Monitoring and Evaluation of Salmonid Habitat Restoration Program

Contract P2196001

Final Report

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Final Report Template

Project Title: Monitoring and Evaluation of Salmonid Habitat Restoration

FRGP Contract Number: P2196001

Grantee Name and Contact Information: Pacific States Marine Fisheries Commission; 205 SE Spokane St., Suite 100; Portland, OR 97202; ATTN: Stan Allen, Senior Program Manager, Sallen@PSMFC.org, phone: 503-595-3114

Author Information: Pacific States Marine Fisheries Commission – Monitoring and Evaluation of Salmonid Habitat Restoration Team: Kori Roberts, Nathan Harris, and Tanielle Redman

Overview of project:

The Pacific States Marine Fisheries Commission (PSMFC) implemented the Monitoring and Evaluation of Salmonid Habitat Restoration (MESHR) project. This contract funded independent, third-party effectiveness and validation monitoring of a randomized selection of Fisheries Habitat Restoration Grant Program (FRGP) and Proposition 1 Restoration Grant Program (Prop 1) projects in coastal California using qualitative and quantitative methods. The funding provided nine projects with pre-treatment effectiveness monitoring, 26 projects with post-treatment effectiveness monitoring, and 26 with validation monitoring. Before-After-Control-Impact (BACI) monitoring also continued for two projects.

A list of the original projects monitored are in the Final Report Attachments Attachment 1, Table 5. The Quality Assurance/ Quality Control (QA/QC) Plan is in Attachment 2. The management questions addressed are in Attachment 3. The overall project goals and measurable project objectives are in Attachment 4. The spatial and temporal scales of the project are described in Attachment 5. The study design and parameters to be monitored are described in Attachment 6. The sampling scheme used is described in Attachment 7. The analysis used is described in Attachment 8.

The MESHR program was established in 2002 and has conducted effectiveness monitoring on FRGP implementation projects for 21 years. The number of years of data collection required to address the management questions is addressed in Attachment 9. A brief abstract is in Attachment 10. The term dates of the contract were February 1, 2022, through April 30, 2024. The Effectiveness Monitoring, Validation Monitoring, and BACI Monitoring elements are in Attachment 11, Attachment 12, and Attachment 13, respectively. Literature cited is in Attachment 14.

Final Budget:

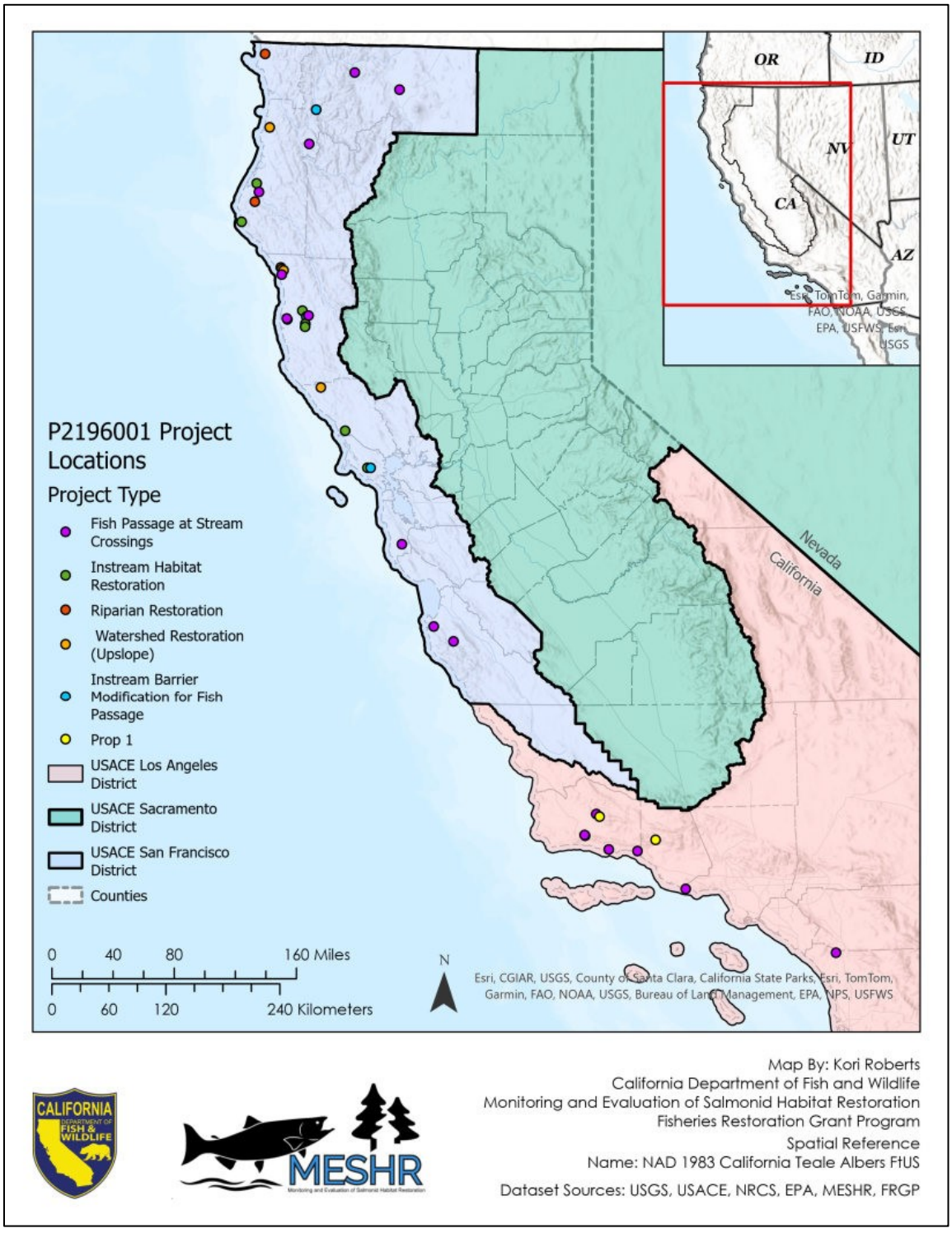
The following budget is funded entirely by FRGP (Table 1). No cost share (cash or in-kind service) was contributed to the project. This budget reflects costs as of April 30, 2024.

Table 1. Final Budget.

Detailed Final Budget for February 1, 2022 – April 30, 2024	
PERSONNEL SERVICES	Total Spent
Fisheries Biologist A	$107,404.91
Fisheries Biologist B	$111,246.17
Fisheries Biologist C	$118,477.53
Seasonal Fisheries Technician A	$18,618.40
Seasonal Fisheries Technician B	$9,788.38
Staff Benefits	$172,479.02
TOTAL PERSONNEL SERVICES	$538,014.41
OPERATING EXPENSES	
Communications	$4,386.83
Supplies	$10,097.85
Training	$700.00
Travel	$17,296.95
Subtotal Operating Expenses: General	$32,481.63
Vehicles	$52,332.19
TOTAL OPERATING EXPENSES	$622,828.23
Indirect Costs	$88,662.43
TOTAL	$711,490.66

Location Map:

Figure 1. Location map of projects.



Performance Measures:

Table 2. Performance Measures.

Category E: Research, Monitoring

Data ID	Metric	Result
E.0.b	*Name* of the habitat project complemented, project ID number, and project sponsor. If project does not complement a habitat project, enter 'None'.	Please see Table 5 for a list of habitat projects complemented. FRGP or Prop 1 were the sponsors for all projects.
E.0.c	*Name* of the Plan, Watershed Assessment, or Recovery Plan that identifies the need for this project (Author, date, title, source, source address. Endnote citation format). If project was not identified in a Plan, enter 'None'.	CDFG. 2004. Recovery Strategy for California Coho Salmon. Report to the California Fish and Game Commission 594 pp. McEwan, Dennis. 1996. Steelhead Restoration and Management Plan for California. California Department of Fish and Game. Sacramento, CA
E.0.d.1	*Number* of cooperating organizations.	23
E.0.d.2	*Name(s)* of cooperating organizations.	See Grantees in Table 5
E.0.e.1	*Number* of reports prepared on key management or restoration data.	7
E.0.e.2	*Name* of report(s) prepared (Author, date, title, source, source address. Endnote citation format).	

Data ID	Metric	Result
	California Department of Fish and Wildlife – Fisheries Restoration Grant Program. March 2022. Annual Report for 2022 to the National Marine Fisheries Service for Fisheries Habitat Restoration Program Projects Conducted under the Department of the Army Regional General Permit No. 12. CDFW Northern Region, Fortuna Restoration Office, Fortuna, CA. Monitoring and Evaluation of Salmonid Habitat Restoration. March 2023. Short-Term Validation Monitoring Report – Summarizing 2022 Activity. CDFW Northern Region, Fortuna Restoration Office, Fortuna, CA. California Department of Fish and Wildlife – Fisheries Restoration Grant Program. March 2023. Annual Report to the National Oceanic and Atmospheric Administration for Fisheries Restoration Grant Program Projects conducted under the Department of the Army Regional General Permit No. 78 (Corps File N. SPL-2020-00120-CLH) within the U.S. Army Corps of Engineers, Los Angeles District. CDFW South Coast Region, Santa Barbara Field Office, Santa Barbara, CA. Monitoring and Evaluation of Salmonid Habitat Restoration. February 2023. 2022 Annual Validation Monitoring Report for the South Coast. CDFW South Coast Region, Santa Barbara Field Office, Santa Barbara, CA. California Department of Fish and Wildlife – Fisheries Restoration Grant Program. March 2024. Annual Report for 2023 to the National Marine Fisheries Service for Fisheries Habitat Restoration Program Projects Conducted under the Department of the Army Regional General Permit No. 12. CDFW Northern Region, Fortuna Restoration Office, Fortuna, CA. California Department of Fish and Wildlife – Fisheries Restoration Grant Program. March 2024. Annual Report to the National Oceanic and Atmospheric Administration for Fisheries Restoration Grant Program Projects conducted under the Department of the Army Regional General Permit No. 78 (Corps File N. SPL-2019-00120-CLH) within the U.S. Army Corps of Engineers Los Angeles District. CDFW South Coast Region, Santa Barbara Field Office, Santa Barbara, CA. Monitoring and Evaluation of Salmonid Habitat Restoration. February 2024. 2023 Annual Validation Monitoring Report for the South Coast. CDFW South Coast Region, Santa Barbara Field Office, Santa Barbara,	

Data ID	Metric	Result
	CA.	
E.1.a	*Dollars* allocated/spent on salmonid monitoring.	$624,580.17
E.1.b.1	Total length of stream monitored *(miles)*.	24.96
E.1.b.2	Total amount of upland/watershed area monitored *(acres)*.	43.24
E.1. b.3	Total area of water area monitored *(square miles)*.	0.0816
(None)	*Number* of stream sites monitored.	41

Sub-Category: Monitoring – Additional by Work Type

E.1.c.3-Biological Instream Monitoring (other than salmon)

Data ID	Metric	Result
E.1.c.3.a	Length of stream monitored *(miles)*.	NA

E.1.c.8-Water Quality Monitoring

Data ID	Metric	Result
E.1.c.8.a	Length of stream monitored for water quality *(miles)*.	NA

E.1.c.9-Water Quantity (flow) Monitoring

Data ID	Metric	Result
E.1.c.9.a	Length of stream monitored for water quantity *(miles)*.	NA

E.1.c.12-Post-Project Implementation or Design Compliance Monitoring

Data ID	Metric	Result
E.1.c.12.a	Length of stream monitored post-project *(miles)*.	0.05
E.1.c.12.c	Area monitored post-project *(acres)*.	0.14

E.1.c.13-Restoration Effectiveness Monitoring

Data ID	Metric	Result
E.1.c.13.a	Length of stream monitored for restoration effectiveness *(miles)*.	4.29
E.1.c.13.c	Area monitored for restoration effectiveness *(acres)*.	43.24

E.1.c.14-Restoration Validation Monitoring

Data ID	Metric	Result
E.1.c.14.a	Length of stream monitored for restoration validation *(miles)*.	22.41
E.1.c.14.c	Area monitored for restoration validation *(acres)*.	50.25

Photos:

Project types for FRGP projects are referred to using the following codes (Table 3). Prop 1 projects do not have project types and are reported as not applicable (NA).

Table 3. FRGP Implementation project types and project type codes.

Project Type	Project Type Code
Fish Passage at Stream Crossings	FP
Instream Barrier Modification for Fish Passage	HB
Instream Habitat Restoration	HI
Riparian Restoration	HR
Instream Bank Stabilization	HS
Watershed Restoration (Upslope)	HU
Prop 1	NA

Table 4. Photos.

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_1_Mid-Klamath_Slate Creek_HB_Pre.jpg	5/16/2022	Mid-Klamath Tributary Fish Passage Improvement Project, HB Project, Pre-treatment/ Slate Creek.	After recent rain event.	At the confluence with the Klamath River.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_2_Mid-Klamath_Slate Creek_HB_Post.jpg	10/5/2022	Mid-Klamath Tributary Fish Passage Improvement Project, HB Project, Post-treatment/ Slate Creek.	Modified channel to concentrate flow towards left bank for fish passage.	At the confluence with the Klamath River.	Upstream
Photo_3_Alpine Creek_FP_Pre.jpg	5/16/2019	Alpine Creek Fish Passage Project, FP Project, Pre-treatment/ Alpine Creek	Left bank fish ladder and failing concrete apron.	20 feet downstream of culvert outlet.	Upstream at culvert outlet
Photo_4_Alpine Creek_FP_Post.jpg	6/7/2022	Alpine Creek Fish Passage Project, FP Project, Post-treatment/ Alpine Creek.	Reconstructed roughened channel.	20 feet downstream of culvert outlet.	Upstream at culvert outlet.
Photo_5_ Dewarren Creek_HI_Pre.jpg	7/30/2019	North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project, HI Project, Pre-treatment/ Dewarren Creek.	Without large wood habitat in wetted portion of channel.	Right bank gravel bar within active channel.	Downstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_6_ Dewarren Creek_HI_Post.jpg	7/12/2022	North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project, HI Project, Post-treatment/ Dewarren Creek.	Large wood features added for salmonid habitat improvement.	Right bank gravel bar within active channel.	Downstream
Photo_7_Cintura Creek_HI_Pre.jpg	7/26/2019	San Geronimo Valley Landowner Assistance Program- Restoring Coho Habitat, HI Project, Pre-treatment/ Cintura Creek.	Mouth of Cintura Creek on right bank of San Geronimo Creek with pre-existing log spanning Cintura Creek.	Bedrock on left bank within active channel.	Downstream
Photo_8_Cintura Creek_HI_Post.jpg	8/10/2022	San Geronimo Valley Landowner Assistance Program- Restoring Coho Habitat, HI Project, Post-treatment/ Cintura Creek.	Large wood, rootwads, and ballast rock placed at the Cintura Creek mouth and instream on right bank of San Geronimo Creek.	Bedrock on left bank within active channel.	Downstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_9_Salmon Creek_HI_Pre.jpg	6/4/2019	Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR), HI Project, Pre-treatment/ Salmon Creek.	Salmon Creek lacking in large wood and general cover. Silt is heavy from landslides and dominates much of the substrate.	Left bank at water's edge.	Upstream
Photo_10_Salmon Creek_HI_Post.jpg	5/3/2022	Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR), HI Project, Post-treatment/ Salmon Creek.	Added large wood scoured out silt and created a pool with higher maximum residual depth while adding cover.	Left bank at water's edge 40 feet downstream of feature 7489.	Upstream
Photo_11_Panther Creek_FP_Pre.jpg	9/9/2019	Panther Creek Barrier Removal Project, FP Project, Pre-treatment/ Panther Creek.	Abandoned Humboldt road crossing and pedestrian bridge in the background.	Mid-channel approximately 35 feet downstream of pedestrian bridge.	Upstream
Photo_12_Panther Creek_FP_Post.jpg	6/29/2022	Panther Creek Barrier Removal Project, FP Project, Post-treatment/ Panther Creek.	Looking upstream at removed crossing and rootwad with improved bank angles visible.	Mid-channel downstream of removed crossing.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_13_Larry Dam Creek_HU_Pre.jpg	6/6/2019	Redwood Creek Habitat Protection Project, HU Project, Pre-treatment/ Larry Dam Creek.	Bridge crossing over Larry Dam Creek.	Mid-channel approximately 40 feet down stream of bridge crossing Larry Dam Creek.	Upstream
Photo_14_Larry Dam Creek_HU_Post.jpg	6/1/2022	Redwood Creek Habitat Protection Project, HU Project, Post-treatment/ Larry Dam Creek.	Former bridge crossing with large wood remnants remaining to stabilize banks that were out sloped to a 2:1 angle to prevent sediment delivery.	Mid-channel approximately 40 feet downstream of former bridge crossing Larry Dam Creek.	Upstream
Photo_15_Tannery Creek_HI-Pre.jpg	8/22/2019	Tannery Creek Large Wood Recruitment Project 2018, HI Project, Pre-treatment/ Tannery Creek.	Tannery Creek lacking large wood habitat in wetted portion of channel, side cutting making banks unstable.	Left bank approximately 6 feet downstream where large wood will be placed.	Right bank

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_16_Tannery Creek_HI-Post.jpg	7/19/2022	Tannery Creek Large Wood Recruitment Project 2018, HI Project, Post-treatment/ Tannery Creek.	Large wood placed in the wetted channel of Tannery Creek redirected flow from banks to scour a pool for cover and improve salmonid habitat.	Left bank approximately 6 feet downstream of feature.	Right bank
Photo_17_Hare Creek_HU_Pre.jpg	6/19/2019	Hare Creek and Bunker Gulch Road Decommissioning Implementation Project, HU Project, Pre-treatment/ Road 400.	Culvert inlet on road 400 along Hare Creek.	30 feet upstream of road crossing.	South towards road 400.
Photo_18_Hare Creek_HU_Post.jpg	9/20/2022	Hare Creek and Bunker Gulch Road Decommissioning Implementation Project, HU Project, Post-treatment/ Road 400	Decommissioned road crossing on road 400, and stream sides laid back at 2:1 slope.	30 feet upstream of excavated road crossing.	South towards decommissioned road 400.

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_19_Soldier Creek_HU_Pre.jpg	7/17/2019	Soldier Creek Sediment Reduction and Salmonid Recovery Project, HU Project, Pre-treatment/ Soldier Creek.	Perched culvert outlet on logging Road 4425 at a high priority stream crossing.	40 feet downstream of culvert.	Upstream to culvert outlet.
Photo_20_Soldier Creek_HU_Post.jpg	10/17/2022	Soldier Creek Sediment Reduction and Salmonid Recovery Project, HU Project, Post-treatment/ Soldier Creek.	Logging Road 4425 decommissioned and culvert removed. Stream crossing sides laid back at 2:1 angle and covered with slash to prevent erosion.	40 feet downstream of removed crossing.	Upstream excavated stream channel.
Photo_21_Miller Riparian Project_HR_Pre.jpg	2/19/2020	Miller Riparian Restoration Project, HR Project, Pre-treatment/ Miller Creek.	Transect number two through newly planted riparian.	Near cattle exclusion fencing.	Southwest
Photo_22_Miller Riparian Project_HR_Post.jpg	8/16/2022	Miller Riparian Restoration Project, HR Project, Post-treatment/ Miller Creek.	Transect number two approximately three years after planted riparian.	Near cattle exclusion fencing.	Southwest

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_23_Leo Carrillo State Park_FP_Pre.jpg	2014	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal. FP Project, Pre-treatment/ Arroyo Sequit.	Lower concrete Arizona crossing with outlet drop measuring greater than 2 feet and acting as a total barrier to fish passage.	30 feet downstream of crossing	Upstream
Photo_24_Leo Carrillo State Park_FP_Post.jpg	10/6/2022	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal, FP Project, Post-treatment/ Arroyo Sequit.	New bridge and reconstructed channel at the lower crossing.	30 feet downstream of crossing	Upstream
Photo_25_Circle G Ranch_FP_Pre.jpg	1/29/2013	Circle G Ranch Fish Passage Restoration, FP Project, Pre-treatment/ Carpinteria Creek.	Concrete channel with grade control steps, undersized bridge, and banks consisting of vertically stacked rocks and concrete.	Mid-channel about 100 feet downstream of crossing.	Upstream
Photo_26_Circle G Ranch_FP_Post.jpg	10/27/2022	Circle G Ranch Fish Passage Restoration, FP Project, Post-treatment/ Carpinteria Creek.	Reconstructed channel and banks and upgraded bridge.	Mid-channel about 100 feet downstream of crossing.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_27_James Creek_HI_Pre.jpg	9/16/2019	James Creek Coho Stream Habitat Enhancement Project, HI Project, Pre-treatment/ James Creek.	Riffle where large wood will be placed.	On right bank of stream channel, 30 feet downstream of large wood feature site.	Upstream
Photo_28_James Creek_HI_Post.jpg	6/14/2023	James Creek Coho Stream Habitat Enhancement Project, HI Project, Post-treatment/ James Creek.	Pool created by large wood feature.	On right bank of stream channel, 30 feet downstream of large wood feature.	Upstream
Photo 29_Little Spring Creek_FP_Pre.jpg	9/11/2019	Little Springs Migration Barrier Removal, FP Project, Pre-treatment/ Little Springs.	Pre-construction view of 30" corrugated metal pipe culvert outlet.	Fifteen feet downstream of culvert outlet.	Upstream
Photo 30_Little Spring Creek_FP_Post.jpg	6/27/2023	Little Springs Migration Barrier Removal, FP Project, Post-treatment/ Little Springs.	Post-construction view of 10'x36" multi-plate arch culvert outlet.	Fifteen feet downstream of culvert outlet.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_31_Roy's Pools_FP_Pre.jpg	6/30/2020	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools, HB Project, Pre-treatment/ San Geronimo Creek.	Concrete dam creating Roy's pools.	Ten feet downstream of beginning concrete dam, mid-channel of San Geronimo Creek.	Upstream
Photo_32_Roy's Pools_FP_Post.jpg	6/21/2023	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools, HB Project, Post-treatment/ San Geronimo Creek.	Reconstructed channel after dam removal.	Mid-channel approximately 35 feet downstream of foot bridge in reconstructed channel where dam was removed.	Upstream
Photo_33_Gulch C_FP_Pre.jpg	2/26/2020	Gulch C Coho Salmon Fish Passage Improvement Project, FP Project, Pre-treatment/ Gulch C.	Outlet of perched culvert prior to removal.	Approximately 30 feet downstream of perched culvert.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_34_Gulch C_FP_Post.jpg	5/30/2023	Gulch C Coho Salmon Fish Passage Improvement Project, FP Project, Post-treatment/ Gulch C.	Culvert installed to allow for fish passage.	Approximately 30 feet downstream of new natural bottom.	Upstream
Photo_35_Middle Slough Restoration_HI_Pre.jpg	6/4/2020	Middle Slough Restoration Project - Phase 2, HI Project, Pre-treatment/ C2.	Main channel site C2 prior to excavation.	Downstream end of main channel alcove excavation site.	Upstream
Photo_36_Middle Slough Restoration_HI_Post.jpg	7/19/2023	Middle Slough Restoration Project - Phase 2, HI Project, Post-treatment/ C2.	800 feet excavated slough and alcove site C2.	Downstream end of main channel alcove excavation site.	Upstream
Photo_38_EBNF Big River_HI_Pre.jpg	6/8/2020	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation, HI Project, Pre-treatment/ East Branch North Fork Big River.	Placing large wood habitat in wetted portion of channel.	Bottom of flatwater downstream of feature site standing mid-channel.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_39_EBNF Big River_HI_Post.jpg	8/29/2023	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation, HI Project, Post-treatment/ East Branch North Fork Big River.	Large wood placed in the wetted channel redirected flow from banks to scour a pool for cover and improve salmonid habitat.	Twenty feet downstream of large wood feature standing mid-channel.	Upstream
Photo_40_Julias Creek_HU_Pre.jpg	6/15/2020	Julias Creek Sediment Reduction and Salmonid Recovery Project, HU Project, Pre-treatment/ Julias Creek.	Perched culvert prior to decommissioning on logging road 4200.	Downstream of crossing to be removed.	Upstream
Photo_41_Julias Creek_HU_Post.jpg	7/31/2023	Julias Creek Sediment Reduction and Salmonid Recovery Project, HU Project, Post-treatment/ Julias Creek.	Excavated stream crossing, stream sides laid back at 2:1 slope.	Downstream deconditioned crossing site.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_42_Quiota Crossing 3_FP_Pre.jpg	9/16/2015	Fish Passage Improvement at Crossing 3, Quiota Creek, FP Project, Pre-treatment/ Quiota Creek.	Concrete low-flow crossing and the undercutting and plunge below the downstream side.	Mid-channel 40 feet downstream of crossing.	Upstream
Photo_43_Quiota Crossing 3_FP_Post.jpg	9/25/2023	Fish Passage Improvement at Crossing 3, Quiota Creek, FP Project, Post-treatment/ Quiota Creek.	Reconstructed channel and the upgraded bottomless arch culvert.	Mid-channel 50 feet downstream of crossing.	Upstream
Photo_44_Quiota Crossing 4_FP_Pre.jpg	9/28/2016	Fish Passage Improvement at Crossing 4, Quiota Creek, FP Project, Pre-treatment/ Quiota Creek.	Concrete low-flow crossing.	Mid-channel 100 feet downstream of crossing.	Upstream
Photo_45_Quiota Crossing 4_FP_Post.jpg	9/25/2023	Fish Passage Improvement at Crossing 4, Quiota Creek, FP Project, Post-treatment/ Quiota Creek.	Reconstructed channel and the upgraded bottomless arch culvert.	Mid-channel 150 feet downstream of crossing.	Upstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_46_Quiota Crossing 5_FP_Pre.jpg	7/23/2018	Fish Passage Improvement at Crossing 5, Quiota Creek, FP Project, Pre-treatment/ Quiota Creek.	Concrete low-flow crossing and the undercutting and plunge below the downstream side.	Mid-channel 60 feet downstream of crossing.	Upstream
Photo_47_Quiota Crossing 5_FP_Post.jpg	9/25/2023	Fish Passage Improvement at Crossing 5, Quiota Creek, FP Project, Post-treatment/ Quiota Creek.	Reconstructed channel and the upgraded bottomless arch culvert.	70 feet downstream of crossing.	Upstream
Photo_48_Quiota Crossing 9_FP_Pre.jpg	9/5/2018	Fish Passage Improvement at Crossing 9, Quiota Creek, FP Project, Pre-treatment/ Quiota Creek.	Concrete low-flow crossing.	60 feet upstream of crossing.	Downstream
Photo_49_Quiota Crossing 9_FP_Post.jpg	9/26/2023	Fish Passage Improvement at Crossing 9, Quiota Creek, FP Project, Post-treatment/ Quiota Creek.	Reconstructed channel and the upgraded bottomless arch culvert.	40 feet upstream of crossing.	Downstream

File Name	Date	Subject/Site Name	Description	Standing	Facing
Photo_50_Quiota Crossing 8_FP_Pre.jpg	1/8/2019	Fish Passage Improvement at Crossing 8, Quiota Creek, FP Project, Pre-treatment/ Quiota Creek.	Dilapidated bridge and concrete abutment lining.	Mid-channel downstream of crossing.	Upstream
Photo_51_Quiota Crossing 8_FP_Post.jpg	9/26/2023	Fish Passage Improvement at Crossing 8, Quiota Creek, FP Project, Post-treatment/ Quiota Creek.	Reconstructed channel and the upgraded bottomless arch culvert.	50 feet downstream of crossing.	Upstream
Photo_52_Morrison Creek Tributary_FP_Post.jpg	5/20/2021	Morrison Creek Tributary Barrier Removal, FP Project, Pre-treatment / Morrison Creek Tributary	Elevated culvert under road draining into plunge pool.	Right bank at edge of water, 10 feet downstream of road crossing.	Upstream
Photo_53_Morrison Creek Tributary_FP_Post.jpg	4/16/2024	Morrison Creek Tributary Barrier Removal, FP Project, Post-treatment / Morrison Creek Tributary	Bridge replaced culvert and added boulder rip rap and rootwads for bank stability.	Right bank at edge of water, 10 feet downstream of road crossing.	Upstream

