

2023 Robles Fish Passage Facility Progress Report



Photos illustrating the range of flood damage to the Robles Fish Passage Facility in 2023 that included forebay and entrance pool sedimentation (top row), timber cutoff wall breach and temporary repair (2nd row), sedimentation inside of facility (third row), and debris fence damage, spillway debris, and section of cutoff wall deposited downstream (bottom row).

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1.0 EXECUTIVE SUMMARY

Casitas Municipal Water District (CMWD) is implementing the Robles Fish Passage Facility Project (Robles Fish Facility) described in the Proposed Action of the Bureau of Reclamation's Biological Assessment (BA); (USBOR 2003). The effects of the Robles Fish Facility were analyzed in the Biological Opinion (BO) prepared by the National Marine Fisheries Service (NMFS 2003a). This 2023 Robles Fish Passage Facility Progress Report, as described by the BO, is the culmination of monitoring, evaluation, and operational data collected during the reporting period of 01 July 2022 to 30 June 2023.

The monitoring and evaluation studies related to the Robles Fish Facility conducted during the 2022-2023 reporting period are included in two main sections of this progress report. The Fisheries Monitoring and Evaluation section includes: upstream fish migration impediment evaluation, sandbar monitoring at the mouth of the Ventura River, fish attraction evaluation, fish passage monitoring, downstream fish passage evaluations, and downstream fish migration through the Robles Reach. The Facility Operation section includes: information and data on the facility status, flow observations and control, costs associated with operation and monitoring, assessment of the effectiveness to provide fish passage, recommendations of priorities for future activities, and revisions deemed necessary to the operations.

Above normal precipitation occurred in the Ventura River Basin during the 2023 fish passage season. Eight BO-defined storm events occurred at the Robles Fish Facility. A large event on 09 January 2023 of over 33,000 cfs (rating peak yet to be determined), estimated at the USGS Foster Park gage station, substantially altered the Ventura River channel, and caused extensive damage to the Robles Fish Facility. The sandbar at the mouth of the Ventura River was open and surface flow was maintained for the entire fish migration season. This provided steelhead (*Oncorhynchus mykiss*) the opportunity to immigrate and find suitable spawning habitat in the Ventura River. Two putative resident *O. mykiss* were observed passing upstream through the Robles Fish Facility.

2.0 GENERAL INTRODUCTION

The National Marine Fisheries Service (NMFS) listed the southern California steelhead, *O. mykiss*, as endangered in 1997 (NMFS 1997) under the Endangered Species Act (ESA, 16 U.S.C. § 1531 et. seq.) of 1973, as amended. Steelhead were organized into stocks (i.e., groups) of evolutionary significant units (ESU) that were considered to be substantially reproductively isolated from other steelhead stocks and were an important part of the evolutionary legacy of the species. The southern California steelhead ESU included, at that time, steelhead populations from the Santa Maria River in San Luis Obispo County south to Malibu Creek in Los Angeles County. The ESU was later extended to the US/Mexican border in San Diego County during 2002 (NMFS 2003b). In a later delineating approach, NMFS categorized the anadromous life history form of *O. mykiss* as a distinct population segment (DPS) as described under the ESA (NMFS 2005). The DPS policy differs from the ESU by delineating a group of organisms by “marked separation” rather than “substantial reproductive isolation” as originally listed. In the case of *O. mykiss* of the southern California steelhead ESU, this marked separation between the two life history forms was considered valid because of physical, physiological, ecological, and behavioral factors related to its anadromous life history characteristics. Resident and anadromous *O. mykiss*, where the two forms co-occur and are not reproductively isolated, are still part of the ESU; however, anadromous *O. mykiss* (i.e., steelhead) are now part of a smaller subset identified as the southern California steelhead DPS. Anadromous *O. mykiss* in the southern California DPS exhibit a winter-run life-history pattern during their spawning migrations; see life history discussion below.

Rainbow trout (*O. mykiss*) can be generally organized into four large groupings (Behnke 1992; Scott and Crossman 1973): 1) coastal rainbow trout that extend from northern Baja California to northern Alaska near the Kuskokwim River and also the Kamchatkan Peninsula of northeastern Asia, 2) Redband trout of the inland Columbia and Frazer River basins, 3) Redband trout of the central valley of California, and 4) trout of the Gulf of California drainages. The taxonomic group of coastal rainbow trout, *O. m. irideus*,

exhibit two life history forms; anadromous and resident. The common name for the anadromous life history form is “steelhead trout” and the resident form are “rainbow trout”. Throughout the range of coastal rainbow trout, the anadromous life history form is widespread (Behnke 1992). There are two general life-history patterns exhibited by adult anadromous steelhead based on when they return from the ocean to spawn in freshwater. The life-history patterns are grouped by either summer or winter spawning runs. There are many exceptions to these patterns, but this general characterization has been used to group steelhead runs by the season in which peak spawning immigration occurs from the ocean (Busby et al. 1996). Summer-run steelhead are generally found in river systems that drain from farther inland, such as the Columbia River basin. Winter-run steelhead are typically found in the coastal systems where river systems are smaller. The winter-run pattern is the more common within the natural range of the species (Busby et al. 1996).

Monitoring and Research of the Robles Diversion and Fish Passage Facility

As stated in the BO (NMFS 2003a), the “Modifications to the Robles Diversion Facility and associated operation criteria have been targeted at improving fish passage conditions within the Robles Reach of the Ventura River while maintaining suitable conditions through the Fish Passage Facility.” The monitoring and evaluation studies and activities related to the modification of the Robles Facility, as outlined in the BO (NMFS 2003a), were intended to achieve three main objectives:

- I. Monitor Fish Passage Facility operations and performance.
- II. Determine if the Fish Passage Facility functions and operates in such a fashion that migrating steelhead:
 - a. Successfully navigate into and through the facility, and
 - b. Move through the facility in good physical condition.
- III. Determine if the operations at the Robles Diversion are enhancing the opportunity for:
 - a. Adult steelhead to migrate upstream to the Robles Facility, and
 - b. Smolts and kelts to migrate downstream through the Robles Reach.

5-year Reevaluation of Initial Evaluation and Monitoring Activities

As described in the BO, a 5-year reevaluation of the initial fish flow operations would be conducted to determine if monitoring and evaluations have been completed (NMFS 2003a). The initiation of the 5-year period began in 2006, which was the first year the Robles Fish Facility was fully operational. An annual and ongoing reevaluation began after the 2010 fish passage season. Through the Cooperative Decision Making Process, the Robles Biological Committee will review annually each of the specific evaluations and determine if the original objectives have been addressed and could be discontinued or if additional study would be needed. Due to the highly variable streamflow conditions and low numbers of adult and juvenile steelhead, all objectives of the monitoring and evaluation program have not yet been accomplished. Progress of the evaluations have been slowed by the historic 5-year exceptional drought that affected much of California, and in particular, the southern coast of California that includes the Ventura River Basin. After the 2017 season, the drought in the Ventura River basin had diminished to a moderate level, which continued through 2018 and into 2019. At the start of the 2021 fish passage season, severe drought returned to the basin and increased to an exceptional level by the end of the season. Similarly, at the start of the 2022 fish passage season, drought was considered moderate and finished the season at an extreme level (US Drought Monitor; <https://droughtmonitor.unl.edu>).

Each aspect of the monitoring and evaluation program is assessed annually to determine if sufficient information has been collected to accomplish each objective. While significant progress has been made to date, it is recommended that several aspects of the monitoring and evaluation for the Robles Fish Facility be continued during 2024. Sufficient data have been collected for the upstream fish migration impediment evaluation to begin data analysis; the final results from that dataset will be used to make recommendations for long-term fish flow operations.

3.0 UPSTREAM FISH MIGRATION IMPEDIMENT EVALUATION

Introduction

The ability of adult steelhead to swim upstream can be impeded during migration at times of low-river flow (NMFS 2003a). Evaluations at shallow water habitat units (i.e., critical riffles) have commonly been conducted to determine if passage impediments exist for adult and juvenile steelhead in California rivers (Dettman and Kelley 1986; Bratovich and Kelley 1988; Hagar 1996). The Robles Reach, which extends downstream from the Robles Fish Facility approximately 6.5 km (NMFS 2003a) to just upstream of the Santa Ana Boulevard bridge (Appendix 1), is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Because of this channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates and cause surface flow to rapidly recede and cease relatively quickly after rain events (Cooke et al. 1992).

An initial assessment of Ventura River potential passage impediments in relation to river discharge was completed by ENTRIX (1999). The physical characteristics of seven potential impediments were evaluated using the Thompson (1972) passage criteria. The Thompson (1972) passage criteria for adult steelhead at critical riffles is a water depth of 0.6 ft for 25% of the total transect width and a continuous portion equal to 10% of the total transect width. ENTRIX (1999) also evaluated the potential impediments using criteria of 0.5 ft and 0.6 ft depth for 25% of the total width and a total width of 8 ft for both depths. The resulting discharge required to meet critical criteria was estimated to be between 40 and 65 cfs. There have been several modifications to the Thompson passage criteria by other researchers; Dettman and Kelly (1986) on the Carmel River used a depth of 0.6 ft over a 5 ft continuous section, a criteria of 0.6 ft depth over an 8-ft section was used on the Santa Ynez River (SYRTAC 2000), and Harrison et al. (2006) used a criteria of 0.6 ft depth over a 10-ft section on the Santa Clara River. Thompson's (1972) depth criterion of 0.6 ft was not based on actual migration observations and

never validated as a minimum condition for passage. Adult salmonids have been observed passing through riffles shallower than the 0.6 ft criterion (Mosley 1982).

The objective of the impediment evaluation is to assess factors that may impede steelhead migrating upstream to the Robles Fish Facility (NMFS 2003a). Because low-river flows have the potential to impede upstream fish migration in the Robles Reach, characterizing the effect of flows on critical riffles in this reach will be the primary focus of the impediment evaluations (NMFS 2003a).

Methods

Selected channel features that may pose an impediment to upstream passage were surveyed multiple times during the fish migration season (January through June) to measure water depth, velocity, and channel width along a transect at each site. The selected sites were planned to be surveyed over a range of discharges from approximately 30-171 cfs (with the upper limit dependent on the ability to safely conduct the surveys), which was correlated with discharge at the Robles Fish Facility. The number of repeated surveys conducted annually has depended on the number and duration of significant rain events, rate of hydrograph recession, previous surveys, and time constraints due to other aspects of the monitoring and evaluation program. The impediment surveys have been conducted since 2010 because of the natural variation of the Ventura River. The currently selected impediment sites (Appendix 2) were resurveyed multiple times to develop a statistically robust data set, given the natural variability of discharge, to rigorously evaluate fish passage in relation to Robles Fish Facility discharge.

Site Selection Process

During the initial phase, the Ventura River was surveyed from the mouth to the Robles Fish Facility (23 km) using standard stream survey techniques and was completed in

2008 (CMWD 2008). This provided physical measurements of all habitat units for the selection process. The survey methodology followed Moore et al. (2002) and was equivalent to a level IV survey as described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2002).

Over the course of three meetings and one conference call between 24 January and 18 June of 2009, the Biological Committee (BC) for the Robles Fish Passage Facility completed an impediment site selection process that culminated in the original selection of eight sites that would be monitored for the impediment evaluation. The BC reviewed physical parameters of the 379 habitat units surveyed and general river characteristics that included: unit type, length, width, water depth, slope, longitudinal location (river km), step height on step units, discharge at Foster Park and the Robles Fish Facility at the time of the surveys, and a river profile for the 23 km of the Ventura River below the Robles Fish Facility. Upon completion of an initial assessment of the data, a list of potential sites was developed that the BC visited in the field on 27 May 2009 to determine if monitoring was warranted. This field and data assessment included regular BC members (at the time of the assessment) Mike Kinsey (BOR), Stan Glowacki (NMFS), Mary Larson (CDFW), and Scott Lewis (CMWD). Mike Gibson (CMWD), hydrologists Bob Hughes (CDFW), and David Crowder (NMFS) also participated in this assessment and selection process.

A flow event that peaked on 20 March 2011 at approximately 20,000 cfs at the USGS Foster Park gage station, a recurrence interval of about 6 years, significantly altered some impediment sites that required modifications to the monitoring. See CMWD (2011) for a detailed description of the high flow caused site alterations. A Biological Committee (BC) field assessment on 11 January 2012 was conducted to review alterations that occurred and select replacement sites for ones that no longer appeared to be impediments. Regular BC members (at the time of the assessment) Ned Gruenhagen (BOR), Rick Bush (NMFS), Mary Larson (CDFW), and Scott Lewis (CMWD) participated in this review and site-selection process; Mike Gibson (CMWD) and hydrologist Bob Hughes (CDFW) were also involved in this assessment and

selection process. Based on this field review, Site 2 was no longer considered a potential impediment due to channel alteration. Site 10 was identified as a replacement site during the January 2012 field trip. Site 8, which was initially selected during dry conditions, was not considered as restrictive as other potential sites after evaluating data collected during 2010 and 2011. Consequently, Site 8 was replaced with Site 9 during the January 2012 field trip. The complete list of current impediment sites that the BC visited and determined to be satisfactory for monitoring during the 2012 season can be found in Appendix 3. However, when new site selections were made (i.e., 11 January 2012), insufficient flows were available to make final site selections or transect placements. Until March of 2014, the lack of precipitation and subsequent insufficient surface flow did not allow for confirmation of these new sites as potential passage impediments. This confirmation was completed after a March 2014 storm provided the first notable surface flows in 3 years and allowed available members of the BC to visit sites 9 and 10 on 03 March 2014. The confirmation was conducted by Scott Lewis (CMWD), Dana McCanne (CDFW), and Mike Gibson (CMWD).

ENTRIX Study Site Assessments

An effort was made to locate and determine the status of the ENTRIX (1999) study sites during 2009. Because there were numerous bed-mobilizing runoff events after the study was completed, the status of all study sites was unknown. Based on the site descriptions in the ENTRIX (1999) study report, field surveys were conducted to locate and describe the existing channel conditions at the original site locations. Of the 7 sites originally identified by ENTRIX (1999), only 4 sites were located with some degree of confidence. Of those 4 sites, all were no longer in the primary low-flow channel. Descriptions of the ENTRIX sites are provided in a previous report (CMWD 2011).

Results

During the reporting period for 2023, 8 BO-defined storm events occurred. A large flow event on 09 January 2023 of over 30,000 cfs (peak to be determined), estimated at the

USGS Foster Park gage station, substantially altered the Ventura River channel. All remaining impediment study sites (Appendix 2) were assessed (Appendix 23) and determined to have changed significantly enough that additional sampling would not be comparable. Therefore, no water depth transects were conducted during the 2023 fish passage season.

Discussion

Data sampled from the population of sites identified as “critical riffles” will be pooled for evaluation to inform recommendations on flows to facilitate fish passage. This includes data collected over 6 seasons and a range of discharges. All impediment sites will be pooled by site and across all years for this initial analysis step. Pooling the data broadly will characterize the full range of data collected at the different impediment sites across a range of hydrologic conditions. All previous impediments will be included for this initial analysis.

Exploratory data analyses are needed to determine the most appropriate and informative methods for analyzing the data, including data pooling, any needed data transformations, other model explorations, outlier determinations, and final model ranking and selection. This process will proceed on a parallel track within the BC, culminating in flow recommendations to the Management Committee based on the BC’s evaluation.

3.1 Sandbar Monitoring

Introduction

The Ventura River, like many other California rivers, frequently develops a seasonal sandbar at the mouth during the late spring or summer that is breached by higher river flows in the late fall or winter. If a sandbar develops, which occurs more often during

dry years, the resulting lagoon can provide important rearing habitat for steelhead juveniles because of the abundant food resources available. Additionally, this can facilitate the physiological and behavioral changes associated with smoltification (Cannata 1998) and also enhance marine survival (Bond et al. 2008).

The primary objective of the sandbar monitoring is to determine if the criteria for initiation of the fish passage augmentation season have been met (NMFS 2003a). As stipulated in the BO, the fish passage augmentation season extends from 01 January through 30 June of each year and commences after the sandbar has been breached at least once during the current year's fish flow operations season. During the fish passage augmentation season, several Robles Fish Facility operation criteria must also be implemented (see NMFS 2003a for a complete list of operational criteria).

Methods

During each sandbar inspection, observations and recordings were made that included: date, time, status of the sandbar, general location of the mouth, tidal stage, water temperature, and discharge at the Robles Fish Facility and the USGS Foster Park gage station. The sandbar was open on 01 January 2023 and its status was monitored once every two weeks through June 2023. Outside of the fish passage augmentation season the sandbar was monitored at least monthly.

Results

During the reporting period, the mouth of the Ventura River was inspected 19 times to determine if the sandbar was open or closed. There were 10 observations made during the fish passage augmentation season (January through June 2023) and 9 observations made outside of the season. The sandbar was open from 01 January 2023 through 30 June 2023 for volitional fish passage (Appendix 4). The sandbar was assumed to be open on 01 January 2023 because discharge peaked at about 2,000 cfs at Foster Park

on 01 January. The sandbar open status was not verified until 31 January 2023. On days the sandbar was inspected during the reporting period, the mean daily discharge at the USGS Foster Park gage station and the Robles Fish Facility ranged from approximately < 1 to 678 cfs and 0 to 172 cfs, respectively. The sandbar was closed during one of the observations in October 2022 and there was evidence that intermittent saltwater intrusions occurred that overtopped the sandbar (i.e., wet sand on the lagoon side of the sandbar). However, these overtoppings were not sufficient to erode the sandbar and cause water to exit the lagoon. The sandbar was open during the entire 2023 fish passage season and the river was observed exiting from the east side of the estuary at the beginning of the season. Following the 25 February 2023 flow event, the river mouth switched to the west side of the estuary.

Discussion

The Ventura River mouth sandbar tends to remain open for volitional fish passage during average to above-average precipitation years and closes only during years with few significant rain events. During years with this common precipitation pattern, the sandbar remains open during the BO-defined fish passage season from January through June (Appendix 5). This pattern commonly includes a period during the summer and fall when the sandbar is closed. A single low precipitation year can produce longer periods of closure (e.g., 2007, 2012, 2016, and 2018). During consecutive dry years, the sandbar will persist into the fish passage season, opening only for short periods after rain events (e.g., 2013-2015).

The tendency of the sandbar to remain open during the fish passage season, in all but very dry years, is likely due to several factors. Although the middle reach of the Ventura River goes dry every year, subsurface water continues to flow during most years and eventually begins to resurface upstream of the confluence with San Antonio Creek. This water resurfacing continues to increase to an area just downstream of the San Antonio Creek confluence. Additionally, tributary flow from San Antonio Creek contributes to the Ventura River via a surface or subsurface connection throughout the

year. Finally, treated effluent water from the Ojai Valley Sanitary District at 7.5 river-kilometers (rkm) increases the discharge by about 3 cfs. Continued lower evapotranspiration caused by the Thomas Fire and above-average rainfall in 2019 and 2023 have together likely contributed to longer periods of surface/subsurface flow and the open sandbar. These hydrologic and geomorphic features have produced longer surface water in the lower Ventura River and prevent the sandbar from fully forming. The sandbar has remained open during most fish passage seasons, which has been approximately 80% of the time since 2006.

The open or closed status of the sandbar indicates general river passage conditions and potential estuary entry and exit conditions for adult steelhead and juvenile *O. mykiss*, respectively. It appears accessibility to the Ventura River or ocean exists during most passage seasons when adult steelhead are typically immigrating and smolts are emigrating. However, lagoon conditions optimal for smaller juvenile rearing and growth (i.e., when the sandbar closes and enables the estuary to form a deeper freshwater lagoon; Bond et al. 2008) appear limited during most years for the study period beginning in 2006.

4.0 EVALUATE FISH MOVEMENT THROUGH THE PASSAGE FACILITY

4.1 Water Velocity and Depth Validation Evaluation

Robles Fish Facility performance testing or evaluations were conducted during the 2023 fish passage season. However, substantial sedimentation and malfunctioning flow meters (see below) at the Facility prevented the higher priority performance testing from being completed (Table 1).

The auxiliary water was operated at 100% open during this season; however, the maximum discharge observed was approximately 65 cfs. Both auxiliary meters were functioning at the start of the season, but after the large January storm event, the lower

(downstream) flow meter malfunctioned and could not be used to validate the new (upstream) flow meter. In addition, the measurement weir gage was impacted by sediment and could not be used to validate auxiliary flow meter readings. The auxiliary maximum discharge was much lower than expected, but extensive sedimentation of the entrance pool raised the water elevation several feet, which in turn decreased total head elevation. To fully test the capacity of the auxiliary pipe, the flow meters will need to be repaired and sediment removed from the entrance pool.

Velocity profiles were conducted at 3 locations in the screenbay over a two-day period. There were 4 replicates collected at each location for a total of 12 profiles as described in the performance study plan (Rogers 2006). Robles inflow during profile data collection was approximately 550 cfs; canal flow of 450 cfs, fishway flow of 50 cfs, and auxiliary of 50 cfs. The ADCP was tethered to a rope and pulley system and guided across the screenbay to collect the velocity profiles at each of the 3 profile locations. Below is a screenshot from the ADCP software as an example for one of the velocity profile transects (the profile is looking downstream with the east side of the screenbay on the left). A full report of the Water Velocity and Depth Validation Evaluation will be completed once data collection has been conducted for all tasks the BC determines necessary.

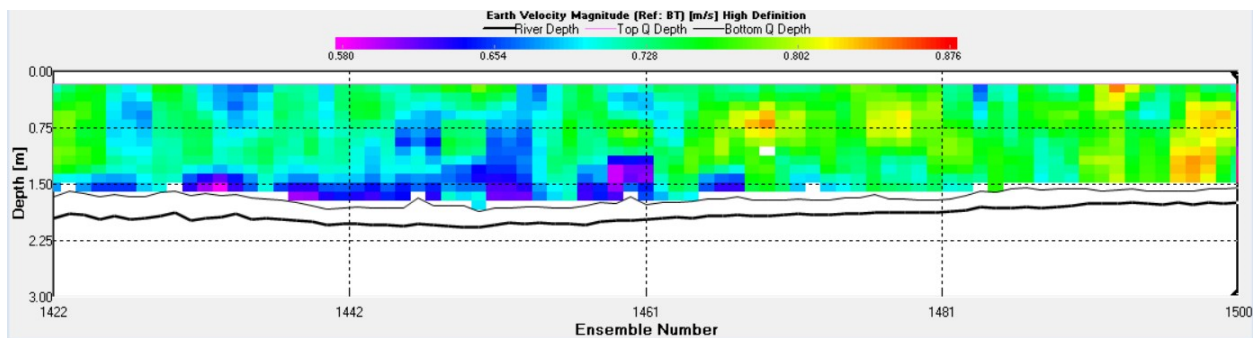


Table 1. Performance testing completion status and remaining priorities.

