Monitoring and Evaluation of Salmonid Habitat Restoration

2025 Annual Validation Monitoring Report for the South Coast

California Department of Fish & Wildlife

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INTRODUCTION

The Monitoring and Evaluation of Salmonid Habitat Restoration (MESHR) team conducts effectiveness, validation, and Before-After-Control-Impact (BACI) monitoring on restoration projects funded through the California Department of Fish and Wildlife (CDFW) Fisheries Restoration Grant Program (FRGP). Each grant cycle, MESHR selects 10% minimum of funded projects to receive effectiveness monitoring to comply with the United States Army Corps of Engineers (USACE) permitting requirements of the regional general permits (RGP-12 for the north coast of California and RGP-78 for the south coast). This report summarizes validation monitoring completed by MESHR staff in Southern California within the area covered by the RGP-78 permit, which includes coastal watersheds from San Luis Obispo County through San Diego County (hereinafter referred to as South Coast).

Projects are selected using a stratified random sampling design stratified by USACE geographic area and FRGP project type. Projects are randomly selected until the 10% minimum is achieved. Final sampling rates are above 10% as additional projects are selected until one to three projects from each area/project type stratum is represented. Due to the low numbers of FRGP projects implemented annually within the region covered by RGP-78, 100% of projects are commonly selected for monitoring. Additionally, Proposition 1 Restoration Grant Program (Prop 1) projects within the South Coast region may be selected for monitoring if they align with FRGP project types and monitoring abilities.

Three project types receiving effectiveness monitoring also receive validation monitoring: instream habitat improvement (HI), fish passage at stream crossings (FP), and instream barrier modification for fish passage (HB). An upslope watershed restoration (HU) project can also include validation monitoring if it has an instream component. A subset of HI projects with validation monitoring also receive BACI monitoring to monitor habitat metrics, fish response, and overall effectiveness of large wood (LW) treatments. Due to the limited number of HI projects implemented in the South Coast region, none have been selected for BACI monitoring as of 2025.

Validation monitoring assesses salmonid response to instream treatments or fish barrier remediation. Snorkel surveys are used to estimate salmonid distribution, relative abundance, and stream habitat availability. Spawning surveys are used to estimate salmonid spatial structure. If conducted as a complete census of available spawning habitat, spawning surveys can be used to provide an index of effective population size. This report summarizes validation monitoring efforts conducted by South Coast MESHR staff from January 1, 2025, to December 31, 2025.

The only anadromous salmonid species present within the RGP-78 region is steelhead trout *Oncorhynchus mykiss*. Steelhead located within the region belong to two Distinct Population Segments (DPSs): the South-Central California Steelhead DPS and the Southern California Steelhead DPS. The South-Central California Steelhead DPS occurs from the Pajaro River watershed in Monterey County to (but not including) the Santa

Maria River watershed in Santa Barbara County. It is currently listed as threatened under the federal Endangered Species Act (ESA; NOAA 1997). The Southern California Steelhead DPS occurs from the Santa Maria River watershed in Santa Barbara County through the Tijuana River at the U.S.-Mexico border. It is currently listed as endangered under both the ESA and California Endangered Species Act (NOAA 1997; California Fish and Game Commission 2025).

Populations of *O. mykiss* exhibit both anadromous (ocean-migrating) and resident (freshwater-only) forms. Although only the anadromous form is protected under the ESA, both anadromous and resident forms are recorded during surveys. This is because the anadromous form is very rare in the South Coast, while the resident form is more common, can interbreed with the anadromous form, and can reproduce and regenerate anadromous runs following dry periods that limit upstream migration. Fish Bulletin 182 recommends using the following terminology: "steelhead" for adult anadromous individuals, "Rainbow Trout" for adult freshwater-resident individuals, and "juvenile *O. mykiss*" for fish whose fate as either of the previous forms cannot yet be established (Boughton et al. 2022). Adult steelhead can be distinguished from adult Rainbow Trout by size, morphology, and coloration. For regulatory purposes, CDFW defines a steelhead as any *O. mykiss* that measures greater than 16 inches and is located within anadromous waters (CDFW 2026). There are no simple criteria for distinguishing juvenile *O. mykiss* from adult Rainbow Trout. Fish Bulletin 182 proposes using the following categories as part of an approach to distinguishing Rainbow Trout and juvenile *O. mykiss*: fish measuring < 150 mm are probably immature, fish measuring 150 – 200 mm are enigmatic, and fish measuring > 200 mm (or approximately 8 inches) are probably adult Rainbow Trout. For this report, we use the term *O. mykiss* to refer to the species in general, regardless of form and life stage. Since our methods do not use the precise categories described in Fish Bulletin 182, for simplicity, we will use juvenile *O. mykiss* to refer to fish measuring up to 8 inches and Rainbow Trout for fish measuring 8 inches or more. We use steelhead to refer to fish that both meet appearance criteria and measure 16 inches or greater.

METHODS

Validation monitoring consists of summer juvenile snorkel surveys and winter adult spawning ground surveys. All three project types that receive validation monitoring receive snorkel surveys, while adult spawning surveys are limited to fish passage projects (FP and HB). Monitoring of HI projects is typically conducted three years after implementation to allow LW features to scour over three winter flow periods. However, FB and HB projects can be monitored one to three years after implementation for fish or redd presence above former barriers. If recolonization by salmonids is not documented upstream of a former barrier within the first three years of post-treatment monitoring, additional monitoring can be done.

Snorkel Surveys

MESHR biologists follow snorkeling protocols adapted from Duffy (2005) and O'Neal (2007) to conduct snorkel validation surveys to determine the presence or absence and density of juvenile salmonids in stream reaches directly associated with instream features or barrier removal locations. For HB and FP projects, one to five pool units upstream and downstream of the project barrier location are snorkeled. For HI projects, up to five randomly selected pool and/or run habitat units adjacent to instream structure locations are selected for snorkeling. South Coast MESHR staff snorkel additional units, up to the length of CDFW's previously established California Coastal Monitoring Program (CMP) reaches. This is to collect data that can be used by both projects and be comparable with past data collected by CMP. This will also help determine the most effective snorkel survey methods for MESHR validation data collection in South Coast streams. Additionally, the stream habitat within and near project sites often dries during the summer snorkel season, making it unlikely that fish will be observed in pools surrounding project sites. So, whenever possible, all upstream available habitat is snorkeled to effectively determine whether steelhead have repopulated these streams following fish passage barrier removals.

