SCOTT RIVER STREAM RESTORATION AND SEDIMENT REDUCTION PROGRAM 2017-2021 FINAL REPORT

Construction of bio-engineered log jam on eastern bank of the Scott River, fall 2018

Siskiyou Resource Conservation District
Scott River Watershed
February 2021

Total Project Cost: $463,176.00
Funding Sources:

- State Water Resources Control Board -- Nonpoint Source Grant Program, CWA 319(h) Projects Agreement D1613103
- National Fish and Wildlife Foundation -- NFWF-USFWS Conservation Partnership Agreement 0125.18.060729
- U.S. Fish and Wildlife Service -- Partners for Fish and Wildlife Agreement F17AC00512

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EXCUTIVE SUMMARY

Scott Valley is located in western Siskiyou County, California and encompasses four small towns, Fort Jones, Greenview, Etna and Callahan. Land use can be generally described as agriculture in the lowlands, commercial timber harvest in the midlands, and recreational wilderness in the uplands. The Scott River drains an 813 square-mile watershed and accounts for a major tributary to the Klamath River. The Scott River has been subject to significant anthropogenic impacts since the mid-1800's including resource extraction, flood control and agriculture, which have resulted in severe incision, unstable banks and degradation of the riparian corridor. In the late 1990's, the Scott River was designated by the U.S. Environmental Protection Agency as impaired under Section 303(d) of the Clean Water Act for non-point source pollution of suspended sediment and water temperature. The State Water Resources Control Board has managed these listings under a conditional waiver as efforts are being made to meet Total Daily Maximum Load allocations through community-based restoration work, such as carried out by the Siskiyou Resource Conservation District (SRCD).

Under the *Scott River Stream Restoration and Sediment Reduction Program*, the SRCD has been working to address sediment and thermal inputs to the Scott River with willing landowners through methods that concurrently enhance habitat for salmonid species in the watershed. From 2017 - 2021, the SRCD developed and implemented bioengineered stabilizations of two critical bank erosion sites located at river-kilometer (rkm) 60 (Scarface Cattle Company/Finley Farms) and rkm 67 (Rancho del Sol). Treatments involved bioengineered structures, recontouring of the floodplain/terraces, and riparian planting that together were intended to initiate more natural stream processes through the reach. Outcomes included the stabilization of 1,400 feet of streambank and revegetation across 3.3 acres with mixed willow species and black cottonwood trees. Additionally, the SRCD developed and distributed a webinar about best management practices for the preservation of water quality within an agricultural landscape. The purpose was to provide educational material about the environmental context for nonpoint source pollution standards, offer local examples of best management practices and highlight resources available for the public to remain in compliance.

The program addressed two major sources of sediment (an estimated 2,681 tons per year) and filled in key areas of the surrounding riparian corridor to improve long-term effective shade. So far, the treatment at rkm 67 has preserved channel boundaries, reduced sediment contributions by 149 tons/year, established instream habitat utilized by salmonids and achieved on average 75% planting survival. It is too early to measure progress at rkm 60. The total program cost was approximately 25% higher than planned due to flood damage during the agreement negotiation phase, although the SRCD was able to secure $129,550 in matching contributions to meet the intended obligations. It took 1.5 - 2 years to fully develop each of the treatments due to engineering and permitting challenges so the agreement required a 6-month extension and implementation occurred one year behind schedule. Finally, due to the global pandemic and staffing constraints, the SRCD had to modify outreach tasks and was unable to complete one of the proposed public presentations.

INTRODUCTION

Background and Problem Statement

The Scott River is located in the Klamath Mountains of Siskiyou County in northern California (Figure 1). Primarily flowing northward and ultimately into the Klamath River, the Scott River drains a 520,184 acre (813 square-mile) watershed. The watershed is geologically complex, with highly variable bedrock composition along with the unconsolidated sediment (primarily alluvial in origin) that makes up much of the valley floor. It has been estimated that approximately 11% of the Scott River watershed is underlain by granitic bedrock, which weathers to fine sediment with relatively little clay, and is therefore considered highly susceptible to erosion (Sommarstrom et al. 1990).

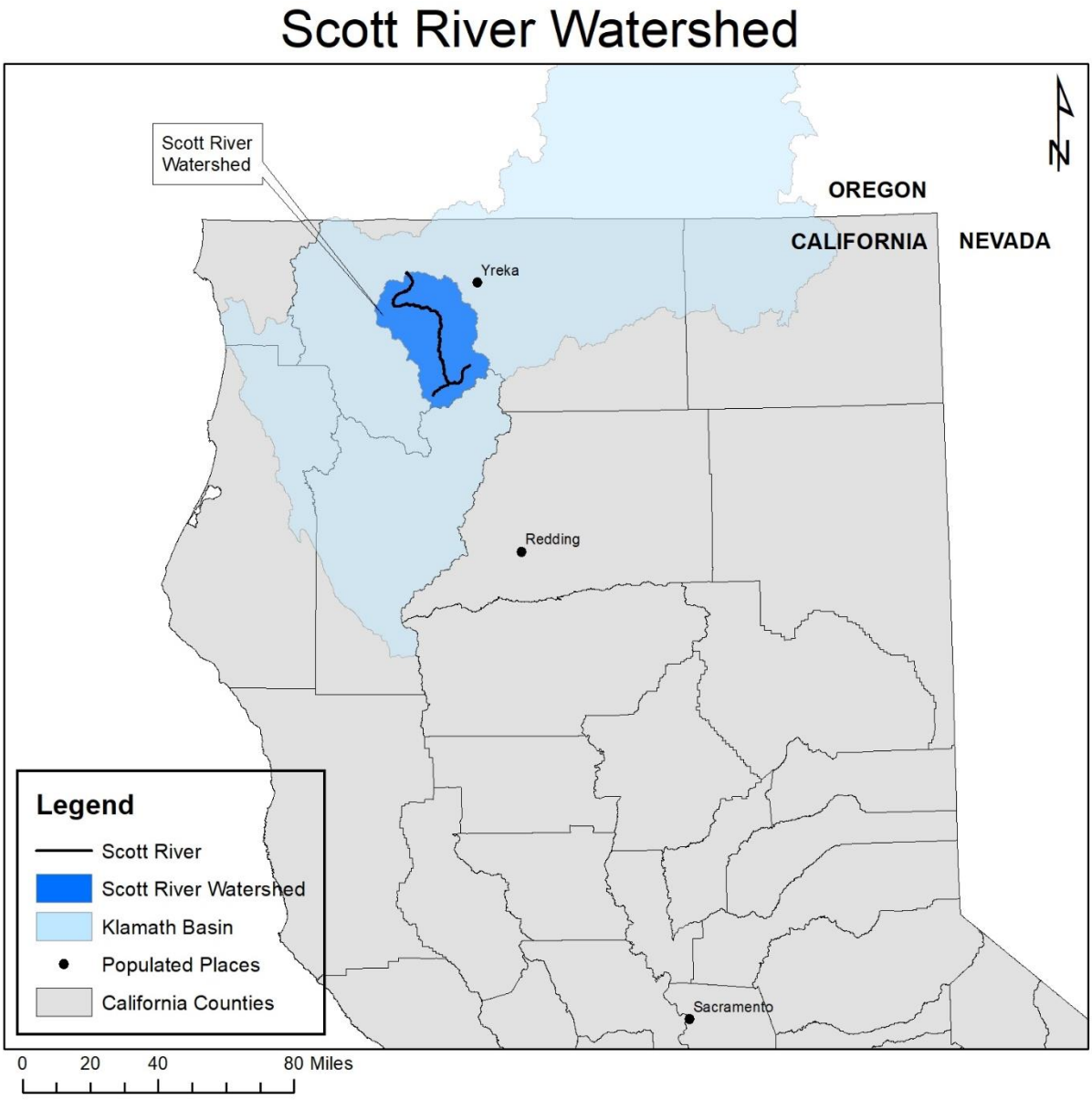

Figure 1. Location Map

Significant lengths of the Scott River and its tributaries have been disturbed by historical land use and resource management practices. These include pervasive logging and mining operations, large-scale beaver trapping and removal, the development of extensive water diversion systems, the conversion of much of the valley floor to agricultural operations, and flood prevention measures including the straightening and leveeing of significant stretches of the mainstem Scott River. The alterations incurred due to these activities impact fluvial form and function as well as the riverine and riparian ecosystems.

The Scott River supports important populations of salmonid (*Oncorhynchus*) species including Chinook salmon (O. *tshawytscha*), coho salmon (*O. kisutch*) and rainbow/steelhead trout (*O. mykiss*). Scott River coho salmon are part of the Southern Oregon Northern California Coast Evolutionarily Significant Unit, which was listed as threatened under the Federal Endangered Species Act in 1997, and under the California Endangered Species Act in 2004. The Scott River population is a core, functionally independent population within the interior Klamath River diversity stratum and is identified as the most productive natural stock in the upper Klamath River basin (NMFS 2014).

Due, in part, to significant anthropogenic impacts since the mid-1800s including extensive gold mining and channelization for flood control, the river has become deeply incised and lost frequent access to the historic floodplain. Consequently, groundwater elevations have dropped and lateral channel migration has produced steep cut banks that contribute large volumes of fine-grained sediment to the river, degrading critical salmonid habitat. The combination of a relatively inaccessible water table and high erosion rates along outside stream meanders has outpaced the ability of riparian vegetation to naturally re-establish, further destabilizing streambanks. Challenged riparian vegetation has resulted in insufficient stream shading, thereby reducing the quality of cold-water habitat. These conditions contributed to the Scott River being listed as impaired for nonpoint source sediment and temperature pollution under the Clean Water Act.

Under section 303 (d) of the Clean Water Act, the U.S. Environmental Protection Agency included the Scott River in the list of impaired waters for excessive levels of suspended sediment and elevated water temperature in 1992 and 1998, respectively. These water quality parameters are known to impact the habitat and survival of salmonid species and the designated beneficial uses which work to protect cold water, migratory fish and habitat. Analysis completed by the North Coast Regional Water Quality Control Board (RWQCB) suggests that current sediment delivery to the Scott River is about 167% of natural sediment delivery (RWQCB 2005b). While the decomposed granite in the watershed factors into the high levels of sediment deposition in the Scott River and its tributaries, land use practices exacerbate the effect.

Anthropogenic sources of sediment include erosion from unpaved and unmaintained roads, mass-wasting events induced by human activities which destabilize slopes, and historical and current silvicultural/agricultural/ranching practices which promote erosion through increased overland flow, alterations to channel geometry, disturbed stream banks, and loss of riparian vegetation. Excessive sedimentation and stream aggradation can negatively impact instream salmonid habitat and cause fish stress throughout their life-history stages. Furthermore, stream aggradation often alters channel morphology, resulting in wider and shallower channels which are likely to experience increased solar loading.

In an effort to address these water quality concerns, the RWQCB adopted the Total Maximum Daily Load (TMDL) Action Plan in 2005, which primarily attributes elevated water temperatures in the Scott River to increased solar radiation due to a decrease in riparian vegetation and stream bank erosion as the primary

source of instream sediment (RWQCB 2005a). The TMDL for the Scott River watershed was set at 550 tons of sediment per square mile per year. In 2006 (and again in 2012 and 2018), the RWQCB approved the *Scott River Conditional Waiver of Waste Discharge Requirements* (R1-2018-0018), intended to promote compliance with the TMDL Action Plan and encourage collaborative, community-based efforts to improve water quality, ecosystem function, and sustainable and economical agricultural practices.

Approach and Objectives

In an effort to further the coordinated approach to reducing anthropogenic effects on water quality and addressing non-point source pollution in the Scott River watershed, the Siskiyou Resource Conservation District (SRCD) established what is now known as the *Scott River Stream Restoration and Sediment Reduction Program* (Program). The purpose of the Program is to address sediment and thermal inputs to the Scott River with willing landowners through methods that concurrently enhance habitat for salmonid species in the watershed. The objectives of this work are as follows:

- Restore natural stream processes within the Scott River to improve channel morphology and sediment management processes as well as sustain adjacent agricultural lands
- Improve the extent, stability and condition of the riparian corridor
- Improve the quantity and quality of instream salmonid habitat
- Increase community awareness of local water quality regulatory standards, beneficial management practices and restoration opportunities

Under the *Scott River Stream Restoration and Sediment Reduction Program* the SRCD successfully implemented four streambank restoration projects on the mainstem from 2008 to 2015 (Figure 2). The first of these was a demonstration site at river-kilometer (rkm) 79.3 that was completed in 2008 through collaboration with the Natural Resources Conservation Service (NRCS) and the California Department of Fish and Wildlife (CDFW). The bioengineered stabilization treatment utilized the techniques and expertise of Chris Hoag and Jon Fripp, as described in *Streambank Soil Bioengineering Field Guide for Low Precipitation Areas* (Hoag and Fripp 2002.). A few years later, after monitoring the effectiveness of that site, the SRCD performed a geomorphic assessment and compiled an action plan for subsequent treatments, commonly known as the *Scott River Watershed (Riparian) Restoration Strategy and Schedule*. Since then, the SRCD has systematically implemented streambank stabilizations at three of the sites identified through that process (rkm 58.1 Hanna Brothers Ranch, rkm 77.9 Spencer Ranch, rkm 83 Merlo Property). The designs for these sites were developed by Cascade Stream Solutions (subcontracted engineering firm) and feature large wood and rock deflectors in association with bioengineered treatments.