Photo_1_Mid-Klamath_Slate Creek_HB_Pre

Photo_2_Mid-Klamath_Slate Creek_HB_Post

Photo_3_Alpine Creek_FP_Pre

Photo_4_Alpine Creek_FP_Post

Photo_5_ Dewarren Creek_HI_Pre

Photo_6_ Dewarren Creek_HI_Post

Photo_7_Cintura Creek_HI_Pre

Photo_8_Cintura Creek_HI_Post

Photo_9_Salmon Creek_HI_Pre

Photo_10_Salmon Creek_HI_Post

Photo_11_Panther Creek_FP_Pre

Photo_12_Panther Creek_FP_Post

Photo_13_Larry Damm Creek_HU_Pre

Photo_14_Larry Damm Creek_HU_Post

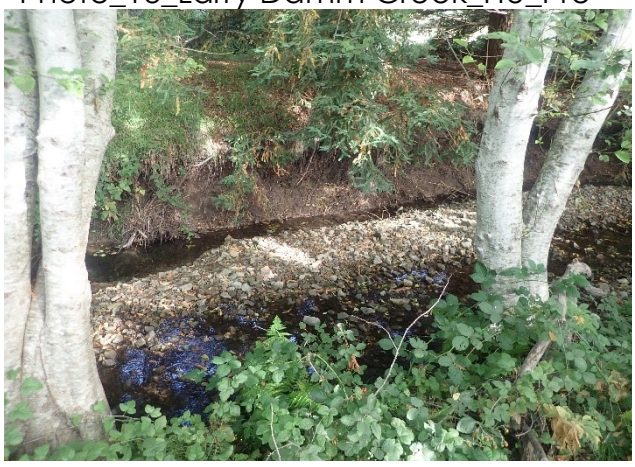


Photo_15_Tannery Creek_HI_Pre

Photo_16_Tannery Creek_HI_Post

Photo 17_Hare Creek_Pre

Photo_18_Hare Creek_Post

Photo_17_Hare Creek_HU_Pre

Photo_18_Hare Creek_HU_Post

Photo_19_Soldier Creek_HU_Pre

Photo_20_Soldier Creek_HU_Post

Photo_21_Miller Riparian Project_HR_Pre

Photo_22_Miller RiparianProject_HR_Post

Photo_23_Leo Carrillo State Park_FP_Pre

Photo_24_Leo Carrillo State Park_FP_Post

Photo_25_Circle G Ranch_FP_Pre

Photo_26_Circle G Ranch_FP_Post

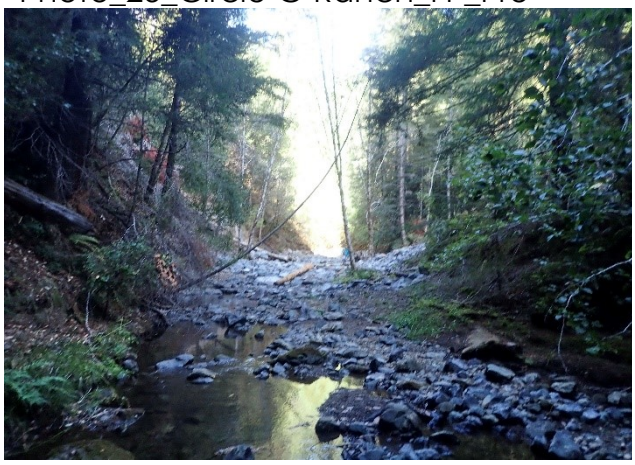


Photo_27_James Creek_HI_Pre

Photo_28_James Creek_HI_Post

Photo 29_Little Spring Creek_FP_Pre

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Photo_42_Quiota Crossing 3_FP_Pre

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Photo_44_Quiota Crossing 4_FP_Pre

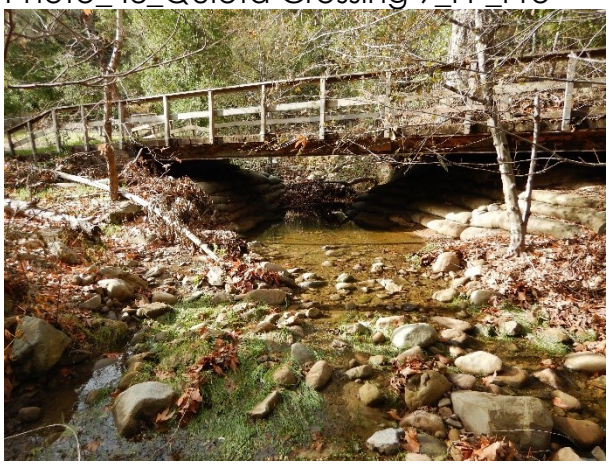
Photo_45_Quiota Crossing 4_FP_Post

Photo_46_Quiota Crossing 5_FP_Pre

Photo_47_Quiota Crossing 5_FP_Post

Photo_48_Quiota Crossing 9_FP_Pre

Photo_49_Quiota Crossing 9_FP_Post



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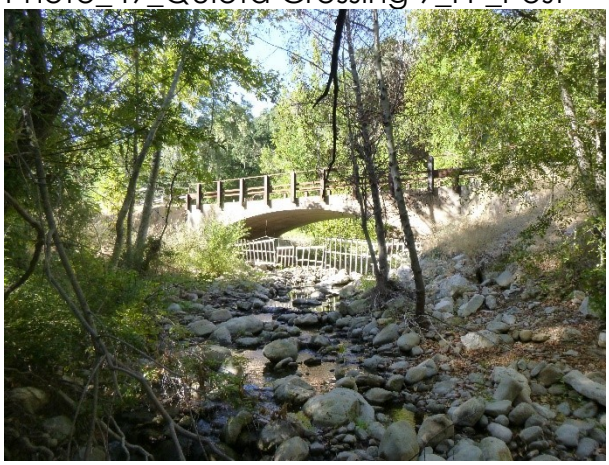


Photo_51_Quiota Crossing 8_FP_Post

Photo_52_Morrison Creek Trib_FP_Post

Photo_53_Morrison Creek Trib_FP_Post

CERTIFICATION OF NON-FEDERAL CONTRIBUTIONS:

No cost share match was provided for this agreement, so the Certification of Non-Federal Contributions is not applicable.

Attachment 1 Original Projects Monitored

Table 5. Original Projects monitored under the P2196001 contract, February 1, 2022 – April 30, 2024, including pre- and post-treatment effectiveness, BACI, and validation monitoring.

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
Q2130401	HU	Buckeye Creek Storm-Proofing and Habitat Protection Project	The Conservation Fund	Pre-effectiveness
Q2010528	HU	Bear Creek Sediment Reduction and Salmonid Recovery Project	Trout Unlimited, Inc.	Pre-effectiveness
Q2010527	HB	Mid-Klamath Tributary Fish Passage Improvement Project	Salmon River Restoration Council	Pre-effectiveness, Post-effectiveness
P1730402	FP	Alpine Creek Fish Passage Project	San Mateo County Resource Conservation District	Post-effectiveness
P1710509	HI	North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	California Conservation Corps	Post-effectiveness, Validation
P1730409	HI	San Geronimo Valley Landowner Assistance Program- Restoring Coho Habitat	Marin Resource Conservation District	Post-effectiveness

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
P1810514	HI	Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	Eel River Watershed Improvement Group	Post-effectiveness
P1810515	FP	Panther Creek Barrier Removal Project	Pacific Coast Fish Wildlife and Wetlands Restoration Association	Post-effectiveness, Validation
Q1910502	HU	Redwood Creek Habitat Protection Project	Redwood National Park	Post-effectiveness
P1830401	HI	Tannery Creek Large Wood Recruitment Project 2018	Gold Ridge Resource Conservation District	Post-effectiveness, Validation
T1710501	HU	Hare Creek and Bunker Gulch Road Decommissioning Implementation Project	Mendocino Land Trust	Post-effectiveness
T1810503	HU	Soldier Creek Sediment Reduction and Salmonid Recovery Project	Trout Unlimited, Inc.	Post-effectiveness
P1610533	HR	Miller Riparian Restoration Project	Eel River Watershed Improvement Group	Post-effectiveness

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
P1310309	HB	Olds Creek Coho Habitat Barrier Removal Project	Trout Unlimited, Inc.	BACI Validation
D1450006	FP	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal	California Department of Parks and Recreation	Post-effectiveness, Validation
P1450010	FP	Circle G Ranch Fish Passage Restoration	Earth Island Institute/South Coast Habitat Restoration	Post-effectiveness, Validation
P1010321	FP	Walton Gulch Bridge Project	California Department of Forestry & Fire Protection	Validation
P1010508	FP	Dunn Creek Fish Passage Project	Mendocino County Resource Conservation District	Validation
P1510523	FP	Fish Passage Improvements at South Fortuna Boulevard	City of Fortuna	Validation
Q2110505	FP	Scott Bar Mill Creek Fish Passage Improvement Project	California Trout, Inc.	Pre-effectiveness
Q2140409	FP	Weston-Champagne Cachagua Creek Fish Passage Project	Resource Conservation District of Monterey County	Pre-effectiveness, Validation

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
Q2140408	FP	Potrero Creek Fish Passage Lower Culvert Project - Carmel Valley Athletic Club	Trout Unlimited, Inc.	Pre-effectiveness
P1610504	HI	James Creek Coho Stream Habitat Enhancement Project	California Conservation Corps	Post-effectiveness, Post-BACI Year 3, Validation
P1710529	FP	Little Springs Migration Barrier Removal	Northwest California Resource Conservation & Development Council	Post-effectiveness, Validation
P1730411	HB	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	Salmon Protection and Watershed Network	Post-effectiveness, Validation
P1810503	FP	Gulch C Coho Salmon Fish Passage Improvement Project	Trout Unlimited, Inc.	Post-effectiveness, Validation
Q1910507	HI	Middle Slough Restoration Project - Phase 2	Mattole Salmon Group	Post-effectiveness
Q1910513	HI	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	California Conservation Corps	Post-effectiveness, Validation

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
Q1910528	HU	Julias Creek Sediment Reduction and Salmonid Recovery Project	Trout Unlimited, Inc.	Post-effectiveness
Q2210506	HR	Lower Stotenburg Coho Habitat Enhancement Project	Smith River Alliance	Pre-effectiveness, Validation
Q1950902	FP	Davy Brown/Munch Creek Fish Passage Construction Project	Earth Island Institute	Validation, Implementation
Q2050905	FP	Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	California Trout, Inc.	Pre-effectiveness, Validation
P1450011	FP	Fish Passage Improvement at Crossing 3, Quiota Creek	Cachuma Operation and Maintenance Board	Post-effectiveness, Validation
P1550010	FP	Fish Passage Improvement at Crossing 4, Quiota Creek	Cachuma Operation and Maintenance Board	Post-effectiveness, Validation
P1650902	FP	Fish Passage Improvement at Crossing 5, Quiota Creek	Cachuma Operation and Maintenance Board	Post-effectiveness, Validation
P1750902	FP	Fish Passage Improvement at Crossing 9, Quiota Creek	Cachuma Operation and Maintenance Board	Post-effectiveness, Validation

Grant Number	Project Type Code	Grant Name	Grantee	Monitoring Visit
P1850902	FP	Fish Passage Improvement at Crossing 8, Quiota Creek	Cachuma Operation and Maintenance Board	Post-effectiveness, Validation
Q2250406	FP	Maria Ygnacio Creek Fish Passage Project Implementation – Patterson Ave Bridge	Earth Island Institute	Validation
Q2296016	NA	Wheeler Gorge Campground Fish Passage Project--Implementation	Earth Island Institute	Validation
Q2196023	NA	Manzana Creek Roads Aquatic Restoration Project	Earth Island Institute	Pre-effectiveness
Q2110514	HI	Ryan Creek Off-channel Coho Habitat Implementation Project	Pacific Coast Fish, Wildlife and Wetlands Restoration Association	Validation
Q1910506	FP	Morrison Creek Tributary Barrier Removal	Smith River Alliance	Post-effectiveness, Validation

Attachment 2 QA/QC Plan

Project Goal

Perform qualitative field assessment and quantitative monitoring and reporting for a range of instream, riparian, and upland habitat improvement activities benefitting anadromous fisheries to 1) meet permitting requirements for the FRGP and 2) provide information to the restoration community and interested parties. FRGP and permit specific metrics for Prop 1 projects were recorded as not applicable.

Project Objectives

1. Determine if restoration projects appear to be performing as intended.

2. Determine if habitat characteristics have been improved by restoration activities.

3. Determine if there has been a measurable fish response to restoration efforts.

4. Provide guidance to Grant Managers, data verification, and reporting for implementation monitoring.

Project Setting

MESHR is based in Fortuna and Santa Barbara, California, and all project monitoring is conducted in anadromous watersheds extending from the Oregon border to the Mexico Border.

Scope of Work and Time Frame Required

Training of personnel (Quality Assurance): April through July 2022; April through July 2023

Field work and Grant Manager guidance (QA): June through December 2022; June through December 2023

Data entry: June through January 2022; June through January 2023

Data verification (Quality Control): October 2022 through January 2023; October 2023 through January 2024

Data analysis: October 2022 through February 2023; October 2023 through February 2024

Preparation of Annual Reports and other documents: January through April 2023; January and April 2024

Writing draft Final Report and draft manuscript: September 2023 through February 2024

Editing drafts to prepare Final Report and manuscript: January 2024 through March 2024

Attachment 3 Management Questions Addressed

Implementation Management Questions

- Are fish habitat restoration projects being carried out as proposed?
- If properly implemented, are restoration projects having the intended beneficial effects on habitat?
- What are the conditions at each site immediately after the treatment is completed?
- Were the project and its features properly implemented?

Effectiveness Management Questions

- Are fish habitat restoration projects being carried out as proposed?
- If properly implemented, are restoration projects having the intended beneficial effects on habitat?
- What are the specific objectives of each feature proposed for the project?
- What are the conditions at each treatment site prior to project implementation?
- What are the conditions at each treatment site after enough time has passed to evaluate effectiveness?

Culvert Fish Passage Effectiveness Management Questions

- Is the project still functioning as designed?
- Have channel or bank adjustments impaired the function of the passageway(s)?
- Did the project(s) have adverse effects on upstream or downstream habitat?
- Is upstream habitat still suitable for the targeted fish species and life stages?

Bank Stabilization Effectiveness Management Questions

- Did the percentage of stream bank with vegetative cover increase after treatment?

- Did the percentage of unstable stream bank decrease after treatment?
- Did the width to depth ratio of the stream change after treatment?
- Did the restoration practice store sediment locally (i.e., rebuild stream banks)?
- Did the restoration practice stop bank retreat?

Instream Substrate Restoration Effectiveness Management Questions

- Has the project or project type improved spawning gravel suitability within the targeted stream reach(es) or habitat unit(s)?
- Has the project or project type improved the quality of rearing habitat within the targeted stream reach(es) or habitat unit(s)?
- What is the duration of the beneficial effects on spawning or rearing habitat?

Riparian Revegetation Effectiveness Management Questions

- Did planted vegetation survive at an acceptable rate?
- Did the restoration practice increase the cover of native riparian vegetation?
- Did the restoration practice increase the amount of shade canopy on the channel?
- Did the restoration practice reduce the abundance of exotic species in the riparian community?
- Did the restoration practice reduce encroachment of vegetation into the active channel?
- Did the restoration practice increase the abundance of coniferous trees in the riparian community?
- Did the restoration practice increase the connectivity and/or area of native riparian vegetation?

Instream Habitat Effectiveness Management Question

- At the site level, has the structure 1) created the desired habitat type; 2) increased pool depth; 3) increased hiding cover; and/or 4) created velocity

refugia?

- At the stream reach level, have the structures 1) increased the frequency or area of desired habitat types; 2) increased the abundance of LW or other structural components; 3) increased channel complexity; 4) decreased width/depth ratios; and/or 5) increased sinuosity?

Roads Effectiveness Management Questions

- Did restoration improve hydrologic conditions in streams?
- Did restoration improve water quality in streams (suspended sediment and turbidity)?
- Did restoration have beneficial effects on instream habitat?

Upland Effectiveness Management Questions

- Has the project reduced chronic inputs of sediment to the stream?
- Has the project reduced episodic inputs of sediment to the stream?
- Has the project reduced suspended sediment loads?
- Has the project reversed or reduced the hydrologic impacts of roads?
- Has the project maintained or increased stream channel stability?
- Has the project reduced the occurrence of recurring maintenance problems?
- Has stream morphology improved significantly in the treated stream reach for the sampled instream structure projects within ten years?
- Has juvenile salmon abundance increased significantly in the impact area for the sampled instream structure projects within ten years?

Validation Management Questions

- Can we detect responses of salmon and steelhead trout to watershed restoration actions by collecting information on juvenile Coho Salmon or steelhead abundance within streams or stream reaches?
- Can we estimate juvenile and resident adult salmonid occupancy rates during the spring/summer (June – September) based on data collected from rapid visual encounter surveys?

- Are projects that place artificial instream structures into streams effective in improving stream morphology and increasing local fish abundance in the treated area at the stream reach level?

Attachment 4 Project Goals and Objectives

The project goal was to address recovery task RW-AM-05: "Use field-tested implementation, effectiveness, and validation monitoring protocols for Coho Salmon (*Oncorhynchus kisutch)* restoration activities." The specific project objective was to conduct independent assessment and monitoring of a random sample of at least 10% of restoration projects funded by FRGP and to report results to permitting agencies and the restoration community. Monitoring conducted on several FRGP project types and implemented features helps determine the effectiveness of restoration and management practices and if they have the desired effect on habitat conditions and watershed processes.

Additionally, this project addressed a recovery task from the Steelhead Restoration & Mgmt. Plan for CA (DFW 1996), SC-10-400-01: monitor restoration projects in watersheds where restoration has or is occurring, to evaluate success of the project implementation, improve knowledge about restoration techniques and their applications, and document biological response.

Attachment 5 Spatial and Temporal Scales

Geographic areas defined by the U.S. Army Corps of Engineers include the San Francisco Bay District that encompasses CDFW's Northern Region, and portions of the Bay Delta and Central regions and the Los Angeles District that encompasses the South Coast area and a portion of the Central Coast. This includes all or part of the following counties: Del Norte, Siskiyou, Humboldt, Mendocino, Trinity, Sonoma, Napa, and Marin, Coastal San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego.

Effectiveness monitoring has two phases: pre-treatment and post-treatment monitoring and typically occurs three years apart. Validation snorkel surveys are conducted on select project types. BACI monitoring is conducted before implementation and after implementation at years 1, 3, 5 and 10. Winter validation monitoring for fish passage projects is conducted annually after implementation.

Attachment 6 Study Design and Parameters to be Monitored

Pre-treatment site assessments occur prior to project implementation and include documenting project location and site access information, georeferencing proposed restoration feature locations, completing pre-treatment checklists, and photo monitoring. The objective of pre-treatment monitoring is to document baseline physical habitat characteristics for comparison with post-treatment monitoring following project implementation. Post-treatment assessments occur three years after implementation and include navigating to each implemented feature evaluated at pre-treatment, completing post-treatment checklists and associated habitat investigations, and photo monitoring. Ratings are assigned to each feature based on if treatments appear to be functioning as intended after three winters. Feature ratings are aggregated to generate an overall project rating.

Both pre- and post-treatment monitoring includes validation monitoring via juvenile snorkel surveys on HI, FP, and HB project types. Data collected includes pool dimensions (length and width), maximum residual pool depth, temperature, and fish counts. Minnow traps are used in lieu of snorkeling when poor stream conditions or water quality prevent snorkeling. Winter spawner surveys document potential redds, adult spawners, and carcasses on selected FP and HB projects.

Attachment 7 Sampling Scheme

The Biological Opinions for Regional General Permit (RGP)-12 (NMFS 2022) and RGP-78 (NMFS 2019) require that a portion of the projects funded through FRGP are monitored by CDFW's Monitoring and Evaluation of Salmonid Habitat Restoration (MESHR) team, which includes staff from CDFW and the Pacific States Marine Fisheries Commission. Each year, the MESHR Team assesses the effectiveness of at least 10% of the FRGP projects funded that year and selects these projects by conducting a random draw from all the year's funded restoration projects.

Projects are selected for effectiveness monitoring using a stratified random sampling method outlined in Harris et al. (2005). Prior to each field season, all FRGP projects to be implemented are compiled into two notification lists, one for RGP-12 and one for RGP-78, From this list projects are stratified by geographic area defined by the U.S. Army Corps of Engineers. Secondly, 10% of each project type in each geographic area is randomly selected for effectiveness monitoring, resulting in over 10 percent of implementation projects selected for effectiveness monitoring (Table 6). Selected projects with the goal of fish passage or instream habitat restoration also receive validation monitoring. The current contract term comprised four notification lists and our drawn samples.

Table 6. The percentage of awarded FRGP implementation projects from both RGP-12 and RGP-78 notification lists that were selected for effectiveness monitoring by year.

Year	Number of permitted implementation projects	Number of projects selected for effectiveness monitoring	Percentage
2022	10	5	50.0%
2023	14	6	42.9%

Attachment 8 Analysis Used

Monitoring data were summarized as graphs and tables and analyzed using standard statistical methods where appropriate. Comparisons of pre-treatment and post-treatment habitat conditions were made when possible, using collected habitat metrics, photos, and answers to qualitative checklist questions. Additional analysis information can be found in the Methods section for each data element (Methods for Effectiveness Monitoring, Methods for Validation Monitoring, Methods for BACI Monitoring).

Attachment 9 Number of Years of Data Collection Required to Address the Management Questions

Effectiveness monitoring has two phases: pre-treatment and post-treatment monitoring and typically occurs three years apart. BACI monitoring is conducted before implementation and after implementation at years 1, 3, 5 and 10. Winter validation monitoring for fish passage projects is conducted annually after implementation. Bilby et al. (2023) stated that some restoration projects may take decades to achieve a desired effect on habitat, and therefore monitoring over a decade may be required to determine any meaningful physical or biological response to restoration.

Attachment 10 Abstract

Over the course of the contract term, from February 1, 2022, through April 30, 2024, MESHR monitored a total of forty-one projects for effectiveness, validation, and BACI.

Effectiveness monitoring was conducted to assess if restoration projects have the desired effect on habitat and if projects meet the goals and objectives set by the Grantees. A total of nine projects received pre-treatment effectiveness monitoring and 26 projects received post-treatment effectiveness monitoring. During pre-treatment, 161 features were monitored using checklists while 343 features were monitored during post-treatment. Twenty-six projects received overall project ratings during post-treatment monitoring: 18 projects were rated as good and eight as fair.

Validation monitoring was conducted to determine if restoration projects have a measurable effect on fish response. A total of twelve projects received juvenile snorkel survey validation monitoring. Three of these projects were surveyed during pre-treatment and nine during post-treatment. Spawning surveys were conducted for 19 projects. Three of these projects were surveyed during pre-treatment and 16 were surveyed during post-treatment. Data from a total of 103 spawning surveys conducted during this contract term is compiled in this report. Minnow trapping surveys were conducted for four projects.

BACI monitoring was conducted to determine if projects that place artificial instream structures into streams are effective in improving stream morphology and increasing local fish abundance in the treated area at the stream reach level. BACI monitoring for post-treatment year 3 was conducted on the James Creek Coho Stream Habitat Enhancement Project in 2023. A validation survey postponed due to low water for post-treatment year 6 on the Olds Creek Coho Habitat Barrier Removal Project was also completed in 2022.

Attachment 11 Effectiveness Monitoring

Methods for Effectiveness Monitoring

The project monitoring framework conducted by MESHR and Grant Managers followed the approach adapted from Qualitative Monitoring of Fisheries Habitat Restoration (Harris et al. 2005). A series of pre-treatment, implementation, and post-treatment checklists were completed to record systematic field observations as a broad assessment of project feature conditions. It was based on the premise that proper project implementation and effectiveness is often visually obvious, and most determinations do not require extensive quantitative measurements (Harris et al. 2005).

Effectiveness monitoring has two phases: pre-treatment and post-treatment monitoring. Pre-treatment monitoring documents existing habitat conditions and selected salmonid population attributes before on-the-ground restoration treatments begin and serves as a baseline benchmark to assess restoration effectiveness during post-treatment. It includes pre-treatment checklists, photo documentation, and georeferencing feature locations and is generally conducted the same year as project implementation.

To begin pre-treatment monitoring of a project MESHR first reviews the grant agreement to determine Objective(s), Location, Project Implementation, and Attachments. After the initial review the evaluator creates a list of the project's features by treatment type and determines the monitoring checklist(s) that will best evaluate those features and their objective(s). Before field work is started MESHR will check with the Grant Manager to determine any changes which may have occurred regarding the project's Statement of Work (SOW), feature types, and/or locations. Any changes should have been approved by the Grant Manager.

For restoration project implementation and effectiveness monitoring, a project is defined as all work taking place under one grant number. A project site is a location, reach, or area where restoration will take place. Typically features within a half mile are characterized as one site and features greater than a half mile apart are separated into different worksites. A feature is a distinct treatment implemented to interact with the environment or improve anadromous salmonid habitat. Many projects employ multiple treatment types within a given work site.

A variety of checklists are used to evaluate each feature within a project site and are based on restoration type (Table 7). They are intended to be rapid assessments of restoration features at project sites. For each monitoring checklist category, there are three types of effectiveness monitoring checklists: pre-treatment, implementation, and post-treatment. For each project, we complete

pre-treatment checklists before a project starts (within a few weeks of implementation), and post-treatment checklists one to three years after a project is completed. The Grant Managers complete implementation checklists. Frequently not all questions on a checklist will be applicable. The goal is to use the checklist questions that best illustrate and evaluate the feature being monitored. Sometimes one feature will require multiple checklists.

Table 7. Checklist Codes and Checklist Titles used for effectiveness monitoring.

Checklist Code	Checklist Title
IN	Instream Habitat & Bank Restoration
CB	Channel Reconstruction & Bank Stabilization
FB	Fish Passage at Barriers
FC	Fish Passage at Stream Crossing
FS	Fish Screening of Diversions
CD	Stream Crossing Decommissioning
CU	Stream Crossing Upgrade
RD	Road Segment Decommissioning
RU	Road Segment Upgrading
US	Upslope Stabilization & Delivery Prevention
RT	Revegetation Treatments
VC	Vegetation Control & Removal
LU	Land Use Treatments & Exclusion Fencing

Checklist Descriptions

The IN checklist is for habitat unit specific instream features. The feature may have instream restoration objectives, stream bank restoration objectives, or both. The checklists include habitat unit specific measures of effectiveness such as instream shelter rating and maximum residual depth.

The CB checklist is for larger instream features that include channel reconstruction or bank stabilization greater than one habitat unit or small treatment area. These types of instream and stream bank features may: 1) extend the length of many habitat units, 2) be in non-wadable stream or river, 3) be in a dry stream reach at the time of survey, or 4) be bank or channel reconstructions where no habitat or stream channel currently exists. The checklists do not focus on habitat specific measures of effectiveness, but more general indicators of channel and bank restoration.

The FB checklist is used for fish passage improvement anywhere other than a stream crossing including grade control or back-flooding weirs or structures associated with fish passage at stream crossings.

The FC checklist is used for fish passage improvement projects at stream crossings. The checklist focuses on fish passage criteria for adults and juveniles, passage problems, and passage objectives.

The FS checklist is used to evaluate projects that include installation of fish screens or head gates at streamflow diversions. The FS checklist addresses fish access, diversion flow, fish screen, channel, and banks.

The CD checklist is used on projects that intend to remove and/or decommission a pre-existing stream crossing. It is often used in conjunction with an RD. The checklist addresses the current crossing type and condition, sediment delivery, and channel or bank conditions.

The CU checklist is used to evaluate modifications, new installations, or replacements of stream crossing structures. It is often used in conjunction with an RU checklist. The CU evaluates the stream crossing feature located in the RU's site, but both the stream crossing and the road upgrade are separate features. The checklist addresses the current stream crossing problems/objectives, the sediment delivery potential, and channel or bank conditions.

The RD checklist is used for projects that will permanently or temporarily decommission roads for vehicle use but may convert the road into a trail. RD treatments include stream crossing excavation, landslide treatment, road drainage improvement, decompaction, and revegetation. The checklist covers drainage and sediment delivery.

The RU checklist is used on projects that improve road drainage to decrease erosion and stream sedimentation. RU techniques include disconnecting and dispersing runoff by using road shape, road surface, critical dips, and rolling dips. The RU evaluates roads that will continue to be accessed by vehicles. Project treatments include road drainage improvements, stream crossing upgrades (CU), and/or treatment of road related landslides (US). The checklist addresses sedimentation and percent connectivity.

The US checklist addresses treatments to gullies, landslides, or eroding slopes, as well as restoration of rock pits, spoil disposal sites, and other developed areas. It can be used in conjunction with an RU or RD. The effectiveness checklist focuses on sediment delivery and feature location.

The RT checklist is for any type of riparian or upland planting feature and can be

used in combination with any checklists provided a planting feature is proposed and implemented. Effectiveness checklists focus on the vegetation composition and cover from planted vegetation. This checklist can also be used when nothing is planted but an area is treated by fencing or acquisition and has the same objectives as a planting feature.

The VC checklist is for any type of riparian or upland feature that removes vegetation, usually non-native invasive species. This type of feature may have the same objectives as a planting project but achieves them by removing certain types of vegetation to increase targeted vegetation. Checklists focus on composition and abundance of native versus non-native species. When vegetation control is done in conjunction with planting, there are two overlapping features, one RT and one VC, and both checklists are used.

The LU checklist is for project features that are land use related. Land use related features 1) impose land use restrictions, 2) change pre-existing land use, 3) install exclusion fencing, or 4) install stock watering stations. Implementation checklists establish the type of land use restriction agreement and covers installation of fencing and watering stations. Checklists cover the basics about adherence to restrictions and the condition and success of fencing. It also references other checklists to use for riparian enhancement, stream bank stabilization, instream habitat improvement, or upslope stabilization.

Checklists do not directly correspond to a project's FRGP project type, but for each project type certain checklists are often used (Table 8). Depending on which types of features will be implemented, every project will not necessarily need all the commonly used checklists. Additionally, projects may include features that require checklists beyond those normally used for a project type.

Table 8. Checklists most used by project type.

Project Type	Monitoring Checklist Category
FP	FB, FC, CU
HB	FB, CB
HI	IN, CB, RT
HS	CB, IN
HR	VC, RT, LU
HU	CU, CD, RU, RD, US
SC	FS

During post-treatment monitoring, each feature within a project receives a performance rating of excellent, good, fair, poor, or fail, based on criteria below (Table 9). The feature ratings are based on design elements described in the proposal, implementation checklist responses, and results from pre- and post-treatment effectiveness monitoring, as well as photographs.

Table 9. Post-Treatment Effectiveness Feature Rating Definitions.

Rating	Goals	Targets	Unintended Effects	Structural Condition
Excellent	Achieved all stated goals.	Met or exceeded targeted values.	No negative unintended effects. Unintended positive effects may outweigh failure to achieve a targeted value.	Excellent to Good.
Good	Achieved most stated goals.	Did not quite meet targeted values. If no targets were specified, maximum rating is good.	No negative unintended effects.	Excellent to Fair.
Fair	Partially achieved most goals, or goals not achieved were outside the control of the feature.	Did not meet targeted values, but the feature still has some functional value.	May have minor unintended negative effects that partially offset goals.	Excellent to Fair.
Poor	Achieved at least one goal; goals not achieved were the fault of the feature.	Did not meet targeted values, feature has little functional value.	May have minor or major unintended negative effects that offsets or negates a targeted gain.	Excellent to Poor.