Snorkel surveys are conducted in teams of two or more, which include at least one data recorder and one snorkeler. During surveys, the wetted stream channel is delineated into discrete, natural units of similar habitat (Hankin 1984). Units are classified as either riffles, pools, or flatwaters according to certain defining characteristics. These habitat types are adopted from definitions outlined in Flosi et al. (2010).

For these surveys, all units with a maximum depth of 0.7 feet (ft) or greater are deemed suitable for snorkeling and are snorkeled in one pass. The snorkeler enters the water at the downstream end of each habitat unit while being careful to minimize disturbance to the water and sediment. Once in the water, the snorkeler moves in a zig-zag pattern towards the upstream end of the unit, making sure to visually search the entire area of the unit. The snorkeler searches the margins of the unit, boulder crevices, and other areas of potential fish cover using a waterproof flashlight. Cover is defined as any natural or artificial stream feature capable of hiding a 3-inch trout from the surface. To avoid duplicate counts, fish are counted as the snorkeler moves past them.

For each salmonid observed, the associated cover and estimated length are recorded. Fish sizes are estimated by 2-inch size bins (0-1.99 inches, 2-3.99 inches, 4-5.99 inches, etc.). The snorkeler assesses the total trout cover available in each unit by estimating the percentages of surface area containing trout cover and surface area containing no cover. The snorkeler also estimates the percentage of total cover each cover type in the unit comprised.

All habitat units are measured for length, mean width, mean depth, maximum depth, and maximum residual depth. Length is measured along the thalweg (line of lowest elevation within a valley or watercourse) and mean unit width is measured perpendicular to the length (thalweg) line. The percentage of surface area that contains

exposed substrate (usually comprised of gravel, boulders, or bedrock) is estimated for each unit. Exposed substrate includes areas of dry exposed substrate not accounted for in measurements of unit length or mean width. This allows for a more accurate surface area calculation of the available wetted habitat.

Water visibility is recorded on a scale of zero to three. A value of zero indicates the snorkeler is unable to perform the survey due to a lack of visibility, one indicates poor visibility, two indicates adequate visibility, and three indicates clear visibility. Water and air temperatures are measured with a thermometer at the beginning of each survey day and subsequently after every tenth unit surveyed. When recorded, stream flow is measured using OTT MF Pro flow meter or recorded from a nearby USGS gauge.

Spawning Surveys

Adult spawning surveys record counts of total redds, live fish, and carcasses in reaches immediately upstream and downstream of a barrier removal location. Spawner surveys are conducted based on the methods outlined in *California Department of Fish & Game's Salmonid Spawning Survey Personal Digital Assistant Data Entry Protocol* (2011) and the *National Marine Fisheries Service's Southern California Steelhead DPS Redd Survey Protocols* (2012 and 2015). The minimum standard survey reach length is approximately 20 bankfull channel widths, though survey lengths further upstream of the standard 20 bankfull channel widths can be established if a surveyed reach does not contain suitable spawning habitat. In addition to MESHR minimum standard survey reach length, the South Coast MESHR team generally surveys the full length of previously established CMP redd survey reaches when restoration projects occur in streams with CMP survey reaches. This allows for more accurate comparison of data collected by MESHR with historical data collected by CMP. Surveys are conducted during the spawning season from January through May. Survey reaches are planned to be surveyed again every two weeks after the initial survey date if weather and time permit. Approximately two weeks is the accepted minimum amount of time redds remain detectable in South Coast stream systems (Boughton et al. 2022). Some creeks may only be surveyed once depending on time available, stream flows and/or weather conditions.

At the start of the survey, air temperature, water temperature, and velocity/flow measurements are recorded. A GPS unit is used to determine survey start and endpoints and coordinates of all recorded observations.

Teams of at least two surveyors walk the reaches in an upstream direction and record observations. Fish observations are identified to species. For each salmonid observation, a total length estimate, location, condition, and life history stage (when possible) are recorded. When redds are observed, measurements of pot and tailspill dimensions are taken. Pot length, width, and depth relative to the adjacent streambed are measured. For tailspill dimensions, the tailspill length and two width measurements (taken at 1/3 and 2/3 the distance along the tailspill from the pot) are recorded. Dominant substrate size is also recorded for both the pot and tailspill. Redds are marked with a flag denoting

the redd record number, distance and bearing of redd from the flag location, date of initial recording, and redd age. Redd ages and significant changes to redd measurements are updated and recorded during subsequent observations. Redds are re-measured when pot and tailspill dimensions have noticeably changed following their initial observation.

Data Analysis

All validation monitoring data are collected using either paper datasheets or a tablet with custom Pendragon forms and subforms. Data are then entered into Excel workbooks and later undergoes quality control to correct any potential errors.

Snorkel survey data are analyzed to calculate salmonid size distributions and densities, and total and mean habitat measurements. To examine trout relative abundances, trout density is calculated as the mean number of trout per square foot. To evaluate trout life stage diversity, the total number of trout per size class is calculated. To examine wetted habitat the total length surveyed, mean unit length, total unit area, mean unit area, mean unit depth, mean unit maximum depth, total unit volume, and mean unit volume are calculated. For each mean the standard error (± SE) is calculated. All analyses are completed using R (version 4.4.1, R Core Team 2024) and R Studio (version 2024.9.0, RStudio, Inc 2024).

Spawning survey data are analyzed to determine salmonid distribution and redd area. Total redd length is calculated as the sum of the pot and tailspill lengths and redd area is calculated as the sum of pot and tailspill areas per Gallagher et al. (2007). These measurements are used to compare the relative sizes of all redds observed to evaluate whether a redd was produced by steelhead or Rainbow Trout. Previous studies using redd surveys have demonstrated that steelhead and Rainbow Trout redds can be distinguished by size (Zimmerman and Reeves 2000; Kendall et al. 2015). Redd size criteria outlined in Fish Bulletin 182 classifies redd size less than 0.95 m^2 as Rainbow Trout (Boughton et al. 2022). We examine *O. mykiss* distribution by calculating total *O. mykiss* observation counts by reach. All analyses are completed using R software.

RESULTS

Validation Monitoring Project Selection

During the 2025 calendar year, four restoration projects received validation monitoring (Table 1).

Table 1. Restoration projects that received validation monitoring in 2025.