2017-2021 Focus and Outcomes

From 2017 - 2021, as discussed in this report, the SRCD developed and implemented bioengineered stabilizations of two critical bank erosion sites on a reach of the Scott River mainstem which serves as a migration corridor and habitat for anadromous salmonid species including coho salmon, Chinook salmon and steelhead trout. The work sites are located at river-kilometer (rkm) 60 (Scarface Cattle Company/Finley Farms) and rkm 67 (Rancho del Sol) and were identified as high priority due to the magnitude of sediment delivery and the importance of the reach for the salmonid fisheries (Figure 2).

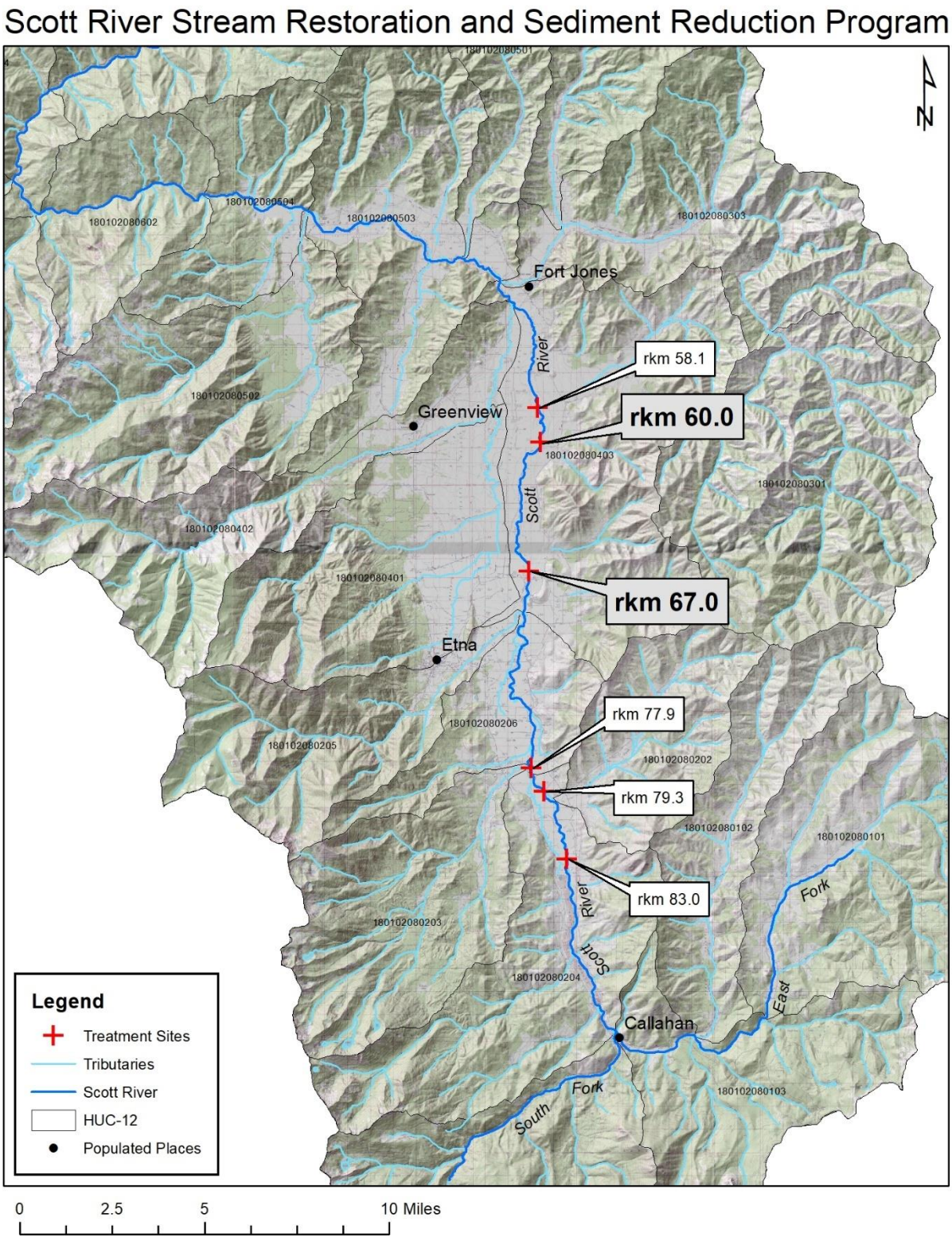

Figure 2. Program Site Map

The SRCD has estimated that stabilization of the bank erosion sites at the rkm 60 and rkm 67 sites could collectively reduce sediment contributions to the Scott River by 3,000 tons per year. This volume was later refined to an estimated 2,681 tons per year through analysis of historical aerial imagery in conjunction with topographic surveys. The treatment of these sites could also, in the long term, address the water temperature impairment by improving stream morphological conditions and the function of the riparian corridor which affect solar inputs to the Scott River.

Work under State Water Resources Control Board (SWRCB) Agreement D1613103 included the following Tasks: (1) Project Management (2) Environmental Clearance (3) Planning and Design (4) Construction (5) Monitoring and Reporting and (6) Outreach and Education. The streambank stabilizations involved a site-specific combination of bioengineered large wood/rock deflectors and riparian revegetation to improve flood conveyance, reduce erosional forces along the banks, and expand coverage of the riparian corridor. Structures and materials installed instream were designed to benefit fisheries habitat by initiating the development of refugial scour pools, sorting spawning gravels, and providing complex shelter elements. Over time these treatments are intended to address the sediment impairment by minimizing erosion and eventually also the water temperature impairment by attenuating direct solar inputs to the Scott River.

The proposed and achieved outcomes of Agreement D1613103 are as follows:

- Stabilization of a combined 650 feet of eroding streambank through the application of bioengineered techniques
  - 1,400 feet of eroding bank were ultimately treated
- Increased streambank vegetative cover through the planting of native riparian species over 4 acres.
  - 3.3 acres were ultimately planted
- Improved salmonid habitat quantity and quality through the placement of instream woody debris features
  - 14 engineered log jams were installed in the Scott River with documented salmonid utilization
- Community involvement in workshops/field days to allow for discussion of the conditional waiver status and options for addressing nonpoint source pollution.
  - Publicly available informational webinar and community meeting

PROGRAM SUMMARY

Funding Distribution

Funding for the *Scott River Stream Restoration and Sediment Reduction Program* from 2017 - 2021 was provided by multiple government agencies and programs (Table 1).

Table 1. Funding Distribution

Source	CFDA	Grantor	Program	Agreement #	Term	Amount
Environmental Protection Agency	66.46	State Water Resources Control Board	Nonpoint Source Grant Program, CWA 319(h) Project	D1613103	6/1/2017 - 3/31/2021	$ 333,626.00
U.S Fish and Wildlife Service	15.663	National Fish and Wildlife Foundation	NFWF-USFWS Conservation Partnership	0125.18.060729	7/1/2018 - 4/30/2020	$ 80,000.00
U.S Fish and Wildlife Service	15.631	U.S. Fish and Wildlife Service	Partners for Fish and Wildlife	F17AC00512	9/13/2017 - 9/30/2022	$ 49,550.00
						$ 463,176.00

Review of Work and Timeline

The first thing done by the SRCD in 2017 was to acquire landowner access agreements for work at both the rkm 67 project site (Rancho del Sol) and the rkm 60 project site (Scarface Cattle Company/Finley Farms). SRCD staff then performed topographic surveys of the Scott River surrounding the project sites and generated maps in Esri ArcGIS comparing the bank conditions between 2010- 2013 and 2017. It was determined that both locations had been substantially impacted by high water in February 2017 and were going to require more extensive treatments than originally anticipated. The SRCD hosted a site visit with the RWQCB to discuss amending the grant agreement to address these changes.

The SRCD focused initial planning efforts on the rkm 67 project site, as it was in line for implementation first. Preston Harris (independent consultant) was designated as the person responsible for coordinating the development and implementation of the streambank stabilization on behalf of the SRCD, including maintaining relations with the landowner. The SRCD worked with Cascade Stream Solutions (subcontracted engineering firm) to explore restoration options, develop conceptual plans, and prepare cost estimates for treatment of the rkm 67 site. Joey Howard (CA licensed Professional Engineer for Cascade Stream Solutions) proceeded through the design process which involved the acquisition of additional topographic survey data, analysis of hydrologic/geomorphic conditions, scour/stability calculations, and hydraulic modeling in order to successively refine the treatment plan. Partners, funders and regulatory agencies provided input during this process. A Basis of Design Report and Final Construction Plans (Appendix III) were completed on July 9, 2018. The SRCD, in collaboration with the landowner, concurrently compiled a Revegetation Plan for rkm 67 to initiate the establishment of a functional riparian zone and ensure long-term stability of the reach.

The SRCD proceeded through the environmental compliance process for the rkm 67 project site, which started with the completion of special status species surveys (aquatic, avian, and botanical). Although a determination pursuant to CEQA had been made in 2014, the SRCD compiled a Supplemental Mitigated Negative Declaration to address avoidance and minimization measures for biological resources in more detail, including direct mitigation for loss of bank swallow (*Riparia riparia*) nesting habitat. SRCD staff acquired a Streambed Alteration Agreement from the CDFW and a Water Quality Certification from the RWQCB. The United States Fish and Wildlife Service (USFWS) handled federal environmental compliance requirements pursuant to NEPA, ESA Section 7, RHA Section 10, NHPA, and CWA 404. The SRCD and USFWS confirmed that both the state and federal authorizations had been secured by September 11, 2018. All of the state and federal environmental compliance documents were forwarded to the SWRCB (state granting agency) for final review. The SWRCB Division of Financial Assistance provided environmental clearance for the project to proceed on August 31, 2018.

The SRCD then completed a competitive bid process to secure a construction subcontractor for implementation of the rkm 67 streambank stabilization. North Rivers Construction was awarded a subcontract for submitting the lowest qualified bid of $105,480. The SRCD also entered into a Landowner Subgrant Agreement with Paul Sweezey for the acquisition of large wood materials from elsewhere on the Rancho del Sol property.

The SRCD issued a Notice to Proceed on September 13, 2018 and heavy equipment was mobilized on September 19, 2018. The riverbed was almost entirely dry (only a few isolated pools remained), so dewatering and turbidity control measures were not necessary. Cascade Stream Solutions staked the footprint of the engineered log jams and North Rivers Construction systematically installed them by excavating the bank, setting the piles, layering the cross-members, and backfilling the structures with vegetative cuttings. North Rivers Construction then used heavy equipment to regrade the floodplain/terrace to improve the conveyance of high water and establish the bank swallow mitigation habitat. Project implementation was completed on October 5, 2018.

The SRCD, in coordination with Cascade Stream Solutions, performed construction inspections, topographic surveys, and photo documentation to confirm adherence to the Final Plans and describe the restored condition of the streambed, banks, and floodplain immediately following implementation. Outcomes included the stabilization of 850 feet of eroding stream bank along the Scott River through the installation of 6 engineered log structures composed of large wood (110 trees), rock, and vegetative cuttings. As-Built Drawings were produced by Cascade Stream Solutions (Appendix III). Representative photographs taken before, during, and after the process were included as a deliverable (Appendix III). A site visit was conducted on February 20, 2019 so that cooperating agencies could see the completed elements of the project. The first effectiveness monitoring surveys (revegetation and fisheries) were completed in July of 2019.

The SRCD then transitioned over to developing the rkm 60 project site on Scarface Cattle Company and Finley Farms. The SRCD contracted with Gary Black of GS Black Inc. (independent consultant) for project coordination services associated with the development and implementation of the streambank stabilization, including maintaining relations with the landowner representatives. The SRCD worked with Gary Black and Cascade Stream Solutions to proceed through a comprehensive design process involving the acquisition of additional topographic survey data, analysis of hydrologic/geomorphic conditions, scour and stability

calculations, and hydraulic modeling in order to successively refine the treatment plan for the rkm 60 project site. Partners, funders and regulatory agencies provided input during this process. A Basis of Design Report and Final Construction Plans were completed on August 15, 2019 (Appendix IV); finalization of the designs was somewhat behind schedule, although the permitting process had already been initiated.

The SRCD proceeded through the environmental compliance process for the rkm 60 site, which had begun with the completion of special status species surveys (aquatic, avian, and botanical). Again, the SRCD was responsible for acquiring all state environmental compliance authorizations, including a Streambed Alteration Agreement from the CDFW and a Water Quality Certification from the RWQCB, both of which were finalized by the first week of September 2019. These processes led to the project being identified as exempt from CEQA by both the CDFW and the RWQCB. Meanwhile, the USFWS took the lead on the federal permitting, which included consultation with the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA). As requested, the SRCD and Gary Black provided assistance to the USFWS through this process. Unexpectedly, the NMFS made the determination that they could not include the proposed activities under the programmatic Biological Opinion for restoration projects within the NOAA Northern California jurisdictional area because the treatment incorporated re-establishment of the levee. This decision required the USFWS to enter into a lengthier consultation process with the NMFS that involved the development of an independent Biological Opinion for the project.