Component	Completed/ Year	Flow Required	Required Flow duration	Anticipated completion	Comments	Completed By	Priority- Flows 30-50 cfs	Priority Flows 700 cfs +
Screens	Yes/2011	671 cfs in channel				Consultant		
Diversion Flume	Yes/2006							
Fishway Vertical Slots	Yes/2018	25-35 cfs in Fishway (34 cfs)	24 hours			Casitas		
	Yes/2020	50 cfs in fishway (50 cfs)	24 hours			Casitas		
	No	50 cfs in fishway + 121 cfs in Auxiliary Pipe	24 hours	After 121 cfs is achieved through the Auxiliary Pipe	River must flow at 2000 cfs for 24 hours to accomplish this task	Casitas		7
Fishway Entrance Gates	Yes/2018	25-35 cfs in Fishway (#5 @ 34 cfs)	24 hours			Casitas		
	Yes/2018	50 cfs in fishway (#5 @ 44 and 50 cfs, #4 @ 50 cfs)	24 hours			Casitas		
	No	50 cfs in fishway + 121 cfs in Auxiliary Pipe (#5 @ 72 cfs, #4 @ 72 cfs, 2019)	24 hours	After 121 cfs is achieved through the Auxiliary Pipe	River must flow at 2000 cfs for 24 hours to accomplish this task	Casitas		3
Auxiliary Water	No	121 CFS in Aux Pipe	24 hours	After 121 cfs is achieved through the Auxiliary Pipe	River must flow at 2000 cfs for 24 hours to accomplish this task	Casitas		4
Entrance Pool	No	400-600 cfs in spillway (400 cfs spill and 50 cfs ladder method testing, 2019)	8 hours	After 121 cfs is achieved through the Auxiliary Pipe		Casitas		1
	No	1200-1500 cfs in spillway	8 hours	After 121 cfs is achieved through the Auxiliary Pipe		Casitas		2
	No	2500-3500 cfs in spillway	8 hours	After 121 cfs is achieved through the Auxiliary Pipe		Casitas		6
Interim Rock Weirs	Yes/2017	20 cfs	4 hours			Casitas		
	Yes/2017	30-40 cfs	4 hours			Casitas		
	Yes/2017	50 cfs	4 hours			Casitas		
Fish Guidance System	No	671 cfs in channel	4 hours			Casitas		8
Forebay	No	1000-2000 cfs	4 hours			Casitas		5
High Flow Fish Exit	Yes/2006	150-200 cfs in channel	4 hours		HF has a continuous read flow meter	Casitas		
	No	600-700 cfs in channel	4 hours			Casitas		9
Low Flow Fish Exit	Yes/2018	20-40 cfs (26 cfs)	2 hours			Casitas		

4.2 Fish Attraction Evaluation

Introduction

River discharge is one of several key environmental factors initiating and facilitating migration of adult and juvenile steelhead, and other salmonids, in natural fluvial

environments (Shapovalov and Taft 1954; Banks 1969; Spina et al. 2005). As adults and juveniles approach fish passage facilities, suitable discharge and water velocities are needed to ensure successful passage (Clay 1995; Beeman and Maule 2001).

The entrance of the fish ladder for the Robles Fish Passage Facility is located approximately 20 m downstream of the spillway gates and is where fish migrating upstream enter and downstream migrating fish exit the facility (i.e., two-way passage facility). The downstream end of the ladder is adjacent to a large pool (entrance pool). The fish ladder entrance was designed for a maximum discharge (i.e., total attraction flow) of 171 cfs (50 cfs through the entire ladder and an additional 121 cfs supplemented at the lower end of the ladder). The reach downstream of the fish ladder entrance is comprised of habitats that steelhead may use during migrations. The distance downstream from the entrance pool to the lowermost rock weir is approximately 200 m. This reach includes all four existing rock weirs and the facility's discharge measurement weir, which also functions as a low-flow road crossing. The habitat types in this reach include the four pools created by the rock weirs, a glide created by the discharge measurement weir, a short riffle, and the entrance pool.

The objective of the fish attraction evaluation is to determine if adult or juvenile steelhead are holding immediately downstream of the Robles Fish Facility during the fish passage augmentation season (NMFS 2003a).

Methods

Three separate methods that covered a range of spatial and temporal scales were employed to determine the presence of *O. mykiss* for the Fish Attraction Evaluation. The methods used included: 1) Weekly bank/snorkel surveys during the fish passage season, 2) post-storm bank/snorkel surveys in the entrance pool during the BO-defined ramp-down period, and 3) post-storm underwater video monitoring at the fish ladder entrance during the ramp-down period.

1) Weekly bank/snorkel fish attraction surveys, a methodology used since 2007, were conducted during the fish passage season from January through June of 2023. The study reach included 200 m downstream and 140 upstream of the fish ladder. The particular survey methodology used (i.e., bank or snorkel) was determined based on water visibility, river discharge, expected steelhead life history stage present at the time of the survey, and safety of surveyors. A combination of bank and snorkel surveys were conducted during the 6-month period. Bank surveys were conducted by one or two surveyors in an upstream direction. The surveyors wore polarized sunglasses to reduce water-surface reflection. Snorkel surveys were conducted by one or two surveyors in an upstream direction. When present, fish species are identified and enumerated to the greatest extent possible permitted by the ambient river conditions and fish densities at the time of each survey. If *O. mykiss* were present, lengths of each fish was estimated to the nearest cm if only a few individuals (generally < 10) were present. In order to collect additional information that may help determine *O. mykiss* upstream and downstream movements through the Robles Fish Facility, an upstream study reach was added in 2009. The upstream study reach included observations in the screenbay of the facility and the area immediately upstream of the low-flow fish exit in the forebay. The total distance of this upstream reach was approximately 140 m.

2) Post-storm bank/snorkel surveys were conducted in the entrance pool during the ramp-down period for all BO-defined storms. This consisted of daily surveys during the 10- or 12-day augmentation period after a storm event. Beginning the day after a BO-defined peak event, a Secchi depth was measured in the entrance pool to determine when surveys could begin. Bank surveys were conducted when visibility was poor and snorkel surveys were conducted after visibility increased (> 1.0 m Secchi), assuming this would allow *O. mykiss* to be observed.

3) The post-storm underwater video monitoring was conducted after a BO-defined storm and during the ramp-down period. After the storm event occurred, video cameras were installed at the entrance of the fish ladder. The video cameras were mounted on a bracket adjacent to the fish ladder entrance and lowered into place to provide

monitoring following the storm event. The cameras recorded the entire 10- or 12-day ramp-down period to a digital video recorder (DVR) and reviewed at a later date.

Results

1) A total of 26 surveys (23 bank and 3 snorkel) were completed during the weekly surveys and no *O. mykiss* were observed (Appendix 6). During the 6-month period, a total of 8,840 m was surveyed by either bank or snorkel methods. Water temperatures during the study period ranged from 11 °C to 21 °C and turbidity ranged from 1 to 800 NTUs when the surveys were conducted. The mean daily discharge at the Robles Fish Facility ranged from 27 to 1,926 cfs at the time of the surveys.

2) There were 8 BO-defined storm events that occurred during 2023. A total of 54 surveys were conducted for the post-storm fish attraction surveys were completed and no *O. mykiss* were observed (Appendix 7). Water temperatures during the study period ranged from 12 °C to 17 °C and turbidity ranged from 10 to 2,199 NTUs when the surveys were conducted. The discharge at the Robles Fish Facility ranged from 31 to 2,700 cfs at the time of the surveys.

3) Post-storm underwater video monitoring could not be conducted during the 8 BO-defined storm events. The large storm event of 9 January 2023 damaged the electrical outlet near the entrance box; thus, power could not be supplied to operate the video equipment used for monitoring. Additionally, sedimentation of the entrance pool prevented the video system from reaching the bottom of the sampling area and the guide strut used to lower and raise the system was also damaged. Repairs will need to be made prior to the 2024 fish passage season.

4.3 Downstream Fish Passage Evaluation

Introduction

Salmonid fish passage evaluations have been conducted throughout the western United States for many years (Odeh 2000). Methods used to determine if a facility is operating as designed and not causing harm to the intended fish species vary. Early work typically entailed trapping and tagging fish before entering a facility and recapturing them after exiting. Trapping and visual inspections for injuries, PIT tagging, radio telemetry, and acoustical telemetry have been conducted extensively as well.

There are two objectives for the downstream fish passage evaluation. The first is to determine if downstream migrants are successfully passing through the Robles Fish Facility. The second objective is to capture and examine steelhead smolts and kelts to determine if injuries are occurring as they pass downstream through the Robles Fish Passage Facility (NMFS 2003a).

Methods

For a full description of evaluation methods, see section 5.0.

Results

No evaluations for the Downstream Passage Evaluation were conducted during 2023. The trap was not operated during 2023 due to the recent listing of steelhead through CESA. Take coverage through the state of California Endangered Species Act (CESA) permitting will have to be secured before trapping may resume.

5.0 DOWNSTREAM FISH MIGRATION THROUGH THE ROBLES REACH

Introduction

When the number of fish physically handled for a study is of concern, such as with an endangered species, radio telemetry can be a useful method over others like extensive trapping (Hockersmith et al. 2000). Telemetry information of emigrating steelhead smolts in the Ventura River could provide estimates of survival, travel time and rates through select reaches, migration relative to river discharge, habitat use, and passage success through critical riffles. By tracking tagged fish until the transmitter batteries are fully discharged, it is anticipated that downstream emigration can be monitored to the Ventura River estuary/lagoon, which could contribute to an understanding of estuary rearing, if any, and final emigration to the ocean.

The purpose of the downstream migration evaluation is to determine how successful smolts are at migrating through the Robles Reach (NMFS 2003a). Because of the limited number of steelhead smolts likely passing downstream through the facility, a NMFS approved pilot study using radio telemetry was used for evaluations.

Methods

A weir trap was to be placed and operated approximately 40 m downstream of the Robles Fish Facility. The weir trap consists of a live-box (120 cm for all three dimensions) with an internal fyke. The trap was to be situated in the center of the river channel and thalweg. The live-box internal frame is constructed of PVC pipe and covered with plastic fencing with 1.9-cm diagonal openings. A plastic fence (3-cm openings) supported by T-bar fence posts was to be extended upstream on both sides of the live-box at 30° angles into the river channel. A 1-m gap on the right bank was designed so any adult steelhead could bypass the trap location and move upstream. Because the vast majority of downstream steelhead migrants were expected to be

captured from mid-March through mid-June (Shapovalov and Taft 1954; Dettman and Kelley 1986), the trap was intended to be operated from mid-March through June 2023 or until water temperatures exceeded a daily mean of 22 °C, which could negatively impact captured fish (SYRTAC 2000), or the surface water connection was lost in the mainstem of the Ventura River. For a full description of evaluation methods, see the 2023 CMWD monitoring and evaluation study plan (Lewis and Gibson 2023).

Results

As noted previously, the trap was not installed and operated during 2023 and therefore no *O. mykiss* were captured during 2023.

6.0 LONG-TERM MONITORING COMPONENTS

6.1 *Monitoring Robles Facility Operations*

6.1.1 *Facility Status*

The 2022-2023 water year was an above average rainfall year as measured in Matilija Canyon. The 73.34 inches of rain measured at the Matilija Canyon Ventura County station (through 29 August 2023) was 214% of the average annual rainfall. Eight BO-defined storm events occurred during 2023 and surface flow over the measurement weir was present for the entire fish passage season. Surface flow will likely be present for the remainder of the year.

Previous annual reports identified several projects, repairs, or significant maintenance to be completed or reported on as to their current status. The principal projects were:

- Install/repaired Sontek IQ pipe flow meter in the auxiliary water supply pipe.

The flow meter had numerous communication issues during 2019 that needed to be resolved before the 2020 season; however, water levels did not recede sufficiently to access the supply pipe for repairs until fall 2021. An inspection revealed calcification buildup on the transducers, which were cleaned. The meter was cleaned again in fall 2022. A redundant Sontek meter was temporarily installed and operational at the upstream end of the Auxiliary pipe in fall 2022, but full installation could not be completed before inflows increased at the facility (i.e., parts and time limitations). Both meters had communication issues during 2023 and will need to be resolved before the start of the 2024 season. However, the redundant upstream meter was working during 2023.

- Maintenance and repair of auxiliary water supply system.

During the summer of 2022, when the Facility was dry, calcification was removed from the Auxiliary diffuser grating by pressure washing and sediment was removed from fish ladder entrance box.

- Maintenance of screenbay, fish screens, and fishway.

Dry conditions starting in the summer of 2022 allowed for maintenance items in the screenbay area to be completed. The downstream side of the fish screens (i.e., behind the screens) and fish guidance device were pressure washed to remove calcification. Sediment in the screenbay was removed by hand once conditions were dry. All 15 vertical slot sills were cleaned, scraped/chiseled free of calcification, and lubed to ensure proper operation during periods of low flow.

- Level and flow sensors repair, replacement, and modifications. Level sensors at the fish ladder entrance were programed to read water levels in the entrance pool. Previously this item was not successfully completed due to presumed sensor and SCADA limitations. However, CMWD contracted with a SCADA technician during late 2019 and early 2020 who was able to use the existing level sensors to record this data. Additionally, the technician provided numerous

updated monitoring and control modifications to the Robles SCADA system. These included: ability to monitor the entrance pool elevation directly, auxiliary and fishway gate position displayed on SCADA PC screen, and backup fishway flow calculation from elevation. Additionally, many of the primary monitoring and controls can now be tracked or adjusted from the CMWD office without being on-site and provide for more refined operations. It is assumed the original sensors are reaching their working life limit and will be replaced with radar sensors as the budget allows. Through June of 2022, three of the original seven ultrasonic water level sensors have been replaced with radar sensors. Additionally, a new Sontek flow meter was installed in the fishway during 2020. The new fishway meter had communication issues during 2023 and will need to be resolved before the start of the 2024 season. During fall 2022, two new radar level sensors were installed downstream of the fish screen baffles (i.e., behind the baffles) on both sides (i.e., east and west) to monitor water levels and will be used to determine effectiveness of prototypes and general diversion efficiency. Radar level sensors are more accurate, dependable, and less affected by temperature variations.

- New diffuser perforated panels for the fish screens and auxiliary water supply. During the 9 BO-defined storms in 2019 and three during 2020, the new diffuser perforated panels did not become obstructed with debris as they previously had. It appears at this time that the new diffuser panels have corrected the issue of debris obstruction and causing reduced flows. Observations will continue to be made to evaluate the effectiveness of the panels. The diffusers were opportunistically cleaned while the facility was shut down for sediment removal in 2019 and only low levels of debris were present. However, during the 2023 storms, the diffuser perforated panels behind the fish screens became obstructed with debris and required cleaning twice. It is unknown why the panels became plugged this year and not the previous few years since the modifications were made, but likely can be attributed to the increase sediment and debris loads and prolonged diversions of 2023. They will continue to be monitored during future storms.

- Prototype evaluation of screen cleaning modifications. Two vertical fish screens were replaced with horizontal screens during 2020 (one on each side of the V-screen). This, along with several other modifications, were intended to be installed for evaluation. A screen back-wash system was not installed because of the expected chance for significant rain during 2020 and the cost of the system. Double brush arm screen cleaners were installed on the west-side of the V-screen during late 2020 and early 2021. After installation of all brush arms, a significant amount of time was needed to adjust and evaluate all components of the brush cleaning system. This included adjusting individual strips of bristles to the screen face, counterweight amounts, cable guides, cable tension, and cable sheaves. Most of these evaluations were facilitated by the use of a cable tension dynamometer that measured and recorded cable load to ensure the cleaning system was not exceeding design specifications.

On 14 December 2021, during a small storm event, preliminary debris samples from the fish screen were collected to be used as a possible metric to determine the effectiveness of various screen cleaning modifications. Four cycles of sampling occurred, at 5 sampling locations, over an 8-h period when diversion through the fish screens was 150-400 cfs. Samples collected during the rising limb and near peak flow showed no apparent differences between sampling locations. Samples collected during the receding limb of the storm event occurred when discharge passing through the screen was lower and consequently little debris was collected. Further data collection is needed to determine if debris sampling of the fish screen is a viable method to evaluate the effectiveness of various screen cleaning modifications. In addition, velocity measurements across the face of the fish screen were also taken during debris sampling, however it was determined the flow meter was not capable of measuring approach velocities, only sweeping velocities. A new velocity meter was purchased in 2022 as soon as this issue was identified (SonTek FlowTracker®2, Acoustic Doppler Velocimeter), although no BO-defined storm events occurred to collect any additional measurements. However, velocity tests

in flowing water did verify that the FlowTracker2 could measure water velocities simultaneously in the two perpendicular planes required. During 2023, substantial approach and sweeping velocity data were collected for the prototype screens. Data analyses are ongoing and will be reported to the BC to help determine the next steps of the evaluation program.

- Auxiliary pipeline box debris cover. To prevent debris from entering the auxiliary water supply, a perforated aluminum plate with ¼" holes was installed (November of 2020) on top of the grating, which has 1" x 3" openings. The grating covers the access opening for maintenance and repair of this area. During spill, at high discharges, the entrance pool water elevation is higher than the top of the fish ladder and water flows into the lower portion of the fish ladder, which allows debris to enter through the 1" x 3" openings of the grating. Once debris enters the auxiliary system, debris larger than the baffle holes becomes impinged and reduces flow from of the auxiliary system into the fish ladder. After the numerous storm events of 2023, it appears the debris cover was effective at preventing debris from entering the auxiliary water supply. A full assessment will be conducted once dry conditions return and the area behind the Aux diffuser panels can be accessed.
- Emergency repairs. The large storm event on 09 January 2023 caused substantial damage at the Robles Fish Passage and Diversion Facility. Two days later, the Casitas Board of Directors adopted a resolution proclaiming the existence of a "local emergency" given the clear and imminent danger to the health, safety and welfare of persons, property and environmental (fish and wildlife) resources within its jurisdiction and mission. Casitas immediately proceeded with the emergency repairs which continued until May 12, 2023. Work involved temporary repairs of the breached and damaged timber cutoff wall. Work also included restoring areas that eroded on the eastern side of the forebay, restoring areas that eroded on the western and eastern sides of the timber cutoff wall, and sediment debris removal from the forebay and screenbay.

The Project Completion Report for the Robles Diversion and Fish Passage Facility Emergency Repair Project was submitted to USACE as required under emergency permitting (CMWD 2023).

6.1.2 Flow Observations and Control

Flow and level measurement devices are located at various locations within the Robles Fish Passage Facility. The primary points for measuring and recording stream flows entering, flowing through, and leaving the Robles Fish Passage Facility are:

- Matilija Creek at Matilija Hot Springs—located approximately 2,100 feet downstream of Matilija Dam with good rating for low to moderate flows and operated by Casitas Municipal Water District, formerly a USGS station. The gage data is now remotely accessible by CMWD after communication upgrades. A second gaging station at this location is operated by Ventura County and has intermittent operational issues. The CMWD bubbler line was damaged in January and was not operational throughout the 2023 fish passage season. The Ventura County gage at the site was operational throughout 2023 and used as the primary gage upstream of Robles.
- Matilija Dam Stage Bubbler—located at the dam, this gage provides the lake elevation. Under high flows, the dam acts as a weir. This is one of the primary locations to determine when a hydrograph peak has occurred during a storm. Ventura County extended the bubbler line to a lower elevation in the fall of 2020 to capture future downloads and drawdowns to the water inlet level.
- North Fork Matilija Creek—located approximately 3,000 feet upstream of its confluence with Matilija Creek with good rating for low to moderate flows but does have intermittent operational issues. It is operated by the Ventura County Watershed District. Numerous issues with this gage during 2023 caused it to be of minimal use to determine flow patterns upstream of the Robles Facility.

- Robles-Casitas Diversion Canal—located on the diversion canal approximately 1,300 feet downstream of the Robles headworks in a trapezoidal channel with a good rating for flows up to 600 cfs.
- Ventura River near Meiners Oaks (VRNMO or Measurement Weir)—located approximately 540 feet downstream of the Robles Fish Passage spillway at a concrete weir section with good rating up to 100 cfs. Rating equations are used above 100 cfs with no verifications at higher flows above 1000 cfs. This is the most reliable flow measurement for releases with a 50-year plus record and a former USGS site. During 2023, sedimentation caused significant issues with its reliability and required frequent hand removal of sediment and clearing of the bubbler line.
- Fish Ladder—Sontek IQ Plus has been added to this location to measure flow in the fish ladder. It operated normally until the 09 January 2023 storm, and then began to have communication issues that could not be resolved. It will be repaired or replaced prior to the start of the 2024 fish passage season.
- Auxiliary Water Supply—Sontek IQ Pipe has been installed to obtain flow measurements in the auxiliary water supply. It has had intermittent operational issues, but because water remained in the lower fish ladder through 2020, an inspection was not done until the summer of 2021. The inspection only revealed calcification buildup on the transducers, which were cleaned. A redundant Sontek meter was installed at the upstream end of the Auxiliary pipe in 2022. The downstream meter operated initially in January of 2023, but failed again and the new redundant upstream meter was used. Both meters had communication issues during 2023 and will need to be resolved before the start of the 2024 season.

All discharge instrumentation can suffer from inaccuracies caused by clogging of bubbler lines, electronic creep, debris or calcification accumulating on sensors, changes to the measured cross sections, vandalism, or equipment problems. For this reason, the data are verified against field measurements and observations when possible. The information gathered from each of these locations has been summarized as mean daily

flows (Appendix 8). The mean daily Robles Fish Facility discharge and corresponding turbidity and temperature measurements for the entire fish passage season are presented in Appendix 9.

Critical Drought Protection Measures (CDPM)—Three of the eight BO-defined storm events that occurred during 2023 were CDPM modified releases. Matilija Dam filled on 01 January 2023, therefore a CMPD download could not be used because the water right requires 30 days of storage before a download can occur. During the third modified release, Lake Casitas storage exceeded the CDPM volume of 100,000 af, thus the release schedule was modified to a standard release. The Matilija Dam intake structure was damaged during the high flow events and Ventura County will be making necessary repairs in the near future. Lastly, the BC began meeting in 2021 to start developing Stage 5 CDPM that will be implemented once Stage 5 storage is reached in Lake Casitas. The meetings were put on hold once the lake exceeded 100,000 af.

6.1.3 Costs Associated with Operation and Monitoring

The BA/BO specified that CMWD provide the costs that are associated with the activity. The following is a summary estimate of direct costs incurred by CMWD during the 2022-23 fiscal year:

- **Fisheries Monitoring:**

Salaries & Benefits	\$ 580,847
Equipment/Material	\$ 41,670
- **Facility Operations:**

Salaries & Benefits	\$ N/A
Equipment/Materials	\$ 44,923
Outside Contracts	\$ 13,670
Utilities	\$ 8,528
Permit	\$ 678
- **Capital Improvements:**

Facility repairs/replace	\$ 40,693
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- **Emergency Repairs:**

Forebay Restoration	\$ 1,297,262
Timber cutoff wall	\$ 75,879
Screenbay cleanouts	\$ 50,330

6.1.4 Water Velocity and Depth Validation Evaluation

Water velocity data was collected in the screenbay during 2023 fish passage season (see 4.1 section). Although 8 BO-defined storm events occurred during 2023, high sedimentation of the forebay, screenbay, and entrance pool prevented higher priority performance testing from being completed. All future performance testing will be completed in general accordance with the NMFS approved Performance Evaluation Program and Biological Committee priorities in section 4.1, Table 1.

6.1.5 Recommendations Regarding the Prioritization of Future Activities

The Robles Fish Facility has completed its 18th season of operation. An assessment of the current fish screens and cleaning system was initiated to determine if modifications could be made to improve fish passage and diversion operations. A prototype evaluation plan was completed and distributed to the BC for review during 2019. Implementation of the evaluation plan was ongoing for the 2023 fish passage season.