Grant #	Project Type	Project Title	Status	Survey
Q2050905	FP	Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	Pre-treatment	Snorkel survey conducted
Q2296016	Prop 1	Wheeler Gorge Campground Fish Passage Project--Implementation	Pre-treatment	Spawner surveys and snorkel surveys conducted
P1450010	FP	Circle G Ranch Fish Passage Restoration	Post-treatment	Spawner surveys conducted
Q1950902	FP	Davy Brown/Munch Creek Fish Passage Construction Project	Post-treatment	Spawner and snorkel surveys conducted

From the effectiveness monitoring selection of 2025, one new project was selected for pre-treatment validation monitoring. Construction on this new project was postponed until 2026, so all pre-treatment monitoring was postponed as well. Two projects, which were selected in previous years to receive pre-treatment validation monitoring in the South Coast region, received monitoring in 2025 (Table 1). Both previously selected projects received pre-treatment snorkel surveys, and one received another season of pre-treatment spawner validation surveys.

Additionally, two projects were surveyed for post-treatment monitoring. One of these projects received snorkel validation surveys, and both had spawner surveys conducted in an effort to confirm successful fish passage. These post-treatment projects are included in 2025 validation efforts (Table 1).

Pre-Treatment Snorkel Survey Observations

The following projects received pre-treatment snorkel validation monitoring in 2025:

- Q2050905 - Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project
- Q2296016 - Wheeler Gorge Campground Fish Passage Project--Implementation

Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project (FP)

This project proposes to improve upstream fish passage at a total barrier to *O. mykiss* passage at all life stages. The culvert will be replaced with a bridge that will be located immediately downstream of the current crossing. The channel will be regraded and reconstructed to match surrounding stream grade and substrate composition. Replacement of this stream crossing will allow for steelhead trout access to 12 miles of spawning and rearing habitat within the Santa Margarita River watershed.

In 2025, four habitat units were snorkeled near and within the treatment area, two below and two above the current crossing. The total area surveyed was 115,222 ft², with an average unit area of 28,805 ± 25,014 ft² (mean ± SE) and average maximum residual depth was 3.2 ± 0.79 ft. No *O. mykiss* were observed during the survey (Table 2). Numerous invasive fish species, including Common Carp *Cyprinus carpio*, black bass *Micropterus* spp., Western Mosquitofish *Gambusia affinis*, Green Sunfish *Lepomis cyanellus*, and Bluegill *Lepomis macrochirus* were observed.

Table 2. Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project pre-treatment snorkel validation survey data.

Date(s)	No. of Units Surveyed	Avg Unit Area (ft²)	SE (ft²)	Avg Max Residual Depth (ft)	SE (ft)	*O. mykiss* observations	Density (fish/ft²)	SE (fish/ft²)
6/28/2022	5	34,965	20,016	4.4	1.4	0	0	0
7/29/2025	4	28,805	25,014	3.2	0.79	0	0	0

A pre-treatment snorkel survey was previously conducted in 2022 prior to a project redesign, and data from this survey is included in the above table for comparison.

Wheeler Gorge Campground Fish Passage Project—Implementation (Prop 1)

This project proposes to remove a total of four low flow stream crossings within the Wheeler Gorge Campground. On North Fork Matilija Creek, one crossing will be replaced with a free-spanning bridge and another crossing will be removed and the area restored. The same will occur on Bear Creek, with one crossing being replaced with a bridge and another crossing being removed and the stream restored. Access will be restored to approximately 13 additional miles of spawning and rearing habitat.

Over the course of four days, 1.25 miles of North Fork Matilija Creek were snorkeled and included habitat downstream of, within, and upstream of the project treatment area. This survey reach began downstream of the project location at an established CMP

survey reach start and ended upstream of the project location at a confluence with a tributary. A total of 136 habitat units were snorkeled. Of these units snorkeled, 74 were below both barriers being addressed by this project, 47 units were located between the 2 barriers, and 15 units were above both barriers. The entire surveyed portion of stream was wetted during the survey. The total area surveyed was 57,997.3 ft², with an average unit area of 426.5 ± 32.49 ft² (mean ± SE) and average maximum residual depth was 1.6 ± 0.06 ft. No *O. mykiss* were observed during the survey (Table 3). Numerous Arroyo Chub *Gila orcuttii*, a native fish species, were observed during the survey downstream of the project site.

Table 3. Wheeler Gorge Campground Fish Passage Project pre-treatment snorkel validation survey data for North Fork Matilija Creek.

Date(s)	No. of Units Surveyed	Avg Unit Area (ft²)	SE (ft²)	Avg Max Residual Depth (ft)	SE (ft)	*O. mykiss* observations	Density fish/ft²	SE (ft²)
6/23/2025-6/26/2025	136	426.5	32.49	1.6	0.06	0	0	0

During a single day of snorkeling, 0.61 miles of Bear Creek were surveyed. The survey reach began at the confluence with North Fork Matilija and the end point was determined by how far could be surveyed that day since only one day was available for snorkeling this creek. Only 65% of the surveyed habitat was wetted at the time, and much of this wetted habitat was too shallow to snorkel. A total of 19 habitat units met the specified depth requirements and were snorkeled. Of those units snorkeled, 2 were located downstream of both barriers that will be addressed by this project. No units were located between the 2 barriers because that habitat was dry at the time of the survey, and 17 units were located upstream of both barriers. The total area surveyed was 2,839.4 ft², with an average unit area of 149.4 ± 20.67 ft² (mean ± SE) and average maximum residual depth was 1.4 ± 0.22 ft. No *O. mykiss*, nor any fish species, were observed during the survey (Table 4).

Table 4. Wheeler Gorge Campground Fish Passage Project pre-treatment snorkel validation survey data for Bear Creek.

Date(s)	No. of Units Surveyed	Avg Unit Area (ft²)	SE (ft²)	Avg Max Residual Depth (ft)	SE (ft)	*O. mykiss* observations	Density fish/ft²	SE (ft²)
7/8/2025	19	149.4	20.67	1.4	0.22	0	0	0

Snorkel surveys have been conducted in previous years in both North Fork Matilija and Bear creeks by CDFW's CMP. Survey methods and reach lengths varied and differed from those used by MESHR in 2025, so data from these surveys are not included in the above tables. North Fork Matilija Creek was snorkeled in 2014, 2018, and 2019. During the 2014 survey, 185 habitat units were surveyed and a total of 132 *O. mykiss* were observed. In that survey, 158 of the habitat units snorkeled and 101 of the *O. mykiss* observations occurred downstream of the lower, total barrier within the project site, while the remaining 27 units snorkeled and 31 *O. mykiss* observed were located upstream of this lower barrier. In 2018, 258 habitat units were snorkeled, all located downstream of the lower project barrier, and 1 *O. mykiss* was observed. In 2019, 515 habitat units were snorkeled, again all downstream of the lower project barrier, and no *O. mykiss* were observed. Bear Creek was snorkeled in 2018 and 2019. In both years, Bear Creek was snorkeled for 1.7 miles from the confluence with North Fork Matilija Creek up to a total natural barrier. A total of 96 habitat units were snorkeled during the 2018 survey, and 177 habitat units were snorkeled in 2019, and no *O. mykiss* were observed during either survey.