From August to September, the SRCD completed a competitive bid process to secure a construction subcontractor for implementation, and North Rivers Construction was selected for submitting the lowest qualified bid at $105,302. Additionally, two full truckloads of fir tree trunks were acquired and delivered to the staging site in preparation for project implementation.

By October 2019, the SRCD and Gary Black were still working with the USFWS to facilitate the ESA Section 7 consultation with NMFS. However, it became clear that the Biological Opinion, and therefore the federal environmental permitting process, would not be completed in time to allow for implementation of the rkm 60 treatment in 2019 as planned. For this reason, the SRCD officially postponed construction and began working with the landowners, project partners, funding entities, and permitting agencies to explore alternative options.

At the turn of the year, the SRCD received the remaining federal environmental compliance documents for the rkm 60 project site. The NMFS consultation and Biological Opinion were completed on January 8, 2020, and had concluded that any adverse impacts would be “temporary and minimal” and that the project was approved to proceed. The Army Corps of Engineers confirmed CWA 404 coverage under Nationwide Permit 27 shortly thereafter. All of the state and federal environmental compliance documents were then forwarded to the SWRCB (state granting agency) for final review. The SWRCB Division of Financial Assistance ultimately required that the SRCD make an independent CEQA Notice of Exemption, which was filed on February 14, 2020, after which they provided environmental clearance for the project to proceed on February 25, 2020.

Based on the pending trajectory of the project, the SRCD entered into a contract with North Rivers Construction for implementation of the restoration treatments at the rkm 60 project site in early 2020. With approval from the RWQCB, the SRCD allowed North Rivers Construction to initiate materials

procurement. North Rivers Construction completed purchasing all materials by the end of April. Additionally, the SRCD, in collaboration with the landowner, compiled a Revegetation Plan for rkm 60 to initiate the establishment of a functional riparian zone and ensure long-term stability of the reach.

In early spring 2020, the additional riparian revegetation efforts occurred at the rkm 67 project site (Rancho del Sol). The SRCD and North Rivers Construction planted 2.0 acres of native species through floodplain and terrace plots. Of this acreage, approximately 0.2 acres were planted at high density (>1,000 plants per acre) and 1.8 acres were planted at low density (around 100 plants per acre). Cottonwoods were sourced from other local areas, while willows were harvested from dense stands within the treatment area and elsewhere on the property. A total of 92 cottonwood poles and 42 willow clumps were installed through all three levels of the western terraces and across the excavated channel through the floodplain. Another 340 willow stems were planted surrounding and between the stabilizing structures, along the water line, and other nearby areas of the banks. Lastly, the SRCD cleared and seeded native perennial herbaceous plants through 14 8'x8' square beds to test the efficacy of hand-harvested seed in revegetation efforts. The SRCD followed up with maintenance activities including mulching, watering, and weed management through the summer of 2020. Annual effectiveness monitoring of the rkm 67 project site, including stream and habitat response, fisheries utilization of restoration features, and revegetation success, was repeated in July 2020.

It wasn't until September 15, 2020, that the SRCD issued a Notice to Proceed for implementation of the rkm 60 project site (Scarface Cattle Co/Finley Farms). The riverbed was almost entirely dry at this time (only a few isolated pools remained), so dewatering and turbidity control measures were not necessary. Heavy equipment was mobilized on September 25, 2020. Cascade Stream Solutions staked the grading lines and North Rivers Construction used heavy equipment to regrade the channel, banks, and terrace to improve the conveyance of high water. North Rivers Construction then systematically installed the engineered log jams by excavating the footprint, setting the piles, layering the cross-members, and backfilling the structures with native gravel. Lastly, cottonwood poles were installed in low-lying eddy zones and the bank swallow habitat was created. The SRCD, in coordination with Cascade Stream Solutions, performed construction inspections, topographic surveys, and photo documentation to confirm adherence to the Final Plans and describe the restored condition of the streambed, banks, and floodplain immediately following implementation. Outcomes included the stabilization of 550 feet of eroding streambank along the Scott River through the installation of 8 engineered log structures composed of large wood (138 logs), rock, and vegetative cuttings. Project implementation was completed on October 14, 2020 and As-Built Drawings were produced by Cascade Stream Solutions (Appendix IV). Representative photographs taken before, during, and after the process were included as a deliverable (Appendix IV).

In late fall 2020, the SRCD and North Rivers Construction planted 1.3 acres of native species through floodplain and terrace plots at the rkm 60 project site. Of this acreage, approximately 0.6 acres were planted at high density (>1,000 plants per acre) and approximately 0.7 acres were planted at medium density (around 500 plants per acre). Cottonwoods and willows were primarily sourced from other local areas, although some willows were collected from dense stands within the treatment area. A total of 105 cottonwood poles and 1,016 willow poles were installed through plots covering bare areas of the terraces, the re-sloped bank and berm, surrounding the stabilizing structures, along the water line and other nearby areas. Lastly, the SRCD seeded native grasses and mulched across all disturbed areas including the

streambanks and levee. A site visit was conducted on December 9, 2020 so that cooperating agencies could see the completed elements of the project.

Public Outreach

Over the winter of 2020-21, the SRCD developed, filmed, and distributed a webinar about best management practices for the preservation of water quality within an agricultural landscape. The primary audience for the webinar was stream-bearing landowners and managers, though the webinar is available to the general public. The webinar was developed with this audience in mind by acknowledging the challenges faced by agricultural operations and emphasizing available resources to help alleviate the regulatory burden. The goals of the webinar included:

- Educate landowners about the RWQCB oversight, the premise of TMDL standards, and the regulatory framework. This included background on non-point source pollution and an explanation of the conditional waiver. It was emphasized that the conditional waiver is positive for everyone involved, as it releases the requirement to file individual permits (and filing fees) and encourages collaborative solutions that benefit both the watershed and the landowner.

- Outline best management practices to maintain conditions of the waiver and discuss implications of their implementation. There was a specific focus on livestock management in the stream channel and riparian corridor, the benefits of stock water systems, irrigation and tailwater management, and how to integrate landowner/livestock usage rights and compliance with restoration and pollution reduction efforts. The webinar gave examples showing what waiver compliance can look like in Scott Valley. Strategies outlined work towards goals identified by the RWQCB, including minimization of cattle access, establishment of riparian vegetation, erosion reduction and the development of nutrient buffers.

- Highlight resources available to landowners and stream users that can help them stay in compliance with the waiver. This includes how landowners can supplement voluntary efforts with financial and/or logistical help from the NRCS and the SRCD, including ranch planning, grant assistance, and labor to complete improvements that will improve their operation, protect water quality, and avoid fees.

The webinar consisted of informational slides complemented by video and audio interviews. Those interviewed included SRCD staff, agency representatives (RWQCB, USFWS and NRCS), and several local ranchers and landowners. Landowners who had been working with the RWQCB on water quality protection measures were highlighted. These interviews with familiar names demonstrated to local landowners and managers what is possible and achievable here in Scott Valley. Viewers were encouraged to contact the SRCD with questions or requests for assistance in the development of water quality protection measures on their property.

The webinar was made public on several platforms, including on the SRCD website (www.siskiyourcd.com), the SRCD Facebook page, and YouTube. A live Question and Answer session was conducted at a public board meeting on February 11, 2021. This allowed attendees to get information

they were interested in, provide feedback and general comments, and allowed the SRCD Board of Directors to interact with the community it serves.

Over the term of Agreement D1613103, the SRCD was not able to complete Task 6.3 which involved a presentation to the Klamath Basin Monitoring Program, Salmonid Restoration Federation, or similar venue on streambank restoration in Scott Valley. This component of the Scope of Work was impacted by the coronavirus pandemic and subsequent staffing constraints. While working through the transition of two key staff members, the SRCD did not make the enrollment deadline for the Klamath Basin Monitoring Program conference. Unfortunately, social distancing requirements led to the cancellation of all other appropriate conferences, including the Scott River Information Forum.

DETAILED SITE DESCRIPTIONS

Scott River river-kilometer 67 -- Rancho del Sol

Public Land Survey System: Township 42 N Range 09 W Section 14 NE ¼
USGS Quadrangle: McConaughy Gulch
Latitude and Longitude: 41.492617° -122.847487° or N 41° 29’ 33.4212” W 122° 50’ 50.9534”
Hydrologic Unit Code: 18010208 0403 Hamlin Gulch – Scott River

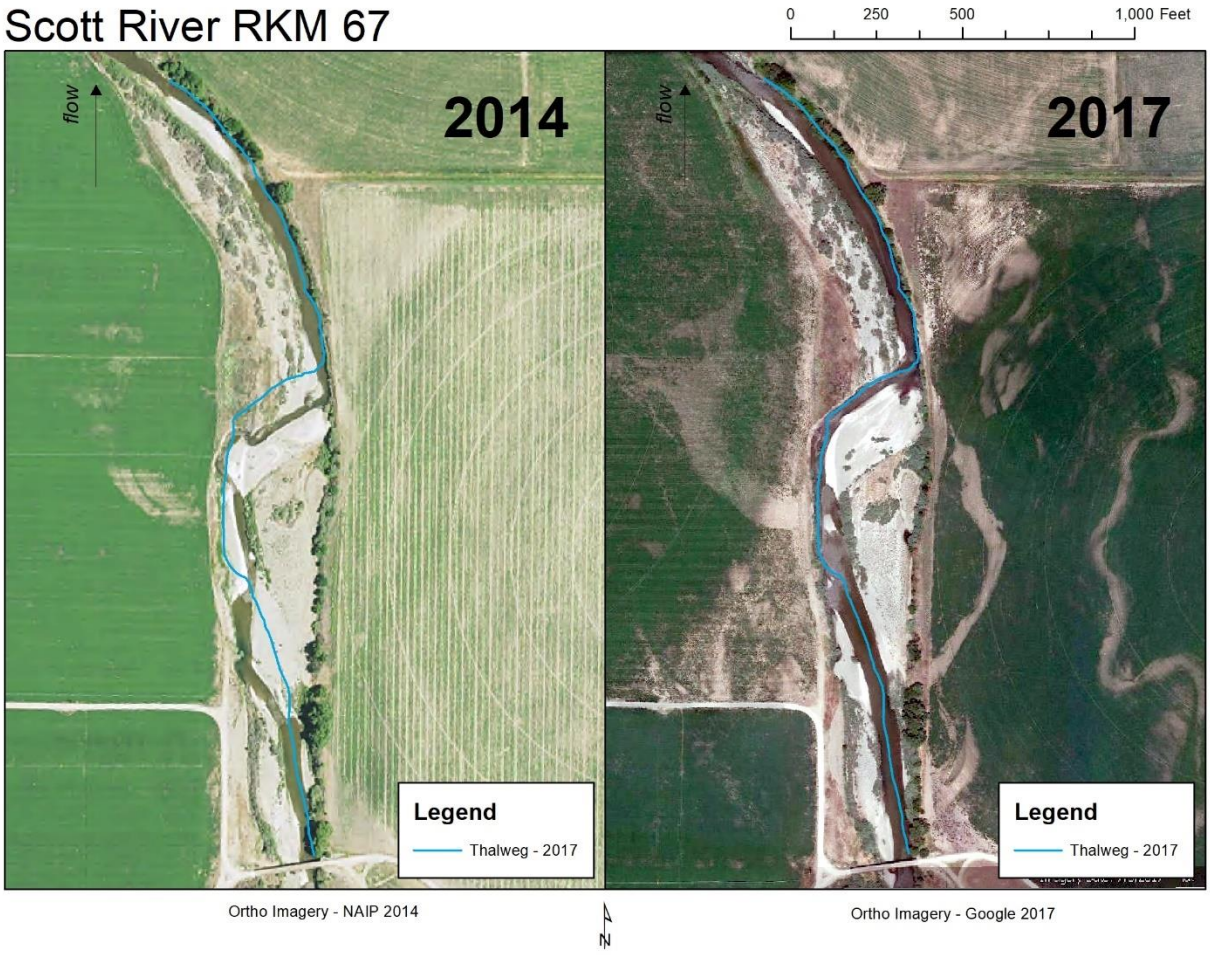

Figure 3. Scott River rkm 67, comparison of aerial imagery

Site Conditions

The Scott River through the valley is characterized by low sinuosity, a slope of less than 2 percent and substrate ranging from cobble to sand. The Rancho del Sol property exists within a transitional zone where the river is being funneled from a moderate width/depth ratio to being fully channelized between levees. It provides spawning habitat (gravels) for Chinook salmon, rearing habitat for rainbow trout and migratory habitat for coho salmon. The rkm 67 site itself is positioned between two specific constriction points: bridge abutments above and narrow rocked banks below (Figure 3). The available floodplain is about twice as wide at the project site than it is upstream and downstream of the project area, resulting in unbalanced

sediment dynamics and significant deposition through the project site. At rkm 67 the channel has been pushed around evolving point bars resulting in pressure on the banks and subsequent erosion. This has been most pronounced against the northwestern terrace as the meander pattern of the channel is driven downstream. The SRCD, in coordination with NRCS, has been monitoring conditions on the Scott River at rkm 67 since 2013. Comparison of survey data from 2013 and 2017 shows that the northwestern terrace lost 0.45 acres of sandy-loam and clay-loam soil over that 5-year time period. (For more information on pollutant loads, see the section titled PROGRAM MONITORING AND EVALUATION, Analysis and Discussion, Pollutant Load Reduction, page 45). The SRCD has observed the western bank in a degrading trend for multiple years as evidenced by active erosion and continued impacts to the extent and diversity of riparian species (Figure 4 and Lewis 1992). In 2017, the western bank remained nearly vertical in most locations with sparse riparian shrubs at the toe of the bank, no vegetation on the top of the bank and patches of invasive weed species (Figure 6). Furthermore, as the channel encounters resistant clay layers within the northwestern terrace it has been redirected more sharply toward the eastern bank. In 2013, the channel was making a very low radius turn to convey water nearly perpendicular across the channel and directly into the eastern bank (Figure 5). The defending rip-rap (1977) is nearing its lifespan and has been unable to prevent damage to the eastern bank from impinging flow (Figure 7). Although the eastern bank supports a moderate density of riparian species along the slope with well-established canopy cover, recent failure (slumping) of the rock rip-rap has introduced vulnerability. Conditions at the rkm 67 project site in 2017 suggested continued erosion of the western bank and increasing pressure on the compromised portion of the eastern bank.