Finally, post-treatment effectiveness evaluations assign overall project performance ratings using percentages of individual project feature ratings according to criteria described in Table 10. When less than five features are rated,

professional judgment guides overall project rating. Feature ratings, project ratings, checklists, and photos are all entered or uploaded to WebGrants Grant Tracking under the Annual Implementation Monitoring and Internal Documentation headings.

Table 10. Overall project rating criteria based on cumulative percentage of feature ratings.

	Excellent Feature Ratings	Good Feature Ratings	Fair Feature Ratings	Poor Feature Ratings	Fail Feature Ratings
Excellent Project Rating	≥ 80%	< 20%	< 20%	0%	0%
Good Project Rating	≥ 80%	≥ 80%	< 20%	≤ 10%	0%
Fair Project Rating	≥ 80%	≥ 80%	≥ 80%	< 20%	< 10%
Poor Project Rating	≥ 50%	≥ 50%	≥ 50%	< 50%	< 25%
Failed Project Rating	< 50%	< 50%	< 50%	≥ 50%	≥ 50%

Photo Monitoring

Photo monitoring is performed on projects selected for effectiveness monitoring. Photo points are monumented that can be found several years after project implementation to create before and after pictures as a qualitative indicator of change over time. Photo points are established pre-treatment and recorded on the photo description form.

Material used to establish photo points in the field include nails, metal tags, flagging, a hammer, a permanent marker, a compass, and camera. For each feature or group of features (if they are in proximity) a photo point is established on a nearby tree or other semi-permanent structure. Photo points are labeled with the abbreviation "PP" followed by a number starting with photo point one ("PP01"). The photo point number and date are written on flagging and a metal identification tag are nailed to a structure or tree.

A waypoint is taken at each photo point location and recorded on the photo description form along with a detailed description of its location (e.g., species and diameter of tree, left or right bank, distance from channel, etc.). Then the location of the photographer relative to the photo point is recorded on the photo description form for any pictures taken nearby (e.g., "10 feet and 70° from PP01

standing mid-channel") as well as the direction that the photographer is facing.

Data Analysis

All effectiveness monitoring data is collected using either paper datasheets or a tablet with custom Pendragon forms. Data is then imported into Access databases for quality control to correct any potential errors. For this report Excel pivot tables summarized, sorted, and queried data to compare data from multiple projects with the same checklist.

Quality Assurance and Quality Control

The QA/QC procedures were completed as described in the proposed QA/QC plan in Attachment 2. Quality Assurance included annual training of Fisheries Biologists, Fisheries Technicians, and Grant Managers. Quality control of implementation monitoring data and performance measures was provided by MESHR. Quality control involved reviewing checklists to correct errors and omissions. Specific aspects of quality control are listed below.

Checklists are reviewed for:

- Appropriate checklists for treatment types used in a project.
- Completeness and potential errors in checklist entries.
- Annual Implementation Monitoring Summary forms and WebGrants entries match.
- Complete entries in WebGrants:
    - Project Status and Descriptions
    - Dewatering and Species Relocation Data 2020+ Field Season
    - Annual Performance Measures: All Projects entered and in correct units of measurement.
    - Annual Implementation Monitoring

Results of Effectiveness Monitoring

Pre-treatment Effectiveness Monitoring

A total of nine pre-treatment evaluations were completed during the contract

term (Table 11).

Table 11. Pre-treatment evaluations conducted between February 1, 2022 to April 30, 2024 by project type.

Monitoring Year	Grant Number	Project Name	Project Type
2022	Q2010527	Mid-Klamath Tributary Fish Passage Improvement Project	HB
2022	Q2010528	Bear Creek Sediment Reduction and Salmonid Recovery Project	HU
2022	Q2050905	Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	FP
2022	Q2130401	Buckeye Creek Storm-proofing and Habitat Protection Project	HU
2023	Q2110505	Scott Bar Mill Creek Fish Passage Improvement Project	FP
2023	Q2140409	Weston-Champagne Cachagua Creek Fish Passage Project	FP
2023	Q2140408	Potrero Creek Fish Passage / Lower Culvert Project – Carmel Valley Athletic Club, Carmel Valley	FP
2023	Q2210506	Lower Stotenburg Coho Habitat Enhancement Project	HR
2024	Q2196023	Manzana Creek Roads Aquatic Restoration Project	NA

Of these, four were FP project types, one was HB, two were HU, one was HR, and one was funded by Prop 1 and reported below as NA (

Table 12). No HI or HS projects were monitored this contract cycle.

Table 12. Number of projects by FRGP project type monitored for pre-treatment during the contract cycle, 2022 - 2024.

FRGP Project Type	Number of Projects Monitored in 2022	Number of Projects Monitored in 2023	Number of Projects Monitored in 2024
FP	0	4	0
HB	1	0	0
HI	0	0	0
HR	0	1	0
HS	0	0	0
HU	2	0	0
NA	0	0	1
Total	**3**	**5**	**1**

For the nine projects that received pre-treatment monitoring, project features were monitored using a total of 161 checklists (Table 13). A total of 28 IN, 15 CB, 17 FB, 8 FC, 12 CD, 31 CU, 2 RD, 5 RU, 36 US, 3 RT, 3 VC, and 1 LU pre-treatment checklists were completed. Only one checklist type, FS, was not used during pre-treatment monitoring over the course of this contract cycle.

Table 13. Number and type of checklists completed for each project during pre-treatment monitoring.

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
Q2010527 Mid-Klamath Tributary Fish Passage Improvement Project	15	0	15	0	0	0	0	0	0	0	0	0	0	30
Q2010528 Bear Creek Sediment Reduction and Salmonid Recovery Project	0	0	0	0	0	12	6	2	1	11	0	0	0	32
Q2050905 Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	0	2	0	1	0	0	1	0	0	0	0	0	0	4
Q2130401 Buckeye Creek Storm-proofing and Habitat Protection Project	0	0	0	0	0	0	9	0	2	1	0	0	0	12
Q2110505 Scott Bar Mill Creek Fish Passage Improvement Project	2	4	1	1	0	0	0	0	0	0	0	0	0	8
Q2140409 Weston-Champagne Cachagua Creek Fish Passage Project	1	3	0	1	0	0	1	0	0	0	0	0	0	6

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
Q2140408 Potrero Creek Fish Passage / Lower Culvert Project - Carmel Valley Athletic Club, Carmel Valley	0	4	1	1	0	0	1	0	0	0	0	0	0	7
Q2210506 Lower Stotenburg Coho Habitat Enhancement Project	10	2	0	4	0	0	0	0	0	0	3	3	1	23
Q2196023 Manzana Creek Roads Aquatic Restoration Project	0	0	0	0	0	0	13	0	2	24	0	0	0	39
Grand Total	**28**	**15**	**17**	**8**	**0**	**12**	**31**	**2**	**5**	**36**	**3**	**3**	**1**	**161**

Mid-Klamath Tributary Fish Passage Improvement Project

This project improved fish passage on 74 tributaries of the Klamath, Salmon, and lower Scott rivers. Tributaries were evaluated to prioritize passage issues and construct pathways near the stream mouths to increase access for juvenile and adult salmonids to thermal refugia during low flows. This project was unique because implementation was repeated annually for fish passage. Consequently, both pre and post monitoring had to be done in the same year instead of waiting three years after construction to evaluate changes from high winter flows.

In 2022, 14 of 15 sites evaluated at pre-treatment received alterations (passage improvement or added cover) and were revisited for post-treatment monitoring. The grant ended and was closed in 2023.

Bear Creek Sediment Reduction and Salmonid Recovery Project

The project goal was to restore salmonid habitat and accelerate fisheries recovery by permanently removing several abandoned roads adjacent to Bear Creek. Road decommissioning took place on 3.5 miles of road and included thirteen stream crossings, twelve landslide fill failures, one ditch relief culvert, and one bank erosion site. Five stream crossings over 1.53 miles of road were upgraded.

Pre-treatment effectiveness monitoring took place in March 2022. Twelve of the thirteen stream crossings to be decommissioned were monitored and eleven of the twelve landslide fill failures and bank erosion sites were monitored. All six stream crossing upgrades were monitored on the road upgrade segment.

Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project

This project proposed to improve upstream fish passage at a total barrier to steelhead trout (*Oncorhynchus mykiss)* by replacing a ten-bay concrete box culvert with a bridge. The channel will be regraded and reconstructed to match the surrounding stream grade and substrate composition. Replacement of this stream crossing will allow steelhead trout at all life stages to access 12 miles of spawning and rearing habitat within the Santa Margarita River watershed.

Pre-treatment monitoring in July 2022 evaluated the crossing for fish passage as well as channel reconstruction and bank stabilization features.

Buckeye Creek Storm-proofing and Habitat Protection Project

This project proposed to decommission 1.4 miles of abandoned logging road, treat 35 sediment related features and upgrade 2.6 miles of maintained road by

implementing storm proofing features.

Pre-treatment effectiveness monitoring was started in March 2022. Many features were not flagged and the road was difficult to access so surveys were postponed. Once access was improved the project was canceled in 2023 and will not receive further monitoring.

Scott Bar Mill Creek Fish Passage Improvement Project

This project aimed to restore fish passage for Coho Salmon to approximately three miles of habitat within the Scott Bar Mill Creek watershed by eliminating a partial rock barrier at the Scott River confluence and replacing a cement ford crossing 200 ft from the mouth with a free span bridge.

Pre-treatment effectiveness monitoring was conducted in June 2023. Two features were monitored for fish passage, the rock barrier at the confluence and the stream crossing to be upgraded. Channel reconstruction and bank stabilization sites were monitored downstream of the crossing where the Mill Creek channel will be redirected, banks will be pulled back to grade, and erosion control treatment will be added. Two instream habitat and bank restoration features were monitored for anticipated addition of a roughened channel and a log boulder instream structure.

Weston-Champagne Cachagua Creek Fish Passage Project

This project proposed to replace an existing concrete ford with a single span bridge to remove a partial barrier to steelhead migration on Cachagua Creek. This will restore access to 8.3 miles of upstream steelhead habitat.

Pre-treatment monitoring in July 2023 evaluated the crossing for fish passage at the Weston-Champagne Cachagua Creek Fish Passage Project site, including the channel, which will be regraded and reconstructed, and the banks, which will be recontoured and stabilized with rock slope protection (RSP). One instream habitat feature, a proposed boulder formed pool, was also monitored.

Potrero Creek Fish Passage / Lower Culvert Project - Carmel Valley Athletic Club, Carmel Valley

This project funded removal of a barrier to steelhead passage by replacing an undersized metal pipe culvert with a larger arched culvert, restoring access to 1.78 miles of upstream spawning and rearing habitat.

The lower culvert project site received pre-treatment monitoring in July 2023 and evaluated the crossing for fish passage. The channel, which reconstructed through the new culvert with engineered streambed material (ESM), was

evaluated as well as three bank features stabilized with RSP.

Lower Stotenburg Coho Habitat Enhancement Project

This project restored fish passage to the lower 0.5 miles of Stotenburg Creek by removing two culverts and upgrading an additional two. The quality and quantity of in-channel habitat was enhanced by installing five beaver dam analogs, willow trenches, and large wood structures, while also enhancing the connectivity between Stotenburg Creek and the mainstem Smith River. Cattle exclusion fencing was installed to protect riparian habitat, improve water quality, and ensure long-term protection of the habitat.

Pre-treatment monitoring was conducted in May 2023 and evaluated all four crossings for fish passage and ten sites for instream structures, including five beaver dam analogs and five large wood structures. In addition, sites for vegetation control and revegetation were monitored.

Manzana Creek Roads Aquatic Restoration Project

This project proposed erosion control and sediment prevention measures at road-related sediment source sites along 2.94 miles of the unsurfaced McKinley Mountain Road and 1.77 miles of the unsurfaced Catway Road. It includes treatment of 13 stream crossing sites and 20 road surface discharge sites, construction of 152 rolling dips, and outsloping of 4.29 miles of unsurfaced road.

Pre-treatment monitoring over three days in January 2024 evaluated one road upgrade feature, six stream crossing features, and five upslope features on Catway Road. One road upgrade feature, seven stream crossing features, and 19 upslope features on McKinley Mountain Road were also evaluated.

Post-Treatment Effectiveness Monitoring

Twenty-six projects received post-treatment monitoring during this contract cycle, including seven HI projects, two HB projects, eleven FP projects, one HR projects, and four HU projects (Table 14).

Table 14. Projects with post-treatment monitoring.

Monitoring Year	Grant Number	Project Name	Project Type
2022	P1730402	Alpine Creek Fish Passage Project	FP
2022	P1810515	Panther Creek Barrier Removal Project	FP

Monitoring Year	Grant Number	Project Name	Project Type
2022	D1450006	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal	FP
2022	P1450010	Circle G Ranch Fish Passage Restoration	FP
2022	Q2010527	Mid-Klamath Tributary Fish Passage Improvement Project	HB
2022	P1710509	North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	HI
2022	P1730409	San Geronimo Valley Landowner Assistance Program - Restoring Coho Habitat	HI
2022	P1810514	Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	HI
2022	P1830401	Tannery Creek Large Wood Recruitment Project 2018	HI
2022	P1610533	Miller Riparian Restoration Project	HR
2022	Q1910502	Redwood Creek Habitat Protection Project	HU
2022	T1710501	Hare Creek and Bunker Gulch Road Decommissioning Implementation Project	HU
2022	T1810503	Soldier Creek Sediment Reduction and Salmonid Recovery Project	HU
2023	P1710529	Little Springs Migration Barrier Removal	FP
2023	P1810503	Gulch C Coho Salmon Fish Passage Improvement Project	FP
2023	P1450011	Fish Passage Improvement at Crossing 3, Quiota Creek	FP
2023	P1550010	Fish Passage Improvement at Crossing 4, Quiota Creek	FP

Monitoring Year	Grant Number	Project Name	Project Type
2023	P1650902	Fish Passage Improvement at Crossing 5, Quiota Creek	FP
2023	P1750902	Fish Passage Improvement at Crossing 9, Quiota Creek	FP
2023	P1850902	Fish Passage Improvement at Crossing 8, Quiota Creek	FP
2023	P1730411	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	HB
2023	P1610504	James Creek Coho Stream Habitat Enhancement Project	HI
2023	Q1910507	Middle Slough Restoration Project - Phase 2	HI
2023	Q1910513	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	HI
2023	Q1910528	Julias Creek Sediment Reduction and Salmonid Recovery Project	HU
2024	Q1910506	Morrison Creek Tributary Barrier Removal	FP

For the 25 projects that received post-treatment monitoring, project features were monitored using a total of 344 checklists (Table 15). A total of 154 IN, 57 CB, 24 FB, 18 FC, 20 CD, 17 CU, 10 RD, 2 RU, 27 US, 13 RT, and 2 VC post-treatment checklists were completed. Two checklist types, FS and LU, were not used during post-treatment monitoring over the course of this contract cycle.

Table 15. Number and type of checklists completed for each project during post-treatment monitoring.

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
P1730402 Alpine Creek Fish Passage Project	0	1	1	1	0	0	1	0	0	0	0	0	0	4
P1810515 Panther Creek Barrier Removal Project	5	1	1	1	0	0	0	0	0	0	0	0	0	8
D1450006 Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal	0	2	0	2	0	0	2	0	0	0	4	0	0	10
P1450010 Circle G Ranch Fish Passage Restoration	1	5	1	1	0	0	1	0	0	0	0	0	0	9
Q2010527 Mid-Klamath Tributary Fish Passage Improvement Project	14	0	14	0	0	0	0	0	0	0	0	0	0	28
P1710509 North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	23	0	0	0	0	0	0	0	0	0	0	0	0	23

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
P1730409 San Geronimo Valley Landowner Assistance Program - Restoring Coho Habitat	2	1	0	0	0	0	0	0	0	0	2	2	0	7
P1810514 Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	16	0	0	0	0	0	0	0	0	0	1	0	0	17
P1830401 Tannery Creek Large Wood Recruitment Project 2018	19	0	0	0	0	0	0	0	0	0	0	0	0	19
P1610533 Miller Riparian Restoration Project	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Q1910502 Redwood Creek Habitat Protection Project	0	0	0	1	0	4	0	1	0	5	0	0	0	11
T1710501 Hare Creek and Bunker Gulch Road Decommissioning Implementation Project	0	16	0	2	0	0	3	3	1	4	0	0	0	29
T1710501 Soldier Creek	0	0	0	0	0	8	0	3	0	4	0	0	0	15

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
Sediment Reduction and Salmonid Recovery Project														
T1810503 Little Springs Migration Barrier Removal	0	0	1	1	0	0	1	0	0	0	0	0	0	3
P1810503 Gulch C Coho Salmon Fish Passage Improvement Project	6	8	2	2	0	0	1	0	0	0	0	0	0	19
P1450011 Fish Passage Improvement at Crossing 3, Quiota Creek	0	3	0	1	0	0	1	0	0	0	0	0	0	5
P1550010 Fish Passage Improvement at Crossing 4, Quiota Creek	1	3	0	1	0	0	1	0	0	0	0	0	0	6
P1650902 Fish Passage Improvement at Crossing 5, Quiota Creek	1	3	1	1	0	0	1	0	0	0	0	0	0	7
P1750902 Fish Passage Improvement at Crossing 9, Quiota Creek	1	3	1	1	0	0	1	0	0	0	0	0	0	7
P1850902 Fish Passage Improvement at Crossing 8,	2	3	1	1	0	0	1	0	0	0	0	0	0	8

Grant Number and Project Name	IN	CB	FB	FC	FS	CD	CU	RD	RU	US	RT	VC	LU	Total Checklists
Quiota Creek														
P1730411 Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	3	2	1	1	0	0	1	0	0	0	4	0	0	12
P1610504 James Creek Coho Stream Habitat Enhancement Project	25	0	0	0	0	0	0	0	0	0	0	0	0	25
Q1910507 Middle Slough Restoration Project - Phase 2	0	2	0	0	0	0	0	0	0	0	1	0	0	3
Q1910513 East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	29	0	0	0	0	0	0	0	0	0	0	0	0	29
Q1910528 Julias Creek Sediment Reduction and Salmonid Recovery Project	0	0	0	0	0	8	2	3	1	14	0	0	0	28
Q1910506 Morrison Creek Tributary Barrier Removal	6	4	0	1	0	0	0	0	0	0	0	0	0	11
Grand Total	**154**	**57**	**24**	**18**	**0**	**20**	**17**	**10**	**2**	**27**	**13**	**2**	**0**	**344**

Alpine Creek Fish Passage Project

This project restored access to over three miles of upstream habitat for Coho Salmon by upgrading an existing arch culvert under a road crossing. It also reconstructed 300 ft of downstream channel with a 4% grade roughened rock ramp while removing failing boulder weirs and a non-functional Denil fish ladder. The channel inlet elevation was lowered through the existing arch culvert. This project will also benefit steelhead trout and Pacific Lamprey.

The retrofitted arch culvert was monitored for effectiveness in 2022. The fish ladder and apron were successfully removed, and the banks were sloped and stable with no remaining signs of erosion or incision. All retrofits were functioning as designed. Two boulder weirs with step pools were maintaining grade control through the project area and no enduring fish passage issues are apparent.

Panther Creek Barrier Removal Project

This project opened year-round access for all life stages of Coho Salmon and other salmonids to approximately 4.5 miles of instream habitat. A road crossing and gauging station that formed a barrier near the mouth of Panther Creek were removed.

The former log stringer bridge that spanned two remnant stacked log abutments were removed as well as three instream sill logs across the channel. Removal of fill behind the log abutments allowed regrading of the channel bank slopes to a more stable angle between 6.1% and 6.4%. Large wood generated from removed materials were used to construct four separate instream habitat structures with an expectation of creating and enhancing three additional pools. Coast redwoods (*Sequoia sempervirens*) were planted in the disturbed riparian habitat following construction.

The channel was reconstructed, and the features were functioning as intended at post-treatment effectiveness monitoring. Five added large wood features improved instream cover at each feature from a instream shelter rating of one to either two or three, and maximum residual depths increased from 1.5 to 1.8 ft.

Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal

This project aimed to provide Southern California Steelhead upstream access to the entire 4.5 miles of historic spawning and rearing habitat in Arroyo Sequit by replacing two concrete Arizona crossings acting as barriers to fish passage with free-span bridges. Additional objectives included restoring stream habitat by converting a hardened roadway to natural stream channel and enhancing

habitat via stream recontouring and native plant revegetation.

Project sites were monitored for effectiveness in October 2022 and two barriers to steelhead trout passage along Arroyo Sequit were successfully removed. Components of bridges and abutments were in good condition and functioning as intended. The boulders and cobble installed in the reconstructed stream channel at both sites were either washed out or buried by sediment, potentially because the channel consisted primarily of gravel and sand. The survival and vigor of planted vegetation was difficult to evaluate as revegetated areas at both sites showed evidence of being burned during the Woolsey Fire. Many native planted species survived or regrew after the fire, though non-native mustard and thistle were observed in the revegetation treatment areas. The project received an overall fair rating.

Circle G Ranch Fish Passage Restoration

This project funded removal of a barrier to Southern California Steelhead passage and provided access to 1.27 miles of upstream habitat on Carpinteria Creek. The barrier consisted of an undersized bridge and associated concrete channel with grade control steps that created a fish jump height of up to three ft.

Post-treatment monitoring in October 2022 found the new bridge and abutments were in good condition and functioning as intended. The RSP installed along both bridge abutments appeared stable and mostly intact, though small material surrounding the boulders appeared to have washed out, exposing the tops of the abutments. Both stream banks were successfully laid back to match the natural slope in the area surrounding the project site. Both banks appeared stable, but some minor stream bank erosion was observed at the base of both banks throughout the site. The reconstructed channel materials appeared stable and were functioning as intended. No visible barriers to fish passage were apparent throughout the reconstructed channel. While the pool and associated boulder and wood structures were buried at the time of post-treatment monitoring, later storm events scoured the area and the pool reformed as intended. This project received an overall rating of good.

Little Springs Migration Barrier Removal

This project funded improved passage for Coho Salmon by replacing an undersized metal pipe culvert on East Louie Road with a natural bottom multi-plate crossing structure and installing grade controls sufficient to maintain the existing stream profile and prevent incision upstream of the crossing.

In 2023, post-treatment monitoring was completed, and the crossing was in good condition and functioning as intended with no remaining fish passage issues.

Mid-Klamath Tributary Fish Passage Improvement Project

This project aimed to improve fish passage on 74 tributaries of the middle Klamath, Salmon, and lower Scott Rivers. In the early summers, tributaries were evaluated to prioritize them according to existing and potential passage problems. Temporary pathways were then constructed at or near the stream confluence by removing barriers or concentrating flows to increase access for juvenile and adult salmonids to thermal refugia during summer low flows.

Resting pools were also constructed along the lower stream sections to facilitate movement, and cut willows were added to the confluence pools at some locations to provide cover. In 2022, 62 tributaries were evaluated for passage work and 44 were treated. A total of 63 impediments were removed or altered.

In 2022, 14 of 15 sites evaluated at pre-treatment received alterations (passage improvement or added cover) and were revisited for post-treatment monitoring. Three tributaries (Camp, Slate, and Nordheimer Creeks) had major work done adding resting pools and extended meanders for slower grade and flow.

Gulch C Coho Salmon Fish Passage Improvement Project

The project restored access for adult and juvenile Coho Salmon and steelhead trout to approximately 1.3 miles of spawning and rearing habitat in Gulch C. Construction removed two old culverts, excavated the stream channel, and installed nine large wood log step weirs and four rootwads. The lower rail crossing was replaced with a 20-foot diameter steel plate culvert, and the upper timber road crossing was replaced with a 50-foot spanning bridge. RSP was added at both crossing sites as well as willow staking and erosion control materials, and 500 redwood saplings were planted.

In 2023, post-treatment monitoring found the crossings were no longer barriers to fish passage, but at low flows the lower crossing had subsurface flow within the culvert. Rock armoring along the lower crossing had also eroded at points, especially on the downstream and right bank. Rock weirs scoured out pools and fish were visible from the surface below the lower crossing. Logs and rootwads were stable and keyed in, but the uppermost rootwad was mostly out of the active channel.

Fish Passage Improvement at Crossing 3, Quiota Creek

This project aimed to provide access to 3.38 miles of spawning and rearing habitat for steelhead trout by removing a passage barrier. A concrete low-flow Arizona crossing with a fully obstructed 16-inch diameter corrugated metal pipe culvert at Crossing 3 was replaced with a 53-foot span concrete bottomless-arch culvert.

Post-treatment monitoring in September 2023 documented that the bottomless arch culvert and wingwalls appeared to be in good condition and functioning as intended. The reconstructed channel retained the intended gradient and substrate composition, and the fish passage barrier was successfully removed with no apparent visible barriers remaining throughout the reconstructed channel. The attempt to redirect flow in the channel upstream of the crossing towards river right was unsuccessful, as the channel was observed shifting back towards river left with continued erosion of the left bank. Most of the large RSP was in place and functioning as intended to protect crossing abutments from scour, but the smaller fill material between the larger rocks appeared to have washed out, exposing the large rock intended to be buried. Some of the large RSP at the upstream ends of both banks had shifted out of its original placement and settled within the channel. The project received an overall fair rating.

Fish Passage Improvement at Crossing 4, Quiota Creek

This project provided access to 3.27 miles of spawning and rearing habitat for steelhead trout by removing a passage barrier. A concrete low-flow Arizona crossing with a fully obstructed 12-inch diameter corrugated metal pipe culvert at Crossing 4 was replaced with a concrete bottomless-arch culvert. An additional objective was restoring stream habitat by reconstructing the channel through the crossing with ESM.

Post-treatment monitoring was completed in September 2023. Components of the bottomless arch culvert and wingwalls appeared to be in good condition and were functioning as intended. The reconstructed channel retained the gradient and substrate composition as intended. The project met its main objective of providing fish passage to all life stages of steelhead trout. The fish passage barrier was successfully removed, and no visible barriers remained throughout the reconstructed channel. The attempt to fill in the river left side channel and direct flow towards the river right main channel upstream of the crossing was unsuccessful. The channel upstream of the crossing was braided and flowing in both the intended channel and the previously filled-in side channel, which caused side cutting and erosion on the left bank. Most of the large RSP was still in place and functioning as intended to protect crossing abutments from scour, but smaller fill material between the larger rocks of the RSP had washed out. This exposed large rock intended to be buried. Some of the large RSP at the upstream ends of the left bank had shifted out of its original placement and settled within the channel. Likely because of the erosion of the small fill on the banks, these features were measured to have slightly higher bank angles than the targeted 2:1 slope. The rootwad feature at the upstream limit of the channel reconstruction was installed with the intent to form a scour pool and help direct flow into the main river right channel. The entire feature washed out and the rootwad could not be

located anywhere within the project boundaries. The project received an overall rating of fair.

Fish Passage Improvement at Crossing 5, Quiota Creek

The objective of this project was to provide access to 3.17 miles of spawning and rearing habitat for steelhead trout by removing a passage barrier. A concrete low-flow Arizona crossing with a fully obstructed 16-inch diameter corrugated metal pipe culvert at Crossing 5 was replaced with a 59-foot span concrete bottomless-arch culvert. An additional objective was restoring stream habitat by reconstructing the channel through the crossing with ESM and adding a rock riffle feature.

The project site was monitored for effectiveness in September 2023. The bottomless arch culvert was in good condition and functioning as intended. Channel conditions appeared ideal for passage for all steelhead life stages during passable flow conditions as the crossing replacement was successful. The channel regrading and reconstruction with ESM retained the intended gradient and good substrate even after significant flow events following implementation. Some materials shifted in the channel resulting in unintended aggradation of boulders and cobble upstream of and under the culvert, causing a reduced freeboard within the culvert. Overall, the channel feature remains passable and provides good fish habitat. The large RSP was in place and functioning as intended to protect crossing abutments from scouring. Some smaller fill material between the larger rocks of the RSP washed out, exposing the large rock that was intended to be buried. The rock riffle at the upstream limit of the channel reconstruction was riffle habitat and installed large boulders were in place, but the channel shifted to the river left side of this feature rather than mid-channel as intended. This resulted in scouring on the river left side and deposition of large sediment on the river right side. No obvious barrier formed within this riffle feature, and it appears passable to all life stages of steelhead trout. This project received an overall rating of fair.

Fish Passage Improvement at Crossing 9, Quiota Creek

The objective of this project was to provide access to 2.73 miles of spawning and rearing habitat for southern steelhead trout by removing a passage barrier. A concrete low-flow Arizona crossing with a partially obstructed 16-inch diameter corrugated metal pipe culvert and a concrete apron at Crossing 9 was replaced with a 55-foot span concrete bottomless-arch culvert. An additional objective included restoring stream habitat by reconstructing the channel through the crossing with ESM and adding buried rock weirs for grade control.

Post-treatment monitoring was completed in September 2023. Components of the bottomless arch culvert and wingwalls appeared to be in good condition and

functioning as intended. The RSP on both banks was functioning as intended to protect crossing abutments from scour. All the large RSP was still in place, though some of the smaller fill material between the larger rocks of the RSP appeared to have washed out in some areas. The channel grading and reconstruction with ESM located upstream of and beneath the new crossing retained the intended gradient and installed ESM. Some shifting of smaller materials might have occurred, but the larger boulders remained in place in the channel under the culvert. Fish passage conditions through the new crossing and this section of reconstructed channel appeared good. Downstream of the crossing and ESM channel section, two rock weirs of large boulders buried under channel material were installed to remain buried and maintain grade control. During post-treatment monitoring, significant channel incision and scouring was observed between and downstream of the rock weirs. As a result, previously buried rock weirs were fully exposed, and water was flowing behind and through gaps in the large boulders. The condition of the boulder weirs observed during post-treatment likely poses a threat to upstream fish passage. The project received an overall rating of fair.