Post-Treatment Snorkel Survey Observations

The following projects received post-treatment snorkel validation monitoring in 2025:

- Q1950902 - Davy Brown/Munch Creek Fish Passage Construction Project

Davy Brown/Munch Creek Fish Passage Construction Project (FP)

This project removed three barriers to fish passage within the Davy Brown Creek sub watershed, restoring access to a total of 3.13 miles of anadromous habitat. Two concrete Arizona crossings along Davy Brown Creek were removed and replaced with free spanning bridges. On Munch Creek, one concrete Arizona crossing was decommissioned and removed.

The entire 2.12 miles of anadromously accessible stream along Davy Brown Creek, from the confluence with Manzana Creek to a total natural barrier to fish passage, was surveyed during 2025 post-treatment snorkel survey validation monitoring. The entire reach was wetted at the time of the survey. A total of 31 habitat units were snorkeled, with a total snorkeled area of 2,284.7 ft^2, an average unit area of 73.7 ± 8.67 ft^2 (mean ± SE) and an average maximum residual depth of 1.1 ± 0.06 ft. A total of 220 *O. mykiss* were observed during the survey, with a calculated fish density of 0.09 ± 0.015 fish/ft^2 (Table 5).

Table 5. Davy Brown/Munch Creek Fish Passage Construction Project pre- and post-treatment snorkel validation survey data for Davy Brown Creek.

Survey	Date(s)	No. of Units Surveyed	Avg Unit Area (ft^2)	SE (ft^2)	Avg Max Residual Depth (ft)	SE (ft)	*O. mykiss* observations	Density (fish/ft^2)	SE (fish/ft^2)
Pre-Treatment	11/22/2021 - 12/7/2021	56	147.9	12.55	1.5	0.12	61	0.008	0.003
Post-Treatment	9/2/2025 - 9/4/2025	31	73.7	8.67	1.1	0.06	220	0.09	0.015

O. mykiss observations were grouped into 2-inch size bins (Table 6). Most *O. mykiss* observed during this survey (n=216) were classified as juvenile *O. mykiss*, most of which (n=141) belonged to the 2-3.99 inch size bin. The 4 observed *O. mykiss* which measured 8 inches or over were classified as Rainbow Trout.

Table 6. *Oncorhynchus mykiss* observations by size bin (in) from snorkel surveys conducted on Davy Brown Creek.

Survey Year	0-1.99	2-3.99	4-5.99	6-7.99	8-9.99	10-11.99	12-13.99	14-15.99	16+	Total
2021	0	24	17	13	6	1	0	0	0	61
2025	10	141	43	22	4	0	0	0	0	220

During pre- and post-treatment surveys, most *O. mykiss* observations occurred upstream of both crossing locations (Figure 1). During the pre-treatment survey, there was no wetted habitat present below the crossings, and all *O. mykiss* were observed in the upstream most portion of the survey reach. The entire reach was wetted during post-treatment surveys and *O. mykiss* were observed throughout the reach, though the majority were recorded in the upper portion of the reach.