Figure 4. Scott River rkm 67 (western bank), 2012

Figure 5. Scott River rkm 67 (northwestern terrace), 2013

Figure 6. Scott River rkm 67 (western bank), 2017

Figure 7. Scott River rkm 67 (eastern bank), 2017

Treatment

Stream restoration at rkm 67 aimed to address nonpoint source impairments to the Scott River by stabilizing erosional streambanks and initiating the establishment of an integrated riparian corridor. The site plan consisted of bioengineered structures, recontouring of the northwestern terrace/floodplain, and riparian planting that together were intended to realign the stream processes of this reach with adjacent reaches as explained in the Basis of Design Report and Revegetation Plan. The treatment components are described here beginning at the upstream end of the project site and moving downstream (Figure 8). Refer to Appendix III. RKM 67 Construction Plans, As-Built Drawings and Photographs.

The introductory section of the treatment area was stabilized with a series of low-profile Engineered Log Jams (ELJs) (Type C) to protect the toe of the slope where erosional forces begin to interface with the western bank and to support any potential slumping that occurs in the future (Figure 9). Type C ELJs consist of ballasted rootwads with transplanted willows installed along the toe of the bank and do not project significantly into the channel. Three Type B ELJs, designed to deflect the thalweg off the bend and reduce water velocities near the bank, were sequentially placed downstream on the western bank (Figure 10). Type B ELJs are larger structures and extend further into the channel than Type C. In order to reduce the subsequent meander curvature and improve flood conveyance, the western terrace and floodplain were recontoured below this point (Figure 12). This process involved 1) excavating a portion of the lower terrace to an elevation similar to the opposite bar 2) enhancing existing flow channels through the floodplain to allow for more frequent access and 3) removing the tip of the gravel bar to provide additional space for flow in the main channel. Extracting material that was promoting the abrupt transition of the channel from

the west to the east (and was positioned for continued erosion) was necessary to initiate stream processes that will reduce pressure (flow, velocity and sheer stress) against the banks. Excavation was designed to work with existing topography and minimize disturbance to riparian vegetation. Willow clumps were salvaged from this area for placement elsewhere. The eastern bank was treated with two consecutive ELJs (a Type A, "apex jam" followed by a Type B) to intercept and deflect impinging flows away from the bank (Figure 11). The ELJs installed on both the western and eastern banks also provide cover to aquatic species, sort spawning gravels, and aid natural vegetation recruitment. Additionally, bank swallow nesting habitat was established nearby on the property to mitigate for potential impacts associated with installation of the ELJs. This involved modifying an existing off-channel berm between the agricultural fields and the floodplain into a near vertical slope.

Figure 8. Scott River rkm 67 (looking downstream), 11/5/18.

Figure 9. Type C ELJ after construction (western bank), 12/4/18.

Figure 10. Type B ELJs after construction (western bank), 11/5/18.

Figure 11. Type B ELJ (left) and Type A ELJ (right) after construction (eastern bank), 11/5/18.

Figure 12. Western terraces and floodplain after re-grading, 12/4/18.

Comprehensive riparian revegetation was an integral component of the treatment plan as it contributes to long-term stability of the banks and development of an ecologically functional riparian corridor. Riparian vegetation provides roughness, diffuses water velocity, reduces erosional forces, secures sediment, improves soil cohesiveness and provides shade. Plantings within and surrounding the ELJs were implemented during the fall 2018 construction period. Additional revegetation activities occurred in the spring of 2020 and covered 2.0 acres of the riparian corridor (Figure 13). Of this acreage, approximately 0.2 acres were planted at high density (>1,000 plants per acre) and 1.8 acres were planted at low density (around 100 plants per acre). A total of 92 cottonwood poles and 42 willow clumps were installed through all three levels of the western terraces and across the excavated channel through the floodplain. Another 340 willow stems were planted surrounding and between the stabilizing structures, along the water line, and other nearby areas of the banks.

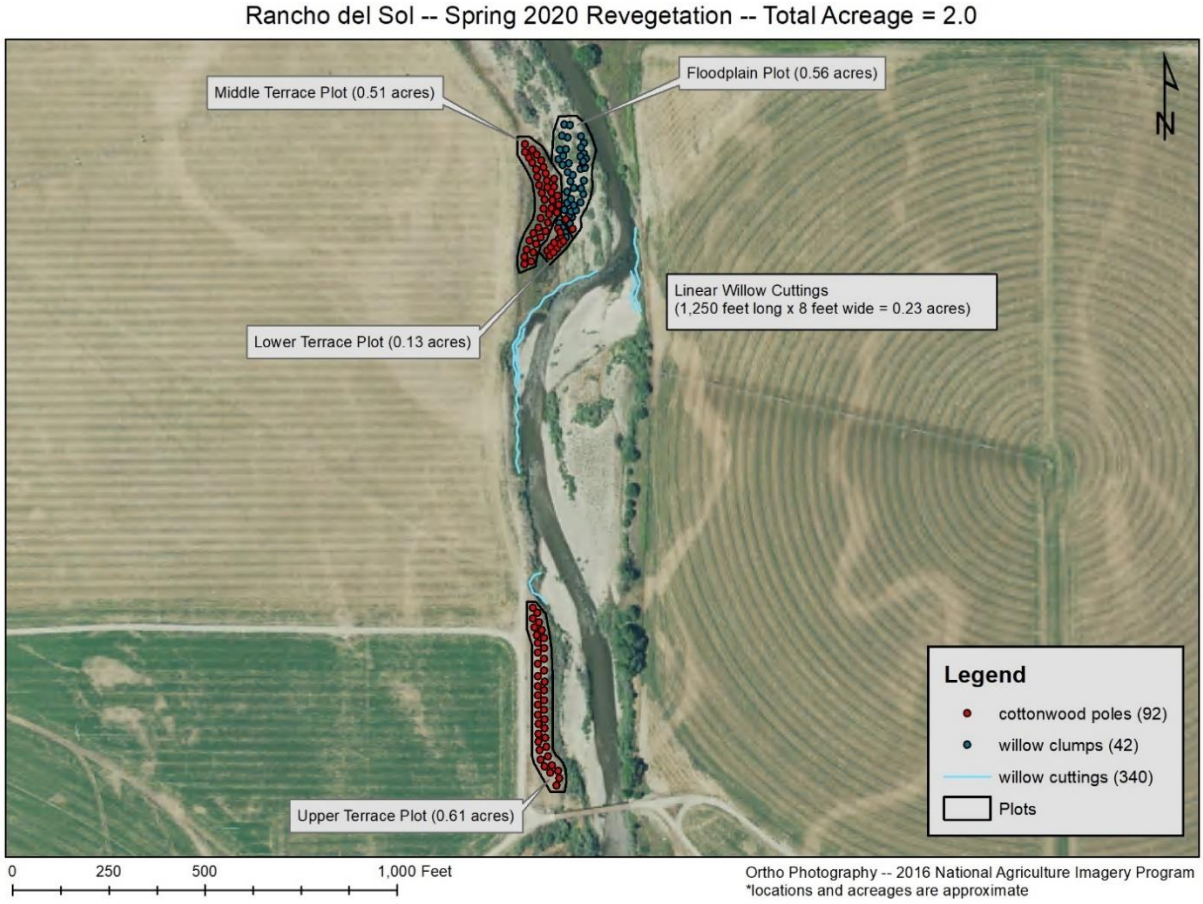

Figure 13. Diagram of planting methods and locations

In accordance with the Revegetation Plan, here is the work that was completed at rkm 67:

- Willow bundles were planted within and surrounding all ELJs (Plot 3 and the equivalent on the eastern side of the river) (Figure 14)
- Willow bundles and willow clumps were planted along the toe of eroding bank in association with the river-left constructed toe (ELJ type C) (Plot 3) (Figure 15)

- Willow whips were planted along the bank and water line through the entire treated area (Plot 3, the equivalent on the eastern side of the river and additional areas) (Figure 16)
- Willow clumps were planted across the newly excavated overflow channels including the re-entrance area near the main channel (Plot 1 and most of the northern salvage area) (Figure 17)
- Cottonwood poles were planted into the lower terraces and floodplain in rows running parallel with the direction of flow (bottom portion of Plot 2 middle terrace, and lower terrace) (Figure 18)
- Willow whips were planted in an eroding cusp on the river left bank upstream from the treatment site (Plot 5)
- Cottonwood poles were planted across the western terrace below the bridge (Plot 7)

Figure 14. Willow bundles growing within Type B ELJ, 7/15/20.

Figure 15. Willow clumps and bundles along the bank in association with the Type C ELJ, 7/25/19.

Figure 16. Willow whips along the water line, 4/17/20.

Figure 17. Willow clumps through the excavated overflow channel, 4/11/20.

Figure 18. Cottonwood poles through the lower terrace, 5/1/20.

Plantings included black cottonwood (*Populus trichocarpa*) and native willow (*Salix*) species including pacific willow (*S. lucida*) and sandbar willow (*S. exgua*). Cottonwood poles were only sourced off-site from other local areas along the Scott River. Willow cuttings were harvested from dense stands available within the treatment area and elsewhere on the property. The selection of species and planting type for each plot was selected to best promote survival and success given plot characteristics. For example, willow clumps, which have spherical root mass, were planted through low lying areas of the floodplain to facilitate sufficient access to water while cottonwoods were planted on elevated terraces because the poles could be installed deeper. Planting involved excavating a hole or trench and subsequently burying the cutting(s). North Rivers Construction was able to reach the water-table for most but not all of the cottonwood plantings. The landowner organized the procurement of locally produced sawdust for mulch, which was applied around all of the cottonwood poles by the SRCD.

Additionally, the SRCD cleared and planted a series of 8' x 8' square test beds with native forbes to promote groundcover establishment. Seeds were collected from the following perennial flowering herbaceous plants: Rayless Golden Aster (*Heterothica oregona)*, Bouncing Bette (*Saponeria officinalis*), and Yarrow (*Achillea millefolium)*. Experimental treatments included coarse versus fine substrate and sawdust mulch versus bare ground, resulting in 12 test plots: three seed species and four different treatments per species.

In coordination with the landowner, the SRCD carried out a weekly watering schedule for the cottonwood poles and seed beds to help promote sprouting and growth. The willow species installed in the floodplain were not watered due to their proximity to the river and logistical constraints. The SRCD also conducted seasonal invasive weed control activities involving hand pulling Marlahan Mustard (*Isatis tinctoria)* and spraying various species of knapweed (*Centauria spp.*) and thistles (*Cirsium spp.*) with non-toxic weed killer consisting of white vinegar, table salt, and liquid dish soap. Intensive weed management occurred during the spring, while irrigation occurred from May through September.

The growth and survival of the various plantings at rkm 67 were assessed in July 2019 and again in July 2020. (For more information, see the section titled PROGRAM MONITORING AND EVALUATION, Analysis and Discussion, Habitat Restoration, page 49).