Fish Passage Improvement at Crossing 8, Quiota Creek

This project provided access to 3.03 miles of spawning and rearing habitat for steelhead trout by replacing the passage barrier at Crossing 8. A temporary bridge over a damaged concrete low-flow crossing was replaced with a 54-foot concrete bottomless-arch culvert. An additional objective was restoring stream habitat by reconstructing the channel through the crossing with ESM, two rock weirs, and a rootwad.

Post-treatment monitoring was conducted in September 2023 and the bottomless arch culvert was in good condition and functioning as intended. Channel conditions appeared good for passage for all steelhead life stages during passable flow conditions. The RSP features installed along both banks were functioning as intended to protect crossing abutments from scour. Along the right bank, all the large RSP was in place. Some smaller fill material between the larger rocks of the RSP appeared to have washed out. On the left bank, some of the larger RSP at the upstream end of this feature shifted into the channel and much of the small fill had washed out. Side cutting into the left bank at the upper end of the RSP and upstream of it was observed. The channel reconstructed with ESM retained the intended gradient and substrate composition, even after significant flow events following implementation. Shifting of smaller materials occurred, but the larger boulders remained in place in the channel. Overall, the channel feature was passable and provided good fish habitat. A pair of rock weirs were installed within the channel reconstruction beneath the culvert intended to maintain pool

habitat. Following strong winter storms, the upstream weir washed out or potentially become partially buried under sediment. The downstream weir was functioning and maintained pool habitat above it as intended. The feature appeared passable to steelhead trout and the intended channel grade was maintained. A rootwad installed at the downstream limit of the channel reconstruction to form a scour pool and provide cover for fish had erosion on the upstream bank. However, the feature remained in place, formed a scour, and was providing instream cover. This project received an overall fair rating.

Fish Passage and Off-Channel Habitat Restoration at Roy's Pools

This project restored access to 3.5 miles of upstream habitat on San Geronimo Creek to adult and juvenile Coho Salmon and steelhead by removing a concrete and metal dam and a narrow fish ladder. The project also added 250 ft of side channel habitat for winter rearing habitat, a major limiting factor for Coho Salmon survival in the watershed.

All man-made structures, including the dam, weirs, and fish ladder, were removed. A series of rock grade control and a mix of ESM was placed on top of and between the rock vanes. The streambed extended 250 ft upstream of the barrier to accommodate grade change following dam removal. A stream segment was relocated to the north to aid in alignment and long-term stability. The old main channel became a new seasonal side channel, which flows during flood events. Two instream wood structures and living willow clusters were placed in two pools upstream of the former dam site. A temporary irrigation system was installed to assist in revegetation. A failing pedestrian bridge over the creek at the location of the dam site was also replaced with a full-span pedestrian bridge.

Post-treatment monitoring was conducted in June 2023. The concrete dam, four sheet metal weirs and fish ladder were removed successfully. The newly graded roughened stream channel was designed as proposed. The original main channel remained as a narrow side channel. The four revegetation features along the main and side channel had good growth and high survival.

Morrison Creek Tributary Barrier Removal Project

This project funded the removal of a total fish barrier to adult and juvenile Coho Salmon and opened access to 0.6 miles of non-natal rearing habitat in the Morrison Creek sub-basin. It also removed the potential for culvert failure at the crossing and the concomitant sediment delivery into the tributary by replacing the culvert with a 30-foot span bridge with a natural channel bottom.

Construction at the site was completed between September 19 and October 5 of 2022. Five channel spanning logs were installed as grade control structures

downstream of the crossing and seven rootwads were placed on the right bank as habitat and erosion control.

Post-treatment validation monitoring was conducted on April 16, 2024. The new bridge was in good condition and no fish passage issues remained. All spanning grade control logs were functioning as intended and had scoured out small pools.

North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 26 instream features. Seventy-six pieces of large wood were installed along a total of 3,168 ft (0.60 miles) of the North Fork Noyo River and Dewarren Creek. Three features using 10 pieces of large wood were installed along 475 ft within the North Fork Noyo River and 23 features consisting of 66 pieces of large wood were installed along 2,693 ft within Dewarren Creek. Eleven pools were anticipated to be created by the new structures.

In 2022, post-treatment reviewed 23 of the 25 features monitored during pre-treatment for effectiveness after three winter flow seasons. Most large wood features consisted of one to three logs either anchored with rebar and cable or wedged between live trees and were predominately functioning as intended through added cover complexity. Small wood accumulation on many features aided in increased cover. Only thirty-five percent of features increased maximum residual depth potentially due to persistent drought conditions and minimal winter flow effects. This project received an overall good rating.

Key pieces as defined in the Recovery Plan for the Evolutionarily Significant Unit of Central Coast Coho Salmon (CCC; NMFS 2012a) were counted throughout the reach during post-treatment effectiveness monitoring in July 2022. The reach included 12 key pieces resulting in 1.2 pieces per 100 meters, a poor rating. Upon reviewing the grant agreement, the applicant used a key piece definition of 14 inches at diameter breast height. While the CCC defines a key piece as 32.8 ft in length, 1.80 ft (21.6 inches) in diameter, and 2.5 cubic meters in size. This likely made our count lower than the applicant's, as our length and diameter key piece criteria were larger to match the cited CCC.

San Geronimo Valley Landowner Assistance Program- Restoring Coho Habitat

This project included two main objectives: 1) provide a demonstration restoration project for San Geronimo Valley residents wanting to conduct salmonid habitat enhancement, and 2) create critical Coho Salmon summer-winter habitat. This project installed large wood structures, rootwads, inset floodplain berms, an alcove, riparian vegetation enhancement, and erosion control.

Construction removed invasive vegetation and graded banks to create an inset floodplain with an alcove at the Cintura Creek mouth. Eighteen pieces of large wood including nine rootwads were anchored in place along with ballast rock. Disturbed areas were seeded and covered with erosion control blankets and native riparian plantings.

Post-treatment effectiveness monitoring was completed in 2022. Banks were successfully pulled back on Cintura Creek with improvement in bank angles and grade through the lower 75 ft to the confluence with San Geronimo Creek. Added large wood was anchored in position and successfully increased maximum residual depth within the treatment area from 2.1 to 3.5 ft. The total large wood count increased from one piece to eight pieces, as well as shifting the second most dominant substrate from sand to gravel. The rock weir at the mouth of Cintura Creek appeared to be buried by bedload and had developed a steep grade at the mouth from head cutting. The upper weir was not monitored. Invasive ivy was removed at implementation from both banks but had returned to the left bank by post-treatment. Three features received a good rating and four received a fair rating leading to an overall rating of fair.

Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)

This project created complex pool habitat and increased channel complexity by constructing nineteen log structures over approximately 1.1 miles of stream using 42 pieces of large wood placed within the bankfull channel. Nine pools were expected to be created from structure installation. In addition, 600 willow cuttings and 200 redwood seedlings were planted in areas where riparian trees were lacking riparian vegetation.

In 2022, 17 of the 18 large wood instream features monitored during pre-treatment received post-treatment effectiveness monitoring following three winter seasons of higher flow. All large wood structures were in their original position and in good condition, with most having solid recruitment of large and small wood, as well as creating pools. Seventy-three percent of pools increased or maintained maximum residual depths. Heavy silt levels from landslides persist in the creek, though many structures helped scour silt and reveal cobble or bedrock. Two structures slowed water causing silt deposition and decreased maximum residual depths. Fourteen instream features received a good rating. Fair ratings were given to two features where silt buildup had decreased max depths or structures weren't in the main channel. One revegetation site planted with willows had 10% survival. The project received an overall rating of good.

Tannery Creek Large Wood Recruitment Project 2018

This project installed 50 pieces of large wood and three rootwads in 2,045 ft (0.39 miles) of Tannery Creek to improve habitat for Coho Salmon. The structures were intended to scour out cooler, deeper pools to improve over-summer survival, provide cover and high flow refugia during storm events, sort spawning gravels, enhance overall channel complexity, and redirect flows away from eroding banks.

Nineteen of the 23 features monitored at pre-treatment received post-treatment effectiveness monitoring in 2022, following three winter flow seasons. Large wood features consisted mainly of one to three logs anchored with rebar and cable or wedged between live trees. Features were predominately functioning as intended by adding cover complexity. Thirteen features had increased residual pool depth at post-treatment monitoring. One feature received a fair rating due to lack of habitat change or scouring. All other features received a good rating, giving the project an overall rating of good.

Key pieces as defined in the CCC were counted throughout the reach during post-treatment effectiveness monitoring in July 2022. The reach included 34 key pieces resulting in 5.5 pieces per 100 meters, a fair rating. Upon reviewing the proposal, the applicant used a key piece definition of twice the average bankfull width length, at least 18 inches in diameter, and 2.5 cubic meters in size. While the CCC defines a key piece as 32.8 ft in length, 1.80 ft (21.6 inches) in diameter, and 2.5 cubic meters in size. This likely made our count lower than the applicant's, as our length and diameter key piece criteria were larger to match the cited CCC.

James Creek Coho Stream Habitat Enhancement Project

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 28 instream features using 93 pieces of large wood along a total of 3,168 ft (0.88 miles) of James Creek. The structures were intended to improve complexity, frequency, and depth of pools, sort and collect spawning gravel, and provide refugia for migrating salmonids.

Of the 26 features monitored at pre-treatment, 25 received post-treatment effectiveness monitoring in 2023 following three winter flow seasons. Large wood features consisted mainly of one to three logs anchored with rebar and cable or wedged between live trees. Features were predominately functioning as intended by adding cover complexity. Twenty-one features had increased residual pool depth at post-treatment monitoring.

Middle Slough Restoration Project - Phase 2

The purpose of the project was to provide high quality winter and summer rearing habitat at the upper tidal margin of the Mattole River estuary. Increasing refuge from high flows and high temperatures for juvenile Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon, and steelhead was also an objective. Eight hundred ft of off-channel habitat were restored to create connectivity to the Mattole Estuary and lower Bear Creek through excavation of the Middle Slough Channel and installation of 12 wood structures and three alcoves. The project also enhanced riparian habitat on the floodplain adjacent to the Middle Slough through installation of 3,000 ft of willow baffles, 4,000 tree plantings, and 4,000 wetland plants.

A total of 1,501 ft of slough and alcove channel was excavated and 3,142 ft of trenched willows was planted on the river terraces floodplain and in the slough alcoves. The excavated alcove and slough created areas of low velocity through a network of wetlands and off-channel features where summer temperatures have been consistently five degrees and up to ten degrees Celsius (C) cooler than the main estuary. Survival of plantings is above 60% for all areas and up to 97% in the slough.

Post-treatment monitoring was completed in 2023. Unanchored large wood structures were placed in the newly excavated channel and created shallow pools, 2-4 inches in depth. Vegetation covered the banks and there was no sign of erosion. Willow plantings on the left bank floodplain terrace of the Mattole River had high survival, looked healthy and had good growth.

East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout in the East Branch North Fork Big River. Thirty-eight instream features using 95 pieces of large wood were installed along a total of 5,455 ft (1.03 miles) of stream. Wood included 10 rootwads and nine extra seed piece logs with a diameter under 12 inches.

Twenty-nine features monitored at pre-treatment received post-treatment effectiveness monitoring on August 29, 2023. All large wood structures were in their original position and in good condition. All features created pool habitats and added cover complexity. Twenty-seven pools increased maximum residual depth, while two stayed the same.

Miller Riparian Restoration Project

This project promoted riparian revegetation and recovery of instream habitats along Oil Creek and Maple Creek by first eliminating livestock browsing, trailing, and trampling of riparian vegetation using 19,908 ft of livestock exclusion fencing. Secondly, stream crossings were upgraded or created, and watering troughs were added as an alternative water source for livestock. Lastly, native riparian species were planted in previously impacted areas.

Post-treatment effectiveness monitoring was conducted on four fences and six crossing upgrades in 2020, and the riparian revegetation was evaluated in 2022. The 3.78 miles of fencing was in good condition with only minor issues, and included wildlife gaps every 800 ft. The crossing upgrades were in good condition, except for one that looked likely to fail as water was going underneath the installed culvert. Five new livestock water troughs were installed successfully and generally met intended Natural Resources Conservation Service standards but were not monitored for effectiveness. Additionally, native tree species with netting to protect against wildlife were planted over 17.6 acres. Riparian planting survival was poor and all species along planting transects were deceased or gone by summer 2022; however, a dozen alders had survived along the lake edge and were between three and six ft tall.

Redwood Creek Habitat Protection Project

This project removed 0.8 miles of abandoned logging road and two bridges along Larry Damm Creek and the adjacent riparian forest and prevented 15,000 cubic yards of sediment from stream crossings and unstable slopes from impacting special status salmonid habitat and water quality. Removal of sediment with potential for delivery began in fall 2019 on 2,500 ft of abandoned logging road including three upslope stream crossings adjacent to Larry Damm Creek. Two bridges and a segment of perched road fill were removed from above Lost Man Creek located upstream of the confluence with Larry Dam Creek. Construction ended October 6, 2020, with a total of approximately 0.8 miles of road and 6.8 acres of upland area treated for sediment control.

Four stream crossings including the bridge removal were monitored post-treatment along with five upslope sections and one road decommissioning. All crossings were pulled back to a 2:1 ratio with substantial slash placed. Vegetation regrowth in disturbed areas was dense with very minimal bare ground. There were no signs of sediment delivery and no diversion potential or incision downstream of crossings. The former bridge crossing no longer presented any fish passage issues.

Hare Creek and Bunker Gulch Road Decommissioning Implementation Project

This project prevented delivery of approximately 4,890 cubic yards of sediment to Bunker Gulch and mainstem Hare Creek by upgrading six road features and 0.56 miles of upslope road, as well as decommissioning 32 road features and 1.92 miles of streamside road. Successful implementation aimed to improve habitat and water quality for Coho Salmon and steelhead trout.

In 2019, Forest Road 400 next to Hare Creek was decommissioned. An upslope section of Forest Road 440 in Bunker Gulch was upgraded, and the creek side section of Forest Road 440 was decommissioned. A total of approximately 2.5 miles of road was treated. Treated sediment delivery features included 21 stream crossings, 12 ditch relief culverts, and four areas of bank erosion. Road drainage treatments included mechanical decompaction (ripping) of 1.9 miles of decommissioned road. Fifty-three crossroad drains were installed, and more than 4,230 ft (0.8 mi.) of road cut and/or fill were outsloped.

Post-treatment monitoring in 2022 on the Hare Creek and Bunker Gulch Road Decommissioning Implementation Project surveyed approximately 2.5 miles of forest roads. Nineteen stream crossing upgrade and decommissioning features and two fish passage at stream crossings features were included. Also, three road segment upgrade and road decommissioning features, and four upslope stabilization features were monitored.

Crossing decommissioning on Forest Roads 400 and 440 included excavating fill material and laying back the channel side slopes to a 2:1 slope. A few crossing features did not meet the 2:1 slope on one side of the channel but there were no signs of sediment delivery to the stream. Slash and wood covered the road surface to minimize erosion and most sections had established vegetation on decompacted areas. No erosion or hydrologic connectivity were observed.

Soldier Creek Sediment Reduction and Salmonid Recovery Project

This project successfully decommissioned 2.48 miles of hydrologically connected streamside riparian roads to prevent 4,616 cubic yards of sediment from entering Usal Creek, home to steelhead trout. Eight upslope stream crossings and 6.02 acres of upland area were also treated, and the road removal decreased road density in the basin by approximately 20% while decompacting 13,096 ft of road.

In 2019, construction successfully decommissioned all 2.48 miles of targeted streamside road. Thirteen features exhibiting future erosion and sediment delivery potential were removed. The project objective was to help normalize the basin hydrograph and allow natural flow paths and runoff, contributing to both summer and winter flows. The project aimed to improve water quality, pool frequency and

depth, and gravel quality.

Eight decommissioned stream crossings, four upslope stabilization sites, and one road with two spur roads were monitored post-treatment. All eight stream crossing features were successfully sloped at a 2:1 ratio with slash placed to prevent erosion. Head cutting remained above and below the treatment areas in five of eight stream crossing decommissioning sites, and one feature showed evidence of slight erosion in the channel at the crossing.

All road sections and upslope treatments were decompacted and outsloped with plenty of slash placed throughout and good regrowth of vegetation with no obvious signs of continued sediment delivery to Soldier Creek.

Julias Creek Sediment Reduction and Salmonid Recovery Project

This project reduced sediment delivery from a legacy timber riparian road system and normalized the hydrology within the Julias Creek watershed by addressing 48 sediment source features, decommissioning 5.23 mi of abandoned road, and upgrading two stream crossings. Approximately 14,445 cubic yards of sediment will be prevented from entering the stream by treating an estimated 15.86 acres of upslope area.

Crews used heavy equipment to open access roads and to decommission and upgrade identified erosion features and associated road reaches. Fill was excavated by bulldozer from designated project features along with opening roads and managing spoils. Wood placed on the side slopes of decommissioned stream crossings provided erosion control, added fluvial geomorphic complexity to small stream channels, and improved instream and riparian habitat conditions. All disturbed and bare soil surfaces on treated erosion features were mulched using local vegetation as slash. Seedlings of 1,270 redwood trees were planted on equipment access routes and other disturbed work areas.

Post-treatment effectiveness monitoring was completed in 2023. The two road and culvert upgrades on logging road 4000 were functioning as intended with minor bank erosion within the vicinity but did not seem to be contributing sediment to the creek. The decommissioned crossing features were well covered with slash and had good regrowth of vegetation to prevent erosion and sediment delivery to Julias Creek. All monitored upslope stabilization features were treated as planned. Decommissioned road segments were treated with slash and vegetation regrowth making access difficult in a timely manner, and consequently only three of seven were monitored at post-treatment.

Checklist Data

FB Checklists

Ten FP projects used post-treatment FB checklists to evaluate data for as-built barrier modification or removal sites (Table 16, Table 17, Table 18, Table 19).

At post-treatment no new barriers accumulated at the site of the removed barriers and the modified barriers remained in the as-built configurations.

Table 16. Has a new barrier accumulated at the site of the removed barrier?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	1	0	0
Panther Creek Barrier Removal Project	0	0	1	0	0
Circle G Ranch Fish Passage Restoration	0	0	2	0	0
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	14	0	0
Little Springs Migration Barrier Removal	0	0	1	0	0
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	2	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	1	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	1	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	1	0	0
Grand Total	**2**	**0**	**23**	**0**	**0**

Table 17. Has the modified barrier remained in the as-built configuration?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	0	0	1
Panther Creek Barrier Removal Project	0	0	0	0	1

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Circle G Ranch Fish Passage Restoration	2	0	0	0	0
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	0	0	14
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	0	0	2
Little Springs Migration Barrier Removal	0	0	0	0	1
Fish Passage Improvements at Crossing 5, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	1	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	0	0	1
Grand Total	***5***	**0**	**0**	**0**	**20**

The Little Springs Migration Barrier Removal did not state that it had an objective to provide adult fish passage and was not applicable. Quiota Creek Fish Passage Improvement at Crossing 9 had a partial barrier remain at post-treatment.

Table 18. If an objective, does the feature provide adult fish passage?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	0	0	1
Panther Creek Barrier Removal Project	0	0	0	0	1
Circle G Ranch Fish Passage Restoration	0	0	0	0	2
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	0	0	14

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	0	0	2
Little Springs Migration Barrier Removal	1	0	0	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	0	0	0	0	1
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	0	0	1
Fish Passage Improvement at Crossing 9, Quiota Creek	0	0	0	1	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	1	0	0	0	0
Grand Total	**2**	**0**	**0**	**1**	**21**

Thirteen of the fourteen Mid-Klamath Tributary Fish Passage Improvement Project features reconstructed for fish passage did not have any barrier remaining to adult species at post-treatment. Tom Martin Creek, a site that is part of the Mid-Klamath Fish Passage Improvement project, remained a temporal barrier to adult fish at post-treatment. Gulch C Coho Salmon Fish Passage Improvement Project upgraded two stream crossings and adult fish passage remained at both due to low flow throughout and subsurface summer flow through the downstream culvert.

Table 19. Does any barrier to targeted adult species remain at the feature?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	1	0	0
Panther Creek Barrier Removal Project	0	0	1	0	0
Circle G Ranch Fish Passage Restoration	0	0	2	0	0
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	13	0	1
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	0	0	2
Little Springs Migration Barrier Removal	0	0	1	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	0	0	1	0	0

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	1	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	0	0	0	1	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	1	0	0
Grand Total	**0**	**0**	**21**	**1**	**3**

Ten FP projects evaluated juvenile fish passage at a removed or modified barrier using the post-treatment FB checklist. Twenty-four of the 25 allowed for juvenile fish passage. Quiota Creek Fish Passage Improvement at Crossing 9 consisted of two boulder weirs designed for grade control and is likely a temporal barrier to juvenile steelhead (Table 20).

Table 20. If an objective, does the feature provide juvenile fish passage?

Project Name	Not Applicable	Don't know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	0	0	1
Panther Creek Barrier Removal Project	0	0	0	0	1
Circle G Ranch Fish Passage Restoration	0	0	0	0	2
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	0	0	14
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	0	0	2
Little Springs Migration Barrier Removal	0	0	0	0	1
Fish Passage Improvements at Crossing 5, Quiota Creek	0	0	0	0	1
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	0	0	1
Fish Passage Improvement at Crossing 9, Quiota Creek	0	0	1	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	0	0	1
Grand Total	**0**	**0**	**1**	**0**	**24**

Ten FP projects evaluated juvenile fish passage at a removed or modified barrier using the post-treatment FB checklist. No barrier remained for juvenile fish passage

at 21 features. Gulch C Coho Salmon Fish Passage Improvement Project consisted of two crossing replacements, of which flow was subsurface at post-treatment and both barriers were categorized as temporal to juvenile fish. Quiota Creek Fish Passage Improvement at Crossing 9 consisted of two boulder weirs designed for grade control and is likely a temporal barrier to juvenile steelhead.

Table 21. Does any barrier to targeted juvenile species remain at the feature?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Alpine Creek Fish Passage Project	0	0	1	0	0
Panther Creek Barrier Removal Project	0	0	1	0	0
Circle G Ranch Fish Passage Restoration	0	0	2	0	0
Mid-Klamath Tributary Fish Passage Improvement Project	0	0	14	0	0
Gulch C Coho Salmon Fish Passage Improvement Project	0	0	0	1	1
Little Springs Migration Barrier Removal	0	0	1	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	0	0	1	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	1	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	0	0	0	0	1
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	1	0	0
Grand Total	**0**	**0**	**22**	**1**	**2**

IN Checklists

Using the IN checklist, features are given a feature type code that corresponds with feature types as described in Table 22.

Table 22. Feature Type Codes and Feature Types.

Feature Type Code	Feature Type
203	Log streambank stabilization structure (other)
301	Log, rootwad, boulder HI combinations

Feature Type Code	Feature Type
303	Log/rootwad structures (other)
310	Boulder weir
313	Boulder wing-deflectors (constrictor) – single
330	Log weir
331	Log wing-deflectors (constrictor) single
332	Log wing-deflectors (constrictor) – opposing
333	Single log structure (digger/cover log)
334	Divide logs
335	Multiple log structure (spider logs/cover log complex)
340	Cover rootwads
341	Cover logs (horizontal)
344	Unanchored large woody debris

Most feature types monitored using the IN checklists were multiple log structures (spider logs/cover log complex; 335) giving it the most diverse ratings, partly through sheer abundance (Table 23). Seventy-six spider log/cover log complex structures received a good rating. One was not evaluated at post-treatment and did not receive a feature rating. Sixty-nine features received a good rating, and five features received a fair rating. Two features received a poor rating: one log, rootwad, boulder combination feature (301) and one boulder weir feature (310). One rootwad cover feature (340) received a fail.

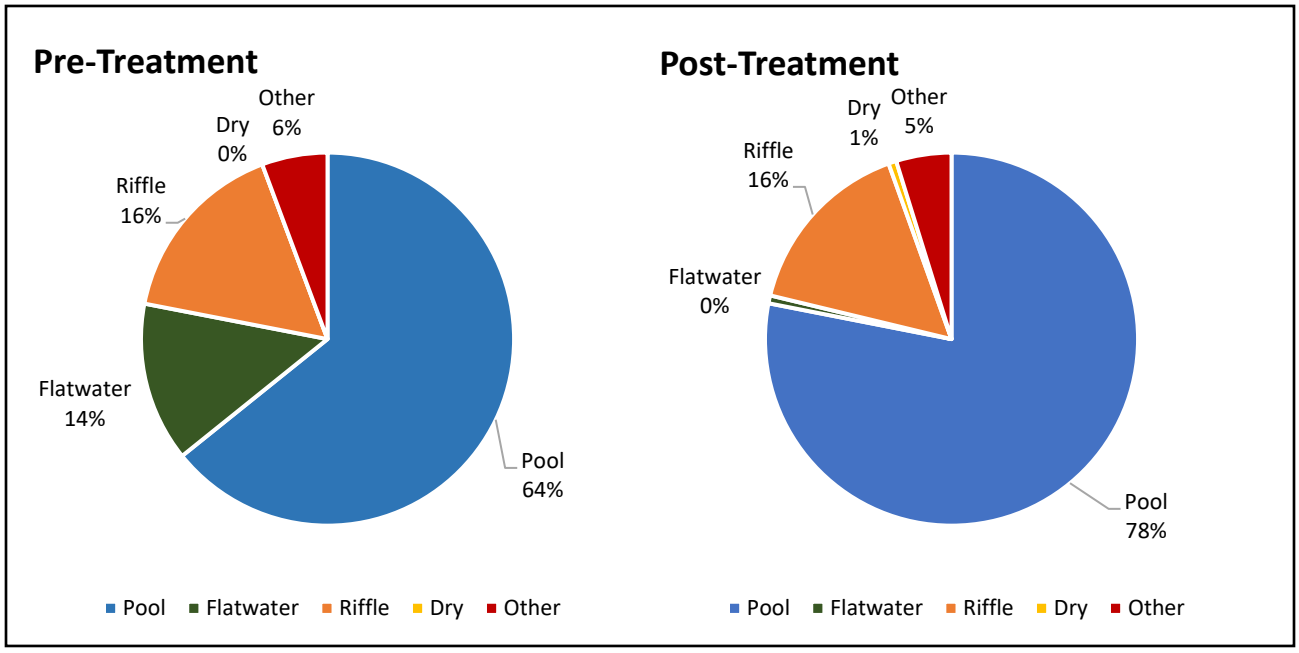
Table 23. Feature types that received post-treatment effectiveness monitoring, 2022-2023.

Project Name	130	155	301	302	303	310	330	332	333	335	340	341	343	344
Panther Creek Barrier Removal Project	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Circle G Ranch Fish Passage Restoration	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Mid-Klamath Tributary Fish Passage Improvement Project	14	0	0	0	0	0	0	0	0	0	0	0	0	0
North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	0	0	0	0	0	0	0	1	0	22	0	0	0	0
San Geronimo Valley Landowner Assist Program-Restoring Coho Habitat	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	0	0	0	0	0	0	0	0	8	7	0	1	0	0
Tannery Creek Large Wood Recruitment Project 2018	0	0	0	0	3	0	0	0	15	0	0	0	1	0
Gulch C Coho Salmon Fish Passage Improvement Project	0	4	0	0	0	0	0	0	0	0	2	0	0	0

Project Name	130	155	301	302	303	310	330	332	333	335	340	341	343	344
Fish Passage Improvement at Crossing 4, Quiota Creek	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	1	1	0	0	1	0	0	0	0	0	0	0	0
James Creek Coho Stream Habitat Enhancement Project	0	0	0	0	0	0	0	0	0	25	1	0	0	0
East Branch North Fork Big River Coho Habitat Enhancement Project	0	0	0	0	4	0	0	0	4	20	1	0	0	0
Morrison Creek Tributary Barrier Removal Project	0	0	0	0	1	0	5	0	0	0	0	0	0	0
Grand Total	**14**	**5**	**3**	**1**	**8**	**4**	**5**	**1**	**27**	**76**	**6**	**1**	**1**	**1**

The IN checklists are primarily used for HI projects where the goal of the project is to improve habitat and stream morphology. The percentage of pool habitat types evaluated using the IN checklist increased from 64% to 78% (Figure 2).

Figure 2. Level habitat type collected within the post-treatment IN checklist using pre-treatment conditions as a comparison.



Eighty-six percent of the IN features increased instream shelter rating and were primarily HI projects consisting of LW features (Table 24). Instream Habitat Restoration checklists can also be used for FP projects where grade control bolder/log weirs are constructed within the channel. Fifteen of the IN features implemented on FP projects did not have an objective to increase instream shelter rating and were not applicable. Gulch C Coho Salmon Fish Passage Improvement Project implemented two instream structures that consisted of rootwads and successfully improved instream shelter rating.