6.1.6 Recommendations Deemed Necessary to the Operations

Forebay sedimentation and high flows caused significant operational issues during 2023 and emergency repairs were made. However, these emergency repairs were temporary in nature and will need to be completed in the off-season (no/low flows) and once permitting can be completed. Casitas continues to recommend the 16-weir project remain on hold until final plans for Matilija Dam Removal Project are completed. These plans include a High Flow Sediment Bypass as part of the removal project that will likely require significant facility modifications to the Robles Fish Passage Facility project area and have not been determined. The Robles Working Group is currently developing sediment bypass alternatives to be designed, evaluated, and selected.

6.2 Fish Passage Monitoring

Introduction

Monitoring of migratory fish moving through fish passage facilities has been conducted using many different methods that include: visual counting, trapping and hand counting, continuous video recording, PIT tagging, radio telemetry, and acoustical telemetry. In each fish passage application, the particular physical and biological conditions (e.g., variable discharge, turbidity, debris, size of facility, and number of fish) usually dictate which method would be most effective. New technologies have been employed to improve fish passage monitoring in turbid conditions specifically. One such monitoring device is the Vaki Riverwatcher® (Riverwatcher). The Riverwatcher has the capability to operate in greater turbidity than more traditional monitoring equipment. Because of this advertised capability, the Riverwatcher was selected to be used in the Robles Fish Facility by the Technical Advisory Group during original facility design.

The primary objective of fish passage monitoring is to provide a long-term index of upstream adults and downstream kelts migrating through the Robles Fish Facility (NMFS 2003a). Although the Riverwatcher has the ability to detect smolt-sized steelhead, the manufacturer recommends it for monitoring fish with body depths ≥ 40 mm (Vaki 2003). Consequently, at the time the Riverwatcher was selected as the monitoring method, it was not known how well it would work at detecting smolt-sized fish given the debris load of the Ventura River (NMFS 2003a).

Methods

Fish migrating upstream and downstream through the Robles Fish Facility were monitored using the Riverwatcher. The Riverwatcher is located in the fish bypass channel, which is the channel between the fish ladder and fish screens. The Riverwatcher consists of two scanner plates with light diodes that transmit beams of

infrared light through the water to a corresponding receiver plate. When a fish swims (or debris drifts) through the infrared light beams, it breaks the light signal and a digital silhouette of the fish is recorded on a computer. Other data recorded when the Riverwatcher scanner is triggered are: date and time, total length (TL) of the fish (from a length/height ratio), swimming speed (m/sec), and direction of the fish movement (upstream or downstream). Additionally, the scanner triggers an underwater camera to record a 10-second video clip (25 frames/sec). Based on this recorded information, all detections are reviewed and classified (see below and Appendix 10).

The Riverwatcher was experiencing technical issues related to malfunctioning video communication during the 2015 monitoring season and was sent to Vaki for servicing. Through diagnostic testing, Vaki concluded no repairs were necessary and did not experience any issues with malfunctioning video. Vaki stated recent improvements to the Riverwatcher system could be integrated into older systems and recommended upgrading the Robles Riverwatcher. This recommendation was discussed and approved by BC members at the 2015 committee meeting. The primary upgrade was changing from an analog camera to a digital camera. In conjunction with updated software, the camera now records video for both upstream and downstream detections. Additional upgrades to the Riverwatcher included: white and infrared lights, cabling, multiplexor, and power supply. To improve video detection of fish, an additional camera was installed and is located upstream of the Riverwatcher scanners in an aluminum tunnel below the Riverwatcher camera. A second DVR camera is located above the Riverwatcher and pointed at the scanner plates. These two DVR cameras are independent of the Riverwatcher system and have to be reviewed separately for detections. The digital cameras recorded continuously at 12 frames/sec and capture about 5 weeks of data until the DVR data storage drive is full. Once the DVR memory is full, it can be exchanged with a second DVR and data can be reviewed.

The Riverwatcher scanner and cameras are positioned at the bottom of an aluminum frame (crowder) covered with 1/2-inch aluminum bars, spaced 1 1/2 inches on center resulting in 1-inch spacing between the bars, which directs the fish to swim between the

scanner plates. The crowder can be raised and lowered in guide slots of the fish bypass channel with the aid of an A-frame hoist for cleaning or repair. The Riverwatcher is usually operated during the entire flow augmentation season as long as sufficient water elevations in the fish bypass are present and debris and turbidity are low enough so the crowder will not be damaged and the Riverwatcher will function properly. During periods of higher debris loads, cleaning and inspections occur multiple times per day. Cleaning and inspections occur once every 2-3 days during periods of low debris.

Prior to 2010, each upstream and downstream Riverwatcher detection was reviewed and classified as either: an adult steelhead, *O. mykiss* non-adult steelhead, other species if identifiable, unknown fish, fish probable, or false detection (see Appendix 10 for detection classification flow chart). At the request of NMFS, this classification system was modified during the review process of the 2010 progress report. It is NMFS' belief that supporting data do not exist to distinguish between the resident *O. mykiss* and anadromous steelhead. All confirmed *O. mykiss* were classified solely as *O. mykiss*. The classifications were determined by using a combination of the silhouette images, estimated lengths, and video clips. In addition, if larger adult sized *O. mykiss* were detected and a useful video clip was recorded, measurements of eye diameter and standard length (SL) were estimated from the video clip to calculate morphometric ratios that were compared to known steelhead and rainbow trout.

A commonly used morphological method to discriminate differences is using body measurements to develop ratios for comparisons, which removes the effects of body size (Strauss and Bond 1990). This is done by comparing SL to the ratio of eye diameter in linear regression. Standard length is measured length from tip of snout to end of hypural plate near the end of the fleshy caudal peduncle, which is unaffected by caudal fin deformities (Anderson and Neumann 1996).

Before 2010, the adult steelhead classification was used if the fish observed was an *O. mykiss* and displayed the typical characteristics of an anadromous adult steelhead, such as black spotting on dorsal, adipose, and caudal fins, black spotting on dorsal side

of body, silvery body, vertical edge to caudal fin, ≥ 38 cm TL (Shapovalov and Taft 1954), and eye diameter/SL ratio ≤ 0.045 (CMWD 2008). The new classification method may include juvenile resident, smolts, adult resident, and adult anadromous *O. mykiss* migrating throughout the basin. Conceivably, after more data are collected from the downstream trapping component, or from other Ventura River basin research projects, a more accurate classification system of Riverwatcher detections could be used again.

The “fish unknown” classification was used if a detection was identified to be a fish based on video evidence, but further classification could not be determined due to high turbidity, or inadequate portion of the fish captured within the camera’s field of view. The “fish probable” classification was used if no fish was observed in the video, but the silhouette was similar to that of a typical fish silhouette confirmed by past video evidence. Even with reasonably good video coverage, smaller fish are still able to pass through the Riverwatcher undetected by the video cameras. This occurs if fish swim very close, high, or low relative to the cameras. In addition, this can happen if a fish swims upstream through the scanners but stops before entering the video field of view. High turbidity can also obscure the video detection and identification of fish.

The “false detection” classification was used when no fish was observed in the video and the silhouette was not similar to that of a typical fish silhouette. Because false detections tended to occur frequently during higher discharges, when turbidity and debris are also high, it is likely that most false detections during these periods are caused by debris, high turbidity, and water turbulence. A second video camera is directed at the Riverwatcher scanner plates to help determine the cause of many of the false detections. After reviewing selected time periods when many assumed false detections occurred, it was concluded that debris, air bubbles, and turbulence were indeed the source of the detections. During low-flow periods (< 10 cfs), 99.9% of the time the Riverwatcher was operational, surface water turbulence was likely the cause of most false detections. When turbidity exceeds about 100 NTUs, hundreds of false detections can occur per hour due to high concentration of suspended solids breaking

the infrared beams of the scanner plates. When turbidity is less than about 100 NTUs, false detections from suspended solids are not as frequent, but poor water visibility does not always allow for video confirmation, depending on how close to the camera a fish swims during passage. Once turbidity falls below about 25-30 NTUs, turbidity does not limit the Riverwatcher to detect and confirm fish passing through the facility (Table 2). In spring 2016, the Riverwatcher was tested in an above-ground pool with wooden fish silhouettes at varying water turbidities. This was intended to simulate natural stream conditions to provide further resolution of the operational capabilities of the Riverwatcher (Lewis et al. 2016).

Table 2. Riverwatcher general operational status for ranges of water turbidity (NTUs).

Approximate Turbidity (NTUs)	Riverwatcher status
> 200	Not functional
100-200	Many false scanner detections, not fully functional
30-100	Scanner functional, but unable to confirm with video
< 30	Scanner functional, grid detectable for video confirmation

A standardization test for the Riverwatcher was developed using wooden silhouettes of typical sizes for smolt and adult steelhead. To confirm the Riverwatcher is functioning correctly, this test is conducted before each fish passage season. A more detailed description of this test can be found in Lewis et al. (2016).

Results and Discussion

The Riverwatcher was operated from 12 December 2022 through 30 June 2023. The Riverwatcher was not operated for about 470 hours due to high turbidity and for about 355 hours due to high debris (primarily algae) loads. During the 2023 fish passage season, the crowder was removed from the fish bypass channel and cleaned or inspected 153 times. The crowder was removed during three Facility shutdowns for a

total of 12 days. Finally, the Riverwatcher was not operational for approximately 13 days due to a damaged scanner plate. During this time, the crowder remained in the channel to allow for monitoring using DVR cameras until loaner scanner plates could be acquired and installed. A total of 3,038 false detections were recorded by the Riverwatcher, of which 1,139 were upstream and 1,899 were downstream. There were 3 non-*O. mykiss* detected passing upstream or downstream through the Riverwatcher; all were Largemouth Bass (Appendix 11). There were 2 *O. mykiss* observed passing upstream on the DVR camera recording during the period when the Riverwatcher was non-operational due to malfunctioning scanner plates. They were observed on 29 April at 20:03 h and on 6 May at 17:35 h and were estimated at 25 cm TL and 28 cm TL, respectively. Based on phenotypic characteristics, they were in all likelihood resident rainbow trout. At 25-28 cm, the lengths were greater than, or at the larger range, of previous *O. mykiss* smolts trapped emigrating downstream at the Robles Fish Passage Facility (range 17-26 cm, mean = 21 cm). Their bodies and caudal peduncles were robust, and the *O. mykiss* did not exhibit the typical slender smolt morphology that occurs from differential growth (i.e., increase of length relative to weight). The margins of the dorsal and caudal fins were not darkened, and abundant spots were visible across their bodies. The fish did not exhibit the typical silvering associated with smolting but did have the typical rainbow trout blue/green color dorsally and a red/pink hue along the lateral area.

The 3,038 false detections recorded by the Riverwatcher were assumed to be caused from turbidity, debris, turbulence, air bubbles, and settings of the Riverwatcher to detect smaller fish (based on previous detections and videos). The review of the second DVR camera directed at the Riverwatcher scanner plates from past detections provides confidence that these are the likely cause of false detections. None of the detections produced silhouettes that appeared to be fish based on previous experience operating the Riverwatcher (see Gibson 2012 for Riverwatcher silhouette detection examples). In the event that one of these silhouettes could have been caused by a fish, all detection video clips created by the Riverwatcher were reviewed and no fish were observed. For the 2023 season, the minimum threshold height remained at 28 mm so large numbers

of false detections could be eliminated while still attempting to detect steelhead smolts. Based on available data from the Ventura Basin, a height of 28 mm was determined to be similar to some of the smallest steelhead smolts expected to emigrate downstream through the Robles Fish Facility. This height corresponds to 146 mm TL and 139 mm FL. The estimated fish detection rate from a Riverwatcher verification study indicated that up to 93% of smolt sized *O. mykiss* will not be detected by the Riverwatcher (Lewis et al. 2016). Additionally, it was concluded that larger-sized fish (i.e., height > 80 mm) appeared to be detected nearly 100% of the time. This height is equal to about 475 mm TL. Shapovalov and Taft's (1954) 9-year study documented only 4% of the total number of adult steelhead were smaller than 475 mm. Therefore, the number of small adult steelhead that may not be detected would likely be low and the vast majority of adult steelhead would be detected.

7.0 ADDITIONAL BIOLOGICAL AND ENVIRONMENTAL MONITORING STUDIES

7.1 *O. mykiss* Presence/Absence Surveys

Methods

In addition to the fish attraction monitoring, *O. mykiss* relative abundance index surveys were conducted in the Ventura River mainstem between the Robles Fish Facility and the Ventura River mouth, San Antonio Creek, and upstream of the Robles Fish Facility in Matilija and North Fork Matilija creeks. These additional sites were surveyed using both bank and snorkeling methods (depending on water conditions and expected life history stage) but were conducted primarily after storm events for adults and during the rest of the year for smolts, parr, and fry. Methods to estimate fish size and numbers were the same as those used in the fish attraction evaluation. A total of 14 sites were monitored and both pool and riffle habitat at each site were included (Appendix 12). These additional areas were surveyed to determine if adult steelhead were entering the Ventura River, migrating upstream, holding and spawning, and if they were successfully passing through the Robles Fish Facility. Also, juvenile *O. mykiss* (smolts and

residents) were surveyed to learn spatial and temporal distribution patterns.

The survey sites were initially selected based on ease of access, coverage of basin, and assumed chance of detecting *O. mykiss*. However, after all habitat surveys were completed, site selection was also based on quantitative measurements identifying high-quality habitats used for *O. mykiss* juvenile rearing and adult holding.

Results

Peak snorkel counts within each year were generally between 350 and 400 *O. mykiss* until 2013. Due to the exceptional 5-year drought (2012-2016) and post Thomas Fire effects, the peak numbers of *O. mykiss* dropped substantially (Appendix 13). No *O. mykiss* were observed during the reporting period ending in June 2023. However, opportunistic snorkeling upstream of Matilija Dam in Murietta Canyon and Upper North Fork Matilija Creek revealed adult and young-of-the-year *O. mykiss* (both 2021 and 2022), indicating successful reproduction and early stages of population increase.

7.2 O. mykiss Index Spawning Surveys

Methods

Spawning surveys were conducted throughout the Ventura Basin accessible to anadromous steelhead or only to resident rainbow trout (i.e., upstream of Matilija Dam). A total of 21 index sites or reaches were subjectively selected (Appendix 14) with small to medium size gravel that is suitable for steelhead spawning (Shapovalov and Taft 1954; Orcutt et al. 1968). During 2008, the spawning index sites selected were initially distributed broadly within the basin to capture general spawning locations and timing. Since 2008, longer reaches have been added to incorporate and replace previously surveyed discrete sites to accommodate for spawning gravel redistribution after storm events. Additional sites have been added to capture quality spawning habitat and to be more representative of each surveyed sub-basin. This initial information was used to

establish long-term index sites to capture population trends. The spawning surveys were conducted biweekly from January through June. Once spawning was observed, surveys continued until at least 2 surveys were completed and no new redds were detected. Observations were made at spawning sites to identify and count *O. mykiss* redds; redds were identified by typical characteristics (Orcutt et al. 1968; Chapman 1988). Once a redd was identified, physical measurements similar to those recorded by Zimmerman and Reeves (2000) were collected to characterize the redd. The physical measurements were only recorded during the first three years because it was felt sufficient data was collected to characterize redds. Currently, larger redds (likely anadromous) have all measurements collected. Pit and tailspill lengths were measured from the upstream end to the downstream end of each, respectively. Redd width was measured at the widest point of the tailspill (Appendix 15). Water depth was measured at four locations: in the pit, adjacent to the pit, upstream of the pit, and at the tailspill. The surface median (D_{50}) and maximum substrate size of each redd tailspill was estimated. All adjacent measurements were taken on the thalweg side of each redd. Photos and GPS locations were also recorded for all redds identified. This information will help determine steelhead spawning habitat selection characteristics.

Results

Spawning surveys started in 2008 and counts initially increased from only 3 redds to a high of 165 redds in 2012. Since the peak in 2012, as the current drought intensified or was sustained, the available habitat diminished, and there has been a corresponding decrease of adult and juvenile *O. mykiss* populations with significantly lower redd counts. No redds were observed in the index areas during 2023 (Appendix 16).

7.3 Ambient Water Quality Monitoring

To evaluate aspects of the monitoring and evaluation program, water quality data is collected throughout the Ventura River basin (Appendix 17). Water temperatures are

recorded at 12 locations throughout the Ventura River basin. The locations include the Ventura River estuary and mainstem, Coyote Creek, San Antonio Creek, North Fork Matilija Creek, and Matilija Creek upstream and downstream of Matilija Dam. The temperature loggers recorded at 30-min intervals. Monthly grab samples are also collected at the same locations with a multiprobe that measures: dissolved oxygen, pH, conductivity, salinity, TDS, and temperature. A monthly water quality profile is also collected in the estuary/lagoon. The profiles are collected at approximately the mid-point of the estuary/lagoon and at least four depths are recorded. A continuous turbidity probe is also installed in the Robles Fish Facility near the Riverwatcher. It records water turbidity at 30-min intervals when the bypass is operational. The probe was ungraded at the start of the 2022 Fish Passage Season and now has a measurement range of 0-4000 NTU; a four-fold increase from the previous probe. Turbidity measurements are also collected at several sites upstream, downstream, and within the Robles Fish Facility. All locations were monitored if sufficient water was present. A weather station at the Robles Fish Facility collects various atmospheric data including: rainfall, temperature, pressure, wind, humidity, and dew point (Appendix 18). Weather station data was not collected at Robles for 2023 due to technical issues, and data from the NOAA Ojai weather station (Station No. USC00046399) was used for the reporting period.

7.4 Estuary/Lagoon Monitoring

The sandbar is monitored during the fish passage season to determine if it is open. If open, Robles Fish Facility operating criteria must be met per the BO. Outside of the passage season, monitoring has been conducted and expanded to better understand the nature of the Ventura River sandbar and how it may affect fish passage year-round and potential estuary/lagoon rearing capacity. The estuary/lagoon has been monitored monthly for water depth as part of the water quality monitoring. In addition, the surface area has been measured every 6 months. However, the spring 2020 survey was not conducted because of COVID-19 protocol issues with two people in one kayak. Together, these physical measurements can provide some general index of rearing

capacity of the Ventura River estuary/lagoon over time. From 2008 through 2011, which were wetter years, the estuary/lagoon depth and size varied. However, since the beginning of the drought in 2012, estuary/lagoon depth and surface area have remained somewhat uniform (Appendix 19).

7.5 Surface Flow Monitoring

The Ventura River, like most rivers in southern California, has significant reaches that lose surface flow during most years after storm flows recede. To quantify this natural pattern, surface flows have been observed and documented since the end of 2007. Like the sandbar monitoring, clear patterns have become apparent. During normal and wet precipitation years, there are typically surface flows throughout the length of the Ventura River mainstem during the fish passage season lasting 9 to 29 weeks. However, even during these years, the Robles Reach can go dry shortly after storms occur. Beginning with the drought in 2012, the Robles Reach was dry for extensive periods of time, even extending downstream of the reach to below the San Antonio Creek confluence. This drought-induced pattern significantly contracted, both spatially and temporally, due to increased precipitation and runoff during the 2017 monitoring period. During 2020, precipitation was about 88% of average and surface flow continued for a longer period and farther downstream than typical (Appendix 20). These longer base flows may be related to Thomas Fire effects that modified the watershed hydrologic cycle. In addition, the much higher than average flows of 2019 probably contributed to the observed increased base flows. Below-average precipitation during 2021 produced little runoff and insignificant surface flow in the Robles Reach; only one brief surface connection occurred (≈ 6 h) following a rain event on 28 January 2021 (Appendix 20). During 2022, the pattern was similar to 2021 with increased spatial and temporal occurrences proportional to the increased precipitation. For 2023, the surface flow was maintained for the entire fish passage season.

7.6 Photographic Index Sites

Photographic index sites were established throughout the Ventura River basin in 2007 to monitor general changes in the stream channel morphology, water conditions, and riparian zones. There are a total of 14 sites where an upstream and downstream photo are taken (Appendix 21). The sites were re-visited twice during the reporting period, in September 2022 and March 2023. As a representation of the general patterns within the mainstem of the Ventura River, Appendix 22 shows the general trend that has been observed of increasing riparian and within channel vegetation over time since 2016. The 2023 high-flow events were large enough to remove the riparian vegetation, most notably in the lower river.

7.7 Underwater Video Monitoring

As time allowed, a pilot study of an underwater video monitoring system was continued to determine if remote monitoring for adults or smolts is feasible within the Ventura River or tributaries. The monitoring system was placed at selected locations when water conditions were suitable to record fish rearing, holding, or migrating. The system consisted of an underwater video camera attached to a DVR that can record for 6-8 hours at a time. The system was powered by a 12-volt DC battery so the system could be placed anywhere within the basin. The video recordings were reviewed to determine presence or absence and relative numbers of *O. mykiss*. If this pilot study is successful, it may be expanded and developed into a more quantitative monitoring tool. This system was also used at the fish ladder entrance during post-storm observations. Underwater video monitoring was not conducted during the 2023 fish passage season.

7.8 Stranding Surveys

Stranding surveys were conducted during the reporting period as part of other monitoring and evaluations (i.e., impediment, snorkel, and spawning surveys). No stranded *O. mykiss* were observed during 2023.

8.0 LITERATURE CITED AND BIBLIOGRAPHY

- Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 477-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Banks, J. W. 1969. A review of the literature on the upstream migration of adult salmonids. *Journal of Fish Biology*, 1:85-136.
- Beeman, J. W., and A. G. Maule. 2001. Residence time and diel passage distribution of radio-tagged juvenile spring Chinook salmon and steelhead in a gateway and fish collection channel of a Columbia River dam. *North American Journal of Fisheries Management*, 21:455-463.
- Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.
- Bond, M. H., A. A. Hayes, G. V. Hanson, and R. B. MacFarlane. 2008. Marine survival of steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. *Canadian Journal of Fisheries and Aquatic Sciences*, 65: 2242-2252.
- Bratovich, P. M., and D. W. Kelley. 1988. Investigation of salmon and steelhead in Lagunitas Creek, Marin County, California. Volume 1. Migration, spawning, embryo incubation and emergence, juvenile rearing, emigration. Marin Municipal Water District. Corte Madera, California.
- Busby, P. B., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. National Marine Fisheries Service. NOAA technical memorandum NMFS-NWFSC-27, August 1996.
- Cannata, S. T. 1998. Observations of steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch*) and water quality of the Navarro River estuary/lagoon, May 1996 to December 1997. Draft report, Humboldt State University Foundation. Humboldt, CA.
- Chapman, D. W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. *Transactions of the American Fisheries Society* 117(1):1-21.
- Clay, H. C. 1995. Design of fishways and other fish facilities, 2nd edition. CRC Press, Inc., Boca Raton, FL.