Scott River river-kilometer 60 -- Scarface Cattle Company and Finley Farms

Public Land Survey System: Township 43 N Range 09 W Section 26 SE ¼
USGS Quadrangle: Fort Jones
Latitude and Longitude: 41.543929° -122.839907° or N 41° 32’ 38.243” W 122° 50’ 23.667”
Hydrologic Unit Code: 18010208 0403 Hamlin Gulch – Scott River

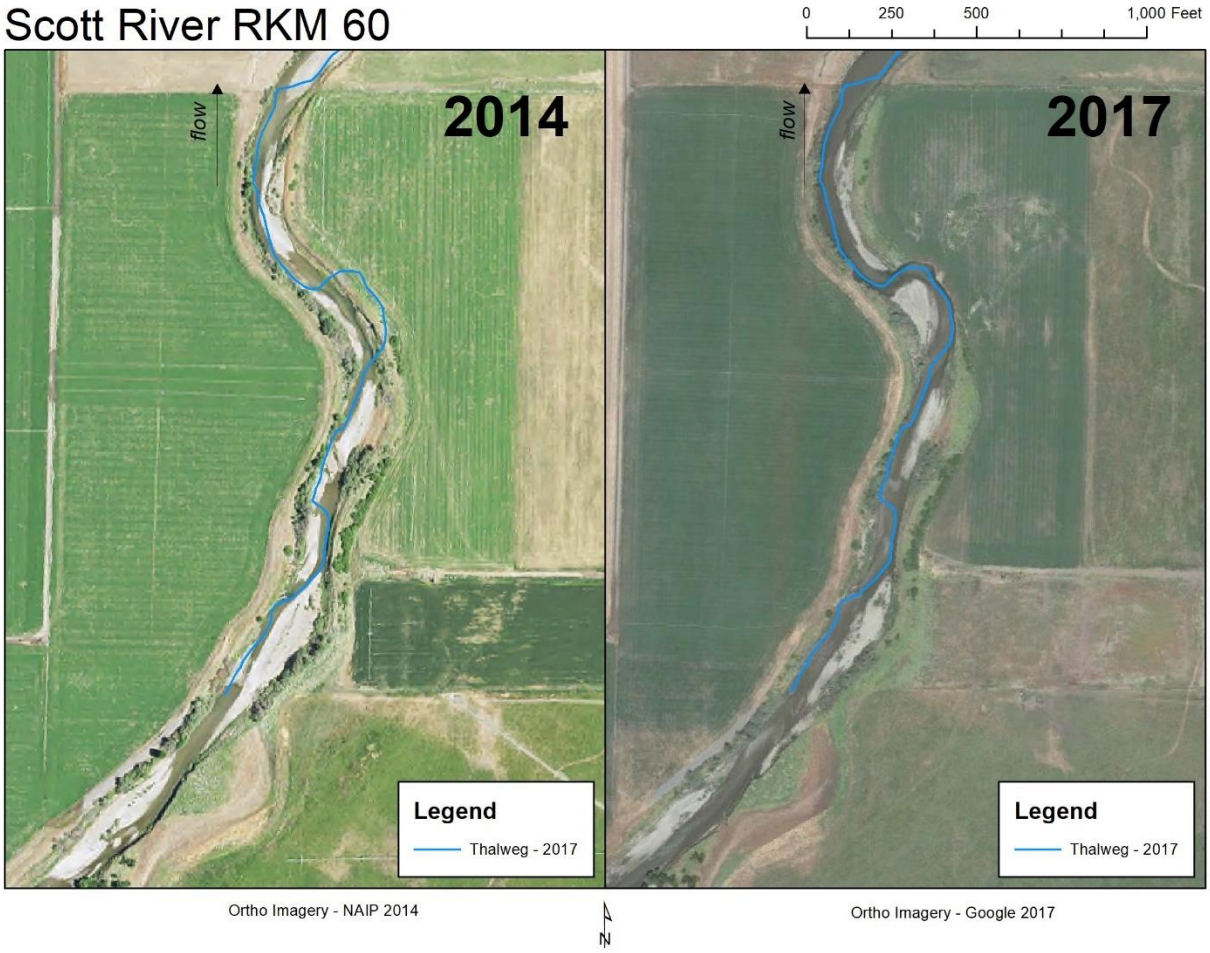

Figure 19. Scott River rkm 60, comparison of aerial imagery

Site Conditions

The SRCD has been monitoring conditions on the Scott River at rkm 60 (Scarface Cattle Company and Finley Farms) for almost a decade. With inadequate meander space, the river flows along the toe of leveed slopes, and the resulting saturation and shear force cause failures producing near vertical banks (Figure 19). Field assessments in 2010 described the eroding section of the eastern bank as being 110 feet long and approximately 12 feet tall after which it was identified as a priority treatment site under the *Scott River Watershed (Riparian) Restoration Strategy and Schedule* (Figure 20-21). Since then, the site has continued to undergo active erosion including several mass wasting events. Approximately 0.54 acres have eroded since 2010, with 68% of that loss occurring during the 2017 flood alone. (For more information on pollutant loads, see the section titled PROGRAM MONITORING AND EVALUATION, Analysis and Discussion,

Pollutant Load Reduction, page 45). In 2017, the eroded face of the eastern bank was approximately four times longer than it was in 2010 and was threatening avulsion (Figure 22). Furthermore, these mass wasting events have altered the functional morphology of the eastern bank significantly. A soil horizon lower in the bank profile consists of higher levels of clay, making it relatively cohesive and resistant. Differential erosion patterns led to the development of a distinct concave section and cusp which conveyed water nearly perpendicular across the channel and directly into the western bank (Figure 23). These flow alterations have already undermined the defending riprap and riparian vegetation and led to recent damage of the western bank.

The eastern terrace has been characterized by leveed agricultural land and lacks a riparian buffer. The hydrologic disconnect and extreme erosion along the east bank has damaged and prevented the natural re-establishment of a stable riparian zone. Existing vegetation consists primarily of weeds. The western bank has experienced less erosion than the eastern bank and therefore supports more mature vegetation. Segments of the western bank contain decent stands of riparian shrubs and trees; however, many of them were vulnerable because impinging flows have eroded through the rock slope protection. Without intervention vegetation loss is likely to continue.

Figure 20. Scott River rkm 60 (eastern bank), 2009

Figure 21. Scott River rkm 60 (eastern bank), 2010

Figure 22. Scott River rkm 60 (eastern bank), 2017

Figure 23. Scott River rkm 60 (eastern bank and western banks), 2017

Treatment

Stream restoration at rkm 60 aimed to address nonpoint source impairments to the Scott River by stabilizing erosional streambanks and initiating the establishment of an integrated riparian corridor. The site plan consisted of bioengineered structures, recontouring the eastern bank, floodplain grading, riparian planting, and re-establishment of the levee that together were designed to allow more natural stream processes through this reach, as explained in the Basis of Design Report and Revegetation Plan. The treatment components are described here beginning at the upstream end of the project site and moving downstream. (Figure 24). Refer to Appendix IV. RKM 60 Construction Plans, As-Built Drawings and Photographs.

The uppermost section of the treatment area was reinforced with a robust engineered log jam (Type B ELJ) intended to immediately redirect the thalweg away from the vulnerable western bank (Figure 25). The Type B ELJs used at this site are very similar to those used at rkm 67 in that they are formed by setting maximum length piles and then layering cross-members which are ballasted and anchored. This ELJ was followed with a series of lower-profile structures involving wood piles surrounding a soil wrap to produce vegetated peninsulas (Figure 26). In the Construction Plans, these structures are referred to as Type A ELJs, though they are not the same type of structures as those described as Type A at the other site. The alignment and interval of these six Type A ELJs was designed to maintain the thalweg off the bend and reduce water velocities near the bank. To allow for the desired thalweg transition, a significant volume of material was excavated from the opposing gravel bar. Beyond the last Type A ELJ, the cusp of the eastern bank was regraded to reduce the meander curvature and improve flood conveyance. Removing the resistant clay layers that were promoting the abrupt transition of the channel from the east to the west was necessary to

reduce pressure (flow, velocity and shear stress) against the banks. Additionally, the treatment involved the establishment of a setback berm with planting benches on the eastern bank. Excavation was designed to work with existing topography and minimize disturbance to riparian vegetation. Any willow shrubs disturbed during construction were salvaged and re-planted within the treatment area. Cut and fill volumes were designed to balance.

The western bank was treated with a single Type B ELJ to intercept impinging flows and protect against erosional damage (Figure 27). Fill for this structure was planned to be sourced from a designated borrow area alongside the river-left access road; however, it was ultimately determined that the material in that area was too fine for this application, so bed load from the gravel bar was used instead. All of the structures are intended to stabilize the streambank, thereby allowing riparian plantings to establish and effectively resist the forces of high flows, while also providing shade, cover, and habitat. Lower velocities along the bank will also allow sediment deposition and promote the natural recruitment of native vegetation to compliment the riparian planting efforts. The utilization of natural and locally available materials is a continued investigation into using softer, vegetation-based methods to address lateral channel migration and encourage riparian re-establishment, as compared to historical practices.

Areas identified as bank swallow habitat were flagged as a non-disturbance zone and avoided during construction. The SRCD attempted to establish additional bank swallow habitat along the inner curvature of the eastern bank at the lower end of the treatment area by shaping a near vertical slope approximately 40 feet in length. Although suitable burrowing soils existed, the intended height could not be achieved without risking bank stability and it is unknown whether the 5 feet of height that was attained will be sufficient for use by swallows.

Figure 24. Type B ELJ (front) and all six Type A ELJs after construction (eastern bank), 11/18/20.

Figure 25. Type B ELJ after construction (eastern bank), 10/30/20.

Figure 26. Type A ELJ (left) and Type B ELJ (right) after construction (eastern bank), 10/30/20.

Figure 27. Type B ELJ after construction (western bank), 10/30/20.

Again, comprehensive riparian revegetation was an integral component of the treatment plan as vegetation contributes to long-term stability of the banks and development of an ecologically functional riparian corridor. All planting activities were completed during the fall 2020 construction period and covered 1.3 acres of the riparian corridor (Figure 28). Of this acreage, approximately 0.6 acres were planted at high density (>1,000 plants per acre) and approximately 0.7 acres were planted at medium density (around 500 plants per acre). A total of 105 cottonwood poles and 1,016 willow poles were installed through plots covering bare areas of the terraces, the re-sloped bank and berm, surrounding the stabilizing structures, along the water line and other nearby areas.

Figure 28. Diagram of planting methods and locations

In accordance with the Revegetation Plan, here is the work that was completed at rkm 60:

- Willow poles and whips were densely planted across the entire disturbed area on the eastern side of the river, from the water line to the top of the re-sloped bank (Plot 2) (Figure 29)
- Willow poles and whips were planted surrounding all ELJs (within Plot 2 and the equivalent area on the western side of the river)
- Cottonwood poles were planted in the backwater eddy areas of the ELJs along the western bank (within Plot 2)
- Willow poles and whips were planted through bare areas of the eastern upper terrace along the fence (Plot 1, upper portion of Plot 4 and Plot 5) (Figure 30, 32)
- Willow poles and whips were planted through bare areas within the middle and lower terraces of the eastern side of the river in rows running parallel with the direction of flow (bottom portion of Plot 4 and bottom portion of Plot 1) (Figure 31, 33)
- Willow poles and whips were planted through the access road on the western side of the river (Plot 3) (Figure 34)

Figure 29. Willow poles and whips planted across the entire disturbed area of the eastern bank, 1/8/21.

Figure 30. Willow planted through the eastern upper terrace along the fence line (Plot 1), 1/21/21.

Figure 31. Willow planted through the eastern lower terrace (Plot 1), 1/21/21.

Figure 32. Willow planted through the eastern upper terrace along the fence line (Plot 5), 1/8/21.

Figure 33. Willow planted through the eastern middle and lower terraces (Plot 4), 1/8/21.

Figure 34. Willow planted through the western access road (Plot 3), 1/8/21.

Plantings included black cottonwood (*Populus trichocarpa*) and native willow (*Salix*) species including pacific willow (*S. lucida*) and sandbar willow (*S. exgua*). Cottonwood poles were only sourced off-site from other local areas along the Scott River. Willow cuttings were harvested from dense stands available on the property as well as from other local areas along the Scott River. Planting involved either excavating a hole (or trench) or driving a steel rod into the ground to make a hole and subsequently burying the cutting(s). When necessary, pressurized water was utilized to close the hole, remove air pockets, and provide initial moisture. Due to drought conditions, North Rivers Construction was not able to reach the water table in most areas, so trenches were watered at the time of installation. The water was supplied from the river by a screened pump. Terrace plots along the fence (upper portion of Plot 1, Plot 4 and Plot 5) were selected specifically because they have the potential to be incidentally watered by existing irrigation infrastructure, which is anticipated to significantly improve their establishment and survival. The landowner provided hay for mulch, which was applied by the SRCD across the entire disturbed area after construction.

PROGRAM MONITORING AND EVALUATION

Methods

At the outset of Agreement D1613103, the SRCD prepared a Project Assessment and Evaluation Plan (PAEP) to outline the goals, desired outcomes, progress indicators, measurement methods and targets for work carried out from 2017-2021 under the *Scott River Stream Restoration and Sediment Reduction Program.* While developing treatments for each of the two project sites, the SRCD compiled an associated monitoring plan that described specific measurable parameters to evaluate functionality and effectiveness. In accordance with those plans, the SRCD employed the following quantitative and qualitative methods to monitor environmental response from project treatments.