Table 24. If an objective, did the feature increase instream shelter rating?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Panther Creek Barrier Removal Project	0	0	0	0	3
Circle G Ranch Fish Passage Restoration	0	0	1	0	0

Project Name	Not Applicable	Don't Know	No	Partially	Yes
North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	0	0	1	1	21
San Geronimo Valley Landowner Assistant Program-Restoring Coho Habitat	1	0	0	0	1
Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	0	0	0	0	16
Tannery Creek Large Wood Recruitment Project 2018	0	0	2	0	17
Gulch C Coho Salmon Fish Passage Improvement Project	4	0	0	0	2
Fish Passage Improvement at Crossing 4, Quiota Creek	1	0	0	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	2	0	0	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	1	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	1	0	0	0	2
James Creek Coho Stream Habitat Enhancement Project	0	0	0	0	25
East Branch North Fork Big River Coho Habitat Enhancement Project	0	0	0	0	29
Morrison Creek Tributary Barrier Removal	4	0	0	0	2
Grand Total	**15**	**0**	**4**	**1**	**118**

Increasing maximum residual depth is a common objective for added instream structures. Fifty-three percent of the monitored features displayed an increased maximum residual depth from pre- to post-treatment results (Table 25). Twenty-five percent of feature maximum residual depths stayed the same or decreased. A negative response documents a decreased or unchanged maximum residual depth, which may be due to a lack of large winter storms. A response of Not Applicable indicates the Grantee did not list increasing maximum residual depth as an objective of the feature and is mainly from FP projects. Partially indicates the overall maximum residual depth increased but the structure caused aggradation in another portion of the habitat unit, or the feature has more than one structure in a long habitat unit, and it scoured at one structure but not the other.

Table 25. If an objective, did the feature increase maximum residual depth in the treatment area?

Project Name	Not Applicable	Don't know	No	Partially	Yes
Panther Creek Barrier Removal Project	3	0	0	0	0
Circle G Ranch Fish Passage Restoration	0	1	0	0	0
North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	0	0	14	0	9
San Geronimo Valley Landowner Assistant Program- Restoring Coho Habitat	1	0	0	0	1
Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	2	0	6	2	6
Tannery Creek Large Wood Recruitment Project 2018	0	0	6	0	13
Gulch C Coho Salmon Fish Passage Improvement Project	5	1	0	0	0
Fish Passage Improvement at Crossing 4, Quiota Creek	1	0	0	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	2	0	0	0	0
Fish Passage Improvement at Crossing 9, Quiota Creek	1	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	1	0	1	0	1

Project Name	Not Applicable	Don't know	No	Partially	Yes
James Creek Coho Stream Habitat Enhancement Project	1	1	4	0	20
East Branch North Fork Big River Coho Habitat Enhancement Project	4	0	2	0	23
Morrison Creek Tributary Barrier Removal Project	6	0	0	0	0
Grand Total	**23**	**7**	**33**	**2**	**73**

IN checklists are primarily used for Instream Habitat Improvement (HI) projects where the goal of the project is to improve habitat and stream morphology by adding LW. All six HI projects increased wood within the treatment area as expected because it is the primary project goal (Table 26). The remaining seven fish passage projects used IN checklists to evaluate grade control bolder/log weirs constructed within the channel and did not have an objective to increase LW and were not applicable.

Table 26. If an objective, did the feature increase large wood count in the treatment area?

Project Name	Not Applicable	Don't know	No	Partially	Yes
Panther Creek Barrier Removal Project	0	0	0	0	3
Circle G Ranch Fish Passage Restoration	0	0	1	0	0
North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project	0	0	0	0	23
San Geronimo Valley Landowner Assistant Program-Restoring Coho Habitat	1	0	0	0	1
Salmon Creek - Salmonid Habitat Enhancement with Accelerated Recruitment (SHEAR)	0	0	0	0	16
Tannery Creek Large Wood Recruitment Project 2018	0	0	0	0	19
Gulch C Coho Salmon Fish Passage Improvement Project	4	0	2	0	0

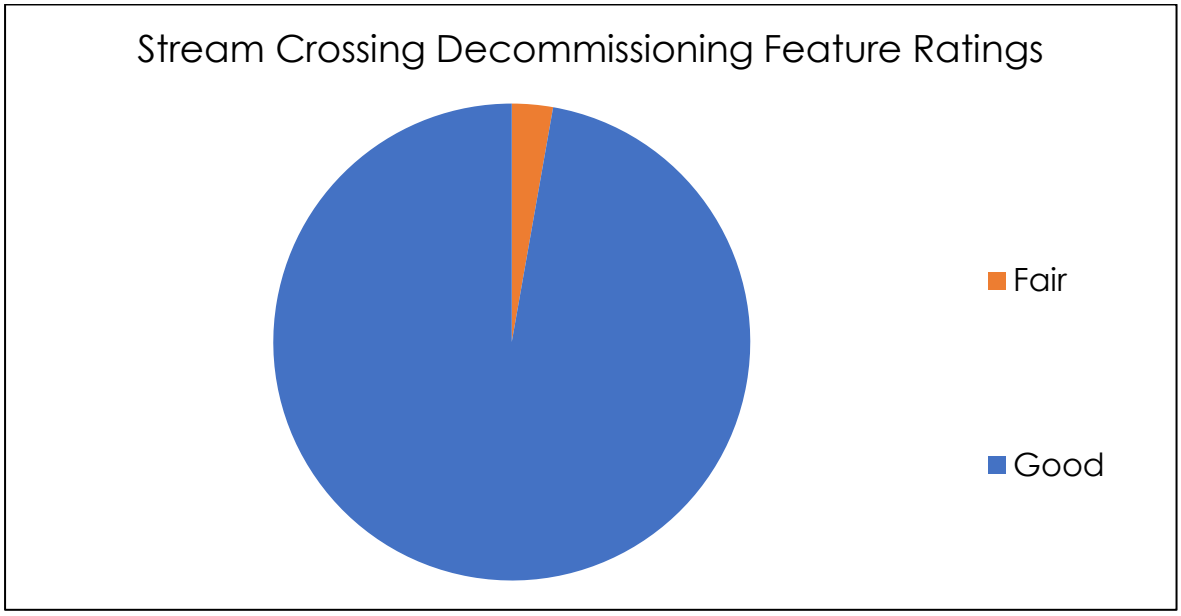
Project Name	Not Applicable	Don't know	No	Partially	Yes
Fish Passage Improvement at Crossing 4, Quiota Creek	1	0	0	0	0
Fish Passage Improvements at Crossing 5, Quiota Creek	1	0	0	0	0
Fish Passage Improvement at Crossing 8, Quiota Creek	1	0	0	0	1
Fish Passage Improvement at Crossing 9, Quiota Creek	1	0	0	0	0
Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	0	0	2	0	1
James Creek Coho Stream Habitat Enhancement Project	0	1	0	0	24
East Branch North Fork Big River Coho Habitat Enhancement Project	0	0	0	0	29
Morrison Creek Tributary Barrier Removal	4	0	0	0	2
Grand Total	**13**	**1**	**5**	**0**	**118**

CD Checklists

One project on Julias Creek had both road decommissioning and a road upgrade segment. During this contract cycle, four road decommissioning projects were monitored for post-treatment effectiveness. All projects used the same checklists to evaluate road decommissioning effectiveness, including RD, CD, and US.

Thirty-six stream crossing decommissioning features were evaluated at post-treatment, of which 35 received a good rating, and one received a fair rating because of incision upstream and head cutting downstream of the treatment area. (Figure 3). No features had excessive erosion or incision within the treatment area, therefore no poor ratings were given.

Figure 3. Ratings of stream crossing decommissions using a CD checklist, 2022-2023.



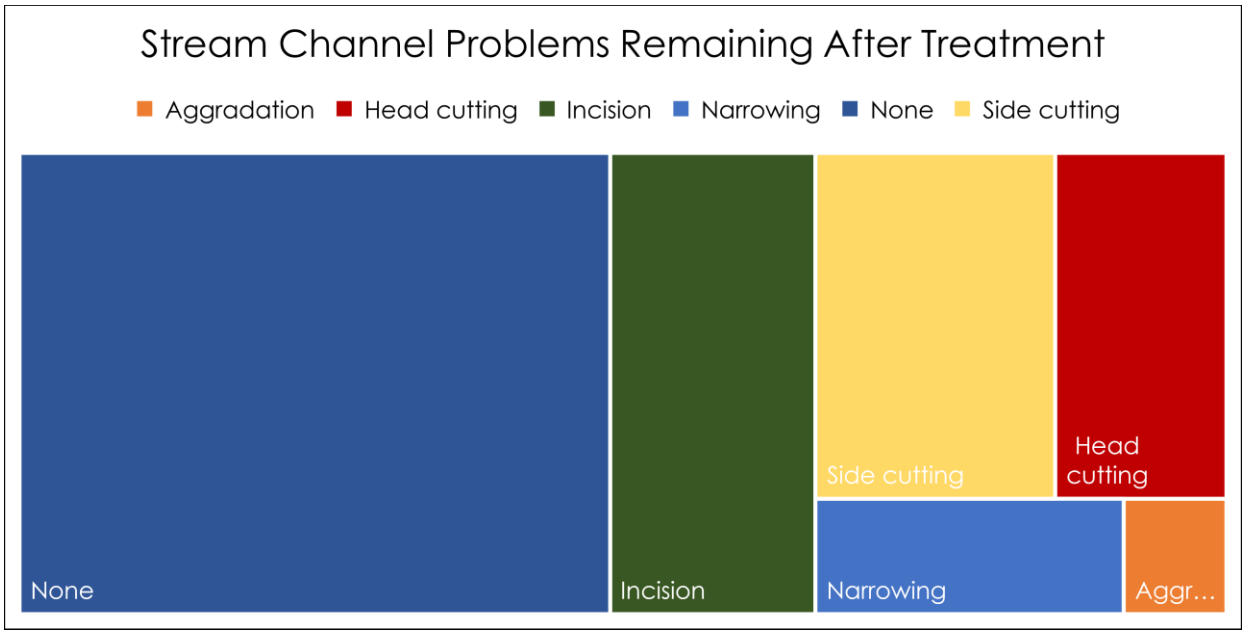
Four HU projects received post-treatment monitoring during the contract period (Table 27). Twenty-nine of the decommissioned crossings that received monitoring did not show signs of sediment delivery. Three crossings on Soldier Creek Sediment Reduction & Salmonid Recovery Project, and four on Julias Creek Sediment Reduction and Salmonid Recovery Project noted signs of sediment deliver to the stream since implementation.

Table 27. Has there been sediment delivery from the crossing (excluding remaining fill) since implementation?

Project Name	Not Applicable	Don't Know	No	Partially	Yes
Redwood Creek Habitat Protection Project	0	0	4	0	0
Hare Creek and Bunker Gulch Road Decommissioning Implementation Project	0	0	16	0	0
Soldier Creek Sediment Reduction & Salmonid Recovery Project	0	0	5	0	3
Julias Creek Sediment Reduction and Salmonid Recovery Project	0	0	4	0	4
Grand Total	**0**	**0**	**29**	**0**	**7**

The CD checklists ask if there are channel problems remaining within the treated area. Thirty-eight percent observed no problems remaining, and 62% found remaining channel problems (Figure 4). The most common remaining problems were channel incision, side cutting and head cutting. Other problems reported were narrowing and aggradation. These problems are often due to not excavating the stream channel enough, steep gradients through the crossing, exposed soils after excavation, and LW or boulders within the crossing that alter hydrology and erode banks.

Figure 4. Common stream channel problems observed at stream crossing decommissioning features after implementation.



Feature and Overall Project Ratings

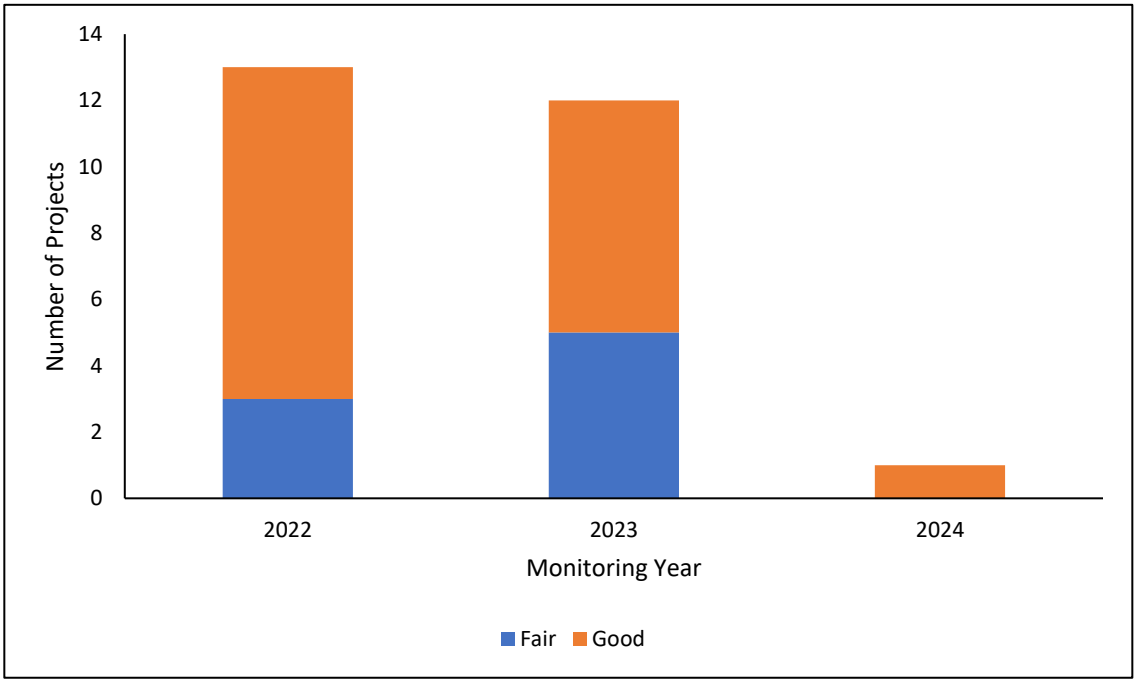
Each feature within a project receives a feature rating of excellent, good, fair, poor, or fail during post-treatment evaluation. Scores are given based on feature condition and how well it achieved the goals and objectives set by the Grantees. During the contract period, 333 project features were monitored and given a feature rating (Table 28). Two features received an excellent rating in 2022. Most features received a good rating totaling 296. Twenty-nine received a fair and five a poor. Only one feature, at the Fish Passage Improvement at Crossing 4, Quiota Creek received a fail in 2023.

Table 28. Post-treatment feature ratings given for all projects monitored during the contract cycle.

Monitoring Year	Excellent	Good	Fair	Poor	Fail
2022	2	163	14	2	0
2023	0	133	15	3	1
2024	0	11	0	0	0
Total	**0**	**307**	**29**	**5**	**1**

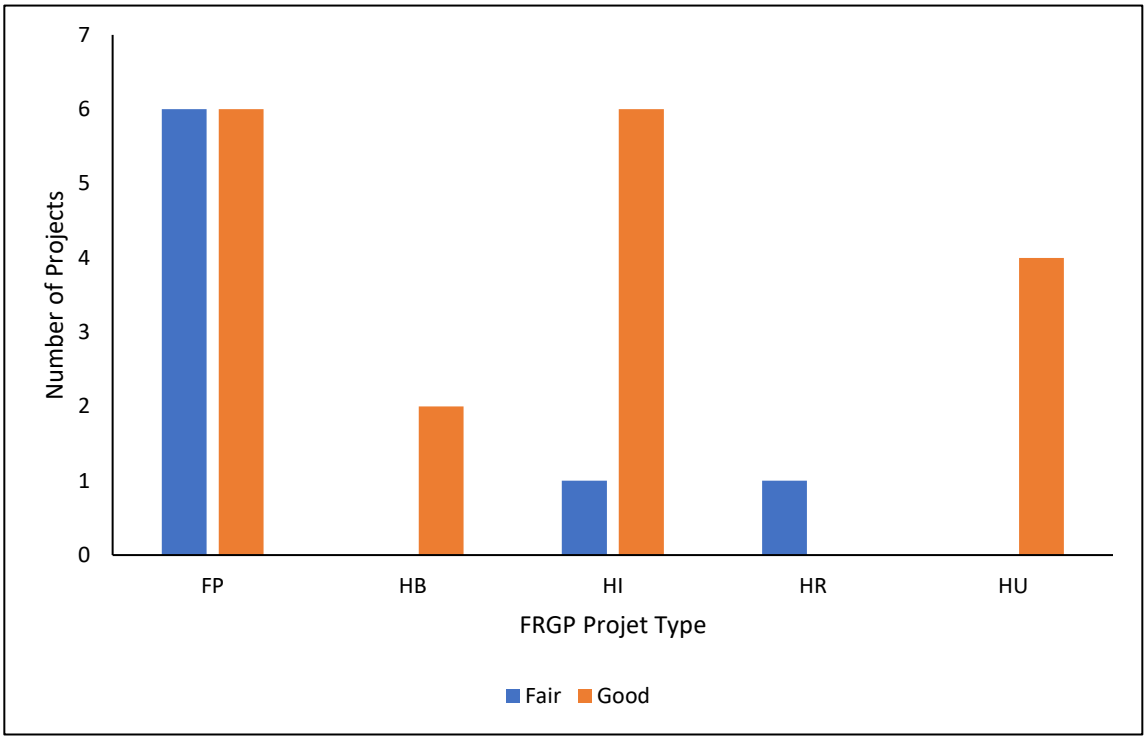
Twenty-six projects were monitored for post-treatment effectiveness during the contract period and received overall project effectiveness ratings. In 2022 ten projects received a good rating and three a fair rating. In 2023 seven projects received a good rating and five a fair rating. One project was monitored for post-treatment effectiveness in 2024 under this contract and received a good rating. No projects received an excellent, poor or fail rating (Figure 5).

Figure 5. Overall project effectiveness ratings by year.



All HB and HU projects received a good project rating (Figure 6). Six FP projects, one HI project, and one HR project also received fair project ratings.

Figure 6. Overall project effectiveness ratings by project type.



Short-Form Case Study Development

Short-form case study reports were completed for select projects receiving post-treatment monitoring throughout the contract term to summarize project features and ratings one to three winters after completion. They present background information like project location and objectives, implementation dates, and post-treatment monitoring results, as well as an explanation of how feature and overall project ratings were assigned. They present post-project results concisely to state and federal agencies, restoration groups, and Grant Managers. Where relevant, they summarize the ability of project features such as culvert replacements or LW structures to perform as expected and remain stable through winter storm conditions. A representative sample of project types are selected for case studies annually from the preceding field season. Previous case studies can be viewed at:

https://www.calfish.org/ProgramsData/ConservationandManagement/RestorationProjects.aspx.

Discussion of Effectiveness Monitoring

Each year, FRGP projects were selected to receive effectiveness monitoring in accordance with FRGP permitting requirements stating that 10% of projects must receive effectiveness monitoring. This requirement was exceeded as over 40% of

implementation projects per year were selected. One project, Q2130401 Buckeye Creek Storm-Proofing and Habitat Protection Project began pre-treatment monitoring in 2022 but was canceled in 2023 and will not receive post-treatment monitoring in the future.

Over the course of this contract term, nine projects received pre-treatment monitoring and 26 received post-treatment monitoring. During pre-treatment monitoring, a total of 161 checklists were used to monitor the features of the nine projects. During post-treatment monitoring, a total of 344 checklists were used to monitor the various project features. The 26 projects monitored during post-treatment received overall project effectiveness ratings, all of which were either Good (n = 18) or Fair (n = 8). This indicates that the projects monitored for effectiveness had met most of their restoration goals.

Ten projects assessed fish passage at barriers using FB checklists, at post-treatment and 70% had no remaining passage problems to targeted juvenile or adult salmonid species. No former barriers and all modified barriers remained in the as-built configurations with no new accumulated barriers. Three projects had juvenile or adult fish passage issues. Quiota Creek Fish Passage Improvement at Crossing 9 had significant channel incision and scouring downstream and between the rock weirs constructed for grade control. As a result, the rock weirs were fully exposed, and flow was travelling behind and through gaps in the large boulders. This is likely a temporal barrier to adult and juvenile fish passage. Gulch C Coho Salmon Fish Passage Improvement Project consisted of two crossing replacements that both had subsurface flow and were recorded as temporal barriers to adult and juvenile fish passage. Subsurface flow through a crossing could be a sign that at implementation the channel was not excavated down to grade. It is more likely that the stream naturally dries during summer. Tom Martin Creek, a site that is part of the Mid- Klamath Fish Passage Improvement Project constructed a concentrated channel near the mouth for juvenile fish passage. The channel appeared too narrow and without enough flow for adult fish passage and was likely a temporal barrier to adults until flows rose.

Fifteen projects implemented instream structures and used the IN checklist to determine if maximum residual depths, instream shelter ratings and LW counts increased. Five projects were HI projects that implemented large wood structures and nine were FP projects. Pool depths increased primarily with LW projects because it was a specific goal of the project. Overall, 55% of these features increased residual pool depth within the feature and 25% did not. Twenty-three percent of pools, primarily in FP projects, were recorded as partially, unknown or not applicable for meeting the objective of increasing residual pool depth. Eighty-six percent of all features increased or partially increased instream shelter rating. Three percent, mainly HI projects that added LW, did not. Increasing instream

shelter rating was not an objective for FP projects and therefore it was not applicable for 13% of projects.

Not all questions on a checklist will be applicable to a project feature. The goal is to use the checklist questions that best illustrate and evaluate the feature that is being monitored. For example, IN checklists are primarily used for HI projects where the goal of the project is to improve habitat and stream morphology. The IN checklists are also used for FP projects where grade control boulder/log weirs are constructed within the channel. It is not the goal of FP projects to change habitat, increase instream shelter rating, LW or maximum residual depth, therefore many of the IN questions are not applicable. The IN checklists are used for FP projects because they capture bank and channel problems when instream treatments are constructed for fish passage.

Thirty-six decommissioned stream crossings were monitored and 36% still had channel problems after implementation. The most common stream channel problems that remained were side cutting, incision and head cutting. These problems are often due to not excavating the stream channel enough, steep gradients through the crossing, exposed soils after excavation, and LW or boulders within the crossing that altered hydrology and eroded banks.

During the contract period, 82% of selected implemented features were monitored for post-treatment effectiveness. A common issue for features that did not receive post-treatment monitoring was locating the features and identifying what was implemented confidently. In some cases, changes in the plans were not well documented by Grantees and Grant Managers. Grant Managers should ensure Grantees follow the conventions specified in the proposal solicitation notice (PSN) including numbering features using station numbers. Grant Managers should complete implementation monitoring checklists in the field and note any changes fromthe original plans. Grant Managers should only approve complete final reports with appropriate maps and as-builts using the PSN conventions. At post-treatment monitoring on Julias Creek Sediment Reduction and Salmonid Recovery Project decommissioned roads were treated with slash and vegetation regrowth so that reaching features by foot was very difficult and slow. Consequently, only three of seven decommissioned roads and eight of 27 decommissioned stream crossings were monitored at post-treatment.

Effectiveness monitoring is a short-term assessment of restoration projects occurring three years after implementation. Short term rapid assessment is effective when evaluating fish passage, instream barrier modification, or upslope watershed restoration projects where results are an immediate improvement after implementation. For these types of projects monitoring questions focus more on meeting intended objectives and looking at current conditions and problems. In

addition, instream habitat and riparian restoration projects address if habitat has been improved by restoration. These processes may take much longer than three years to detect a physical or biological response. Bilby et al. (2023) stated that the slow response of environmental processes to restoration actions can lead to a premature conclusion that a project has been ineffective.

Attachment 12 Validation Monitoring

Methods for Validation Monitoring

Validation monitoring surveys on HI, HB, and FB projects selected for effectiveness monitoring consist of three components: 1) juvenile snorkel surveys, 2) adult spawning ground surveys, and 3) juvenile minnow trap sampling. An HU project can also include validation monitoring if it has an instream component. All three validation project types receive snorkel surveys three years after implementation. Adult spawning surveys are limited to fish passage projects (FP and HB) and can be monitored the first winter after implementation. Surveys may continue until fish or redd presence is documented above the former barriers. Minnow trapping is conducted when snorkel surveys are not a suitable option due to poor water quality or visibility, or to document for winter non-natal rearing.

Juvenile Snorkel Surveys

Snorkel surveys focus on juvenile salmonid presence in stream reaches directly associated with proposed and/or completed restoration treatments following protocols described in Duffy (2005) and O'Neal (2007). Methods used by the North Coast (RGP-12 permit region) and South Coast (RGP-78 permit region) MESHR crews differ slightly and are described in detail below.

North Coast MESHR Snorkel Methods

For HB and FP projects, up to five pool units are randomly selected immediately upstream and downstream of a migration barrier removal location. For HI projects, up to five randomly selected pool and/or run habitat units adjacent to proposed LW structure locations are selected for snorkeling at pre-treatment and revisited following three winters of higher flows. Minimum qualifications to snorkel habitat units include maximum residual depth ≥ 0.8 ft, average wetted width ≤ 16.4 ft, and visibility ≥ 4 ft. If the average wetted width of a pool or flatwater run is ≥ 16.5 ft, maximum depth must be ≥ 1.5 ft.

Each unit is surveyed from downstream to upstream by one diver in a single pass (to minimize fish and sediment disturbance) during daylight hours. A waterproof flashlight is used to view undercut banks or other dimly lit areas. Fish are identified to species when able, grouped by age class, and enumerated. Age class designation is assigned according to visually estimated lengths: 0-3 inches (in) = young-of-year (YOY); 3-6 in = 1+ years of age; > 6 in = 2+ years of age. Physical dimension measurements (average width, maximum length, and maximum residual depth) for each unit are recorded. Air and water temperatures are recorded at each site prior to entering the water and again if water temperatures could increase to stressful levels (> 68° Fahrenheit [F]).

Coho Salmon and steelhead trout are the primary targeted species for validation monitoring; however, Chinook Salmon and coastal cutthroat trout (*Oncorhynchus clarkii clarkii)* are also recorded. Chinook Salmon may be underrepresented because surveys are often conducted after most juveniles have begun migrating to the ocean.

South Coast MESHR Snorkel Methods

In certain situations, South Coast MESHR 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 southern California streams. Additionally, the stream habitat within and near project sites often dries during the summer snorkel season. So, any upstream available habitat must be 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 ft or greater are deemed of adequate depth to snorkel 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 percentage 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 thalweg. The percentage of surface area that contained exposed substrate (usually comprised of gravel, boulders, or bedrock) is estimated for each unit. Exposed substrate included 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 is poor visibility, two is adequate visibility, and three is 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. Stream flow is measured using a flow meter or recorded from a nearby United States Geological Survey gauge.

Adult 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* (2012b 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 Southern California 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. 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 Global Positioning System (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 from spawner surveys conducted by partners presented in this report may use different methods, including surveys of different stream lengths or frequency than those conducted by MESHR.

Minnow Trapping Surveys

The goal of minnow trapping surveys is to determine juvenile salmonid presence in stream reaches directly associated with migration barrier removal locations or instream features when snorkeling is not a viable option. Up to five minnow traps are baited with sterilized salmon roe and left in calmer water with some cover. Individual traps are deployed for approximately two hours and all fish captured are documented and released. Minnow trapping surveys may also be used during the winter to evaluate off channel rearing.

Data Analysis

All validation monitoring data is collected on paper datasheets or a tablet with custom Pendragon forms. Data is entered into Excel and undergoes quality control to correct potential errors.

Snorkel survey data are analyzed to calculate salmonid size distributions and densities, and total and mean habitat measurements. To examine salmonid numbers, fish density is calculated as the number of fish per square foot using the total number of fish observed and the total area of habitat snorkeled. To evaluate salmonid life stage diversity, the total number of fish per size class is calculated. To examine wetted habitat the total length surveyed, total unit area, mean unit area, and mean unit maximum residual depth are calculated. South Coast MESHR data receives further calculations: for each mean the standard error (± SE) is calculated. All analyses are completed using either Excel or R (version 4.1.1, R Core Team 2021) and R Studio (version 1.4.1717, RStudio, Inc 2021).

Spawning survey data are analyzed to determine salmonid presence and distribution. Southern California spawning data are further analyzed to determine 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 trout or resident rainbow trout. Spawner survey data analyses are completed using Excel (Northern California) and R software (Southern California).

Results of Validation Monitoring

Validation monitoring results reported here are through April 30, 2024.

Juvenile Snorkel Surveys

During this contract cycle three projects received pre-treatment snorkel validation monitoring and nine projects received post-treatment snorkel surveys (Table 29).

Table 29. Projects that received snorkel validation monitoring during the contract term from February 1, 2022, through April 30, 2024.

Grant Number	Project Title	Project Type	Monitoring Type
Q2110505	Scott Bar Mill Creek Fish Passage Improvement Project	FP	Pre
Q2140409	Weston-Champagne Cachagua Creek Fish Passage Project	FP	Pre
Q2050905	Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	FP	Pre
P1710509	North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement project	HI	Post
P1810515	Panther Creek Barrier Removal Project	FP	Post
P1830401	Tannery Creek Large Wood Recruitment Project	HI	Post
P1810504	Gulch C Coho Salmon Fish Passage Improvement Project	FP	Post
P1610504	James Creek Coho Stream Habitat Enhancement Project	HI	Post
Q1910513	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	HI	Post
D1450006	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal	FP	Post

Grant Number	Project Title	Project Type	Monitoring Type
P1450010	Circle G Ranch Fish Passage Restoration	FP	Post
Q1910506	Morrison Creek Tributary Barrier Removal	FP	Post

Pre-Treatment Snorkel Survey Observations

Scott Bar Mill Creek Fish Passage Improvement Project

This project proposed to restore Coho Salmon access to three miles of habitat in the Scott River. Proposed treatment includes eliminating a partial rock barrier at the confluence by extending lower Mill Creek. Removing a cement crossing 200 ft upstream of the mouth that is a full barrier and replacing it with a free span bridge was also part of the proposal.

On June 27, 2023, five pools were snorkeled, four below the bridge and one above. Coho Salmon were only present in the two lowest pools, but trout were observed throughout, including nine trout above the barrier. The density of Coho Salmon throughout the surveyed units was 0.007 fish/ft² and the density of trout was 0.081fish/ft² (Table 30).