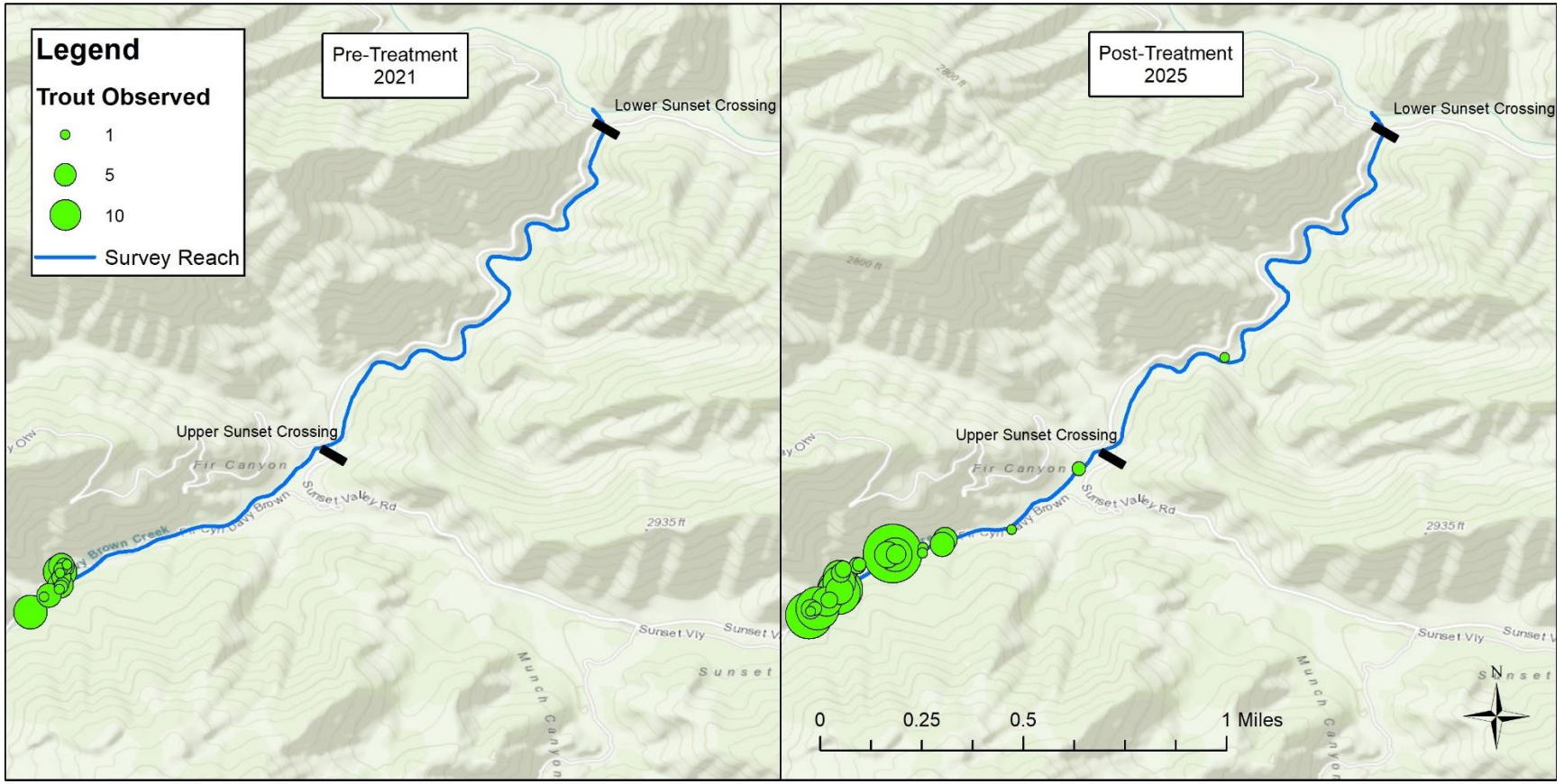

Figure 1. *Oncorhynchus mykiss* observations during pre-treatment snorkel surveys in 2021 and post-treatment snorkel surveys in 2021 along the 2.12-mile-long survey reach on Davy Brown Creek.

All 0.5 miles of anadromously accessible stream along Munch Creek, from the confluence with Davy Brown Creek to a total natural barrier to fish passage, was surveyed during 2025 post-treatment snorkel survey validation monitoring. The survey reach was 100% wetted at the time. A total of 11 habitat units were snorkeled, with a total snorkeled area of 1,132.3 ft^2, an average unit area of 102.9 ± 30.01 ft^2 (mean ± SE) and an average maximum residual depth of 1.1 ± 0.12 ft. A total of 12 *O. mykiss* were observed during the survey, with a calculated fish density of 0.016 ± 0.006 fish/ft^2 (Table 7).

Table 7. Davy Brown/Munch Creek Fish Passage Construction Project pre- and post-treatment snorkel validation survey data for Munch Creek.

Survey	Date(s)	No. of Units Surveyed	Avg Unit Area (ft^2)	SE (ft^2)	Avg Max Residual Depth (ft)	SE (ft)	*O. mykiss* observations	Density ($fish/ft^2$)	SE ($fish/ft^2$)
Pre-Treatment	12/7/2021-12/8/2021	43	97.9	8.74	1.6	0.08	24	0.004	0.001
Post-Treatment	9/9/2025	11	102.9	30.01	1.1	0.12	12	0.016	0.006

O. mykiss observations were grouped into 2-inch size bins (Table 8). Most *O. mykiss* observed during this survey (n=7) were classified as juvenile *O. mykiss*. The 5 observed *O. mykiss* which measured 8 inches or greater were classified as Rainbow Trout.

Table 8. *Oncorhynchus mykiss* observations by size bin (in) from snorkel surveys conducted on Munch Creek.

Survey Year	0-1.99	2-3.99	4-5.99	6-7.99	8-9.99	10-11.99	12-13.99	14-15.99	16+	Total
2021	3	13	3	2	3	0	0	0	0	24
2025	0	0	3	4	3	2	0	0	0	12

During both pre- and post-treatment surveys, *O. mykiss* were observed throughout the Munch Creek survey reach (Figure 2). All observations occurred upstream of the crossing during both surveys.

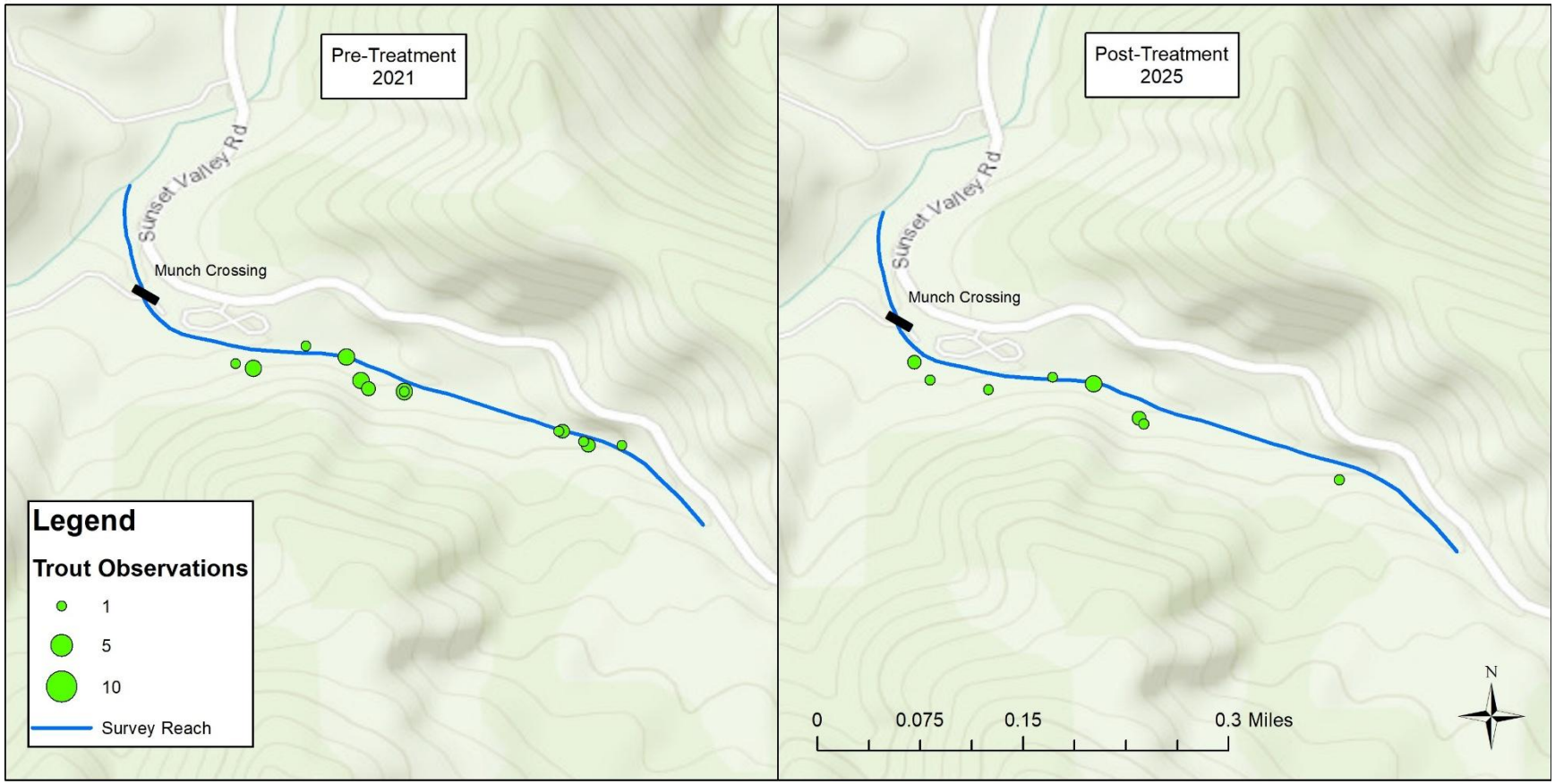

Figure 2. *Oncorhynchus mykiss* observations during pre-treatment snorkel surveys in 2021 and post-treatment snorkel surveys in 2021 along the 0.5-mile-long survey reach on Munch Creek.

Adult Spawning Survey Observations

The following projects received spawning survey validation monitoring in 2025:

- P1450010 - Circle G Ranch Fish Passage Restoration
- Q1950902 - Davy Brown/Munch Creek Fish Passage Construction Project
- Q2296016 - Wheeler Gorge Campground Fish Passage Project--Implementation

Circle G Ranch Fish Passage Restoration (FP)

This project, completed in 2016, removed a barrier along Carpinteria Creek, located approximately 2.9 miles upstream of the mouth of the estuary. The barrier, consisting of approximately 100 feet of concrete lined channel and banks and an undersized bridge, was removed. It was replaced with a larger free spanning bridge and regraded and reconstructed channel consisting of engineered streambed materials. Additionally, the banks were reconstructed and revegetated with native plants.

Carpinteria Creek was surveyed for 4.2 miles, the entire accessible part of the stream from the estuary to a natural barrier to anadromy. During the 2025 spawning season, three spawning surveys were conducted by MESHR and CDFW staff. No *O. mykiss* or redds were observed during these surveys (Table 9).

Table 9. Circle G Ranch Fish Passage Restoration: observations from 2025 adult spawning surveys conducted after barrier removal.

Reach Length (mi.)	Date Surveyed	Live *O. mykiss*	Carcasses	Redds
4.21	2/24/2025	0	0	0
4.21	3/30/2025	0	0	0
4.21	4/10/2025	0	0	0

Approximately bi-weekly spawning surveys have been conducted by CDFW and previous Pacific States Marine Fisheries Commission (PSMFC) project staff along this same survey reach annually from 2016 through 2021 and by CDFW and MESHR staff from 2022 through 2025. No *O. mykiss* or redds have been observed during these surveys.

Davy Brown/Munch Creek Fish Passage Construction Project (FP)

This project removed three barriers to fish passage within the Davy Brown Creek sub-watershed. Two concrete Arizona crossings along Davy Brown Creek were removed and replaced with free spanning bridges. The lower crossing is located just 120 ft upstream of the confluence with Manzana Creek. The upper crossing is located approximately 1.2 miles upstream of the lower crossing. On Munch Creek, one concrete Arizona crossing,

located approximately 0.1 miles upstream of the confluence with Davy Brown Creek, was decommissioned and removed. Additionally, the channel was regraded and reconstructed with native streambed material at all three crossing locations. Access was restored to a total of 3.13 miles of anadromous habitat.

During the 2025 spawning season, surveys began in February following the first major storms of the season. Davy Brown Creek was surveyed for 2.12 miles, from the confluence with Manzana Creek to a natural waterfall barrier to anadromy. Munch Creek was surveyed for 0.5 miles from the confluence with Davy Brown Creek to a natural fish passage barrier. Davy Brown and Munch Creeks were each surveyed five times during the 2025 spawning season (Table 10).

Table 10. Davy Brown/Munch Creek Fish Passage Restoration Project observations from adult spawning surveys in 2025 following barrier removal. Both Davy Brown Creek (DVB) and Munch Creek (MCH) were surveyed.

Reach Length (mi.)	Date Surveyed	Live *O. mykiss*	Carcasses	Redds
2.12 (DVB)	2/18/2025	43	0	1
0.5 (MCH)	2/26/2025	34	0	3
2.12 (DVB)	3/11/2025	82	1	13
0.5 (MCH)	3/19/2025	11	0	1
2.12 (DVB)	3/26/2025	49	0	3
0.5 (MCH)	4/2/2025	6	0	0
2.12 (DVB)	4/9/2025	87	1	0
0.5 (MCH)	4/15/2025	20	0	0
2.12 (DVB)	4/23/2025	44	0	0
0.5 (MCH)	4/29/2025	7	0	0

A total of 17 redds and 305 live *O. mykiss* were observed during the three surveys conducted this season on Davy Brown Creek. Two Rainbow Trout carcasses were also observed. Of the 305 live *O. mykiss* observed, 192 were juvenile *O. mykiss*, 112 were Rainbow Trout, and one was a potential steelhead (16 inches or greater). Of the juvenile *O. mykiss* observations, 15 were young-of-year (YOY) trout (< 2 inches). All 17 redds recorded in Davy Brown Creek were classified as likely Rainbow Trout redds. The nine measured redds had areas ranging between 0.04 m^2 and 0.36 m^2. The remaining 8 redds were unable to be measured as Rainbow Trout were observed on, around, or actively digging within the redds during the surveys and no measurements were taken to avoid disturbing the fish.

A total of 4 redds and 78 live *O. mykiss* were observed during the three surveys during the 2025 spawning season on Munch Creek. Of the 78 *O. mykiss* observed, 62 were juvenile *O. mykiss* and 16 were Rainbow Trout. No YOY trout (< 2 inches) were observed in Munch Creek this season. All 4 redds recorded in Munch Creek were

classified as likely Rainbow Trout redds. The two measured redds had areas of 0.1 m² and 0.13 m². The remaining two redds were unable to be measured as Rainbow Trout were observed on, around, or actively digging within the redds during the surveys and no measurements were taken to avoid disturbing the fish.

Individuals were not marked or tagged, resulting in the potential for redundant fish counts in subsequent surveys. One *O. mykiss* observed on Davy Brown Creek was estimated to be approximately 16 inches, which meets the established minimum size for anadromous steelhead ($\geq$ 16 inches). No redds large enough to be attributed to steelhead were observed.