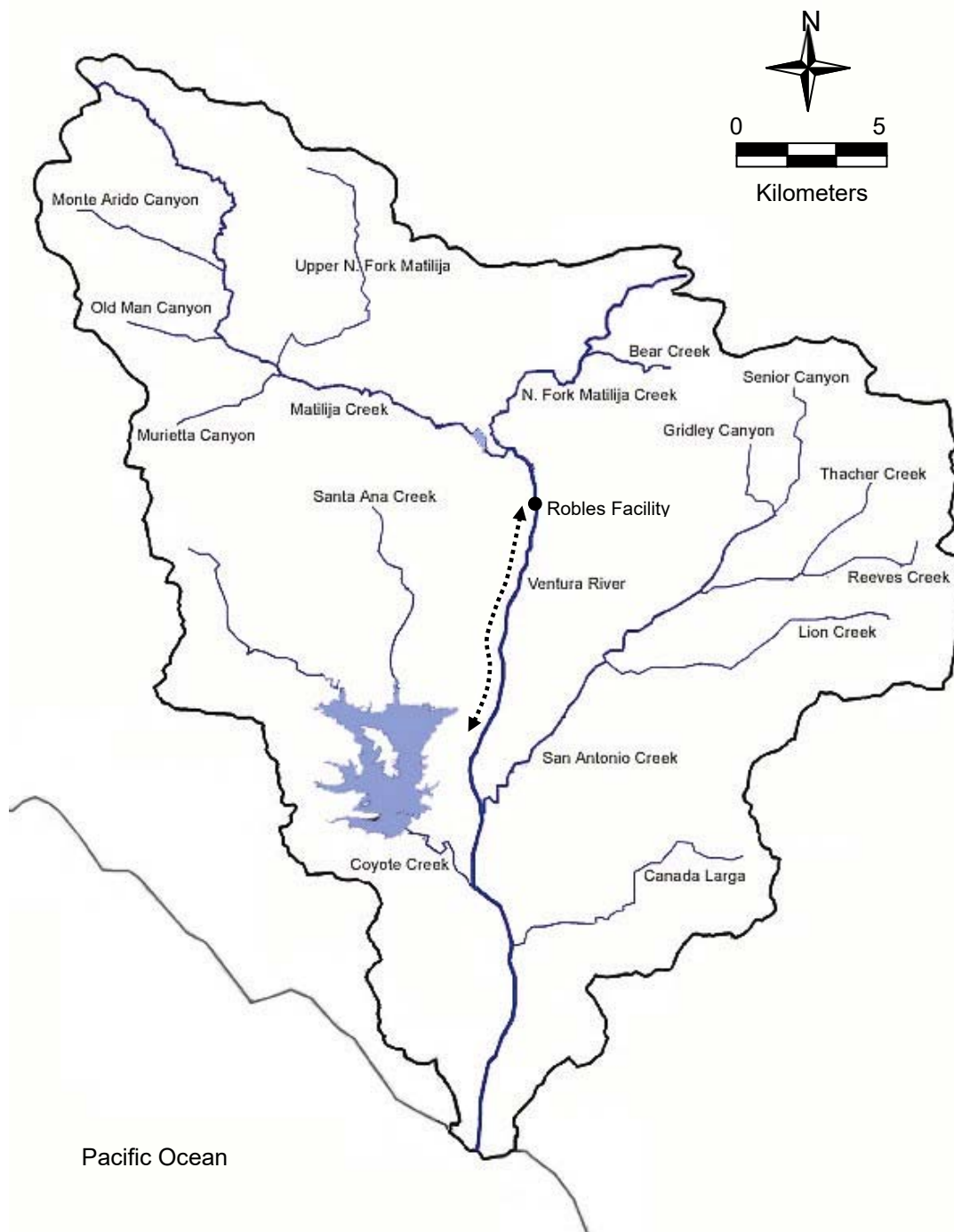
- Cooke, R. U., A. Warren, and A. S. Goudie. 1992. Desert geomorphology. UCL Press, London.
- CMWD. 2005. 2005 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2006. 2006 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2007. 2007 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2008. 2008 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2009. 2009 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2010. 2010 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2011. 2011 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.
- CMWD. 2023. Robles Diversion and Fish Passage Facility Emergency Repair Project. Casitas Municipal Water District, Oak View, CA. Project Completion Report.
- Dettman, D. H., and D. W. Kelley. 1986. Assessment of the Carmel River steelhead resource, Volume 1. biological investigations. Monterey Peninsula Water Management District, Monterey, CA.
- ENTRIX. 1999. Evaluations of natural passage barriers on the Ventura River downstream of Robles Diversion. ENTRIX, Walnut Creek, CA.
- Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 2002. California salmonid stream habitat restoration manual, Volume I, 3rd edition. California Department of Fish and Game. Inland Fisheries Division, Sacramento, CA.
- Gibson, M. 2012. Selected data from Vaki Riverwatcher operated in the Robles Fish Passage Facility from 2010-2011 with additional examples from previous years data. Prepared for the Robles BC, Casitas Municipal Water District, Oak View, California.

- Hagar, J. 1996. Salinas River steelhead status and migration flow requirements. Monterey County Water Resources Agency. Salinas, California.
- Hockersmith, E. E., W. D. Muir, S. G. Smith, B. P. Sandford, N. S. Adams, J. M. Plumb, R. W. Perry, and D. W. Rondorf. 2000. Comparative performance of sham radio-tagged and PIT-tagged juvenile salmon. US Army Corps of Engineers, Walla Walla District.
- Harrison, L. R., E. A. Keller, E. Kelley, and L. A. K. Mertes. 2006. Minimum flow requirements for southern steelhead passage on the lower Santa Clara River, CA. University of California, Santa Barbara.
- Lewis, S. D., M. W. Gibson, and J. L. Switzer. 2015. 2016 monitoring and evaluation study plan for the Robles Fish Passage Facility and related studies. Casitas Municipal Water District, Oak View, California.
- Lewis, S. D., and M. W. Gibson. 2023. 2023 monitoring and evaluation study plan for the Robles Fish Passage Facility and related studies. Casitas Municipal Water District, Oak View, California.
- Moore, K., K. Jones, and J. Dambacher. 2002. Methods for stream habitat surveys, Version 12.1. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Natural Production Program, Corvallis, OR.
- Mosley, M. P. 1982. Critical depths for passage in braided river, Canterbury, New Zealand. New Zealand Journal of Marine and Freshwater Research, Vol. 16:351-357.
- National Marine Fisheries Service. 1997. Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead. Federal Register, 50 CFR Parts 222 and 227 [Docket No. 960730210-7193-02; I.D. 050294D] RIN 0648-XX65. Vol. 62, page 43937.
- National Marine Fisheries Service. 2003a. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.
- National Marine Fisheries Service. 2003b. Endangered and Threatened Species: Range Extension for Endangered Steelhead in Southern California. Federal Register, 50 CFR Part 224 [Docket No. 001025296-2079-02; I.D. 072600A] RIN 0648-AO05. Vol. 67 page 21586.

- National Marine Fisheries Service. 2005. Endangered and Threatened Species: Request for Comment on Alternative Approach to Delineating 10 Evolutionarily Significant Units of West Coast *Oncorhynchus mykiss*. 50 CFR Parts 223 and 224 [Docket No. 040525161–5274–05; I.D. No. 052104F] RIN No. 0648–AR93. Vol. 70 page 67130.
- Orcutt, D. R., B. R. Pulliam, and A. Arp. 1968. Characteristics of steelhead trout redds in Idaho streams. Bureau of Commercial Fisheries, Boise, Idaho.
- Odeh, M. 2000. Advances in fish passage technology: engineering design and biological evaluation. American Fisheries Society, Bethesda, Maryland.
- Rodgers, W. 2006. Robles Diversion Dam fish screen and fishway project; post-construction evaluation program. Wood Rodgers Engineering, Sacramento, CA.
- Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Ottawa, Bulletin 184.
- Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*), with special reference to Waddell Creek, California, and recommendations regarding their management. State of California Department of Fish and Game, fish bulletin No. 98.
- Spina, A. P., M. A. Allen, and M. Clarke. 2005. Downstream migration, rearing abundance, and pool habitat associations of juvenile steelhead in the lower main stem of a south-central California stream. North American Journal of Fisheries Management, 25:919-930.
- Strauss, R. E., and C. E. Bond. 1990. Taxonomic methods: In Schreck C. B. and P. B. Moyle, editors. Methods for fish biology. AFS, Bethesda, Maryland.
- SYRTAC (Santa Ynez River Technical Advisory Committee). 2000. Lower Santa Ynez River fish management plan. Santa Ynez River Consensus Committee, Santa Barbara, CA.
- Tan, S. S., and T. A. Jones. 2006. Geologic map of the Matilija 7.5' quadrangle Ventura County, California: a digital database. Version 1.0, Los Angeles, CA.
- Thompson, K. 1972. Determining stream flows for fish life. Pacific Northwest River Basins Commission, instream flow requirements workshop. Portland, Oregon. Proceedings: 31-50.

- U.S. Bureau of Reclamation. 2003. Revised biological assessment for diversion operations and fish passage facilities at the Robles Diversion, Ventura River, CA. South-Central California Area Office, February 21, 2003.
- Vaki. 2003. User manual for Riverwatcher. Vaki Aquaculture Systems Ltd., Iceland.
- Zimmerman, C. E., and G. H. Reeves. 2000. Population structure of sympatric anadromous and nonanadromous *Oncorhynchus mykiss*: evidence from spawning survey and otolith microchemistry. Canadian Journal of Fisheries and Aquatic Sciences, 57:2152-2162.

9.0 APPENDICES



Appendix 1. Basin map of the Ventura River. The Robles Fish Passage Facility is identified by the black dot, and the Robles Reach is identified by the dashed line downstream of the Robles Facility.

Appendix 2. Summary data of impediments sites for upstream fish migration impediment evaluations at the beginning of the 2023 fish passage season.

Site No.	Latitude (N)	Longitude (W)	rkm	Habitat Type ^a	Site Description	Length (m)	Slope (%)	Percent Substrate ^b						Active Channel Width (m)
								SO	SD	GR	CB	BD	BR	
10-2	34.365265°	-119.311082°	11	RI	Near Casitas Springs at bottom of levy	38.2	1.0	0	0	10	70	20	0	44.5
3-2	34.373789°	-119.308417°	12	RB	Near Casitas Springs at top of levy	22.0	3.7	10	5	10	65	10	0	27.0
4 ^c	34.384743°	-119.310030°	14	RI	0.5 km upstream of San Antonio Cr. confluence	23.8	5.0	0	0	0	15	85	0	27.9
5-2	34.396095°	-119.309537°	15	RI	0.4 km downstream of Santa Ana Blvd. bridge	8.4	7.0	0	5	5	45	45	0	50.6
6-5 ^c	34.411318°	-119.301491°	17	CB	1.4 km upstream of Santa Ana Blvd. bridge	26.1	5.0	0	0	0	65	35	0	33.8
9	34.426708°	-119.301831°	19	RI	0.2 km upstream of Hwy 150 bridge	67.9	1.5	0	0	0	30	70	0	32.4
7	34.438184°	-119.299528°	20	RB	1.1 km upstream of Hwy 150 bridge	31.6	2.0	5	0	10	40	45	0	65.9

^aThe habitat types are: RB = rapid with protruding boulders, RI = riffle, and CB = cascade over boulders.

^bThe substrate types are: SO = silt and organics, SD = sand, GR = gravel, CB = cobble, BD = boulders, and BR = bedrock.

^cSite was substantially altered by high flows and sediment during 2017 (4) or 2019 (6-5) and is no longer monitored.

Appendix 3. Completed transects through 2023 at impediment sites for target downstream discharge releases from the Robles Fish Facility.

Robles Discharge (cfs)	Impediment Sites								
	3-2	4	5-2	6-2 6-3	6-4 6-5	7	9	10	10-2
171	x		x	x, x			x	x	
100	x	x	x			x	x	x	x
82	x, x	x	x		x	x, x	x, x	x	x
74	x	x	x, x	x, x	x	x	x		x
68	x		x		x	x	x		x
62	x	x, x, x, x	x	x		x	x	x	x
56	x		x	x	x	x	x	dry	x
50	x	x	x	x, x	x	x, x	x	x, x	x
40	x	x, x, x	x, x	x	x	x, x, x	x, x, x	x	x
30	x	x, x	x, x	x	x, x	x, x, x	x, x, x	x, x	x
20	x	x	x		x	x	x		x

Completed transects rounded to nearest Robles discharge (e.g., the four transects measured for Site 4 at 62 cfs ranged from 61-63 cfs) based on mean 2.6 rkm/h lag time and averaging hourly discharge of released water from Robles. Colors correspond to year of survey: x = 2010, x = 2011, x = 2014, x = 2017, x = 2018, and x = 2019. Sites 4, 6-2 through 6-5, and 10 (gray columns) were alter by storm flows over time and data are no longer collected.

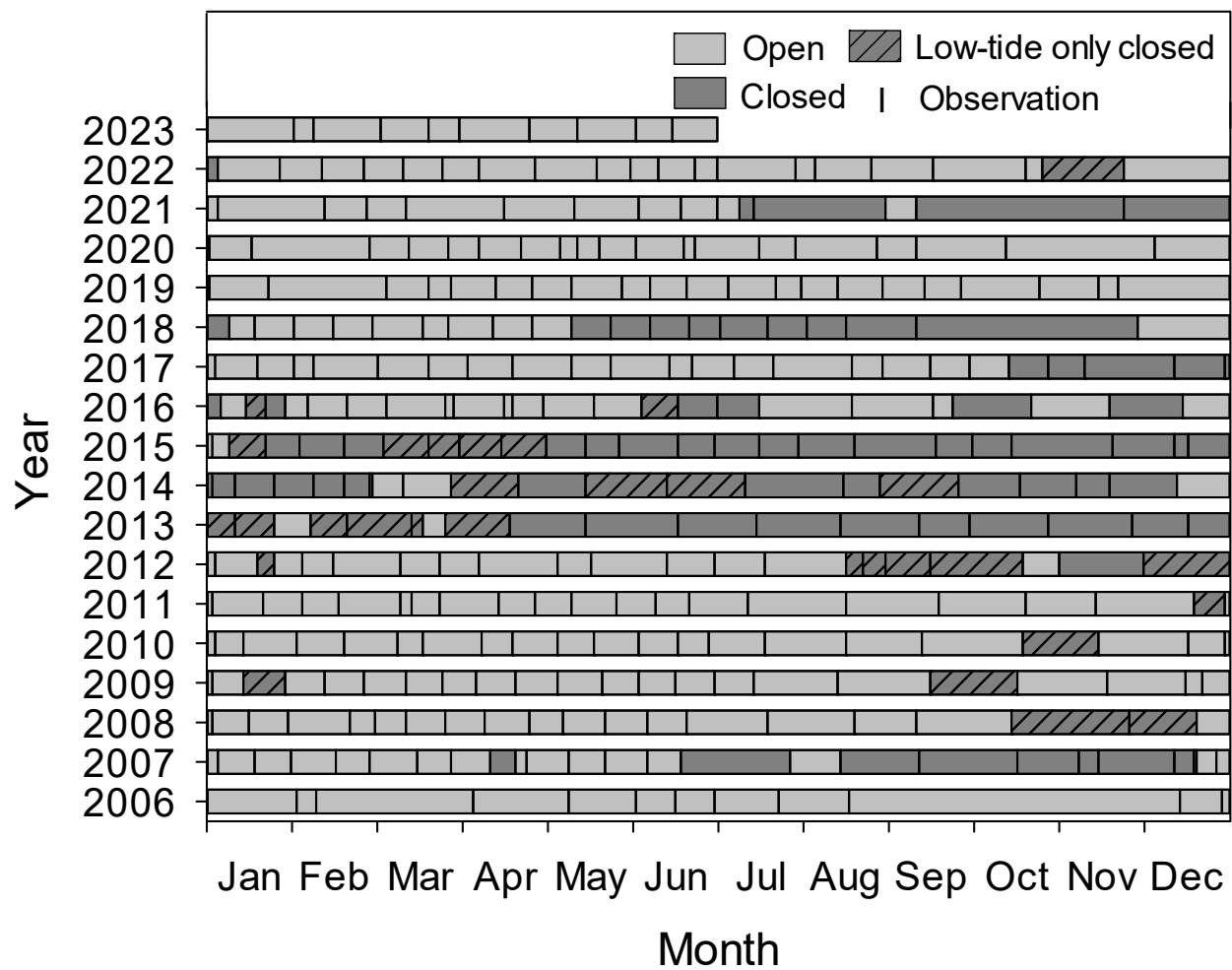
Appendix 4. Ventura River sandbar monitoring data from July 2022 through June 2023.

Date	Sandbar Breached (Y/N)	Time (24h)	Tide Height (ft)	Tidal State	High Tide		Low Tide		Mean Daily Discharge at Foster ^a (cfs)	Mean Daily Discharge at Robles (cfs)	Notes
					Time (24h)	Height (ft)	Time (24h)	Height (ft)			
7/1/2022	Y	11:37	3.20	flood	12:53	3.47	6:09	-0.44	4.7	0.0	Open, east bank
7/29/2022	Y	13:52	3.14	ebb	11:35	3.85	16:20	2.33	3.7	0.0	Open, east bank
8/5/2022	Y	10:43	2.49	flood	15:54	5.07	8:46	2.03	3.3	0.0	Open, east bank
8/25/2022	Y	14:20	2.29	ebb	10:03	4.11	15:05	2.18	3.9	0.0	Open, east bank
9/16/2022	Y	11:00	4.01	flood	13:43	4.74	6:53	2.84	2.4	0.0	Open, east bank
10/19/2022	Y	14:10	3.06	flood	18:11	4.48	12:56	2.87	1.7	0.0	Open, east bank
10/25/2022	N ^b	16:05	-0.17	slack	9:32	6.11	16:21	-0.20	1.4	0.0	If breached, east bank
11/23/2022	Y	14:10	-0.60	ebb	7:58	6.64	15:13	-0.98	1.1	0.0	Open, east bank
12/29/2022	Y	12:20	3.45	flood	14:15	3.97	8:55	2.20	3.1	9.0	Open, east bank
1/31/2023	Y	10:20	1.58	ebb	5:32	5.10	13:24	-0.23	60.6	26.0	Open, east bank
2/7/2023	Y	15:00	0.45	ebb	9:43	5.38	16:44	-0.36	47.8	27.0	Open, east bank
3/3/2023	Y	11:00	1.71	ebb	6:50	5.02	14:08	-0.47	678.0	117.0	Open, west bank
3/20/2023	Y	15:00	-0.89	ebb	9:04	6.00	15:46	-1.12	533.0	172.0	Open, west bank
3/31/2023	Y	16:00	0.87	flood	20:35	3.80	13:57	0.00	356.0	36.0	Open, west bank
4/25/2023	Y	9:00	0.27	flood	1:15 ^c	4.28	8:46	0.26	99.9	30.0	Open, west bank
5/12/2023	Y	14:00	1.51	flood	18:00	3.96	10:53	-0.34	77.8	31.0	Open, west bank
6/2/2023	Y	13:15	2.08	ebb	9:34	3.54	14:22	1.86	48.5	27.0	Open, west bank
6/15/2023	Y	11:15	2.90	ebb	9:12	3.46	13:53	1.97	58	33.0	Open, west bank
6/30/2023	Y	10:41	2.85	ebb	8:48	3.24	13:06	2.29	50	31.0	Open; west bank

^aUSGS gauging station number 11118500, downstream of Foster Park.

^bSandbar was closed at low tide, but intermittent saltwater sandbar overtopping intrusions occurred during some high tides.

^cTide occurred on following day.



Appendix 5. Sandbar status at the mouth of the Ventura River from 2006 through June of 2023. Each observation is indicated by a vertical line and the sandbar status was assumed to remain unchanged until the next observation.

Appendix 6. Weekly fish attraction counts at the Robles Fish Facility during 2023.

Date	Method	Direction	Length (m)	Temp (°C)	Turbidity (NTU)	Robles Discharge (cfs) ^a	Species ^b	Count
1/7/2023	BANK	Downstream	200	13	53	80	NFO	0
1/7/2023	BANK	Upstream	140	13	53	80	NFO	0
1/15/2023	BANK	Downstream	200	12	800	760 ^c	NFO	0
1/15/2023	BANK	Upstream	140	12	800	760 ^c	NFO	0
1/20/2023	BANK	Downstream	200	12	31	117 ^c	NFO	0
1/20/2023	BANK	Upstream	140	12	31	117 ^c	NFO	0
1/24/2023	BANK	Downstream	200	12	15	64 ^c	NFO	0
1/24/2023	BANK	Upstream	140	12	15	64 ^c	NFO	0
2/2/2023	BANK	Downstream	200	13	20	31	NFO	0
2/2/2023	BANK	Upstream	140	13	20	31	NFO	0
2/7/2023	BANK	Downstream	200	11	2	27	NFO	0
2/7/2023	BANK	Upstream	140	11	2	27	NFO	0
2/14/2023	BANK	Downstream	200	13	20	27	NFO	0
2/14/2023	BANK	Upstream	140	13	20	27	NFO	0
2/21/2023	BANK	Downstream	200	14	3	30	NFO	0
2/21/2023	BANK	Upstream	140	14	3	30	NFO	0
2/28/2023	BANK	Downstream	200	13	124	256 ^c	NFO	0
2/28/2023	BANK	Upstream	140	13	124	256 ^c	NFO	0
3/8/2023	BANK	Downstream	200	14	10	1926 ^c	NFO	0
3/8/2023	BANK	Upstream	140	14	10	1926 ^c	NFO	0
3/16/2023	BANK	Downstream	200	12	135	640 ^c	NFO	0
3/16/2023	BANK	Upstream	140	12	135	640 ^c	NFO	0
3/20/2023	BANK	Downstream	200	13	16	172 ^c	NFO	0
3/20/2023	BANK	Upstream	140	13	16	172 ^c	NFO	0
3/30/2023	BANK	Downstream	200	11	31	51	NFO	0
3/30/2023	BANK	Upstream	140	11	31	51	NFO	0
4/4/2023	BANK	Downstream	200	11	7	31	NFO	0
4/4/2023	BANK	Upstream	140	11	7	31	NFO	0
4/11/2023	BANK	Downstream	200	15	8	29	NFO	0
4/11/2023	BANK	Upstream	140	15	8	29	NFO	0
4/17/2023	BANK	Downstream	200	14	38	30	NFO	0
4/17/2023	BANK	Upstream	140	14	38	30	NFO	0
4/25/2023	BANK	Downstream	200	18	1	30	NFO	0
4/25/2023	BANK	Upstream	140	18	1	30	NFO	0
5/2/2023	SNORKEL	Downstream	200	15	4	116	NFO	0
5/2/2023	SNORKEL	Upstream	140	15	4	116	NFO	0
5/12/2023	BANK	Downstream	200	18	23	31	NFO	0
5/12/2023	BANK	Upstream	140	18	23	31	NFO	0
5/16/2023	BANK	Downstream	200	20	1	31	NFO	0
5/16/2023	BANK	Upstream	140	20	1	31	NFO	0
5/24/2023	SNORKEL	Downstream	200	17	1	31	NFO	0
5/24/2023	SNORKEL	Upstream	140	17	1	31	NFO	0
6/2/2023	BANK	Downstream	200	18	1	27	NFO	0
6/2/2023	BANK	Upstream	140	18	1	27	NFO	0

Appendix 6 cont.