A network of permanent benchmarks were established within each of the project sites to be used as survey controls. A longitudinal profile and cross-sections were periodically surveyed from the permanent benchmarks to document changes in stream and bank morphology over time. A preliminary topographic survey was completed in 2017 to document existing conditions as well as inform the development of the Final Construction Plans. Construction inspection and an as-built topographic surveys were performed immediately after project implementation to document adherence to the Final Plans (Appendix III and IV). Subsequent topographic surveys were conducted at the rkm 67 project site in the fall of 2020 to document ongoing stream response to the bioengineered treatment including repositioning of the thalweg, scour/deposition associated with the log jams and adjustments to the bank slope or boundaries. This survey also informed sediment transport calculations.

Qualitative methods involved visual documentation of the project site through photopoints established with geospatial coordinates and bearings. Photos were taken pre-treatment to document initial site conditions, during implementation to document the construction process and post-treatment to document the completed site plan (Appendix III and IV). Photopoints were revisited a minimum of annually (usually mid-summer) after project implementation to monitor ongoing stream response. Additional photographs were taken under various flow conditions to document the thalweg interaction with the log jams.

The SRCD conducted direct observation surveys to document the utilization of the constructed features by salmonids during both the summer rearing period and the fall/winter spawning period.

> Summer rearing period: Snorkel surveys were employed to document juvenile salmonid abundance and distribution within the project site and the surrounding reach of the Scott River on an annual basis following treatment. Crews enumerated fish by species and age class and described microhabitat utilization of the constructed features. These were completed at the rkm 67 site in July of 2019 and 2020. As the rkm 60 project was implemented in the fall of 2020, it was not possible to conduct a post-implementation snorkel survey before closure of Agreement D1613103.
>
> Fall/winter spawning period: Wading surveys were utilized to document adult salmonid spawning activity within the project site and the surrounding reach of the Scott River on an annual basis through the fall/winter months. Crews mapped the redd distribution and indicated utilization of gravels sorted by the engineered log jams or other constructed features. Wading surveys were only completed in

the fall of 2019 because drought conditions prevented Chinook salmon entry into Scott Valley during the fall of 2018 and 2020.

The SRCD compiled detailed maps of the revegetation areas following project implementation. Riparian planting assessments were conducted on an annual basis through revegetated areas. Plant survival was assessed through visual observation and photo documentation for stem emergence and leaf production during full leaf out (generally before the end of July). The number of plants that meet these criteria were counted and compared with the total number installed to calculate the percentage survival. An effort was made to determine and address causes of plants failing to thrive (i.e. insufficient water supply or browse by wildlife). Natural recruitment was also documented. Revegetation assessments were completed at the rkm 67 site in July of 2019 and 2020. As the rkm 60 project was implemented in the fall of 2020, it was not possible to conduct a revegetation assessment before closure of Agreement D1613103.

Finally, the SRCD periodically checked through the spring and summer months as to whether bank swallows were utilizing any habitat (existing or constructed) within the rkm 67 project site. The SRCD has not observed utilization of the bank swallow mitigation site yet, although we have seen occupancy of nesting habitat adjacent to the engineered log jams in undisturbed bank areas.

Analysis and Discussion

Taken together, the results from these monitoring efforts allowed the SRCD to track and assess project effectiveness. In accordance with the PAEP, the SRCD achieved the following outcomes in relation to the proposed targets:

Table 2. PAEP Pollutant Load Reduction Table

Project Goals	Desired Outcomes	Targets	Realized Outcomes
Prevent significant stream bank erosion thereby reducing instream sedimentation, improving channel morphology, and protecting riparian habitat and agricultural lands.	Stabilize approximately 650 feet of actively eroding streambank at two sites through the placement of instream large woody debris features (redirecting the thalweg away from the bank) and the application of bioengineering techniques (increasing the structural integrity of the streambank itself). Make progress towards attaining the Scott River TMDL's for sediment and temperature.	- Preservation of current stream channel boundaries ** - Reduce sediment contributions by approximately 3,000 tons per year through the treatment of both sites ***	RKM 67: • The treatment stabilized a combined 850 feet of eroding streambank on both the eastern and western sides of the river. • The treatment preserved the eastern and western channel boundaries as intended; however, it has resulted in some remaining erosion of the northwestern terrace. For more information, refer to the Pollutant Load Reduction section below. • As of the fall 2020, the project site at rkm 67 is mobilizing approximately 149 tons/year less sediment than was observed in the years prior to treatment. Further sediment reductions are expected in the future as the river channel reaches equilibrium and sediment balance. For more information, refer to the Pollutant Load Reduction section below. RKM 60: • The treatment stabilized a combined 550 feet of eroding streambank on both the eastern and western sides of the river. • Given that construction occurred in the fall of 2020, insufficient time has passed to be able to determine if the treatment preserved channel boundaries as intended. • Similarly, insufficient time has passed to be able to assess the treatment's impact on sediment dynamics.

** Target Achieved*
*** Met at RKM 67, insufficient time to monitor for targets at RKM 60 due to delayed implementation*
**** Difficult to measure target during timeframe of grant agreement*

Table 3a. PAEP Habitat Restoration Table

Project Goals	Desired Outcomes	Targets	Realized Outcomes
Improve quantity and complexity of instream salmonid habitat.	Increase instream salmonid habitat quality and quantity through the placement of large woody debris (LWD) features.	- Installation of 200 pieces of large woody debris ***** - Development of a minimum of at least 13 scour pools ****** - Document juvenile salmonid utilization of the habitat features ******	RKM 67: • Treatment involved the installation of 6 ELJs composed of 110 pieces of large woody debris • The ELJs resulted in the development of 5 scour pools by 2019 and 7 scour pools by 2020. • The ELJs scoured the channel to produce low-velocity refugial habitats with complex shelter elements and shaded cover which are critical to salmonids at every life stage • Two of the ELJs racked additional woody debris thereby increasing their habitat value • All ELJs resulted in the redistribution of substrate which sorted spawning gravels • Dive surveys completed in July of 2019 and 2020 showed utilization of the constructed habitat features by juvenile and adult salmonids, especially where complex cover was provided by the ELJs • Wading surveys completed in the fall of 2019 found that Chinook salmon are using spawning habitat associated with the treatment, 7 redds were found within the project area, 3 of which were within the influence of substrate sorting by the ELJs RKM 60: • Treatment involved the installation of 8 ELJs composed of 138 pieces of large woody debris • Given that construction occurred in the fall of 2020, insufficient time has passed for scour pools to form or for the SRCD to monitor salmonid utilization.

** Target Achieved*
*** Met at RKM 67, insufficient time to monitor for targets at RKM 60 due to delayed implementation*
**** Difficult to measure target during timeframe of grant agreement*

Table 3b. PAEP Habitat Restoration Table

Project Goals	Desired Outcomes	Targets	Realized Outcomes
Improve the ecological function of the riparian corridor.	Increase streambank vegetative cover by planting native riparian species over 4 acres. Enhancing riparian recruitment provides ecosystem benefits including the attenuation of direct solar inputs to stream, soil and bank stabilization, entrapment and storage of suspended sediment, and pollutant filtration.	- Implementation of 4 acres of riparian planting at the two sites combined ***** - 75% survival of plantings at the end of contract. ****** - Stream area that is influenced by tree canopy is not expected to be measurable over the duration of this agreement	RKM 67: • Revegetation efforts have increased riparian vegetation across 2 acres of the floodplain and terraces • Plantings associated with the ELJs (Fall 2018): A total of 37 willow sprouts were observed in 2019 and 153-233 willow sprouts were observed in 2020, representing over 75% survival. Additionally, all 12 willow clumps installed along the bank of the Type C ELJ showed healthy growth in 2019 and 2020, representing 100% survival. • Plantings through floodplain and terrace plots (Spring 2020): A revegetation assessment in July 2020 confirmed survival of 96% of the cottonwood poles, 93% of the willow clumps, and 53% of the willow whips. Since these plantings have not yet matured, it is too early to report on long-term viability. For more information, refer to the Habitat Restoration section below. • Areas where willows were salvaged for planting purposes are exhibiting vigorous regrowth • Natural recruitment has been observed around and between all ELJs RKM 60: • Revegetation efforts have increased riparian vegetation across 1.3 acres of the floodplain and terraces. Though the target was to plant 2 acres, it was determined that the rkm 60 project site could only realistically support about 1 acre without maintenance. To compensate for the reduced acreage the SRCD planted these areas more thoroughly. Approximately 0.6 acres were planted at high density (>1,000 plants per acre) and 0.7 acres were planted at medium density (approx. 500 plants per acre). For more information, refer to the Habitat Restoration section below. • Given that construction occurred in the fall of 2020, insufficient time has passed to assess the survival of these plantings.

** Target Achieved*

*** Met at RKM 67, insufficient time to monitor for targets at RKM 60 due to delayed implementation*

**** Difficult to measure target during timeframe of grant agreement*

Table 4. PAEP Education, Outreach and Capacity Building Table

Project Goals	Desired Outcomes	Targets	Realized Outcomes
Increase community awareness of local water quality regulatory standards, beneficial management practices and restoration opportunities.	- Host at least 2 workshops/field days annually - Allow stakeholders and community members to visit and learn from the project sites - Discuss progress, success, and concerns - Inform community members of the environmental context for water quality issues, explain local TMDL standards and waiver status, and discuss the community's role in addressing TMDLs.	- Identification of at least two community members interested in developing water quality related projects on their property *****	The SRCD has identified 4 landowners in the Scott River watershed who are interested in developing water quality related projects on their property.

** Target Achieved*
*** Met at RKM 67, insufficient time to monitor for targets at RKM 60 due to delayed implementation*
**** Difficult to measure target during timeframe of grant agreement*

Pollutant Load Reduction

Despite significant impacts to each of the project sites over the winter of 2017 (prior to execution of Agreement D1613103), the SRCD was able to leverage commitment from the SWRCB to secure and additional $129,550 in matching contributions (39% more funding) and successfully address both the rkm 60 and rkm 67 project sites within a four-year timeline. The treatments involved stabilization of 550 feet at rkm 60 and 850 feet at rkm 67 for a total of 1,400 feet, which is more than double the intended 650 feet. The treatment at rkm 67 preserved the eastern and western channel boundaries as intended; however, it has resulted in some remaining erosion of the intermediary northwestern terrace (more on this below). At rkm 60, an insufficient amount of time has passed to determine if the treatment preserved channel boundaries as intended.

Attainment of the Scott River TMDL for suspended sediment will require a 64% reduction in the 139 tons per square mile of the watershed per year of sediment load attributed to "Small, Discrete Streamside Features, Other" (RWQCB, 2005a). The *Scott River Stream Restoration and Sediment Reduction Program* contributed to this goal by addressing two high-priority erosional sites.

Scott River rkm 67 (Rancho del Sol): Based on topographic surveys, historic aerial imagery, and the 2010 LiDAR DEM, the SRCD has calculated that the western bank at rkm 67 has lost an area of approximately 0.45 acres from 2013 to 2017 (Figure 35). With an average height of 9.0 feet and "sandy loam, loose" soil composition, a total of 6,840 tons of material have been lost. This correlates to an average of 1,710 tons per year being contributed to the Scott River. The treatment implemented in the fall of 2018 was intended to minimize sediment contributions from this site.

There have been two topographic surveys conducted through the Scott River at rkm 67 since treatment of the site: one in December 2018 for the as-built reporting and a second in November 2020 for follow-up monitoring and analysis. Since treatment, the river channel has been responding to the morphological changes and beginning to rebalance sediment transport through this reach of the Scott River, which has resulted in localized changes to erosional and depositional areas through the project site.

Over the last two years, the eastern and western banks, which were experiencing significant pressure prior to treatment, have maintained their boundaries. The Type B and C ELJs have reduced velocities and shear stress along the vulnerable slopes and significantly moved the thalweg away from the bank under observed flow conditions. The thalweg now ranges from approximately 20 to 50 feet out into the channel from its pre-implementation position. Additionally, fine-grained sediment deposits and failed slope materials have accumulated along the toe of these protected segments of bank, further demonstrating that erosional forces have been effectively diverted away from the banks. Sediment can now accrete in these areas rather than be mobilized and transported, as was observed before treatment. These banks were near vertical and geotechnically unstable, but through time they will be able to achieve their angle of repose, further ensuring the stabilization of the banks.