Previous spawning surveys had been conducted by a PSMFC monitoring project in 2017 along the same survey reaches used by MESHR starting in 2022. Surveys were conducted approximately once every two weeks throughout the spawning season from January through May. Numerous Rainbow Trout or juvenile *O. mykiss* were recorded on both Davy Brown and Munch Creeks upstream of the barriers. No steelhead or steelhead redds were observed during previous spawner surveys.

Wheeler Gorge Campground Fish Passage Project – Implementation

This project proposes to remove a total of four low flow stream crossings, two on North Fork Matilija Creek and two on Bear Creek. Two of the four crossings will be replaced with vehicular bridges while the remaining two will be removed and the area restored. This project will restore access to approximately 13 additional miles of spawning and rearing habitat.

North Fork Matilija Creek was surveyed along three CMP reaches for a total of 4.85 miles, from the confluence with Matilija Creek to a highway crossing just upstream of the project site at Wheeler Gorge Campground. There is a Bear Creek survey reach that is 1.7 miles long, from the confluence with North Fork Matilija Creek to a total natural barrier to fish passage, but it was not surveyed in 2025. In 2025, one survey was conducted on North Fork Matilija Creek. No *O. mykiss* or redds were observed during this survey (Table 11).

Table 11. Wheeler Gorge Campground Fish Passage Project – Implementation: observations from adult spawning surveys conducted in 2025 prior to barrier removal. Three combined reaches on North Fork Matilija Creek (NFM) were surveyed.

Reach Length (mi.)	Date Surveyed	Live *O. mykiss*	Carcasses	Redds
4.85 (NFM1-3)	4/7/2025	0	0	0

Bi-weekly spawning surveys have been conducted by CDFW and PSMFC (from the MESHR project and/or previous projects) along these same or similar survey reaches annually from 2013 through the 2025 spawning season. Several Rainbow Trout and juvenile *O. mykiss* and Rainbow Trout redds were observed in these reaches in past

years, though no adult steelhead or steelhead redds have been observed since surveys began in 2013. Additionally, parts of North Fork Matilija Creek and its tributary Cannon Creek, which are located upstream of the total barrier at Wheeler Gorge have been surveyed several times in past years, most recently in 2018. No *O. mykiss* or redds have been observed during those surveys. Regular surveys of CMP reaches upstream of the total barrier within the project site will begin after the barriers are removed following project implementation.

DISCUSSION

Juvenile Snorkel Validation Surveys

For HB and FP projects, juvenile snorkel survey data can determine if projects restored or improved fish passage upstream of a barrier via fish presence or increased densities. Pre-treatment validation monitoring is essential to document baseline biological productivity prior to restoration to compare to post-treatment data.

The Santa Margarita River Bridge Replacement received pre-treatment snorkel validation monitoring, and no *O. mykiss* were observed in any habitat units surveyed either above or below the barrier to fish passage. Four habitat units were snorkeled during this survey, two above and two below the barrier. Habitat units were generally large and deep, with an average unit area of 28,805 ± 25,014 ft² (mean ± SE) and an average unit maximum residual depth of 3.2 ± 0.79 ft. They also contained good potential cover for salmonids. It is likely that other factors besides the barrier to fish passage contributed to the lack of *O. mykiss* observations within the survey reach. Large numbers of nonnative aquatic species were observed within the habitat units snorkeled, including common carp, black bass, green sunfish, bluegill, mosquitofish, and red swamp crawfish. These could compete with or potentially predate on native *O. mykiss*. Additionally, high water temperatures of 77°F were recorded at the start of the snorkel survey, with temperatures rising over the course of the survey day. These temperatures would likely limit juvenile *O. mykiss* from utilizing this part of the river as summer habitat. Although studies have shown that *O. mykiss* in southern California potentially have higher heat preferences and tolerances than their northern counterparts, the temperatures observed during the snorkel survey were higher than the accepted 24°C (75°F) heat tolerance limit for *O. mykiss* (Spina 2007).

This is the second time pre-treatment snorkel surveys have been conducted at this project site. The project was delayed and redesigned after cultural resources were discovered within the previous project footprint. All pre-treatment effectiveness and validation monitoring were redone since project designs have changed. Snorkel conditions and observations were very similar during this and the previous survey. The first unit from the original survey was skipped during the 2025 survey to avoid sensitive cultural areas, so one fewer habitat unit was snorkeled. During post-treatment monitoring, additional habitat in the upper watershed might be considered for snorkel validation surveys if habitat is found to have more favorable summer conditions for

juvenile *O. mykiss* (e.g., lower water temperatures, increased canopy cover, fewer invasive aquatic species).

Portions of North Fork Matilija and Bear creeks received pre-treatment snorkel surveys as part of monitoring for the Wheeler Gorge Campground Fish Passage Project. North Fork Matilija Creek was snorkeled in the summer of 2025 for 1.25 miles, which included habitat downstream, within, and upstream of the project site. No *O. mykiss* were observed throughout the 136 habitat units snorkeled. Bear Creek was snorkeled in 2025 for 0.61 miles, beginning at the confluence with North Fork Matilija Creek and including habitat downstream, within, and upstream of the project locations on Bear Creek. Nineteen habitat units were surveyed and no *O. mykiss* were observed. Both creeks have received snorkel surveys by CDFW and/or previous PSMFC projects in previous years. During snorkel surveys conducted in North Fork Matilija Creek in 2014, 132 *O. mykiss* were observed. Most of these *O. mykiss* were located downstream of the total fish passage barrier that will be removed as part of this project, but some *O. mykiss* (n=31) were observed upstream of this barrier. This indicates that a resident Rainbow Trout population previously persisted upstream of the total barrier to fish passage, though no *O. mykiss* have been observed there by CDFW or PSMFC staff since this survey. In both 2018 and 2019, all of the anadromously accessible habitat within North Fork Matilija Creek up to the total barrier in the project site was snorkeled. One *O. mykiss* was observed during the 2018 survey and no *O. mykiss* were observed during the 2019 survey. All habitat in Bear Creek up to a total natural barrier to anadromy was snorkeled in both 2018 and 2019. No *O. mykiss* were observed during either of these surveys. The decline in *O. mykiss* observations across these survey years can be attributed to several factors: drought, fire, and debris flows. The 2014 survey occurred during a long period of drought that persisted until summer 2017 and drastically reduced *O. mykiss* abundances in the region. Then, from late 2017 through early 2018, a massive wildfire, the Thomas Fire, burned through the watershed. Severe winter storms immediately followed the fire in January 2018 which caused debris flows and sedimentation throughout the watershed. Though Bear Creek had never been snorkeled prior to the Thomas Fire and debris flows, it had received prior spawner and drought surveys during which *O. mykiss* had been observed. No *O. mykiss* have been observed in Bear Creek by any survey method following the 2018 Thomas Fire and subsequent debris flows.

Post-treatment snorkel validation monitoring was completed on one project in 2025: Davy Brown/Munch Creek Fish Passage Construction Project. All 2.12 miles of Davy Brown Creek up to a total natural barrier to fish passage were snorkeled. All of Munch Creek was snorkeled for 0.5 miles up to a natural fish passage barrier. Both creeks had previously received pre-treatment snorkel surveys in 2021. Though the same survey reaches were used during pre- and post-treatment surveys, these reaches differed in percent wetted between the 2021 and 2025 surveys. The Davy Brown Creek survey reach was 100% wetted during the 2025 post-treatment survey and 34.8% wetted during pre-treatment in 2021. The Munch Creek survey reach was also 100% wetted during 2025 surveys but 91.7% wetted during pre-treatment in 2021. For Davy Brown Creek, the number of habitat units snorkeled, average habitat unit area, and average maximum

residual depths decreased between pre-treatment and post-treatment. Alternatively, *O. mykiss* observations in Davy Brown Creek increased from 61 during pre-treatment to 220 during post-treatment. In Munch Creek, the number of units snorkeled and maximum residual depth decreased between pre- and post-treatment surveys, while average unit area remained similar. *O. mykiss* observations in Munch Creek decreased from 24 during pre-treatment to 12 during post-treatment. The differences in the number of units that meet snorkel requirements, depths and areas of habitat units, numbers of trout observed in post-treatment compared to pre-treatment could be attributed to several factors including drought, fire, and post-fire sedimentation. The 2021 pre-treatment snorkel surveys occurred during a drought year, while 2025 was a normal water year. This had minimal effect on available habitat on Munch Creek between the survey years. On the other hand, wetted habitat on Davy Brown Creek during pre-treatment surveys was only present upstream of the upper crossing, while the rest of the stream from the confluence with Manzana to the upper crossing was dry. Additionally, both survey reaches were affected during the gap between pre- and post-treatment monitoring by the Lake Fire, which occurred in July 2024. Significant portions of the Davy Brown and Munch watersheds burned during this fire. Following the fire, winter storms that occurred in early 2025 resulted in significant sedimentation throughout both Davy Brown and Munch creeks. This sediment accumulation drastically altered the water depth and deep habitat availability in both creeks. This is observed in the decreased average maximum residual depth and decreased number of habitat units that meet minimum depth requirements for snorkeling in both creeks during post-treatment surveys. In Munch Creek, a similar distance of habitat was wetted during both surveys, but the habitat was much shallower and less suitable during post-treatment, which could account for the lower numbers of *O. mykiss* observed. Though habitat was shallow during post-treatment, all surveyed habitat in Davy Brown Creek was wetted during post-treatment, and *O. mykiss* were able to access and utilize habitat that was previously inaccessible during drought conditions. This significant increase in available wetted habitat during post-treatment could account for the increase in the number of trout observed in Davy Brown Creek. With full wettedness in 2025 and the removal of the former barriers, *O. mykiss* could easily migrate downstream from the upper watershed refugia habitat or upstream from Manzana Creek to colonize habitat previously inaccessible during drought years. The results of this survey indicate that *O. mykiss* were capable of passage through former barrier locations following project implementation.

Small changes in fish density based on individual surveys can be due to daily, seasonal, or annual variability in fish abundance in a particular stream or stream reach. Larger sample sizes over a longer period are necessary for statistical analyses to determine if variability in fish densities is significant. Using available resources, MESHR conducts pre- and post-treatment surveys under similar conditions (e.g., flow, temperature, visibility, or seasonal re-distribution of salmonids) to reduce variability in fish densities, but additional factors may affect salmonid distribution.

Adult Spawning Validation Surveys

Documenting fish response to barrier removal or modification using spawner surveys is more critical for complete barrier removals than for partial or temporal barrier modifications or LW addition projects. No evidence of fish above a barrier at pre-treatment followed by observed fish upstream after barrier removal suggests new habitat was opened by the project. However, confidence in re-occupation above the barrier increases with more surveys conducted during both pre- and post-treatment monitoring.

Pre-treatment spawning surveys were conducted for one fish passage type project, Wheeler Gorge Campground Fish Passage Project. Though this project has not yet been implemented, surveys were conducted to collect baseline spawner data before the proposed barrier removals. No *O. mykiss* or evidence of spawning activity was observed during these surveys. Spawning surveys will continue at these project locations following treatment to attempt to document spawning activity above the removed barriers.

Post-treatment spawning surveys were conducted during the 2025 spawning season following project implementation at two project locations: Circle G Ranch Fish Passage Restoration, and Davy Brown/Munch Creek Fish Passage Restoration Project. No steelhead spawning activity was observed upstream of removed barriers during any of these surveys, though Rainbow Trout spawning activity was observed within Davy Brown and Munch creeks. Additionally, an *O. mykiss* estimated to be approximately 16 inches in total length was observed on Davy Brown Creek. This fish does meet the established minimum size to be considered a steelhead, though large Rainbow Trout are also capable of attaining lengths greater than 16 inches. While conditions favorable to anadromous fish passage throughout the Santa Maria watershed occurred this season prior to this fish observation, this fish had coloration and morphology more similar to a Rainbow Trout. It is more likely that a fish this size originated from larger refugia habitat further downstream in the watershed within Manzana Creek or the Sisquoc River. Regardless of whether this fish is a steelhead or large Rainbow Trout, its presence upstream of both former barriers to fish passage on Davy Brown Creek indicates that *O. mykiss* can now access this formerly inaccessible habitat. If time and availability permit, post-treatment spawning surveys will continue to be conducted at these project sites that have not yet had a recorded fish response upstream of former barrier sites.

Multiple factors such as human error and surveys with unclear or turbulent water during elevated flows could explain the lack of observations. Also, rain events that occur following spawning activity may lead to destruction of redds and the displacement of eggs. With above average precipitation this water year, the heavy rain and high stream flows made it difficult or impossible to conduct regular spawning surveys at most sites. Even when reaches were accessible, high flows and turbid water may have concealed salmonids or spawning activity. The low frequency of spawning surveys at many sites was likely a major factor in the lack of spawning activity observations. Conducting spawning surveys every two weeks should allow for detection of new redds before they

degrade until they are no longer visible. In practice, however, this is complicated by high flow events that may erase redds before observation.

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