Date	Method	Direction	Length (m)	Temp (°C)	Turbidity (NTU)	Robles Discharge (cfs) ^a	Species ^b	Count
6/9/2023	BANK	Downstream	200	17	1	33	NFO	0
6/9/2023	BANK	Upstream	140	17	1	33	NFO	0
6/14/2023	BANK	Downstream	200	18	1	33	NFO	0
6/14/2023	BANK	Upstream	140	18	1	33	NFO	0
6/21/2023	SNORKEL	Downstream	200	21	2	32	NFO	0
6/21/2023	SNORKEL	Upstream	140	21	2	32	NFO	0
6/28/2023	BANK	Downstream	200	20	1	31	NFO	0
6/28/2023	BANK	Upstream	140	20	1	31	NFO	0
		Upstream	3,640				Upstream	0
		Downstream	5,200				Downstream	0
		Total	8,840				Total	0

^aDaily mean discharge recorded by instrumentation at the Robles Fish Passage Facility (Appendix 8).

^bOMY = *O. mykiss* and NFO = no fish observed.

^cWeir impacted by sediment and periods of spill exceeded current range of rating table; discharge estimated.

Appendix 7. Post-storm fish attraction counts of *O. mykiss* at the Robles Fish Facility for 2023 Storm Events.

Date	Time	Method	Location	Temp (°C) ^a	Turbidity (NTU) ^a	Robles Discharge (cfs) ^a	Species ^b	Count
1/6/2023	14:00	Bank	Entrance Pool	13	500	90	NFO	0
1/7/2023	12:10	Bank	Entrance Pool	13	115	70	NFO	0
1/8/2023	12:20	Bank	Entrance Pool	14	80	55	NFO	0
1/9/2023	7:00	Bank	Entrance Pool	14	1496	1200	NFO	0
1/10/2023	12:00	Bank	Entrance Pool	14	N/A ^d	N/A ^d	NFO	0
1/11/2023	11:00	Bank	Entrance Pool	14	N/A ^d	N/A ^d	NFO	0
1/12/2023	15:00	Bank	Entrance Pool	14	N/A ^d	N/A ^d	NFO	0
1/13/2023	15:00	Bank	Entrance Pool	14	1050	743 ^c	NFO	0
1/14/2023	12:00	Bank	Entrance Pool	14	1094	937 ^c	NFO	0
1/15/2023	12:00	Bank	Entrance Pool	14	959	760 ^c	NFO	0
1/16/2023	16:00	Bank	Entrance Pool	15	507	789 ^c	NFO	0
1/17/2023	14:00	Bank	Entrance Pool	14	205	591 ^c	NFO	0
1/18/2023	12:00	Bank	Entrance Pool	13	146	185 ^c	NFO	0
1/19/2023	11:30	Bank	Entrance Pool	13	51	182 ^c	NFO	0
1/20/2023	12:00	Bank	Entrance Pool	13	27	119 ^c	NFO	0
1/21/2023	11:30	Bank	Entrance Pool	13	21	117 ^c	NFO	0
1/22/2023	11:00	Bank	Entrance Pool	13	17	99 ^c	NFO	0
1/23/2023	10:00	Bank	Entrance Pool	12	15	99 ^c	NFO	0
1/24/2023	11:30	Bank	Entrance Pool	13	10	65 ^c	NFO	0
1/25/2023	11:30	Bank	Entrance Pool	13	10	45 ^c	NFO	0
1/26/2023	12:00	Bank	Entrance Pool	15	10	88 ^c	NFO	0
2/25/2023	12:00	Bank	Entrance Pool	12	2199	2700 ^c	NFO	0
2/26/2023	12:00	Bank	Entrance Pool	13	977	1000 ^c	NFO	0
2/27/2023	12:00	Bank	Entrance Pool	13	303	750 ^c	NFO	0
2/28/2023	10:00	Bank	Entrance Pool	12	124	220 ^c	NFO	0
3/1/2023	10:00	Bank	Entrance Pool	12	203	529	NFO	0
3/2/2023	14:00	Bank	Entrance Pool	15	57	125	NFO	0
3/3/2023	10:00	Bank	Entrance Pool	12	38	119	NFO	0
3/4/2023	11:30	Bank	Entrance Pool	13	24	117	NFO	0
3/5/2023	11:45	Bank	Entrance Pool	13	21	106	NFO	0
3/6/2023	10:30	Bank	Entrance Pool	13	18	114 ^c	NFO	0
3/7/2023	12:00	Bank	Entrance Pool	14	15	45 ^c	NFO	0
3/8/2023	12:30	Bank	Entrance Pool	15	10	37	NFO	0
3/11/2023	10:00	Bank	Entrance Pool	14	380	239 ^c	NFO	0
3/12/2023	12:15	Bank	Entrance Pool	16	108	170 ^c	NFO	0
3/13/2023	15:00	Bank	Entrance Pool	17	44	114 ^c	NFO	0
3/14/2023	12:00	Bank	Entrance Pool	15	69	519 ^c	NFO	0
3/15/2023	11:00	Bank	Entrance Pool	15	671	1579 ^c	NFO	0
3/16/2023	11:00	Bank	Entrance Pool	13	226	650 ^c	NFO	0
3/17/2023	11:45	Bank	Entrance Pool	14	57	334 ^c	NFO	0
3/18/2023	12:00	Bank	Entrance Pool	15	30	230 ^c	NFO	0
3/19/2023	11:15	Bank	Entrance Pool	14	20	254 ^c	NFO	0

Appendix 7 cont.

Date	Time	Method	Location	Temp (°C) ^a	Turbidity (NTU) ^a	Robles Discharge (cfs) ^a	Species ^b	Count
3/20/2023	10:00	Bank	Entrance Pool	15	16	201 ^c	NFO	0
3/21/2023	10:00	Bank	Entrance Pool	13	95	406 ^c	NFO	0
3/22/2023	11:40	Bank	Entrance Pool	13	1035	127 ^c	NFO	0
3/23/2023	10:00	Bank	Entrance Pool	13	75	601	NFO	0
3/24/2023	15:00	Bank	Entrance Pool	16	53	350	NFO	0
3/25/2023	12:00	Bank	Entrance Pool	13	34	280	NFO	0
3/26/2023	14:00	Bank	Entrance Pool	15	19	220	NFO	0
3/27/2023	15:30	Bank	Entrance Pool	16	14	156	NFO	0
3/28/2023	15:00	Bank	Entrance Pool	17	13	60	NFO	0
3/29/2023	10:00	Bank	Entrance Pool	14	159	72	NFO	0
3/30/2023	12:00	Bank	Entrance Pool	14	31	40	NFO	0
3/31/2023	12:00	Bank	Entrance Pool	14	20	31	NFO	0

^aEnvironmental conditions at time of survey.

^bOMY = *O. mykiss* and NFO = no fish observed.

^cWeir impacted by sediment/periods of spill exceeded range of rating table; discharge estimated.

^dDiversion facility closed and no data available.

Appendix 8. Monthly flow summary for Robles Fish Facility, reporting year 2022-2023.

Ventura River Flow Assessment
Reporting Year 2022 -2023

	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source	Stream Mean	Daily Flows		Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
Jul-22									
1	0.7	0.4	1	20	0	0	0	0	0
2	0.7	0.4	1	20	0	0	0	0	0
3	0.7	0.4	1	20	0	0	0	0	0
4	0.7	0.4	1	20	0	0	0	0	0
5	0.7	0.4	1	20	0	0	0	0	0
6	0.7	0.4	1	20	0	0	0	0	0
7	0.7	0.4	1	20	0	0	0	0	0
8	0.7	0.4	1	20	0	0	0	0	0
9	0.7	0.3	1	20	0	0	0	0	0
10	0.7	0.3	1	20	0	0	0	0	0
11	0.7	0.3	1	20	0	0	0	0	0
12	0.7	0.3	1	20	0	0	0	0	0
13	1	0.3	1	20	0	0	0	0	0
14	1	0.3	1	20	0	0	0	0	0
15	1	0.3	1	20	0	0	0	0	0
16	0.9	0.3	1	20	0	0	0	0	0
17	0.8	0.2	1	20	0	0	0	0	0
18	0.7	0.2	0.9	20	0	0	0	0	0
19	0.6	0.2	0.9	20	0	0	0	0	0
20	0.6	0.2	0.8	20	0	0	0	0	0
21	0.6	0.2	0.8	20	0	0	0	0	0
22	0.6	0.3	0.9	20	0	0	0	0	0
23	0.6	0.3	0.9	20	0	0	0	0	0
24	0.7	0.3	0.9	20	0	0	0	0	0
25	0.7	0.3	1	20	0	0	0	0	0
26	0.7	0.3	1	20	0	0	0	0	0
27	0.7	0.3	1	20	0	0	0	0	0
28	0.7	0.3	1	20	0	0	0	0	0
29	0.7	0.3	0.9	20	0	0	0	0	0
30	0.7	0.3	1	20	0	0	0	0	0
31	0.7	0.3	1	20	0	0	0	0	0
Totals	22	10	32	620	0	0	0	0	0

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
Aug-22	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck. (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	0.7	0.3	1.0	20	0	0	0	0	0
2	0.7	0.3	1.0	20	0	0	0	0	0
3	0.6	0.3	0.9	20	0	0	0	0	0
4	0.5	0.4	0.9	20	0	0	0	0	0
5	0.6	0.4	0.9	20	0	0	0	0	0
6	0.5	0.4	0.9	20	0	0	0	0	0
7	0.5	0.3	0.8	20	0	0	0	0	0
8	0.5	0.3	0.8	20	0	0	0	0	0
9	0.5	0.3	0.8	20	0	0	0	0	0
10	0.5	0.3	0.8	20	0	0	0	0	0
11	0.5	0.3	0.8	20	0	0	0	0	0
12	0.5	0.3	0.8	20	0	0	0	0	0
13	0.5	0.4	0.8	20	0	0	0	0	0
14	0.5	0.4	0.8	20	0	0	0	0	0
15	0.5	0.4	0.8	20	0	0	0	0	0
16	0.5	0.4	0.8	20	0	0	0	0	0
17	0.5	0.4	0.8	20	0	0	0	0	0
18	0.5	0.3	0.8	20	0	0	0	0	0
19	0.5	0.2	0.7	20	0	0	0	0	0
20	0.5	0.2	0.7	20	0	0	0	0	0
21	0.5	0.2	0.7	20	0	0	0	0	0
22	0.5	0.3	0.8	20	0	0	0	0	0
23	0.5	0.3	0.7	20	0	0	0	0	0
24	0.5	0.2	0.7	20	0	0	0	0	0
25	0.5	0.3	0.7	20	0	0	0	0	0
26	0.5	0.2	0.7	20	0	0	0	0	0
27	0.5	0.3	0.7	20	0	0	0	0	0
28	0.5	0.3	0.8	20	0	0	0	0	0
29	0.5	0.3	0.8	20	0	0	0	0	0
30	0.5	0.3	0.8	20	0	0	0	0	0
31	0.5	0.3	0.7	20	0	0	0	0	0
Totals	15	9	25	620	0	0	0	0	0

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). Discharge Estimated

M=Missing TBD=To be determined

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

Sep-22	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck. (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	0.4	0.2	0.7	20	0	0	0	0	0
2	0.5	0.2	0.7	20	0	0	0	0	0
3	0.5	0.2	0.7	20	0	0	0	0	0
4	0.4	0.2	0.7	20	0	0	0	0	0
5	0.4	0.2	0.7	20	0	0	0	0	0
6	0.4	0.2	0.7	20	0	0	0	0	0
7	0.4	0.2	0.7	20	0	0	0	0	0
8	0.4	0.2	0.7	20	0	0	0	0	0
9	0.5	0.2	0.6	20	0	0	0	0	0
10	0.5	0.2	0.7	20	0	0	0	0	0
11	0.5	0.2	0.7	20	0	0	0	0	0
12	0.5	0.3	0.9	20	0	0	0	0	0
13	0.5	0.4	1.0	20	0	0	0	0	0
14	0.5	0.3	0.9	20	0	0	0	0	0
15	0.5	0.4	0.9	20	0	0	0	0	0
16	0.5	0.3	0.9	20	0	0	0	0	0
17	0.6	0.4	0.9	20	0	0	0	0	0
18	0.6	0.4	1.0	20	0	0	0	0	0
19	0.6	0.4	0.9	20	0	0	0	0	0
20	0.6	0.4	1.0	20	0	0	0	0	0
21	0.6	0.4	1.0	20	0	0	0	0	0
22	0.5	0.4	0.9	20	0	0	0	0	0
23	0.5	0.3	0.9	20	0	0	0	0	0
24	0.5	0.3	0.8	20	0	0	0	0	0
25	0.5	0.3	0.8	20	0	0	0	0	0
26	0.5	0.3	0.8	20	0	0	0	0	0
27	0.4	0.3	0.7	20	0	0	0	0	0
28	0.4	0.3	0.7	20	0	0	0	0	0
29	0.4	0.3	0.7	20	0	0	0	0	0
30	0.5	0.3	0.8	20	0	0	0	0	0
Totals	15	9	24	600	0	0	0	0	0

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

Oct-22	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	0.46	0.32	0.78	20	0	0	0	0	0
2	0.46	0.35	0.81	20	0	0	0	0	0
3	0.46	0.34	0.80	20	0	0	0	0	0
4	0.45	0.32	0.77	20	0	0	0	0	0
5	0.45	0.33	0.78	20	0	0	0	0	0
6	0.46	0.33	0.79	20	0	0	0	0	0
7	0.46	0.34	0.80	20	0	0	0	0	0
8	0.46	0.33	0.79	20	0	0	0	0	0
9	0.46	0.33	0.79	20	0	0	0	0	0
10	0.49	0.35	0.84	20	0	0	0	0	0
11	0.49	0.39	0.88	20	0	0	0	0	0
12	0.50	0.41	0.91	20	0	0	0	0	0
13	0.51	0.41	0.92	20	0	0	0	0	0
14	0.52	0.44	0.96	20	0	0	0	0	0
15	0.56	0.46	1.02	20	0	0	0	0	0
16	0.57	0.48	1	20	0	0	0	0	0
17	0.54	0.49	1.03	20	0	0	0	0	0
18	0.51	0.42	0.93	20	0	0	0	0	0
19	0.47	0.40	0.87	20	0	0	0	0	0
20	0.47	0.38	0.85	20	0	0	0	0	0
21	0.49	0.39	0.88	20	0	0	0	0	0
22	0.52	0.47	0.99	20	0	0	0	0	0
23	0.53	0.48	1.01	20	0	0	0	0	0
24	0.51	0.42	0.93	20	0	0	0	0	0
25	0.51	0.42	0.93	20	0	0	0	0	0
26	0.53	0.42	0.95	20	0	0	0	0	0
27	0.54	0.43	0.97	20	0	0	0	0	0
28	0.54	0.42	0.96	20	0	0	0	0	0
29	0.53	0.42	0.95	20	0	0	0	0	0
30	0.53	0.41	0.94	20	0	0	0	0	0
31	0.53	0.41	0.94	20	0	0	0	0	0
Totals	16	12	28	620	0	0	0	0	0

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

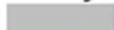
M=Missing TBD=To be determined

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

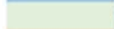
Nov-22	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	0.56	0.4	1	20	0	0	0	0	0
2	0.57	0.5	1	20	0	0	0	0	0
3	0.58	0.5	1	20	0	0	0	0	0
4	0.55	0.5	1	20	0	0	0	0	0
5	0.55	0.5	1	20	0	0	0	0	0
6	0.57	0.5	1	20	0	0	0	0	0
7	0.77	0.7	2	20	0	0	0	0	0
8	1	3	4	20	0.7	0	0.1	0	0.1
9	0.99	2	2	20	0.3	0	0.5	0	0.5
10	0.79	1	2	20	0.1	0	0	0	0
11	0.77	1	2	20	0	0	0	0	0
12	0.77	1	2	20	0	0	0	0	0
13	0.81	1	2	20	0	0	0	0	0
14	0.84	1	2	20	0	0	0	0	0
15	0.88	0.9	2	20	0	0	0	0	0
16	0.88	0.9	2	20	0	0	0	0	0
17	0.90	0.9	2	20	0	0	0	0	0
18	0.98	0.9	2	20	0	0	0	0	0
19	1	0.9	2	20	0	0	0	0	0
20	1	0.9	2	20	0	0	0	0	0
21	1	1	2	20	0	0	0	0	0
22	1	1	2	20	0	0	0	0	0
23	1	0.9	2	20	0	0	0	0	0
24	1	0.9	2	20	0	0	0	0	0
25	1	1	2	20	0	0	0	0	0
26	1	1	2	20	0	0	0	0	0
27	1	1	2	20	0	0	0	0	0
28	1	1	2	20	0	0	0	0	0
29	1	1	2	20	0	0	0	0	0
30	1	1	2	20	0	0	0	0	0
Totals	27	29	56	600	1	0	1	0	1

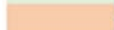
*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

 Represents change on date dictated by storm flow augmentation ramp-down schedule.

 Peak flow met BO definition of potential migration event.

 Fishway flow meter malfunction. Calculated fishway used.

 Weir heavily impacted by sediment or periods of spill exceeded reliable accuracy of rating table, discharge estimated.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

Dec-22	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	2	1	3	20	0	0	0	0	0
2	2	1	3	20	0	0	0	0	0
3	2	2	4	20	0.1	0	0	0	0
4	2	1	4	20	0.5	0	0.4	0	0
5	2	1	3	20	0.1	0	0.4	0	0
6	2	1	3	20	0.8	0	0	0	0
7	2	1	3	20	0.1	0	0	0	0
8	2	1	3	20	0.8	0	0	0	0
9	2	1	3	20	0.2	0	0	0	0
10	4	18	22	20	1	0	1	0	1
11	163	227	390	20	26	0	397	133	530
12	47	16	63	20	22	0	18	32	50
13	44	11	55	20	23	0	18	22	40
14	40	9	49	20	22	0	17	20	37
15	11	8	19	20	20	0	16	0.5	16
16	9	8	17	20	16	0	12	0	12
17	8	7	15	20	13	0	10	0	10
18	7	7	14	20	11	0	9	0	9
19	7	7	13	20	10	0	8	0	8
20	6	7	13	20	9	0	7	0	7
21	6	7	12	20	8	0	7	0	7
22	5	7	12	20	8	0	6	0	6
23	5	6	11	20	7	0	5	0	5
24	5	6	11	20	7	0	5	0	5
25	5	6	11	20	7	0	5	0	5
26	5	6	11	20	7	0	5	0	5
27	6	6	12	20	7	0	5	0	5
28	7	6	13	20	9	0	7	0	7
29	6	6	11	20	7	0	5	0	5
30	5	6	11	20	7	0	5	0	5
31	15	110	125	20	13	0	91	26	117
Totals	432	508	939	620	264	0	661	233	895

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

Represents change on date dictated by storm flow augmentation ramp-down schedule.

Peak flow met BO definition of potential migration event.

Fishway flow meter malfunction. Calculated fishway used.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

Jan-23	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	139	79	218	20	31	0	124	188	290
2	45	27	72	20	23	0	22	36	58
3	32	17	49	20	21	0	20	19	40
4	48	29	75	20	22	0	20	35	55
5	1260	617	1877	20	32	0	1877	205	1882
6	261	84	345	90	40	22	110	235	345
7	138	52	190	70	46	42	80	85	165
8	103	42	145	55	45	24	62	53	115
9	6180	4560	10740	50	18	5	2783	102	2885
10	4120	4540	8660	171	0	0	741	0	741
11	928	1890	2818	171	0	0	103	0	103
12	518	1300	1818	90	0	0	508	0	508
13	372	1100	1472	70	0	0	743	0	743
14	455	1420	1875	55	0	0	937	0	937
15	418	1480	1898	90	13	13	760	88	848
16	608	1040	1648	70	33	48	943	244	1188
17	433	254	687	90	29	60	591	215	806
18	353	179	532	70	23	47	449	185	634
19	301	180	481	55	41	14	185	253	438
20	250	125	375	74	42	32	117	241	358
21	227	112	339	68	47	21	119	202	321
22	199	111	310	62	44	18	104	175	279
23	179	115	294	58	46	10	88	155	241
24	161	119	280	56	48	8	64	135	200
25	147	119	266	50	49	1	61	125	186
26	138	126	264	40	47	0	88	107	195
27	129	154	283	30	47	0	60	109	170
28	122	239	361	30	35	0	45	107	151
29	117	259	376	30	31	0	30	104	133
30	128	304	432	30	32	0	24	104	128
31	113	230	343	30	32	0	26	90	116
Totals	18620	20883	39503	1853	916	364	11663	3575	15237

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

Represents change on date dictated by storm flow augmentation ramp-down schedule.

Peak flow met BO definition of potential migration event.

Weir heavily impacted by sediment or periods of spill exceeded reliable accuracy of rating table, discharge estimated.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

	(1)	(2)	(1) + (2)		(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows			B.O. Required Flow Release (cfs)	Robles Facility Mean Daily Flows				
Feb-23	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	101	112	213	30	32	0	26	82	108
2	94	68	162	30	29	0	31	70	101
3	88	42	130	30	30	0	23	70	93
4	84	33	117	30	30	0	22	66	89
5	80	31	111	30	30	0	22	63	85
6	78	30	108	30	31	0	21	60	81
7	75	28	103	30	30	0	27	56	83
8	73	27	100	30	10	0	109	17	126
9	69	26	95	30	0	0	90	0	90
10	66	26	92	30	18	2	53	22	75
11	63	26	89	30	30	0	31	44	75
12	60	26	86	30	31	0	26	42	68
13	57	26	83	30	31	0	22	40	62
14	55	26	81	30	32	0	27	38	60
15	52	26	78	30	32	0	30	35	66
16	51	25	76	30	32	0	30	34	64
17	49	24	73	30	32	0	29	33	62
18	48	24	72	30	33	0	29	31	60
19	46	24	70	30	32	0	30	29	59
20	43	24	67	30	33	0	29	28	56
21	41	24	65	30	33	0	30	26	57
22	40	24	64	30	33	0	29	25	54
23	44	30	74	30	33	0	30	29	58
24	2360	1920	4280	30	26	0	1707	168	1876
25	1580	1300	2880	171	19	60	2567	217	2784
26	529	375	904	171	43	60	599	439	1038
27	478	177	655	171	44	60	353	452	805
28	434	148	582	171	41	60	256	419	675
Totals	6838	4672	11510	1404	828	242	6279	2637	8916

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). Discharge Estimated

M=Missing TBD=To be determined

Represents change on date dictated by storm flow augmentation ramp-down schedule.

Peak flow met BO definition of potential migration event.

Fishway flow meter malfunction. Calculated fishway used.

Auxiliary pipe flow meter malfunction. Discharge estimated.

Weir heavily impacted by sediment or periods of spill exceeded reliable accuracy of rating table, discharge estimated.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows	North Fork Matilija Ck.*	Sum of Creek Flows (cfs)		Robles Facility Mean Daily Flows				
Mar-23	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	515	181	696	100	46	54	390	454	844
2	389	145	534	82	46	36	168	434	602
3	331	126	457	74	43	31	117	390	507
4	305	109	414	68	43	25	114	353	467
5	306	101	407	62	44	18	112	330	442
6	278	91	369	56	44	12	2122	296	2418
7	247	80	327	43	42	1	1926	272	2198
8	224	74	298	30	38	0	38	259	297
9	216	73	289	30	34	0	33	242	276
10	528	155	683	30	44	0	421	362	783
11	517	125	642	171	50	60	278	454	732
12	372	100	472	171	50	60	152	380	532
13	326	91	417	100	50	50	149	309	457
14	590	240	830	82	50	32	519	379	899
15	979	457	1436	74	50	24	1456	449	1905
16	615	218	833	171	50	60	640	475	1115
17	485	166	651	171	50	60	309	481	790
18	398	136	534	171	50	60	221	425	646
19	358	117	475	100	50	50	223	370	593
20	310	101	411	82	50	32	172	339	511
21	708	381	1089	74	50	24	910	430	1340
22	720	346	1066	171	50	60	1034	463	1497
23	522	244	766	171	50	60	606	499	1106
24	455	195	650	171	50	60	399	497	895
25	390	167	557	171	50	60	284	469	753
26	340	140	480	100	50	50	254	422	676
27	308	120	428	74	50	24	201	386	588
28	291	103	394	61	50	11	111	360	471
29	403	120	523	54	50	4	74	425	499
30	355	107	462	42	42	0	51	402	452
31	319	92	411	30	37	0	36	362	398
Totals	13100	4901	18001	2987	1453	1018	13520	12168	25688

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

Represents change on date dictated by storm flow augmentation ramp-down schedule.