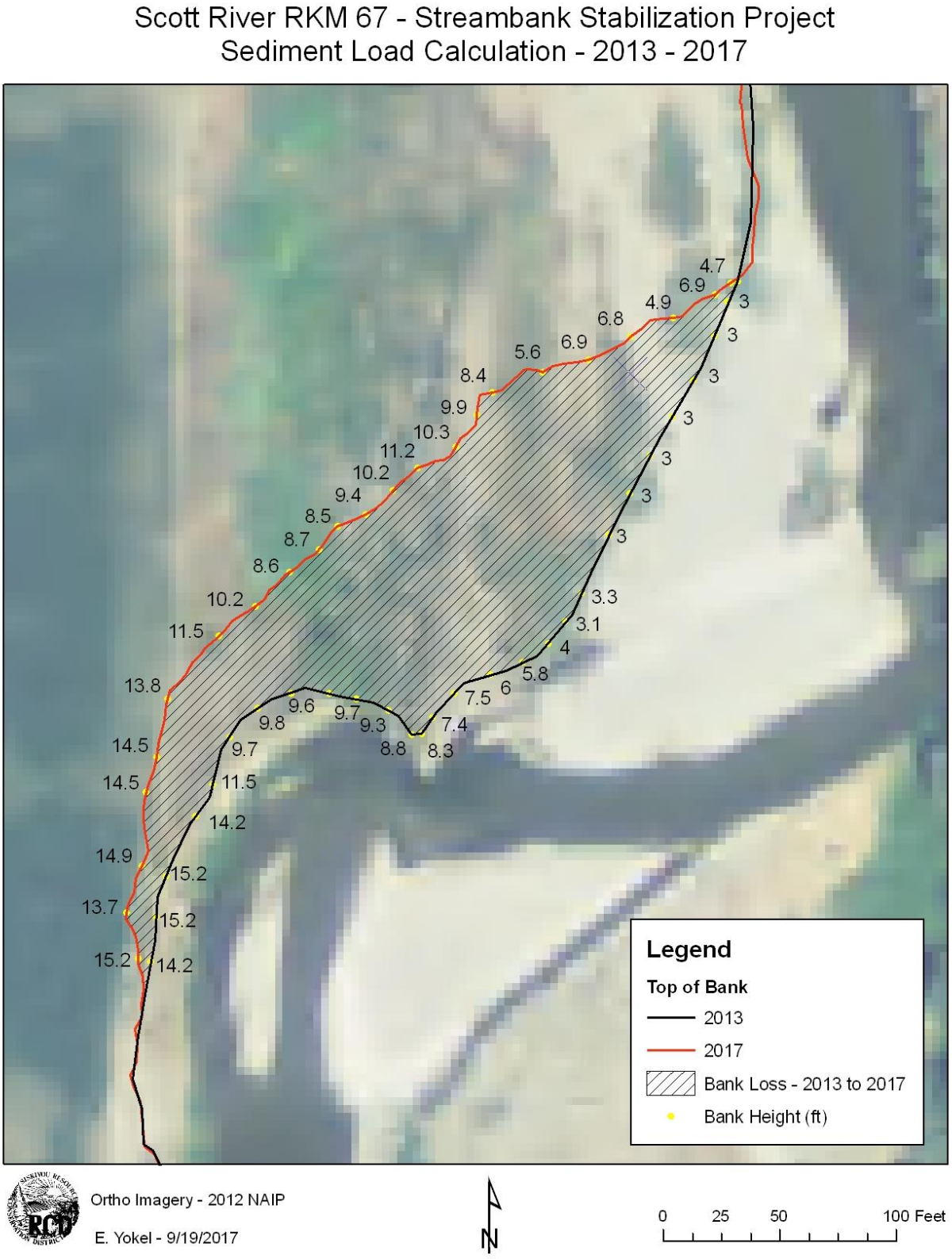

Figure 35 – Map illustrating method utilized to calculate sediment load from 2013 to 2017.

While the banks maintained their position, a portion of the intermediary northwestern terrace has continued to migrate downstream following treatment. Much of the sediment loss during this period resulted from attenuation of the sharp bend of the primary channel. Comparison of the site surveys between 2018 (as-built) and 2020 shows that the depositional lateral bar migrated downstream and the northwestern terrace retreated as the primary channel adjusted to the log structures, and the river-left to river-right bend became less abrupt. The reconfiguration of the northwestern terrace resulted in the mobilization of approximately 0.37 acres of sediment. Though the terrace is currently behaving as an erosional area, it is anticipated that eventually the lower northwest terrace will come to store sediment. Treatment enhanced floodplain connectivity while also increasing riparian vegetation density, the latter of which will increase localized roughness and reduce shear stress. This combination of factors will lead to more regular inundation of relatively low velocity water that will lead to the accretion of sediment in that area.

Volumetric comparison of the 2018 (as-built) and 2020 surfaces indicates that stream flows have transported about 5,530 cubic yards of material from the site and imported about 2,920 cubic yards to the site. The net change in fluvially transported material is about 2,610 cubic yards from the site. Again, assuming "sandy loam, loose" soil composition, this represents a total loss of 3,122 tons between 2018 and 2020, or 1,561 tons per year. Given that 1,710 tons were lost per year prior to project implementation, the bank stabilization and revegetation treatment has reduced sediment loading by 149 tons per year (1,710 minus 1,561).

Further reductions in sediment mobilization are expected in the future as the stream system continues the process of equilibration by adjusting channel alignment and profile. Project treatment will promote lateral stability and prevent the erosion of the confining banks. Additionally, because the project area is less confined than the upstream and downstream reaches which are characterized by higher transport capacities, it is anticipated that the site will ultimately return to being a net-depositional area following the achievement of a dynamic equilibrium. However, Cascade Stream Solutions notes that it is not likely that this reach of the Scott River will reach true sediment balance without significant improvement in condition both up and downstream. This would probably require widening the upstream bridge crossing, increasing the floodplain width, and setting back the levees.

Scott River rkm 60 (Scarface Cattle Company/Finley Farms): Based on topographic surveys, historic aerial imagery, and the 2010 LiDAR DEM, the SRCD has calculated that the eastern bank at rkm 60 has lost an area of approximately 0.37 acres from 2010 to 2017 (Figure 36). With an average bank height of 9.0 feet and loamy soil composition, a total of 6,800 tons of material have been lost. This correlates to an average of 971 tons per year being contributed to the Scott River. The treatment implemented in the fall of 2020 was intended to minimize sediment contributions from this site. As of January 2021, it is too early to determine whether or how much the treatment has altered sediment dynamics at the site.

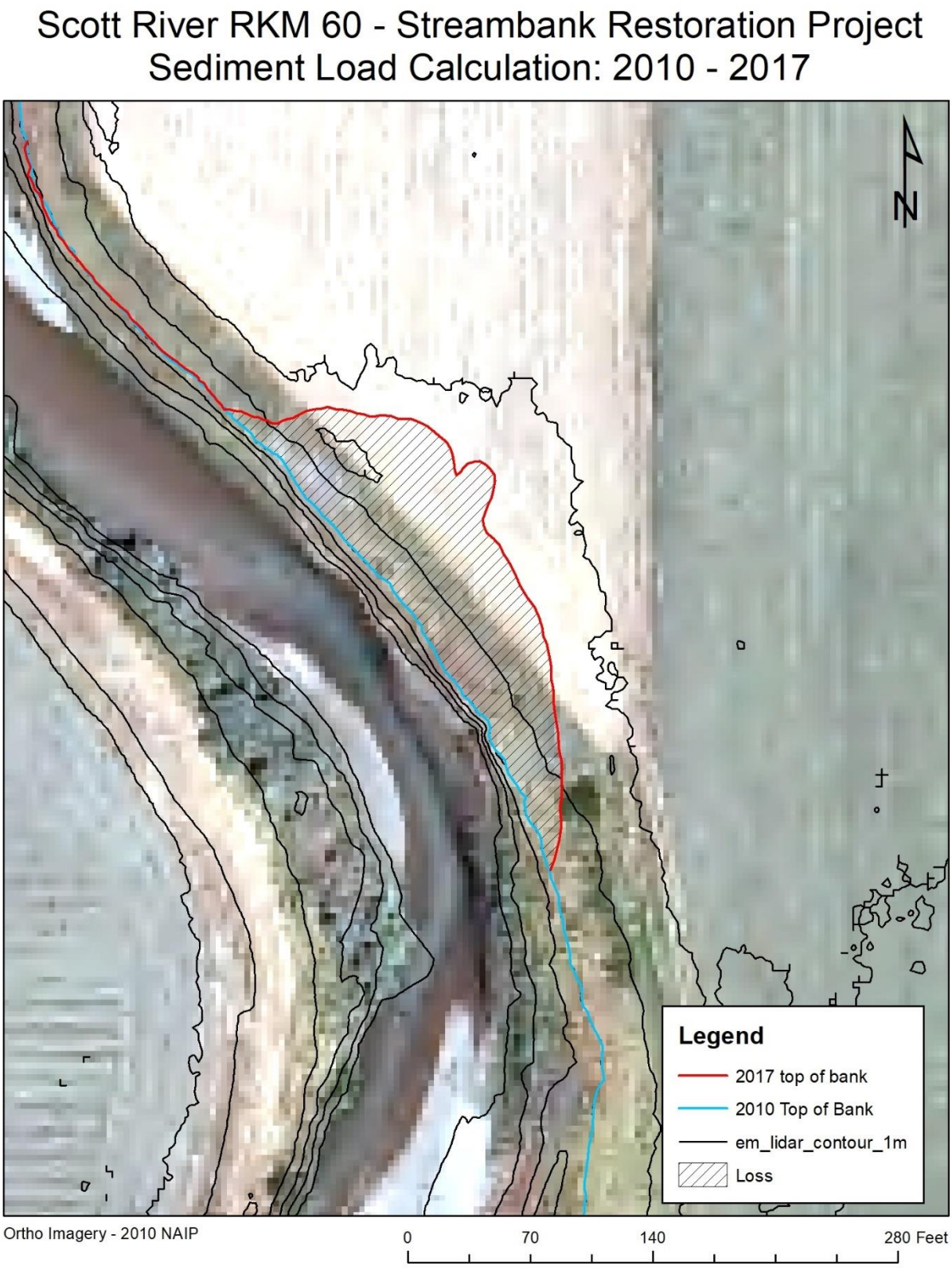

Figure 36 – Map illustrating method utilized to calculate sediment load from 2010 to 2017

It is particularly difficult to measure a project's impact on sediment dynamics. Stream channels adjust in response to changes, and the time required for an altered river channel to reach equilibrium is unknown. Therefore, it is difficult to ascertain what sediment balance will ultimately be achieved in response to the treatments. The SRCD has presented the data collected so far at rkm 67 (2 years since treatment) but does not believe that it covers a sufficiently long time period to adequately evaluate sediment load reductions. Though it will not be measured under Agreement D1613103, it is the professional opinion of the SRCD and Cascade Stream Solutions that both of the treatments will facilitate the Scott River in better balancing sediment dynamics to the extent possible given the artificially confined channel conditions adjacent to the site.

Habitat Restoration

The treatments at both sites collectively involved the installation of 14 ELJs composed of 248 pieces of large wood, which is beyond the target of 200 pieces of large wood. At rkm 67, these ELJs resulted in the development of 7 scour pools, although, at rkm 60, an insufficient amount of time has passed for scour pools to form (need winter high water). With respect to the target of 13 scour pools, the rkm 67 site accounts for just over half of the target. The SRCD anticipates that the remaining 6 scour pools will develop at the rkm 60 site within the next couple of years, especially because 8 ELJs were installed, ultimately meeting the target after the conclusion of Agreement D1613103.

The ELJs benefit anadromous salmonids by scouring the channel to produce low-velocity refugial habitat and by redistributing substrate to sort spawning gravels. Two ELJs were found to have racked additional woody debris thereby increasing their habitat value. The effectiveness of these processes is supported by salmonid utilization of the constructed habitat features, which was documented at rkm 67 as described next.

A snorkel survey conducted in late July 2019, discovered only a few salmonids within the rkm 67 project area. Water quality conditions this time of year often prompt salmonids to complete their seasonal migration into cold water tributaries or down river towards the ocean. However, several juvenile coho salmon, rainbow trout, and adult steelhead were documented occupying the scour pools and backwater eddies of the Type C and Type B ELJs on the western bank (Figures 37-38). The following year, a snorkel survey was conducted a month earlier in mid-June 2020 and discovered a decent population of rainbow trout throughout the project area. These fish were found mainly in deeper areas where complex cover elements such as undercut banks, riprap, submerged woody debris, or overhanging terrestrial vegetation were available. This included the scour pools and backwater eddies of all the ELJs. A total of 628 rainbow trout were counted occupying the habitat formed by the constructed features (Figures 39-41).

Figure 37. Steelhead trout occupying sheltered habitat created by Type B ELJ on western bank, 7/25/19.

Figure 38. Steelhead trout underneath woody debris of Type B ELJ on western bank, 7/25/19.

Figure 39. Scour pools surrounding Type C ELJ with different age classes of rainbow trout, 6/19/20.

Figure 40. Juvenile rainbow trout in scour pool surrounding Type B ELJ on western bank, 6/19/20.

Figure 41. Juvenile rainbow trout in scour pool surrounding Type B ELJ on eastern bank, 6/19/20.

Wading surveys conducted in the fall of 2019 showed that Chinook salmon are using spawning habitat associated with the constructed features at rkm 67. Seven total redds were found within the project area. Of these, three redds were located within the influence of substrate sorting by the ELJs and two redds were located near where the constructed side channel reconnects with the river. It may be that the straining effect of the willows, along with differential gradients at the point of connection, may have resulted in the modification and sorting of substrate, improving spawning habitat there. From a fisheries perspective, the installation of ELJs at both of the sites undoubtedly improved the quantity and quality of instream habitat, outcomes which support designated beneficial uses associated with cold water, migratory fish and habitat.