Table 30. Scott Bar Mill Creek Fish Passage Improvement Project pre-treatment snorkel validation survey data.

Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Unknown Salmonid species	Unknown Salmonid (Fish/ft^2)
225.4	1.06	82	6	3	0.081	8	0	0.0070	1	0.0010

Weston-Champagne Cachagua Creek Fish Passage Project

This project proposed to remove a partial barrier to steelhead migration on Cachagua Creek by replacing an existing concrete ford with a single span bridge. This will restore access to 8.3 miles of upstream steelhead habitat.

Five habitat units were snorkeled within the treatment area, three below and two above the current crossing. The total area surveyed was 1,969 ft², with an average unit area of 393.8 ft² and average maximum residual

depth of 1.1 ft. Juvenile trout were observed in every habitat unit, with 85 trout observed below and 71 above the current barrier. Trout density in the surveyed units was 0.079 fish/ft² (Table 31).

Table 31. Weston-Champagne Cachagua Creek Fish Passage Project pre-treatment snorkel validation data.

Survey Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
7/19/2023	5	393.8	1.1	152	4	0	0.0792

Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project

This project proposed to improve fish passage at a total barrier by replacing a culvert with a bridge and opening access to 12 miles of spawning and rearing habitat for steelhead trout at all life stages within the Santa Margarita River watershed. The channel will be regraded and reconstructed to match surrounding stream grade and substrate composition.

Five pools were snorkeled near the treatment area, three below and two above the current crossing. The total area surveyed was 174,827 ft², with an average pool area of 34,965 ± 20,016 ft² and average maximum residual depth of 4.4 ± 1.4 ft. No trout were observed during the survey (Table 32). Numerous invasive fish species, including common carp (*Cyprinis carpio*), black bass (*Micropterus* spp.), bullhead catfish (*Ameiurus* sp.), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*) were observed.

Table 32. Pre-treatment snorkel validation monitoring results for the Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project in 2022.

Survey Date	No. of Units Surveyed	Avg Unit Area Surveyed (ft^2)	SE (ft^2)	Avg Max Residual Depth (ft)	SE (ft)	Trout Observations	Trout Density (fish/ft^2)
6/28/2022	5	34,965	20,016	4.4	1.4	0	0

Additionally, high water temperatures up to 85°F were recorded at the end of the snorkel survey, which would likely limit juvenile steelhead from utilizing this part of the river as summer habitat. Although studies have shown that steelhead in southern California potentially have higher heat preferences and tolerances than their northern counterparts, the temperatures observed during the snorkel survey were much higher than the accepted 24° C (75° F) heat tolerance limit for trout (Spina 2007).

Post-Treatment Snorkel Survey Observations

North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project

This project included 26 instream features consisting of 76 pieces of large wood over 3,168 ft (0.60 miles) of North Fork Noyo and Dewarren creeks to improve the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout.

Five pools were surveyed at both pre- and post-treatment. Average survey pool area decreased from 338 to 280 ft^2 from pre- to post-treatment, and average maximum residual depth (2.0 to 2.1 ft) remained about the same. Trout densities decreased from 0.010 fish/ft^2 at pre-treatment to 0.0036 fish/ft^2 at post-treatment (Table 33). Coho Salmon densities increased from 0.011 at pre-treatment to 0.033 fish/ft^2 at post-treatment. Combined fish densities at pre-treatment were 0.021 fish/ft^2 and increased to 0.036 fish/ft^2 at post-treatment.

Table 33. North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	7/30/2019	5	338.0	2.0	14	2	1	0.01	19	0	0.011
Post	7/13/2022	5	280.2	2.1	3	2	0	0.0036	46	0	0.033

Panther Creek Barrier Removal Project

This project removed an abandoned road crossing and gauging station that restricted salmonid passage, while also improving instream habitat conditions by installing four large wood habitat structures. The barrier removal provides approximately 4.5 miles of instream habitat access to Coho Salmon and other salmonids.

Four pools were surveyed at both pre- and post-treatment, two pools below the crossing and two pools above at pre-treatment, and one pool below the crossing and three above at post-treatment. The surveyed average pool area at pre-treatment was 286 ft^2 and decreased to 244 ft^2 at post-treatment. The average maximum residual depth was 1.5 ft at pre-treatment and increased to1.8 ft at post-treatment. Trout densities were 0.018 fish/ft^2 at pre-treatment and increased to 0.027 fish/ft^2 at post-treatment (Table 34). The apparent trout density increases were driven by more 1+ and 2+ trout observations while YOY numbers declined. No Coho Salmon were observed during either survey.

Table 34. Panther Creek Barrier Removal Project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	6/7/2019	4	286.0	1.5	18	3	0	0.018	0	0	0
Post	6/29/2022	4	244.4	1.8	7	14	5	0.027	0	0	0

Tannery Creek Large Wood Recruitment Project 2018

This project included 43 key pieces of large wood at 42 features over 2,045 ft of Tannery Creek to enhance overall channel complexity to improve rearing and spawning habitat for Coho Salmon.

Five pools were surveyed at pre- and post-treatment with average survey pool areas of 378 ft^2 and 362 ft^2, respectively. Average maximum residual depth at pre-treatment was 1.7 ft and increased to 2.3 ft at post-treatment. Overall fish densities were lower (0.034 fish/ft^2 decreased to 0.0094 fish/ft^2) as Coho Salmon decreased (0.016 fish/ft^2 to 0.0094 fish/ft^2) and trout were absent at post-treatment (0.019 fish/ft^2 to 0.000 fish/ft^2) (Table 35).

Table 35. Tannery Creek Large Wood Recruitment Project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	8/22/2019	5	378	1.7	32	3	0	0.019	30	0	0.016

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Post	7/20/2022	5	361.54	2.3	0	0	0	0	17	0	0.0094

Gulch C Coho Salmon Fish Passage Improvement Project

The project restored access for adult and juvenile Coho Salmon and steelhead trout to approximately 1.3 miles of spawning and rearing habitat. Two salmonid migration barriers were replaced and improved the geomorphic function of Gulch C.

The pre-treatment surveys were completed in 2020 and the post-treatment surveys were completed in 2023. Total pools snorkeled increased from five to six at post-treatment though the stream length sampled remained the same. During post-treatment, three pools were snorkeled downstream of the lower former barrier, one pool in between the former barriers, and two upstream of the upper former barrier. Total area surveyed and average maximum residual depth decreased because of the removal of a large and deep plunge pool below the lower crossing that developed from a perched culvert. Fish numbers increased overall though all fish were observed below the lower crossing (Table 36). Trout densities increased at post-treatment from zero to 0.22 fish/ft^2 and Coho Salmon densities increased from 0.0018 fish/ft^2 to 0.30 fish/ft^2.

Table 36. Gulch C Coho Salmon Fish Passage Improvement Project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	6/2/2020	5	114.1	2.10	0	0	0	0	1	0	0.0018

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Post	5/31/2023	6	75.0	0.98	100	0	0	0.22	135	0	0.30

James Creek Coho Stream Habitat Enhancement Project

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 28 instream features using 93 pieces of large wood along a total of 3,168 ft (0.88 miles) of James Creek.

Five pools were surveyed at both pre- and post-treatment and both average survey area and average maximum residual depth increased since implementation. Trout numbers decreased in both total numbers and fish per square ft, while Coho Salmon increased in both (Table 37).

Table 37. James Creek Coho Stream Habitat Enhancement Project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	9/16/2019	5	733.8	1.72	70	1	0	0.019	73	0	0.020
Post	6/15/2023	5	786.5	3.08	12	6	1	0.0048	131	19	0.038

East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 38 instream features using 95 pieces of LW along a total of 5,455 ft (1.03 miles) of East Branch North Fork Big River.

Pre-treatment surveys were completed 06/09/2020 and post-treatment surveys were completed 08/28/2023. Five pools were surveyed at both pre- and post-treatment and average maximum residual depth increased since implementation (+ 0.83 ft). Average salmonid numbers per square foot remained the same or slightly increased (Table 38). Overall trout densities decreased from 0.008 fish/ft^2 to 0.005 fish/ft^2, while Coho Salmon densities increased slightly from 0.019 fish/ft^2 to 0.025 fish/ft^2.

Table 38. East Branch North Fork Big River Coho Habitat Enhancement Project pre- and post-treatment snorkel validation survey data.

Survey	Date	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	6/9/2020	665	1.65	25	3	0	0.0084	64	0	0.019
Post	8/28/2023	572.8	2.48	9	6	0	0.0052	55	16	0.025

Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal

This project funded removal of two concrete Arizona crossings that were total or severe temporal barriers to upstream steelhead passage. From 2015 through early 2017, both crossings were replaced with free spanning bridges, restoring access to 4.5 miles of historic spawning and rearing habitat. At both sites, the channel was recontoured to match the natural stream gradient and reconstructed with native boulders and cobble.

In 2022, 2.3 miles of Arroyo Sequit, from the estuary up to a boundary with private property, were snorkeled

during post-treatment validation. Along this survey reach only 22.5% of the instream habitat was wetted at the time and only three habitat units met survey requirements, which were all upstream of both project sites. A total area of 205.6 ft² of stream habitat was snorkeled for an average area of 68.5 ± 34.7 ft² (mean ± SE) and an average maximum residual depth of 1 ± 0.1 ft. No trout were observed during the survey.

In 2023, the same 2.3 miles of Arroyo Sequit were surveyed during post-treatment validation snorkel surveys. At the time of this survey approximately 38.5% of the instream habitat surveyed was wetted. A total of 53 habitat units met survey requirements, which were all upstream of both project sites. A total area of 17,101.7 ft² of stream habitat was snorkeled for an average area of 322.7 ± 37.1 ft² and an average maximum residual depth of 1.5 ± 0.11 ft. No trout were observed during the survey (Table 39). Post-treatment data was collected by MESHR and CDFW in 2022 and 2023, all previous data was collected by CDFW.

Table 39. Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal, post-treatment snorkel validation survey data.

Survey	Date(s)	No. of Units Surveyed	Avg Unit Area (ft^2)	SE (ft^2)	Avg Max Depth (ft)	SE (ft)	Avg Max Residual Depth (ft)	SE (ft)	Trout observations	Trout Density (fish/ft^2)
Post	6/8/2020	20	58.1	7.2	1.2	0.1	NA	NA	0	0
Post	5/5/2021-5/6/2021	23	52	5.5	1.1	0.1	NA	NA	0	0
Post	8/17/2022-8/18/2022	3	68.5	34.7	1.1	0.1	1	0.1	0	0
Post	9/12/2023-10/11/2023	53	322.7	37.09	1.8	0.1	1.5	0.1	0	0

This survey reach was selected because much of the lower portion of Arroyo Sequit, including the area

surrounding both project sites, seasonally dries each year, with summer refugia remaining in the upper watershed. This is also the survey reach used by the CMP, which allows for 2023 and 2022 validation data collected by MESHR to be easily compared with data collected by CDFW in previous years. Snorkel surveys have been conducted annually in Arroyo Sequit by the Resource Conservation District of the Santa Monica Mountains (RCDSMM) from 2005 to 2019 and by CDFW in 2020 and 2021. Surveys conducted by RCDSMM used different methods, so habitat data from these surveys could not be directly compared with data collected by CDFW or MESHR.

Circle G Ranch Fish Passage Restoration

This project removed a total barrier to fish passage on Carpinteria Creek. It consisted of an undersized bridge and approximately 100 ft of concrete lined channel and banks containing several grade control steps. From August 2015 to February 2016, the concrete was removed and the banks and channel were regraded and reconstructed with native material. The undersized bridge was replaced with a larger free spanning bridge, restoring access to 1.3 miles of upstream fish habitat.

The entire 4.21 miles of accessible stream along Carpinteria Creek from the estuary to a total natural barrier to fish passage was surveyed during 2022 post-treatment snorkel survey validation monitoring. Much of this survey reach was dry, with only 25.4% of instream habitat recorded as wet at the time of the survey. A total of 28 habitat units were snorkeled, with a total area of 6,879 ft^2, an average unit area of 245.7 ± 27.5 ft^2 and an average maximum residual depth of 1.9 ± 0.2 ft. No trout were observed during this survey (Table 40). Post-treatment data was collected by MESHR in 2022, all previous data was collected by CDFW.

Table 40. Circle G Ranch Fish Passage Restoration pre- and post-treatment snorkel validation survey data.

Survey	Date(s)	No. of Units Surveyed	Avg Unit Area (ft^2)	SE (ft^2)	Avg Max Depth (ft)	SE (ft)	Avg Max Residual Depth (ft)	SE (ft)	Trout observations	Trout Density (fish/ft^2)
Pre	11/17/2014-11/18/2014	47	278.6	23.2	2.2	0.2	NA	NA	9	0.000687

Survey	Date(s)	No. of Units Surveyed	Avg Unit Area (ft^2)	SE (ft^2)	Avg Max Depth (ft)	SE (ft)	Avg Max Residual Depth (ft)	SE (ft)	Trout observations	Trout Density (fish/ft^2)
Pre	6/3/2015	35	259.5	30.9	2.4	0.3	NA	NA	6	0.000661
Pre	10/20/2015-10/22/2015	59	249	23.6	2.3	0.2	NA	NA	8	0.000544
Post	8/3/2017-8/8/2017	44	269.7	28.8	2.4	0.2	NA	NA	0	0
Post	7/22/2019-7/23/2019	30	203.6	26.9	1.7	0.1	NA	NA	0	0
Post	10/27/2022-11/1/2022	28	245.7	27.5	2	0.2	1.9	0.2	0	0

This survey reach has also been used by CDFW for past CMP snorkel surveys, so data from previous surveys is available to compare with data collected by MESHR in 2022. Additionally, much of the lower portion of Carpinteria Creek, including the area around the project site, seasonally dries each year. Most summer refugia is found in the upper watershed. Trout were observed during snorkel surveys conducted by CDFW up through 2015, before implementation of the restoration project, but have not been observed since (Table 41). Snorkel data was collected by MESHR staff in 2022, all previous data was collected by CDFW.

Table 41. Trout observations by two-inch size bin from snorkel surveys conducted on Carpinteria 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
2014	0	1	4	3	1	0	0	0	0	9

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
2015 (1)	0	0	1	4	0	1	0	0	0	6
2015 (2)	0	0	3	4	1	0	0	0	0	8
2017	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	0

Morrison Creek Tributary Barrier Removal

This project funded the removal of a total fish barrier to adult and juvenile Coho Salmon and opened access to 0.6 miles of non-natal rearing habitat in the Morrison Creek sub-basin. It also removed the potential for culvert failure at the crossing and the concomitant sediment delivery into the tributary by replacing the culvert with a 30-foot span bridge with a natural channel bottom. Construction at the site was completed between September 19 and October 5 of 2022. Five channel spanning logs were installed as grade control structures downstream of the crossing and seven rootwads were placed on the right bank as habitat and erosion control.

Post-treatment validation monitoring was conducted on April 16, 2024, and five pools were snorkeled. Four pools were below the crossing and immediately downstream of four installed channel spanning logs, while the fifth pool was above the crossing. Average dive pool size increased from 66.65 to 99.40 ft^2, while average maximum residual depth decreased from 1.25 to 0.85 ft due to removal of a plunge pool below the crossing. Trout densities decreased from 0.0048 to 0.0025 fish/ft^2 while Coho Salmon densities increased from 0.0 to 0.028 fish/ft^2 (Table 42). No fish were observed above the crossing at pre-treatment, but multiple Coho Salmon were documented above the crossing at post-treatment.

Table 42. Morrison Creek Tributary Barriere Removal Project pre- and post-treatment snorkel validation survey data.

Survey	Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
Pre	5/20/2021	4	66.64	1.25	1	1	0	0.0048	0	0	0.0
Post	4/16/2024	5	99.4	0.85	0	1	0	0.0025	14	0	0.028

Adult Spawning Surveys

Sixteen fish passage projects received spawner surveys following project implementation to validate whether fish reclaimed previously blocked habitat. An additional three projects received spawning surveys prior to fish passage barrier removal to collect pre-treatment data (Table 43).

Table 43. Projects that received spawner survey validation monitoring during the contract term, from February 1, 2022, through April 30, 2024. Data collected in January 2022 is also presented in this report as it was not included in the previous final grant report.

Grant Number	Project Title	Project Type	Monitoring Type
P1810515	Panther Creek Barrier Removal Project	FP	Post
P1010321	Walton Gulch Bridge Project	FP	Post
P1110315	Water Gulch Dam and Crossing Removal Project	HB	Post
P1010508	Dunn Creek Coho Fish Passage Project	FP	Post
D1450006	Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal	FP	Post
P1450010	Circle G Ranch Fish Passage Restoration	FP	Post
P1050003	Quiota Creek Fish Passage Improvement, Crossing 7	FP	Post
P1050005	Fish Passage Improvement at Crossing 2, Quiota Creek	FP	Post
P1250007	Fish Passage Improvement at Crossing 1, Quiota Creek	FP	Post
P1450011	Fish Passage Improvement at Crossing 3, Quiota Creek	FP	Post
P1450014	Fish Passage Improvement at Crossing 0A, Quiota Creek	FP	Post
P1550010	Fish Passage Improvement at Crossing 4, Quiota Creek	FP	Post
P1650902	Fish Passage Improvement at Crossing 5, Quiota Creek	FP	Post
P1750902	Fish Passage Improvement at Crossing 9, Quiota Creek	FP	Post
P1850902	Fish Passage Improvement at Crossing 8, Quiota Creek	FP	Post
Q1950902	Davy Brown/Munch Creek Fish Passage Construction Project	FP	Post

Grant Number	Project Title	Project Type	Monitoring Type
Q2050905	Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project	FP	Pre
Q2250406	Maria Ygnacio Creek Fish Passage Project Implementation – Patterson Ave Bridge	FP	Pre
Q2296016	Wheeler Gorge Campground Fish Passage Project--Implementation	Prop1	Pre

Panther Creek Barrier Removal Project

This project removed the remains of an abandoned road crossing and gauging station that restricted passage of salmonids and improved instream habitat conditions by installing four LW habitat structures. The barrier removal allows for year-round access for all life stages of Coho Salmon and other salmonids to approximately 4.5 miles of instream habitat.

Three spawning surveys were conducted on Panther Creek. No fish or spawning activity were observed (Table 44).

Table 44. Panther Creek Barrier Removal Project adult spawning survey observations after barrier removal.

Reach Length (ft.)	Date Surveyed	Water Temp (°F)	Live Fish Observations	Carcass Observations	Redd Observations
767	1/13/2022	49.1	0	0	0
3763	1/24/2022	43.7	0	0	0
600	2/1/2023	42.8	0	0	0

Walton Gulch Bridge Project

This project removed an undersized and perched culvert barrier to Coho Salmon and steelhead trout and replaced it with an open bottom arch culvert. It opened access to approximately 4,000 ft of spawning and rearing habitat to all life stages of anadromous species. It also has capacity for a 100-year flow event and the associated bedload and debris.

Surveys conducted on Walton Gulch in January 2022 and February 2023 did not document any spawning activity above a former bridge barrier (Table 45). Spawner surveys are planned in the future to document possible spawning activity above the former barrier.

Table 45. Walton Gulch Bridge Project adult spawning survey observations after barrier removal.

Reach Length (ft.)	Date Surveyed	Water Temp (°F)	Live Fish Observations	Carcass Observations	Redd Observations
1650	1/26/2022	45.5	0	0	0
1670	2/7/2023	NA	0	0	0

Water Gulch Dam and Stream Crossing Removal Project

This project removed a remnant splashboard dam and partial barrier impeding access to two miles of spawning and rearing habitat for Coho Salmon and steelhead trout. Two remnant stringer log bridges and a culverted stream crossing farther upstream were also removed to prevent future passage issues. Salvaged wood from the two log bridge crossings was installed in Water Gulch and adjacent Chamberlain Creek to help enhance stream channel complexity and provide bank protection.

On January 26th, 2022, MESHR conducted a single spawner survey on Water Gulch and found two carcasses, one unknown and one female Coho Salmon, both of which were upstream of the former barrier. No redds or live fish were observed during this survey (Table 46).

Table 46. Water Gulch Dam and Stream Crossing Removal Project: adult spawning survey observations after barrier removal.

Reach Length (ft.)	Date Surveyed	Water Temp (°F)	Live Fish Observations	Carcass Observations	Redd Observations
5115	1/26/2022	42.8	0	2	0

Dunn Creek Coho Fish Passage Project

This project removed three former culvert crossings which had been complete barriers to fish passage. Crossings were replaced by spanning bridges in 2011, providing access to 0.8 miles of fish habitat.

Steelhead spawning activity in Dunn Creek has been documented, including five redds in March 2015. Two redds and two carcasses (one identified as a steelhead) were observed in February 2016, and two potential steelhead redds in February 2018. The dates these redds and carcasses were found suggest these were all from steelhead trout spawning activities. Spawner surveys in 2019, 2020, 2022, and 2023 found no additional evidence of spawning (Table 47).

Table 47. Dunn Creek Coho Fish Passage Project adult spawning survey observations after barrier removal.

Reach Length (ft.)	Date Surveyed	Water Temp (°F)	Live Fish Observations	Carcass Observations	Redd Observations
7600	1/27/2022	44.6	0	0	0
6100	2/8/2023	NA	0	0	0

Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal

This project removed two stream crossing barriers to upstream fish passage along Arroyo Sequit, the first located approximately 0.1 miles upstream of the mouth of the estuary and the second located approximately 0.65 miles upstream of the first barrier. The barriers were removed, and fish passage restored by late 2015, while overall project construction was completed in early 2017.

Arroyo Sequit was surveyed for 2.3 miles, from the estuary to a private property boundary. Six spawning surveys were conducted by MESHR during the 2022 spawning season. An additional six spawning surveys were conducted by MESHR and CDFW during the 2023 spawning season. During the 2024 spawning season, landowner permission was granted to extend the length of Arroyo Sequit that can be surveyed by an additional 0.41 miles to another private property boundary. As a result, Arroyo Sequit was split into two survey reaches. These survey reaches have each been surveyed twice during the 2024 season. No steelhead or redds were observed during any of these surveys (Table 48).

Table 48. Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal project adult spawning surveys results during the contract period. One or two reaches on Arroyo Sequit (SQT) were surveyed, with the second reach being established in 2024.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.31 (SQT)	2/14/2022	0	0	0
2.31 (SQT)	3/1/2022	0	0	0
2.31 (SQT)	3/23/2022	0	0	0
2.31 (SQT)	4/7/2022	0	0	0
2.31 (SQT)	4/21/2022	0	0	0

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.31 (SQT)	5/3/2022	0	0	0
2.31 (SQT)	1/24/2023	0	0	0
2.31 (SQT)	2/7/2023	0	0	0
2.31 (SQT)	2/27/2023	0	0	0
2.31 (SQT)	3/20/2023	0	0	0
2.31 (SQT)	4/13/2023	0	0	0
2.31 (SQT)	4/26/2023	0	0	0
1.65 (SQT1)	2/29/2024	0	0	0
1.07 (SQT2)	3/11/2024	0	0	0
2.72 (SQT 1+2)	4/9/2024	0	0	0

Annual spawning surveys have been conducted in Arroyo Sequit since 2010. The RCDSMM conducted monthly surveys during spawning seasons from 2010 through 2019. Over the course of all these surveys, only two steelhead were recorded and no redds or spawning activity were observed (Dagit et al. 2019). CDFW conducted bi-weekly spawning surveys during the 2020 and 2021 spawning seasons and observed no steelhead or redds during any survey. MESHR have conducted spawner surveys in partnership with the CMP since 2022, and again no steelhead or redds have been observed. Observations of anadromous steelhead upstream of the former barriers indicate that fish passage has been restored at the project locations. Despite the observations of adults, the lack of spawning activity or young-of-year steelhead observations indicate that successful recolonization has not yet occurred in Arroyo Sequit. Surveys will continue during future spawning seasons to document successful spawning upstream of the former barrier.

Circle G Ranch Fish Passage Restoration

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 ft 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 and banks consisting of ESM.

Carpinteria Creek was surveyed for 4.2 miles, the entire part of the stream from the estuary to a natural barrier to fish passage that is accessible to anadromous fish. During the 2022 spawning season, four spawning surveys were conducted. Spawning surveys concluded in March as no spawning activity had been previously observed and a sand berm blocked access to the estuary. Additionally, the lower portion of the creek had dried, preventing future upstream migration of steelhead for the duration of the spawning season. During the 2023 spawning season, six spawning surveys were conducted by MESHR and CDFW. No steelhead or redds were observed during these surveys. Four spawning surveys were conducted during the 2024 spawning season, and again no steelhead or redds were observed (Table 49).

Table 49. Circle G Ranch Fish Passage Restoration observations from adult spawning surveys conducted after barrier removal.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
4.21	1/25/2022	0	0	0
4.21	2/10/2022	0	0	0
4.21	3/2/2022	0	0	0
4.21	3/22/2022	0	0	0
4.21	1/24/2023	0	0	0
4.21	2/15/2023	0	0	0
4.21	3/9/2023	0	0	0
4.21	4/4/2023	0	0	0
4.21	4/19/2023	0	0	0
4.21	5/2/2023	0	0	0
4.21	1/25/2024	0	0	0
4.21	2/14/2024	0	0	0

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
4.21	3/13/2024	0	0	0
4.21	4/25/2024	0	0	0

Bi-weekly spawning surveys have been conducted by CDFW and PSMFC staff (from the MESHR project and/or previous projects) along this same survey reach annually from 2016 through the current 2024 spawning season. No steelhead or redds have been observed during these surveys. Surveys will continue in the future to document successful spawning upstream of the former barrier.

Fish Passage Improvement at Crossings 0A, 1, 2, 3, 4, 5, 7, 8, and 9, Quiota Creek

Between 2011 and 2019, nine separate FP projects were completed at stream crossings along Quiota Creek, a tributary to the Santa Ynez River. Each of these projects removed a partial barrier to fish passage along Quiota Creek. All the projects involved replacement of a concrete Arizona crossing with a bottomless arch culvert except for crossing 8, which replaced an undersized and damaged bridge with a bottomless arch culvert. Additionally, crossing 6 was replaced with a bottomless arch culvert in 2008 but was not funded through FRGP. The first crossing (0A) is 0.07 miles upstream of the confluence with the Santa Ynez River, while the last crossing (9) is 3.3 miles upstream of the confluence. One barrier to fish passage remains on Quiota Creek at crossing 0B, though efforts are underway to replace this concrete crossing with a bottomless arch culvert.

Quiota Creek was surveyed by MESHR in 2023 for 0.78 miles from crossing 3 through crossing 9 where landowner access was obtained. The remaining barrier to fish passage at crossing 0B is downstream of this survey reach. Four additional spawner surveys were conducted by the Cachuma Operation and Maintenance Board (COMB) through the 2023 spawning season. No steelhead or redds were observed during these surveys (Table 50).

Table 50. Fish Passage Improvement at Crossings, Quiota Creek, observations from adult spawning surveys conducted after barrier removal.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
0.75	4/4/2023	0	0	0

Annual spawning surveys conducted by COMB staff on the reach since 2012 have

observed no steelhead. Redds and trout were observed on Quiota Creek during spawner surveys conducted in 2012, and were likely resident trout based on size.

Davy Brown/Munch Creek Fish Passage Construction Project

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 start of Davy Brown Creek at 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, and the channel was regraded and reconstructed with native streambed material. Access was restored to a total of 3.13 miles of anadromous habitat.

Construction was still ongoing during the winter of 2022, though channel reconstruction was complete. As a result, spawning surveys began this year to determine if anadromous steelhead could pass through the project sites following winter storms. Davy Brown Creek was surveyed for 2.12 miles, from the confluence with Manzana Creek to a natural waterfall barrier to anadromy. A total of 2 redd and 184 trout observations were made over the course of 7 surveys conducted during the 2022 spawning season on Davy Brown Creek (Table 51).

Table 51. Davy Brown/Munch Creek Fish Passage Restoration Project observations from adult spawning surveys in 2022 and 2023 following barrier removal. Both Davy Brown Creek (DVB) and Munch Creek (MCH) were surveyed.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.12 (DVB)	2/9/2022	17	0	1
0.5 (MCH)	2/9/2022	5	0	0
2.12 (DVB)	2/23/2022	14	0	0
0.5 (MCH)	2/24/2022	2	0	0
2.12 (DVB)	3/7/2022	26	0	0
0.5 (MCH)	3/8/2022	5	0	0
0.5 (MCH)	3/30/2022	14	0	0

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.12 (DVB)	3/31/2022	49	0	1
2.12 (DVB)	4/12/2022	34	0	0
0.5 (MCH)	4/13/2022	3	0	0
2.12 (DVB)	4/26/2022	35	0	0
0.5 (MCH)	4/28/2022	15	0	0
2.12 (DVB)	5/10/2022	9	0	0
0.5 (MCH)	5/11/2022	24	0	0
0.5 (MCH)	4/25/2023	1	0	0
2.12 (DVB)	4/27/2023	21	0	0
0.5 (MCH)	3/11/2024	24	0	0
2.12 (DVB)	3/12/2024	44	0	3
2.12 (DVB)	4/2/2024	19	0	0
0.5 (MCH)	4/4/2024	19	0	0
2.12 (DVB)	4/22/2024	285	0	0
0.5 (MCH)	4/23/2024	85	0	0

All 184 trout observations on Davy Brown Creek in 2022 were of an indeterminate life stage, with estimated sizes ranging from 2 to 12 inches. Previous studies using redd surveys have demonstrated that anadromous and resident 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). Based on these criteria, both redds recorded in Davy Brown Creek in 2022 would be classified as likely resident trout redds, as they had measured areas of 0.11 m^2 and 0.28 m^2. Munch Creek was surveyed for 0.5 miles from the confluence with Davy Brown Creek to a natural fish passage barrier. A total of 68 trout were observed through seven surveys during the 2022 spawning season on Munch Creek. Of the 68 trout observed, 34 were of an

indeterminate life stage, with estimated sizes from 2 - 12 inches, and 34 were YOY trout (< 2 inches). Individuals were not marked or tagged, resulting in the potential for redundant fish counts in subsequent surveys. During all surveys conducted along both creeks, no adult anadromous steelhead (≥ 16 inches) or redds large enough to be attributed to anadromous adult steelhead were observed.