Peak flow met BO definition of potential migration event.

Fishway flow meter malfunction. Calculated fishway used.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

Apr-23	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
1	291	83	374	30	33	0	31	334	365
2	267	77	344	30	33	0	31	312	343
3	248	71	319	30	34	0	31	295	326
4	225	66	291	30	33	0	31	273	304
5	205	61	266	30	33	0	31	254	285
6	194	57	251	30	33	0	31	238	268
7	178	55	233	30	32	0	31	223	254
8	163	53	216	30	32	0	31	209	239
9	157	50	207	30	31	0	30	196	225
10	152	48	200	30	31	0	29	190	219
11	146	46	192	30	31	0	29	179	209
12	142	45	187	30	32	0	41	162	203
13	129	44	173	30	31	0	30	158	188
14	119	44	163	30	31	0	30	138	168
15	125	42	167	30	31	0	29	139	169
16	123	41	164	30	31	0	30	131	161
17	121	40	161	30	31	0	30	126	156
18	118	39	157	30	31	0	30	120	149
19	114	38	152	30	31	0	30	113	143
20	112	37	149	30	31	0	29	108	137
21	109	36	145	30	31	0	30	101	131
22	104	35	139	30	31	0	30	96	126
23	101	34	135	30	31	0	30	92	122
24	99	33	132	30	32	0	31	87	118
25	95	32	127	30	32	0	30	84	115
26	92	31	123	30	32	0	31	80	111
27	89	30	119	30	31	0	31	77	107
28	86	29	115	30	31	0	31	74	105
29	85	29	114	30	31	0	31	72	103
30	82	28	110	30	31	0	31	71	102
Totals	4271	1354	5625	900	949	0	920	4730	5650

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). **Discharge Estimated**

M=Missing TBD=To be determined

Fishway flow meter malfunction. Calculated fishway used.

**Ventura River Flow Assessment
Reporting Year 2022 -2023**

	(1)	(2)	(1) + (2)		(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows			B.O. Required Flow Release (cfs)	Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
May-23									
1	82	28	110	30	31	0	31	71	102
2	82	28	110	30	10	0	118	22	138
3	81	27	108	30	0	0	145	0	145
4	92	29	121	30	26	0	87	45	132
5	98	27	125	30	35	0	35	65	99
6	87	26	113	30	31	0	31	61	92
7	80	25	105	30	32	0	31	58	89
8	75	24	99	30	32	0	31	56	88
9	73	24	97	30	32	0	31	55	86
10	71	24	95	30	31	0	31	54	85
11	70	23	93	30	32	0	31	52	83
12	68	23	91	30	32	0	31	51	82
13	66	22	88	30	31	0	31	50	81
14	64	22	86	30	31	0	31	51	82
15	62	21	83	30	32	0	31	51	82
16	60	21	81	30	32	0	31	53	84
17	59	21	80	30	32	0	31	54	85
18	56	20	76	30	31	0	31	55	86
19	55	20	75	30	31	0	31	57	88
20	53	20	73	30	30	0	31	59	90
21	52	20	72	30	30	0	31	60	91
22	51	19	70	30	30	0	30	61	92
23	51	19	70	30	30	0	30	61	91
24	51	19	70	30	31	0	31	64	95
25	49	19	68	30	30	0	30	66	96
26	48	18	66	30	30	0	31	67	97
27	47	18	65	30	31	0	31	67	97
28	46	18	64	30	30	0	30	67	97
29	46	18	64	30	30	0	30	68	98
30	46	17	63	30	28	0	29	70	99
31	46	17	63	30	28	0	29	70	99
Totals	1967	677	2644	930	902	0	1212	1741	2954

*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). Discharge Estimated

M=Missing TBD=To be determined

Fishway flow meter malfunction. Calculated fishway used.

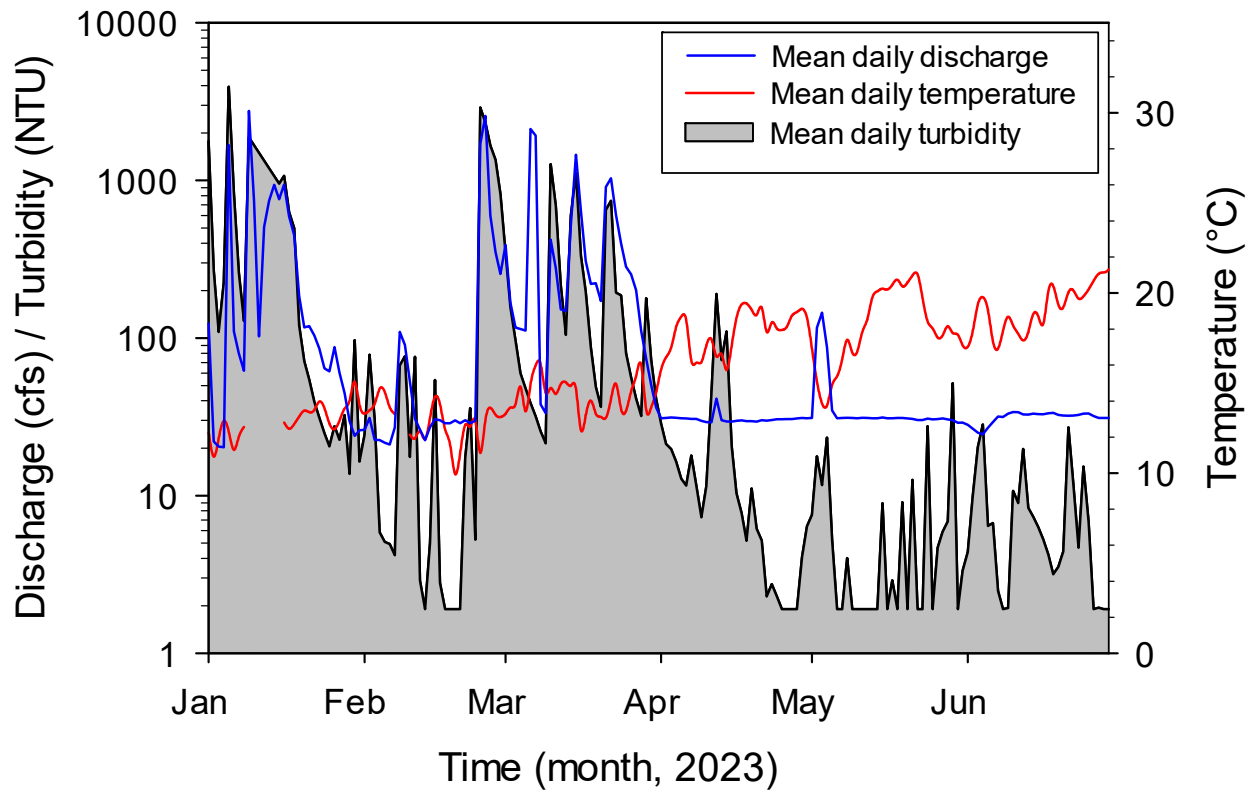
**Ventura River Flow Assessment
Reporting Year 2022 -2023**

	(1)	(2)	(1) + (2)	B.O. Required Flow Release (cfs)	(3)	(4)	(5)	(6)	(5) + (6)
	Source Stream Mean Daily Flows				Robles Facility Mean Daily Flows				
	Matilija Ck D/S Dam* (cfs)	North Fork Matilija Ck.* (cfs)	Sum of Creek Flows (cfs)		Fishway Ladder (cfs)	Auxiliary Pipe (cfs)	VRNMO Weir (cfs)	Diversion Canal (cfs)	Total Inflow (cfs)
Jun-23									
1	47	17	64	30	27	0	28	71	99
2	45	17	62	30	26	0	27	72	98
3	40	17	57	30	24	0	25	66	91
4	38	16	54	30	24	0	24	64	89
5	38	16	54	30	26	0	27	59	86
6	40	16	56	30	29	0	29	61	90
7	40	16	56	30	32	0	32	53	85
8	37	15	52	30	32	0	32	49	81
9	36	15	51	30	32	0	33	45	78
10	36	15	51	30	32	0	34	44	78
11	35	15	50	30	32	0	34	44	78
12	35	14	49	30	32	0	33	46	78
13	34	14	48	30	32	0	33	43	75
14	33	14	47	30	32	0	33	37	71
15	33	14	47	30	31	0	33	39	72
16	32	14	46	30	32	0	33	39	71
17	31	13	44	30	32	0	33	32	66
18	30	13	43	30	32	0	34	31	65
19	31	13	44	30	31	0	32	33	66
20	30	13	43	30	31	0	32	31	63
21	28	13	41	30	30	0	32	28	60
22	28	13	41	30	31	0	32	27	59
23	28	12	40	30	31	0	32	25	58
24	27	12	39	30	31	0	33	23	56
25	27	12	39	30	32	0	33	21	54
26	26	12	38	30	30	0	32	21	53
27	26	12	38	30	30	0	31	21	52
28	25	12	37	30	29	0	31	19	50
29	24	11	35	30	29	0	31	15	46
30	24	11	35	30	30	0	31	10	41
Totals	984	417	1401	900	904	0	939	1169	2108

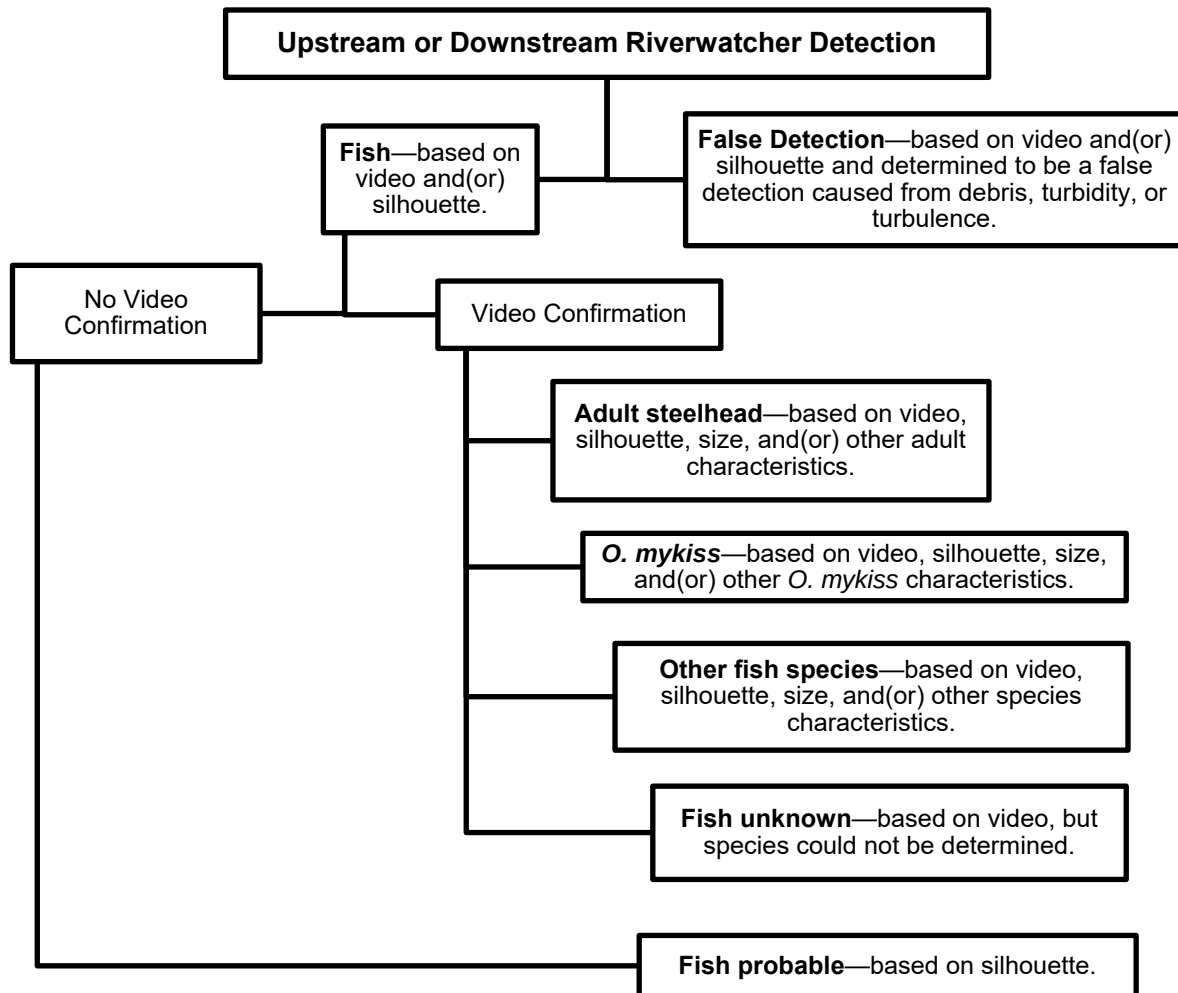
*Flow data from Matilija Ck and North Fork Matilija Ck are preliminary and subject to change (VCWPD). Discharge Estimated

M=Missing TBD=To be determined

Fishway flow meter malfunction. Calculated fishway used.



Appendix 9. Mean daily discharge, water temperature, and turbidity at the Robles Fish Facility during the 2023 fish passage season.



Appendix 10. Riverwatcher detection classification flow chart outlines the pathways for upstream and downstream detections.

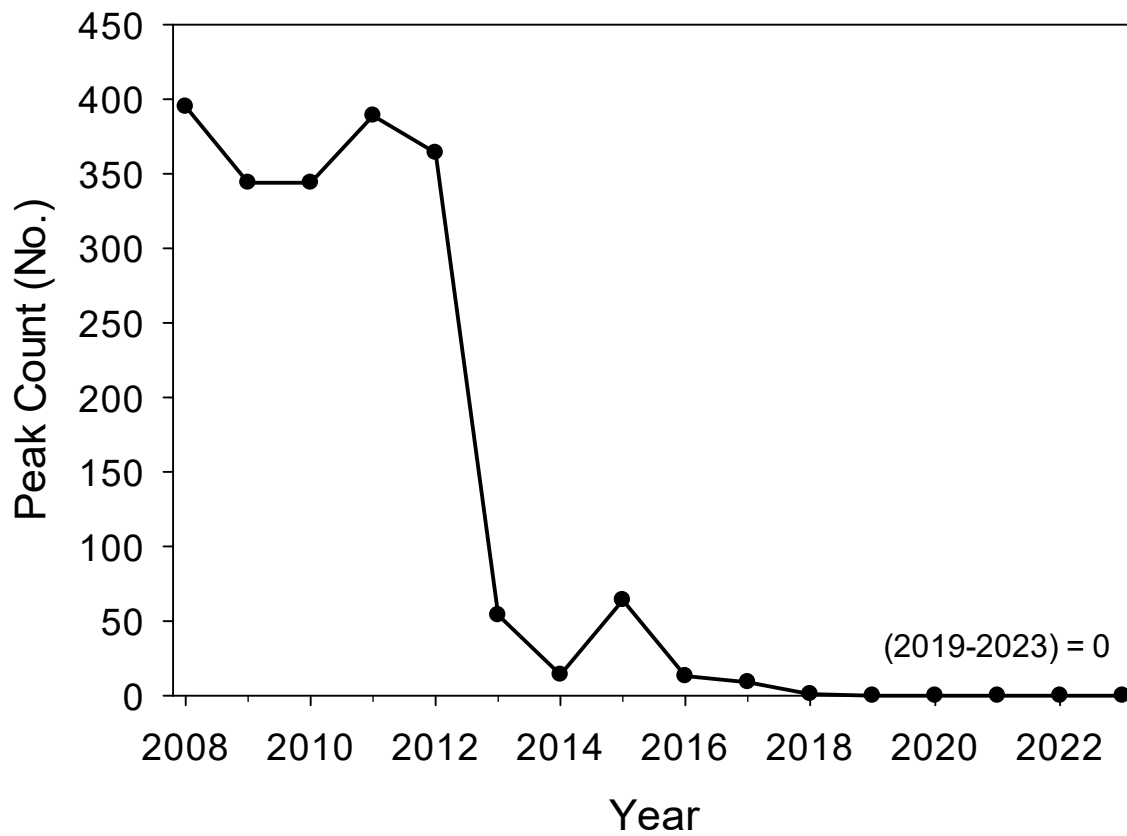
Appendix 11. Summary of Riverwatcher detections at the Robles Fish Passage for the 2023 fish passage season.

	Upstream	Downstream
<i>O. mykiss</i>	0	0
Fish, non <i>O. mykiss</i>	1	2
Fish, unknown	0	0
Fish, probable	0	0
False detections	1139	1899
Total	1140	1901
Mean date - <i>O. mykiss</i>	n/a	n/a
Mean date - fish, non <i>O. mykiss</i>	12/29/2022	12/20/2022
Mean date - fish, unknown	n/a	n/a
Mean date - fish, probable	n/a	n/a
Mean time - <i>O. mykiss</i> (24h)	n/a	n/a
Mean time - fish, non <i>O. mykiss</i> (24h)	8:11	13:34
Mean time - fish, unknown (24h)	n/a	n/a
Mean time - fish, probable (24h)	n/a	n/a
Mean length ^a - <i>O. mykiss</i> (cm)	n/a	n/a
Mean length ^a - fish, non <i>O. mykiss</i> (cm)	45.6	97.7
Mean length ^a - fish, unknown (cm)	n/a	n/a
Mean length ^a - fish, probable (cm)	n/a	n/a
Mean daily temperature - <i>O. mykiss</i> (°C)	n/a	n/a
Mean daily temperature - fish, non <i>O. mykiss</i> (°C)	13.6	10.9
Mean daily temperature - fish, unknown (°C)	n/a	n/a
Mean daily temperature - fish, probable (°C)	n/a	n/a
Mean daily turbidity - <i>O. mykiss</i> (NTU)	n/a	n/a
Mean daily turbidity - fish, non <i>O. mykiss</i> (NTU)	1.5	3.9
Mean daily turbidity - fish, unknown (NTU)	n/a	n/a
Mean daily turbidity - fish, probable (NTU)	n/a	n/a
Mean daily turbidity - false detections (NTU)	314.2	245.5
Mean daily discharge - <i>O. mykiss</i> (cfs)	n/a	n/a
Mean daily discharge - fish, non <i>O. mykiss</i> (cfs)	5.5	6.8
Mean daily discharge - fish, unknown (cfs)	n/a	n/a
Mean daily discharge - fish, probable (cfs)	n/a	n/a
Mean daily discharge - false detections (cfs)	261.8	223.7

^aLength calculated by formula: $TL = 687.68 / (1 + \exp(-(D - 50.78)/23.97)) / 10$ where D is Riverwatcher measured body depth (mm).

Appendix 12. *O. mykiss* relative abundance survey index sites in the Ventura Basin

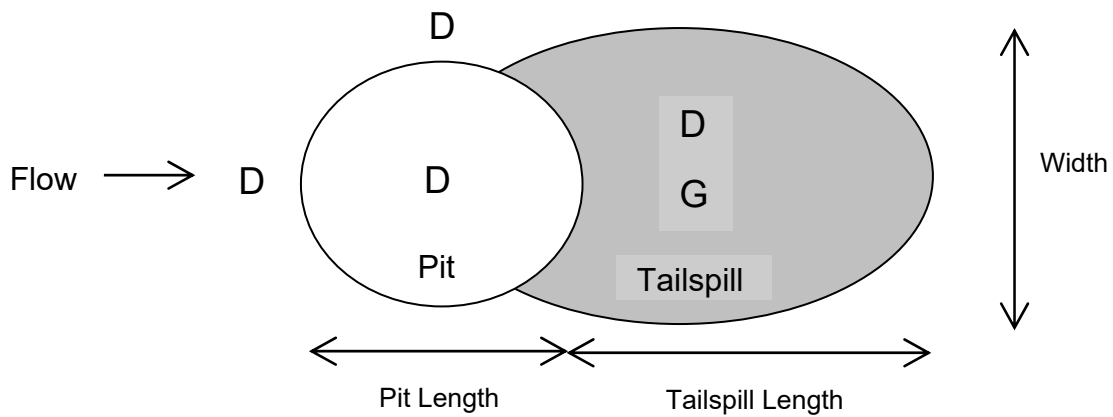
Site No.	Location	River km	Site	Lat.	Long.	Length (m)	Width (m)
1	Ventura River	0.9	Main Street pool	34.28126	-119.30887	25.1	10.0
		0.9	Main Street riffle	34.28164	-119.30893	34.0	8.0
2	Ventura River	9.4	Foster Park pool 1	34.35236	-119.30790	25.0	15.4
		10.0	Foster Park pool 2	34.35508	-119.30988	46.0	16.0
		9.7	Foster Park riffle	34.35308	-119.30877	45.0	11.0
3	Ventura River	13.0	San Antonio conf. pool 1	34.38042	-119.30752	33.0	22.0
		13.0	San Antonio conf. riffle	34.38011	-119.30755	42.0	14.0
		12.9	San Antonio conf. pool 2	34.37969	-119.30781	50.0	10.0
4	Ventura River	18.8	Hwy 150 pool 1	34.42643	-119.30220	43.3	14.0
		18.8	150 pool 2	34.42689	-119.30123	49.5	9.0
		18.7	Hwy 150 riffle	34.42576	-119.30258	43.6	11.0
5	Ventura River	22.1	Land Cons. pool 1	34.45342	-119.29314	50.1	19.1
		22.2	Land Cons. pool 2	34.45448	-119.29293	48.6	15.1
		22.1	Land Cons. Riffle	34.45411	-119.29315	44.6	18.8
6	Ventura River	23.2	Robles weir pools	34.46306	-119.29058	58.7	19.0
		23.3	Robles glide	34.46368	-119.29065	78.3	17.3
		23.4	Robles entrance pool	34.46446	-119.29058	39.8	21.8
		23.4	Fish ladder entrance box	34.46460	-119.29062	15.0	3.0
		23.5	Robles screenbay	34.46451	-119.29133	42.2	13.5
		23.5	Robles forebay	34.46503	-119.29053	33.0	17.2
7	San Antonio Cr.	0.2	Lower San Antonio pool 1	34.38088	-119.30542	16.0	6.0
		0.2	Lower San Antonio riffle	34.38098	-119.30711	20.2	3.5
		0.4	Lower San Antonio pool 2	34.38103	-119.30657	40.0	6.0
8	San Antonio Cr.	9.4	Upper San Antonio riffle	34.43268	-119.25090	25.0	5.0
		9.5	Upper San Antonio pool	34.43241	-119.25095	19.8	5.5
9	NF Matilija Cr.	0.1	Lower NF pool 1	34.48508	-119.30105	7.3	13.3
		0.1	Lower NF pool 2	34.48533	-119.30138	7.9	10.9
		0.2	Lower NF riffle	34.48523	-119.30198	17.8	8.0
10	NF Matilija Cr.	6.6	Upper NF pool	34.50956	-119.27520	29.0	9.0
		6.6	Upper NF riffle	34.50933	-119.27528	33.1	7.5
11	Matilija Cr.	0.3	Lower Matilija pool	34.48282	-119.30170	21.1	24.7
		0.3	Lower Matilija riffle	34.48302	-119.30154	15.9	8.0
12	Matilija Cr.	2.1	Upper Matilija pool	34.49190	-119.31599	89.4	13.7
		2.1	Upper Matilija riffle	34.49233	-119.31704	51.0	9.0
14	San Antonio Cr.	4.3	Fraser St. pool	34.40276	-119.28169	12.8	13.8
		4.4	Fraser St. riffle	34.40291	-119.28157	30.8	5.9
15	Ventura River	8.5	Bedrock pool	34.34539	-119.29931	50.0	17.0
		8.5	Bedrock pool riffle	34.34569	-119.29958	37.0	6.0