The treatments also involved revegetation through the riparian corridor. The SRCD planted 1.3 acres at rkm 60 and 2.0 acres at rkm 67, for a total of 3.3 acres, which is less than the intended 4.0 acres. This occurred because it was determined that the rkm 60 project site could only realistically support about 1 acre without maintenance. To address this discrepancy, the SRCD planted the rkm 60 plots more thoroughly, which also worked to further protect the extremely vulnerable banks after construction. Approximately 0.6 acres were planted at high density (>1,000 plants per acre) and 0.7 acres were planted at medium density (approx 500 plants per acre). Given that construction occurred in the fall of 2020, an insufficient amount of time has passed to assess the survival of these plantings. Furthermore, these plantings will not be maintained by the SRCD as all funding agreements will be closed before the summer of 2021; however, the plots were selected because they have the potential to be incidentally watered by existing irrigation infrastructure. With respect to the 2.0 acres at rkm 67, the SRCD assessed the survival of these plantings in July 2019 and again in July 2020. Results included the following:

- Plantings associated with ELJs (Fall 2018): A total of 37 willow sprouts were observed in 2019 and 153-233 willow sprouts were observed in 2020, representing over 75% survival. Additionally all 12 willow clumps installed along the bank of the Type C ELJ showed healthy growth in 2019 and 2020, representing 100% survival (Table 5).
- Plantings through terrace and floodplain plots (Spring 2020): The SRCD confirmed survival of 96% of the cottonwood poles, 93% of the willow clumps and 53% of the willow whips in July 2020 (Table 6). Since these plantings have not yet matured, it is too early to report on long-term viability. Low survival of the willow whips planted along the spring water line is suspected to be related to recession of the stream channel over the summer and drought conditions. The SRCD planted these at high density (>1,000 plants per acre) to compensate for possible loss.
- Areas where willows were salvaged for planting purposes exhibited vigorous re-growth (Table 6).
- The ELJs have relieved erosional forces against the stream banks of the Scott River by deflecting current towards the center of the channel and causing backwater eddies that deposit fine grained sediment along the toe thereby building bank support and ideal conditions for natural vegetative recruitment. Natural recruitment has been observed around and between all structures (Table 5).

Table 5. Observed Responses – Log Structures

Structure/ Feature	**# of sprouts observed (2019)**	**# of sprouts observed (2020)**	**Natural Recruitment**	**Scour Pool**	**Sediment Deposition**	**Debris Racking**
River-Left ELJ type C	6 sprouts in structures 12 clumps on bank	15 sprouts in structures 12 clumps on bank	Yes	Yes (4)	Yes	Yes
River-Left ELJ type B (upper)	4 sprouts	20-30 sprouts	Yes	Yes	Yes	Yes
River-Left ELJ type B (middle)	6 sprouts	4 bundles 40-60 sprouts	Yes	No	Yes	No
River-Left ELJ type B (lower)	7 sprouts	6 bundles 12 sprouts	Yes	Yes	Yes	No
River-Right ELJ type A (Apex Jam)	7 sprouts	50-100 sprouts	Yes	No	Yes	No
River-Right ELJ type B	7 sprouts	16 sprouts	Yes	Yes	Yes	No

Table 6. Observed Responses – Plots/Areas

Plot/Area	**Species/Type Planted**	**Count Planted**	**Count Thriving July 2020**
Water Line	willow whips	340	179
Plot 1 and Salvage Area	willow clumps	42	39
Plot 2, lower terrace and Plot 7	cottonwood poles	92	88
River-right Sourcing Area	willow clumps	N/A	>100

These actions have resulted in demonstrable progress towards improving the function of the Scott River riparian corridor by measurably increasing vegetation coverage through key areas. These plantings will provide ecological benefits by adding roughness, diffusing water velocities, reducing erosional forces, securing sediment, and improving soil cohesiveness. Over the long term, these plantings are intended to address the water temperature impairment by attenuating direct solar inputs to the Scott River.

As of the conclusion of Agreement D1613103, it is not yet possible to measure some objectives related to treatment functionality due to contract-related time constraints and the extended timescale of geomorphic processes, making it difficult to quantify all of the elements of the PAEP as anticipated. The delayed implementation of the rkm 60 project has resulted in insufficient time for expected outcomes to come to fruition or be surveyed before the end of the agreement term. However, the rkm 67 site has produced the desired outcomes and achieved the proposed targets, which gives us confidence that the rkm 60 site is likely to do the same.

CONCLUSIONS

Lessons Learned

The past few years of the *Scott River Stream Restoration and Sediment Reduction Program* revealed a lot about what works and what is challenging about this type of restoration. Overall, the SRCD considers both of the treatments to have successfully addressed vulnerable segments of the Scott River and significantly enhanced aquatic habitat quality. However, projects such as these have proven to be difficult to implement due to tight available timelines, the complexity of the engineering requirements, and the extensive permitting process. Some of these factors can be managed, while others cannot be due to the nature of this type of restoration.

To begin, mass erosion sites are inherently unstable; the banks in question can be altered dramatically from one year to the next. For this reason, stabilization projects should be designed and constructed in the same year, generally from March through October. In order for engineered construction plans to remain valid they must be executed before conditions change. If a project is delayed and cannot be implemented in a given year as intended, then there is the risk that the treatment will have to be redesigned and the permitting documents amended to account for modifications to the plans.

Large-scale bank stabilizations require significant engineering due to the unavoidable focus on concerns such as evulsion and flood events. Developing and finalizing construction plans for both sites discussed in this report required extensive time, which exacerbated an inherently challenging timeline. The Final Basis of Designs and Final Plans were not received by the SRCD until mid-summer for both projects. Some of these delays were due to circumstances at the engineering firm. However, the delay was also due in part to multiple revisions to the plans following feedback from partners and agencies. Delays in the development of final construction plans can jeopardize the ability of the SRCD, or any other agency, to implement the project during the same year before conditions change again. In the future the SRCD will prioritize a more efficient design and engineering process. This will involve the clear establishment of deadlines with the contracted engineering firm as well as requests to partners and agencies to submit feedback within a specified timeframe.

Additionally, the SRCD found that the environmental permitting process for bank stabilization projects on the Scott River has become progressively more involved and time consuming. Although the SRCD was diligent in maintaining communication with state regulatory permitting agencies, their involvement early in the process (including site visits) did not always lead to a successful identification of all of the state's concerns. For example, in the case of the treatment at rkm 67, CDFW brought up a very significant concern, mitigation for the loss of bank swallow habitat, after months of project development and consultations, and after the SRCD had moved on from the planning phase and was working on the logistics of implementation. This was a significant challenge for the SRCD to overcome. In the future, the SRCD will request that regulatory agencies submit their feedback within a specified timeframe in order to avoid last minute changes. Burdensome permitting took significant staff time and was enough to affect the project budget. The SRCD recommends adding a contingency factor into the budget for personnel services to accommodate the extra workload.

With respect to treatment effectiveness, the treatment at rkm 67 successfully prevented lateral migration of the eastern and western banks of the Scott River. However, the SRCD has found that the river's interface with the intermediary northwestern terrace, which runs almost perpendicular to the outer banks, has migrated downstream in response to armoring of the western bank and altered the angle and location where flow transitions over to the eastern bank. For this reason, the apex jam and ELJ installed in the eastern bank do not directly intercept the impinging flows as frequently as expected; rather, the thalweg meets the eastern bank slightly downstream where rock-slope protection (rip-rap) remains and the apex log jam only defends the eastern bank when the side channel along river right become activated. Regardless of its relative functionality with respect to defending the eastern bank, the apex log jam will always provide critical habitat for salmonids and other aquatic species.

Rivers experience a period of adjustment following morphological changes, both natural and anthropogenic, and the time required for an altered channel to reach equilibrium is unknown. These factors, however, make it particularly challenging to measure the project's effectiveness with respect to preventing erosion. The western bank, which had been experiencing severe erosion, is certainly more stable now that the project has been implemented. However, the SRCD cannot yet make a determination with respect to the lower northwestern terrace, potential future impacts to the eastern bank, or future sediment balance. Similarly, though total sediment contributions have been calculated to be 149 tons per year less than they were pre-treatment, it is unlikely that sediment dynamics have fully stabilized at the site and it is unclear whether this will be the ultimate reduction in sediment pollution attributable to the treatment. It is the opinion of the SRCD that sediment reduction benefits will increase with time, but this is not demonstrable at the time of this report. Geomorphic processes occur on timelines that far exceed grant agreements and so it is unrealistic to comprehensively measure project performance with these types of parameters.

More broadly, bank stabilization may be inherently challenged by the conflicting needs of river morphology and adjacent land uses. Due to historical and current modification to the river channel and corridor, Cascade Stream Solutions consider the Scott River, from the tailings downstream to the canyon, to be unstable, exhibiting pervasive incision and bank failure. It is their expectation that stability issues will continue until a comprehensive and extensive project is implemented that includes increasing the channel corridor to a width sufficient to convey flows and transport sediment in a more natural, functional way established not by direct intervention but by river adjustment through time.

As is evident, the primary focus of large bank stabilization projects is to prevent mass erosion and address the sediment TMDL developed by the Water Board. However, part of the reason the sediment TMDL was established was to protect salmonid habitat. Reducing erosion and sedimentation helps maintain the sorted gravel beds necessary for spawning and reduces the risk that eggs will be smothered by settling sediment. At its foundation, this effort is focused on protecting and improving salmonid habitat. However, it may be that simply addressing the sediment TMDL is not as cost-effective as other types of fish habitat restoration work. As bank stabilization projects are generally quite expensive, the SRCD has been discussing whether there are other, more cost-effective restoration mechanisms by which the community can manage and reduce the impact of sedimentation. Perhaps restoration funding would be more efficiently spent in the creation of more extensive, high-quality habitat within the stream channel rather than focusing specifically on stabilizing the banks. The aforementioned effects on aquatic habitat that the TMDL is concerned with (turbidity and embedded substrate) can be addressed without the sole focus being on mass erosion sites. Furthermore, habitat-centric projects are significantly easier to implement because they can accommodate

a multi-year timeline, require less extensive engineering, have a flexible design process, and are eligible for simplified permitting pathways. For these reasons, the SRCD has come to think that, for the same total cost, more comprehensive habitat restoration and creation would be possible, all while more passively addressing concerns about bank protection and sedimentation.

The SRCD will utilize the aforementioned considerations when discussing the type of restoration work to pursue, identifying sites, avoiding scheduling constraints, ensuring the efficient use of funds, and in the development and implementation of future projects. The SRCD is committed to monitoring the effectiveness of restoration projects and learning from experience, to improve the potential for salmonids to thrive throughout the Scott River Watershed.

Next Steps

Before proceeding with new bank stabilization projects, the SRCD recommends consulting with the various regulatory agencies about their priorities and regulatory opinions on streambank restoration work, particularly as it pertains to salmonid habitat and swallow habitat.

During the permitting process for both of these projects, it became clear that views on bank stabilization treatments are evolving. For example, the rkm 67 treatment was covered under a programmatic Biological Opinion for restoration projects, while the rkm 60 treatment resulted in the NMFS issuing an independent Biological Opinion that was counter to the prevailing positions of the USFWS and the RWQCB. A next step for the SRCD in developing a bank stabilization project should include gathering representatives from these partnering agencies to discuss and compare current information on the effectiveness of this type of restoration work and any concerns that have emerged with respect to utility or unintended impacts. As noted in the Lessons Learned, it would also behoove the SRCD, agencies, and funding entities to examine the cost-benefit analysis. Conclusions will likely depend on what the specific restoration objective is for the area. If the primary objective is to directly meet the goals of the RWQCB waiver and nonpoint source pollution targets, bank restorations are likely an appropriate treatment. However, if the restoration goal is focused on salmonid habitat protection or improvement, there may be less expensive restoration mechanisms by which the SRCD and agencies can manage and reduce the impact of sedimentation. Conversations between partners can help determine under what particular scenarios bank stabilization is suitable and productive.

Additionally, the SRCD should consult with CDFW about bank swallows, which have been listed as threatened under the California Endangered Species Act since 1989. Bank swallows nest in burrows built in vertical banks, often along streams and rivers. They avoid slopes that have slumping faces with aggregate material at the base that increase their susceptibility to predation. This puts the bank swallow habitat needs at odds with bank stabilization projects, which work to reduce the incidence of vertical banks and the erosion that creates them. Next steps should include working with CDFW to reconcile the differing needs of coho salmon and bank swallows, both of which are listed as threatened at the state level. One action that could help clarify the situation would be for CDFW to conduct bank swallow surveys to determine the status of local populations and evaluate whether the concerns noted at the state level pertain to the Scott River watershed. This information could inform management with respect to bank swallows on a local level, weigh the differing needs of two special status species, and help determine whether bank stabilization is a viable method to continue to pursue to reduce erosion and to protect salmonid habitat.

In situations where it is determined that streambank restoration is cost effective and appropriate, the SRCD and other resource managers should continue the implementation of bank stabilization projects and riparian replanting efforts at high priority locations as identified in the *Scott River Watershed (Riparian) Restoration Strategy and Schedule*. The SRCD should continue to work with the RWQCB to identify additional streambank and riparian restoration locations for the purpose of addressing water quality targets while also restoring and enhancing fish habitat within the Scott River and associated tributaries.