In January 2023, severe winter storms closed the roads to these sites, so surveys were unable to be conducted until roads reopened in mid-April. One survey was conducted during the 2023 spawning season on Davy Brown Creek, in which 21 trout were observed. Of the 21 trout observed, 10 were of an indeterminate life stage, with estimated sizes ranging from 4 to 10 inches, and 11 were YOY trout (0-2 inches). One survey was conducted on Munch Creek, in which one 6-inch trout was observed. No adult anadromous steelhead (≥ 16 inches) and no redds were observed during these surveys.

During the 2024 spawning season, surveys began in March following strong winter storms in previous months. A total of 3 redd and 348 trout observations were made during the three surveys conducted this season on Davy Brown Creek. Of the 348 trout observed, 82 were of an indeterminate life stage, with estimated sizes from 3 - 14 inches, and 266 were YOY trout (< 2 inches). All three redds recorded in Davy Brown Creek would be classified as likely resident trout redds. Two of the redds had measured areas of 0.12 m^2 and 0.18 m^2, while the third redd was unable to be measured as resident trout were observed on the redd during the survey and no measurements were taken to avoid disturbing the fish. A total of 128 trout were observed during the three surveys during the 2024 spawning season on Munch Creek. Of the 128 trout observed, 62 were of an indeterminate life stage, with estimated sizes from 3 - 13 inches, and 66 were YOY trout (< 2 inches). Individuals were not marked or tagged, resulting in the potential for redundant fish counts in subsequent surveys. No adult anadromous steelhead (≥ 16 inches) or redds large enough to be attributed to anadromous adult 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 resident trout were recorded on both Davy Brown and Munch Creeks upstream of the barriers. No anadromous adult steelhead or anadromous redds were observed during the 2017 spawner surveys.

Santa Margarita River Bridge Replacement and Fish Passage Barrier Removal Project

This project proposes to replace a box culvert stream crossing, which is a current fish passage barrier, with a large bridge to restore access to approximately 12

miles of upstream fish habitat. The barrier is on the Santa Margarita River 19 miles upstream of the estuary.

No previous regular spawning surveys have been conducted in the upper watershed by CDFW or other organizations. Four pre-treatment spawning surveys were conducted during the 2022 spawning season to scout and develop survey reaches, identify suitable spawning and rearing habitat, and determine presence/absence and distribution of anadromous steelhead trout or resident trout to identify where best to focus future spawning surveys. A 2.1-mile reach along the mainstem of the Santa Margarita River, which includes habitat both downstream and upstream of the current barrier to fish passage, was surveyed twice. An additional 1.3 miles of the Santa Margarita River mainstem upstream of the previous reach was surveyed once. An approximately 1-mile survey along Rainbow Creek, a tributary to the Santa Margarita River with a confluence located 2.3 miles upstream of the current barrier to fish passage, was conducted once. No trout or redds were observed during any of these surveys (Table 52).

Table 52. Observations from adult spawning surveys conducted in 2022 prior to barrier removal. Two reaches on the mainstem Santa Margarita River (SMR) were surveyed and a tributary reach upstream of the barrier, Rainbow Creek (RBW).

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.08 (SMR1)	2/16/2022	0	0	0
0.96 (RBW)	2/17/2022	0	0	0
2.08 (SMR1)	3/16/2022	0	0	0
1.31 (SMR2)	3/17/2022	0	0	0

The habitat observed in the surveys conducted along the mainstem of the Santa Margarita River did not appear suitable for steelhead spawning. The substrate mainly consisted of sand and large boulders. Despite the lack of spawning habitat, these survey reaches may continue to be monitored for steelhead migration. Some suitable spawning habitat was observed along the Rainbow Creek survey reach. During post-treatment spawning surveys, additional spawning surveys might be conducted further upstream along the Santa Margarita River if more suitable spawning habitat is found, and if access is available.

Maria Ygnacio Creek Fish Passage Project Implementation – Patterson Ave Bridge

This project proposes to modify the existing Patterson Ave Bridge fish passage

barrier to allow for fish passage at the site for juvenile and adult steelhead. The barrier is located within the Goleta Slough Complex, at the confluence of Atascadero and Maria Ygnacio creeks, approximately 1.5 miles upstream of the mouth of the estuary. Removal of the barrier restoring access to 0.77 miles of upstream migratory habitat, to the next impassible barrier. Other upstream barriers within Maria Ygnacio Creek have had designs for removal completed, so this project is the first step in a larger effort to remove all barriers within the watershed.

No previous regular spawning surveys have been conducted in the upper watershed by CDFW or other organizations. In 2023, several survey reaches were established along Maria Ygnacio Creek by the CMP. A 2.1-mile reach along Maria Ygnacio Creek, which begins at the confluence of Maria Ygnacio and Atascadero creeks and is the location of the current barrier to fish passage, was surveyed five times. An additional 1.4 miles of Maria Ygnacio Creek upstream of the previous reach was surveyed four times. The remaining 1.3 miles of upstream habitat up to a natural barrier to anadromy was unable to be surveyed due to an inability to gain landowner access. These reaches were surveyed on an approximately bi-weekly basis by MESHR and/or CDFW. Nine pre-treatment spawning surveys were conducted during the 2023 spawning season. No trout or redds were observed during any of these surveys (Table 53).

Table 53. Maria Ygnacio Creek Fish Passage Project Implementation – Patterson Ave Bridge observations from adult spawning surveys in 2023 prior to barrier removal. Maria Ygnacio Creek (MYG) was delineated into four CMP survey reaches, the downstream-most three were surveyed during the 2023 spawning season.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.1 (MYG 1+2)	2/8/2023	0	0	0
1.4 (MYG 3)	3/13/2023	0	0	0
2.1 (MYG 1+2)	3/20/2023	0	0	0
1.4 (MYG 3)	4/3/2023	0	0	0
2.1 (MYG 1+2)	4/5/2023	0	0	0
1.4 (MYG 3)	4/18/2023	0	0	0
2.1 (MYG 1+2)	5/1/2023	0	0	0

1.4 (MYG 3)	5/16/2023	0	0	0
2.1 (MYG 1+2)	5/30/2023	0	0	0
3.5 (MYG 1,2,3)	3/20/2024	1	0	0
3.5 (MYG 1,2,3)	4/8/2024	0	0	0
3.5 (MYG 1,2,3)	4/24/2024	100	0	0

Spawning surveys along the three accessible survey reaches were conducted three times during the 2024 spawning season. A total of 101 trout were observed during these surveys on Maria Ygnacio Creek. Of the 101 trout observed, 3 were of an indeterminate life stage, with estimated sizes ranging from 5 - 7 inches, and 98 were YOY trout (< 2 inches). No anadromous steelhead (≥ 16 inches) or redds were observed during these surveys. As no signs of anadromous steelhead were observed and adult resident trout are known to be present, it is likely that these YOY were the product of resident spawning activity.

Some habitat observed in the surveys conducted along the upper portions of Maria Ygnacio appeared suitable for steelhead spawning. Post-treatment spawning surveys will be conducted to determine if fish passage is restored or improved following project implementation.

Wheeler Gorge Campground Fish Passage Project – Implementation

This project proposed 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 for 4.7 miles, from the confluence with Matilija Creek to the total barrier to fish passage at Wheeler Gorge Campground. Bear Creek was surveyed for 1.7 miles, from the confluence with North Fork Matilija Creek to a total natural barrier to fish passage. During the 2023 spawning season, nine spawning surveys on North Fork Matilija Creek and three spawning surveys on Bear Creek were conducted by MESHR and CDFW. Road closures caused by landslides that occurred during severe winter storms in January 2023 prevented access to the upper survey reaches until April 2023. In 2024, ten surveys were conducted on North Fork Matilija Creek and five surveys were conducted on Bear Creek. MESHR assisted with two redd surveys on Bear Creek and one survey on North Fork Matilija Creek, all other surveys were completed by CDFW. No trout or

redds were observed during any of these surveys (Table 54).

Table 54. Wheeler Gorge Campground Fish Passage Project – Implementation: observations from adult spawning surveys conducted in 2023 prior to barrier removal. Two reaches on North Fork Matilija Creek (NFM) were surveyed and one reach on Bear Creek (BER) was surveyed.

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.5 (NFM1)	2/6/2023	0	0	0
2.5 (NFM1)	2/23/2023	0	0	0
2.5 (NFM1)	3/28/2023	0	0	0
2.5 (NFM1)	4/12/2023	0	0	0
1.7 (BER)	4/12/2023	0	0	0
2.2 (NFM2)	4/12/2023	0	0	0
2.5 (NFM1)	4/24/2023	0	0	0
2.2 (NFM2)	4/25/2023	0	0	0
1.7 (BER)	4/27/2023	0	0	0
2.2 (NFM2)	5/22/2023	0	0	0
1.7 (BER)	5/22/2023	0	0	0
2.5 (NFM1)	5/24/2023	0	0	0
2.5 (NFM1)	1/11/2024	0	0	0
2.2 (NFM2)	1/16/2024	0	0	0
1.7 (BER)	1/23/2024	0	0	0
2.5 (NFM1)	2/15/2024	0	0	0
2.2 (NFM2)	2/15/2024	0	0	0
1.7 (BER)	2/15/2024	0	0	0

Reach Length (mi.)	Date Surveyed	Live Fish Observations	Carcass Observations	Redd Observations
2.5 (NFM1)	3/5/2024	0	0	0
2.2 (NFM2)	3/5/2024	0	0	0
1.7 (BER)	3/5/2024	0	0	0
2.5 (NFM1)	3/26/2024	0	0	0
2.2 (NFM2)	3/26/2024	0	0	0
1.7 (BER)	3/26/2024	0	0	0
2.5 (NFM1)	4/18/2024	0	0	0
2.2 (NFM2)	4/18/2024	0	0	0
1.7 (BER)	4/18/2024	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 survey reaches annually from 2013 through the current 2024 spawning season. Several resident trout and resident redds were observed in these reaches in past years, though no adult steelhead or steelhead redds have been observed during these surveys. Additionally, a 1.4-mile reach of North Fork Matilija Creek from the total barrier in Wheeler Gorge up to the total natural barrier to anadromy has been surveyed several times in past years, most recently in 2018. No trout or redds have been observed during those surveys. Regular surveys of this reach will begin after the barriers are removed following project implementation.

Minnow Trapping Surveys

During this contract cycle, snorkeling was not practical for four projects and minnow traps (Gee's, galvanized wire mesh) were deployed instead (

Table 55).

Table 55. Projects that received minnow trapping validation monitoring during the contract term, from February 1, 2022, through April 30, 2024.

Grant Number	Project Title	Project Type	Monitoring Type
Q2210506	Lower Stotenburg Coho Habitat Enhancement Project	HR	Pre
Q2110514	Ryan Creek Off-Channel Coho Habitat Implementation Project	HI	Pre
P1710529	Little Springs Migration Barrier Removal Project	FP	Post
P1510523	Fish Passage Improvements at South Fortuna Boulevard	FP	Post

Lower Stotenburg Coho Habitat Enhancement Project

This project proposed to restore the lowest 0.5 miles of Stotenburg Creek and enhance connectivity with the Smith River. Treatments included beaver dam analogues, willow trenches, and LW structures. It also proposed to improve fish passage and increase winter rearing habitat, plus add cattle-exclusion fencing to protect riparian bank stability and water quality.

Minnow trapping was only able to be completed at the lowest pool just above the confluence with the Smith River due to lack of water. Four traps were placed around the large pool (approximately 3,000 ft^2 with an average depth of two ft) but only captured five stickleback and no salmonids (Table 56).

Table 56. Lower Stotenburg pre-treatment minnow trapping survey results.

Monitoring Type	Date Surveyed	No. of Traps Used	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Pre	5/9/2023	4	0	0	0	0	5 stickleback

Ryan Creek Off-Channel Coho Habitat Implementation Project

This project is scheduled to begin construction in the late summer of 2024. The project will improve connectivity to and enhance an existing 0.5-acre perennial on-stream pond and construct a large off-channel alcove. It will provide approximately 40,000 sq. ft. of non-natal winter high flow refugia and rearing habitat for coho salmon. Approximately 18 instream LWD structures along 1,600 feet of mainstem Ryan Creek within the project area will be constructed.

On March 14th, 2024, pre-treatment minnow trapping was conducted with Pacific Coast Fish, Wildlife, and Wetlands Restoration Association. Early spring trapping was conducted to assess the presence of salmonids after winter flows connected the off-channel pond. A total of nine traps were baited and set for two hours with in the proposed construction areas. Five traps were set in the off-channel pond, one in an alcove between the pond and Ryan Creek, one upstream and one downstream of the proposed outlet of the off-channel pond that will connect to the mainstem of Ryan Creek. The last was set in a small right bank tributary to Ryan Creek downstream of the outlet of the culvert on R-Line Road on Grean Diamond property. Fifteen stickleback and three California newts were trapped and no Salmonids.

Table 57. Ryan Creek pre-treatment minnow trapping survey results.

Monitoring Type	Date Surveyed	No. of Traps Used	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Pre	3/14/2024	9	0	0	0	0	14 stickleback 3 California newt

Little Springs Migration Barrier Removal

The objective of this project was to improve passage for Coho Salmon by replacing an undersized metal pipe culvert on East Louie Road. Treatment included a natural bottom multi-plate crossing structure and grade controls sufficient to maintain the existing stream profile and prevent incision upstream of the crossing.

Minnow trapping was used on Little Springs Creek due to a riffle/run throughout the project site with extensive vegetation on the banks and within the channel, making snorkel observations very difficult. At post-treatment four minnow traps were placed near the crossing, two above and two below. No fish were captured

but unknown fish were visible from the surface (Table 58).

Table 58. Little Springs Migration Barrier Removal pre- and post-treatment minnow trapping survey results.

Monitoring Type	Date Surveyed	No. of Traps Used	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Pre	7/14/2020	6	0	0	0	0	20 Speckled Dace
Post	6/27/2023	4	0	0	0	0	None

Fish Passage Improvement at South Fortuna Boulevard

An existing culvert was retrofitted with a notched bottom and a forty-foot roughened rock chute was added below the culvert. Fish passage was enhanced during low and high flows which provides access to 10.95 miles of historical habitat for Coho Salmon.

Minnow trapping surveys were conducted in Strongs Creek to look for non-natal rearing of Coho Salmon during winter high flows. The high and turbid water was not appropriate for snorkeling.

On January 11th, 2022, MESHR conducted a minnow trapping survey in Strongs Creek. Four traps were baited and set, two downstream of the South Fortuna Boulevard culvert and two upstream. No salmonids were caught but eleven Sacramento Pikeminnow were caught downstream of the culvert.

In 2023, four minnow traps were placed around the crossing, two above and two below. The only fish captured was one Threespine Stickleback above the crossing. On January 30th, 2024, four traps were set, two below, one within and one above the crossing. Two Sculpin (*Scotus* sp.) were captured, one below and one within the crossing (

Table 59).

Table 59. Fish Passage Improvement at South Fortuna Boulevard winter minnow trapping survey results.

Monitoring Type	Date Surveyed	No. of Traps Used	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Post	1/11/2022	4	0	0	0	0	11 Sacramento Pikeminnow
Post	3/27/2023	4	0	0	0	0	1 stickleback
Post	1/31/2024	4	0	0	0	0	2 Sculpin

Discussion of Validation Monitoring

Validation data were collected to verify if restoration efforts benefited fish populations. Unfortunately, due to timing and current protocols each site does not collect enough data to draw statistically robust conclusions about fish response to restoration efforts.

Conducting multiple pre- and post-treatment surveys under similar seasonal conditions such as flow, temperature, visibility, and after early season re-distribution of salmonids, may reduce variability in validation monitoring of instream habitat enhancement. However, it is difficult to draw conclusions about fish response to LW treatment without more rigorous study of the various factors affecting salmonid distribution. One solution would be engaging already funded programs conducting validation work on a larger scale to increase data, potentially by aligning MESHR data collection protocols with the CMP, so these data are comparable. This method is already being used for certain Southern California projects. A second option would be to use ArcMap or a similar GIS software to compare generalized random tessellation stratified sample reaches used by CMP with FRGP project location sites. This would add comparable control reaches where restoration work was not completed, as well as a large snapshot of time and more samples of snorkel/spawner data at each restoration site. Currently, no solid conclusions can be reached about how fish numbers are affected by restoration efforts, and whether numbers are driven by larger annual population trends.

Juvenile Snorkel Surveys

Pre-treatment validation monitoring is essential to document baseline biological productivity prior to restoration to compare to post-treatment data. However, 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.

Three FP projects received pre-treatment snorkel surveys during this contract term. The Scott Bar Mill Creek Fish Passage Improvement Project had five pools snorkeled, four below the bridge and one above. Coho Salmon were only present in the two lowest pools, but trout were observed throughout, including nine trout above the barrier. For the Weston-Champagne Cachagua Creek Fish Passage Project, five habitat units were snorkeled within the treatment area, three below and two above the current crossing. Trout densities above the barrier (0.076 fish/ft^2) and below the barrier (0.082 fish/ft^2) were similar, though fish density was slightly greater below the barrier. The Santa Margarita River Bridge Replacement received pre-treatment snorkel validation monitoring, and no trout were observed in any habitat units surveyed either above or below the barrier to fish passage. Post-treatment validation snorkeling will be conducted on these projects to determine whether fish density and distribution are affected by the barrier removal.

For HI projects and other projects with an instream component, juvenile snorkel survey data may indicate whether projects increased the quality and/or quantity of salmonid habitat via increased fish densities in treated areas. During this contract, four HI projects received post-treatment snorkel surveys, which were compared with pre-treatment data. For the North Fork Noyo River-Dewarren Creek Coho Habitat Enhancement Project, all salmonid densities increased between pre- and post-treatment surveys. Both trout and Coho Salmon densities increased, and combined salmonid densities increased from 0.021 fish/ft^2 to 0.036 fish/ft^2. Two projects had mixed results in densities for different salmonid species between pre- and post-treatment. The James Creek Coho Stream Habitat Enhancement Project had decreased trout densities but a slight increase in Coho Salmon densities, with combined salmonid densities increasing from 0.039 fish/ft^2 to 0.048 fish/ft^2. The East Branch North Fork Big River Coho Habitat Enhancement Project trout densities decreased slightly while Coho Salmon densities increased slightly, for a combined salmonid density increase from 0.029 fish/ft^2 to 0.03 fish/ft^2.

The snorkel data from the remaining project showed decreased salmonid densities following post-treatment monitoring. For the Tannery Creek Large Wood Recruitment Project, both trout and Coho Salmon densities decreased, with a combined salmonid density decrease from 0.036 fish/ft² to 0.01 fish/ft².

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- and post-treatment data were compared for five FP projects with post-treatment snorkel surveys. Increased salmonid densities upstream of the former barrier were observed for two projects: Panther Creek Barrier Removal Project and Morrison Creek Tributary Barrier Removal Project. For three projects monitored in Northern California (RGP-12 region), several units were snorkeled downstream and upstream of the barriers. For the Panther Creek Barrier Removal Project, salmonid densities upstream of the former barrier increased from 0.018 fish/ft² to 0.033 fish/ft². For the Gulch C Coho Salmon Fish Passage Improvement Project, both trout and Coho Salmon densities increased, but all fish were observed below the lower former barrier. For the Morrison Creek Tributary Barrier Removal Project, trout were observed below the barrier at both pre and post-treatment, but no fish were observed above the barrier at pre-treatment. Coho Salmon were observed below and above the former barrier at post-treatment. For two projects monitored in Southern California (RGP-78 region) longer distances were surveyed, often up to natural barriers to anadromy. For the Circle G Ranch Fish Passage Restoration project, the entire 4.21 miles of anadromous stream in Carpinteria Creek was surveyed in 2022. For the Leo Carrillo State Park, Arroyo Sequit Steelhead Trout Barrier Removal project, 2.1 miles of anadromous stream in Arroyo Sequit were surveyed in 2022 and 2023. No trout were observed, indicating that steelhead recolonization has likely not yet occurred.

Snorkel surveys are an excellent method for collecting fish observation data. However, one limiting factor is potential individual snorkeler error, which is minimized through protocol training. Observations can also be hindered by water depth and clarity, as well as visibility through bubble curtains, dark stream sections, vegetation, undercut banks, or other impediments to a clear view of fish.

Adult Spawning Surveys

Re-colonization of habitat above former barriers by adult anadromous salmonids typically occurs within one to five years after barrier removal (Anderson and Quinn 2007, Kiffney et al. 2008, and Pess 2009). Success of validation spawner surveys depend on 1) availability of suitable spawning habitat above a former barrier, 2) discovery of this habitat by spawners, 3) overlap of run timing with time of spawner surveys, and 4) annual variability of run size and spawner distribution. All are

important considerations when evaluating spawner survey data, particularly when sample sizes remain low in the first years after implementation. 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 would increase with more surveys during both pre- and post-treatment monitoring.

Documenting fish response to barrier removal or modification using spawner surveys is more informative for complete barrier removals than for partial or temporal barrier modifications or LW addition projects.

Pre-treatment spawning surveys were conducted for three Fish Passage type projects which have not yet been implemented to collect baseline spawner data before the proposed barrier removals. No salmonid 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.

Following project implementation at sixteen project locations, no anadromous adult salmonid spawning activity was observed upstream of removed barriers during the post-treatment spawning surveys conducted during this contract term following project implementation at sixteen project locations. Observations of two Coho Salmon carcasses were made upstream of the former barrier during one spawning survey of the Water Gulch Dam and Stream Crossing Removal Project, and although spawning activity was not confirmed, these observations indicated that fish passage above the barrier site was possible. 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. While water year 2022 was slightly below average in precipitation statewide, water year 2023 is looking to be significantly above average (California Water Watch 2024), and 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 can conceal 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.

Minnow Trapping Surveys

Minnow trapping is not useful for comparing fish density like snorkeling but does provide an opportunity to document fish presence when water quality or visibility prevents snorkeling as an option. Minnow trapping surveys conducted at four project locations during this contract period did not collect any salmonids. The lack of salmonid captures during these surveys does not necessarily indicate the absence of salmonids in these streams. Limitations to the survey methods used could include trap openings being too small to allow for the capture of larger bodied fish, timing of trapping surveys not coinciding with the time fish are present in the surveyed units, and the frequency of minnow trapping being too low. Other studies which have successfully used minnow trapping methods to capture salmonids had several days of trapping efforts and used greater numbers of traps (Bryant 2000; Parish and Garwood 2015). Increasing minnow trapping efforts, either frequency of trapping surveys or number of traps, would be the best potential solution to improve the confidence in our minnow trapping results.

Attachment 13 BACI Monitoring

Methods for BACI Monitoring

For the last ten years, a BACI effectiveness monitoring pilot study focused on habitat metrics and fish response has been conducted to help determine effectiveness of LW treatments. Adapted from the Washington State Salmon Recovery Funding Board (Crawford 2011) and the U.S. Environmental Protection Agency (Kaufmann et al., 1999), the protocols measure stream habitat characteristics of a subsample of LW installation projects to determine if LW structures improve stream habitat over time by analyzing standardized and repeatable measurements including LW volume, channel substrate, residual pool depth, longitudinal profile, and juvenile fish abundance.

Projects with BACI are monitored longer and more intensively than effectiveness and validation monitoring. Habitat and fish parameters are recorded prior to treatment and one, three, five, and ten years after implementation. Intensive monitoring with a small team limits total projects, but a more focused study allows increased statistical data analyses between pre-treatment monitoring and multiple post-treatment visits.

Once a site was selected for BACI, impact and control reaches were established, and initial pre-treatment data were collected (physical habitat parameters and juvenile salmonid numbers of target species via snorkel surveys). During post-treatment monitoring, treatment and control reaches were resurveyed and constructed LW structure locations were documented.

The center point of the treatment reach was established to encompass all, or part of the area targeted for LW installation. Five representative bankfull width measurements upstream and downstream of the center point were averaged and multiplied by 20 to determine treatment reach length. For streams with average bankfull widths of 25 ft or less, the minimum reach length was 500 ft. For streams with average bankfull widths of 80 ft or more, the maximum reach length was 1,650 ft. The control reach was equal in length to the impact reach, located upstream of the impact reach with similar habitat. Once impact and control reaches were established, a total of 11 cross-channel transects were delineated, dividing each reach into ten equal segments.

Physical parameters were recorded at 11 transects in both impact and control reaches through direct measurement, visual estimates, and observations. Channel/riparian parameters included: 1) bank angle, height, and undercut distance; 2) bankfull width and height, and wetted width; 3) riparian vegetation structure and canopy cover; 4) substrate size class and embeddedness; 5) fish cover type and abundance; and 6) presence and proximity of human caused

disturbances.

Attribute data were collected at ten equally spaced intervals between transects along the thalweg in both reaches. Thalweg profile attribute data include: 1) thalweg depth; 2) habitat classification (pool, riffle, run, dry, etc.); 3) pool forming features (LW, rootwad, boulder, or bedrock, etc.); 4) presence of backwaters or side channels; 5) presence of small, soft sediment; and 6) additional wetted width and substrate measurements midway between transects.

Individual pieces of LW were enumerated and measured throughout both reaches. Length and diameter size class estimates were assigned to each qualifying piece of LW. Qualifying criteria for LW were: 1) Each piece must be greater than five ft in length and four inches in diameter one-third of the way up from the base; 2) the stem of the LW piece must extend below the bankfull elevation; 3) the LW piece must be dead; and 4) wood embedded in the stream bank is counted if the exposed portion meets the length and width requirements.

Pool dimensions including maximum length, average width, and maximum residual depth were directly measured at every pool in both reaches. Pools were defined as: 1) depressions in the streambed that are concave in profile, laterally and longitudinally; 2) bound by a "head" crest (upstream break in streambed slope) and a "tail" crest (downstream break in streambed slope); and 3) spanning at least 50% of the wetted channel width at any location within the pool.

Juvenile salmonid snorkel surveys in both reaches for BACI projects were done before other survey activities to avoid fish disturbance and degraded observer visibility.

Surveys began at the downstream end of each reach and proceeded upstream with each reach snorkeled by one or two observers depending on the width and depth of the pool. Juvenile salmonids were identified by species and size class to obtain counts for every pool greater than 0.8 ft maximum depth. Fish densities were calculated using juvenile salmonid numbers divided by pool dimensions (length times width). Pools with less than four ft horizontal water visibility were not snorkeled.

Longitudinal profiles were taken using an auto level with a relative elevation at established benchmarks. The graphed profiles give an overall snapshot of thalweg depth during each BACI monitoring cycle. Changes in thalweg distance relative to transects may be due to changes in overall thalweg length or position through habitat units.

Results of BACI Monitoring

A total of four FRGP projects have been consistently monitored using the BACI design (Table 60). Continued BACI monitoring this contract cycle included post-treatment year 3 on James Creek (Big River) and a postponed validation survey due to low water for post-treatment year 6 on Olds Creek (Noyo River). No new sites or restoration projects were selected for BACI monitoring in 2022 and 2023, as a suitable project site was not found among the projects randomly selected.

Table 60. BACI monitoring conducted during and prior to 2021 and the extension of monitoring through this contract cycle (2022-2023).

Project	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Olds Creek Coho Habitat Barrier Removal Project	Year 0	Year 1	Year 2	Year 3	--	--	Year 6	--	Year 8*	
Ramon Creek Sediment Reduction and Instream Enhancement Project	Year 0	Year 1	--	Year 3	--	--	Year 6	--	--	
Little River Coho Habitat Enhancement Project	--	Year 0	Year 1	--	Year 3	--	Year 5	--	--	
James Creek Coho Stream Habitat Enhancement Project	--	--	--	Year 0	Year 00	Year 000	--	Year 1	--	Year 3

**Year 8 on Olds Creek was only year 6 validation being completed.*

The Olds Creek Coho Habitat Barrier Removal Project had an eleven-foot-tall remnant flashboard dam 620 ft upstream from the Noyo River confluence that created a total barrier to juvenile salmonids and a partial and temporal barrier to adult salmonids. The dam was removed in 2014 and opened 2.6 miles of potential spawning habitat upstream and seven LW structures were installed over 600 ft downstream of the dam (lower impact reach). Another eight LW structures were constructed over 700 ft just above the former dam in 2016 (upper impact reach). Additional LW structures were implemented in 2017 that included three structures within the control reach.

The James Creek Coho Stream Habitat Enhancement Project added 29 features using 91 pieces of LW in 2019 and 2020 to improve spawning and rearing habitat for salmonids over 0.14 miles about 1,570 ft above the confluence with the North Fork Big River. A previous barrier modification project downstream of the BACI project bypassed a former bedrock cascade barrier to open 3.4 miles to Coho Salmon spawning and rearing.

Large Wood

Large Wood volume in James Creek fluctuated between three years of pre-treatment monitoring but the impact consistently had higher volume all three years. When structures were added to the impact reach, large wood volume increased by 43.4% between 2019 and 2021, then decreased by 6.8% between 2021 and 2023. The recorded wood volume in the control was lower than pre-treatment monitoring but remained in a similar range (Table 61).