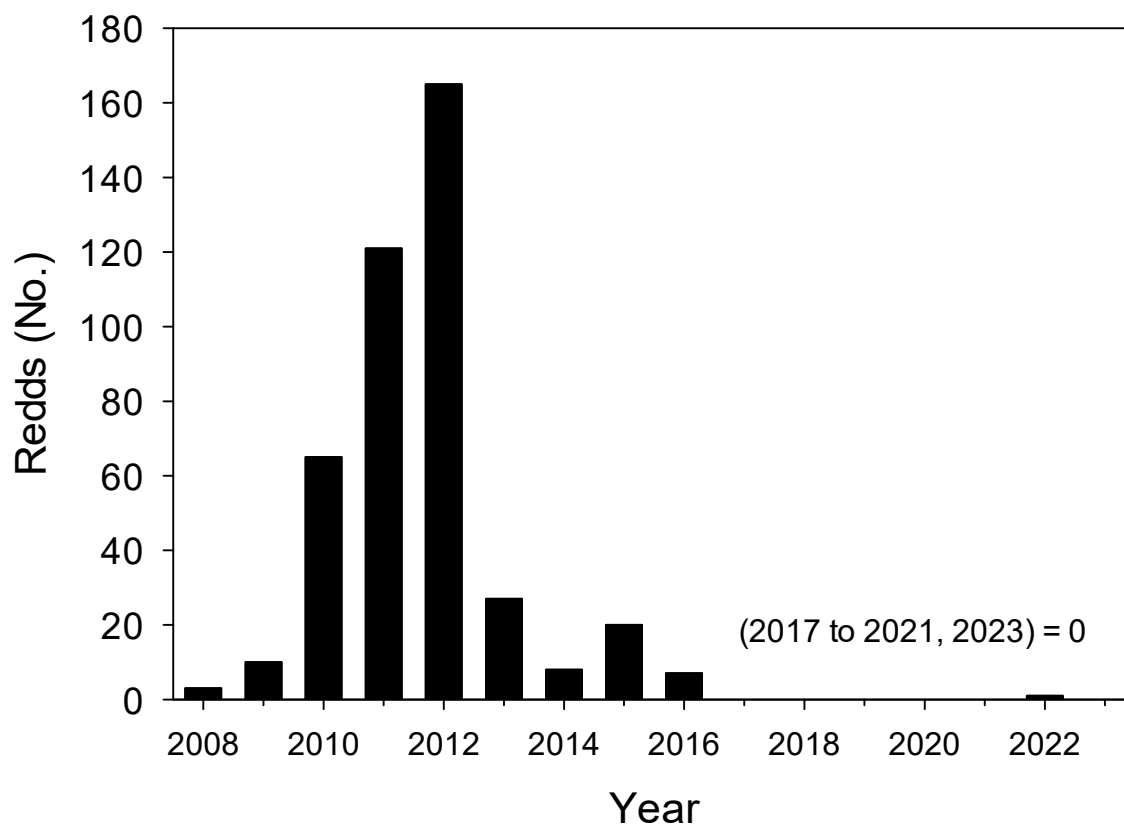
Appendix 13. Peak snorkel counts of *O. mykiss* during the period 2008-2023 at survey index sites in the Ventura Basin.

Appendix 14. *O. mykiss* spawning index sites in the Ventura Basin.

Site No.	Unit	Location	River km	Description	Lat.	Long.	Length (m)	Width (m)	Spawning Area (m ²)
24	1	Ventura River	0.8	Main St. Bridge	34.28085	-119.30862	220.0	10.0	2,200
2	1	Ventura River	7.9	Near Treatment Plant	34.34030	-119.29782	90.0	18.0	1,620
	2		8.1	Near Treatment Plant	34.34208	-119.29849	39.0	20.0	780
4	1	Ventura River	15.5	Near Santa Ana Blvd bridge	34.39950	-119.30853	26.7	8.0	214
5	1	Ventura River	18.7	Upstream of Hwy 150	34.42641	-119.30227	18.0	10.0	180
6	1	Ventura River	22.1	Land Conservancy pool tailout	34.45334	-119.29309	18.1	19.5	353
	2		22.2	Land Conservancy pool tailout	34.45445	-119.29298	16.3	14.7	240
7	1	Ventura River	23.3	Robles-1st weir pool	34.46334	-119.29061	15.4	23.9	368
	2		23.4	Robles tailout of entrance pool	34.46436	-119.29045	18.2	21.9	399
8	2	Ventura River	24.3	Upstream of Robles	34.46504	-119.29032	6.2	15.4	95
	3		23.4	Upstream of Robles forebay	34.46504	-119.29032	80.0	6.0	480
12	1	NF Matilija Cr.	0.7	Lower NF Matilija Cr.	34.48825	-119.30525	41.0	9.0	369
13	1	NF Matilija Cr.	6.6	Downstream of Wheeler Gorge	34.50911	-119.27501	23.0	8.0	184
	2		6.6	Downstream of Wheeler Gorge	34.50960	-119.27528	22.3	8.0	178
14	1	Matilija Cr.	1.9	Lake Matilija delta	34.49000	-119.31446	26.2	14.6	383
	2		2.1	Upstream of Lake Matilija	34.49198	-119.31645	15.0	10.0	150
	3		2.2	Upstream of Lake Matilija	34.49209	-119.31661	315	9.0	2,835
15	1	Matilija Cr.	8.4	End of Matilija Road	34.50456	-119.37449	20.0	19.0	380
17	1	Ventura River	9.3	DS of Foster to US reach	34.35069	-119.30463	1750	11.0	19,250
18	1	Ventura River	12.3	Casitas Springs	34.37354	-119.30877	60	12.0	960
	2		12.7	Casitas Springs	34.37712	-119.30721	230	9.0	2070
19	1	San Antonio Cr.	0.0	Mouth to end of Old Cr. Rd. reach	34.38030	-119.30738	2160	8.0	17,280
20	1	San Antonio Cr.	4.2	DS to US of Frasier St.	34.40197	-119.28237	180	8.0	1,440
21	1	San Antonio Cr.	7.8	Camp Comfort reach	34.42493	-119.26110	690	5.0	3,450
22	1	San Antonio Cr.	9.5	Upper San Antonio Cr. reach	34.43269	-119.25087	640	5.0	3,200
23	1	NF Matilija Cr.	0.1	Lower NF Matilija Cr.	34.48520	-119.30118	120	6.0	720
25	1	NF Matilija Cr.	4.1	Near Wheeler's Springs Reach	34.50826	-119.28955	300	4.5	1,350
26	1	NF Matilija Cr.	1.0	Downstream of NF gage bridge	34.49049	-119.30586	302	4.3	1,299
27	1	Matilija Cr.	5.7	Upstream Matilija hot springs	34.50030	-119.34993	105	8.0	840
Total = 63,266									



Appendix 15. Diagram of *O. mykiss* redds measurements (cm). (D) = locations of depth measurements and (G) = location of gravel substrate sampling.



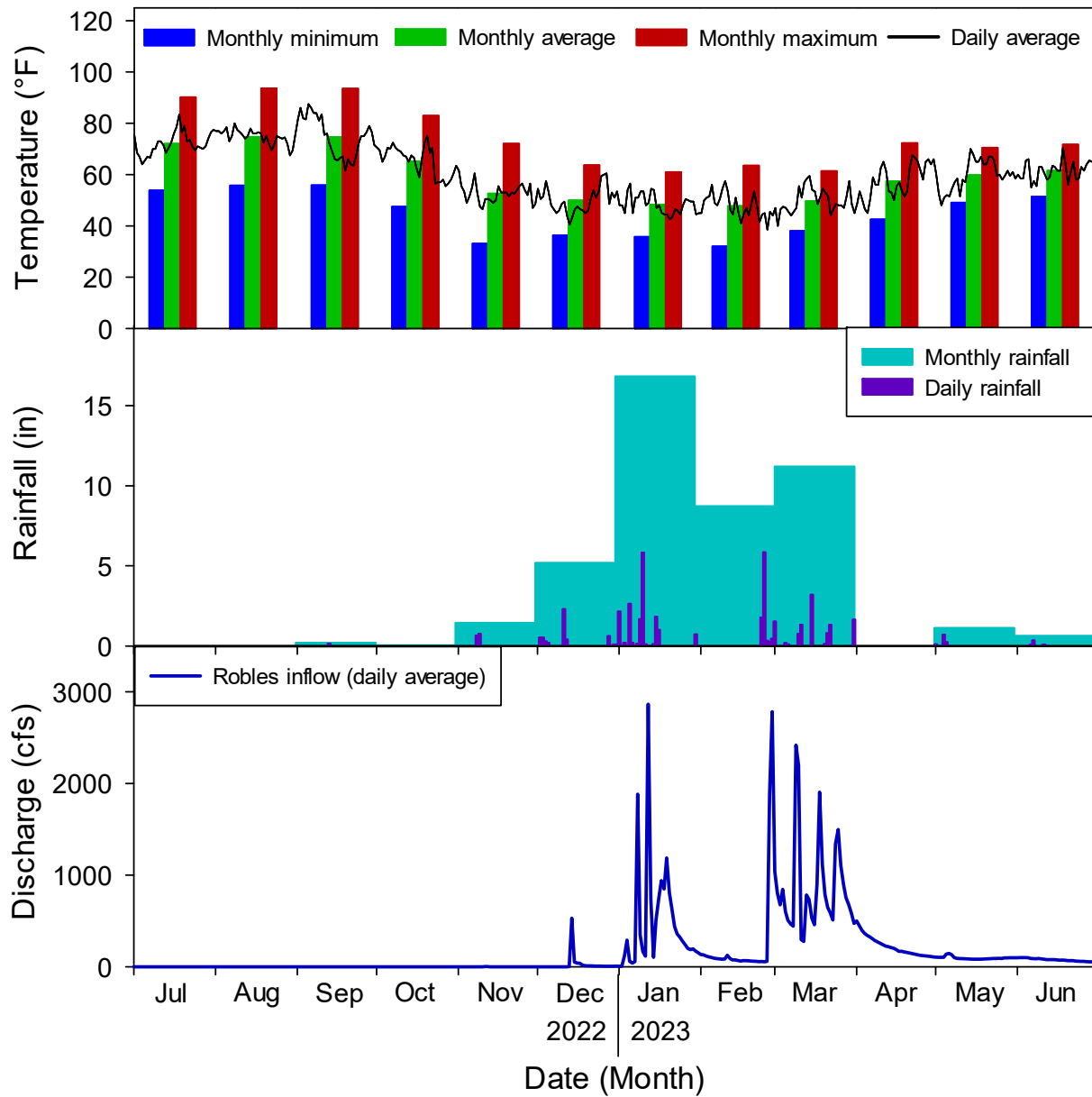
Appendix 16. Total number of *O. mykiss* redds counted at index spawning sites from 2008 through 2023 spawning years.

Appendix 17. Water quality monitoring sites and sampling summary.

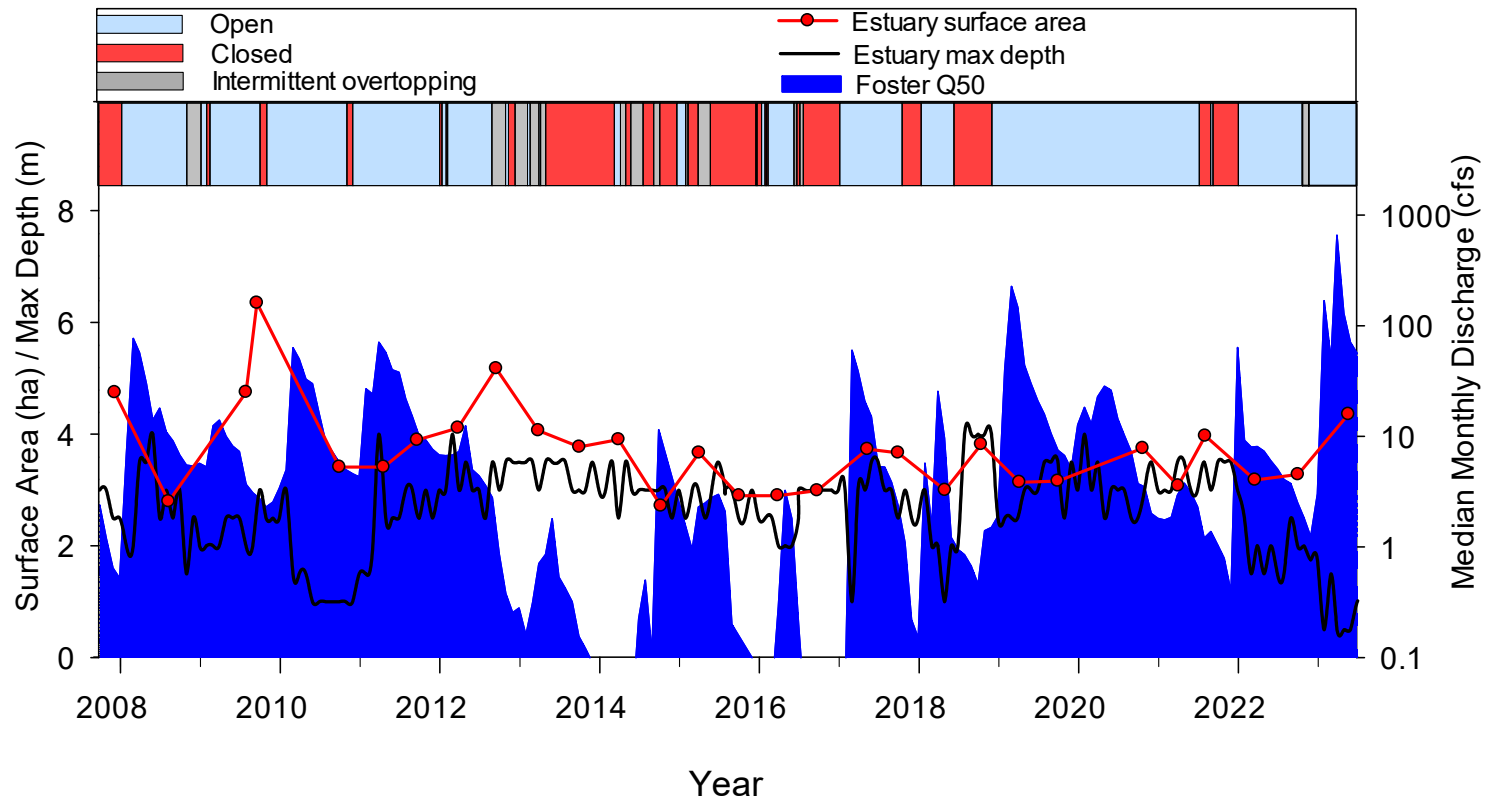
Site Number	Site Description	Site Location ^a	Sampling Method ^b	Sampling Type	Frequency
1	Estuary	V 0.3 km	Multiparameter	Grab profile	Monthly
2	Main St. Bridge	V 1.0 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
3	Foster Park	V 9.7 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
4	Santa Ana Blvd Bridge	V 15.5 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
5	Hwy 150 Bridge	V 18.7 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
6	Robles Dam	V 23.5 km	Temperature Multiparameter Turbidity Weather	Continuous Grab Continuous Continuous	30 min Monthly Hourly 30 min
7	North Fork Matilija	N 1.3 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
8	Below Matilija Dam	M 1.0 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
9	Above Matilija Dam	M 2.1 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
10	Middle Matilija	M 8.5 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
11	Lower San Antonio	S 0.3 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
12	Middle San Antonio	S 9.5 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
13	Lower Coyote	C 0.4 km	Temperature Multiparameter	Continuous Grab	30 min Monthly
14	Fraser St.	S 4.4 km	Temperature	Continuous	30 min

^aSite location is identified by the river system and kilometers from its confluence. C = Coyote Creek, M = Matilija Creek, N = North Fork Matilija Creek, S = San Antonio Creek, V = Ventura River.

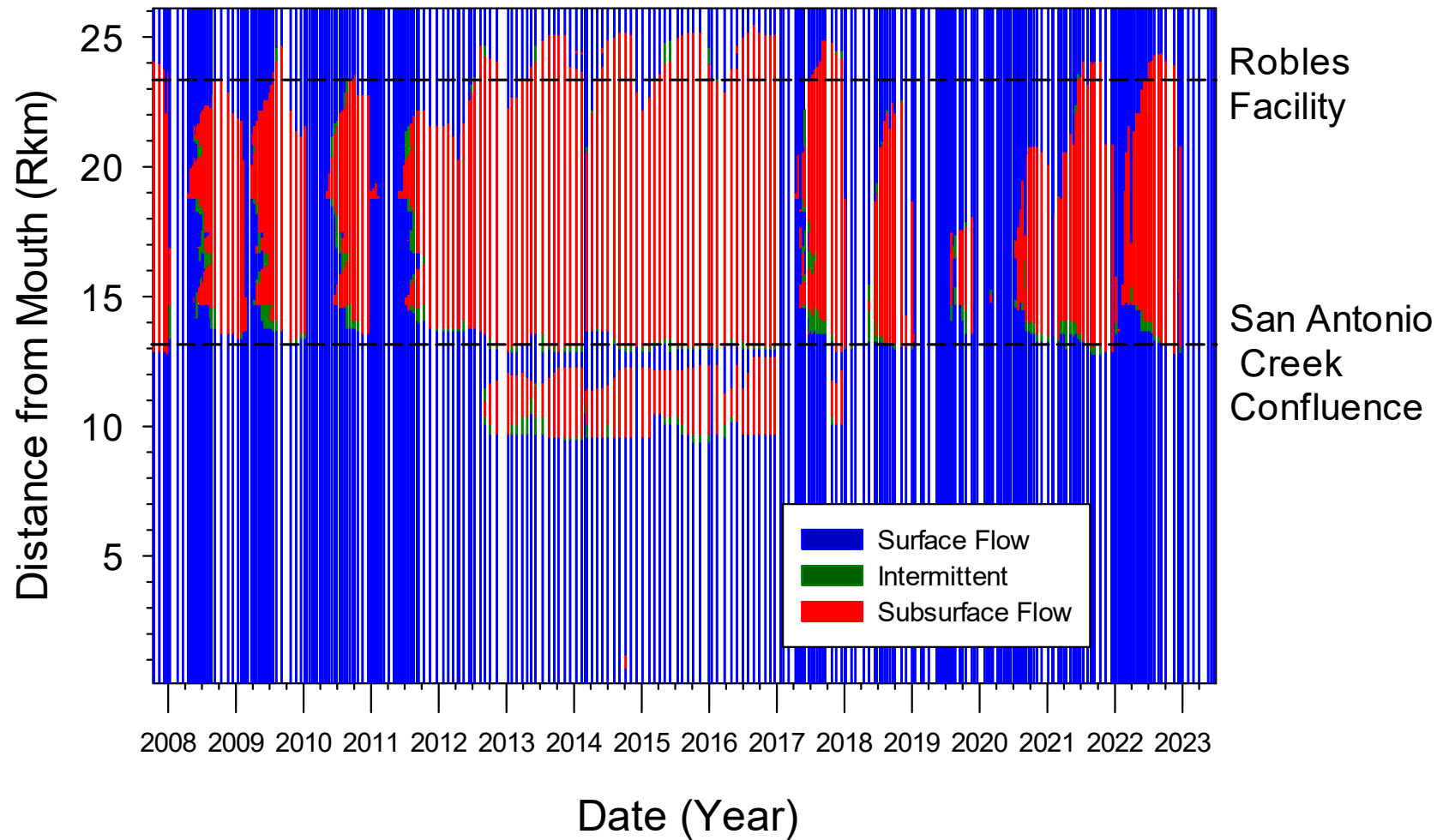
^bTemperature data were collected using programmable loggers. Multiparameter water quality probe was used to collected water quality data including: temperature, dissolved oxygen, conductivity, salinity, pH, turbidity (separate meter). Turbidity data was collected using a programmable logger.



Appendix 18. Summary of weather and discharge data at the Robles Fish Facility for the reporting period.



Appendix 19. Ventura River estuary/lagoon water depth, surface area, sandbar status, and discharge at Foster Park from 2008 to 2023.

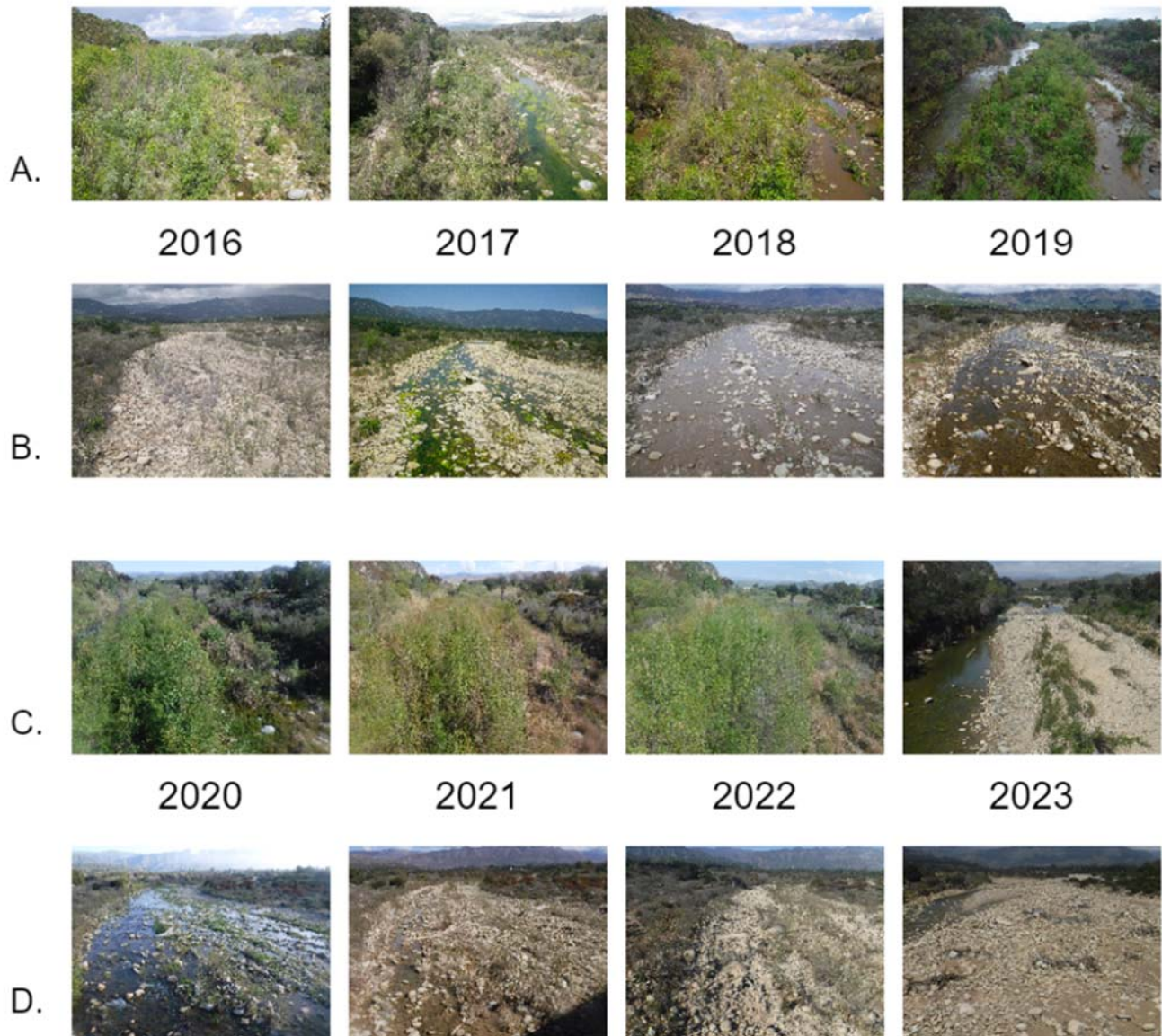


Appendix 20. Ventura River channel surface and subsurface flow status for the lower 26 km from 2007 to 2023.

