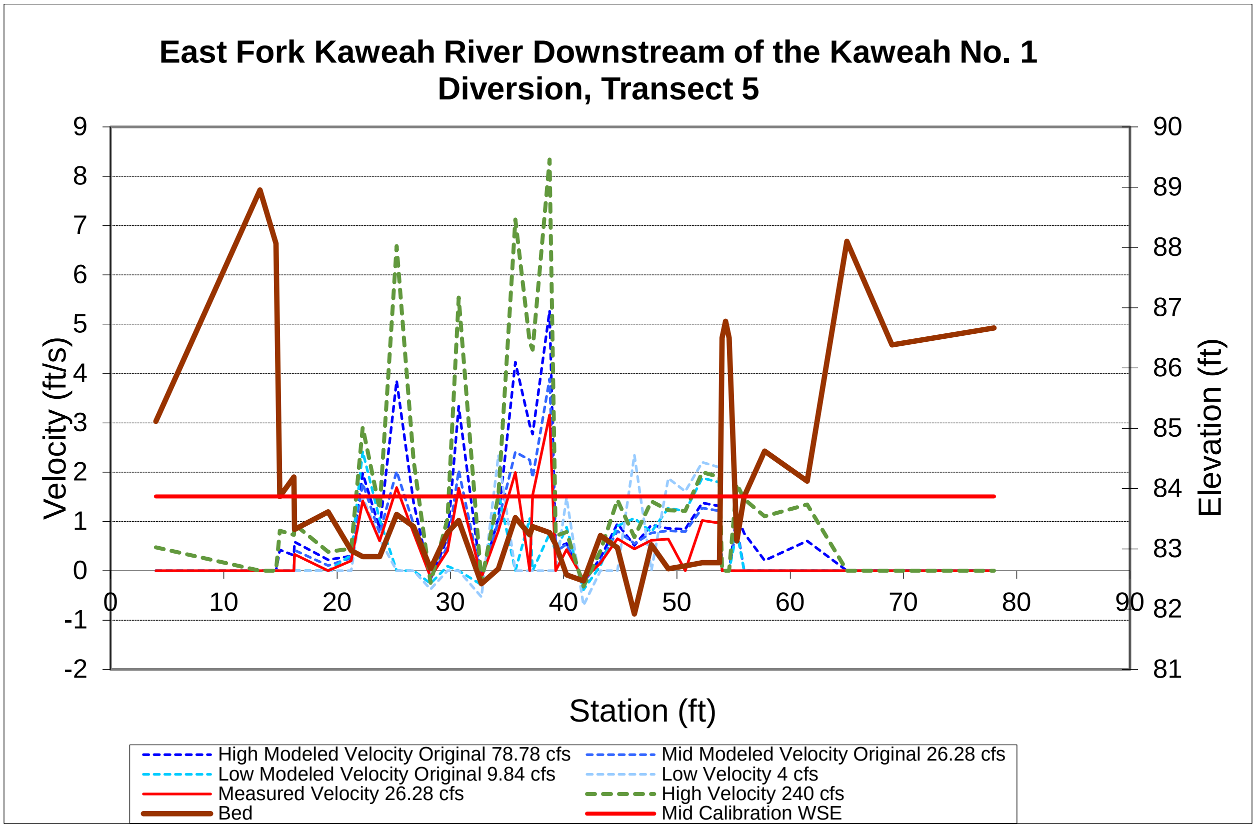

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
-4
-6
-8
-10
92
90
88
86
84
82
80
78
76
-20
-10
0
10
20
30
40
50
60
70
80
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

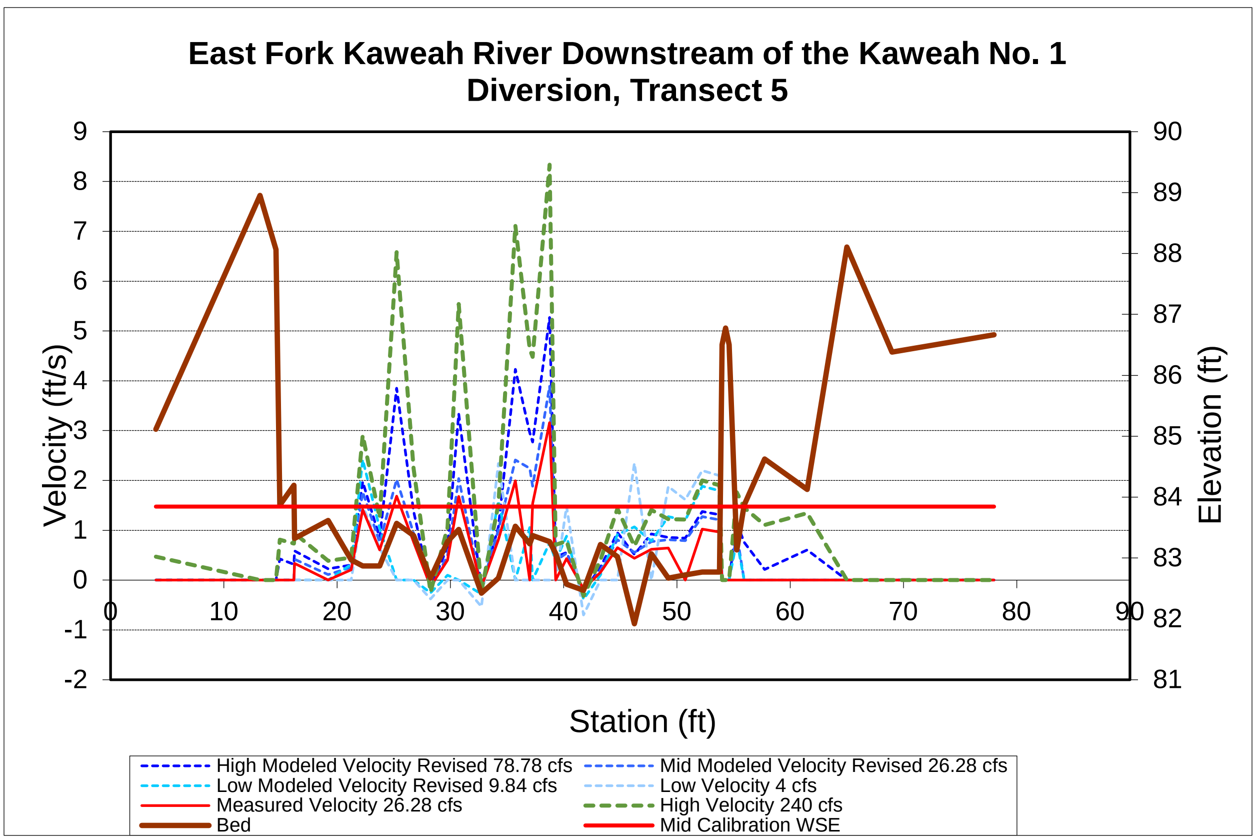

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
6
4
2
0
-2
-4
-6
92
90
88
86
84
82
80
78
76
-20
-10
0
10
20
30
40
50
60
70
80
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

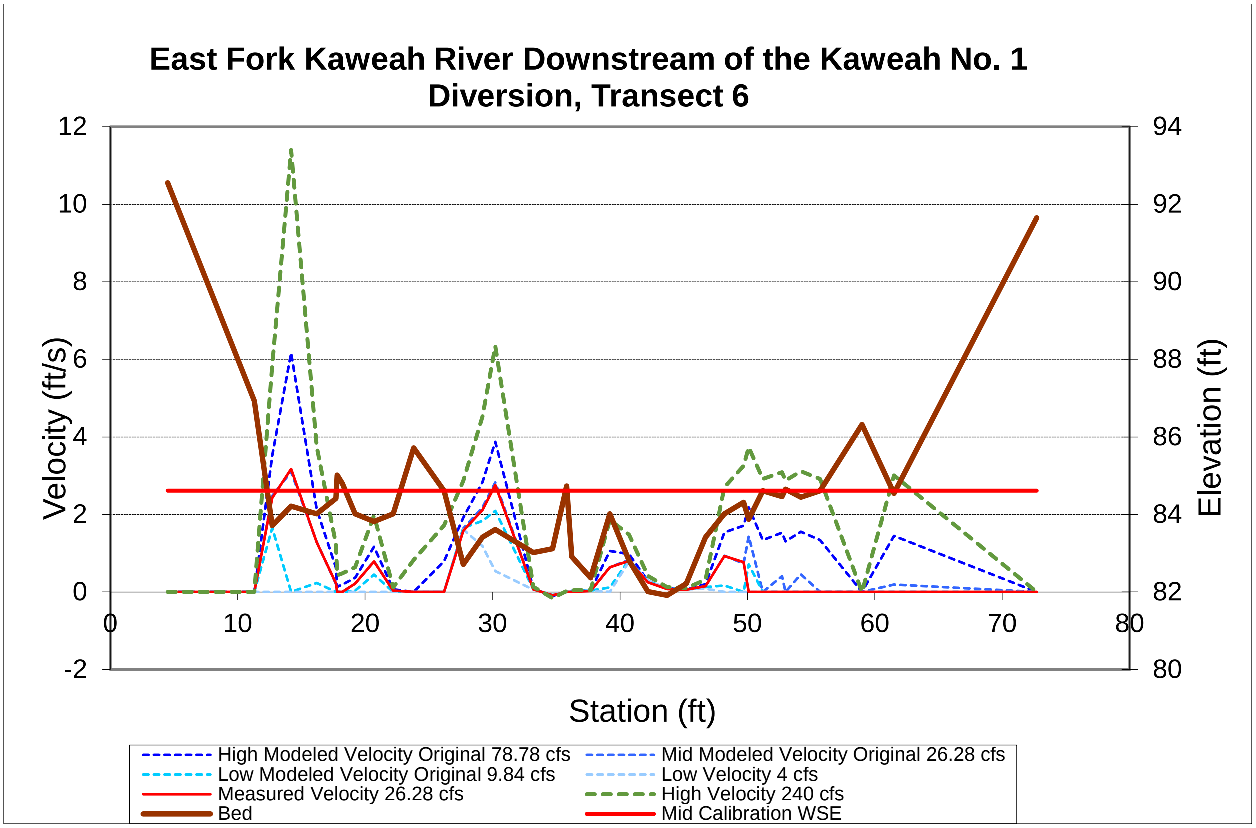

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

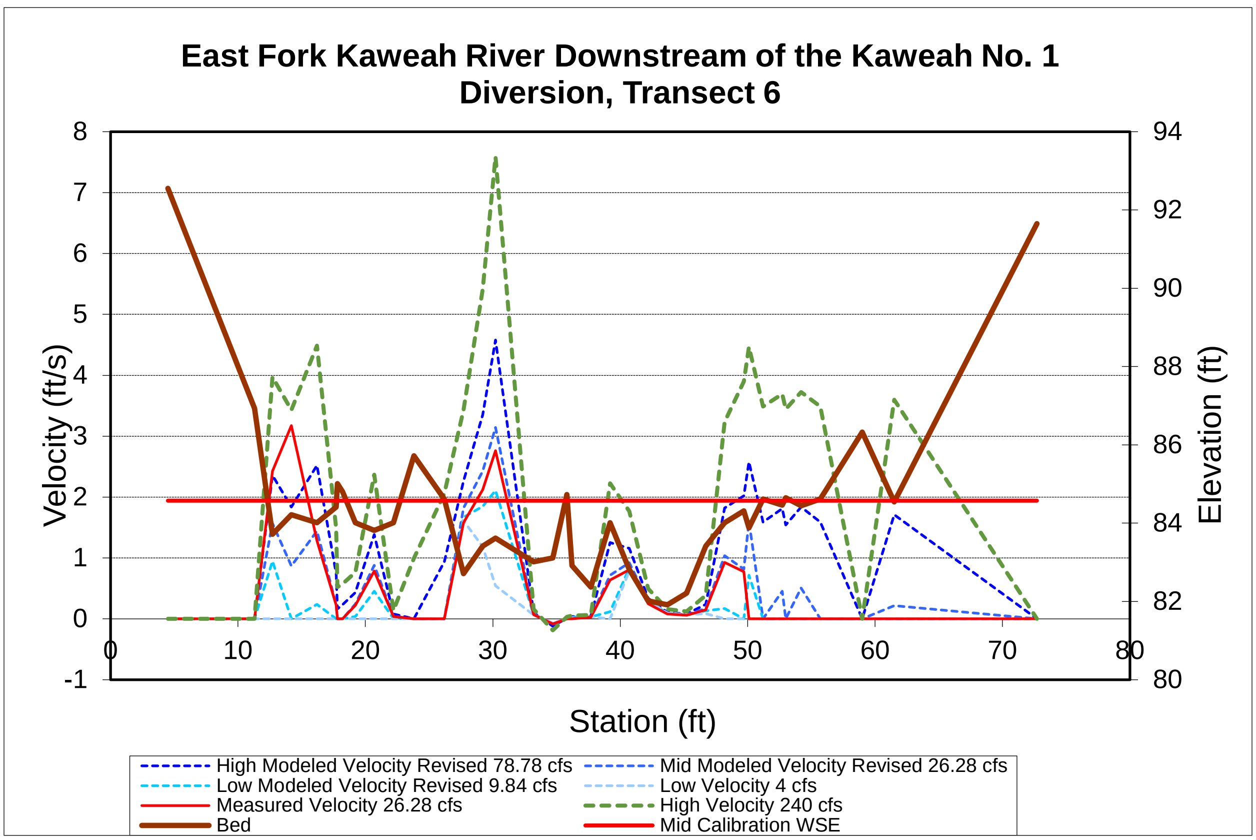


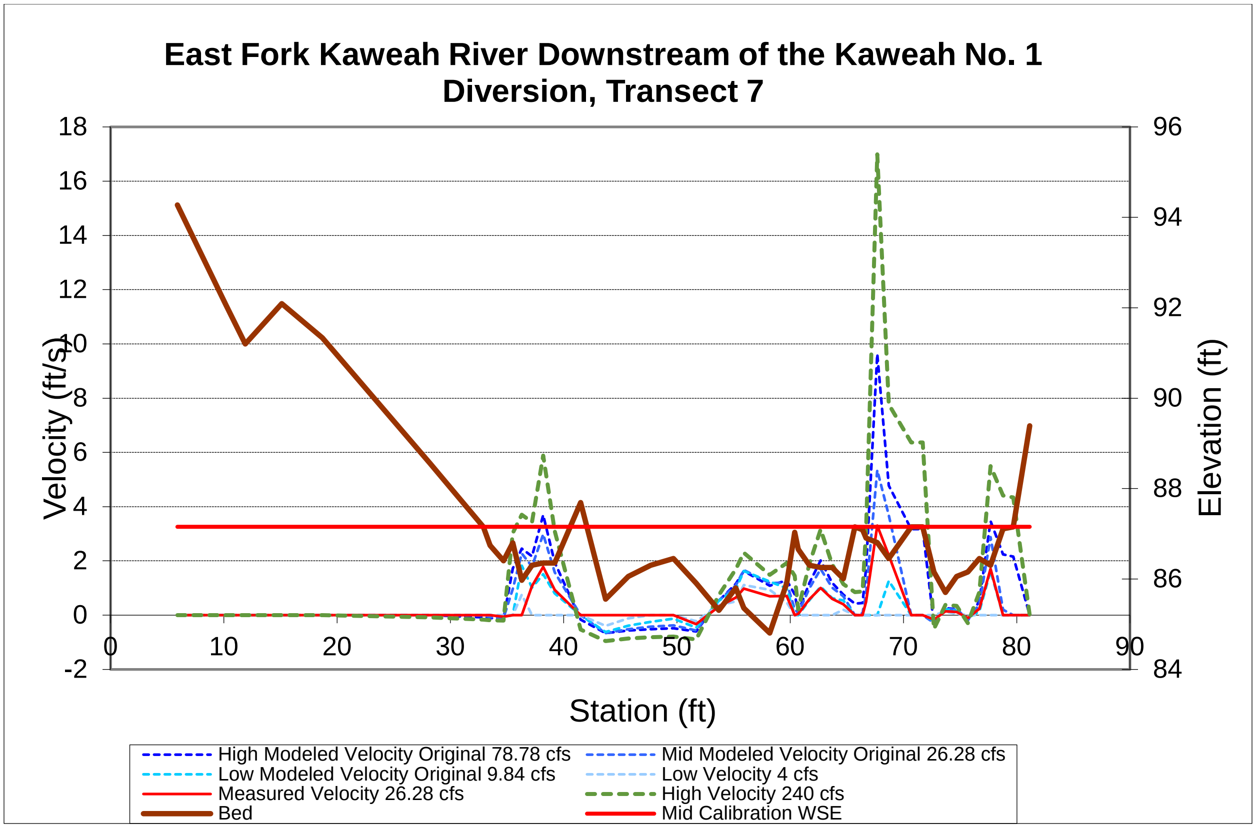
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

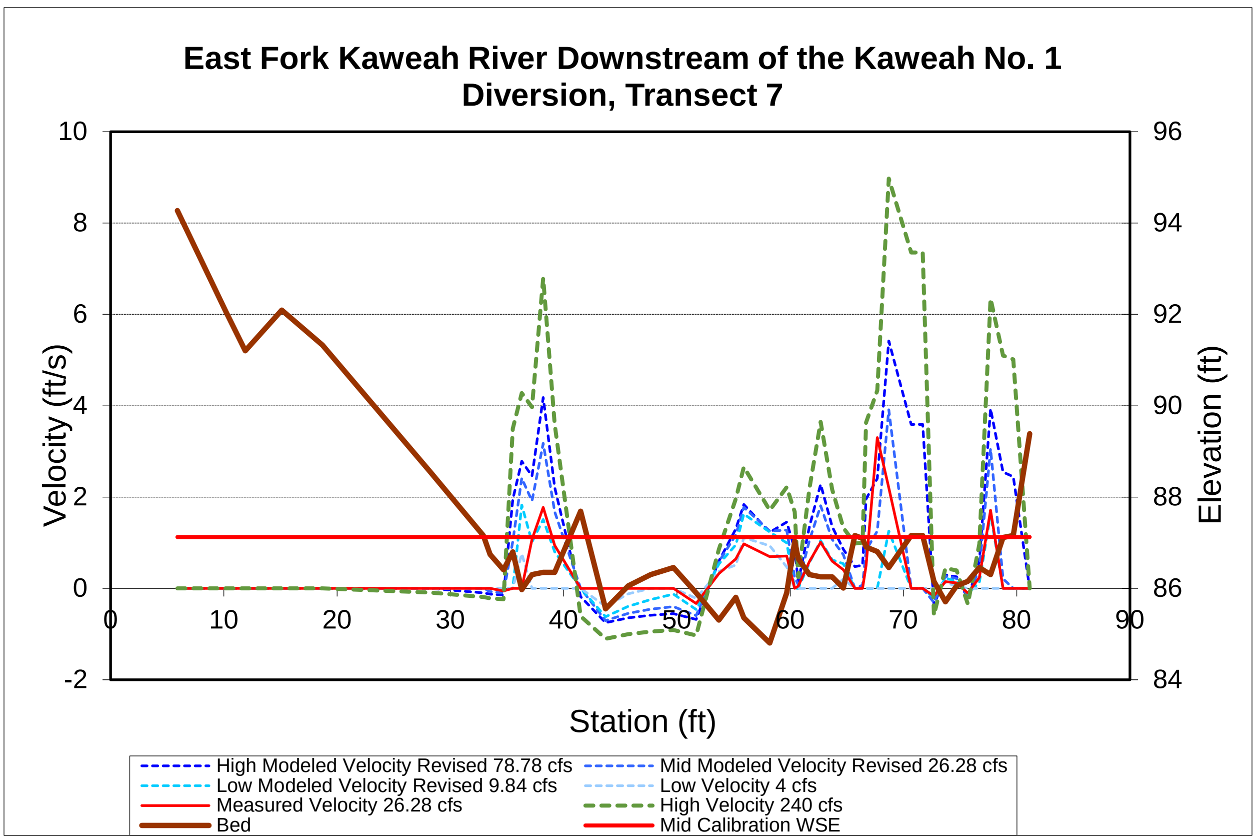


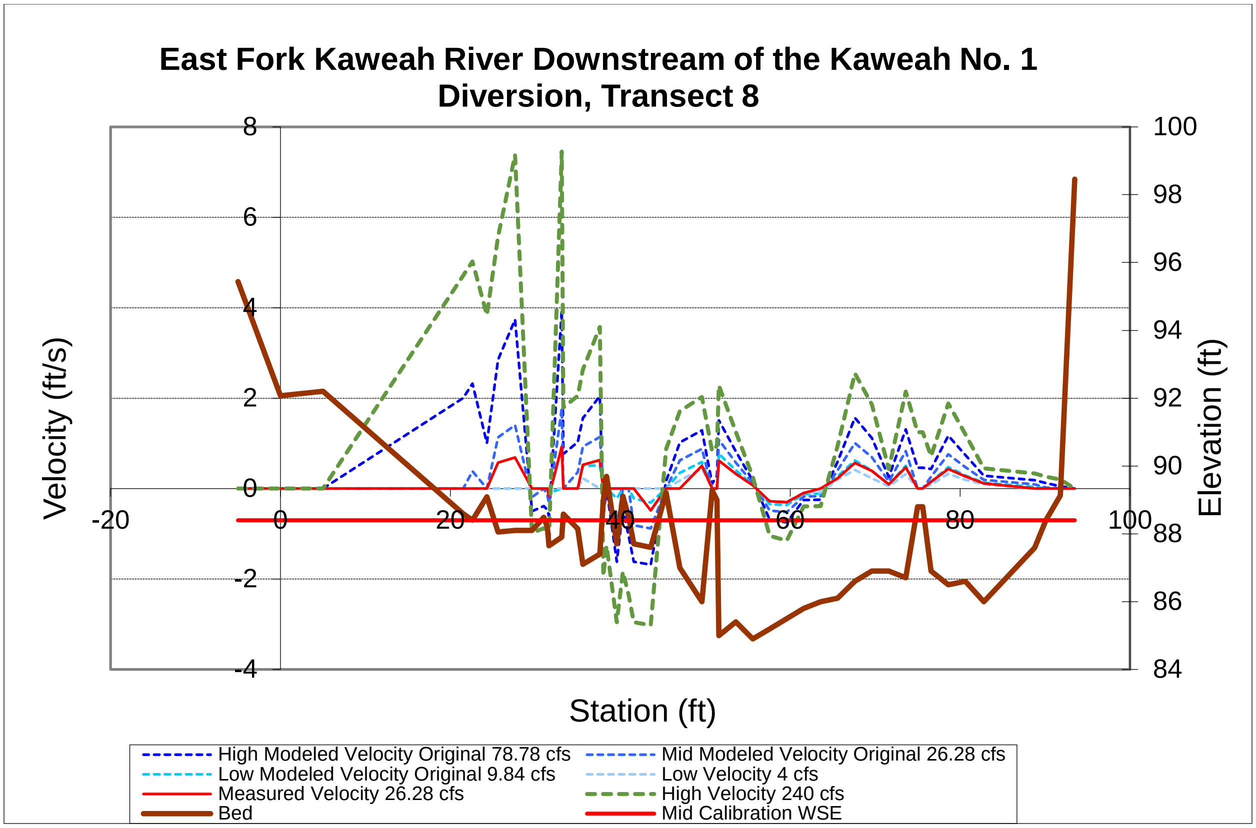
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
12
10
8
6
4
2
0
-2
94
92
90
88
86
84
82
80
0
10
20
30
40
50
60
70
80
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

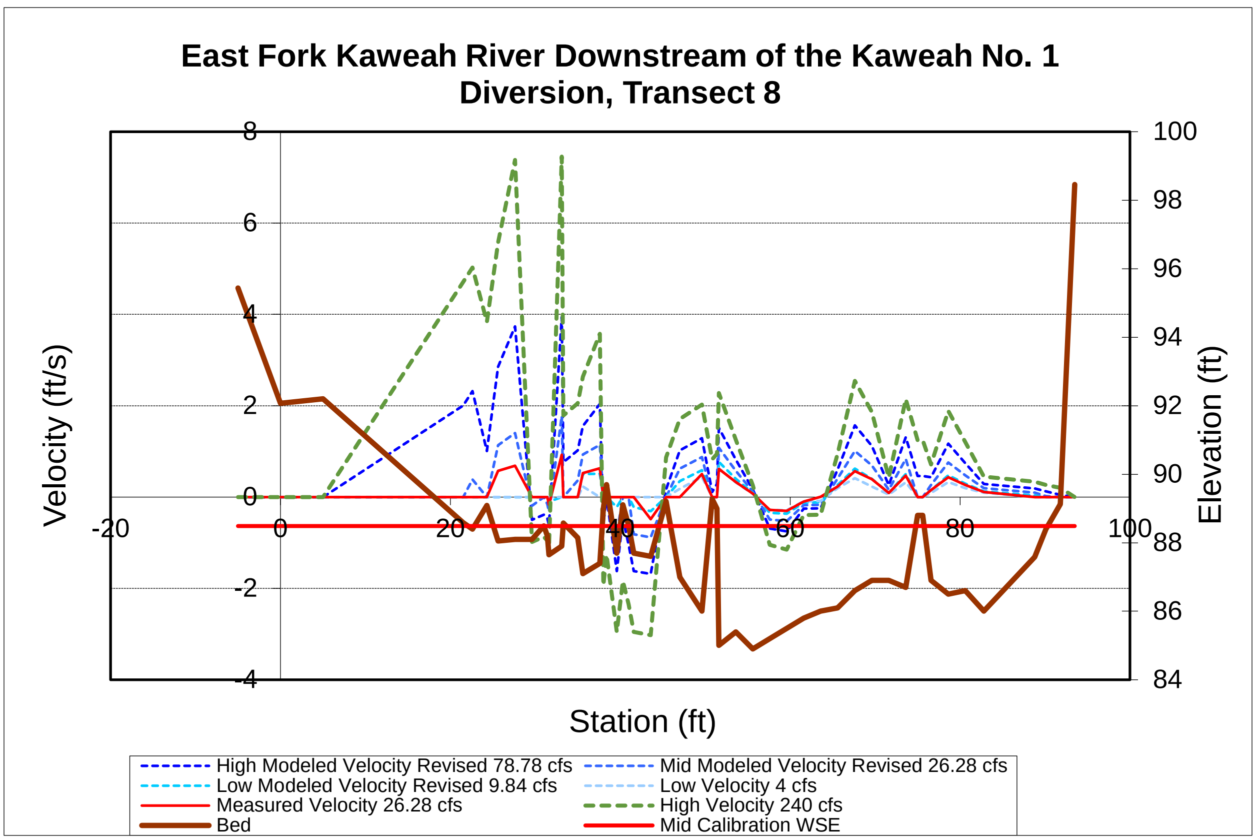

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
7
6
5
4
3
2
1
0
-1
94
92
90
88
86
84
82
80
0
10
20
30
40
50
60
70
80
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

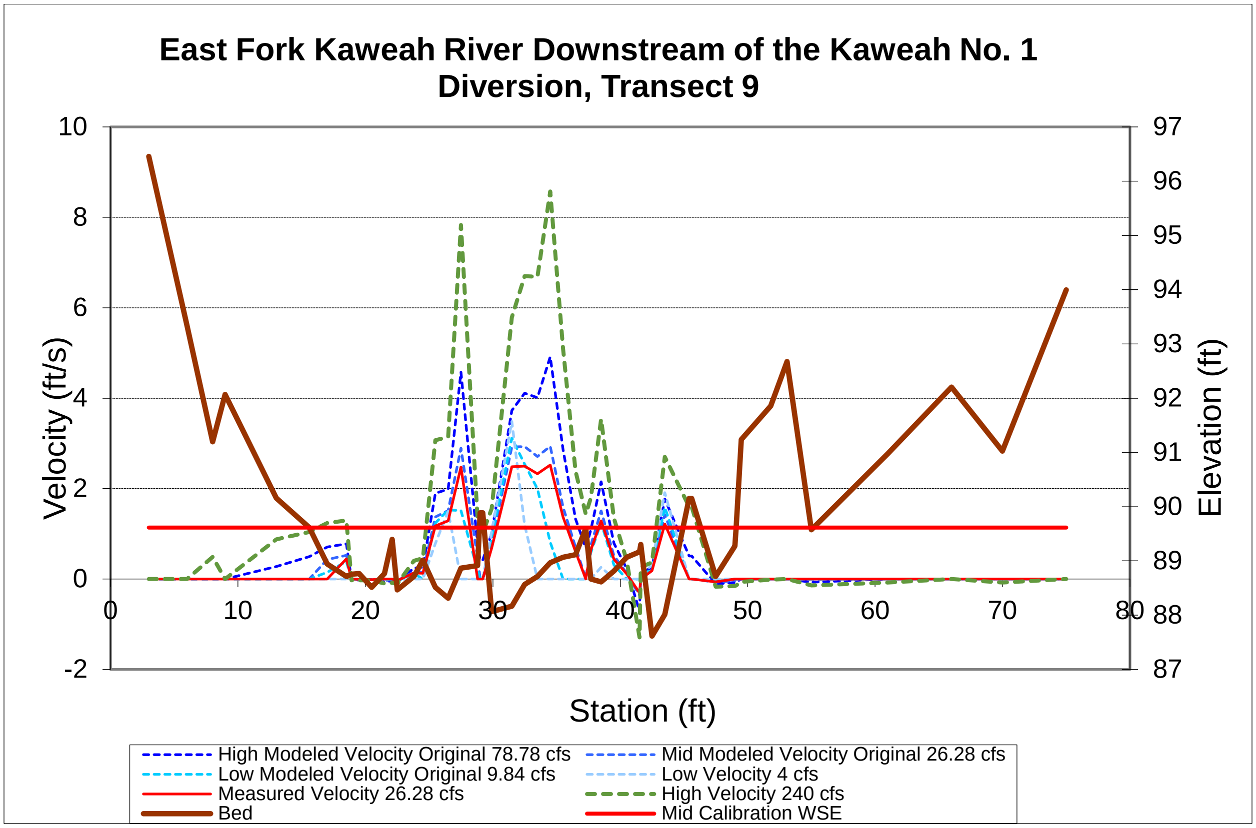

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

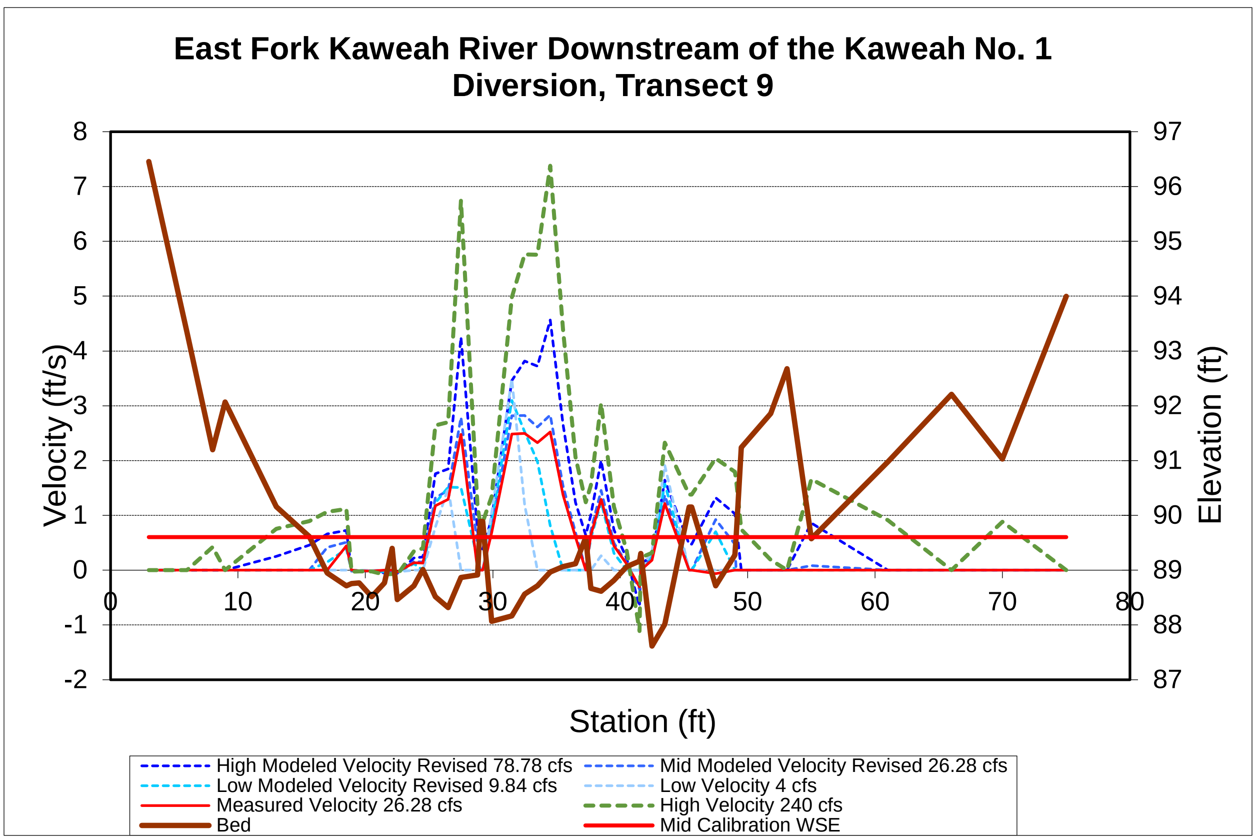


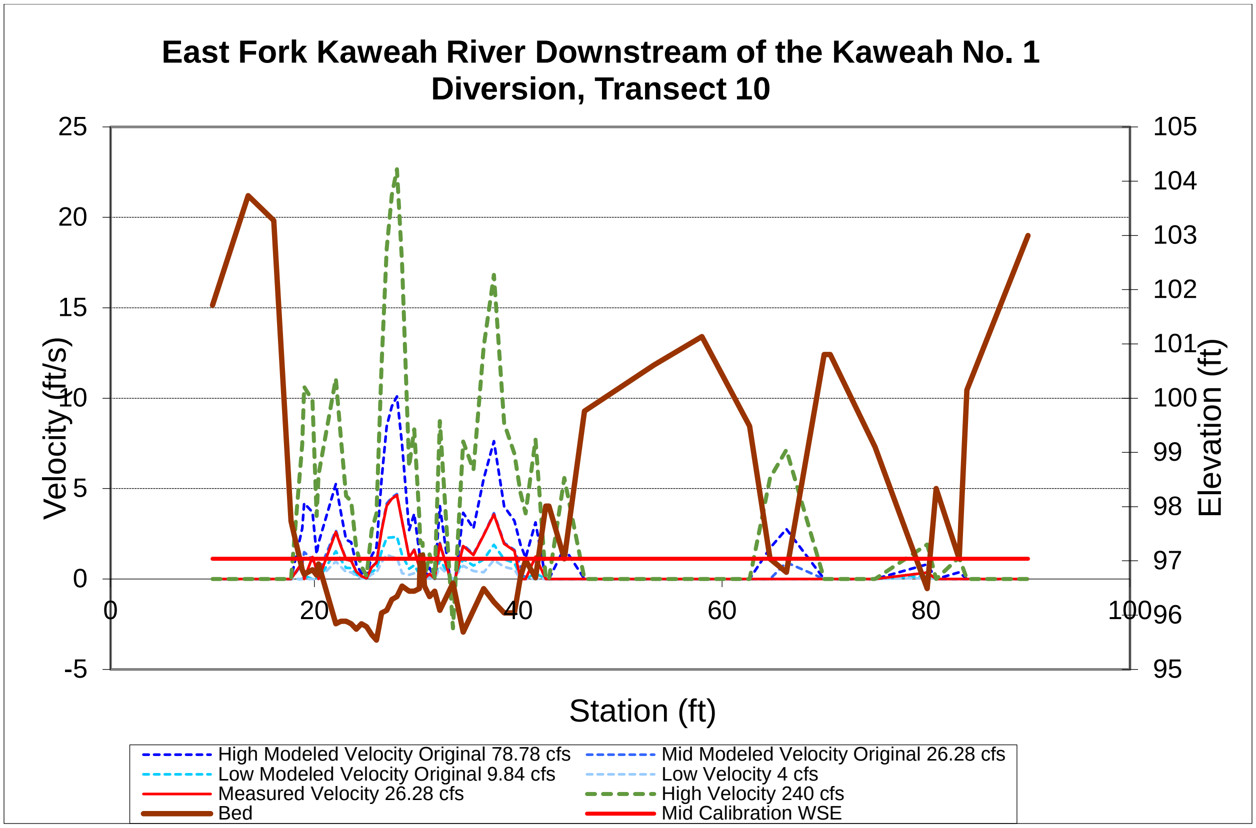
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
6
4
2
0
-2
-4
100
98
96
94
92
90
88
86
84
-20
0
20
40
60
80
100
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

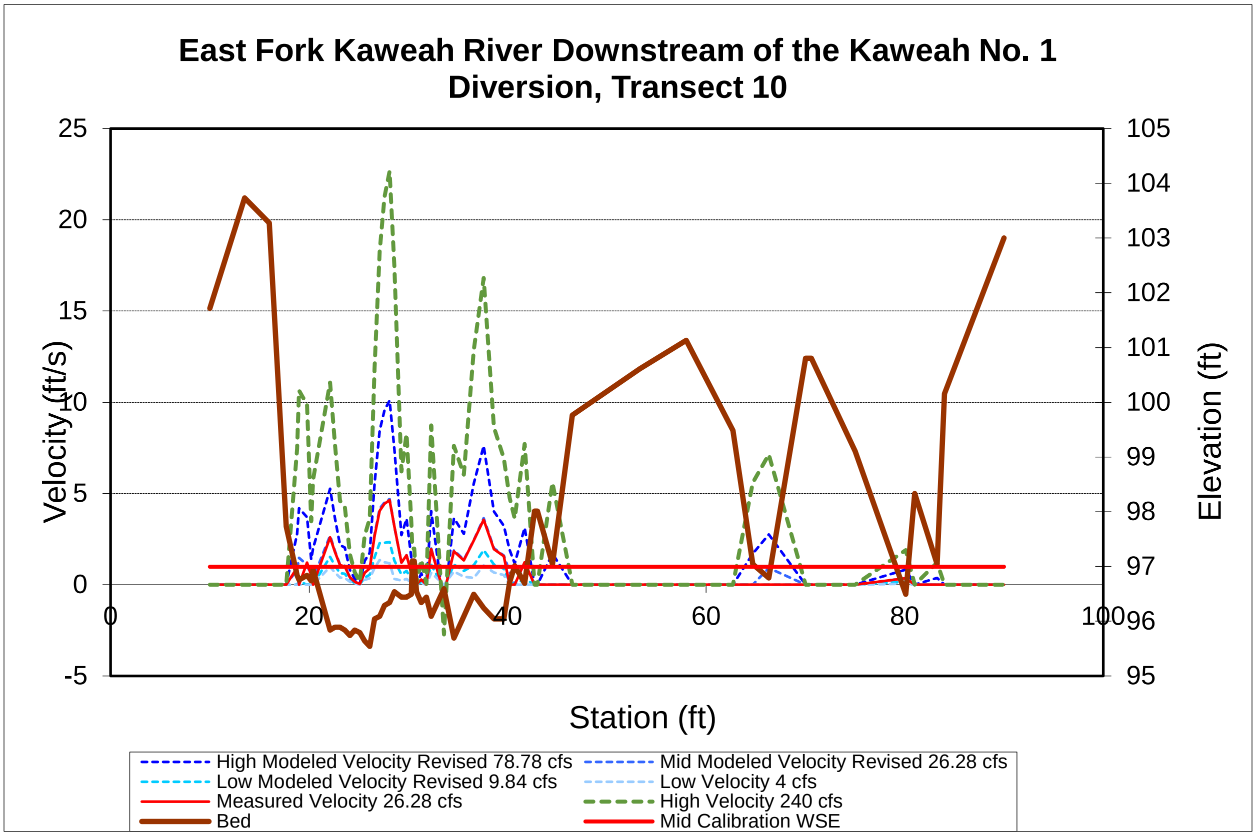


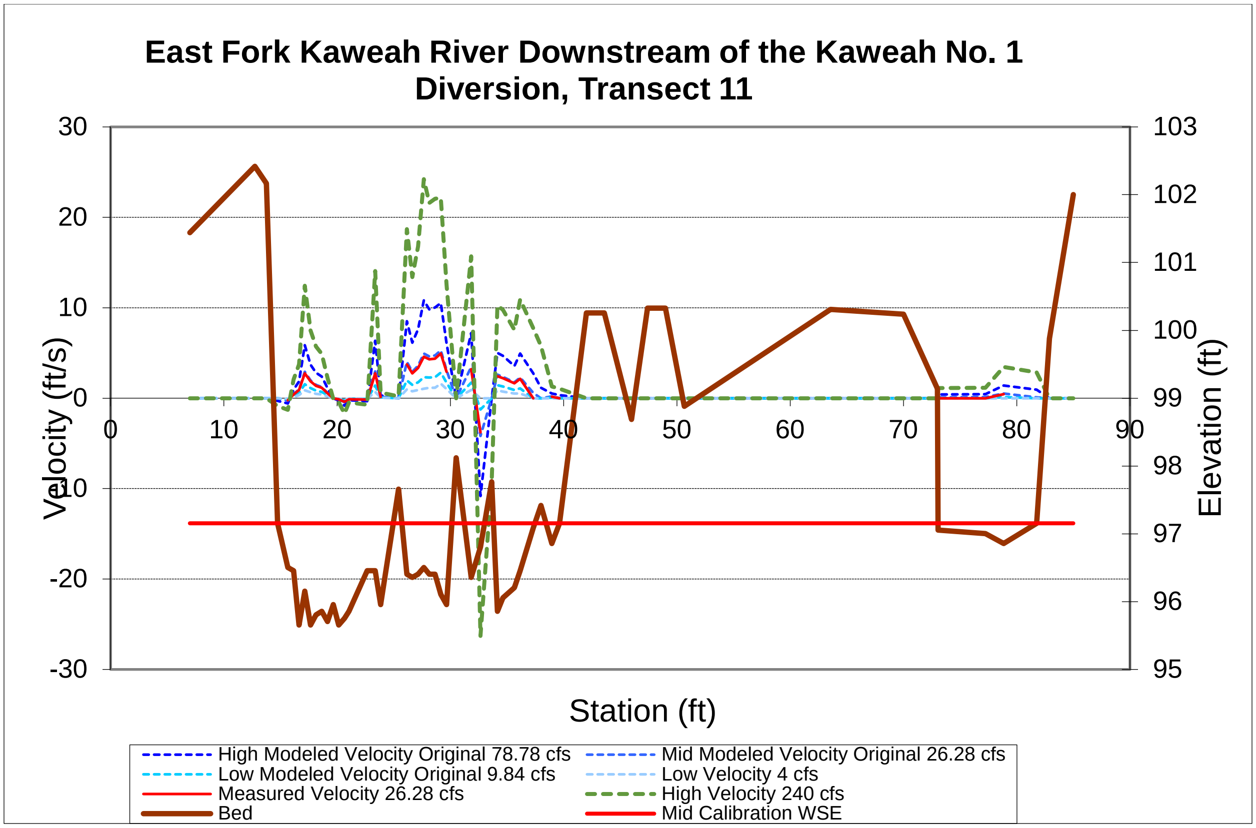
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
6
4
2
0
-2
-4
100
98
96
94
92
90
88
86
84
-20
0
20
40
60
80
100
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

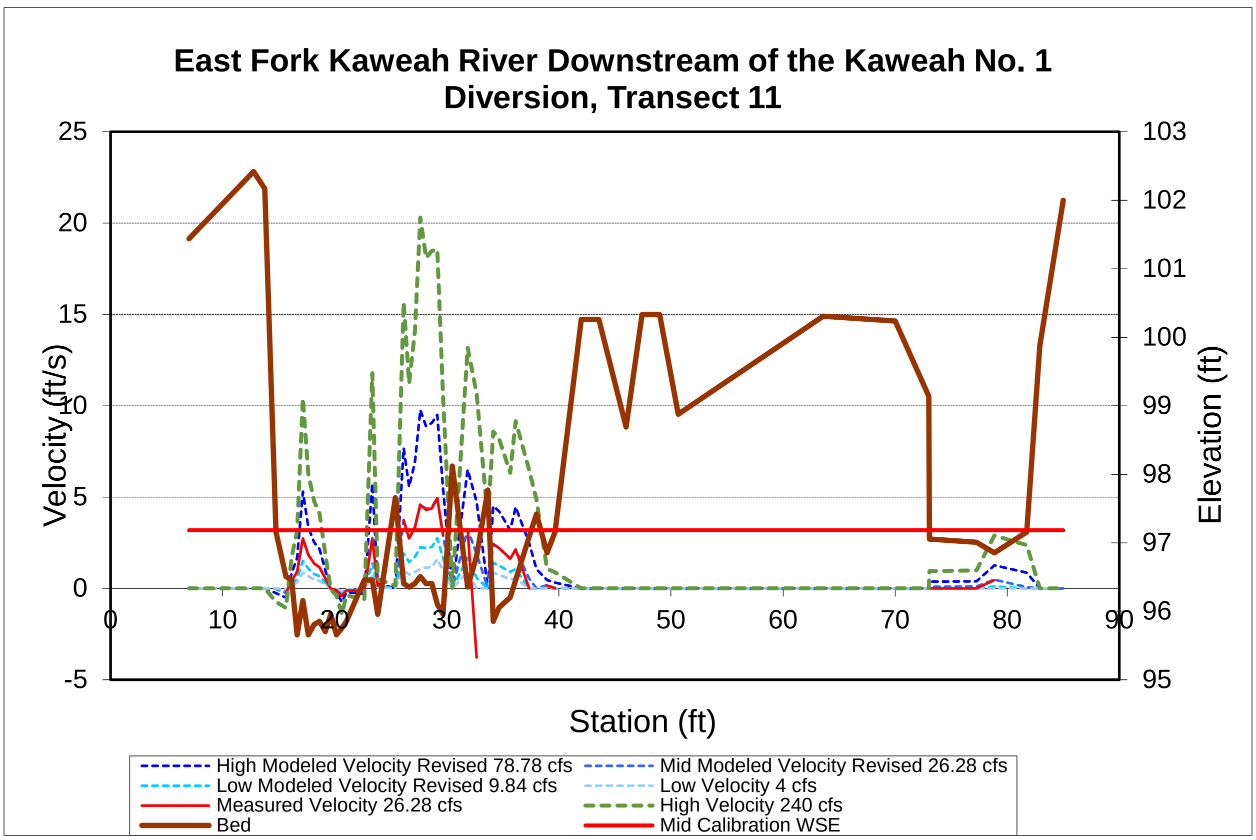

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
97
96
95
94
93
92
91
90
89
88
87
0
10
20
30
40
50
60
70
80
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

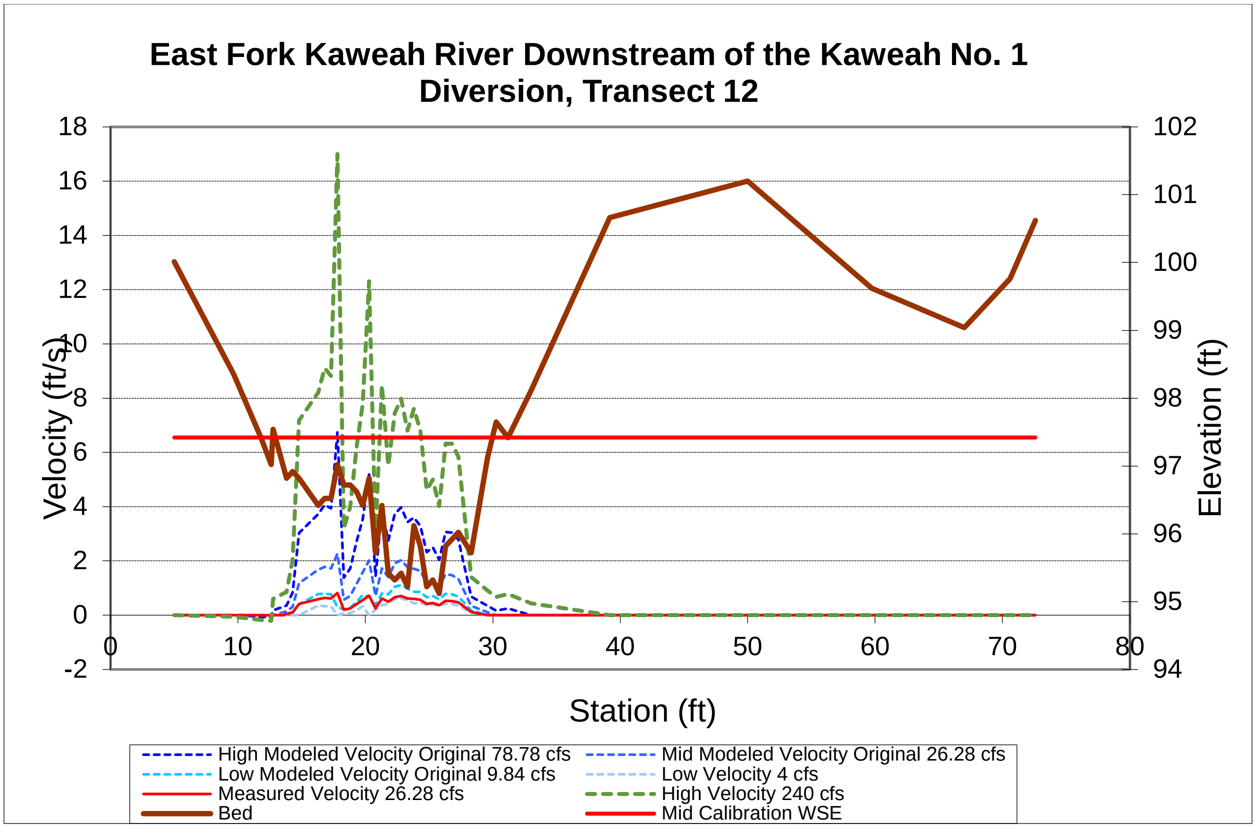

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
7
6
5
4
3
2
1
0
-1
-2
97
96
95
94
93
92
91
90
89
88
87
0
10
20
30
40
50
60
70
80
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
105
104
103
102
101
100
99
98
97
96
95
0
20
40
60
80
100
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

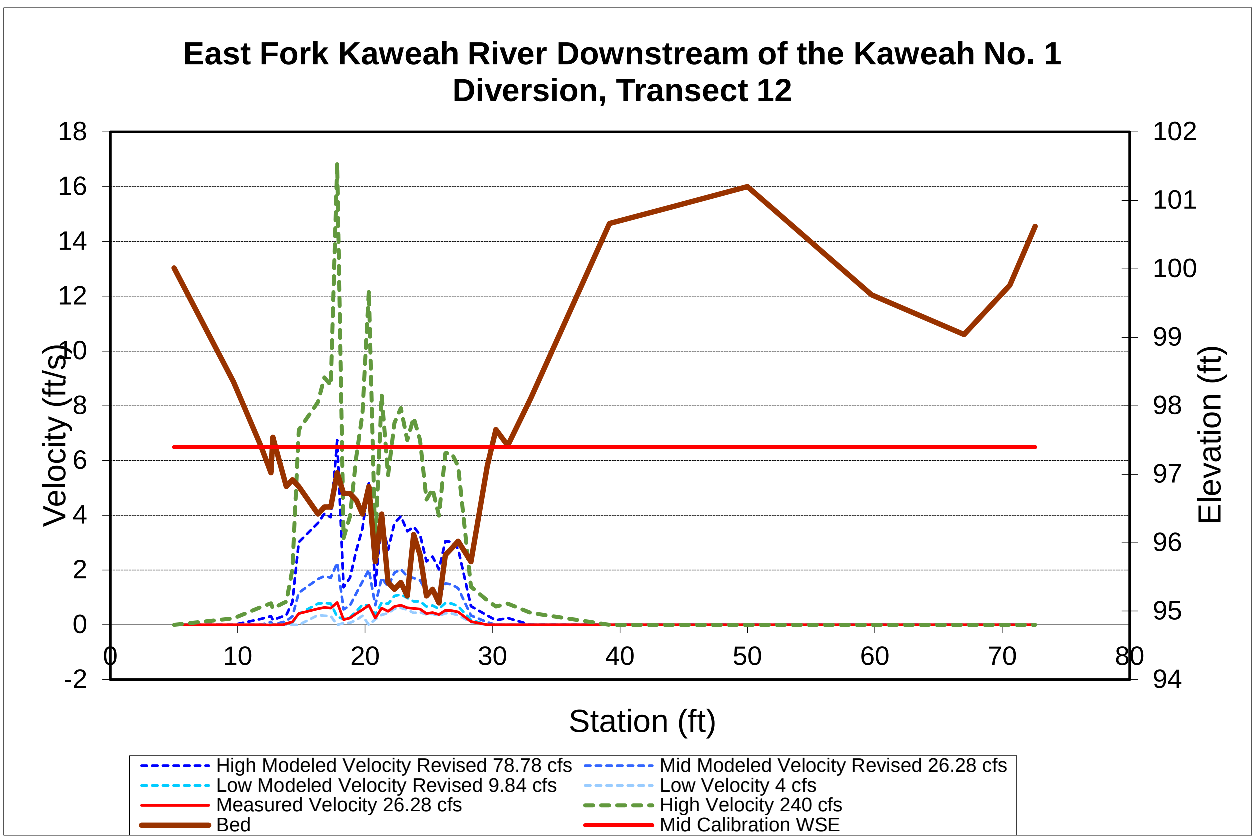

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
105
104
103
102
101
100
99
98
97
96
95
0
20
40
60
80
100
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
20
10
0
-10
-20
-30
103
102
101
100
99
98
97
96
95
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

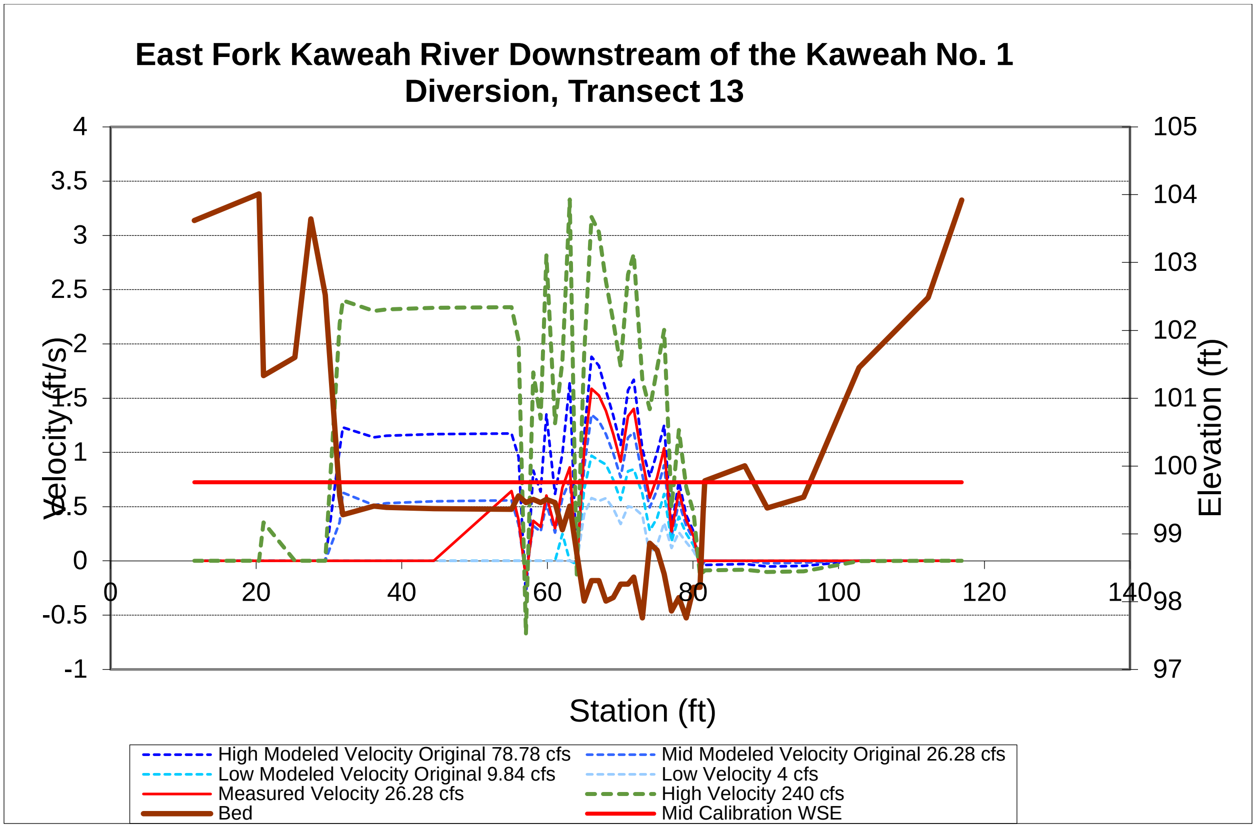

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
103
102
101
100
99
98
97
96
95
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE



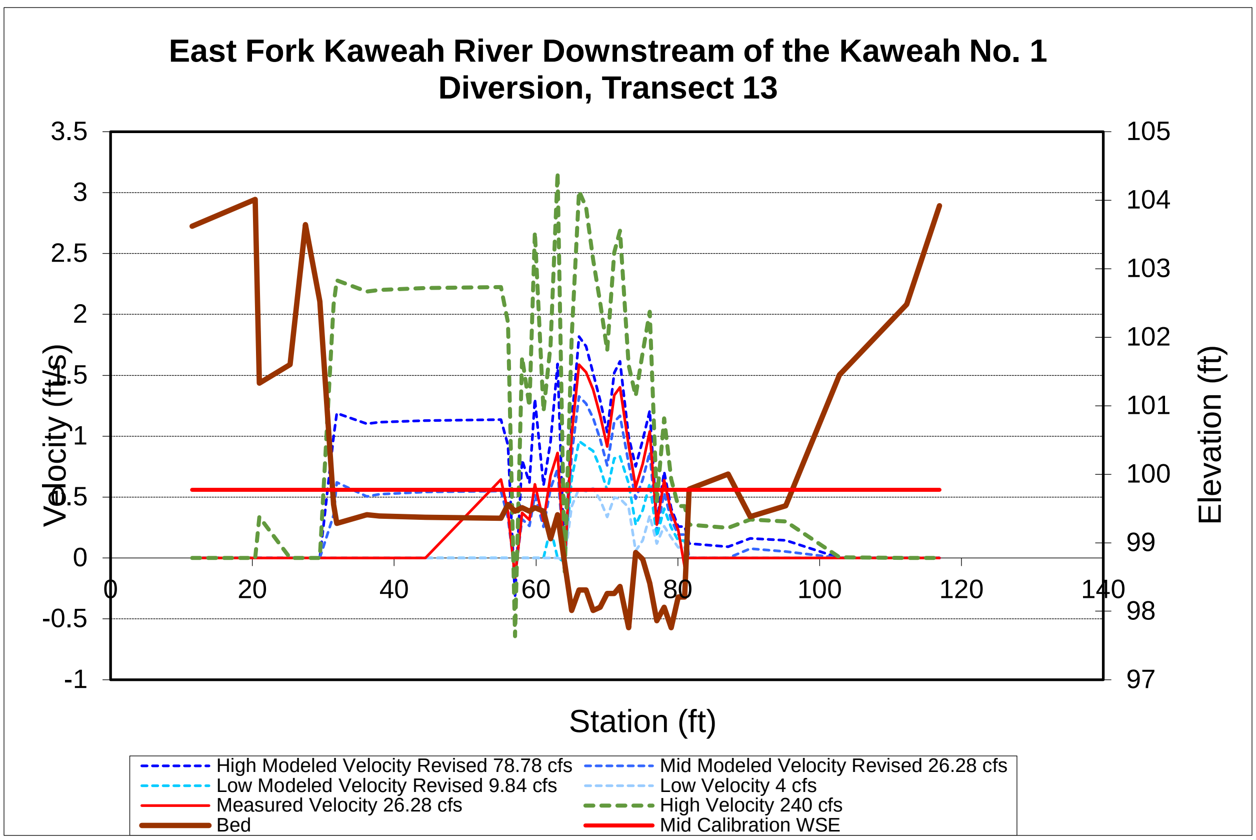
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE



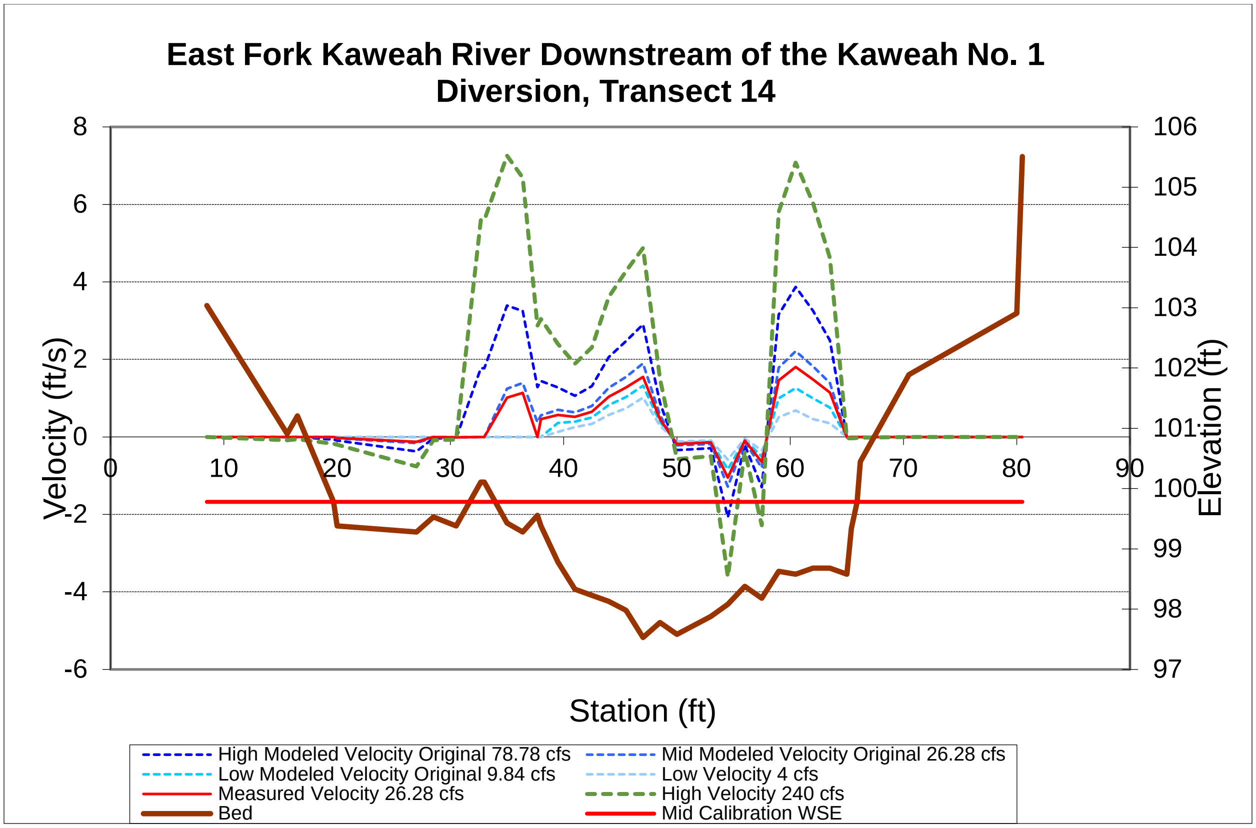
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

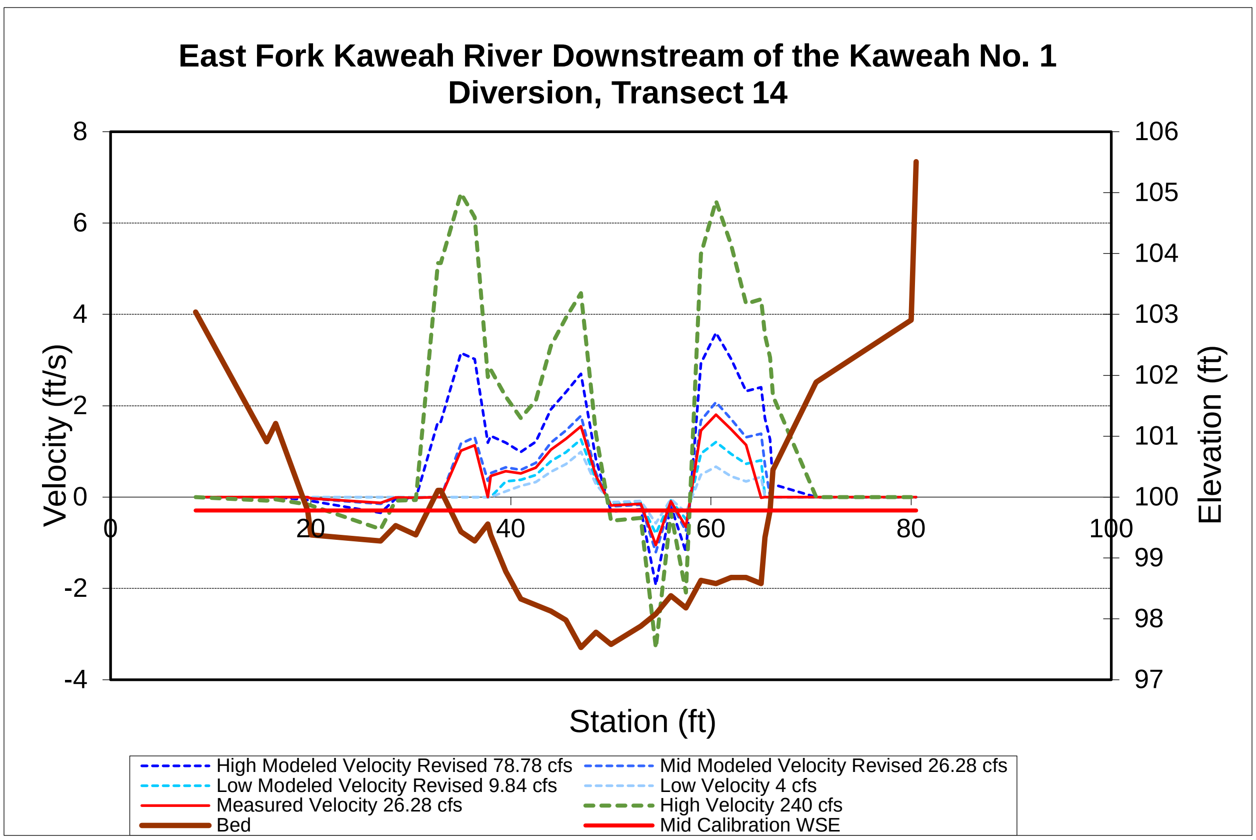


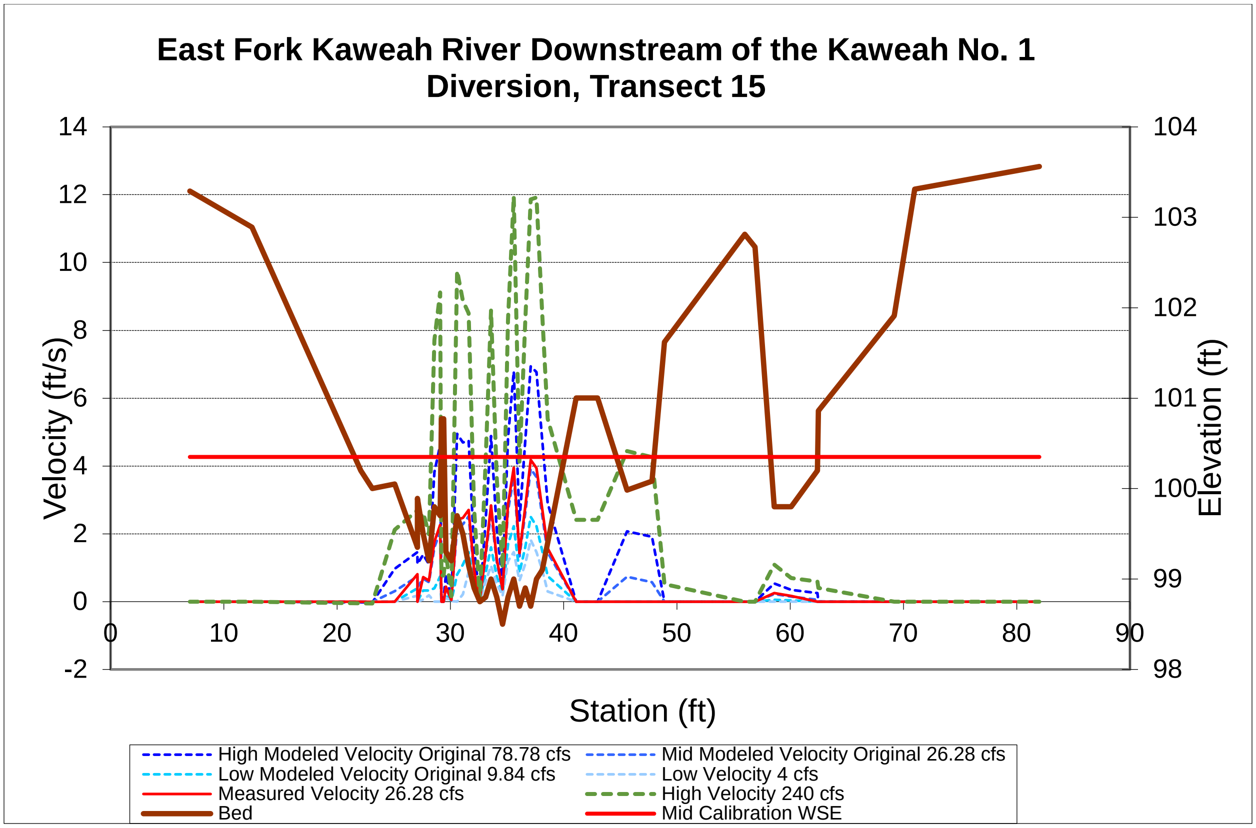
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 13
Velocity (ft/s)
Elevation (ft)
Station (ft)
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
105
104
103
102
101
100
99
98
97
0
20
40
60
80
100
120
140
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

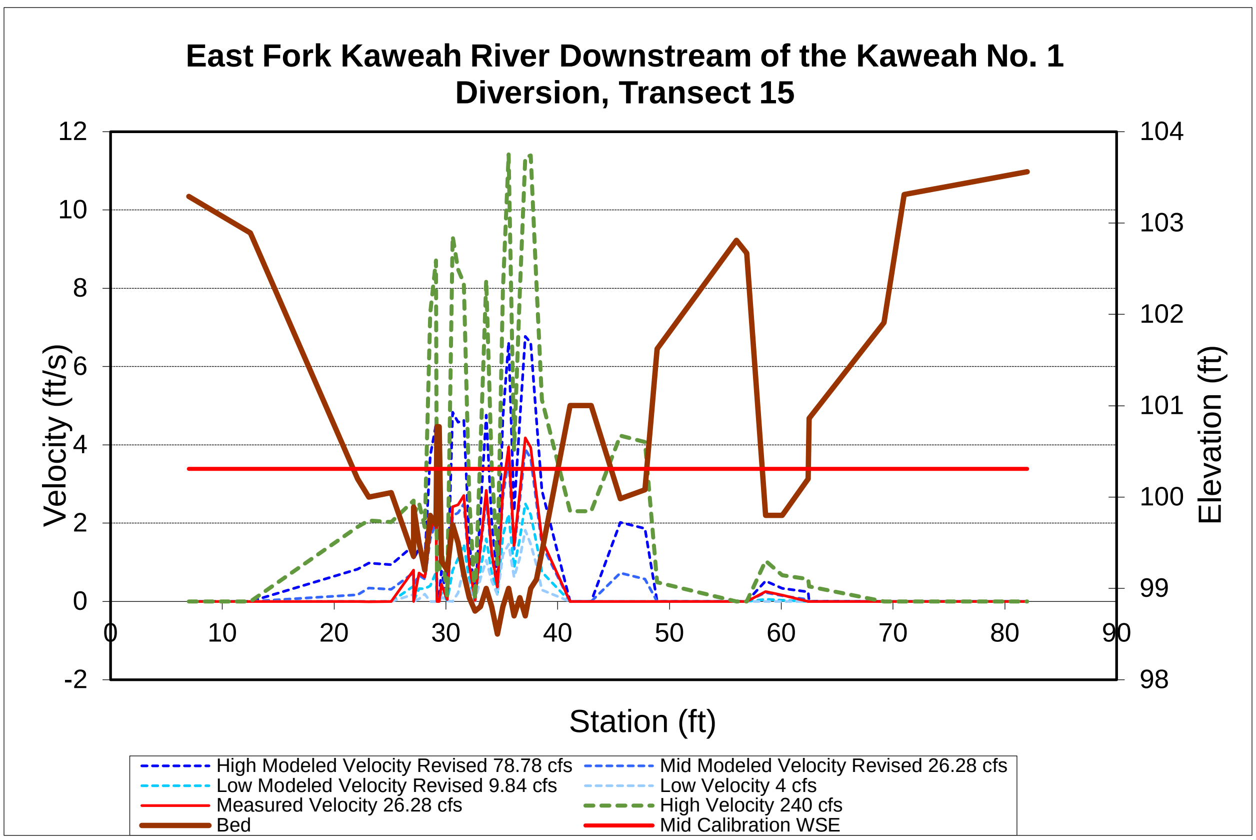


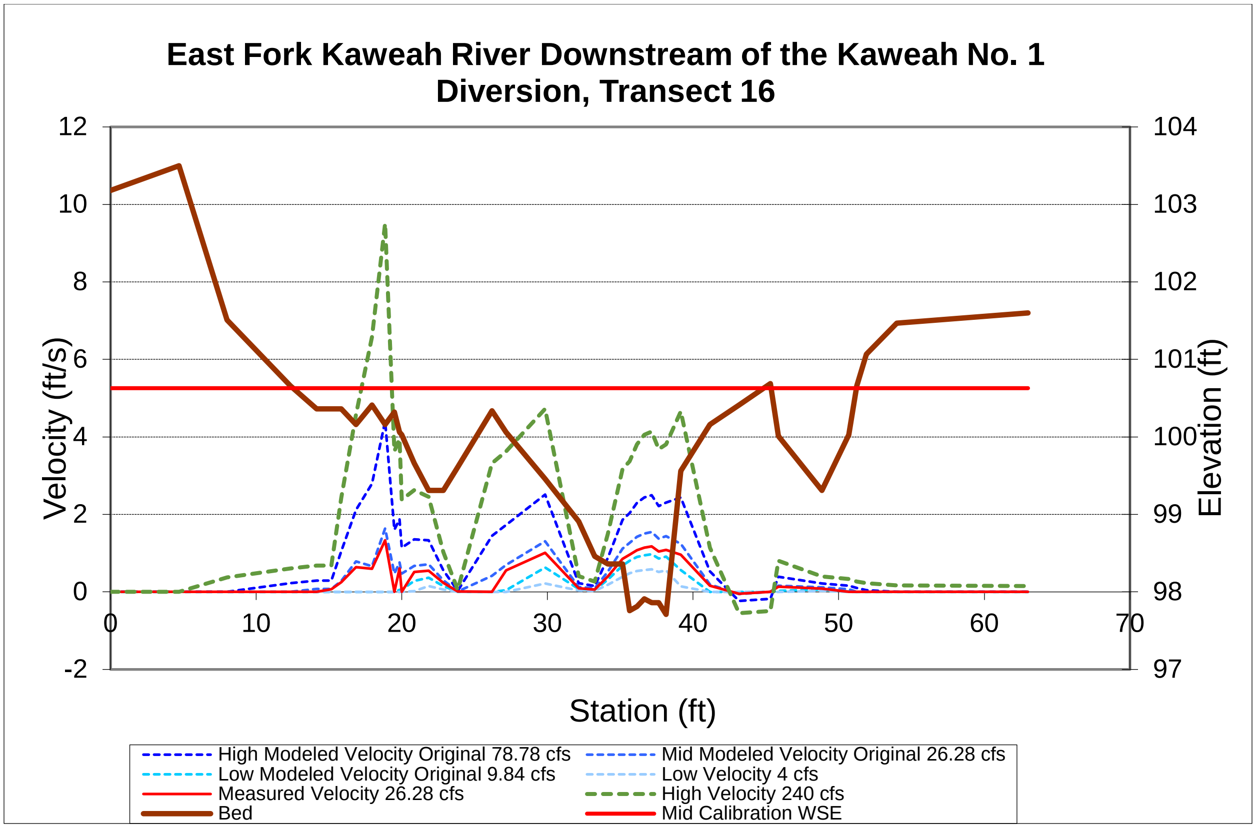
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 13
Velocity (ft/s)
Elevation (ft)
Station (ft)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
105
104
103
102
101
100
99
98
97
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

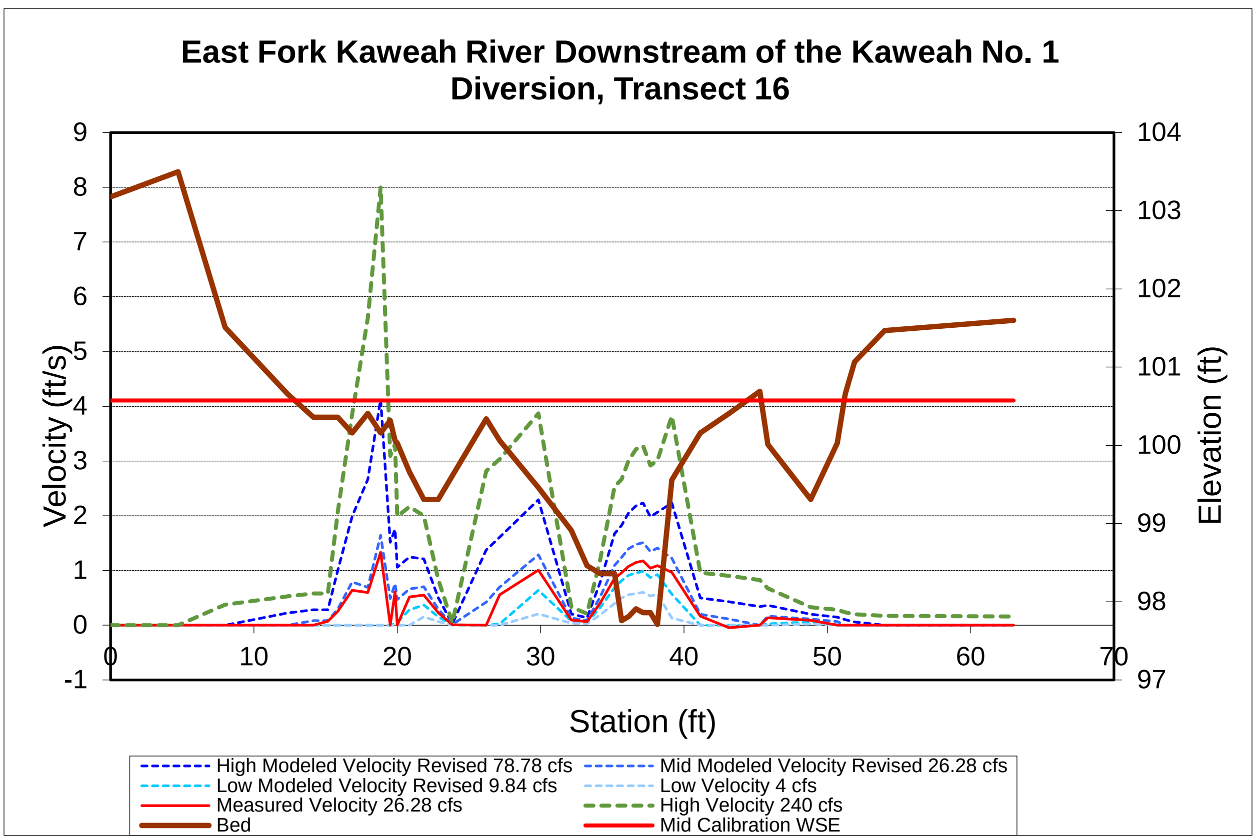

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 14
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
6
4
2
0
-2
-4
-6
106
105
104
103
102
101
100
99
98
97
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

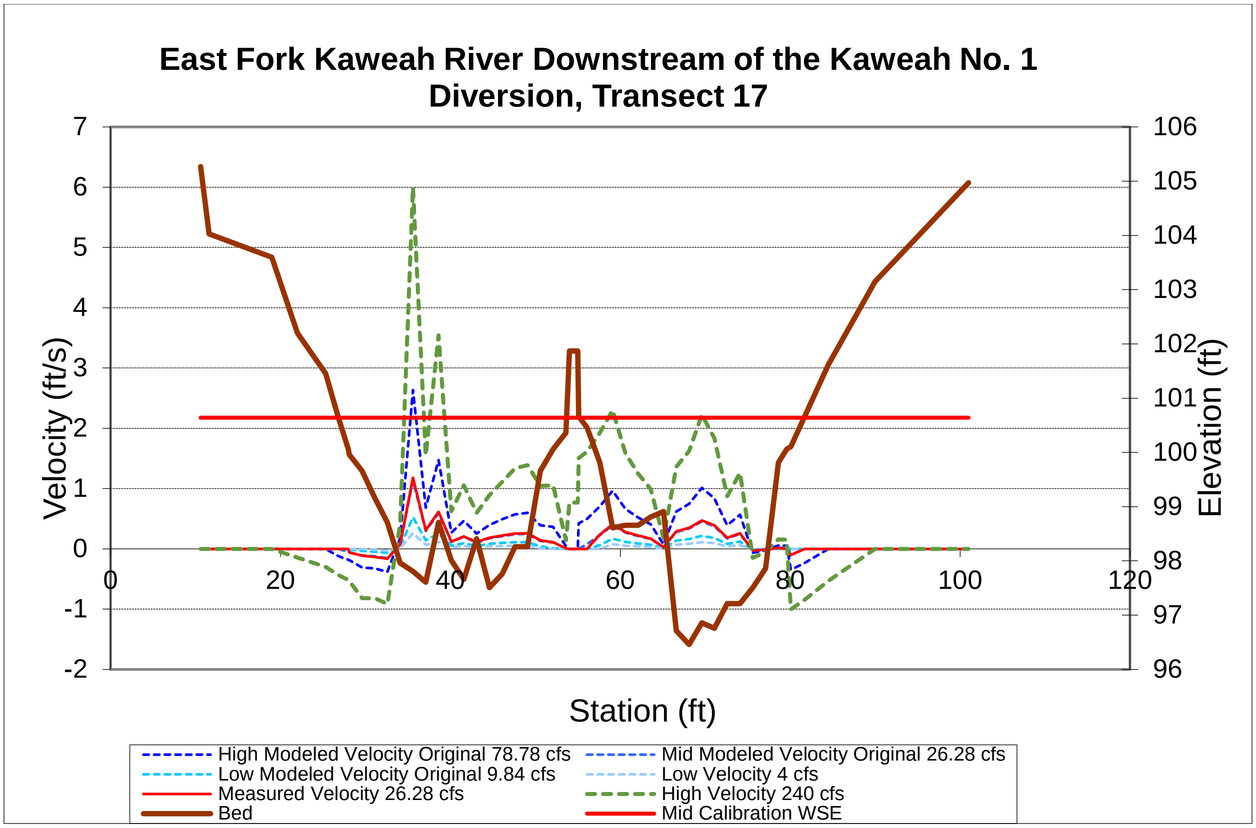

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 14
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
6
4
2
0
-2
-4
106
105
104
103
102
101
100
99
98
97
0
20
40
60
80
100
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

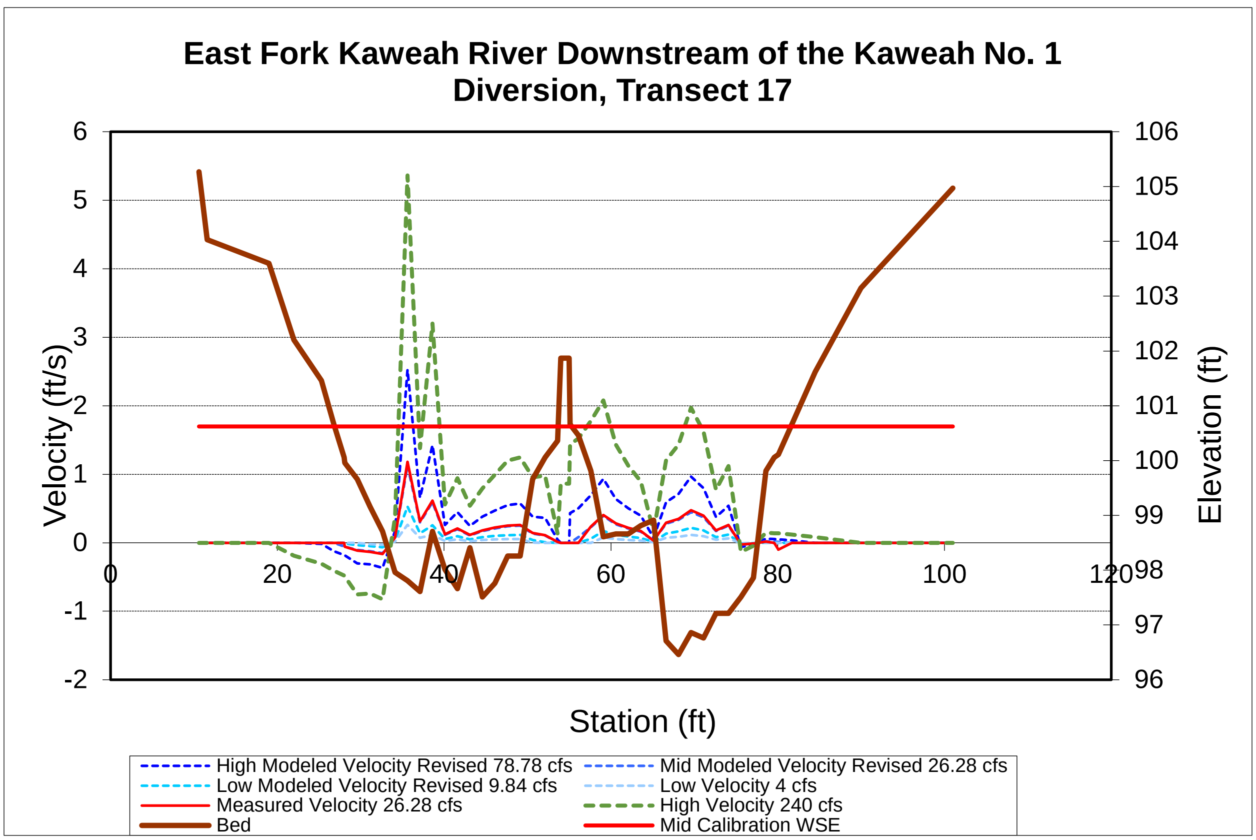

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 15
Velocity (ft/s)
Elevation (ft)
Station (ft)
14
12
10
8
6
4
2
0
-2
104
103
102
101
100
99
98
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

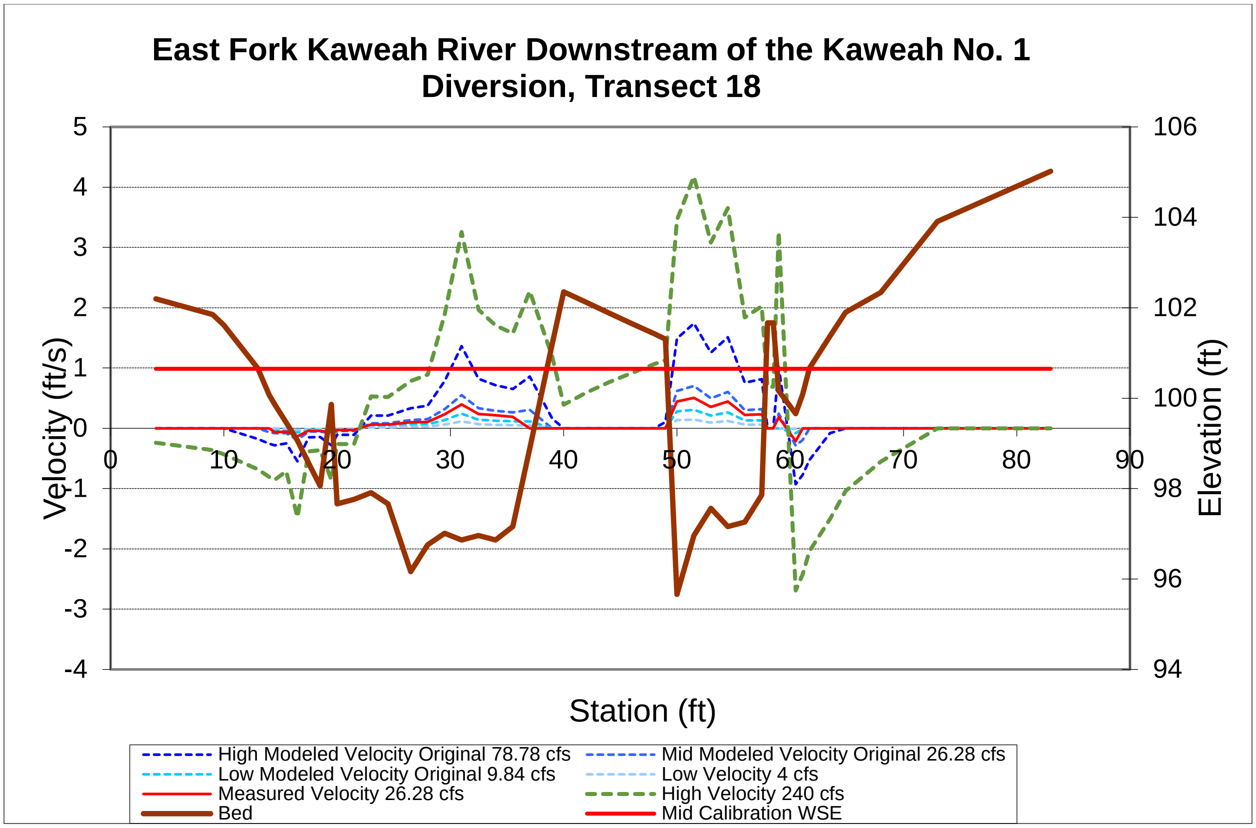

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 15
Velocity (ft/s)
Elevation (ft)
Station (ft)
12
10
8
6
4
2
0
-2
104
103
102
101
100
99
98
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

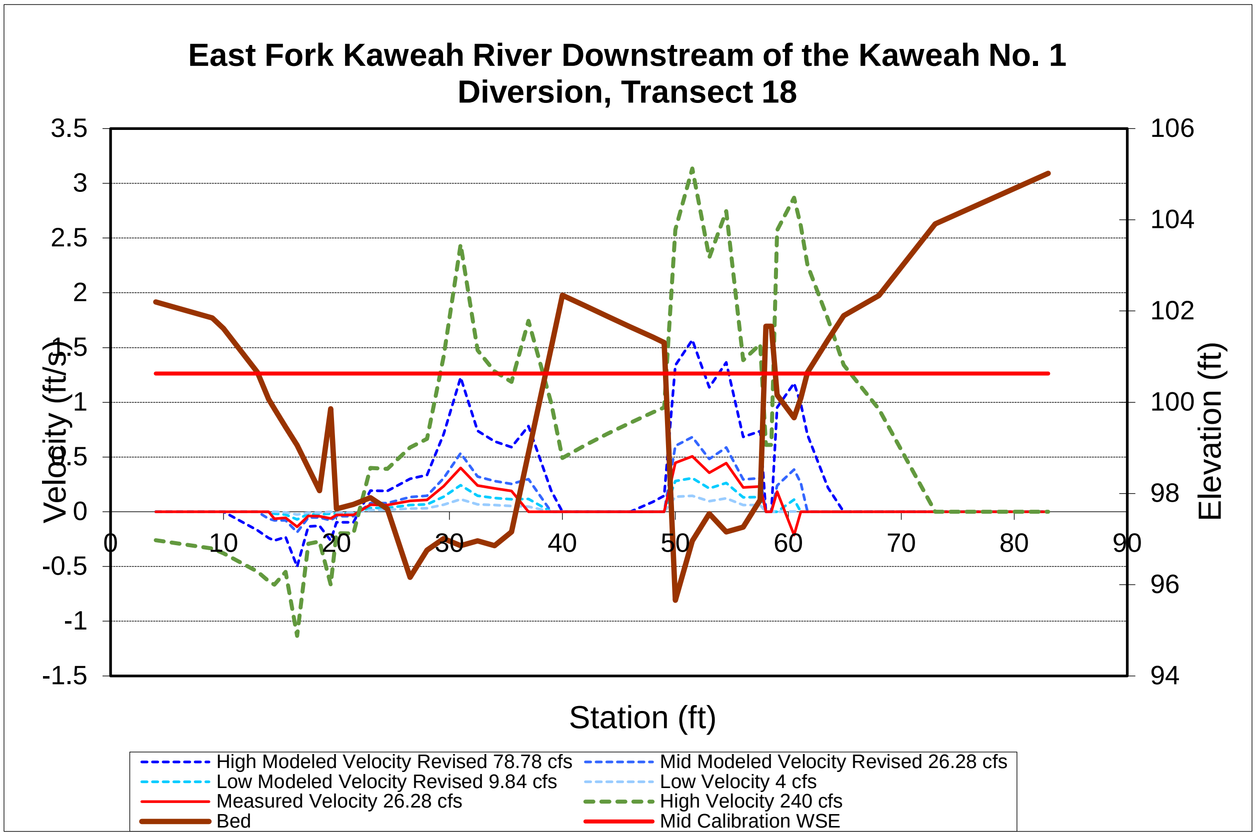

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 16
Velocity (ft/s)
Elevation (ft)
Station (ft)
12
10
8
6
4
2
0
-2
104
103
102
101
100
99
98
97
0
10
20
30
40
50
60
70
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

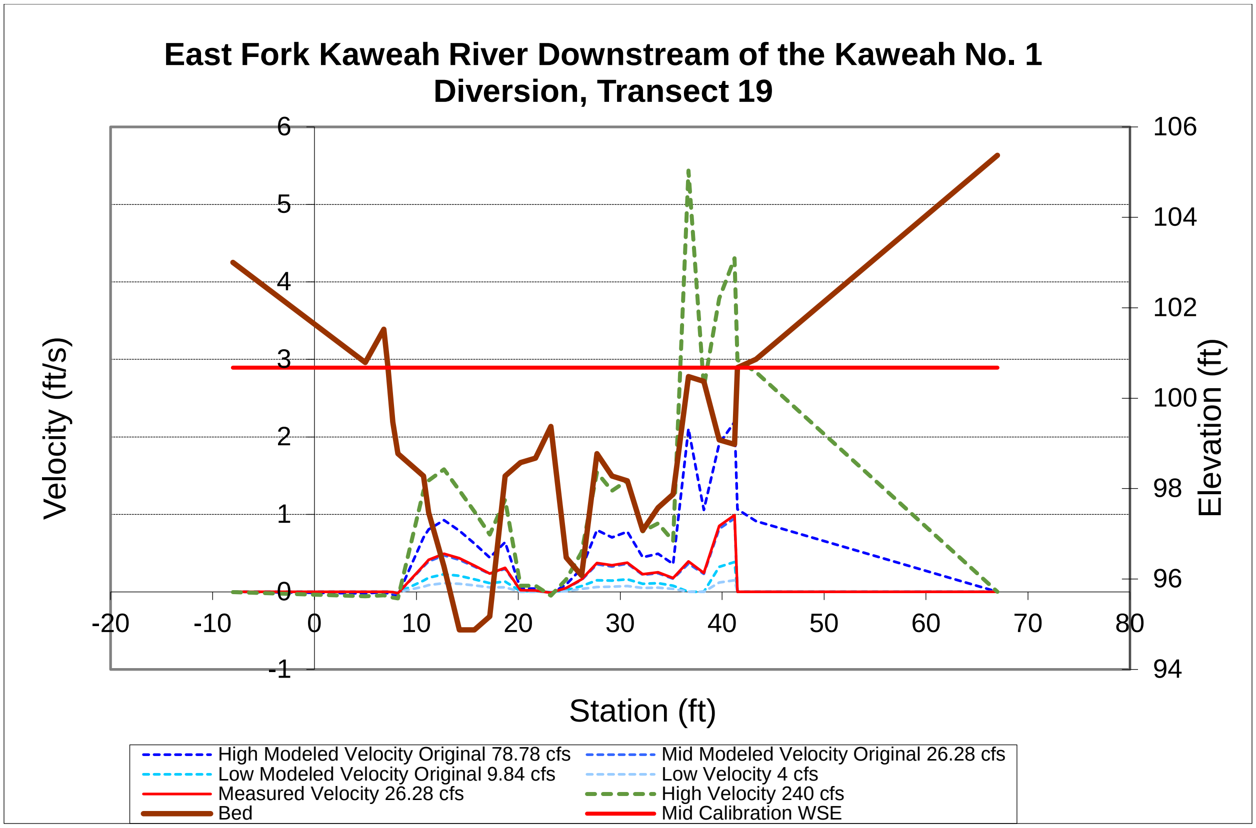

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 16
Velocity (ft/s)
Elevation (ft)
Station (ft)
9
8
7
6
5
4
3
2
1
0
-1
104
103
102
101
100
99
98
97
0
10
20
30
40
50
60
70
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 17
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 17
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 18
Velocity (ft/s)
Elevation (ft)
Station (ft)
5
4
3
2
1
0
-1
-2
-3
-4
106
104
102
100
98
96
94
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 18
Velocity (ft/s)
Elevation (ft)
Station (ft)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
106
104
102
100
98
96
94
0
10
20
30
40
50
60
70
80
90
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE


East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 19
Velocity (ft/s)
Elevation (ft)
Station (ft)
6
5
4
3
2
1
0
-1
106
104
102
100
98
96
94
-20
-10
0
10
20
30
40
50
60
70
80
High Modeled Velocity Original 78.78 cfs
Mid Modeled Velocity Original 26.28 cfs
Low Modeled Velocity Original 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

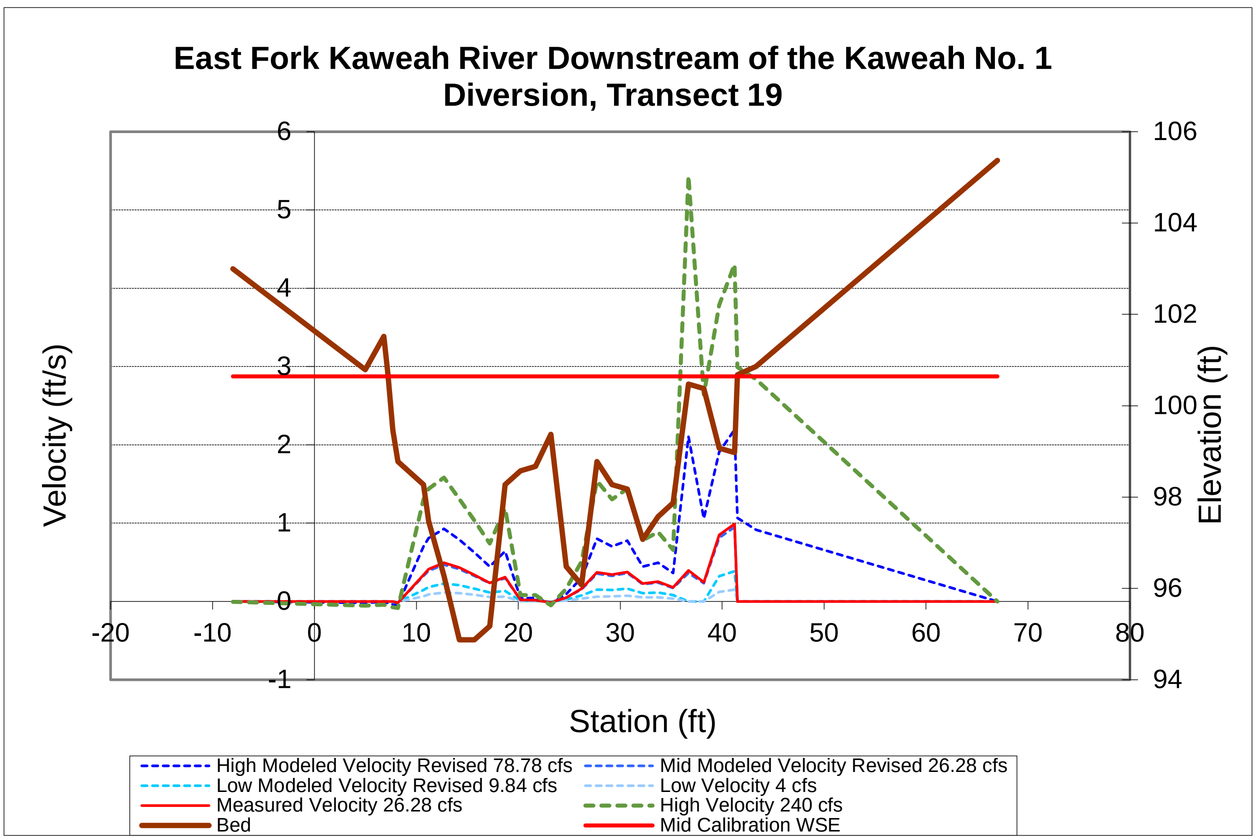
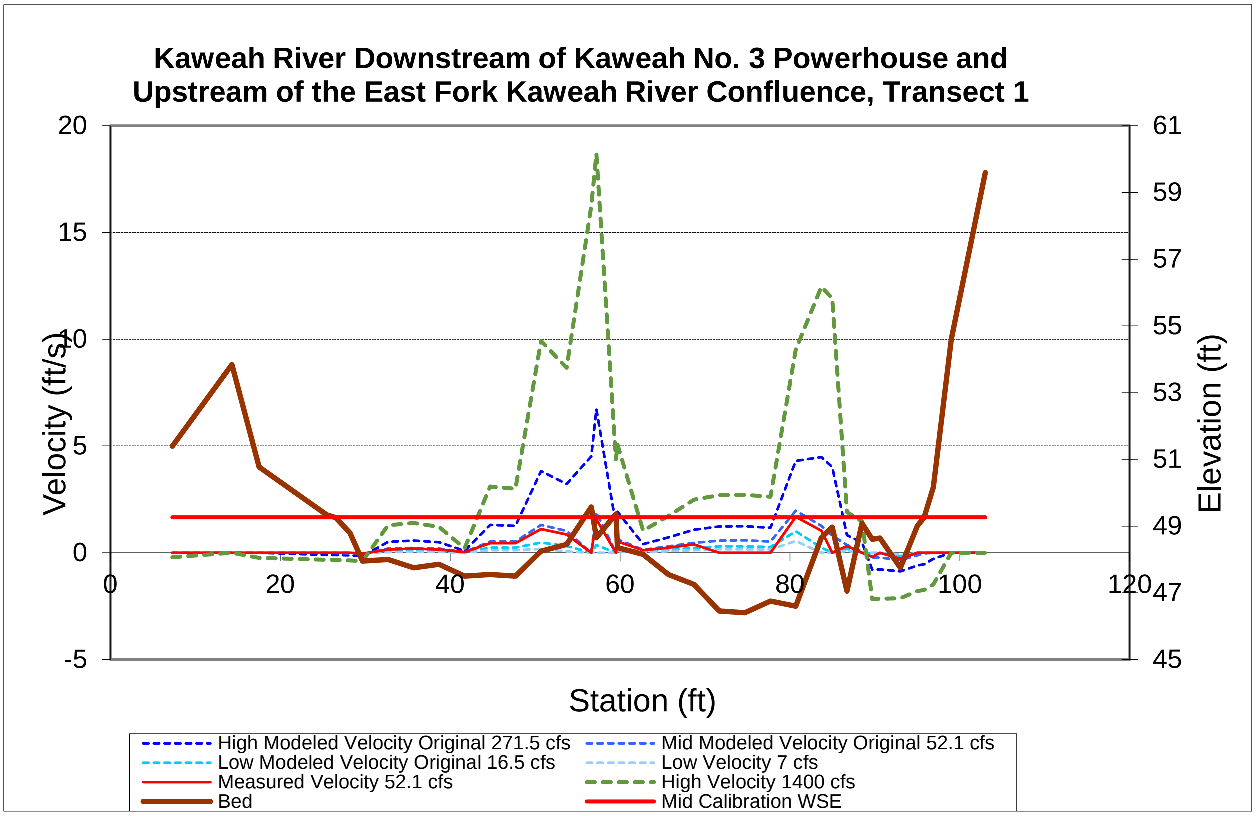
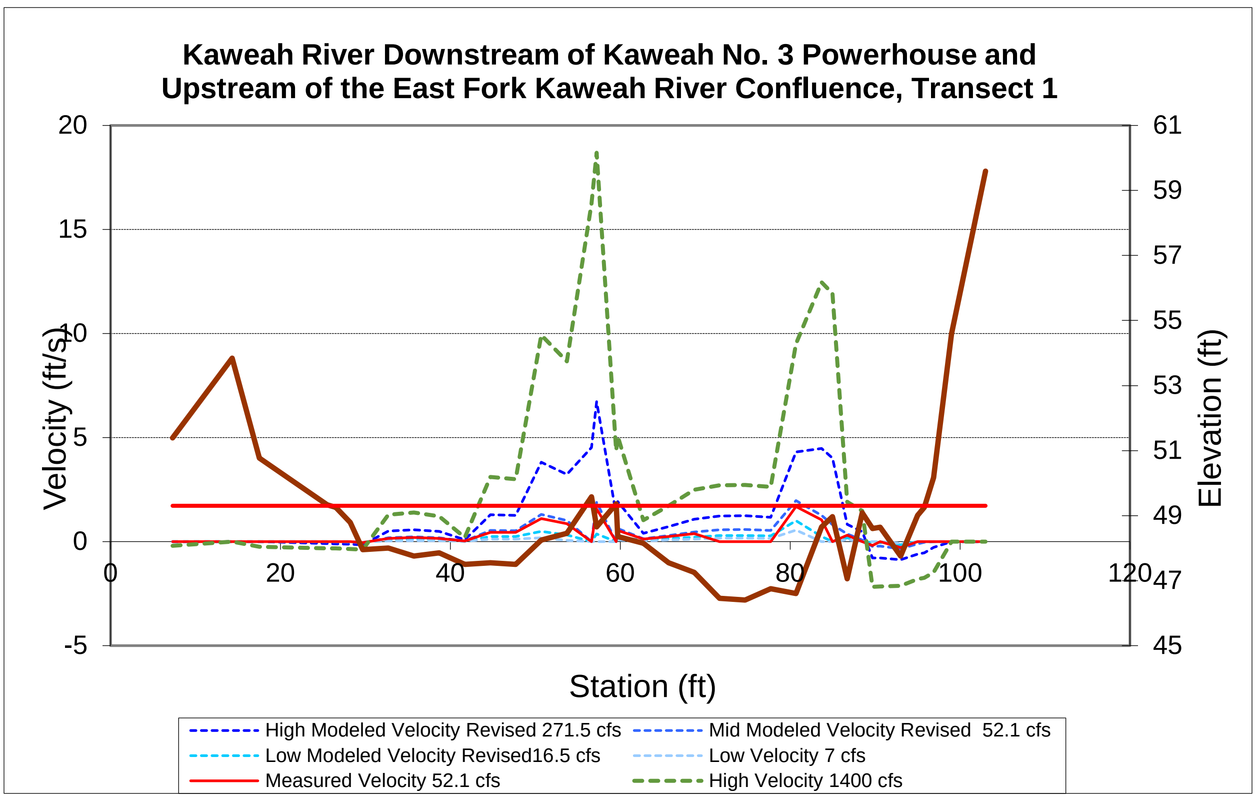
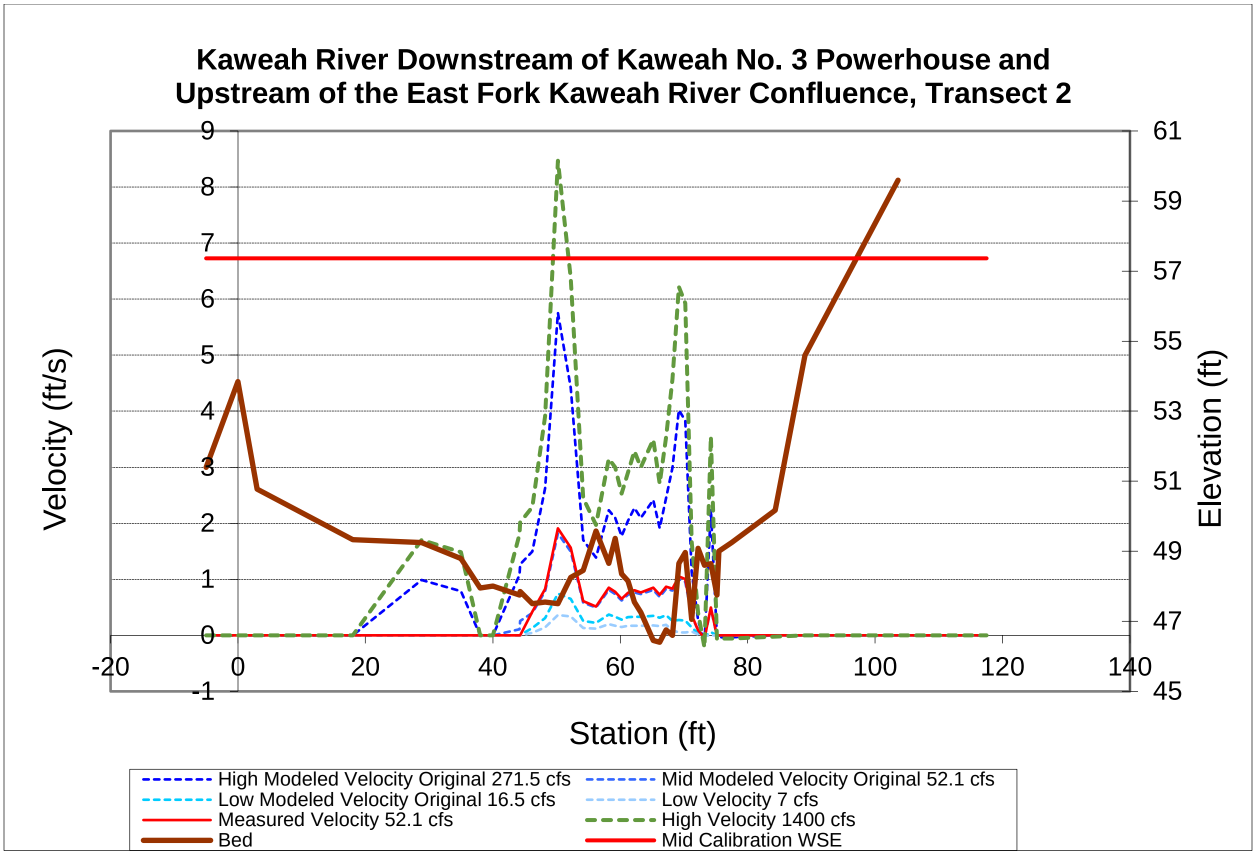
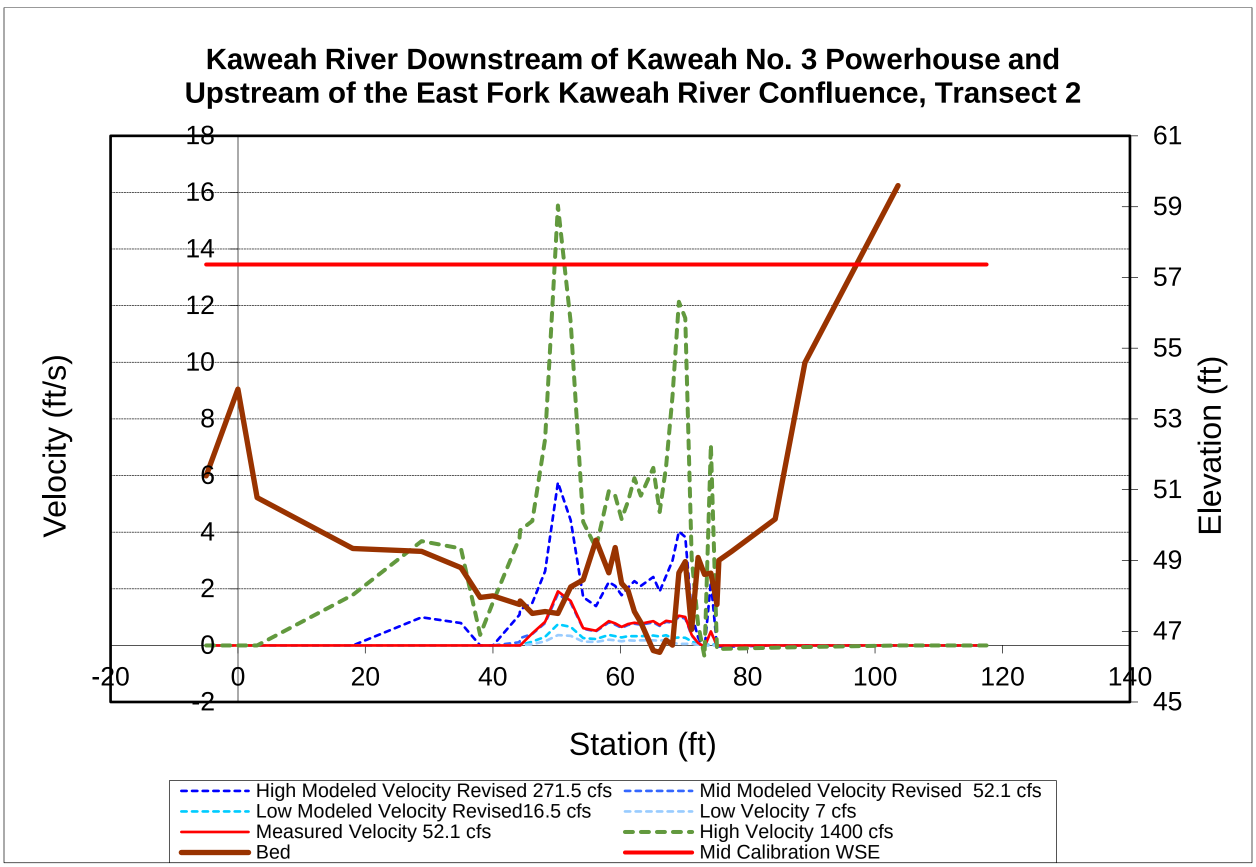

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion, Transect 19
Velocity (ft/s)
Elevation (ft)
Station (ft)
6
5
4
3
2
1
0
-1
106
104
102
100
98
96
94
-20
-10
0
10
20
30
40
50
60
70
80
High Modeled Velocity Revised 78.78 cfs
Mid Modeled Velocity Revised 26.28 cfs
Low Modeled Velocity Revised 9.84 cfs
Low Velocity 4 cfs
Measured Velocity 26.28 cfs
High Velocity 240 cfs
Bed
Mid Calibration WSE

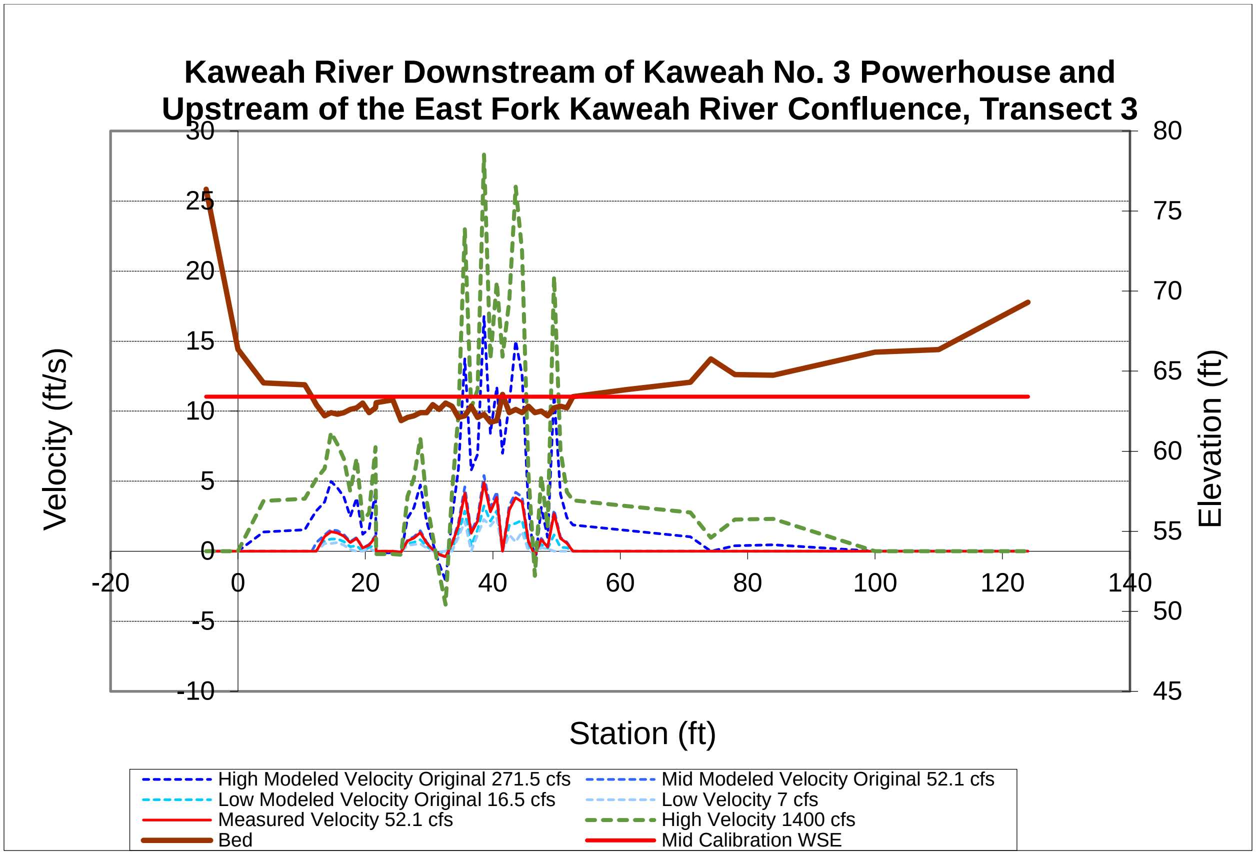
Figure D.C-2. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Velocity Calibration Report (Original on top Revised on bottom).

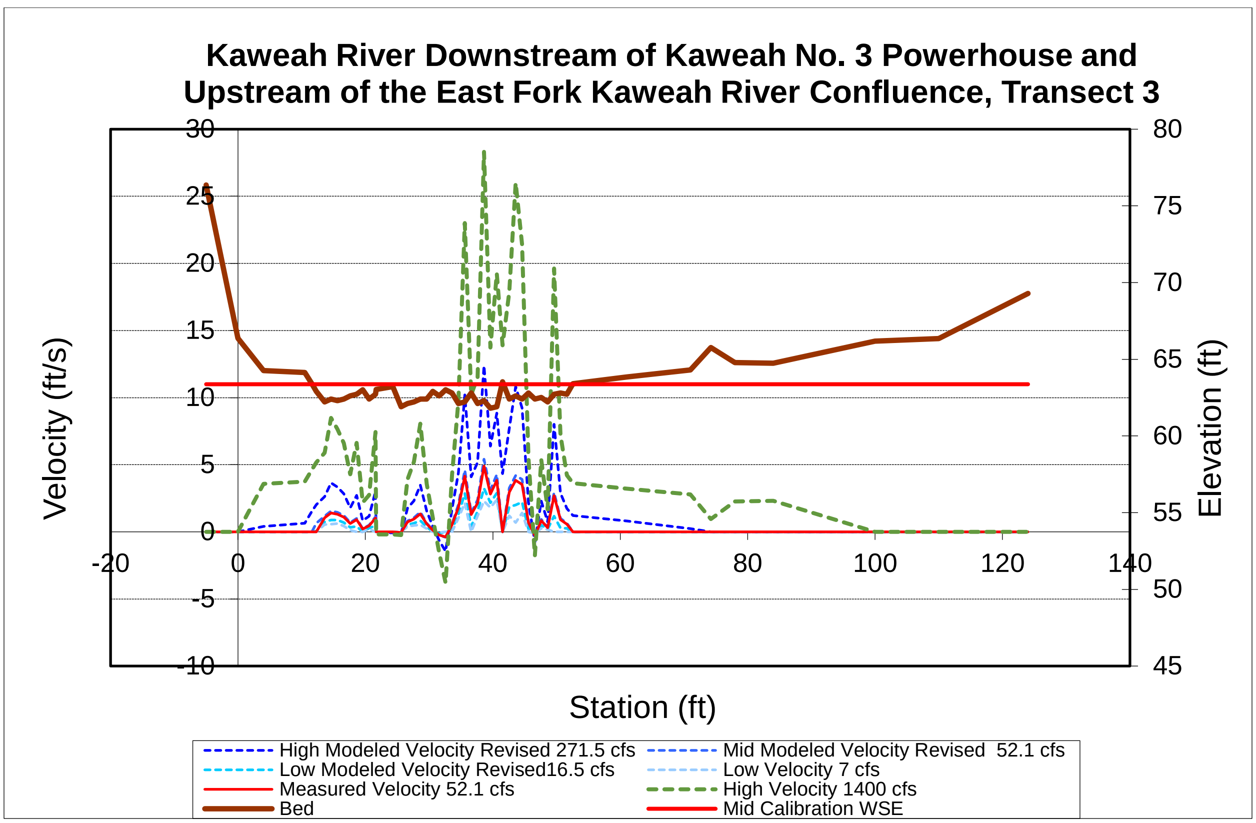


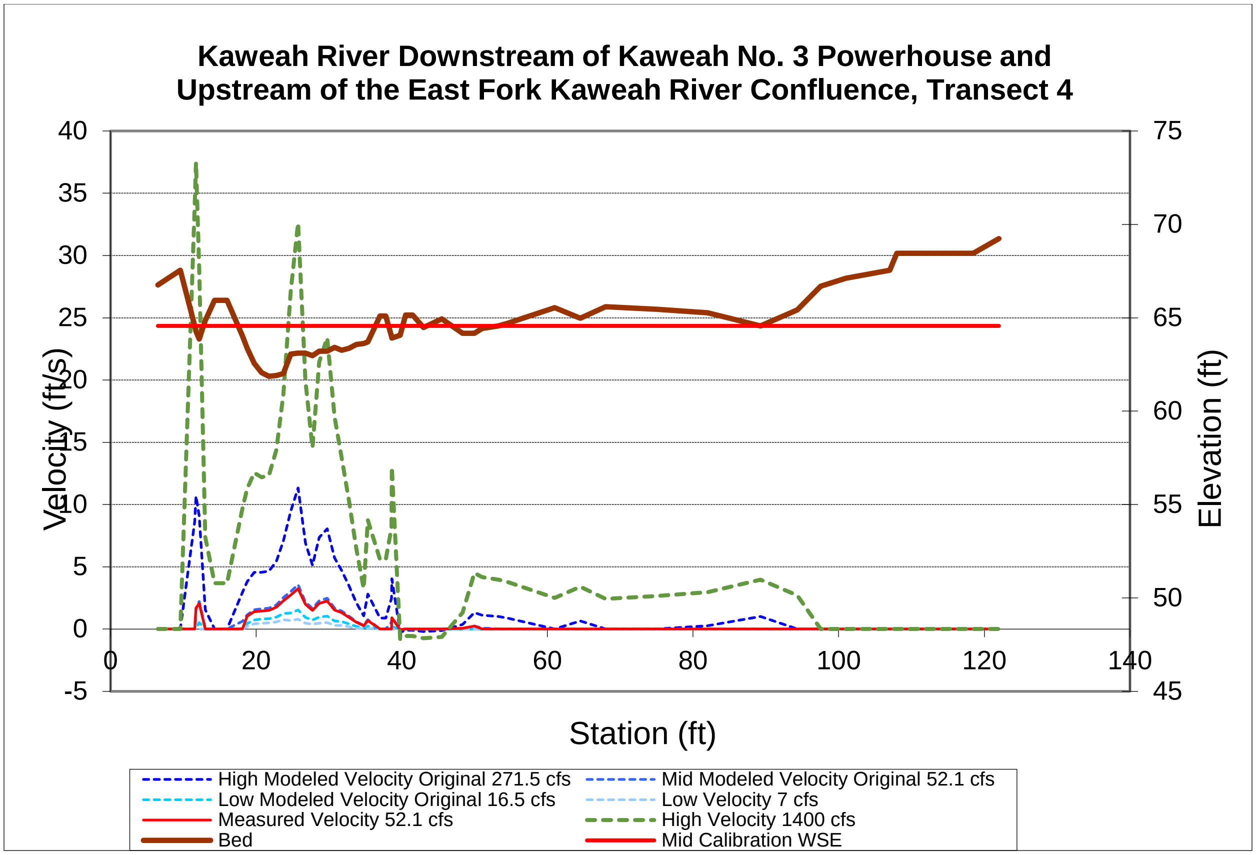


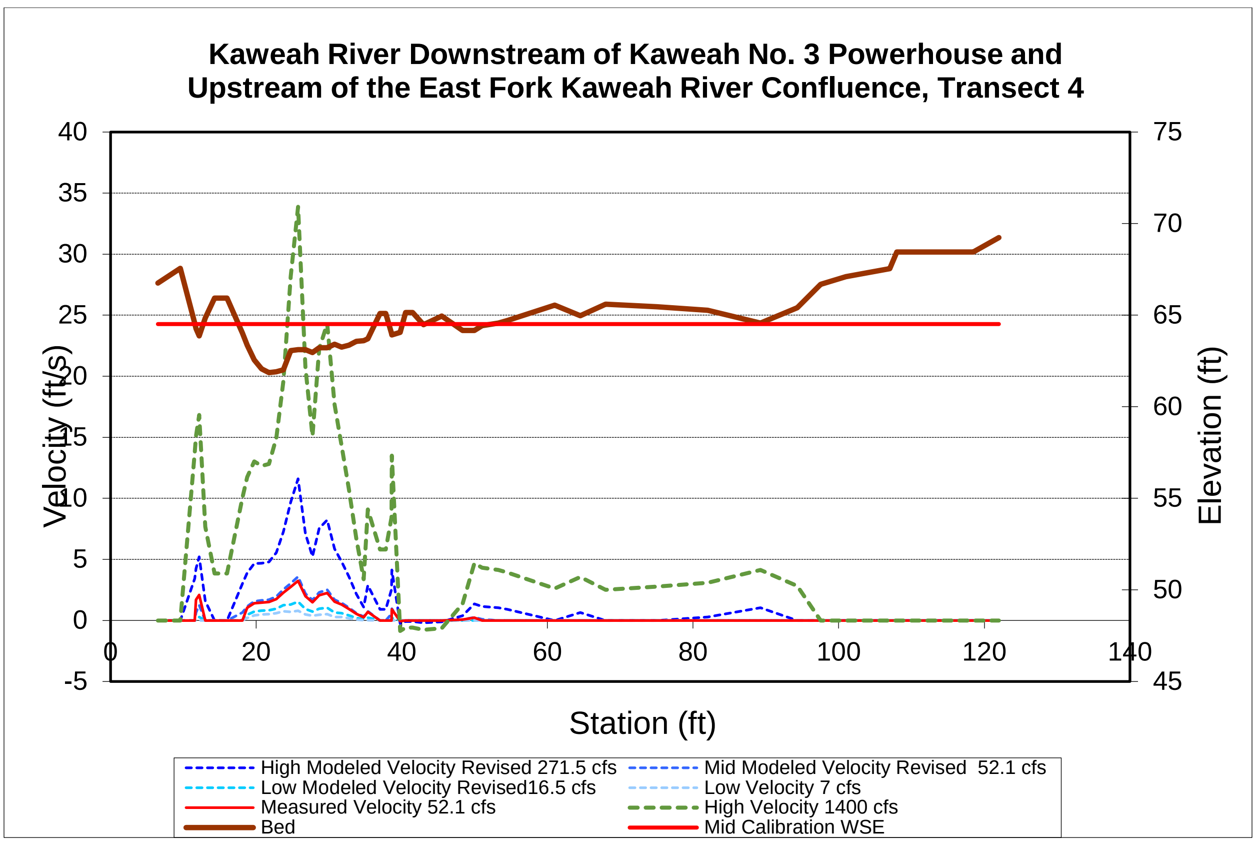

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
-20
0
20
40
60
80
100
120
140
-1
0
1
2
3
4
5
6
7
8
9
45
47
49
51
53
55
57
59
61
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

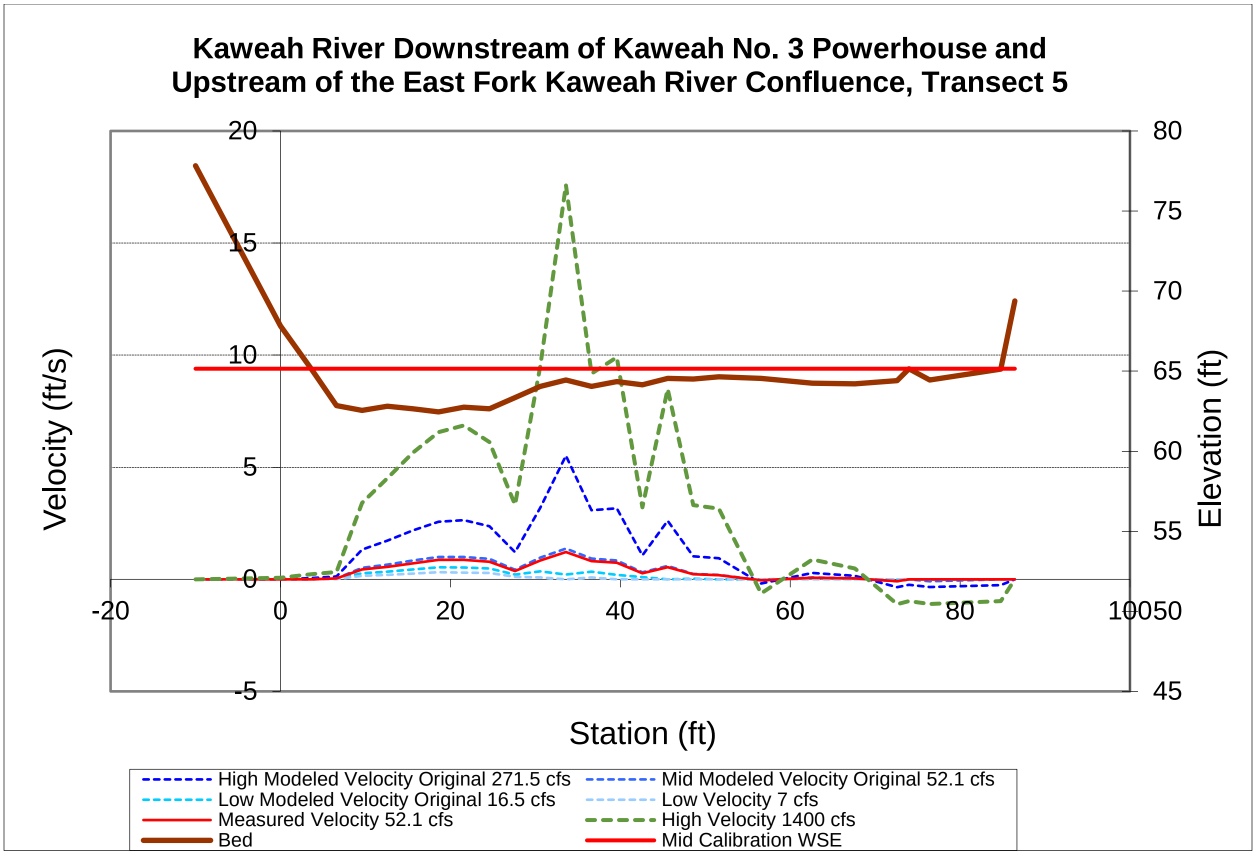

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
-20
0
20
40
60
80
100
120
140
-2
0
2
4
6
8
10
12
14
16
18
45
47
49
51
53
55
57
59
61
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

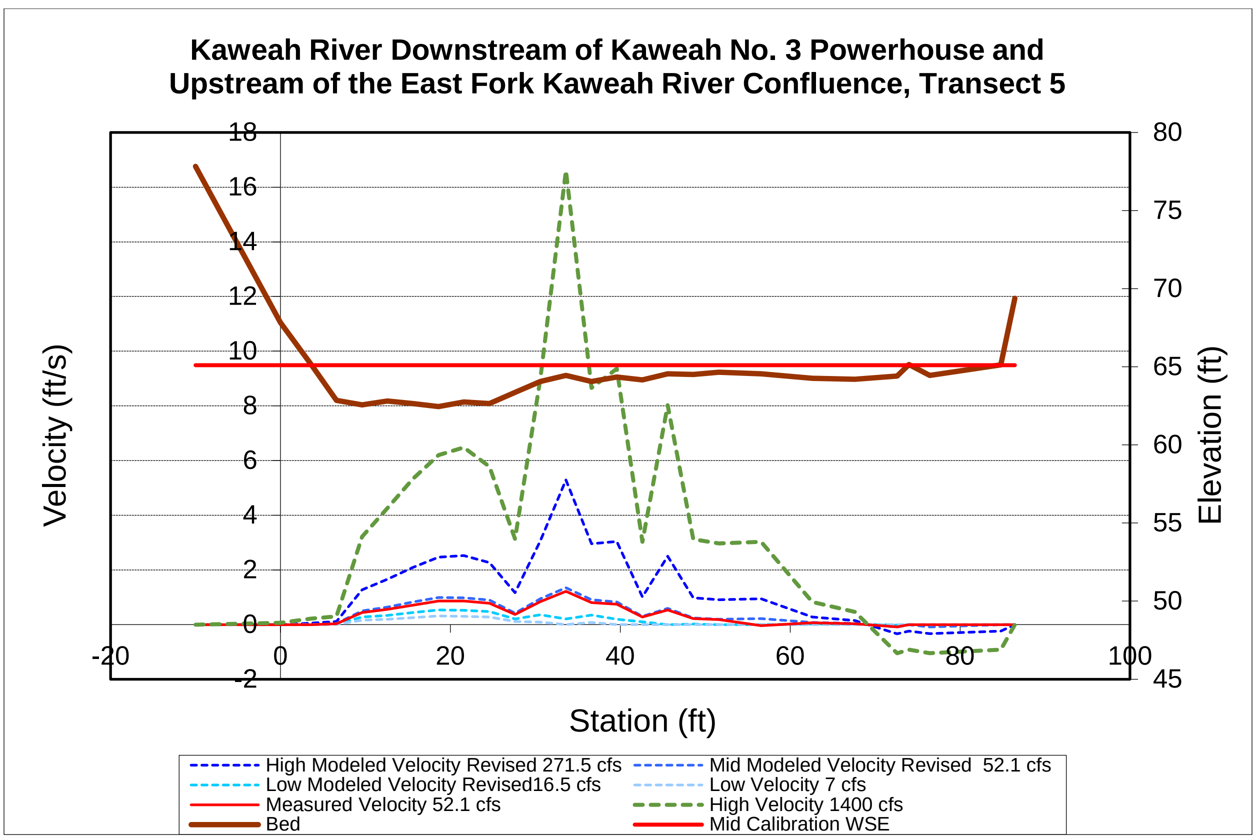

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

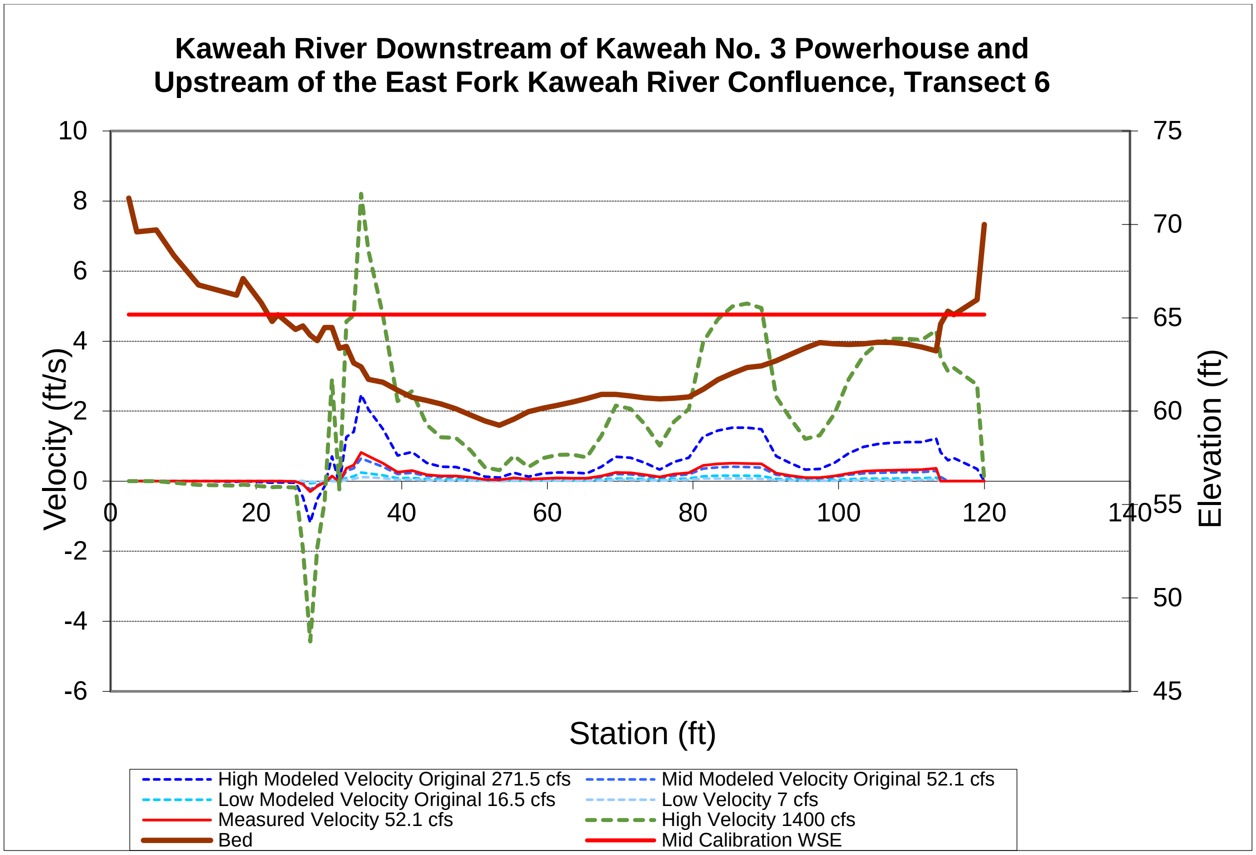

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

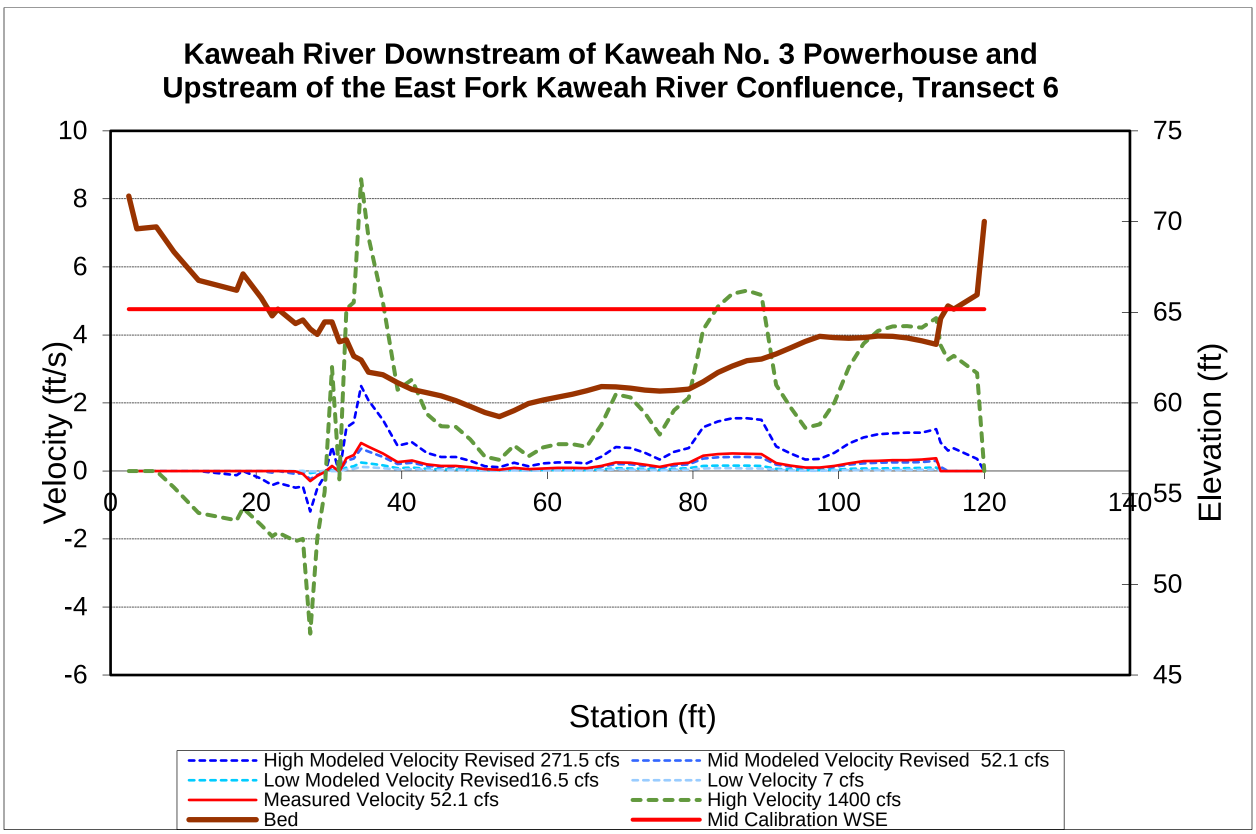

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
40
35
30
25
20
15
10
5
0
-5
75
70
65
60
55
50
45
0
20
40
60
80
100
120
140
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

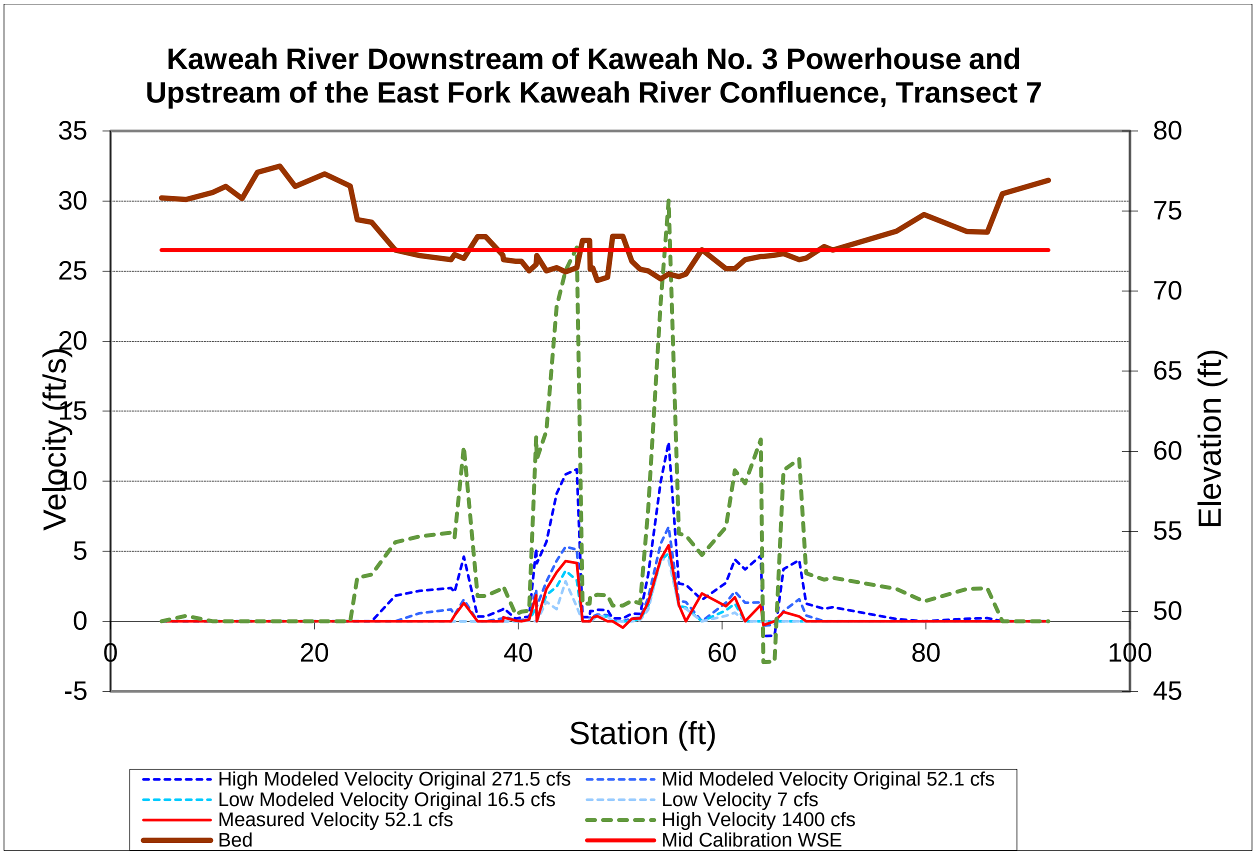

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
40
35
30
25
20
15
10
5
0
-5
75
70
65
60
55
50
45
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

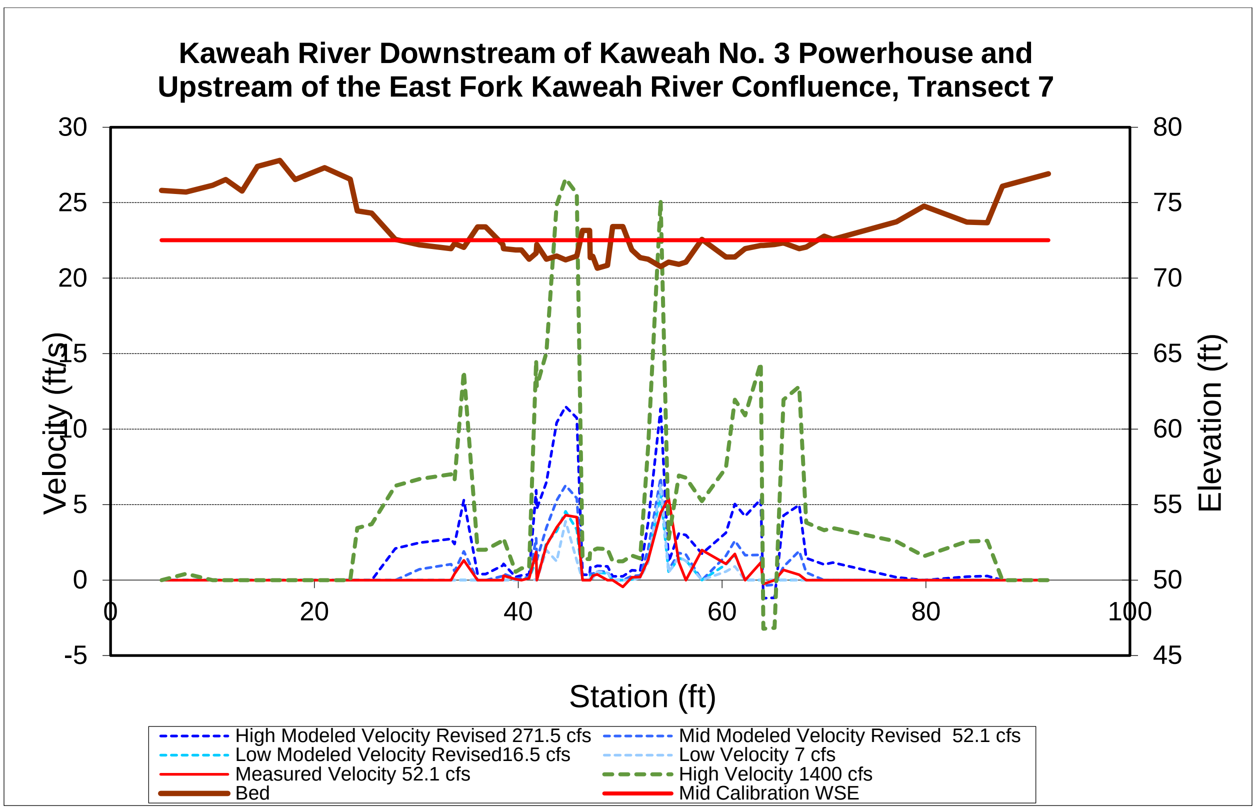

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

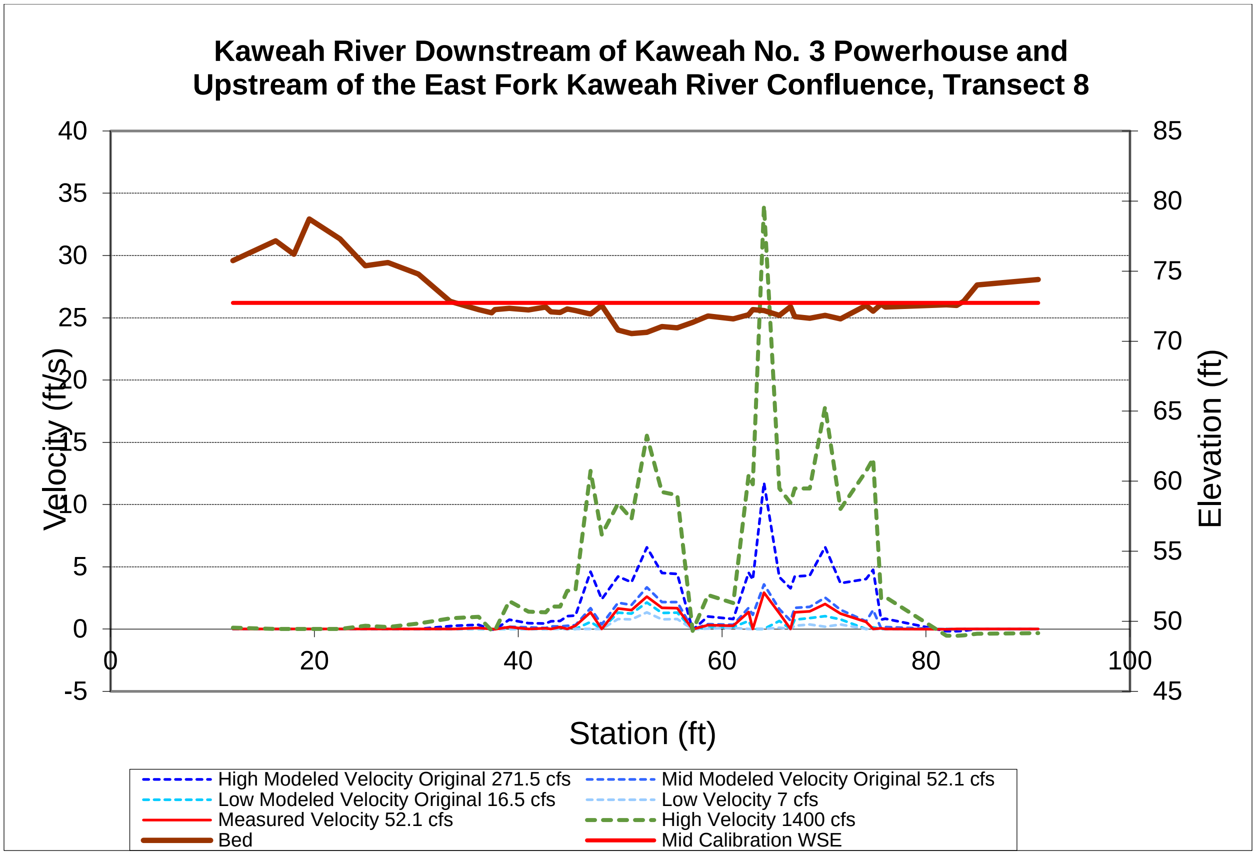

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

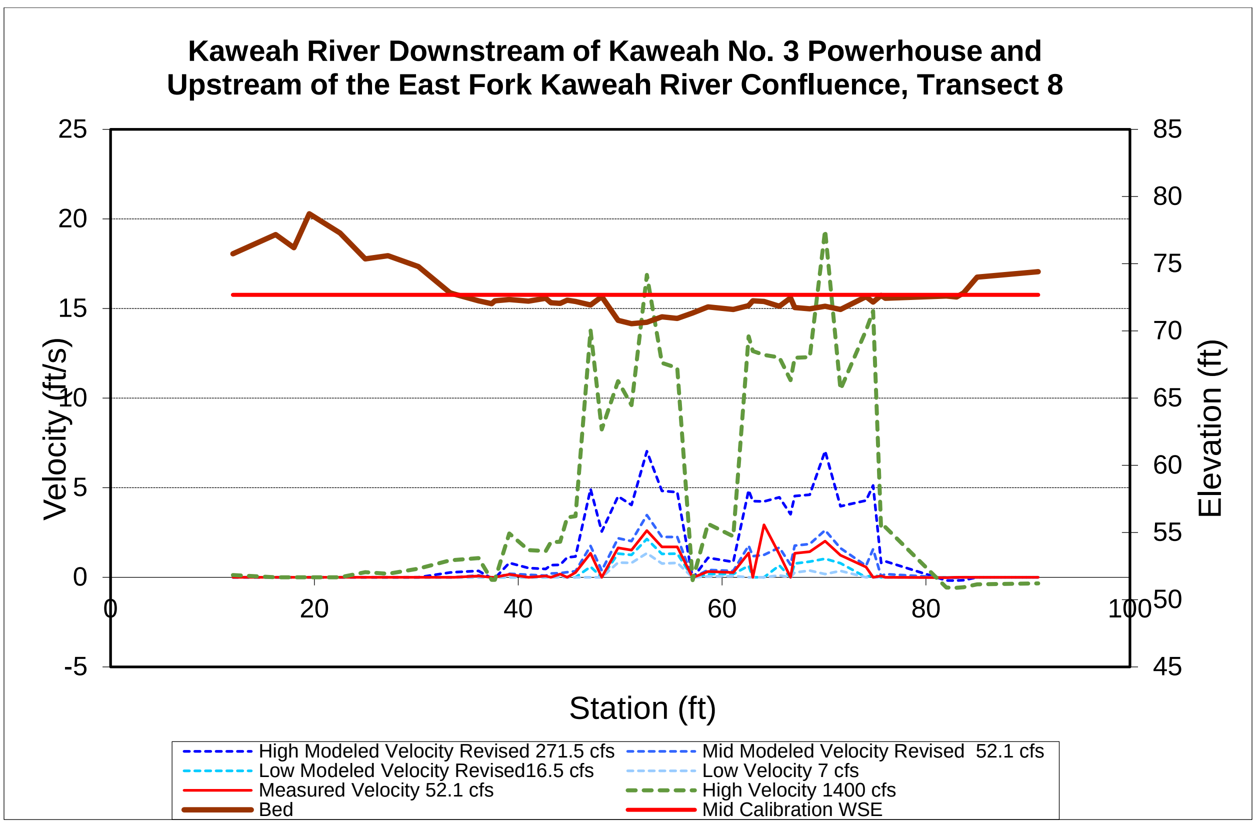

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

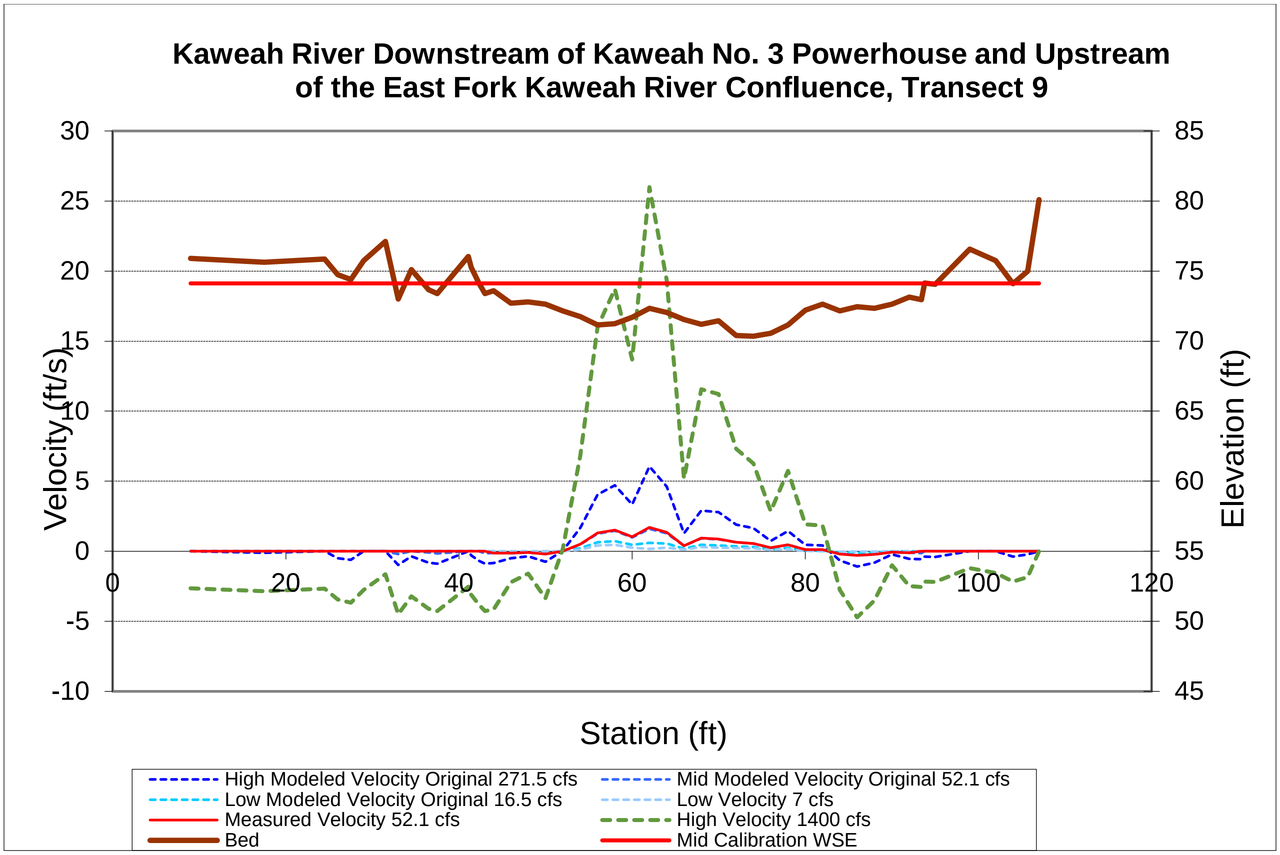

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

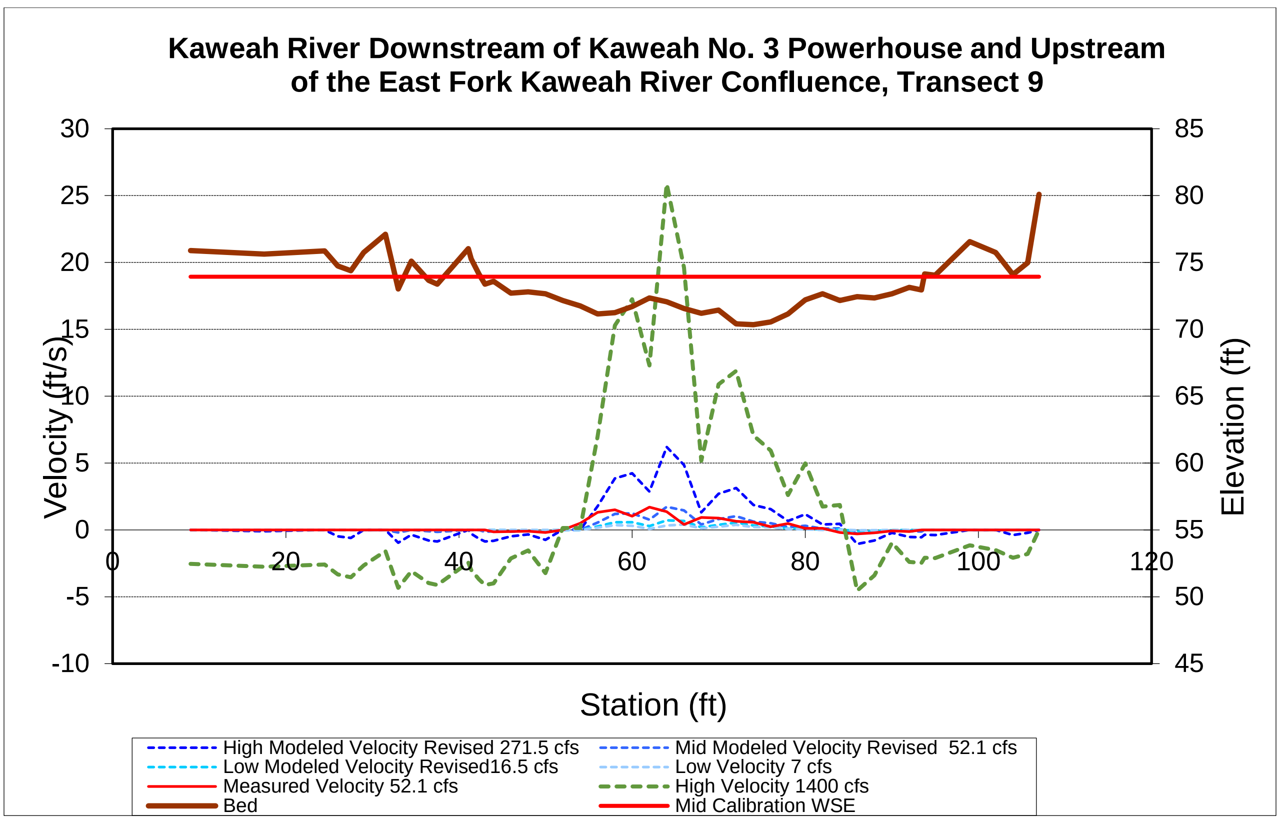


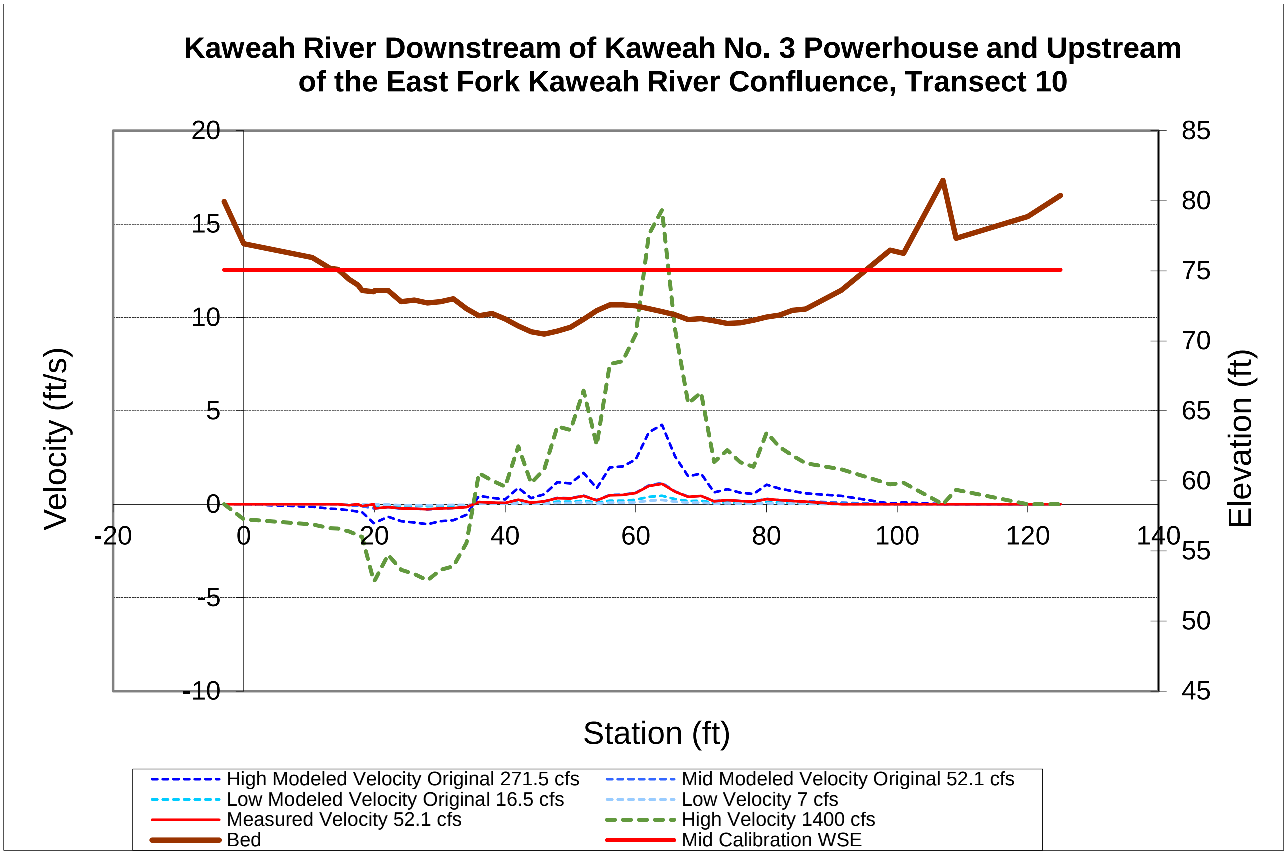
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
40
35
30
25
20
15
10
5
0
-5
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

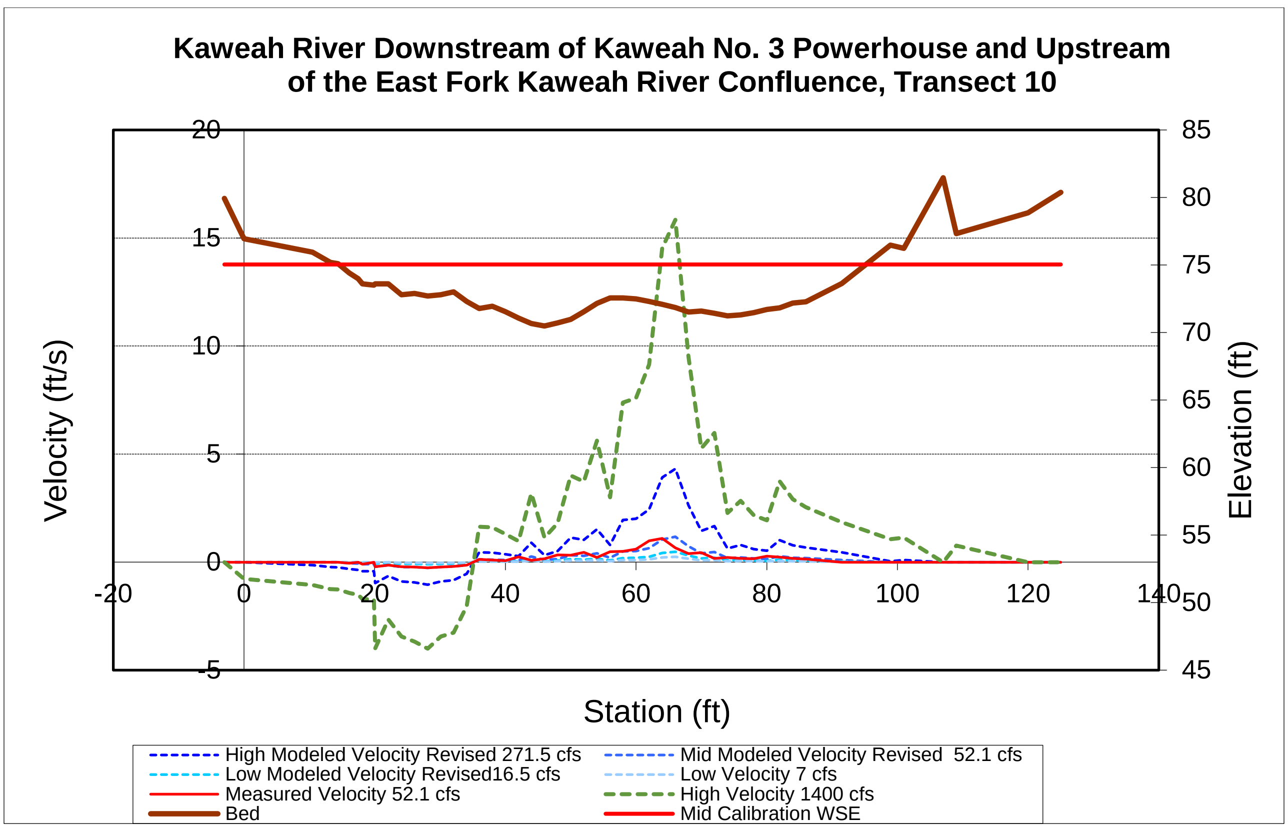


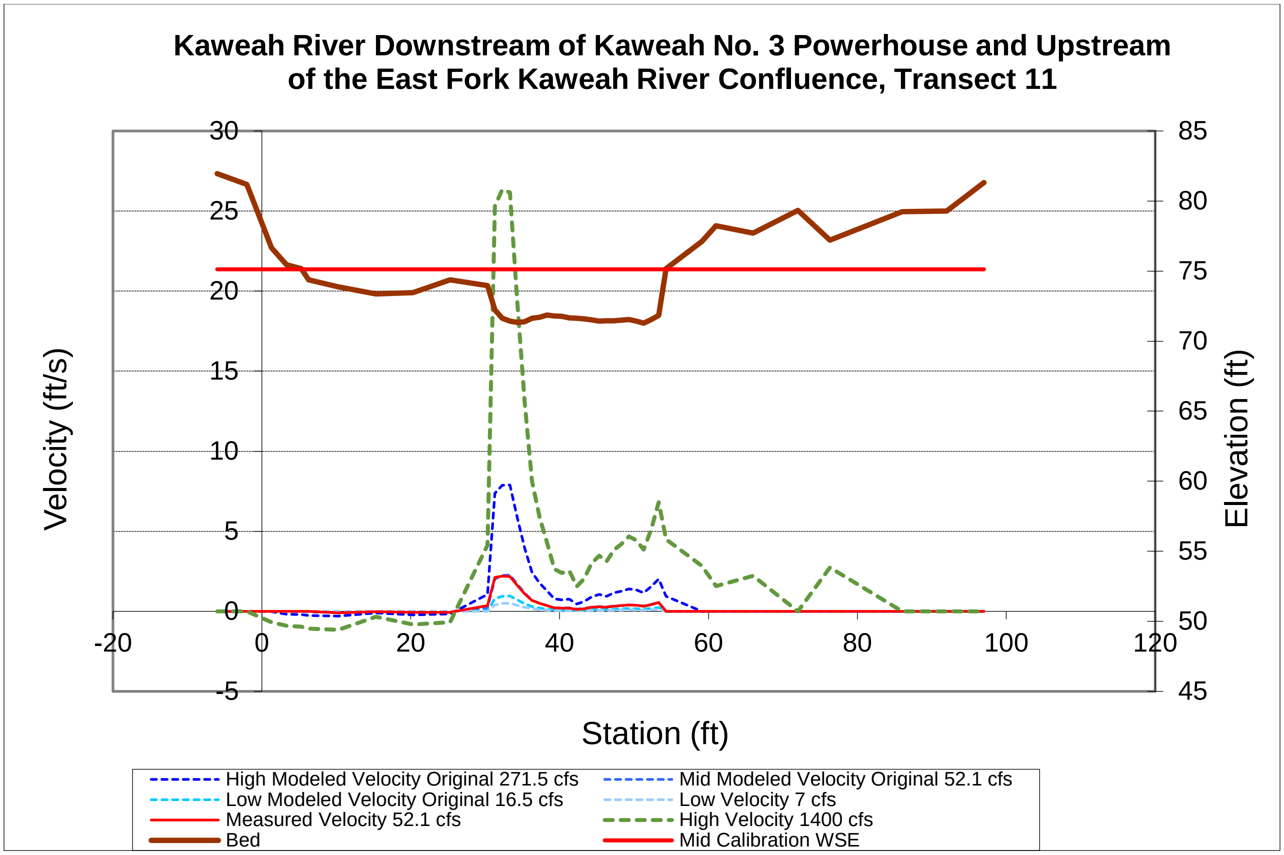
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

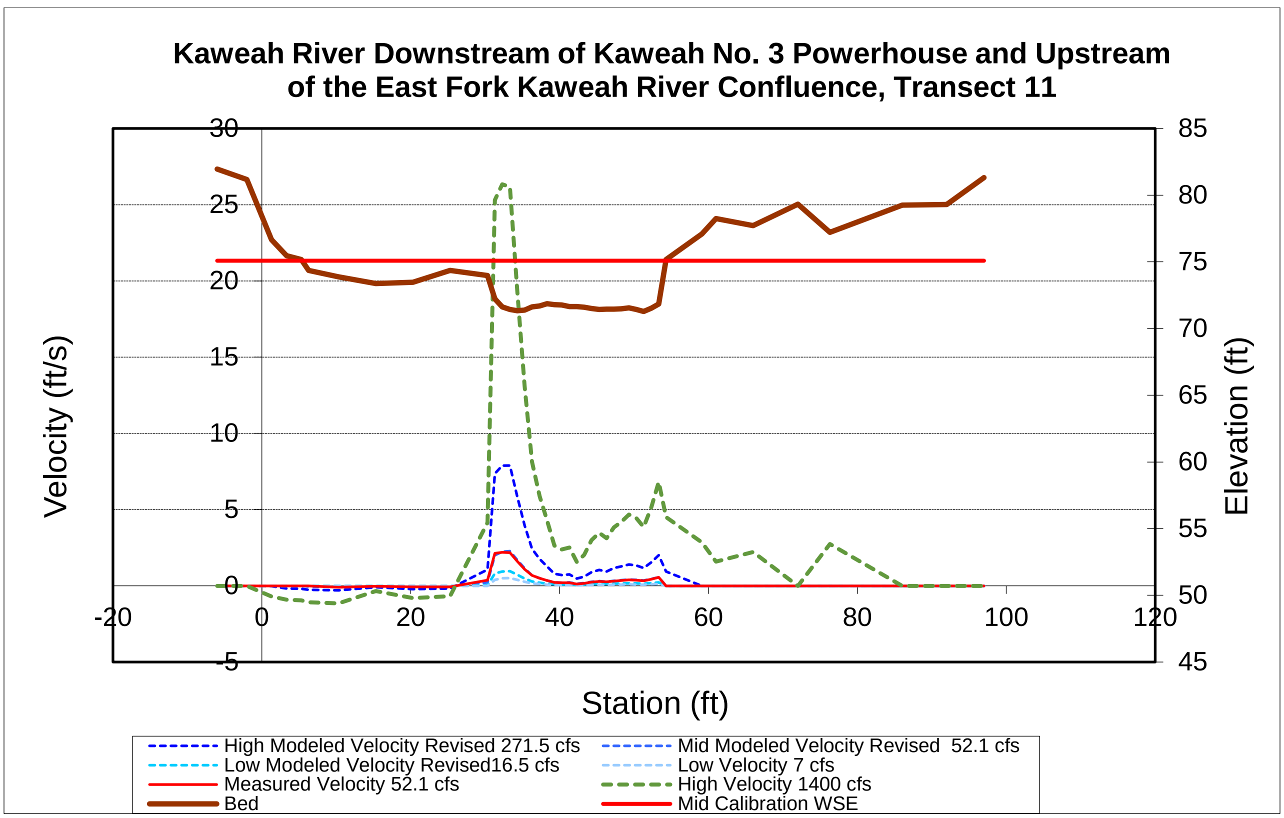

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

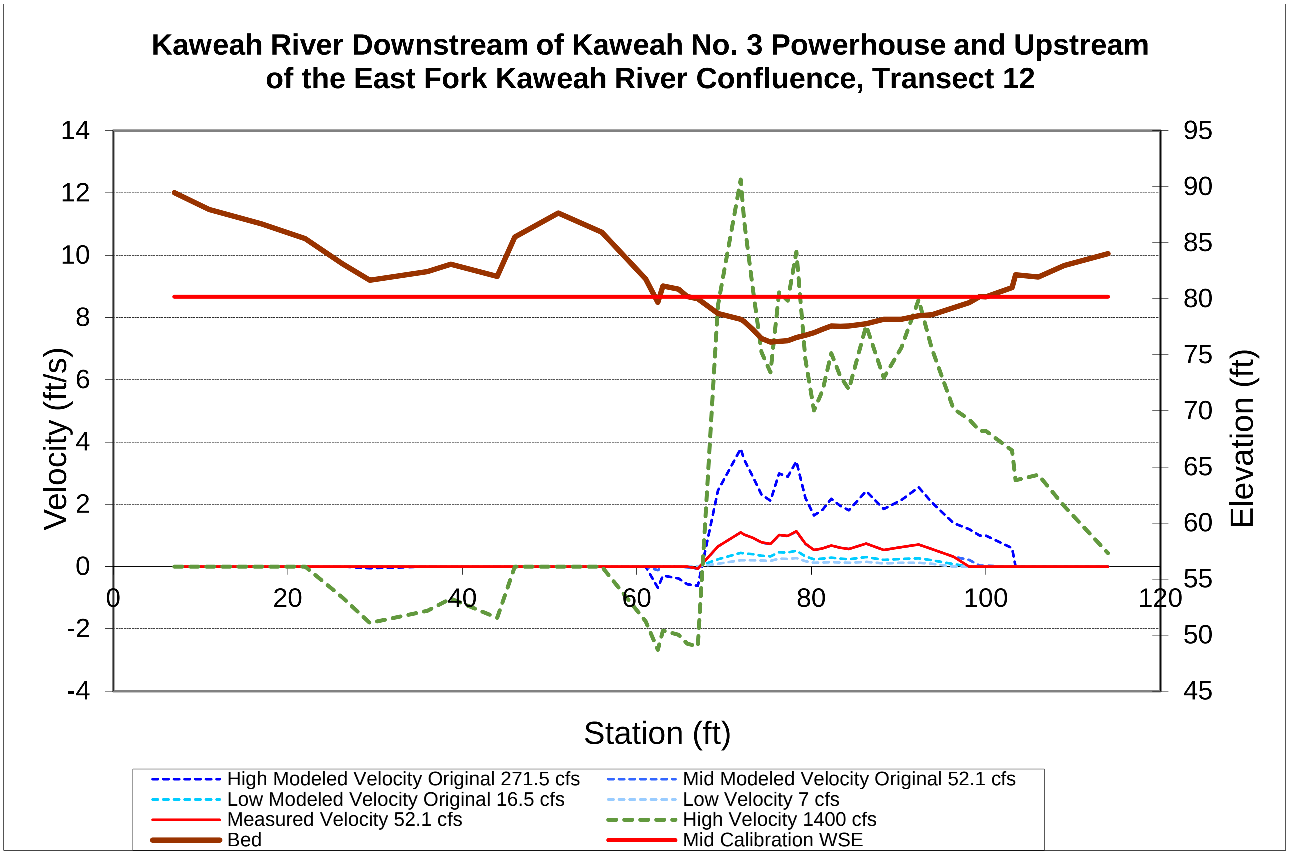

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

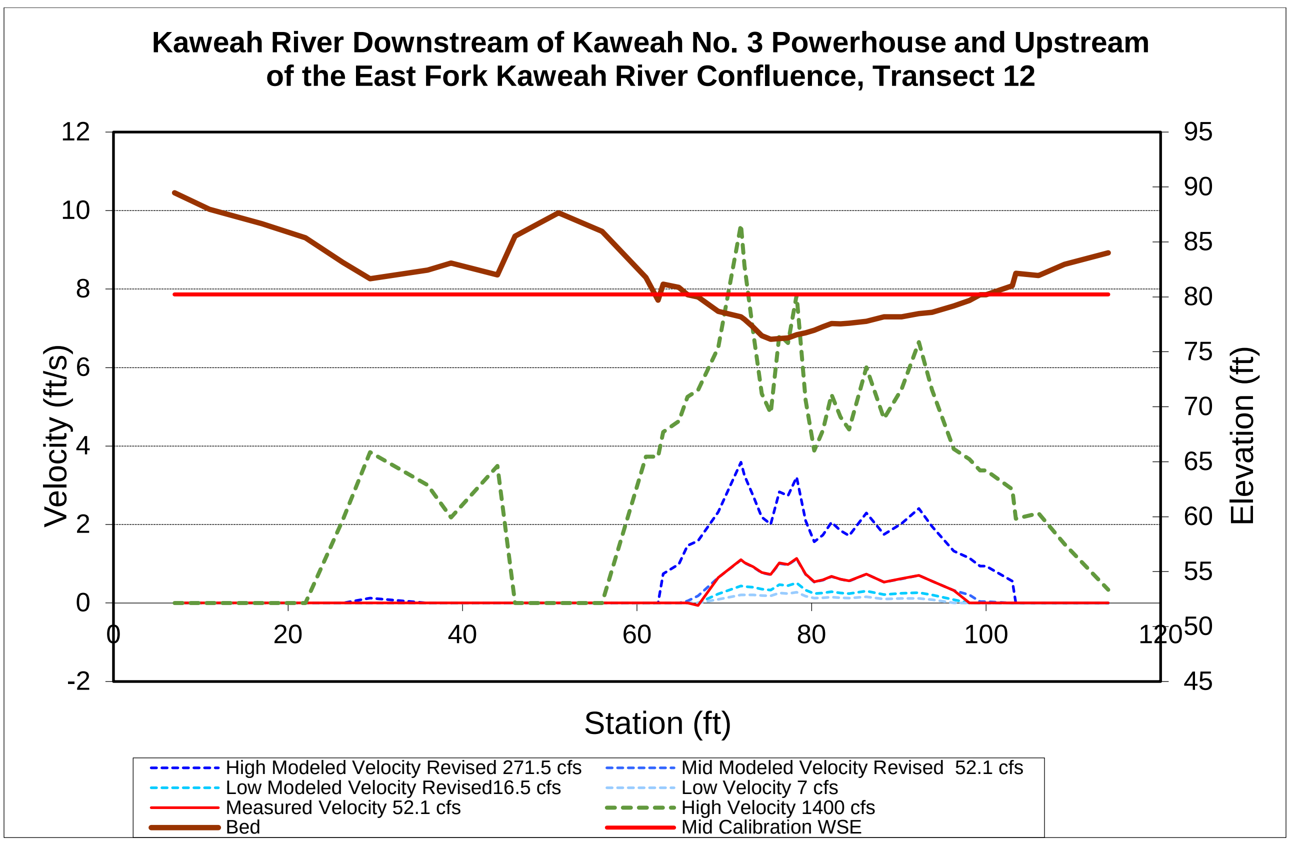

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

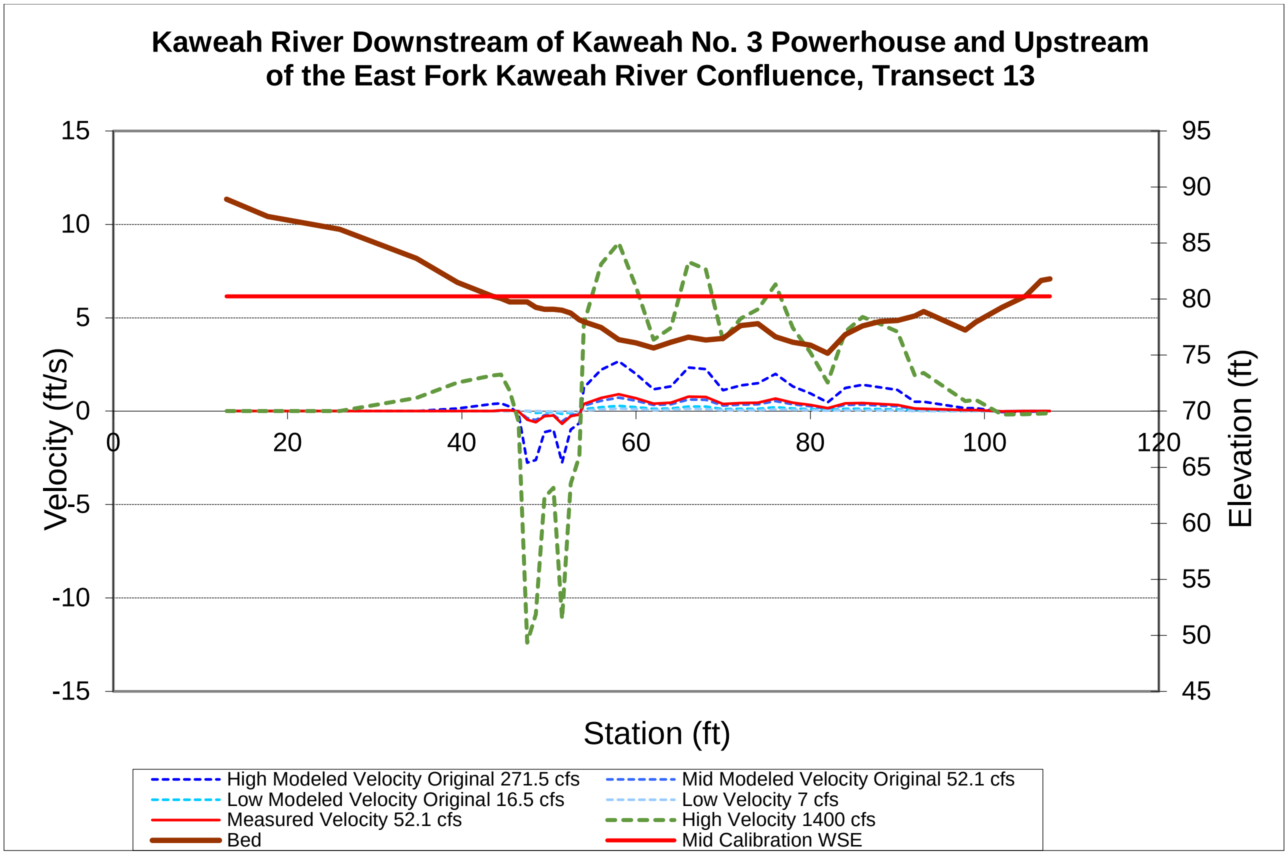

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

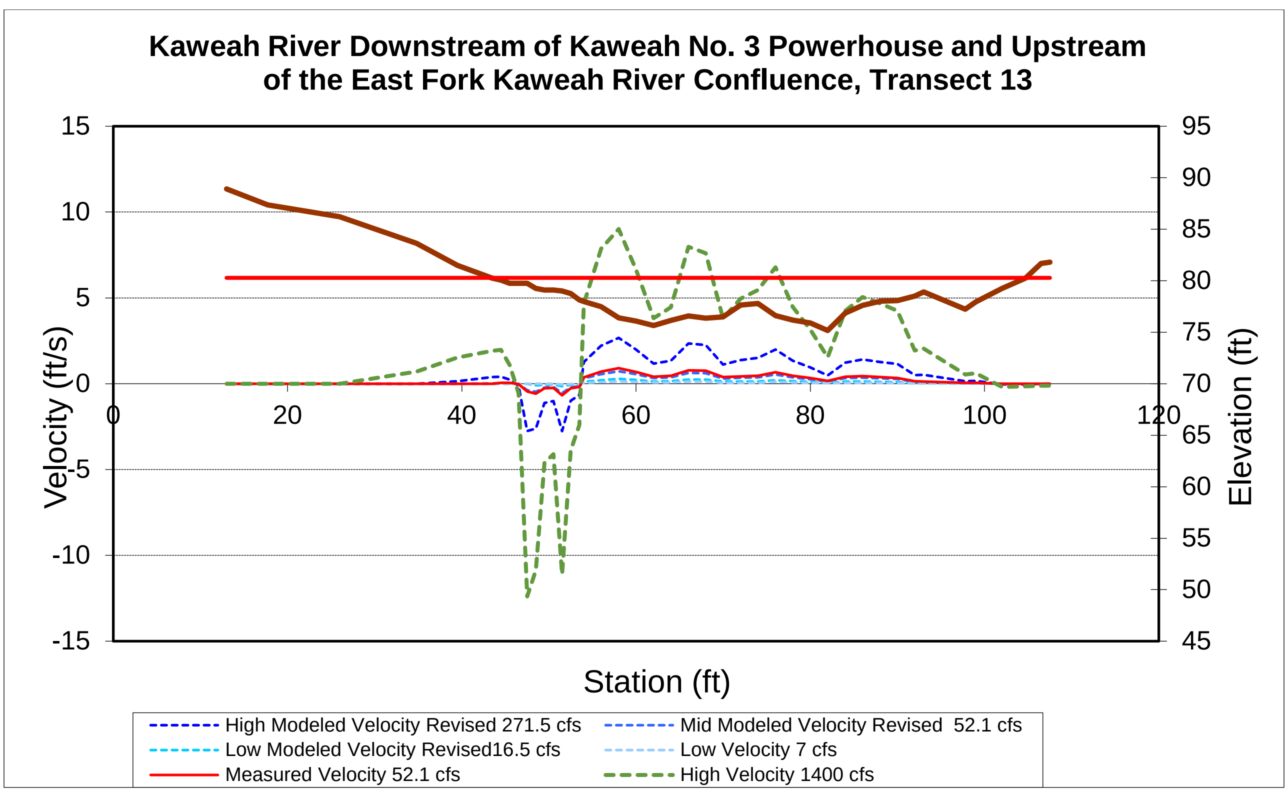


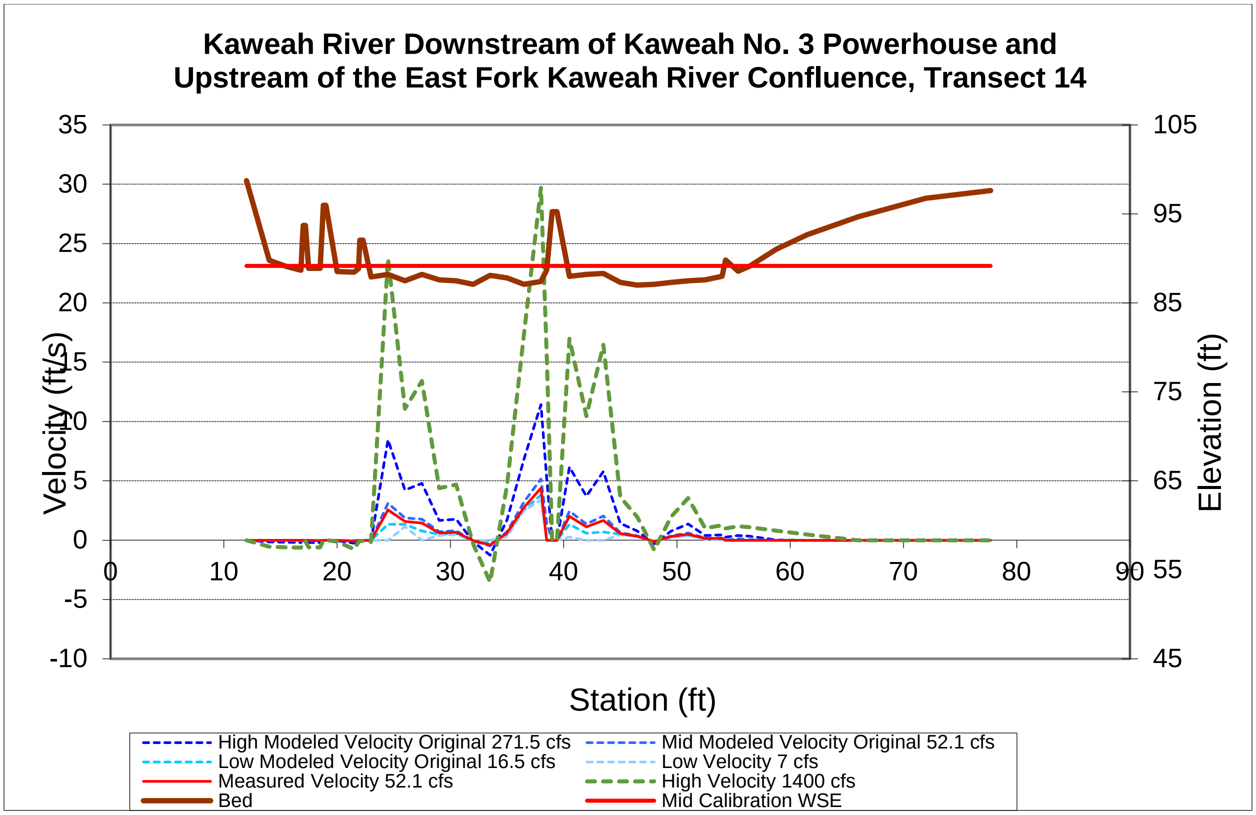
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
14
12
10
8
6
4
2
0
-2
-4
95
90
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
120
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

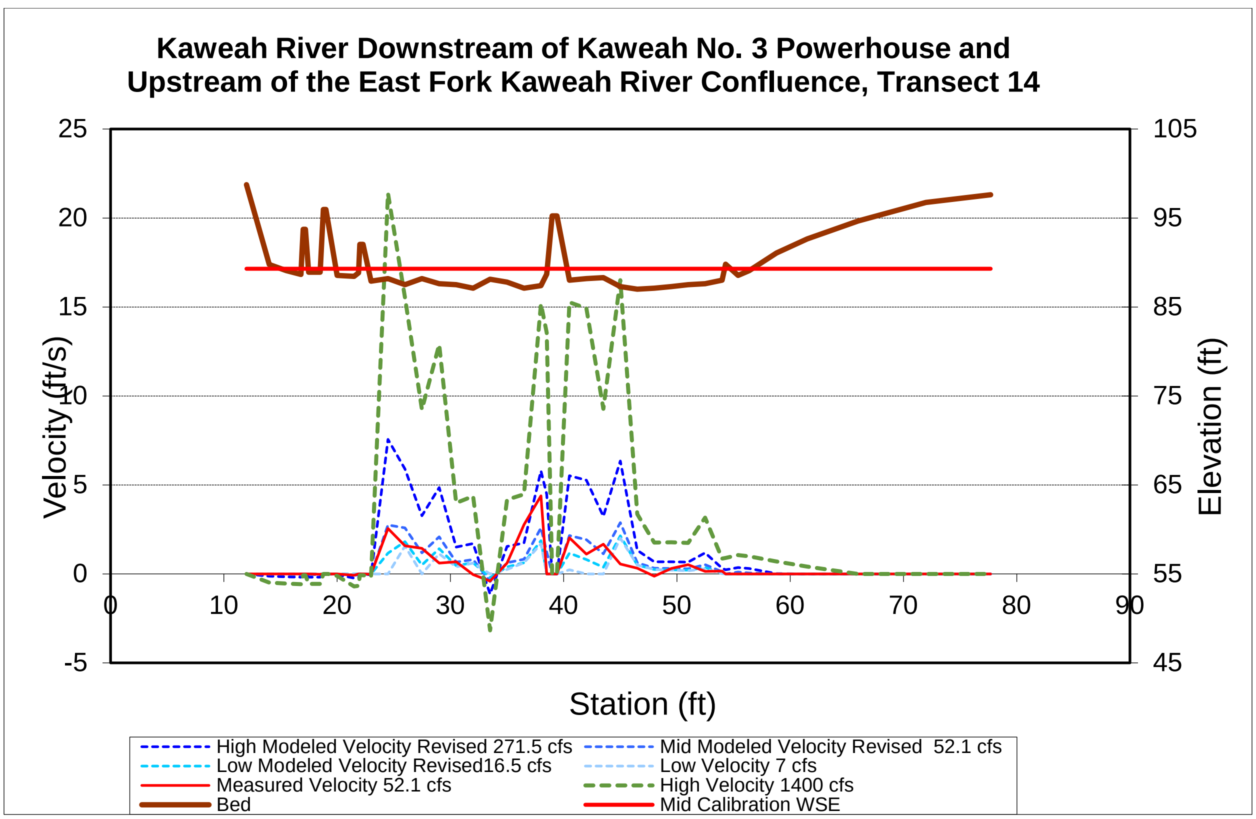


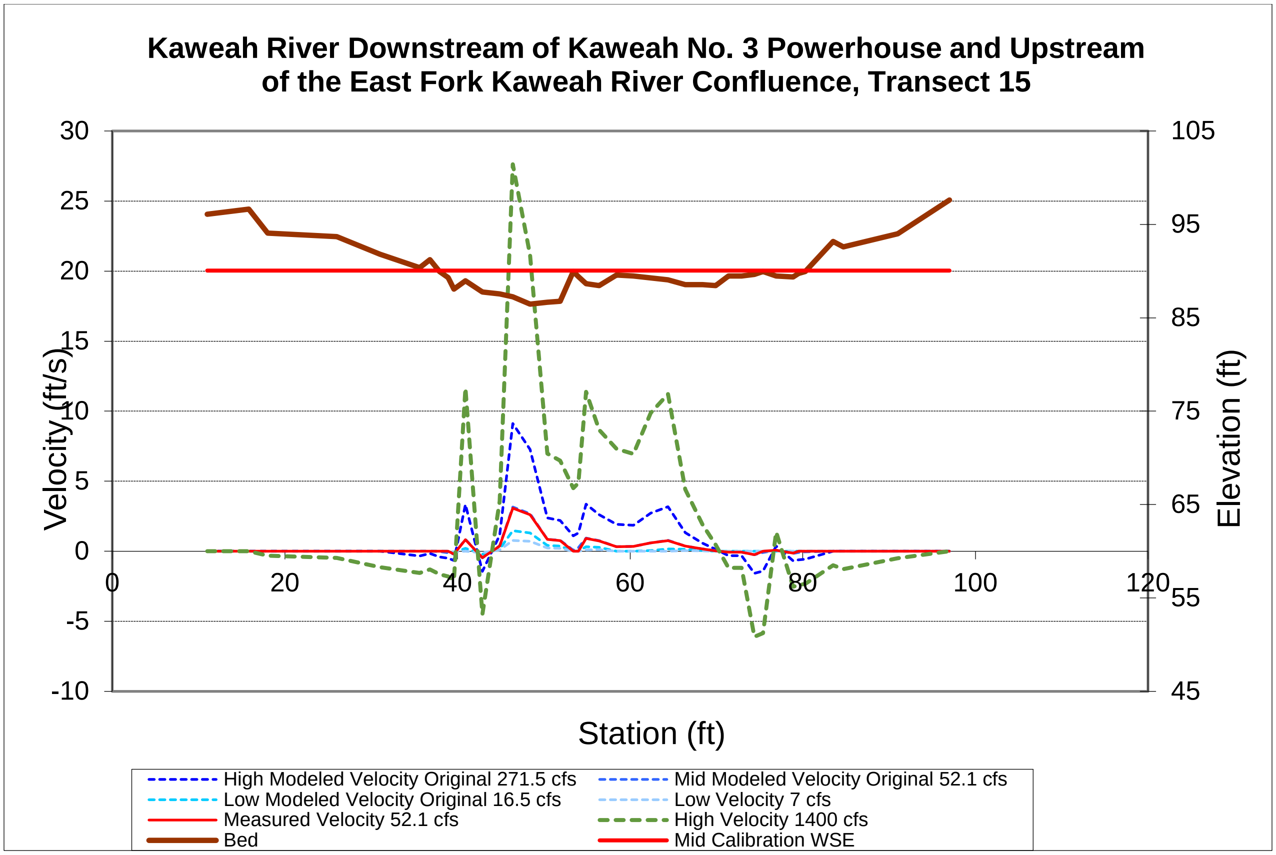
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
12
10
8
6
4
2
0
-2
95
90
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
120
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

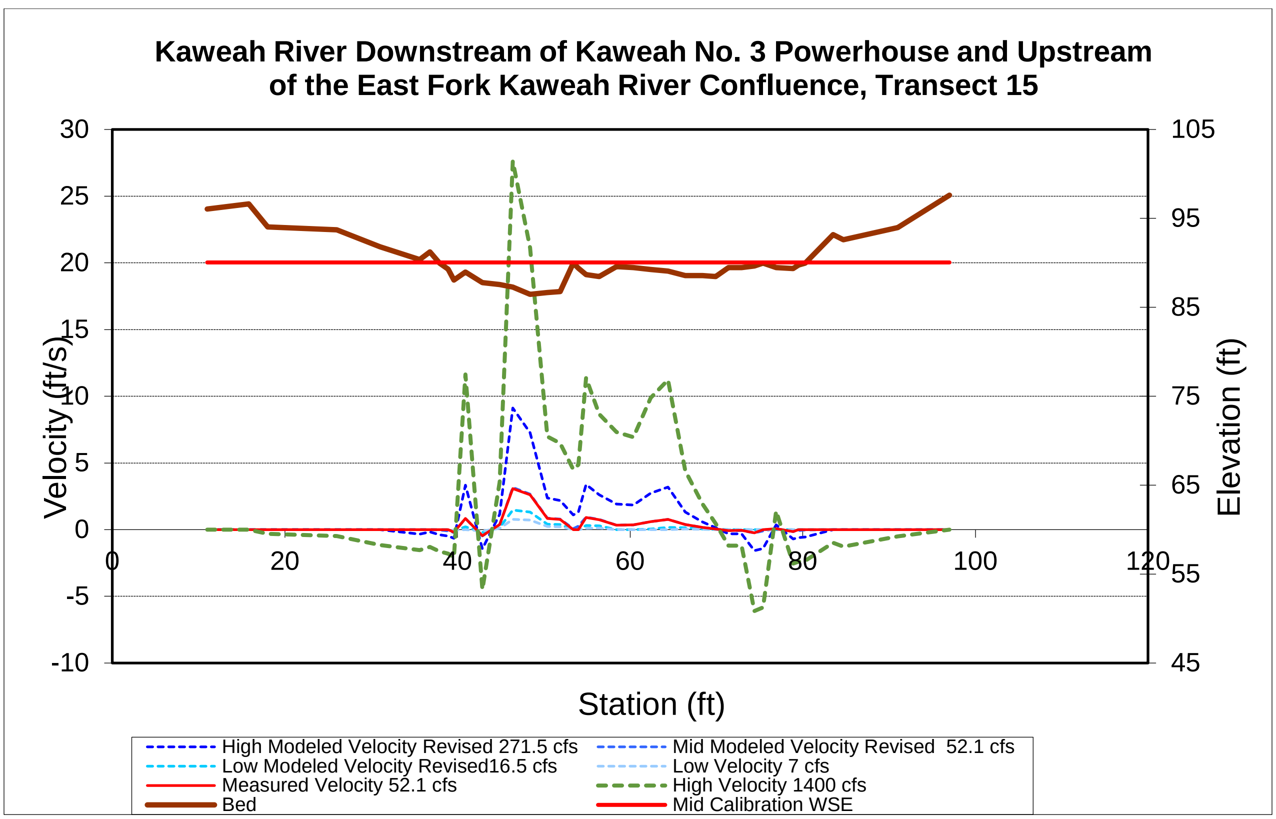

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 13
Velocity (ft/s)
Elevation (ft)
Station (ft)
15
10
5
0
-5
-10
-15
95
90
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
120
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

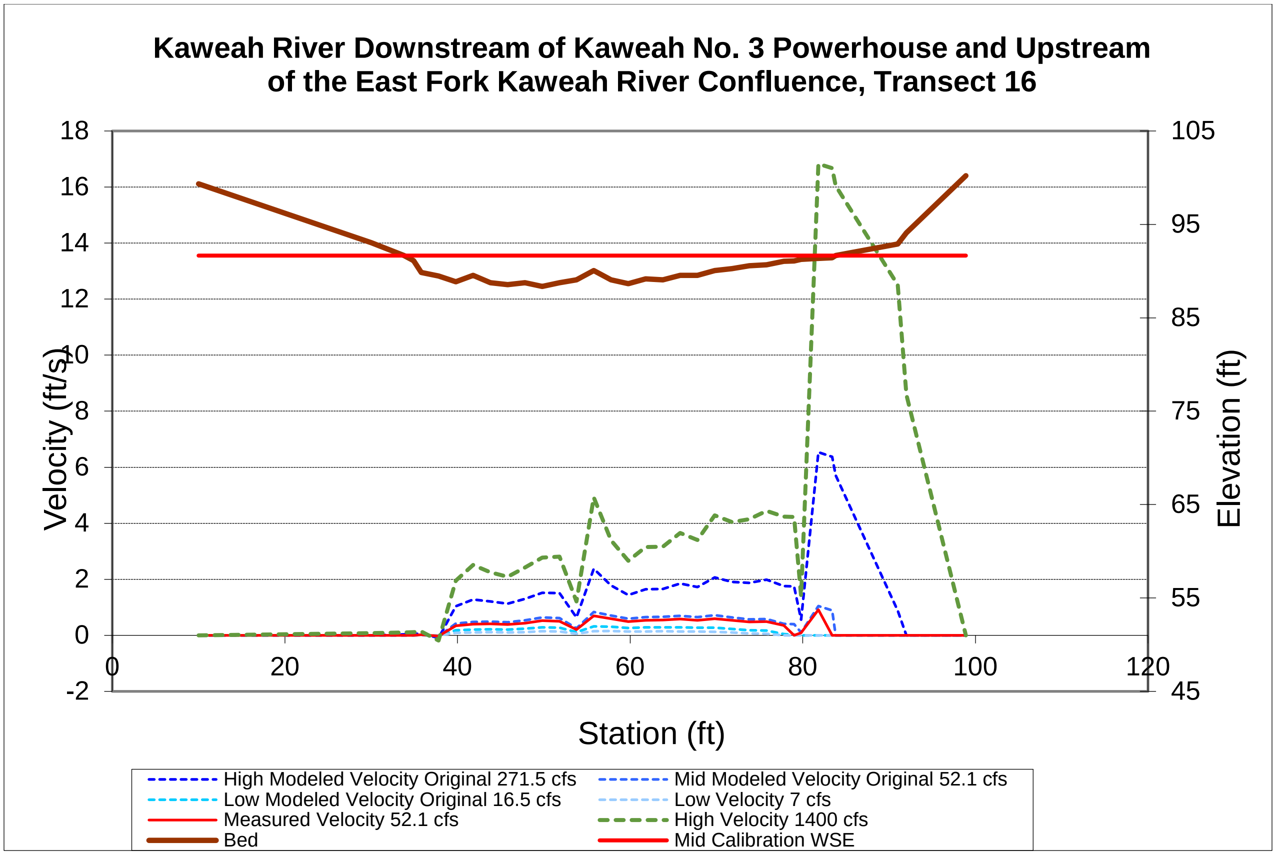

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 13
Velocity (ft/s)
Elevation (ft)
Station (ft)
15
10
5
0
-5
-10
-15
95
90
85
80
75
70
65
60
55
50
45
0
20
40
60
80
100
120
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs

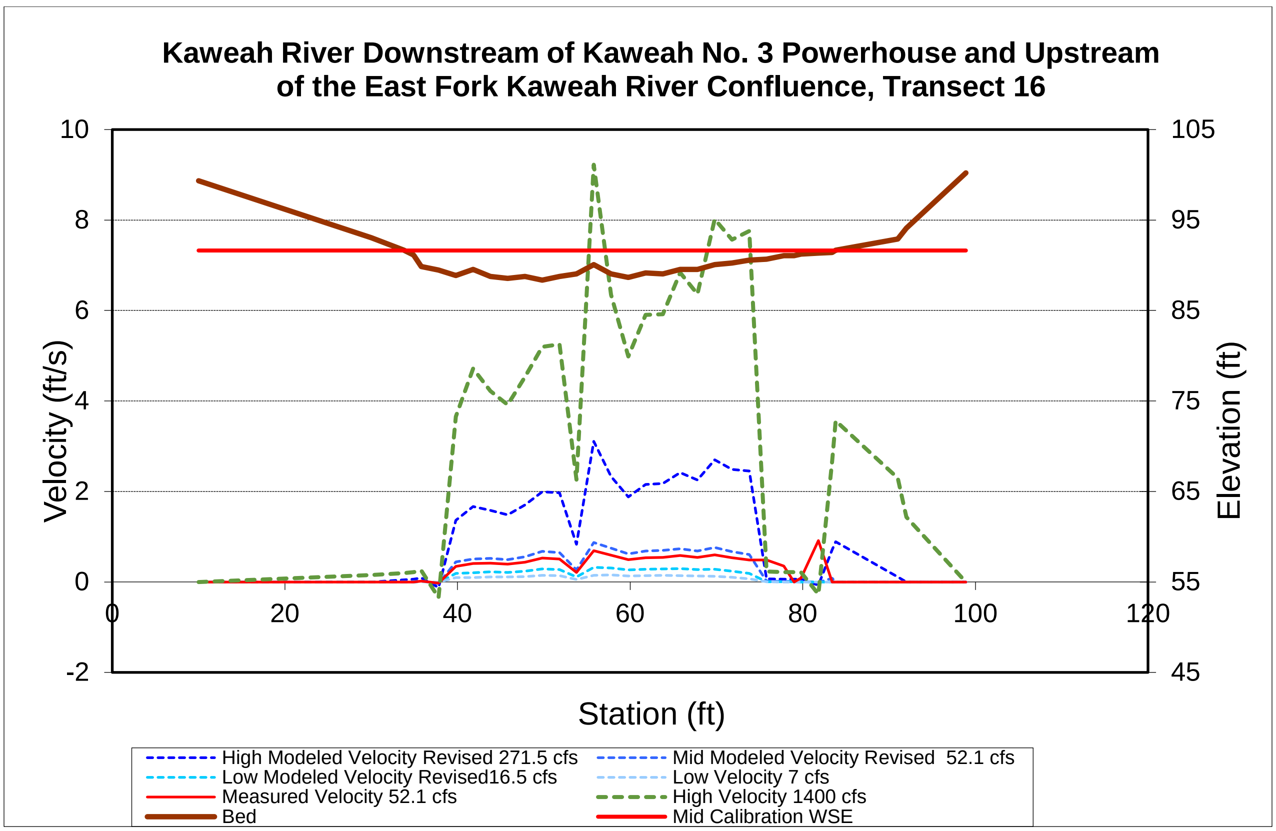

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 14
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

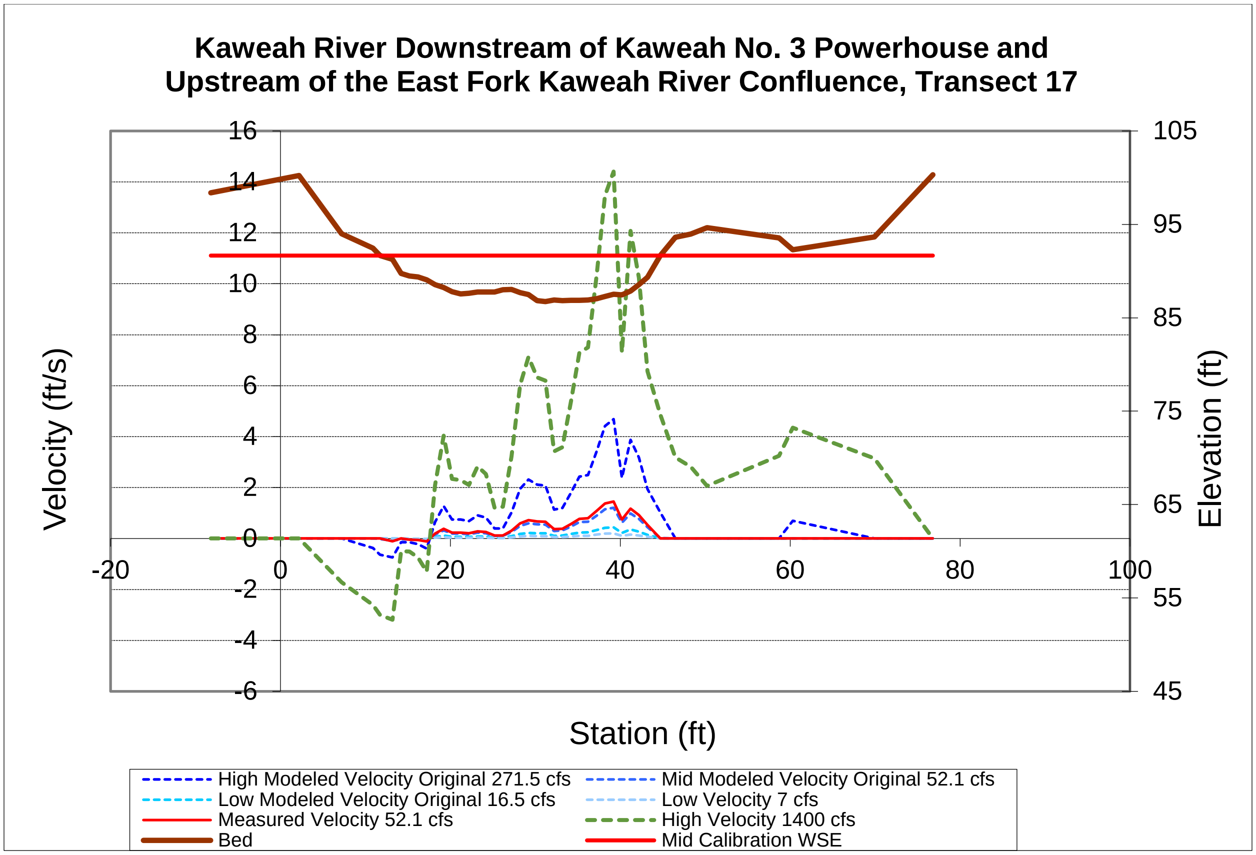

Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 14
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

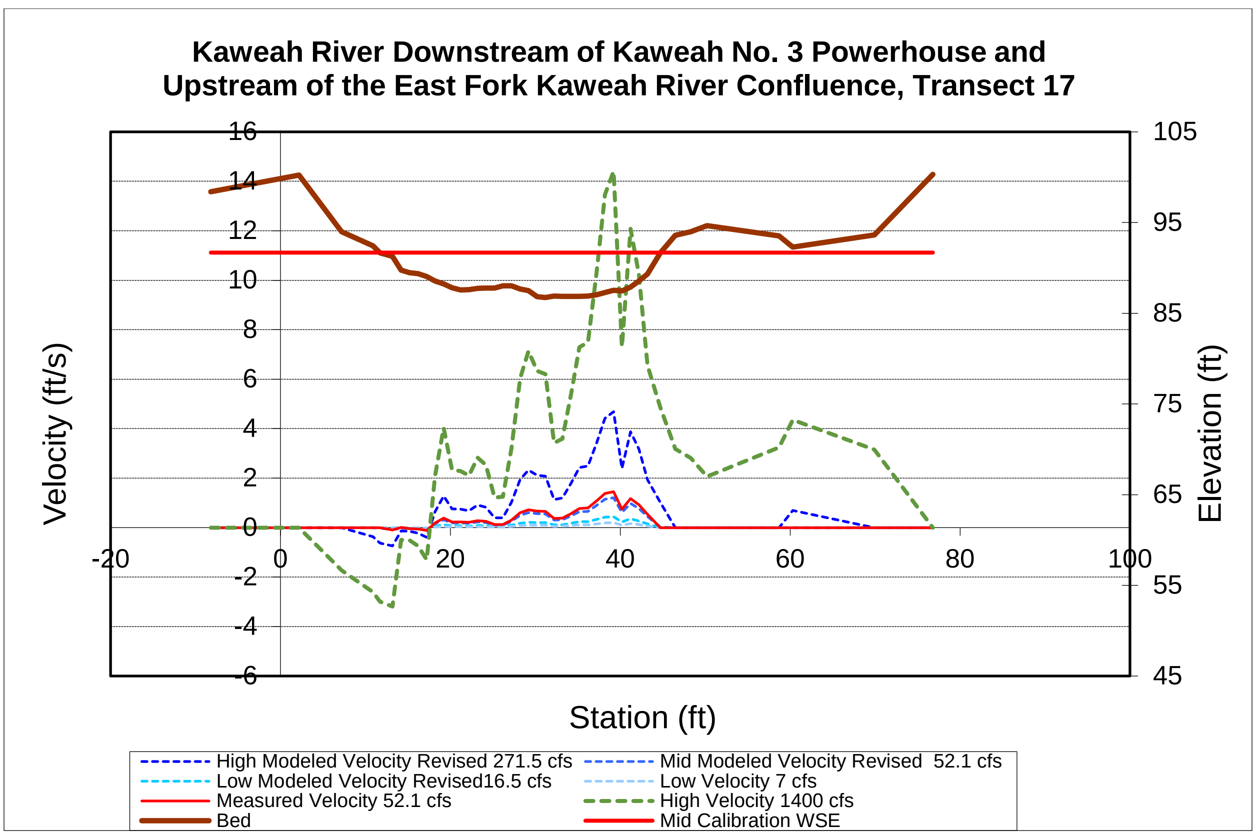

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 15
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
-10
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

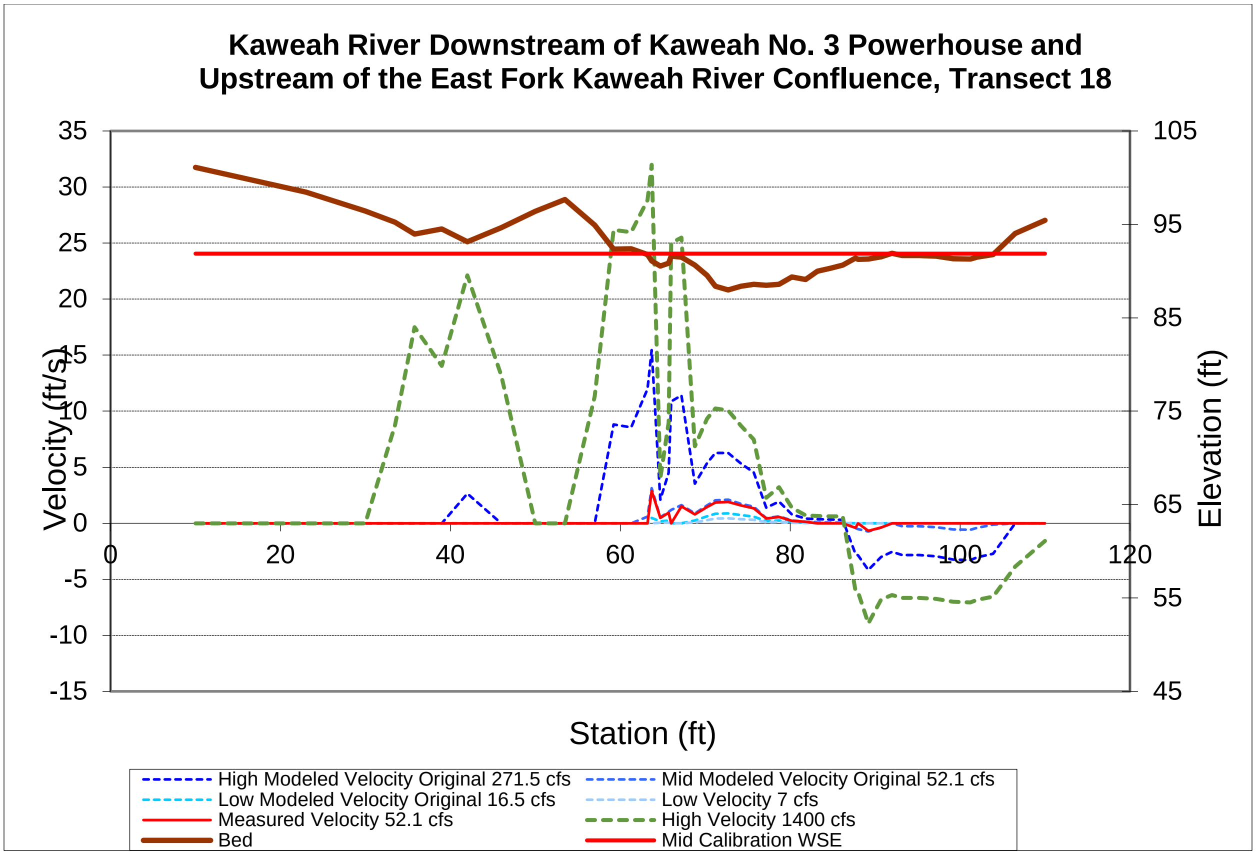

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 15
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
-10
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 16
Velocity (ft/s)
Elevation (ft)
Station (ft)
18
16
14
12
10
8
6
4
2
0
-2
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

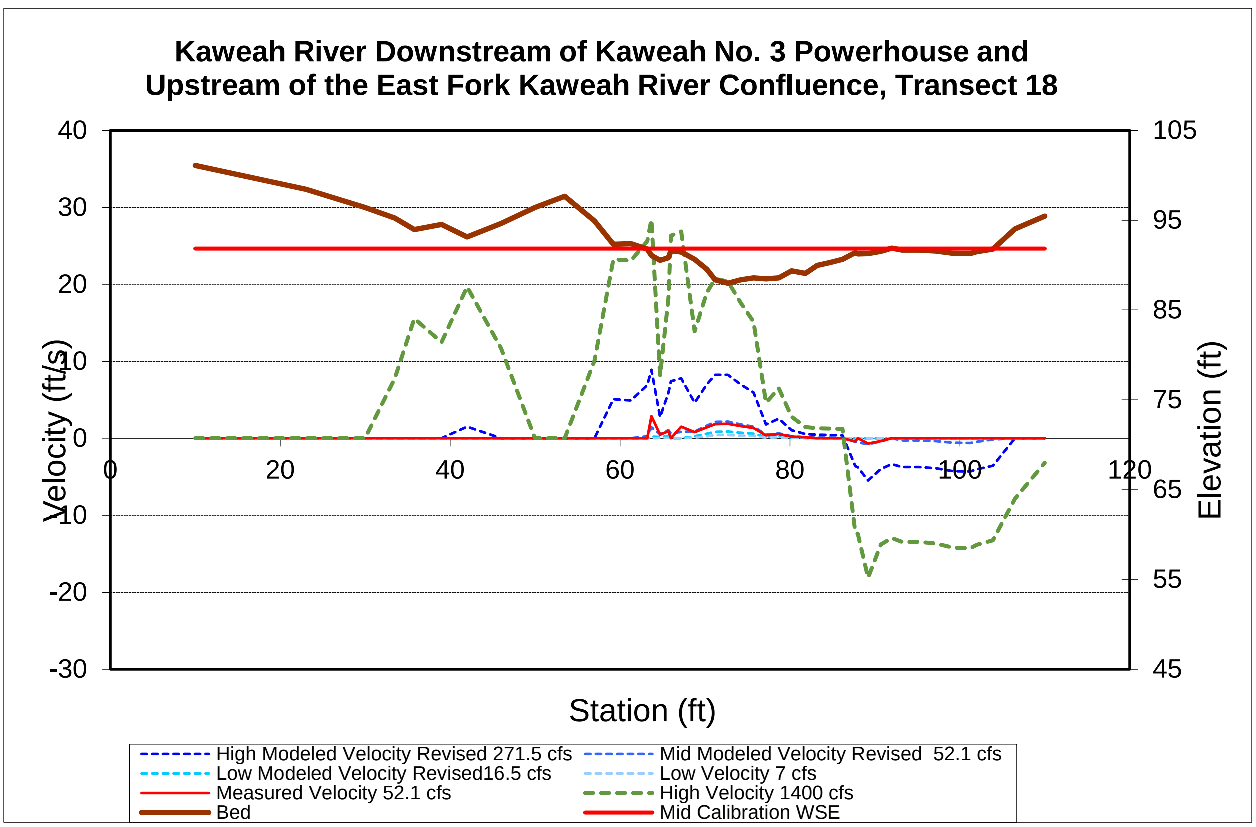

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 16
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 17
Velocity (ft/s)
Elevation (ft)
Station (ft)
16
14
12
10
8
6
4
2
0
-2
-4
-6
105
95
85
75
65
55
45
-20
0
20
40
60
80
100
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence, Transect 17
Velocity (ft/s)
Elevation (ft)
Station (ft)
16
14
12
10
8
6
4
2
0
-2
-4
-6
105
95
85
75
65
55
45
-20
0
20
40
60
80
100
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

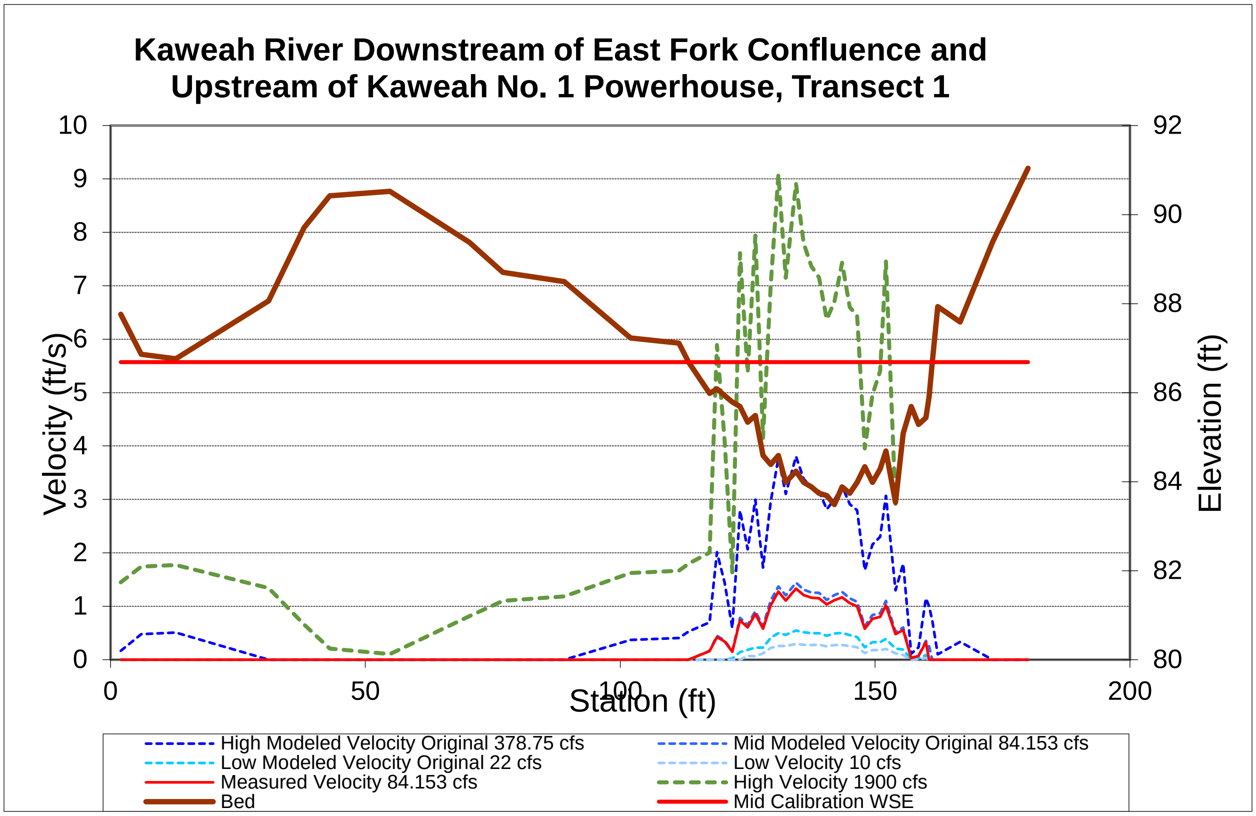


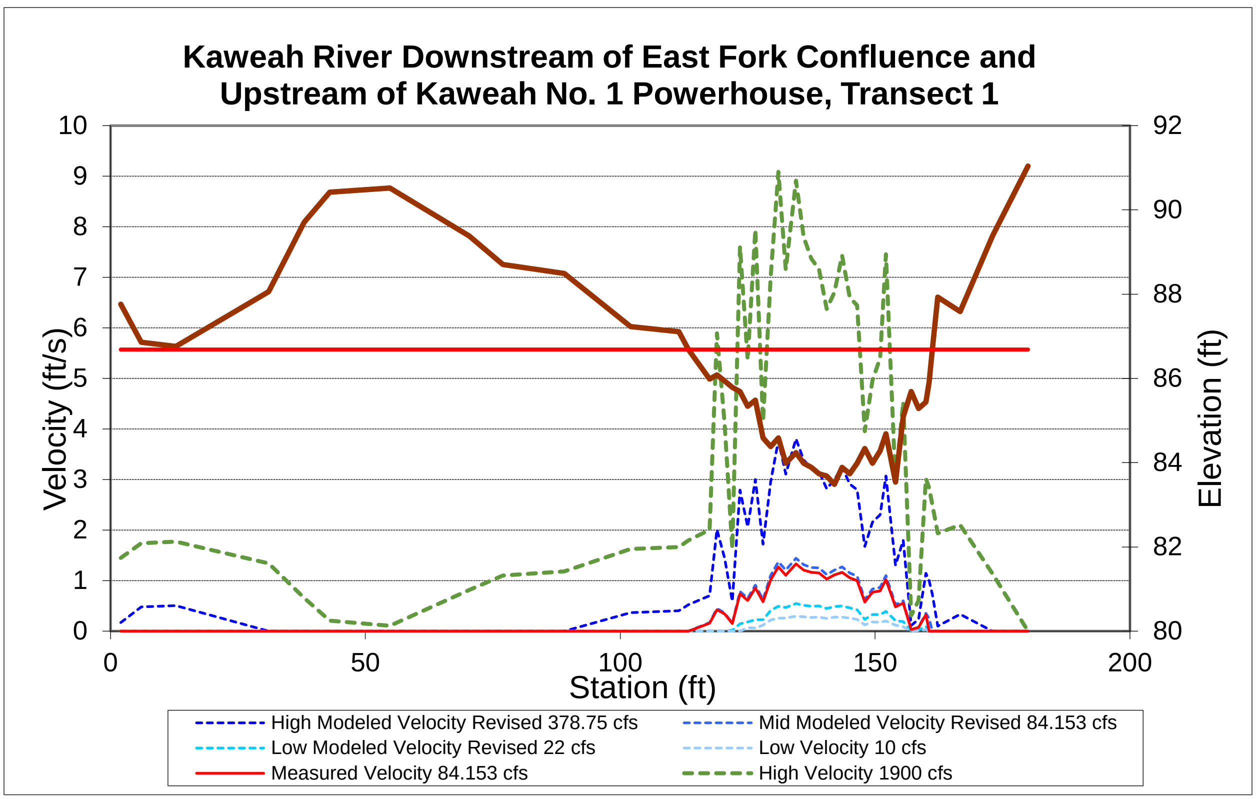
Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 18
Velocity (ft/s)
Elevation (ft)
Station (ft)
35
30
25
20
15
10
5
0
-5
-10
-15
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Original 271.5 cfs
Mid Modeled Velocity Original 52.1 cfs
Low Modeled Velocity Original 16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

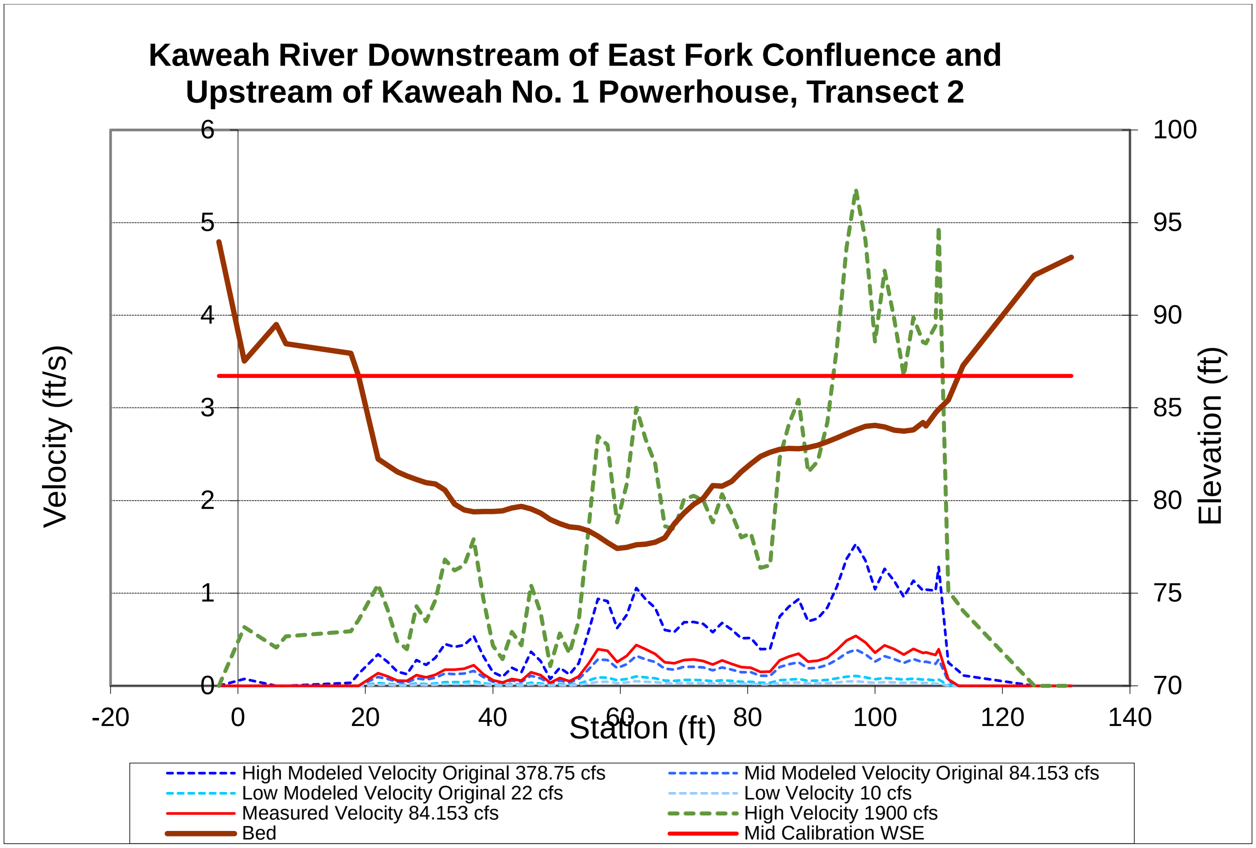


Kaweah River Downstream of Kaweah No. 3 Powerhouse and
Upstream of the East Fork Kaweah River Confluence, Transect 18
Velocity (ft/s)
Elevation (ft)
Station (ft)
40
30
20
10
0
-10
-20
-30
105
95
85
75
65
55
45
0
20
40
60
80
100
120
High Modeled Velocity Revised 271.5 cfs
Mid Modeled Velocity Revised 52.1 cfs
Low Modeled Velocity Revised16.5 cfs
Low Velocity 7 cfs
Measured Velocity 52.1 cfs
High Velocity 1400 cfs
Bed
Mid Calibration WSE

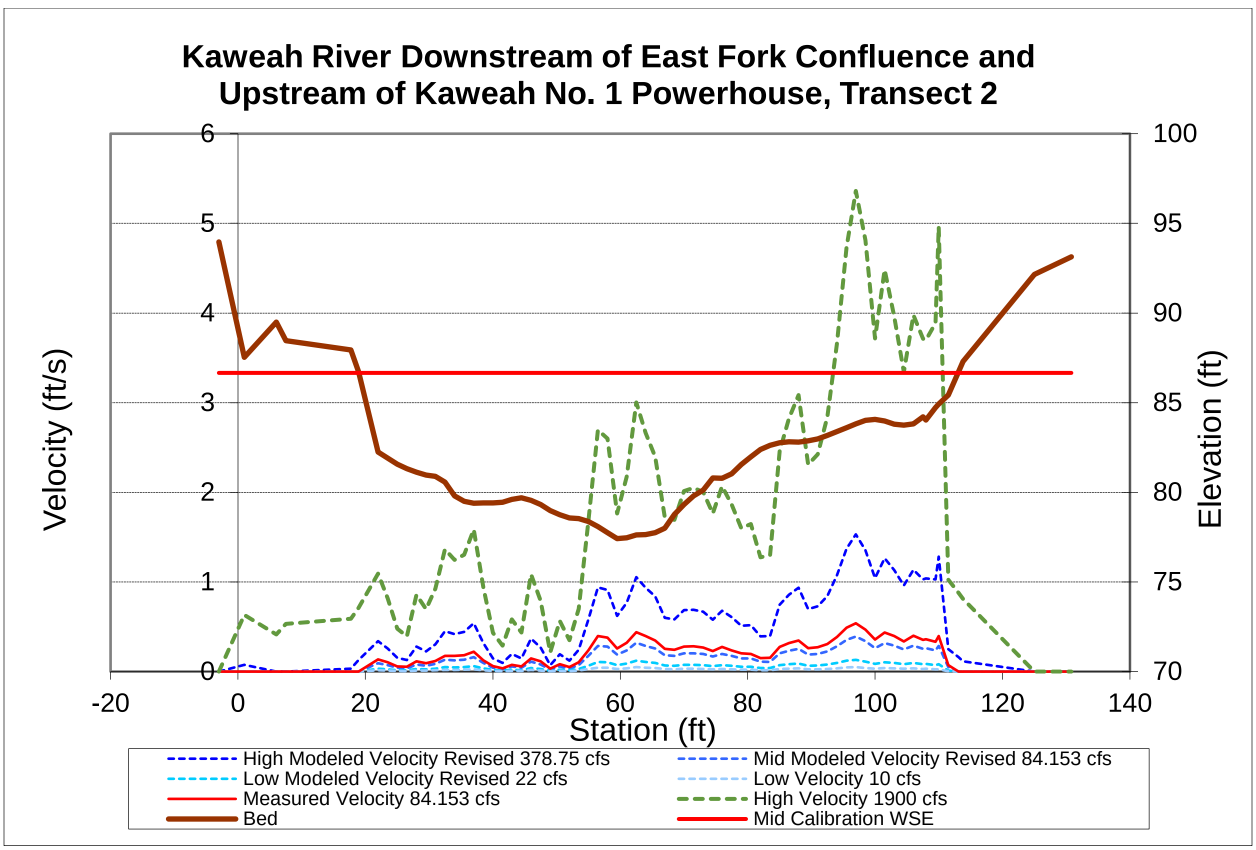
Figure D.C-3. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Velocity Calibration Report (Original on top Revised on bottom).



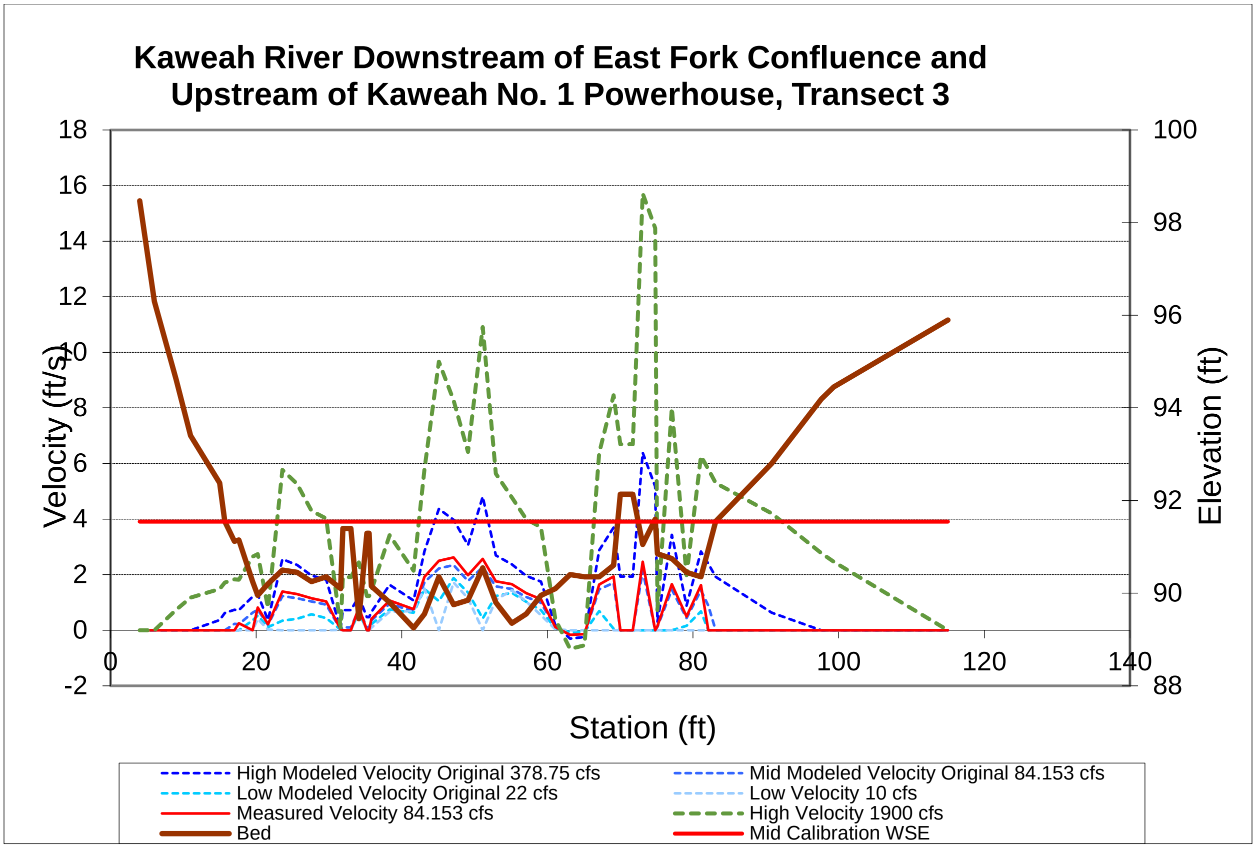


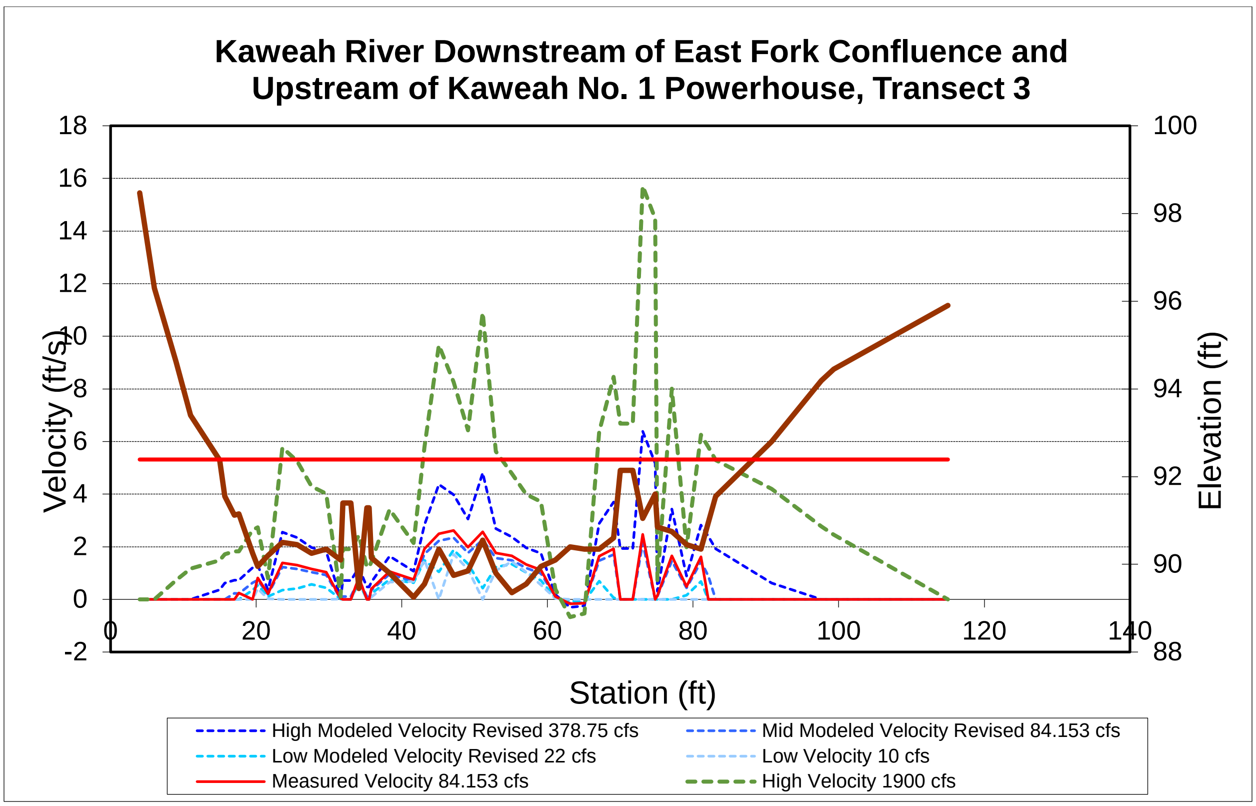


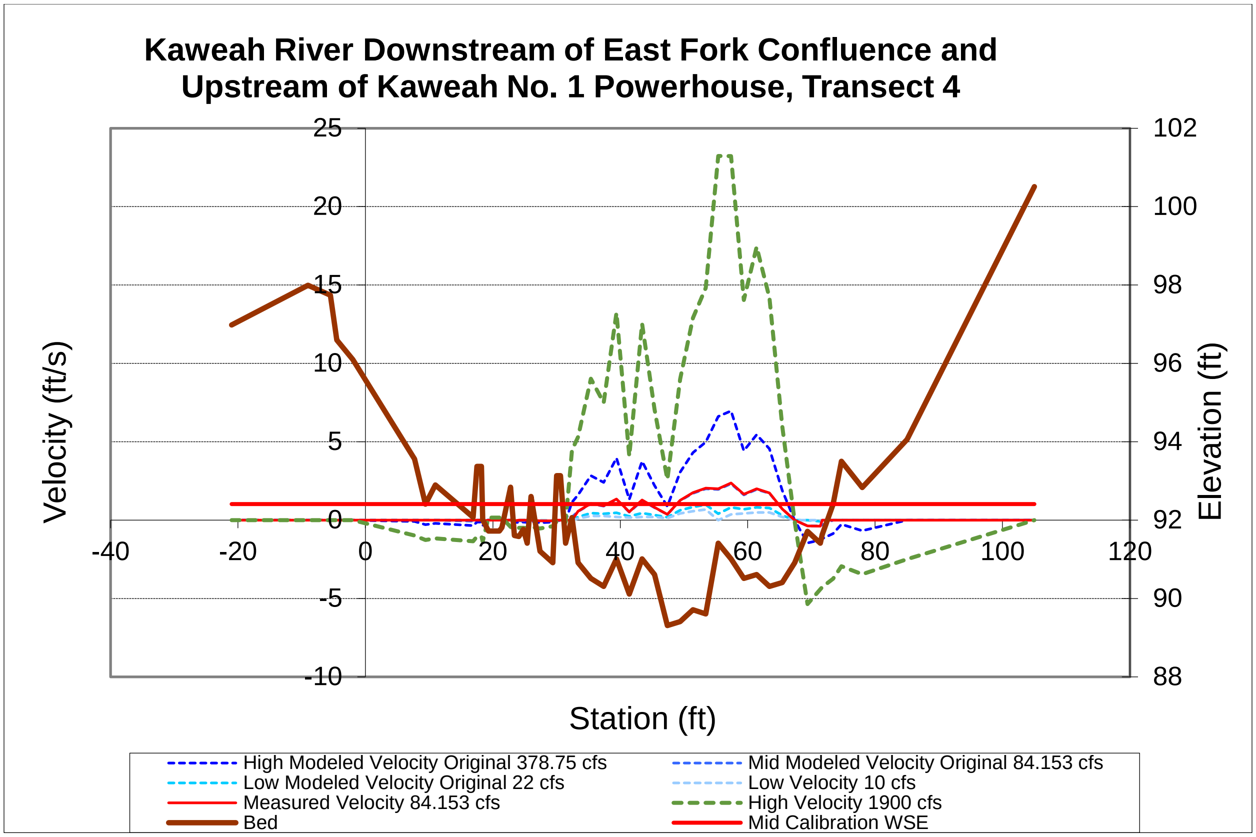
Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
1
2
3
4
5
6
70
75
80
85
90
95
100
-20
0
20
40
60
80
100
120
140
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

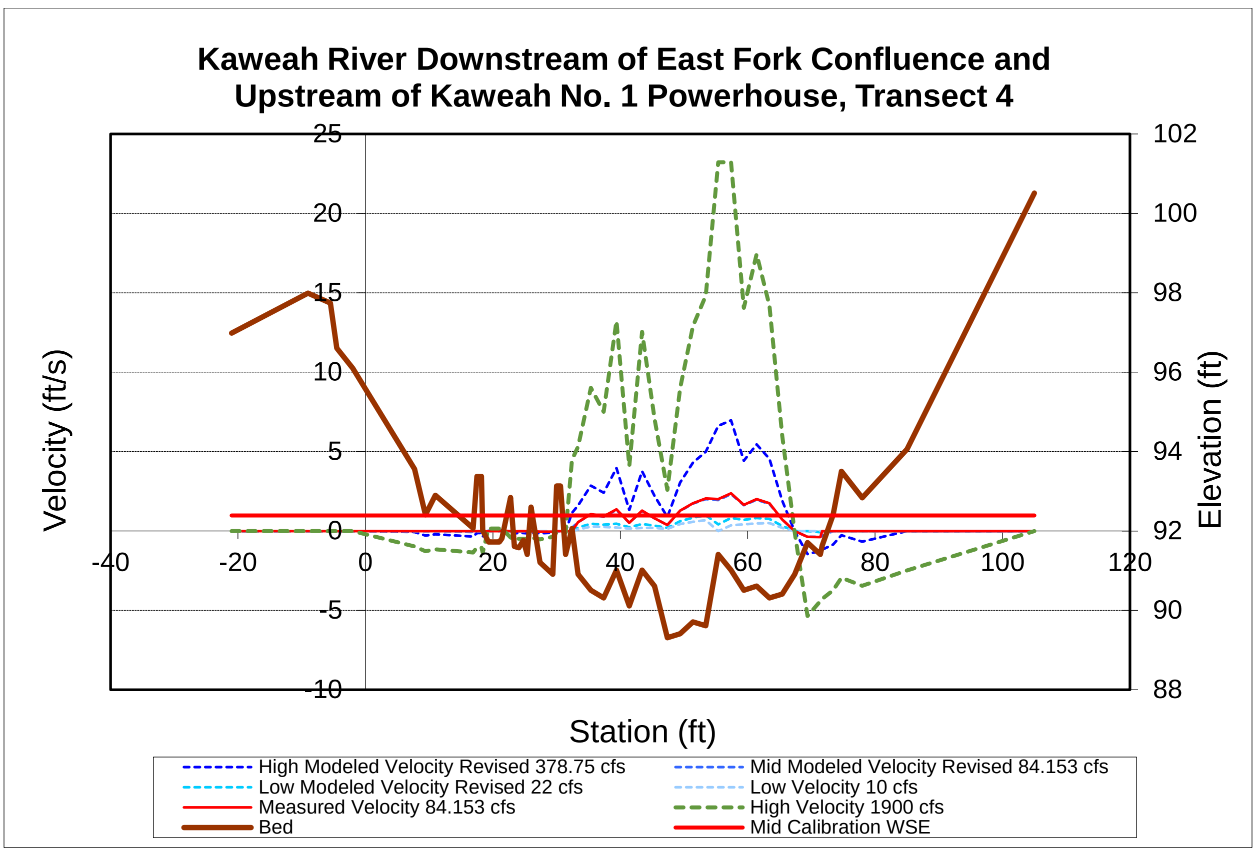


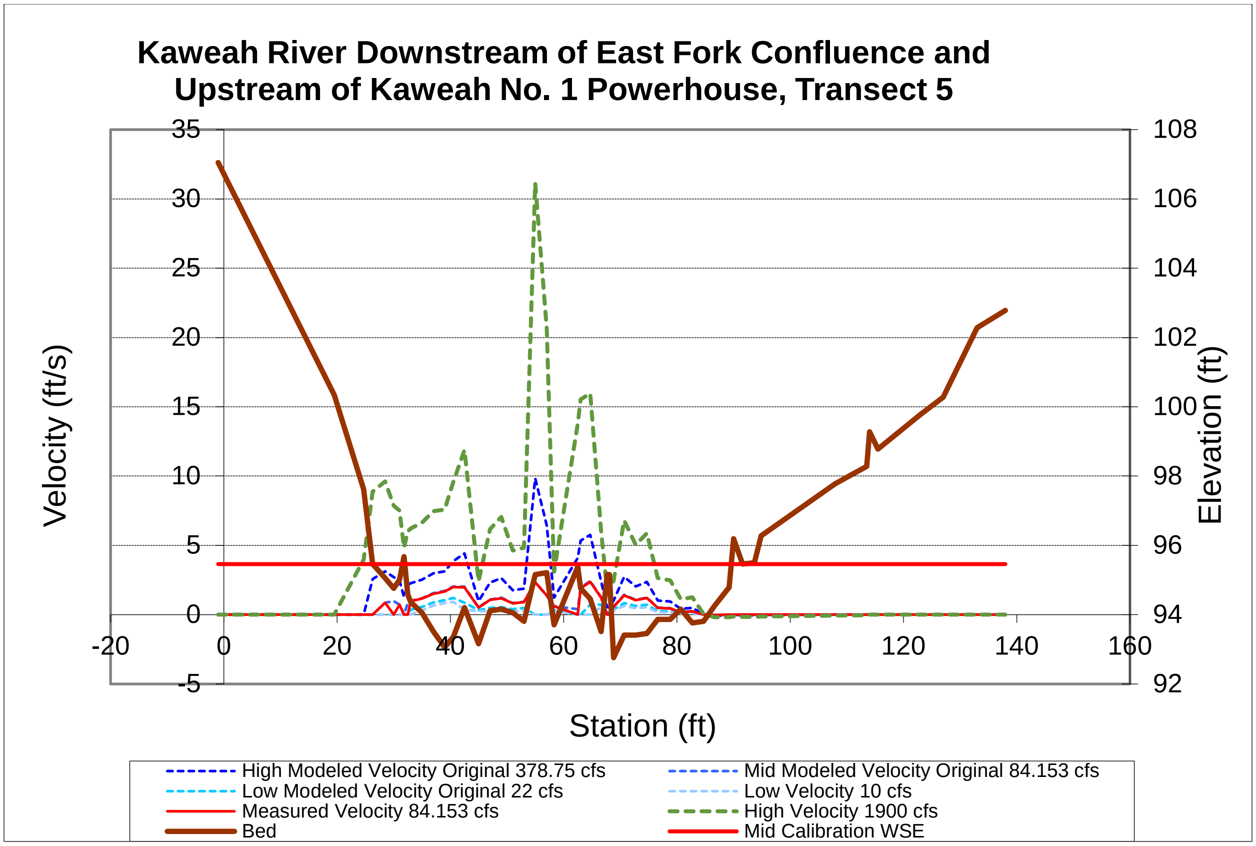
Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
1
2
3
4
5
6
70
75
80
85
90
95
100
-20
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

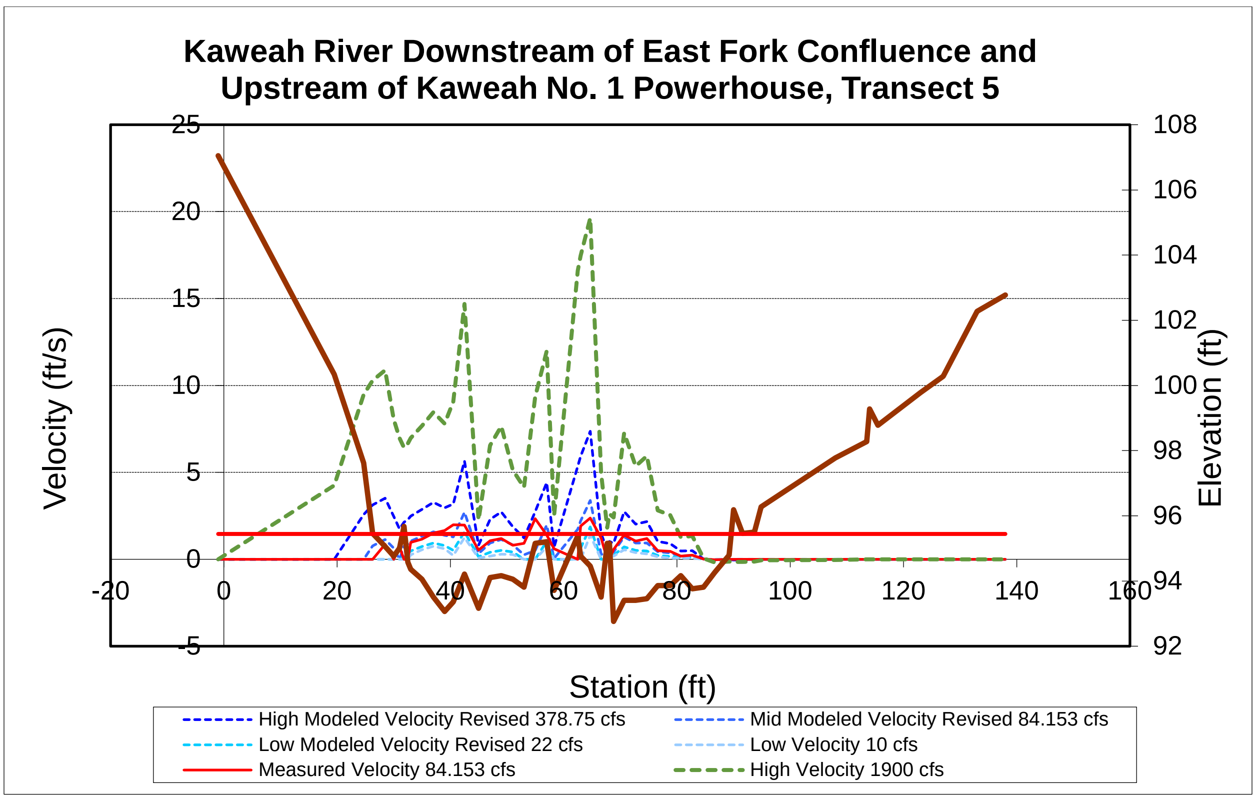

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
18
16
14
12
10
8
6
4
2
0
-2
100
98
96
94
92
90
88
0
20
40
60
80
100
120
140
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

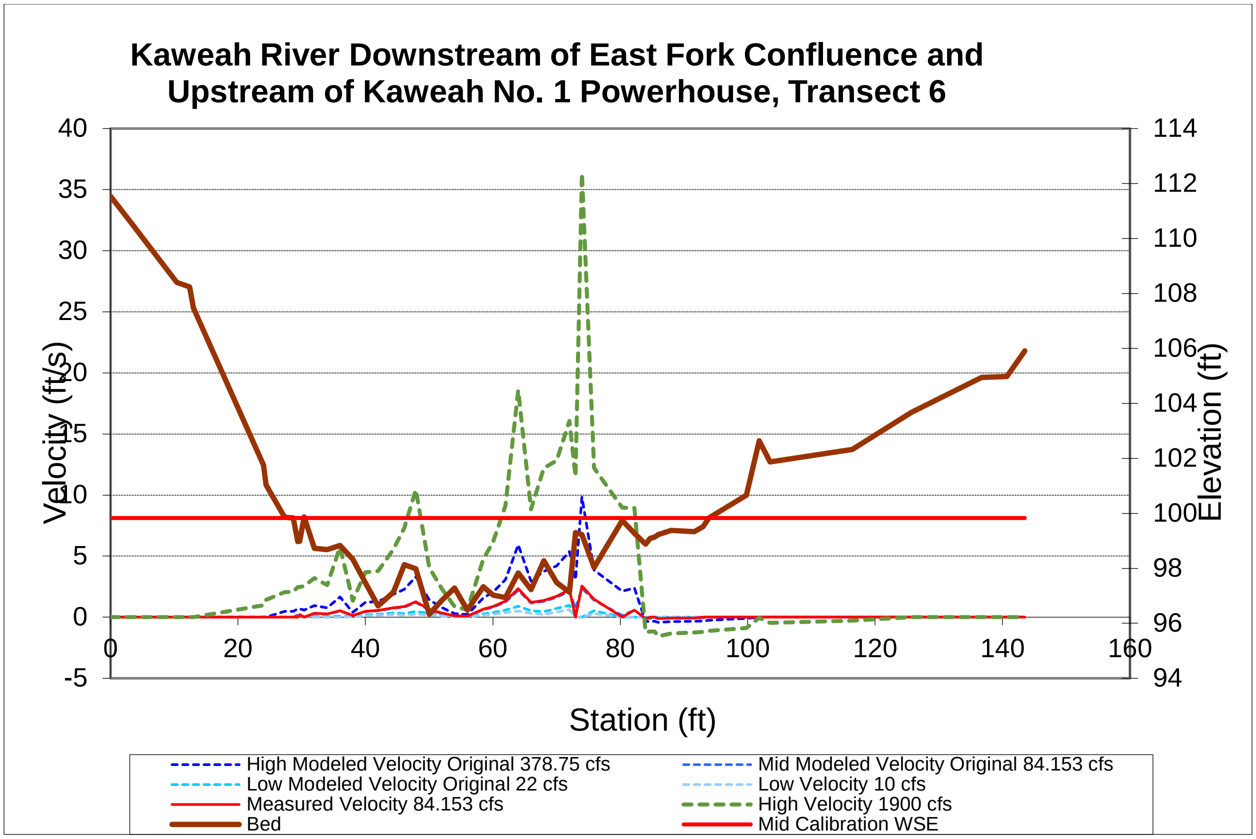

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
18
16
14
12
10
8
6
4
2
0
-2
100
98
96
94
92
90
88
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs

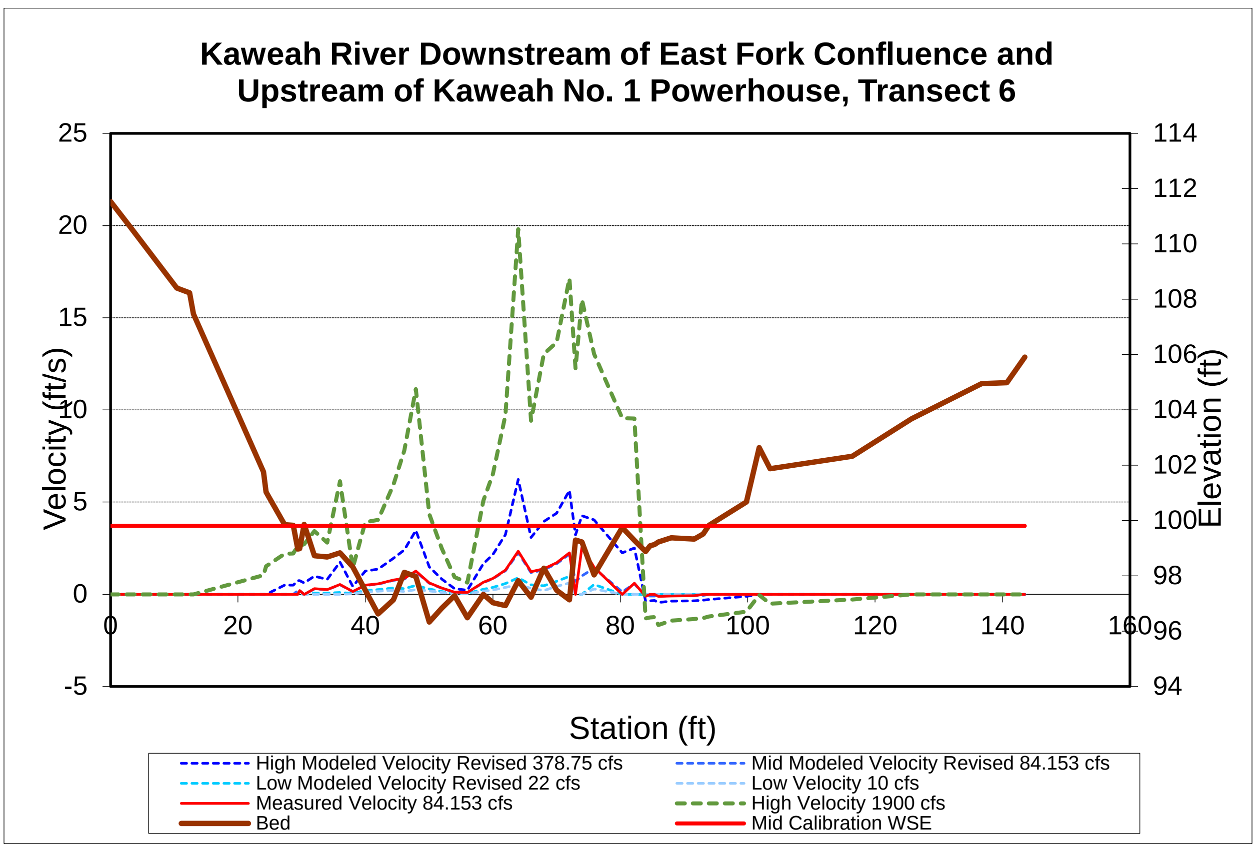

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
-10
102
100
98
96
94
92
90
88
-40
-20
0
20
40
60
80
100
120
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

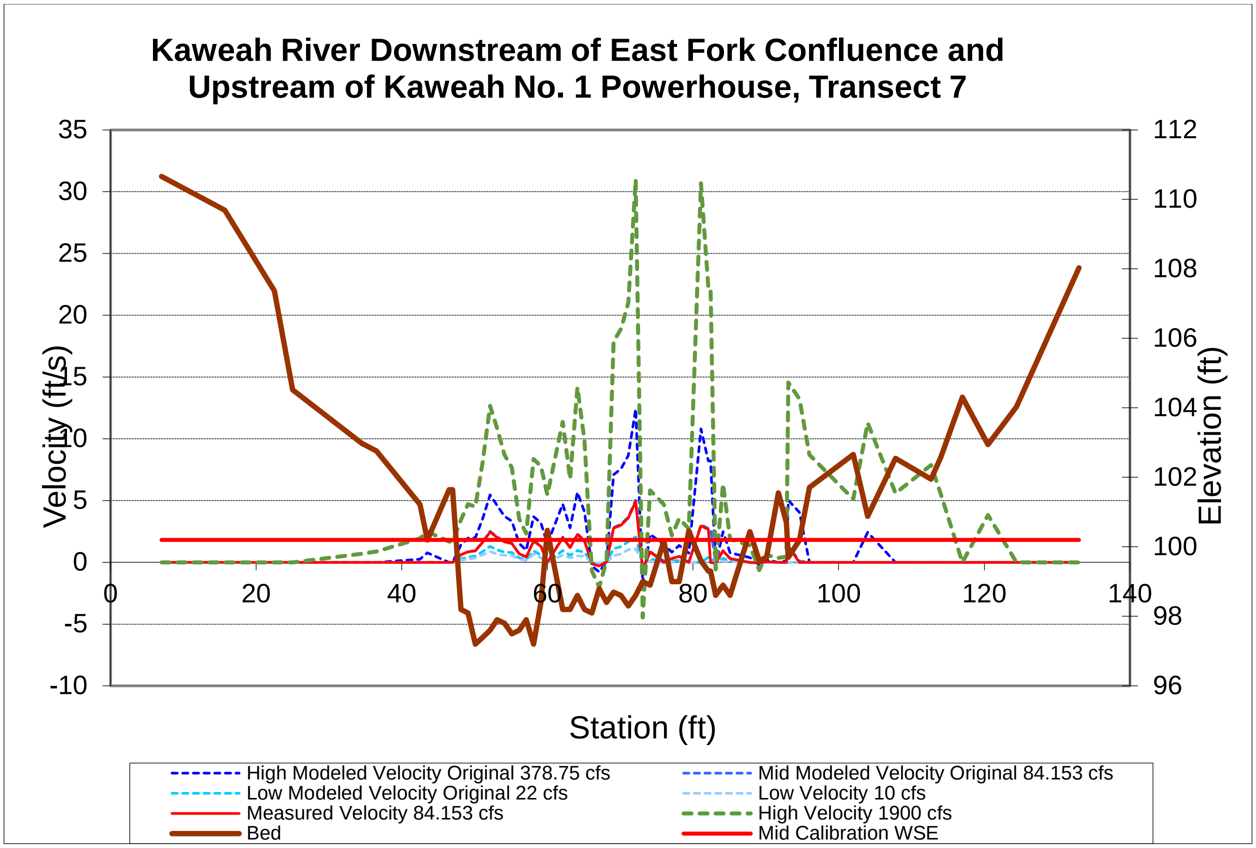

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
-10
102
100
98
96
94
92
90
88
-40
-20
0
20
40
60
80
100
120
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

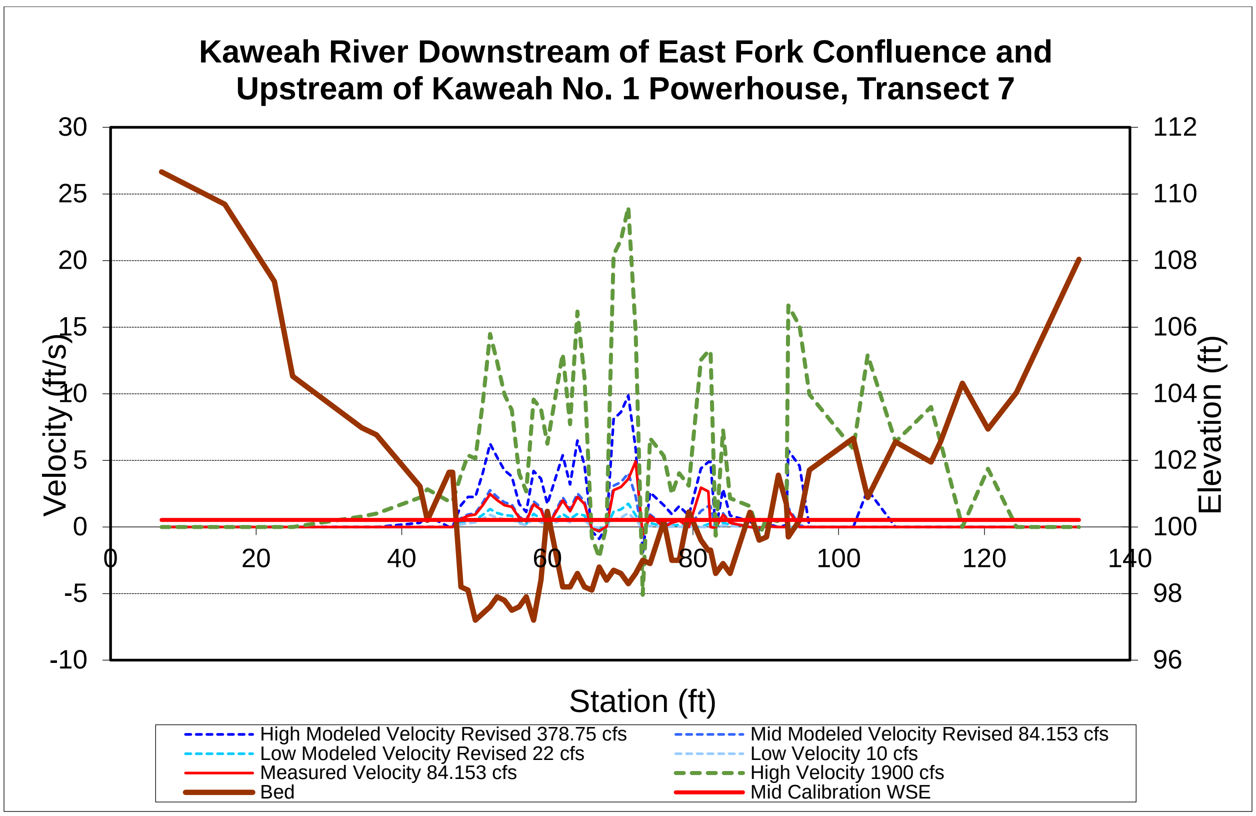

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

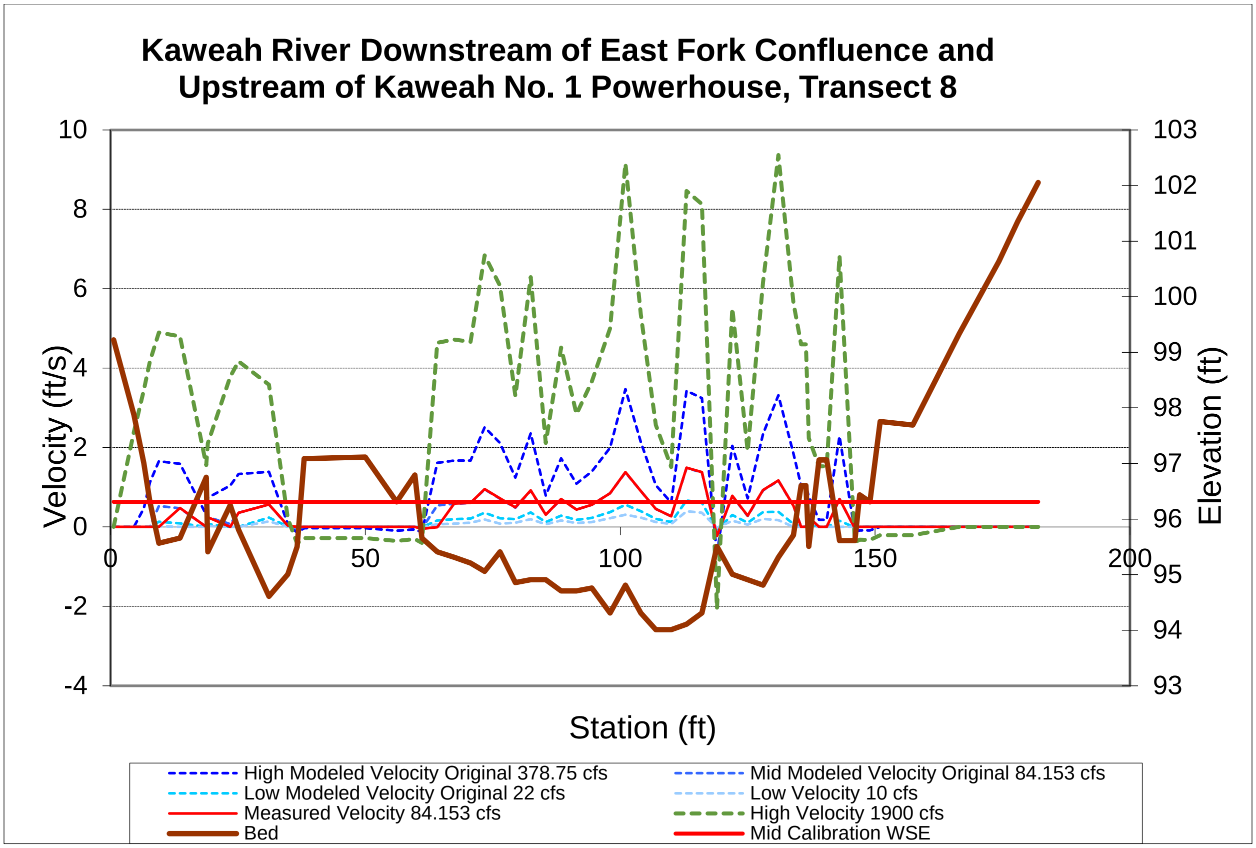

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs

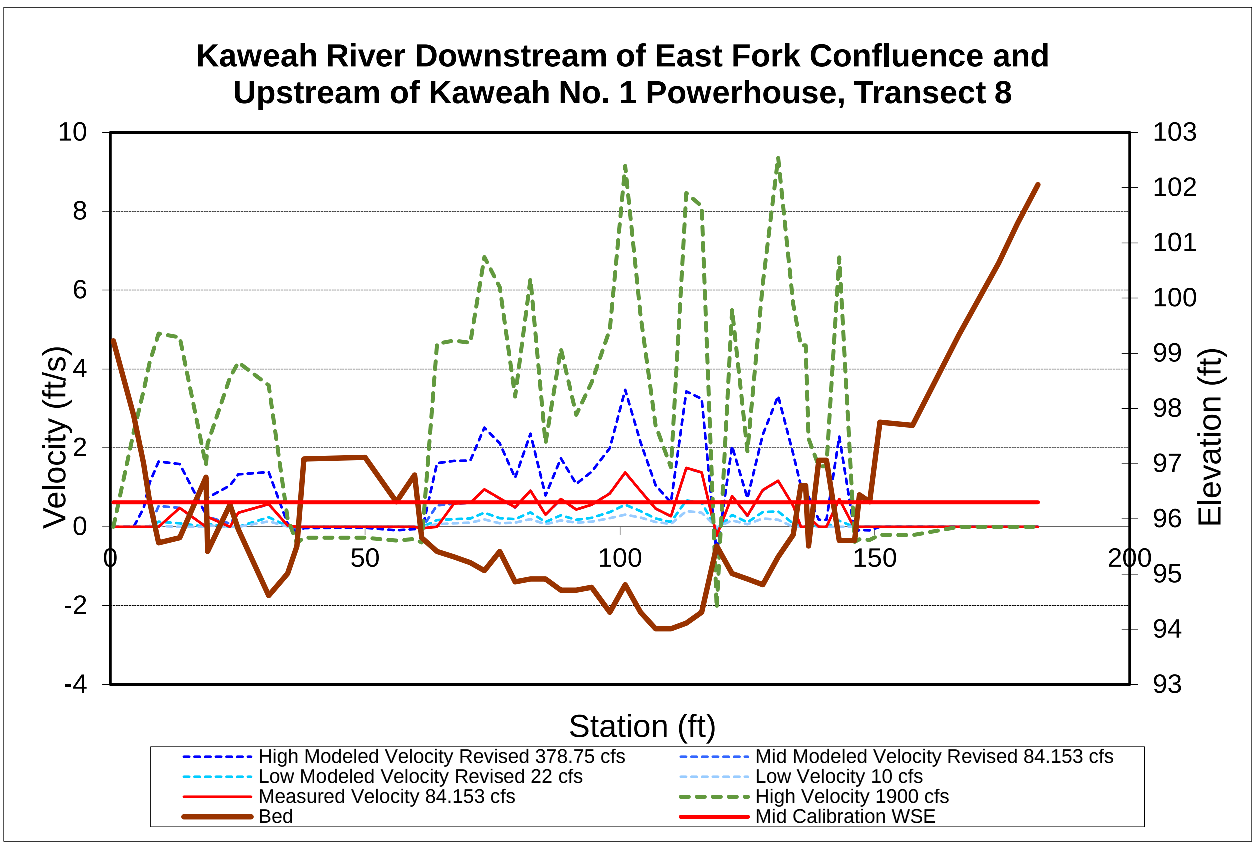

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

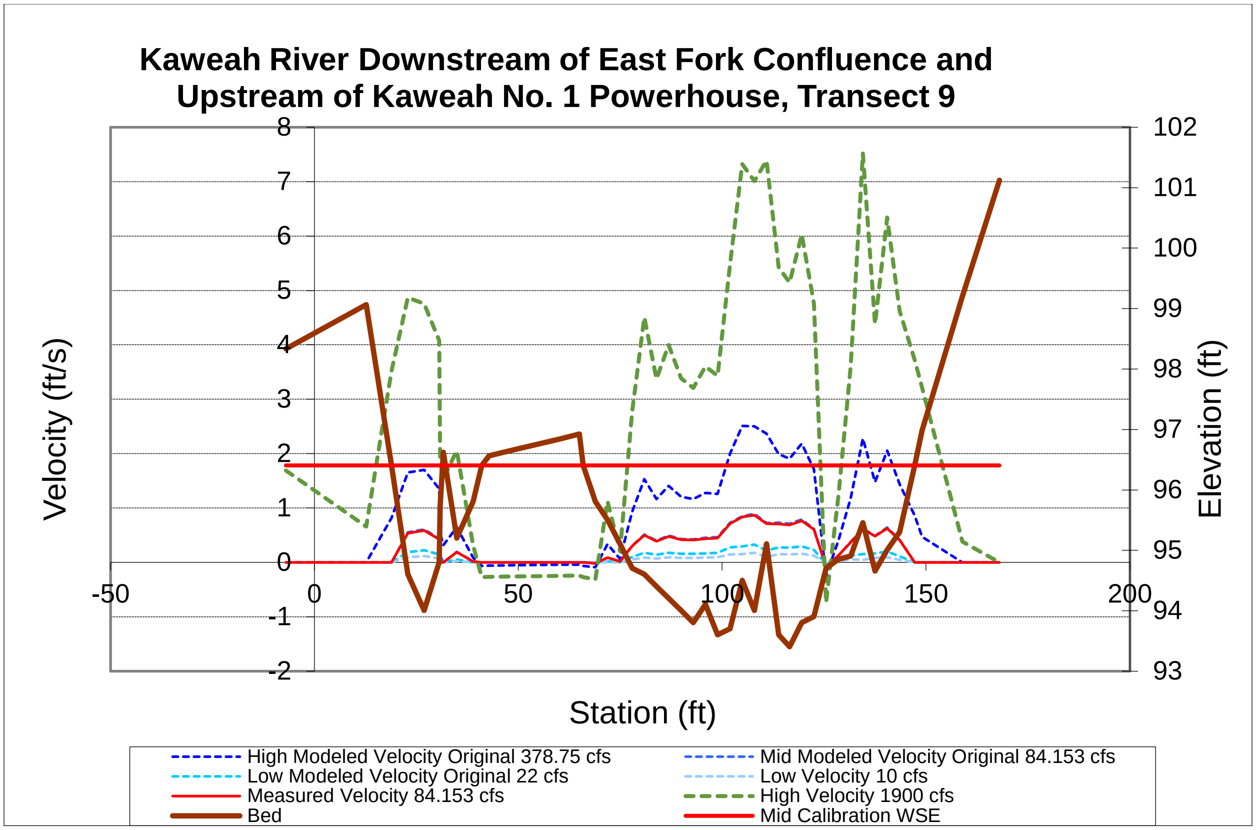

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
35
30
25
20
15
10
5
0
-5
-10
112
110
108
106
104
102
100
98
96
0
20
40
60
80
100
120
140
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

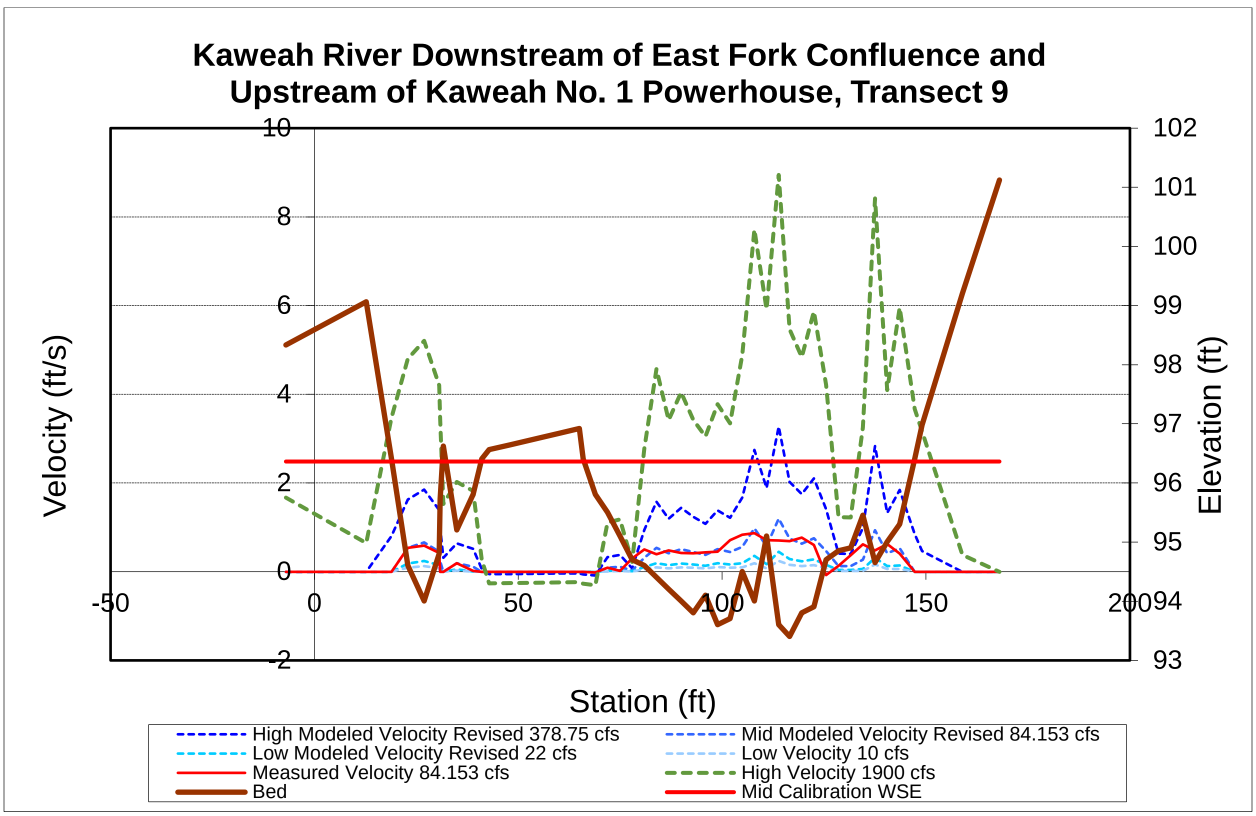

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
-10
112
110
108
106
104
102
100
98
96
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
-4
103
102
101
100
99
98
97
96
95
94
93
0
50
100
150
200
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

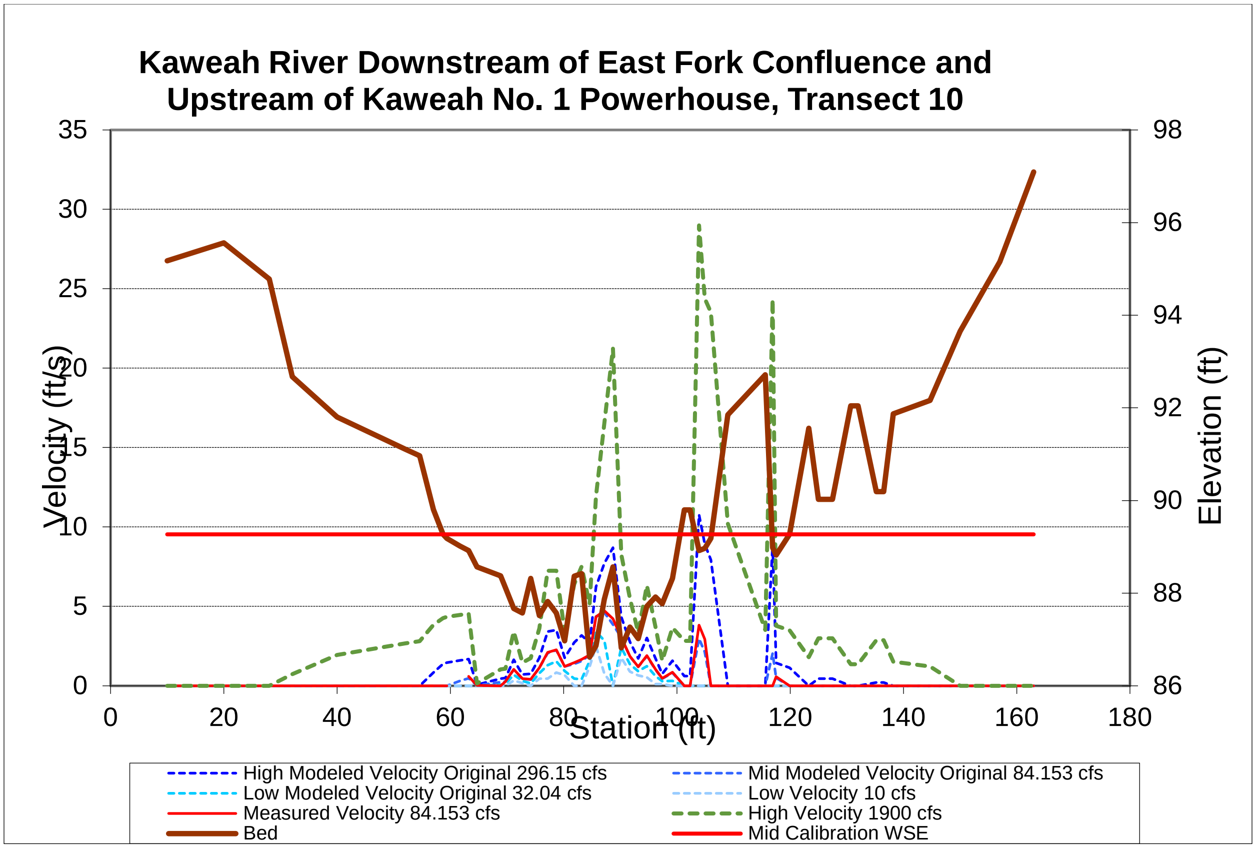

Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
-4
103
102
101
100
99
98
97
96
95
94
93
0
50
100
150
200
High Modeled Velocity Revised 378.75 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 22 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

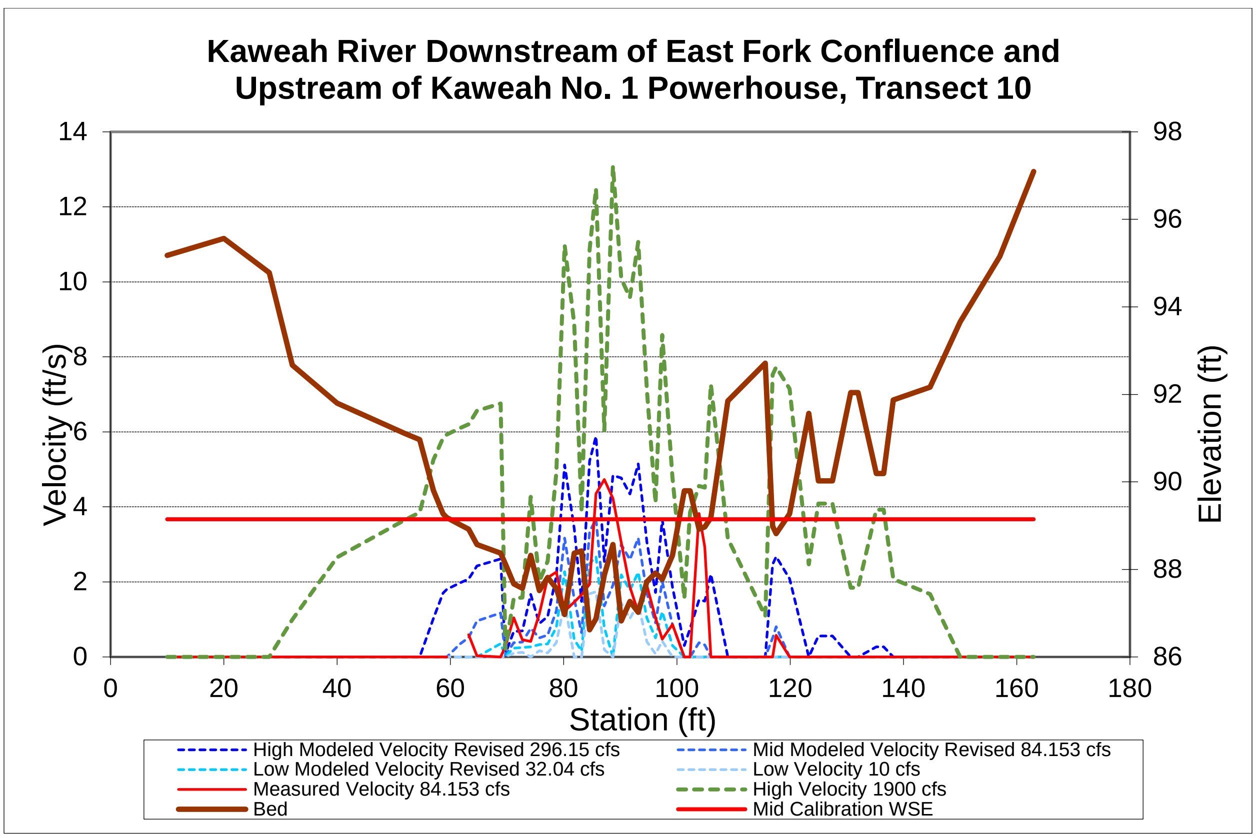


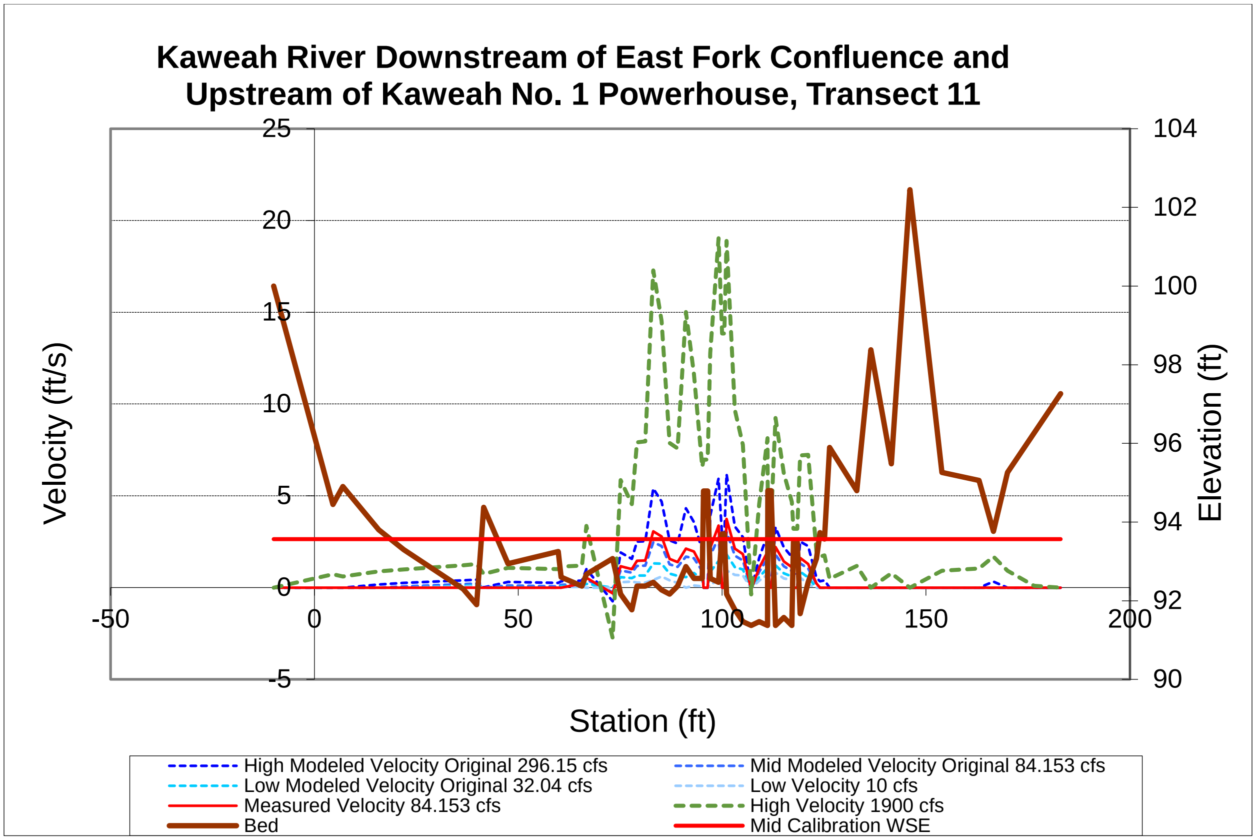
Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
8
7
6
5
4
3
2
1
0
-1
-2
102
101
100
99
98
97
96
95
94
93
-50
0
50
100
150
200
High Modeled Velocity Original 378.75 cfs
Low Modeled Velocity Original 22 cfs
Measured Velocity 84.153 cfs
Bed
Mid Modeled Velocity Original 84.153 cfs
Low Velocity 10 cfs
High Velocity 1900 cfs
Mid Calibration WSE

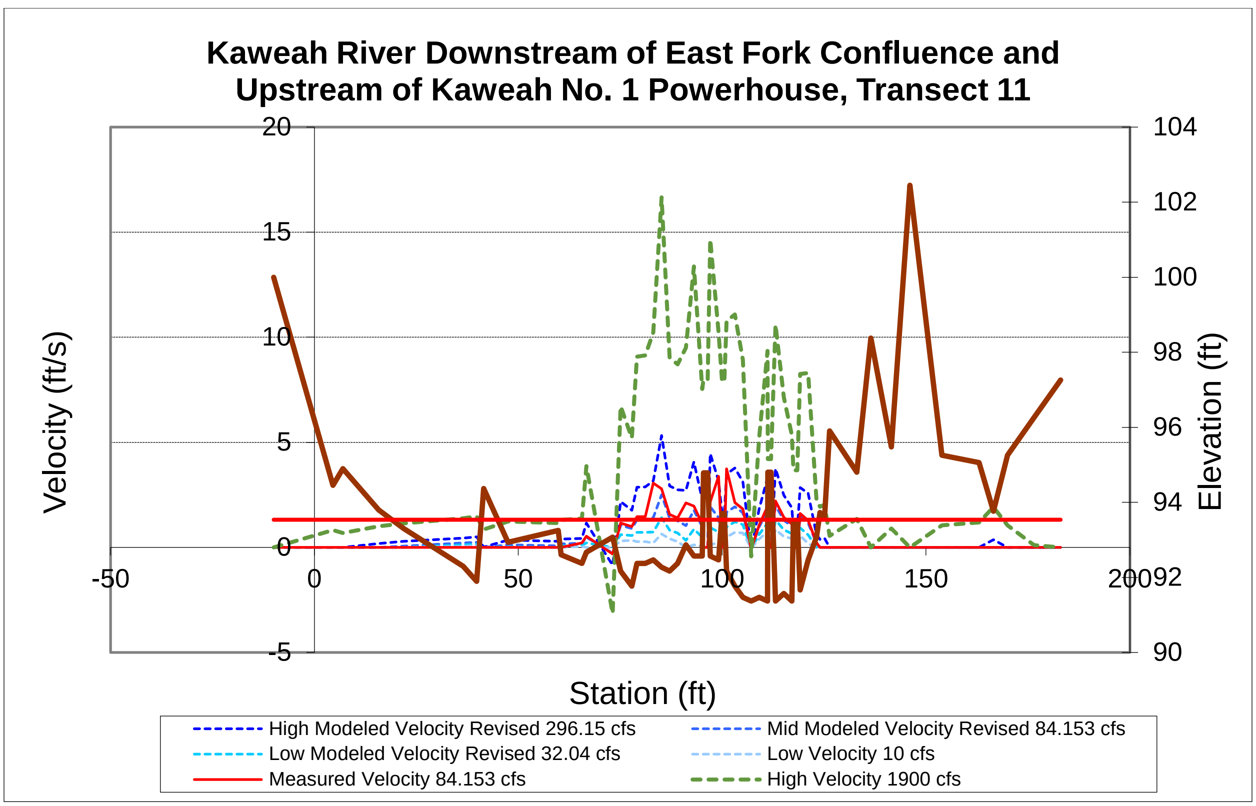


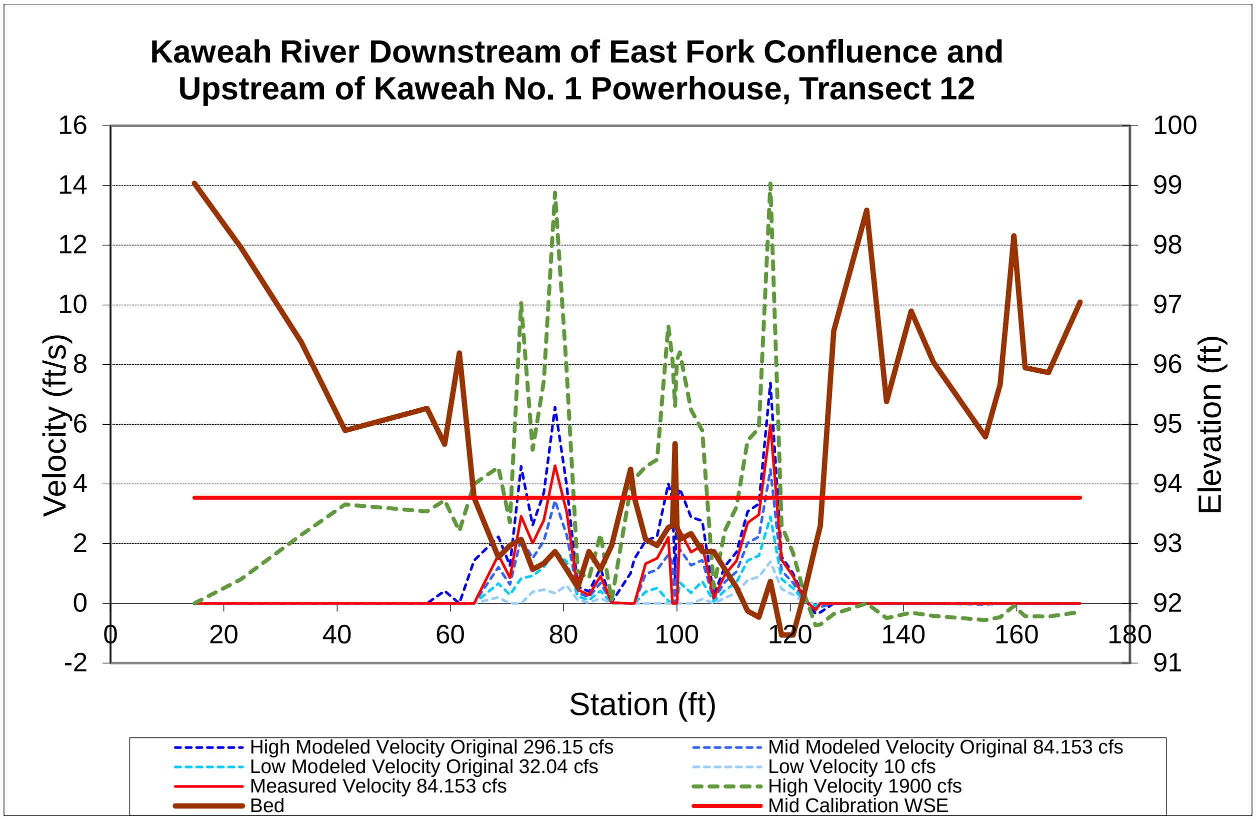
Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
10
8
6
4
2
0
-2
102
101
100
99
98
97
96
95
94
93
-50
0
50
100
150
200
High Modeled Velocity Revised 378.75 cfs
Low Modeled Velocity Revised 22 cfs
Measured Velocity 84.153 cfs
Bed
Mid Modeled Velocity Revised 84.153 cfs
Low Velocity 10 cfs
High Velocity 1900 cfs
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
5
10
15
20
25
30
35
86
88
90
92
94
96
98
0
20
40
60
80
100
120
140
160
180
High Modeled Velocity Original 296.15 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
2
4
6
8
10
12
14
86
88
90
92
94
96
98
0
20
40
60
80
100
120
140
160
180
High Modeled Velocity Revised 296.15 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 296.15 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of East Fork Confluence and
Upstream of Kaweah No. 1 Powerhouse, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 296.15 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs


Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 296.15 cfs
Mid Modeled Velocity Original 84.153 cfs
Low Modeled Velocity Original 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

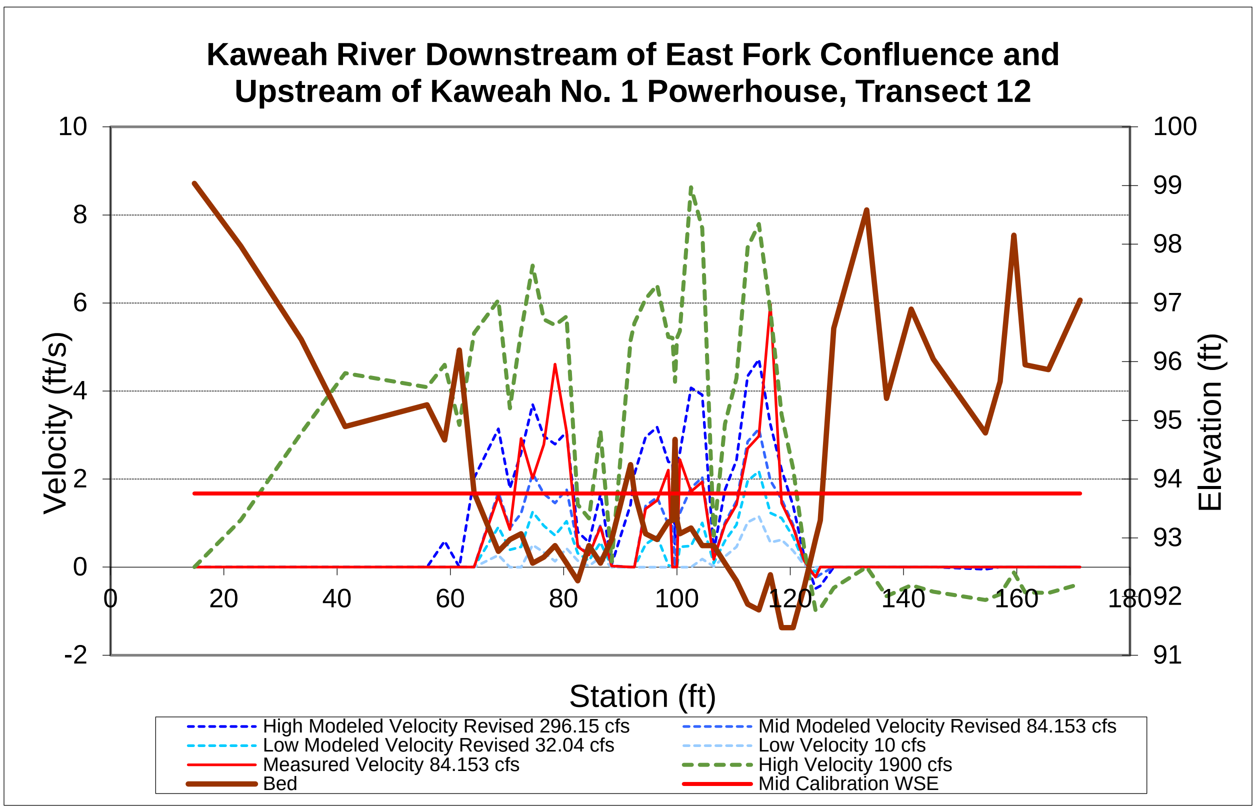
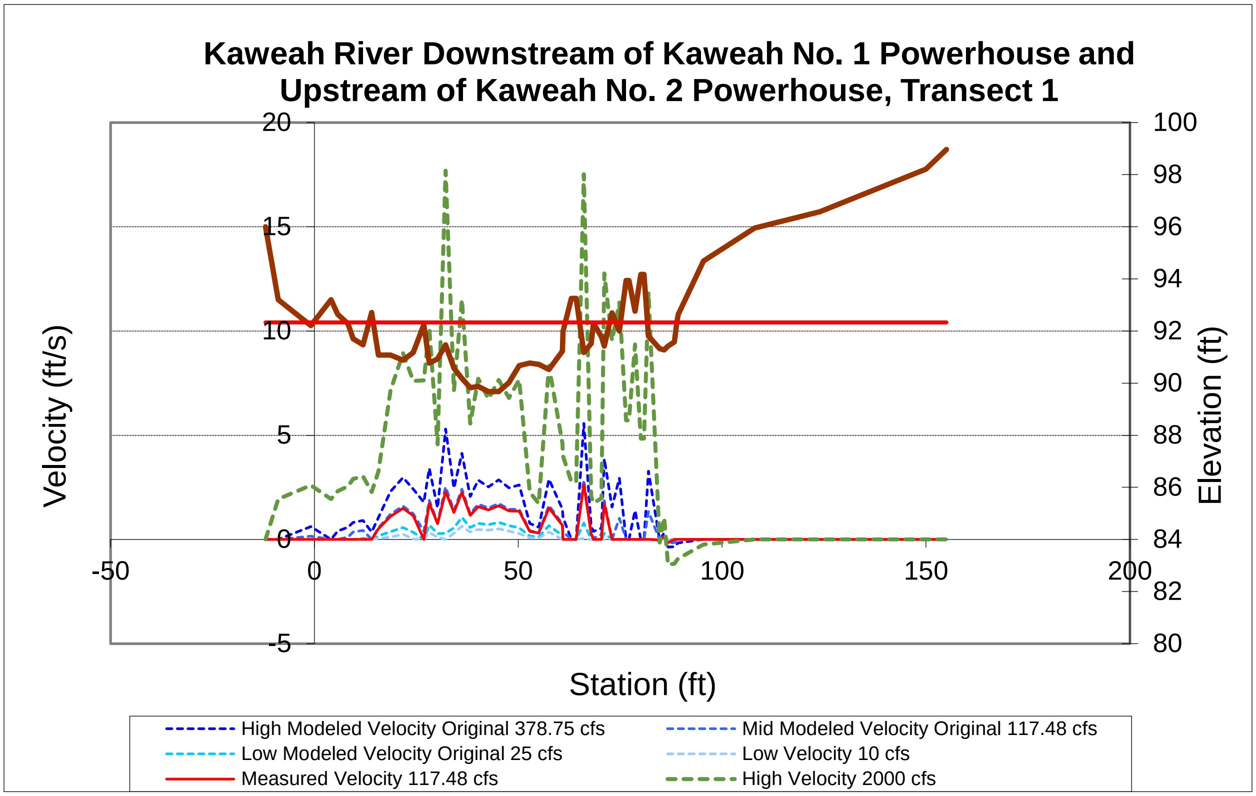
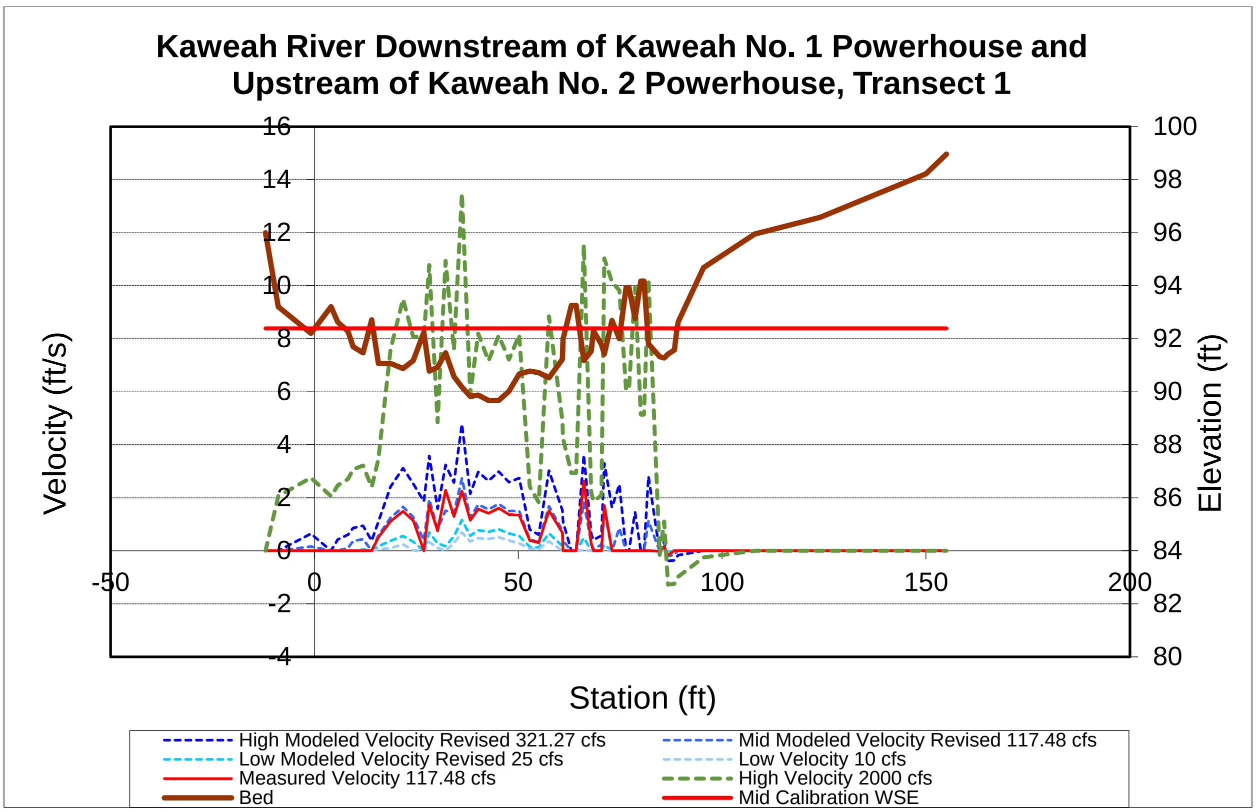
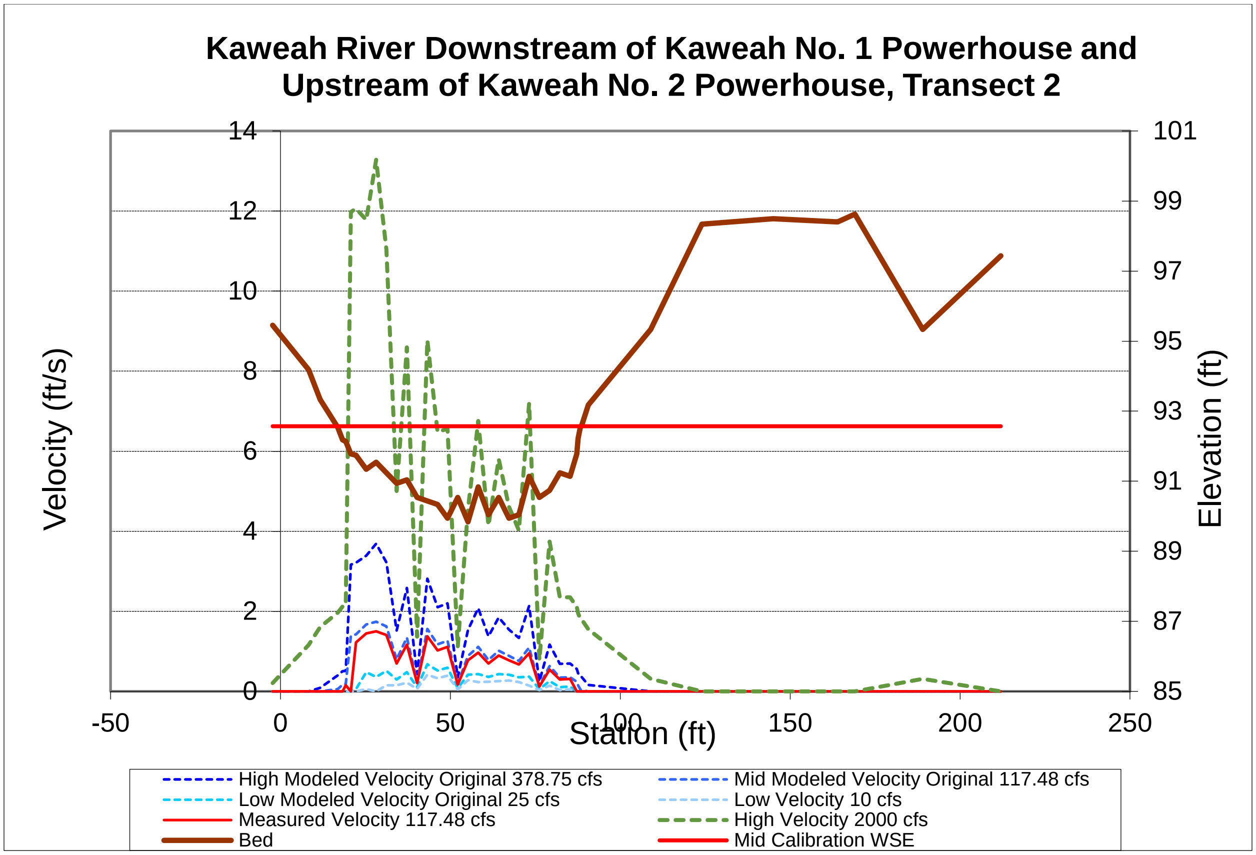

Kaweah River Downstream of East Fork Confluence and Upstream of Kaweah No. 1 Powerhouse, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 296.15 cfs
Mid Modeled Velocity Revised 84.153 cfs
Low Modeled Velocity Revised 32.04 cfs
Low Velocity 10 cfs
Measured Velocity 84.153 cfs
High Velocity 1900 cfs
Bed
Mid Calibration WSE

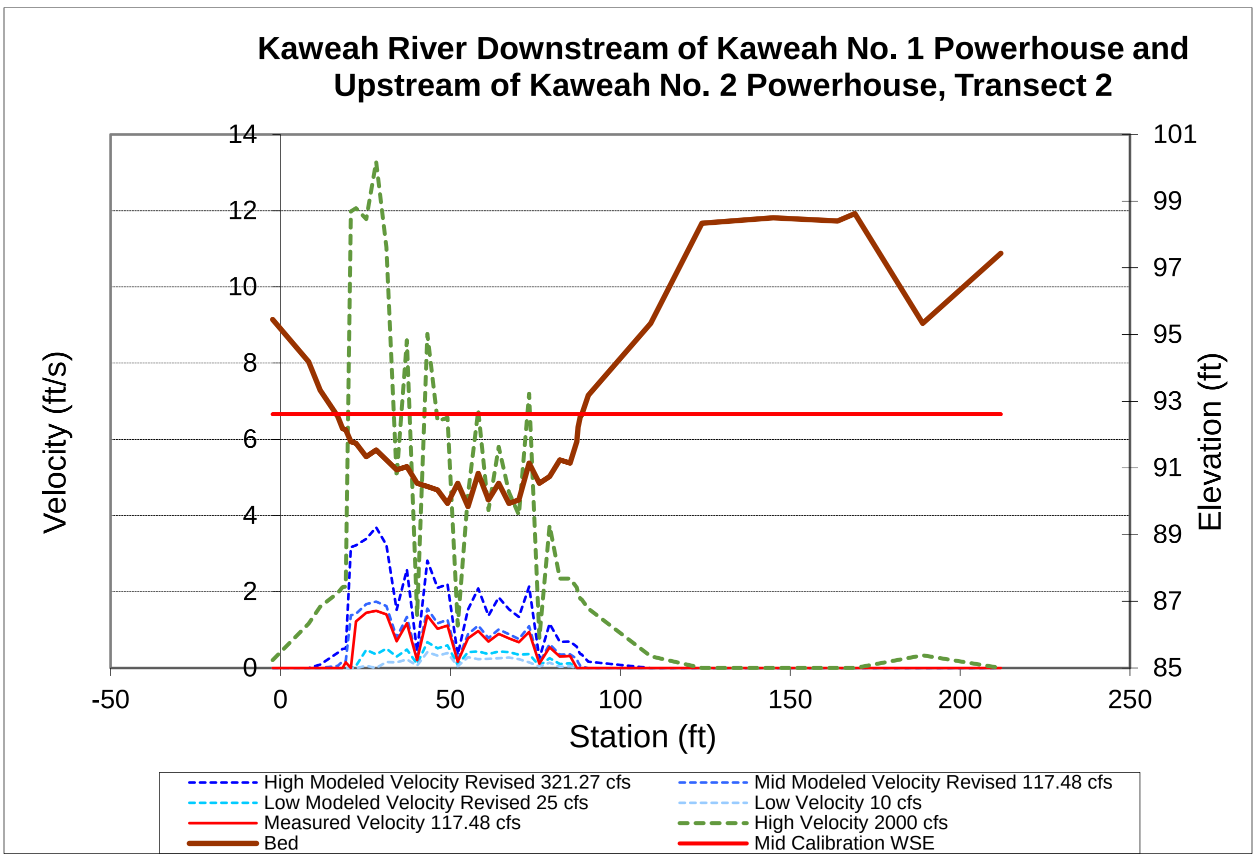
Figure D.C-4. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Velocity Calibration Report (Original on top Revised on bottom).



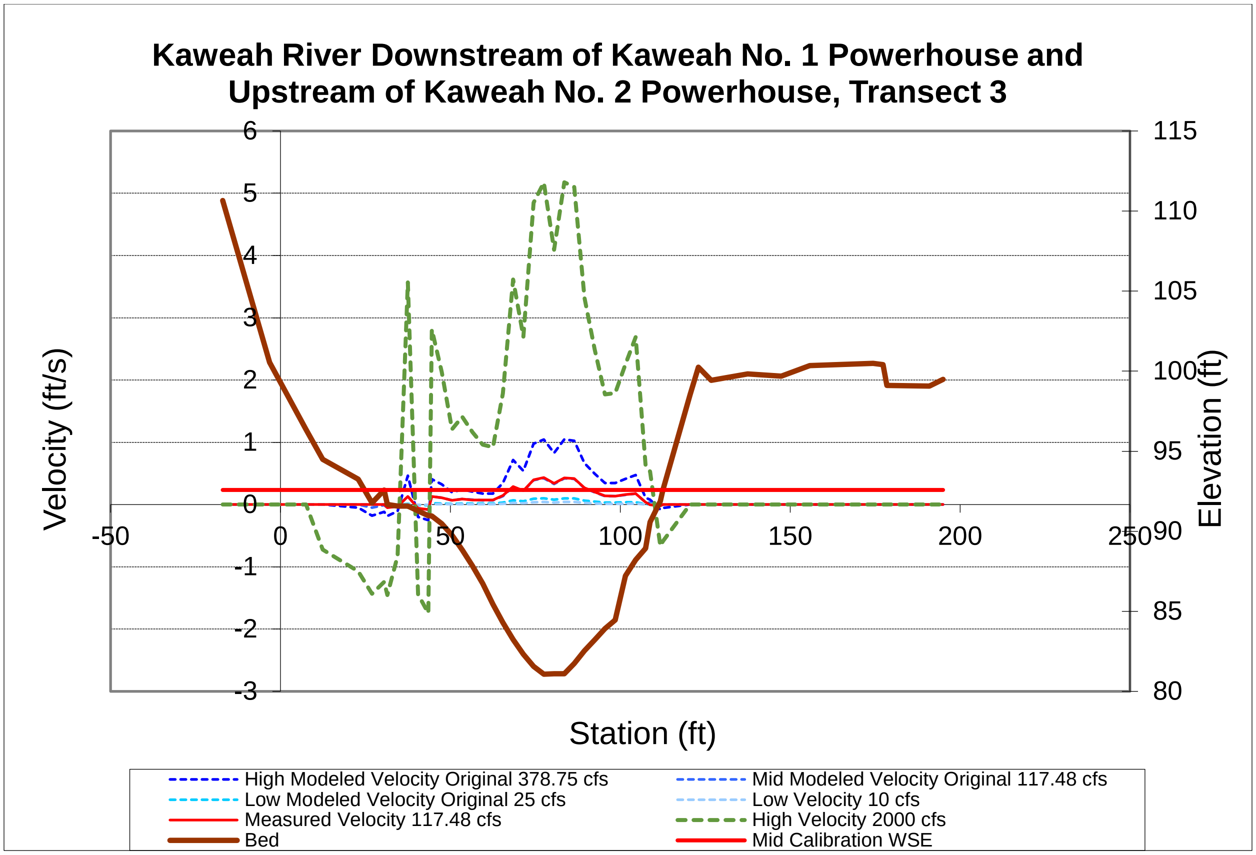


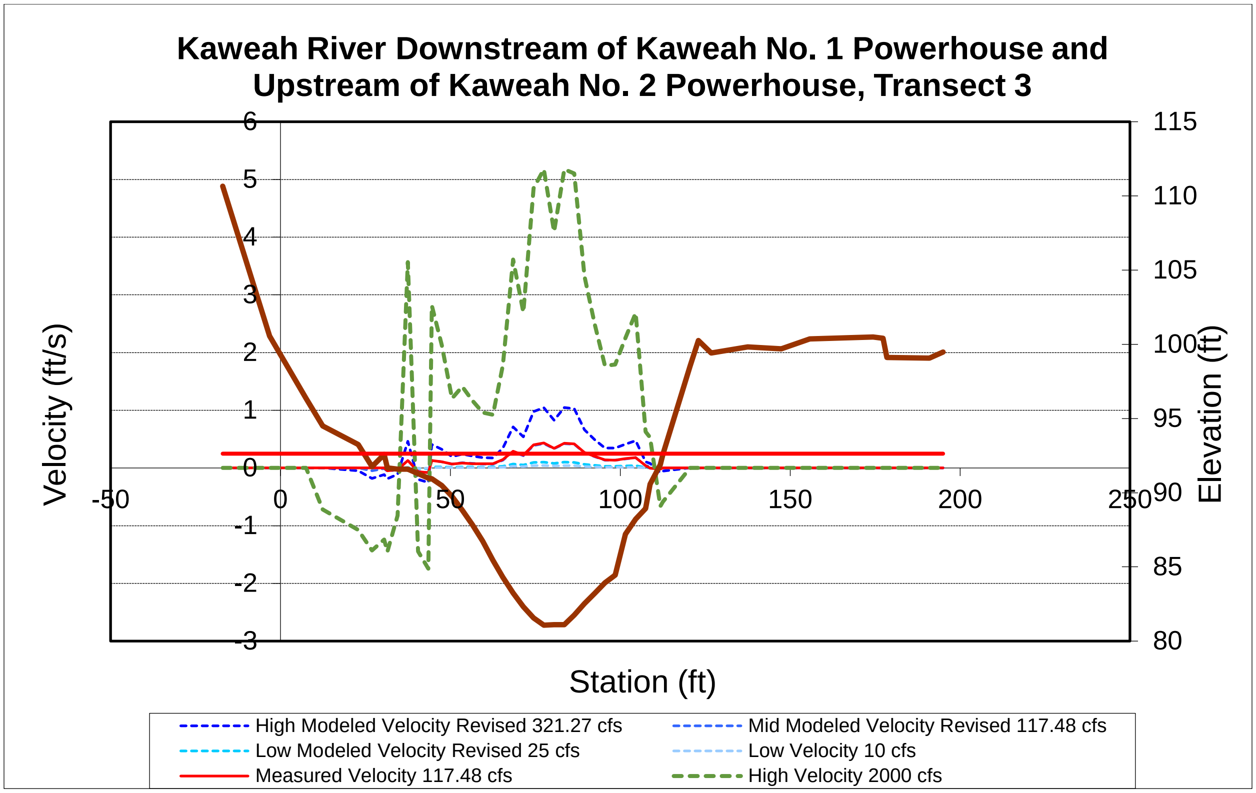


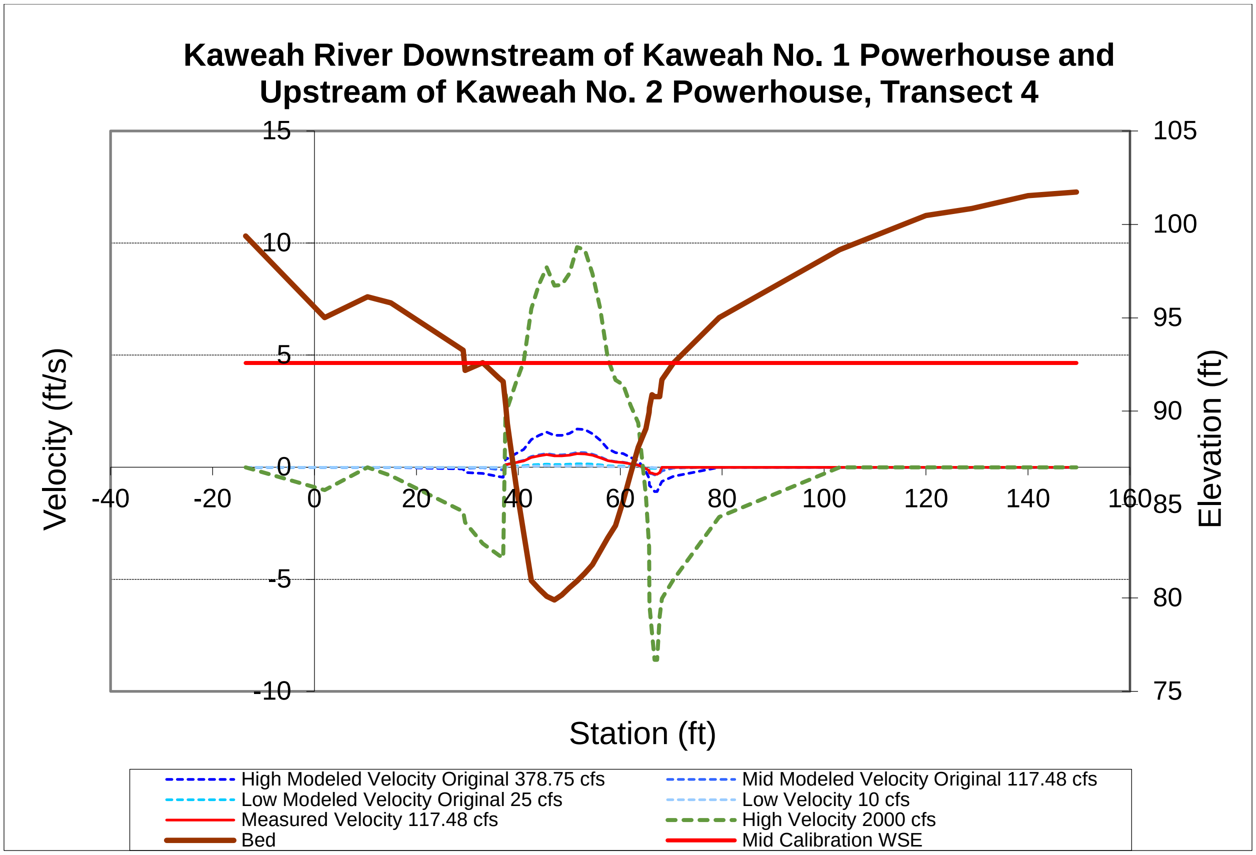
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
14
12
10
8
6
4
2
0
101
99
97
95
93
91
89
87
85
-50
0
50
100
150
200
250
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

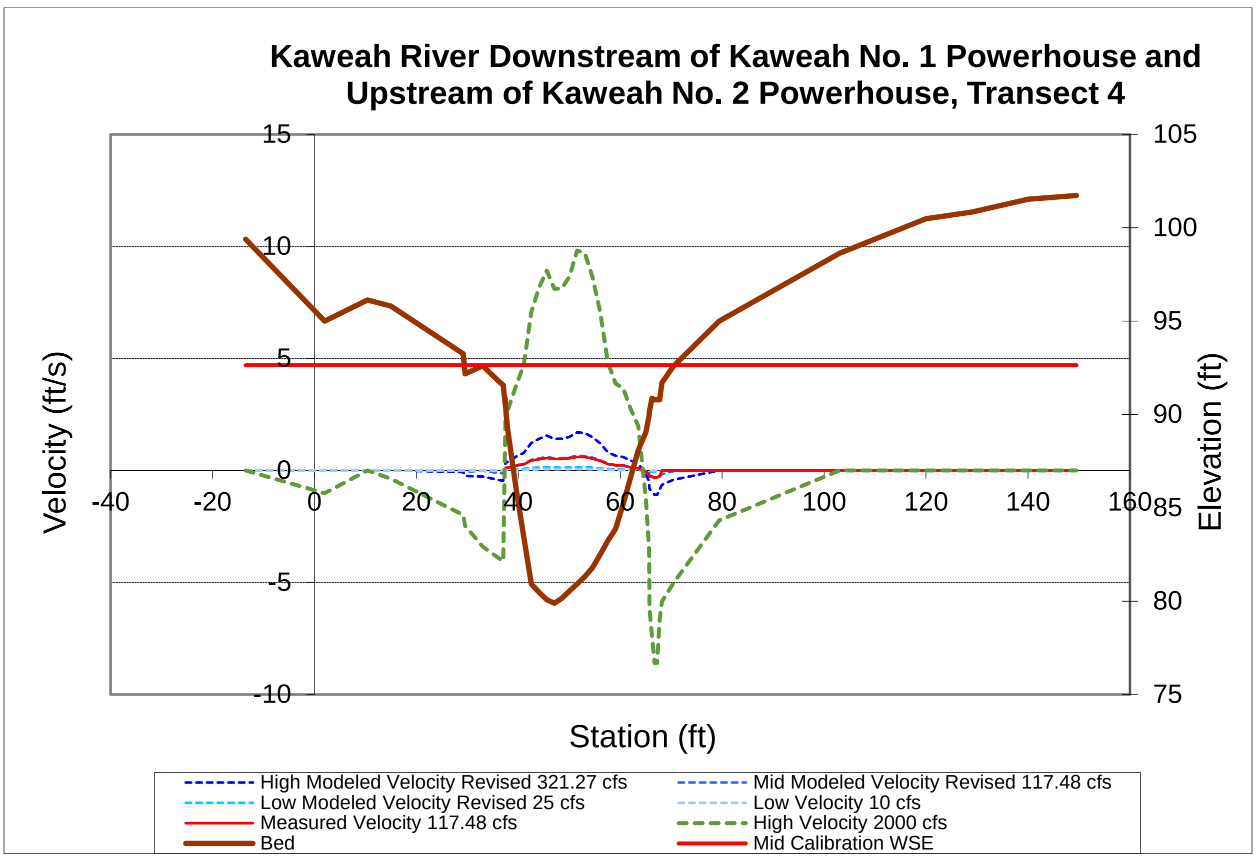


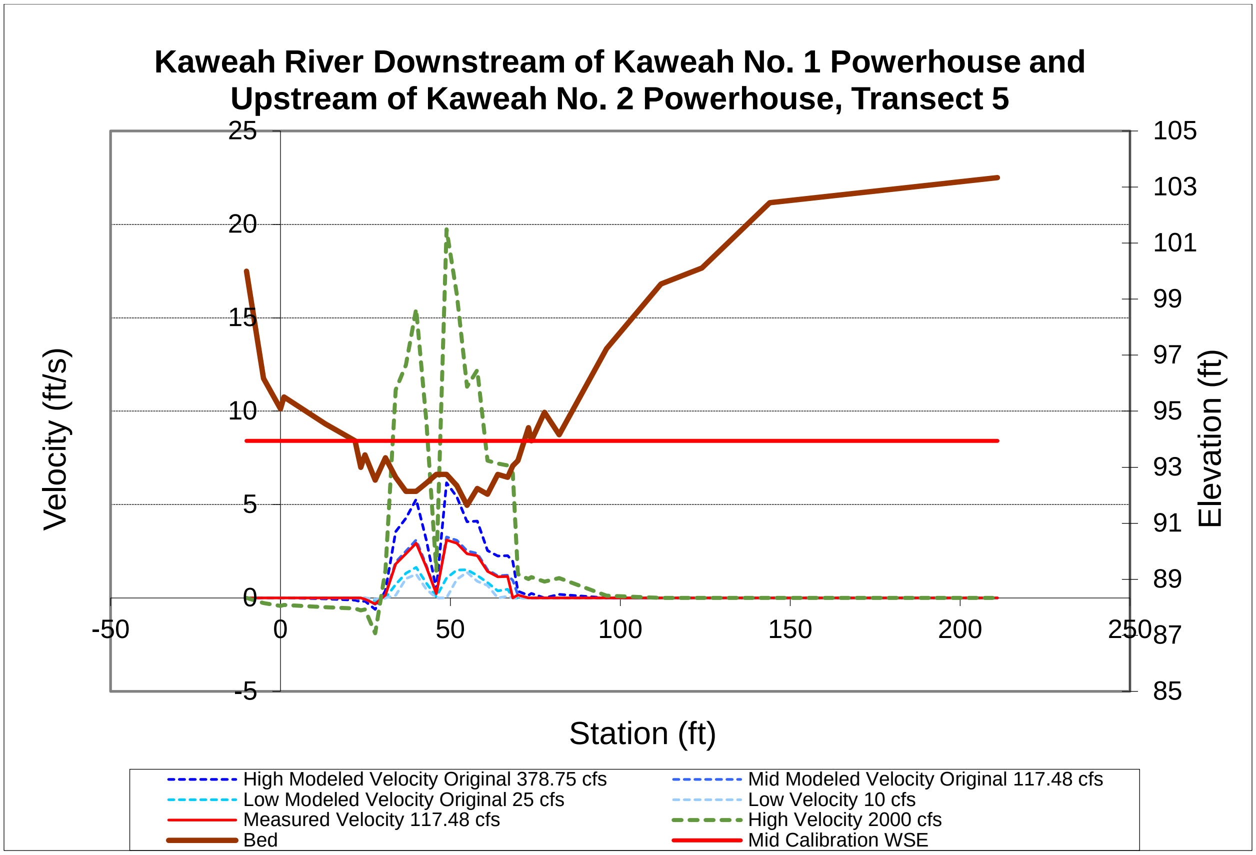
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 2
Velocity (ft/s)
Elevation (ft)
Station (ft)
14
12
10
8
6
4
2
0
101
99
97
95
93
91
89
87
85
-50
0
50
100
150
200
250
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

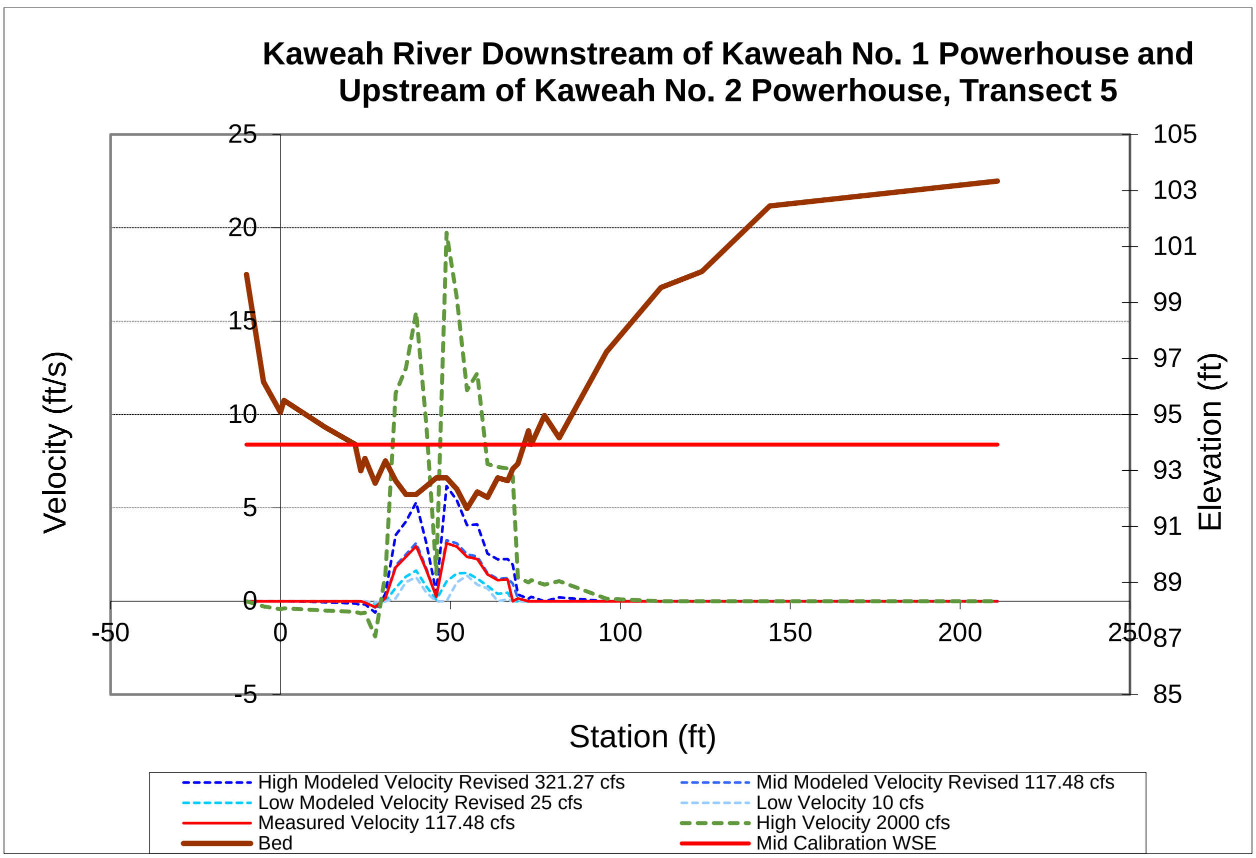

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

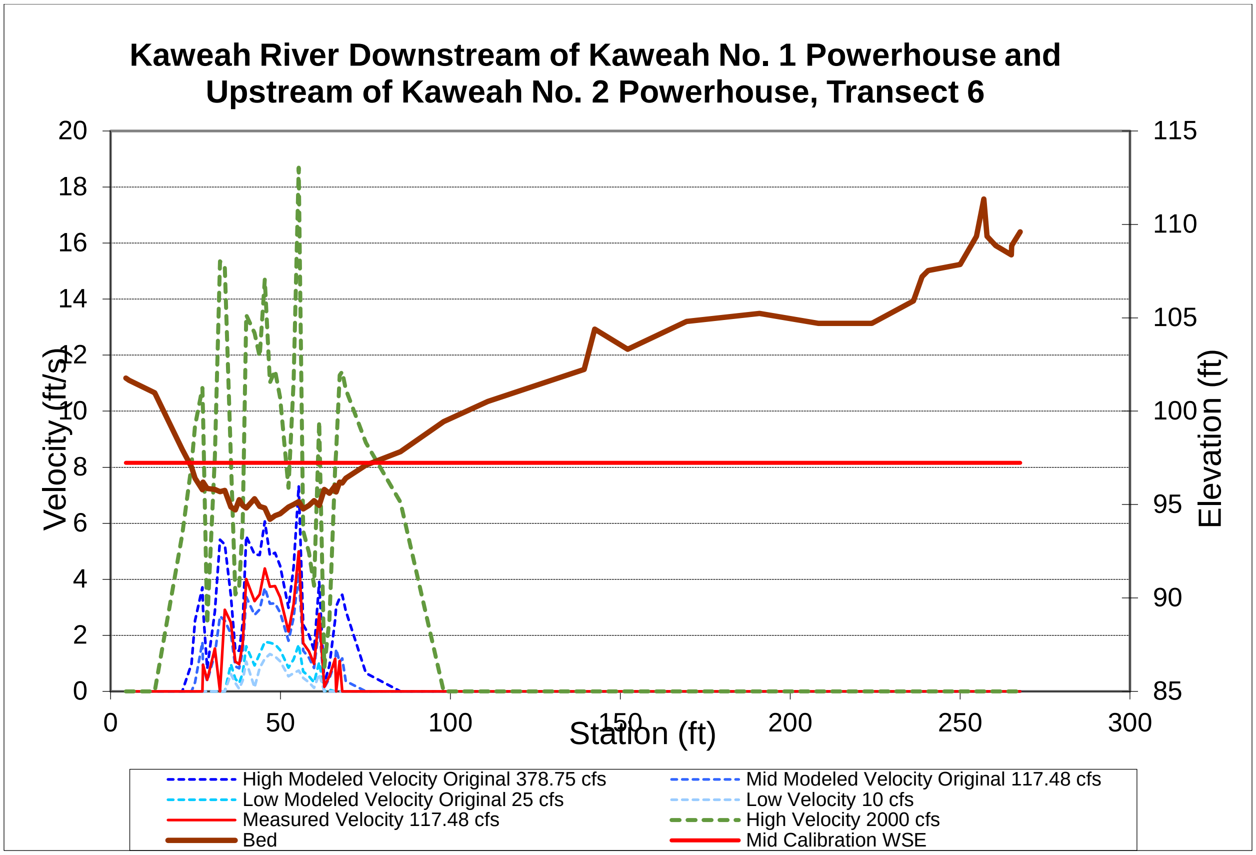

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 3
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs

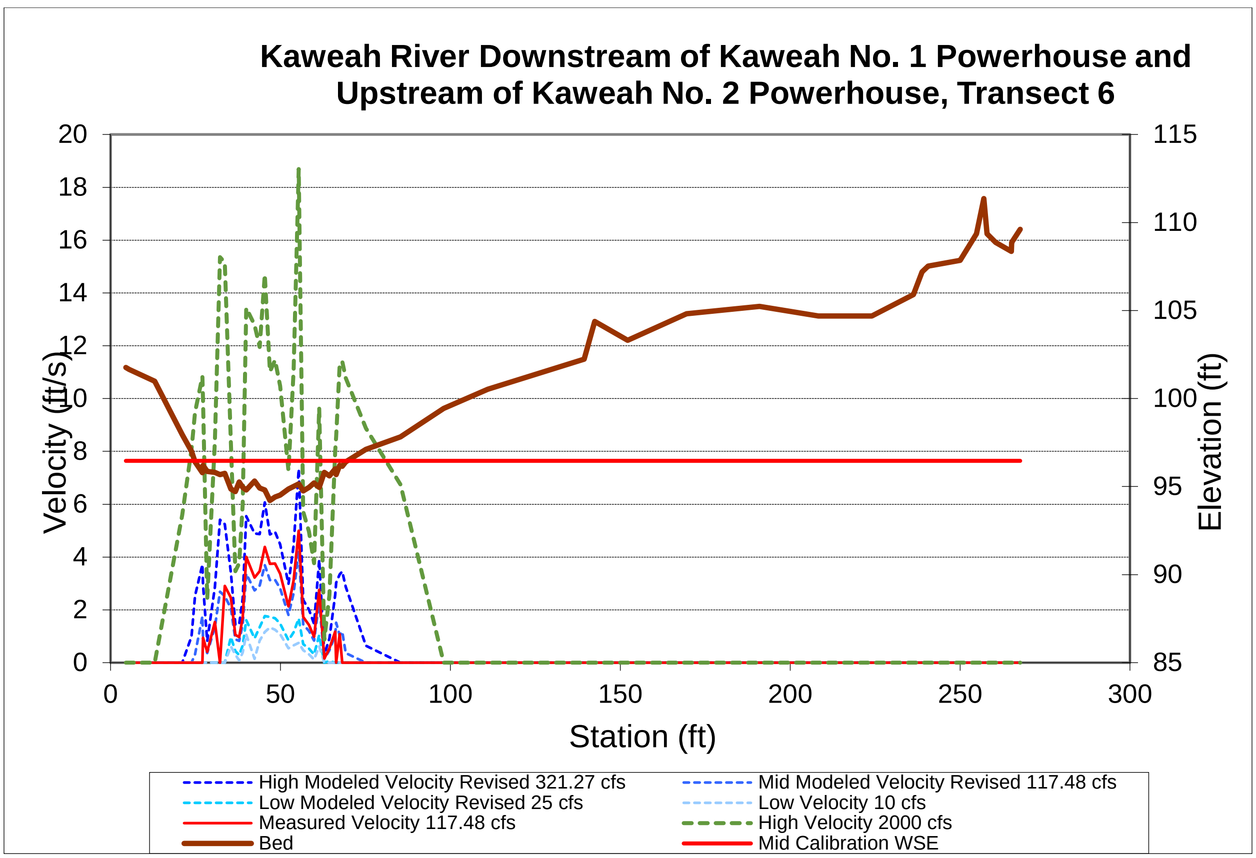

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

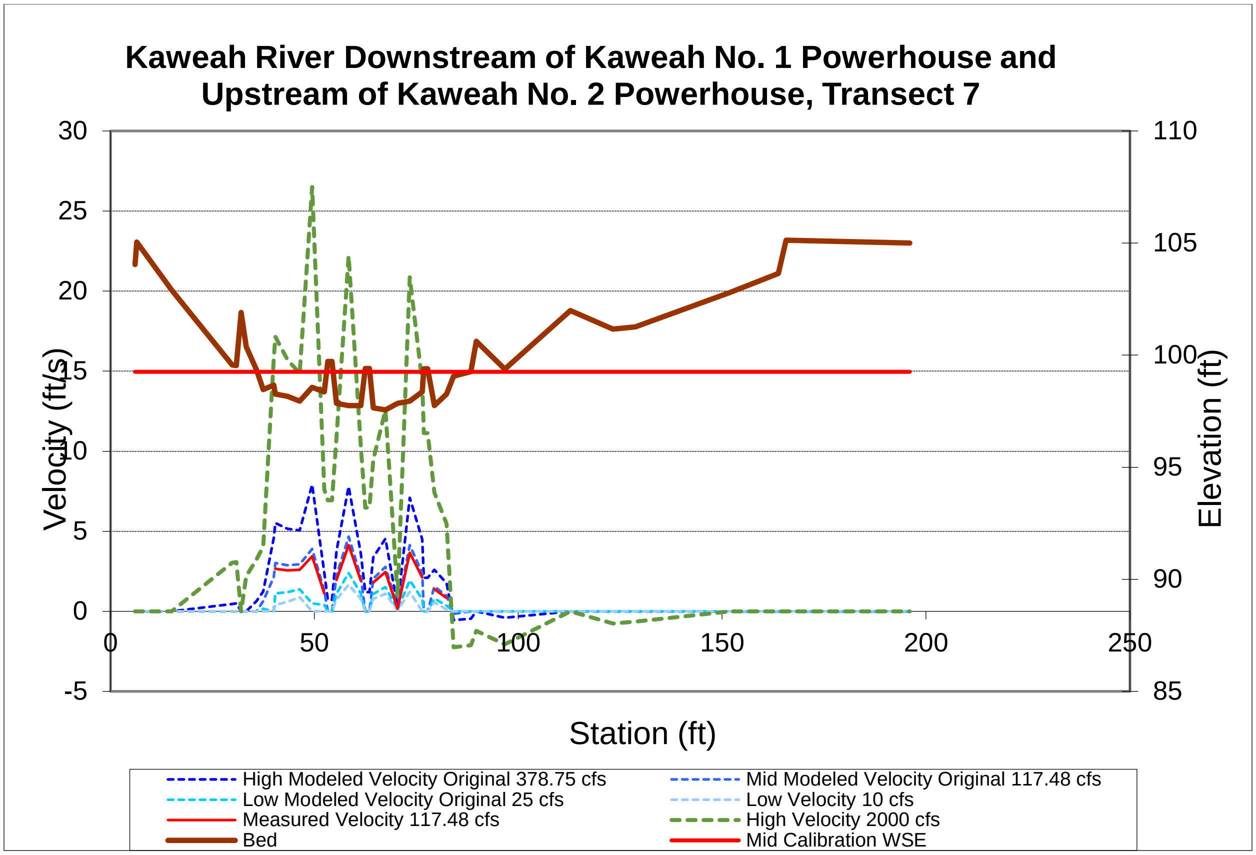

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 4
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

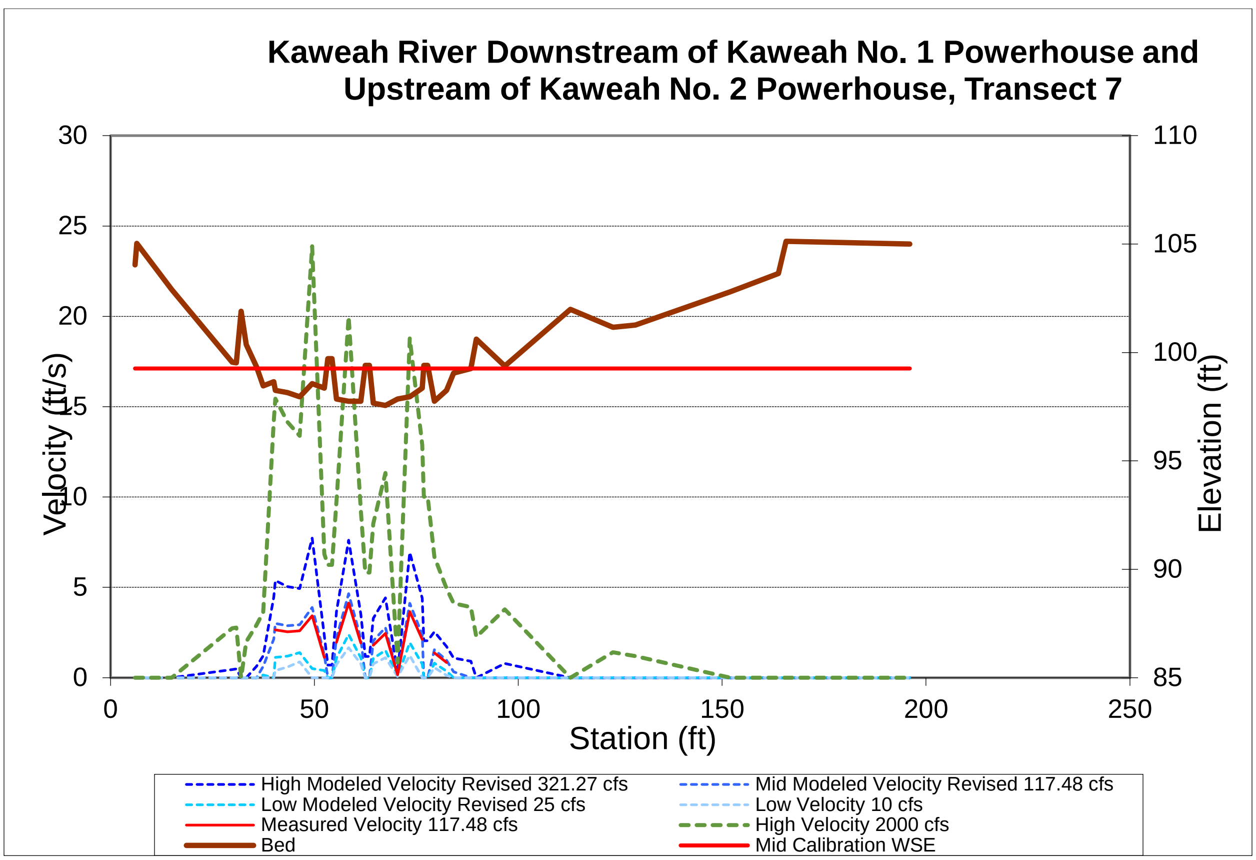

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

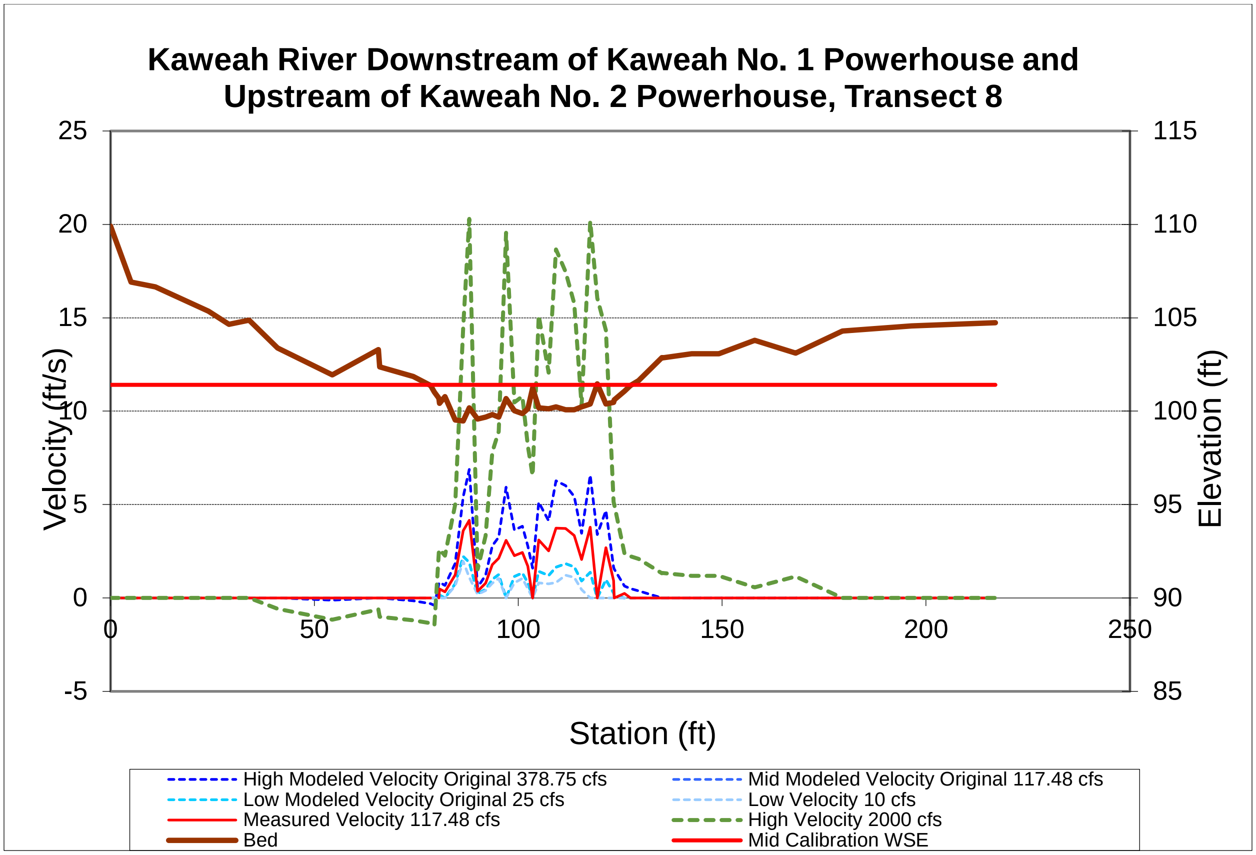

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 5
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

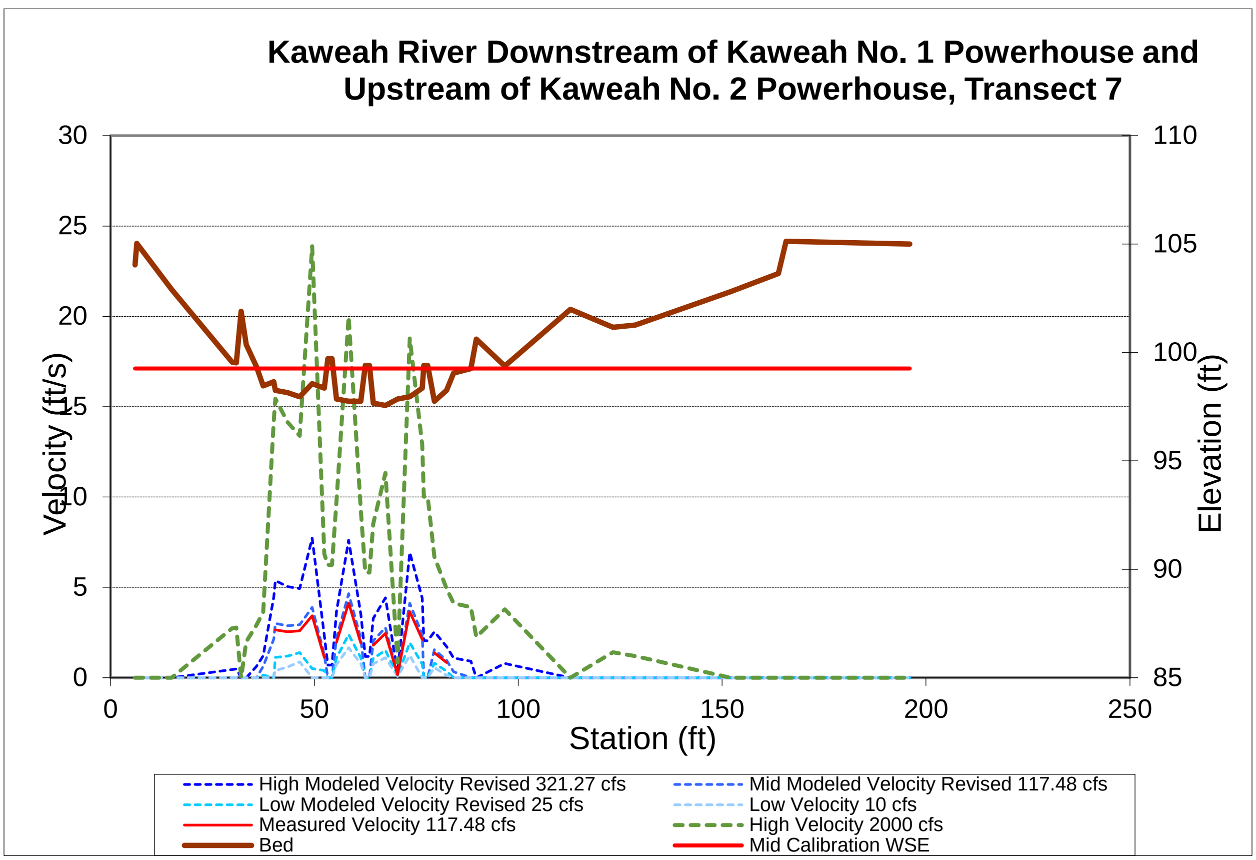

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
2
4
6
8
10
12
14
16
18
20
85
90
95
100
105
110
115
0
50
100
150
200
250
300
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

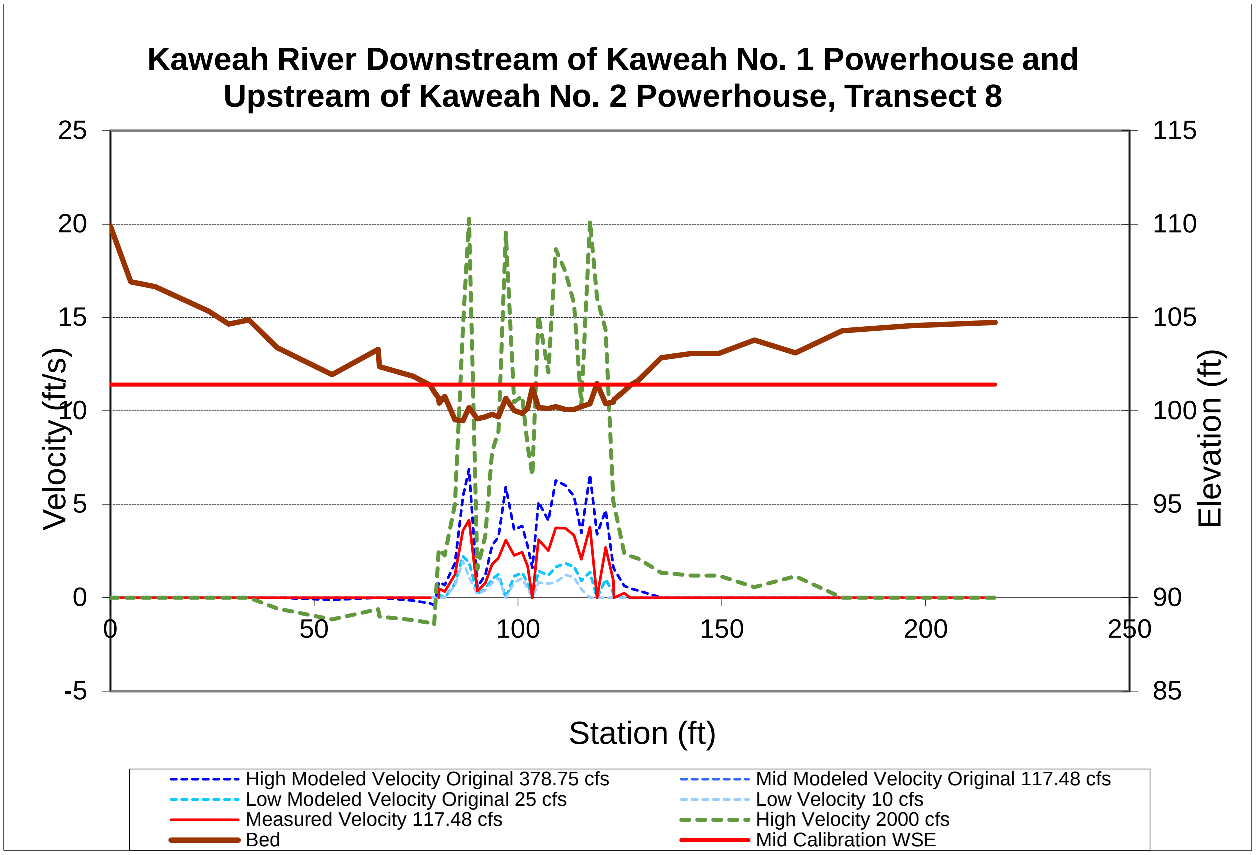

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 6
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
2
4
6
8
10
12
14
16
18
20
85
90
95
100
105
110
115
0
50
100
150
200
250
300
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

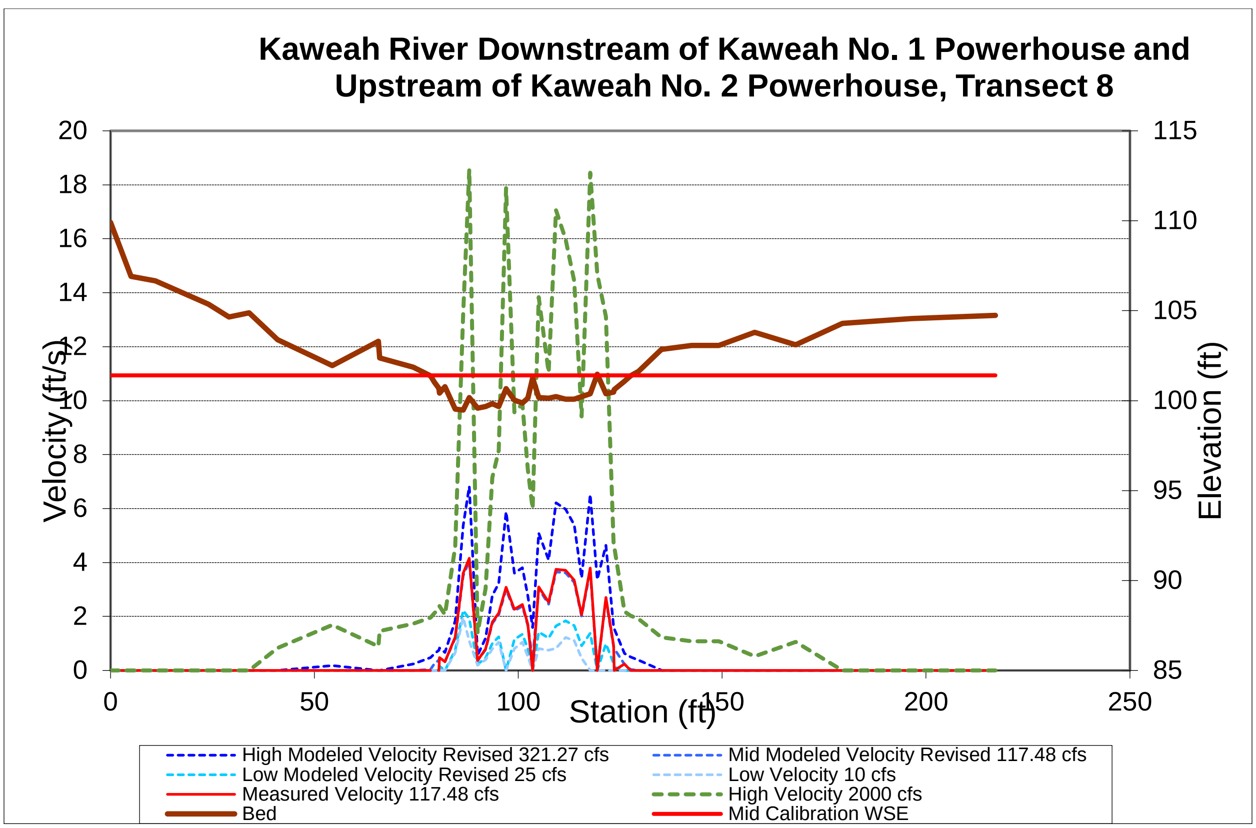

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

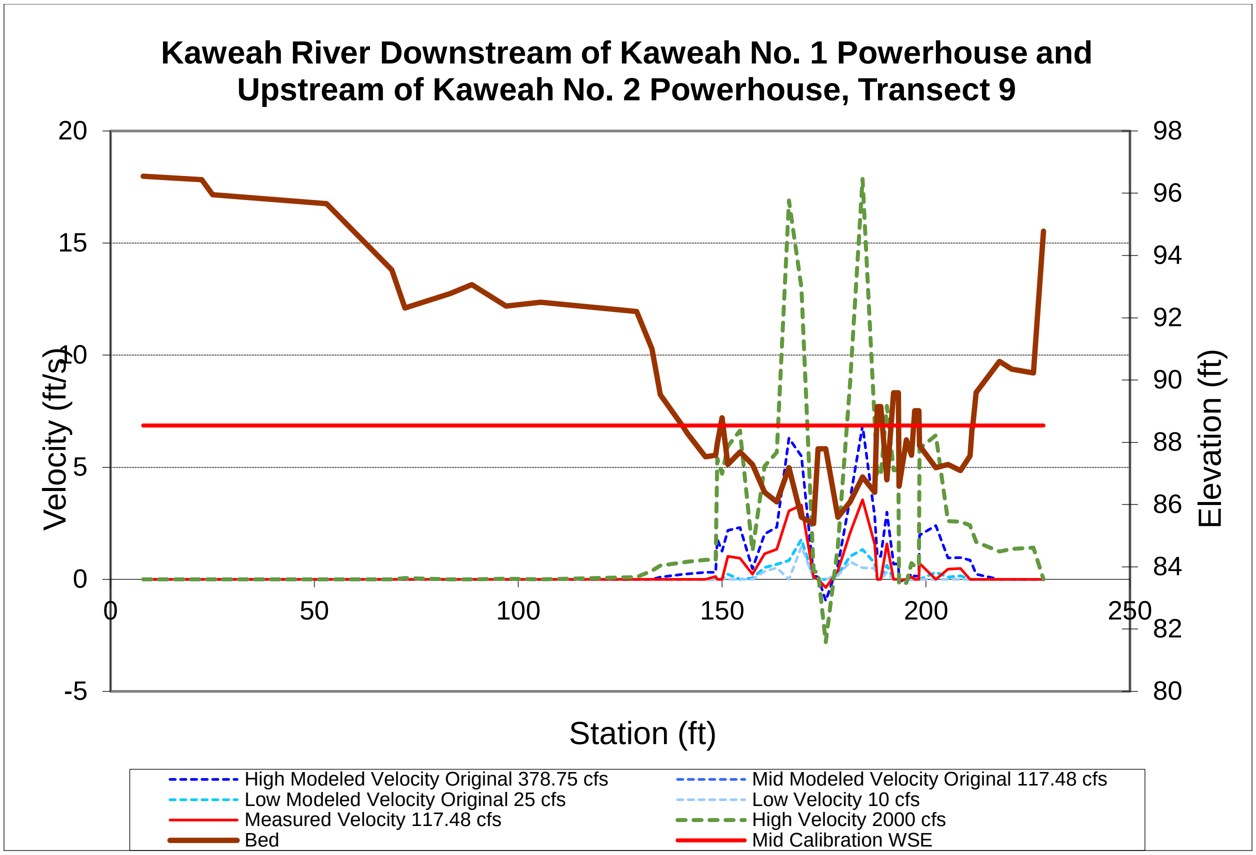

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

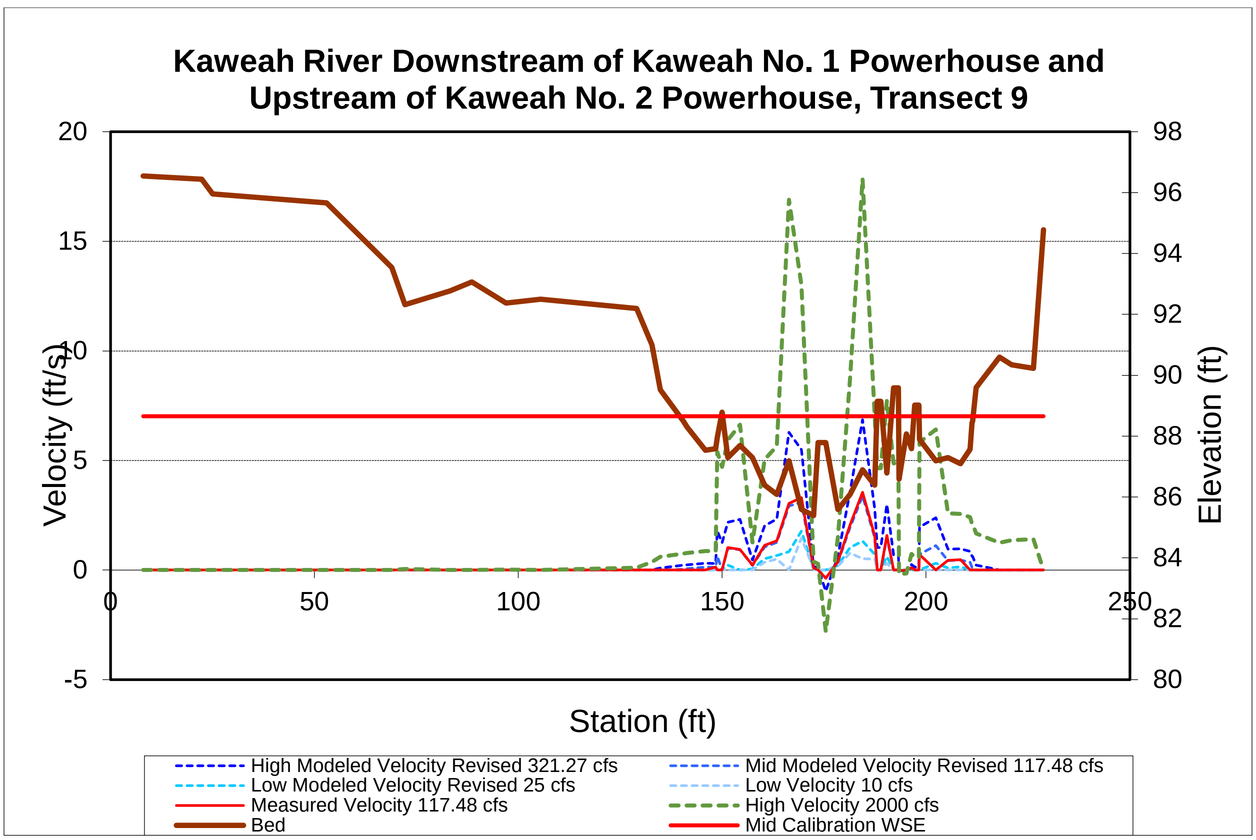

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
115
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

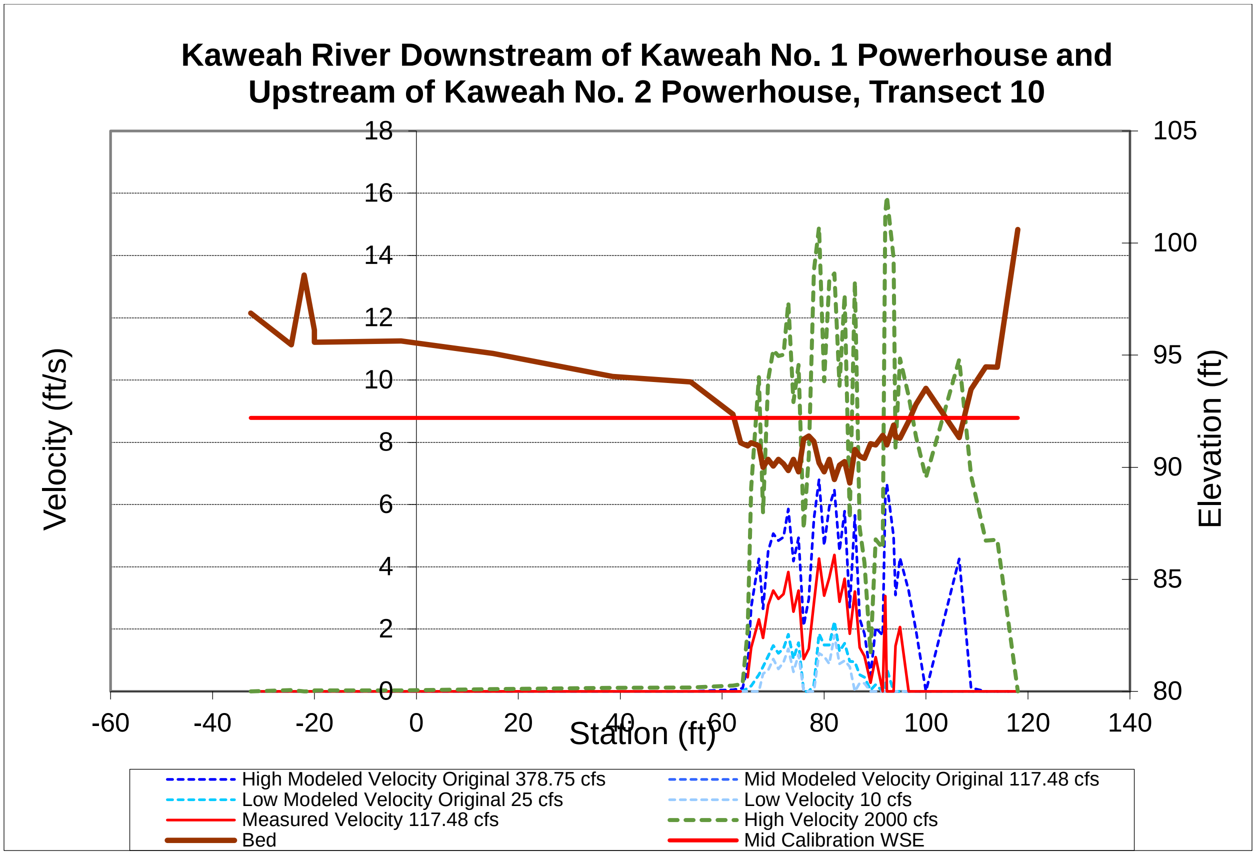

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 7
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

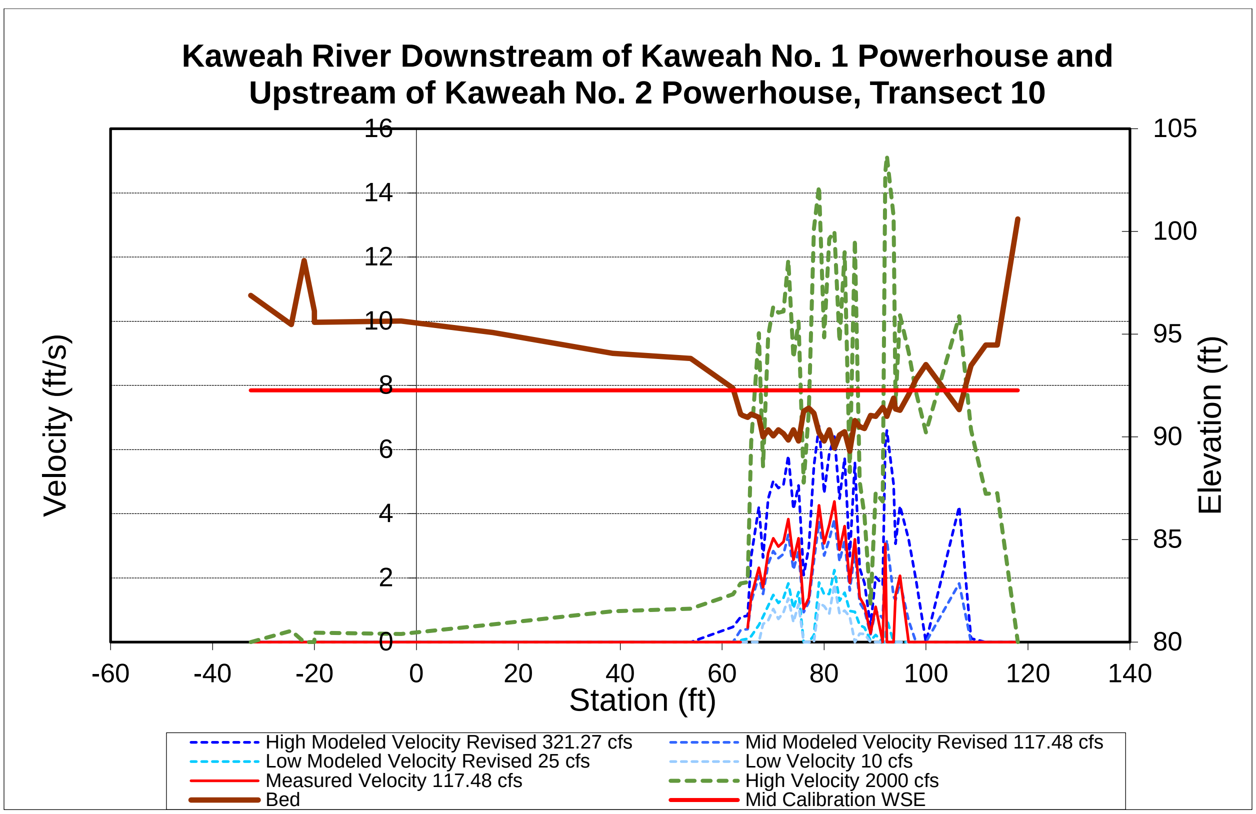

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
-5
115
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

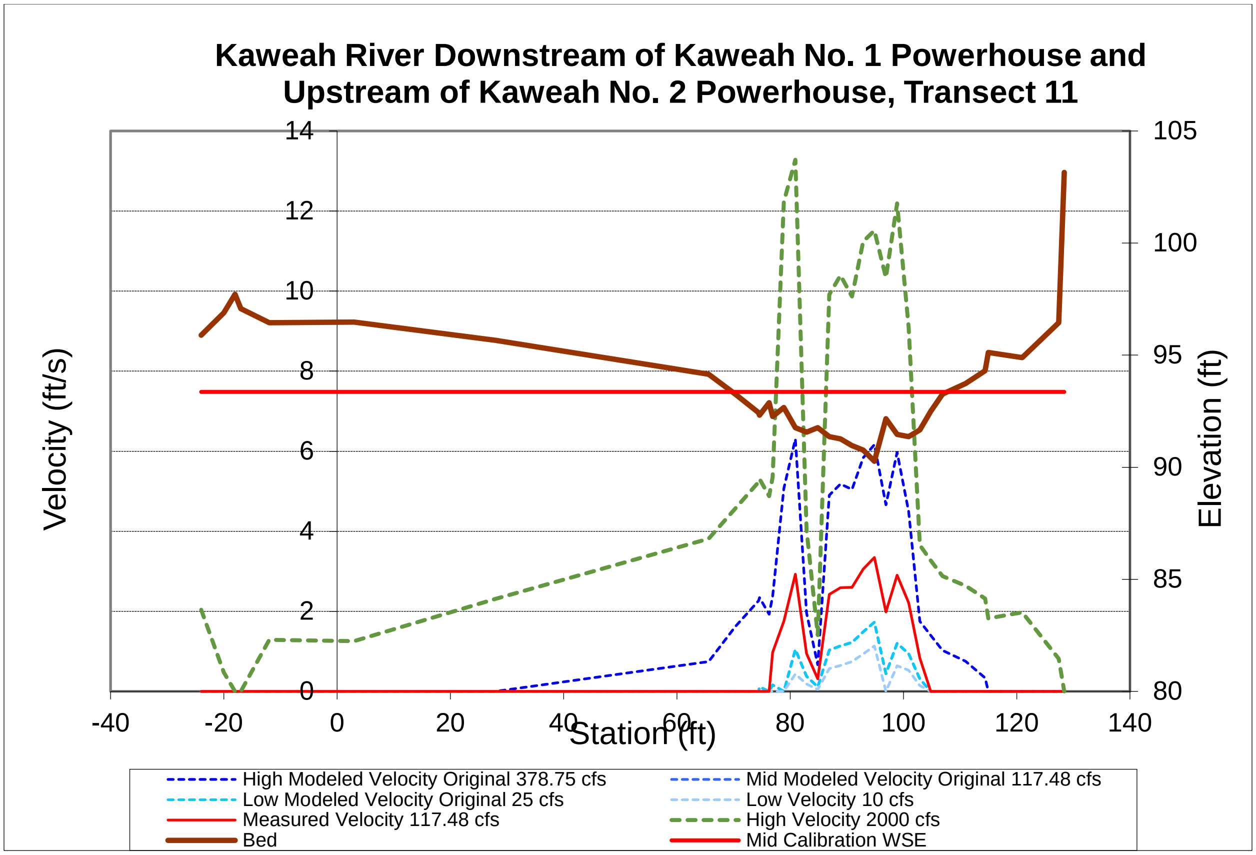

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 8
Velocity (ft/s)
Elevation (ft)
Station (ft)
20
18
16
14
12
10
8
6
4
2
0
115
110
105
100
95
90
85
0
50
100
150
200
250
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

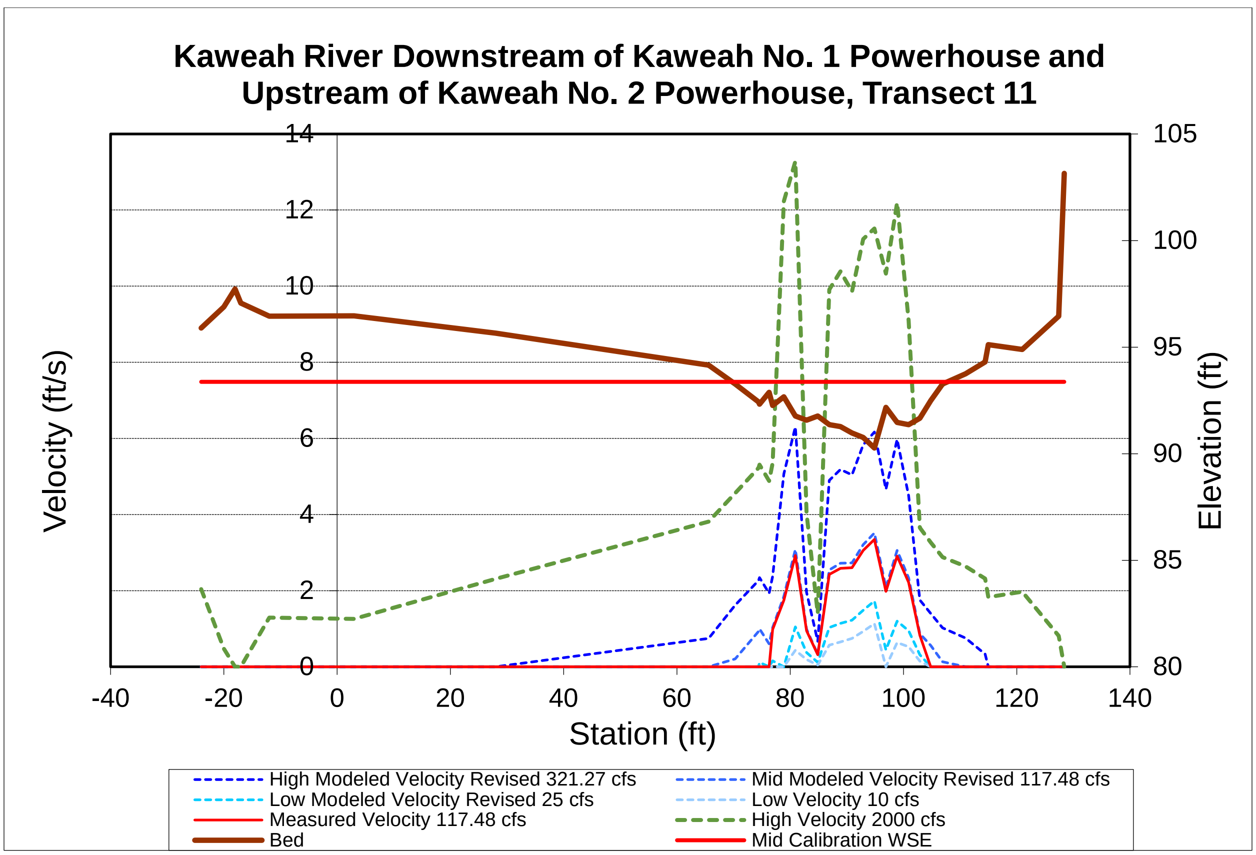

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

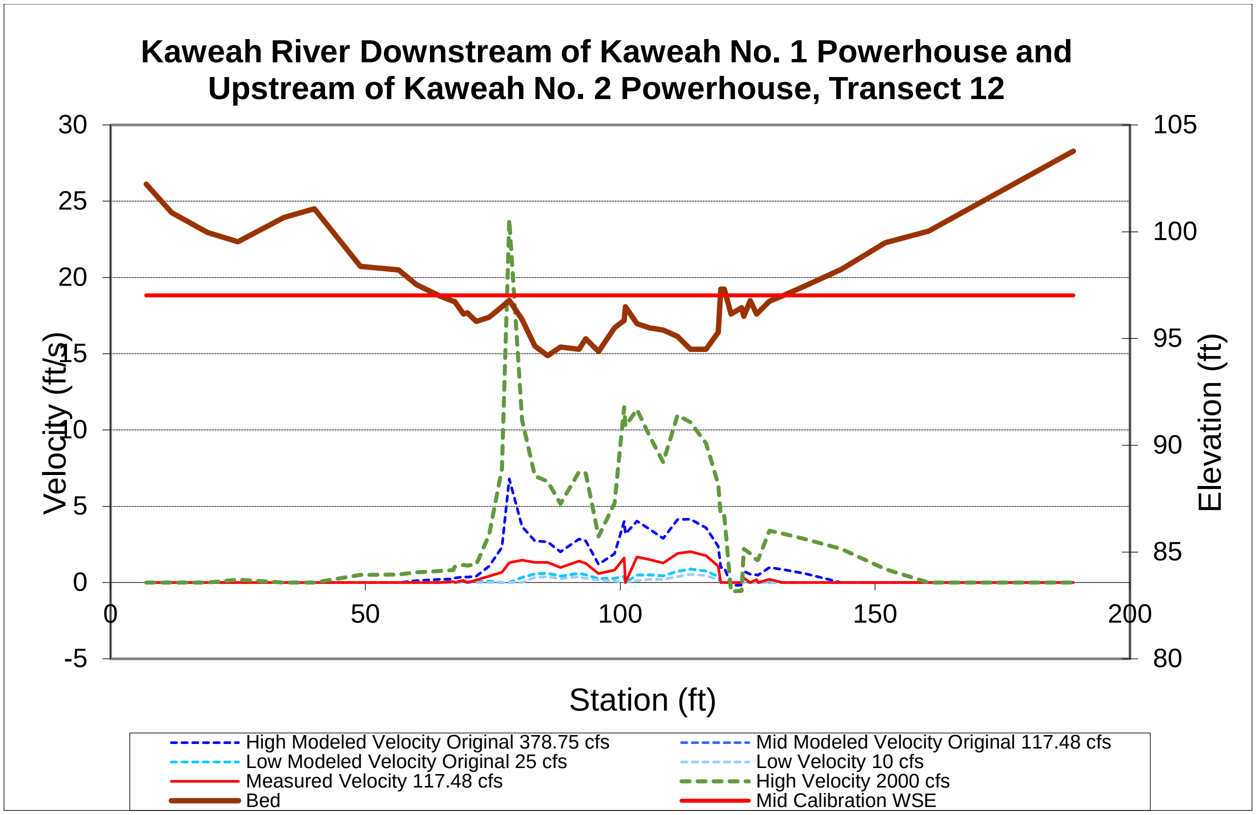

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 9
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

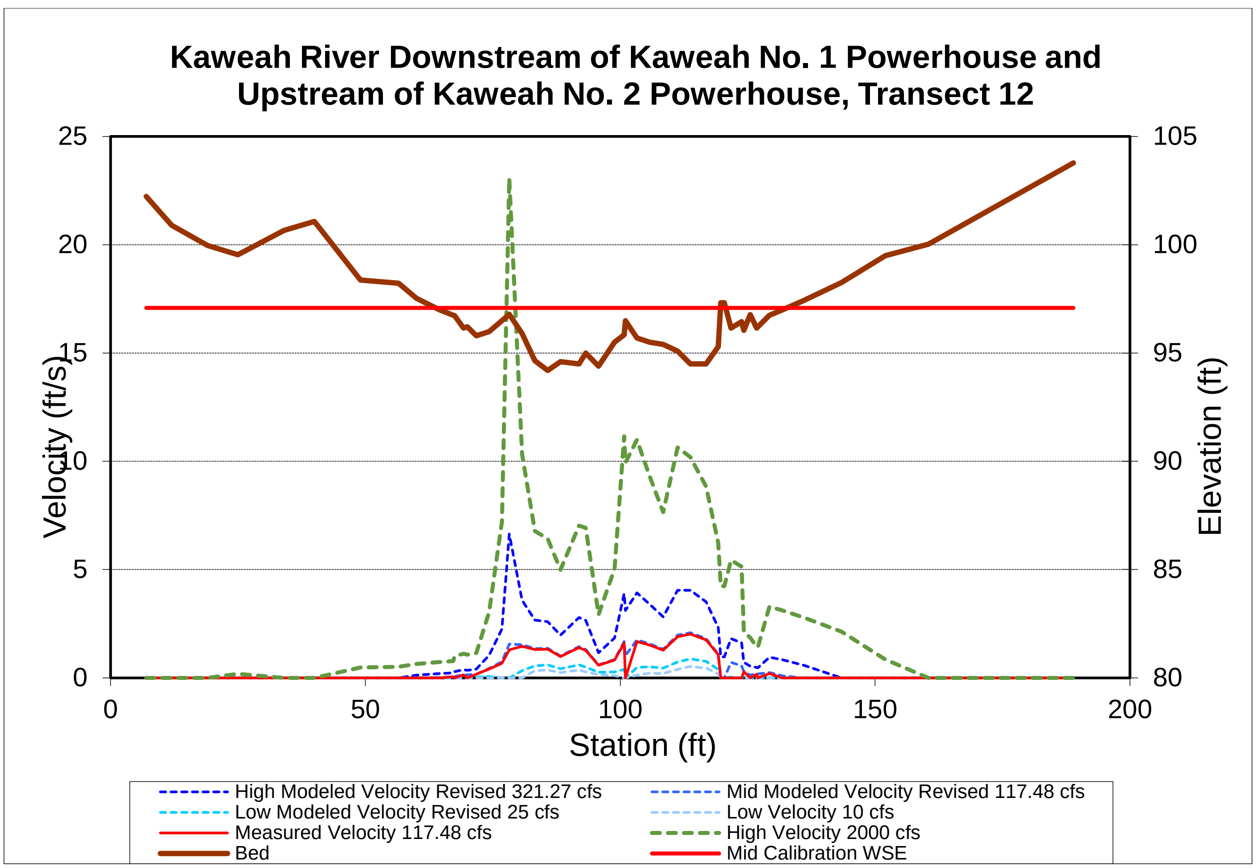

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 10
Velocity (ft/s)
Elevation (ft)
Station (ft)
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
2
4
6
8
10
12
14
80
85
90
95
100
105
-40
-20
0
20
40
60
80
100
120
140
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 11
Velocity (ft/s)
Elevation (ft)
Station (ft)
0
2
4
6
8
10
12
14
80
85
90
95
100
105
-40
-20
0
20
40
60
80
100
120
140
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
30
25
20
15
10
5
0
-5
105
100
95
90
85
80
0
50
100
150
200
High Modeled Velocity Original 378.75 cfs
Mid Modeled Velocity Original 117.48 cfs
Low Modeled Velocity Original 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE


Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse, Transect 12
Velocity (ft/s)
Elevation (ft)
Station (ft)
25
20
15
10
5
0
105
100
95
90
85
80
0
50
100
150
200
High Modeled Velocity Revised 321.27 cfs
Mid Modeled Velocity Revised 117.48 cfs
Low Modeled Velocity Revised 25 cfs
Low Velocity 10 cfs
Measured Velocity 117.48 cfs
High Velocity 2000 cfs
Bed
Mid Calibration WSE

APPENDIX E

WUA Results

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Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

East Fork Kaweah River Upstream of the Confluence with Kaweah River

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

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Table E-1a. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Weighted Usable Area (ft^2 / 1000 ft)								WETTED PERIMETER (ft^2)
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUVENILE	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	
7.0	1	8703	16177	24787	26636	13992	28647	22181	37
10.0	4	10648	18600	25505	28235	15654	30172	23877	40
16.5	19	13997	21844	26434	30832	18227	32427	26614	44
20.0	32	15510	23017	26172	31508	19298	32884	27839	46
25.0	59	17282	24300	26184	32821	20582	33740	29402	48
30.0	107	18566	25114	26385	33442	21651	34340	30605	50
35.0	154	19583	25944	26400	33430	22627	34725	31730	51
40.0	216	20397	26580	26189	33327	23466	34901	32738	53
45.0	298	21118	27126	25982	33932	24209	35214	33772	54
52.1	434	21959	27565	25129	34843	25022	35096	34927	55
75.0	733	24281	27790	22886	34568	27130	33437	37445	58
100.0	843	25740	27642	21709	33889	28494	32383	39383	60
125.0	863	26346	27342	20328	34290	29310	31809	41017	62
150.0	800	26541	26829	18786	33864	29867	30706	42065	63
175.0	646	26477	26123	17579	32683	30100	29312	42546	65
200.0	479	26412	25280	16667	31340	30161	27984	42771	66
225.0	321	26362	24514	16022	30308	30111	26995	43016	68
250.0	178	26295	23696	15083	29414	29959	25945	43152	69
271.5	100	25816	22694	14390	28629	29522	24975	42870	70
300.0	53	25398	21497	13872	27267	29055	23969	42301	72
350.0	32	24799	20376	13341	25597	28607	22939	41963	74
400.0	21	23854	19270	12557	24165	27879	22214	41332	75
497.0	14	21904	17939	11436	23378	26541	20973	40192	78
600.0	54	20412	17232	9707	22130	25334	19322	39183	81
700.0	138	19230	15955	8232	20118	24168	17398	38195	83
800.0	133	18055	14394	7910	18707	23021	16195	37202	85
900.0	165	17048	13498	7556	17491	22131	15306	36259	86
1000.0	207	16151	12845	6408	17024	21313	14142	35428	87
1200.0	207	14716	11269	5243	15170	20056	12014	33727	90
1400.0	155	13647	9896	4845	13534	19061	10702	32485	92

Table E-1b. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Percent of Maximum Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Percent of Maximum Weighted Usable Area								
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUVENILE	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	WETTED PERIMETER
7.0	0	33	58	94	76	46	81	51	41
10.0	0	40	67	96	81	52	86	55	43
16.5	2	53	79	100	88	60	92	62	48
20.0	4	58	83	99	90	64	93	65	50
25.0	7	65	87	99	94	68	96	68	53
30.0	12	70	90	100	96	72	98	71	54
35.0	18	74	93	100	96	75	99	74	56
40.0	25	77	96	99	96	78	99	76	57
45.0	35	80	98	98	97	80	100	78	58
52.1	50	83	99	95	100	83	100	81	59
75.0	85	91	100	87	99	90	95	87	63
100.0	98	97	99	82	97	94	92	91	65
125.0	100	99	98	77	98	97	90	95	67
150.0	93	100	97	71	97	99	87	97	69
175.0	75	100	94	67	94	100	83	99	71
200.0	55	100	91	63	90	100	79	99	72
225.0	37	99	88	61	87	100	77	100	74
250.0	21	99	85	57	84	99	74	100	75
271.5	12	97	82	54	82	98	71	99	77
300.0	6	96	77	52	78	96	68	98	78
350.0	4	93	73	50	73	95	65	97	80
400.0	2	90	69	48	69	92	63	96	82
497.0	2	83	65	43	67	88	60	93	85
600.0	6	77	62	37	64	84	55	91	88
700.0	16	72	57	31	58	80	49	89	90
800.0	15	68	52	30	54	76	46	86	92
900.0	19	64	49	29	50	73	43	84	94
1000.0	24	61	46	24	49	71	40	82	95
1200.0	24	55	41	20	44	66	34	78	98
1400.0	18	51	36	18	39	63	30	75	100

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Table E-2a. East Fork Kaweah River Upstream of the Confluence with Kaweah River Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Weighted Usable Area (ft^2 / 1000 ft)								WETTED PERIMETER (ft^2)
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	
4.0	0	4227	9962	17276	16708	6848	19151	12196	28
6.0	0	5431	11893	17722	18088	7930	20406	13675	30
9.8	0	7299	14283	17986	19389	9503	21699	15697	34
15.0	1	9539	16416	18945	20906	11222	23471	18102	40
20.0	11	11213	17736	19877	22003	12399	24691	19794	43
26.3	19	12930	19179	20446	22532	13630	25830	21626	45
30.0	28	13715	19728	19947	22941	14226	26027	22565	46
35.0	41	14663	20465	19804	24018	14974	26616	23785	47
40.0	52	15420	20875	19306	24685	15575	26709	24734	48
45.0	65	16173	21351	19110	25014	16230	26756	25681	49
50.0	79	16815	21757	18948	25284	16828	26776	26585	50
60.0	109	17668	22103	18188	25556	17722	26427	27877	51
70.0	131	18498	22309	17530	26129	18509	26148	29089	52
78.8	150	19108	22311	17082	26081	19108	25783	29921	53
90.0	175	19770	22066	16364	25729	19804	25222	30850	54
100.0	193	20226	21891	16128	25742	20507	25033	31814	55
110.0	208	20535	21666	15823	25656	20908	24783	32416	56
120.0	221	20652	21210	15284	25136	21188	24194	32752	57
130.0	233	20810	20990	15095	24941	21435	23983	33109	57
140.0	237	20928	20890	14914	24758	21662	23834	33482	58
150.0	236	20931	20642	14432	24560	21896	23409	33770	59
160.0	233	20958	20510	14144	24439	22051	23162	33940	59
170.0	231	20959	20346	13857	24193	22185	22896	34041	60
180.0	228	20920	20087	13414	23983	22267	22534	34005	60
190.0	226	20936	19995	13166	23887	22384	22334	34020	61
200.0	222	20961	19925	12877	23696	22502	22099	34033	61
210.0	218	20965	19808	12536	23429	22606	21838	34088	61
220.0	213	20932	19594	12059	23168	22682	21466	34130	62
230.0	209	20890	19424	11652	23091	22771	21122	34193	62
240.0	205	20555	18852	10884	22461	22765	20237	34030	63

Table E-2b. East Fork Kaweah River Upstream of the Confluence with Kaweah River Percent of Maximum Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Percent of Maximum Weighted Usable Area								
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	WETTED PERIMETER
4.0	0	20	45	84	64	30	72	36	44
6.0	0	26	53	87	69	35	76	40	48
9.8	0	35	64	88	74	42	81	46	54
15.0	1	46	74	93	80	49	88	53	64
20.0	4	53	79	97	84	54	92	58	68
26.3	8	62	86	100	86	60	96	63	71
30.0	12	65	88	98	88	62	97	66	73
35.0	17	70	92	97	92	66	99	70	75
40.0	22	74	94	94	94	68	100	72	77
45.0	27	77	96	93	96	71	100	75	78
50.0	33	80	98	93	97	74	100	78	79
60.0	46	84	99	89	98	78	99	82	82
70.0	55	88	100	86	100	81	98	85	83
78.8	63	91	100	84	100	84	96	88	85
90.0	74	94	99	80	98	87	94	90	86
100.0	82	96	98	79	99	90	93	93	88
110.0	88	98	97	77	98	92	93	95	89
120.0	93	99	95	75	96	93	90	96	90
130.0	98	99	94	74	95	94	90	97	91
140.0	100	100	94	73	95	95	89	98	92
150.0	99	100	93	71	94	96	87	99	93
160.0	98	100	92	69	94	97	87	99	94
170.0	97	100	91	68	93	97	86	100	95
180.0	96	100	90	66	92	98	84	99	96
190.0	95	100	90	64	91	98	83	99	97
200.0	94	100	89	63	91	99	83	100	97
210.0	92	100	89	61	90	99	82	100	98
220.0	90	100	88	59	89	100	80	100	99
230.0	88	100	87	57	88	100	79	100	99
240.0	86	98	84	53	86	100	76	100	100

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Table E-3a. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Weighted Usable Area (ft^2 / 1000 ft)								WETTED PERIMETER (ft^2)
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	
10.0	155	8388	20233	33150	28871	13567	33474	24059	52
15.0	212	11080	24210	35733	30887	15377	36825	26767	57
22.0	283	14294	28207	37089	33955	17588	39962	30128	61
27.0	328	16279	30263	37237	36026	18906	41608	32117	63
32.0	364	18121	32097	37115	37343	20216	42768	34076	65
40.0	407	20582	33797	36188	38643	22058	43475	36849	68
45.0	417	22024	34784	35970	39702	23143	43921	38530	69
50.0	425	23364	35658	35312	40450	24130	43978	40030	70
60.0	427	25358	36025	33701	39997	25586	43332	42084	72
84.2	365	28781	36452	31451	40985	28088	43034	46429	76
100.0	334	30080	35667	29466	40059	29020	41473	47893	78
125.0	335	31606	35038	28568	38755	30302	40762	49933	81
150.0	349	32445	34613	28065	37866	31162	40055	51199	84
200.0	399	32811	33720	27387	36879	32060	39096	52503	89
250.0	401	32967	33557	27449	37210	32757	38827	53389	92
296.2	412	32777	33301	26774	36649	32995	38241	53722	95
378.8	551	32520	32905	27407	36554	33450	38275	54387	101
425.0	534	31910	32332	26792	35199	33272	37470	54021	103
500.0	501	31842	32818	26623	36236	33575	37993	54840	106
600.0	436	31613	32165	24825	35527	33810	36867	55204	109
750.8	243	32345	32361	24564	35310	34663	36217	56015	115
791.5	209	32539	32580	24307	34900	34898	35987	56112	116
900.0	134	33017	32915	23791	35341	35450	35809	56432	119
1000.0	94	33784	33209	22913	36304	36265	35467	57029	121
1100.0	65	33894	32125	21045	34815	36489	33844	56740	124
1200.0	43	34283	31337	20545	34241	37104	33305	57296	126
1300.0	28	34411	30875	20276	33310	37441	32859	57390	128
1500.0	16	34760	30198	18532	33853	37928	31973	58367	132
1700.0	12	35054	29393	15420	33799	39155	29885	59379	135
1900.0	8	34233	26549	13309	31186	39127	27260	58363	138

Table E-3b. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Percent of Maximum Weighted Usable Area and Wetted Perimeter.

Discharge (cfs)	Percent of Maximum Weighted Usable Area								
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	WETTED PERIMETER
10.0	28	24	56	89	70	35	76	41	37
15.0	38	32	66	96	75	39	84	45	41
22.0	51	41	77	100	83	45	91	51	44
27.0	60	46	83	100	88	48	95	54	46
32.0	66	52	88	100	91	52	97	57	47
40.0	74	59	93	97	94	56	99	62	49
45.0	76	63	95	97	97	59	100	65	50
50.0	77	67	98	95	99	62	100	67	51
60.0	77	72	99	91	98	65	99	71	52
84.2	66	82	100	84	100	72	98	78	55
100.0	61	86	98	79	98	74	94	81	57
125.0	61	90	96	77	95	77	93	84	59
150.0	63	93	95	75	92	80	91	86	61
200.0	73	94	93	74	90	82	89	88	65
250.0	73	94	92	74	91	84	88	90	67
296.2	75	94	91	72	89	84	87	90	69
378.8	100	93	90	74	89	85	87	92	73
425.0	97	91	89	72	86	85	85	91	75
500.0	91	91	90	71	88	86	86	92	76
600.0	79	90	88	67	87	86	84	93	79
750.8	44	92	89	66	86	89	82	94	83
791.5	38	93	89	65	85	89	82	94	84
900.0	24	94	90	64	86	91	81	95	86
1000.0	17	96	91	62	89	93	81	96	88
1100.0	12	97	88	57	85	93	77	96	90
1200.0	8	98	86	55	84	95	76	96	91
1300.0	5	98	85	54	81	96	75	97	93
1500.0	3	99	83	50	83	97	73	98	96
1700.0	2	100	81	41	82	100	68	100	98
1900.0	1	98	73	36	76	100	62	98	100

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Table E-4a. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Weighted Usable Area and Wetter Perimeter.

Discharge (cfs)	Weighted Usable Area (ft^2 / 1000 ft)								WETTED PERIMETER (ft^2)
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	
10	141	4288	11671	18908	14407	8237	19276	14244	37
15	177	5630	13685	19801	16517	9193	21195	16391	41
20	193	6999	15328	20462	18399	10140	22690	18327	44
25	207	8282	16598	21023	19294	11051	23829	19992	46
30	225	9323	17603	21189	19648	11824	24561	21287	48
35	243	10193	18392	21265	20164	12458	25230	22413	50
40	257	10943	19057	21383	20675	12976	25774	23481	52
45	263	11724	19702	21254	21443	13542	26218	24540	53
50	225	12370	19987	21021	21564	14059	26207	25354	54
75	203	14999	21439	19209	23439	16075	26191	29117	57
100	188	16850	21477	18168	23783	17502	25447	31656	60
117	183	17696	21088	16829	22909	18153	24068	32653	61
121	181	17864	21047	16780	22754	18280	23942	32843	62
125	180	18021	21035	16816	22687	18394	23900	33044	62
150	161	18606	20614	17191	21780	18893	23678	33765	64
200	121	18964	20569	18227	20673	19374	24172	34035	68
250	102	19140	20719	17808	22483	19551	24378	34102	71
300	90	19336	21148	18088	21850	19852	24459	33891	74
321	87	19406	21491	18481	21750	19947	24853	33859	75
409	71	19574	22161	18820	21896	20197	25583	33635	79
450	66	19866	22739	18413	23181	20374	26052	34024	81
500	60	20374	23220	17565	25103	20611	26004	34629	82
700	35	22652	24166	17492	24085	21688	25955	36868	91
900	17	23672	24214	17281	24203	22124	26482	38296	97
974	11	23736	24162	17165	25001	22229	26287	38218	99
1100	2	24409	24608	17194	24736	22575	26393	38820	101
1500	0	25607	23546	14522	24313	23132	25497	40436	111
1700	50	25436	22535	14656	22517	23161	24835	40681	115
1900	371	23726	21184	13650	21365	22302	23109	39315	120
2000	565	23587	21164	14743	20877	22225	23663	39413	122

Table E-4b. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Percent of Maximum Weighted Usable Area and Wetter Permeter.

Discharge (cfs)	Percent of Maximum Weighted Usable Area								
	RBT SPAWNING	RAINBOW TROUT ADULT	RAINBOW TROUT JUV	RAINBOW TROUT FRY	HARD HEAD / PIKEMINNOW JUV	HARD HEAD / PIKEMINNOW ADULT	SAC SUCKER JUV	SAC SUCKER ADULT	WETTED PERIMETER
10	25	17	47	88	57	36	73	35	31
15	31	22	56	93	66	40	80	40	34
20	34	27	62	96	73	44	86	45	36
25	37	32	67	98	77	48	90	49	38
30	40	36	72	99	78	51	93	52	40
35	43	40	75	99	80	54	95	55	41
40	46	43	77	100	82	56	97	58	42
45	47	46	80	99	85	58	99	60	43
50	40	48	81	98	86	61	99	62	44
75	36	59	87	90	93	69	99	72	47
100	33	66	87	85	95	76	96	78	49
117	32	69	86	79	91	78	91	80	50
121	32	70	86	78	91	79	90	81	51
125	32	70	85	79	90	79	90	81	51
150	29	73	84	80	87	82	89	83	52
200	21	74	84	85	82	84	91	84	56
250	18	75	84	83	90	84	92	84	58
300	16	76	86	85	87	86	92	83	60
321	15	76	87	86	87	86	94	83	61
409	13	76	90	88	87	87	97	83	65
450	12	78	92	86	92	88	98	84	66
500	11	80	94	82	100	89	98	85	68
700	6	88	98	82	96	94	98	91	75
900	3	92	98	81	96	96	100	94	79
974	2	93	98	80	100	96	99	94	81
1100	0	95	100	80	99	97	100	95	83
1500	0	100	96	68	97	100	96	99	91
1700	9	99	92	69	90	100	94	100	94
1900	66	93	86	64	85	96	87	97	98
2000	100	92	86	69	83	96	89	97	100

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APPENDIX F

Wetted Perimeter Time Series Results

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Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

East Fork Kaweah River Upstream of the Confluence with Kaweah River

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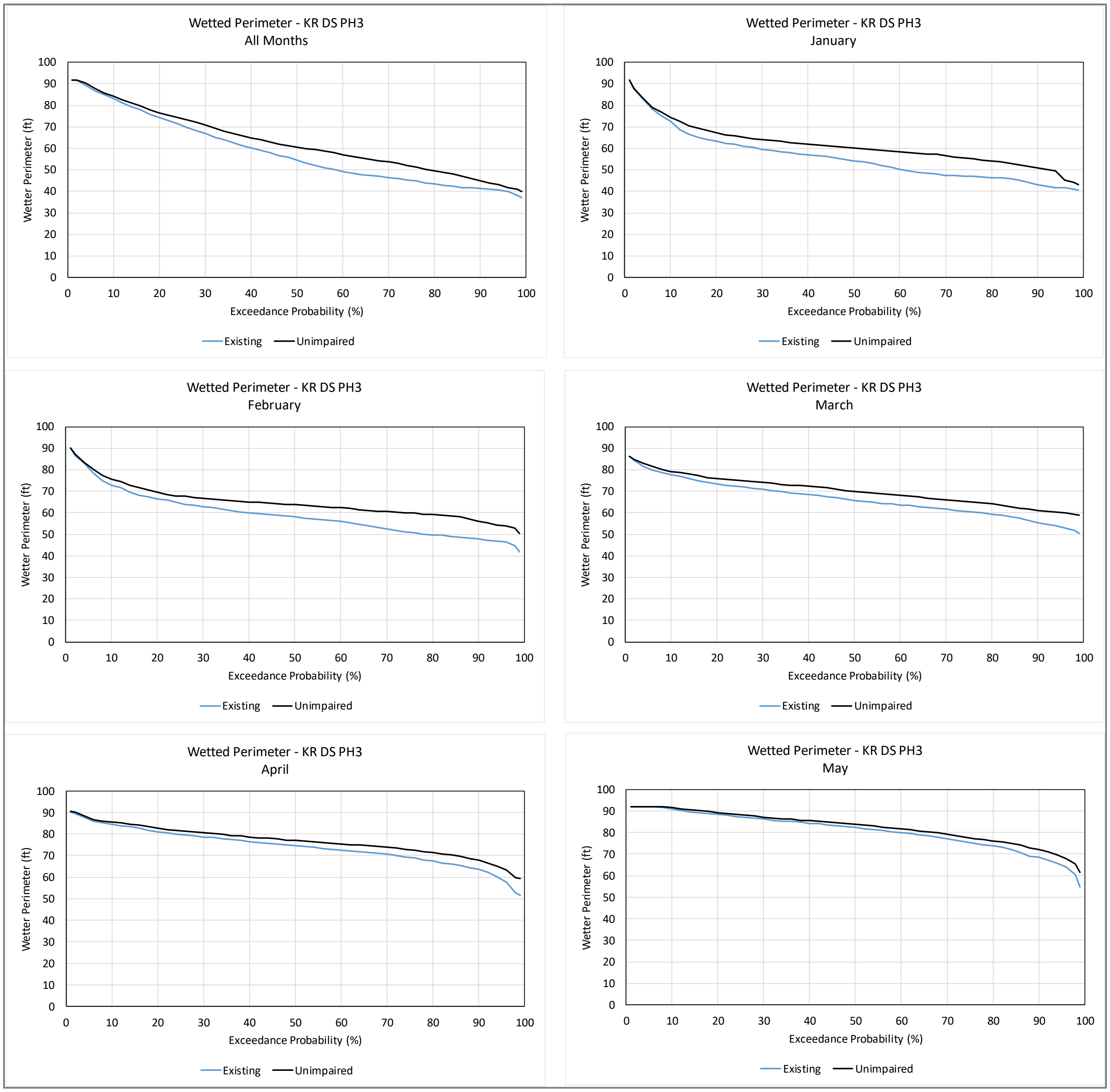
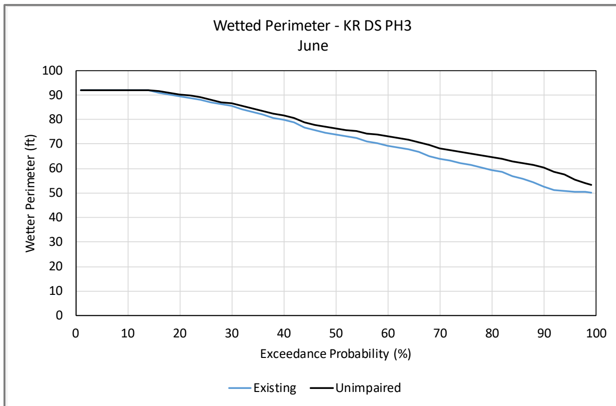
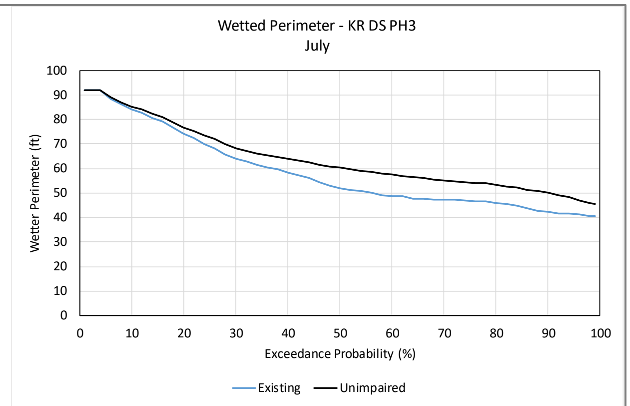
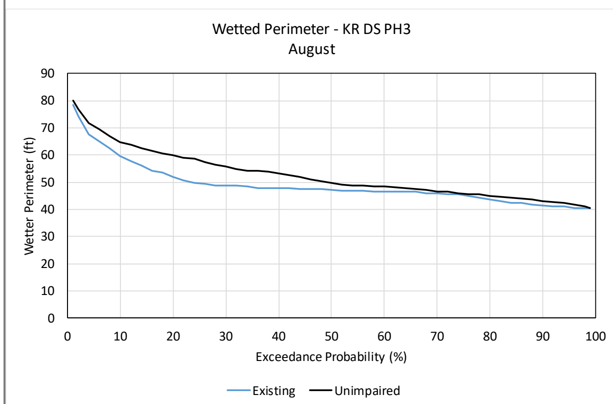
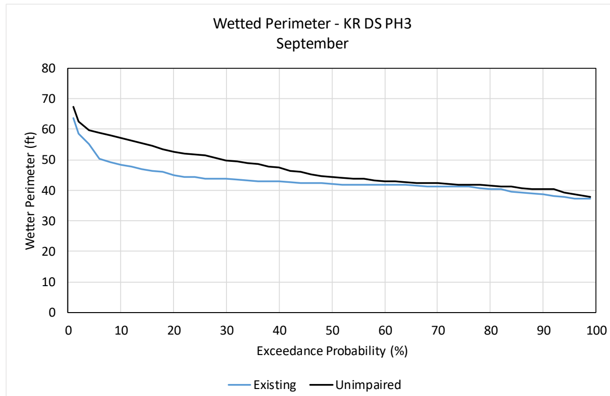
Figure F-1. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Wetted Perimeter Exceedance Plots for All Water Years and each Month Separately.

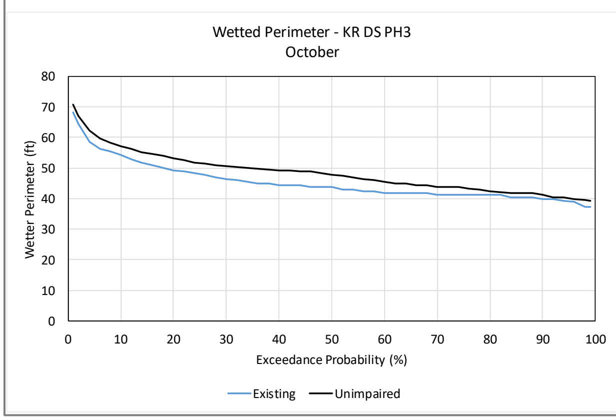


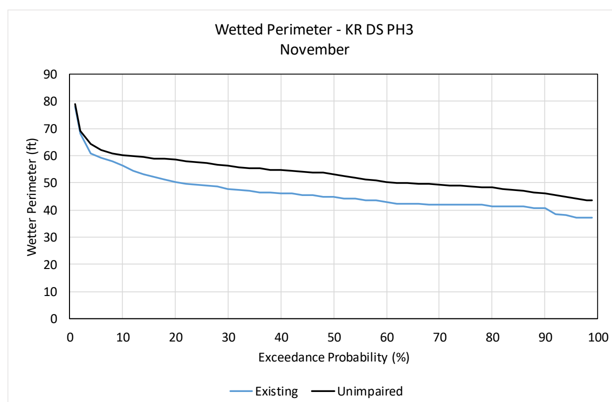

Wetted Perimeter - KR DS PH3
June
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR DS PH3
July
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR DS PH3
August
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR DS PH3
September
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR DS PH3
October
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR DS PH3
November
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired

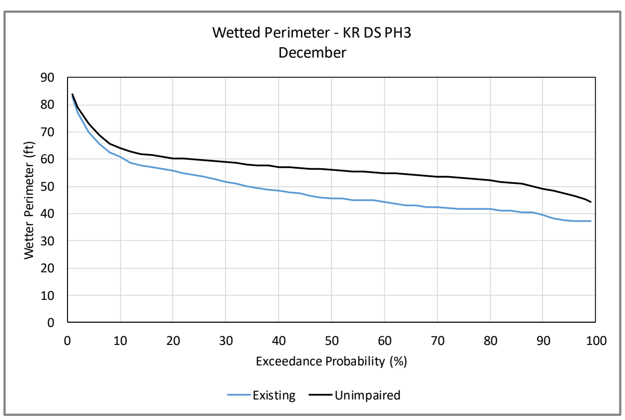
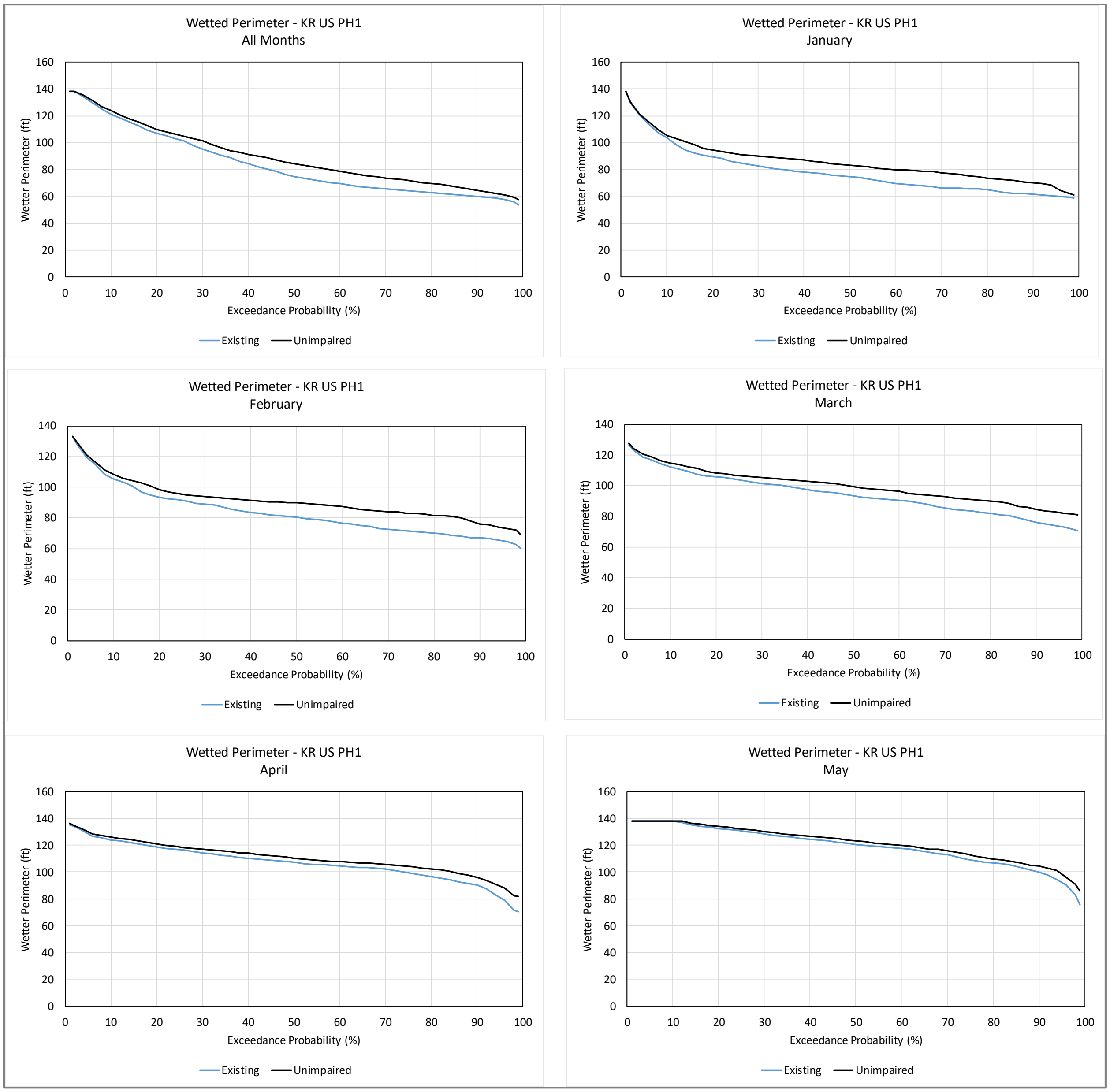
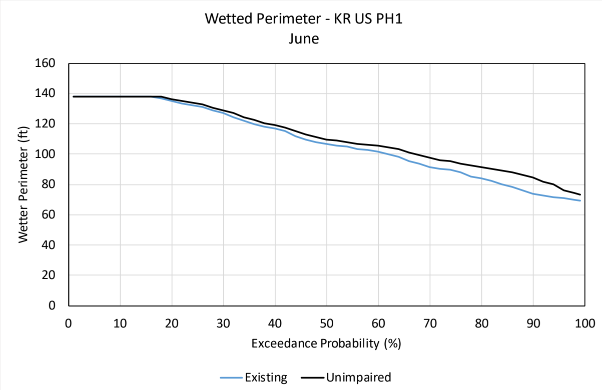
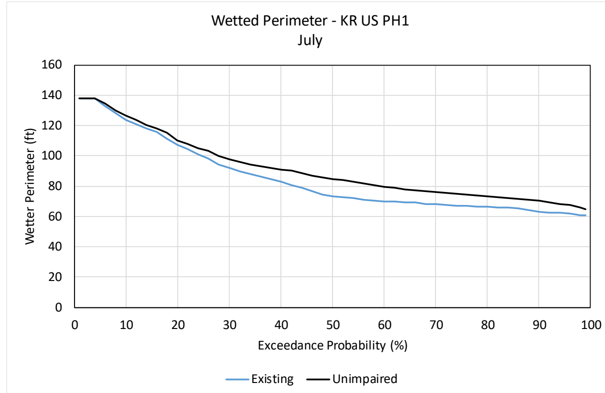
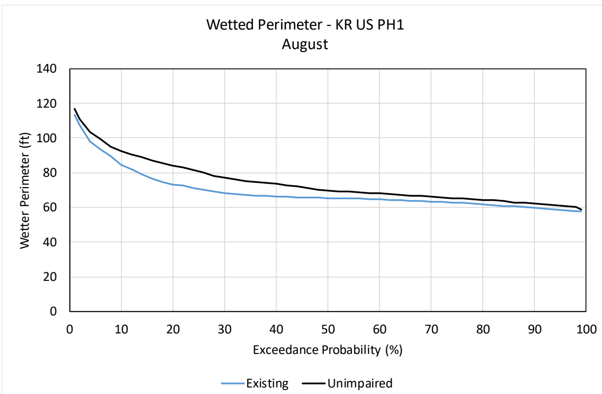

Wetted Perimeter - KR DS PH3
December
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired

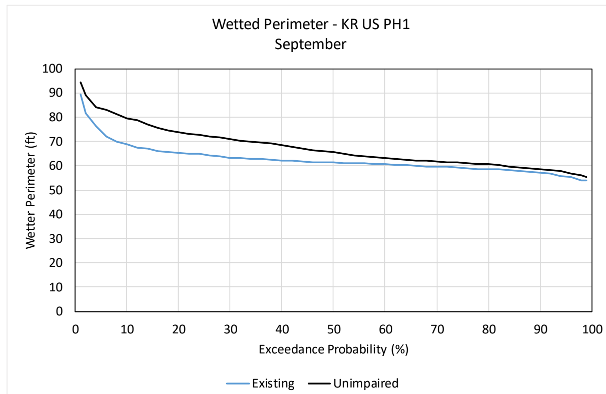
Figure F-2. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Wetted Perimeter Exceedance Plots for All Water Years and each Month Separately.

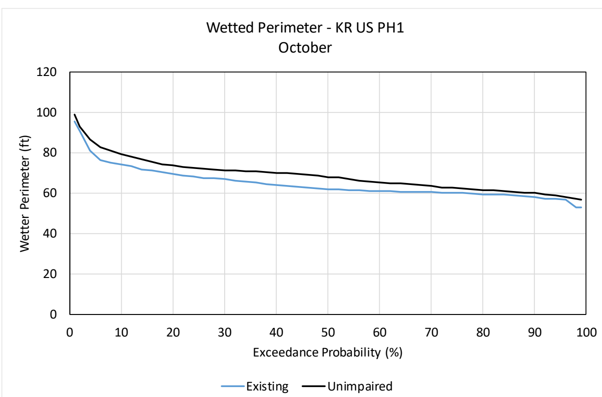


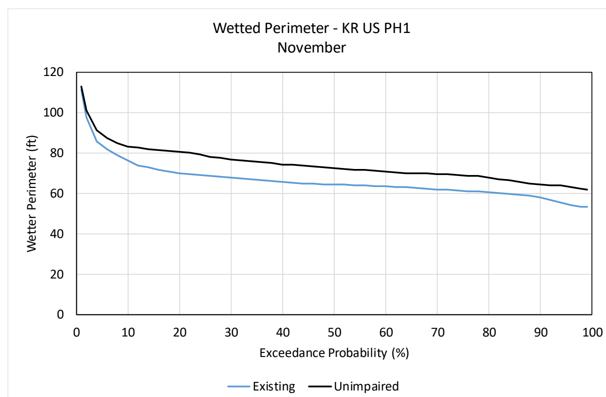

Wetted Perimeter - KR US PH1
June
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH1
July
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH1
August
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH1
September
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH1
October
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH1
November
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired

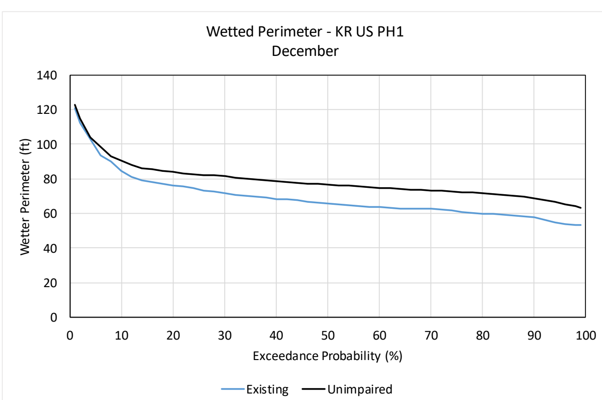
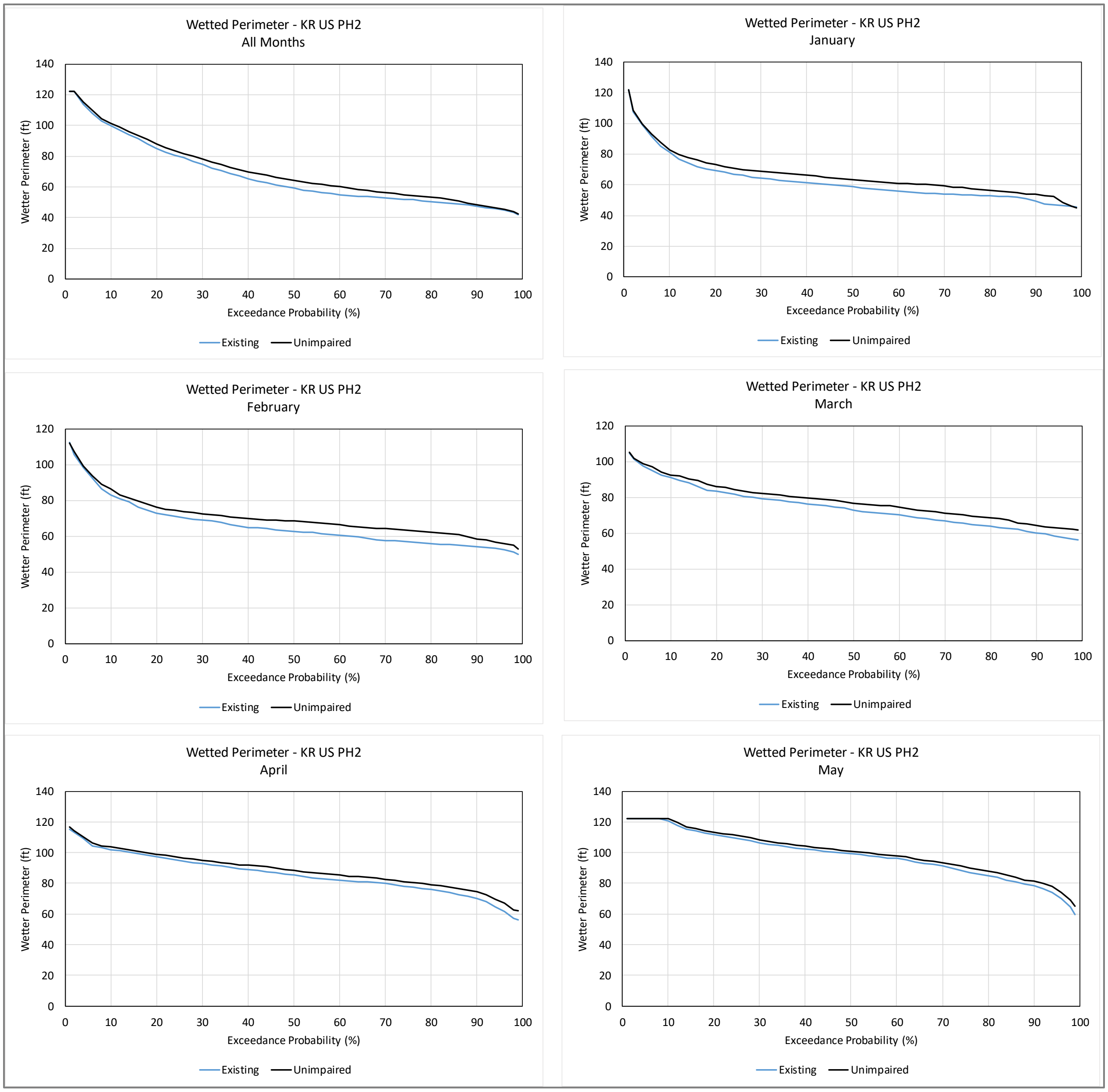
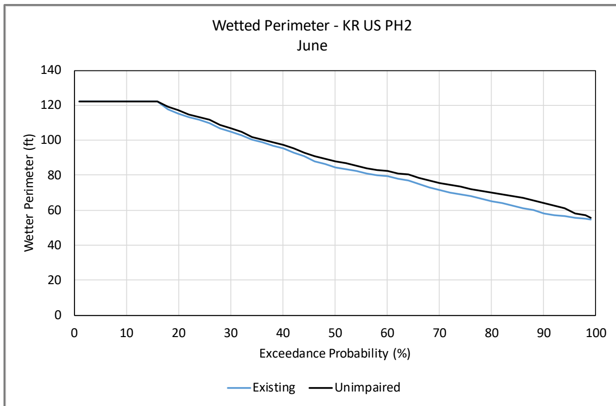
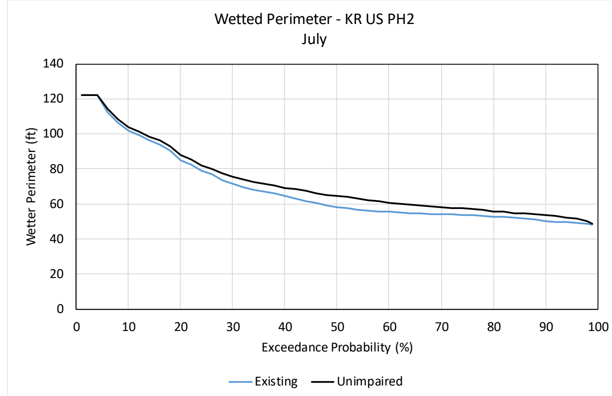
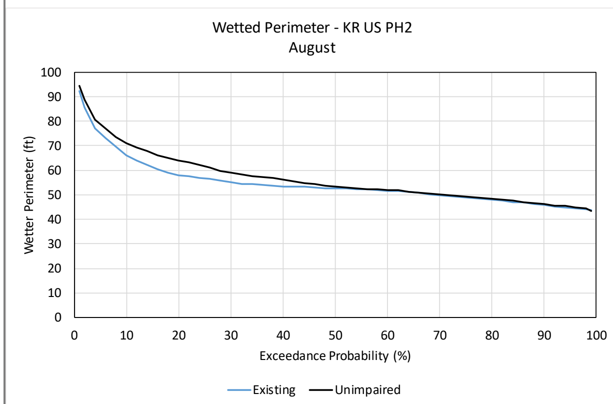

Wetted Perimeter - KR US PH1
December
Wetter Perimeter (ft)
Exceedance Probability (%)
Existing
Unimpaired

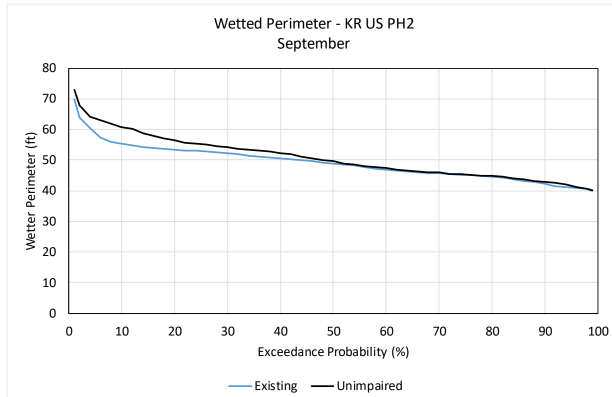
Figure F-3. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Wetted Perimeter Exceedance Plots for All Water Years and each Month Separately.

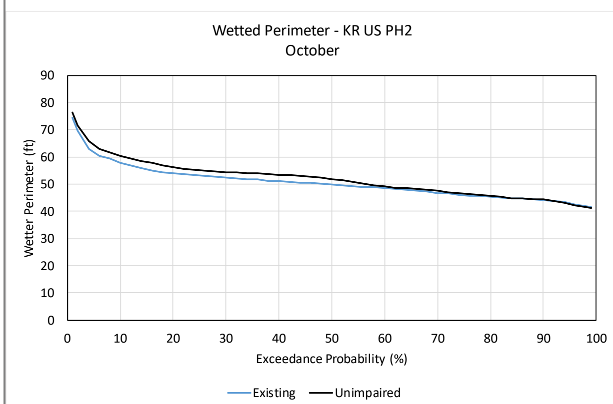


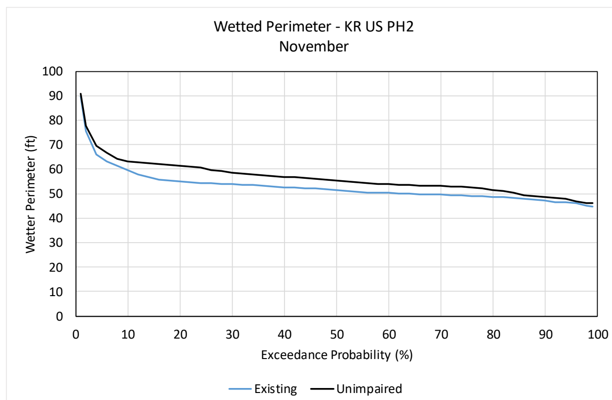

Wetted Perimeter - KR US PH2
June
Wetter Perimeter (ft)
140
120
100
80
60
40
20
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH2
July
Wetter Perimeter (ft)
140
120
100
80
60
40
20
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH2
August
Wetter Perimeter (ft)
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH2
September
Wetter Perimeter (ft)
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH2
October
Wetter Perimeter (ft)
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - KR US PH2
November
Wetter Perimeter (ft)
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

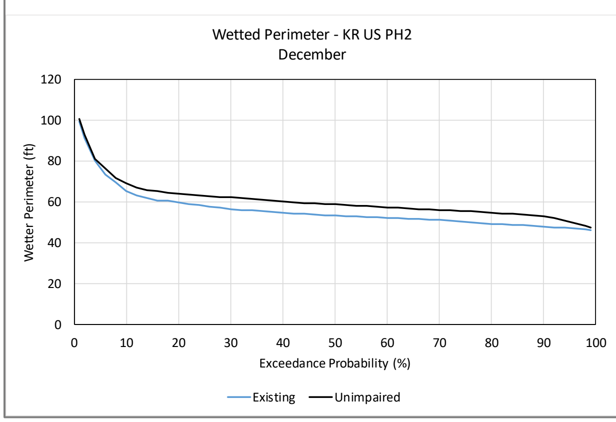
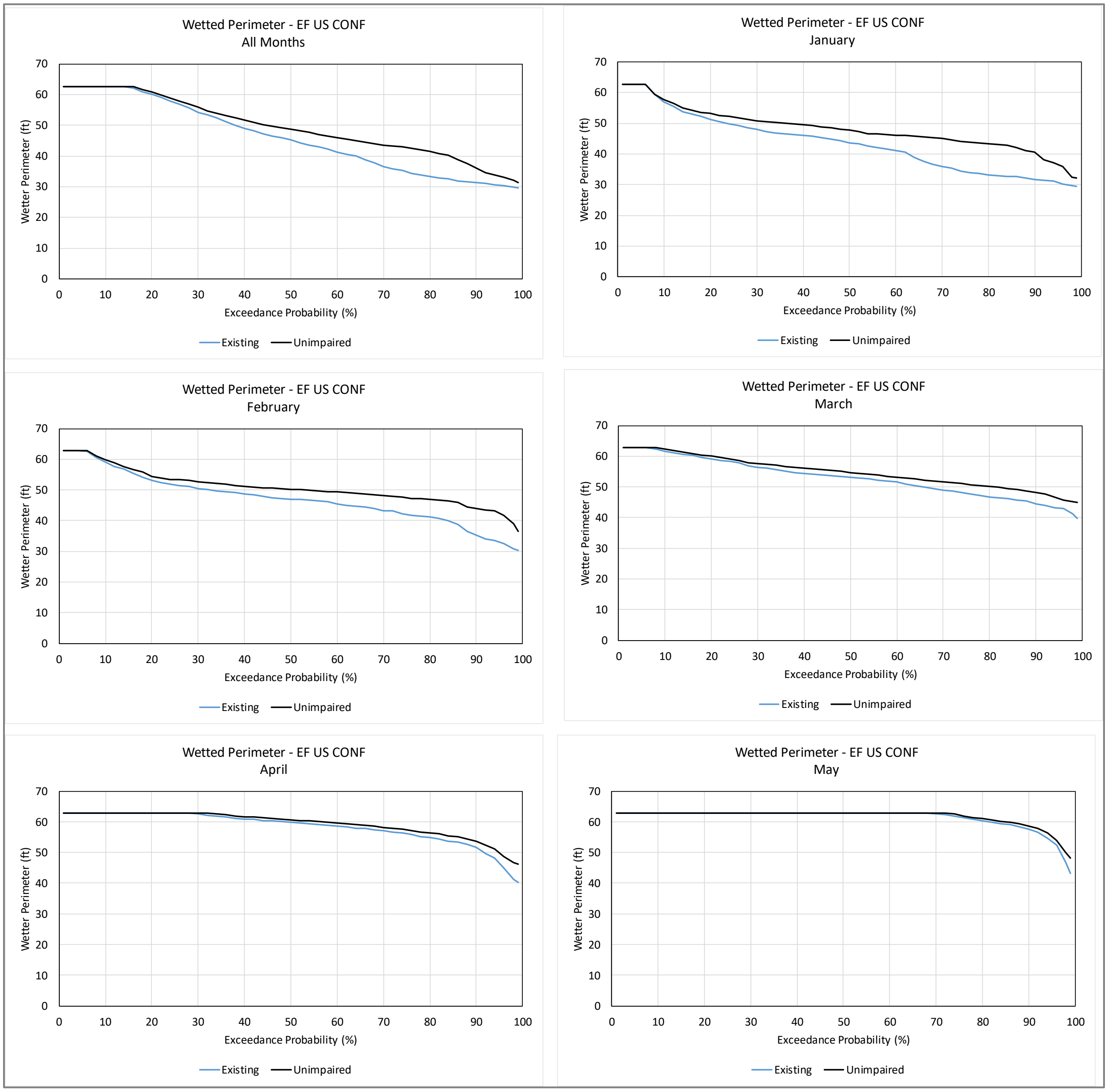
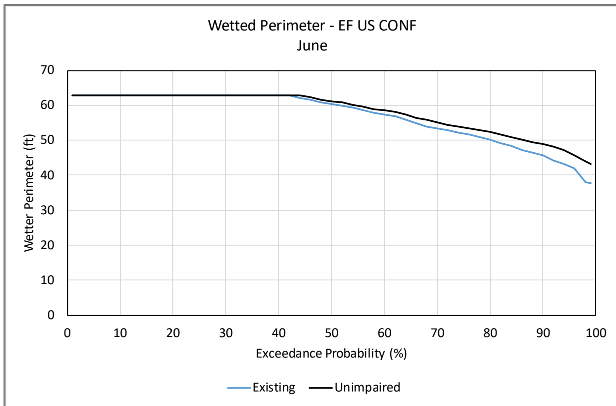
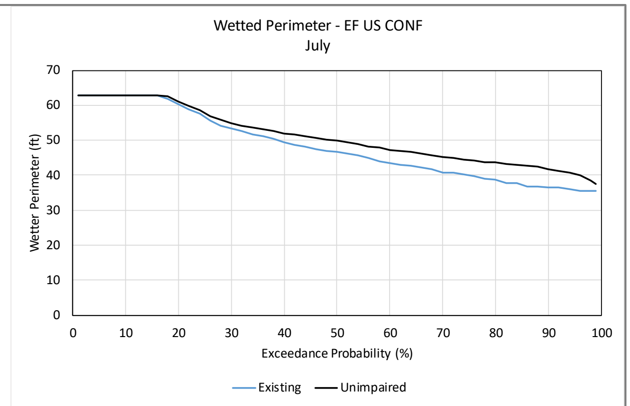
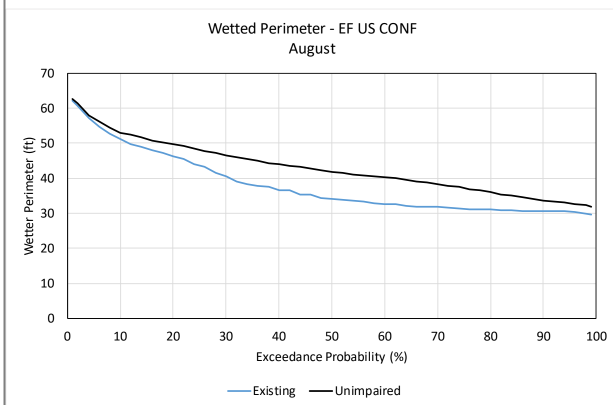

Wetted Perimeter - KR US PH2
December
Wetter Perimeter (ft)
120
100
80
60
40
20
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

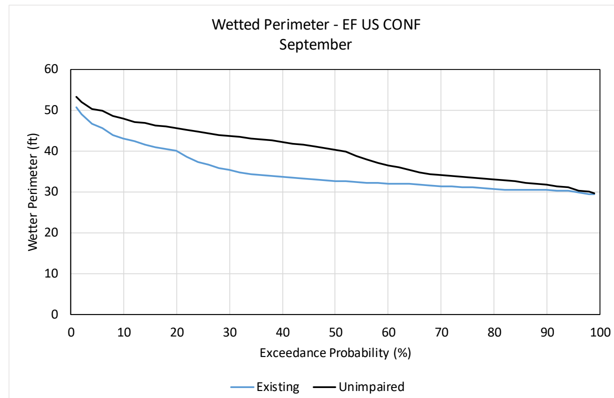
Figure F-4. East Fork Kaweah River Upstream of the Confluence with Kaweah River Wetted Perimeter Exceedance Plots for All Water Years and each Month Separately.

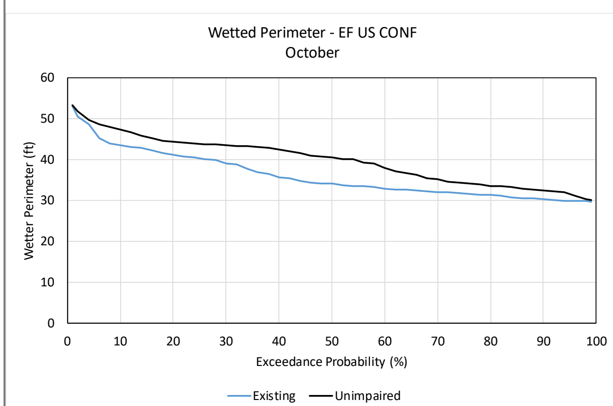


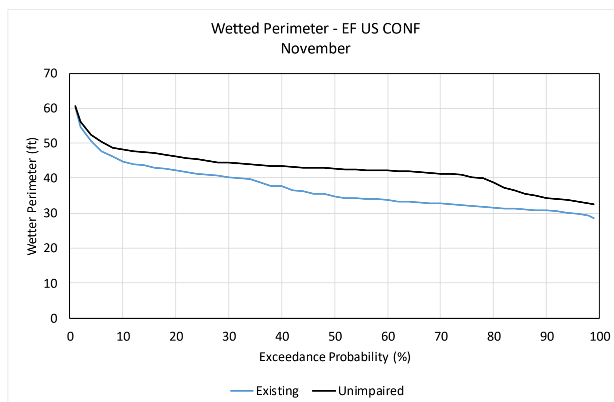

Wetted Perimeter - EF US CONF
June
Wetter Perimeter (ft)
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

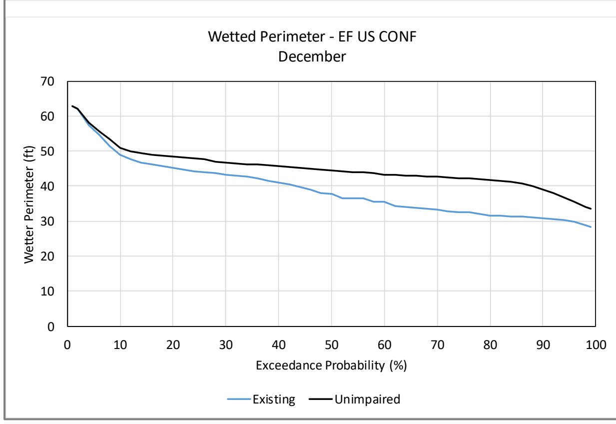

Wetted Perimeter - EF US CONF
July
Wetter Perimeter (ft)
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - EF US CONF
August
Wetter Perimeter (ft)
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - EF US CONF
September
Wetter Perimeter (ft)
0 10 20 30 40 50 60
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - EF US CONF
October
Wetter Perimeter (ft)
0 10 20 30 40 50 60
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - EF US CONF
November
Wetter Perimeter (ft)
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


Wetted Perimeter - EF US CONF
December
Wetter Perimeter (ft)
0 10 20 30 40 50 60 70
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

APPENDIX G

WUA Time Series Results

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Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse

East Fork Kaweah River Upstream of the Confluence with Kaweah River

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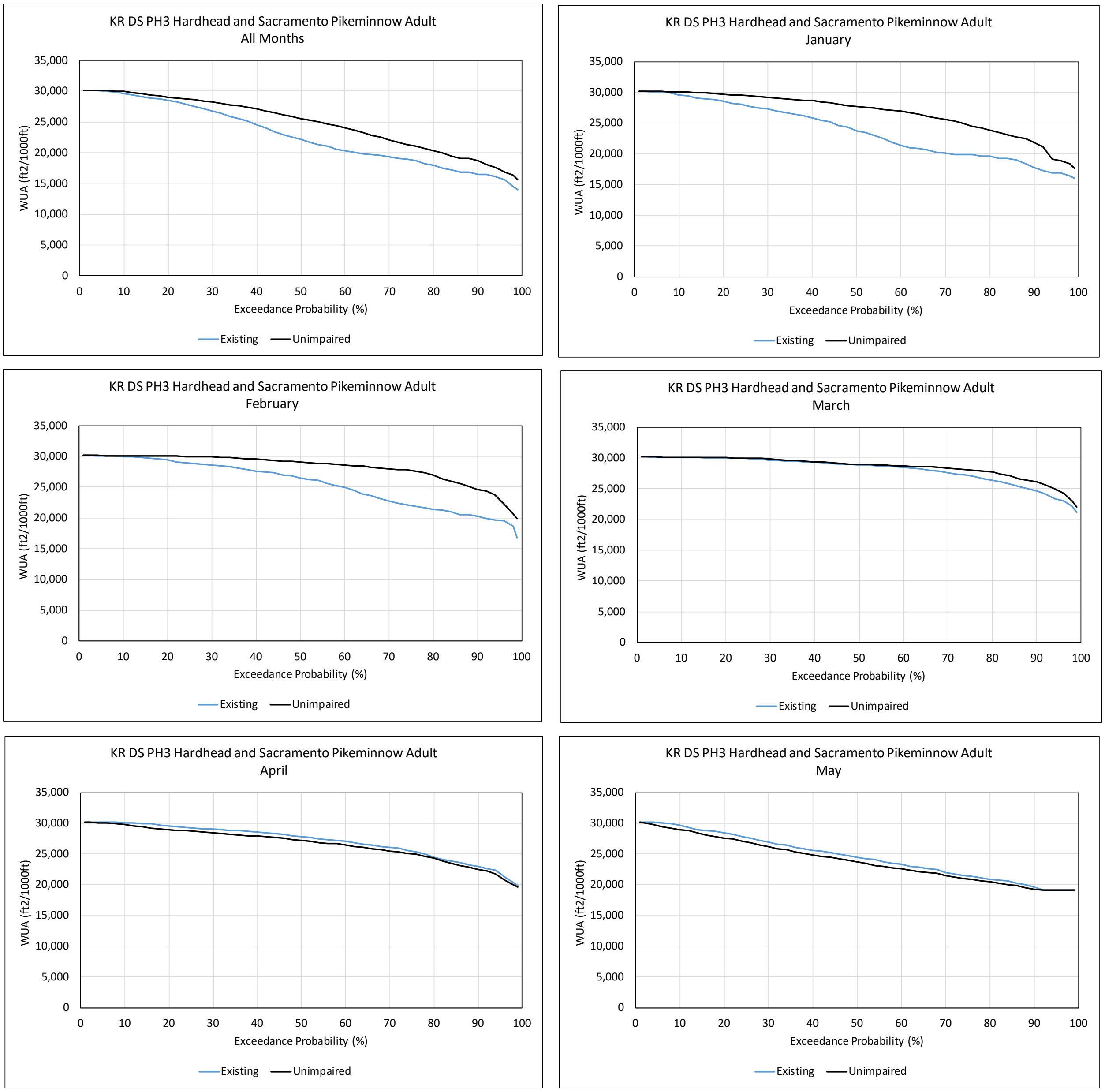
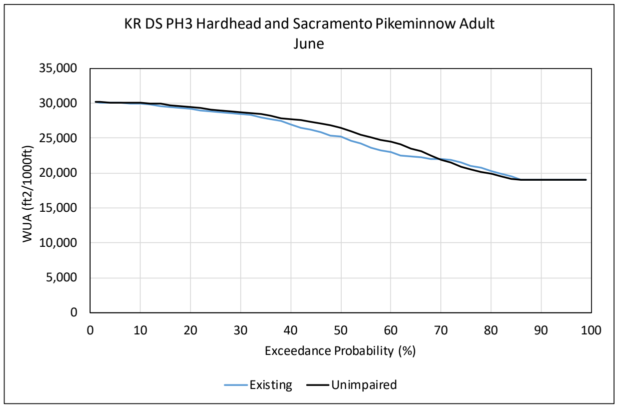
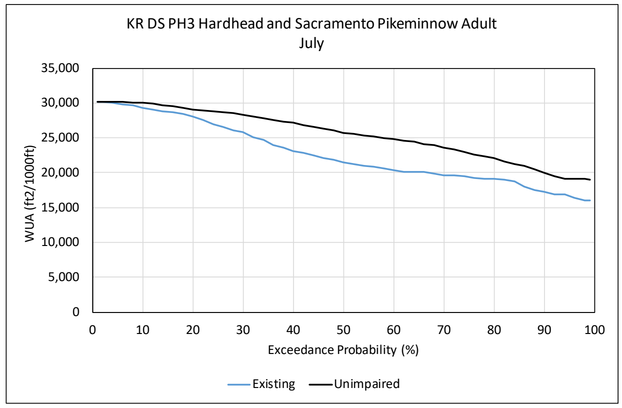
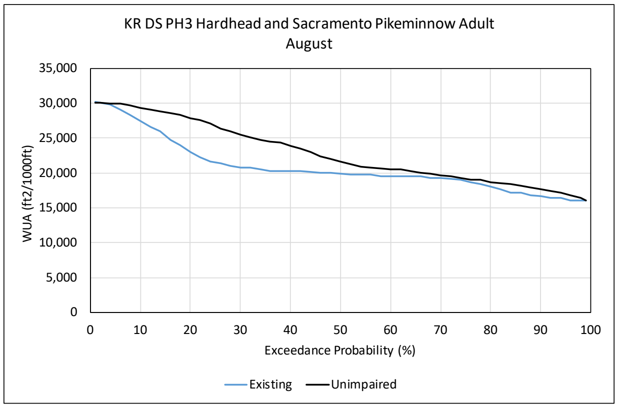
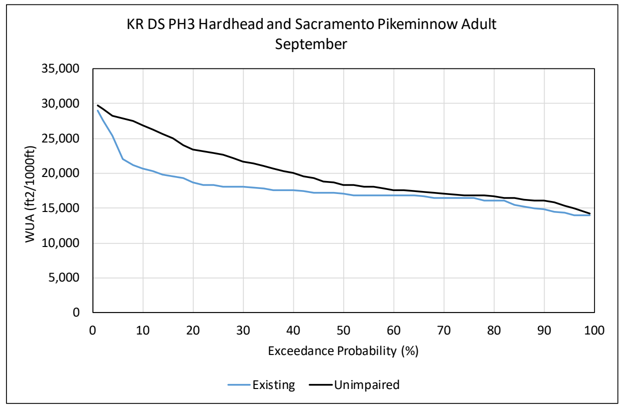
Figure G-1. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Hardhead and Sacramento Pikeminnow Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

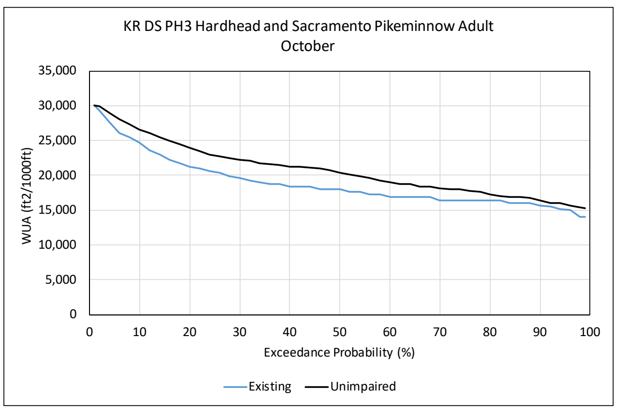


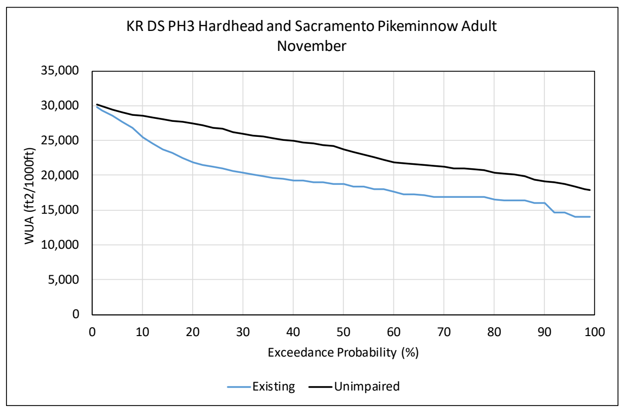

KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
June
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
July
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
August
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
September
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
October
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
November
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

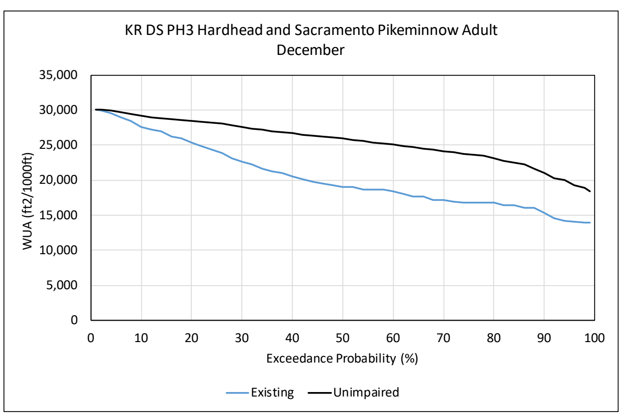
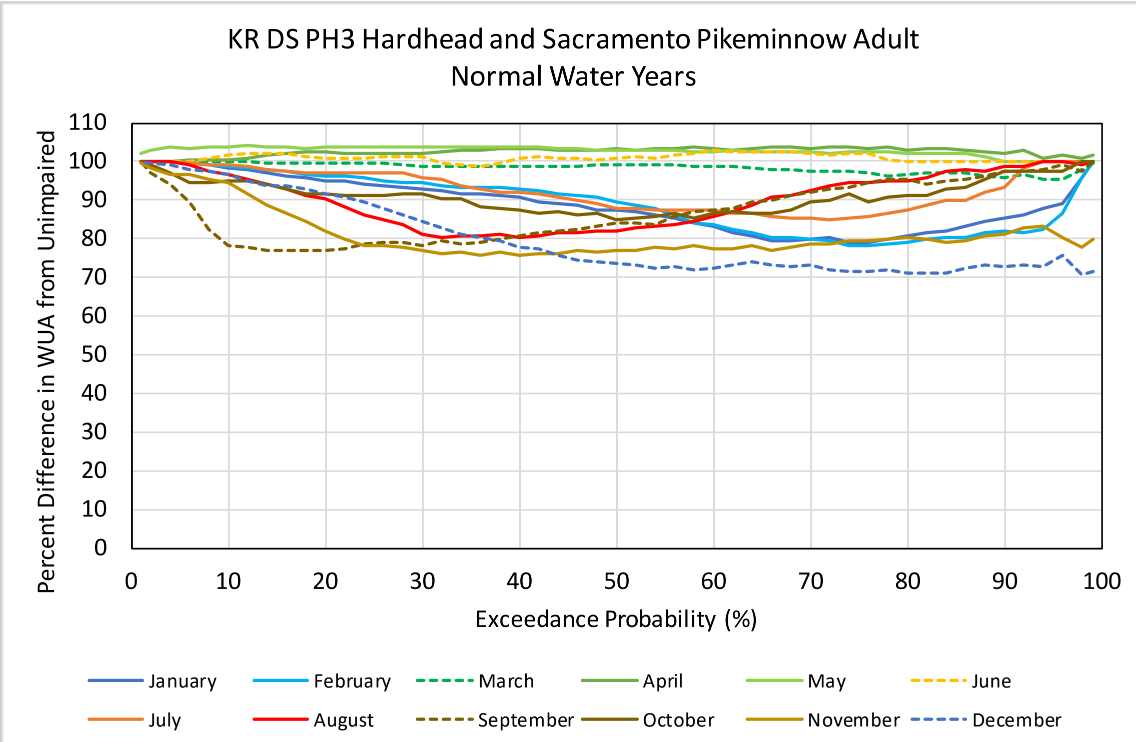

KR DS PH3 Hardhead and Sacramento Pikeminnow Adult
December
WUA (ft2/1000ft)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-2. 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 Exceedance Plots for Normal and Dry Water Years.



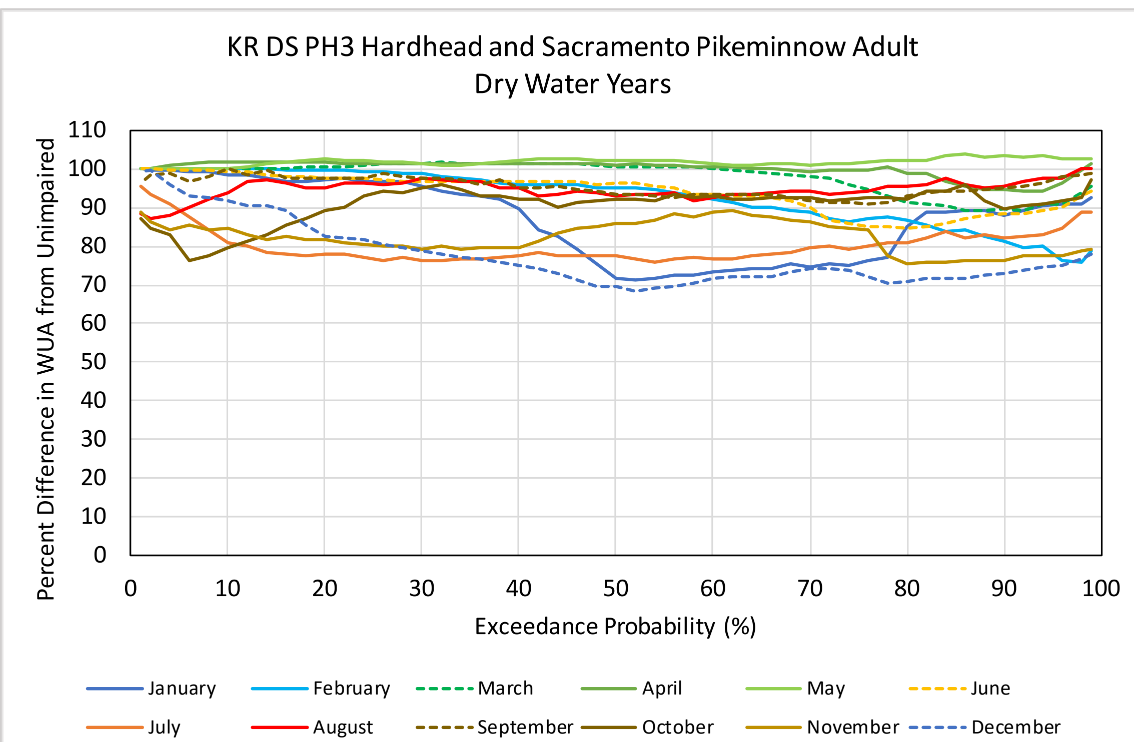


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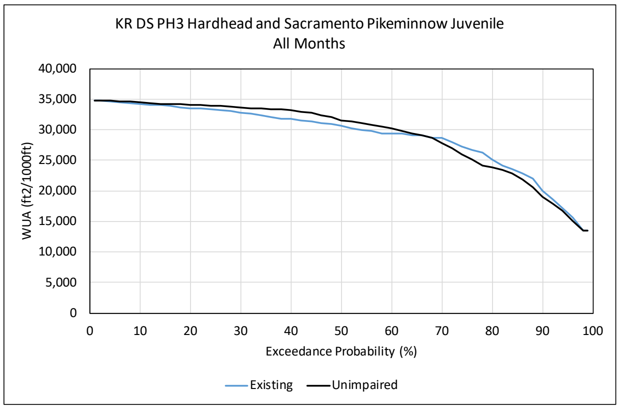
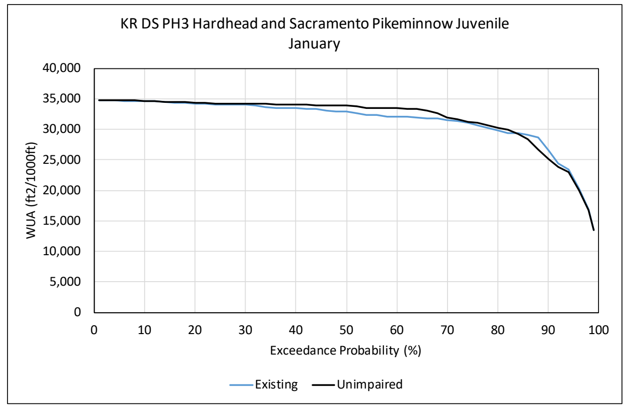
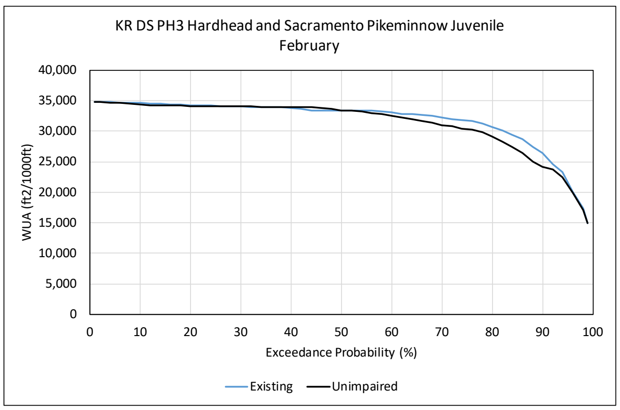
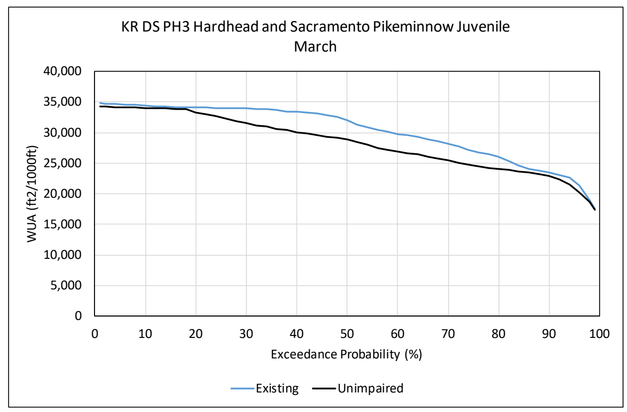
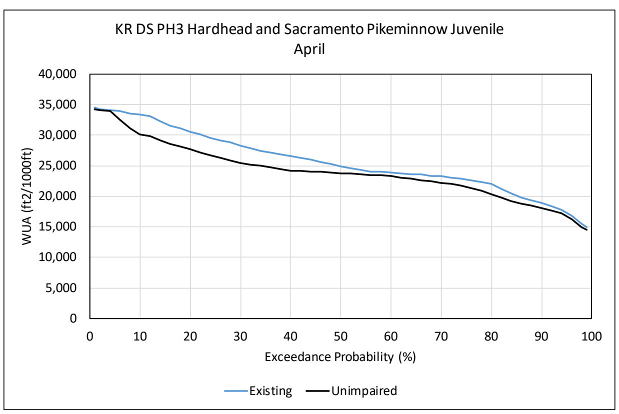
Figure G-3. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Hardhead and Sacramento Pikeminnow Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

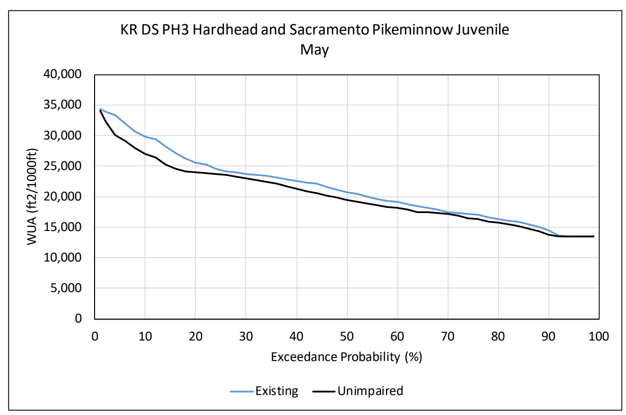


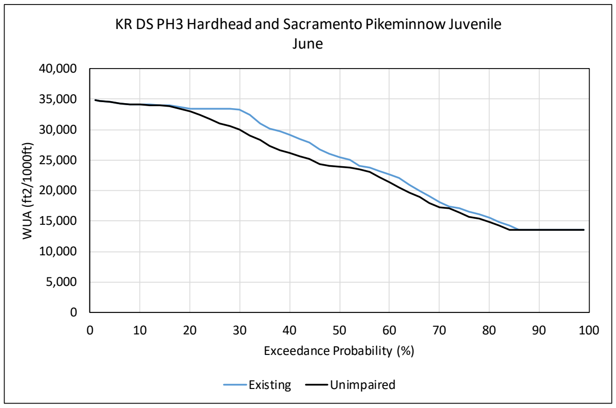


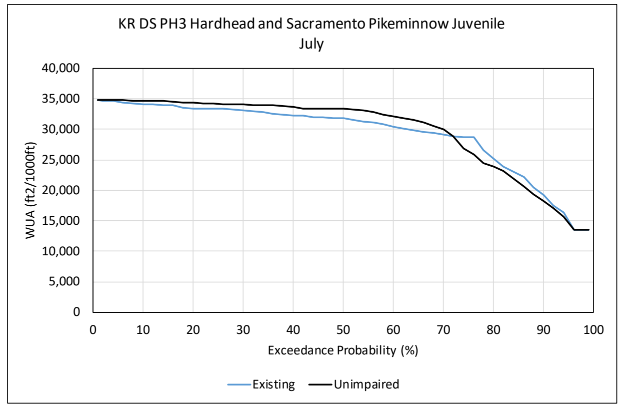


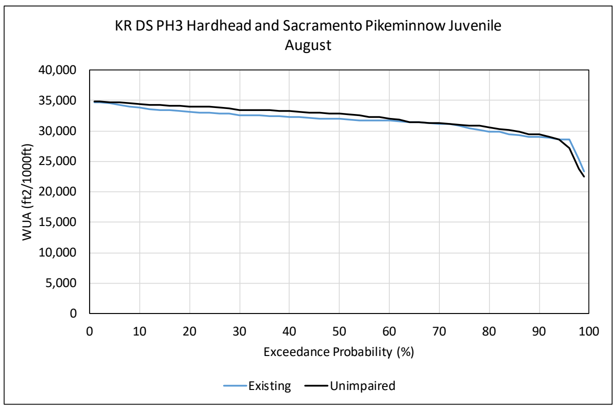


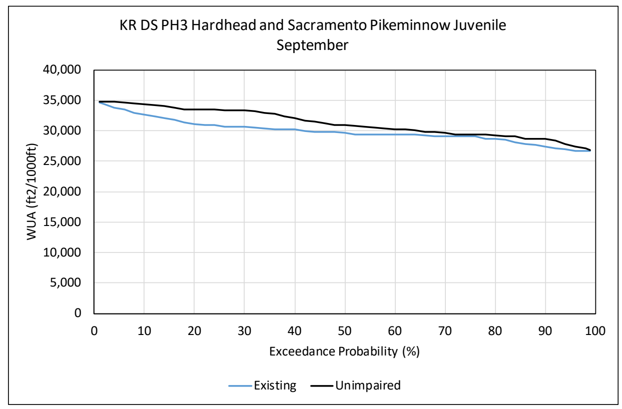


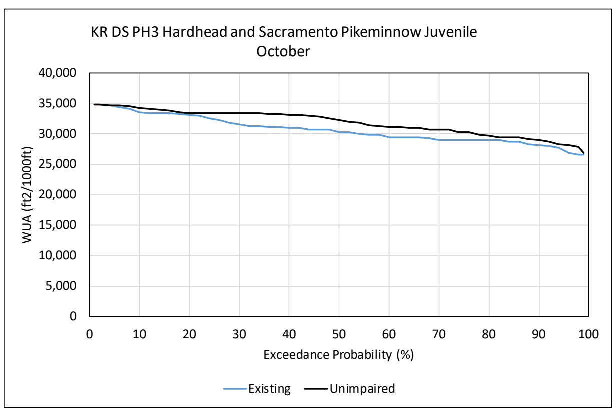


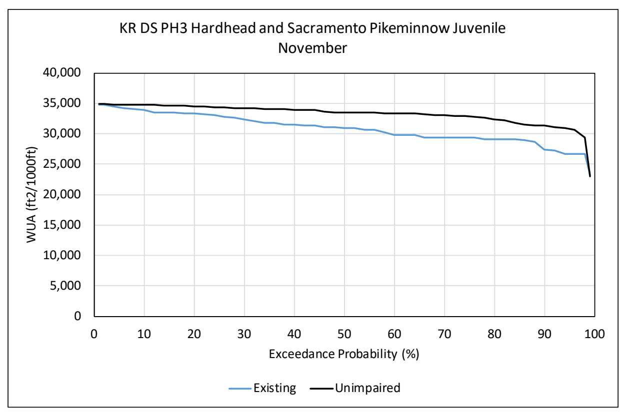

KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

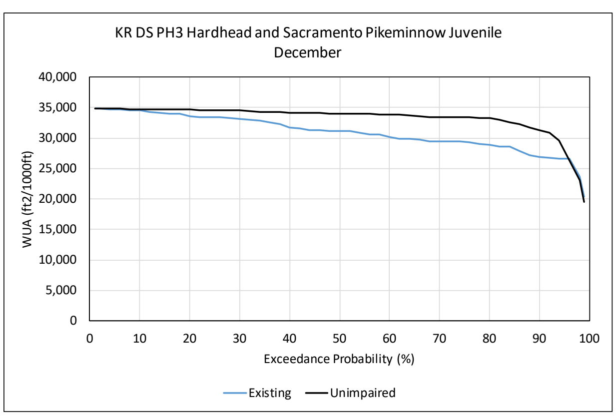
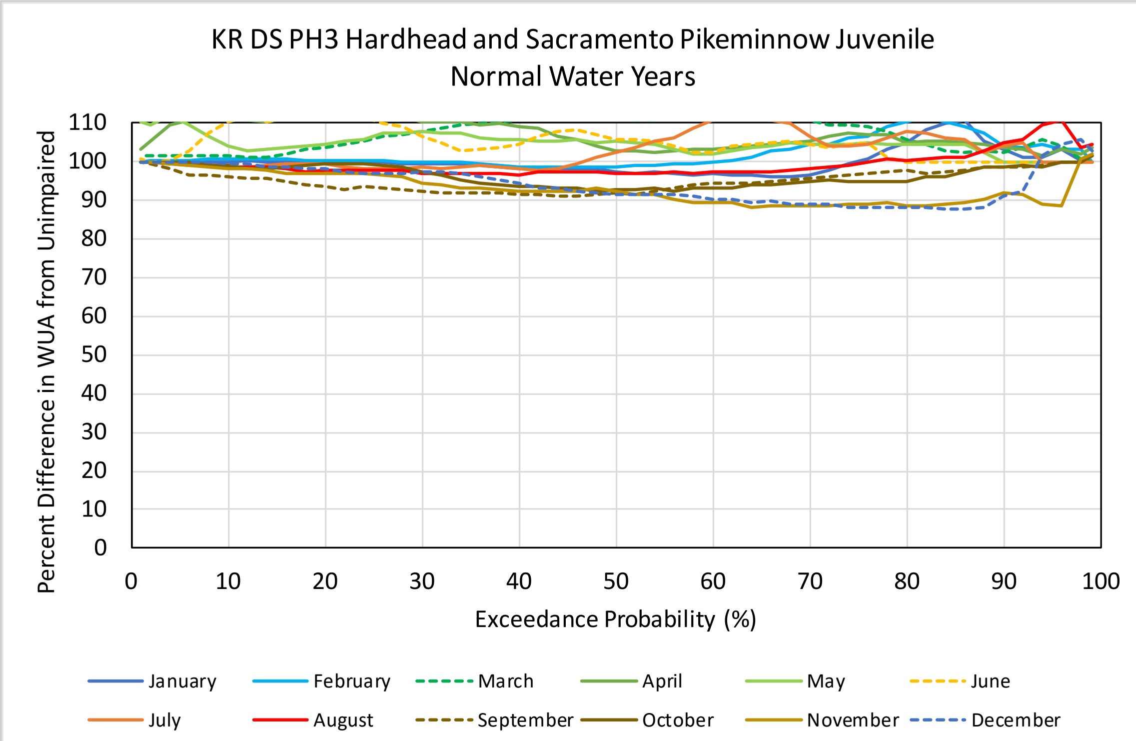

KR DS PH3 Hardhead and Sacramento Pikeminnow Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-4. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Hardhead and Sacramento Pikeminnow Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



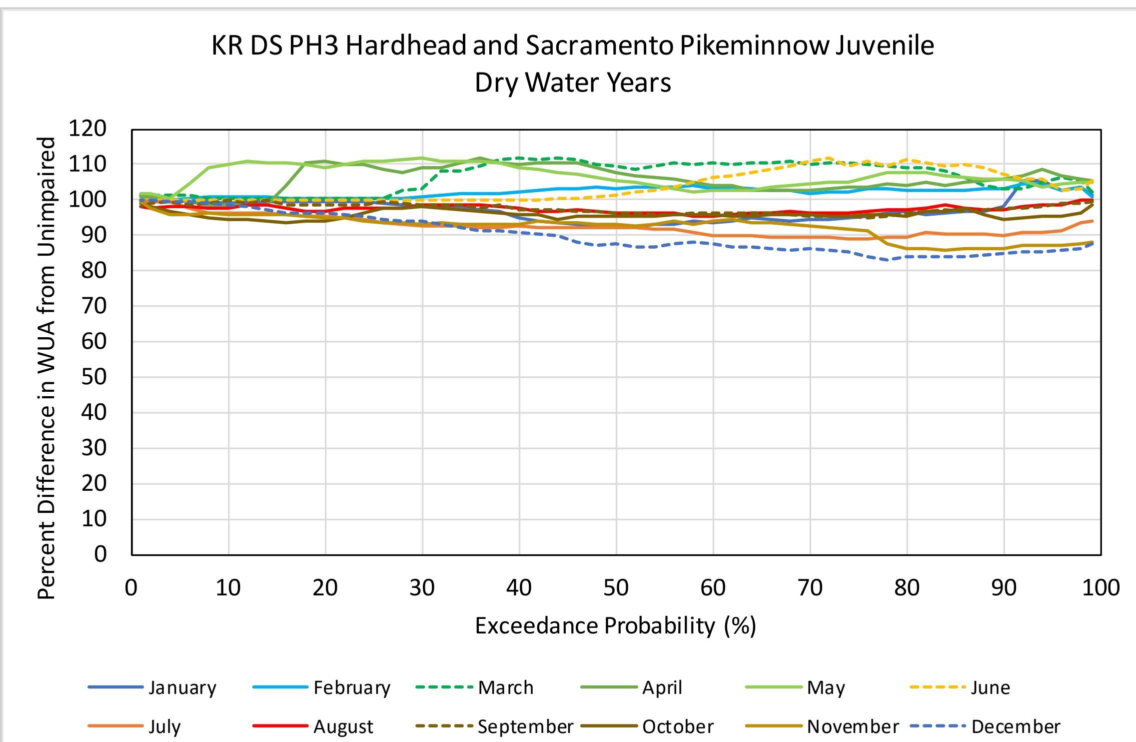


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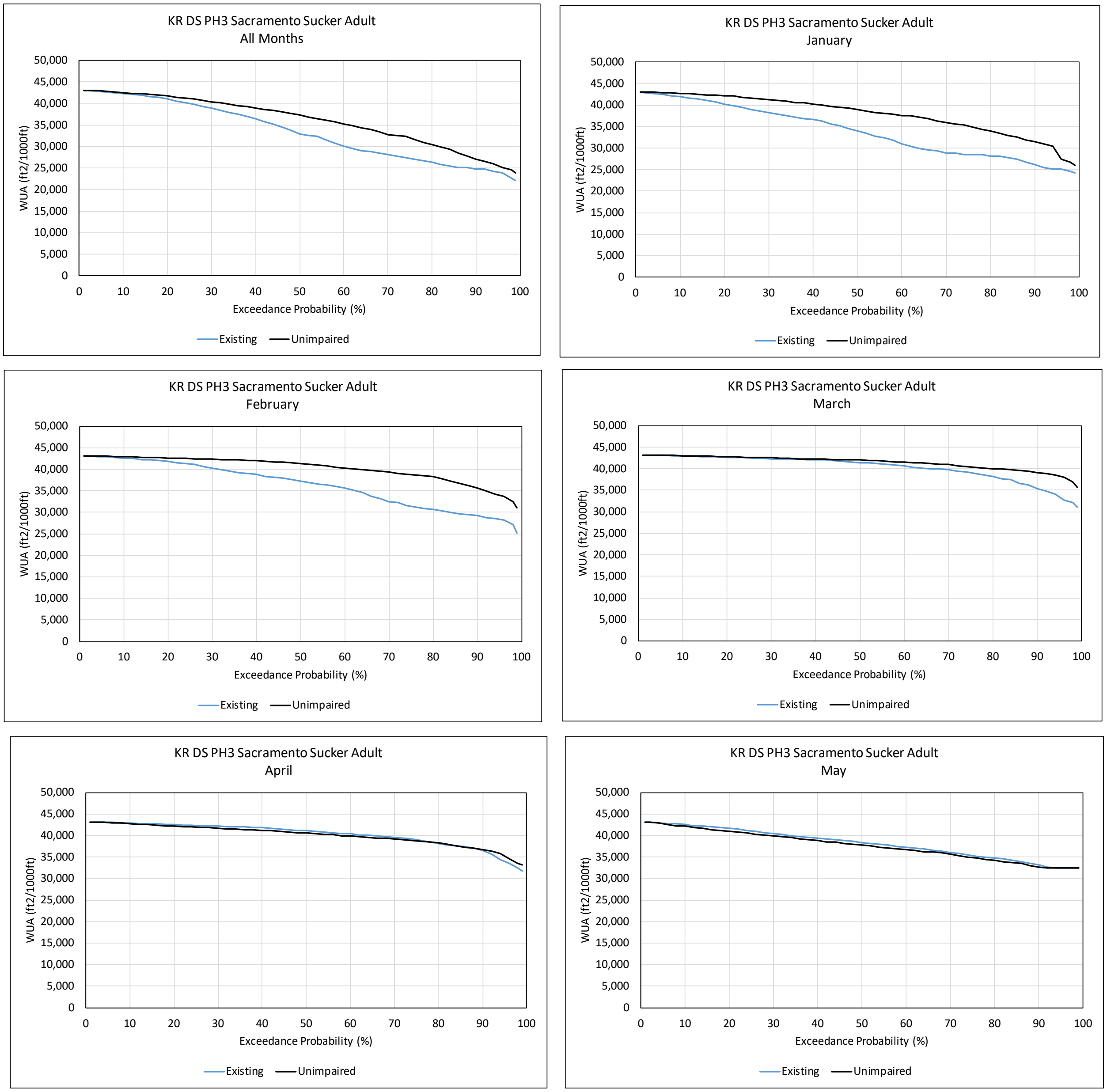
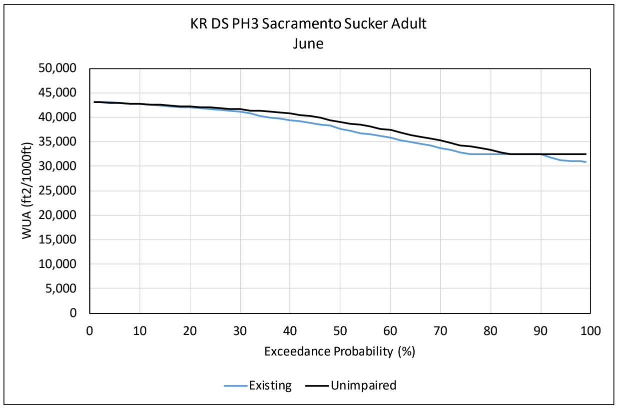
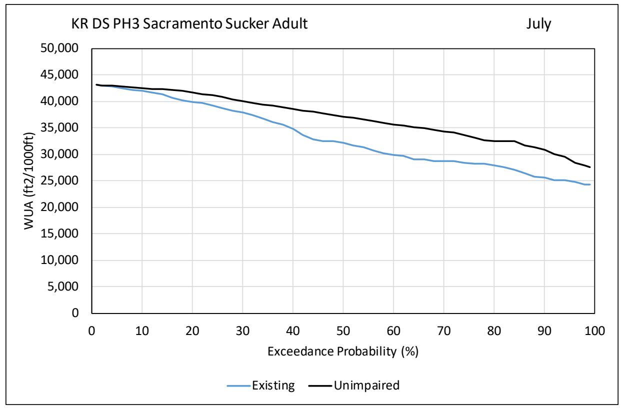
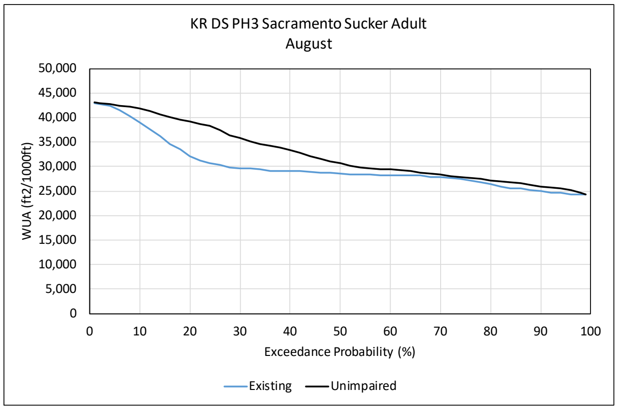
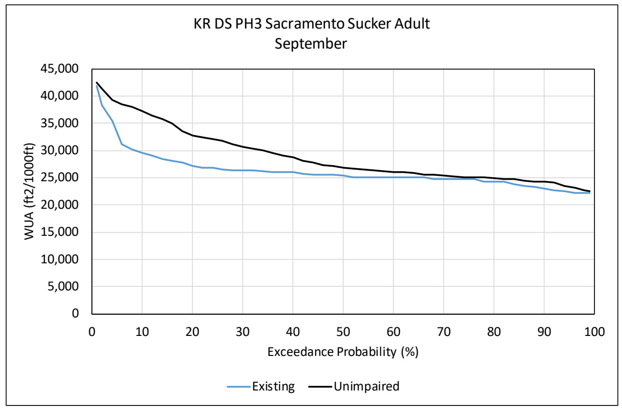
Figure G-5. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Sacramento Sucker Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

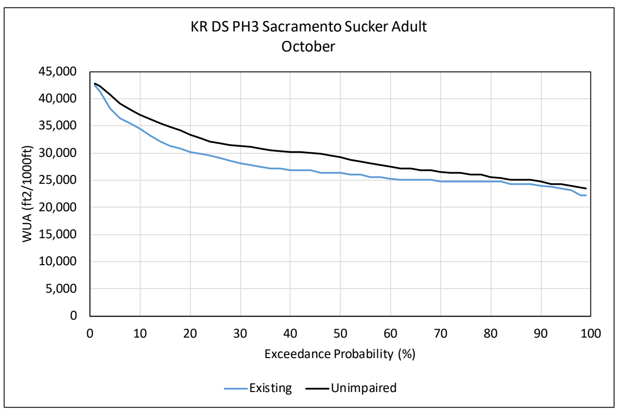


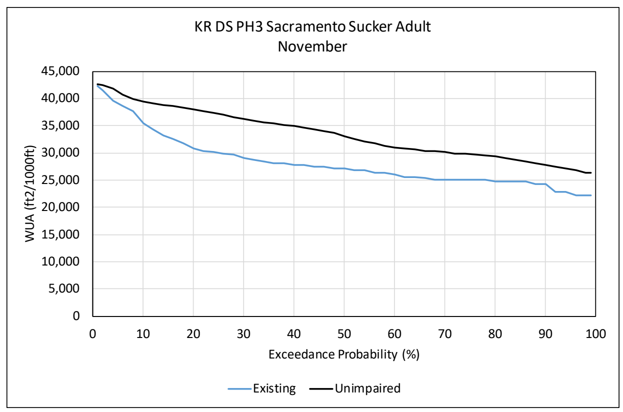

KR DS PH3 Sacramento Sucker Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

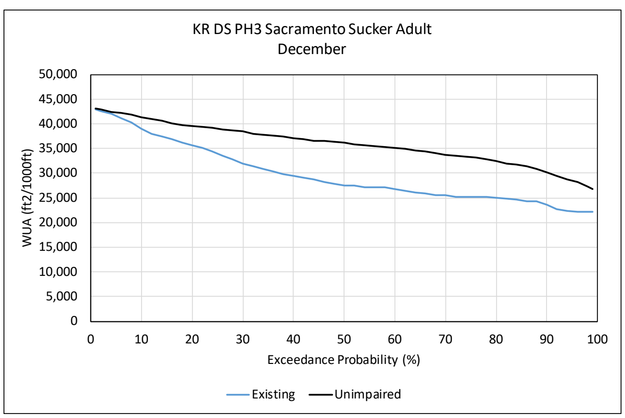
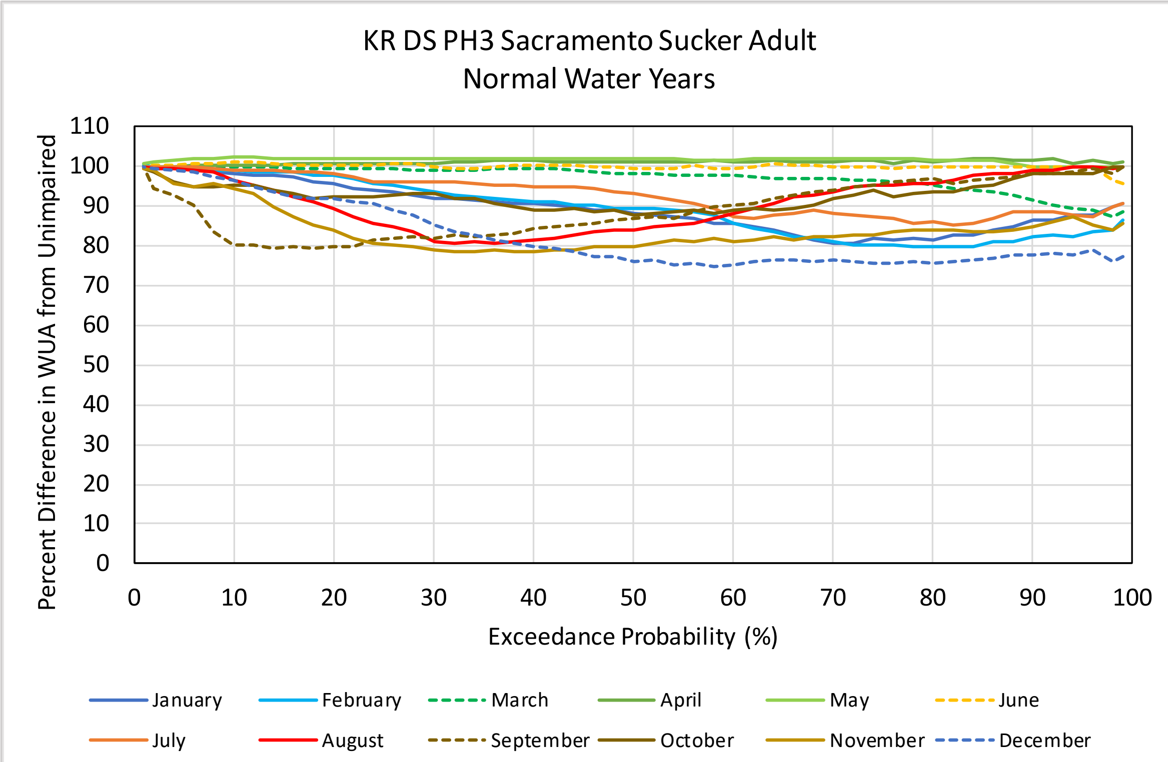

KR DS PH3 Sacramento Sucker Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-6. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Sacramento Sucker Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



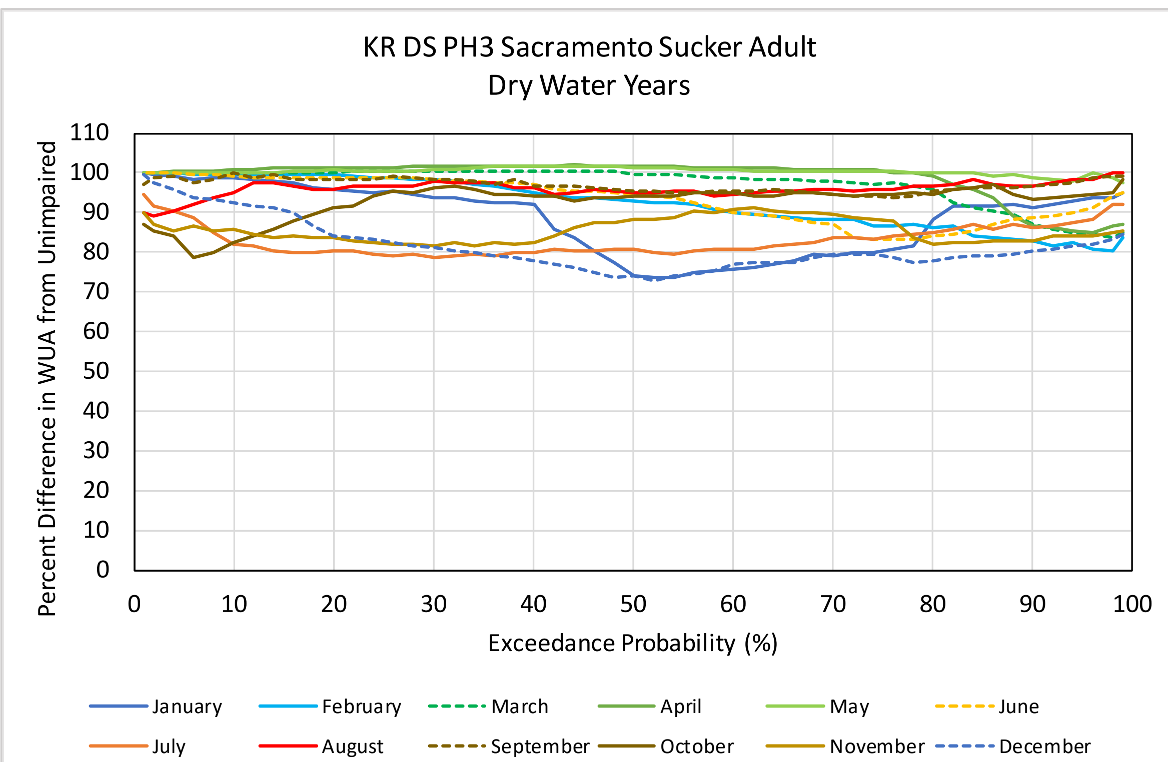


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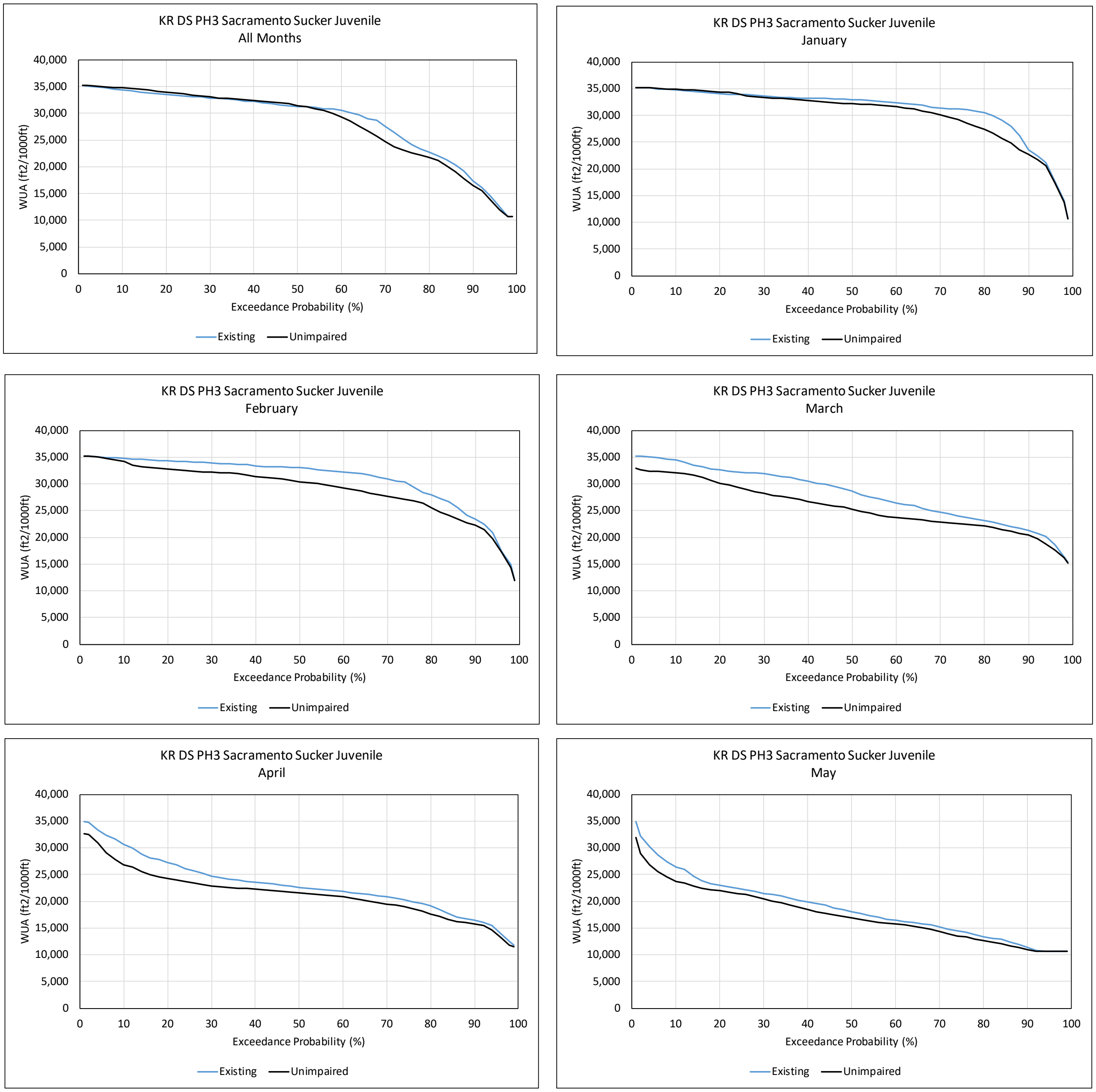
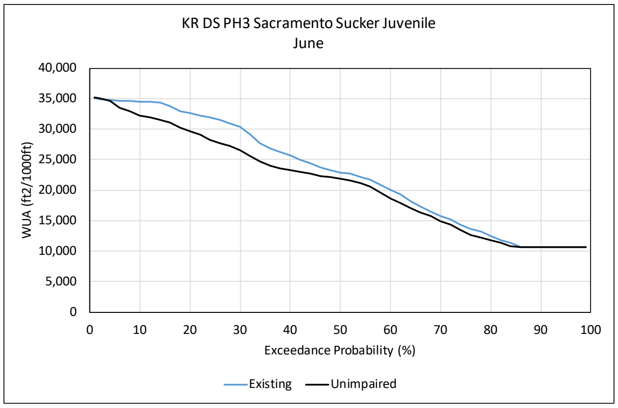
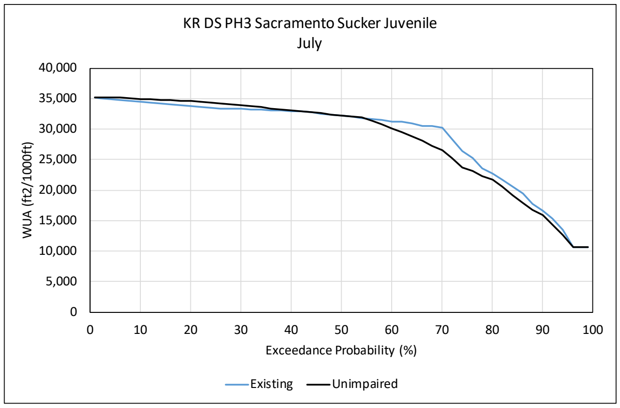
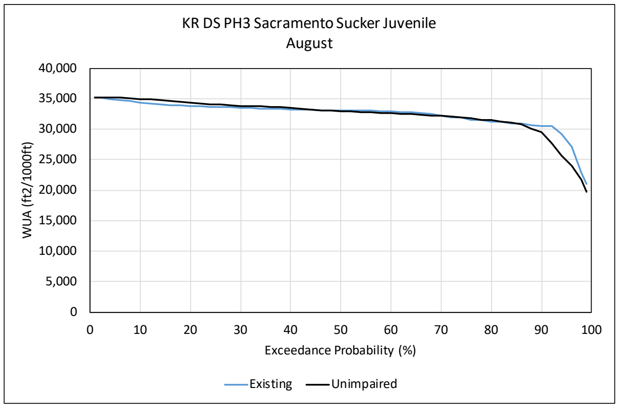
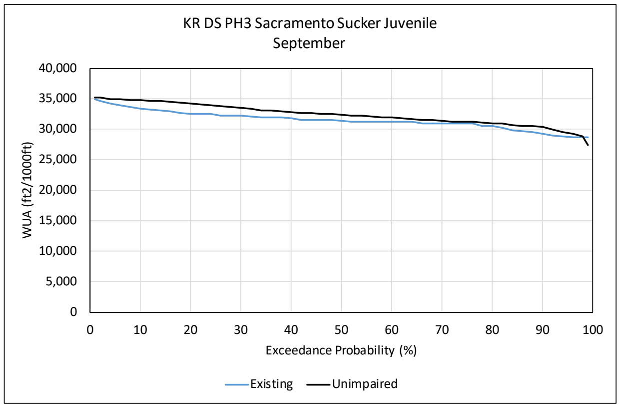
Figure G-7. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Sacramento Sucker Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

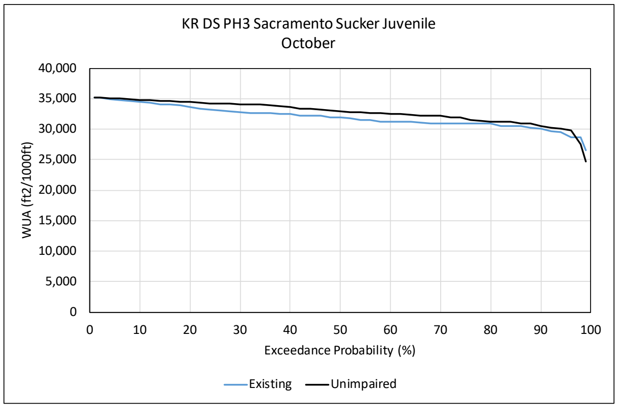


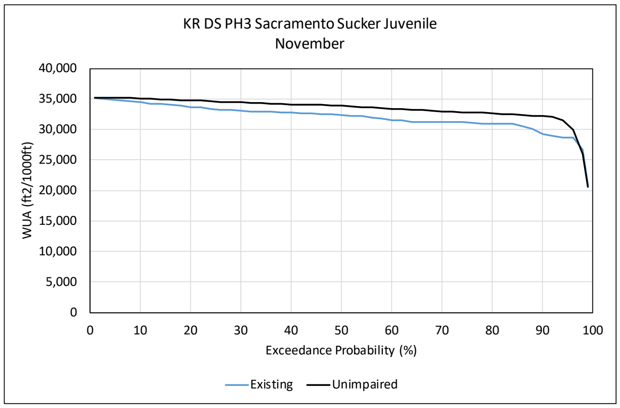

KR DS PH3 Sacramento Sucker Juvenile
June
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Juvenile
July
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Juvenile
August
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Juvenile
September
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Juvenile
October
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Sacramento Sucker Juvenile
November
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

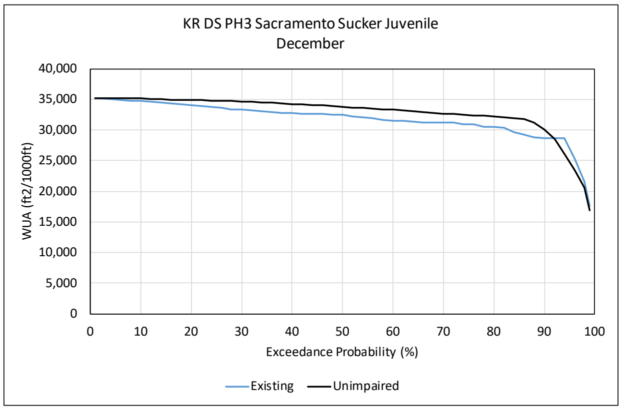
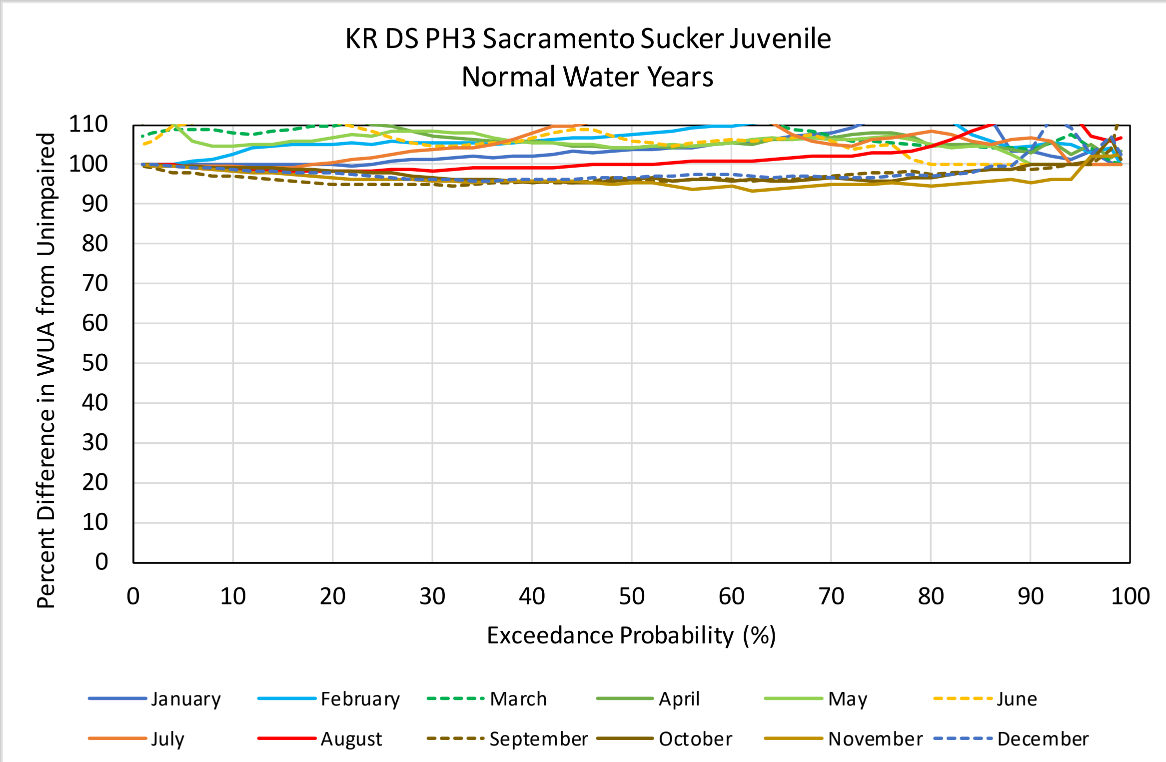

KR DS PH3 Sacramento Sucker Juvenile
December
WUA (ft2/1000ft)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-8. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Sacramento Sucker Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



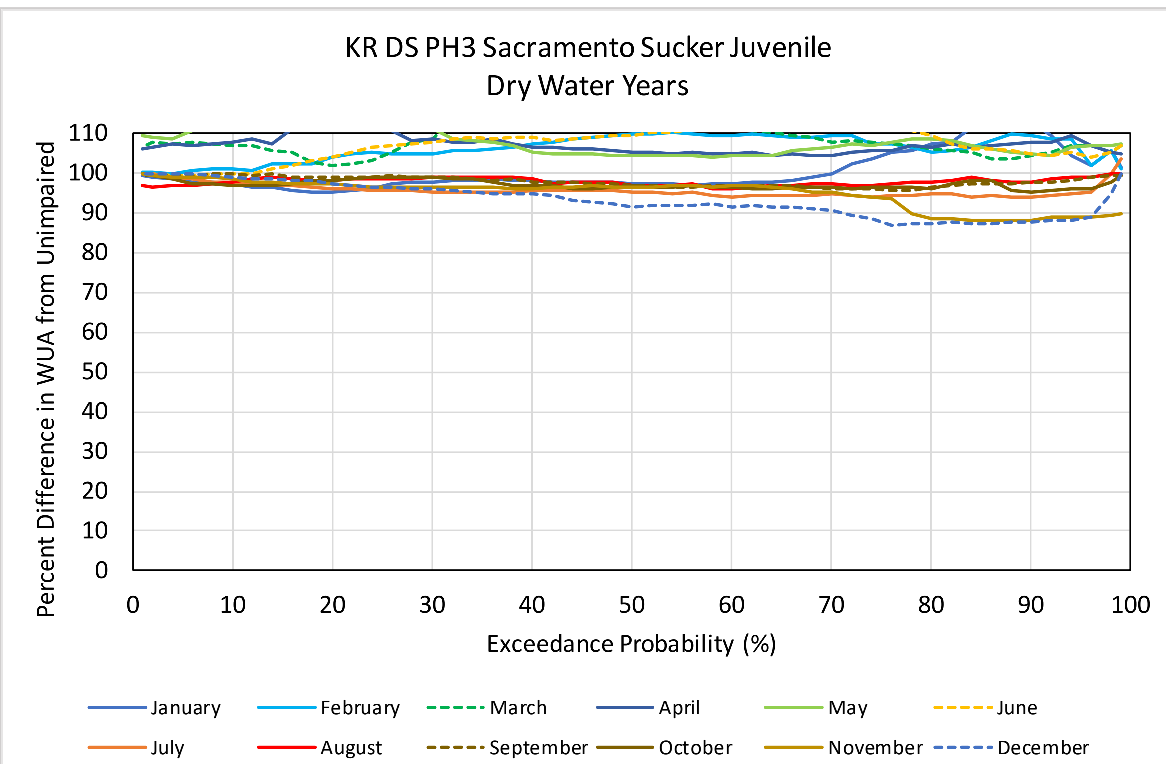


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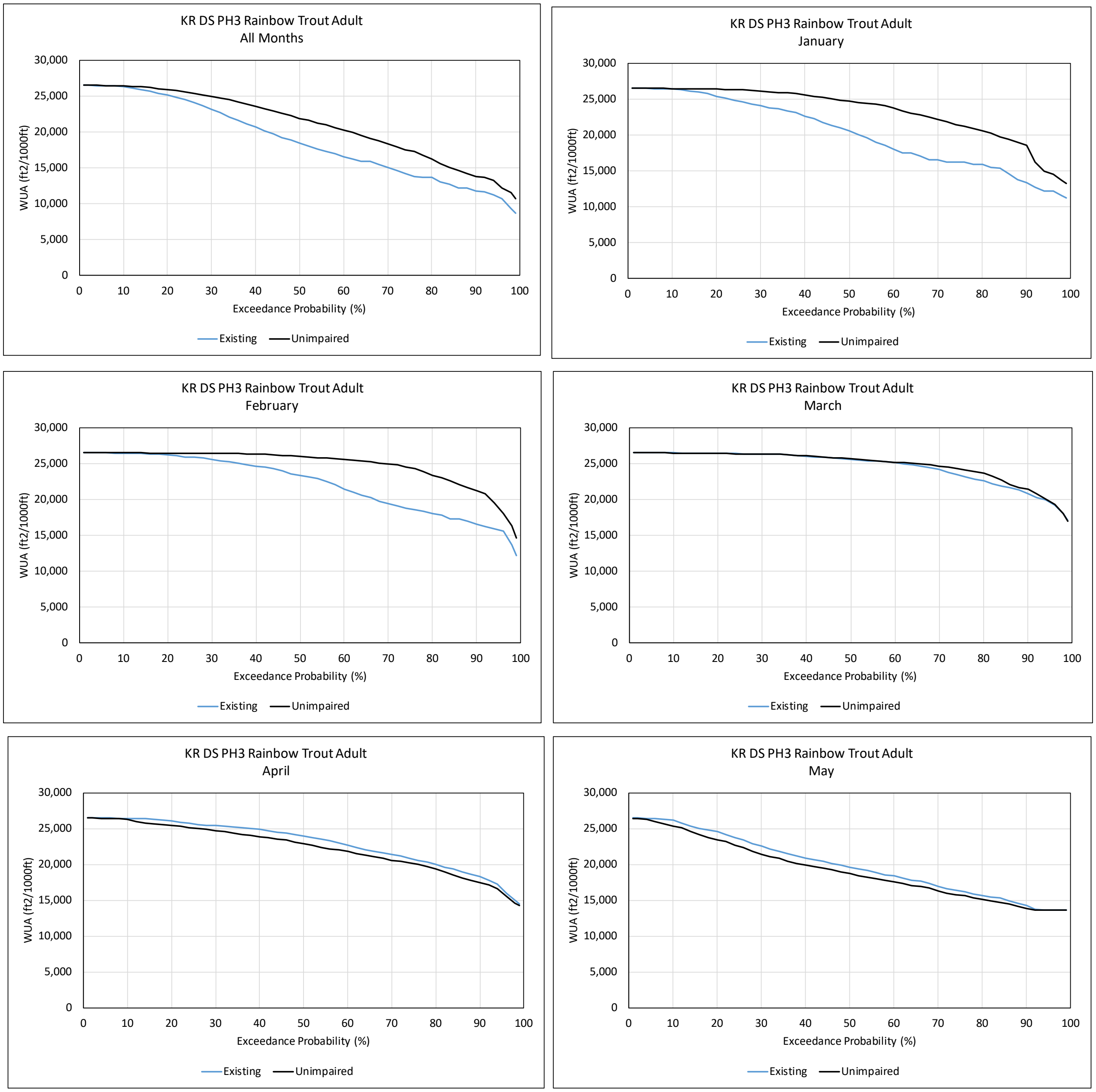
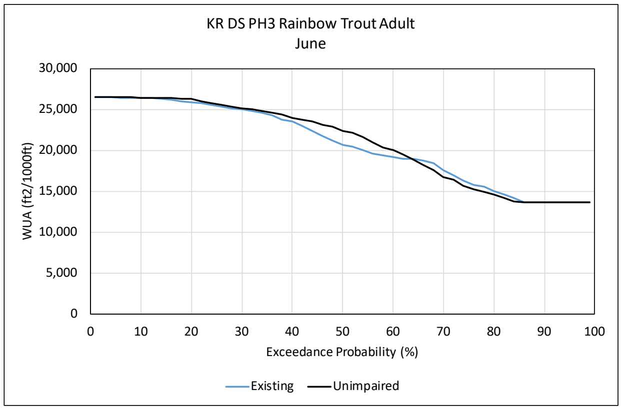
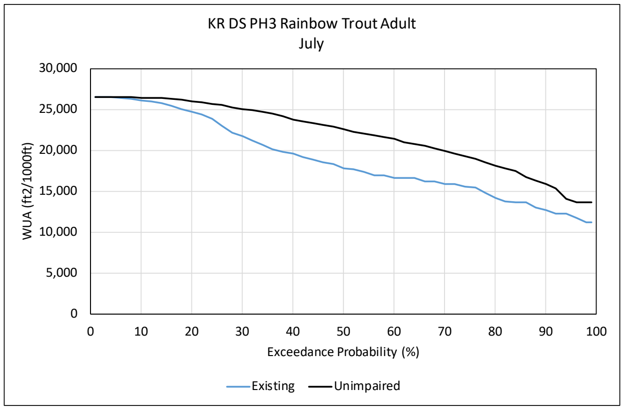
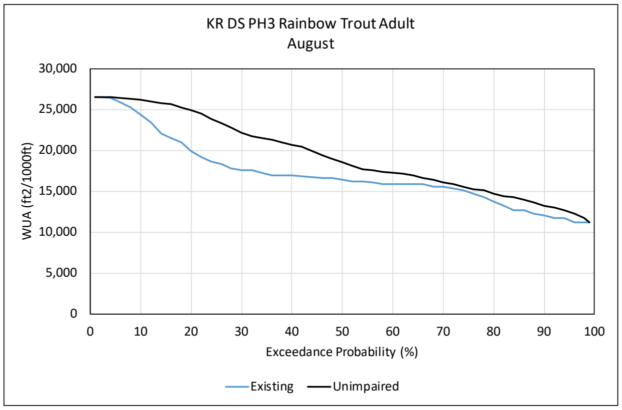
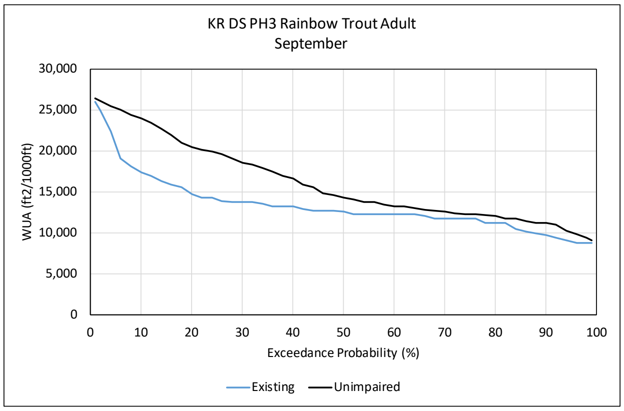
Figure G-9. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

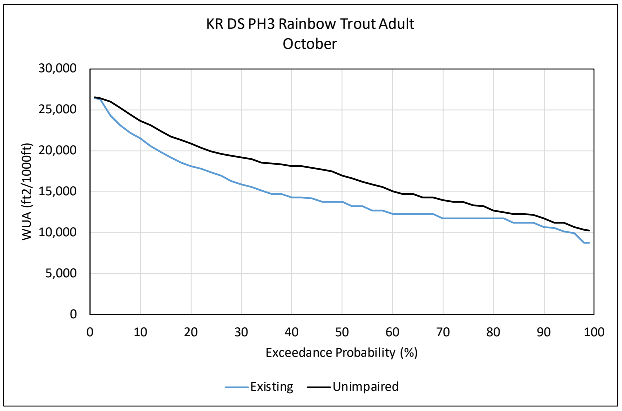


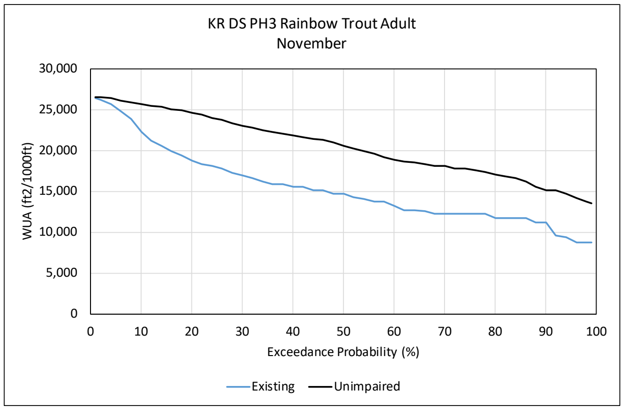

KR DS PH3 Rainbow Trout Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

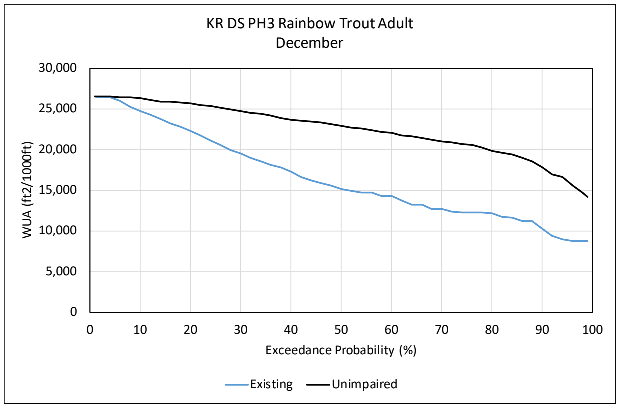
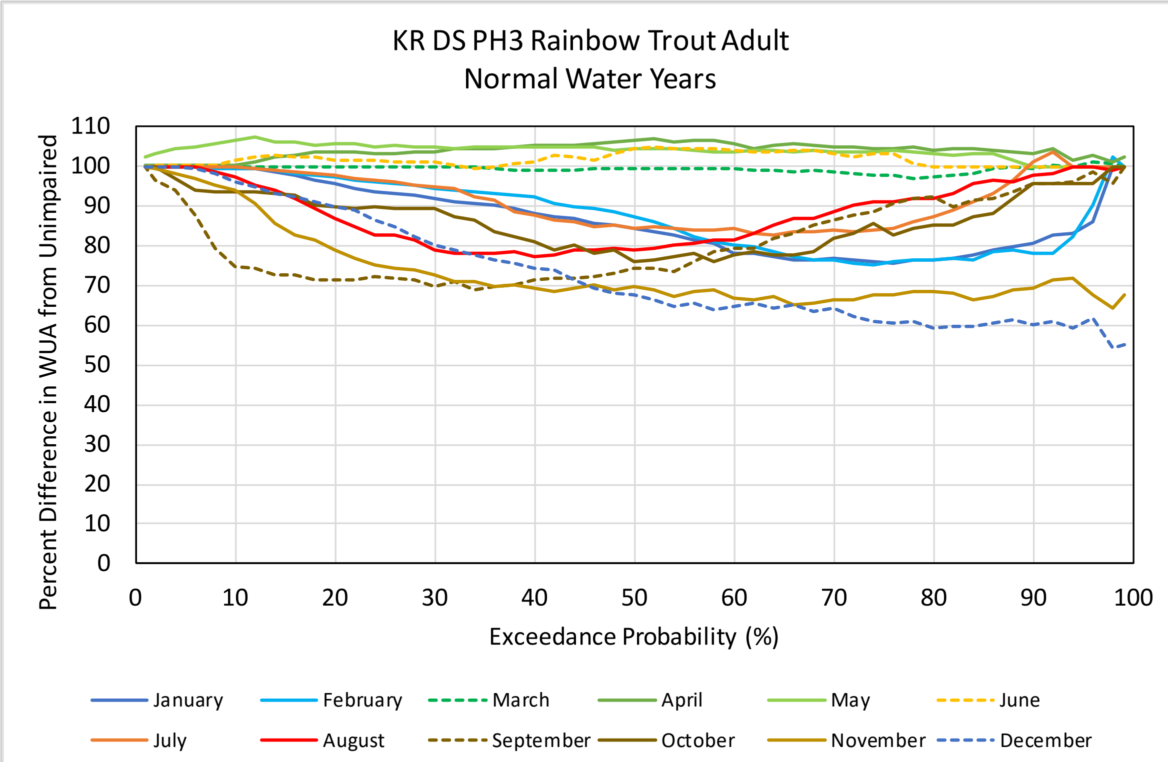

KR DS PH3 Rainbow Trout Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-10. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



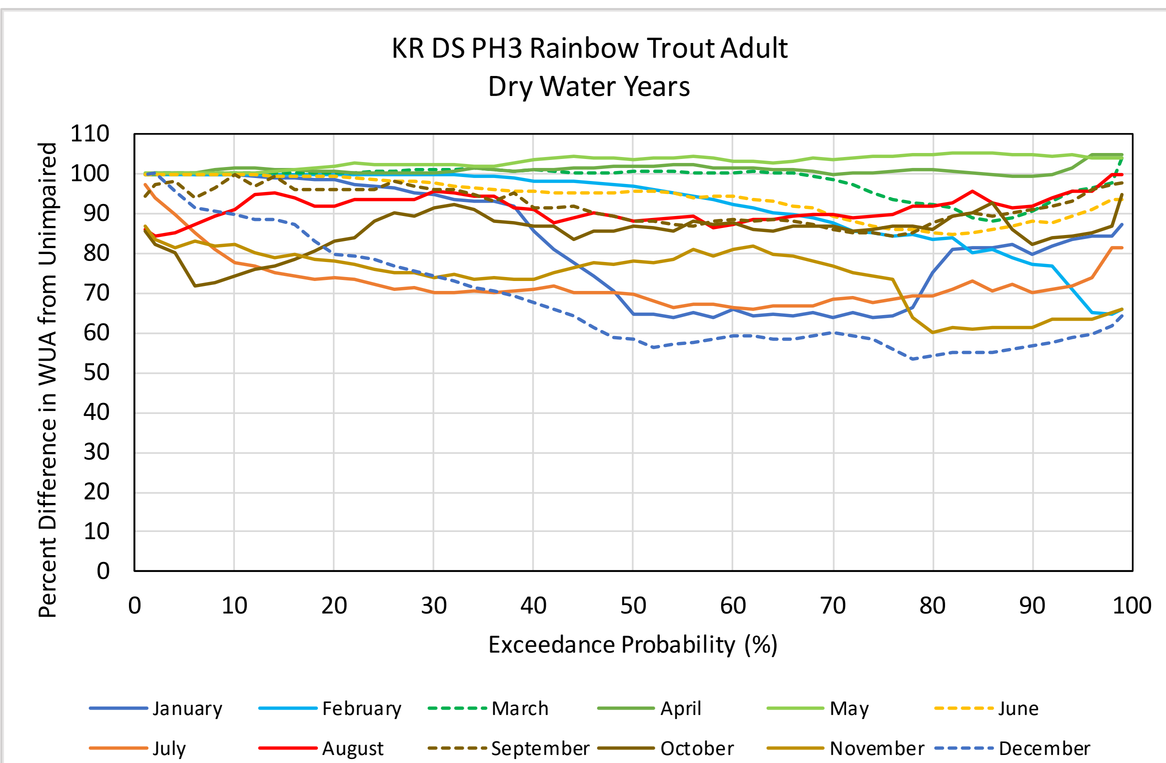


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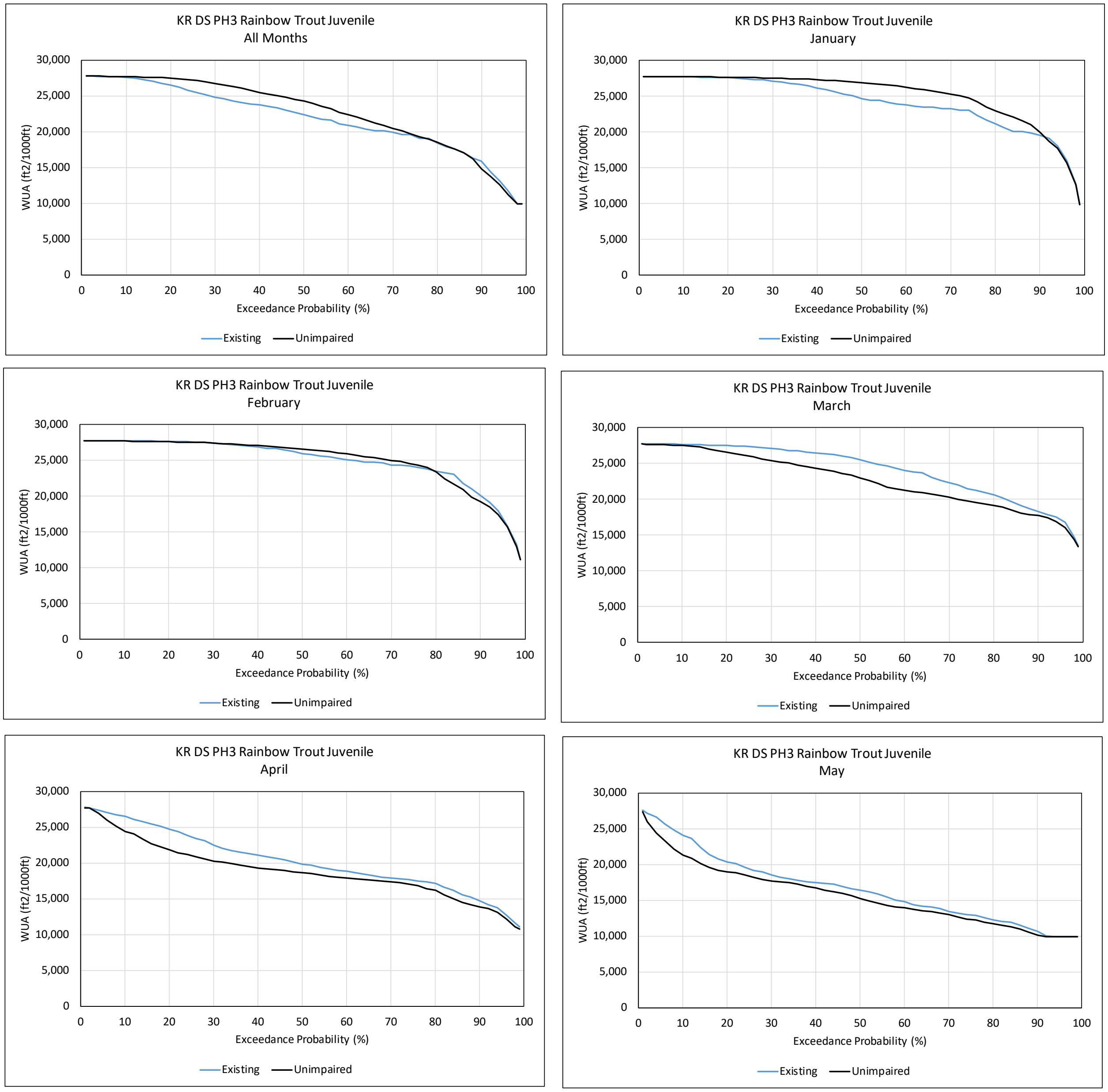
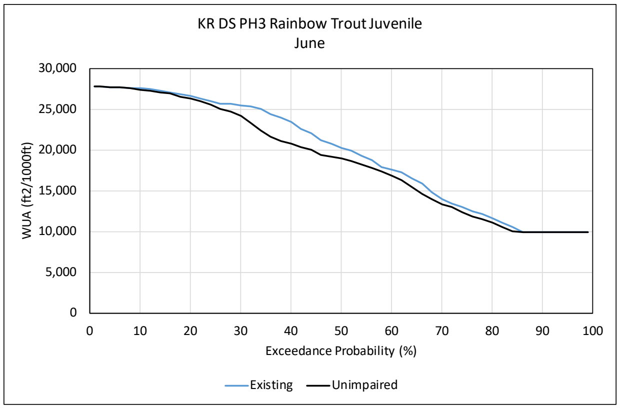
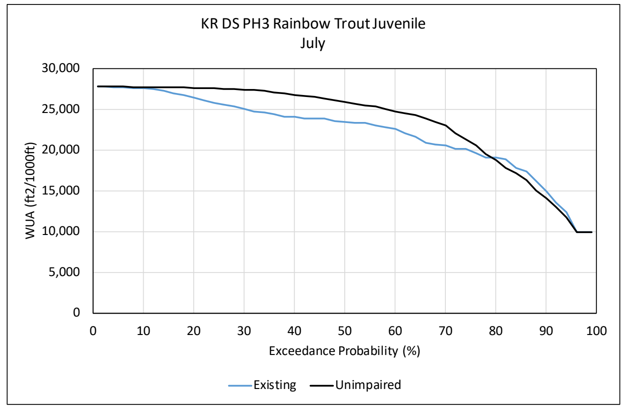
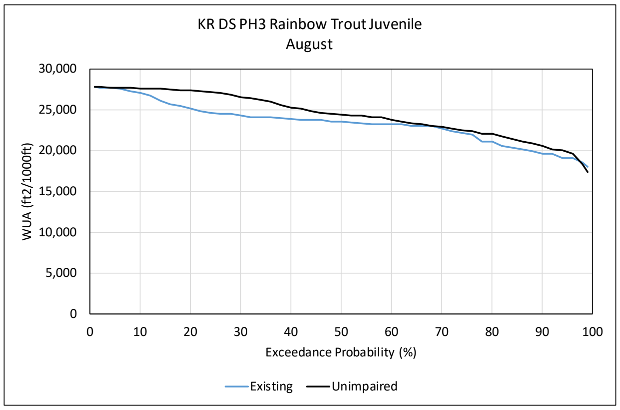
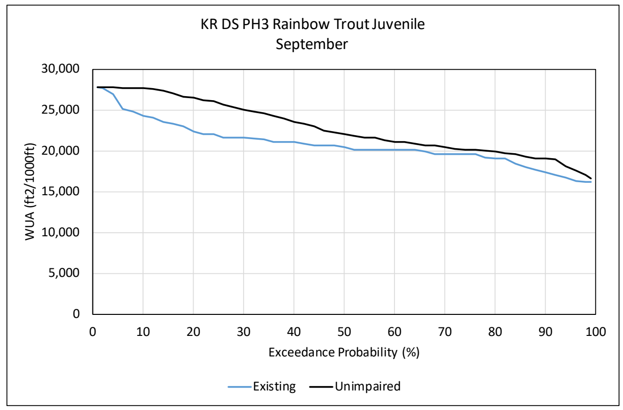
Figure G-11. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

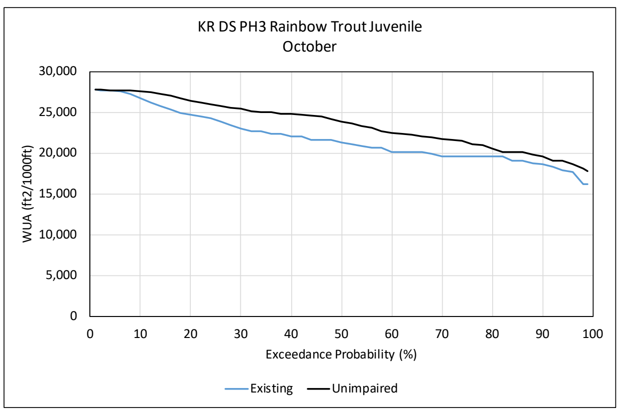


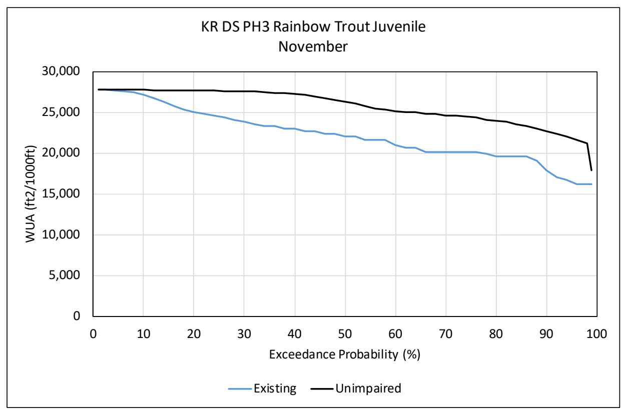

KR DS PH3 Rainbow Trout Juvenile
June
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Juvenile
July
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Juvenile
August
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Juvenile
September
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Juvenile
October
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR DS PH3 Rainbow Trout Juvenile
November
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

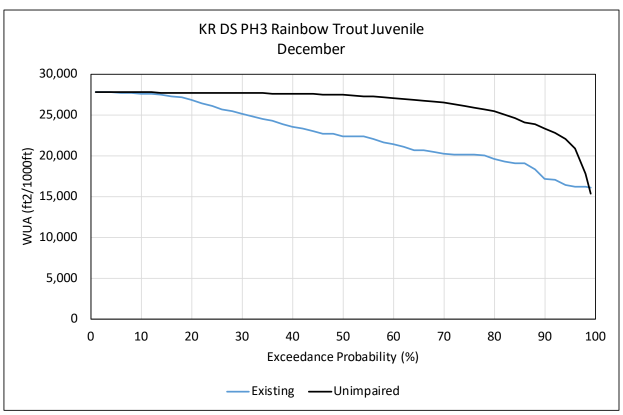
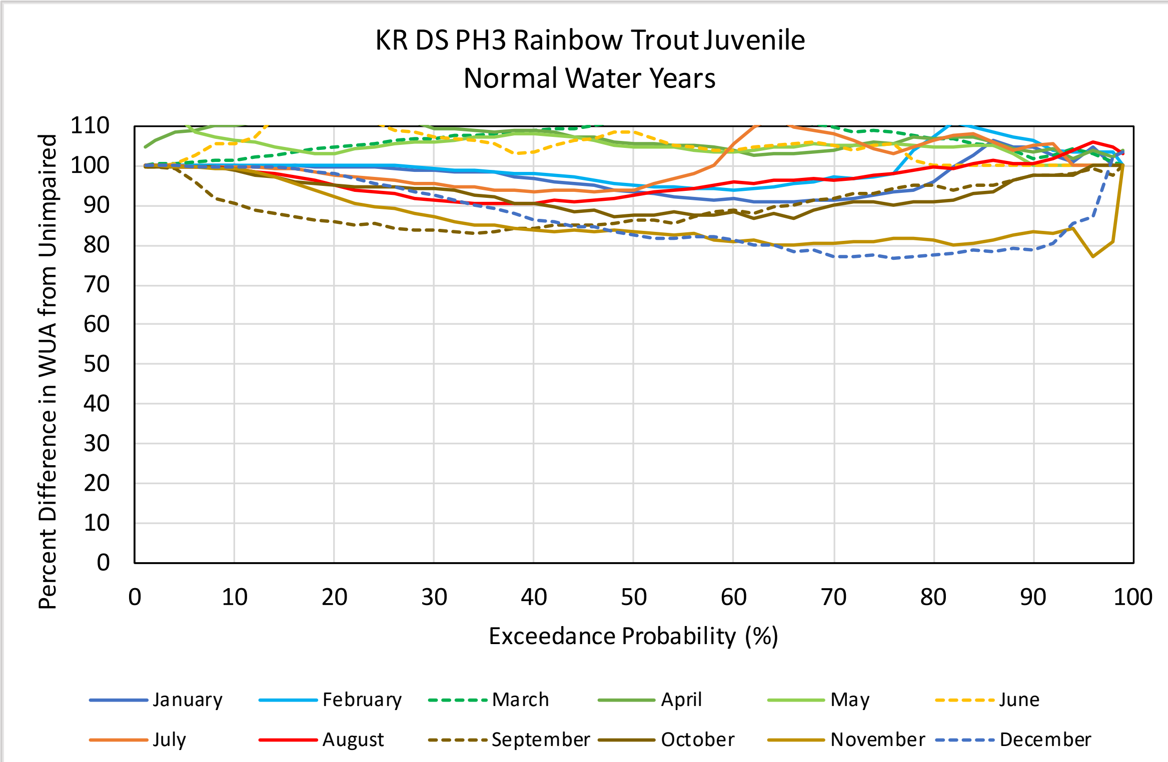

KR DS PH3 Rainbow Trout Juvenile
December
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-12. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



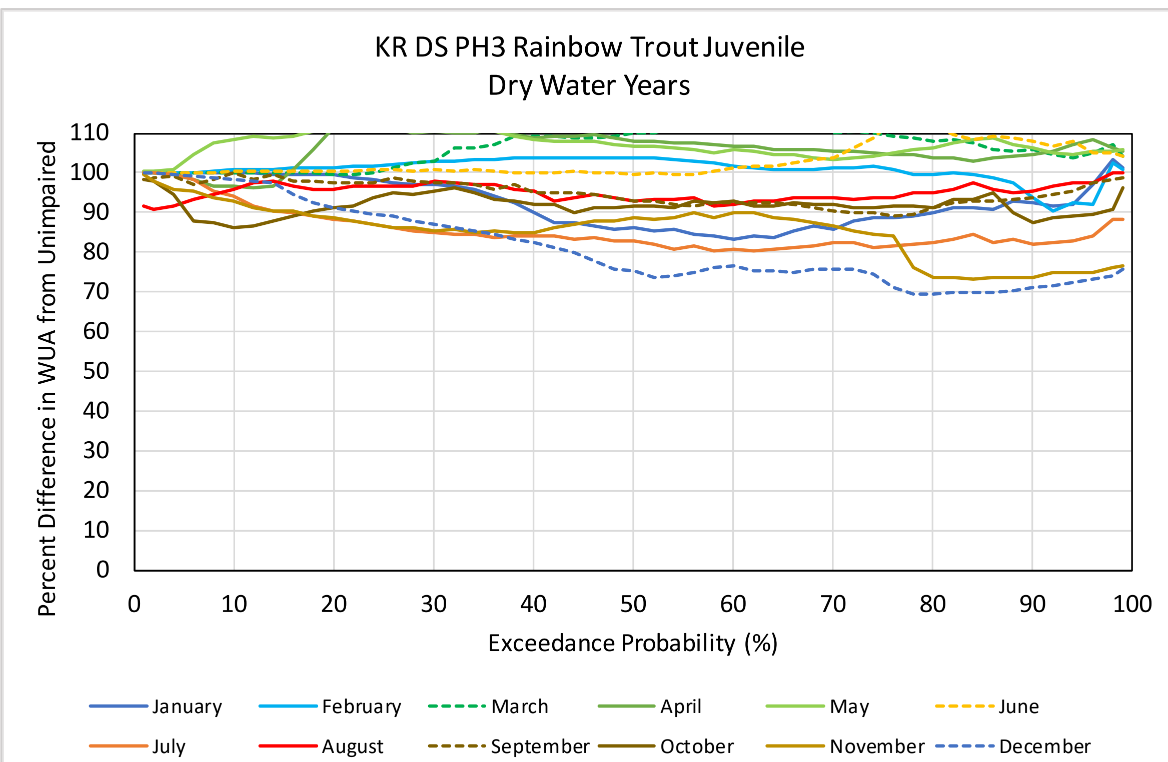


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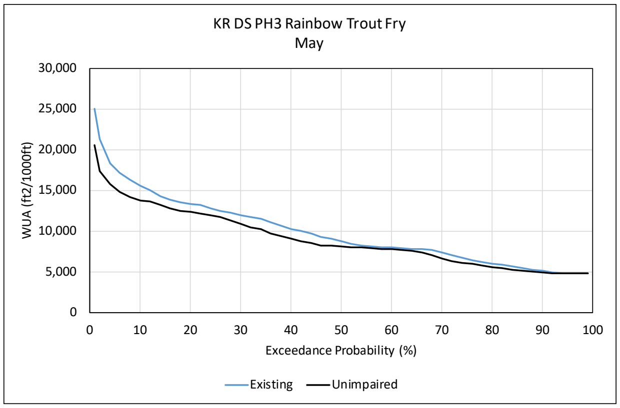
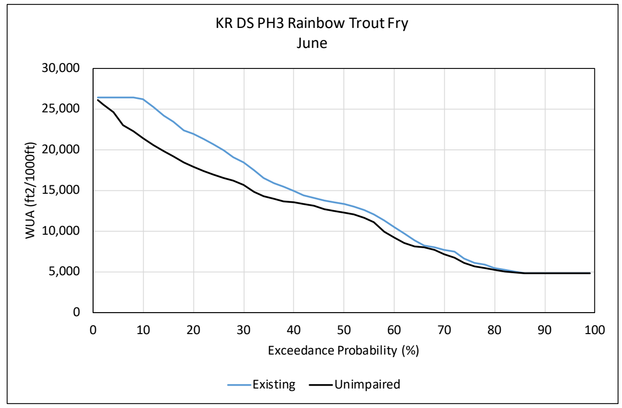
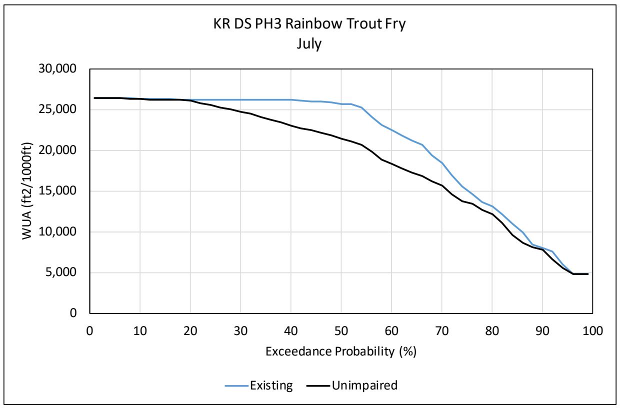
Figure G-13. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Fry Habitat Exceedance Plots for All Water Years May through August.







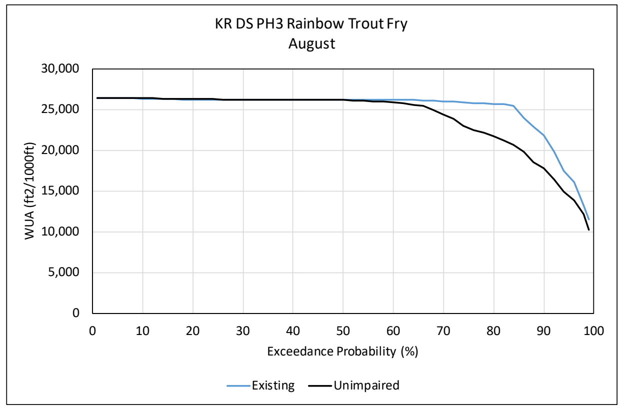


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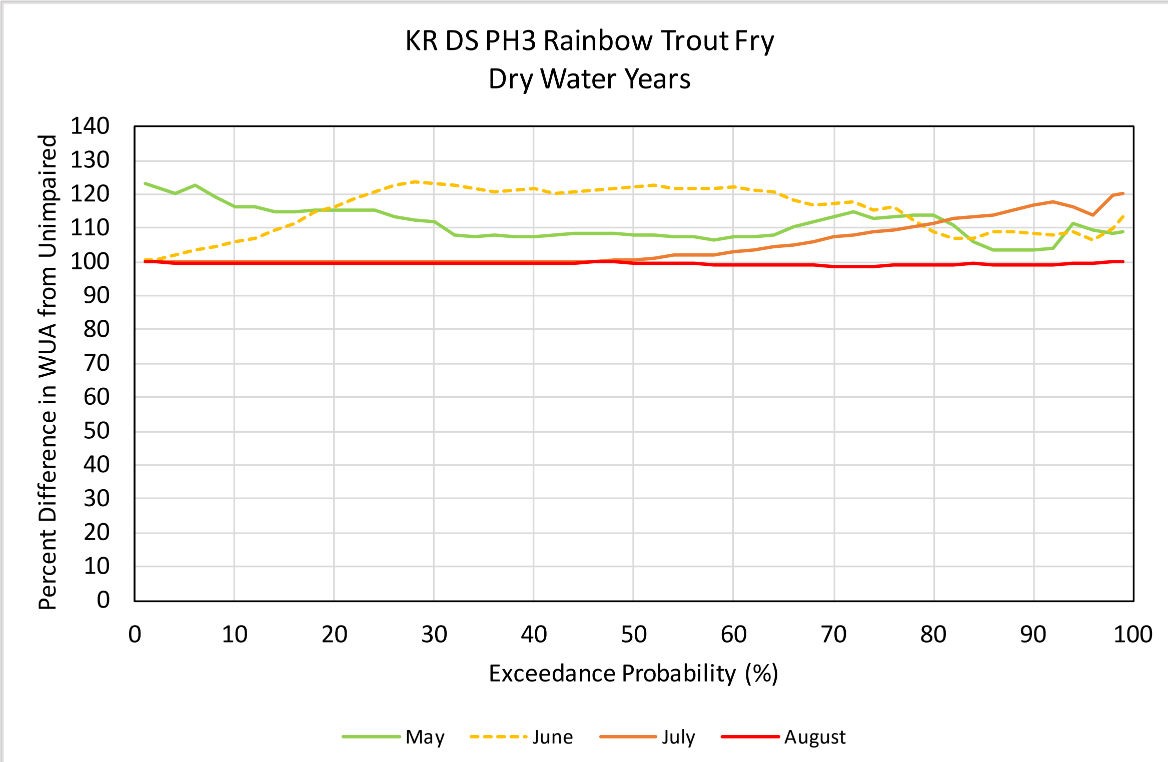
Figure G-14. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Fry Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



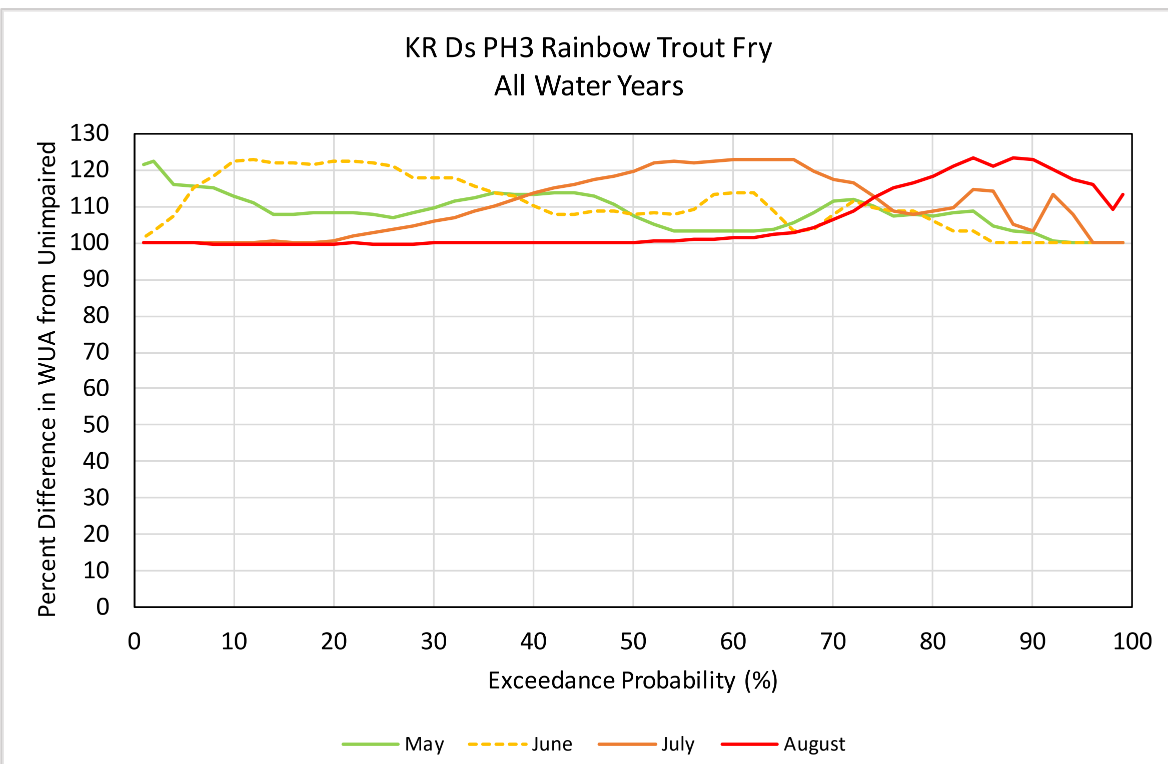


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Figure G-15. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence Rainbow Trout Spawning Habitat Exceedance Plots for All Water Years, March through May.

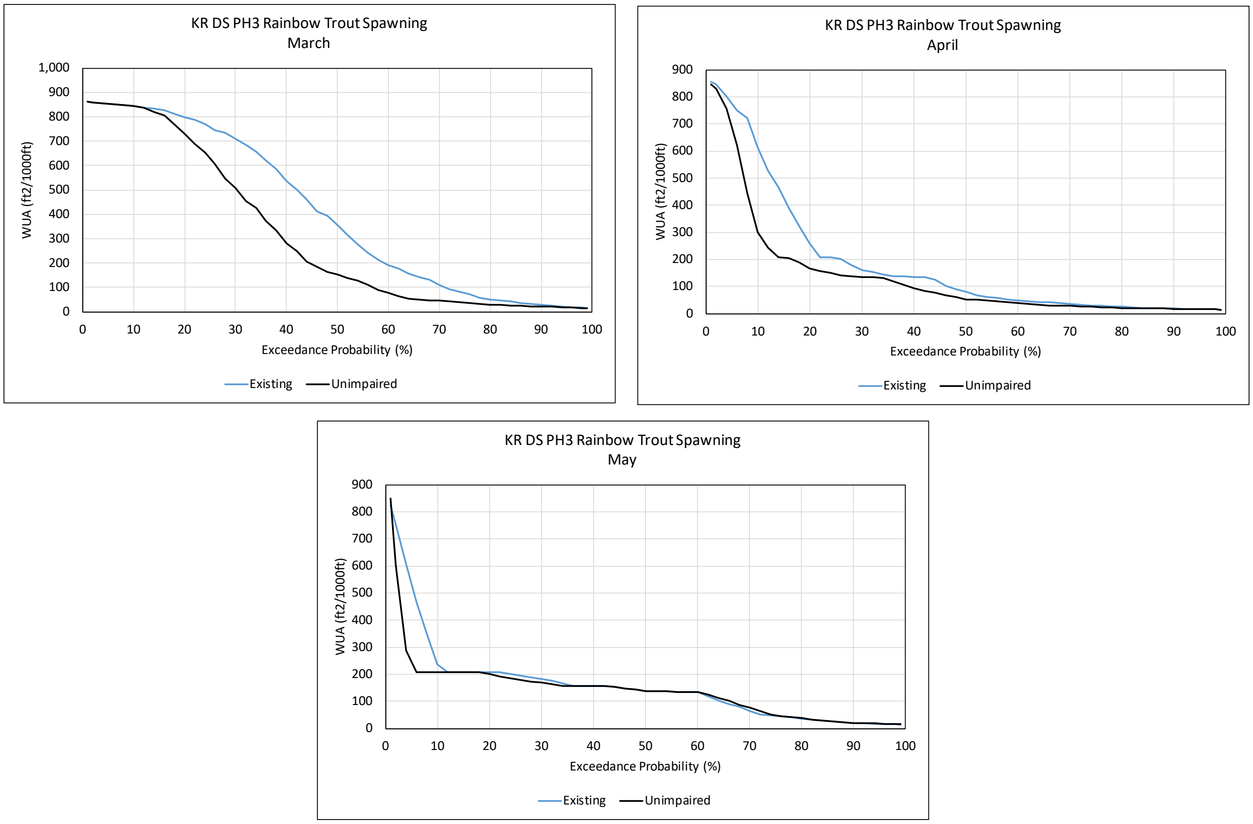

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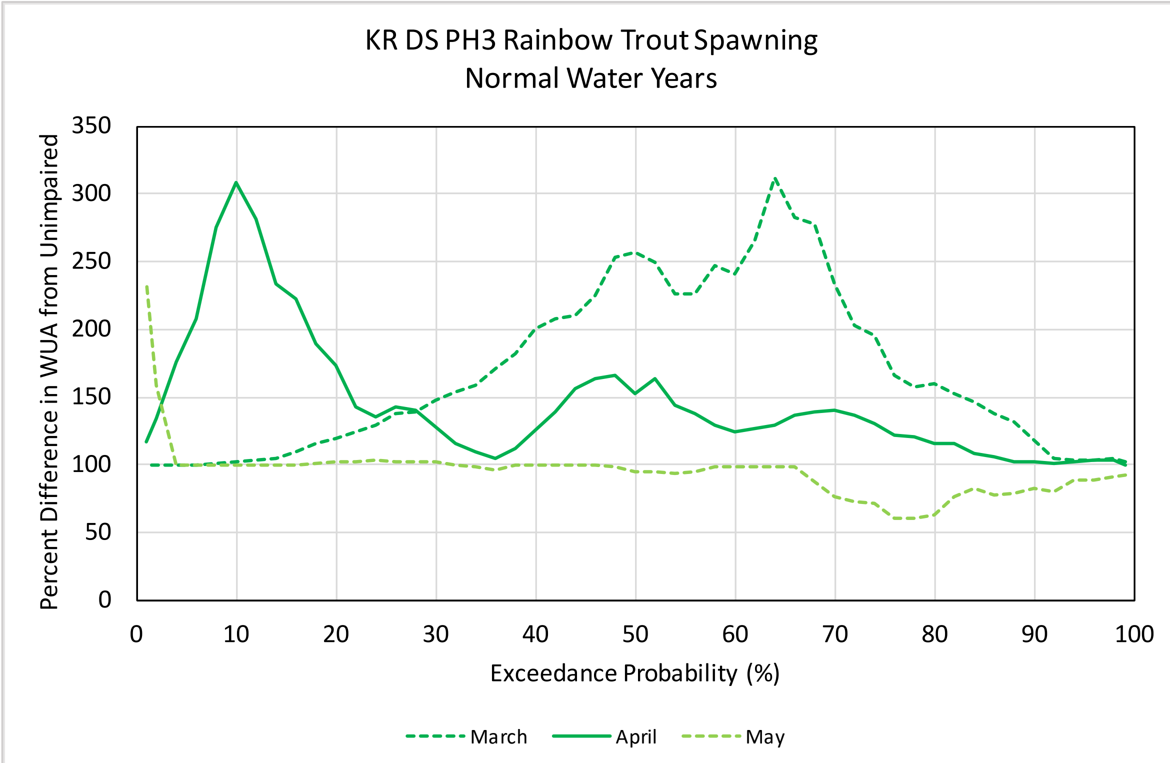
Figure G-16. Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kawah River Confluence Rainbow Trout Spawning Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



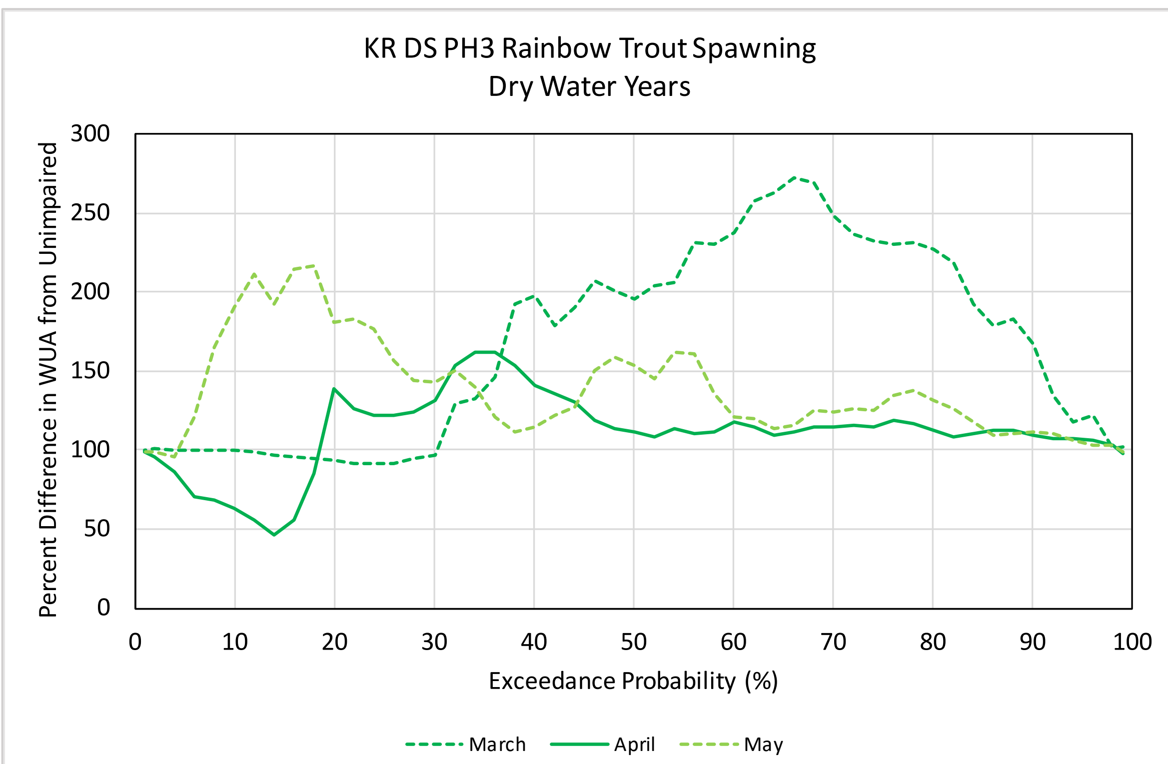


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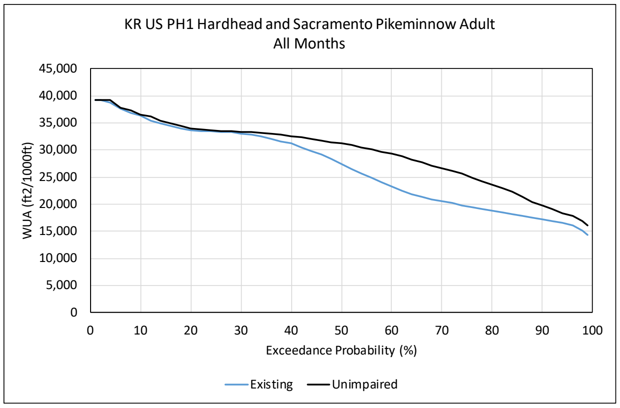
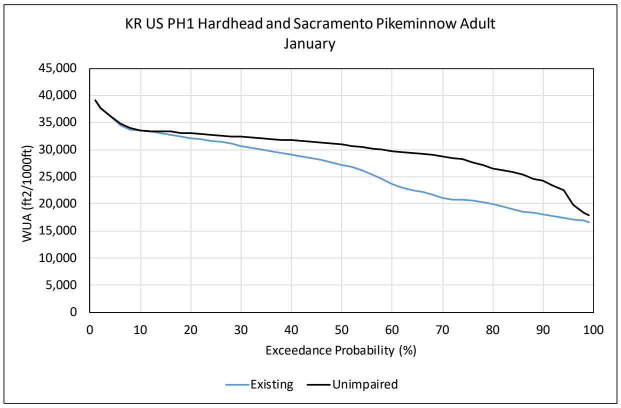
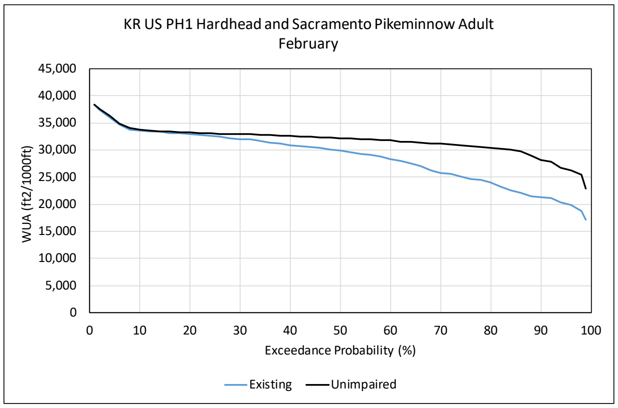
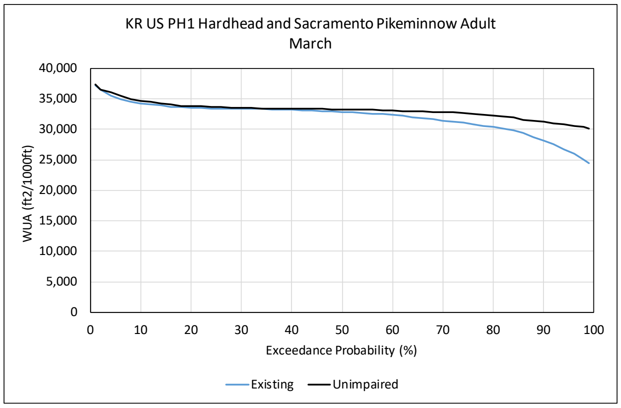
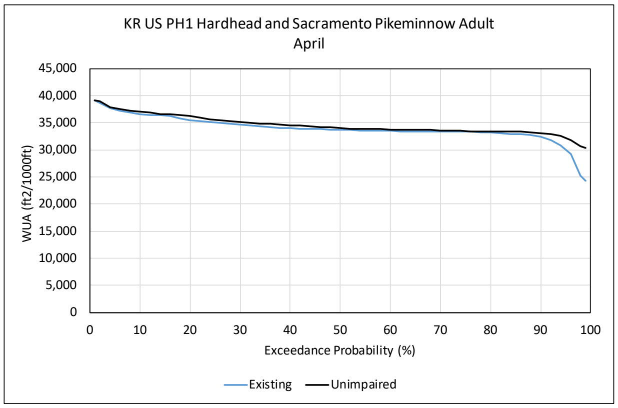
Figure G-17. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Hardhead and Sacramento Pikeminnow Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

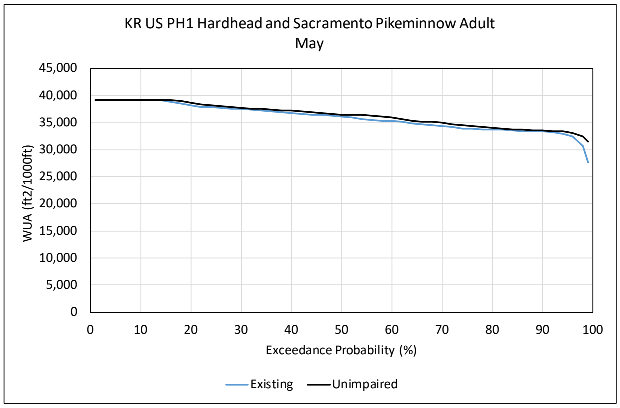


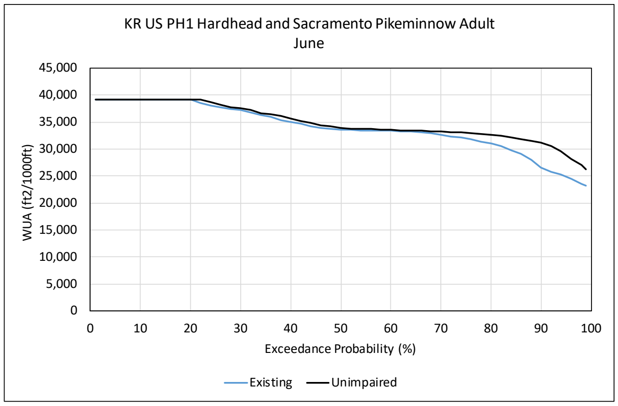


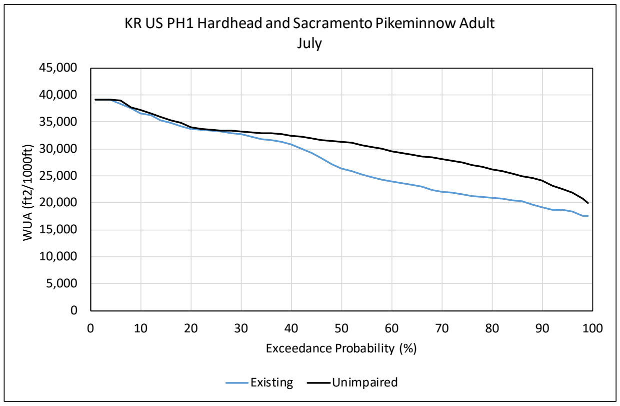


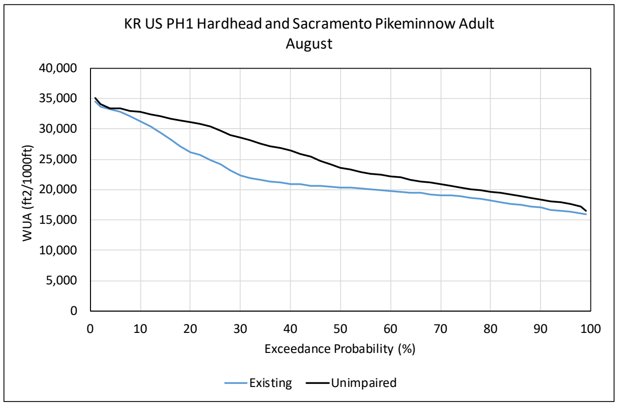


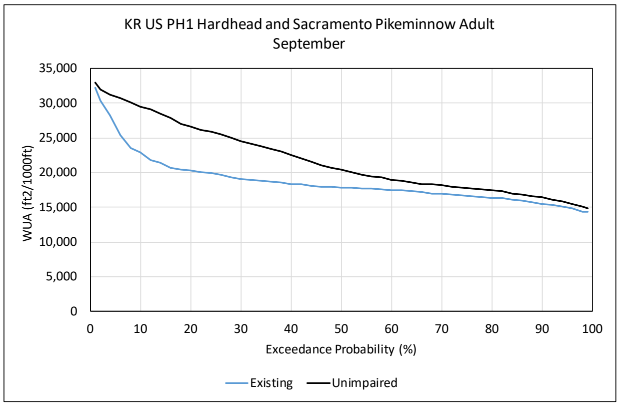


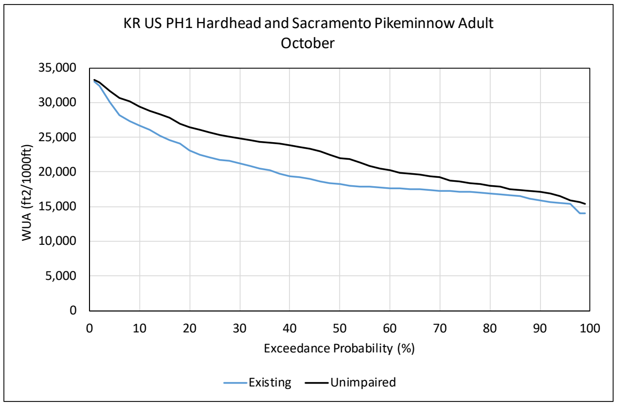


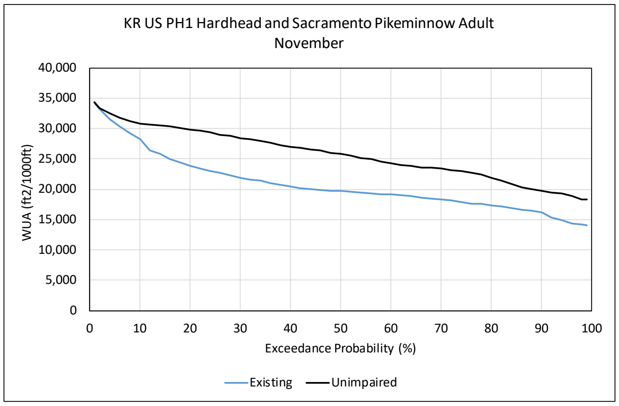

KR US PH1 Hardhead and Sacramento Pikeminnow Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

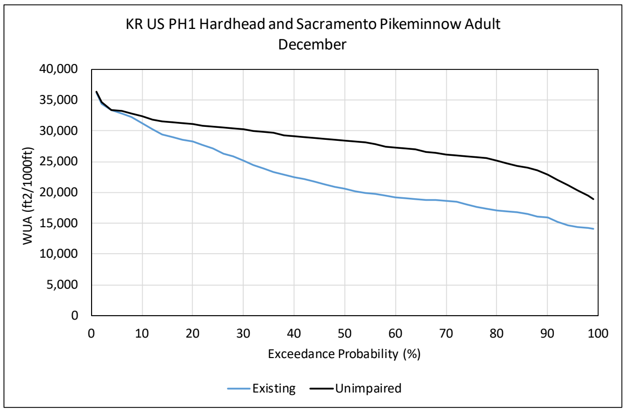
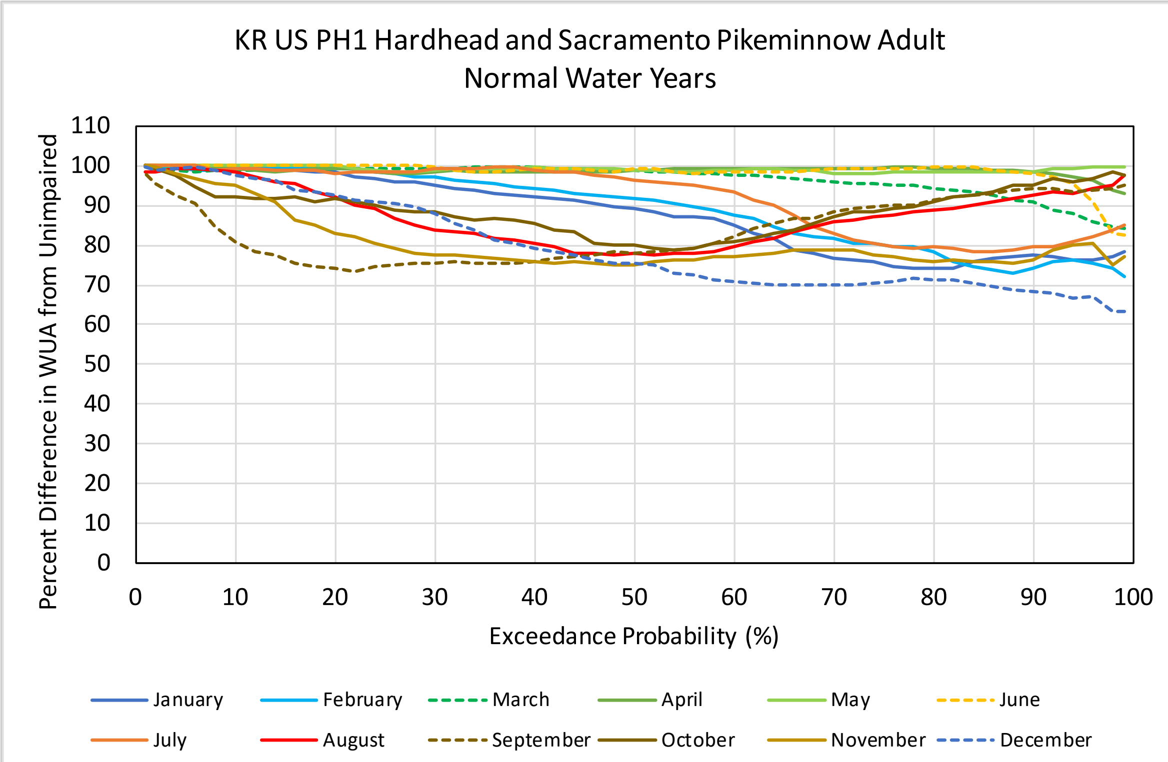

KR US PH1 Hardhead and Sacramento Pikeminnow Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-18. 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 for Normal and Dry Water Years.



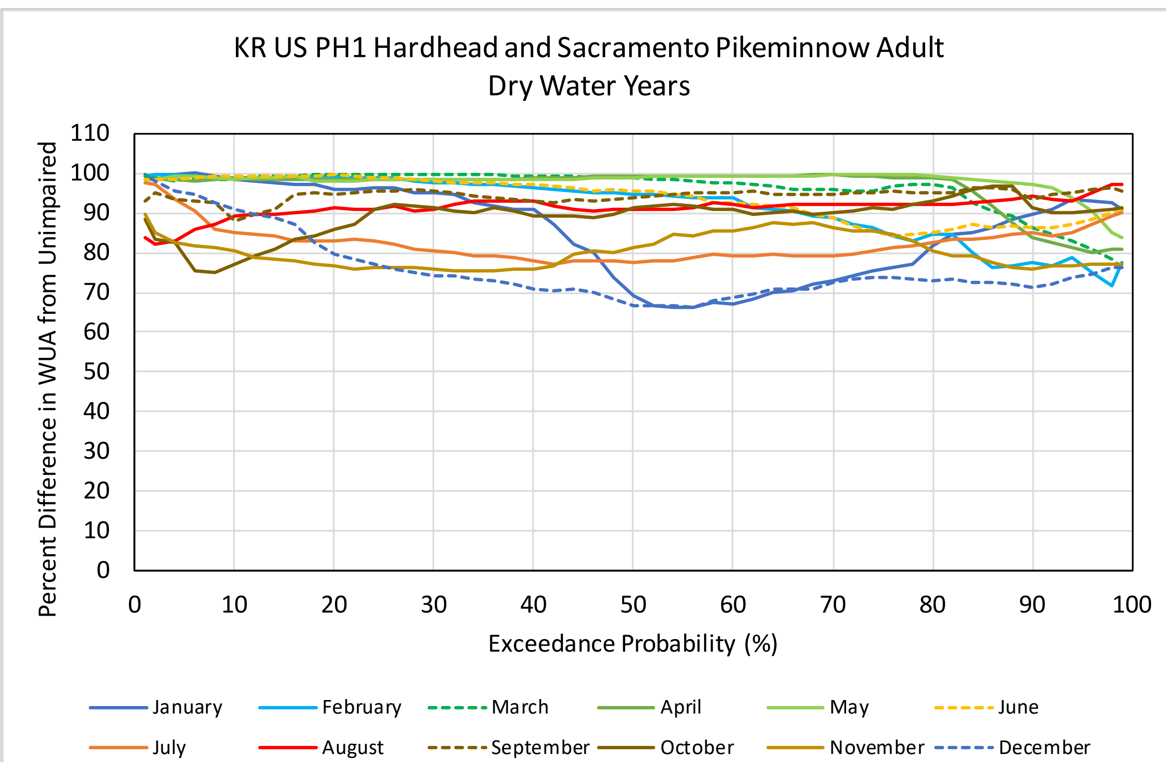


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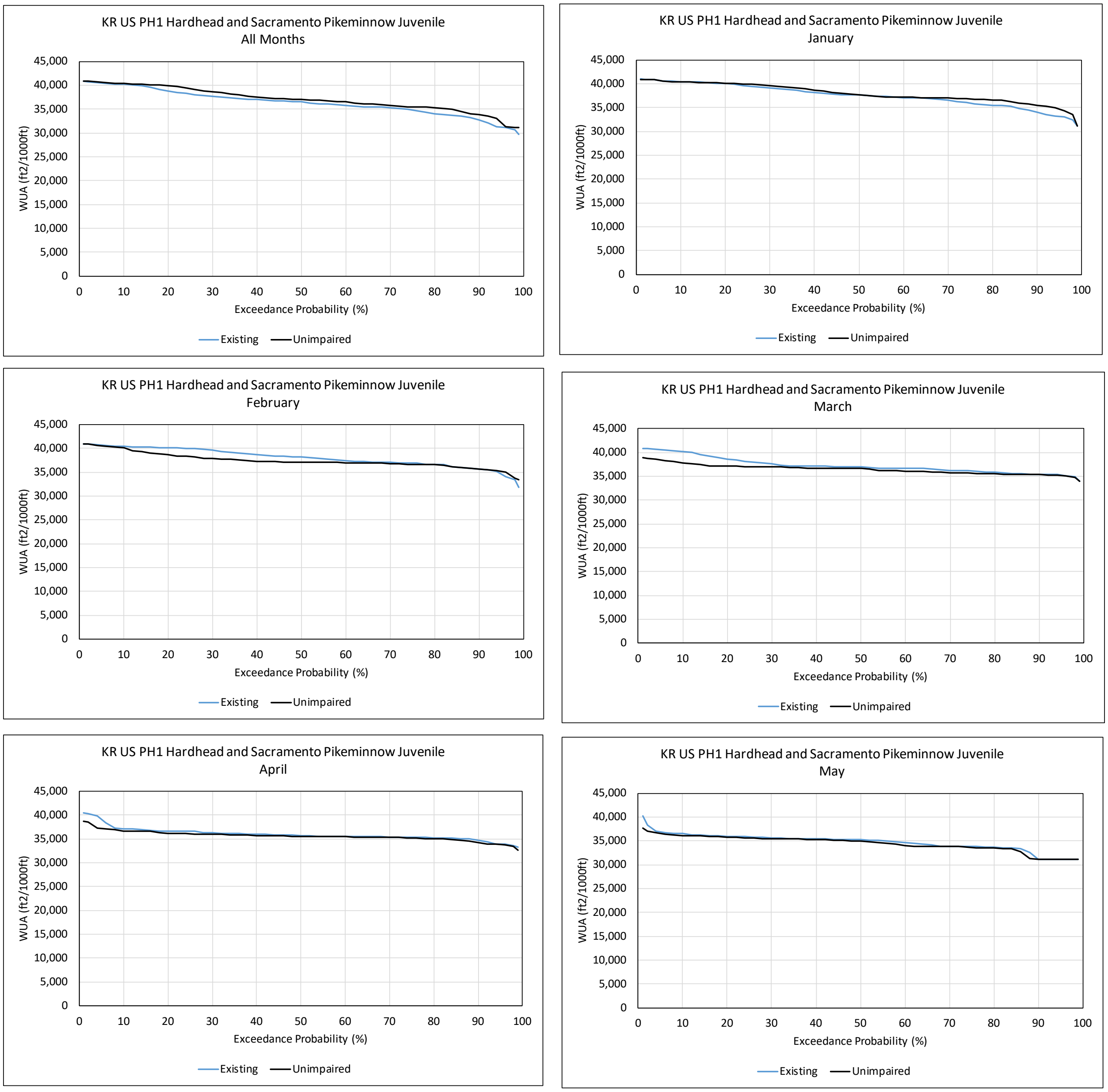
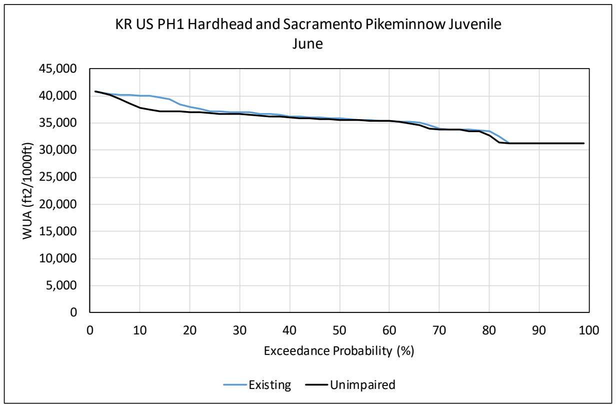
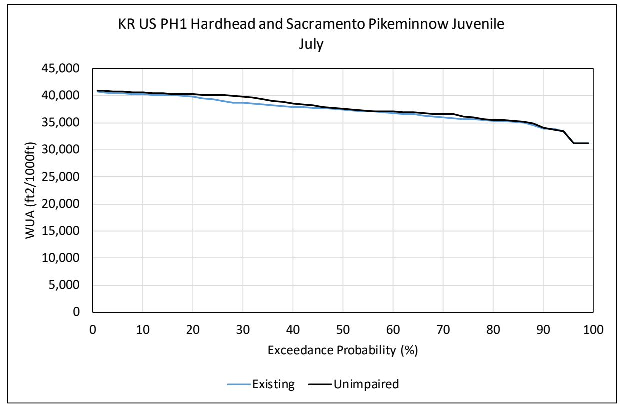
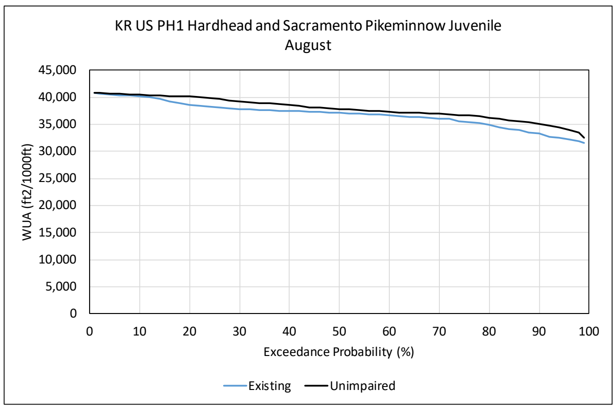
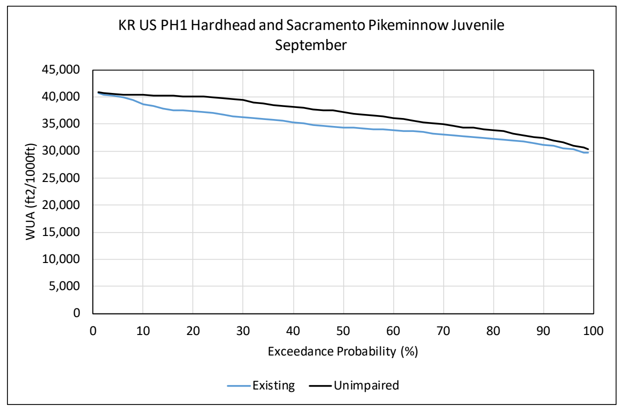
Figure G-19. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Hardhead and Sacramento Pikeminnow Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

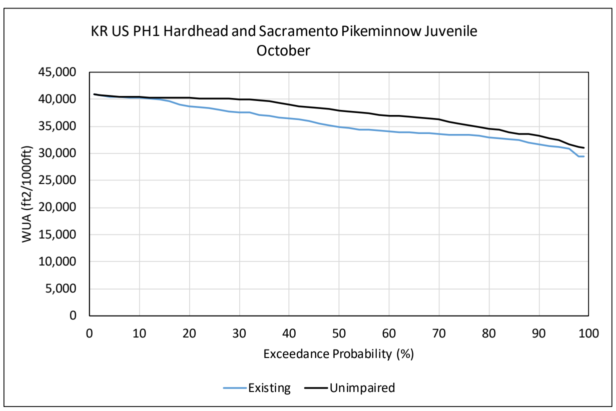


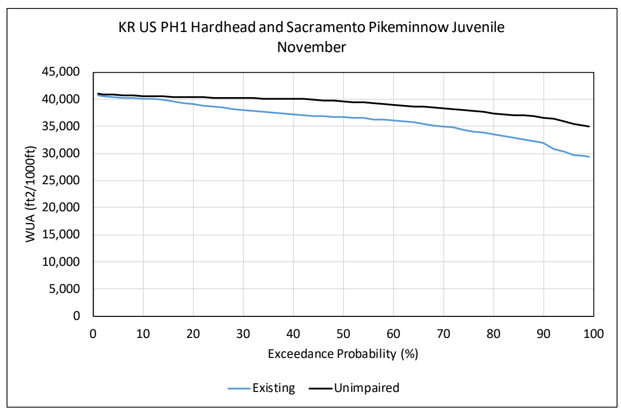

KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
June
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
July
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
August
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
September
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
October
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
November
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

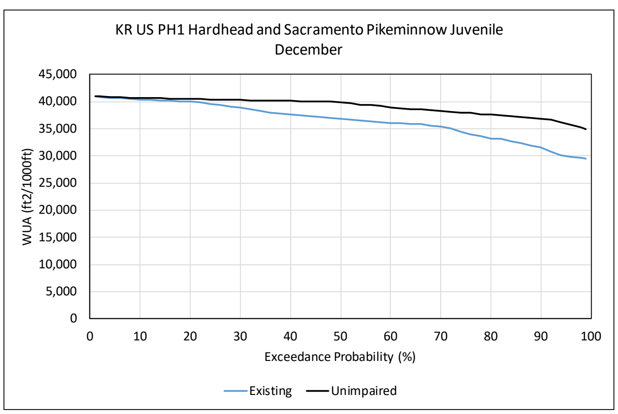
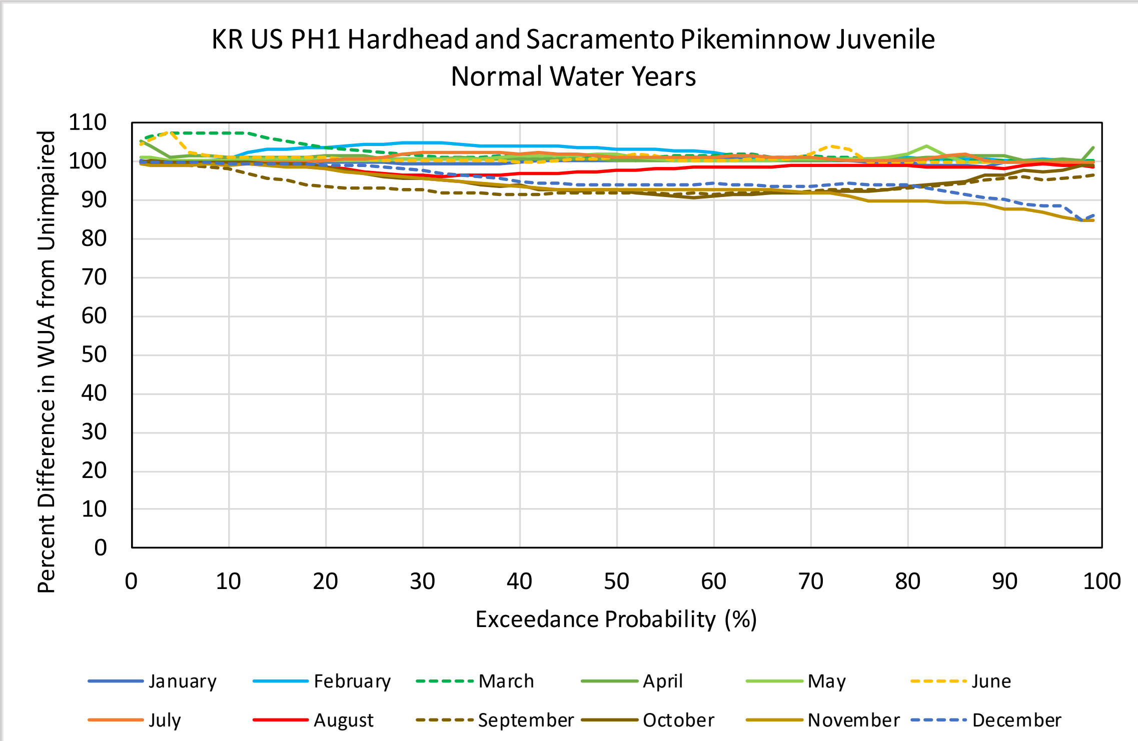

KR US PH1 Hardhead and Sacramento Pikeminnow Juvenile
December
WUA (ft2/1000ft)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-20. **Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Hardhead and Sacramento Pikeminnow Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**



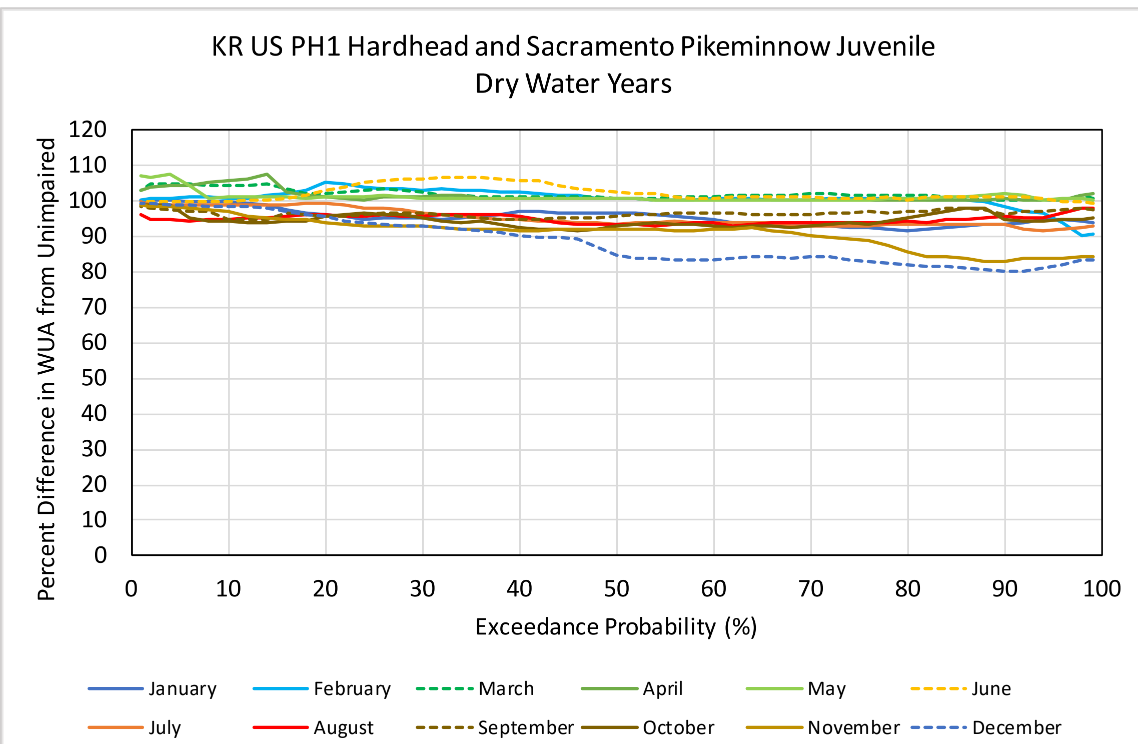


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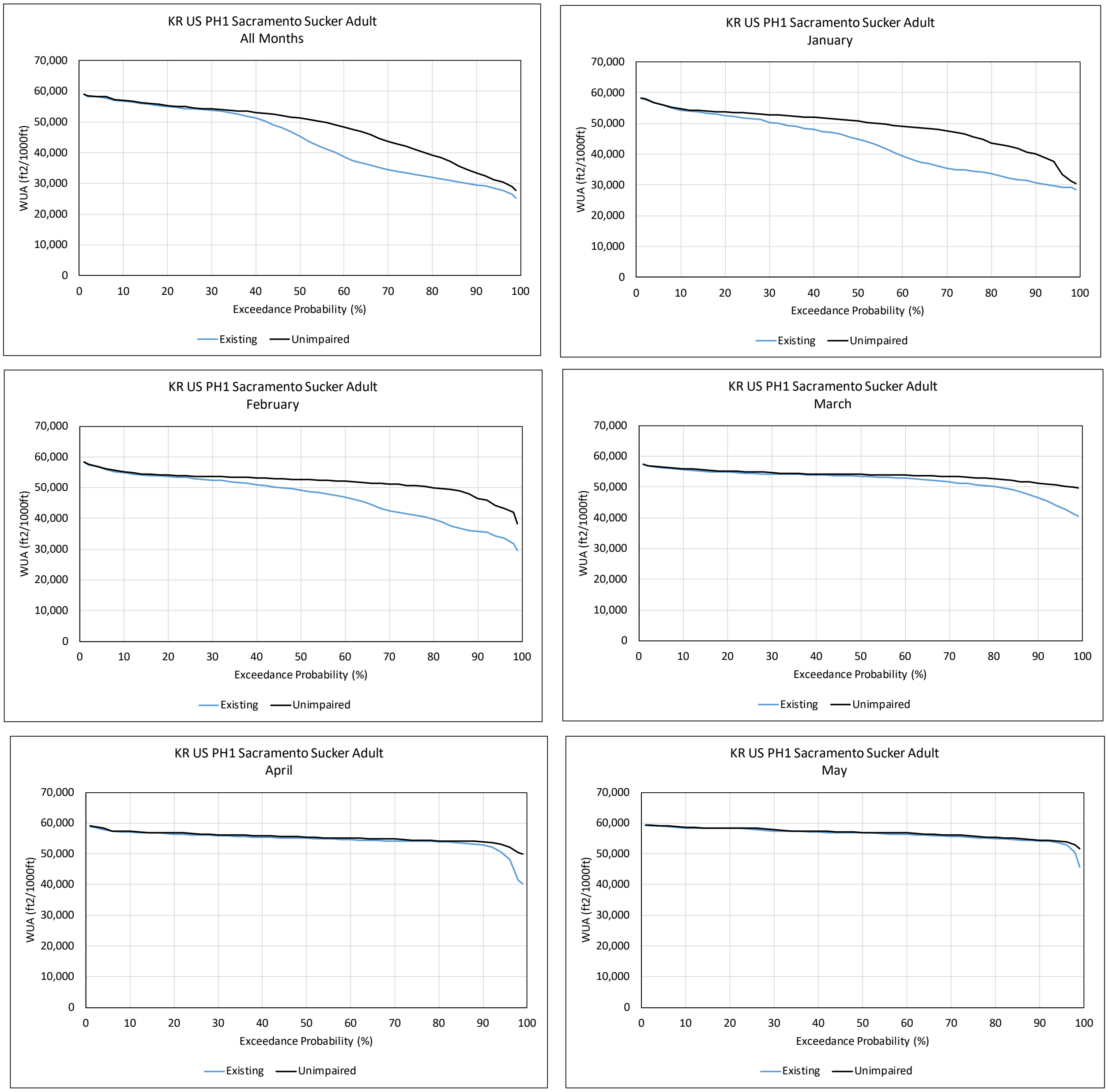
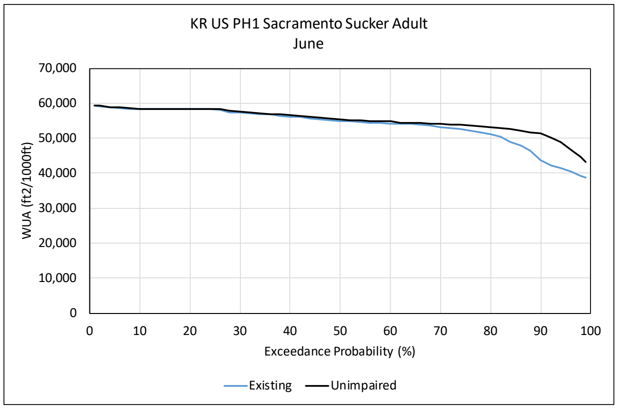
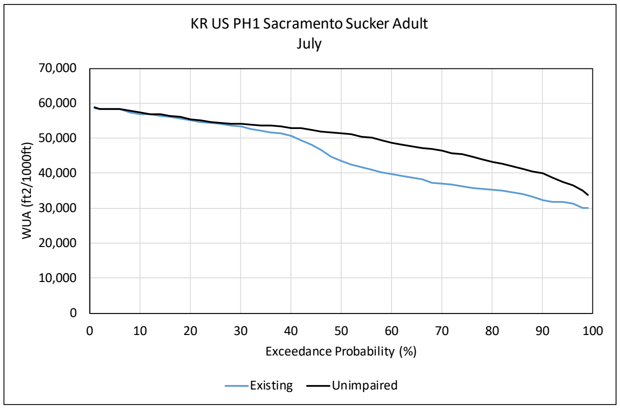
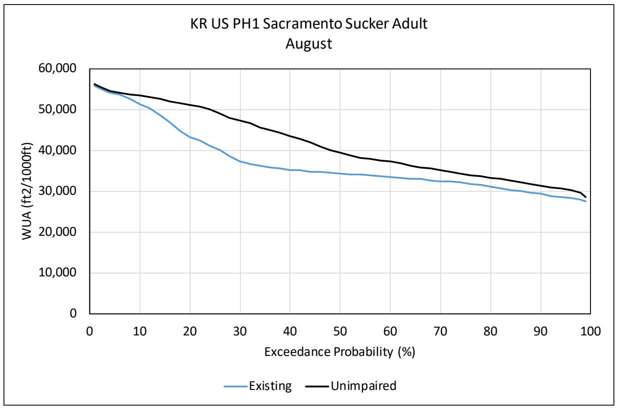
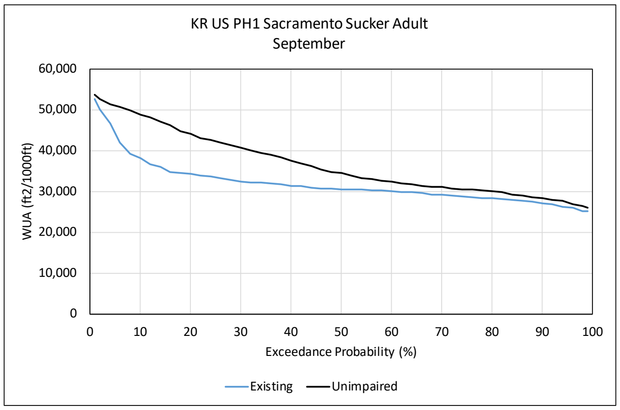
Figure G-21. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Sacramento Sucker Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

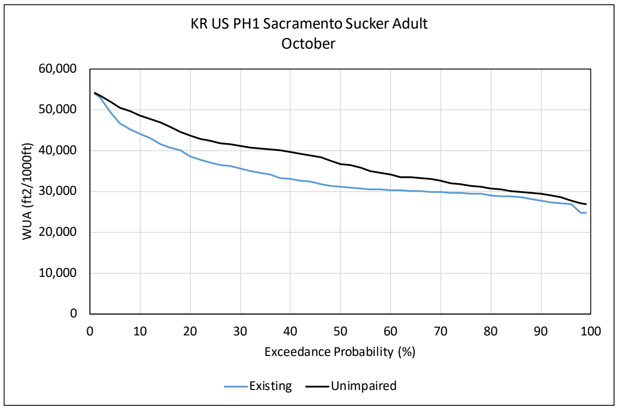


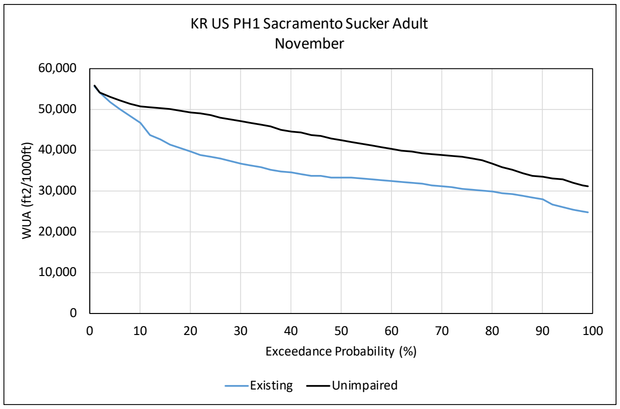

KR US PH1 Sacramento Sucker Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

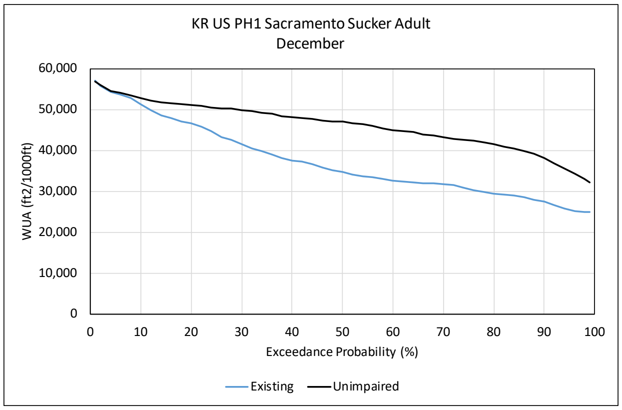
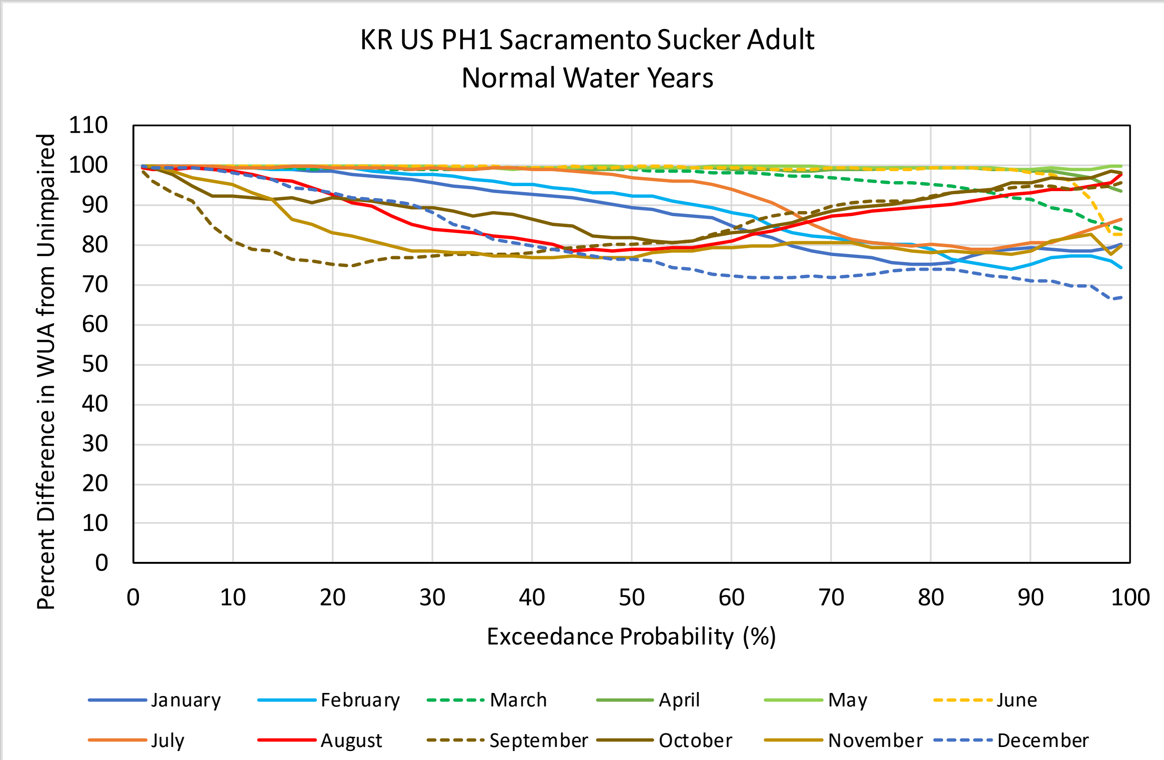

KR US PH1 Sacramento Sucker Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-22. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Sacramento Sucker Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



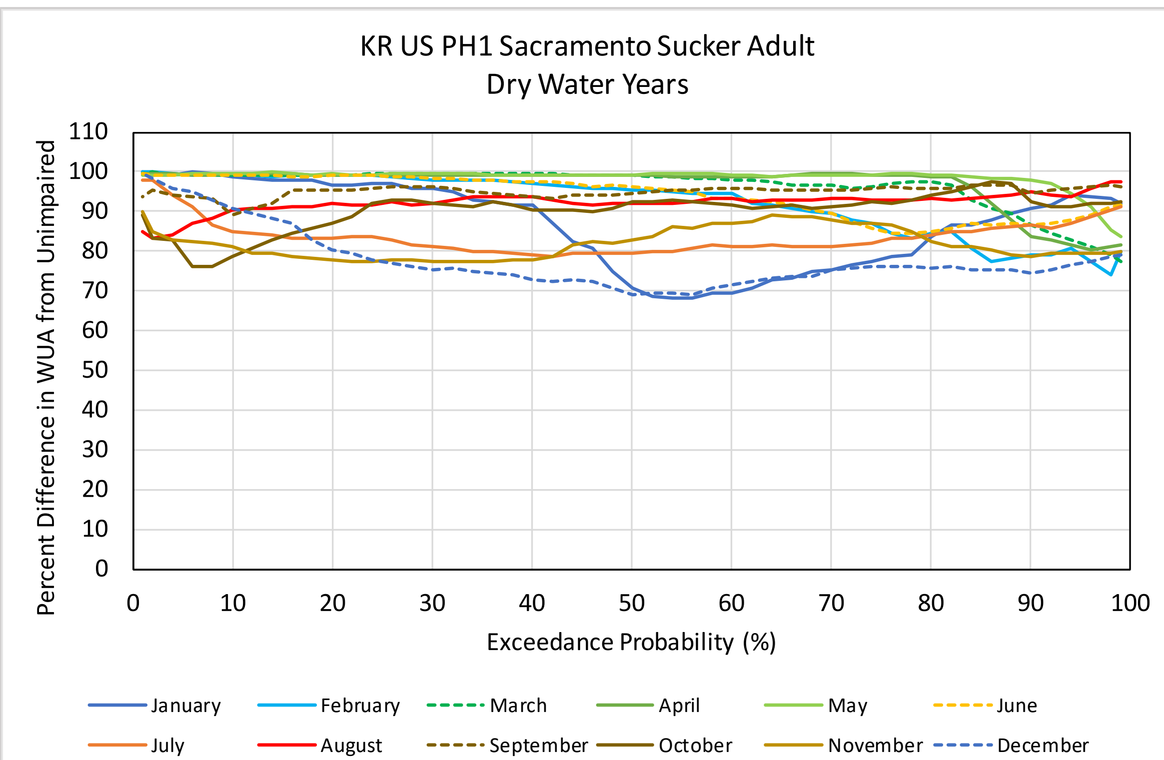


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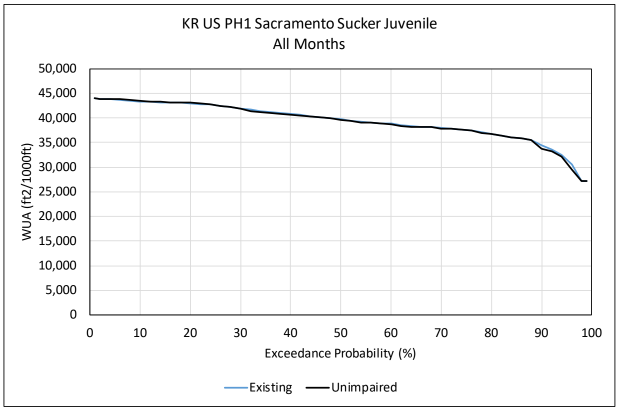
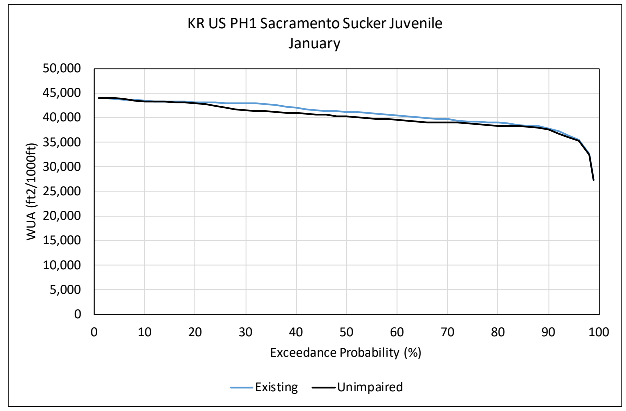
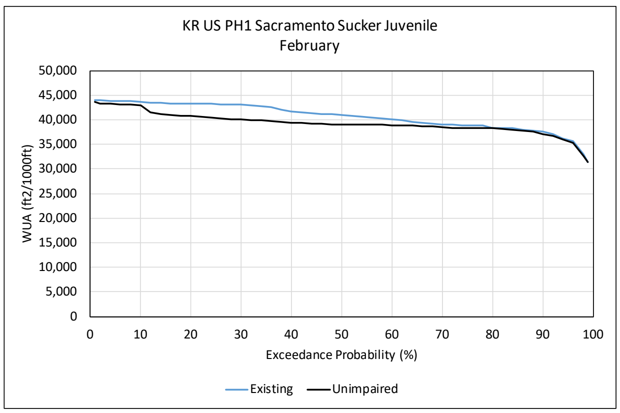
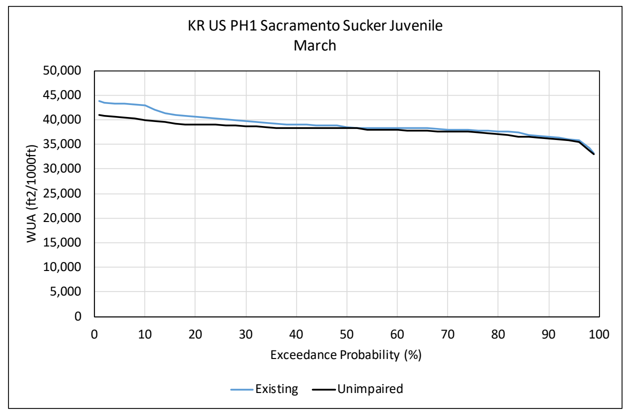
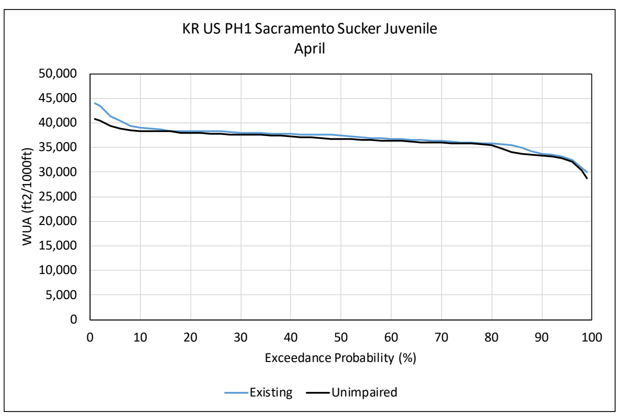
Figure G-23. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Sacramento Sucker Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

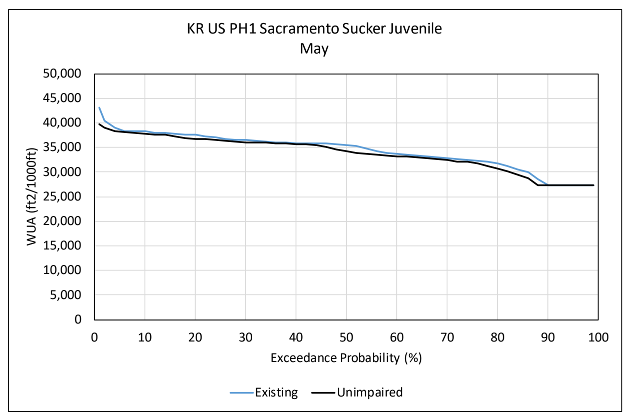


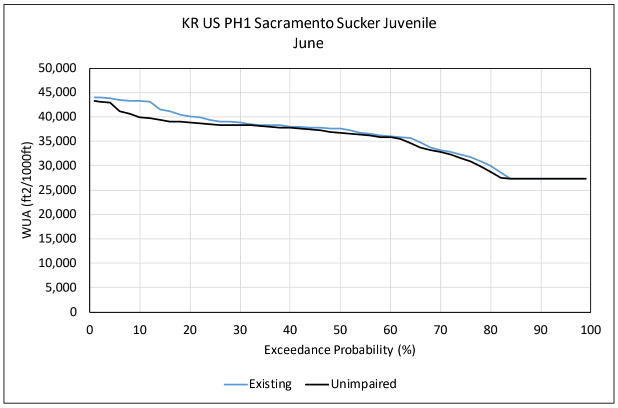


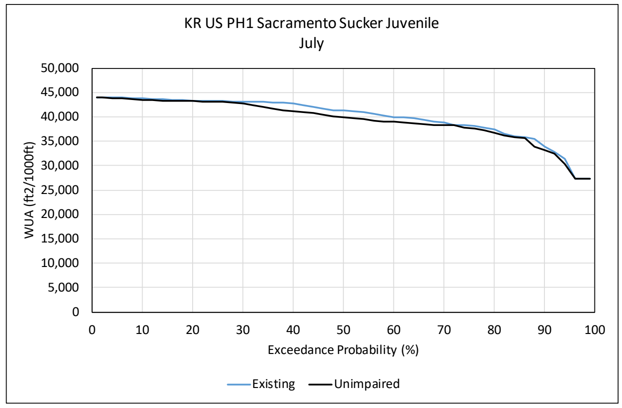


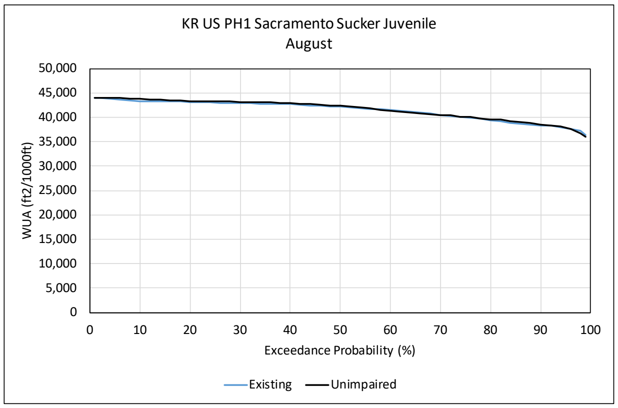


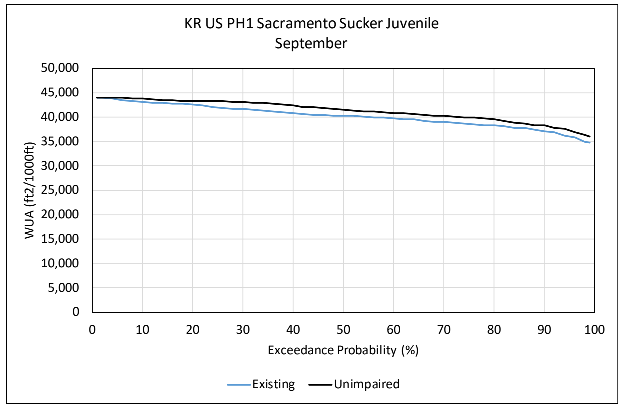


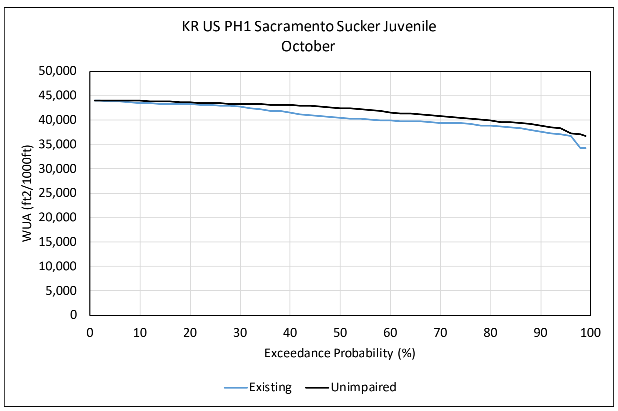


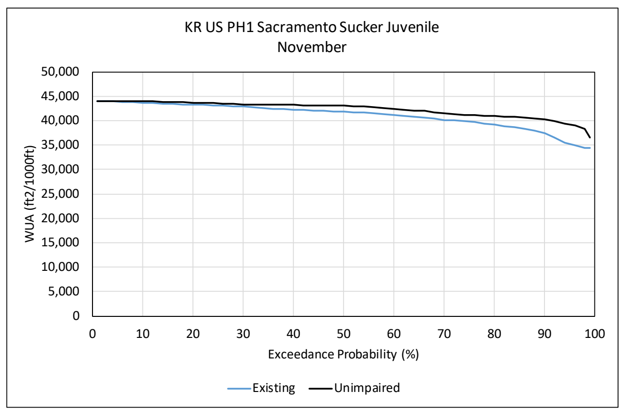

KR US PH1 Sacramento Sucker Juvenile
June
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Juvenile
July
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Juvenile
August
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Juvenile
September
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Juvenile
October
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Sacramento Sucker Juvenile
November
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

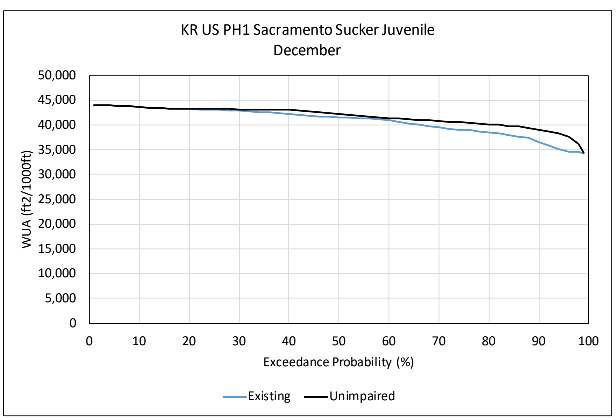
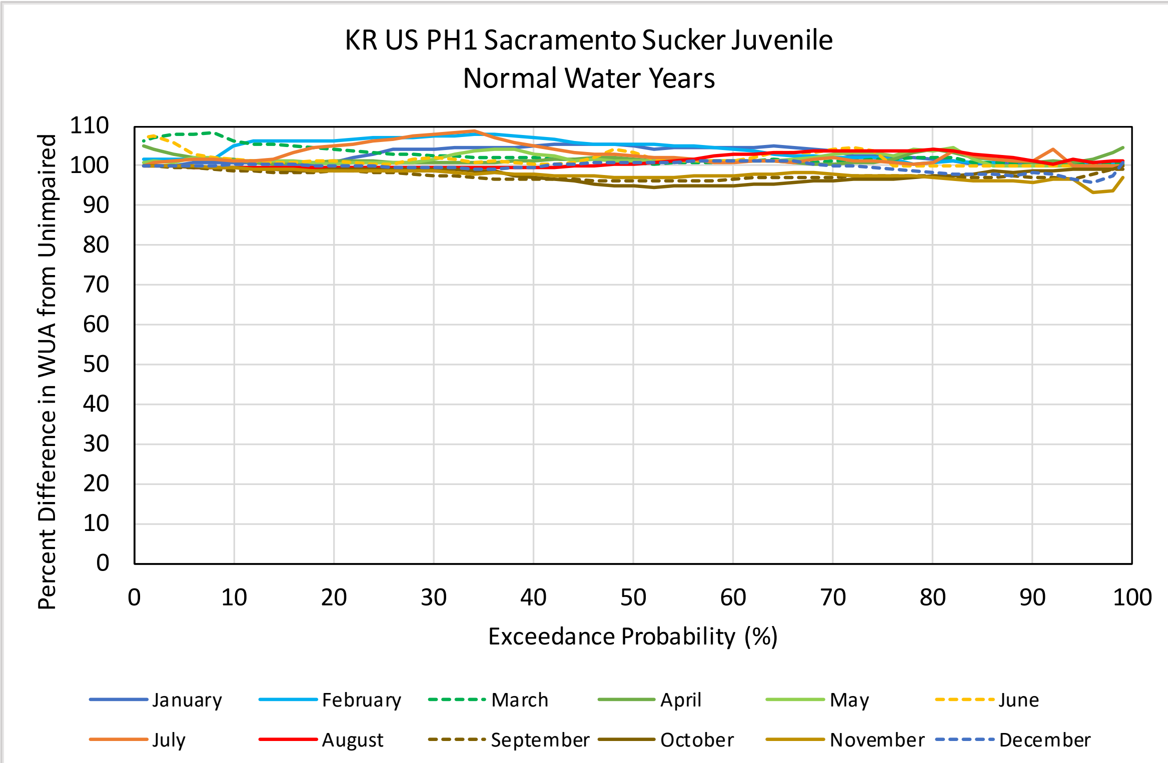

KR US PH1 Sacramento Sucker Juvenile
December
WUA (ft2/1000ft)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-24. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Sacramento Sucker Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



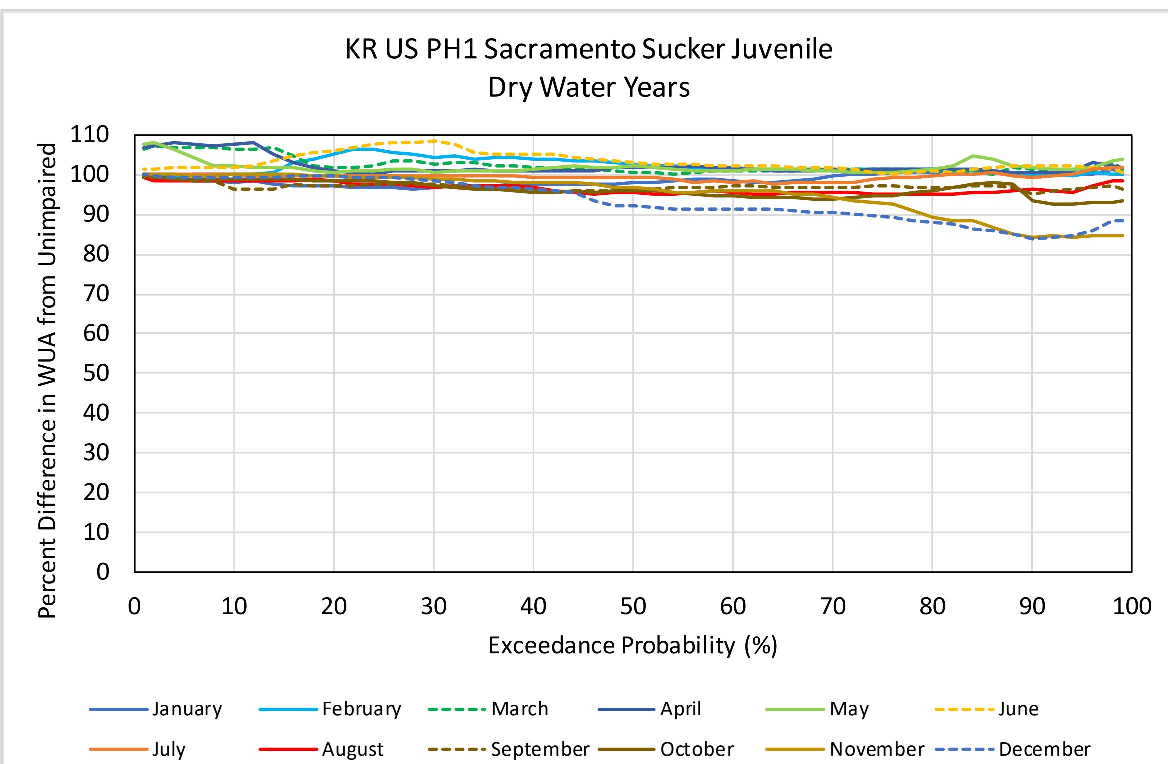


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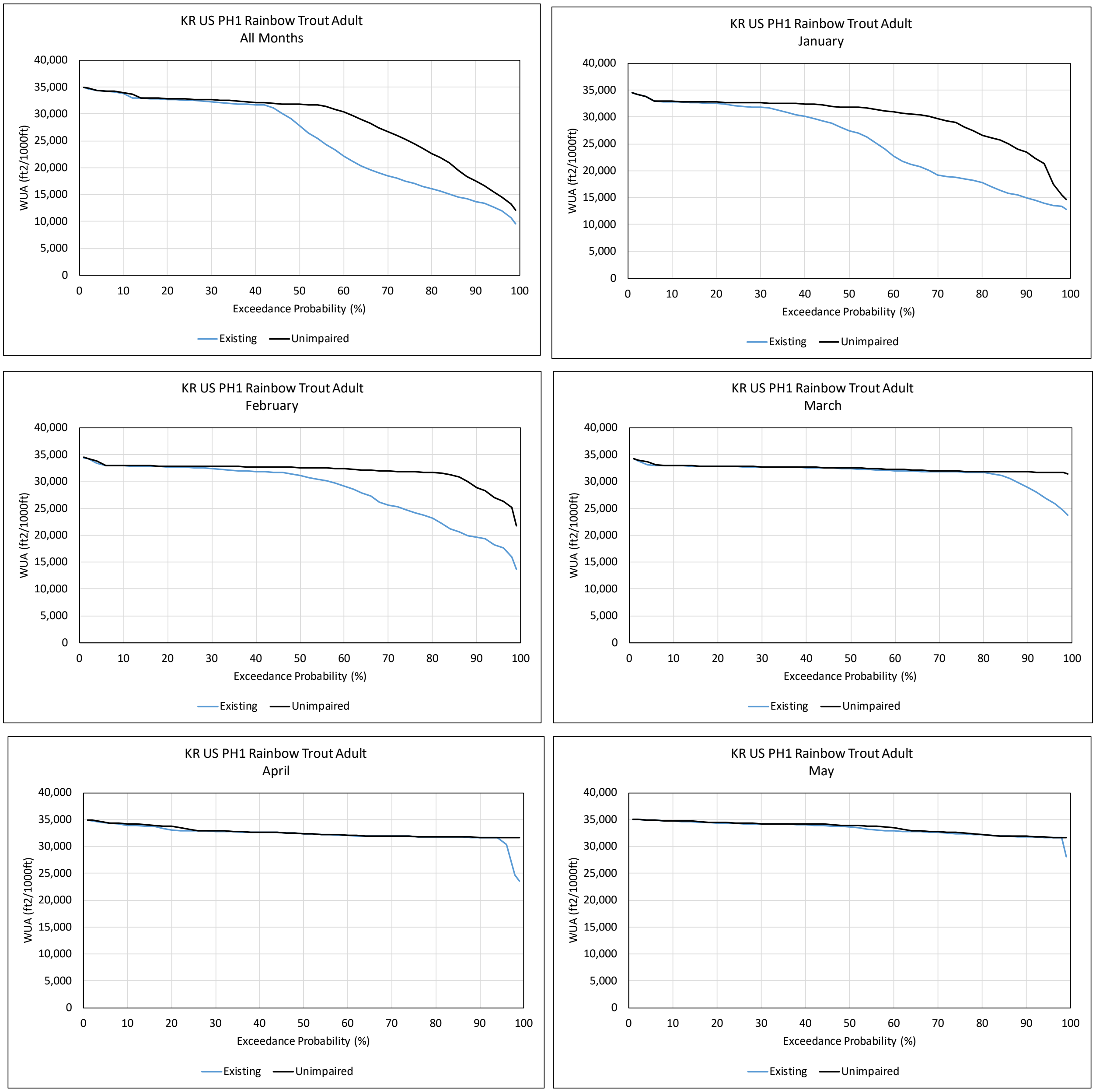
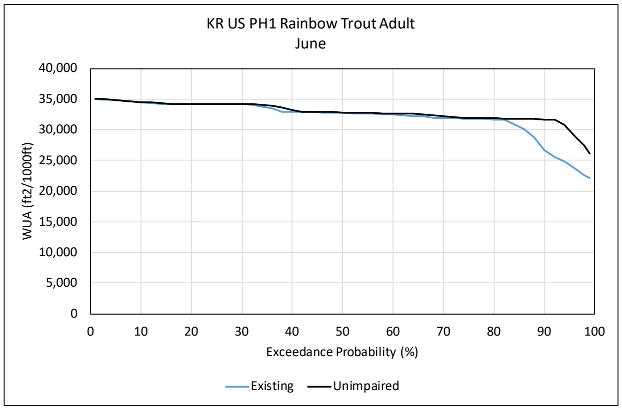
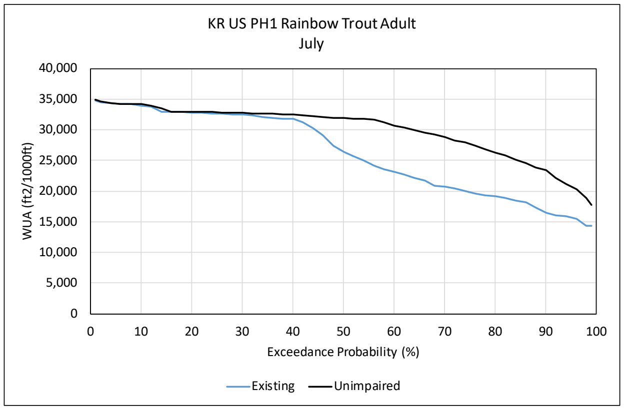
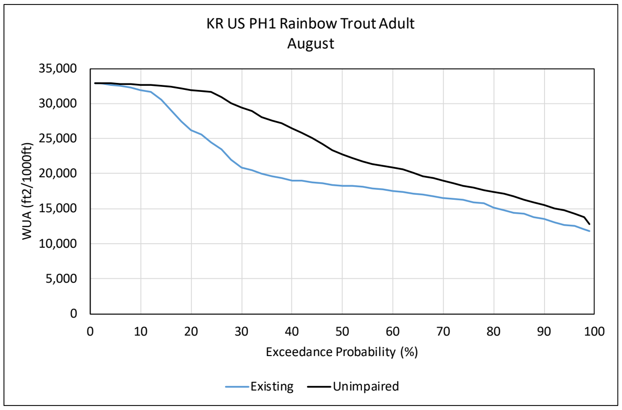
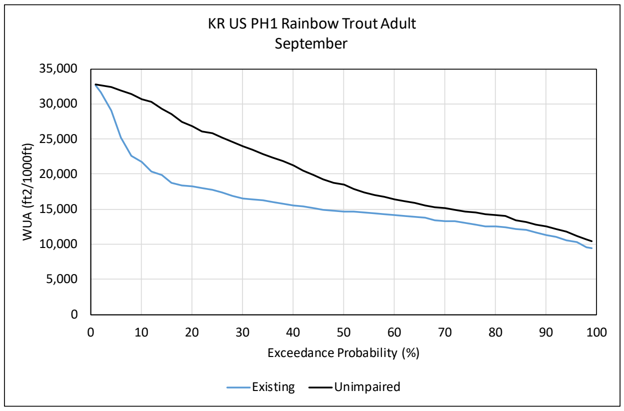
Figure G-25. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

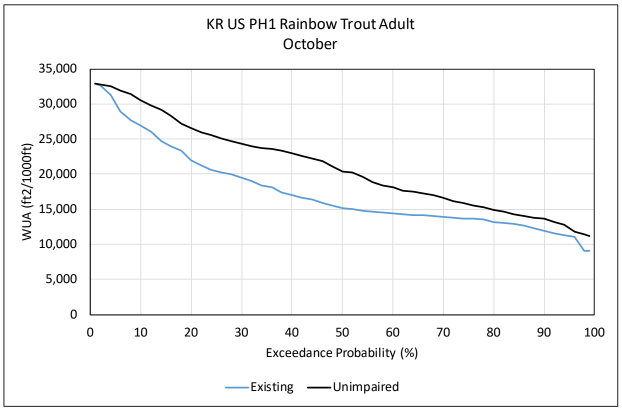


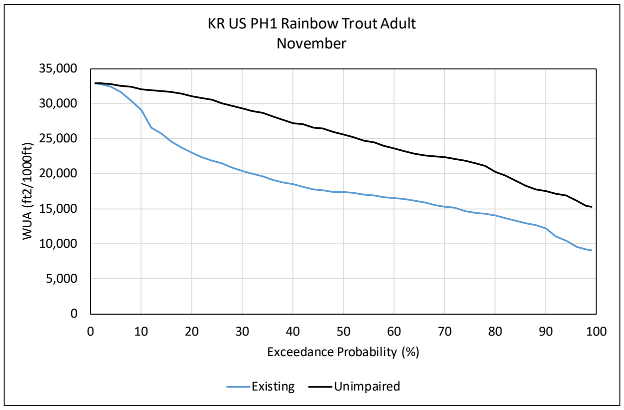

KR US PH1 Rainbow Trout Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

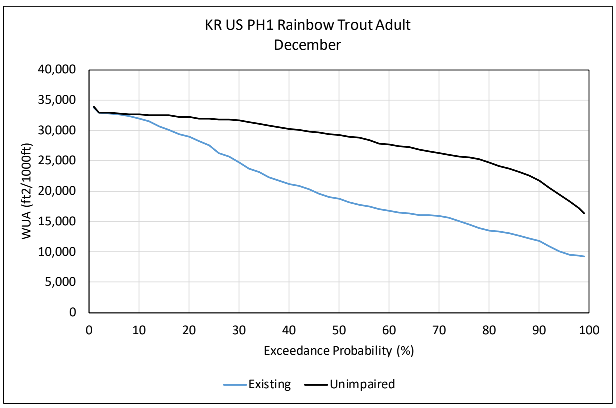
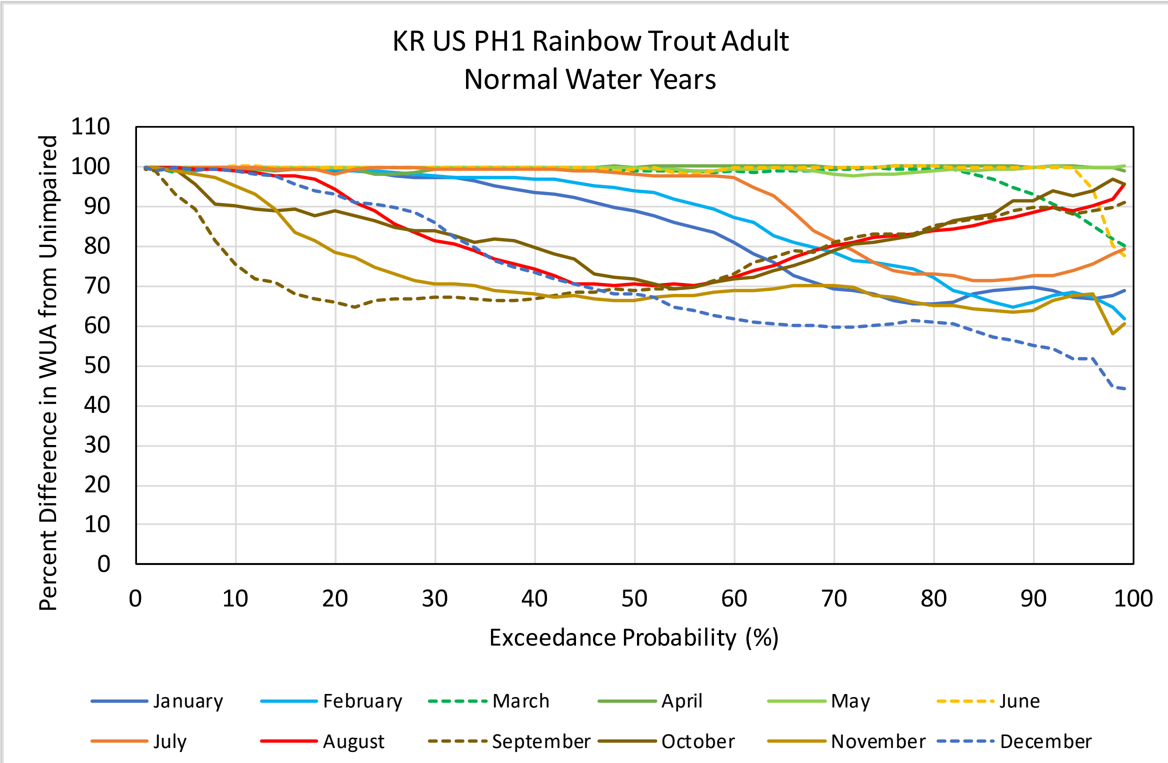

KR US PH1 Rainbow Trout Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-26. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



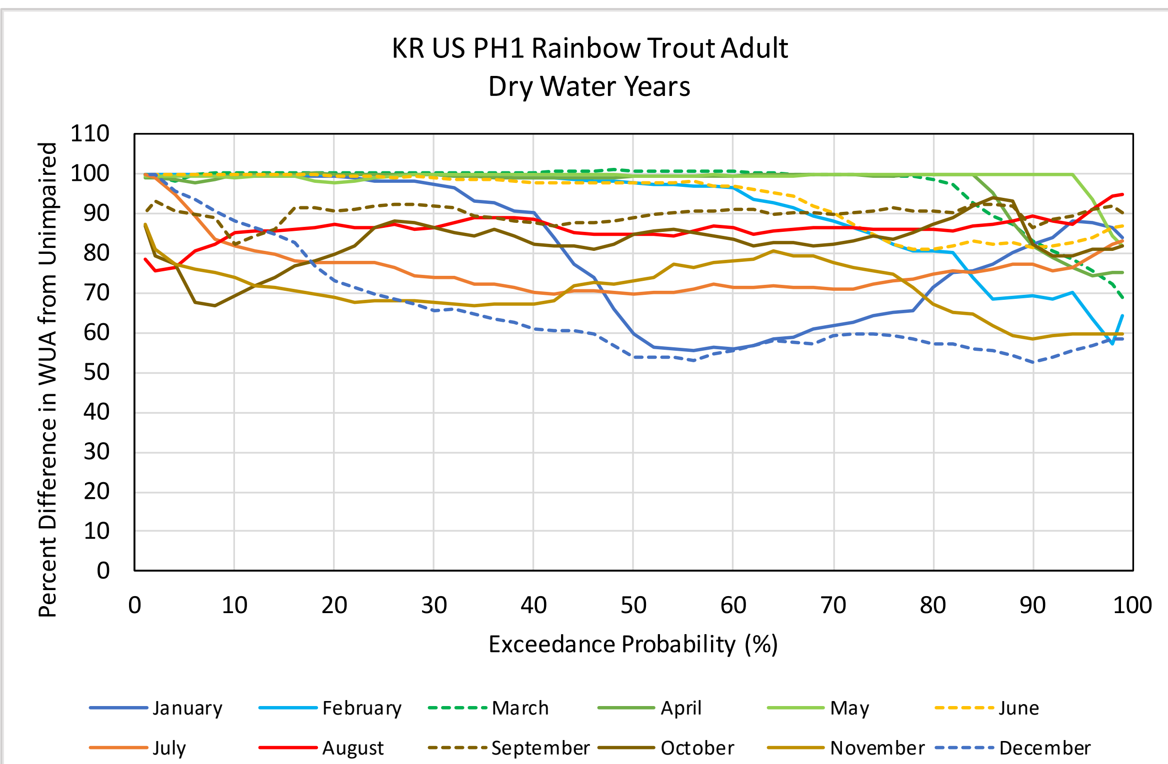


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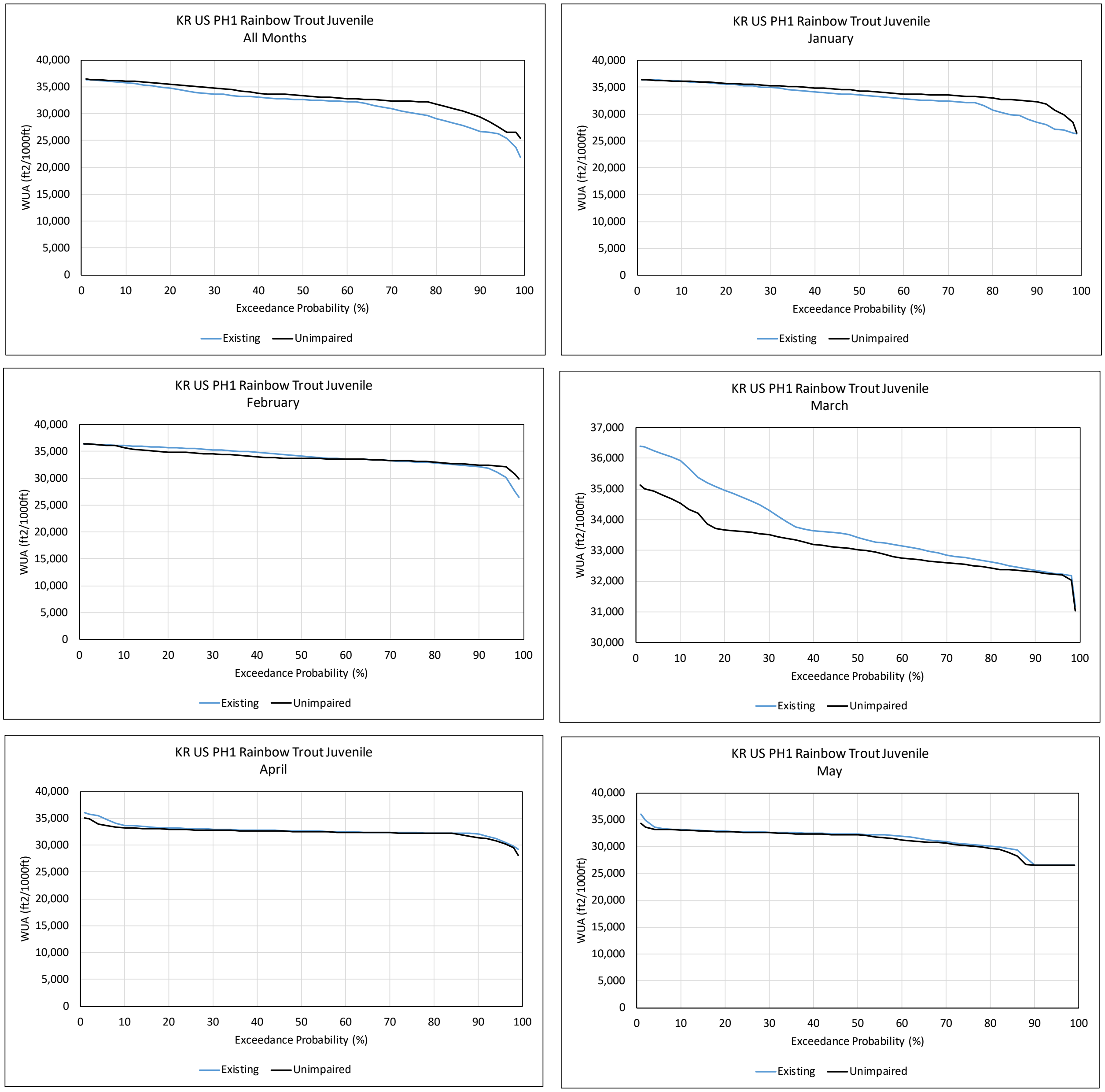
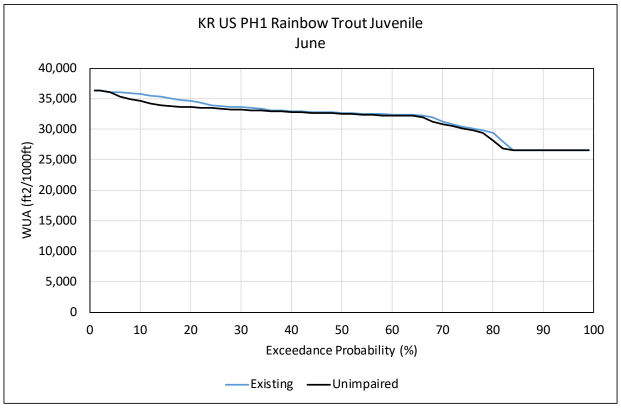
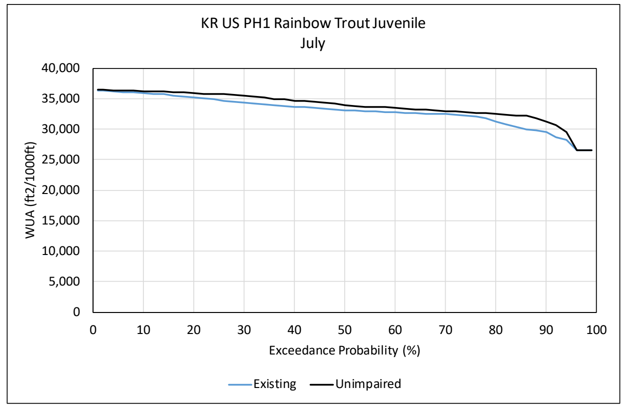
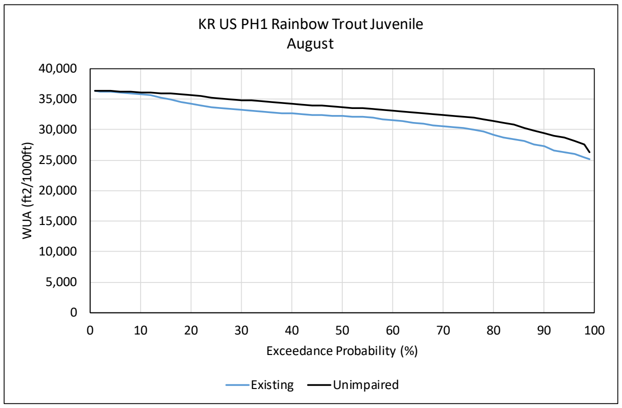
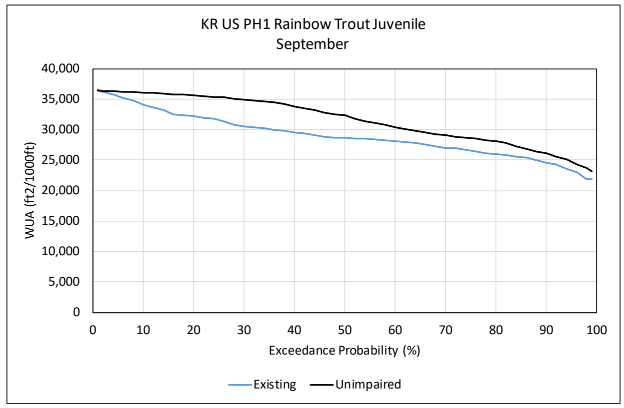
Figure G-27. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

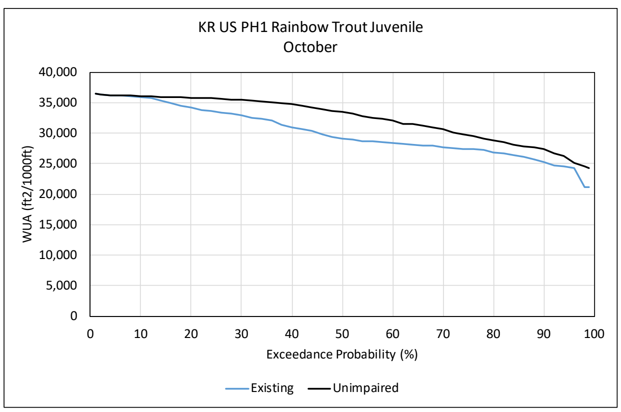


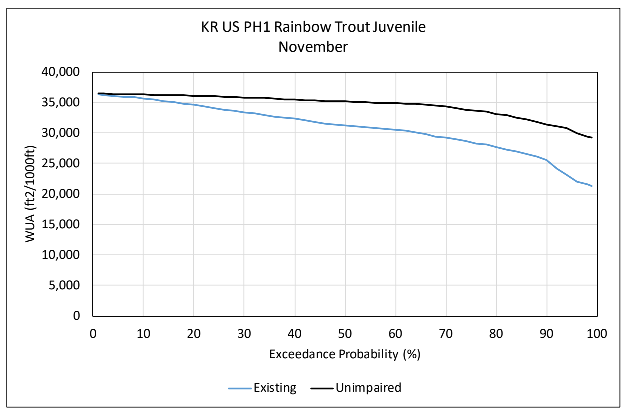

KR US PH1 Rainbow Trout Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH1 Rainbow Trout Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

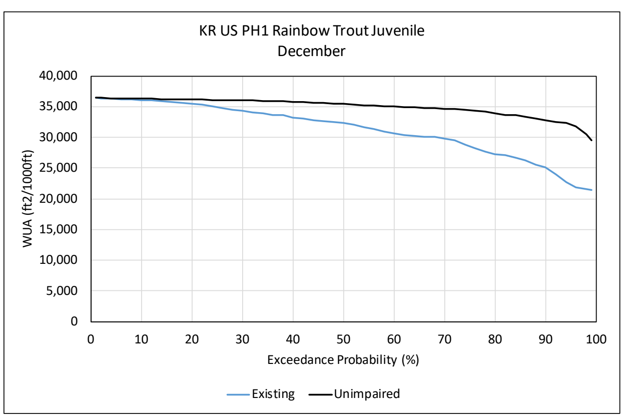
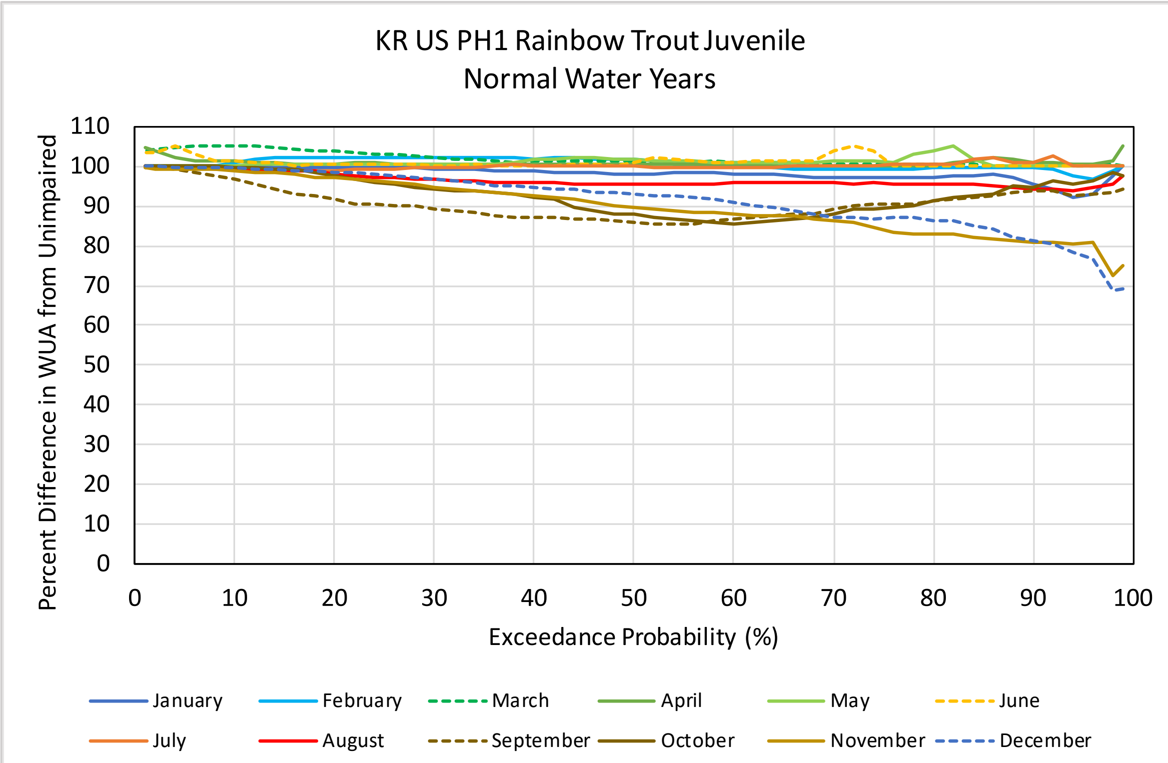

KR US PH1 Rainbow Trout Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-28. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



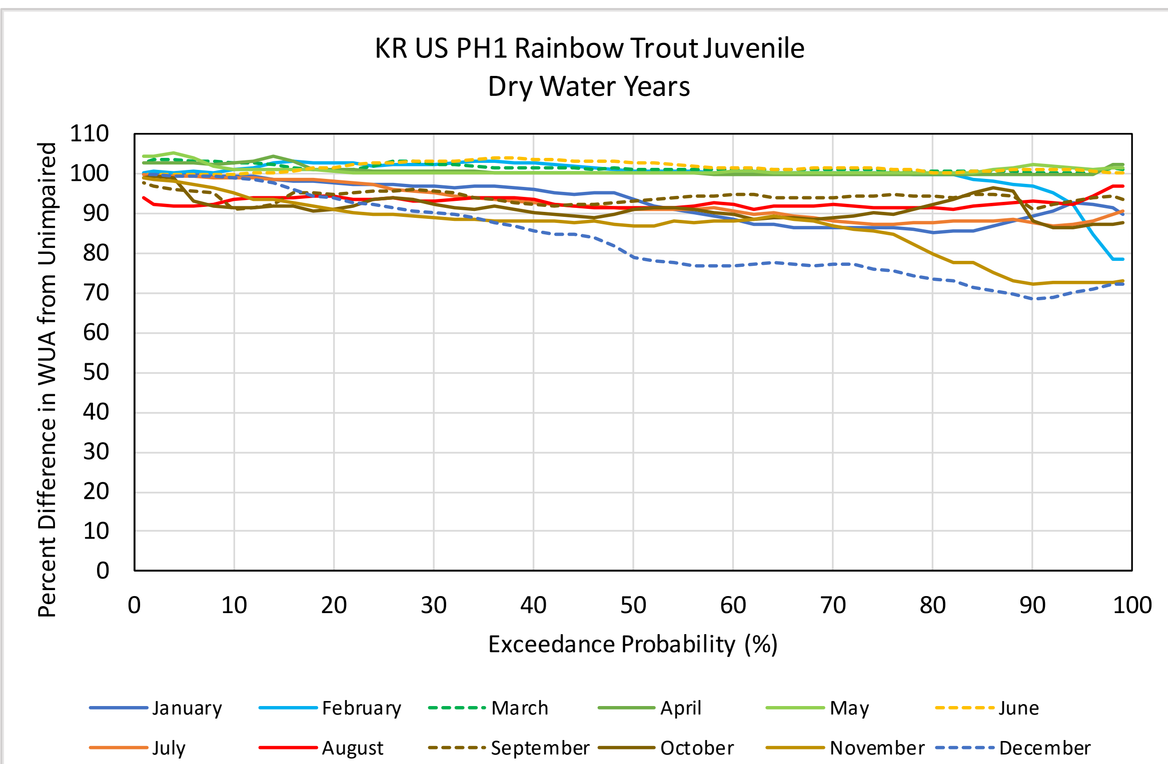


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Figure G-29. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Fry Habitat Exceedance Plots for All Water Years May through August.

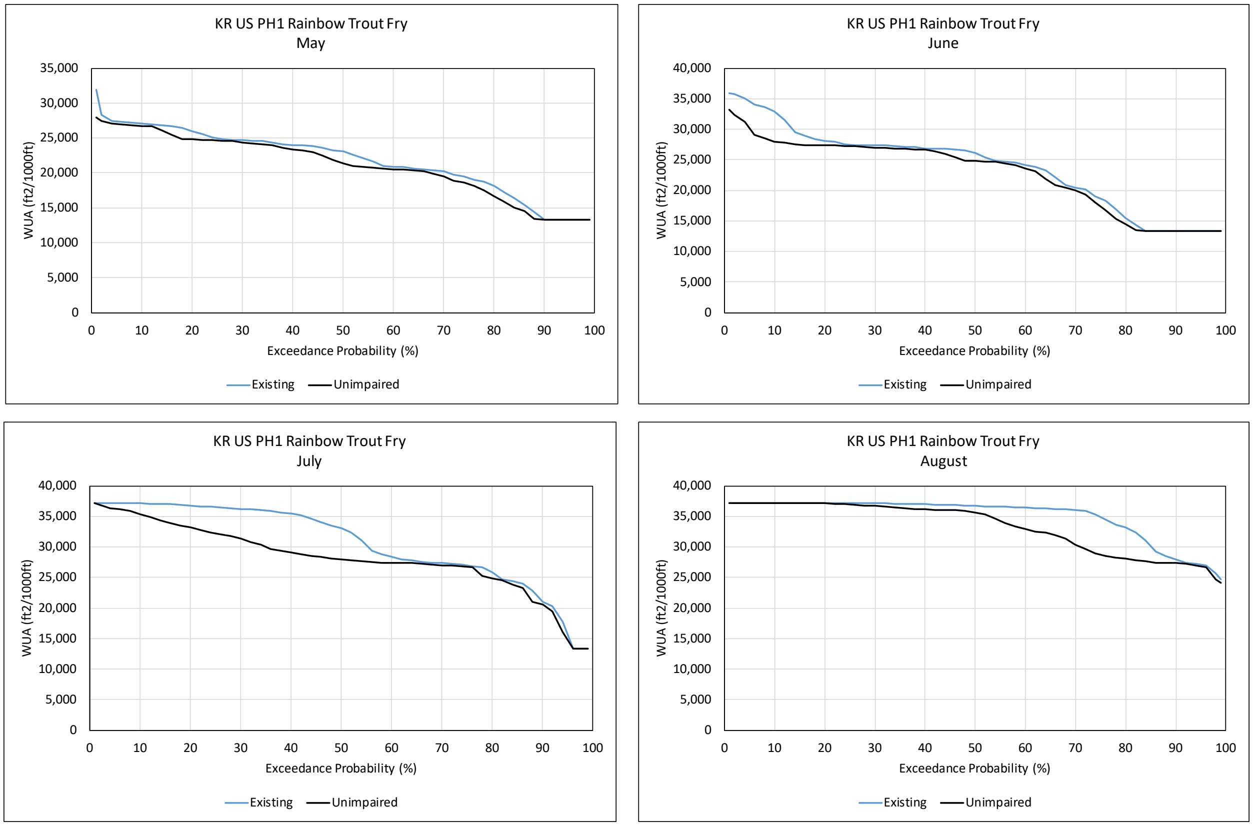

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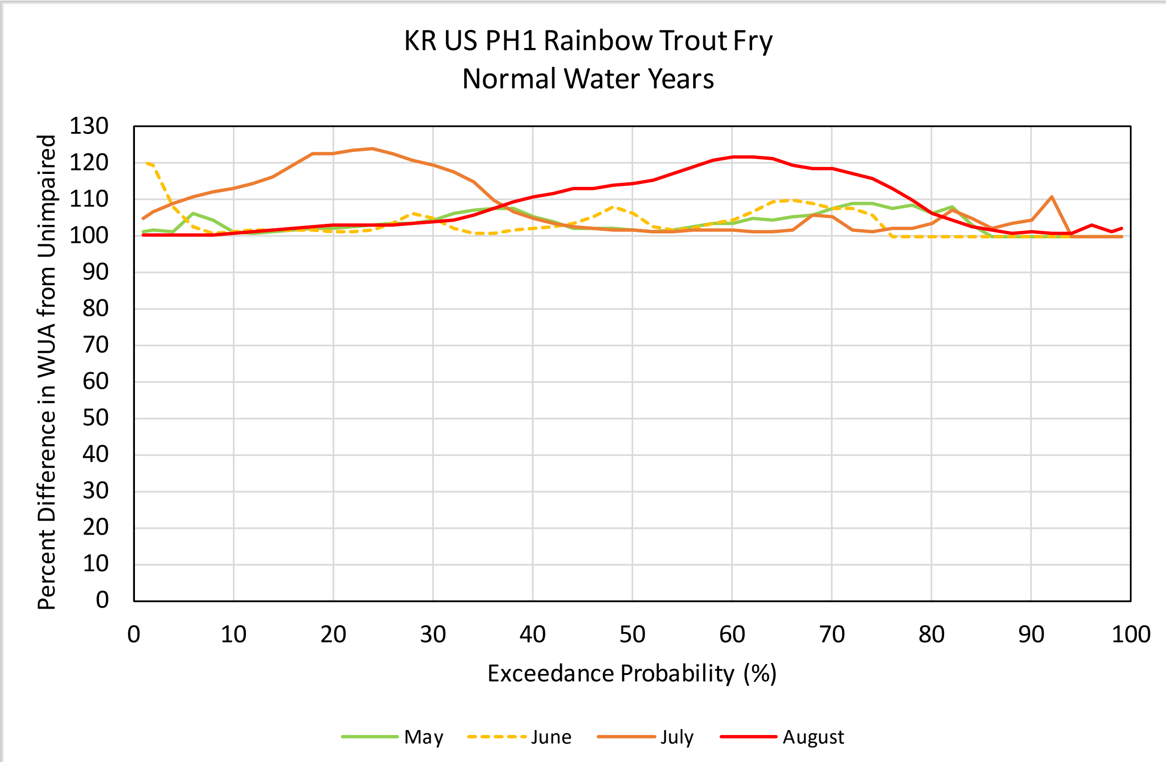
Figure G-30. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Fry Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



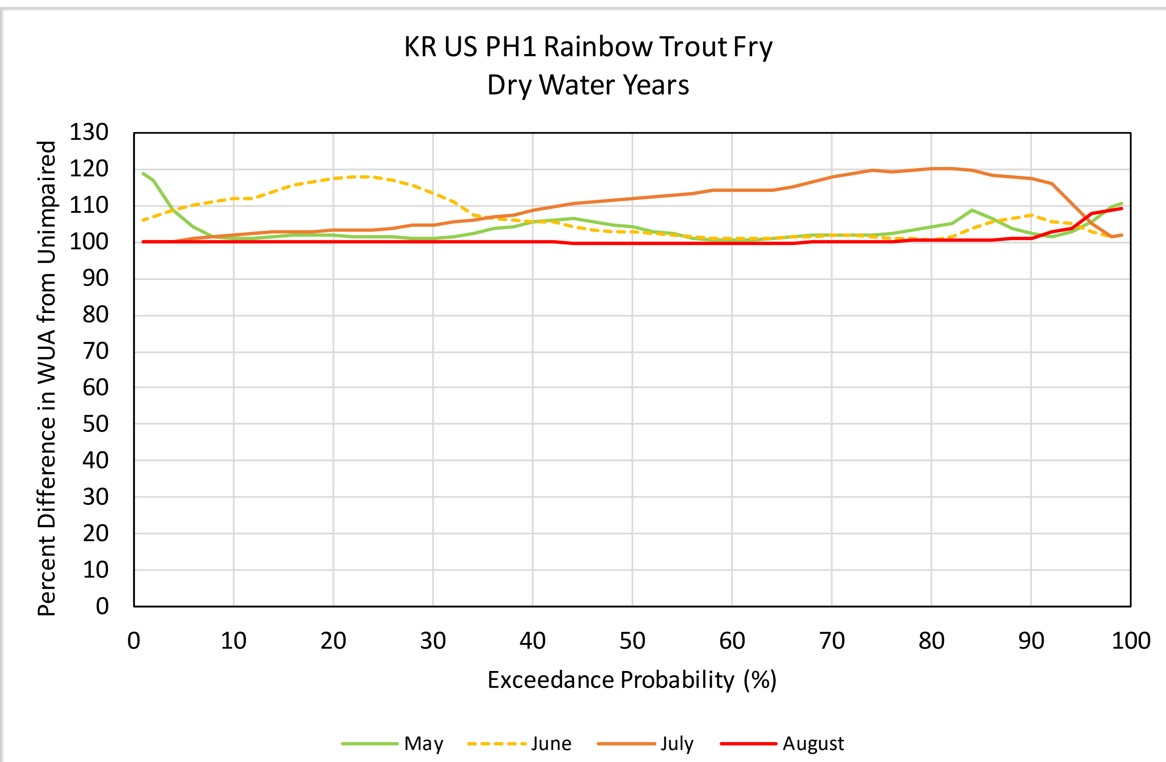


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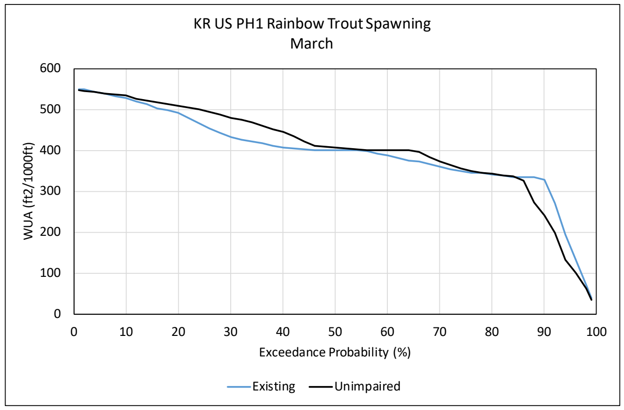
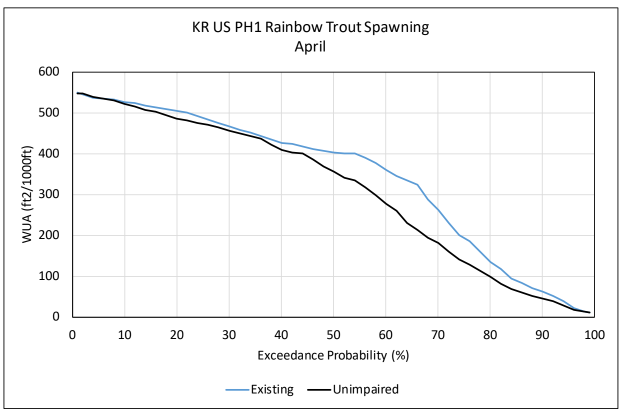
Figure G-31. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Spawning Habitat Exceedance Plots for All Water Years March through May.





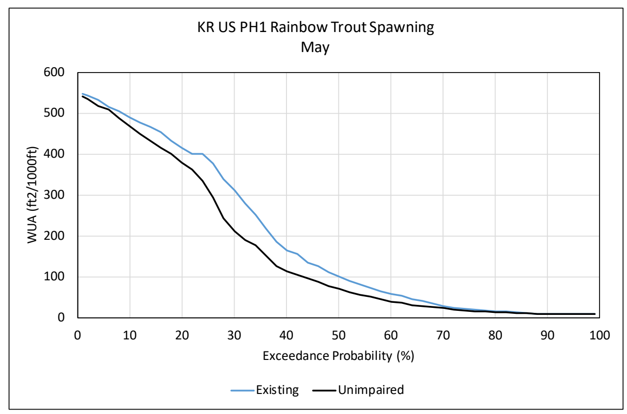


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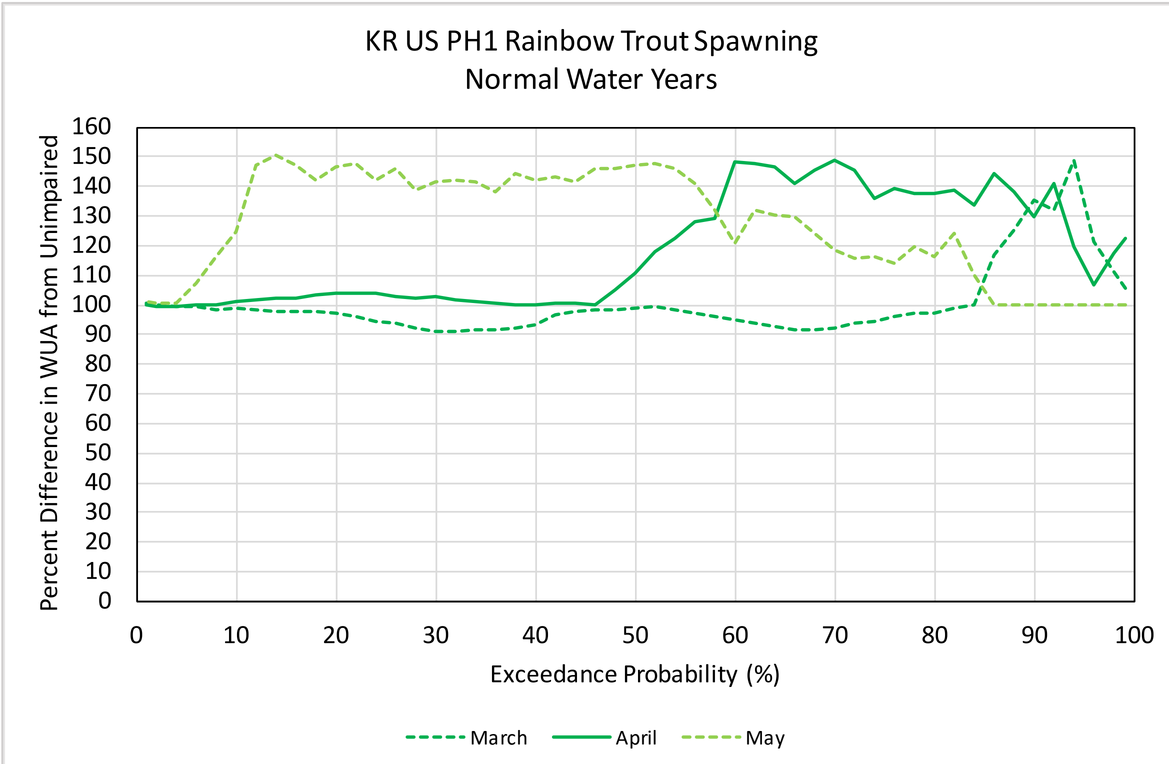
Figure G-32. Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse Rainbow Trout Spawning Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



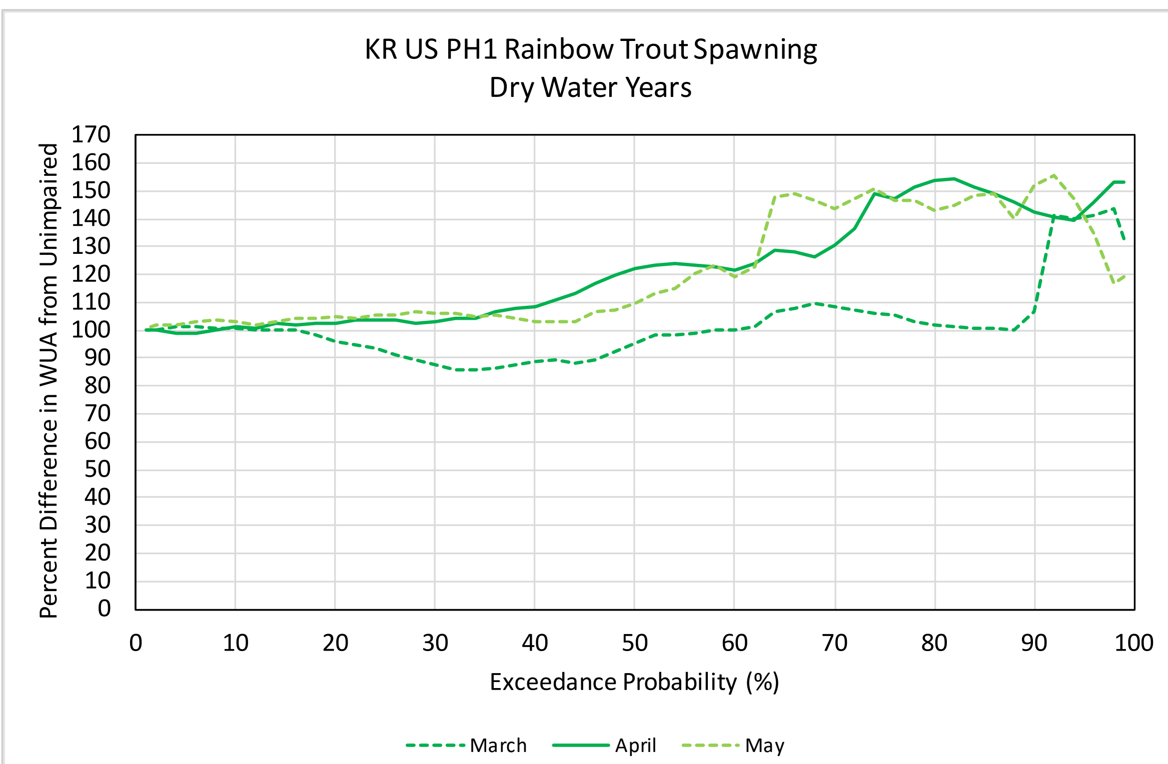


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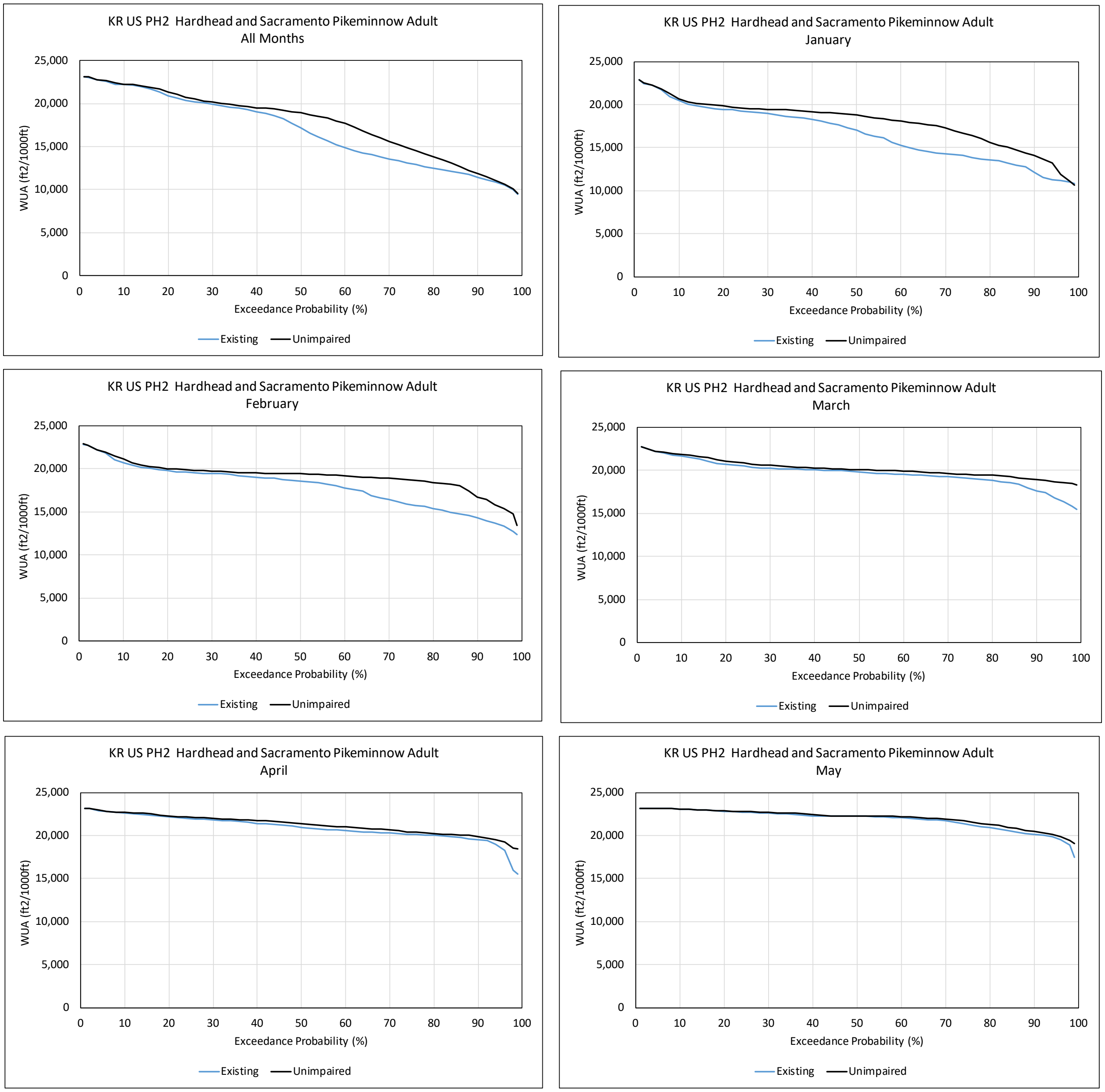
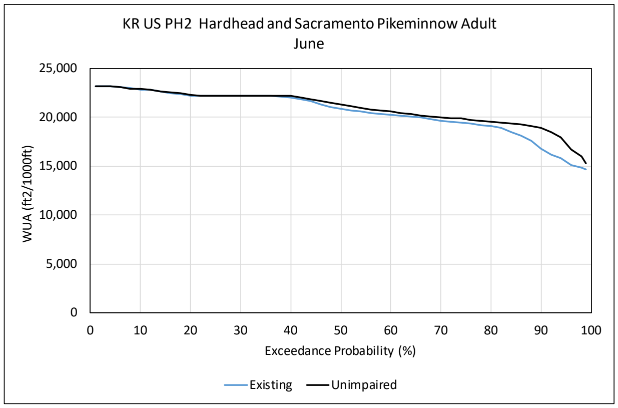
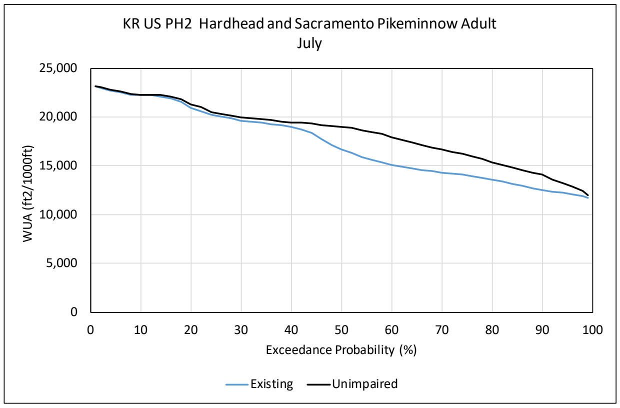
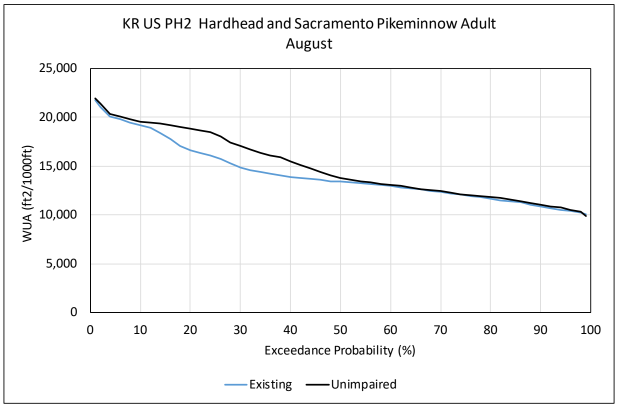
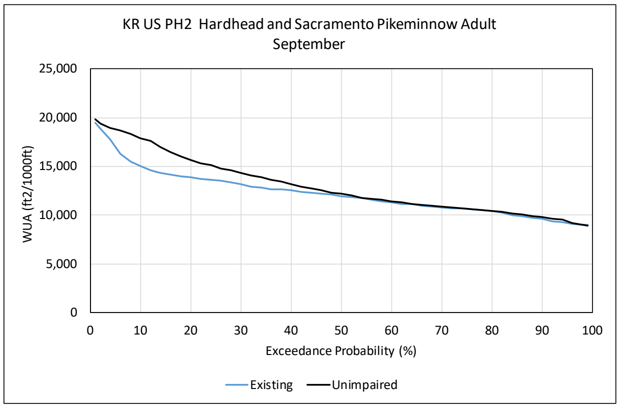
Figure G-33. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Hardhead and Sacramento Pikeminnow Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

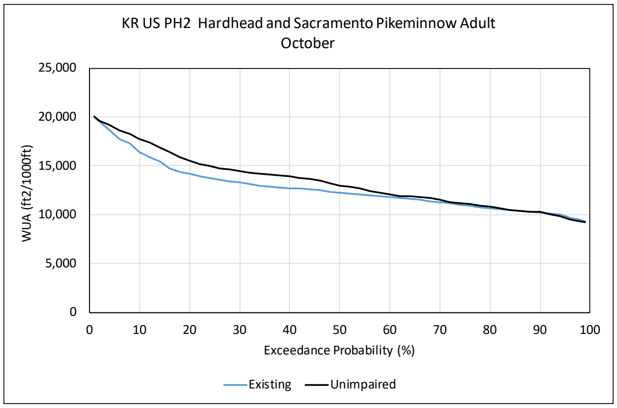


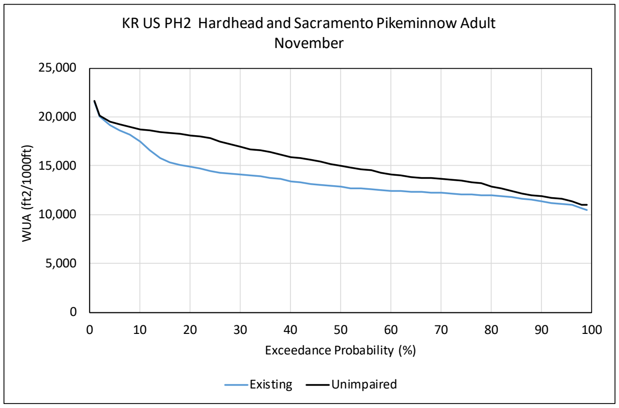

KR US PH2 Hardhead and Sacramento Pikeminnow Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

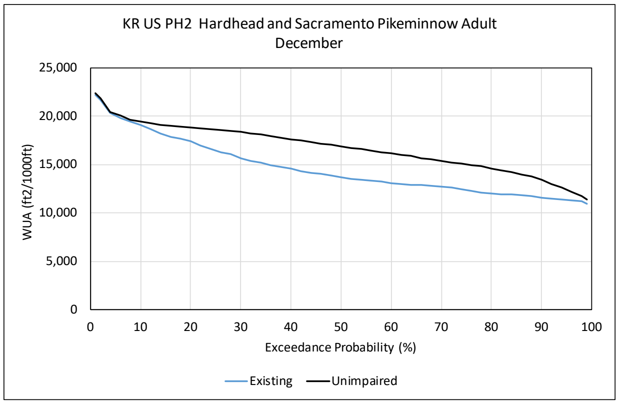
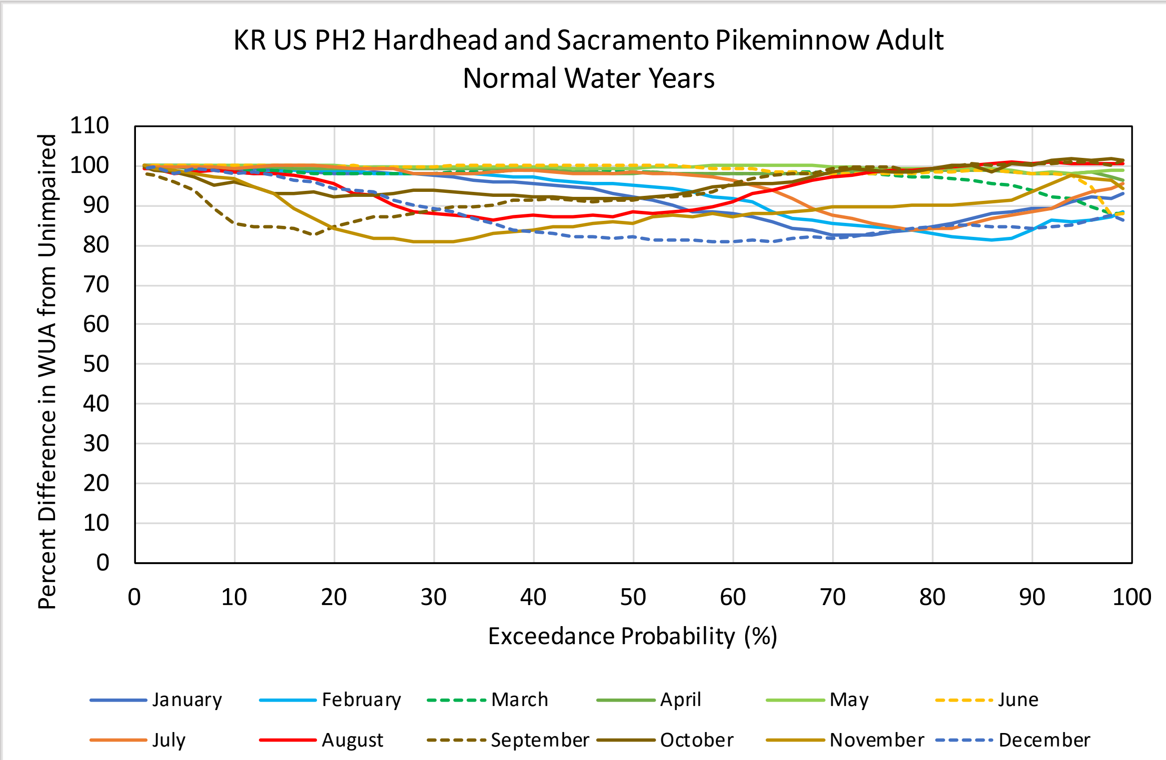

KR US PH2 Hardhead and Sacramento Pikeminnow Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-34. **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 for Normal and Dry Water Years.**



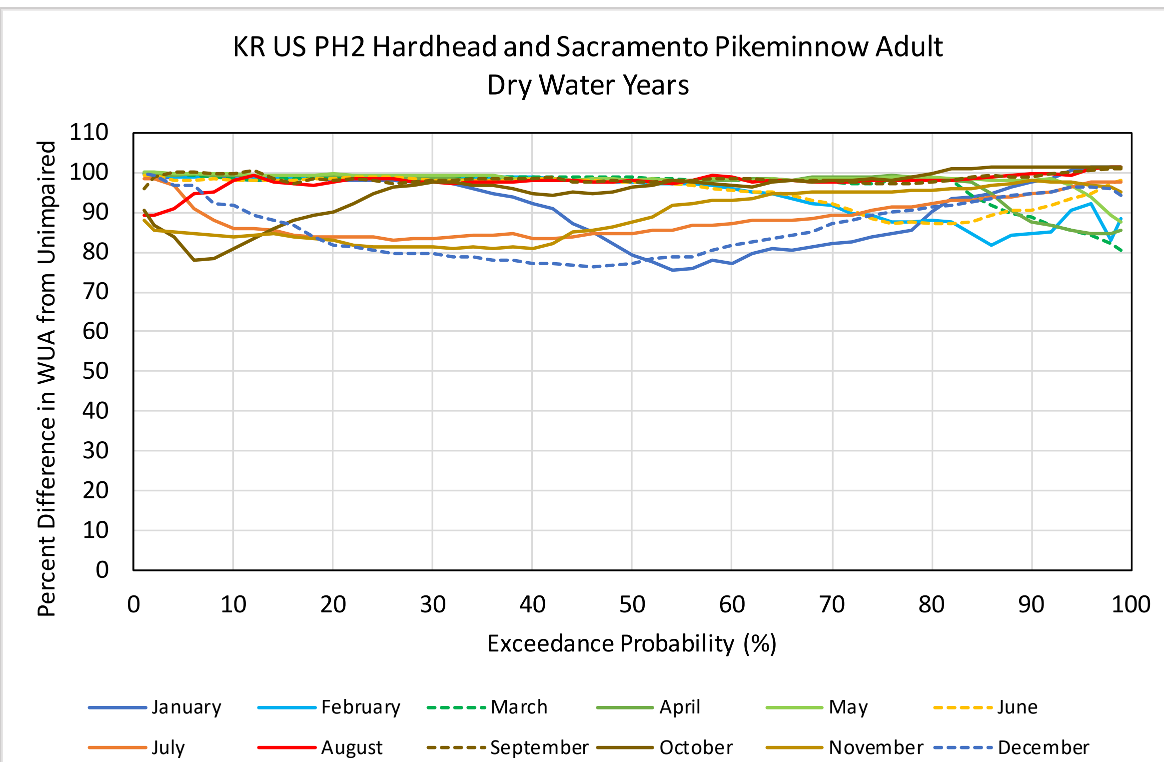


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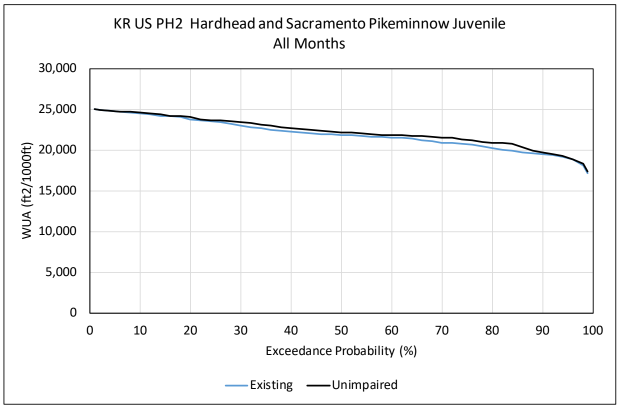
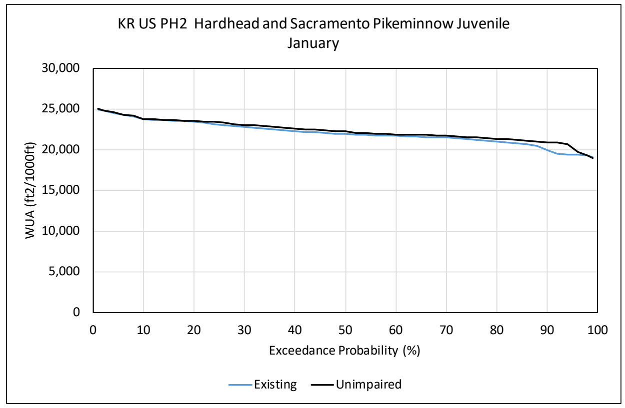
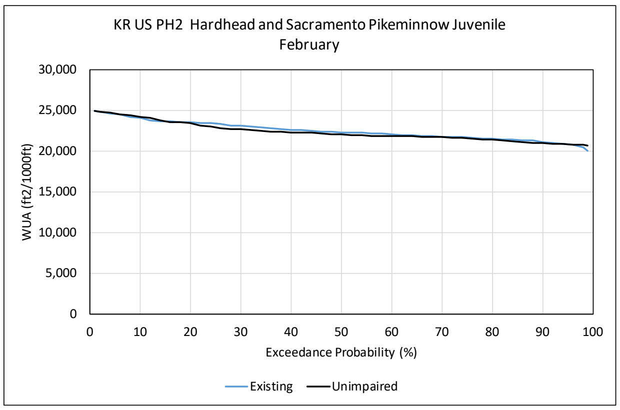
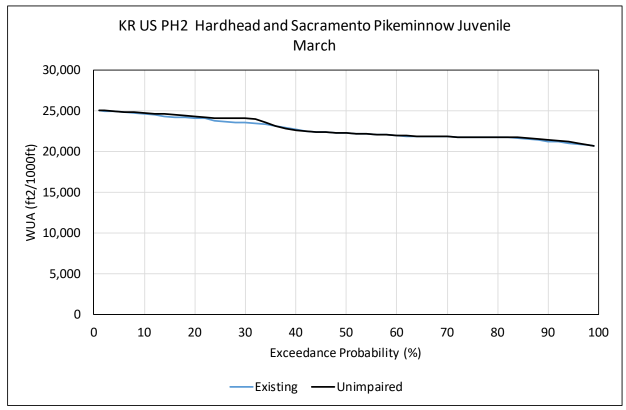
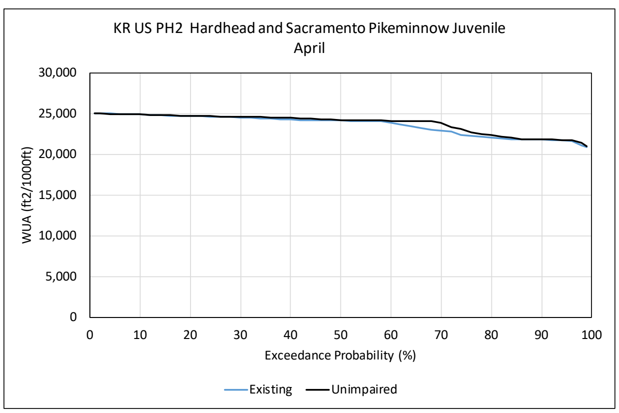
Figure G-35. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Hardhead and Sacramento Pikeminnow Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

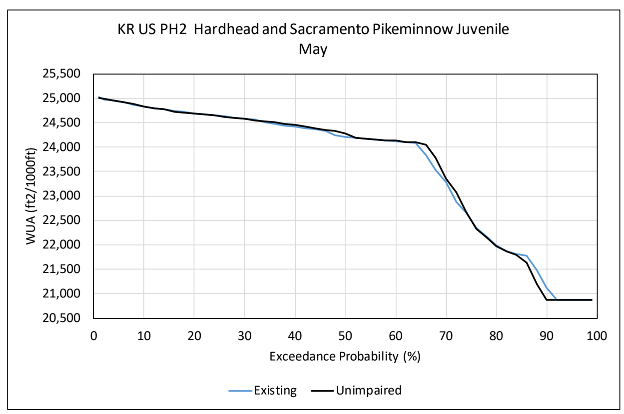


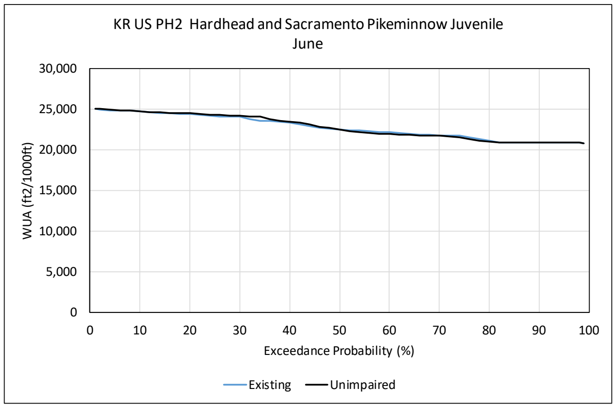


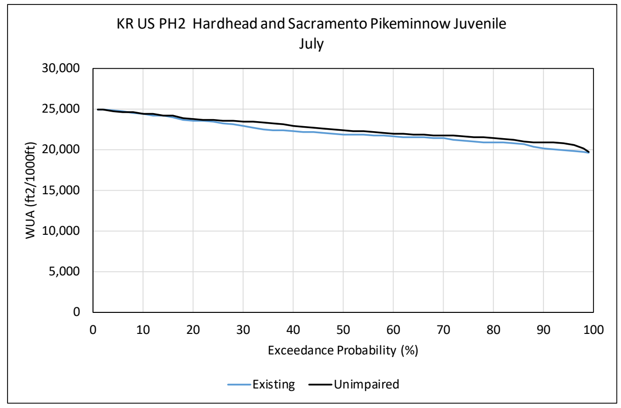


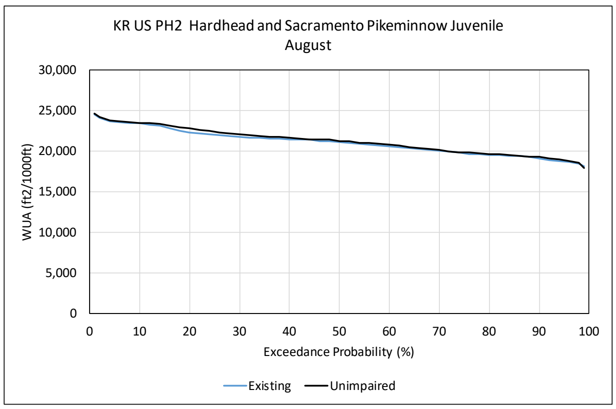


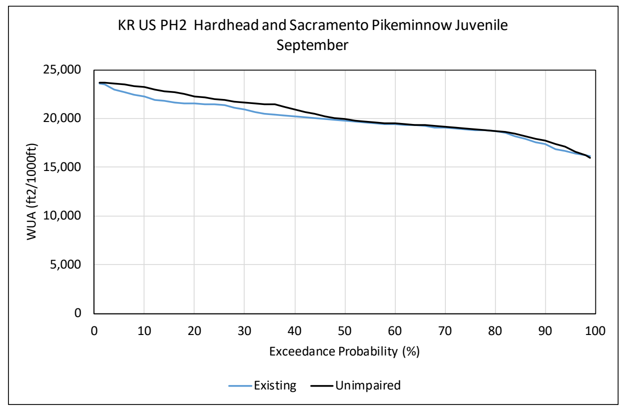


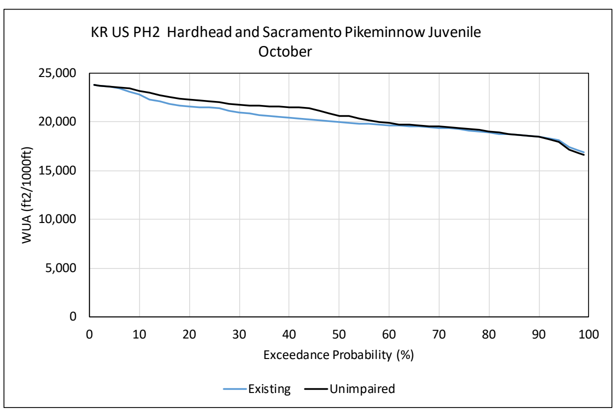


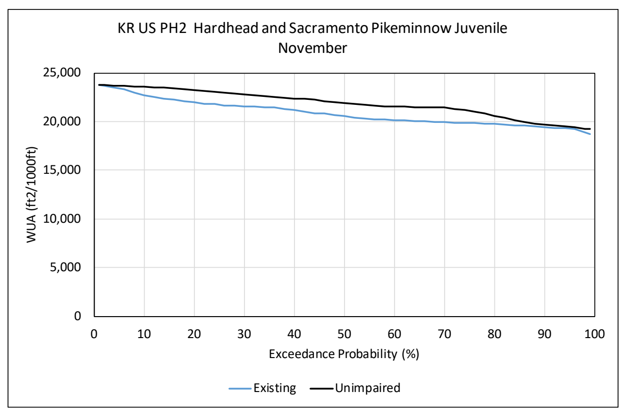

KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

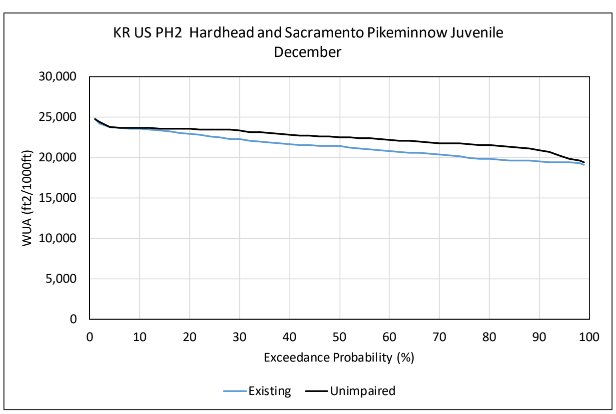
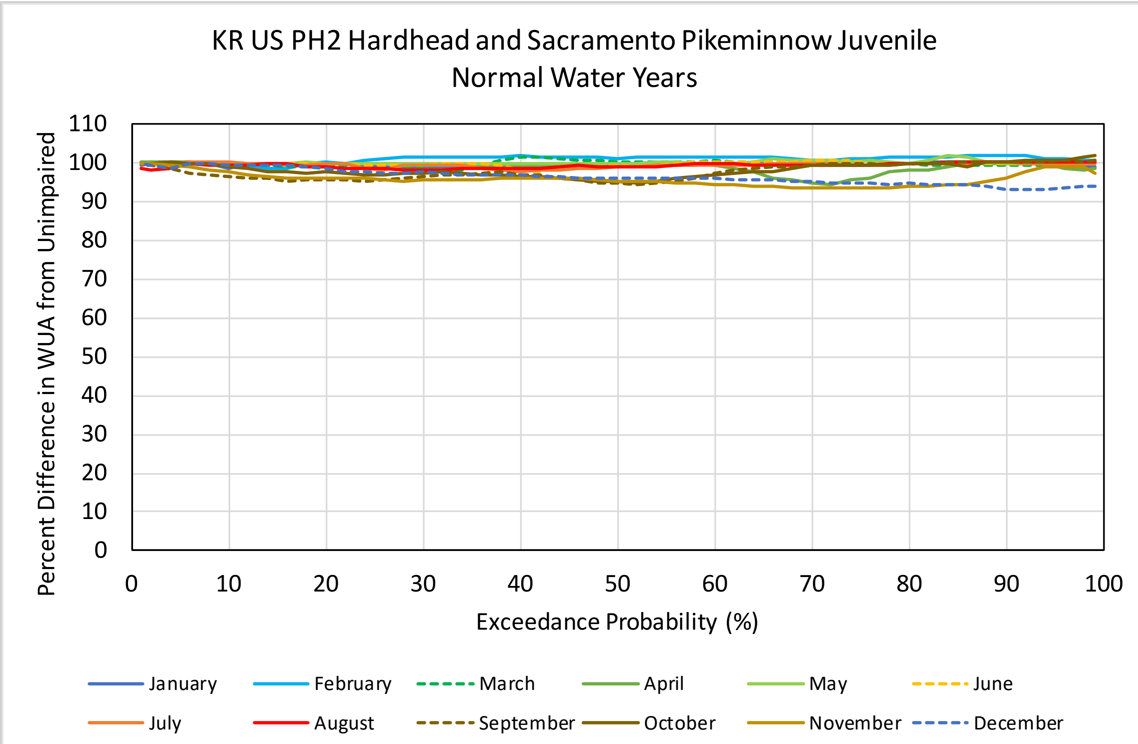

KR US PH2 Hardhead and Sacramento Pikeminnow Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-36. **Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Hardhead and Sacramento Pikeminnow Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**



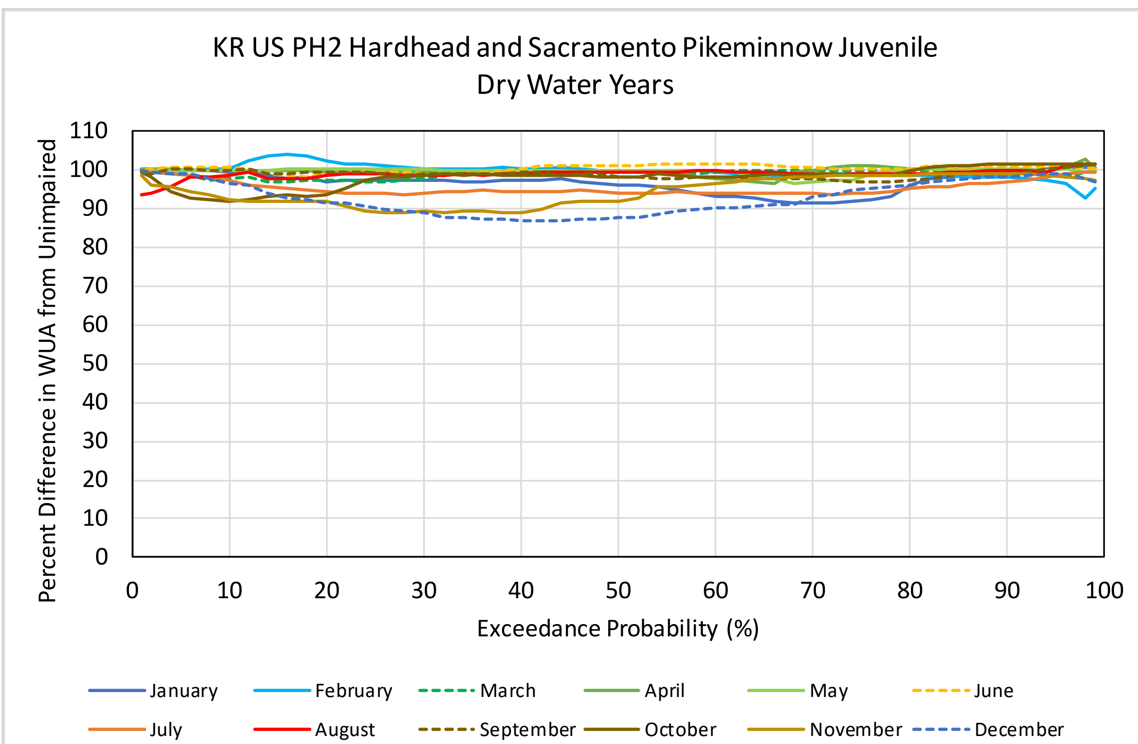


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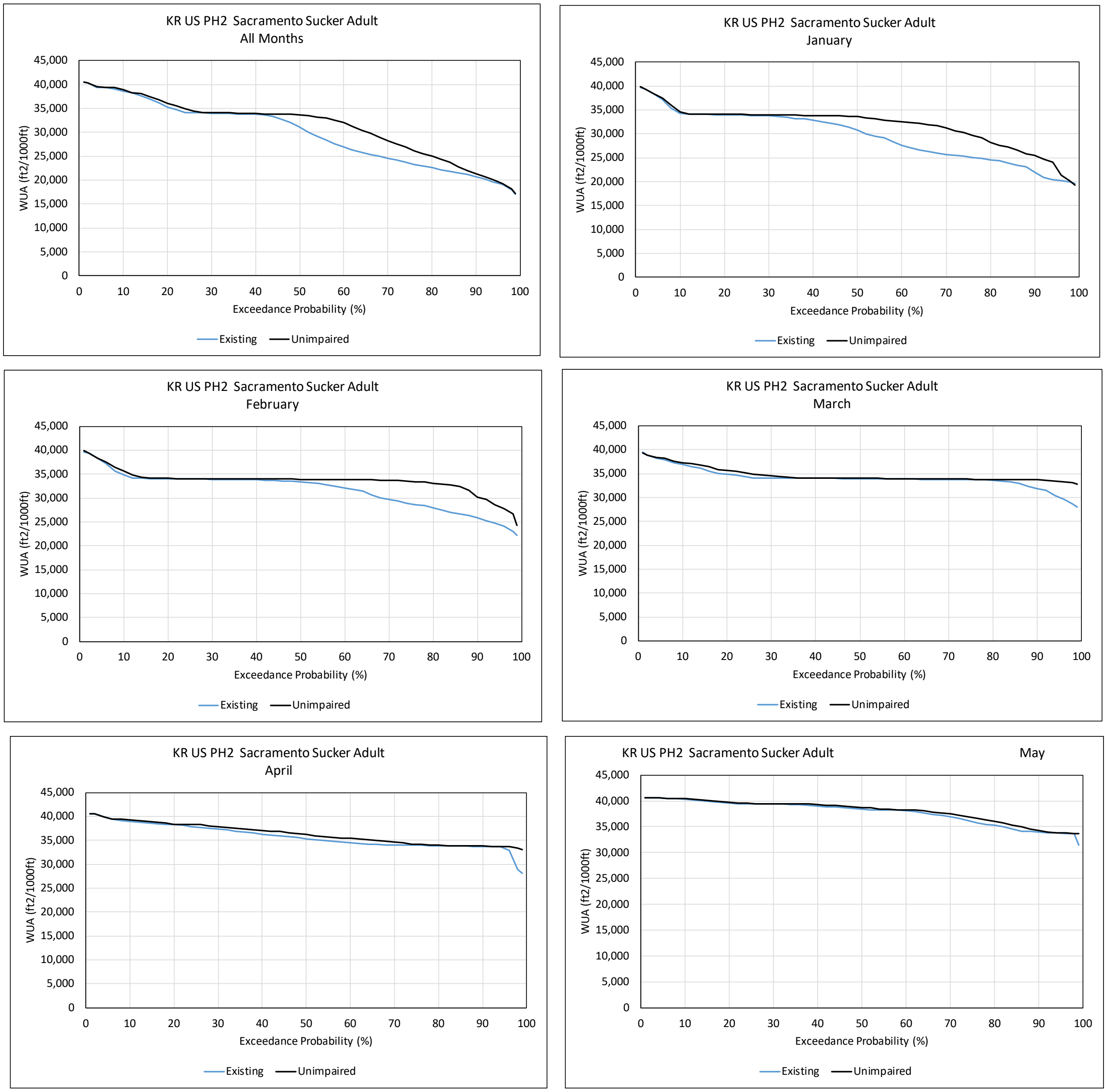
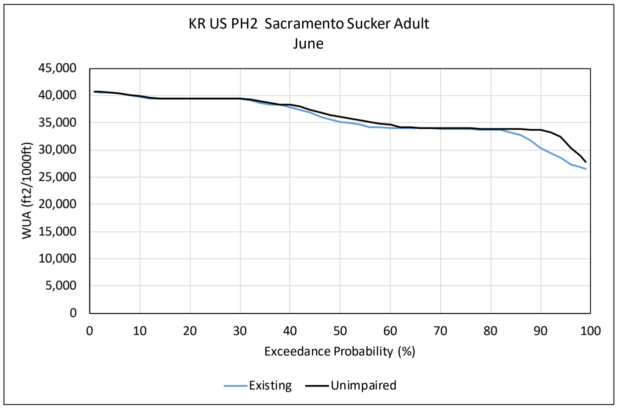
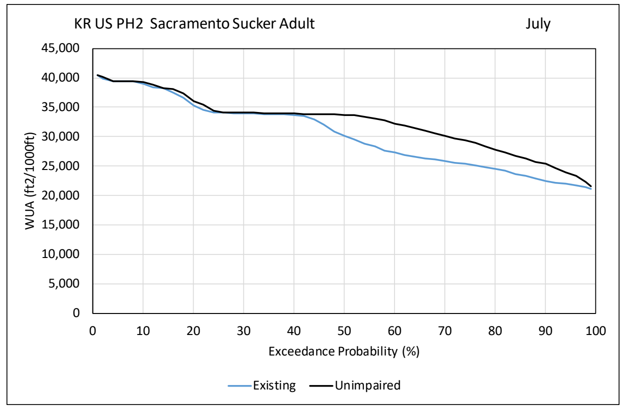
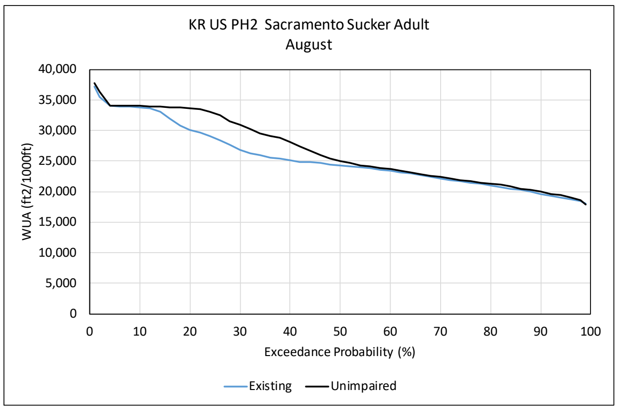
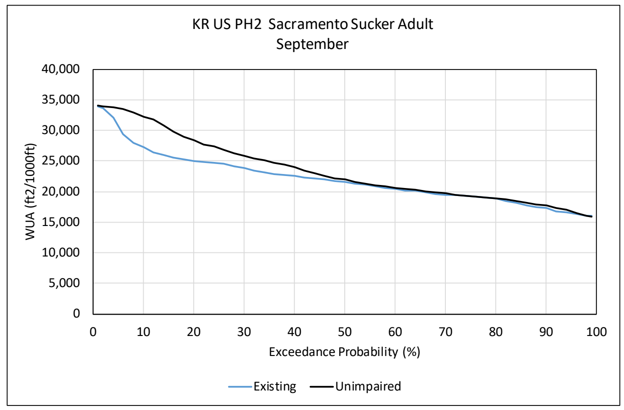
Figure G-37. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Sacramento Sucker Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

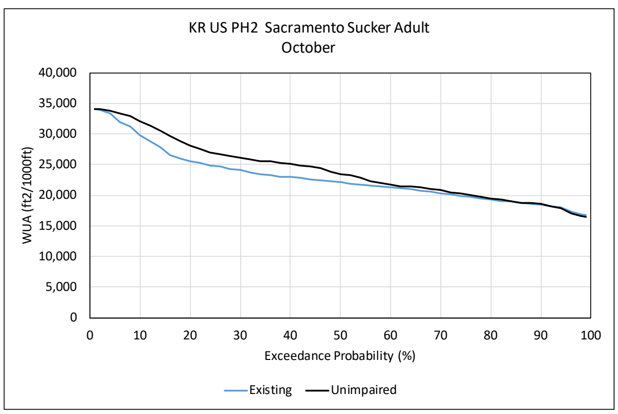


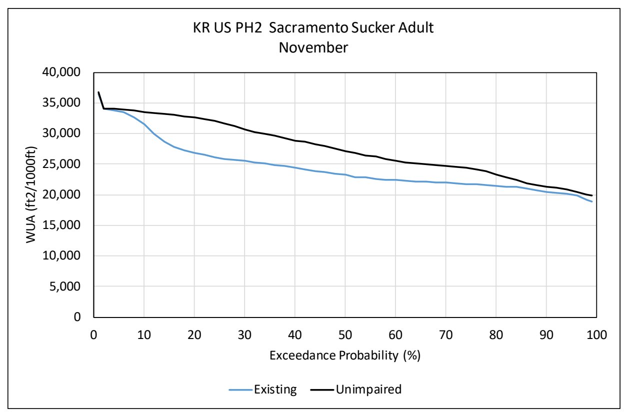

KR US PH2 Sacramento Sucker Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

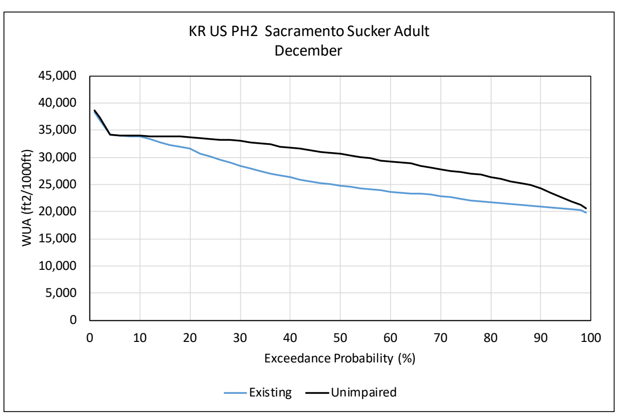
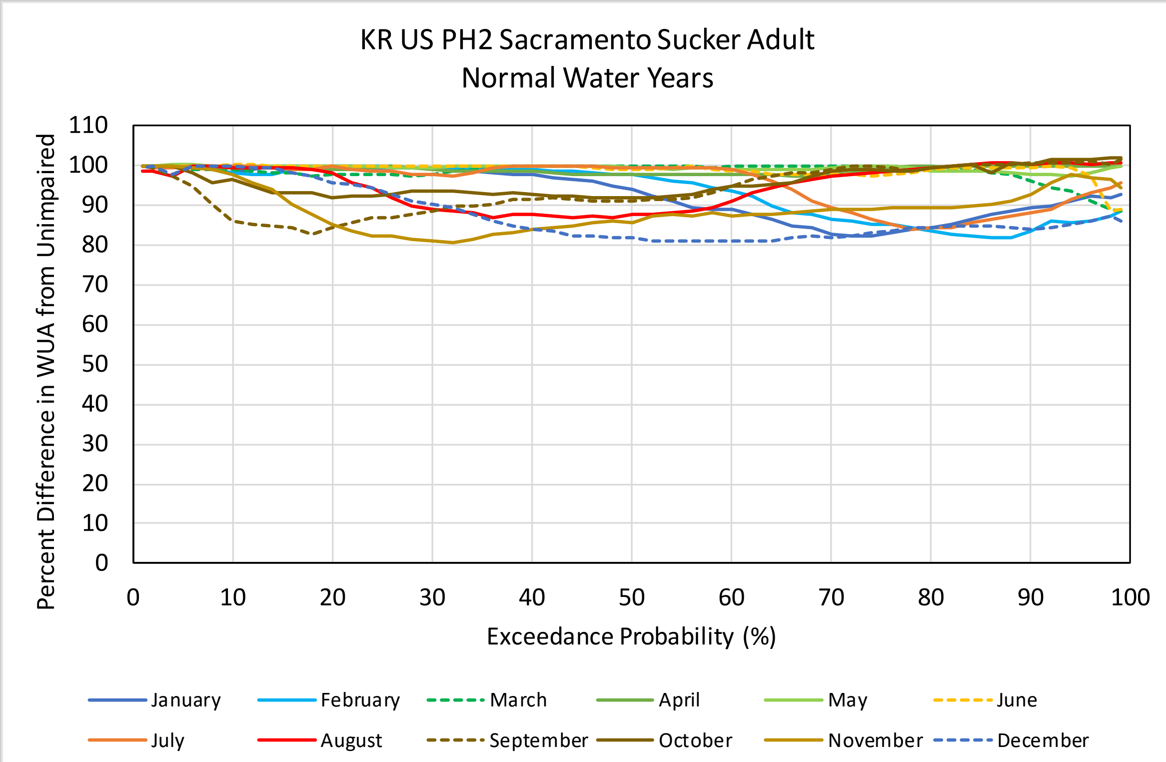

KR US PH2 Sacramento Sucker Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-38. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Sacramento Sucker Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



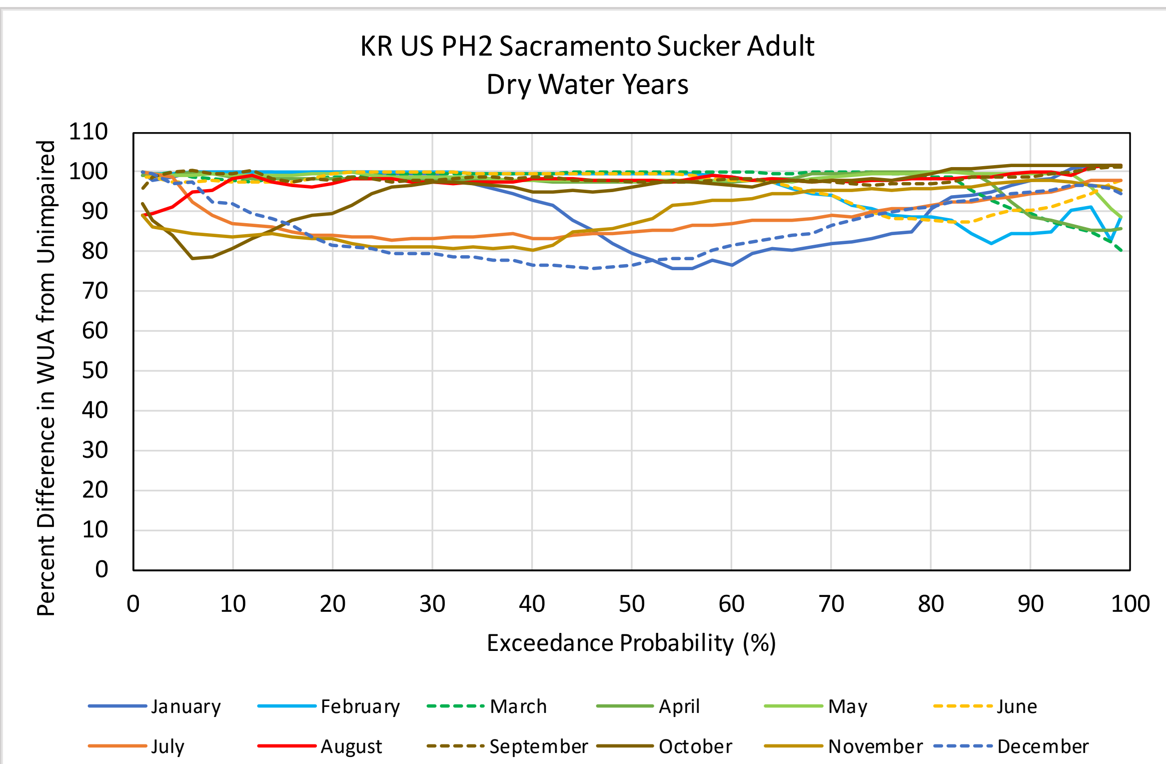


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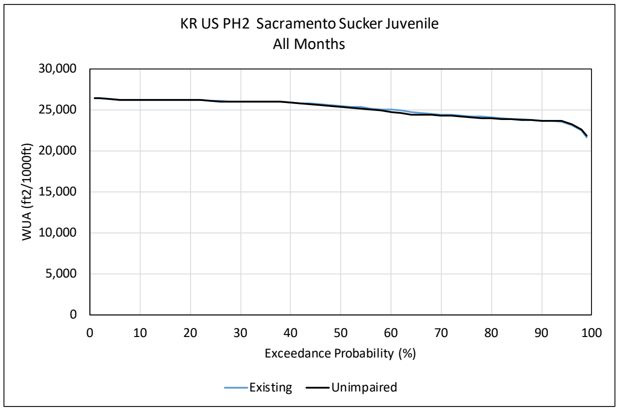
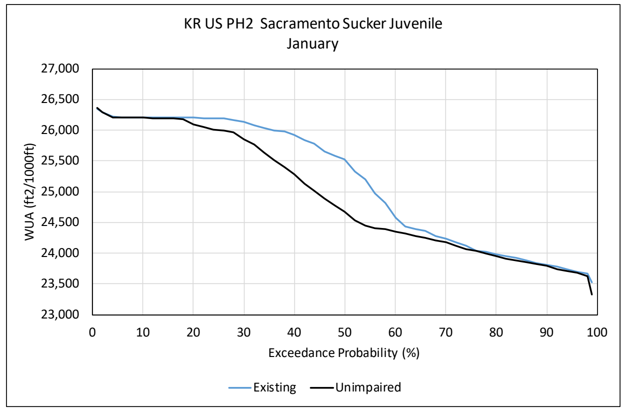
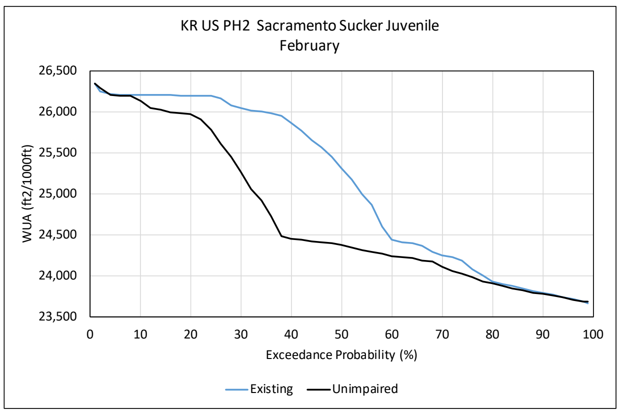
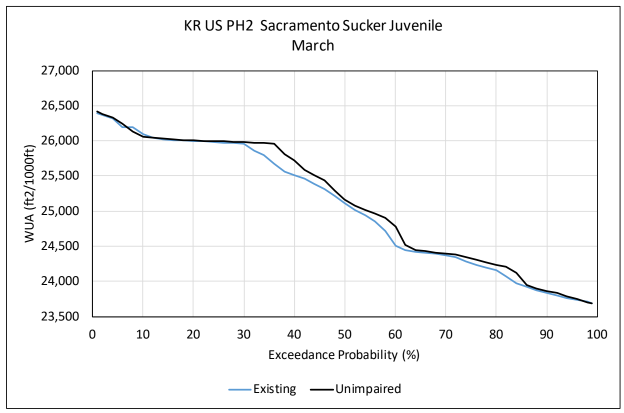
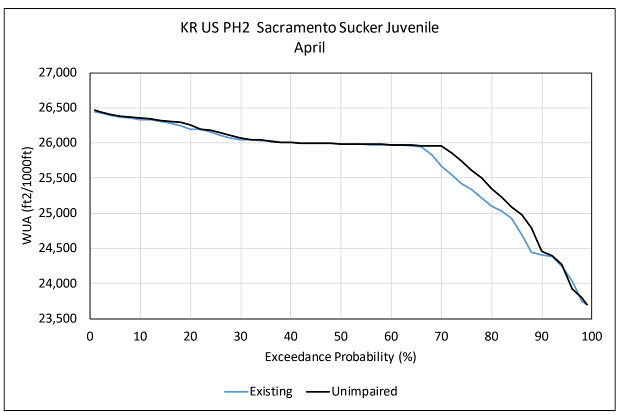
Figure G-39. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Sacramento Sucker Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

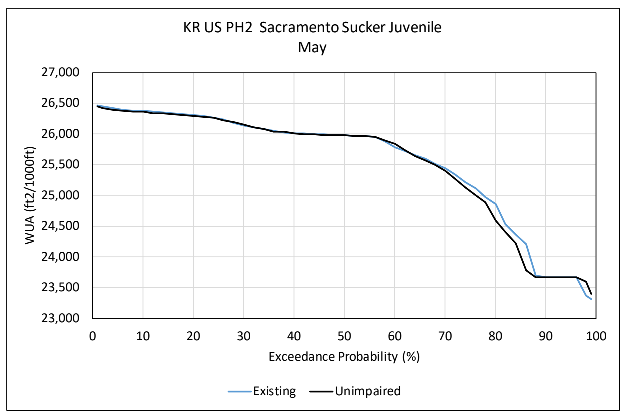


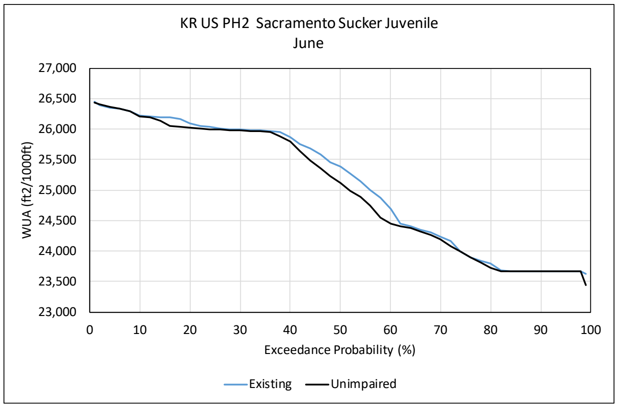


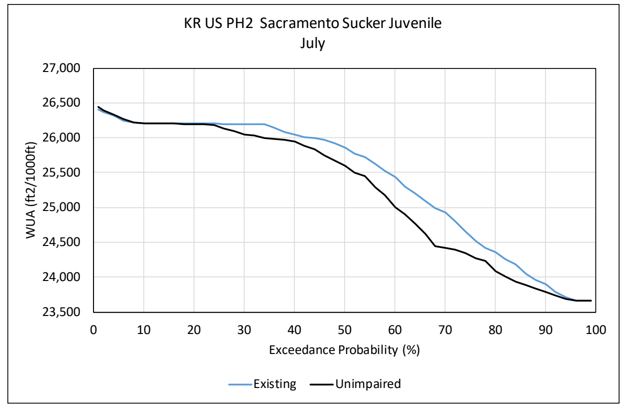


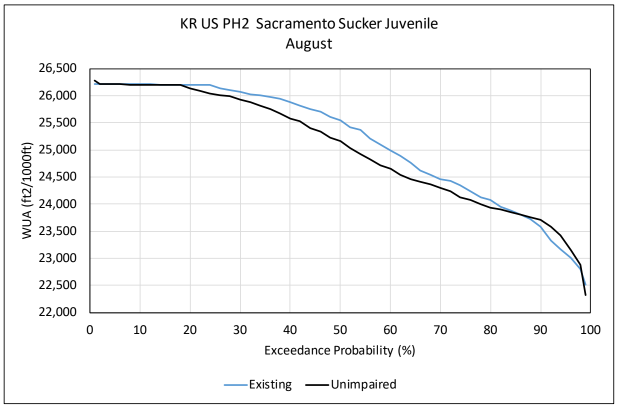


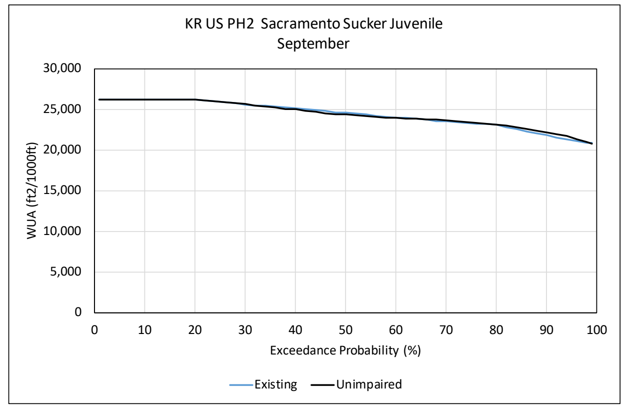


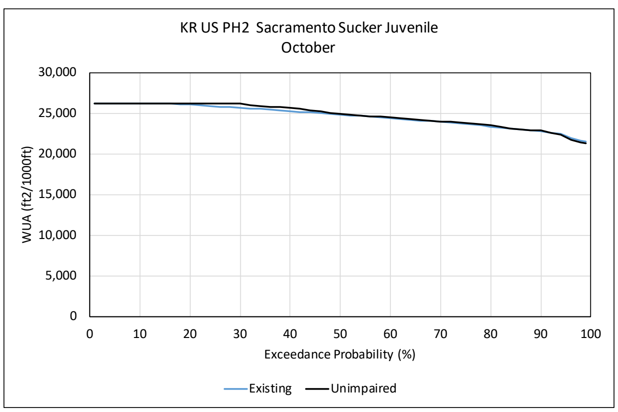


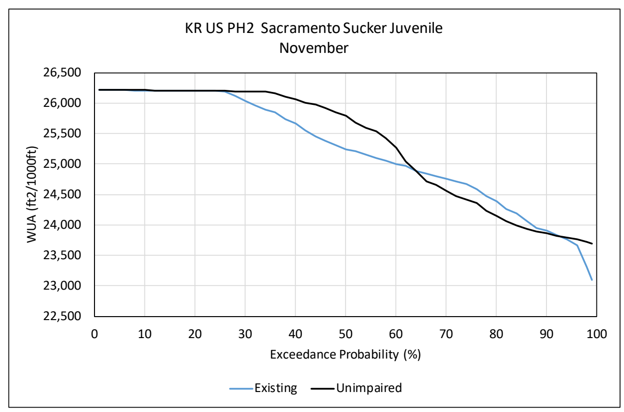

KR US PH2 Sacramento Sucker Juvenile
June
WUA (ft2/1000ft)
27,000
26,500
26,000
25,500
25,000
24,500
24,000
23,500
23,000
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Juvenile
July
WUA (ft2/1000ft)
27,000
26,500
26,000
25,500
25,000
24,500
24,000
23,500
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Juvenile
August
WUA (ft2/1000ft)
26,500
26,000
25,500
25,000
24,500
24,000
23,500
23,000
22,500
22,000
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Juvenile
September
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Juvenile
October
WUA (ft2/1000ft)
30,000
25,000
20,000
15,000
10,000
5,000
0
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Sacramento Sucker Juvenile
November
WUA (ft2/1000ft)
26,500
26,000
25,500
25,000
24,500
24,000
23,500
23,000
22,500
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

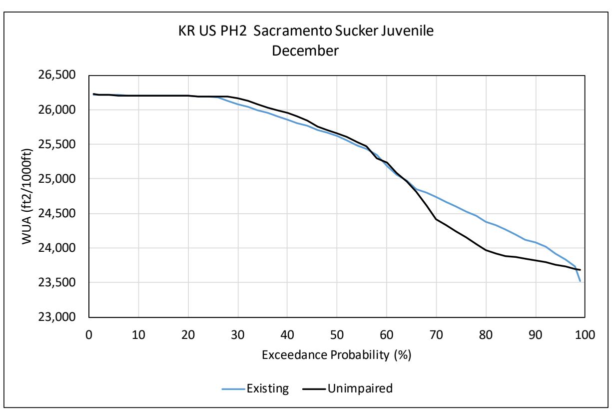
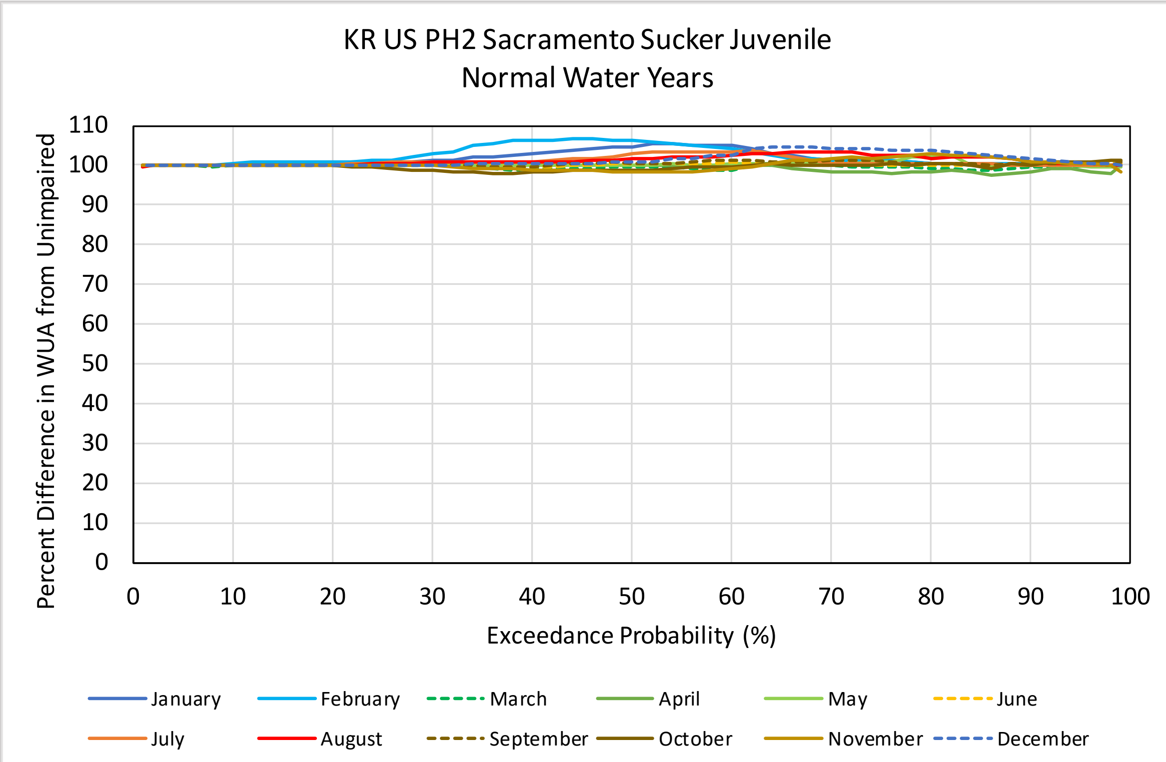

KR US PH2 Sacramento Sucker Juvenile
December
WUA (ft2/1000ft)
26,500
26,000
25,500
25,000
24,500
24,000
23,500
23,000
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-40. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Sacramento Sucker Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



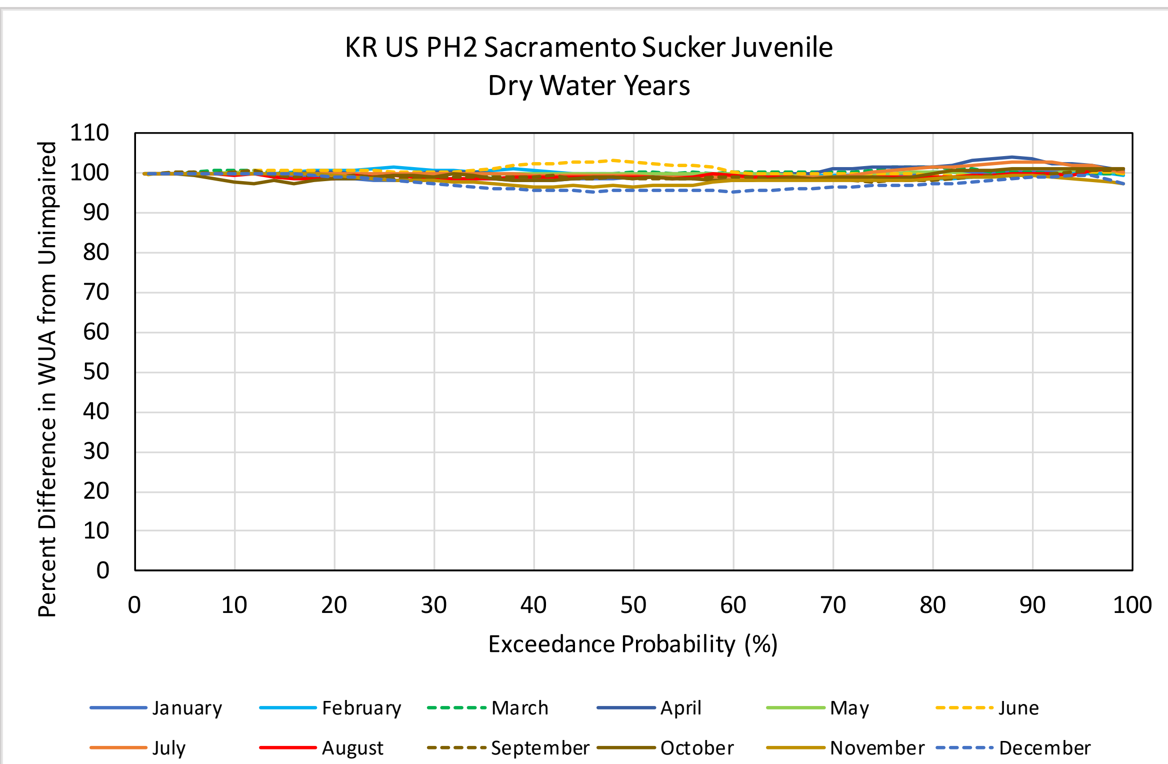


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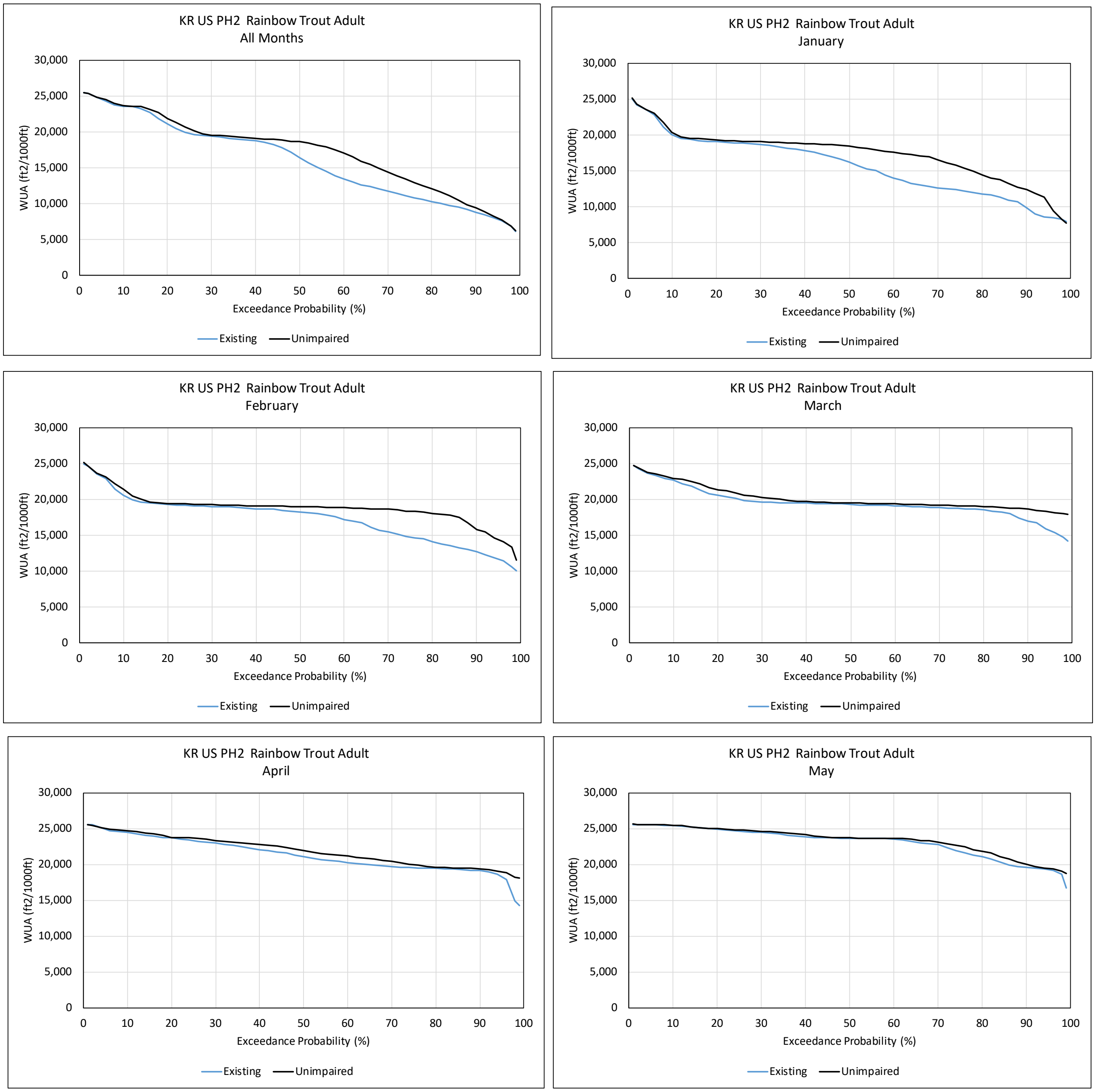
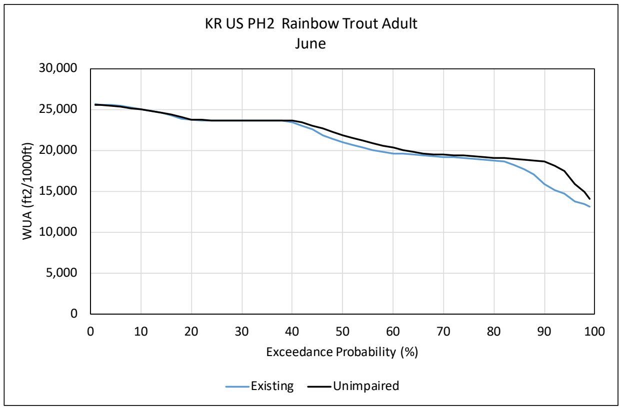
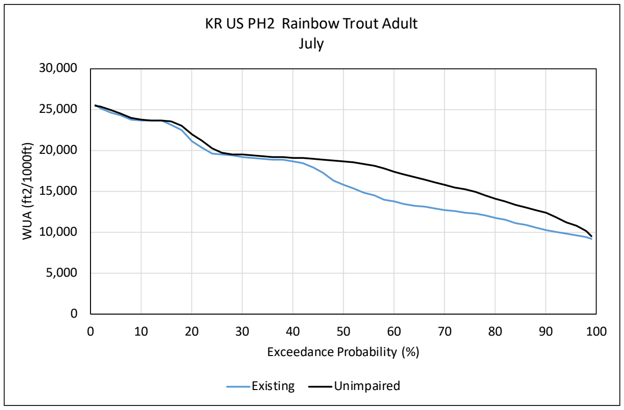
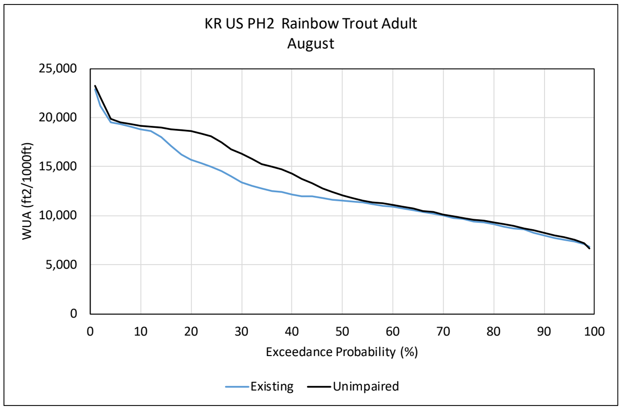
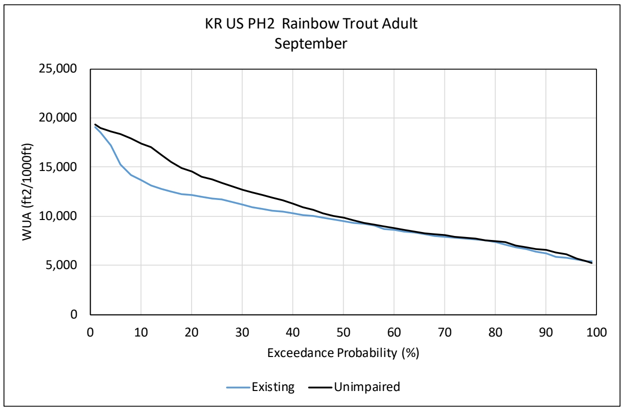
Figure G-41. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

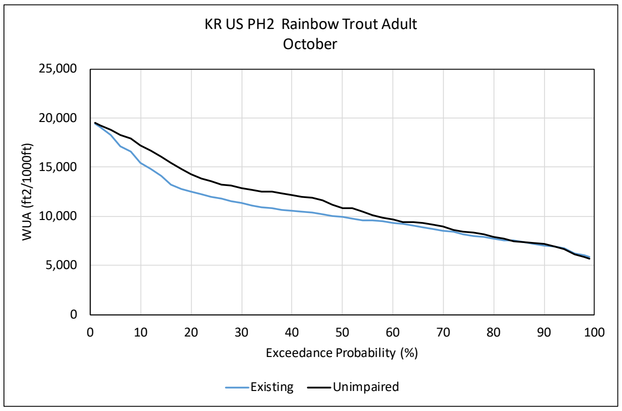


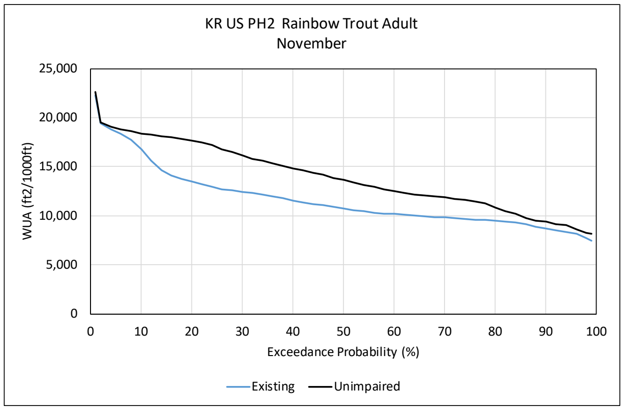

KR US PH2 Rainbow Trout Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

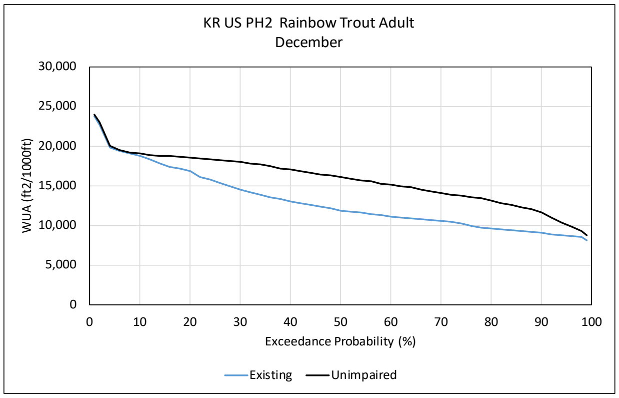
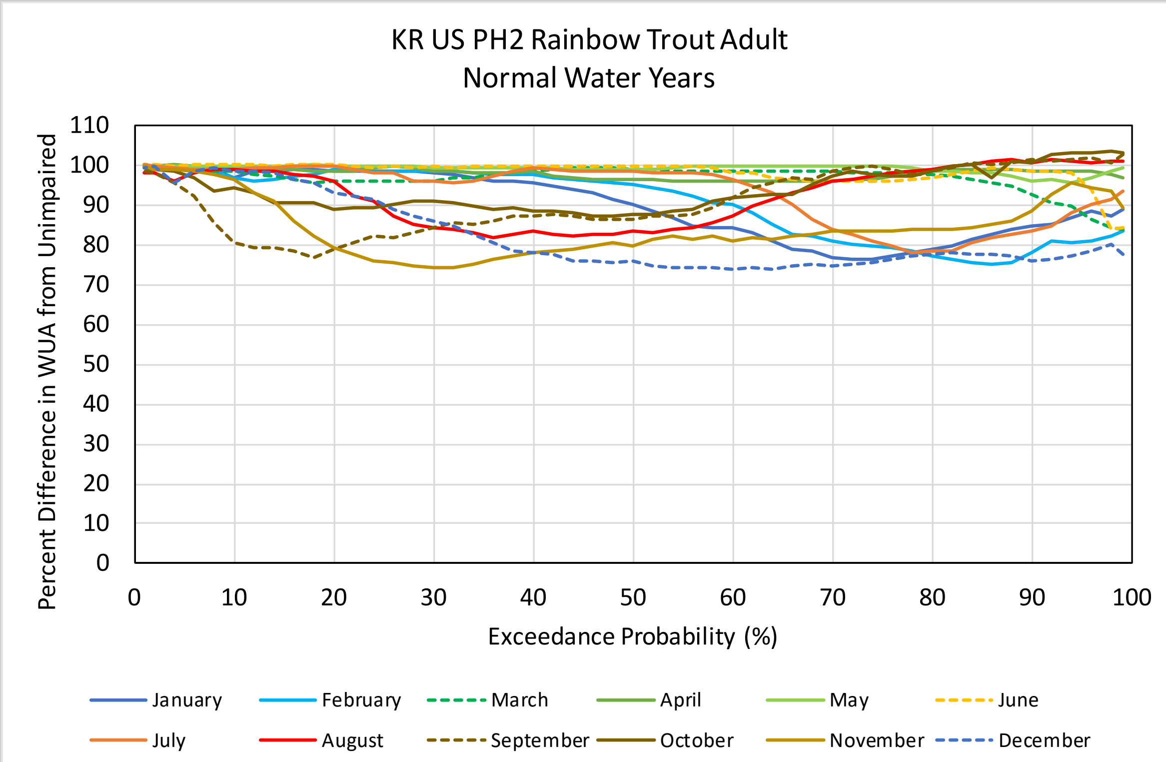

KR US PH2 Rainbow Trout Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-42. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



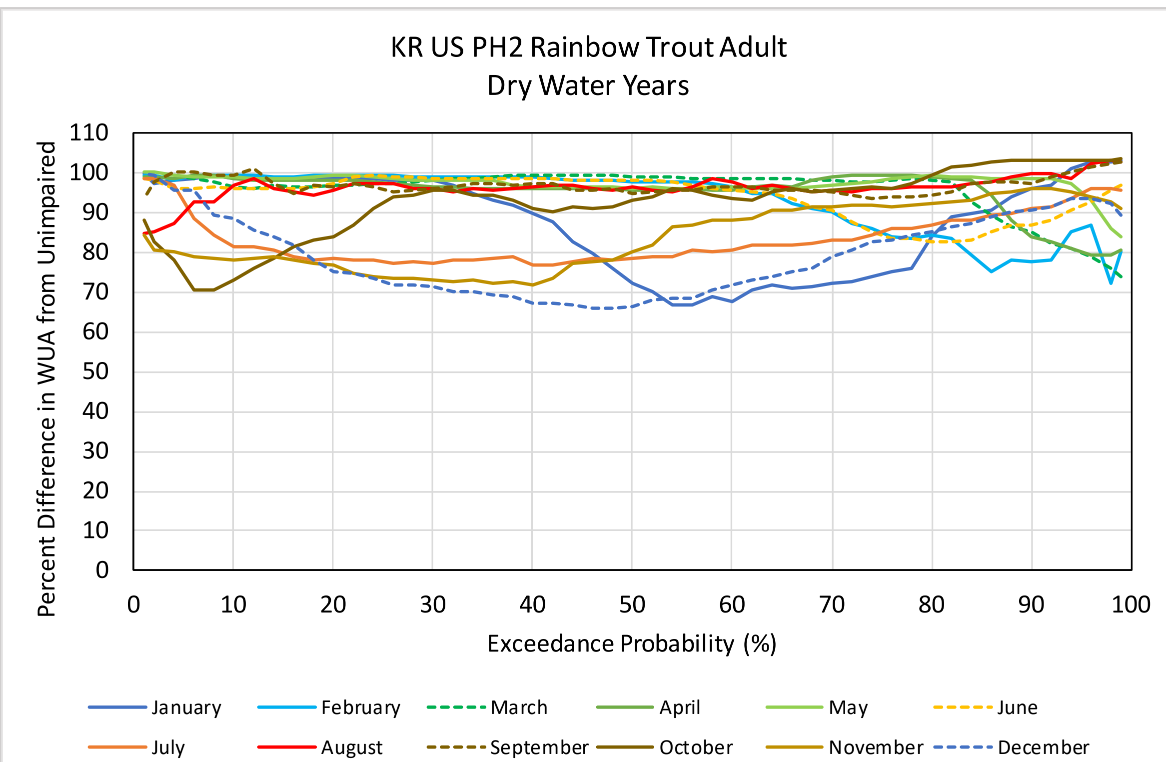


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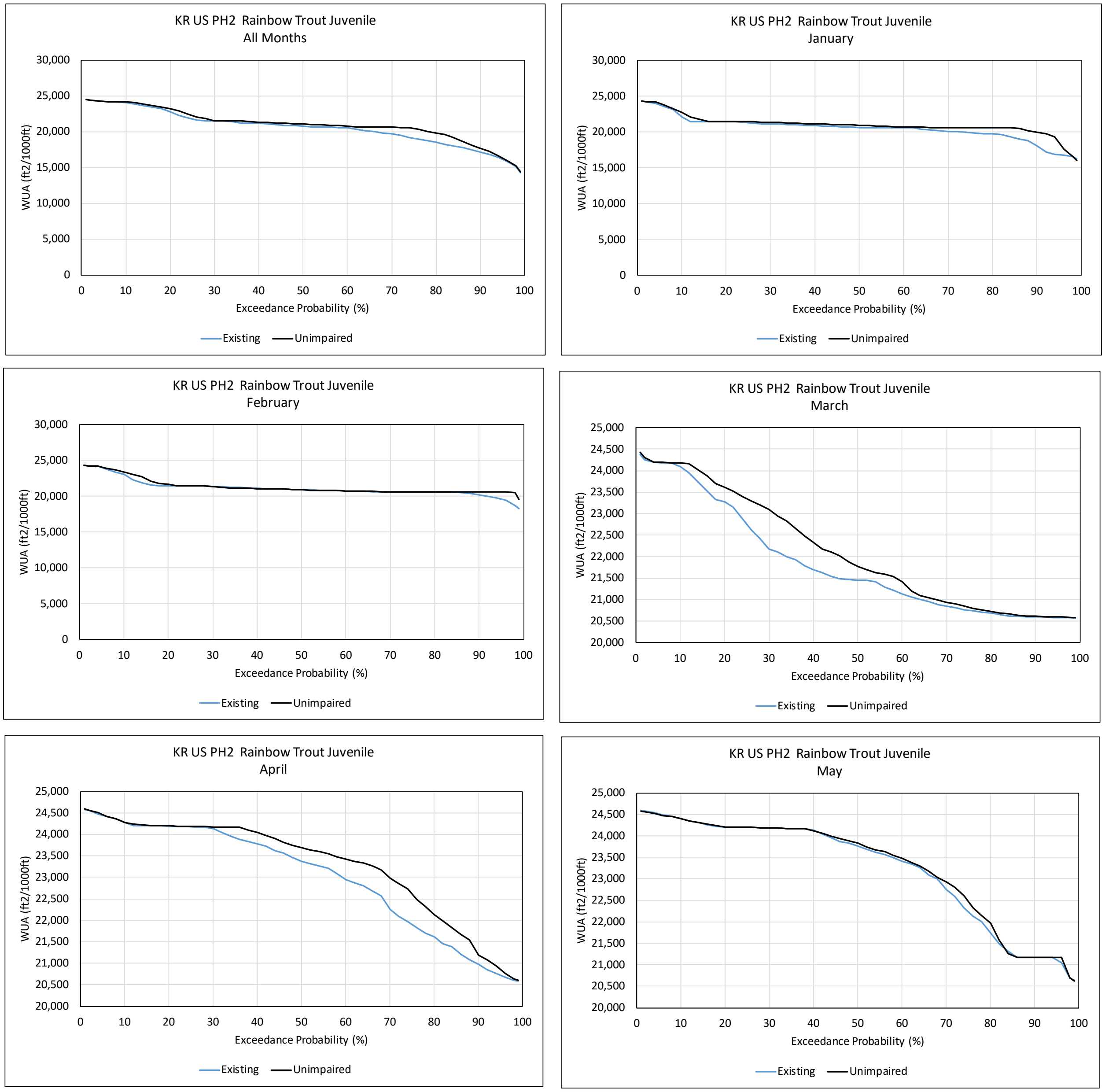
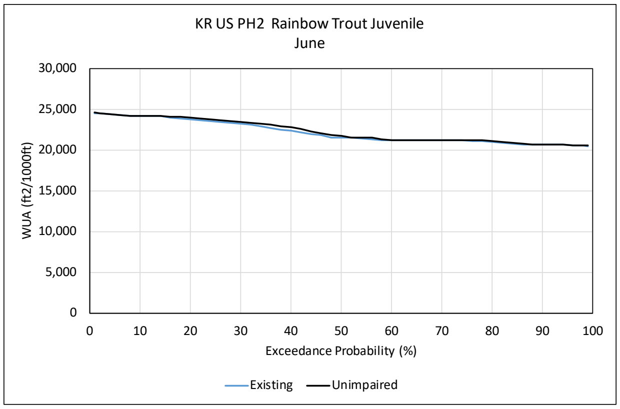
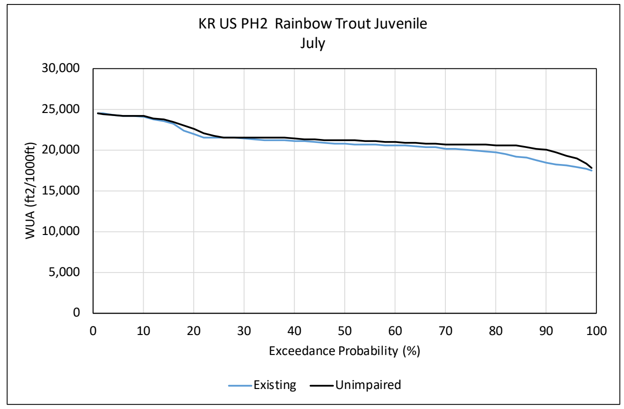
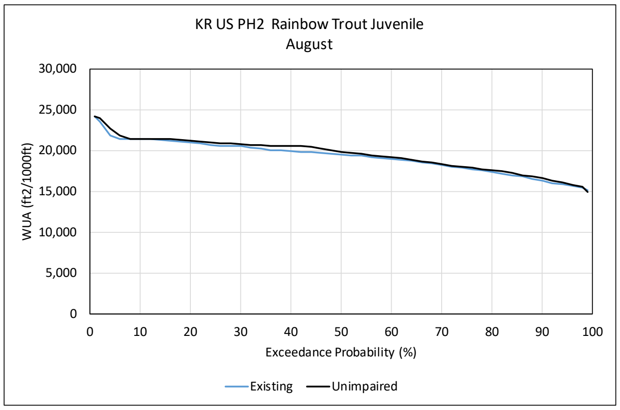
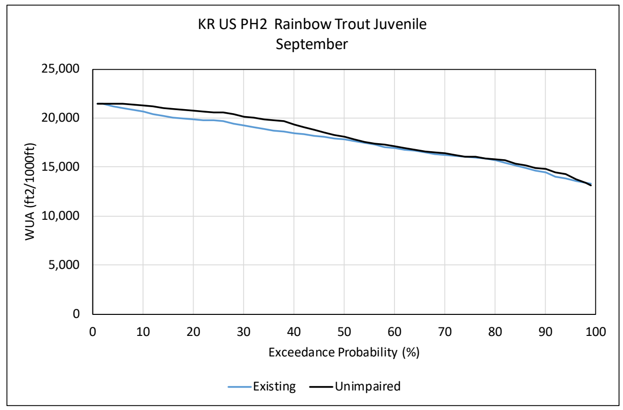
Figure G-43. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

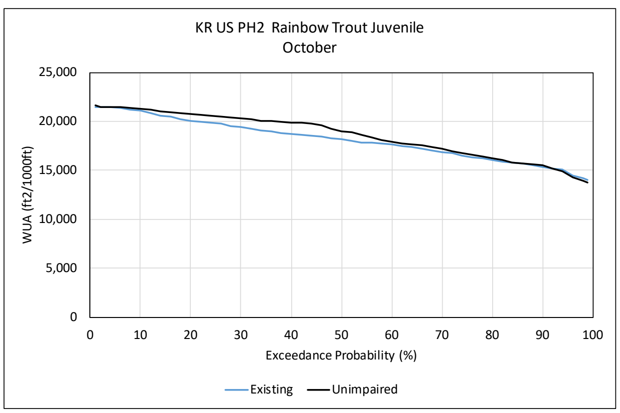


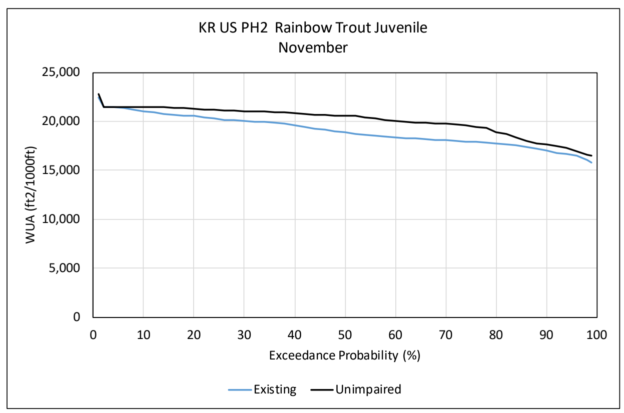

KR US PH2 Rainbow Trout Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


KR US PH2 Rainbow Trout Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

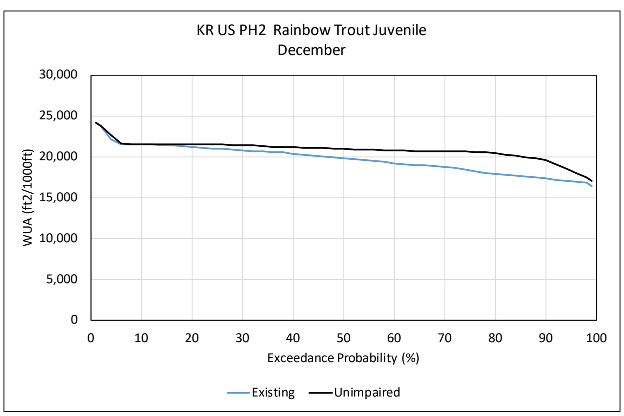
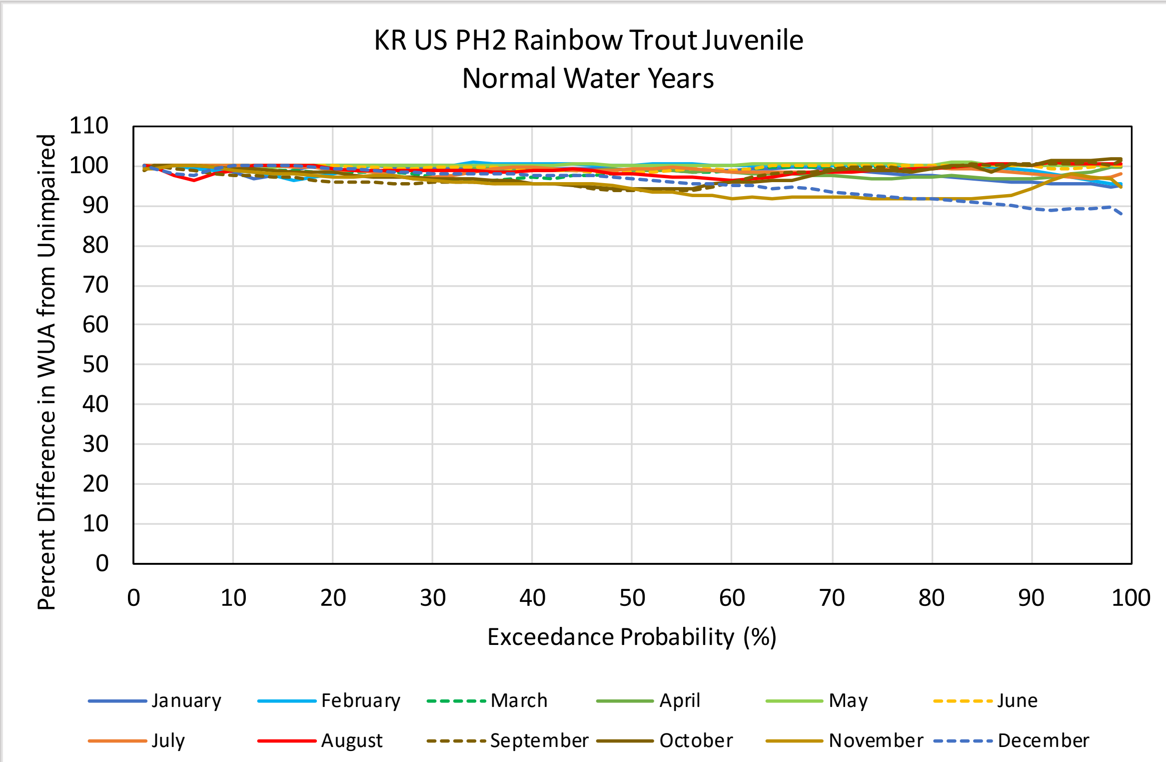

KR US PH2 Rainbow Trout Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-44. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



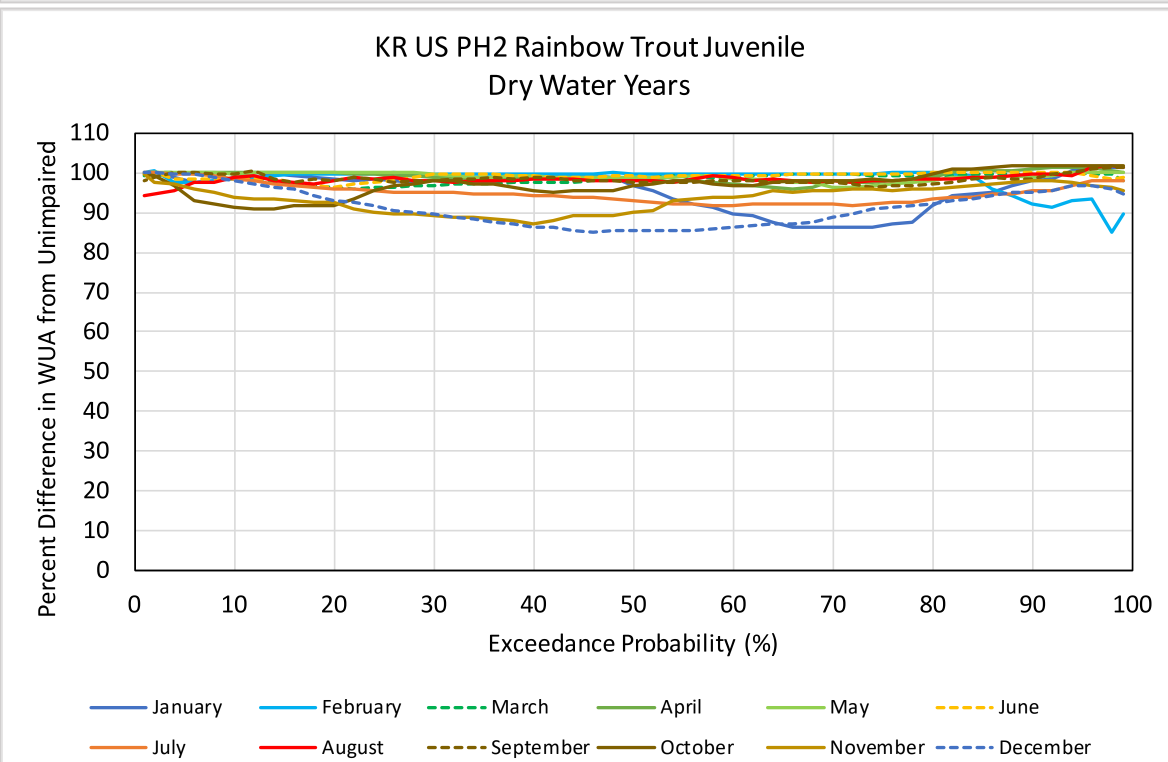


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Figure G-45. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Fry Habitat Exceedance Plots for All Water Years May through August.

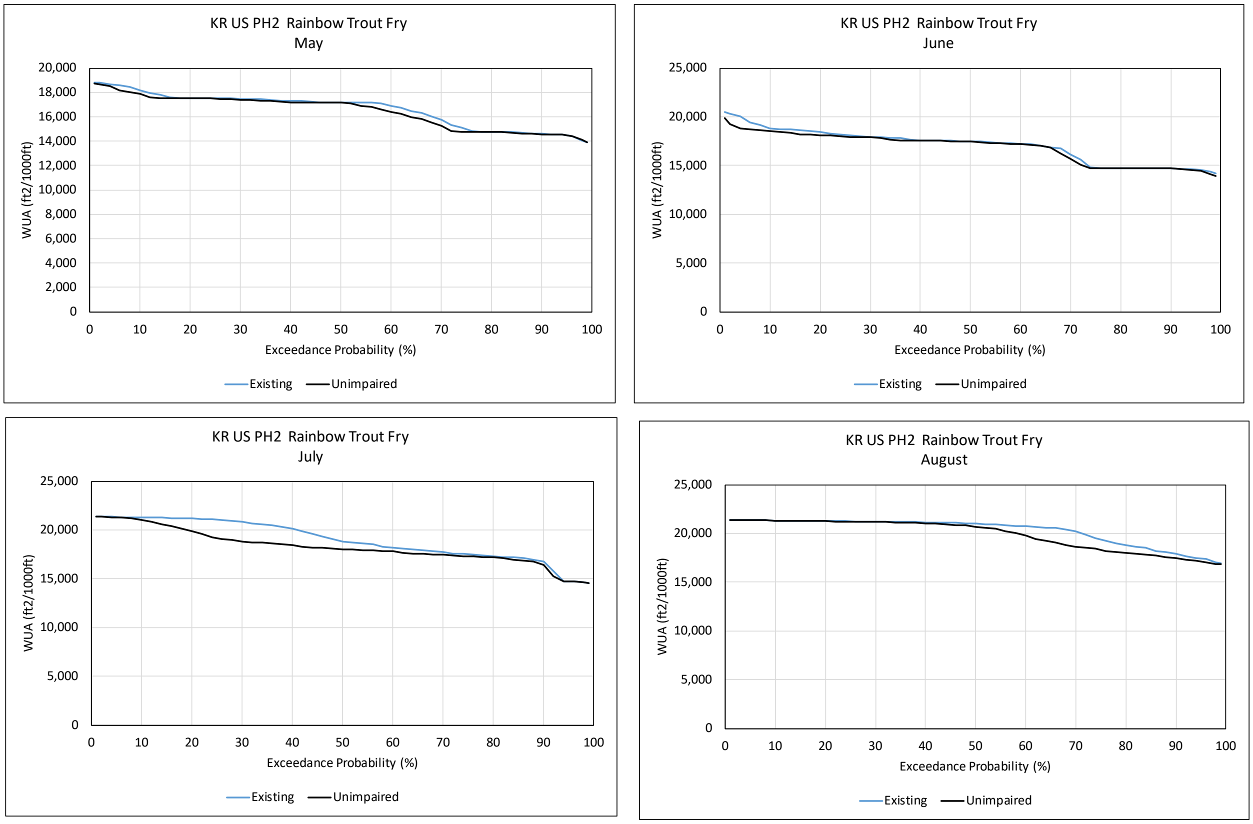

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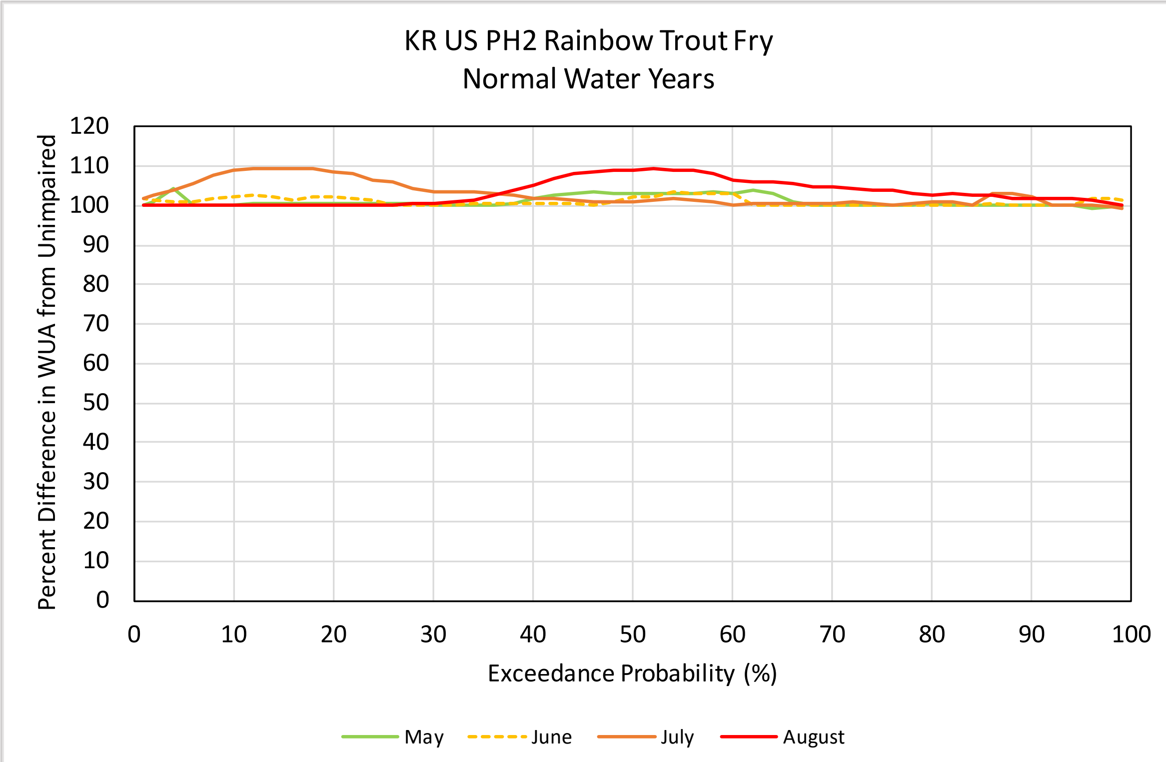
Figure G-46. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Fry Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



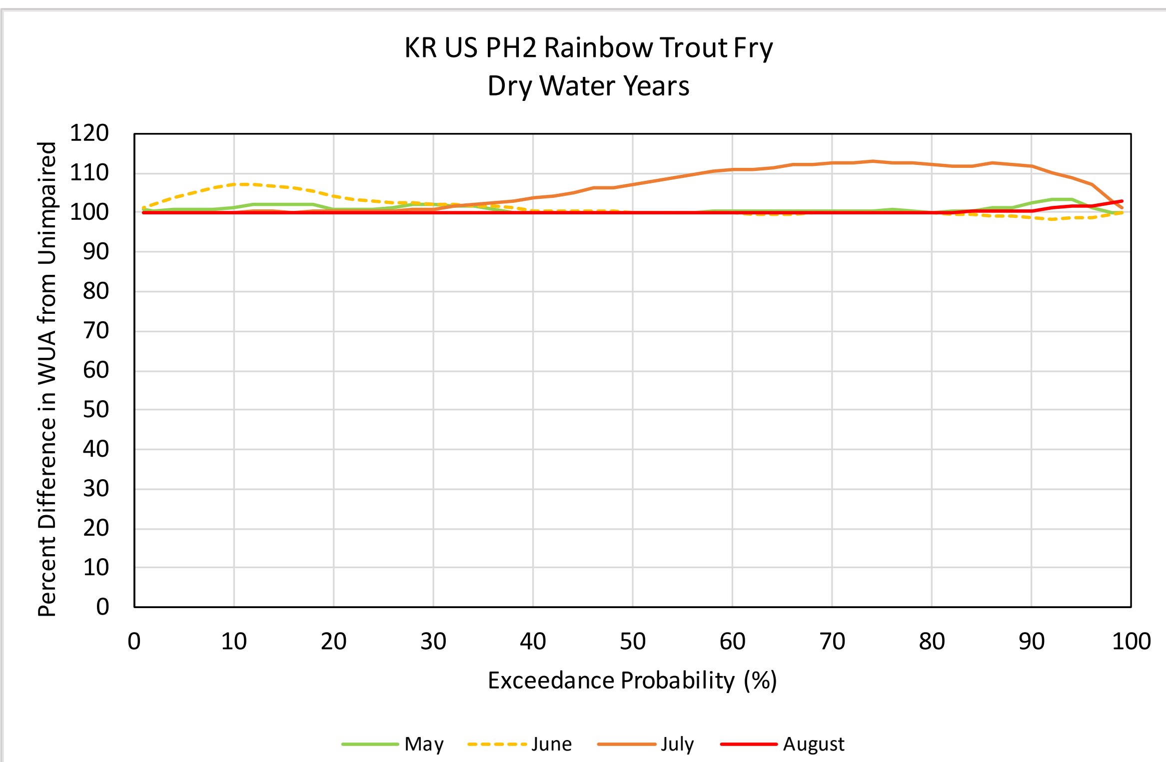


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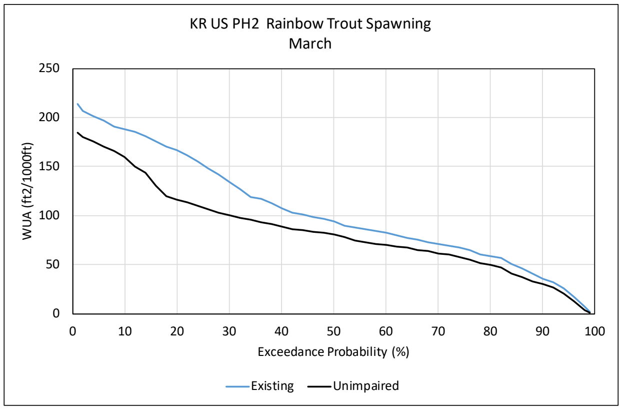
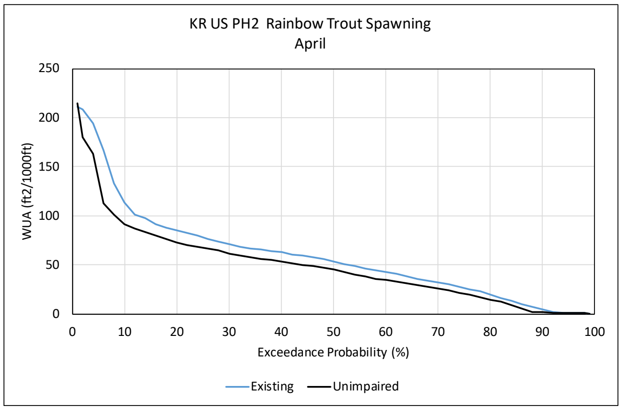
Figure G-47. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Spawning Habitat Exceedance Plots for All Water Years March through May.





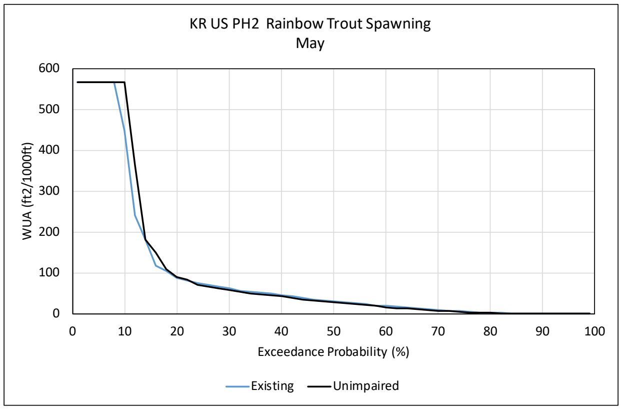


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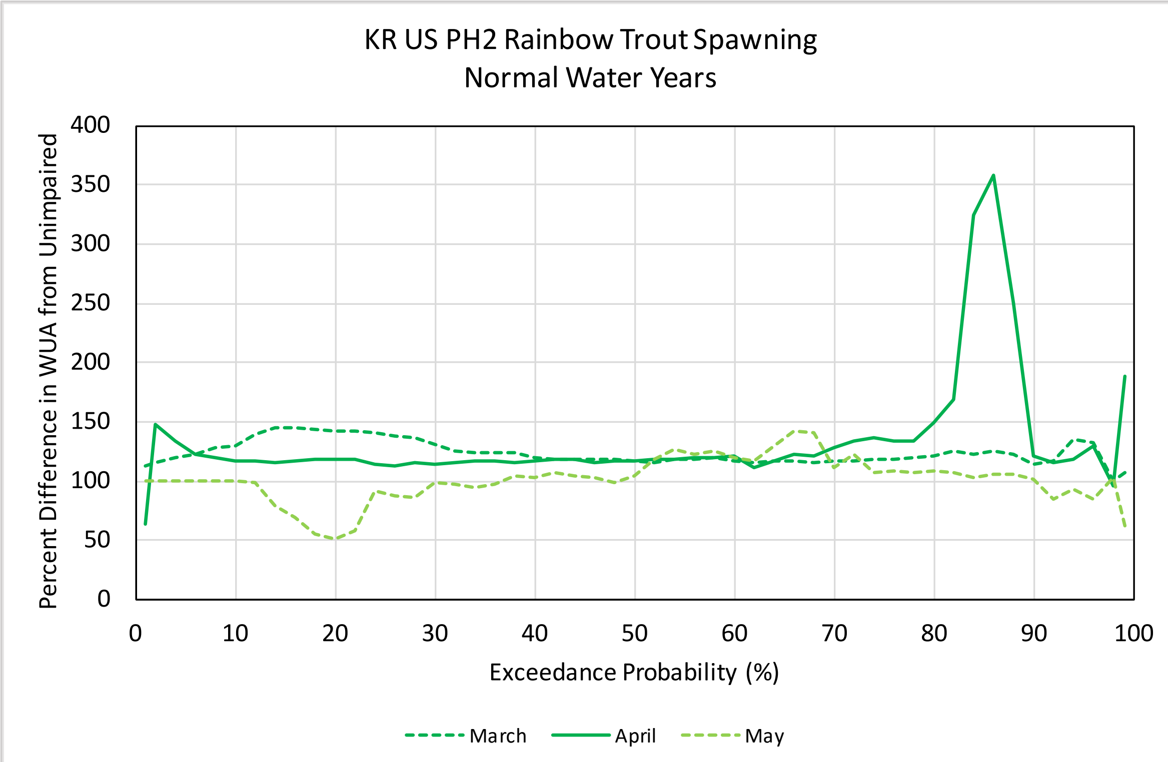
Figure G-48. Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse Rainbow Trout Spawning Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



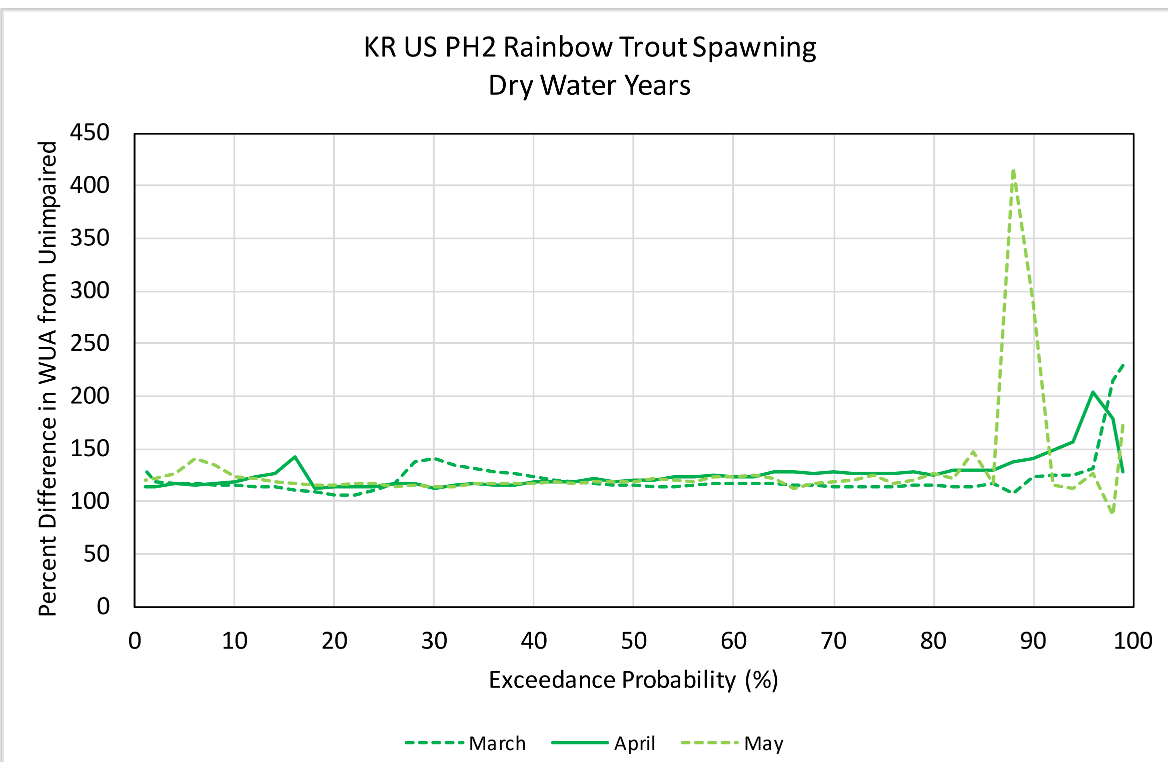


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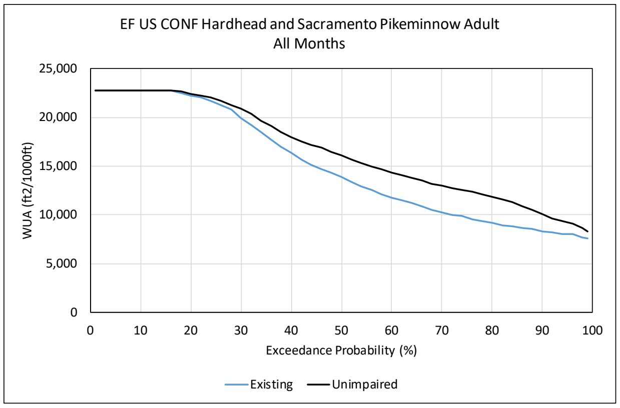
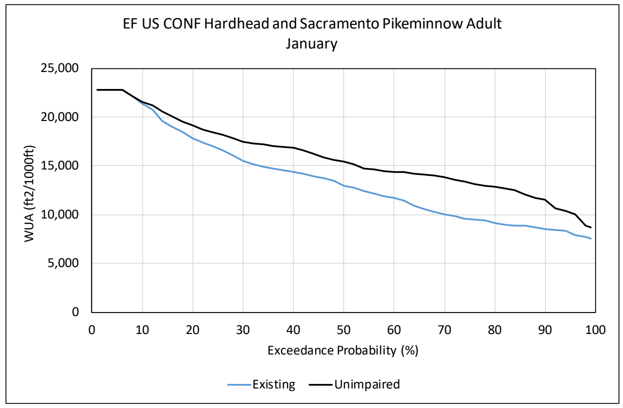
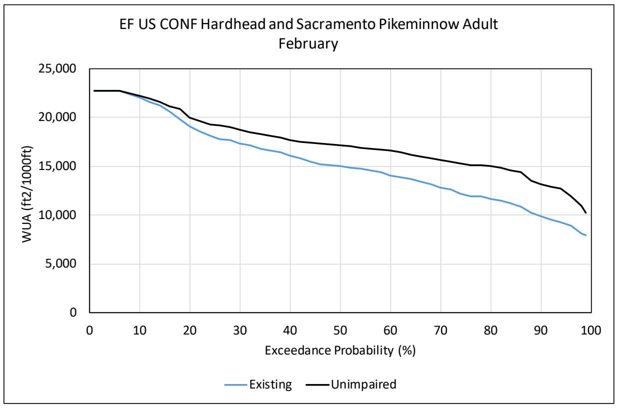
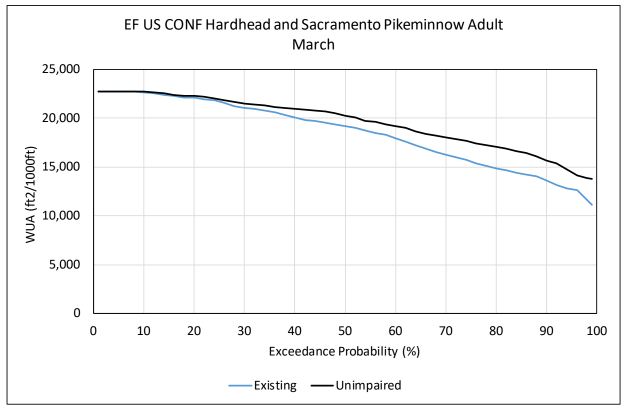
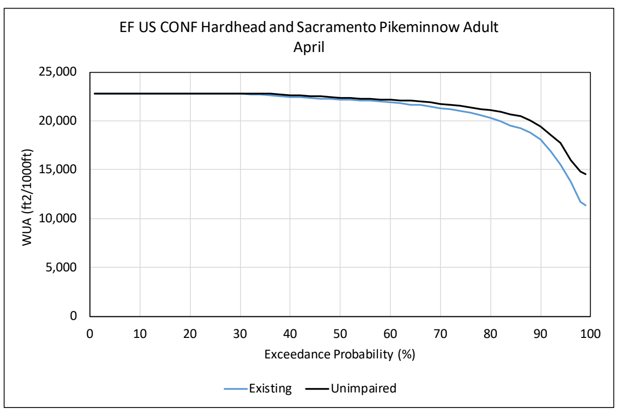
Figure G-49. East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

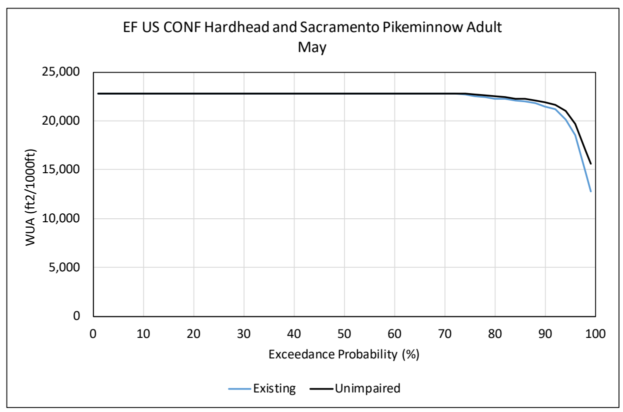


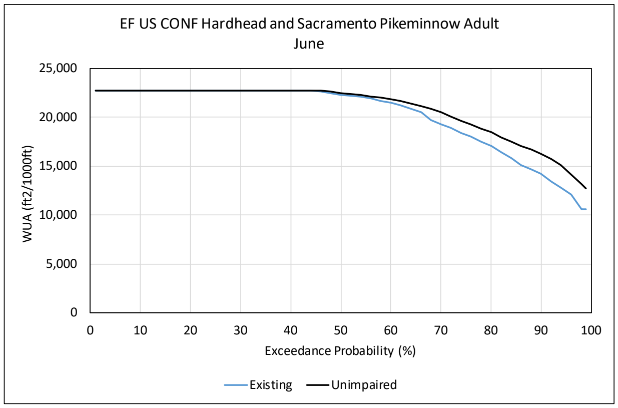


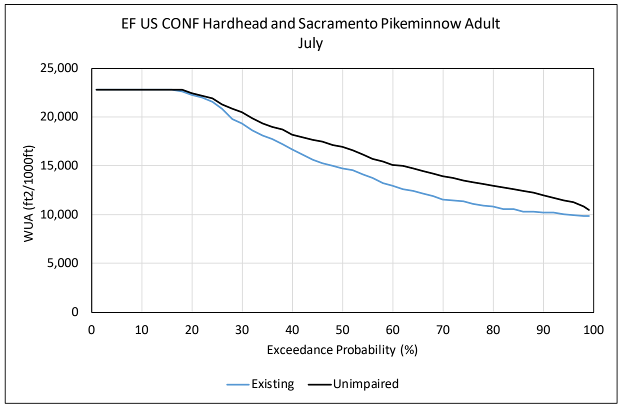


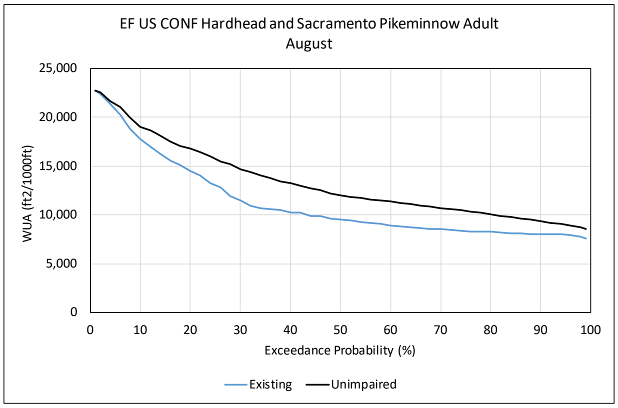


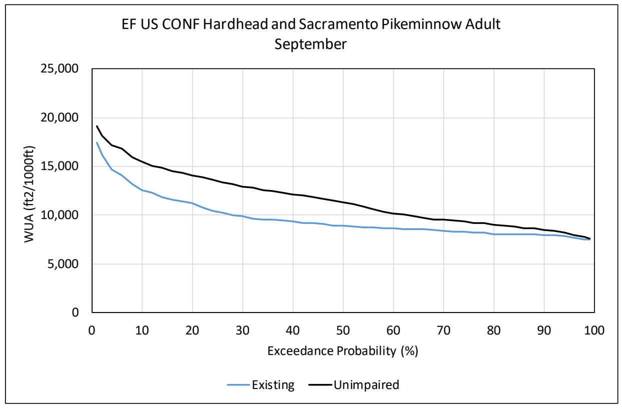


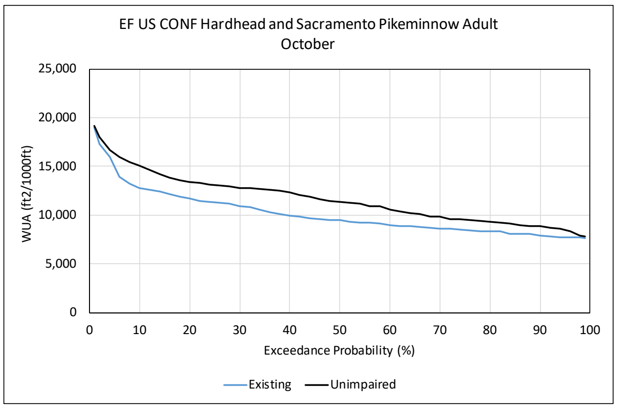


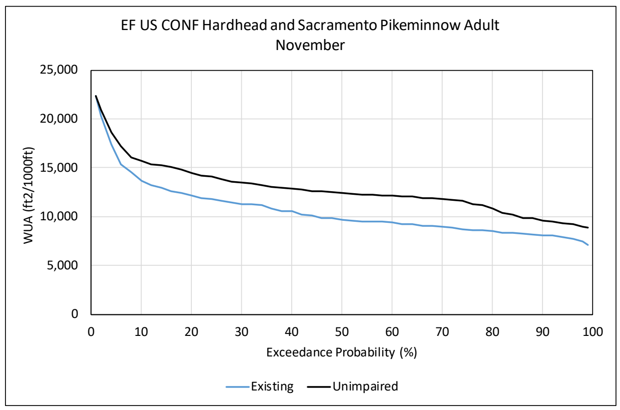

EF US CONF Hardhead and Sacramento Pikeminnow Adult
June
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF Hardhead and Sacramento Pikeminnow Adult
July
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF Hardhead and Sacramento Pikeminnow Adult
August
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF Hardhead and Sacramento Pikeminnow Adult
September
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF Hardhead and Sacramento Pikeminnow Adult
October
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF Hardhead and Sacramento Pikeminnow Adult
November
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

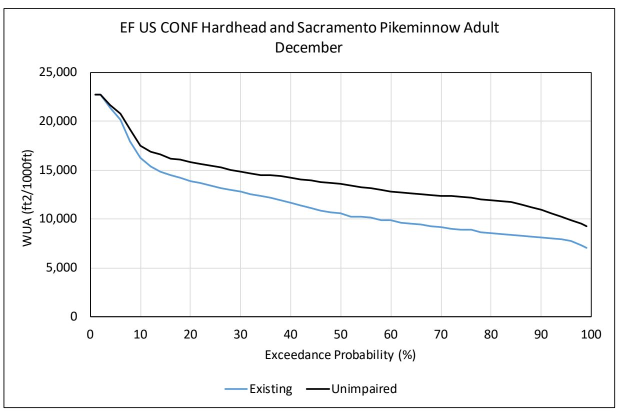
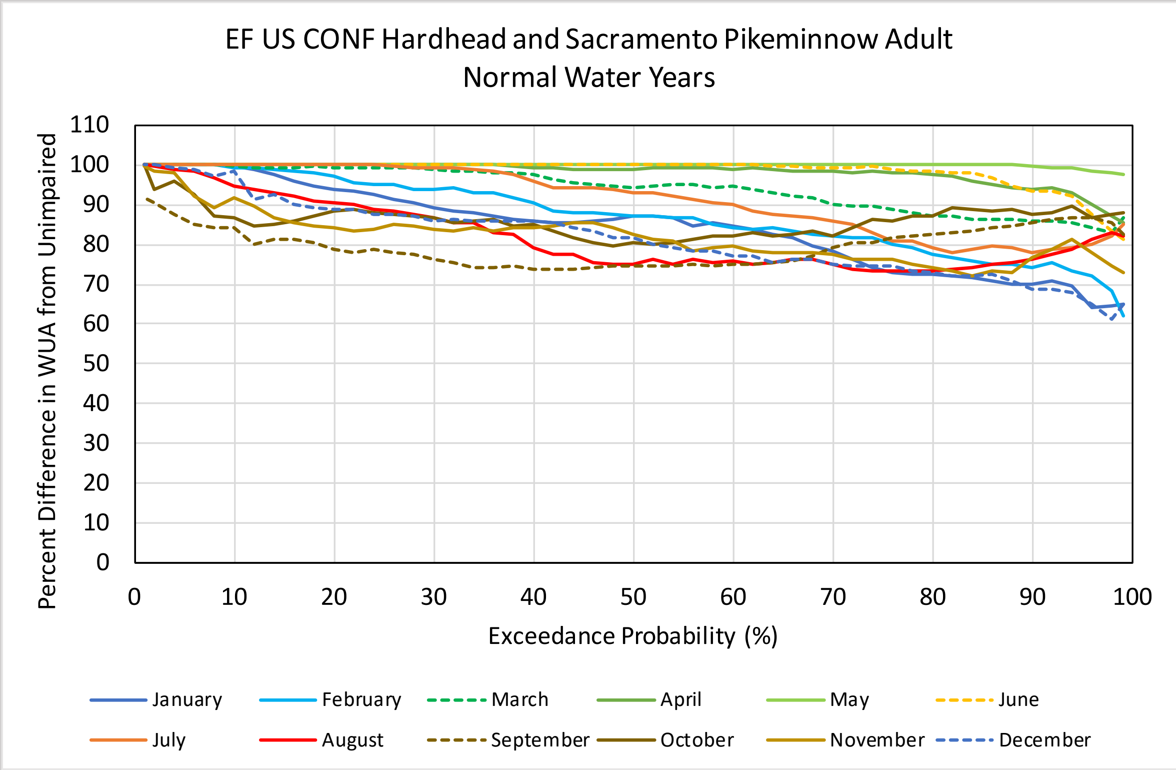

EF US CONF Hardhead and Sacramento Pikeminnow Adult
December
WUA (ft2/1000ft)
25,000
20,000
15,000
10,000
5,000
0
0
10
20
30
40
50
60
70
80
90
100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-50. **East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**



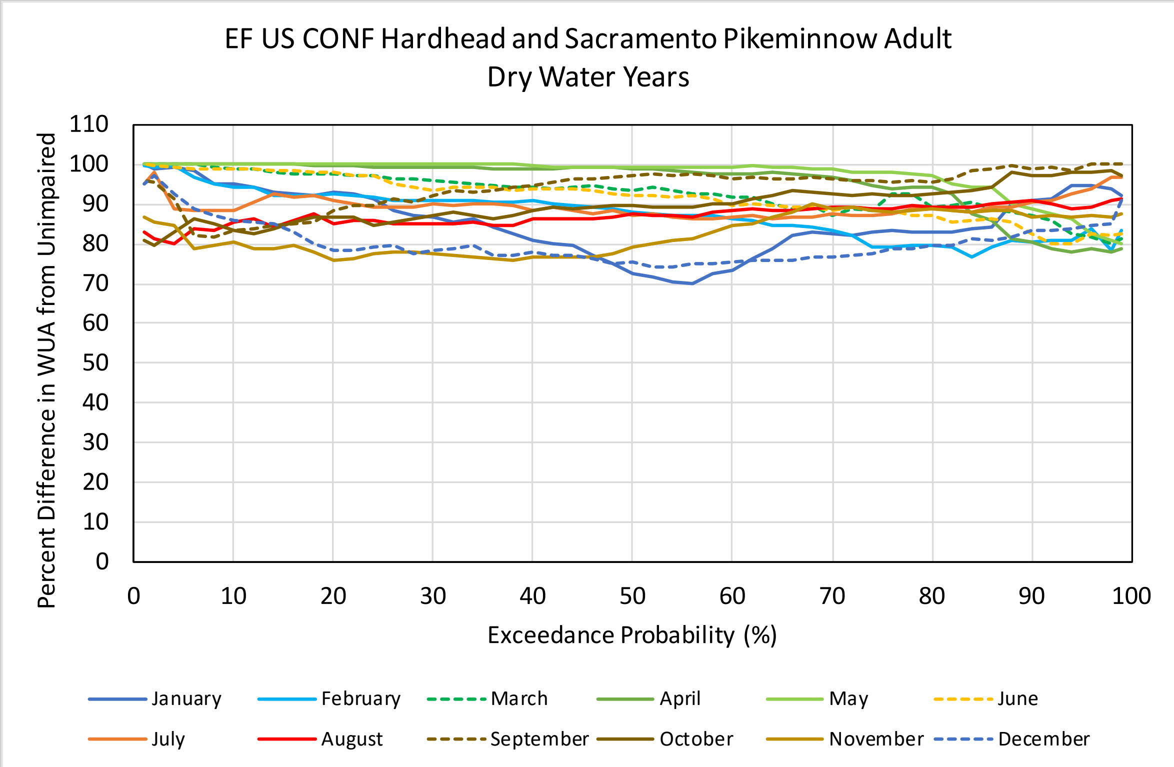


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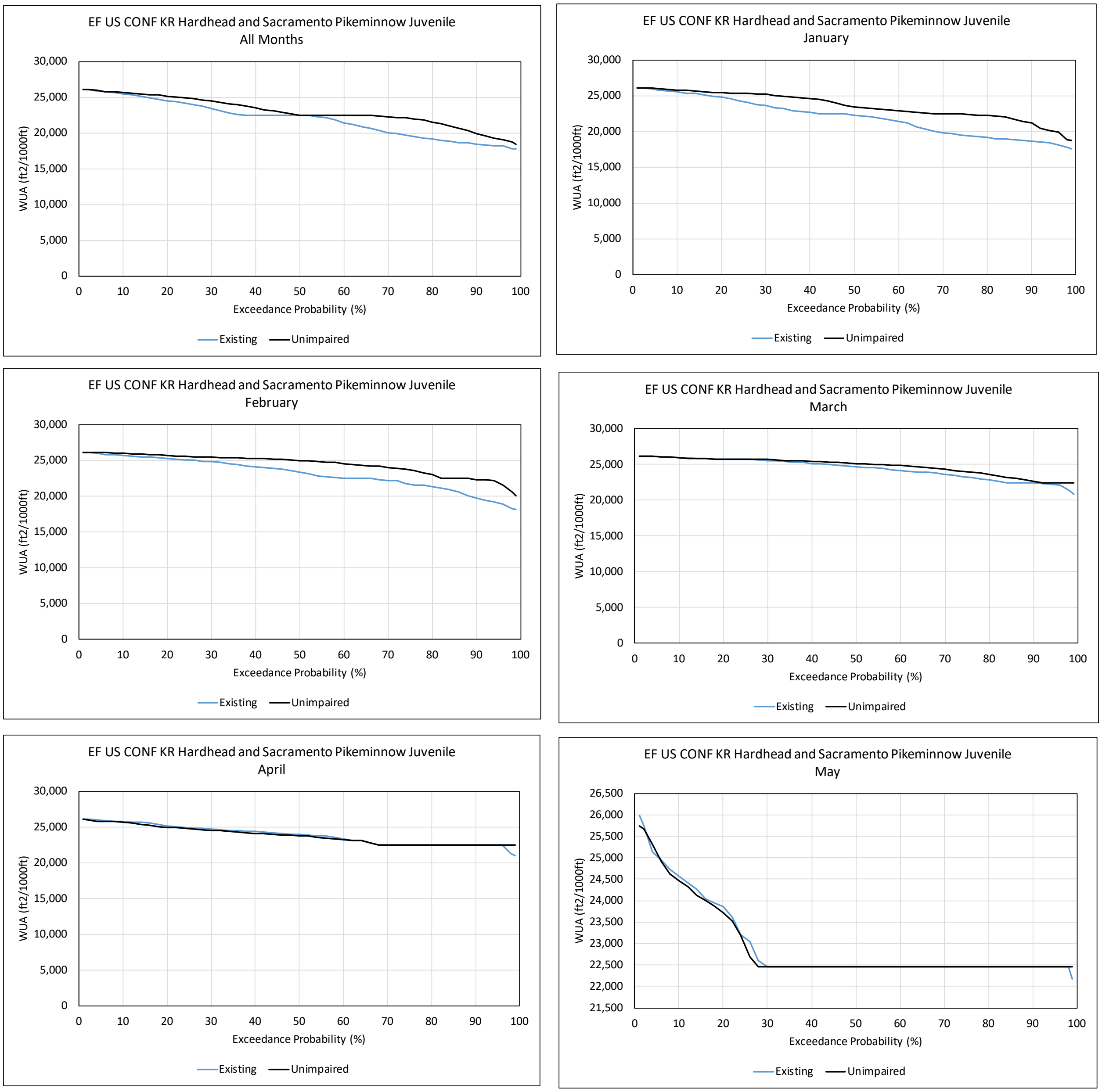
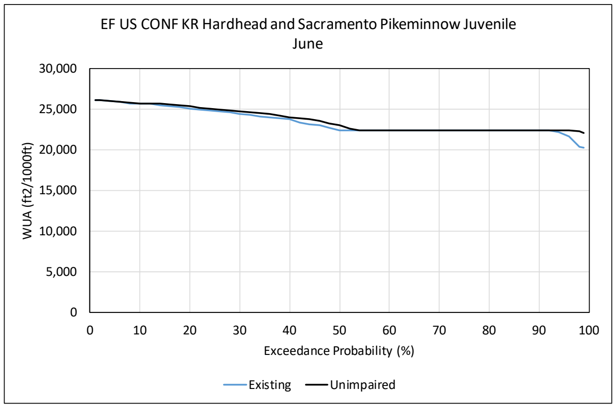
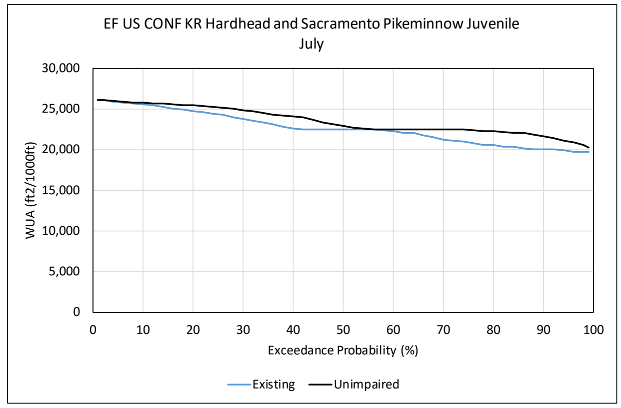
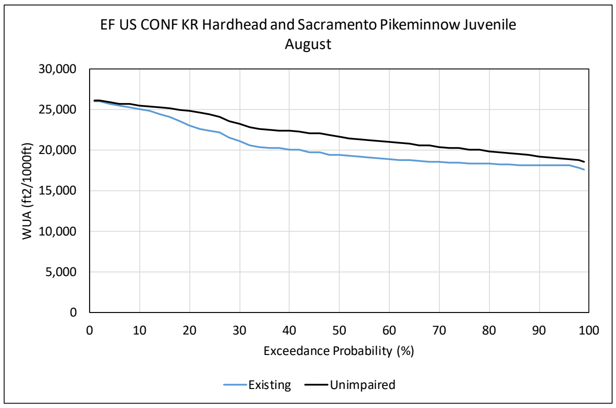
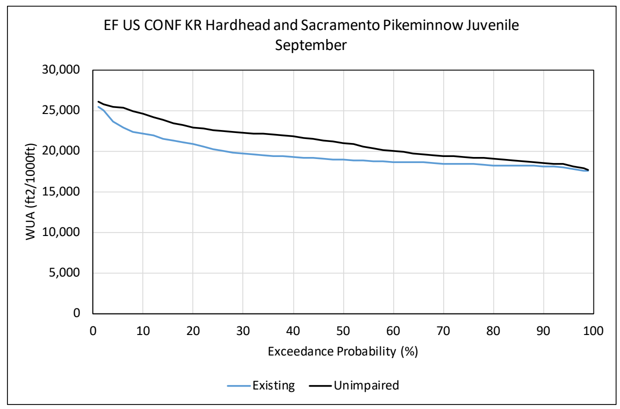
Figure G-51. East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

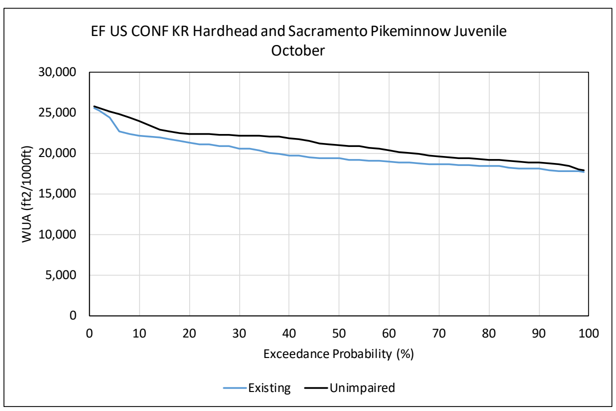


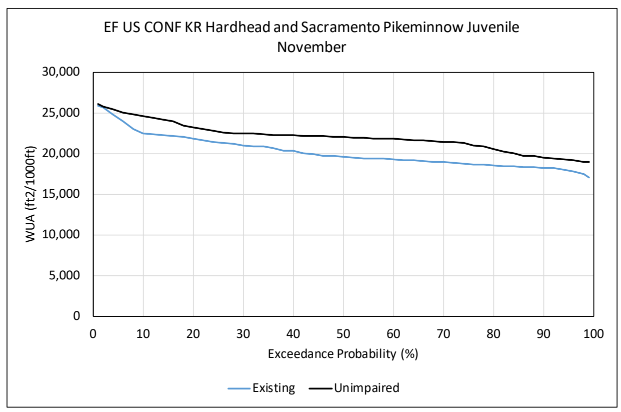

EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

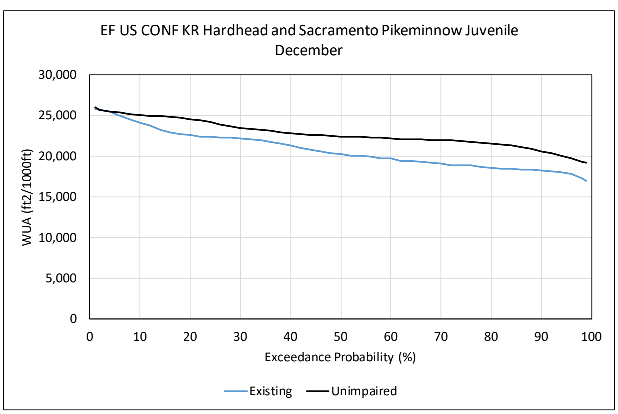
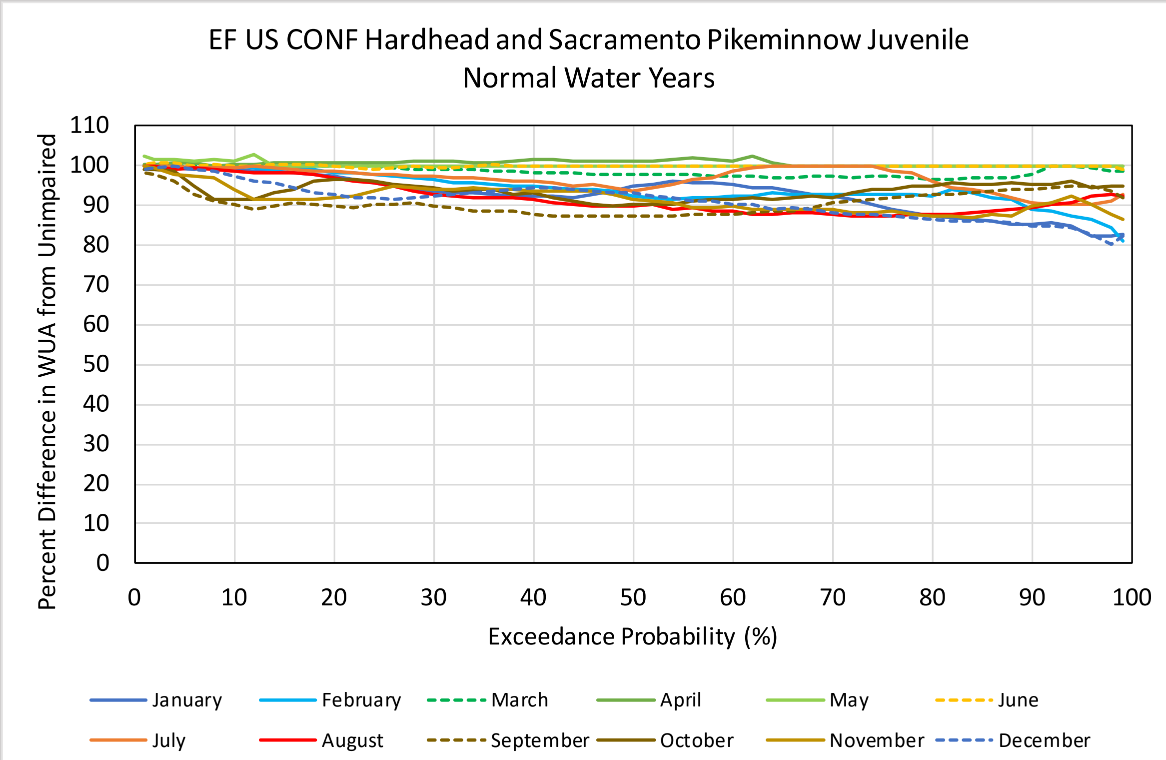

EF US CONF KR Hardhead and Sacramento Pikeminnow Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-52. East Fork Kaweah River Upstream of the Confluence with Kaweah River Hardhead and Sacramento Pikeminnow Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



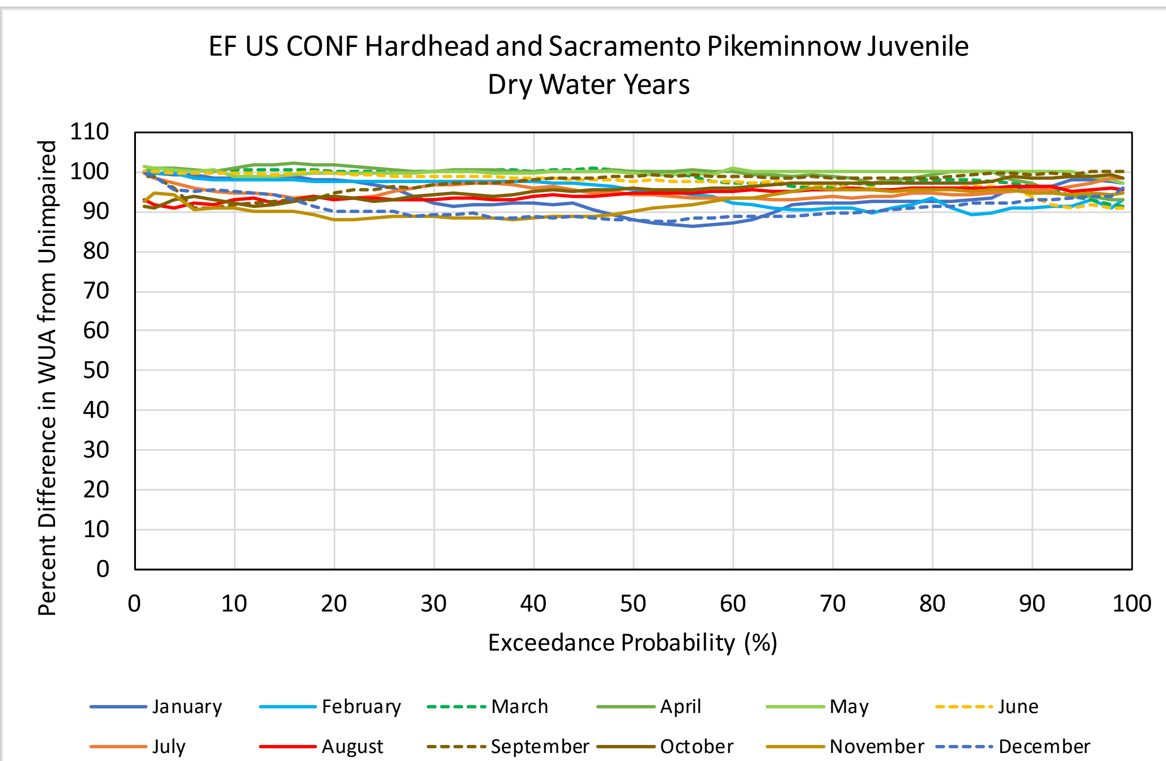


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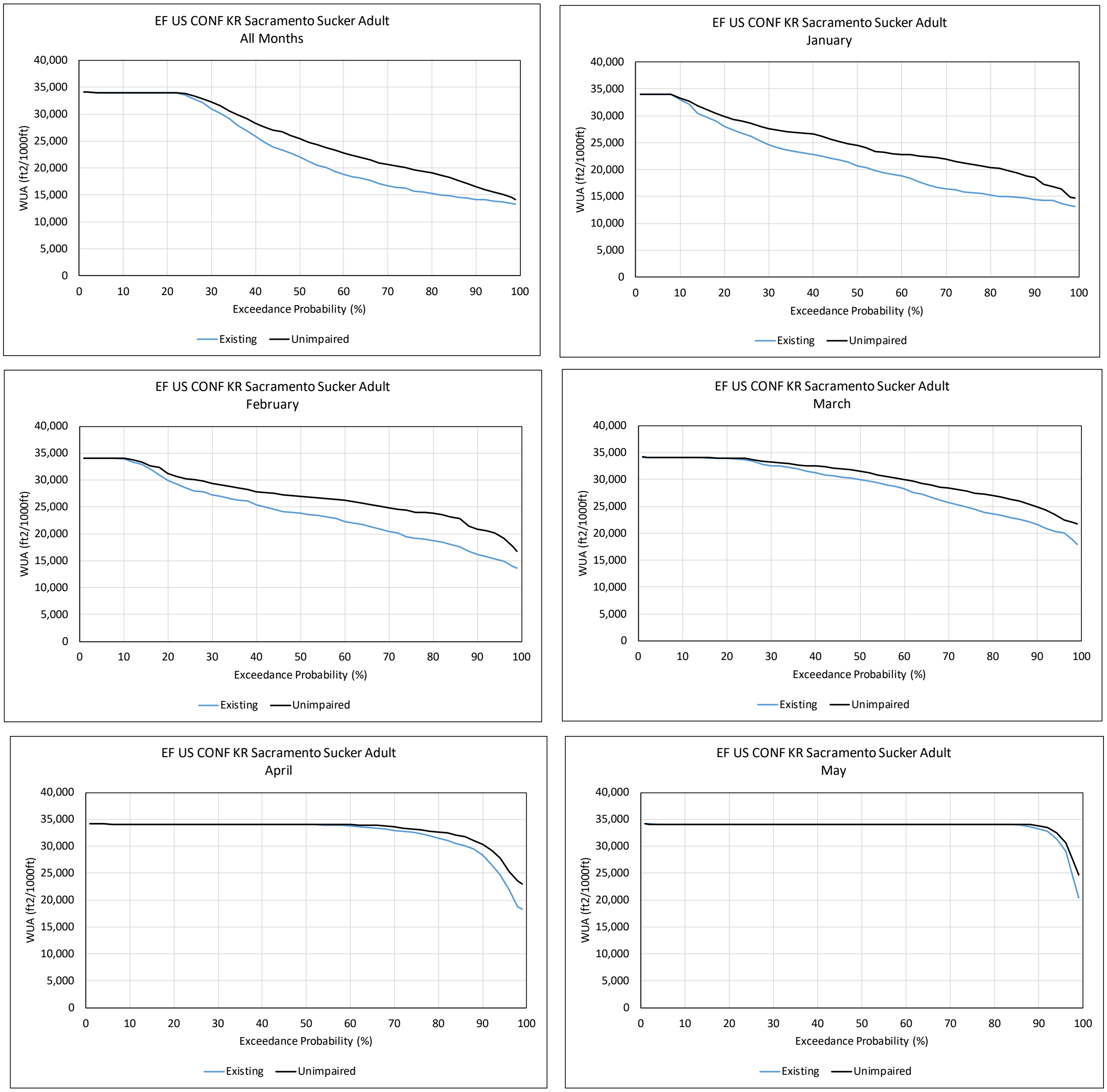
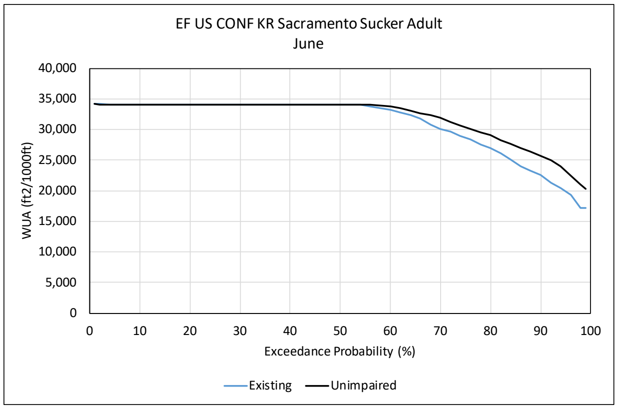
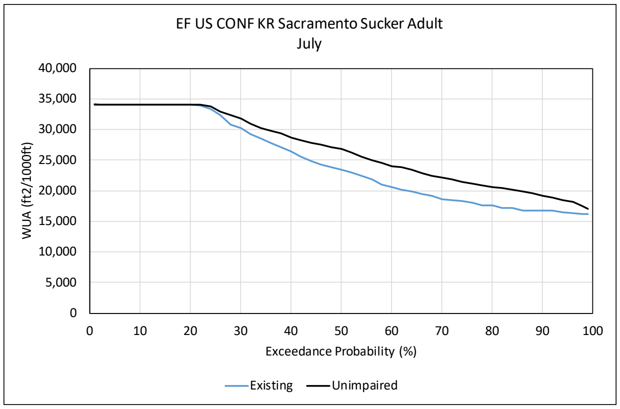
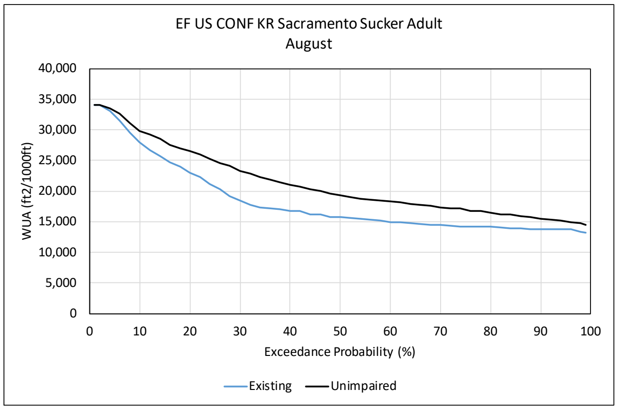
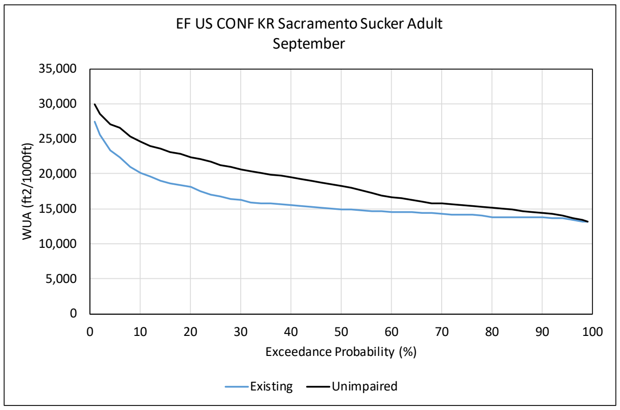
Figure G-53. East Fork Kaweah River Upstream of the Confluence with Kaweah River Sacramento Sucker Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

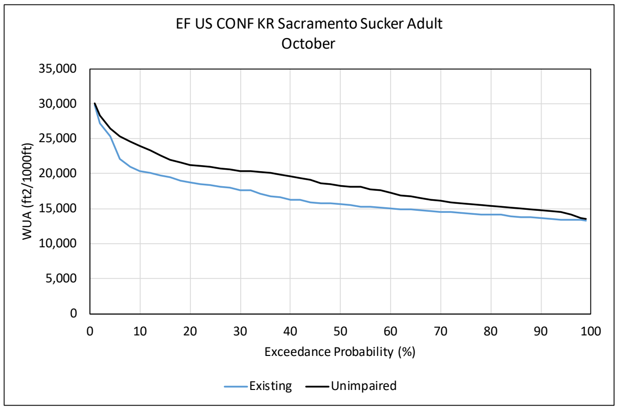


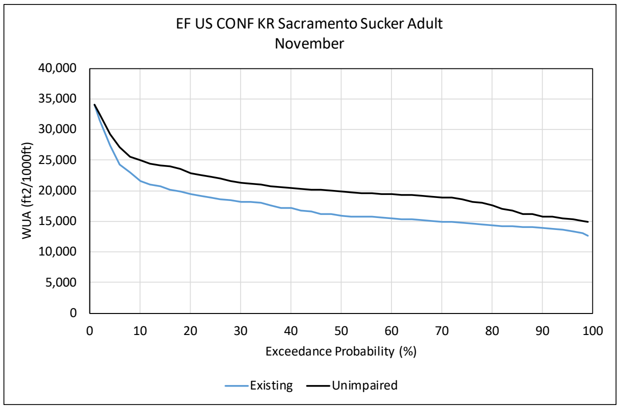

EF US CONF KR Sacramento Sucker Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

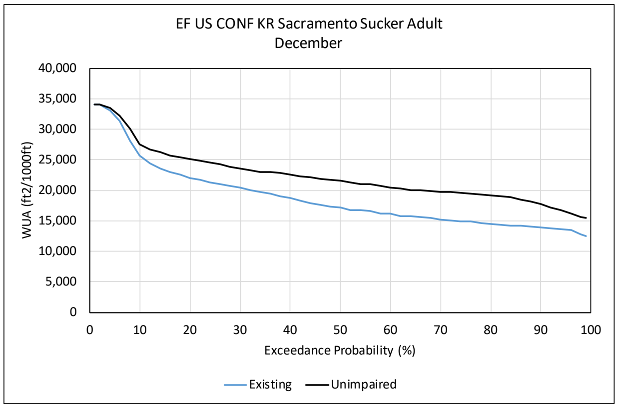
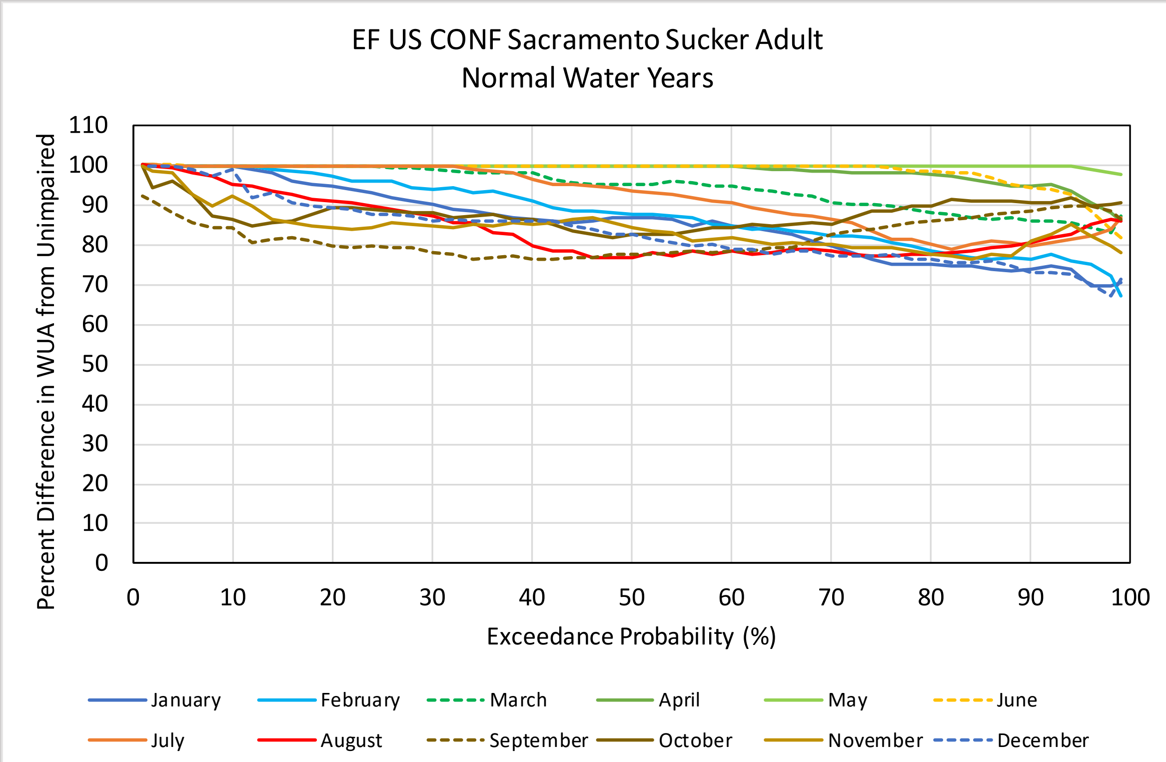

EF US CONF KR Sacramento Sucker Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-54. East Fork Kaweah River Upstream of the Confluence with Kaweah River Sacramento Sucker Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



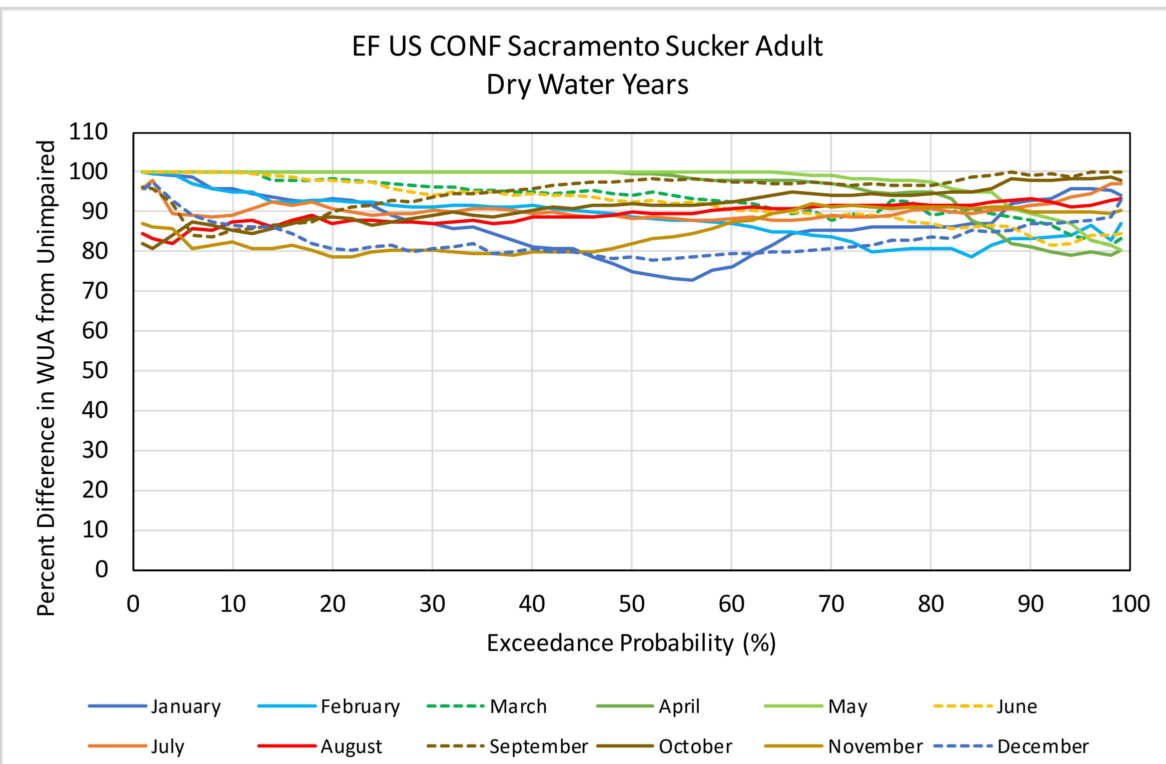


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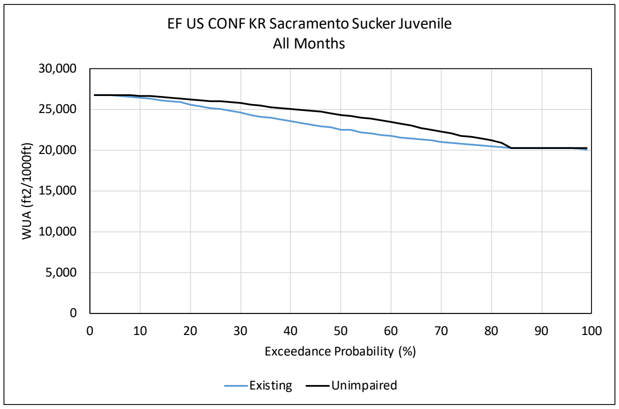
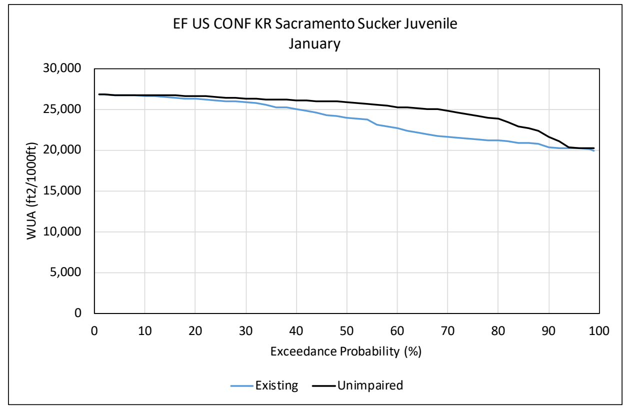
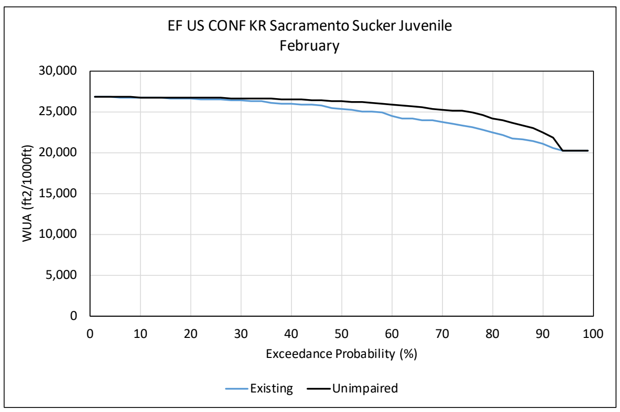
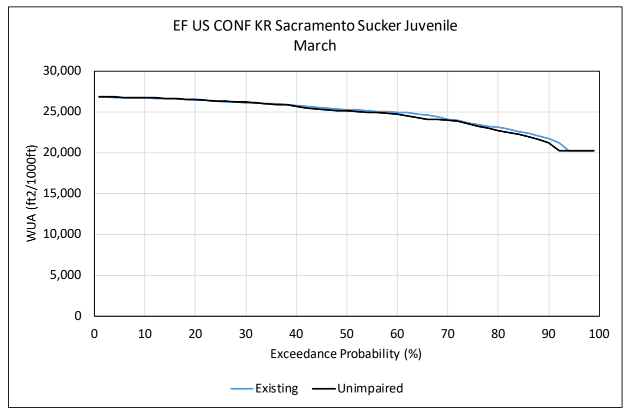
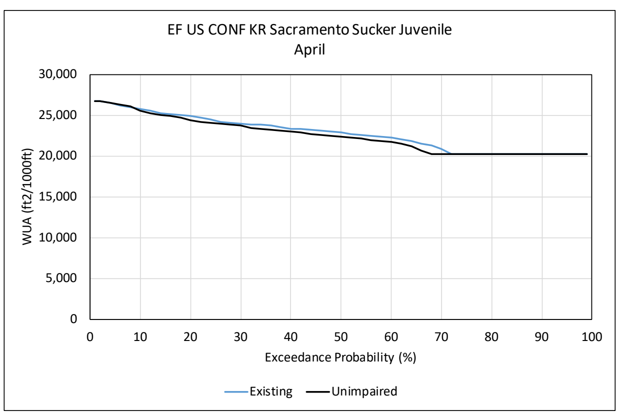
Figure G-55. East Fork Kaweah River Upstream of the Confluence with Kaweah River Sacramento Sucker Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

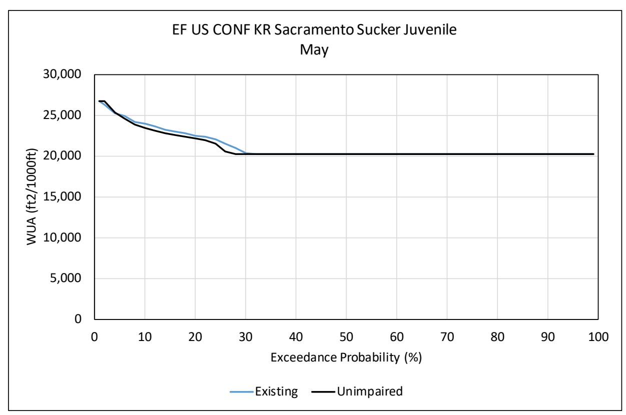


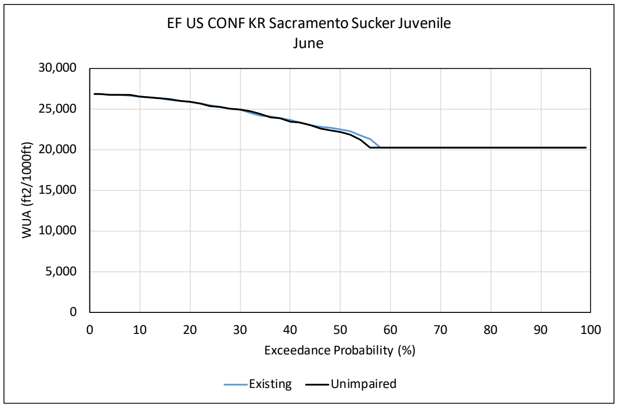


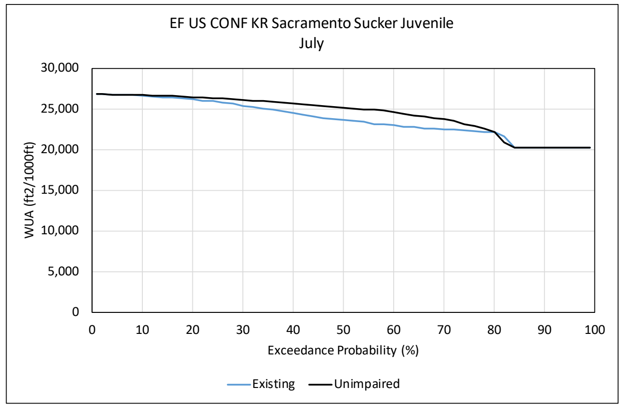


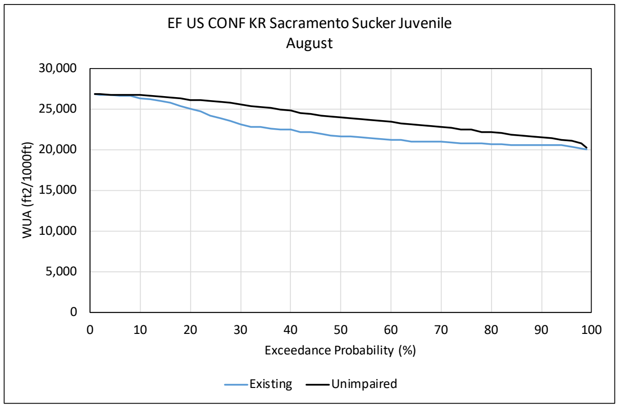


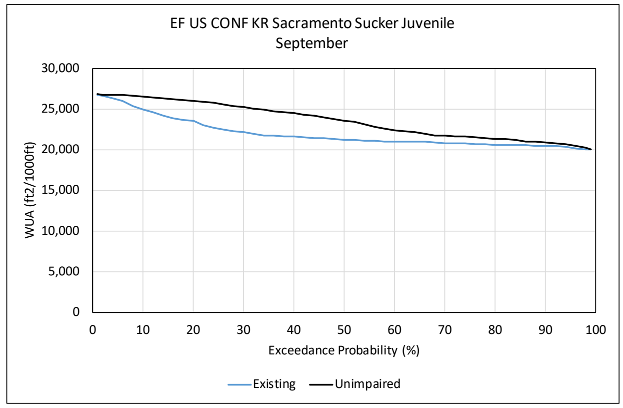


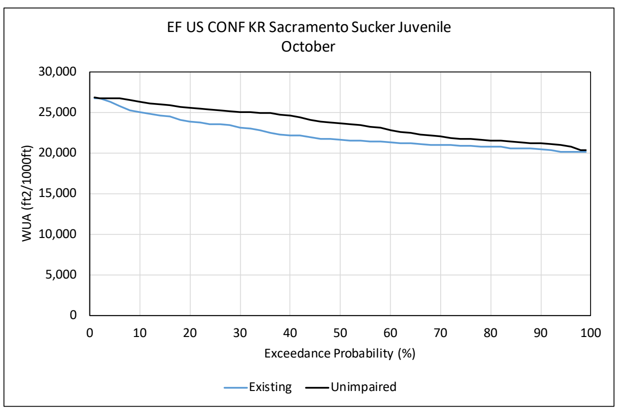


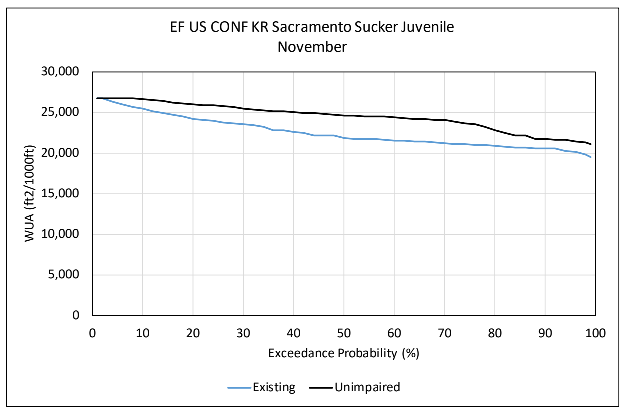

EF US CONF KR Sacramento Sucker Juvenile
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Juvenile
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Juvenile
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Juvenile
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Juvenile
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Sacramento Sucker Juvenile
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

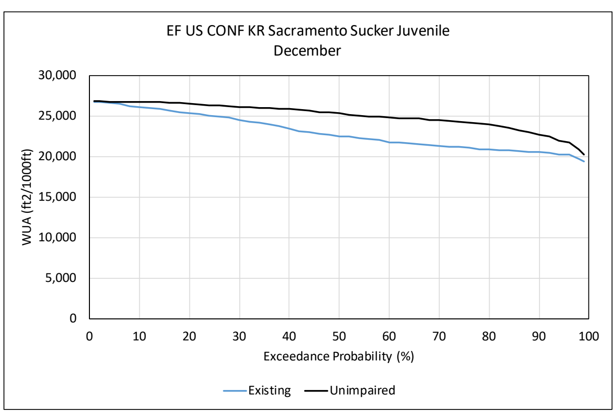
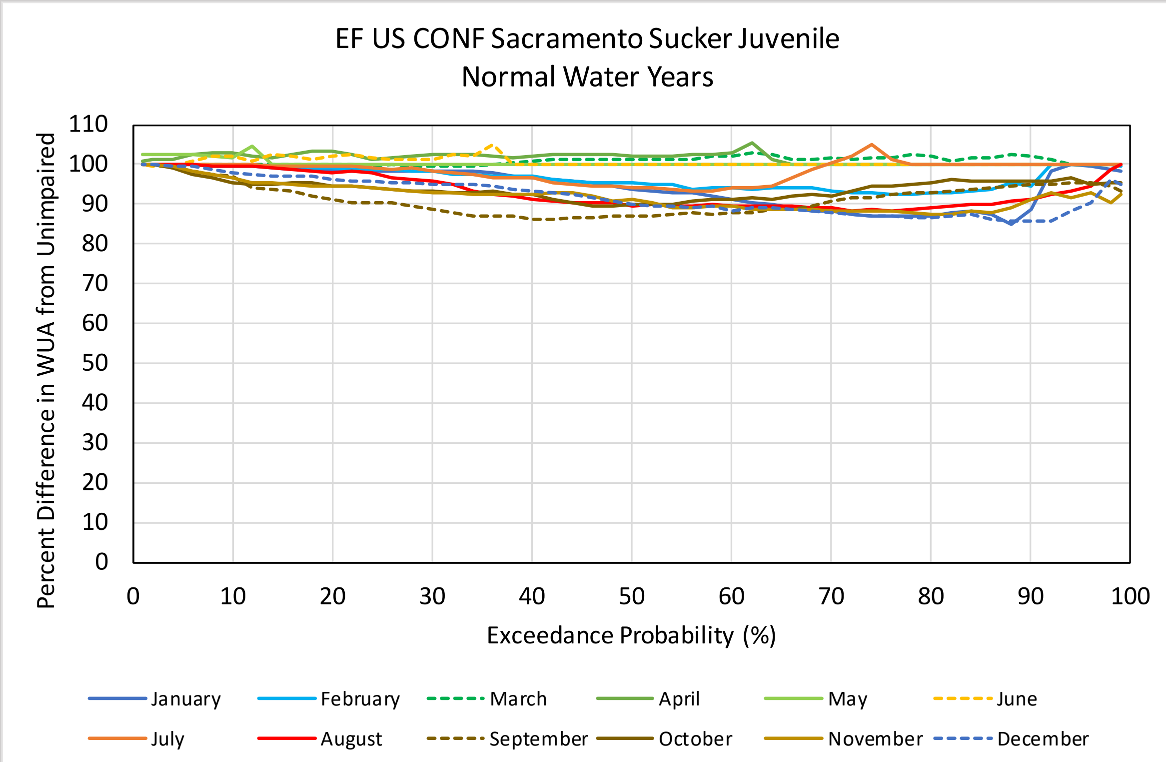

EF US CONF KR Sacramento Sucker Juvenile
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-56. East Fork Kaweah River Upstream of the Confluence with Kaweah River Sacramento Sucker Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



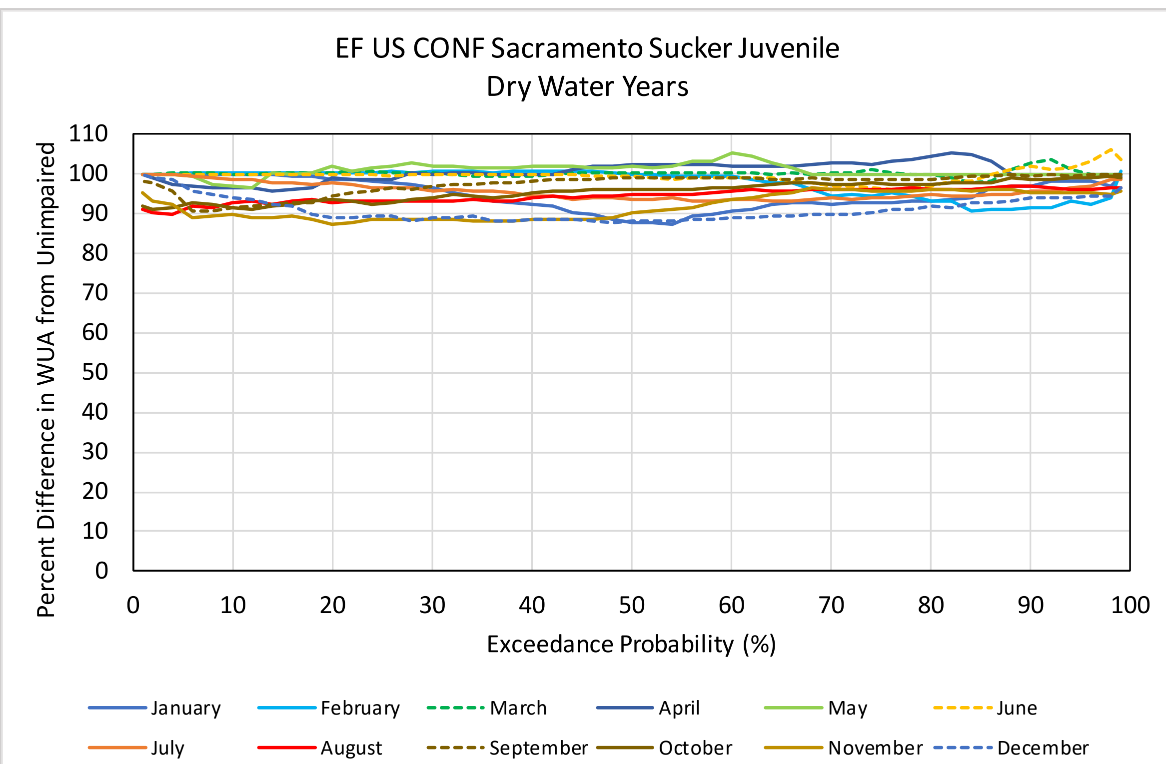


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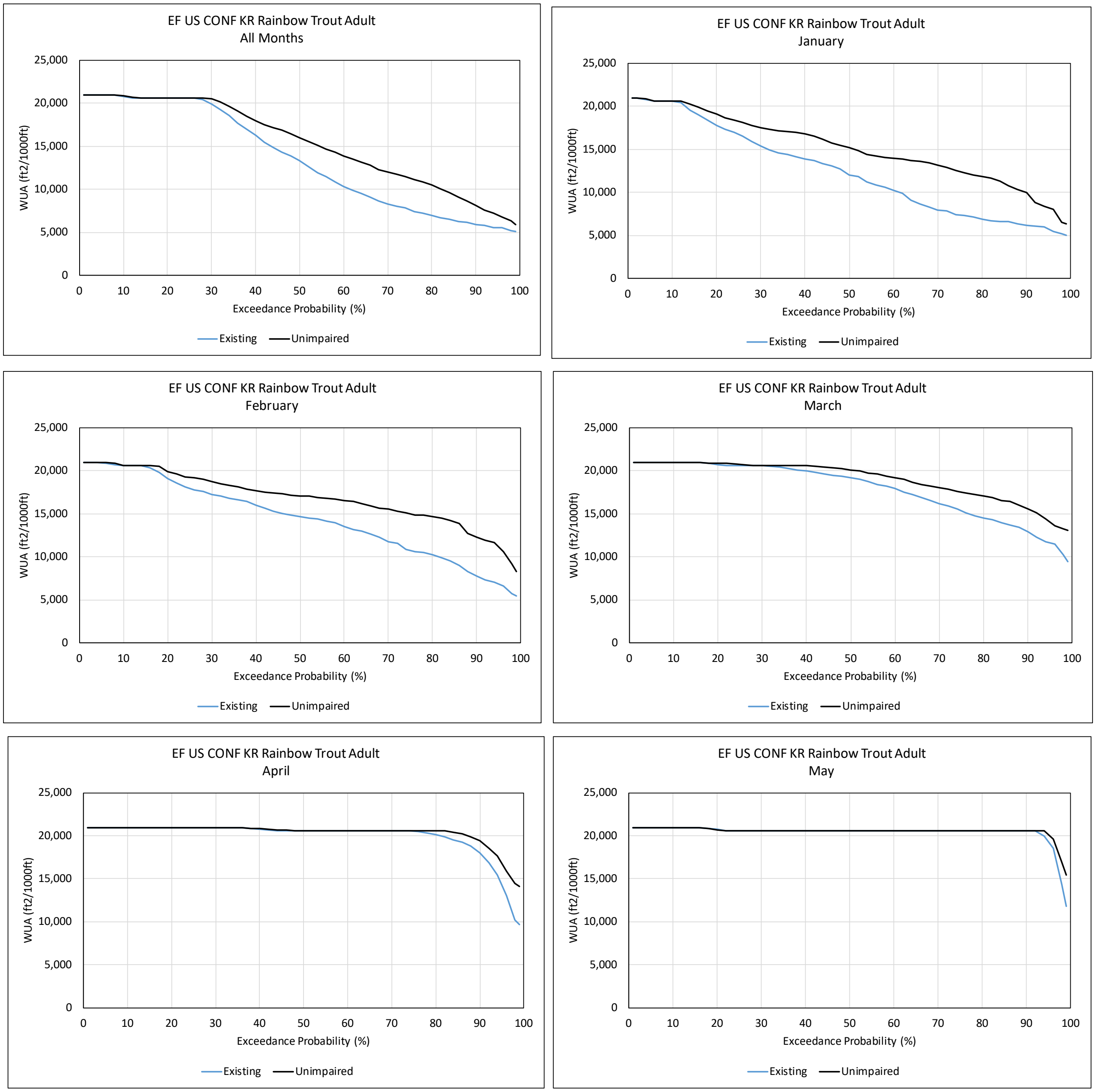
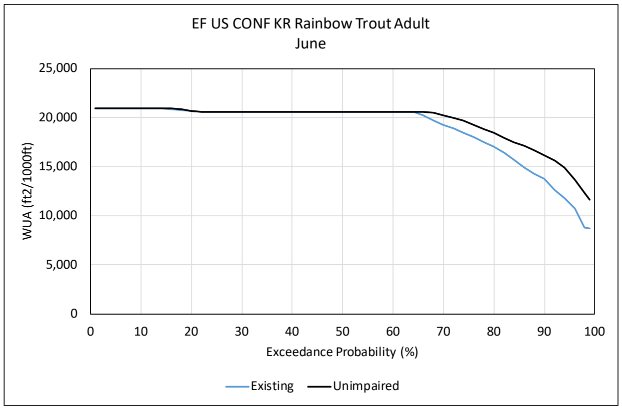
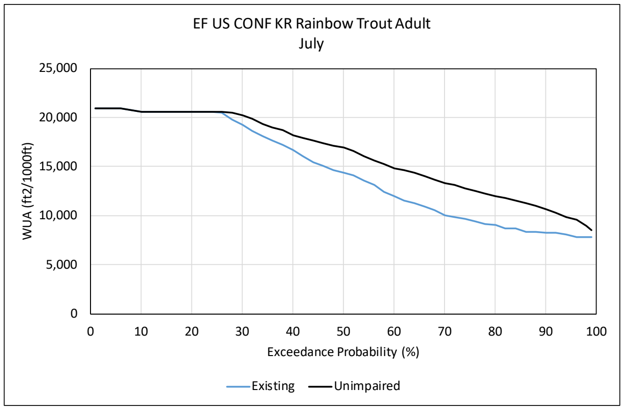
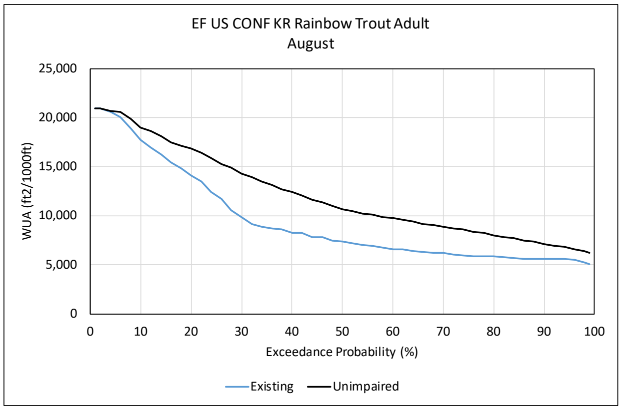
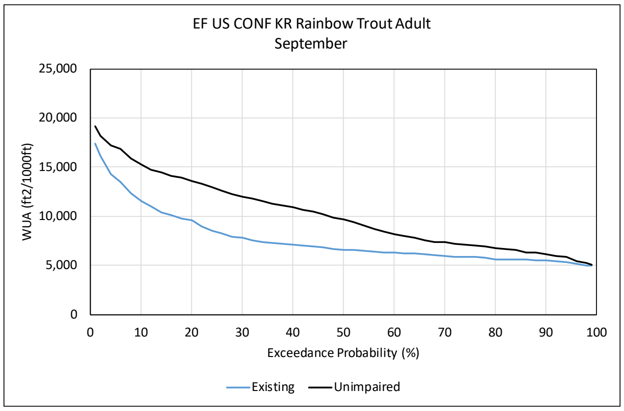
Figure G-57. East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Adult Habitat Exceedance Plots for All Water Years and each Month Separately.

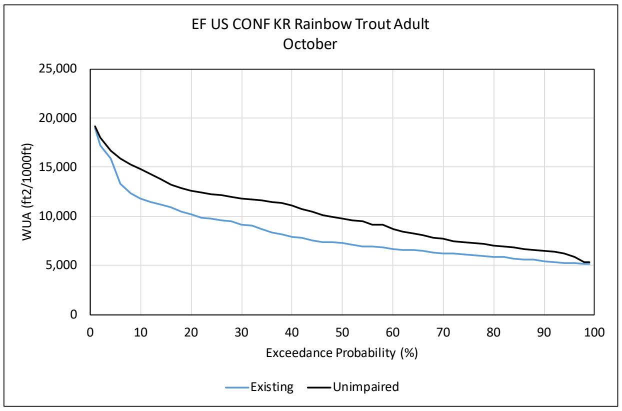


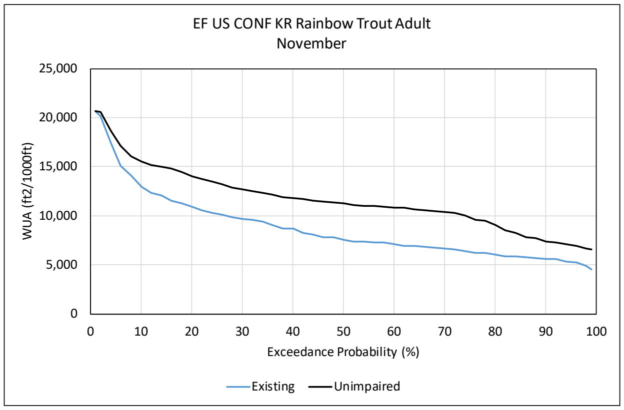

EF US CONF KR Rainbow Trout Adult
June
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Adult
July
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Adult
August
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Adult
September
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Adult
October
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Adult
November
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

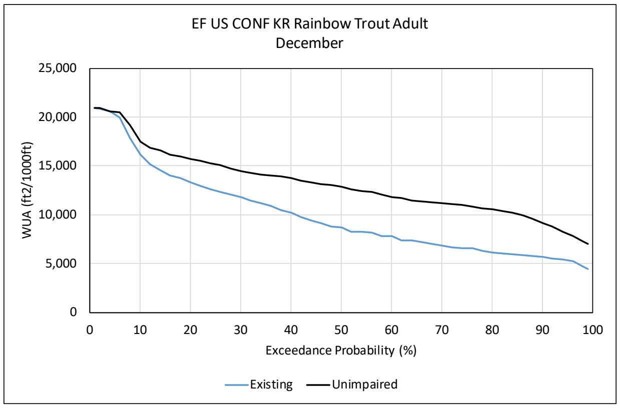
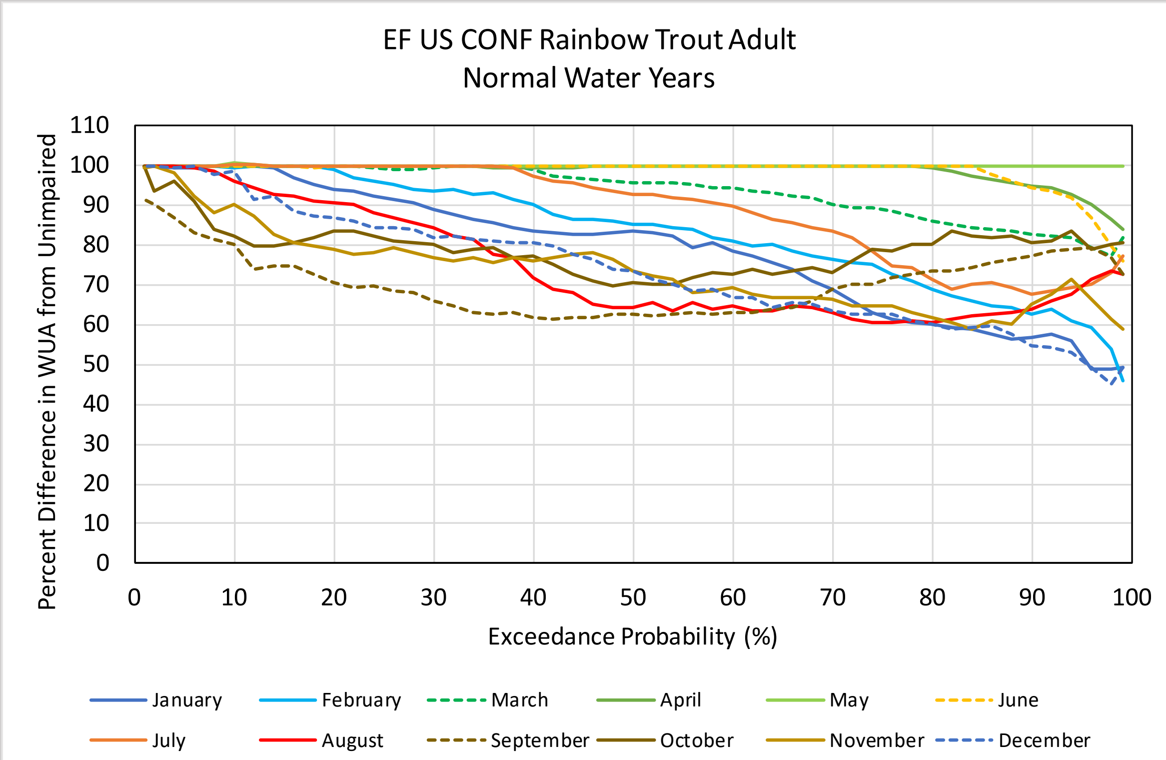

EF US CONF KR Rainbow Trout Adult
December
WUA (ft2/1000ft)
Exceedance Probability (%)
Existing
Unimpaired

Figure G-58. **East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Adult Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**



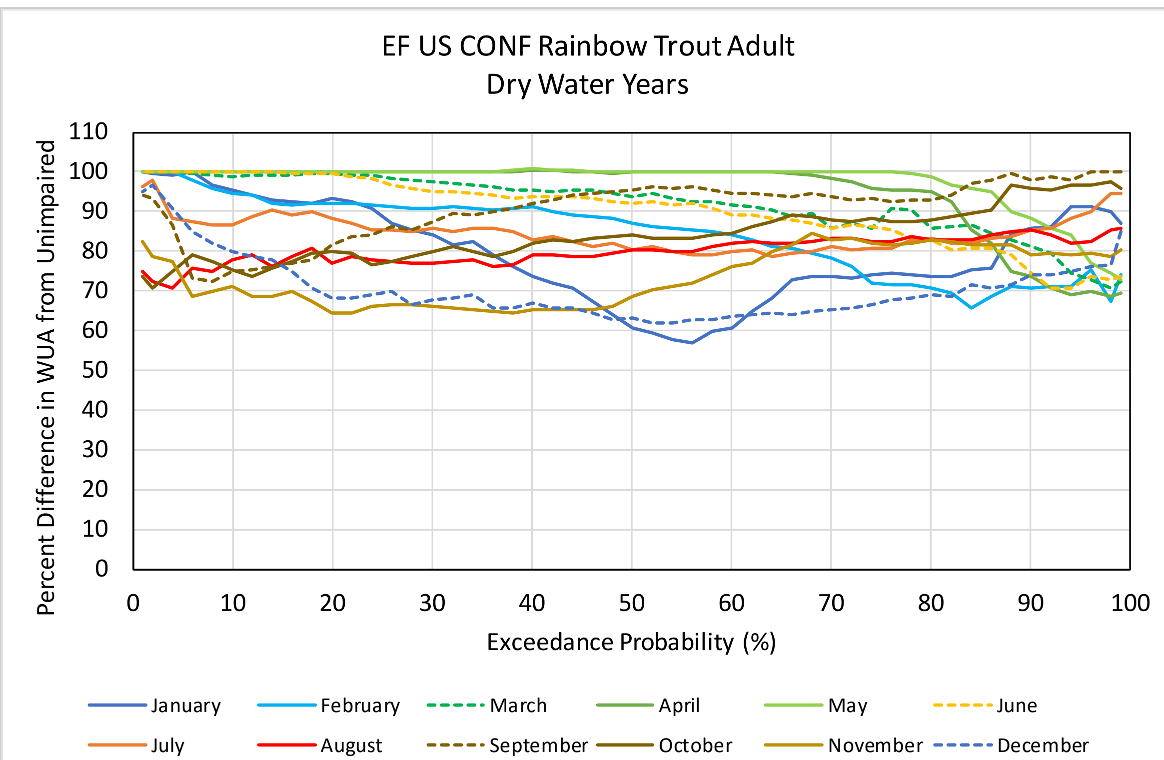


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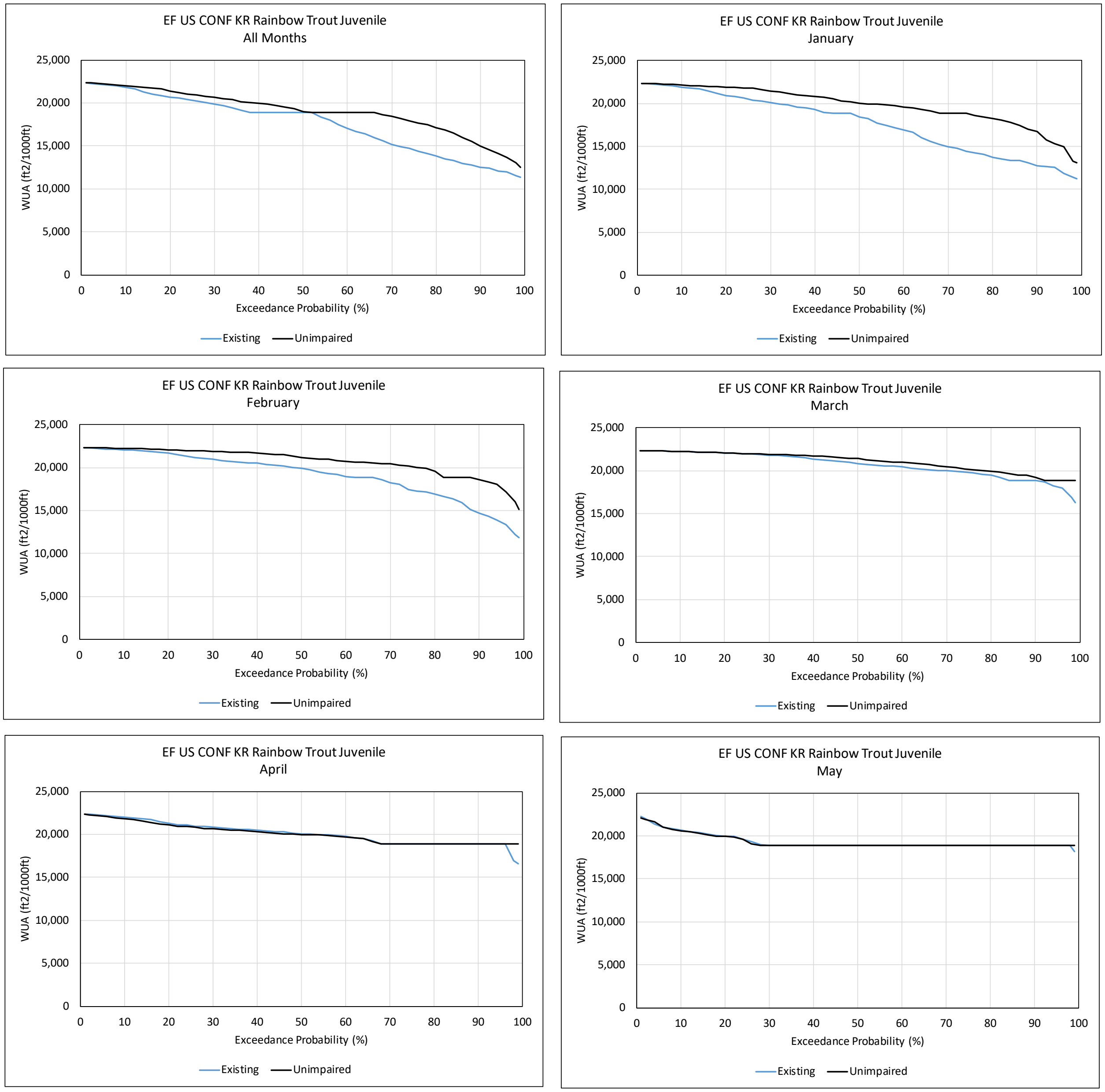
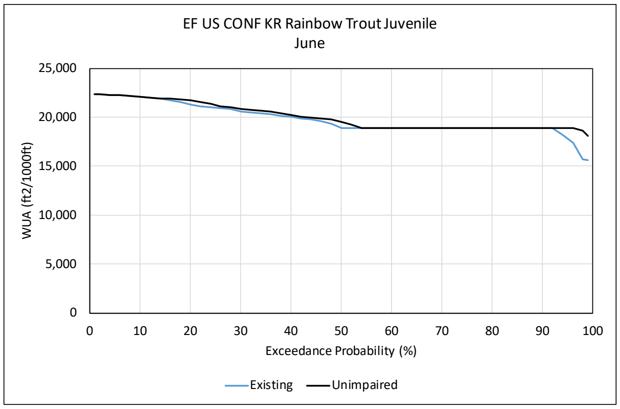
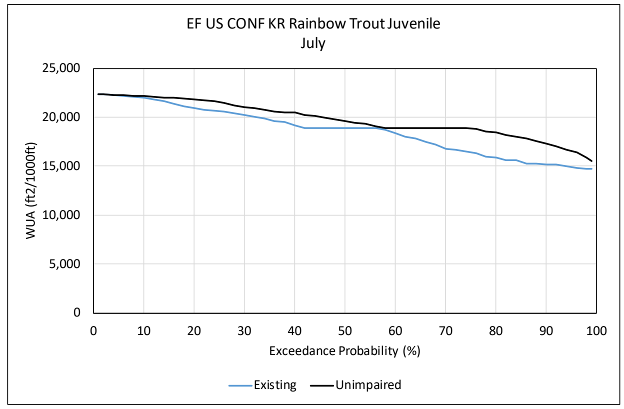
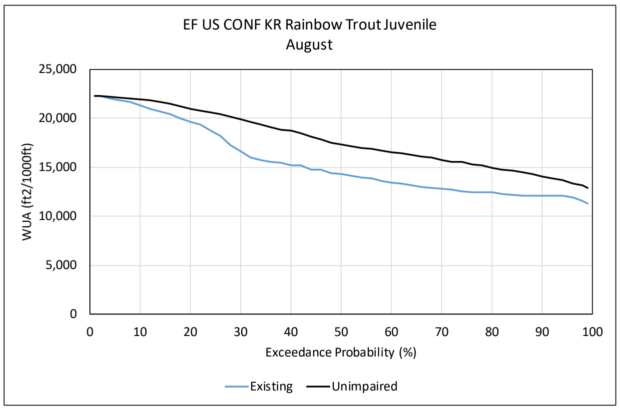
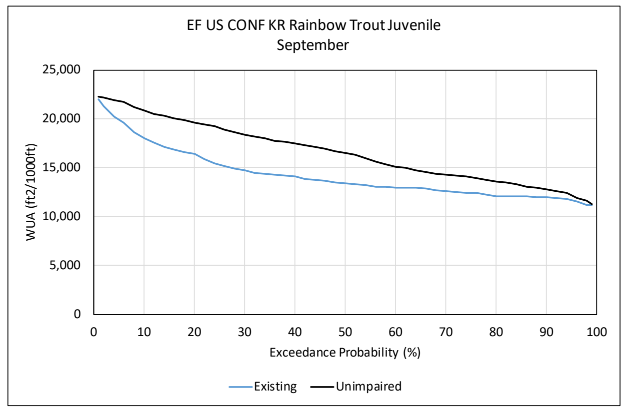
Figure G-59. East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Juvenile Habitat Exceedance Plots for All Water Years and each Month Separately.

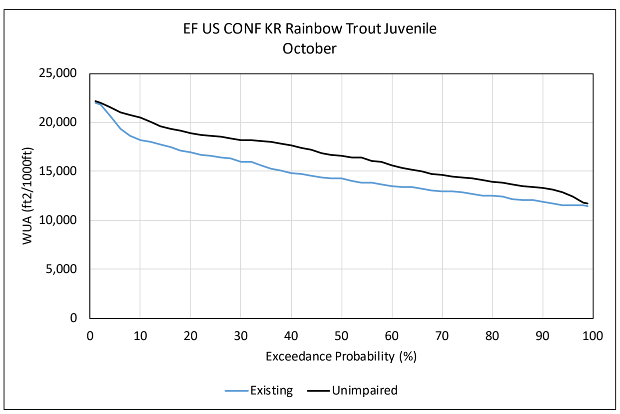


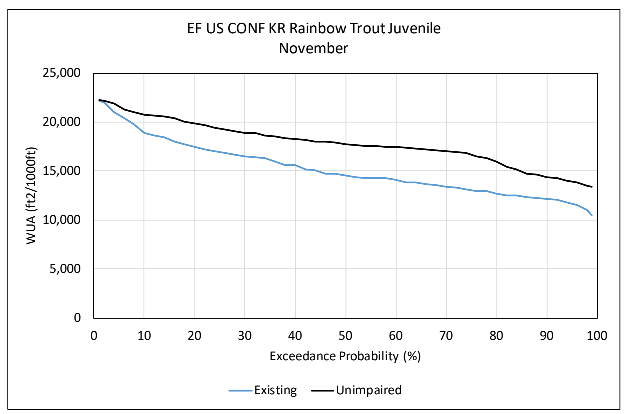

EF US CONF KR Rainbow Trout Juvenile
June
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Juvenile
July
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Juvenile
August
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Juvenile
September
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Juvenile
October
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired


EF US CONF KR Rainbow Trout Juvenile
November
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

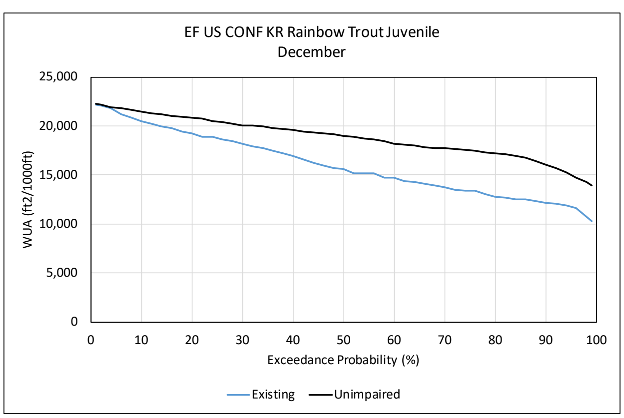
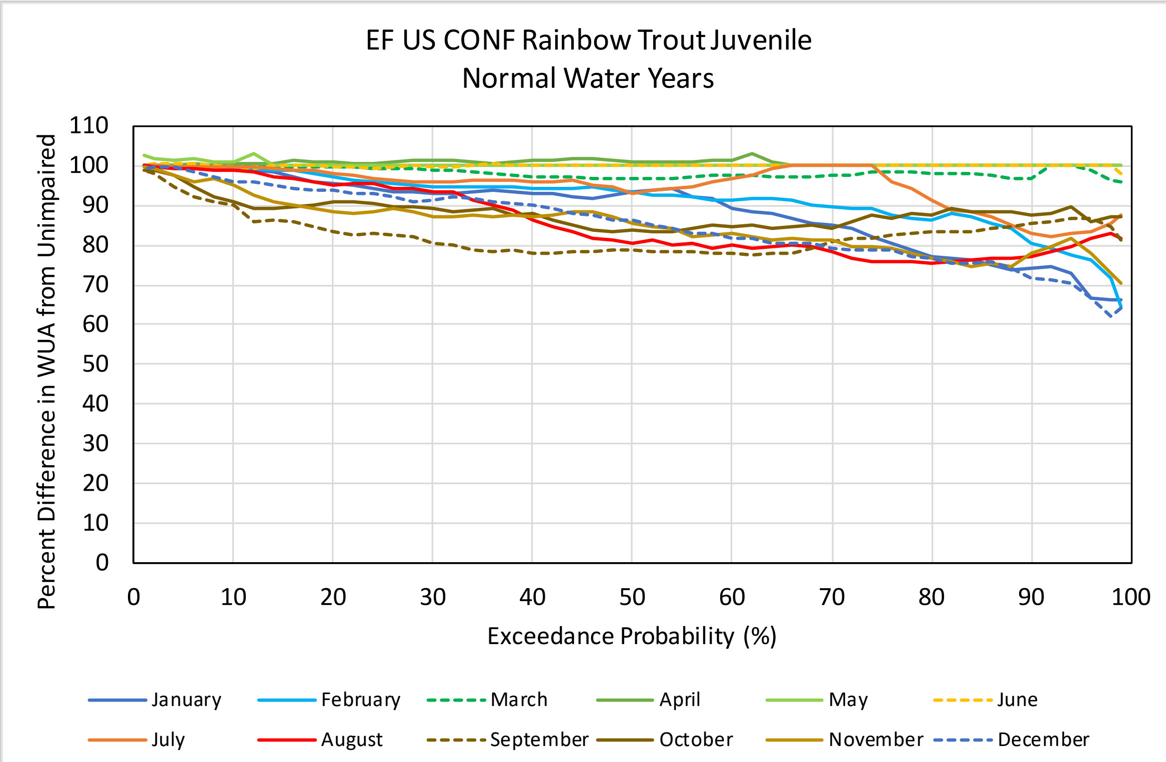

EF US CONF KR Rainbow Trout Juvenile
December
25,000
20,000
15,000
10,000
5,000
0
WUA (ft2/1000ft)
0 10 20 30 40 50 60 70 80 90 100
Exceedance Probability (%)
Existing
Unimpaired

Figure G-60. East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Juvenile Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.



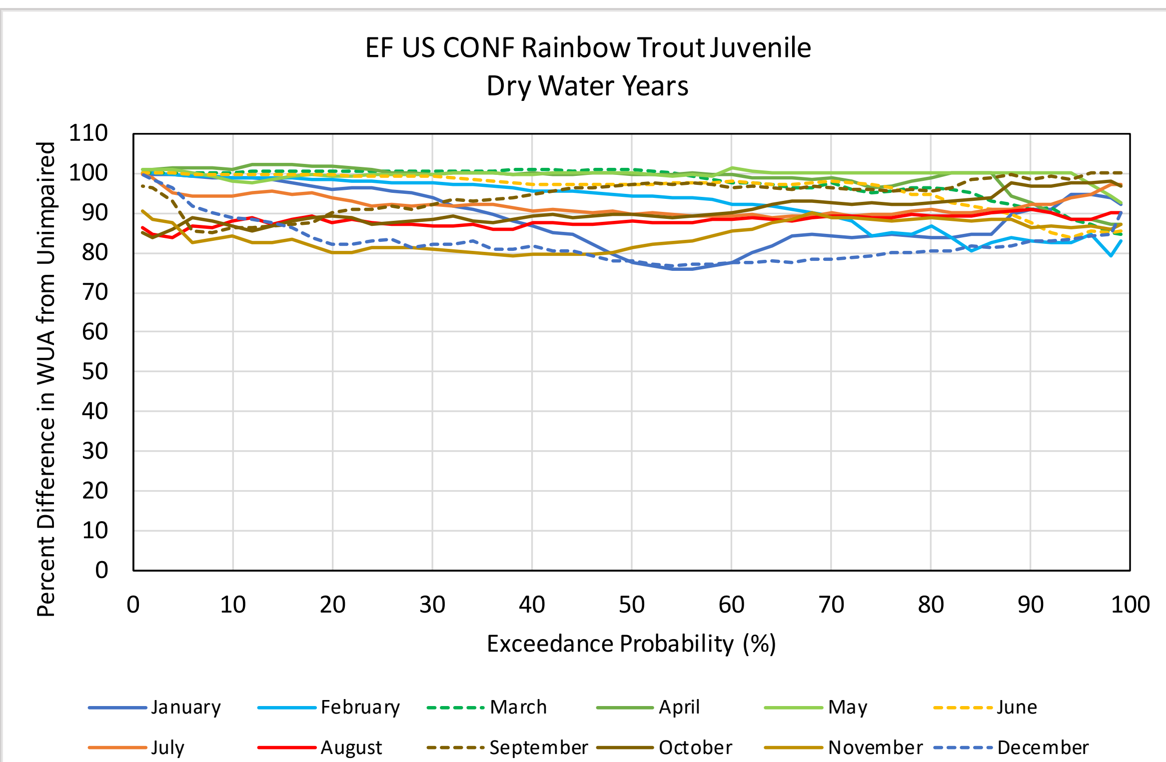


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Figure G-61. East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Fry Habitat Exceedance Plots for All Water Years May through August.

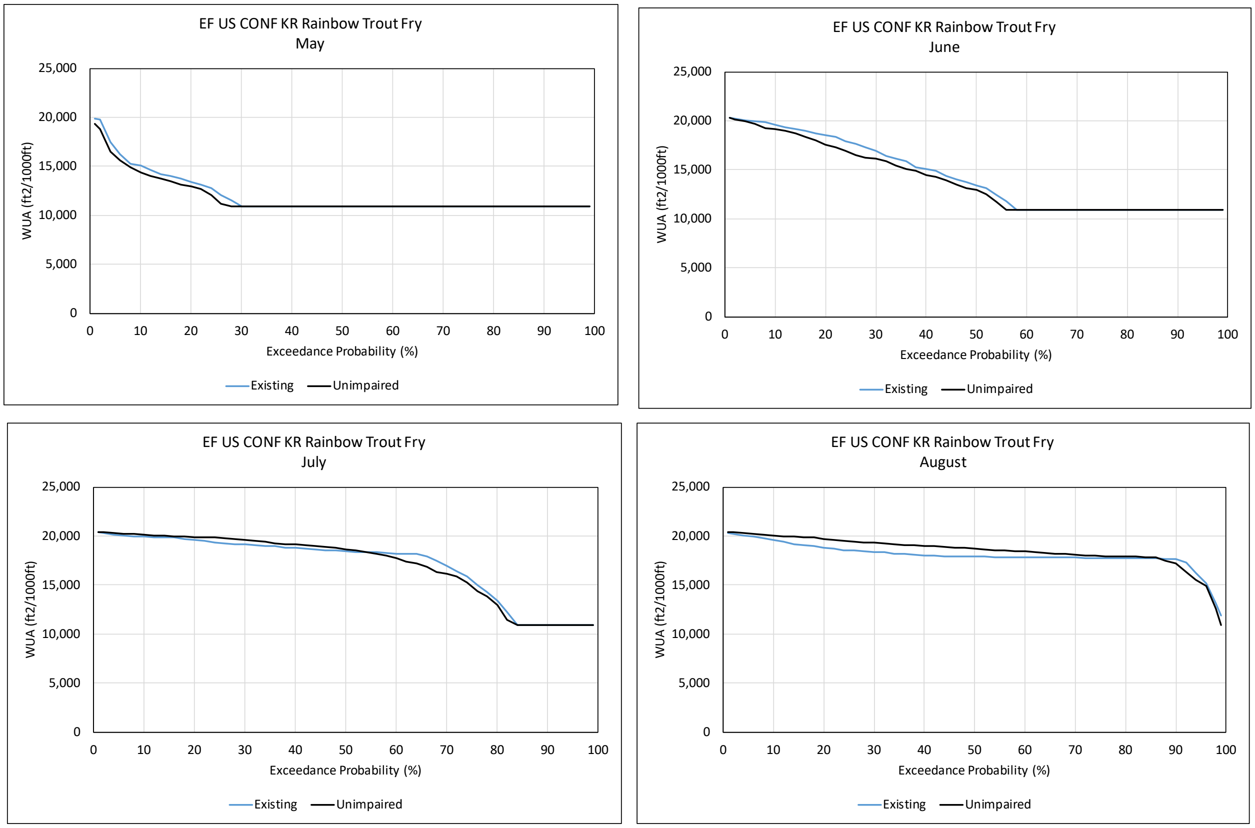

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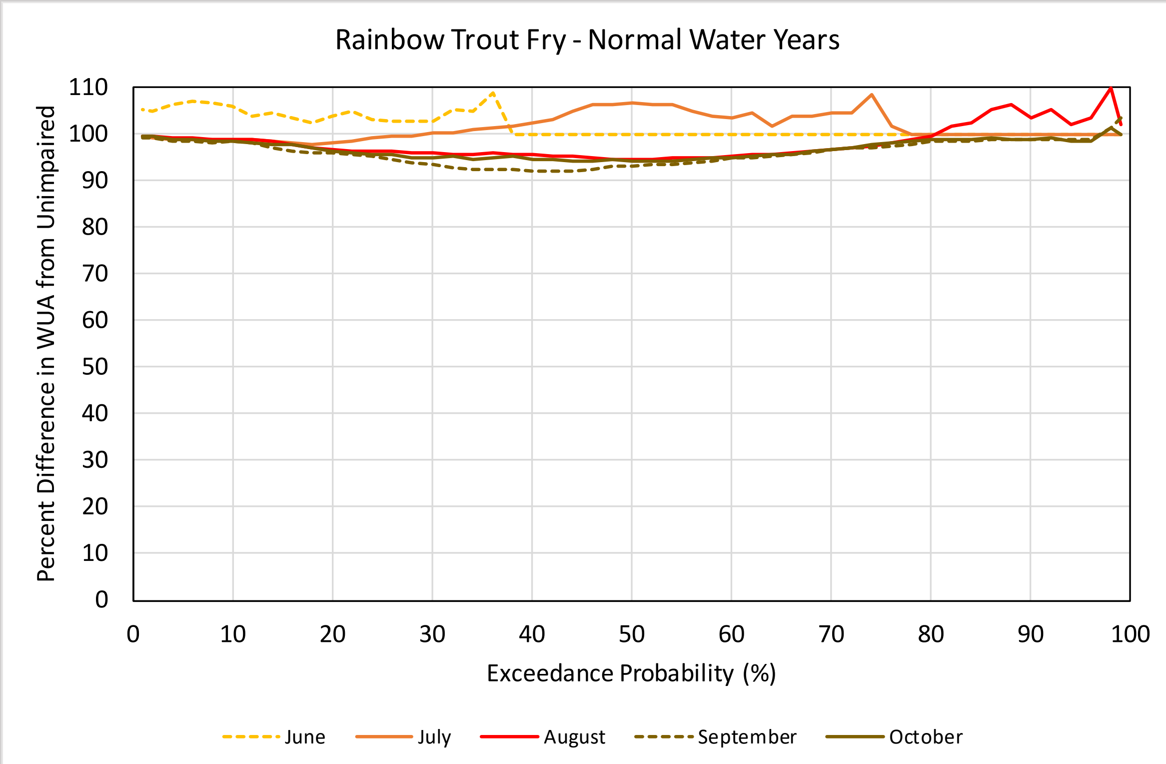
Figure G-62. **East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Fry Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**



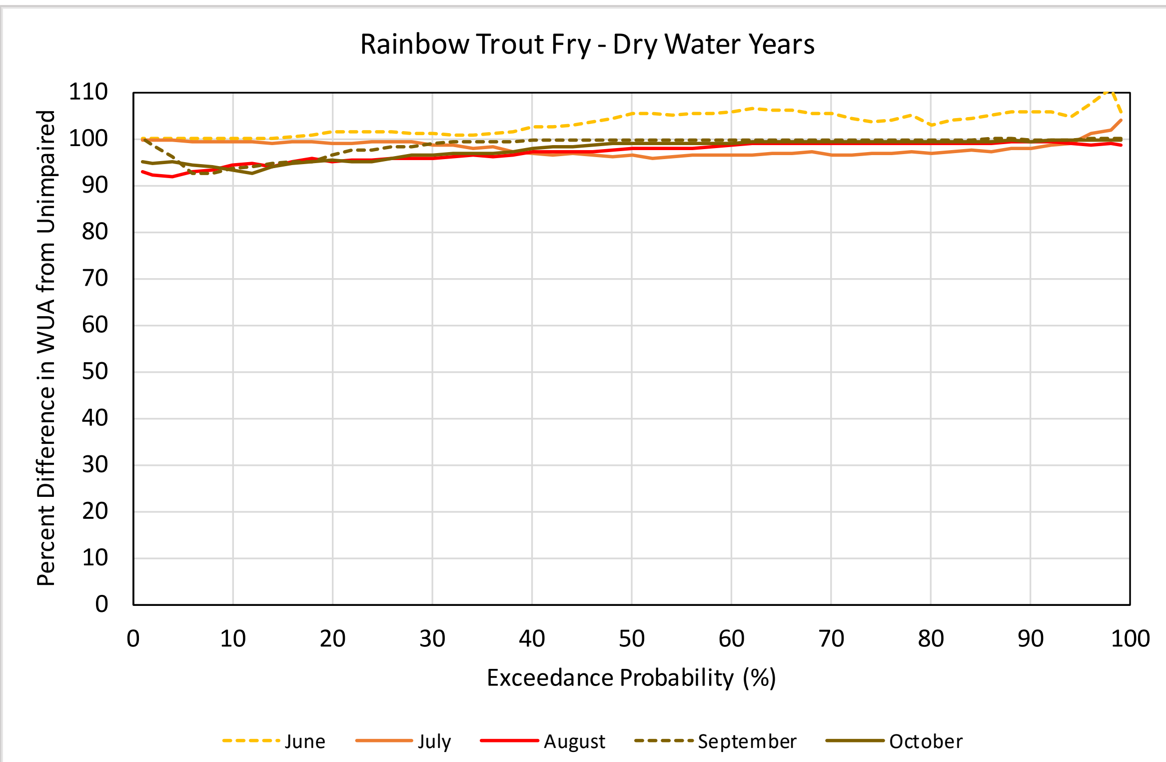


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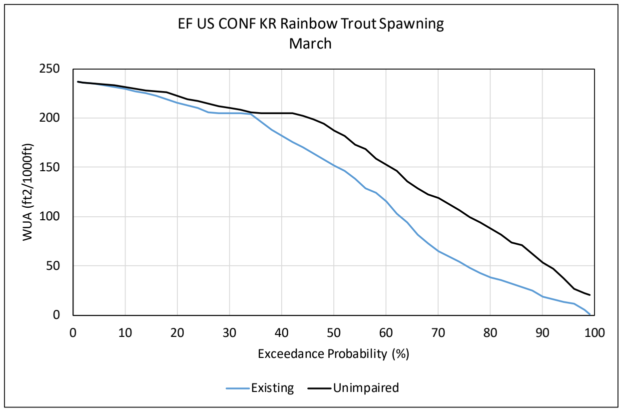
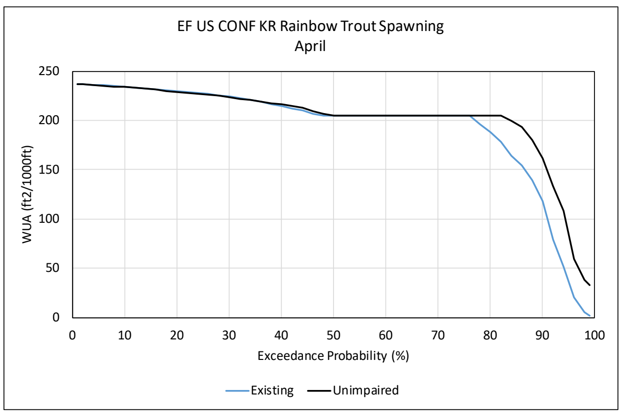
Figure G-63. East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Spawning Habitat Exceedance Plots for All Water Years March through May.





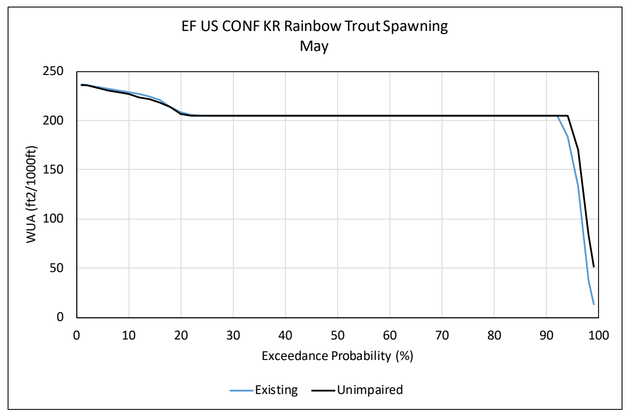


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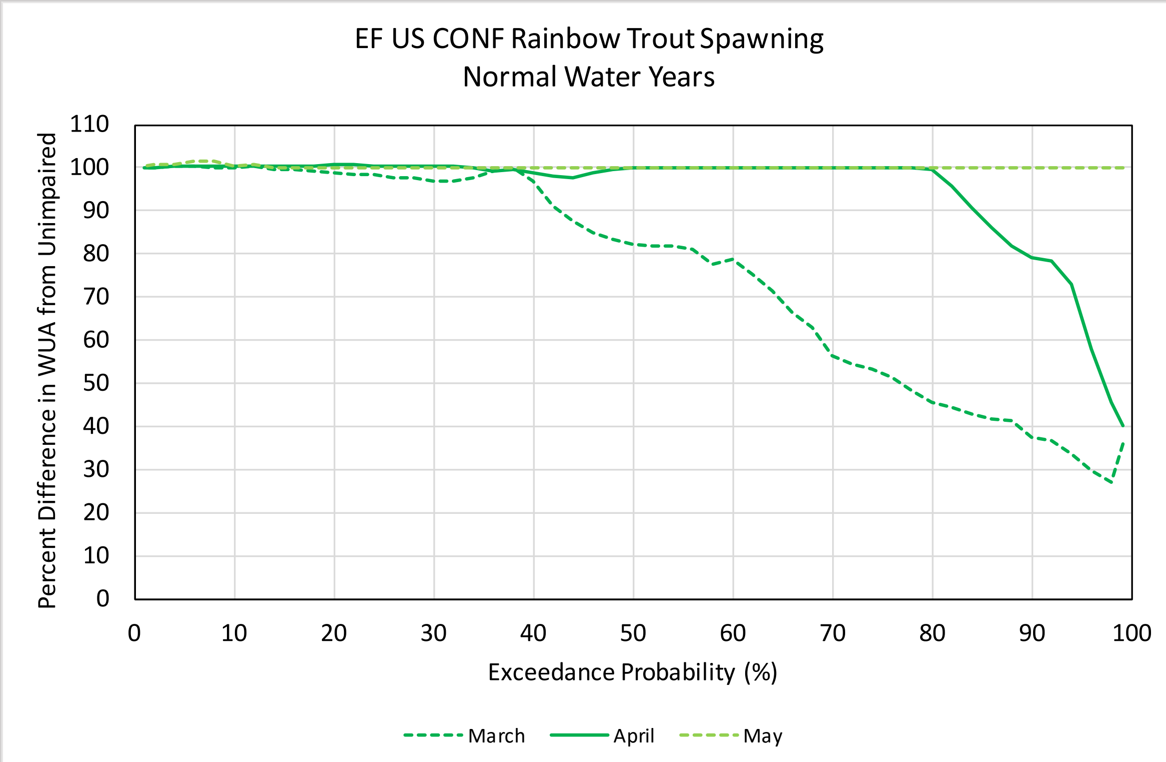
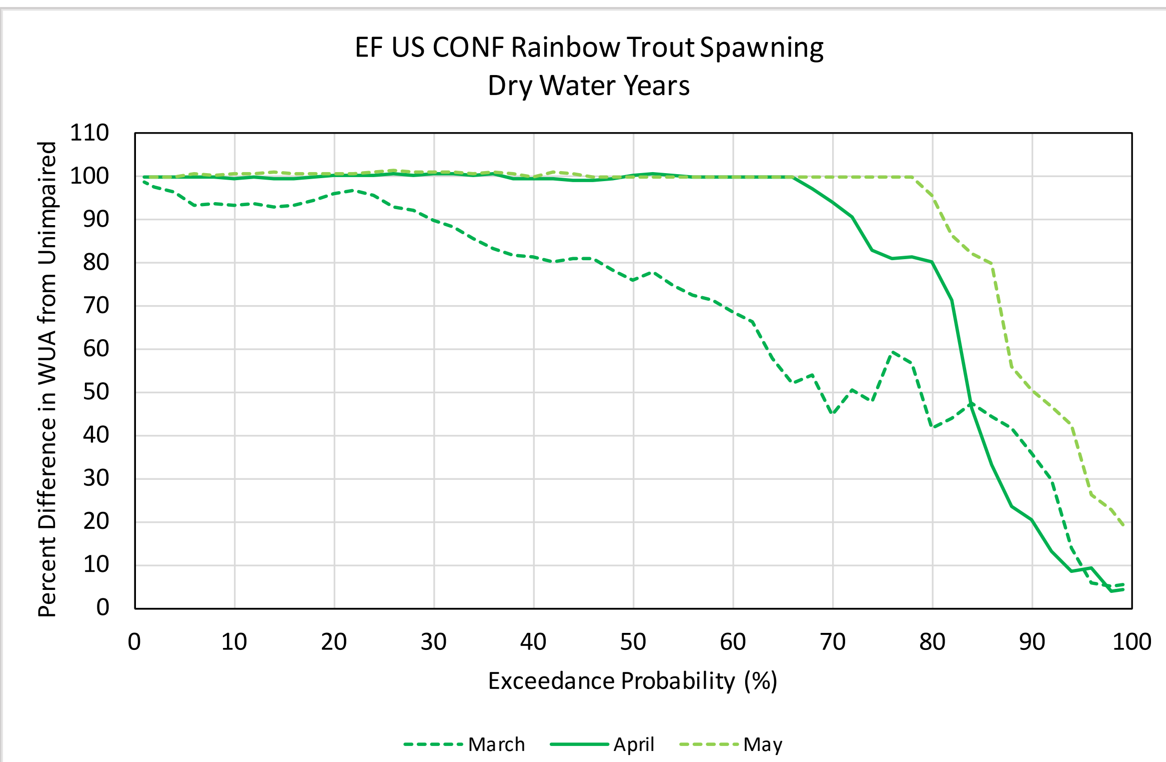
Figure G-64. **East Fork Kaweah River Upstream of the Confluence with Kaweah River Rainbow Trout Spawning Habitat Percent of Unimpaired Exceedance Plots for Normal and Dry Water Years.**





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Kaweah Project, FERC Project No. 298

AQ 2 – Fish Population
Final Technical Study Report

December 2019

An EDISON INTERNATIONAL® Company

Southern California Edison Company
Regulatory Support Services
1515 Walnut Grove Avenue, Rosemead, CA 91770

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List of Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
CDFW	California Department of Fish and Wildlife
FERC	Federal Energy Regulatory Commission
ft	feet
g	grams
lbs	pounds
lbs/acre	pounds per acre
lbs/mile	pounds per mile
m	meters
mm	millimeters
msl	mean sea level
PCWA	Placer County Water Agency
PSP	Proposed Study Plan
QSS	quantitative study sites
RSP	Revised Study Plan
SCE	Southern California Edison Company
SNP	Sequoia National Park
TL	total length
TSP	Technical Study Plan
TSR	Technical Study Report
YOY	young-of-year

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1 INTRODUCTION

This Technical Study Report (TSR) describes the data and findings developed by Southern California Edison Company (SCE) in association with implementation of the AQ 2 – Fish Population Technical Study Plan (AQ 2 – TSP) for the Kaweah Project (Project). The AQ 2 – TSP was included in SCE's Revised Study Plan (RSP)[1] (SCE 2017a) and was approved by the Federal Energy Regulatory Commission (FERC) on October 24, 2017, as part of its Study Plan Determination for the Project (FERC 2017). Specifically, this report provides a description of the methods and results of AQ 2 –TSP completed in 2018.

2 STUDY OBJECTIVES

The AQ 2 – TSP included two study objectives, as follows:

- Document fish species composition, distribution, and abundance in the bypass river reaches[2].
- Characterize fish growth, condition factor, and population age structure in the bypass river reaches.

3 EXTENT OF STUDY AREA

The study area includes the bypass river reaches associated with the Project and the comparison river reaches upstream or downstream of the Project. Specific study areas are identified in Table AQ 2-1 and Map AQ 2-1. Some portions of the East Fork Kaweah River downstream of Kaweah No. 1 Diversion were inaccessible due to the rugged terrain (see Map AQ 2-1). Field data were only collected in portions of the river that were accessible.

It should be noted that the majority of lands along the bypass reaches are privately owned and outside the FERC Project boundary. For the purposes of this fish population study, SCE took the following steps to obtain approval to conduct field studies on private property:

- SCE provided notification to landowners about Project relicensing and requested authorization to enter property to conduct the field studies.
- If authorization was obtained, SCE completed field studies at the original location as described in the TSP, otherwise, the nearest location within the reach where permission was available was sampled.

4 STUDY APPROACH

4.1 <u>Study Sites</u>

The general locations of study sites for developing fish standing crop estimates (fish per mile [fish/mile] and/or pounds per acre [lbs/acre]) are shown in Table AQ 2-1 and Map AQ 2-1. River sampling sites (electrofishing and/or snorkeling) were generally 100 meters (m) long or longer (one site was 83 m). Some of the larger river sites (e.g., Kaweah River) required sampling sites up to 260 m to include multiple habitat types (see Appendix A). The specific locations of the sampling sites were determined in the field in coordination with the interested resource agencies. The AQ 1 – Instream Flow TSP microhabitat mapping was used to identify representative reach sampling sites with mesohabitat types in similar proportion to the larger geomorphic river segments. Where possible, sampling sites were chosen that

1 SCE filed a Proposed Study Plan (PSP) on May 24, 2017 (SCE 2017b). Three comments were filed on the PSP; however, they did not result in revisions to any of the study plans. Therefore, SCE filed a Revised Study Plan (RSP) on September 19, 2017, which stated that the PSP, without revision, constituted its RSP. FERC subsequently issued a Study Plan Determination on October 24, 2017, approving all study plans for the Kaweah Project.

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 that reach. Typically the diverted water re-enters the river through a powerhouse at the downstream end of the bypass reach.

overlapped with the instream flow study sites (see the AQ 1 – Instream Flow TSP). Sampling sites were chosen far enough upstream or downstream of access locations to minimize the effects of fishing on fish population results, where applicable. Where comparisons were to be made between locations upstream and downstream of Project facilities, comparison study sites were, to the extent possible, located in sections of river with similar habitat types and similar sampling methods were used. Table AQ 2-2 shows the specific site locations, lengths, and sampling methods, which were selected in consultation with interested resource agencies.

4.2 Fish Sampling

The study sites were sampled to identify the spatial distribution and abundance of fish species. 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 (Table AQ 2-2). Multi-pass electrofishing (e.g., Reynolds 1996; Van Deventer and Platts 1989; Rexstad and Burnham 1992) was used to sample and estimate fish populations in shallow stream habitats (<1.5 m) at each study site. The study sites were partitioned into mesohabitat types for sampling using block nets. Captured fish from each pass were kept in separate live wells or buckets. Fish were anesthetized (CO_2), enumerated, identified to species, and measured (fork length and weight), and scale samples were obtained. Fish were returned to the study site when the sampling was completed. Sampling protocols and field data forms were consistent with those in Flosi et al. 1998. The lengths and widths of the habitat units sampled were recorded to calculate fish abundance by length and area (density) of stream sampled. Very small, post-larval hardhead or Sacramento pikeminnow that could not be identified to species were recorded as unidentified juvenile mixed minnow.

Snorkeling (Dolloff et al. 1996) was used to assess fish populations in deep water habitats (≥ 1.5 m) at each representative reach study site (Table AQ 2-2). Snorkelers surveyed in lanes along the river and identified, counted, and estimated the length of each fish observed. Fish data was recorded by habitat unit type. Snorkeling protocols and field data forms were consistent with those in Flosi et al. 1998. Juvenile hardhead and Sacramento pikeminnow (less than approximately 3 inches) were recorded as a single category, unidentified juvenile mixed minnow, where identification was uncertain.

4.3 Special Purpose Qualitative Fry Emergence Sampling

Qualitative sampling using single pass electrofishing and/or seining gear was also used to collect seasonal information on emergence of fry (i.e., to identify timing of spawning and early fry rearing). 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). Three samplings were initially planned to be equally spaced through early May to early July time period; however, due to permitting delays the first sampling event could not be conducted and sampling was only conducted in June and July 2018.

4.4 Data Reporting

The following analyses were completed:

- Fish standing crop was estimated for each species at each study site in terms of density (e.g., fish/mile and fish/acre) and biomass (lbs/mile and lbs/acre. For each mesohabitat sampled in each study reach, the number and weight of fish was divided by mesohabitat length to obtain fish/mile and lbs/mile and by mesohabitat area to obtain fish/acre and lbs/acre. The fish density and biomass for each mesohabitat type sampled within each study reach was averaged and then multiplied by (weighted by) the proportion of the mesohabitat type in the study reach. The weighted mesohabitat densities were then summed to obtain fish density and biomass for each study reach. Because cascade habitat was not safe to sample, cascade habitat was excluded from the analysis and fish density and biomass were reported excluding cascades.

- Fish standing crop estimates for the Project were compared to similar datasets from other watersheds/studies.
- A distribution map for each species in the study area was created using the quantitative abundance estimates and qualitative sampling data.
- A fish life stage periodicity chart (or life history chronology chart by month) for each species was created based on available literature, consultation with qualified fisheries biologists, and the fish population sampling data.
- Length frequency histograms of sampled fish data were generated to examine distribution modality and, in conjunction with scale data, to determine the age structure of fish populations.
- Fish growth and age data were summarized using length frequency and scale analysis. The scale analysis used the narrower growth rings (circuli) during the cold water season compared to other times of the year to identify the number of growth years (i.e., number of annuli).
- Fish condition was calculated using Fulton's condition factor (K) (ratio of body weight to body length). A formula attributed to Fulton (Nash et. al 2006) was used to calculate the condition factor of individual fish (Ricker 1975):

$$K = weight\ (g) \times 10^5 / (fork\ length\ [mm])^3$$

5 STUDY RESULTS

5.1 Fish Standing Crop Estimates

Sacramento sucker, Sacramento pikeminnow, and hardhead (including young-of-year [YOY] mixed minnows), in general, were the dominant fish species in the study reaches (Tables AQ 2-3 and AQ 2-4). 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 AQ 2-1 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 20–30°C (Celsius) (68–86°F [Fahrenheit]) during the summer months (Figure AQ 2-2).

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 AQ 2-4 and Figure AQ 2-3). 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 AQ 2-3).

Fish densities by mesohabitat type within each sample reach are shown in Table AQ 2-5 (fish/mile) and Table AQ 2-6 (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 AQ 2-7.

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 AQ 2-4). 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 AQ 2-4. 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.

5.2 Fish Distribution

The results from the quantitative and qualitative fish population sampling were used to characterize the distribution of each fish species observed in the Kaweah River and in the East Fork Kaweah River during 2018 sampling (Table AQ 2-8 and Table B-1 Appendix B). 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. Hardhead, a California Department of Fish and Wildlife (CDFW) Species of Special Concern (Moyle et al. 2015), 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. 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.

5.3 Life Stage Periodicity Chart

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 AQ 2-9).

5.4 Timing of Emergence

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 AQ 2-10. 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 2000). At water temperatures in the 15°C to 20°C (59°F to 68°F) range (observed water temperature in June-early July), growth of fry after emergence would be approximately 20 mm/month (calculated from observed fry growth rates in Hokanson et al. 1977). Back calculation, therefore indicates that rainbow trout observed in early July (40 to 50 mm), would have been emergence size (26 mm) in early to 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.

5.5 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 (Figure AQ 2-5). 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 AQ 2-5; Figure AQ 2-6; and Table B-2 Appendix B). The largest/oldest rainbow trout collected were 3^+ years old (approximately 200 mm) (Figure AQ 2-5). Length frequency histograms for rainbow trout at each sampling site where they were observed are provided in Appendix C. A length versus weight relationship for rainbow trout is also provided in Figure AQ 2-7. 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 AQ 2-5).

5.6 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 vicinity was 1.17 (Table AQ 2-10). 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 AQ 2-11. 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 AQ 2-10. Reference data for the condition factors for these species were not available.

5.7 Electronic Database

An electronic database (Excel spreadsheet) of all the fish sampling data (date, location, fish species, fish size, and fish sampling techniques) was developed and provided on CD accompanying this report.

6 LITERATURE CITED

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

Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater Observation. Pages 533-554 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

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

FERC (Federal Energy Regulatory Commission). 2017. Study Plan Determination for the Kaweah Hydroelectric Project. October 24.

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Steam Restoration Manual, Third Edition. State of California, The Resources Agency, California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

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.

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.

Moyle, P.B. 2002. Inland fishes of California: Revised and Expanded. University of California Press, Ltd.

Moyle, P.B., R.M. Quiñones, J.V. Katz, and J. Weaver. 2015. Fish Species of Special Concern in California. Sacramento: California Department of Fish and Wildlife. www.wildlife.ca.gov

Nash, R.D.M., A.H. Valencia, and A.J. Geffen. 2006. The Origin of Fulton's Condition Factor—Setting the Record Straight. Fisheries. Vol 31 No 5. May 2006.

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).

Reclamation (US 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.

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.

Rexstad, E., and K. Burnham. 1992. User's Guide for Interactive Program CAPTURE. Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, Fort Collins, Colorado.

Reynolds, J.B. 1996. Electrofishing. Pages 83-120 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada 191:1-382.

SCE (Southern California Edison Company). 2017a. Kaweah Project, Revised Study Plan. Filed with FERC on September 19.

SCE. 2017b. Kaweah Project, Proposed Study Plan. Filed with FERC on May 24.

Van Deventer, J.S., and W.S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data-User's guide for MicroFish 3.0. U.S. Department of Agriculture, Forest Service. Intermountain Research Station, General Technical Report INT-254.

TABLES

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Table AQ 2-1. Fish Population River Sampling Reaches.

Study Reach	Site ID	Bypass Reaches	Comparison Reaches (upstream or downstream of the Project)	Number of Fish Population Sampling Sites
Kaweah River				
Kaweah River Upstream of Kaweah No. 3 Powerhouse	US PH3		X	1
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence	DS PH3	X		1
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse	US PH1	X		1
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse	US PH2	X		1
Kaweah River Downstream of Kaweah No. 2 Powerhouse	DS PH2		X	1
East Fork Kaweah River				
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion	EF US K1 Div		X	1
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion	EF DS K1 Div	X		1
East Fork Kaweah River Upstream of Confluence with Kaweah River	EF US Confl	X		1

Table AQ 2-2. Fish Population River Sampling Locations.

Study River and Site ID	Sampling Location			Site Length (ft)	Sampling Dates	
	River Miles	Elevation (ft msl)	GPS at Downstream Starting Location		Electrofishing	Snorkeling
Kaweah River						
US PH3	9.1	1390	36.48756, -118.83513	671.4	10/18/2018	10/02/2018
DS PH3	8.6	1305	36.48091, -118.83754	434.8	10/06/2018	10/01/2018
US PH1	7.1	1135	36.47197, -118.85854	851.8	10/17/2018	10/01/2018 10/19/2018
US PH2	5.1	960	36.46070, -118.87954	782.8	10/08/2018	10/01/2018
DS PH2	4.7	915	36.46098, -118.88537	635.8	10/03/2018	10/01/2018 10/19/2018
East Fork Kaweah River						
EF US K1 Div	5.6	2820	36.44527, -118.78006	272.9	10/05/2018	10/02/2018
EF DS K1 Div	4.7	2580	36.45113, -118.79029	434.7	10/02/2018	10/02/2018
EF US Confl	0.1	1280	36.47896, -118.83752	574.9	10/09/2018	10/02/2018 10/19/2018

Table AQ 2-3. 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
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 AQ 2-4. 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 AQ 2-5. Density of Species, Fish per Mile, and Percent of Young-of-Year at Quantitative Sampling Sites.

Study Site[3]	Species[1] Density (fish per mile)							
	RBT (% YOY)[2]	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[4]	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[4]	176 (83%)	35	458	11158	1901	0	0	0
RUN[4]	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[4]	0	26	35	0	52	0	0	250
RUN[4]	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[4]	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[4]	0	187	0	0	150	0	0	212
RUN[4]	0	0	0	0	0	0	0	0
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[4]	0	0	0	0	2624	0	0	0

Study Site[3]	Species[1] Density (fish per mile)							
	RBT (% YOY)[2]	HH	SPM	MXD	SS	SC	CAR	SMB
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[4]	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[4]	0	47	47	2134	62	0	0	171
RUN[4]	0	0	0	1998	57	0	0	29

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

[2] YOY: young-of-year

[3] Sites: HGR = high gradient riffle, LGR = low gradient riffle, MCP = mid-channel pool

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

Table AQ 2-6. Density of Species, Fish per Acre, and Percent of Young-of-Year at Quantitative Sampling Sites.

Study Site[3]	Species[1] Density (fish per acre)							
	RBT (% YOY)[2]	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[4]	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[4]	31 (83%)	6	80	1959	334	0	0	0
RUN[4]	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[4]	0	3	5	0	7	0	0	34
RUN[4]	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[4]	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[4]	0	29	0	0	23	0	0	33
RUN[4]	0	0	0	0	0	0	0	0
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[4]	0	0	0	0	540	0	0	0

Study Site[3]	Species[1] Density (fish per acre)							
	RBT (% YOY)[2]	HH	SPM	MXD	SS	SC	CAR	SMB
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[4]	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[4]	0	7	7	327	10	0	0	26
RUN[4]	0	0	0	466	13	0	0	7

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

2 YOY: young-of-year

3 Sites: HGR = high gradient riffle, LGR = low gradient riffle, MCP = mid-channel pool

4 These sites were sampled by snorkeling. All other sites were sampled by electrofishing.

Table AQ 2-7. Rainbow Trout Biomass at Quantitative Sampling Sites.

Study Site[1]	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[2]	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[2]	0.2	0.04
RUN[2]	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[2]	0	0
RUN[2]	0	0
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)		
LGR	0	0
MCP[2]	0	0
Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)		
HGR	0	0
LGR	0	0
RUN	0	0
MCP[2]	0	0
RUN[2]	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[2]	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[2]	15.5	4.3

Study Site[1]	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[2]	0	0
RUN[2]	0	0

Notes:

[1] Sites: HGR = high gradient riffle, LGR = low gradient riffle, MCP = mid-channel pool

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

Table AQ 2-8. 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 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 10/06/2018	•	•	•	•	•		•	
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)	10/01/2018 10/17/2018 10/19/2018	•	•	•		•			•
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)	10/01/2018 10/08/2018		•	•	•	•	•		•
Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)	10/01/2018 10/03/2018 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 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 10/09/2018 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 AQ 2-9. Species and Life Stage Periodicities (gray shaded areas indicate periods when the life stage is assumed to be present).

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 AQ 2-10. Qualitative Fry Sampling in the Vicinity of the Diversions. Generally Sampling 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 AQ 2-11. Average Condition Factors, Standard Deviation, and Sample Size by Species Collected by Electrofishing in the Study Reaches 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 AQ 2-12. Rainbow Trout (RBT) Condition Factors by Site.

Study Reach	RBT		
	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

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FIGURES

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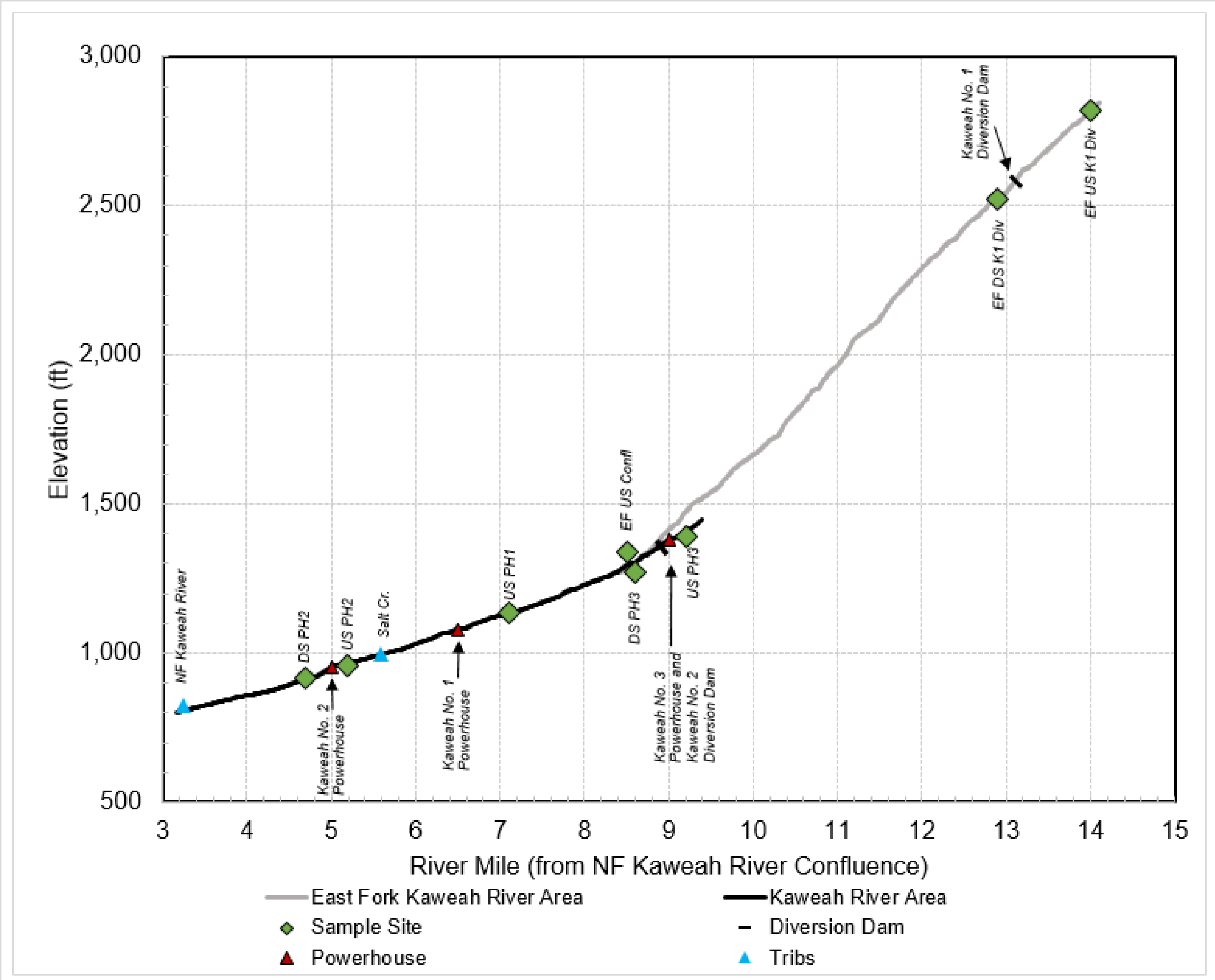

Figure AQ 2-1. Elevation of Fish Sampling Sites on the Kaweah River and East Fork Kaweah River.

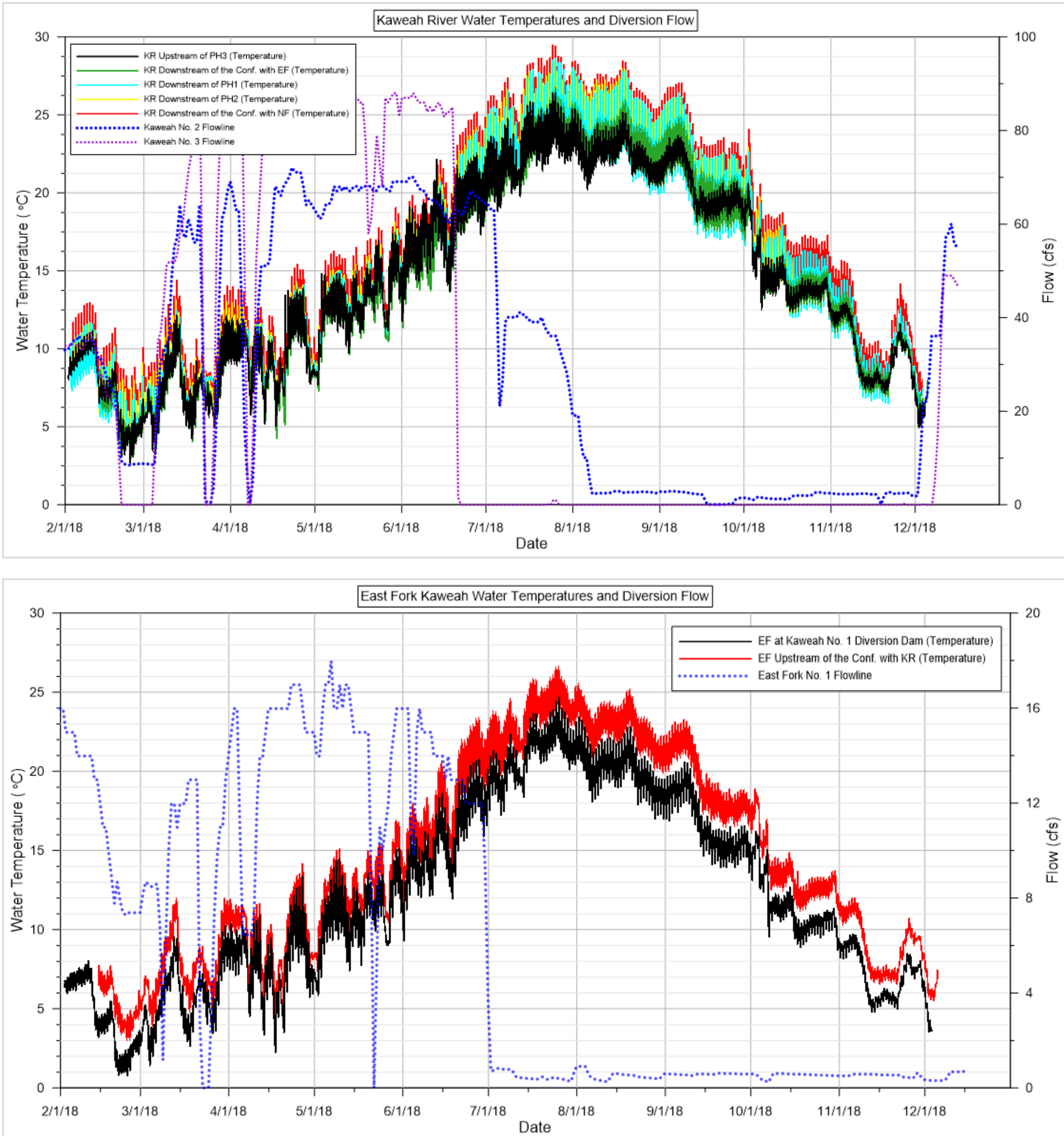

Figure AQ 2-2. Water Temperature (2018) in the Vicinity of the Kaweah River and East Fork Kaweah River Fish Sampling Sites.

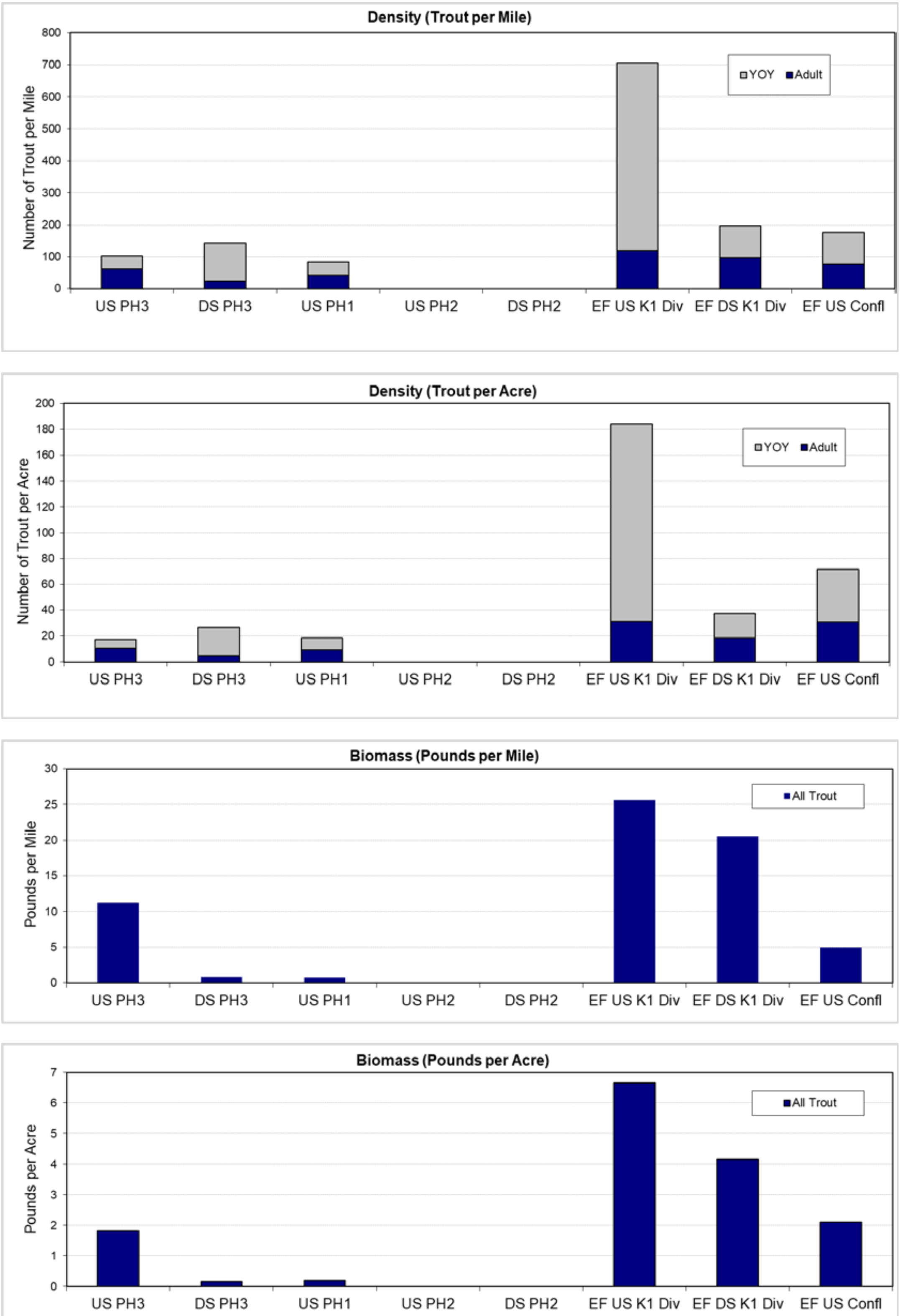

Figure AQ 2-3. The Density and Biomass of Rainbow Trout in Study Reaches.

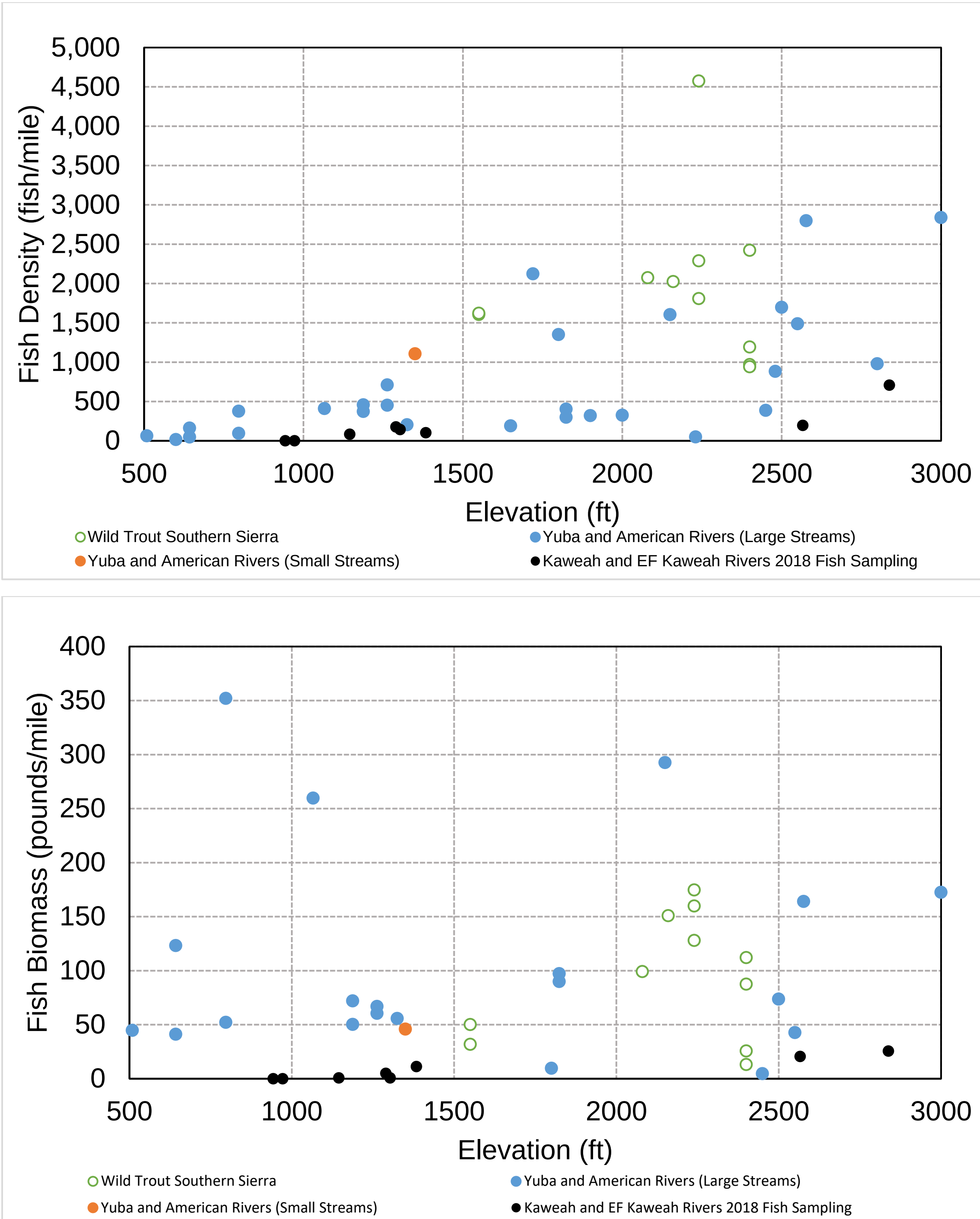

Figure AQ 2-4. Rainbow Trout - Elevation vs. Fish per Mile (Top) and Elevation vs. Pounds per Mile (Bottom).

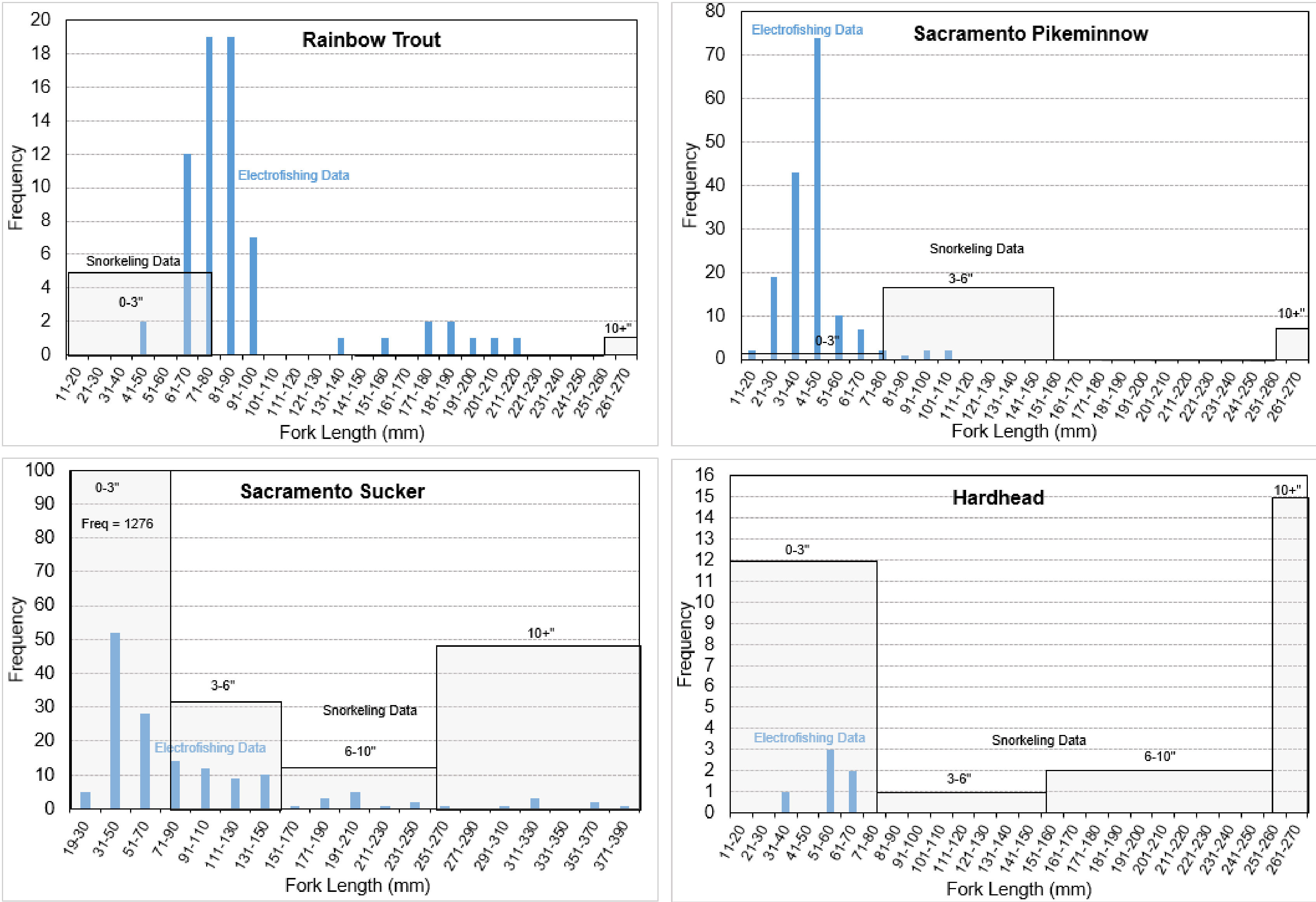

Figure AQ 2-5. Length Frequency Histograms for Each Species Captured Across All Sites.

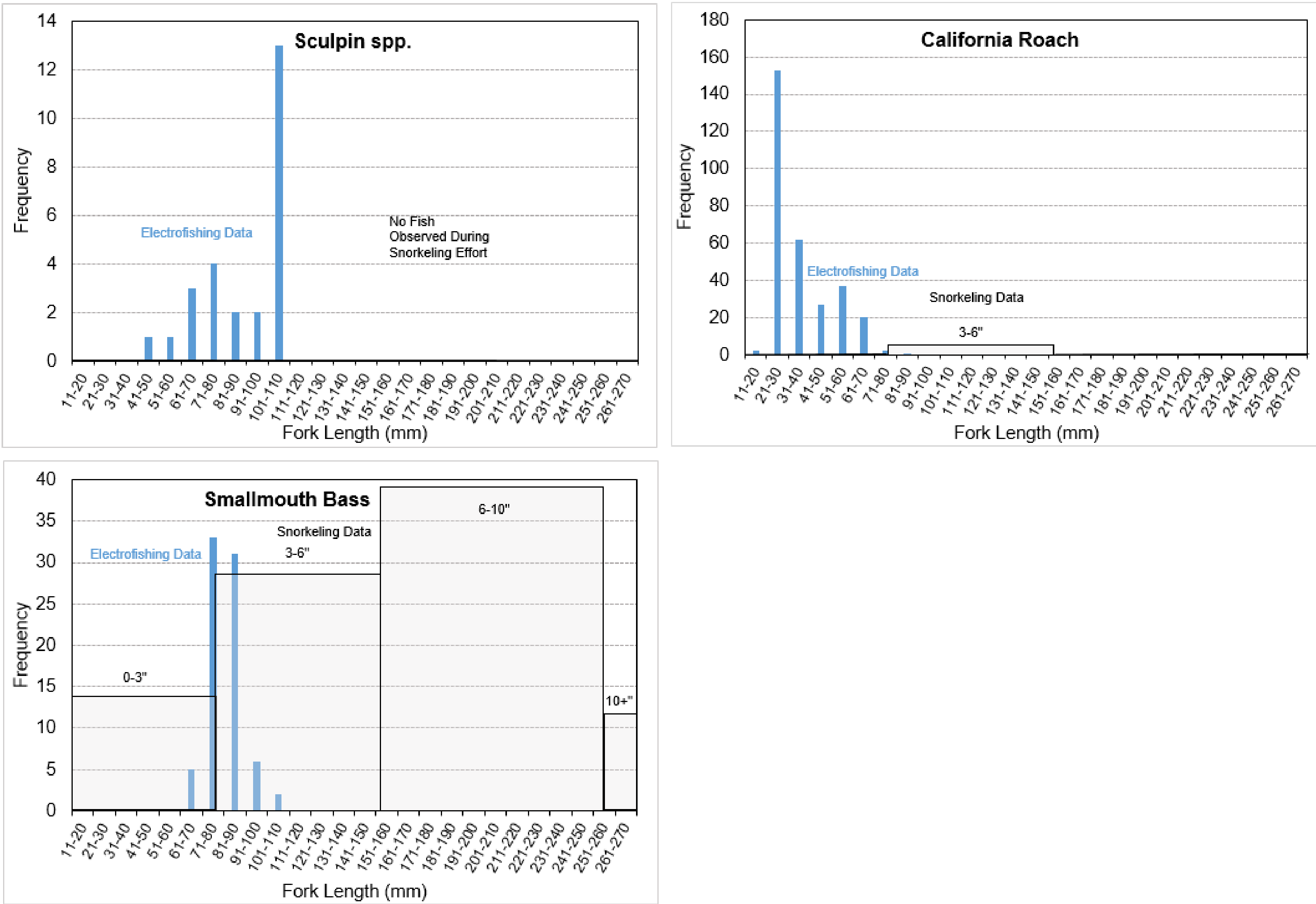

Figure AQ 2-5. Length Frequency Histograms for Each Species Captured Across All Sites (CONTINUED).

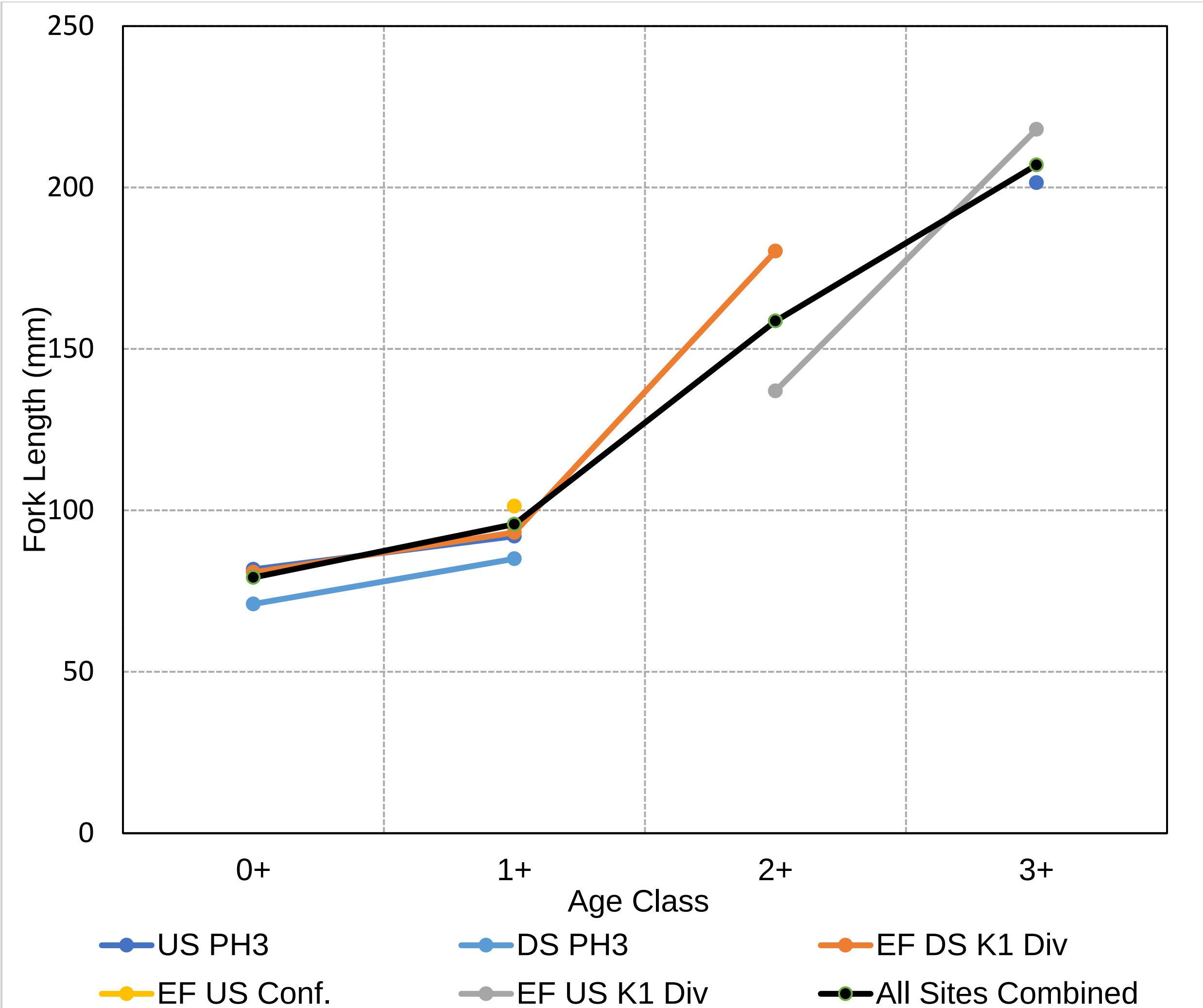

Figure AQ 2-6. 2018 Age and Growth Rates of Rainbow Trout for All Study Sites Combined Based on Scale Analysis (n=30).

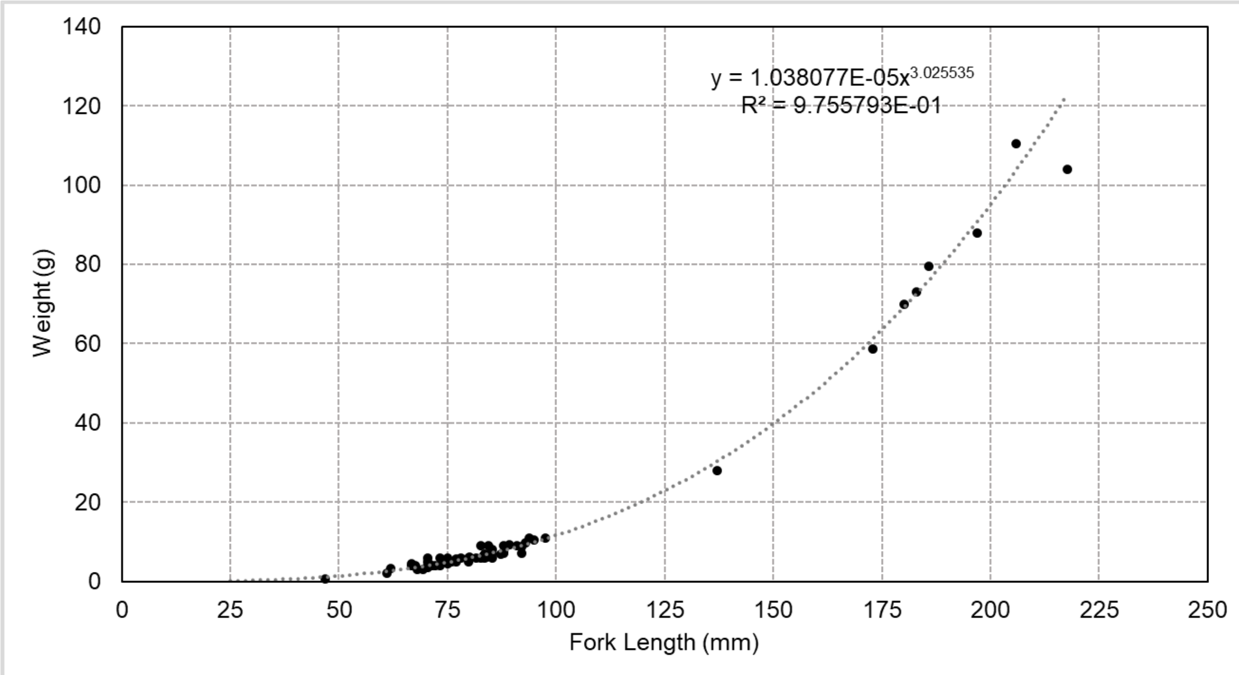

Figure AQ 2-7. Length and Weight Relationship for Rainbow Trout for All Study Sites Combined.

MAPS

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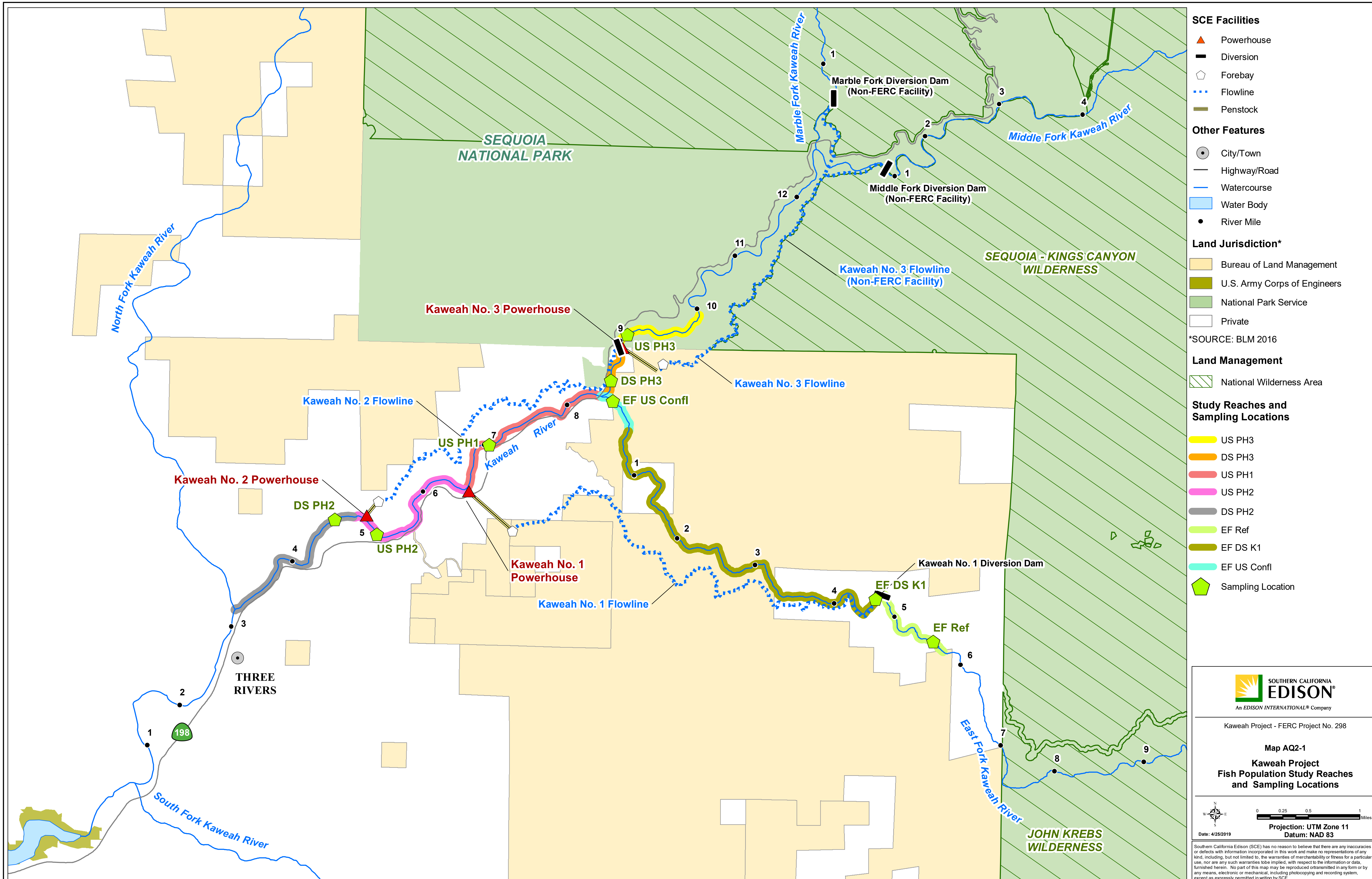

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APPENDIX A

Fish Population Sampling Site Description

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A.1 Sample Reaches

Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft²)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	347.9	93.0	32351.4	8.0	14.0	51.8%	60.0%
2	Pool	S	195.0	84.0	16370.7	6.0	11.3	29.0%	30.3%
Total	**--**	**--**	**542.9**	**--**	**48722.1**	**--**	**--**	**80.9%**	**90.3%**
Average	**--**	**--**	**271.4**	**88.5**	**24361.0**	**7.0**	**12.7**	**--**	**--**
1	Run	E	41.5	26.2	1090.2	--	--	6.2%	2.0%
Total	**--**	**--**	**41.5**	**--**	**1090.2**	**--**	**--**	**6.2%**	**2.0%**
1	LGR	E	48.0	44.0	2111.2	--	--	7.1%	3.9%
Total	**--**	**--**	**48.0**		**2111.2**	**--**	**--**	**7.1%**	**3.9%**
1	HGR	E	39.0	52.0	2027.5	--	--	5.8%	3.8%
Total	**--**	**--**	**39.0**		**2027.5**	**--**	**--**	**5.8%**	**3.8%**
Grand Total	**--**	--	**671.4**	**--**	**53951.0**	**--**	**--**	**100%**	**100%**

Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft²)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	150.0	47.0	7045.3	3.0	6.0	34.5%	36.3%
2	Pool	S	111.0	48.0	5324.7	4.0	5.5	25.5%	27.4%
Total	**--**	**--**	**260.9**	**--**	**12370.0**	**--**	**--**	**60.0%**	**63.8%**
Average	**--**	**--**	**130.5**	**47.5**	**6185.0**	**3.5**	**5.8**	**--**	**--**
1	Run	E	49.2	42.6	2097.9	--	--	11.3%	10.8%
Total	**--**	**--**	**49.2**	**42.6**	**2097.9**	**--**	**--**	**11.3%**	**10.8%**
1	HGR	E	68.9	45.9	3163.0	--	--	15.8%	16.3%
Total	**--**	**--**	**68.9**	**--**	**3163.0**	**--**	**--**	**15.8%**	**16.3%**
1	LGR	E	55.8	31.7	1768.0	--	--	12.8%	9.1%
Total	**--**	**--**	**55.8**	**--**	**1768.0**	**--**	**--**	**12.8%**	**9.1%**
Grand Total	**--**	**--**	**434.8**	**--**	**19398.8**	**--**	**--**	**100.0%**	**100.0%**

Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	362.9	69.6	25246.5	6.0	16.0	42.6%	51.6%
2	Pool	S	249.0	49.0	12196.7	5.5	10.0	29.2%	24.9%
Total	**--**	**--**	**611.9**	**--**	**37443.2**	**--**	**--**	**71.8%**	**76.5%**
Average	**--**	**--**	**305.9**	**59.3**	**18721.6**	**5.8**	**13.0**	**--**	**--**
1	Run	E	135.0	48.0	6476.8	--	--	15.8%	13.2%
Total	**--**	**--**	**135.0**	**48.0**	**6476.8**	**--**	**--**	**15.8%**	**13.2%**
1	HGR	E	45.0	63.0	2834.5	--	--	5.3%	5.8%
Total	**--**	**--**	**45.0**	**--**	**2834.5**	**--**	**--**	**5.3%**	**5.8%**
1	LGR	E	60.0	37.0	2219.6	--	--	7.0%	4.5%
Total	**--**	**--**	**60.0**	**--**	**2219.6**	**--**	**--**	**7.0%**	**4.5%**
Grand Total	**--**	**--**	**851.8**	**---**	**48974.1**			**100.0%**	**100.0%**

Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	344.9	74.2	25602.5	6.0	14.0	53.2%	57.8%
2	Pool	S	239.9	66.0	15834.0	5.0	10.0	37.0%	35.8%
Total	**--**	**--**	**584.9**	**--**	**41436.5**	**--**	**--**	**90.3%**	**93.6%**
Average	**--**	**--**	**292.4**	**70.1**	**20718.3**	**5.5**	**12.0**	**--**	**--**
1	LGR	E	63.0	45.0	2834.0	--	--	9.7%	6.4%
Total	**--**	**--**	**63.0**	**--**	**2834.0**	**--**	**--**	**9.7%**	**6.4%**
Grand Total	**--**	**--**	**647.8**	**--**	**44270.5**	**--**	**--**	**100.0%**	**100.0%**

Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	162.0	45.0	7288.7	3.5	7.5	25.5%	18.4%
2	Pool	S	260.9	59.0	15390.7	2.0	4.0	41.0%	38.8%
Total	**--**	**--**	**422.9**	**--**	**22679.4**	**--**	**--**	**66.5%**	**57.2%**
Average		**--**	**211.4**	**52.0**	**11339.7**	**2.8**	**5.8**	**--**	**--**
1	Run	E	78.0	84.0	6546.6	--	--	12.3%	16.5%
Total	**--**	**--**	**78.0**	**--**	**6546.6**	**--**	**--**	**12.3%**	**16.5%**
1	HGR	E	63.0	90.0	5666.0	--	--	9.9%	14.3%
Total	**--**	**--**	**63.0**	**--**	**5666.0**	**--**	**--**	**9.9%**	**14.3%**
1	LGR	E	72.0	66.0	4751.3	--	--	11.3%	12.0%
Total	**--**	**--**	**72.0**	**--**	**4751.3**	**--**	**--**	**11.3%**	**12.0%**
Grand Total	**--**	**--**	**635.8**	**--**	**39643.3**	**--**	**--**	**100.0%**	**100.0%**

East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	102.0	34.0	3466.3	3.5	7.5	37.4%	37.6%
2	Pool	S	57.0	51.0	2904.6	2.0	4.0	20.9%	31.5%
Total	**--**	**--**	**158.9**	**--**	**6370.9**	**--**	**--**	**58.2%**	**69.1%**
Average	**--**	**--**	**79.5**	**42.5**	**3185.5**	**2.8**	**5.8**	**--**	**--**
1	Run	S	57.0	21.0	1196.6	--	--	20.9%	13.0%
Total	**--**	**--**	**57.0**	**--**	**1196.6**	**--**	**--**	**20.9%**	**13.0%**
1	HGR	E	57.0	29.0	1651.3	--	--	20.9%	17.9%
Total	**--**	**--**	**57.0**	**--**	**1651.3**	**--**	**--**	**20.9%**	**17.9%**
Grand Total	**--**	**--**	**272.9**	**--**	**9218.9**	**--**	**--**	**100.0%**	**100.0%**

East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)

Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	147.0	30.0	4406.2	4.0	6.0	33.8%	28.4%
2	Pool	S	150.0	33.0	4948.3	5.0	12.0	34.5%	31.8%
Total	**--**	**--**	**296.9**	**--**	**9354.5**	**--**	**--**	**68.3%**	**60.2%**
Average	**--**	**--**	**148.5**	**31.5**	**4677.2**	**4.5**	**9.0**	**--**	**--**
1	Run	E	78.7	42.6	3356.6	--	--	18.1%	21.6%
Total	**--**	**--**	**78.7**	**--**	**3356.6**	**--**	**--**	**18.1%**	**21.6%**
1	HGR	E	59.0	47.9	2827.3	--	--	13.6%	18.2%
Total	**--**	**--**	**59.0**	**--**	**2827.3**	**--**	**--**	**13.6%**	**18.2%**
Grand Total	**--**	**--**	**434.7**	**--**	**15538.4**	**--**	**--**	**100.0%**	**100.0%**

East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)

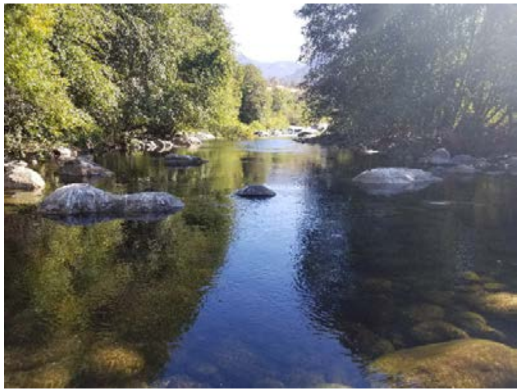
Unit Number	Unit Type[1]	Sampling Method[2]	Length (ft)	Width (ft)	Unit Area (ft^2)	Mean Depth (ft)	Max Depth (ft)	% of Total Survey Length	% of Total Survey Area
1	Pool	S	141.0	45.0	6344.1	3.0	6.0	24.5%	24.5%
2	Pool	S	197.9	60.0	11875.1	7.0	14.0	34.4%	45.8%
Total	**--**	**--**	**338.9**	**--**	**18219.2**	**--**	**--**	**59.0%**	**70.3%**
Average	**--**	**--**	**169.5**	**52.5**	**9109.6**	**5.0**	**10.0**	**--**	**--**
1	Run	S	95.0	48.0	4558.2	1.5	4.0	16.5%	17.6%
2	Run	S	90.0	22.0	1980.1	3.0	6.0	15.7%	7.6%
Average	**--**	**--**	**92.5**	**35.0**	**3269.2**	**2.3**	**5.0**	**--**	**--**
Total	**--**	**--**	**185.0**	**--**	**6538.3**	**--**	**--**	**32.2%**	**25.2%**
1	HGR	E	27.0	18.0	485.8	--	--	4.7%	1.9%
Total	**--**	**--**	**27.0**	**--**	**485.8**	**--**	**--**	**4.7%**	**1.9%**
1	LGR	E	24.0	28.0	672.8	--	--	4.2%	2.6%
Total	**--**	**--**	**24.0**	**--**	**672.8**	**--**	**--**	**4.2%**	**2.6%**
Grand Total	**--**	**--**	**574.9**	**--**	**25916.1**	**--**	**--**	**100.0%**	**100.0%**

A.2 Photos of Representative Habitat Units

High Gradient Riffle

Low Gradient Riffle

Mid-Channel Pool



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APPENDIX B

Quantitative Fish Population Sampling Data

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Table B-1. 2018 Summary of Quantitative Fish Sampling at Kaweah River and East Fork Kaweah River

Study Site	DATE	Sample Type	Species[1]							
			RBT	HH	SPM	MXD	SS	SC	CAR	SMB
Kaweah River										
Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)	10/18/2018	Electrofishing	10	--	--	--	25	--	183	--
	10/02/2018	Snorkeling	--	--	--	2473	778	--	4	--
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)	10/06/2018	Electrofishing	6	2	147	--	27	--	44	--
	10/01/2018	Snorkeling	5	1	16	873	108	--	1	--
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)	10/17/2018	Electrofishing	2	--	6	--	20	--	--	26
	10/01/2018 10/19/2018	Snorkeling	--	3	4	--	6	--	--	29
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)	10/08/2018	Electrofishing	--	--	--	--	8	2	--	17
	10/01/2018	Snorkeling	--	8	1	2	9	--	--	35
Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)	10/03/2018	Electrofishing	--	4	3	--	15	11	--	32
	10/19/2018	Snorkeling	--	15	--	--	12	--	--	17
East Fork Kaweah River										
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)	10/05/2018	Electrofishing	35	--	--	--	30	--	--	--
	10/02/2018	Snorkeling	--	--	--	--	79	--	--	--
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)	10/02/2018 10/05/2018	Electrofishing	8	--	--	--	18	--	1	--
	10/02/2018	Snorkeling	1	--	--	--	333	--	--	--
East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)	10/09/2018	Electrofishing	7	--	6	--	7	--	7	2
	10/19/2018	Snorkeling	--	3	3	207	6	--	--	12

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

Table B-2. The 2018 Average Length and Number of Scale Aged Rainbow Trout

Study Reach	Age-Class			
	0+	1+	2+	3+
	Average Fork Length (mm) (Number of Scale Aged Rainbow Trout)			
Kaweah River				
Kaweah River Upstream of Kaweah No. 3 Powerhouse (US PH3)	82 (4)	92 (2)	--	202 (2)
Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence (DS PH3)	71 (2)	85 (2)	--	--
Kaweah River Downstream of East Fork Kaweah Confluence and Upstream of Kaweah No. 1 Powerhouse (US PH1)	--	--	--	--
Kaweah River Downstream of Kaweah No. 1 Powerhouse and Upstream of Kaweah No. 2 Powerhouse (US PH2)	--	--	--	--
Kaweah River Downstream of Kaweah No. 2 Powerhouse (DS PH2)	--	--	--	--
East Fork Kaweah River				
East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion (EF US K1 Div)	--	--	137 (1)	218 (1)
East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion (EF DS K1 Div)	81 (4)	93 (4)	180 (1)	--
East Fork Kaweah River Upstream of Confluence with Kaweah River (EF US Confl)	--	101 (7)	--	--

APPENDIX C

Length Frequency Histograms

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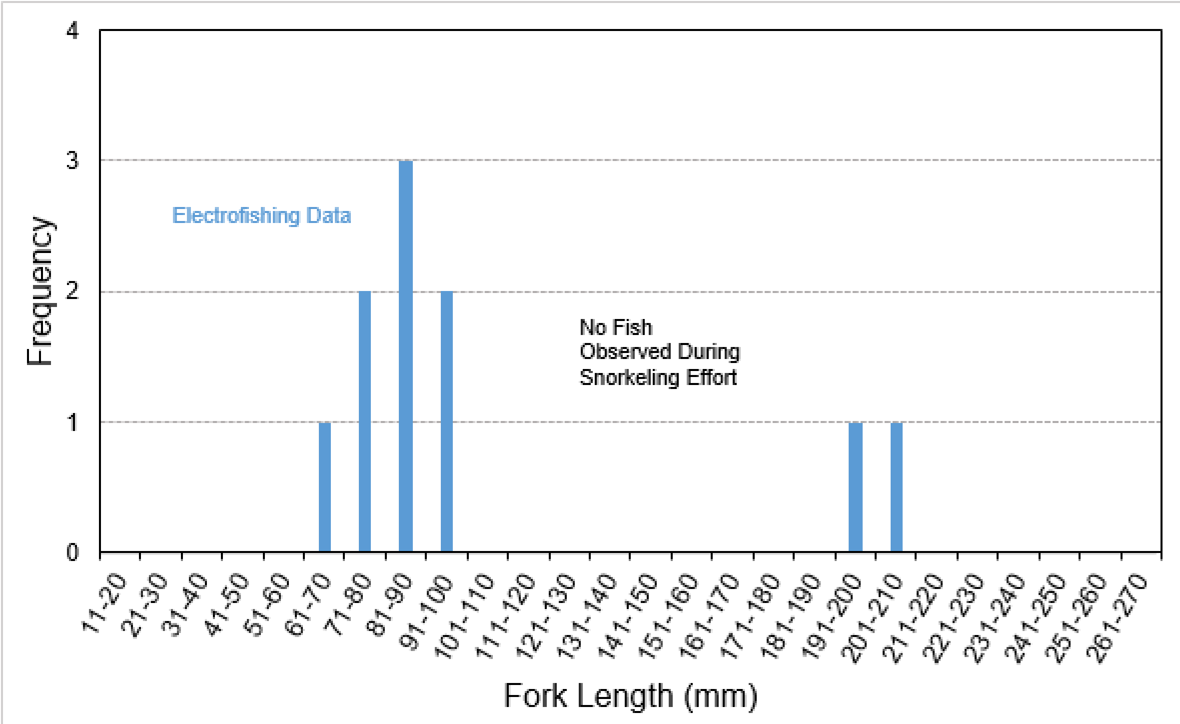

Figure C-1. **Kaweah River Upstream of Kaweah No. 3 Powerhouse: Rainbow Trout Length Frequency Histogram.**

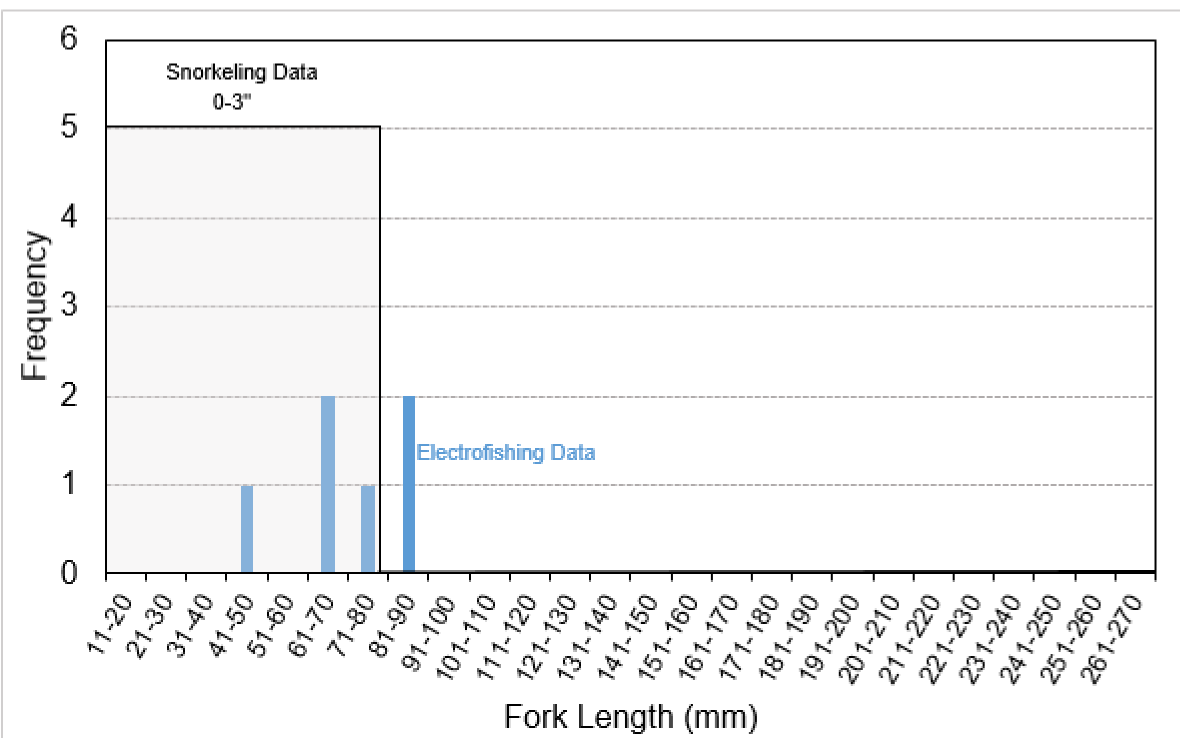

Figure C-2. **Kaweah River Downstream of Kaweah No. 3 Powerhouse and Upstream of the East Fork Kaweah River Confluence: Rainbow Trout Length Frequency Histogram.**

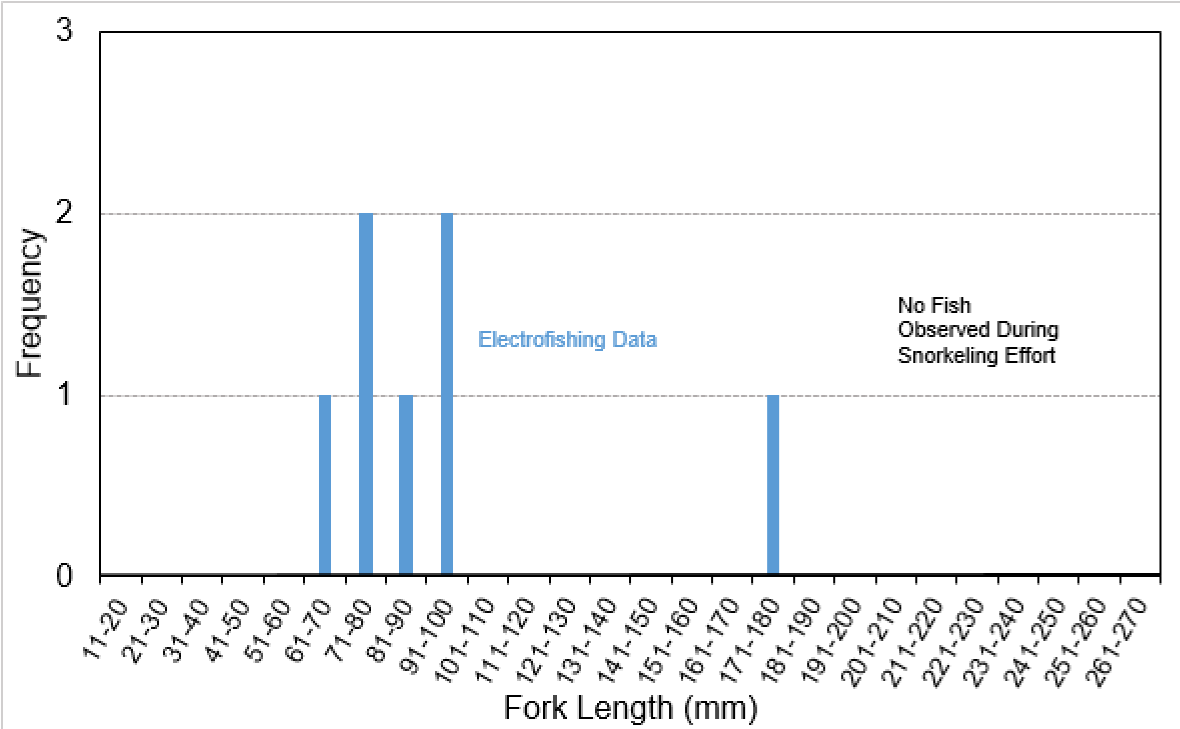

Figure C-3. East Fork Kaweah River Upstream of Confluence with Kaweah River: Rainbow Trout Length Frequency Histogram.

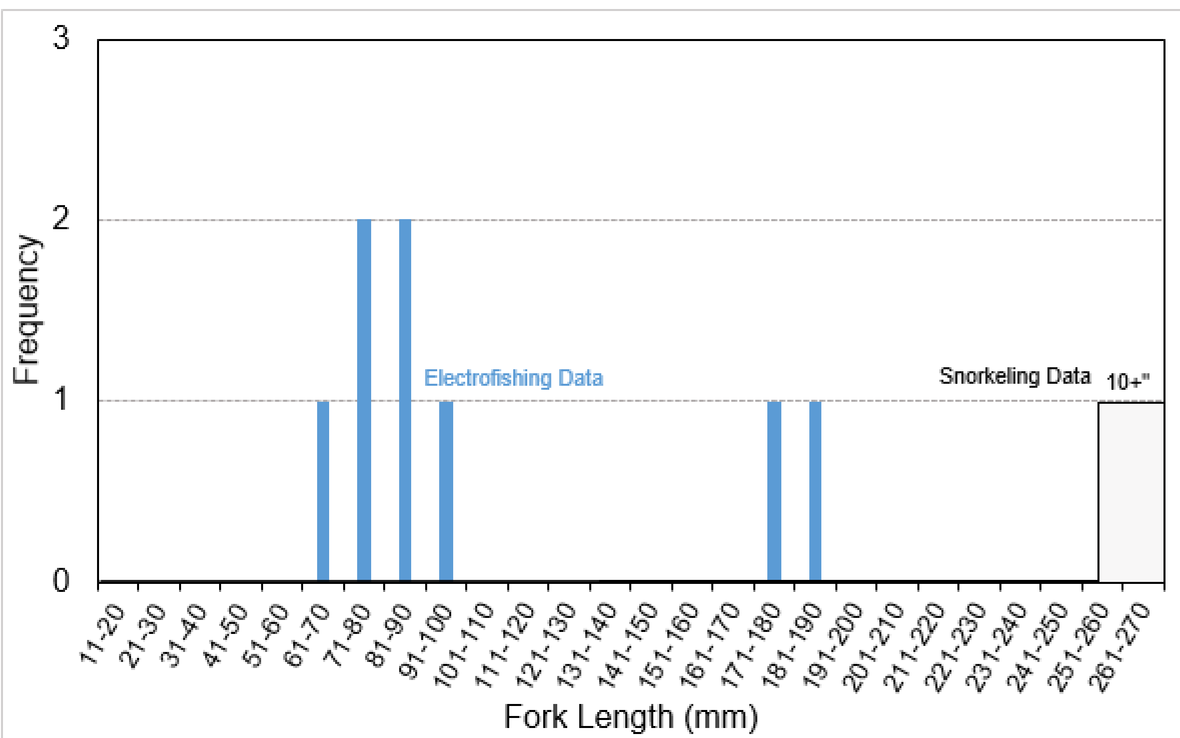

Figure C-4. East Fork Kaweah River Downstream of the Kaweah No. 1 Diversion: Rainbow Trout Length Frequency Histogram.

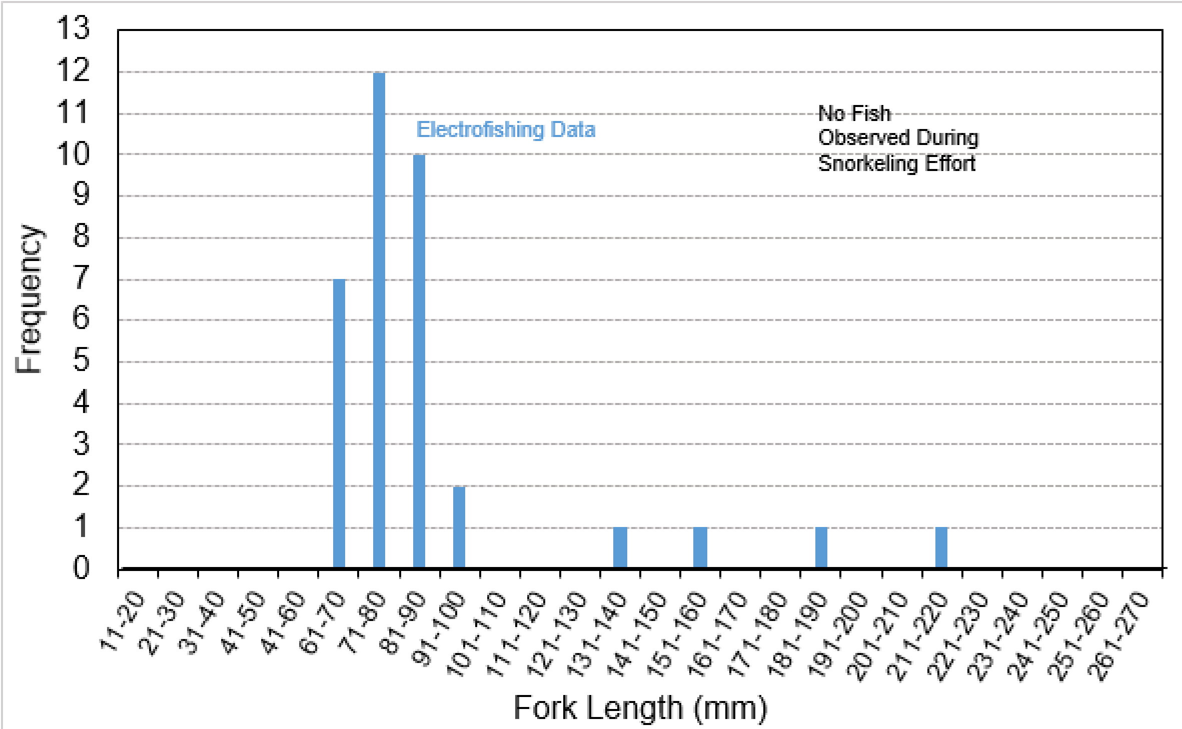

Figure C-5. East Fork Kaweah River Upstream of the Kaweah No. 1 Diversion: Rainbow Trout Length Frequency Histogram.

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Kaweah Project, FERC Project No. 298

AQ 3 – Macroinvertebrates
Final Technical Study Report

December 2019

SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company

Southern California Edison Company
Regulatory Support Services
1515 Walnut Grove Avenue, Rosemead, CA 91770

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List of Acronyms

BMI	Benthic Macroinvertebrate
EPT	Ephemeroptera, Plecoptera, and Trichoptera
FERC	Federal Energy Regulatory Commission
ft	feet
IBI	Index of Biotic Integrity
in	inch
PCWA	Placer County Water Agency
m	meters
m^3	cubic meters
mm	millimeters
Project	Kaweah Project
PSP	Proposed Study Plan
RSP	Revised Study Plan
RWB	Reachwide Benthos
SAFIT	Southwest Association of Freshwater Invertebrate Taxonomists
SCE	Southern California Edison Company
SWAMP	Surface Water Ambient Monitoring Program
TSP	Technical Study Plan
TSR	Technical Study Report

1 INTRODUCTION

This Technical Study Report (TSR) describes the data and findings developed by Southern California Edison Company (SCE) in association with implementation of the AQ 3 – Macroinvertebrates Technical Study Plan (AQ 3 – TSP) for the Kaweah Project (Project). The AQ 3 – TSP was included in SCE's Revised Study Plan (RSP)[1] (SCE 2017a) and was approved by the Federal Energy Regulatory Commission (FERC) on October 24, 2017 as part of its Study Plan Determination for the Project (FERC 2017). Specifically, this report provides a description of the methods and results of AQ 3 –TSP completed in 2018. The TSR sections include the study objectives, extent of the study area, study approach, study results, and literature cited.

2 STUDY OBJECTIVES

The AQ 3 – TSP included two study objectives, as follows:

- Document the density and size distribution of drifting macroinvertebrates in selected bypass river reaches for input to bioenergetics growth analysis.
- Document the benthic macroinvertebrate community in the bypass reaches and reference reaches to characterize general habitat conditions.

3 EXTENT OF STUDY AREA

The study area includes the bypass river reaches associated with the Project and the comparison river reaches upstream or downstream of the Project. The specific locations of the sampling sites were determined in the field in coordination with interested resource agencies. Comparison study sites were, to the extent possible, located in sections of river with similar habitat types. The locations of study sites for collecting benthic macroinvertebrate samples are shown in Table AQ 3-1 and Map AQ 3-1.

It should be noted that the majority of lands along the bypass reaches are privately owned and outside of the FERC project boundary. For the purposes of this macroinvertebrate study, SCE took the following steps to obtain approval to conduct field studies on private property:

- SCE provided notification to landowners about Project relicensing and requested authorization to enter property to conduct the field studies.
- If authorization was obtained, SCE completed field studies at the original location as described in the TSP; otherwise, the nearest location within the reach where permission was available was sampled.

4 STUDY APPROACH

4.1 Macroinvertebrate Drift Sampling

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 AQ 3-1 and Map AQ 3-1). At each sampling site, two representative riffles were identified for sampling. At the downstream end of each riffle, three drift samples were collected across the stream (left-center, center and right-center of the channel) using a sampling methodology similar to that used in Hayes et al. 2000. Drift samples were collected twice during

[1] SCE filed a Proposed Study Plan (PSP) on May 24, 2017 (SCE 2017b). Three comments were filed on the PSP, however, they did not result in revisions to any of the study plans. Therefore, SCE filed a Revised Study Plan (RSP) on September 19, 2017 which stated that the PSP, without revision, constituted its RSP. The FERC subsequently issued a Study Plan Determination on October 24, 2017 approving all study plans for the Kaweah Project.

the day (mid-morning and mid-afternoon). At each location where drift samples were collected, three 15.24-centimeter (6 inch [in]) diameter drift nets (mesh size 0.5 millimeter [mm], modified from Field-Dodgson 1985) were stacked vertically in the water column at 0.1 of the depth above the river bed, 0.4 of the depth above the river bed, and just below the surface (including the surface) (Figure AQ 3-1). In shallow areas, only one or two nets were used depending on depth.

Water velocity at the mouth of each of the stacked drift nets was measured at the start and end of each drift sample collection period. Duration of each sample period was approximately two hours. Organism lengths were measured and abundance within each 2 mm size class was determined. Mean drift density (number of organisms/cubic meters [m^3]) and size frequency were calculated for the combined summer and fall sampling and for the summer and fall sampling separately. Drift density results from the study reaches were compared to data from other rivers.

General aquatic invertebrate length versus weight relationships (Cummins and Wuycheck 1971; Smock 1980) were used to convert macroinvertebrate drift to energy equivalents (joules/m^3) 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). Prey energy was calculated as follows:

$$PE_i = 0.3818\,(100 \cdot PL_i)^{2.46}$$

Where: PE_i = Prey energy (joules•prey^{-1}) for prey size class i

PL_i = Prey length (m) for prey size class i

4.2 Benthic Macroinvertebrate Sampling

Benthic and physical habitat characterization data was collected in the bypass and comparison reaches following the Surface Water Ambient Monitoring Program (SWAMP) reachwide benthos (RWB) protocol (Ode 2016). The RWB sampling did not target any specific type of mesohabitat. RWB 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. Physical habitat measurements were also collected at all transects. Sampling sites for benthic macroinvertebrates are identified in Table AQ 3-1 and Map AQ 3-1. Composite benthic samples and physical habitat characterization data were collected using SWAMP methodology. 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). Historical benthic macroinvertebrate data, one sample location in the study area (ENTRIX 2007) was included in the study results for comparative purposes.

5 STUDY RESULTS

5.1 Macroinvertebrate Drift Sampling

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 AQ 3-2, Figure AQ 3-2), 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 AQ 3-3, Figure AQ 3-3). Appendix A shows the individual results for the summer and fall samples.

Average summer/fall drift densities were similar between comparison and bypass reaches (Table AQ 3-2, Figure AQ 3-2). 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 AQ 3-4, Figure AQ 3-4). 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).

The most prevalent size class of drifting macroinvertebrates was in the 1 to 3 mm range and macroinvertebrates between 1 and 5 mm made up 80.6 percent of the population (Table AQ 3-5, Figure AQ 3-5). The size of the drifting macroinvertebrates was similar to that in other studies (Addley 2005, PCWA 2011) where most of the macroinvertebrates were relatively small, with few macroinvertebrates larger than 5 mm. Trout gill raker spacing typically precludes fish from feeding on prey smaller than about 1 mm (Bannon and Ringler 1986) and larger fish have larger gill raker spacing. For example, gill raker spacing for a 300 mm salmonid can be on the order of 3.45 mm (Wankowski 1979) and can limit the amount of prey available to larger fish. Macroinvertebrates less than 1 mm in size made up 5.8 percent on average (3.4 to 8.8 percent) of the macroinvertebrate population in the study reaches (Table AQ 3-5).

5.2 Benthic Macroinvertebrate Sampling

Benthic Macroinvertebrate (BMI) sampling metric results and IBI scores are presented in Table AQ 3-6. Physical habitat data from sampling reaches in presented in Table AQ 3-7. Kaweah River comparison reaches had IBI scores of 35 and 37 and Kaweah River bypass reaches had 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 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 percent, respectively) compared to 2007 (16 and 51.1 percent, respectively). The percent of intolerant individuals was lower in 2018 (2.7 percent) compared to 2007 (10 percent).

5.3 Data Availability

Drift and benthic macroinvertebrate laboratory data are available to interested stakeholders in an Excel spreadsheet electronic format upon request.

6 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, J.D. 1987. Macroinvertebrate Drift in a Rocky Mountain stream. Hydrobiologia 144:261-268.

Bannon, E., and Ringler, N.H. 1986. Optimal prey size for stream resident brown trout (Salmo trutta): tests of predictive models. Can. J. Zool. 64:704-713.

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

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). 2017. Study Plan Determination for the Kaweah Hydroelectric Project. October 24.

Field-Dodgson, M.S. 1985. A simple and efficient drift sampler. New Zealand Journal of Freshwater Research, 19: 167–172.

Hayes, J.W., J.D. Stark, and K.A. Shearer. 2000. Development and test of a whole-lifetime foraging and bioenergetics growth model for drift-feeding brown trout. Trans. Am. Fish. Soc. 129:315-332.

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

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.

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.

SCE (Southern California Edison Company). 2017a. Kaweah Project, Revised Study Plan. Filed with FERC on September 19.

SCE. 2017b. Kaweah Project, Proposed Study Plan. Filed with FERC on May 24.

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

Wankowski, J.W.J. 1979. Morphological limitations, prey size selectivity, and growth response of juvenile Atlantic salmon *Salmo salar*. Journal of Fish Biology 14:89–100.

TABLES

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Table AQ 3-1. 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 AQ 3-2. 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 AQ 3-3. Average Macroinvertebrate Drift Density (Summer and Fall) at Kaweah River Study Locations and Comparable 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 AQ 3-4. Average 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 AQ 3-5. Average 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	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 AQ 3-6. BMI 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 AQ 3-7. SWAMP 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%

FIGURES

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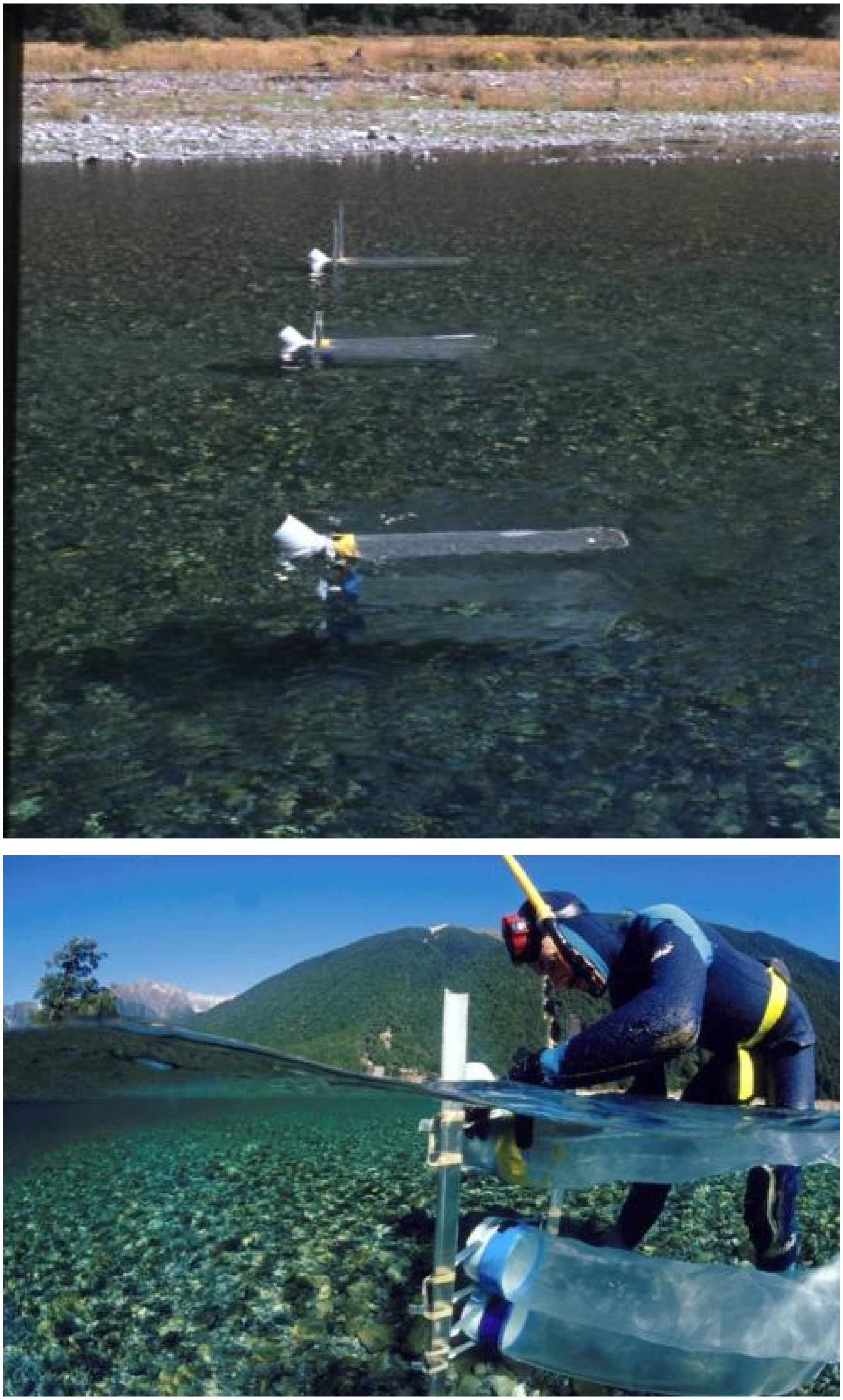

Figure AQ 3-1. Macroinvertebrate Drift Sampling Nets

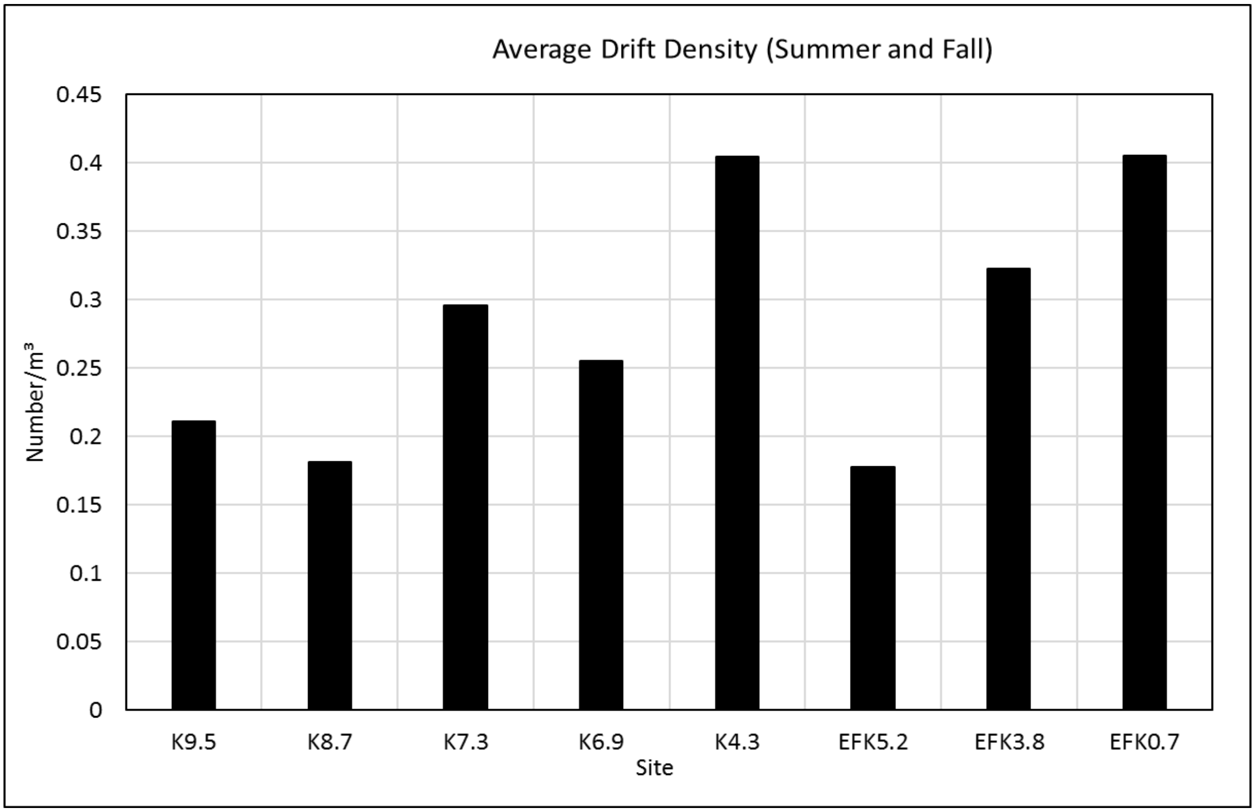

Figure AQ 3-2. Average Macroinvertebrate Drift Density (Summer and Fall) (number/m^3) by Location

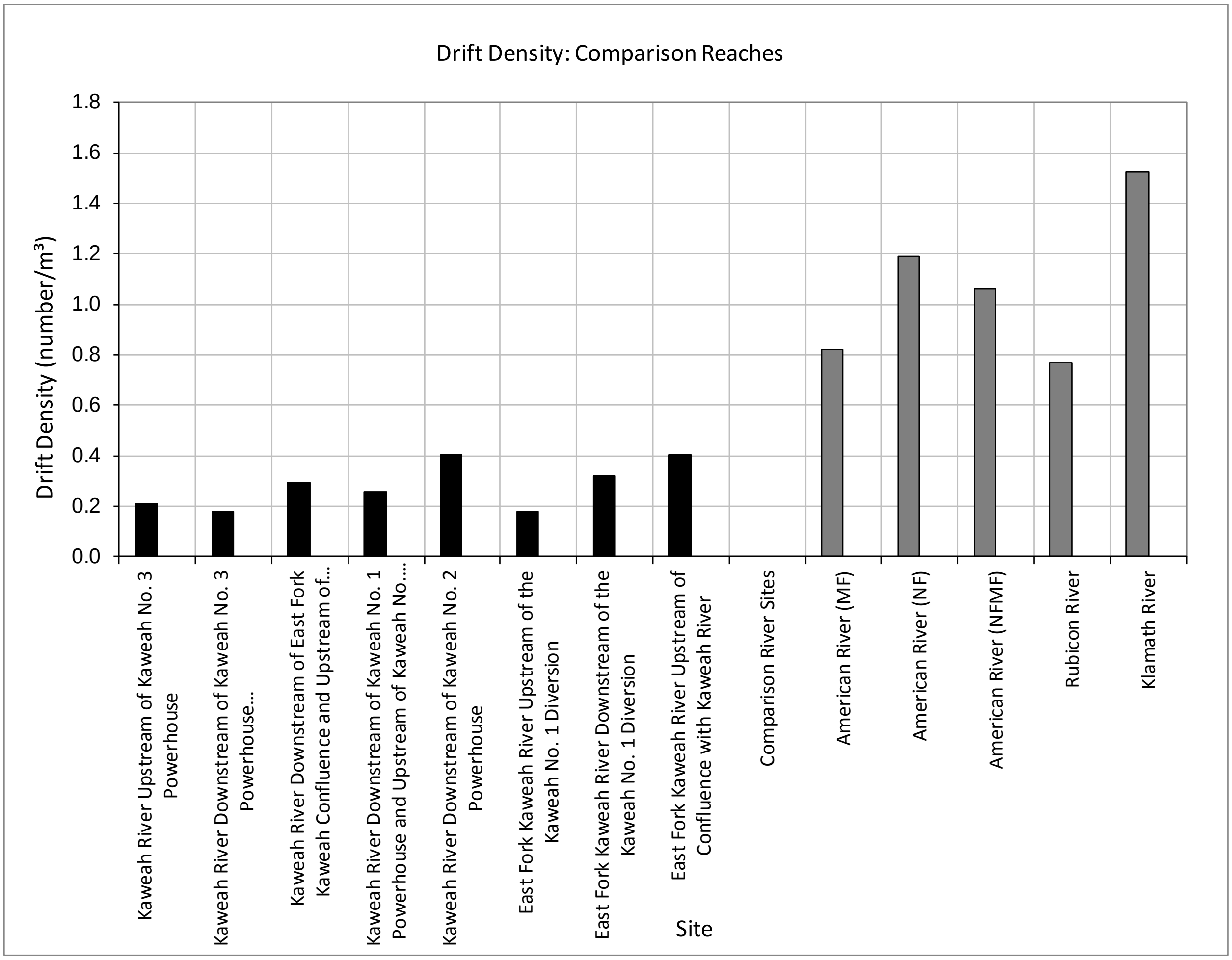

Figure AQ 3-3. Average Drift Density (Summer and Fall) at Kaweah River Study Locations (black) and Comparable Locations (grey)

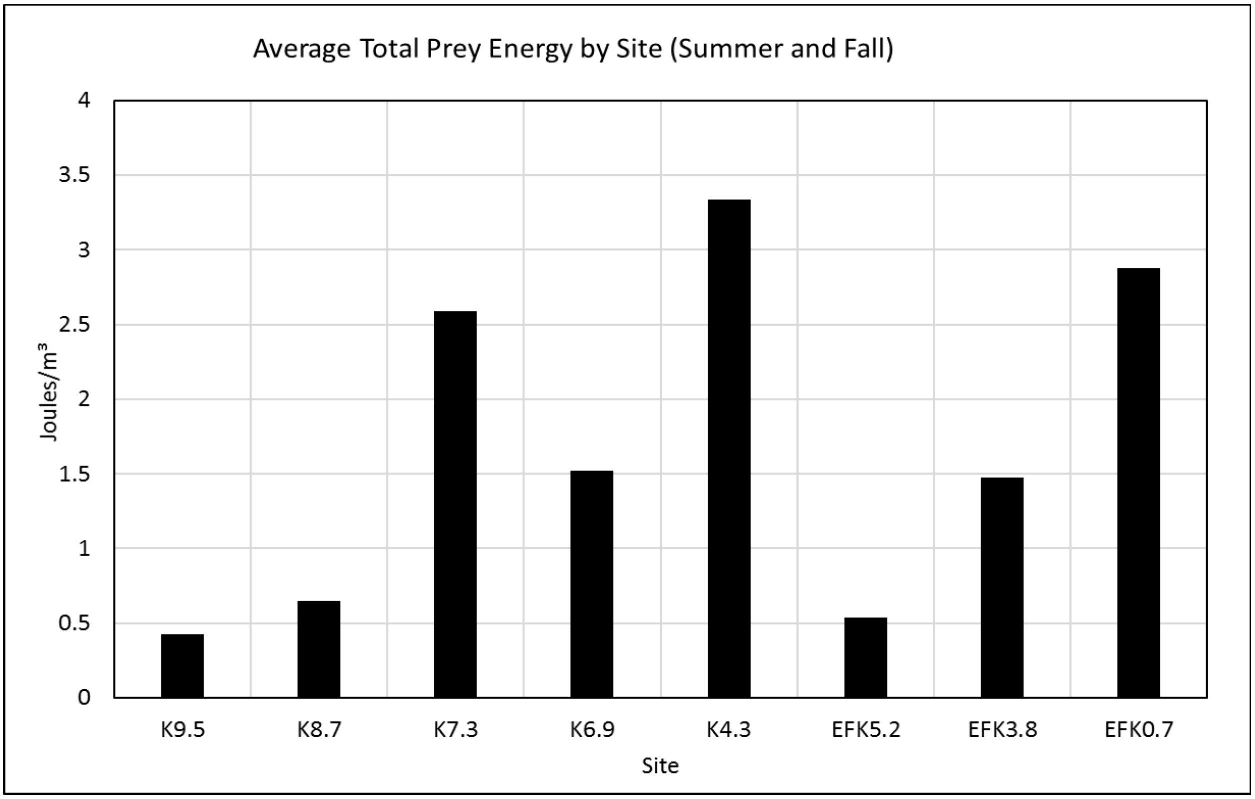

Figure AQ 3-4. Average Total Prey Energy (Summer and Fall) by Site

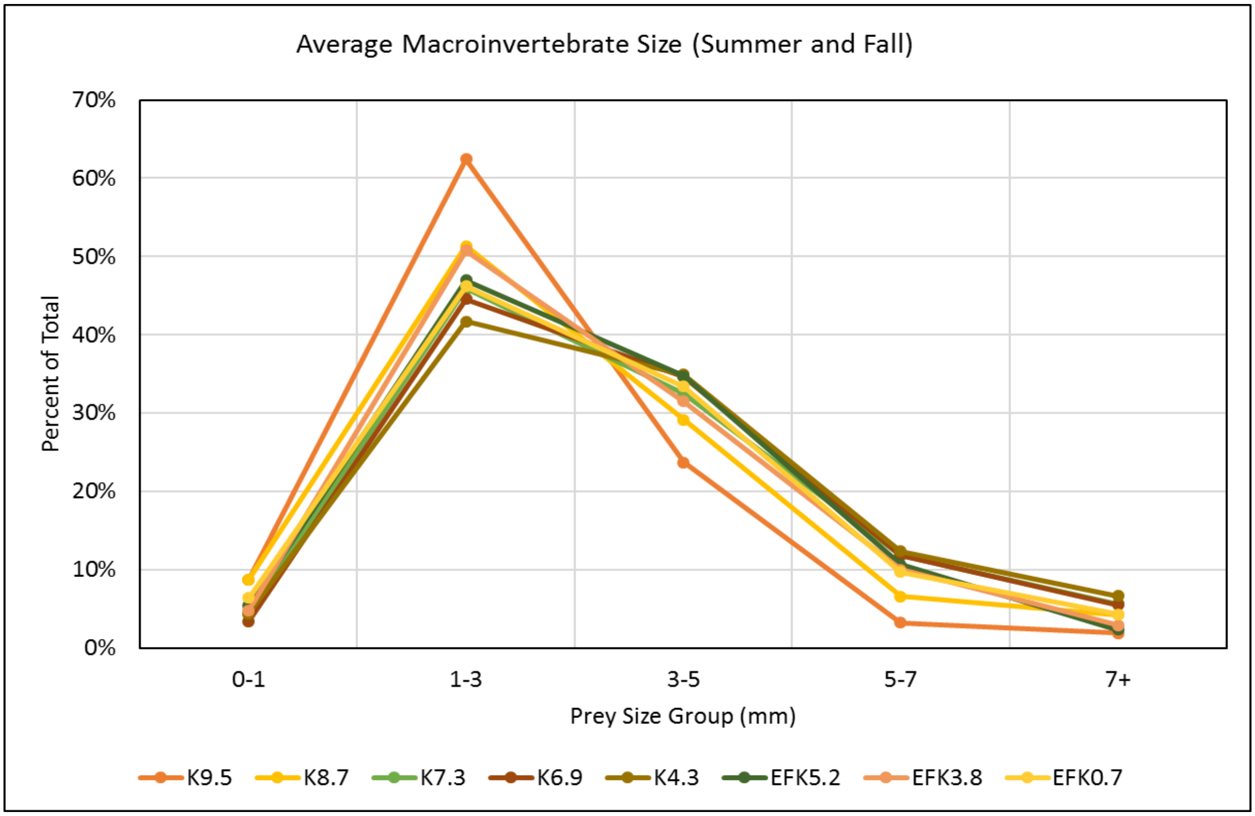

Figure AQ 3-5. Macroinvertebrate Drift Size (Percent of Total) by Location

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MAPS

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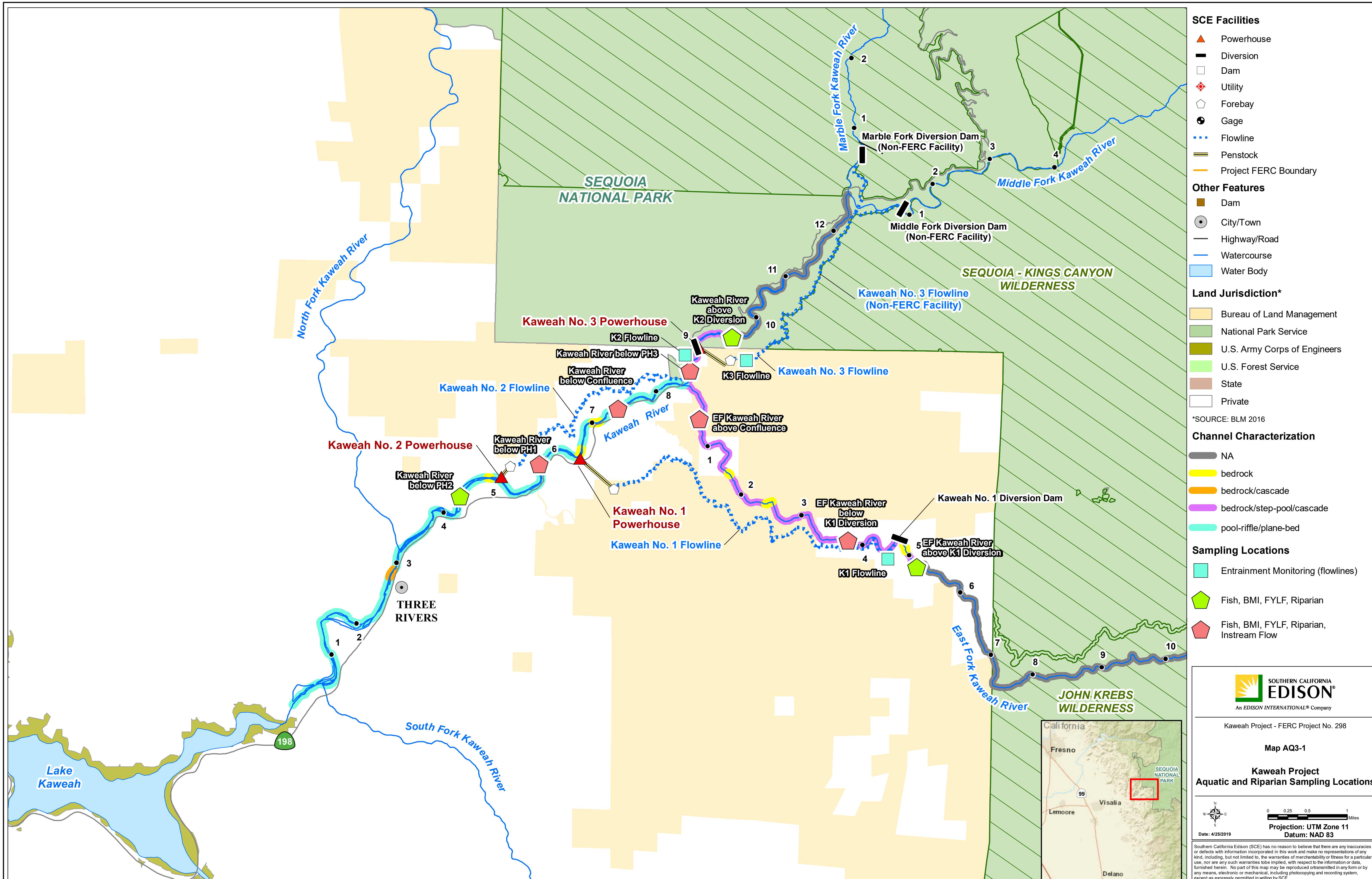

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Appendix A

Summer and Fall Sampling Data

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Table AQ 3-1a. Drift Density by Site for Summer Sampling (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	0.020	0.027	0.017	0.011	0.016	0.009	0.014	0.040	0.019
>1-3	0.122	0.122	0.148	0.100	0.145	0.075	0.155	0.233	0.138
>3-5	0.047	0.046	0.083	0.061	0.103	0.046	0.069	0.143	0.075
>5-7	0.005	0.012	0.032	0.026	0.046	0.016	0.024	0.036	0.025
>7	0.005	0.009	0.021	0.015	0.028	0.005	0.008	0.024	0.014
Total	0.200	0.216	0.301	0.213	0.339	0.151	0.270	0.476	0.271

Table AQ 3-1b. Drift Density by Fall for Summer Sampling (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	0.017	0.008	0.008	0.006	0.019	0.010	0.016	0.015	0.012
>1-3	0.142	0.068	0.124	0.126	0.191	0.091	0.165	0.145	0.132
>3-5	0.053	0.054	0.109	0.122	0.185	0.080	0.141	0.124	0.108
>5-7	0.008	0.011	0.037	0.034	0.052	0.022	0.042	0.039	0.031
>7	0.002	0.006	0.013	0.011	0.024	0.003	0.010	0.012	0.010
Total	0.222	0.148	0.292	0.298	0.470	0.205	0.375	0.335	0.293

Table AQ 3-1c. Macroinvertebrate Size (Percent of Total) at the Drift Sampling Locations for Summer.

Length (mm)	Site								Average
	K9.5	K8.7	K7.3	K6.9	K4.3	EFK5.2	EFK3.8	EFK0.7	
0-1	10.1%	12.3%	5.5%	5.0%	4.8%	5.9%	5.3%	8.4%	7.2%
>1-3	61.1%	56.5%	49.2%	47.0%	42.8%	49.7%	57.5%	49.0%	51.6%
>3-5	23.5%	21.5%	27.7%	28.5%	30.5%	30.5%	25.4%	29.9%	27.2%
>5-7	2.7%	5.4%	10.7%	12.4%	13.6%	10.7%	8.8%	7.6%	9.0%
>7	2.7%	4.2%	6.8%	7.2%	8.3%	3.2%	3.1%	5.0%	5.1%

Table AQ 3-1d. Macroinvertebrate Size (Percent of Total) at the Drift Sampling Locations for Fall.

Length (mm)	Site								Average
	K9.5	K8.7	K7.3	K6.9	K4.3	EFK5.2	EFK3.8	EFK0.7	
0-1	7.4%	5.2%	2.9%	1.9%	4.0%	4.8%	4.4%	4.4%	4.4%
>1-3	63.8%	46.1%	42.6%	42.2%	40.6%	44.2%	44.1%	43.5%	45.9%
>3-5	23.9%	36.8%	37.3%	40.9%	39.3%	38.9%	37.5%	36.9%	36.4%
>5-7	3.7%	7.7%	12.9%	11.3%	11.0%	10.6%	11.2%	11.7%	10.0%
>7	1.1%	4.2%	4.4%	3.8%	5.0%	1.4%	2.7%	3.6%	3.3%

Table AQ 3-1e. Total Summer Prey Energy (J/m^3).

Length (mm)	Site								Average
	K9.5	K8.7	K7.3	K6.9	K4.3	EFK5.2	EFK3.8	EFK0.7	
0-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>1-3	0.2	0.4	0.8	0.3	0.5	0.1	0.4	1.1	0.5
>3-5	0.1	0.2	0.9	0.4	0.8	0.2	0.3	1.5	0.5
>5-7	0.0	0.0	0.3	0.2	0.4	0.1	0.1	0.2	0.2
>7	0.0	0.0	0.3	0.1	0.3	0.0	0.0	0.3	0.1
Total	0.3	0.6	2.3	1.1	2.0	0.4	0.8	3.1	1.3

Table AQ 3-1f. Total Fall Prey Energy (J/m^3).

Length (mm)	Site								Average
	K9.5	K8.7	K7.3	K6.9	K4.3	EFK5.2	EFK3.8	EFK0.7	
0-1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>1-3	0.3	0.2	0.6	0.4	0.9	0.2	0.5	0.6	0.5
>3-5	0.2	0.4	1.7	1.3	3.0	0.4	1.3	1.6	1.2
>5-7	0.0	0.0	0.5	0.2	0.5	0.1	0.3	0.4	0.2
>7	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.1	0.1
Total	0.5	0.7	2.9	2.0	4.7	0.7	2.2	2.7	2.0