Table 61. Large wood density in the control and impact reaches of James Creek during BACI monitoring years. Post year 3 occurred during this contract cycle. Volume is measured in cubic meters per kilometer.

James Creek LW volume (m^3 / km)	Pre Year 0 (2017)	Pre Year 00 (2018)	Pre Year 000 (2019)	Post Year 1 (2021)	Post Year 3 (2023)
Control	80.5	83.5	134.1	70.9	74.4
Impact	260.9	168.4	209.5	300.4	279.9

Total pieces of large wood within the James Creek reaches also remained similar prior to project implementation. The impact reach ranged between 25 and 34 pieces but jumped to 59 following addition of wood structures before decreasing to 48 pieces in 2023. Prior to implementation, less than a third of large wood pieces were longer than 20 ft, but after structures were added over 40% were longer than 20 ft. The control reach ranged between 13 and 20 pieces of large wood throughout the surveys, and between 30.8% and 50% of large wood pieces were longer than 20 ft (Table 62).

Table 62. Total LW pieces in the control and impact reaches of James Creek during BACI monitoring years, and percent of LW pieces greater than 20 ft in length.

James Creek total LW pieces	Pre Year 0 (2017)	% > 20 ft length	Pre Year 00 (2018)	% > 20 ft length	Pre Year 000 (2019)	% > 20 ft length	Post Year 1 (2021)	% > 20 ft length	Post Year 3 (2023)	% > 20 ft length
Control	13	30.8	14	50.0	17	35.3	20	35.0	13	46.2
Impact	34	29.4	25	32.0	33	27.3	59	42.4	48	47.9

Longitudinal Profile

Longitudinal profile surveys in the James Creek Coho Stream Habitat Enhancement Project were conducted in 2017, 2018, 2019, 2021 and 2023. Large wood structures were added into the impact reach in 2020. The longitudinal profile survey results for the impact reach are presented in Figure 7 and the longitudinal profile survey results for the control reach are presented in Figure 8.

Figure 7. James Creek impact reach longitudinal profiles. Station F is the midpoint of the reach.

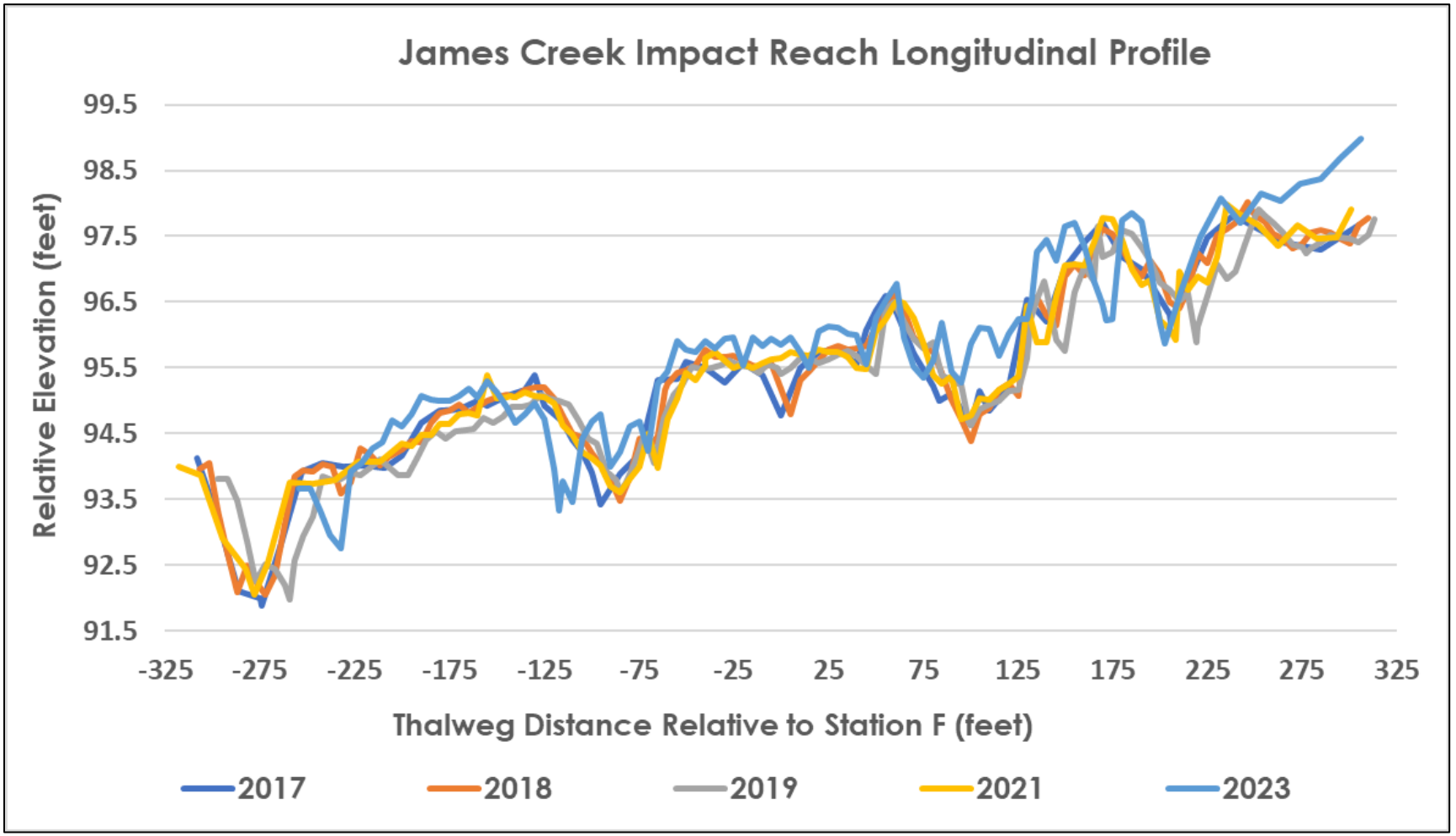
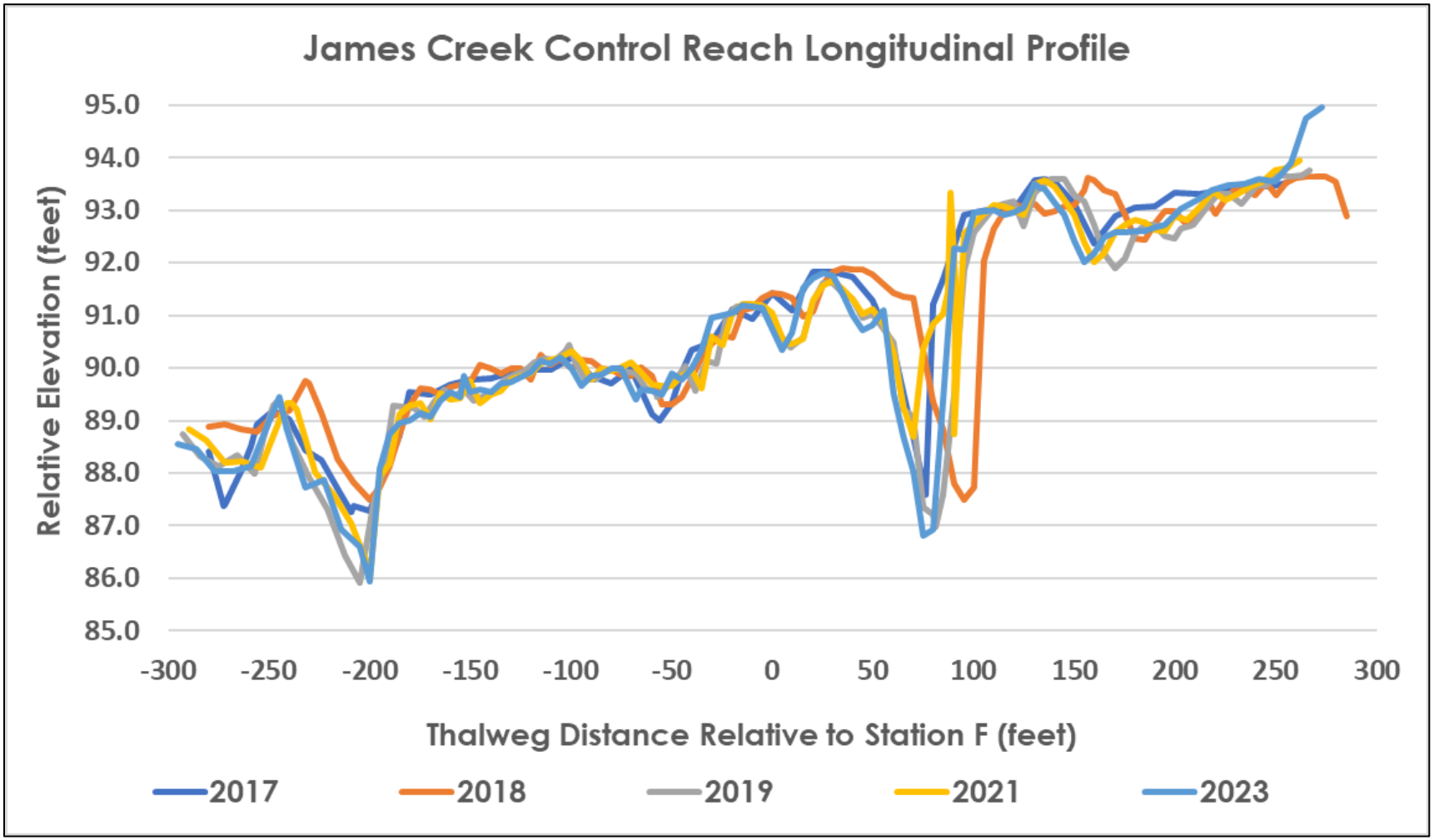
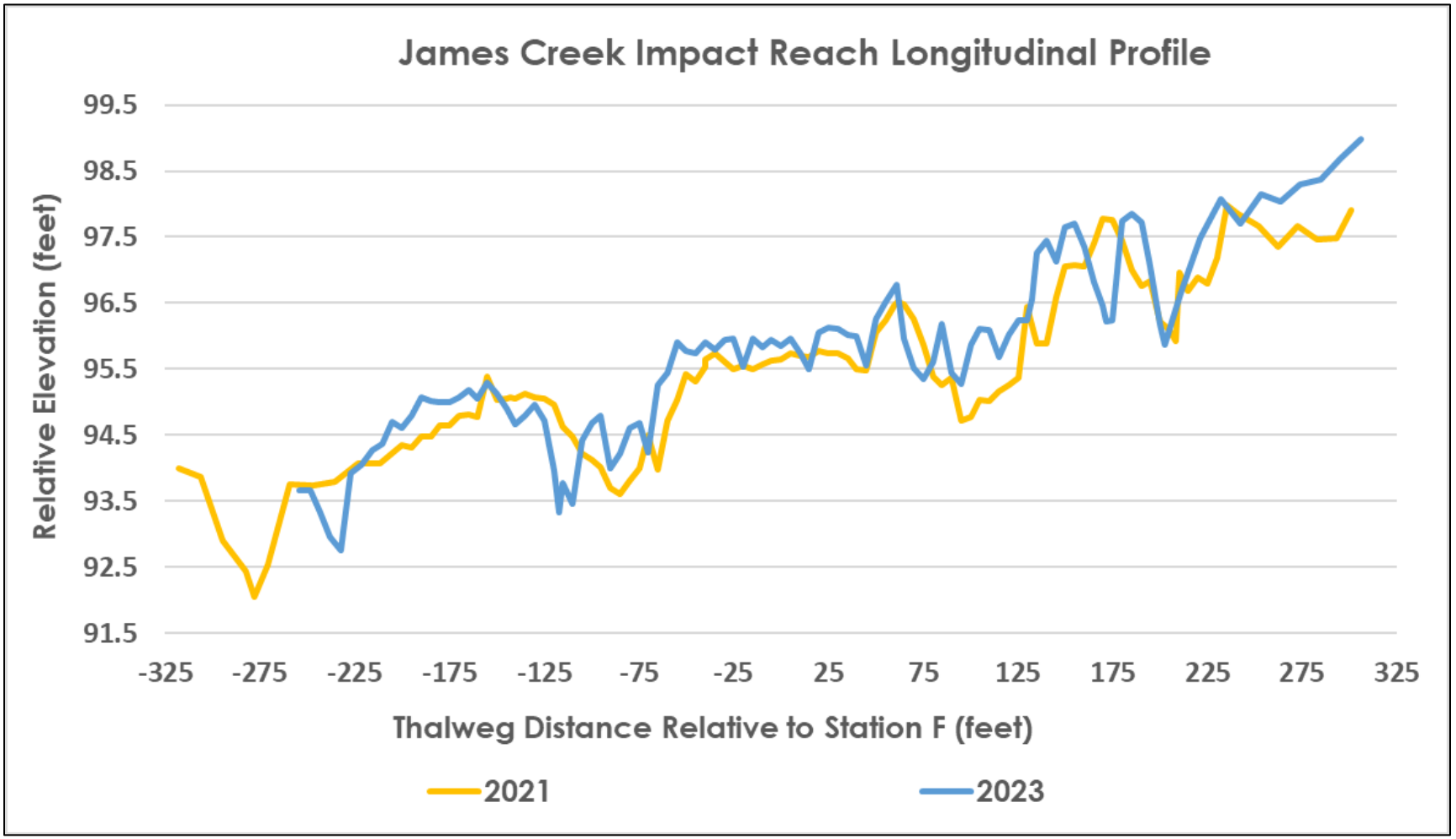


Figure 8. James Creek control reach longitudinal profiles by year. Station F is the midpoint of the reach.



Through the first year after construction (2021) the BACI longitudinal profile survey detected no large thalweg profile changes in the James Creek impact reach, likely due to the passage of only one mild winter since implementation. However, two additional winters passed prior to the 2023 survey and changes in the longitudinal profile were more notable (Figure 9). For example, a pool formed at the lowest point within the impact reach, moving the bottom of the longitudinal profile upstream 64 ft.

Figure 9. James Creek impact reach longitudinal profiles of post-treatment surveys (2021 and 2023). Station F is the midpoint of the reach.



Olds Creek BACI Snorkel Results

Olds Creek received BACI validation monitoring in 2014 (Table 63) before the Olds Creek Coho Habitat Barrier Removal Project was implemented. Coho Salmon and trout, both YOY and 1+, were observed throughout the study reach, but Coho Salmon densities were higher in each section.

Table 63. Olds Creek BACI pre-treatment snorkel survey results year 0 in 2014.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout (Fish/ ft^2)
Upper Impact	47	9	0.058	17	4	0.025
Lower Impact	68	23	0.031	34	1	0.014
Control	69	18	0.039	17	6	0.011

Snorkel surveys were conducted in 2015 after the Olds Creek Coho Habitat Barrier Removal Project was implemented and the flashboard dam was removed (Table 64). Total numbers of both Coho Salmon and trout increased overall for most sections (except trout in the lower impact) and densities increased for both species in all sections.

Table 64. Olds Creek BACI post-treatment snorkel survey results year 1 in 2015.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout (Fish/ ft^2)
Upper Impact	213	11	0.131	54	1	0.035
Lower Impact	128	9	0.103	26	1	0.029
Control	239	13	0.088	38	2	0.016

Snorkel surveys were conducted in 2016, two years after the Olds Creek Coho Habitat Barrier Removal Project was implemented (Table 65). Coho Salmon densities were down from post year 1 to post year 2, even though

total numbers were up in the lower impact. Trout total numbers increased in all three sections, but density increased slightly in the upper impact, decreased in the lower impact, and stayed the same in the control.

Table 65. Olds Creek BACI post-treatment snorkel survey results year 2 in 2016.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
Upper Impact	190	10	0.083	85	1	1	0.038
Lower Impact	173	14	0.049	50	5	0	0.018
Control	143	2	0.046	45	2	1	0.016

Snorkel surveys were conducted in 2017, three years after the Olds Creek Coho Habitat Barrier Removal Project was implemented (Table 66). Coho Salmon and trout total numbers and densities decreased from post year 2 to post year 3 in all sections except trout in the control, where the density remained the same.

Table 66. Olds Creek BACI post-treatment snorkel survey results year 3 in 2017.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
Upper Impact	115	4	0.073	63	5	0	0.025
Lower Impact	73	0	0.0299	19	13	1	0.0137
Control	44	1	0.015	53	0	0	0.016

Snorkel surveys in Olds Creek were postponed year 5 (2019), year 6 (2020) and year 7 (2021) due to time constraints and lack of sufficient water. Snorkel surveys were conducted in 2022, eight years after the Olds Creek Coho Habitat Barrier Removal Project was implemented (Table 67). Coho Salmon total numbers increased from post year 3 to post year 8 in all sections but densities declined in the upper impact reach. Trout

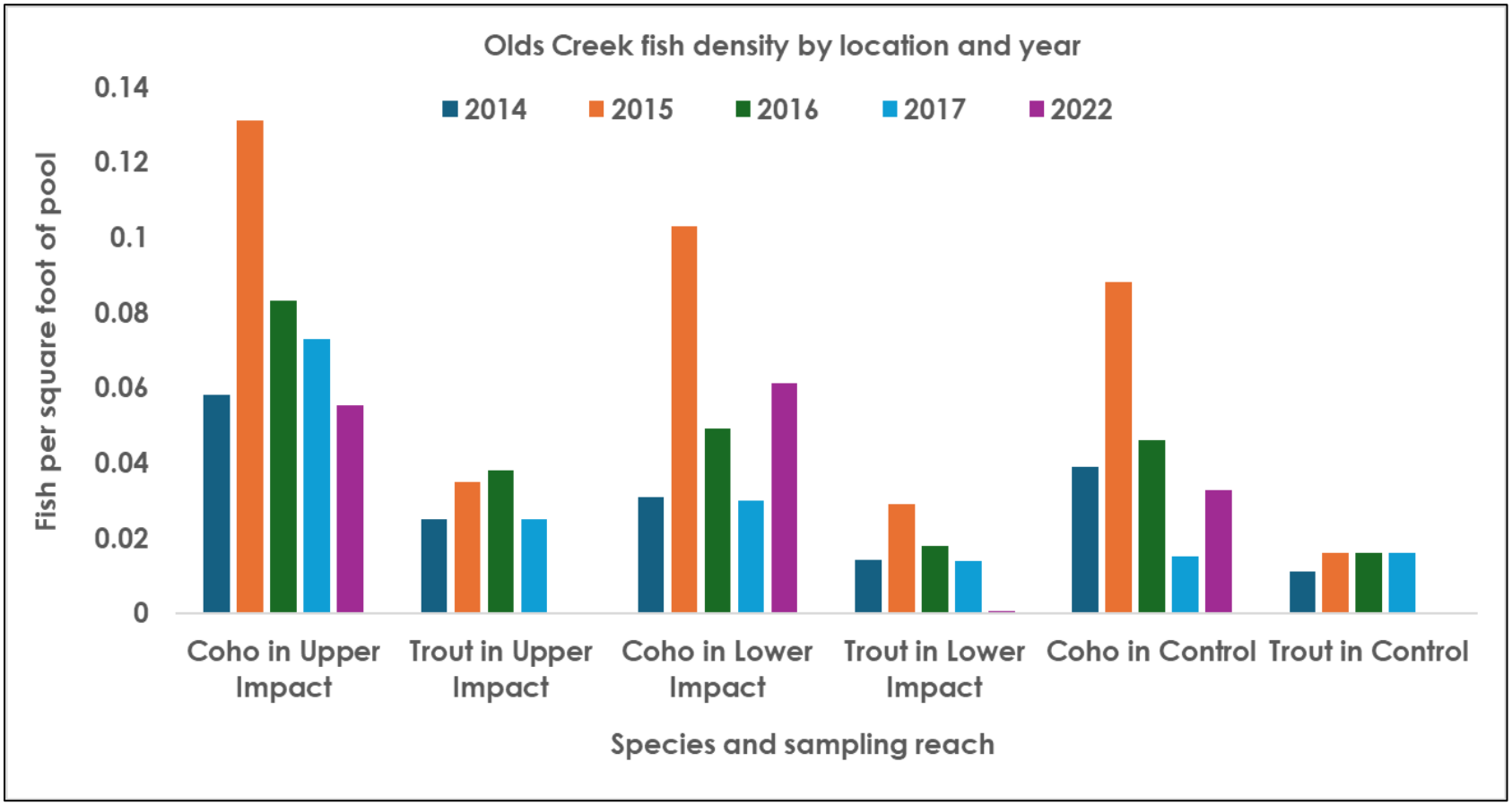
numbers declined precipitously, and a single Chinook Salmon was observed in the upper impact and the control.

Table 67. Olds Creek BACI post-treatment snorkel survey results year 8 in 2022.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout (Fish/ ft^2)	Chinook Salmon YOY	Chinook Salmon (Fish/ ft^2)
Upper Impact	162	0	0.0552	0	1	0.0002	1	0.0007
Lower Impact	117	0	0.0613	1	0	0.0006	0	0
Control	144	0	0.0326	0	0	0	1	0.002

Fish density by reach, year and species is presented in Figure 10.

Figure 10. Olds Creek fish density by year, sorted by species and reach.



James Creek BACI Snorkel Results

James Creek will have the most robust data set with three years of pre-treatment monitoring in 2017 (Table 68), 2018 (Table 69), and 2019 (Table 70), instead of the standard one year of pre-treatment monitoring.

Snorkel surveys were conducted in 2017, three years prior to implementation of the James Creek Coho Stream

Habitat Enhancement Project. Coho Salmon were not observed in either the impact or control reach, but trout were present in both reaches.

Table 68. James Creek BACI pre-treatment snorkel survey results year 0 in 2017.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
Impact	0	0	0	67	10	4	0.0263
Control	0	0	0	73	6	0	0.0286

Snorkel surveys were conducted in 2018, two years prior to implementation of the James Creek Coho Stream Habitat Enhancement Project. Coho Salmon were observed in both reaches but at lower total numbers and density than trout. Trout increased in both total numbers and density, which were similar in both the impact and control reach.

Table 69. James Creek BACI pre-treatment snorkel survey results year 00 in 2018.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
Impact	26	0	0.0062	98	16	1	0.0287
Control	6	1	0.0027	60	19	2	0.0409

Snorkel surveys were conducted in 2019, one year prior to implementation of the James Creek Coho Stream Habitat Enhancement Project. Coho Salmon total numbers and densities increased from pre year 00 to pre year 000 in both reaches, while trout total numbers and densities decreased during the same time. Total numbers and density were higher in the impact than the control for Coho Salmon, but trout total numbers were higher in the impact while densities were higher in the control.

Table 70. James Creek BACI pre-treatment snorkel survey results year 000 in 2019.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
Impact	73	0	0.0226	70	1	0	0.0216
Control	20	0	0.006	24	1	0	0.0106

Post-treatment started in 2021 (Table 71) and year 3 of post-treatment monitoring occurred during this contract cycle (Table 72).

Snorkel surveys were conducted in 2021, one year following implementation of the James Creek Coho Stream Habitat Enhancement Project. All fish numbers declined extensively for both species in the impact and control reaches.

Table 71. James Creek BACI post-treatment snorkel survey results year 1 in 2021.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout (Fish/ ft^2)	Unknown Fish	Unknown Fish (Fish/ ft^2)
Impact	0	0	0	6	1	0.002	0	0
Control	0	0	0	0	1	0.0006	0	0

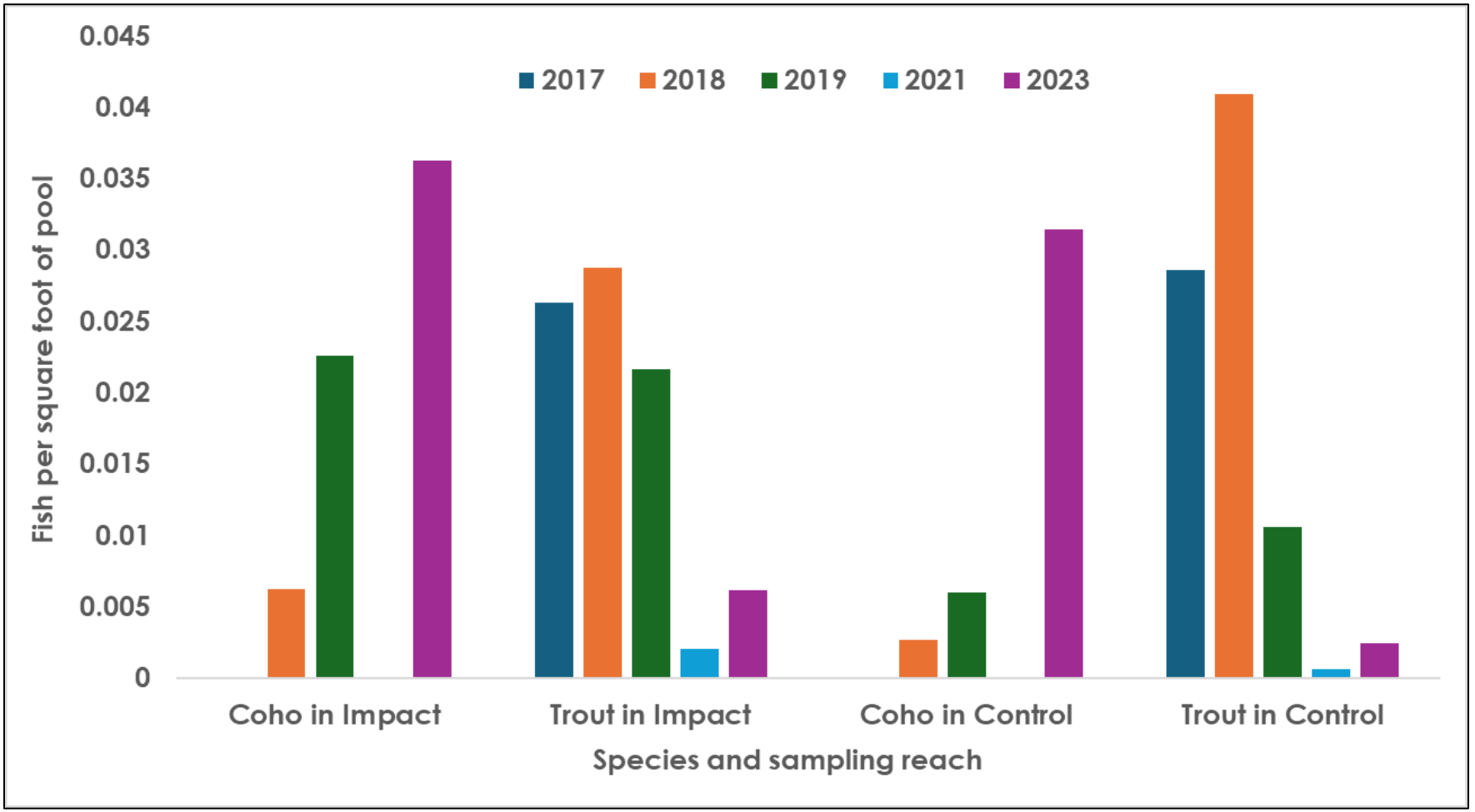
Snorkel surveys were conducted in 2023, three years following implementation of the James Creek Coho Stream Habitat Enhancement Project. Coho Salmon total numbers and densities rebounded from post year 1 to post year 3 and were higher than any pre-treatment survey. Trout total numbers and densities increased slightly from post year 1 to post year 3 but were still well below numbers and densities prior to implementation of the project.

Table 72. James Creek BACI post-treatment snorkel survey results year 3 in 2023.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Unknown Fish	Unknown Fish (Fish/ ft^2)
Impact	131	19	0.0362	12	6	1	0.0061	1	0.0002
Control	114	10	0.0314	6	0	1	0.0024	0	0

Fish density by reach, year and species is presented in Figure 11.

Figure 11. James Creek fish density by reach and year, sorted by species and reach.



Discussion of BACI Monitoring

As projects get larger and more expensive, fewer projects are funded each year, reducing the number of projects selected for effectiveness. No appropriate sites were found to add to the BACI study in 2022 and 2023. Ideally project sites that have suitable control reaches would be incorporated into the proposal solicitation process rather than relying on random chance that a project will match requirements for BACI.

As BACI studies have continued, new variables have emerged that complicate analyses. For example, Olds Creek has two treatment types and two impact sites including dam removal and LW installation, plus more LW was added to the control reach partway through the ten-year sampling plan. In addition, a barrier was removed downstream of the James Creek project during our survey period, potentially complicating any conclusions drawn from the BACI results.

The addition of LW to James Creek increased total LW volume as expected followed by a slight decrease after two winter flow seasons. However, the control reach offers perspective on that small decline in LW volume in the impact, considering the variation in LW volume documented over five years of surveys.

Total LW pieces in James Creek remained similar throughout the survey years in the control reach, but the impact reach nearly doubled following project implementation. The percentage of LW pieces greater than 20 ft in length was higher prior to treatment in the control, but the impact was higher in both post-treatment surveys. Total pieces declined between post year 1 and post year 3 in the impact, but the percentage of pieces longer than 20 ft increased, suggesting the loss was higher in shorter pieces.

The longitudinal profile on James Creek offers an excellent look at multiple pre-treatment changes from natural variability prior to addition of LW structures. Though it is early in the ten-year study, the latest data from 2023 suggests that increased changes in the stream profile are resulting from the instream additions.

Snorkel surveys during BACI monitoring are limited to five pools in each impact and control reach, so drawing broader conclusions from the limited data set is difficult. James Creek appears to have had a recovery in Coho Salmon in post year 3 following no observations in post year 1, presumably from the disruption of the project; however, in 2017 there were also no Coho Salmon observations, three years prior to construction.

No BACI projects have yet reached the conclusion of the full ten-year study.

Final BACI monitoring for Olds and Ramon creeks is scheduled for year 10 in 2024, and Little River is scheduled for year 10 in 2025.

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