Appendix 21. Photographic monitoring sites within the Ventura River basin.

Site Number	Site Description	Site Location ^a	Photo Direction	Frequency
1	Train bridge in estuary, east bank	V 0.3 km	Downstream	Biannual
2	Train bridge in estuary, west bank	V 0.3 km	Upstream Downstream	Biannual
3	Main Street Bridge	V 1.0 km	Upstream Downstream	Biannual
4	Shell Road Bridge	V 5.2 km	Upstream Downstream	Biannual
5	Casitas Vista Road Bridge (Foster Park)	V 9.7 km	Upstream Downstream	Biannual
6	Santa Ana Boulevard Bridge	V 15.5 km	Upstream Downstream	Biannual
7	Highway 150 Bridge	V 18.7 km	Upstream Downstream	Biannual
8	Robles Fish Passage Facility	V 23.5 km	Downstream	Biannual
9	Camino Cielo Road Bridge	V 25.7 km	Upstream Downstream	Biannual
10	Highway 33 Bridge at NF Matilija USGS Gauging Station	N 1.3 km	Upstream Downstream	Biannual
11	End of North Matilija Road	M 8.5 km	Upstream Downstream	Biannual
12	Highway 33 Bridge near Old Creek Road	S 0.3 km	Upstream Downstream	Biannual
13	Creek Road near Creek Lane	S 9.5 km	Upstream Downstream	Biannual
14	Santa Ana Road Bridge	C 0.4 km	Upstream Downstream	Biannual

^aSite location is identified by the river or tributary system and kilometers from its confluence.
C = Coyote Creek, M = Matilija Creek, N = North Fork Matilija Creek, S = San Antonio Creek, V = Ventura River.



Appendix 22. Multiple-year photo comparison of ephemeral and perennial reaches of the Ventura River. Photo series Row A and Row C are looking upstream from the bridge near the Shell Rd exit off Hwy 33. Photo series Row B and Row D are looking upstream from Hwy 150 Bridge.

Appendix 23. Photo comparison of impediment sites for upstream fish migration impediment evaluations.

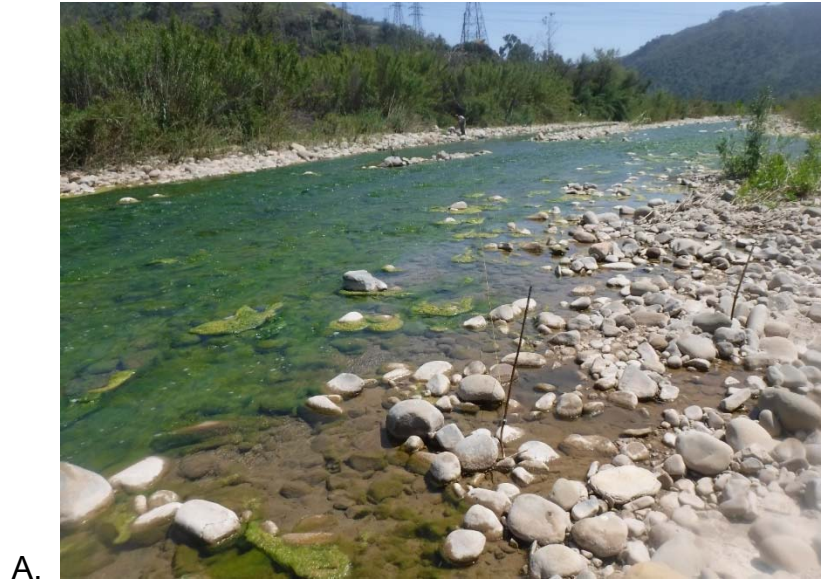


Photo comparison of Site 10-2 before (A. May 2019, 30 cfs at VRNMO) and after (B. September 2023) the large storm event in January. The stream channel thalweg has shifted 270 ft to the east and the site is no longer in the active channel.



A.



B.

Photo comparison of Site 3-2 before (A. February 2019, 62 cfs at VRNMO) and after (B. September 2023) the large storm event in January. The stream channel thalweg has shifted 100 ft to the east and the site is no longer in the active channel.



Photo comparison of Site 5-2 before (A. May 2019, 30 cfs at VRNMO) and after (B. September 2023) the large storm event in January. The stream channel thalweg has shifted 30 ft to the west and the streambed scoured 6 ft. The site is still within the active channel but has changed significantly.



Photo comparison of Site 9 before (A. February 2019, 100 cfs at VRNMO) and after (B. September 2023) the large storm event in January. The stream channel thalweg has shifted 30 ft to the south and the streambed scoured 2 ft. The site is still within the active channel but has changed significantly.



Photo comparison of Site 7 before (A. April 2018, 20 cfs at VRNMO) and after (B. September 2023) the large storm event in January. The stream channel thalweg has shifted 10 ft to the west and the streambed scoured 2-3 ft. The site is still within the active channel but has changed significantly.

**Flow Assessment at Robles Diversion and Fish Passage Facility
Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)**

Date: 1-6-23 Time: 0945 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	1-5		malfunction
Matilija Cr above dam	1	0645	2746
Matilija Dam		0820	5074
Matilija Cr at Hot Spr.		0820	4139
Robles Canal			58
Robles Weir			> 4184 TBD
			≈ 6-7k cfs
Total Robles Inflow	1-5		
BO Defined Storm Event: <u>(Y)N</u>			
BO Defined Overlapping Event: <u>Y/(N)</u>			

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr	0950	121
Matilija Cr above Reservoir	0945	155
Matilija Dam	09:45	786
Matilija Cr at Hot Springs	0945	317
Robles Canal	0945	306
Robles Weir	0945	38
Total Robles Inflow	0945	344

SANC 0859 1734
VENR Foster 1015 9730

Date Matilija Reservoir Filled: 1-1-23
Count of Days: 5

Lake Casitas volume 77,720 ac-ft

CDPM Method:

- ☒ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☐ Standard Release
☐ Back-to-Back Release

M9 - Matilija Download								
Day	Date	Robles Release	Robles Inflow		Matilija Inflow	Matilija Outflow	Matilija Elevation	
			Canal	Weir				
1	1-6	90						
2	1-7	70						
3	1-8	55						
4	1-9	50						
5	1-10	50						
6	1-11	50						
7	1-12	50						
8	1-13	50						
9	1-14	50						
10	1-15	40						
11								
12								
13								
14								
15								
16								
17								
18								

new BO storm on 1-9

Comments:

Flow Assessment at Robles Diversion and Fish Passage Facility
Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)

Date: 1-10-23 Time: 1000 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	1-9	NA	8532 est.
Matilija Cr above dam			error
Matilija Dam			error
Matilija Cr at Hot Spr.		1805	14690
Robles Canal			closed
Robles Weir			~4K max
Total Robles Inflow			
	1-9		23,222
BO Defined Storm Event: <u>Y/N</u>			
BO Defined Overlapping Event: <u>Y/N</u>			

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr		error
Matilija Cr above Reservoir		error
Matilija Dam		error
Matilija Cr at Hot Springs		4,835
Robles Canal		closed
Robles Weir		error
Total Robles Inflow		
		>4,835

SANC conf. 1744 6,966
 SANC CampC. 1811 9,694
 VR usgs 1855 37,000
 Date Matilija Reservoir Filled: 1-1-23
 Count of Days: 109

TBD
 Lake Casitas volume ~93,700 af

CDPM Method:
☒ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☐ Standard Release
☐ Back-to-Back Release

(Robles peak est. w/ cross section)
 area + velocity 18-20k cfs

-M9 - Matilija Download-								
Day	Date	Robles Release	Robles Inflow		Matilija Inflow	Matilija Outflow	Matilija Elevation	
			Canal	Weir				
1	1-10	>671	closed					
2	1-11	>671	closed					
3	1-12	90	"	583	Hot Springs, 1000h			
4	1-13	70	"	426	"	1000h		
5	1-14	55		386	"	0915h		
6	1-15	50						
7	1-16	50						
8	1-17	50						
9	1-18	50						
10	1-19	50						
11	1-20	50						
12	1-21	40						
13								
14								
15								
16								
17								
18								

new BO storm on 1-14

Comments:

Cutoff wall failed @ 0100-0500h on 1-10-23 on east side w/ most water going through failure. Repairs started on 1-11.

**Flow Assessment at Robles Diversion and Fish Passage Facility
Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)**

Date: 1-15-23 Time: 10:00h Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	1-14		error
Matilija Cr above dam			"
Matilija Dam			"
Matilija Cr at Hot Spr.		1710	865
Robles Canal			closed
Robles Weir		1759	1,604(error)
Total Robles Inflow	✓	1759	865-1604
BO Defined Storm Event: <u>Y/N</u>			
BO Defined Overlapping Event: <u>Y/(N)</u>			

SANC conf. 1559 1,195
SANC camp. 1506 783
VR Foster USGS 1630 1,930

Date Matilija Reservoir Filled: 1-1-23
Count of Days: 14

Lake Casitas volume 94,427 497.95 ft³ @ 0800, 1-15
CDPM Method:
☒ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☐ Standard Release
☐ Back-to-Back Release

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr		error
Matilija Cr above Reservoir		"
Matilija Dam		"
Matilija Cr at Hot Springs	0925	490
Robles Canal		closed
Robles Weir	1000	804(error)
Total Robles Inflow	1000	490-804

M9 - Matilija Download							
Day	Date	Robles Release	Robles Inflow		Matilija Inflow	Matilija Outflow	Matilija Elevation
			Canal	Weir			
1	1-15	90	→ 80-90, sediment in box + EP				
2	1-16	70	→ 80-90, "		"	"	← new BO storm on 1-16
3	1-17	55					
4	1-18	50					
5	1-19	50					
6	1-20	50					
7	1-21	50					
8	1-22	50					
9	1-23	50					
10	1-24	40					
11							
12							
13							
14							
15							
16							
17							
18							

Comments:

Started filling forebay + diverting water and fish ladder
@ 1300h (1-15-23) w/ 80-90 cfs out fish ladder, sediment
in entrance box and EP.

**Flow Assessment at Robles Diversion and Fish Passage Facility
Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)**

Date: 1-17-23 Time: 09:15 Prepared by: Scott Lewis

Storm Peak Discharge

	date	time	cfs
North Fork Matilija Cr	1-16		error
Matilija Cr above dam		23:50	951 (error)
Matilija Dam			error
Matilija Cr at Hot Spr.		03:10	853
Robles Canal		03:53	200
Robles Weir		03:53	1,407 (error)
Total Robles Inflow		03:53	1,053-1,407
BO Defined Storm Event:	D/N		Fw=28, >76
BO Defined Overlapping Event:	Y/N		Aux=48

SANC cont. 11:59 1,120
SANC camp. 02:01 556
VR Foster USGS 06:55 1,550

Date Matilija Reservoir Filled: 1-1-23
Count of Days: 16

Current Discharge (Day 1 after peak)

	time	ds
North Fork Matilija Cr		error
Matilija Cr above Reservoir		11
Matilija Dam		11
Matilija Cr at Hot Springs	08:10	517
Robles Canal	09:02	240
Robles Weir	09:02	601
Total Robles Inflow	09:02	757-841

Fw=33
Aux=42 >75

Lake Casitas volume 98,068 500.36' @ 08:04, 1-17

CDPM Method:

- ☒ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☐ Standard Release
☐ Back-to-Back Release

M9 - Matilija Download

Day	Date	Robles Release	Robles Inflow Canal	Robles Inflow Weir	Matilija Inflow	Matilija Outflow	Matilija Elevation
1	1-17	90	releasing more to scour sediment in box & EP				
2	1-18	70					
3	1-19	55					
4	1-20	5074	Lake Casitas Over 100,000 AF				
5	1-21	5068	Changed to Standard Release				
6	1-22	5062					
7	1-23	5056					
8	1-24	5056					
9	1-25	50					
10	1-26	40					
11							
12							
13							
14							
15							
16							
17							
18							

Comments:

**Flow Assessment at Robles Diversion and Fish Passage Facility
Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)**

Date: 2-25-23 Time: 9:30 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	2-24	20:50	3836
Matilija Cr above dam		17:55	4829/5710
Matilija Dam			error
Matilija Cr at Hot Spr.		20:50	9416
Robles Canal		21:10	130
Robles Weir		21:10	> 4184
Total Robles Inflow		21:10	~ 11,126*
BO Defined Storm Event: <u>Y/N</u>			
BO Defined Overlapping Event: <u>Y/N</u>			

VR-Foster, VC 22:10 9040
VR-Foster, usgs 22:45 14,100
SANC 21:59 4613

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr		error
Matilija Cr above Reservoir	09:30	453/685 (VC/usgs)
Matilija Dam		error
Matilija Cr at Hot Springs	09:40	1500
Robles Canal	09:29	71
Robles Weir	09:29	2645
Total Robles Inflow	09:29	2716

VR-Foster-VC 10:00 2189
VR-Foster-usgs 09:35 2550
SANC 10:00 1836

Lake Casitas volume 111,514 ac-ft

CDPM Method:

- ☐ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☒ Standard Release
☐ Back-to-Back Release

Date Matilija Reservoir Filled: NA

Count of Days: NA

9416 + 3323 = 12,739 cfs
(MATC-HS) + (VF) = high est. $\bar{x}$ = 11,126

14100 - (3587 + 100) = 9513 cfs
(VR-Foster) - (SANC/Tribs) = Low est.

M9 - Matilija Download

Day	Date	Robles Release	Matilija			
			Robles Inflow Canal	Robles Inflow Weir	Matilija Inflow	Matilija Outflow Elevation
1	2-25	—	>671	2716	09:30	
2	2-26	—	>671	1052	08:30	
3	2-27	—	>671	783	08:00	
4	2-28	171	<671	660	08:30	
5	3-1	100				
6	3-2	82				
7	3-3	74				
8	3-4	68				
9	3-5	62				
10	3-6	56				
11	3-7	43				
12	3-8	30				
13						
14						
15						
16						
17						
18						

Comments:

Facility shut down @ ~ 21:00h, 2-24, due to sediment in screebay. Modified brushes on 2-25 and started facility up at ~ 09:00h.

Flow Assessment at Robles Diversion and Fish Passage Facility
Standard and Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)

Date: 3-11-23 Time: 09:50 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	3-10	16:15	427
Matilija Cr above dam		16:00	893/1220
Matilija Dam		16:35	213/1095.94
Matilija Cr at Hot Spr.		17:55	1146
Robles Canal		18:00	354
Robles Weir			1311
Total Robles Inflow			1,665
BO Defined Storm Event: <u>Y/N</u>			
BO Defined Overlapping Event: <u>Y/N</u>			

VR-Foster, VC 19:30 2075
 VR-Foster, us6s 18:15 2550
 SANL 15:59 984

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr	09:40	238
Matilija Cr above Reservoir	09:40	460/693
Matilija Dam	09:25	13/1095.52
Matilija Cr at Hot Springs	09:20	578
Robles Canal	09:50	256
Robles Weir		467
Total Robles Inflow		723

(vc/us6s)
(cfs/ft)

Date Matilija Reservoir Filled: NA
 Count of Days: NA

Lake Casitas volume 128,640 ac-ft, 54.1%

CDPM Method:

- ☐ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☒ Standard Release
☐ Back-to-Back Release

M9 - Matilija Download						
Day	Date	Robles Release	Robles Inflow - Canal - Weir	Matilija Inflow	Matilija Outflow	Matilija Elevation
1	3-11	2671				
2	3-12	171	535	09:00		
3	3-13	100				
4	3-14	82				
5	3-15	74	new storm peak on 3-15 @ 2865			
6	3-16	68				
7	3-17	62				
8	3-18	56				
9	3-19	56				
10	3-20	50				
11	3-21	40				
12	3-22	30				
13						
14						
15						
16						
17						
18						

Initial Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	171	334	to 671
2	100	274	to 334
3	82	247	to 274
4	74	227	to 247
5	68	207	to 227
6	62	187	to 207
7	56	167	to 187
8	56		NA
9	50	50	to 167
10	50		NA
11	40		NA
12	30		NA

Back-to-Back Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	100	247	to 600
2	74	204	to 247
3	61	181	to 204
4	54	150	to 181
5	50		NA
6	50		NA
7	50		NA
8	50		NA
9	40		NA
10	30		NA

Comments:

New storm peak on 3-15 at 2865 cfs.

Flow Assessment at Robles Diversion and Fish Passage Facility
Standard and Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)

Date: 3-16-23 Time: 09:30 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	3-15	04:40	732
Matilija Cr above dam		02:30	626/803
Matilija Dam		06:45	2533/1097.50
Matilija Cr at Hot Spr.		06:30	1613
Robles Canal		06:17	423
Robles Weir		06:17	2442
Total Robles Inflow	3-15	06:17	2865
BO Defined Storm Event: <u>Y/N</u>			
BO Defined Overlapping Event: <u>Y/N</u>			

VR-Foster, VC 05:30 4874
 VR-Foster, us6s 04:40 5140
 SANC, Camp Cont. 04:21 2675

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr	08:20	350
Matilija Cr above Reservoir	07:40	299/416
Matilija Dam	08:25	1349/1096.92
Matilija Cr at Hot Springs	08:25	659
Robles Canal	08:30	472
Robles Weir	08:30	675
Total Robles Inflow	08:30	1147

VR-Foster, VC 08:40 1332
 VR-Foster, us6s 08:50 1473
 SANC, Cont. 09:00 454

(VC/us6s)
 (cfs/ft)

Date Matilija Reservoir Filled: NA
 Count of Days: NA

Lake Casitas volume 137,435 / 57.7% @ 07:03, 3-16

CDPM Method:

- ☐ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☒ Standard Release
☐ Back-to-Back Release

M9 - Matilija Download						
Day	Date	Robles Release	Robles Inflow Canal	Robles Inflow Weir	Matilija Inflow	Matilija Outflow
1	3-16	5671	1147	08:30		
2	3-17	5671	858	08:00		
3	3-18	171	628	08:30		
4	3-19	100				
5	3-20	82				
6	3-21	74	new storm peak on 3-21 @ 13:50			
7	3-22	68				1,891 cfs
8	3-23	62				
9	3-24	56				
10	3-25	56				
11	3-26	43				
12	3-27	30				
13						
14						
15						
16						
17						
18						

Initial Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	171	334	to 671
2	100	274	to 334
3	82	247	to 274
4	74	227	to 247
5	68	207	to 227
6	62	187	to 207
7	56	167	to 187
8	56	NA	
9	50	50	to 167
10	50	NA	
11	40	NA	
12	30	NA	

Back-to-Back Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	100	247	to 600
2	74	204	to 247
3	61	181	to 204
4	54	150	to 181
5	50	NA	
6	50	NA	
7	50	NA	
8	50	NA	
9	40	NA	
10	30	NA	

Comments:

Flow Assessment at Robles Diversion and Fish Passage Facility
Standard and Critical Drought Protection Measures (Stage 3-4, 100k - 65k af)

Date: 3-22-23 Time: 09:00 Prepared by: Scott Lewis

Storm Peak Discharge			
	date	time	cfs
North Fork Matilija Cr	3-21	17:40	619
Matilija Cr above dam		11:45	436/581
Matilija Dam		20:31	1492/1096.91
Matilija Cr at Hot Spr.		19:20	1054
Robles Canal		19:30	442
Robles Weir		19:30	1792
↓			
Total Robles Inflow	3-21	19:30	2234
BO Defined Storm Event: <u>Y</u> N			
BO Defined Overlapping Event: <u>Y</u> N			

VR-Foster, VC 18:00 2738
 VR-Foster, USGS 18:55 2720
 SANC Conf. 20:44 783

Current Discharge (Day 1 after peak)		
	time	cfs
North Fork Matilija Cr	08:05	378
Matilija Cr above Reservoir	07:40	335/459
Matilija Dam	07:25	1197/1096.72
Matilija Cr at Hot Springs	07:20	804
Robles Canal	08:30	440
Robles Weir	08:30	1017
Total Robles Inflow	08:30	1457

(VC/USGS)
(cfs/ft)

VR-Foster, VC 08:00 1690
 VR-Foster, USGS 08:15 1940
 SANC Conf. 06:49 521

Date Matilija Reservoir Filled: NA
 Count of Days: NA

Lake Casitas volume 146,572 ac-ft, 61.6% @ 07:03, 3-22

CDPM Method:

- ☐ <30 days - M4 - Modified Overlapping Release
☐ ≥30 days - M9 - Matilija Download with Initial Release
☐ Standard Release
☒ Back-to-Back Release

M9 - Matilija Download						
Day	Date	Robles Release	Robles Inflow	Matilija Inflow	Matilija Outflow	Matilija Elevation
1	3-22	>600	1457			
2	3-23	>600	1106			
3	3-24	>600	930			
4	3-25	>600	756			
5	3-26	100	571			
6	3-27	74				
7	3-28	61				
8	3-29	54				
9	3-30	42				
10	3-31	30				
11						
12						
13						
14						
15						
16						
17						
18						

Initial Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	171	334	to 671
2	100	274	to 334
3	82	247	to 274
4	74	227	to 247
5	68	207	to 227
6	62	187	to 207
7	56	167	to 187
8	55	NA	
9	50	50	to 167
10	50	NA	
11	40	NA	
12	30	NA	

Back-to-Back Release			
Day After Release Peak	(cfs)	Determining Inflow (cfs)	
1	100	247	to 600
2	74	204	to 247
3	61	181	to 204
4	54	150	to 181
5	50	NA	
6	50	NA	
7	50	NA	
8	50	NA	
9	40	NA	
10	30	NA	

Comments: