2017 ANNUAL REPORT

TRINITY RIVER RESTORATION PROGRAM

Trinity River Restoration Program
Restore • Adapt • Improve

Trinity River Restoration Program

Thank You to the Trinity River Restoration Program partners for their contributions to this report.

On the cover: *Large wood and revegetation plantings along the mainstem river were incorporated in the 2017 Deep Gulch and Sheridan Creek channel rehabilitation project on the Trinity River.*

Contents

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Acronyms

AEAM	Adaptive Environmental Assessment and Management
BA	Biological Assessment
BLM	Bureau of Land Management
CDFW	California Department of Fish and Wildlife
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
CLOMR	Conditional Letter of Map Revision
DOI	Department of the Interior
EA/IS	Environmental Assessment/ Initial Study
EIS	Environmental Impact Statement
EO	Executive Orders
ESA	Endangered Species Act
ESL	Environmental Study Limit
FEMA	Federal Emergency Management Administration
FIRM	Flood Insurance Rate Map
FNF	full natural flow
FY	fiscal year
GRTS	generalized random-tessellation stratified (sampling design)
HVT	Hoopa Valley Tribe
LiDAR	light detection and ranging
LOMR	Letter of Map Revison
Master EIR	Master Environmental Impact Report for Channel Rehabilitation and Sediment Management for remaining Phase 2 Sites
msl	mean sea level
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (now NOAA Fisheries)
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historical Places
NOAA	National Oceanic and Atmospheric
Fisheries	Administration Fisheries (formerly NMFS)
PA	programmatic agreement
PT	Pear Tree Gulch rotary screw trap site
Reclamation	Bureau of Reclamation
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
S3	Stream Salmonid Simulator
SWRCB	State Water Resources Control Board
TMC	Trinity Management Council
TREIS/EIR	Trinity River Environmental Impact Statement/Environmental Impact Report
TRRP	Trinity River Restoration Program
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCT	Willow Creek rotary screw trap site
WY	water year (October through September)
YT	Yurok Tribe

Measurements

ºC	degrees Celsius
ºF	degrees Fahrenheit
af	acre foot
afa	acre foot annually
cfs	cubic foot per second
cm	centimeter
cms	cubic meter per second
km	kilometer
km^3	cubic kilometer
m	meter
m^2	square meter
NTU	nephelometric turbidity unit
rkm	river kilometer

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Introduction

The Trinity River Restoration Program (TRRP) is a partnership of Federal, State, Tribal, and Trinity County entities that share responsibility for restoring the Trinity River between Lewiston Dam and the confluence of the North Fork Trinity River, California. TRRP is administered by two U.S. Department of the Interior (DOI) agencies: the Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (USFWS). Other partner entities share in the decision-making process through their responsibility to the Trinity Management Council (TMC). The TMC functions as a board of directors that sets the priorities and schedules for strategic implementation by the Program's Executive Director. Partners in the TMC include:

- Hoopa Valley Tribe (HVT)
- Yurok Tribe (YT)
- Trinity County
- California Natural Resources Agency (which includes the State of California's Department of Water Resources [CDWR] and Department of Fish and Wildlife [CDFW])
- U.S. Forest Service (USFS)
- National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries)

This 2017 TRRP annual report provides concise summaries of major Program activities and accomplishments, as well as citations, references, and contacts for more information. Visit TRRP.net to learn more about the progress towards restoring the Trinity River.

The TMC, along with many other participants and stakeholders, worked together to achieve the vision of a healthier Trinity River and a more productive naturally spawning fishery. In the 2017, the Program:

- Constructed the largest channel rehabilitation project to date
- Released the peak restoration flow amount of 11,000 cubic feet per second (cfs) from Lewiston Dam
- Continued to develop a fish production model, the Stream Salmonid Simulator (S3), to evaluate the effects of management actions on Chinook salmon production
- Continued gravel augmentation and monitoring under adaptive management
- Redesigned the TRRP website and the DataPort, a key resource for managing program information and coordinating data across the partnership

About this Report:

The Trinity River Restoration Program (TRRP) restores and maintains the Trinity River's anadromous fishery resources by rehabilitating the river itself. This annual report summarizes activities and monitoring results for water year (WY) 2017.

TRRP's Mission

The TRRP mission is to restore the fisheries and wildlife of the Trinity River between Lewiston Dam and the confluence of the North Fork Trinity River, California (Figure 1). The defined goal is to restore the Trinity River's anadromous fishery resources in a managed river that has the characteristics of a healthy alluvial river as set out in the legislation and Federal decision documents that were instrumental in creating the Program.

The TRRP was created by the Record of Decision (ROD) in 2000, which outlined the plan for restoring the Trinity River and its fish and wildlife populations (DOI 2000). The Program was the result of nearly 20 years of studies on the Trinity River and its fishery resources that culminated in the Trinity River Flow Evaluation Final Report, (termed the Trinity River Flow Evaluation Study) (USFWS and HVT 1999) and the Trinity River Mainstem Fishery Restoration Environmental Impact Statement/ Environmental Impact Report (TREIS/EIR), completed in 2000 (USFWS et al. 2000). The ROD is based on the TREIS/EIR, which is the environmental compliance document under the National Environmental Policy Act of 1969 (NEPA)/California Environmental Quality Act of 1970 (CEQA).

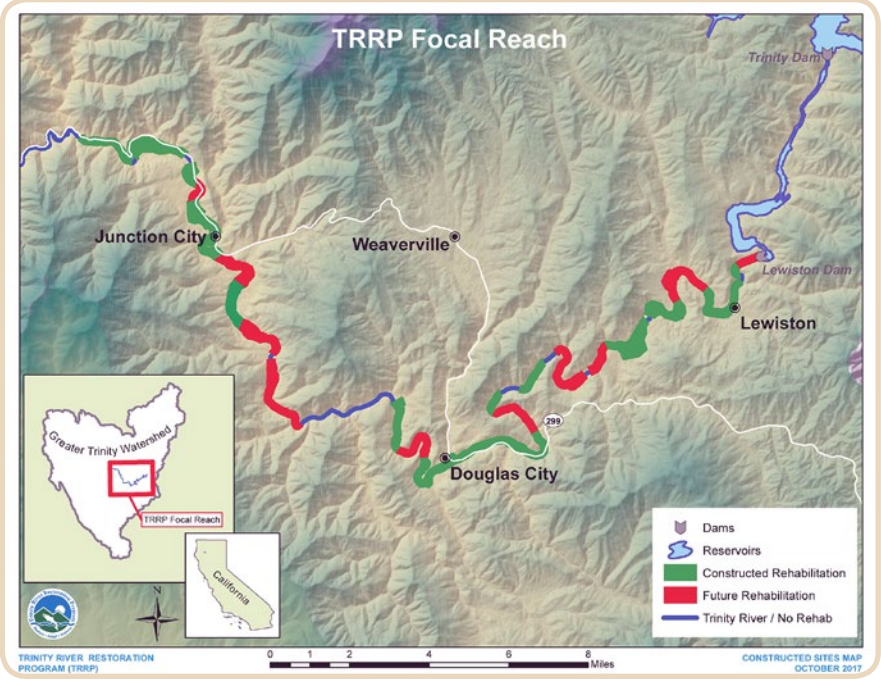

Figure 1. Map of the TRRP Focal Reach, as of 2017.

TRRP Background

As early as 1955, Congress passed legislation authorizing the Trinity River Division as an integral component of the Central Valley Project. The legislation directed the Secretary of the Interior to ensure the preservation and propagation of fish and wildlife in the Trinity River Basin by adopting appropriate measures.

Completion in 1964 of Trinity and Lewiston Dams restricted anadromous fish to habitat below Lewiston Dam. (See Important Terms on page 6.) The dams also

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—TRRP Background continued

inundated more than 20,000 acres of the former Trinity River Valley and eliminated the sediment supply below the dams from more than 700 square miles of the upper watershed.

Water diversions from Lewiston Reservoir to Whiskeytown Reservoir via the Clear Creek tunnels and, ultimately, to the Sacramento River diminished the annual flows in the Trinity River by up to 90 percent of the flows before the two dams were constructed. The diminished flows resulted in encroachment of riparian (streamside) vegetation onto the former floodplain, establishment of riparian berms, and fossilization of point bars as far downstream as the North Fork Trinity River. The ages and species of riparian vegetation became less diverse and the floodplain was less frequently inundated, leading to reduced fish habitat quantity and quality.

In 1981, in response to the declines in the Trinity River's salmon and steelhead populations, the Secretary of the Interior directed the USFWS to begin a 12-year flow study to determine the effectiveness of flow restoration and other measures to mitigate for the impacts of the two dams. In 1984, Congress enacted the Trinity River Fish and Wildlife Program to further promote and support wildlife management and fishery restoration actions in the Trinity River basin. Under this program, nine pilot bank rehabilitation projects between Lewiston Dam and the North Fork Trinity River were implemented between 1991 and 1993.

In 1992, Congress enacted the Central Valley Project Improvement Act. One purpose of the act was to protect, restore, and enhance fish, wildlife, and associated habitats in the Trinity River basin. The act also directed the Secretary of the Interior to complete the 12-year Trinity River Flow Evaluation Study (Flow Study) and to develop recommendations "regarding permanent instream fishery flow requirements, Trinity River Division operating criteria, and procedures for the restoration and maintenance of the Trinity River fishery." The Trinity River Flow Evaluation Final Report (Flow Evaluation Report) was ultimately published in 1999, providing a framework for restoration activities below Lewiston Dam (USFWS and HVT 1999).

In 1994, the USFWS and Trinity County began the public process for developing the TRRP actions in December 2000. The ROD directed DOI agencies to implement the Flow Evaluation Alternative and elements of the Mechanical Restoration Alternative (DOI 2000) analyzed in the TREIS/EIR. The ROD set forth Trinity River flows for five water-year types: extremely wet (815,200 acre-feet annually [afa]), wet (701,000 afa), normal (646,900 afa), dry (452,600 afa), and critically dry (368,600 afa).

Laws and Guiding Documents

1955. Congress authorized Trinity River Division of the Central Valley Project.

1963. Trinity and Lewiston Dams were completed.

1981. Interior Secretary increased flows to ~300 cfs (8.5 cubic meters per second [cms]) and initiated Flow Study.

1984. Congress enacted Trinity River Basin Fish and Wildlife Management Act to implement salmon restoration.

1992. Congress enacted Central Valley Project Improvement Act with 340,000 acre-feet (0.42 cubic kilometerd [km^3]) of water available to the Trinity River.

1999. Flow Study completed and used as preferred alternative in TREIS/EIR.

2000. ROD signed, establishing modern TRRP with minimum water volume allocations determined annually by the water year type.

2009. Master Environmental Impact Report provided all parts and appendices for the Draft and Final Master EIR in one document (North Coast Regional Water Quality Control Board [RWQCB] and Reclamation, 2009).

2009. Integrated Assessment Plan identified the scope of research needed to evaluate restoration of the Trinity River and its fisheries.

2014. The Scientific Advisory Board conducted the Phase I Review of the Program's restoration actions through the Phase I channel rehabilitation sites.

TRRP Adaptive Management

TRRP's Adaptive Environmental Assessment and Management (AEAM) component provides interdisciplinary information for developing and testing hypotheses regarding how the river is responding to restoration activities. Teams of scientists, managers, stakeholders, and policy makers use this information to update the restoration approach to best restore natural channel conditions and associated salmon populations. The adaptive management process (Figure 2) is systematically repeated as management actions are adjusted to benefit the Trinity River and its fishery resources over time.

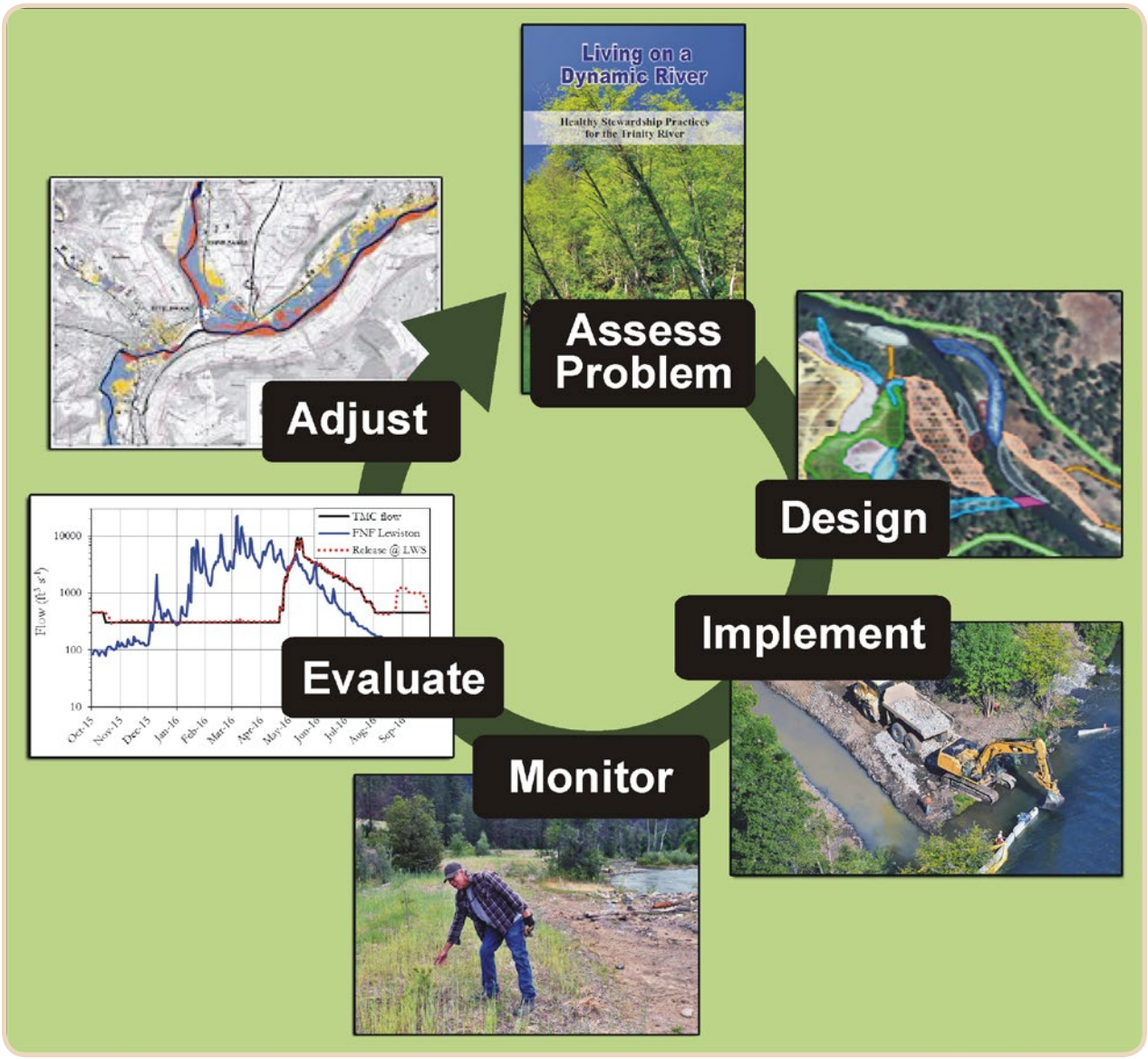


Figure 2. The adaptive management process.

TRRP Restoration Strategy

This restoration strategy does not strive to recreate pre-dam conditions. Rather, the goal is to create a dynamic alluvial channel that exhibits all the characteristics of the pre-dam river but at a smaller scale. In accordance with the ROD, the TRRP's restoration strategy consists of:

- *Flow management*—a variable flow regime based on five water year types, determined by California Department of Water Resources, to emulate natural flows.
- *Mechanical channel rehabilitation*—treatment of 44 channel rehabilitation sites and 3 side channel sites along the Trinity River to reshape the channel form to promote physical processes that will create and maintain fish and riparian habitat.
- *Sediment management*—augmentation of gravels below Lewiston Dam and reduction in fine sediments, which degrade fish habitats.
- *Watershed restoration*—a program to reduce fine sediment input to the Trinity River and to improve fish habitat connectivity within the tributaries and between the tributaries and the mainstem river.
- *Infrastructure improvements*—modification of structures in the floodplain to allow peak flows.
- *Adaptive environmental assessment and monitoring*—a rigorous program to monitor and improve restoration activities.
- *Environmental compliance and mitigation*—measures to minimize or eliminate short-term impacts.

Restoration activities in the past 12 years have focused on the first four management elements outlined in the ROD, supported by compliance and infrastructure work in the context of environmental mitigation and adaptive management. The four elements place a priority on physical restoration of the river to create the attributes of an alluvial river system that are known to enhance habitat for anadromous fish species. The ROD describes expected physical and biological outcomes from flow, channel rehabilitation, gravel, and watershed restoration activities. Monitoring and evaluation activities show progress toward these desired states.

Justin Ly, Fish Biologist, NOAA Fisheries

Justin has worked in the Klamath Basin since 2003, and more specifically on the Trinity River since 2016. After earning his bachelor's degree in marine biology from the University of California at Santa Cruz, Justin worked for the California Department of Fish and Game in Rancho Cordova collecting salmon data and tissue samples throughout the Sacramento Valley tributaries. After the fun field work, Justin has spent the next twenty years in Federal service working for the USFWS, Natural Resources Conservation Service (NRCS), and now NOAA Fisheries in Arcata, California. As the North Coast branch supervisor, Justin enjoys making a difference to recover imperiled fish species and restore habitat. In his spare time, Justin loves playing basketball and volleyball with friends and family.

Important Terms

Anadromous Fish. Fish, such as salmon and steelhead that spawn in fresh water, migrate to the ocean to grow and then return to fresh water to spawn.

Fossilization. The process of stabilization and "hardening" of gravel bars by rooted riparian vegetation, which also contributes to increased deposition of alluvial silts on the bars, promoting establishment of yet more vegetation and so on.

Geomorphology. The science of landforms, with an emphasis on their origin, evolution, form, and distribution across the physical landscape.

Hydraulic. The moving or wearing down of material by flowing water. In geographic processes, hydraulic action is also known as erosion.

Hydrograph. A chart that displays the change of a hydrologic variable over time. A discharge hydrograph, for example, shows the rate of flow (discharge) versus time past a specific point in a river.

Hyporheic zone. A region beneath and alongside a streambed where shallow groundwater and surface water.

LiDAR—light detection and ranging. An optical remote-sensing technique that uses laser light to densely sample the surface of the earth, producing highly accurate x,y,z measurements

Morphodynamic. The study of landscape changes due to erosion and sedimentation.

Point bars. Features of alluvial river channels formed by the deposition of sediment on the convex bank of a curve in the channel as erosion of the opposite concave bank occurs.

Point cloud. A set of three-dimensional point locations that provide a digital representation of an object or surface. Point clouds for natural resource sciences are typically derived from laser scanning methods, including aerial LiDAR and ground-based scanners, sonar methods for bathymetry (underwater topography), and recent methods for processing photographs with computer vision techniques. Point clouds often include thousands to millions of points.

Programmatic environmental document. A programmatic environmental impact statement evaluates the effects of broad proposals or planning-level decisions that may include a wide range of individual projects; implementation over a long timeframe; and implementation across a large geographic area.

Record of Decision (ROD). A legally binding document that identifies a Federal agency's decision on how it will proceed with the proposed action identified in an environmental document prepared to comply with the National Environmental Policy Act (NEPA).

Restoration flows. All ROD-mandated flows, including summer and winter base flows and peak flows in the spring.

Riparian. Located on the bank of a river or other water body. The riparian zone is the area of direct two-way interactions between aquatic and terrestrial systems.

2017 Highlights

In 2017, TRRP:

- Coordinated and scheduled the peak release of 11,693 cfs from Lewiston Dam allowed under the ROD in an Extremely Wet water year (Figure 3) combined with gravel augmentation with a total of 3,550 cubic yards of gravel added to the river.

  The April 27 timing of the 2017 peak release was scheduled earlier than in previous years to better match the historic timing of spring snowmelt. The S3 fish production model is one of the tools used to evaluate TRRP efforts to optimize fish restoration flow releases.

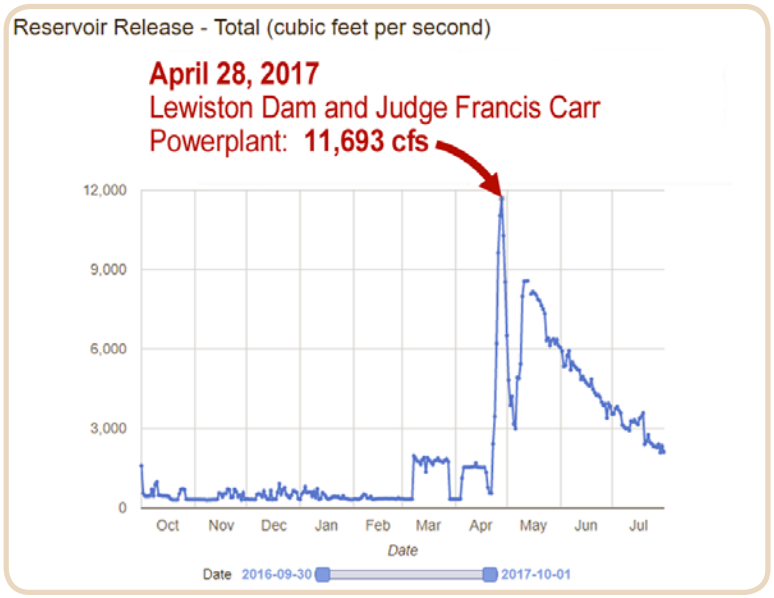


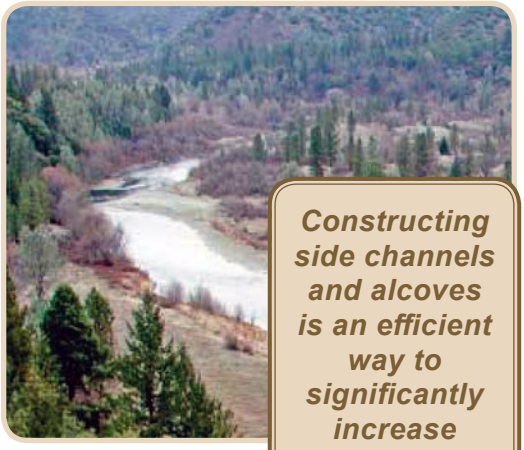
Figure 3. Reservoir releases from water.usbr.gov.

- Conducted channel rehabilitation work at 32 of the 47 sites within the TRRP Focal Reach (on the Trinity River between Lewiston Dam and the confluence of the North Fork Trinity River) as described in the Trinity River Flow Evaluation Study (Figure 4).
- Completed a 177-acre channel rehabilitation project to lower floodplains and construct key habitat features at the Deep Gulch and Sheridan Creek channel rehabilitation site (Figure 4).
- Overhauled the TRRP website and the DataPort (previously the Online Data Portal) for better data management and viewing on cell phones.

Figure 4. Aerial photography of the Deep Gulch and Sheridan Creek area in 2016 before the 2017 channel rehabilitation project. The narrow channel lacked the complexity of habitat important for successfully rearing juvenile salmonids. Photo by Ken Decamp (all rights reserved).

Deep Gulch and Sheridan Creek

In 2017, the TRRP completed construction of the Deep Gulch and Sheridan Creek channel rehabilitation project, including:



Sheridan Creek Bank rehabilitation site with newly formed gravel bars.

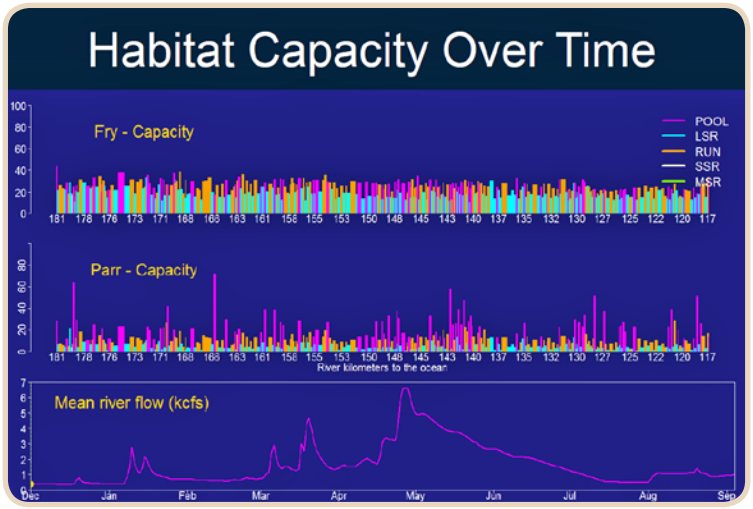
Constructing side channels and alcoves is an efficient way to significantly increase salmonid habitats.

- Constructed surface and subsurface flow-connected wetlands to provide juvenile salmon rearing and foraging habitat
- Enhanced existing high-use spawning riffles through constructed meanders
- Lowered areas of the floodplain to increase connection to the river at a greater range of flows, thereby increasing shallow rearing habitat for juvenile salmonids
- Installed engineered log jams to increase channel complexity and coverage for juvenile fish-rearing area, provide habitat variability, and enhance groundwater retention and riparian conditions
- Revegetated construction-disturbed upland and riparian areas

Fish Production Model

The USFWS is collaborating with the U.S. Geological Survey (USGS) and the Columbia River Research Laboratory, Dr. Thomas Hardy from Watershed Systems Group, Inc., and Texas State University to develop the Stream Salmonid Simulator (S3). The S3 model will enable evaluation of the effects of TRRP management actions and restoration scenarios on juvenile Chinook salmon (*Oncorhynchus tshawytscha*) production.

The S3 model is composed of coordinated sub-models that reflect an array of physical and biological processes that affect the growth, movement, and survival of juvenile salmonids (Figure 5). The S3 model is constructed to:



1. Link habitat and flow to population dynamics
2. Operate on spatial scales that capture habitat quality gradients in the basin
3. Run on temporal scales that capture variability in river discharge that can result from flow management actions

The S3 model will update sub-models as new data and analyses become available. Sub-models in development will incorporate a module for salmon-rearing conditions in the lower Klamath River and the Pacific Ocean and an upstream adult migration

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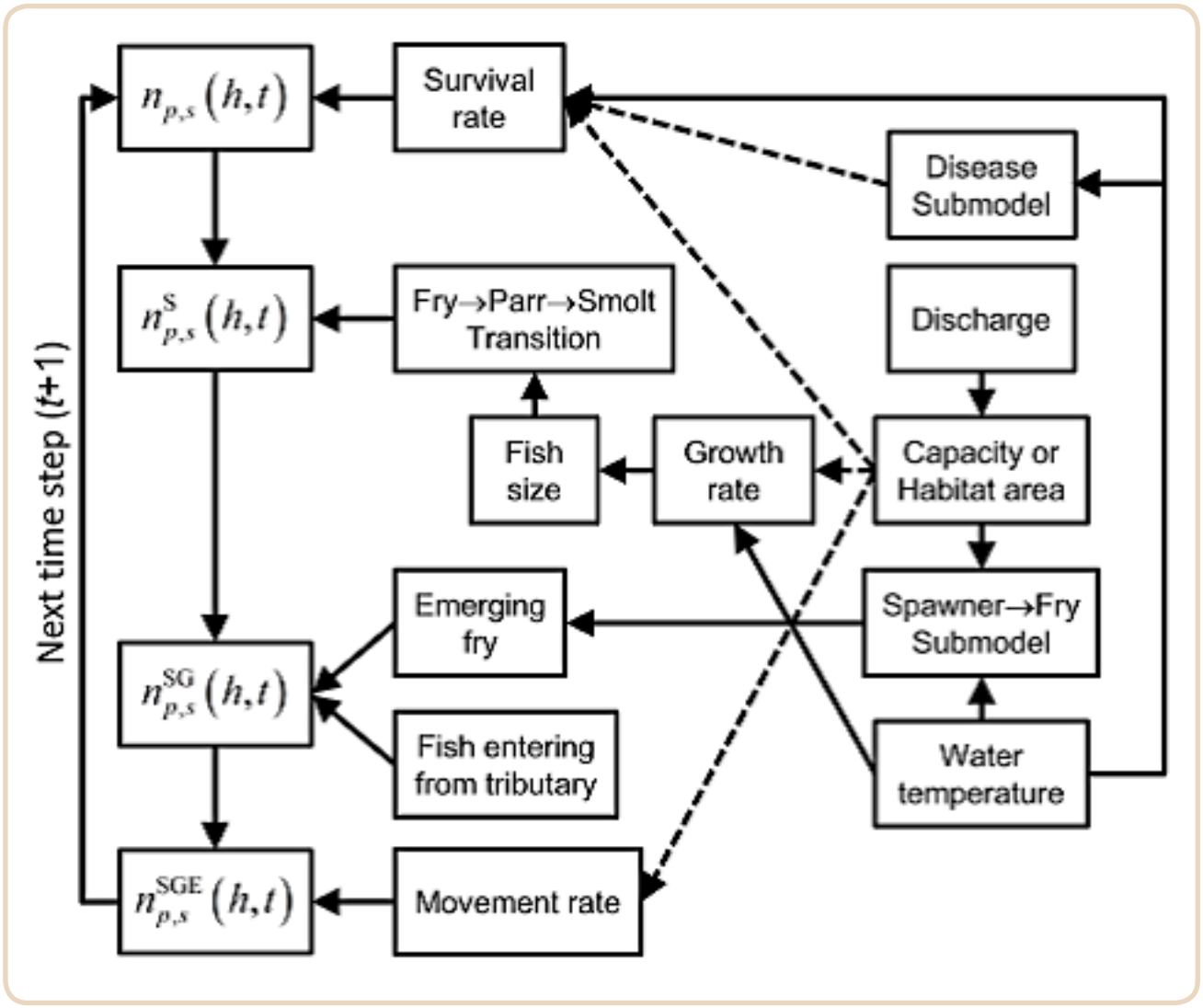
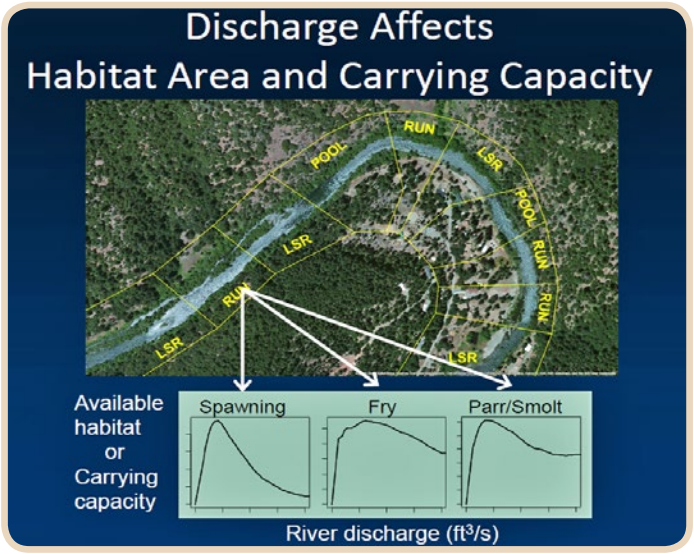


Figure 5. Schematic summary of the S3 model showing linkages between physical drivers, demographic processes, and changes in daily abundance. Dashed lines show submodels that that may be turned on or off to represent different dynamic processes in the S3 model. From Perry et al. 2018.

—Fish Production Model continued

module that will enable the S3 model to function as a full life-cycle model. As development continues, the S3 model will include predictions of fish dynamics for coho salmon (*Oncorhynchus kisutch*) and steelhead (*Oncorhynchus mykiss*), as requested by NOAA Fisheries and Reclamation. Modules for foothill yellow-legged frogs (*Rana boylii)* and cottonwood recruitment prediction are also planned for development.



An existing riffle was incorporated into the design at Sheridan Creek.

Juvenile Chinook salmon observed spring 2018 at a logjam feature constructed at the Deep Gulch site in 2017.

Photo by Aaron Martin, Yurok Tribal Fisheries Department (all rights reserved).

Funding and Expenditures

TRRP funding has varied between $10 and $16.66 million per year. In fiscal year (FY) 2017, the Program received a total of $15.119 million, as shown in Table 1.

Table 1. Fiscal Year 2017 Funding (in millions of dollars)

BUREAU OF RECLAMATION	
Water and Water-related Funds	$11.91
Central Valley Project Improvement Act Restoration Fund	$1.5
FISH AND WILDLIFE SERVICE	
FY 2017 Appropriations	$1.71
TOTAL	**$15.12**

Most of the funding supported physical modifications to the river and the associated watershed monitoring of physical and biological responses. Other partner agencies contributed in-kind services to support TRRP activities.

The FY 2017 budget allocations went to three primary areas: Administration ($2.5 million), Restoration Rehabilitation Implementation ($7.88 million), and Science Program ($4.85 million) (Table 2).

Table 2. Fiscal Year 2016 Budget Allocations (in millions of dollars)

Trinity River Restoration Program Budget Allocations	
TRRP Administration	$2.5
Restoration Rehabilitation Implementation	$7.88
Science Program	$4.85
TOTAL	**$15.23**

Juvenile salmonids in the Trinity River.

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Activities and Accomplishments

Flow Management

Restoration Releases

Each year, the TRRP's Flow Workgroup and the TMC recommend a schedule for releasing restoration flows to the Trinity River. Selection criteria for determining the year's hydrograph include:

- Providing suitable temperatures for all salmonid life stages
- Reducing the travel time for outmigrating smolts
- Managing riparian seed germination
- Reducing fine sediment storage
- Providing monitoring opportunities to support learning and adaptive management strategies

The water volume for the restoration flow release to the Trinity River below Lewiston Dam is based on the forecasted total annual inflow to Trinity and Lewiston reservoirs, grouped into five water year types. Forecasts are used because the actual water year type is not known when the annual release schedules are developed. The CDWR forecasted water year type for 2017 was Extremely Wet (California Natural Resources Agency 2017). Based on this Extremely Wet water year designation, the TMC recommended a restoration release of 815,000 acre feet (af). Reclamation implemented a modified ROD hydrograph to meet programmatic objectives for the Extremely Wet water year. The 2017 hydrograph promotes additional ecologic function in the river by increasing hydrologic variability and optimizing water temperature for juvenile salmonids as described in the ROD hydrograph for Extremely Wet water years. The descending limb receded slowly to promote riparian vegetation establishment. TRRP's technical experts consulted with Central Valley Operations to ensure that specific ramping schedules to protect sensitive species were observed.

Nancy Snodgrass, Engineer, California Department of Water Resources

Nancy joined CDWR's Northern Region Office in January 2000 as an engineer in the Engineering Studies Section after earning her B.S. in Environmental Resources Engineering from Humboldt State University in 1999. Her focus is in hydrology and hydraulics, and she is a registered Professional Engineer. She has worked on the Trinity River since 2001—providing assistance in surveying and restoration design as well as participating on several workgroups. Nancy currently sits on the Watershed Workgroup and manages the CDWR-managed Hamilton Property along Grass Valley Creek and Trinity River in Lewiston, California.

Nancy lives in Red Bluff, California with her husband and two beautiful children. She stays busy with kids' sports, academics, and co-running the household. The family enjoys spending time on their houseboat on Trinity Lake, fishing, kayaking, and water sports.

Flow Release Rates from Lewiston Dam

Figure 6 shows the summer release hydrograph based on the ROD volumes for an extremely wet year. Figure 7 shows the daily average WY2017 flow releases from Lewiston Dam to the Trinity River, based on the Lewiston gage (USGS #11525500). Figure 7 also shows the "full natural flow" (FNF) at Lewiston in WY2017. Reclamation released flows higher than 450 cfs in August 2017 to supplement flows for the Hoopa Valley Tribe's Boat Dance ceremony. Except for a reservoir management release conducted in early April prior to the start of the restoration releases, all other flow releases were conducted for river restoration purposes (i.e., the TMC flow, which is the recommended TRRP restoration flow release) (Figure 8).

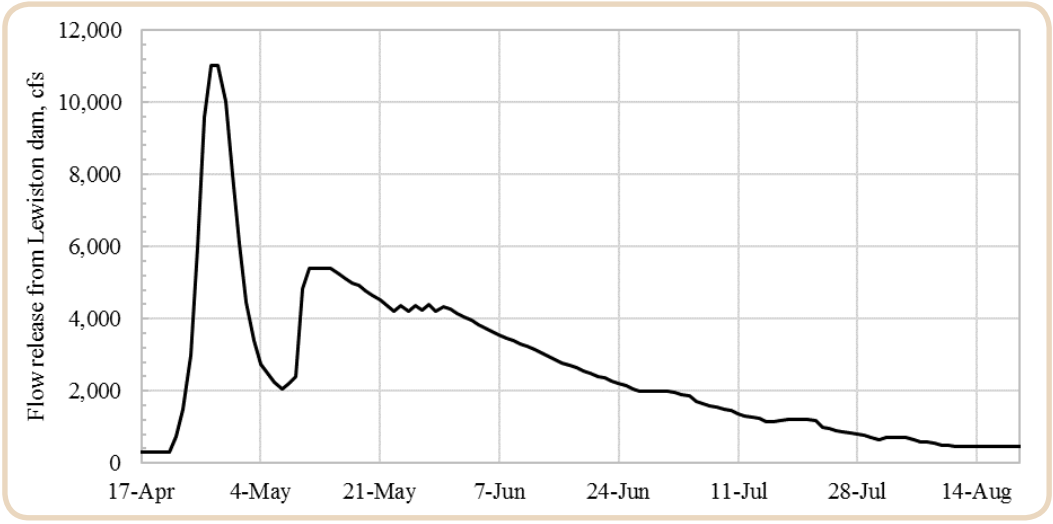

Figure 6. Hydrograph designed for release from Lewiston Dam in summer WY2017.

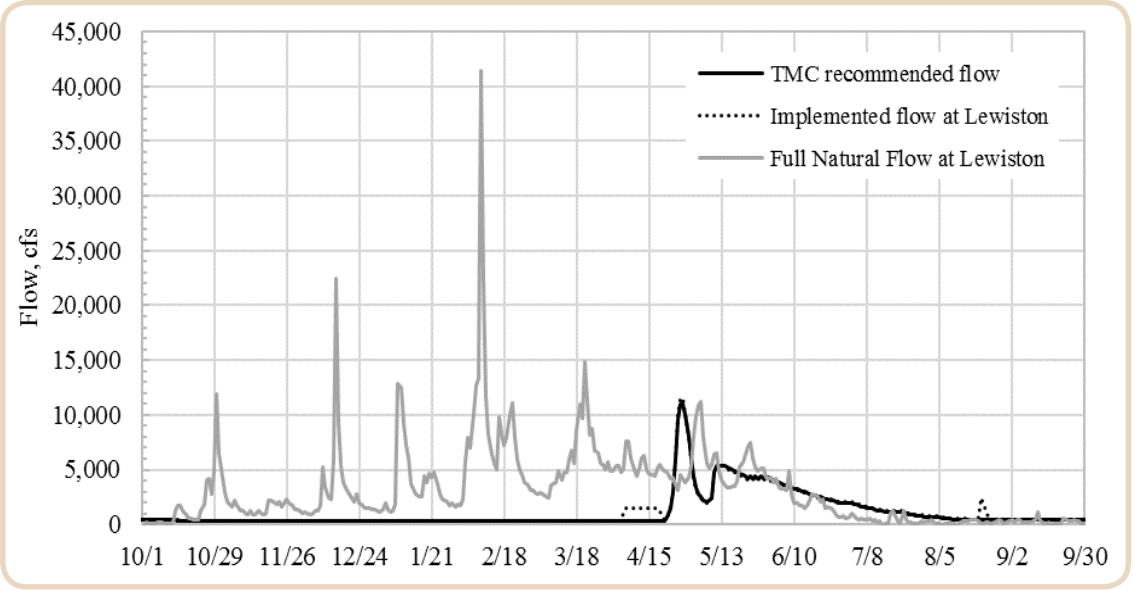

Figure 7. Plots of the TMC recommended flow release, the implemented flow, and the full natural flow for the Trinity River at Lewiston.

The FNF is the quantity of water that would have passed the gage at Lewiston if Trinity and Lewiston Dams and other diversions or impedances had not been in place.

Figure 8. Restoration flows near the Bureau of Land Management's (BLM) Bucktail boat launch area on April 27, 2017 when approximately 11,000 cfs was released from Lewiston Dam.

Implementation of Restoration Flow Schedule

Outcome of Hydrograph Implementation

In addition to showing actual water releases and the FNF, Figure 7 illustrates the releases from Lewiston Dam relative to the TMC-specified release schedule and compared to the FNF, as measured by the Lewiston gage located below Lewiston Dam gage (USGS #11525500). Actual deviations (shown in the black dotted line on Figure 7) were due to operational constraints at Lewiston Reservoir and are within the measurement accuracy of the gage. Elevated flows in August were part of the flows released for the HVT's Boat Dance Ceremony.

Temperature Targets and Compliance

To protect all life stages of Trinity River salmonids, regulatory compliance mandates implementing scientifically based temperature targets, which are established for multiple time periods at multiple locations along the Trinity River (Table 3). River temperature is measured at Douglas City and above the confluence with the North Fork Trinity River to meet regulatory compliance targets specified in State Water Resources Control Board (SWRCB) Order WR 90-5 (SWRCB 1990). Additional targets for Douglas City and Weitchpec were added by the TREIS/EIR.

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Galen Anderson, Hydrologist, Hayfork Ranger District, U.S. Forest Service

Galen spent most of the first 20 years of his life in Minnesota, just south of St. Paul. In 1981, he joined the U.S. Air Force as a jet engine technician, then a C-141B flight engineer, and finished as an aviation resource manager. Duty stations included Germany, Utah, California, and Washington. He retired from the Air Force after 27 years of service. Next, Galen returned to school and earned a B.S. in Biological Systems Engineering at the University of California at Davis. He started with the USFS as an intern hydrologist at Hayfork Ranger District prior to graduation. Currently, he's involved in small NEPA projects, best management practices evaluations, road surveys, sediment source inventories, water rights, instream monitoring, and watershed restoration projects, as well as serving as a field resource advisor during fires. Galen is an active participant in the TRRP Flow and Watershed Work Groups, which provide technical review and input on restoration flow scheduling and proposed tributary restoration projects.

Galen married his wife, Nancy, in 2009, and moved to Lewiston, California in 2016, within a mile of the Trinity River. Galen never has enough time to pursue his hobbies, which include cycling, welding, and working on projects in and out of the garage.

Table 3. Trinity River Temperature Targets by Reach and Date

Source	Target Reach	Dates	Target
Basin Plan for the North Coast Region (North Coast RWQCB 2011)	*Lewiston to Douglas City*	*July 1–September 14*	*≤60 °F (15.5 °C)*
	Lewiston to Douglas City	*September 15–30*	*≤56 °F (13.3 °C)*
NMFS (2000) and WR 90-51	*Lewiston to North Fork Trinity River*	*October 1–December 31*	*≤56 °F (13.3 °C)*
ROD Springtime Objectives for the Trinity River (USFWS et al. 2000)	*Lewiston to Weitchpec*	**Normal & Wetter Water Years — Optimum**	
		April 15–May 22	*≤55.4 °F (12.8 °C)*
		May 23–June 4	*≤59.0 °F (15.0 °C)*
		June 5–July 9	*≤62.6 °F (17.0 °C)*
		Dry & Critically Dry Water Years — Marginal	
		April 15–May 22	*≤59.0 °F (15.0 °C)*
		May 23–June 4	*≤62.6 °F (17.0 °C)*
		June 5–June 15	*≤68.0 °F (20.0 °C)*

The temperature target point recommended by the Trinity River Flow Evaluation Study at the confluence of the Trinity and Klamath Rivers (just upstream from Weitchpec on the Trinity River) is meant to ensure that temperature regimes are suitable for outmigrating salmonid smolts. The Weitchpec temperature target is designed to provide optimal temperatures in normal or wetter years and marginal temperatures in dryer years, based on outmigrating fish studies (Table 3). The Hoopa gage (USGS #11530000) is roughly 12 river miles (19.5 river kilometers) upstream of Weitchpec.

Figure 9 shows water temperatures and temperature targets at Weitchpec and flows at Hoopa during the juvenile Chinook outmigration period (April 15 - July 9) for the Extremely Wet water year. Mean daily water temperatures periodically exceeded the 'optimal' range in April and exceeded targets temperatures for a continuous 21-day period in June and July (Figure 9). Marginal temperature targets were met 57 days out of the 85-day target period, or 56% of the time at Weitchpec. The average water temperature above the optimal target was 2.5 °F, with the peak exceedance of 4.8 °F occurring July 5.

The target to not exceed 60 °F at Douglas City from July 1 to September 14 supports summer holding spring run Chinook and rearing juvenile coho salmon. The compliance mandate set forth by the State Water Resources Control Board in WR 90-5 (SWRCB 1990) from September 15 through September 30 (56 °F) supports spawning Chinook salmon and migrating adult coho salmon. River temperatures at Douglas City during the target period are influenced by the release temperatures at Lewiston Dam and local weather.

In water year (WY) 2017, water temperatures for the Trinity River at Douglas City remained below temperature targets throughout the compliance period (Figure 10). The average temperature below the temperature targets was 0.44 °F, and the lowest temperature was 8.9 °F below the targeted value on

—continued

— Temperature Targets and Compliance continued

July 1. In addition, a sharp decline in water temperatures occurred when discharges above the 450 cfs baseflow were released for the HVT's ceremony from August 20 - 25. During this period, the lowest water temperature was 7.6 °F below the temperature target.

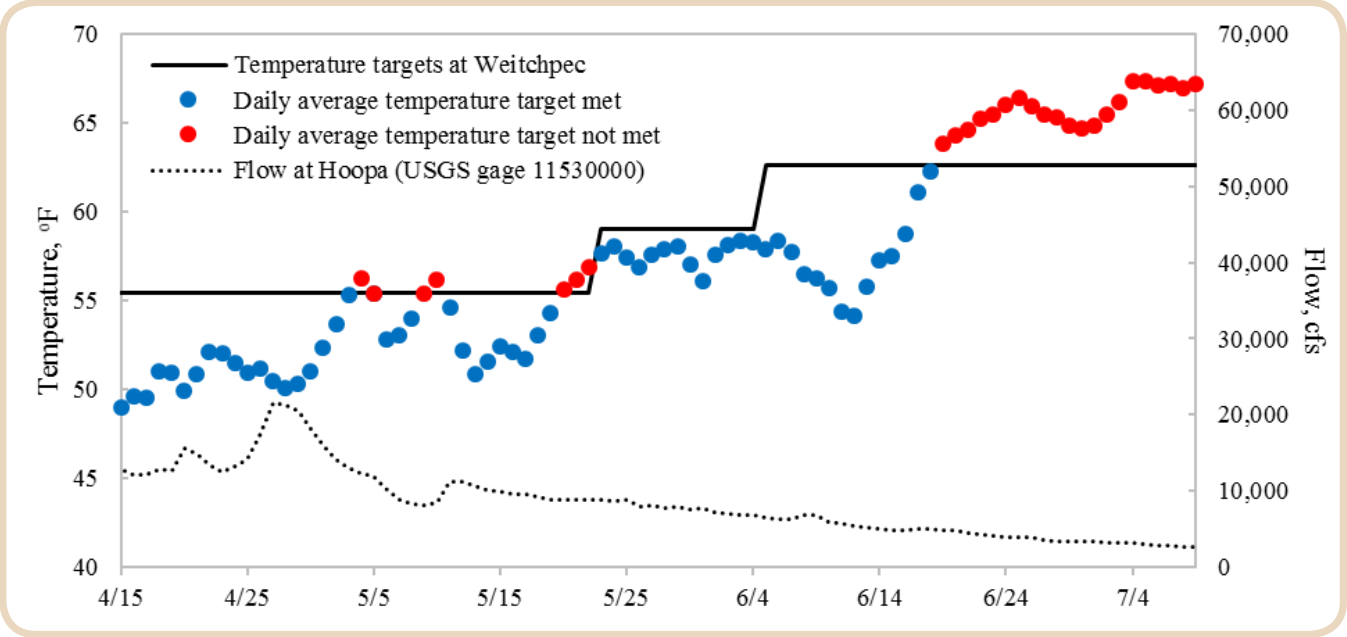


Figure 9. Water temperatures that were above (red dot) or below (blue dot) temperature targets during the compliance period for the Trinity River at Weitchpec. Temperature targets for 'optimal' conditions that are targeted in Extremely Wet water years are shown as a solid black line.

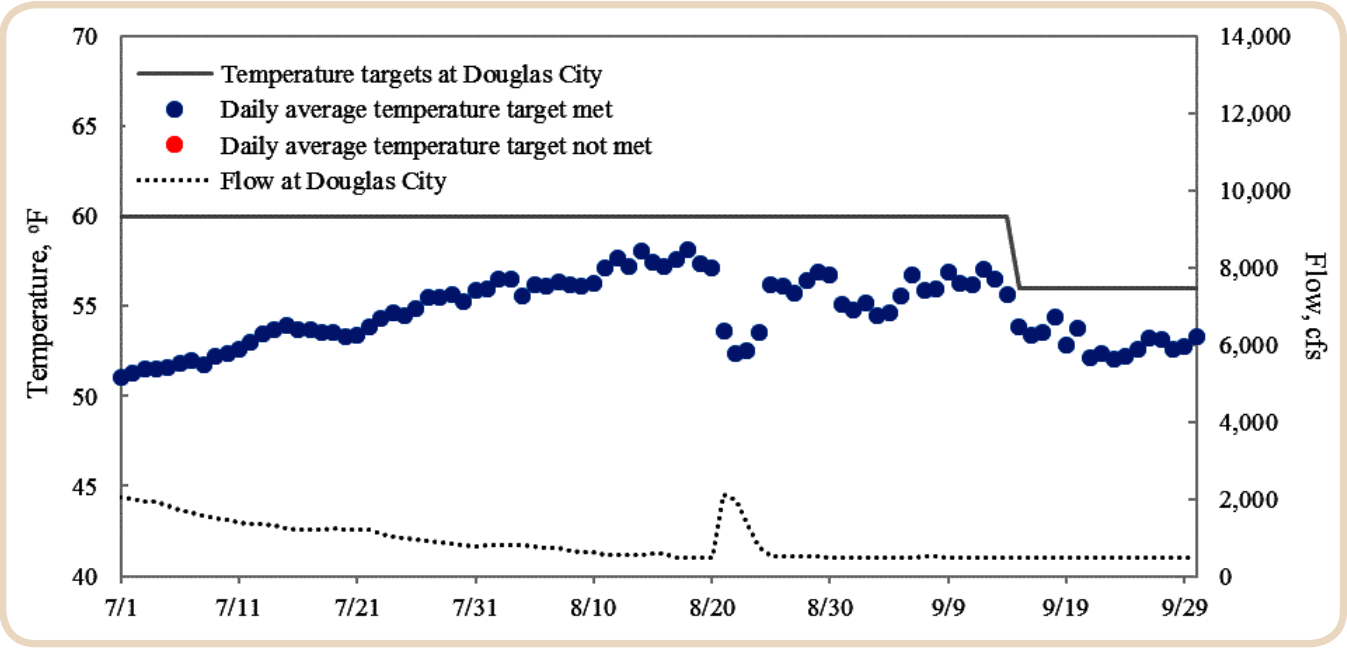


Figure 10. Temperature targets were met on the Trinity River at Douglas City for the entire compliance period in WY2017. Temperature targets for 'optimal' conditions that are targeted in Extremely Wet water years are shown as a solid black line. Flow at Douglas City is shown in cfs.

Water Volume Accounting

The total volume of water released from Lewiston Dam to the Trinity River for the Extremely Wet water year in 2017 was 865,954 af. Of that total, restoration flow releases accounted for 821,266 af. The difference between the allocated volume of water for river restoration (815,200 af) and the measured restoration releases (821,266 af) was 0.7%, which is less than the ±10% accuracy of the stream gage record. Therefore, the volume of the restoration flow releases was equivalent to the allocated volume when measurement error is considered. Additional flow releases for tribal ceremonial purposes and a reservoir management release accounted for 44,687 af.

Water Export Volume

Reclamation exported 628,436 acre-feet (af) of water from the Trinity River to the Sacramento River in WY2017 via the Judge Carr Power Plant. Exports in WY2017 to the Judge Carr Power Plant were approximately 42.1% of the total release of water from Trinity Reservoir (Table 4).

Table 4. Water Releases and Diversions as Percent Long-term Average Inflow

Water Year	Restoration Releases to the Trinity River	Diversions to the Sacramento River	All Other Releases to the Trinity River[1]	Total Releases and Diversions
	30.3%	53.4%	0.3%	84.0%
2002	38.5%	50.2%	0.0%	88.7%
2003	35.7%	68.4%	8.6%	112.7%
2004	51.9%	78.7%	9.4%	140.0%
2005	51.6%	37.2%	0.3%	89.1%
2006	64.6%	107.7%	32.4%	204.7%
2007	36.2%	49.0%	0.3%	85.5%
2008	51.7%	44.3%	0.0%	96.0%
2009	35.5%	43.0%	0.9%	79.4%
2010	52.4%	21.9%	0.0%	74.3%
2011	57.6%	37.7%	0.9%	96.1%
2012	51.6%	56.6%	3.1%	111.3%
2013	36.0%	68.0%	2.3%	106.3%
2014	29.5%	49.3%	5.2%	84.0%
2015	35.9%	35.9%	4.6%	76.4%
2016	56.5%	22.2%	3.1%	81.9%
2017	55.0%	42.1%	3.0%	100.1%
Average (2001 - 2017)	45.3%	50.9%	4.4%	100.6%
Five Year Average (2012 - 2017)	42.6%	42.1%	3.0%	89.7%

[1]*Includes Trinity Reservoir storage management releases, supplemental flow releases for the lower Klamath River, and tribal ceremonial releases to the Trinity River.*

Reservoir Conditions

WY2017 began October 1, 2017 with Trinity Reservoir holding 966,100 af (39.5% of capacity) and a water surface elevation of 2,251.3 feet mean sea level (msl) (Figure 11). The water year ended September 30, 2017 with Trinity Reservoir holding 1,791,000 af, (73.2% of capacity) at 2,325.0 feet msl. The total release from Trinity Reservoir in WY2017 was 1,494,390 af, which is 64.2% of the WY2017 FNF at Lewiston (2,329,200 af). Total evaporation from Trinity and Lewiston Reservoirs was 43,740 af in WY2017.

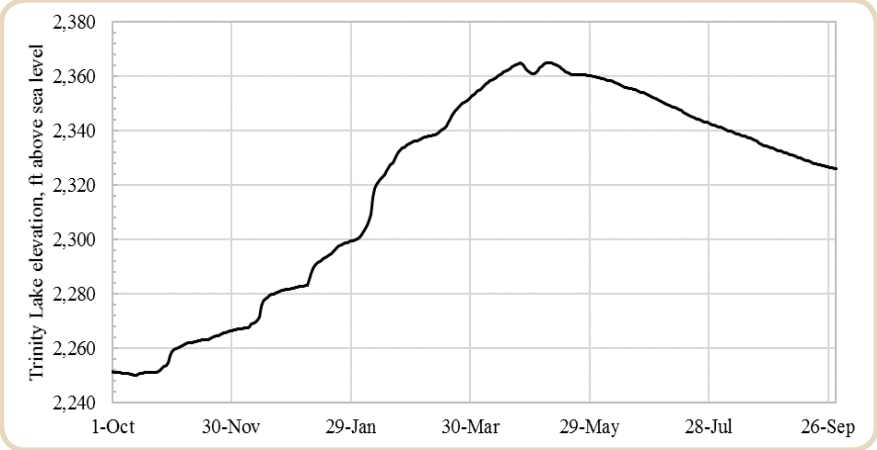


Figure 11. Water surface elevations for Trinity Reservoir in WY2017.

Trinity Reservoir.

Mike Dixon, Ph.D., TRRP Implementation Branch Chief, Reclamation

Mike grew up in Northern California—hiking and fishing whenever free time permitted, which drove him to a career in conservation science. He has a B.S. in Ecology and Systematic Biology from Cal Poly-San Luis Obispo, an M.S. in Biology from the University of Minnesota-Duluth, and a Ph.D. in Conservation Biology from the University of Minnesota-Twin Cities.

Mike came to the program in 2016, following previous roles as a conservation planner and then a refuge manager with the USFWS. In his position with the TRRP, Mike coordinates the design, review, permitting, and construction of mainstem channel rehabilitation projects and is also actively involved in the TRRP's tributary restoration efforts. He coordinates the Design Work Group, co-coordinates the Interdisciplinary Team, and participates in all of the program's technical work groups. Mike has a parallel career of 16 active and reserve years of service in the U.S. Coast Guard, where he holds the rank of Lieutenant Commander and currently serves as the Assistant Waterside Security Officer at Port Security Unit 312 in San Francisco.

Mike lives in Weaverville, California on a small farm on the East Branch of East Weaver Creek with his wife, Julia, and their two kids.

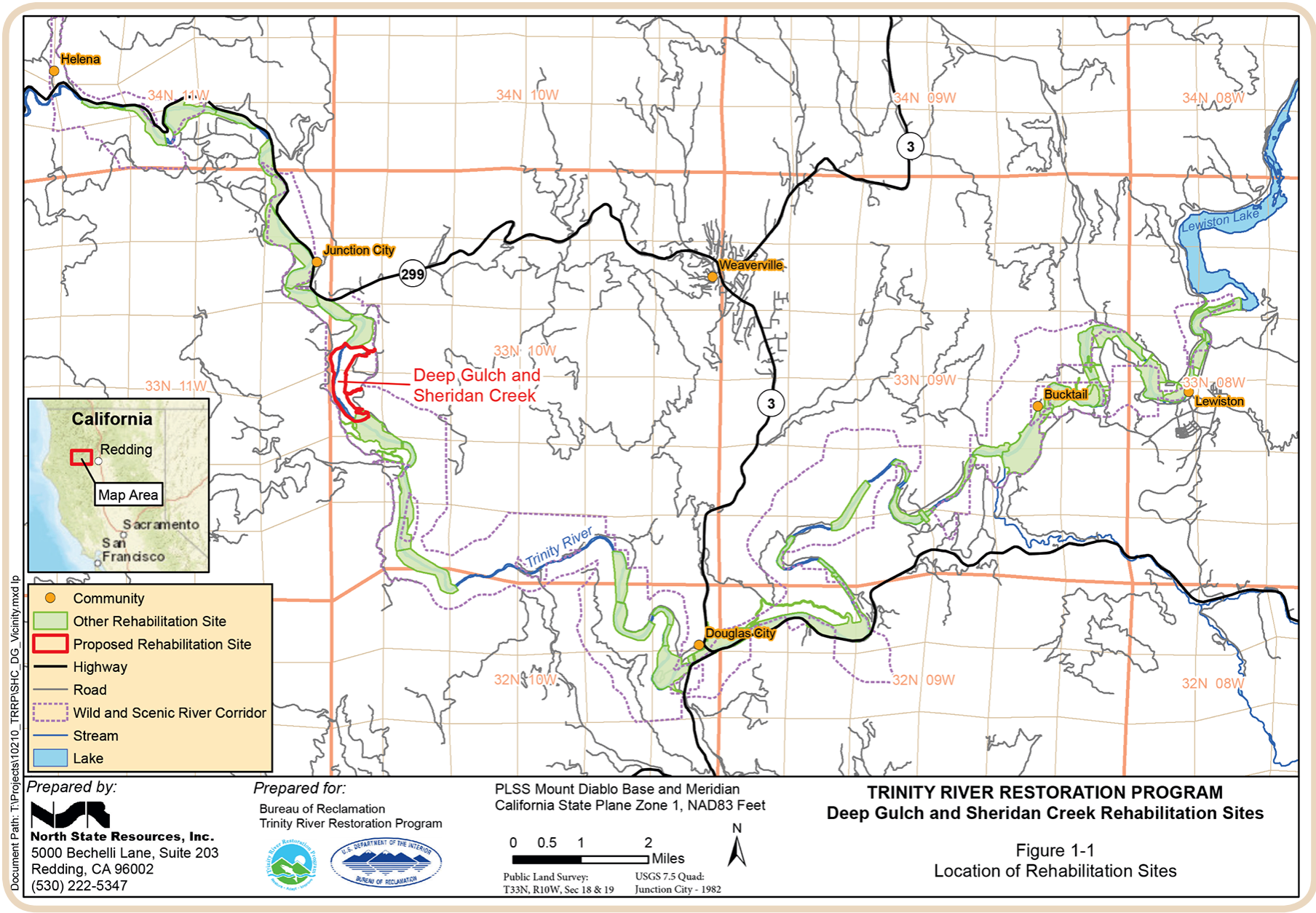
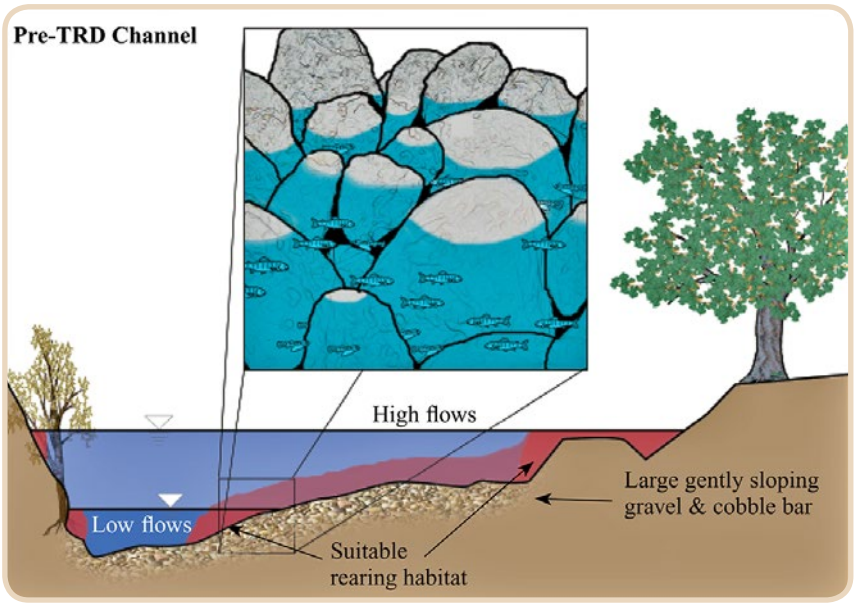


Figure 12. Location of the 2017 channel rehabilitation project within the Trinity River Watershed.

Mechanical Channel Rehabilitation

Deep Gulch and Sheridan Creek Channel Rehabilitation

The two sites, Deep Gulch and Sheridan Creek, were identified as separate projects in the 2009 Master EIR and then analyzed as a single project for site specific environmental impacts in 2017 (North Coast RWQCB et al. 2017). The Deep Gulch portion abuts the upstream (southern boundary) of the Sheridan Creek portion and the site location is roughly one mile upstream of Junction City, California (Figure 12 on the facing page). The combined project area encompassed approximately 177 acres, which includes 138 acres of BLM-managed land and 39 acres of private land.



Channel rehabilitation work was conducted at the Deep Gulch and Sheridan Creek channel rehabilitation project to improve habitat conditions in the Trinity River near Junction City. The primary objective for the Deep Gulch and Sheridan Creek channel rehabilitation project was to re-establish a functioning, topographically complex floodplain, while also increasing in-channel habitat and diversity, including riparian and aquatic habitat. Activities at the site included:

- Constructed surface and subsurface flow-connected wetlands to provide juvenile salmon rearing and foraging habitat
- Shifted the main channel into two new meanders to decrease slope and increase channel complexity and spawning area
- Lowered areas of the floodplain to increase connection to the river at a greater range of flows, thereby increasing shallow rearing habitat
- Installed engineered log jams to increase juvenile fish-rearing area, provide habitat variability, create areas of physical change, and enhance groundwater retention and riparian conditions
- Revegetated construction-disturbed upland and riparian areas

Site Characteristics

The Deep Gulch and Sheridan Creek channel rehabilitation project site is characterized by a relatively wide alluvial valley bottom, relatively low water surface slopes, low sinuosity, and simple channel geometry (Figure 13). Evidence of historic dredge activities is visible at several locations throughout the site. Although some mature riparian vegetation occurs on alluvial features, upland vegetation adjacent to the project area is characterized as scattered stands of mixed conifer/hardwood forest with an understory of shrubs and grasses. A major riffle feature supporting salmonids was already in the Sheridan Creek site. This was incorporated into the design features (Figure 14).

Figure 13. Historic mine dredge tailings and hydraulic mine scars are visible at the Deep Gulch and Sheridan Creek channel rehabilitation project area photographed in August 2016. Photo by Ken DeCamp (all rights reserved).

Figure 14. An existing riffle was incorporated into the Sheridan Creek design to enhance spawning and rearing habitat.

Initial Concept

The Deep Gulch and Sheridan Creek channel rehabilitation project was designed to increase aquatic habitat for salmonids over a range of flow conditions by creating hydraulic and ecological complexity in the form of in-channel and riverine elements.

The project increased channel and hydraulic complexity at the existing pool-riffle features by expanding the channel, excavating adjacent overbank areas, adding large woody material to support rearing habitat, and installing log jams to interact with river flows to increase bed topography and create eddies. The rehabilitation activities were needed to increase optimal habitat over a wide range of flows for fry and presmolt fish above the site's existing conditions.

The design elements for the 2017 project included mid-channel islands, split flows, side channels, off-channel ponds, alcoves, floodplain, large wood and boulder habitat structures, and riparian revegetation. Site-specific design features are designed to evolve over time under the congressionally mandated flow releases described in the ROD.

Rehabilitation Design Process

From 2014 to 2016, the Yurok Tribe Design Group designed the rehabilitation work at the Sheridan Creek site and the Federal Design Group designed the Deep Gulch site. Both design groups used a multi-disciplinary and multi-organizational approach that focused on including stakeholder input early in the design phase.

The Design Groups responsible for this channel rehabilitation project reached out to local landowners and the riverine community during the planning process to discuss and evaluate design elements and measures that best met the project goals and objectives. Through this collaborative process, several alternatives were formally evaluated using objective and quantitative metrics before an agreement was reached on the best alternative to implement. This more structured design process helped to foster better communication and transparency and created an environment that allowed for new ideas and recommendations (Figure 15).

Figure 15. Members from the Design Team visited Deep Gulch and Sheridan Creek during construction to discuss the project and incorporate ideas into future designs.

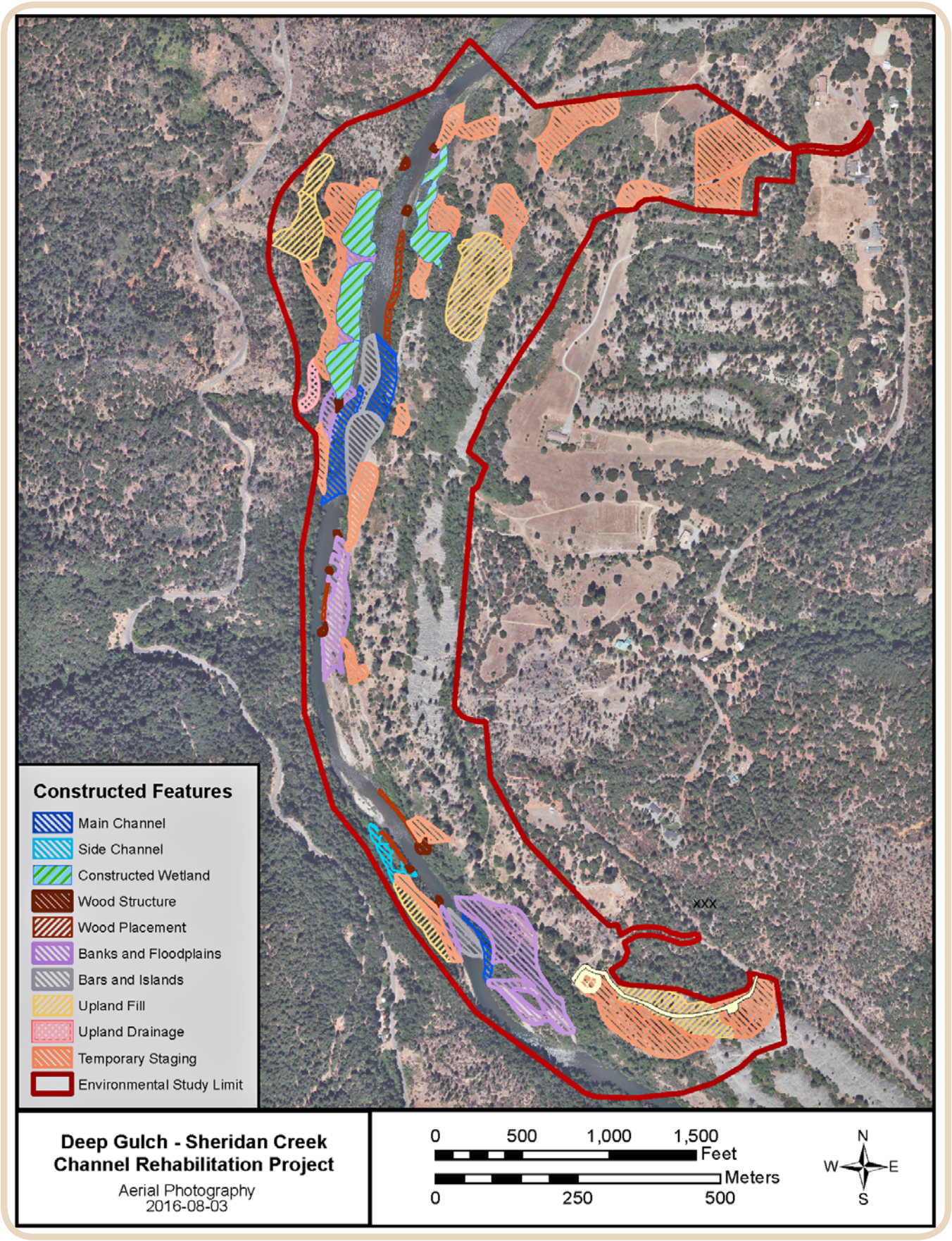


Figure 16. Constructed features at the Deep Gulch and Sheridan Creek site.

Rehabilitation Activities

The activity areas for the Deep Gulch and Sheridan Creek channel rehabilitation are shown in Figure 16 on the facing page. A description of the activity areas is described in detail in the Final Environmental Assessment/Initial Study (EA/IS) for the site (North Coast RWQCB et al. 2017). A number of rehabilitation activities at the site were completed, including:

- Reduced the encroachment of riparian vegetation.
- Placed large wood material.
- Physically altered alluvial features (i.e., placed or excavated alluvial material to construct floodplains and side channels).
- Constructed large wood hydraulic and habitat structures.
- Removed or replaced riparian and upland vegetation at strategic locations.
- Constructed several off-channel wetland features that were inset into lowered floodplains. These wetlands were loaded with large wood and their edges revegetated to provide cover and shade, which will maintain cool water temperatures for juvenile salmon rearing (Figure 17).

—continued

Figure 17. Large wood pieces were placed throughout the constructed wetlands at the Sheridan Creek area of the 2017 project.

— Rehabilitation Activities continued

Construction activities were delayed due to the Helena Fire in the Junction City, California, area. After the delay, TRRP consulted NOAA Fisheries to extend the in-river work period from September 15 to September 30. Project work was completed in the fall of 2017, and revegetation activities will continue for the next several years (Figure 18).

Figure 18. The revegetation work at Deep Gulch and Sheridan Creek will continue for several years and is implemented and monitored by the Hoopa Valley Tribe.

Towards completion of the 2017 project, crews saw salmon and steelhead using the newly created habitat to spawn (Figure 19). After four months of intense construction at the site, fish and their freshly dug redds were a welcome sight and juvenile salmon have been observed more recently at the site.

Figure 19. Salmonid swimming in the Deep Gulch area of the project in November of 2017. Photo by Matt Mais, Yurok Tribe (all rights reserved).

Coarse Sediment Management

Trinity and Lewiston Dams trap the supply of coarse sediment (gravel and small cobble) above Lewiston Dam. The ROD directs implementation of a coarse sediment augmentation program below Lewiston Dam to replace the coarse sediment trapped behind the dams and to balance the coarse sediment transported during high-flow releases. The combination of the high-flow releases and coarse sediment augmentation is intended to increase the availability and quality of physical habitat by promoting the processes of scour and fill that maintain bars, pools, juvenile rearing habitat, spawning beds, and other elements of channel complexity. Progress toward these goals is assessed by measuring coarse sediment transport, estimating sediment fluxes, and tracking changes in channel topography.

Water year 2017 was an Extremely Wet year in which the flow releases from Lewiston Dam attained a peak daily mean discharge of 11,600 cfs on April 28 and a separate daily mean peak of 5,360 cfs on May 14. A total of 3,550 cubic yards of coarse sediment was introduced into the river channel before the late April peak. About 60% of the total sediment was placed in the river at the Lowden Ranch gravel injection site, about six miles downstream from Lewiston Dam, on April 18 and 19 when river flow was between 1,250 and 1,500 cfs (Figure 20). The remainder was pushed into the channel about one mile downstream from the dam on April 25, when the rising limb of the flow releases had reached 6,000 cfs. At both locations, the flow peak that followed redistributed the sediment throughout the stream reach. Subsequent sediment monitoring at a location about 13 miles downstream from Lewiston Dam indicates that the augmentations increased coarse sediment storage in the river upstream from that location by about 1,400 cubic yards.

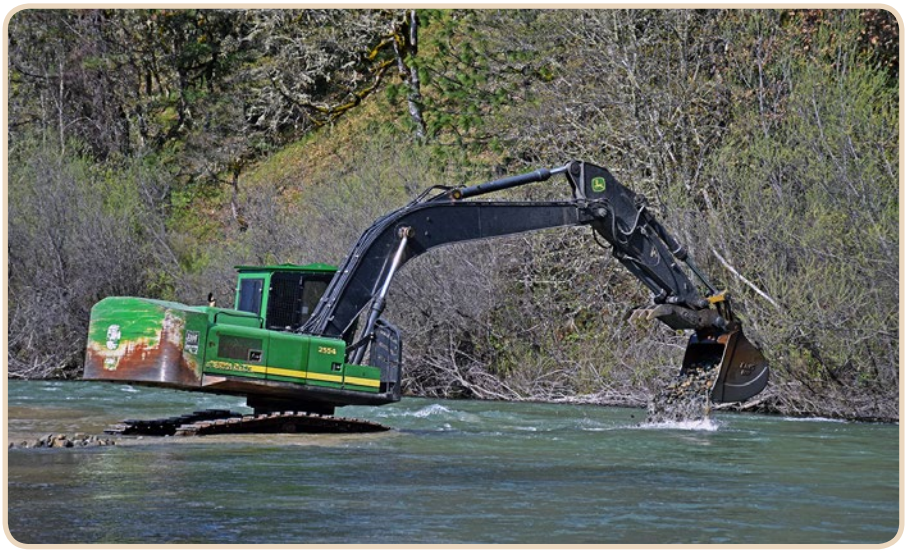


Figure 20. Cobbles and gravel are needed to create the perfect habitat for fish spawning.

Andreas Krause, Geomorphologist, Yurok Tribal Fisheries

Growing up in the arid Southwest, where rivers are the lifeblood of local communities and the environment, Andreas developed a passion for water and river restoration. His passion led him to a master's degree in Civil and Environmental Engineering from University of California, Davis, California in 1999.

He has led a varied career: testing bombs, designing subdivisions, developing water resource and flood protection plans, and conducting environmental and river restoration. For the last 16 years, Andreas worked to restore the Trinity River by conducting scientific research and engineering designs for flow releases, channel rehabilitation, gravel augmentation, sediment transport, and fluvial geomorphology.

Seeking new challenges, Andreas has recently taken a job with Caltrans. Andreas lives in Arcata with his wife, Jen. He enjoys hiking, scuba diving, staying healthy, and giving back to the community.

Sediment Transport Monitoring

TRRP monitors sediment transport rates during annual spring flow releases at four locations downstream from Lewiston Dam. This monitoring is intended to assess gravel augmentation needs and to determine whether management objectives to increase coarse sediment transport rates and coarse sediment storage are being met. In addition to collecting physical samples of bedload sediment discharge, the TRRP continues to use acoustic bedload transport monitoring (Figure 21). This applied technology, which uses hydrophones to detect acoustic vibrations caused by bedload transport, is safer and less expensive than traditional bedload monitoring methods, which requires the collection of a large number of physical bedload samples during the peak flow period.

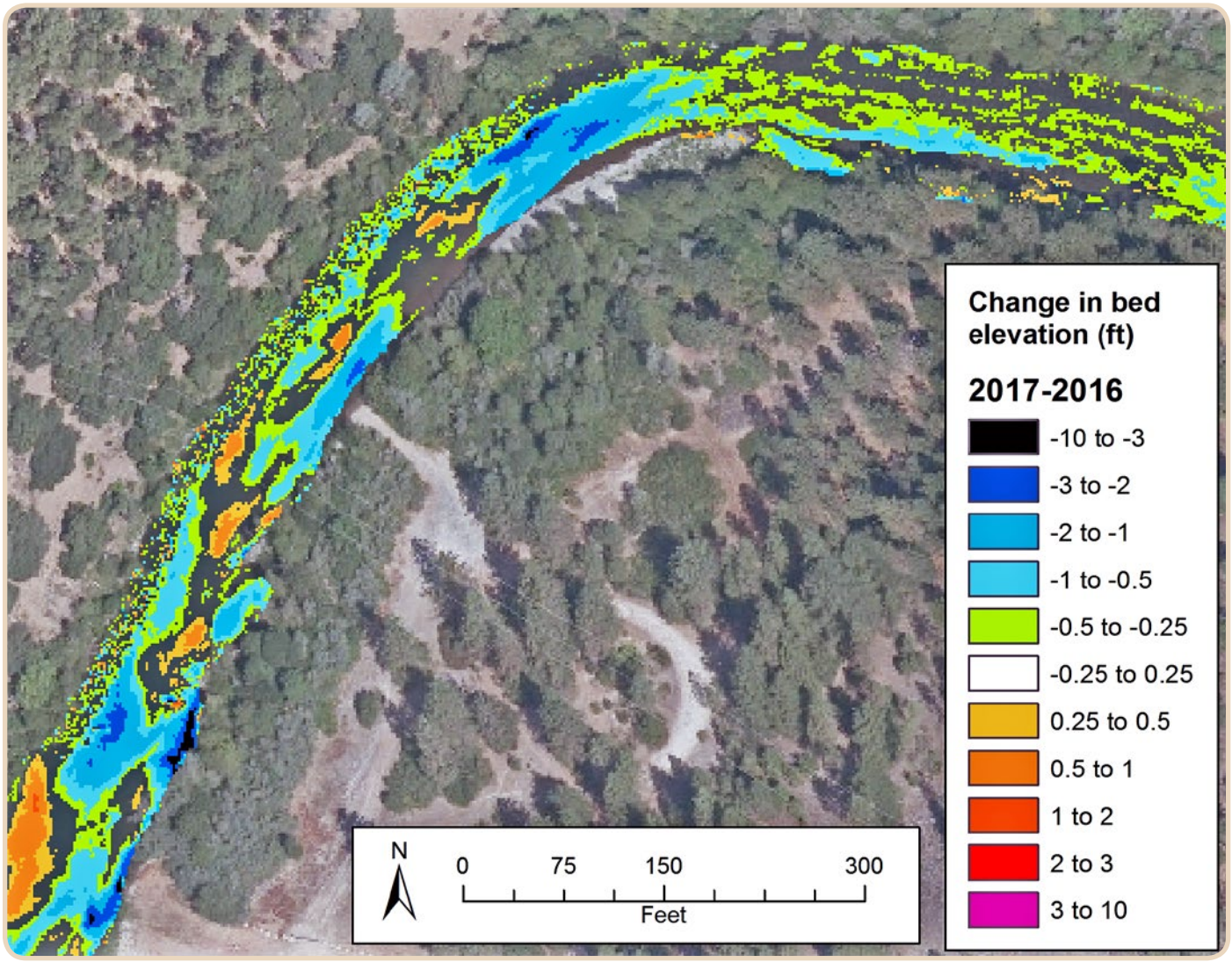


Figure 21. Observed changes in bed elevations downstream from the Lowden Ranch gravel injection site observed in 2017 during the 2017 restoration flow release. Most of the changes were minor both spatially and in magnitude.

Physical and Biological Responses to Restoration Flows

Riparian Species Monitoring

Continued fish and wildlife monitoring in 2017 helped to assess the TRRP's overall effectiveness in meeting its goals and objectives (Figure 22). Monitoring also provides reliable data on longer term trends which informs adaptive management decisions on the overall effectiveness of the Program (TRRP and ESSA 2009).

*Figure 22. Riparian habitat is important to the wildlife native to the Trinity River. Automated game cameras are placed at previously constructed channel rehabilitation sites to monitor wildlife, which in 2017 photographed a mountain lion (*Puma concolor*), a ringtail cat (*Bassariscus astutus*), and a black bear (*Ursus americanus*).*

Much of the TRRP's actions on wildlife are guided by the 1984 Trinity River Basin Fish and Wildlife Management Act (Public Law 98-541) that acknowledged the loss of habitat for deer and other wildlife species caused by the inundation of riparian and upland areas behind Lewiston and Trinity Dams. Congress directed the Secretary of the Interior to take appropriate actions to maintain and propagate such wildlife.

Riparian Monitoring

The TRRP intends to indirectly restore the Trinity River fishery by restoring natural processes. An important suite of natural processes includes establishment, growth, and mortality of vital riparian species, such as such as black cottonwoods (*Populus trichocarpa*). Riparian vegetation provides numerous benefits to fish as a source of cover, shade, and food for the insects that fish eat—not to mention being a source of large woody debris the river can scour or deposit sediment around. Riparian vegetation also provides habitat elements for songbirds and other species.

Figure 23. Mature black cottonwood near a Trinity River channel rehabilitation site.

Before implementation of the ROD, dense stands of willows grew along the riverbank, which trap sediment during floods. That sediment forms into berms, which confined the river and prevented the gradually-sloping banks from forming. Juvenile salmonids need these gradually sloping banks to feed in and to avoid predation by larger fish. The TRRP uses flows to promote establishing vegetation on the floodplain and to scour the willow seedlings that sprout along the summer baseflow channel margin. Frequent high-flow releases help minimize the dense willow thickets forming directly along the river's edge.

Back Cottonwood Seed Dispersal Period

The TRRP sets the timing of spring floods to promote the natural recruitment of black cottonwoods (Figure 23 and Figure 24). For successful recruitment, the flow peak needs to occur before the seed dispersal period, the seeds need to fall on suitable surfaces, and the water surface needs to recede slowly enough that the seedling roots can track the water table as it sinks to its late-summer level. In addition, the flows need to interact with appropriate surfaces for riparian vegetation to become established. TRRP creates those surfaces by moving sediment with heavy equipment during channel rehabilitation projects.

Black cottonwood seed dispersal periods are monitored to synchronize the timing of spring ROD releases to the dispersal period to enhance germination. In WY2004, WY2015, WY2016, and WY2017, seed dispersal was quantified to compare the consistency of seed dispersal timing and to investigate potential environmental factors affecting timing. in WY 2017, black cottonwood flowering, capsule formation, and seed dispersal were monitored at 31 trees across 5 sites.

Observations included:

- Seed dispersal in WY2017 occurred over six weeks (May 17 to June 27; 41 days). The seed dispersal period was almost exactly the same length as in WY2016 (42 days), but it occurred one month later.

- Seed dispersal in WY2017 coincided with the ROD streamflow recession (Figure 25). Seed dispersal peaked during a four-day period when streamflows was between 4,000 and 4,200 cfs. The prolonged 2017 receding limb streamflow pattern was designed and implemented to support cottonwood seed germination.

By monitoring when the peak of seed dispersal occurs, TRRP can schedule flow releases so that the water reaches and wets floodplains during the peak seed dispersal period. The data collected in WY2017 is summarized in Figure 25.

Figure 24. Black cottonwood seeds. Photo by Jean Pawek 2013 (all rights reserved).

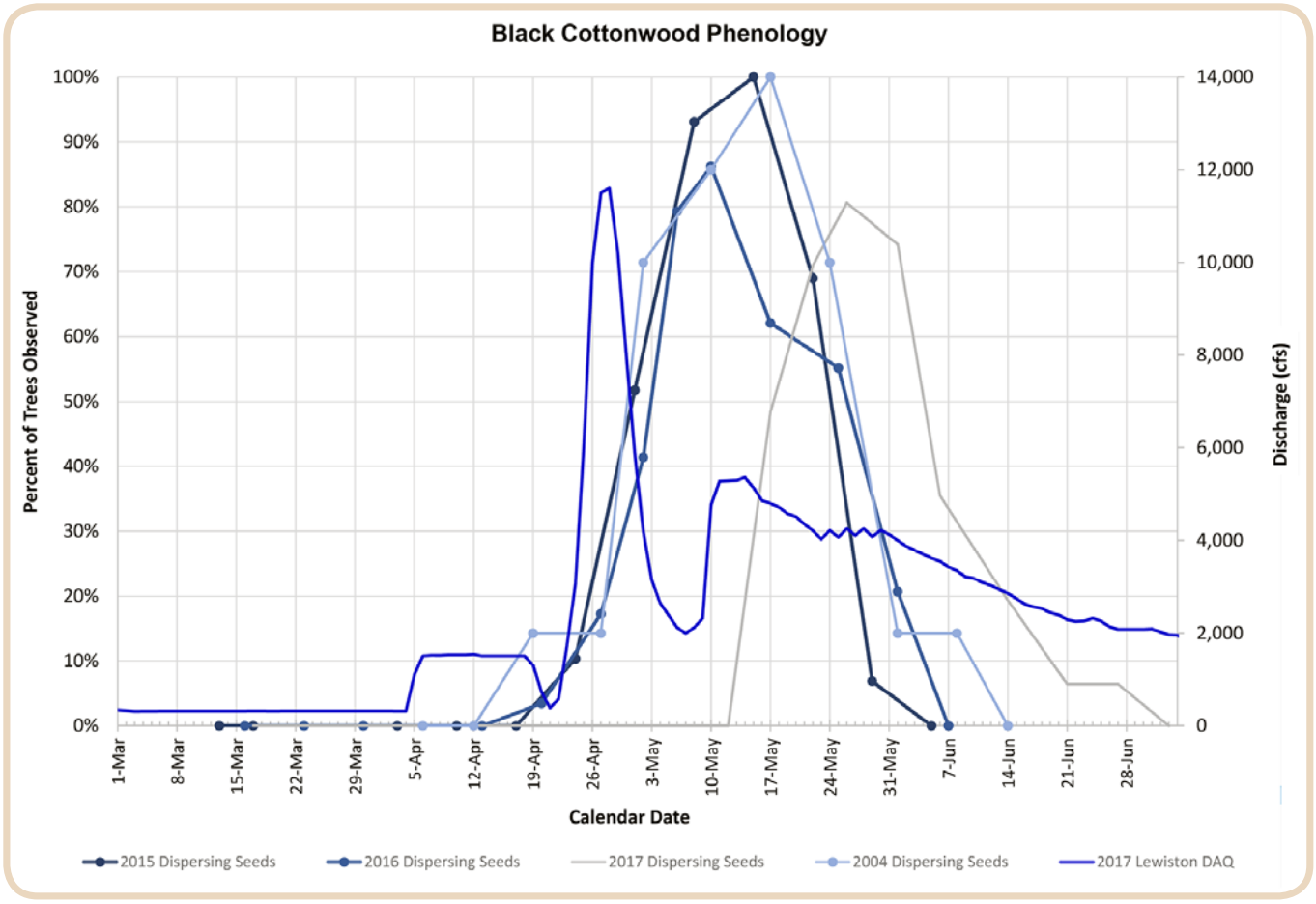


Figure 25. Seed dispersal period for black cottonwoods and the restoration flow hydrograph in WY 2017.

Large Wood Storage

Native vegetation provides many resources to the river. One of the most important, large wood, not only provides cover for fish, but also increases the complexity of the channel from interaction with high flows (Figure 26).

Figure 26. Wood placed at the Deep Gulch and Sheridan Creek site constructed in 2017 increases habitat benefits for salmonids.

In 2017, large wood planform mapping was conducted to establish a baseline condition for large wood storage conditions. Large wood load distribution mapping showed a net loss of large wood from the system between 2012 and 2017. Moreover, the current amount of large wood is about one-tenth of the target that some experts recommended in 2011.

The restoration reach is divided into 400 meter 16 generalized random-tessellation stratified (GRTS) sampling sections, and those sections are grouped together in subsets within five Panel sections of the river that are monitored on a rotating basis. Changes in large wood storage were compared at GRTS Panel 4 and 5 sites between 2012 and 2017 at a summer baseflow of 300 cfs. Table 5 shows the net change in large wood at eight GRTS Panel 4 sites and eight Panel 5 sites between 2012 and 2017 and summarizes naturally recruited and placed wood pieces mapped at rehabilitated (R) and un-rehabilitated (U) sites. Mapping results include:

- The total number of large wood pieces greater than 20 centimeters (cm) in diameter increased at seven of the eight GRTS Panel 5 sites, and decreased at all GRTS Panel 4 sites.
- The average density of large wood pieces greater than 20 cm at 16 GRTS Panel 4 and 5 sites decreased for both naturally recruited wood and placed wood.
- The largest losses in number of wood pieces occurred within the 20 - 30 cm and 30 - 46 cm diameter classes.

Table 5. Net Change in Total Large Wood Greater than 20 cm in Diameter

GRTS Panel	GRTS Site	Site Name	2012 Pieces	2017 Pieces	2012 Density	2017 Density	Net Change Pieces	Net Change Density
Panel 4	GRTS400-49	HVT Screw Trap (U)	43	17	17.2	6.8	-26	-10.4
	GRTS400-50	Johnson Point (U)	22	11	8.8	4.4	-11	-4.4
	GRTS400-51	Sawmill (R)	47	35	18.8	14	-12	-4.8
	GRTS400-52	Upper Indian Creek (R)	35	14	14	5.6	-21	-8.4
	GRTS400-53	Conner Creek (R)	14	8	5.6	3.2	-6	-2.4
	GRTS400-54	Lower Brown's Creek (U)	17	16	6.8	6.4	-1	-0.4
	GRTS400-55	Lower Poker Bar (U)	37	24	14.8	9.6	-13	-5.2
	GRTS400-56	Lower Steiner Flat (U)	31	18	12.4	7.2	-13	-5.2
Panel 5	GRTS400-65	Lime Point (U)	24	29	9.6	11.6	5	2
	GRTS400-66	Upper Conner Creek (R)	15	17	6	6.8	2	0.8
	GRTS400-67	Old Lewiston Bridge (R)	12	20	4.8	8	8	3.2
	GRTS400-68	Lower Treadwell Bridge (U)	28	54	11.2	21.6	26	10.4
	GRTS400-69	Lower Pear Tree (R)	15	18	6	7.2	3	1.2
	GRTS400-71	Bucktail Bridge (R)	31	13	12.4	5.2	-18	-7.2
	GRTS400-72	Lower Indian Creek Confluence (R)	26	31	10.4	12.4	5	2
	GRTS400-73	Sheridan Creek (R)	16	17	6.4	6.8	1	0.4

R = rehabilitated; U = unrehabilitated

Comparing the 2017 results at eight GRTS Panel 4 and eight GRTS Panel 5 sites to prior large wood mapping within the TRRP Focal Reach showed:

- There may be more large wood than originally estimated. The number of pieces surveyed in 2017 averaged 4.8 pieces per 100 meters (m) of river length, compared to the 2.0 pieces per 100 m of naturally recruited wood on the Trinity River mainstem that was estimated by Cardno ENTRIX and CH2M Hill (2011). This is the same average as the sample results in WY 2016.

- Large wood remains far below levels recommended by Cardno ENTRIX and CH2M Hill (2011) as in all previously mapped years, beginning in 2010. To achieve the recommended number, each GRTS panel 400 m site would need over 200 pieces of large wood. Currently, these sites average approximately 20 pieces per site.

- Although the average number of large wood pieces mapped per river kilometer (rkm) was 69.5 in 2012 and 48.4 in 2017, the total number large wood pieces greater than 20 cm in diameter was not statistically significant between years (Figure 27).

James Lee, Riparian Ecologist for TRRP and Hoopa Valley Tribal Fisheries Department

James has served as TRRP's riparian ecologist since 2012. He caught his first Trinity salmon right below the Old Lewiston Bridge in the late summer of 1987—a 10 pound "sorehead" that wasn't much to look at, but was good enough for the smoker. Experiences like this instilled a love of the outdoors in him, and he studied hard at Shasta College (A.A., 1994), the University of California at Davis (B.S., 1997), and the University of Georgia (M.S., 1999) to become a wildlife and fisheries biologist. After a series of jobs at an environmental consulting firm, a timber company, the Kansas Department of Wildlife and Parks, and the University of Arizona, he came home to work on the Trinity River.

James lives in Lewiston with his son, Henry, his fiancé, Amy, and their Chesapeake Bay Retriever, Penny. His hobbies include fishing, hunting, boating, camping, and gardening.

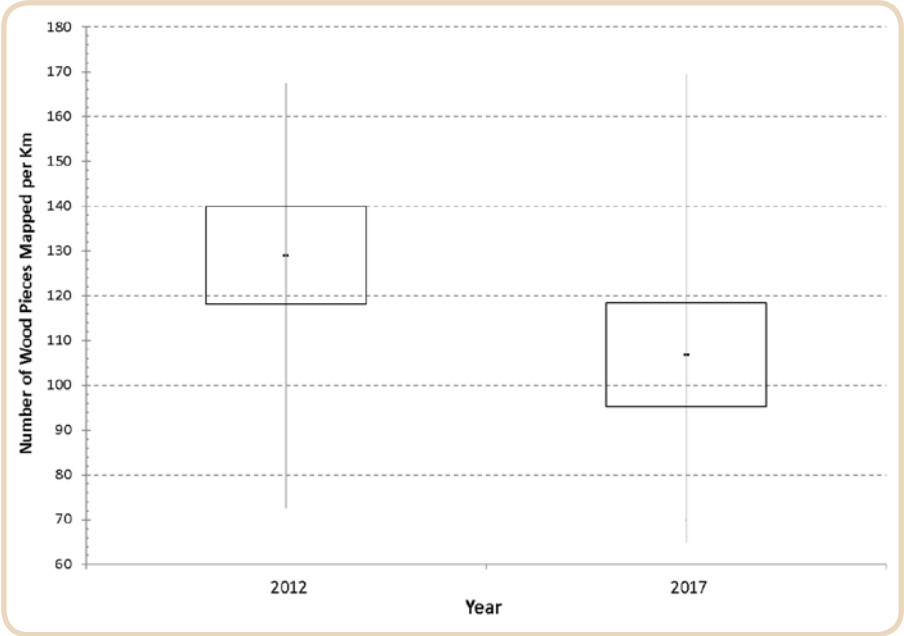


Figure 27. Total number of large wood pieces mapped per km at eight GRTS Panel 4 and eight GRTS Panel 5 sites between 2012 and 2017.

Vegetation Response to Channel Rehabilitation

Channel rehabilitation is intended to improve geomorphic and riparian processes that will in turn improve salmonid spawning and rearing habitat. Construction activities necessarily result in disturbance to existing topography and riparian vegetation. Phreatophtic vegetation is vegetation that requires contact with groundwater during summer months and is highly indicative of riparian conditions, such as willows (*Salix*), cottonwoods (*Populus*), and alders (*Alnus*). The areal extent of phreatophytic vegetation at 27 sites is monitored and evaluated using planform vegetation maps to better meet the objective to increase or maintain the areal extent of phreatophtic vegetation through channel rehabilitation and flow management activities.

Nine constructed channel rehabilitation sites have phreatophytic vegetation areal coverage that is equal to or exceeds the pre-construction coverage. Phreatophytic vegetation increased by 0.1 - 0.2 hectares at eleven constructed channel rehabilitation sites, decreased by a similar amount at three sites, and decreased by almost three times as much at one site.

The largest decrease in phreatophytic vegetation (0.7 hectares) at Lower Junction City, a 2014 constructed channel rehabilitation site.

Six of the ten sites constructed ten or more years ago have not achieved the compliance targets for riparian vegetation recruitment within the environmental study limit (ESL).

Fisheries Monitoring

Juvenile Salmon Habitat Assessment

Restoration Reach Systemic Habitat Estimate

TRRP's restoration efforts (including gravel augmentation, watershed restoration, flow management, and mechanical channel rehabilitation) are expected to catalyze fluvial processes that create rearing habitat within rehabilitation sites and throughout portions of the restoration reach that have not been directly rehabilitated (Figure 28).

Figure 28. Vegetation coverage and shallow, slow flowing water are a few of the elements that create juvenile salmonid rearing habitat. In April 2018 thousands of juvenile Chinook salmon were observed in rehabilitation features constructed at the Deep Gulch and Sheridan Creek site. Photo by Aaron Martin, Yurok Tribe (all rights reserved).

TRRP has conducted a study to evaluate changes in rearing habitat within a 64-kilometer (km) restoration reach of the Trinity River downstream of Lewiston Dam at 450 cfs (12.7 cubic meters per second [cms]) every year since 2009. Rearing habitat was mapped at 16 randomly selected 400-meter river segments in 2012, and these segments were revisited in 2017. Ten of the 16 segments had more total presmolt habitat areas in 2017 than in 2012 (Figure 29). Six of the 16 segments overlapped rehabilitation sites: three sites constructed before 2012 and three sites constructed after 2012. Habitat availability increased at three segments that overlapping rehabilitation sites constructed after 2012 and at two segments that overlapping sites constructed before 2012. The largest increase was observed at rkm 53 at the lower end of the Lower Junction City rehabilitation site, constructed in 2014. Habitat availability decreased at one segment overlapping portions of Lewiston Cableway and Hoadley Gulch rehabilitation sites. Ten of the 16 surveyed segments were in unconstructed portions of the restoration reach, five of which, showed higher habitat values in the 2017 survey. Between 2012 and 2017, the restoration reach experienced six high streamflow releases from Lewiston Dam, peaking at 9,600 cfs. Overall, the median total presmolt habitat area increased from 2,890 square meters (m^2) to 2,912 m^2.

Rehabilitation Site Assessments

The TRRP re-surveyed four rehabilitation sites (Lowden Ranch, Lower Bucktail-Dark Gulch, Reading Creek, Hocker Flat) previously surveyed before and after construction at five streamflow levels between 300 - 2,000 cfs in 2017. This data collection effort

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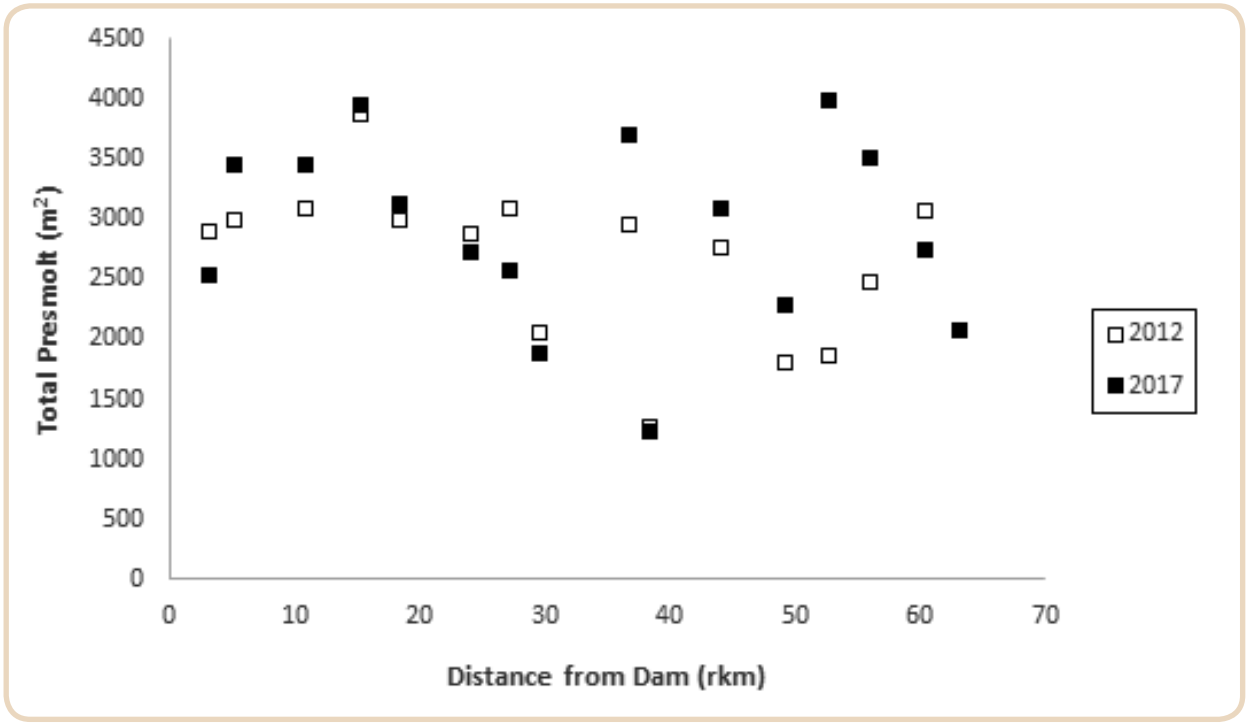

Figure 29. Total presmolt habitat area measured at 16 randomly selected 400 m river segments in the restoration reach of the Trinity River in 2012 and 2017. Note the increase in the segment located at 63 rkm is not apparent because of the resolution of the y-axis scale.

— Juvenile Salmon Habitat Assessment continued

expanded the number of sites that can be analyzed for trends in the relationship between discharge and habitat availability. The data collected at all four sites in 2017 will supplement similar data already collected from Upper Bucktail-Dark Gulch and Lewiston Cableway.

We observed a range of responses among the four sites, and the Lower Bucktail-Dark Gulch is a good case study of this response range. The site was originally constructed in 2008 and was re-constructed in 2016 because previously constructed features were not performing as expected and because the TRRP discovered that the full restoration potential of this reach had not been realized. Post-construction monitoring of the original site occurred in 2009 and re-surveyed in 2015. The 2015 re-survey served as a pre-construction effort to compare to the 2017 post-construction survey. Total presmolt habitat increased from 324% to 984% across the range of all flows, with the largest increase occurring at 700 cfs (Figure 30). Most of these increases resulted from adding a side channel that flows into a large pond maintained by a beaver dam analog that reduces flow velocities and increases pond depth and extent (Figure 31). These extensive off-channel features provide habitat and other resources to a range of aquatic species in addition to juvenile salmonids as well as to terrestrial wildlife species.

Synthesis Reporting

Adaptive management requires synthesizing monitoring data, which is then interpreted by scientists, managers, and policy makers to help inform subsequent restoration actions. The TRRP has recently assessed habitat availability at summer base streamflow (450 cfs) throughout the restoration reach from 2009 - 2013 (Goodman et al. 2016) and at TRRP rehabilitation sites from 2005 - 2015 (Boyce et al. 2018). The TRRP also collected systemic and rehabilitation site-specific survey data in 2017, which will be included in two additional reports that will provide a long-term perspective on trends in juvenile salmonid rearing habitat. These analyses, which look at rearing habitat availability at different streamflows over relatively long time-scales, provide TRRP with a valuable opportunity to revisit the design objectives for rehabilitation sites and to evaluate progress in general.

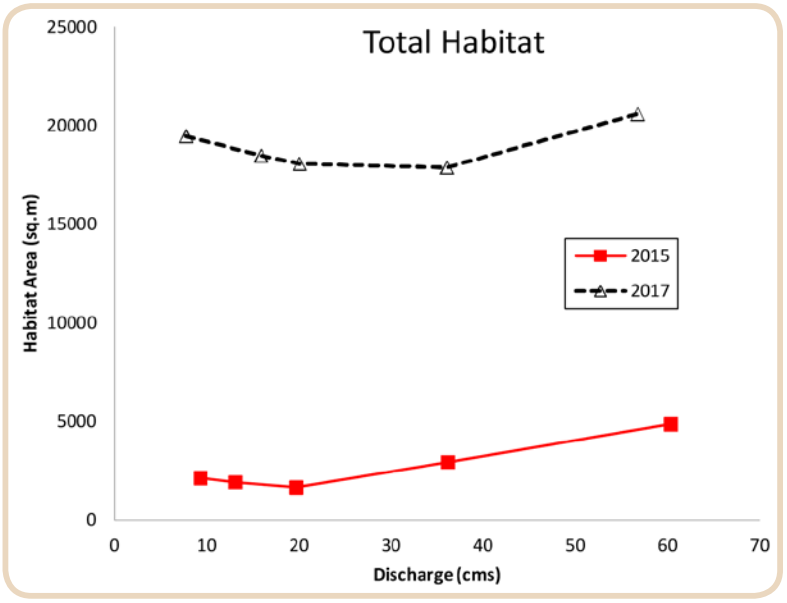

Figure 30. Total presmolt habitat area at the Lower Bucktail-Dark Gulch rehabilitation site before construction (2015) and after construction (2017).

A third synthesis report will use the newly updated 40-mile S3 hydraulic model of the restoration reach. It will compare available habitat across constructed and unconstructed areas at multiple streamflows. These analyses integrate available information about the overall TRRP restoration strategy and specific rehabilitation site design objectives and consider the geomorphic context and environmental fluctuations that existed or occurred during the appropriate time period to explain the results and inform management decisions. For example, Goodman et al. 2016 found that the magnitude of habitat change throughout the restoration reach was not related to annual peak streamflows from 2009 - 2013.

Figure 31. A low flow side channel beneath a beaver dam analog constructed at the Bucktail 2016 channel rehabilitation project, which was included in the 2017 habitat assessments.

Juvenile Chinook Salmon Abundance

Juvenile salmonid outmigrant monitoring occurred at two sampling sites along the Trinity River in 2016; at the Willow Creek rotary screw trap site (WCT) on the lower Trinity River and at the Pear Tree Gulch rotary screw trap site (PT) immediately above the confluence with the North Fork Trinity River (Figure 32).

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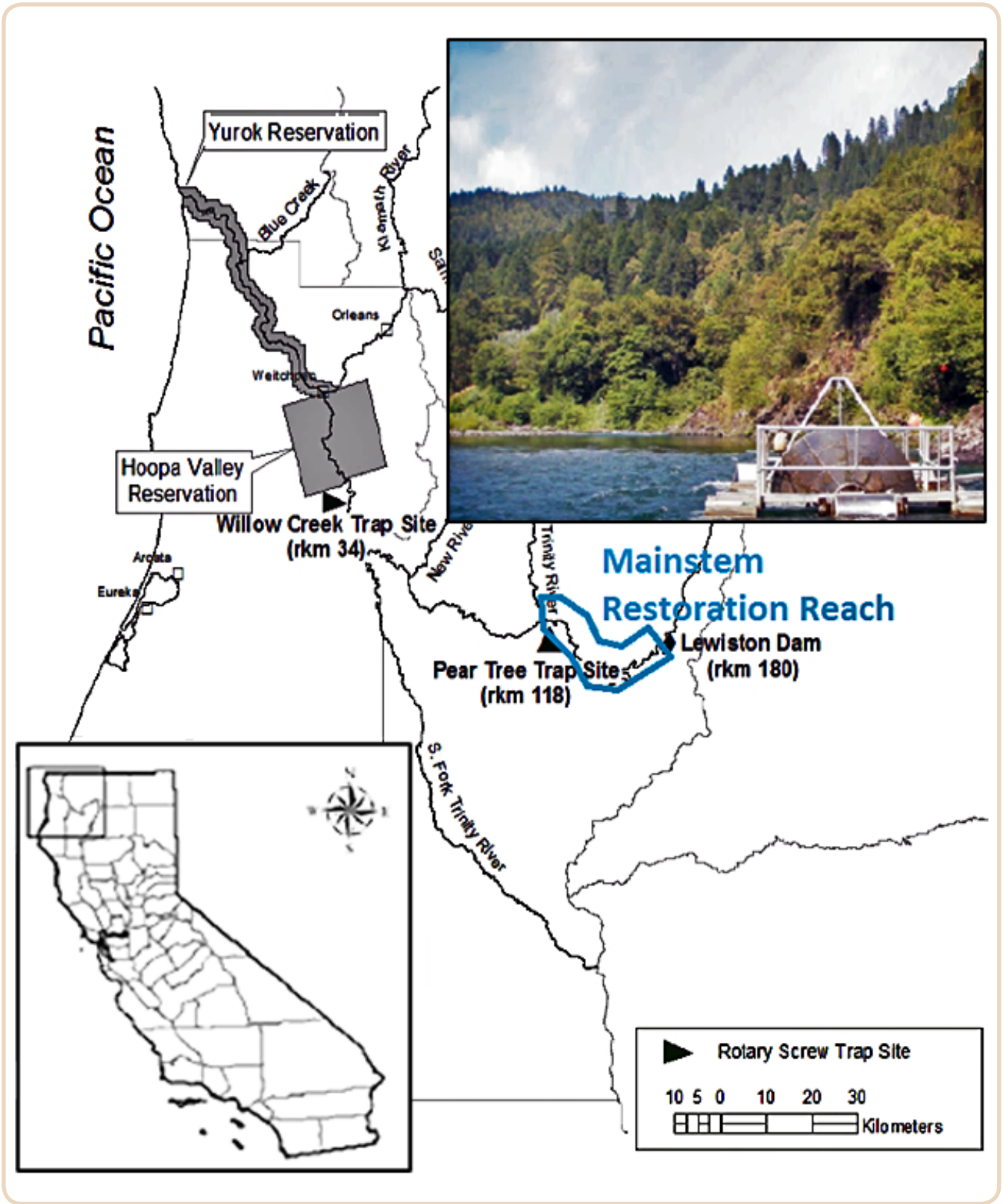


Figure 32. Map of the screw trap sites in 2017.

— Juvenile Salmon Habitat Assessment continued

Figure 33 shows the he numbers of juvenile Chinook salmon at WCT and PT. Sampling at WCT typically occurs from March through August and at PT from January through August, capturing the bulk of the emigrating naturally produced juvenile Chinook salmon. It is important to note that the population is not sampled from September through December. In addition, WCT sampling captures juvenile salmon that originate from the entire basin above the WCT site, while PT sampling captures juvenile salmon that originate from the restoration reach of the Trinity River.

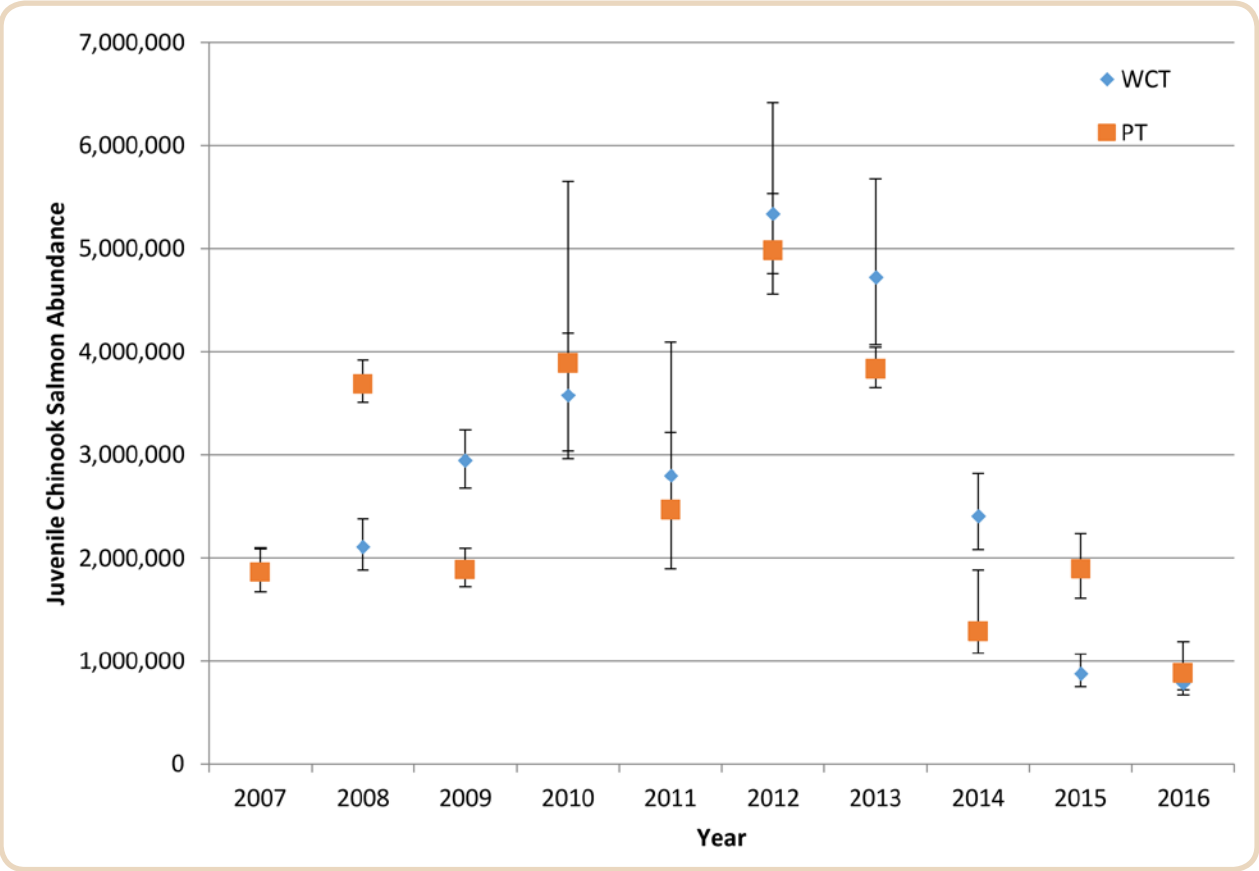


Figure 33. Abundance of naturally produced juvenile Chinook salmon at Willow Creek (WCT) and Pear Tree (PT) trap sites, 2007 - 2016. Error bars represent 95% credible limits of the annual estimates.

It is natural for salmon populations to vary dramatically from year to year—reflecting variation in freshwater and marine conditions and the level of harvest of adults.

Annual population estimates of naturally produced juvenile Chinook salmon (spring- and fall-run combined) in 2016 were 0.8 million fish at WCT and 0.9 million fish at PT (Figure 33). Since 2007, these are the lowest estimates at WTC and PT. These lower values in 2016 likely reflect the low spawning population size during 2015 and are possibly related to increased mortality during egg incubation and fry emergence. Analyses to determine cause and effect are planned for 2018, including analyses relating the size of the spawning population to the number of juveniles produced, as well as habitat availability and temperature regimes to assess factors that influence juvenile population sizes.

Salmon Redd Distribution and Abundance

To evaluate the distribution and abundance of Chinook salmon spawning activity, the USFWS, USFS, CDFW, the Hoopa Valley Tribe, and the Yurok Tribal Fisheries Program conduct salmon spawning surveys annually on the mainstem Trinity River (Figure 34).

Figure 34. Anne Beulke and Amelia Fleitze from the USFS measure and mark the location of a Chinook salmon carcass found in the Trinity River (left).

Steve Gough and Todd Buxton from USFWS navigate a rapid while conducting a salmon redd and carcass survey on the Trinity River (right).

During the 2017 surveys, 1,982 salmon redds were located, and 1,400 salmon carcasses were examined. Of these carcasses, 527 were fresh Chinook salmon and 3 were fresh coho salmon carcasses. Natural-origin Chinook salmon built an estimated 1,600 redds, hatchery-origin Chinook salmon built 348 redds and Coho salmon built the remaining 34 redds (Table 6). The number of redds observed in 2017 was the second lowest since the survey, was initiated in 2002 in its current iteration (Figure 35).

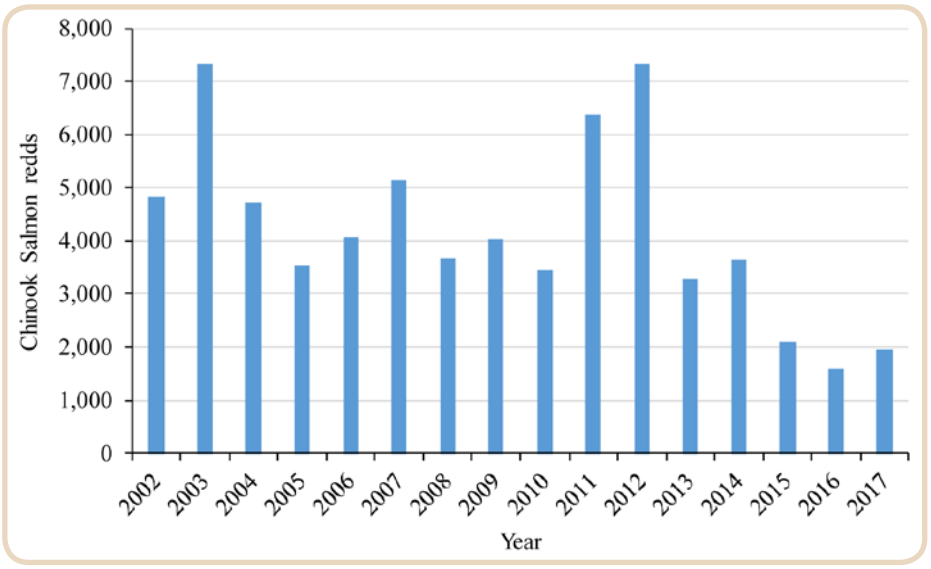


Figure 35. Estimated numbers of Chinook salmon redds from mainstem Trinity River surveys, 2002 - 2017.

Surveys showed that hatchery-origin Chinook salmon tended to spawn relatively closely to Lewiston Dam, the location of the Trinity River Hatchery, while natural-origin Chinook salmon spawned throughout the mainstem, with particularly high numbers spawning within the restoration reach itself (Figure 36).

—continued

— Salmon Redd Distribution and Abundance continued

Table 6. Estimated Numbers of Chinook and Coho Salmon Redds Observed in the Mainstem Trinity River in 2017.

Bootstrap-generated 95% confidence intervals are in parentheses.

Species	Origin	2017
Chinook Salmon	All	1,607[b]
	Natural	1,516 (1,453–1,580)
	Hatchery	91 (27–154)
Coho Salmon[a]	All	64[b]
	Natural	NA
	Hatchery	NA

[a]Our survey season only partially covers the Coho salmon spawning period.
[b]Confidence intervals are generated with both Chinook and Coho salmon data. Not enough Coho Salmon female carcasses were found in 2016 to calculate a confidence interval.

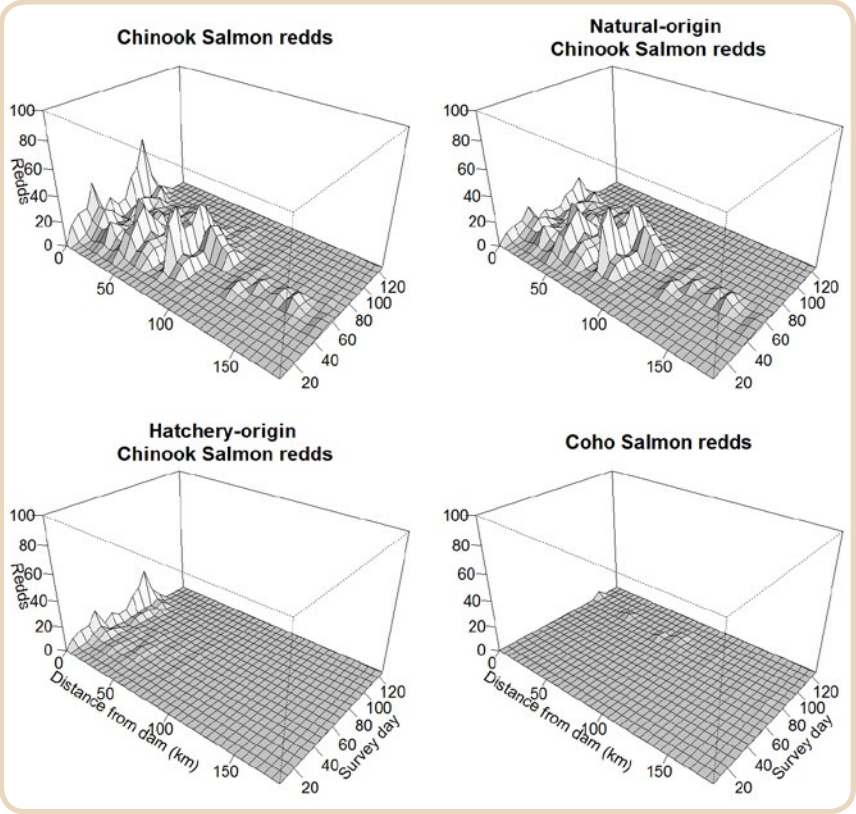


Figure 36. Spatio-temporal distribution of mainstem Trinity River salmon redds observed in 2017. Pigeon Point and Burnt Ranch whitewater reaches were not surveyed. Survey Day I = September I and Survey Day I20 = December 29.

Josh Boyce, Ph.D., Fish Biologist, USFWS

Josh Boyce began his work on the Trinity River in 2015 with the USFWS. In his current position, Josh conducts effectiveness monitoring for TRRP restoration efforts and assists in developing hydraulic models of the Trinity River to help facilitate adaptive management of the Program. For example, Josh recently completed a long-term analysis of juvenile salmonid habitat availability at TRRP rehabilitation sites, and he is currently writing a summary report of all TRRP large wood installations since 2005.

Josh was born in Montana, raised in Texas and has resided in California, New York, Mississippi, and Idaho. After finishing college in Austin, Texas in 1995, Josh moved to Happy Camp, California, to volunteer with the USFS before earning an M.S. in lamprey genetics at Humboldt State University in 2002. He then moved on to a research position at the Rockefeller University, studying zebrafish genetics and behavior. That work inspired him to earn a Ph.D. in reproductive biology of rainbow trout at the University of Idaho in 2009. Josh completed a post-doctoral position studying reproductive physiology of Columbia basin steelhead trout in 2015.

Josh and his wife, Rosine, first met while traveling through Australia in 1996. Josh returned to the U.S., Rosine returned to her native England, and after eight years they reunited and were married in 2006. They have two sons, 6 and 8, and are happily settled in coastal Humboldt County, California.

Salmonid Spawning Escapement and Harvest

TRRP supports CDFW's monitoring for run-size and escapement of naturally produced and Trinity River Hatchery produced spring and fall-run Chinook and coho salmon as well as for adult fall-run steelhead. The provisional estimated escapement of 2017 adult fall Chinook salmon to natural spawning grounds in the Trinity River Basin in 2017 is approximately 6,050 fish. Preliminary estimates for 2017 indicate that 8,216 naturally-produced fall-run Chinook salmon and 7,435 hatchery-produced fall-run Chinook salmon returned to natural river areas or the Trinity River Hatchery (including age-2 jacks). Details on the 2017 escapement monitoring for Trinity River salmonids are provided in Table 7 and a recent perspective of naturally-produced fall-run Chinook escapement is presented in Figure 37. Figure 38 shows a weir.

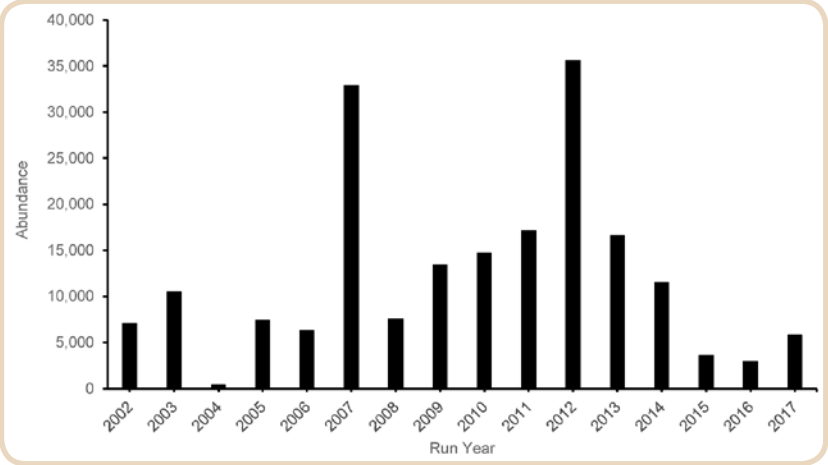


Figure 37. Naturally-produced adult fall Chinook salmon escapement upstream of Willow Creek Weir, 2002-2017 (includes returns to natural spawning areas and Trinity River Hatchery).

Table 7. Preliminary 2017 Adult Escapement Estimates for Trinity River Salmonids (CDFW 2018 in preparation).

Species	Natural Produced Escapement		Hatchery Produced Escapement	
	2017	Program Goal	2017	Program Goal
Spring Chinook Salmon	1,464	6,000	2,153	3,000
Fall Chinook Salmon	5,801	62,000	3,969	9,000
Coho Salmon	56	1,400	350	2,100
Fall Steelhead adults	2,346	40,000	4,494	10,000

Adult Fall Run Chinook Salmon Harvest

TRRP's supports dependent ocean fisheries, as well as in-river recreational and tribal fisheries as part of the goal to restore anadromous fish populations. Natural and hatchery-produced fall Chinook salmon from the Trinity River support the recreational fishery and the Hoopa Valley Tribal fishery on the Trinity River and contribute to the recreational fishery and Yurok Tribal fishery in the lower Klamath River below its confluence with the Trinity River.

In 2017, the estimated adult fall Chinook salmon harvest for the recreational fishery was 7 fish on the Trinity River and 64 fish on the lower Klamath River (river mouth to Weitchpec). The estimated tribal harvest of adult fall Chinook salmon was 1,660 fish by the Hoopa Valley Tribal fishery and 216 fish by the Yurok fishery. Recreational angling for fall Chinook salmon was closed in the

—continued

— Adult Fall Run Chinook Salmon Harvest continued

Figure 38. The Junction City weir (JCW) configuration in 2017 helped monitor salmon escapement.

Klamath River in 2017 due to the expected low return, and the 71 fish harvested by anglers were caught incidentally during the spring Chinook salmon fishery.

The large number of age-2 jacks observed in 2017 fall Chinook salmon run suggests that adult returns to the Klamath and Trinity River will be considerably better in 2018 (Figure 39).

Figure 39. Age-2 jack. Photo courtesy of CDFW, all rights reserved.

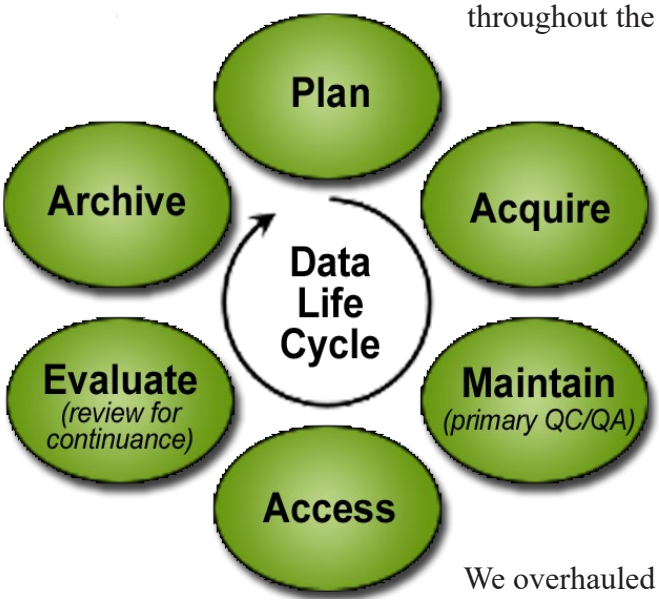
Wade Sinnen, Senior Environmental Scientist, California Department of Fish and Wildlife

Wade has worked on the Trinity River since 1991 in several positions from scientific aide to his current position as Senior Environmental Scientist. He as been involved with the TRRP since its inception. Wade was born in Wisconsin and picked up his love of fishing at an early age, which led him to his career choice. Wade attended Humboldt State University, where he earned a degree in fisheries biology. He began his career working on reservoirs in Southern California, but soon migrated north to work with salmonids and the Restoration Program. His work in Northern California has been focused on monitoring and researching Klamath basin salmonid populations and fisheries management.

Wade is married to Cathy and has two children, Donovan and Sheridan. They live in McKinleyville, California, with their various pets and enjoy time together gardening, traveling, and hanging out. Wade's hobbies include fishing, golfing, hiking, and spending time with relatives and friends on their 40-acre "homestead" in Wisconsin.

Data Management

The ultimate products of the TRRP will be twofold: a more functional river and the information we gather about it. The Program's online data portal (DataPort) at www.trrp.net/dataport is a key resource for managing Program information and coordinating data across the partnership and was newly designed in 2017. Data stewardship encompasses this information throughout the data life cycle to ensure that data are:



- Developed appropriately
- Accessible for efficient use
- Properly analyzed
- Maintained or archived with sufficient documentation to enable future use

Thus, data stewardship improves the efficiency and rigor of data use both short-term and long-term, providing a solid foundation for Adaptive Management.

We overhauled the TRRP website and DataPort (previously the Online Data Portal) in 2017. TRRP now has more direct management of the site, rather than going through a contractor, leading to both cost efficiencies and improved ability to update website functionality. The new site is better designed for viewing on small screens, such as on cell phones, and the menu system has been simplified. Many details remain in the site and can be found by following links, or from the search tool available next to the menus (look for the magnifying glass icon).

The DataPort library www.trrp.net/library provides convenient access to over 1,450 reports and other documents, as well as over 80 data packages. Many of the reports and documents are scanned items dating as far back as 1900. The DataPort includes dynamic maps www.trrp.net/dataport/map with a flexible interface (Figure 40). The DataPort also includes millions of data points on stream flow, water temperature, and reservoir operations. A time series data explorer is still under development, but these data appear in tables and graphs throughout the website. Note that most time series graphs on the site can be zoomed by dragging your mouse (Figure 41).

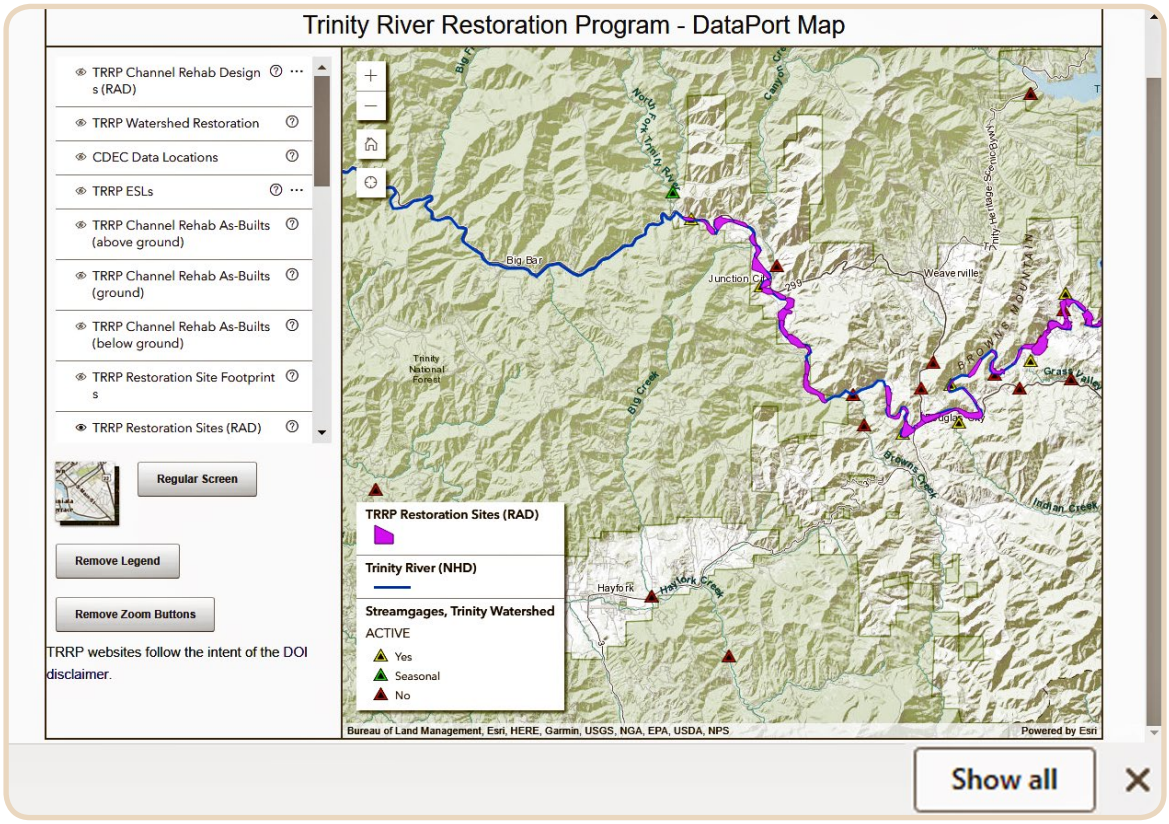


Figure 40. Clicking the "Large Screen" button will provide options by the map, and clicking the "Regular Screen" will revert to a view with options under the map.

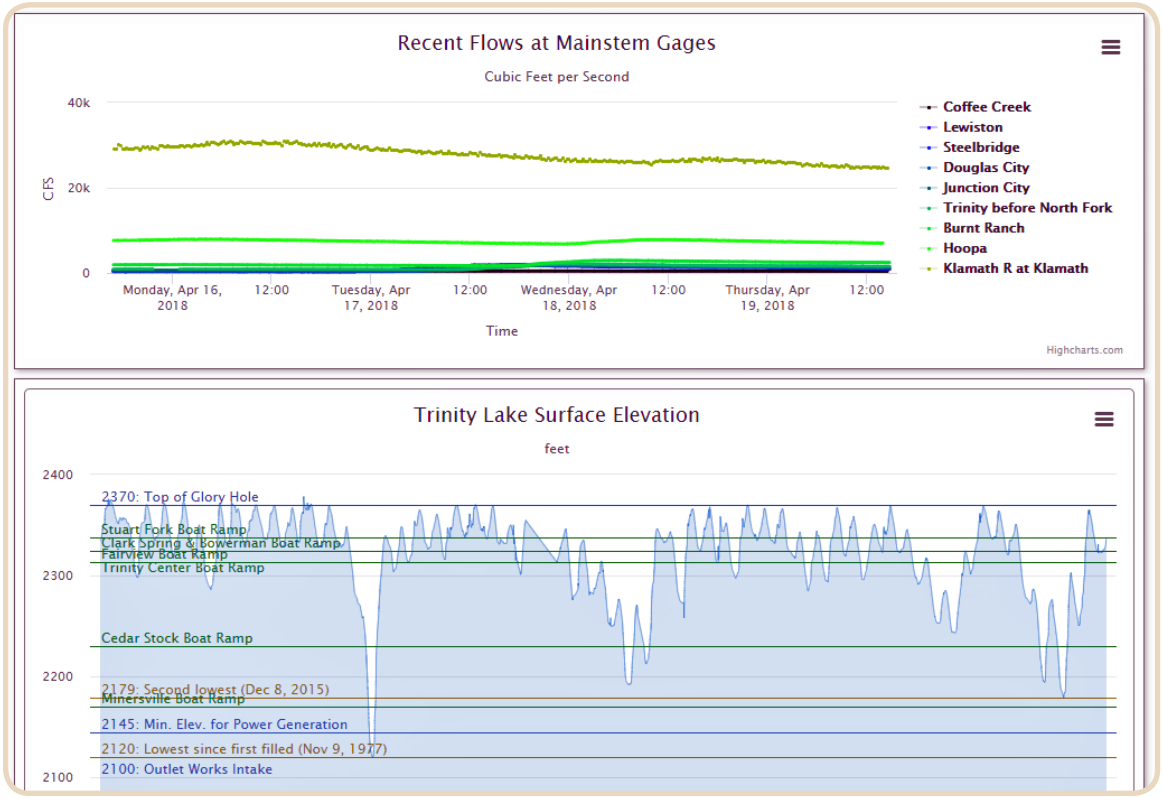


Figure 41. The updated DataPort page features time series data, which allows users to zoom to specific points over time.

Remote Sensing

Historic aerial photography datasets going as far back as 1944 provide context for current river conditions and are accessible on our website (Figure 42). High-resolution aerial photography may be TRRP's most widely used type of data since it provides the context for documenting changes in the river channel, designing restoration actions, planning scientific investigations, and communicating both within the TRRP and with the public.

Figure 42. Aerial images from 1944 (left) and 2017 (right).

Detailed topographic models have similarly widespread utility, and the data can be collected over large areas by aerial LiDAR (light detection and ranging) and boat-based bathymetric sonar. Because LiDAR and sonar costs are significantly greater than for aerial photography, data collection is limited to documenting the rehabilitation sites completed each year, while reach-wide collection occurs less frequently.

In 2016, TRRP collected data for a new reach-wide topography model. Processing data and combining LiDAR, sonar and other data sources into a unified topography is a time-intensive process. The final product of the 2016 topography was completed in 2017. Changes in data collection technologies led to better detail in the 2016 topography than in the prior 2011/12 topography model. These changes make precise interpretations challenging at times. Moreover, the 2016 data was collected after restoration flows with peaks designed for geomorphic change in both 2015 and 2016 (a "Wet" year and 2017 (an "Extremely Wet" year). Nonetheless, the two models can be compared for general patterns and river bed dynamics, such as the changes just below the Douglas City Campground (Alcatraz Hole) where some areas are scouring and others are aggrading (Figure 43 to Figure 45).

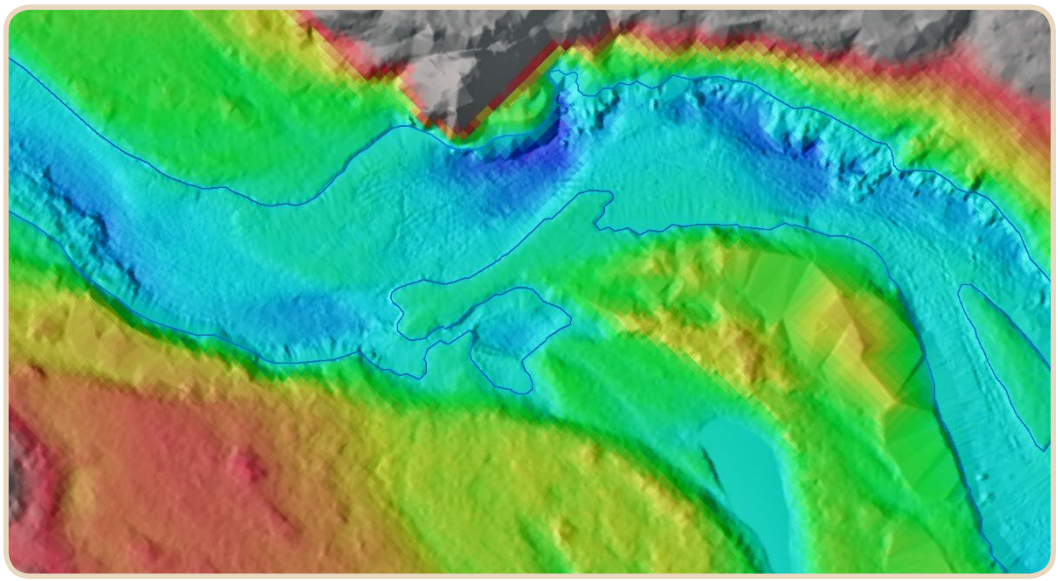


Figure 43. 2011/12 topography model showing river channel below Douglas City Campground. Deep areas are blue, higher elevations are red, and a thin blue line indicates the edge of water in November 2011.

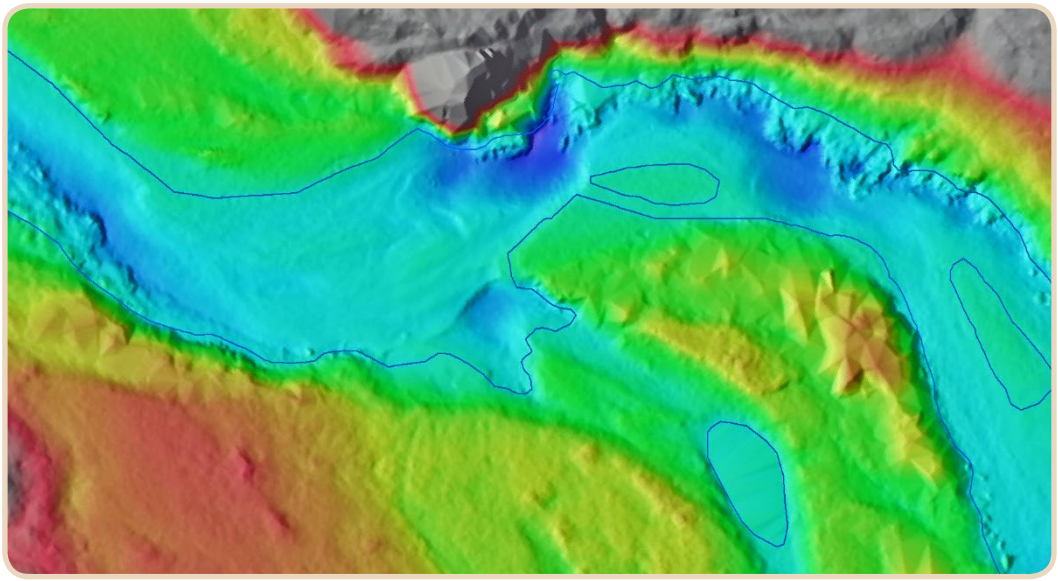


Figure 44. 2016 topography model showing river channel below Douglas City Campground. Deep areas are blue, higher elevations are red, and a thin blue line indicates the edge of water in November 2016.

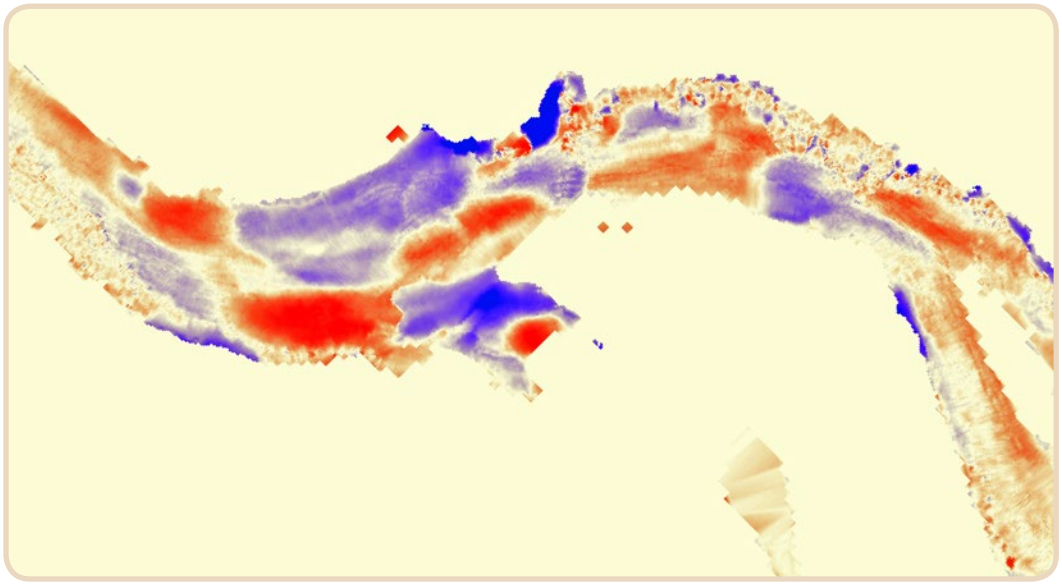


Figure 45. Difference between topography models within the channel. Blue indicates areas that have scoured deeper while red indicates aggradation.

Environmental Compliance and Mitigation

NEPA, CEQA, and Other Mandates

The National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) compel Federal, State, and local agencies to analyze and disclose to the public the potential environmental effects of their proposed actions, and CEQA requires feasible mitigation to minimize significant adverse environmental effects.

To meet NEPA and CEQA requirements, TRRP continues to inform the Northern California community, including partners, collaborators, and public and private stakeholders, about its proposals. Public meetings are held during the early stages of project site design and gravel augmentation planning. Subsequent meetings also help keep the public informed about any modifications made to the designs based on public or agency input and associated monitoring and evaluation before, during, and after any in-channel project construction and revegetation (Figure 46).

Figure 46. Program staff met with landowners prior to the start of construction at the Deep Gulch and Sheridan Creek channel rehabilitation project in 2017 to answer questions and provide information on project scheduling.

The Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement (USFWS et al. 2000) serves as the programmatic document under NEPA, and the Master Environmental Impact Report for Channel Rehabilitation and Sediment Management for remaining Phase 2 Sites (Master EIR) (North Coast-RWQCB and Reclamation 2009) serves as the programmatic document under CEQA. The TRRP completes site-specific environmental analyses to determine if the impacts are the same as described in the programmatic document and to identify and decide on specific environmental commitments to reduce construction impacts.

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—NEPA, CEQA, And Other Mandates continued

In addition to NEPA and CEQA, the following statutes, Acts, and Executive Orders (EO) provide regulatory guidance and are programmatically discussed in the Master EIR. These guidelines broadly define the type and intensity of actions that the TRRP may perform to benefit the health of the Trinity River fishery:

- Endangered Species Act (ESA) of 1973
- Clean Water Act
- Wild and Scenic Rivers Act
- National Historic Preservation Act of 1966
- Archaeological Resources Protection Act of 1979
- EO 11988 for Floodplain Management
- EO 11990 for the Protection of Wetlands
- EO 13112 for Invasive Species
- EO 12898 for Environmental Justice

Channel Rehabilitation Compliance

Channel rehabilitation projects are designed to re-establish the physical form and hydrological functions that existed before the dams were built more than 50 years ago.

Activities associated with channel rehabilitation projects have the potential to result in short- and long-term impacts on protected Trinity River resources. Monitoring and mitigation help ensure long-term beneficial results.

Biological Assessments

TRRP is working towards completing Biological Assessments (BA) to address potential new effects of restoration activities on species (or their habitats) listed as threatened or endangered and to update its programmatic coverage under the Federal ESA. BAs are now expected to include:

1) Process-based sections where expert review of proposed actions may facilitate work when site specific evaluations are not realistic due to financial or logistic limitations,

2) Effects analyses for watershed activities that cover a range of work areas and include both habitat and sediment management efforts, and

3) Monitoring activities that evaluate the effects of restoration activities on fish populations.

—continued

—NEPA, CEQA, And Other Mandates continued

In the same way that TRRP works with private landowners to implement mutually beneficial projects across individual ownerships, TRRP works with Federal partners to ensure that environmental compliance meets the needs of various government owners for projects which are planned over variable space and time. Reclamation is working with TMC member agencies and Federal land managers (e.g., BLM and USFS) to update the TRRP impact analyses to meet the satisfaction of the Program partners.

Reclamation anticipates completing draft BAs by 2019 and will be in formal consultation with the USFWS and NOAA Fisheries until programmatic Biological Opinions are completed after that. While Reclamation is in formal consultation, the 2000 Biological Opinions (as amended) and with guidance from the draft BAs, will remain in effect to meet ESA compliance requirements.

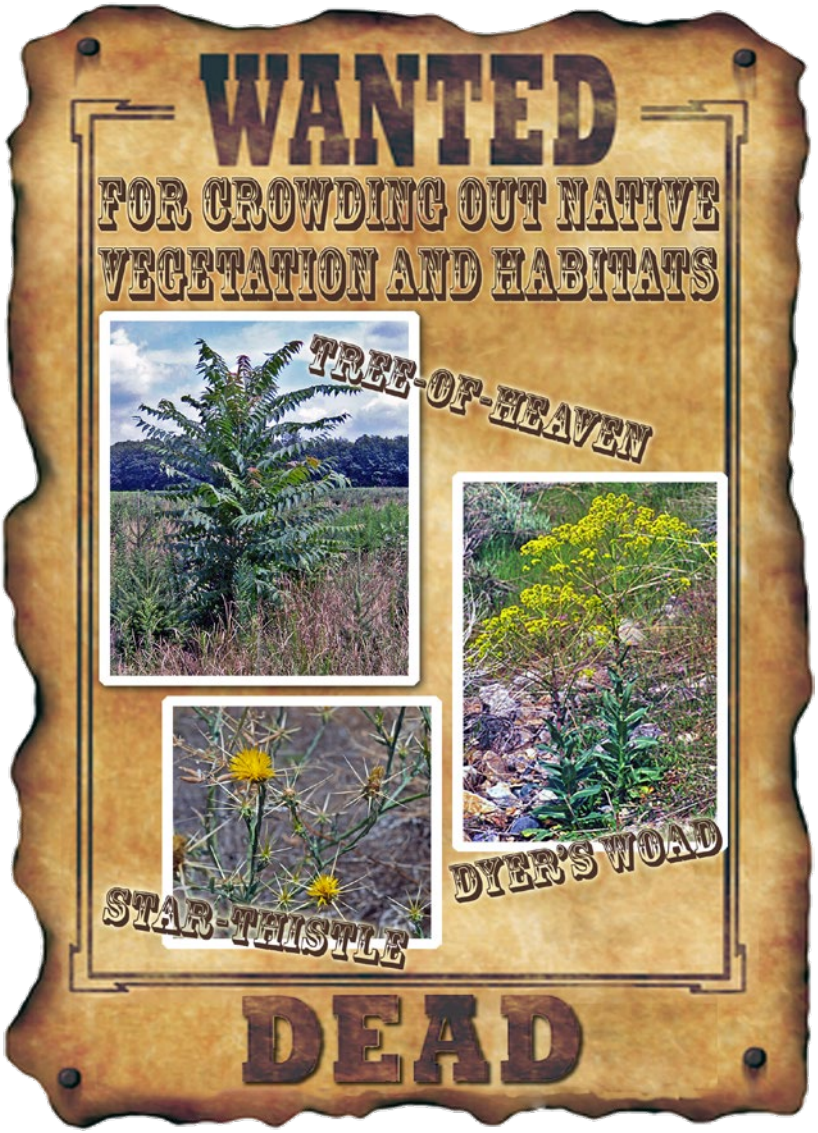

Figure 47. Invasive species harm native vegetation and habitats.

Environmental Mitigation

To support the goal of long-term benefits to the Trinity River fishery and associated habitats, specific measures are required to avoid, minimize, and mitigate for short-term adverse effects, such as removing riparian and wetland vegetation. Environmental permits require no net loss of riparian lands and wetlands. TRRP uses performance monitoring to determine the success of mitigation efforts during and after construction. This monitoring has been key to the understanding why vegetation performance and developing methods to increase vegetation survival. Program vegetation methods now include irrigation, soil amendments (to fertilize and hold water), and increased excavation to lower floodplains so that plants may more frequently access the groundwater table.

Other important work involves removing invasive species which can out-compete native vegetation, such as Dyer's woad (*Isatis tinctoria*), star-thistle (*Centaurea solstitialis*), and tree-of-heaven (*Ailanthus altissima*) (Figure 47).

—continued

—NEPA, CEQA, And Other Mandates continued

Drought and high temperatures can substantially reduce the survival rate of native plants, which means that crews must return to the project sites to monitor and counter vegetation losses to keep native plant survival at or above replacement requirements.

FEMA Floodplain Mapping and County Floodplain Development Compliance

New Trinity River Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), also called Flood Hazard Zone maps, became effective on July 20, 2016 (Figure 48). These FIRMs included topography from TRRP projects constructed through 2013 (Lorenz Gulch), but did not include projects constructed after the draft FIRMs were available early in 2014. Consequently, TRRP staff are working with Reclamation's Technical Service Center, FEMA, and Trinity County to update the FIRMs to include changes from projects constructed in 2014 and 2015. For 2014 and 2015 projects, changes are made through the Letter of Map Revision (LOMR) process.

Figure 48. Sample of a FIRM.

To ensure that new TRRP project designs (i.e., those constructed after the July 2016 FIRMs became effective) meet current FEMA requirements to maintain or decrease flood elevations around structures, Trinity County submits a Conditional Letter of Map Revision (CLOMR) application prior to construction and follows up with a LOMR application based on surveyed conditions and hydraulic modeling post-construction.

Because the 2016 effective maps include a regulated floodway, FEMA requires that TRRP channel rehabilitation project designs will cause no increase in 100-year flood elevations around structures. Reclamation conducts hydraulic modeling of the design condition to evaluate impacts of the proposed project on flood elevations and assists the County in submitting of the CLOMR application. After the project has been constructed and hydraulic modeling of the post-project surveyed "as-built" condition completed, the County submits the LOMR application to FEMA and notifies local landowners that the floodplain modeling predicted during the CLOMR notification was correct and LOMR modeling confirms that 100-year flood elevations have not increased near structures.

Cultural Resources

TRRP works with BLM, USFS, and Reclamation archaeologists to evaluate the status of cultural resources (e.g., old homesteads, apple orchards, and mining remnants) at proposed channel rehabilitation sites. Archaeologists also evaluate whether these resources might make a significant contribution to our understanding of history and might be eligible for inclusion in the National Register of Historic Places (NRHP). In addition, Reclamation works with BLM and USFS managers to meet guidelines of the Archaeological Resources Protection Act of 1979 when working on federally managed lands adjacent to the Trinity River.

Much of the Program's work is confined to the floodplain, where historic resources have lost much of their integrity during flood events. However, the large scope of the channel rehabilitation projects and the interrelatedness of the remaining historic sites along the river (e.g., Trinity Historical Mining District) have highlighted the need for a comprehensive analysis of historic resources throughout the restoration reach—as these may be sequentially impacted by restoration activities.

TRRP's map-based historic context report helps to determine which areas within the proposed project sites might be eligible for NRHP listing (AECOM 2013). The historic context is used to facilitate site-specific surveys to evaluate proposed channel rehabilitation sites. Pre-project surveys at Deep Gulch and Sheridan Creek and at other up-coming channel rehabilitation sites enable TRRP to design around areas that might be of historic interest.

Figure 49. During summer base flow, much of the Trinity River has low turbidity with the substrate visible in shallow sections.

Turbidity

Background and Monitoring

Turbidity, or water clarity measured in nephelometric turbidity units (NTU), is typically low in the Trinity River during summer (Figure 49). Turbidity in the Trinity River occurs naturally during storms or other runoff events (Figure 50) and may also be caused by construction or other human activities in the river. As the CEQA lead agency for the 2009 Master EIR, the North Coast RWQCB worked with TRRP to develop water quality mitigation measures for TRRP activities, such as gravel augmentation or mechanical channel rehabilitation.

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—Turbidity Background and Monitoring continued

TRRP's long-term (5-year) water quality certification language states that "turbidity levels downstream of the 500 linear foot zone of dilution shall not be increased to greater than 20 NTUs or 20% above background, whichever is greater." This permitting detail ensures that TRRP actions are consistent with the permit conditions, help to protect of the river, and allow for lawful restoration activities.

Figure 50. Turbidity occurs on the Trinity River during storm events, such as the February storm in 2017.

During the 2017 channel rehabilitation construction, the TRRP was within permit conditions for turbidity. Construction contractors used turbidity curtains (Figure 51) and other mitigation measures to minimize turbidity during the in-river construction season. A short-term spike in turbidity was measured at the North Fork Trinity River monitoring site during the release of water from Lewiston Dam from August 21 to August 23, 2017 for the HVT's Boat Dance Ceremony.

Figure 51. Work at the 2017 Sheridan Creek project within a turbidity curtain to mitigate turbidity in the river.

Donna Rupp, Outreach and Watershed Coordinator, Trinity County Resource Conservation District

After a 20-year career in marketing communications, Donna changed direction to pursue her life-long interest in ecology. She graduated from Portland State University in 2010 with a Master's in Environmental Management. Her studies included wetland, river, and riparian ecology.

In October 2010, Donna started her AmeriCorps volunteer term of service at the Trinity County Resource Conservation District and was subsequently hired as a regular employee in 2011. Her unique background fuses science and communications, helping to provide rare insights in supporting TRRP's outreach efforts. As the Trinity River Watershed Council coordinator, Donna enjoys working with people who are engaged in the protection, enhancement, restoration, and revitalization of resources in the Trinity River Watershed.

Donna has two adult daughters. In her spare time, she enjoys gardening, hiking with friends and her dog Charlie, cooking, and reading.

Public Outreach in 2017

The TRRP is committed to engaging the community in a variety of ways. Whether through public events, education opportunities, public meetings, or our website, the Program strives to inform and work with community stakeholders.

Public Events

Through hosting and attendance at public events, TRRP engages with community members to share our habitat restoration approach. Two public rafting trips on the river in 2017 provided opportunities to see the river from a unique perspective with restoration professionals for the community, stakeholders, river-front landowners, and people interested in learning more about Trinity River (Figure 52).

Figure 52. TRRP sponsors free rafting trips for the public as an opportunity to share information about the river and the efforts to recover naturally spawning salmon and steelhead.

Public Meetings and Workshops

TRRP holds formal and informal public meetings to increase public knowledge and understanding of program activities. Several of these meetings were held in 2017 to describe projects proposed for implementation in 2017 and to provide information to the public on restoration objectives.

Formal public meetings were held to describe the proposed 2017 Deep Gulch and Sheridan Creek channel rehabilitation project and to inform the public of TRRP designs and goals as recommended under NEPA and CEQA guidelines.

A Flow and Gravel Recommendation informational meeting was held to provide a forum for local residents to learn about the 2017 flow release schedule based on the forecasted Extremely Wet water year designation and the associated gravel augmentation recommendations. TRRP held an open house in July to provide the public a chance to meet informally with Program staff from various partner entities and discuss Trinity River restoration.

In addition to formal meetings to describe proposed projects and their potential environmental impacts, a meeting was held with the landowners and residents near the 2017 rehabilitation project in Junction City to provide information on the construction schedule and to answer questions about the channel rehabilitation project.

These meetings provide an important venue for the community to ask questions on restoration activities and become better informed.

Community Events and Education

TRRP continues to provide financial support to the Trinity County Resource Conservation District for the Trinity River Salmon Festival, Trinity County Fair, Day at the Wetlands, Weaverville Summer Day Camp, and sixth grade Environmental Camp (Figure 53). Supporting interactive learning opportunities designed to connect community youth with the species, natural cycles and cultural importance of the Trinity River inspires the next generation of river stewards.

—continued

Figure 53. TRRP supports and participates in education events in the Trinity River Watershed, including the Environmental Summer Camp (above) and Day at the Wetlands (below).

—Community Events and Education continued

Participation in community events provides opportunity for information sharing between people dedicated to improving the Trinity River (Figure 54).

Figure 54. Program staff work with local partners and area schools to discuss restoration efforts and watershed stewardship.

Inform

In 2017, TRRP funded the publishing and distribution of the Trinity County Resource Conservation District's newsletter, the Conservation Almanac (www.tcrcd.net/index.php/publications-and-downloads/conservation-almanac). The almanac reaches over 300 people every quarter and highlights the importance of Trinity County's natural resources and the benefits of a healthy watershed.

A brochure was created and distributed throughout the watershed to highlight the need for and benefits of variable restoration flow releases.

In-Person Contact and Response

The program continued to collaborate with community members by welcoming walk-ins, answering telephone calls, and responding to email messages. Topics of special interest included: restoration flow release schedules, duration, ramping rates, and maximum peaks.

Individual meetings with private landowners were held on their properties to arrange for rights of entry for upcoming projects and monitoring revegetation at previous project sites.

Internet and Media Presence

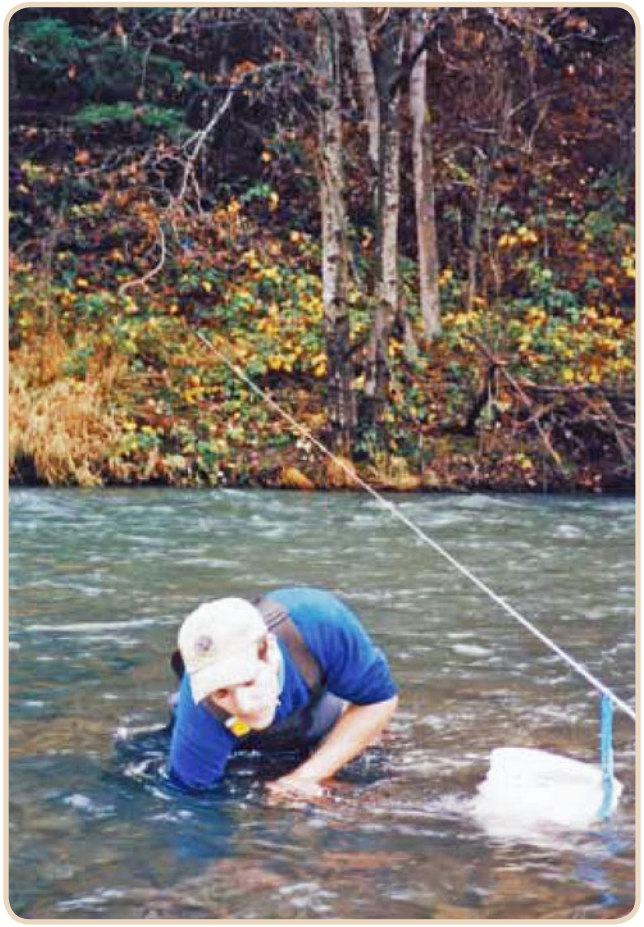
We updated the Program's official website, www.trrp.net, to improve public access to pertinent, useful, and accessible information in 2017. In addition to resources on Trinity River flows, calendar announcements, scientific data, technical papers, and other information is regularly updated on the website (Figure 55).

A number of articles regarding the Program's 2017 activities appeared in various regional media. The Program also funds the outreach website, www.trinityriver.org.

Figure 55. A new feature, 360 degree photospheres, provide the public excellent opportunities to view channel rehabilitation sites. Visit www.trrp.net/restoration/channel-rehab/past-sites/deep-gulch-and-sheridan-creek/ to view the 360-degree spherical photos.

Looking Ahead: 2018 Program Activities

In 2018, the Program continues to execute the restoration strategy based on the ROD (DOI 2000), the Trinity River Mainstem Fishery Restoration EIS/EIR (USFWS et al. 2000), and the Trinity River Flow Evaluation Final Report (USFWS and HVT 1999). Activities proposed for the year include:



Improving management actions to better achieve restoration goals requires field monitoring.

- Developing, designing, and meeting compliance requirements for the lower canyon suite of channel rehabilitation projects, including Dutch Creek, Chapman Ranch, Sky Ranch, and Oregon Gulch channel rehabilitation projects
- Providing WY2018 flow schedule planning and implementation
- Completing identified priority watershed projects
- Augmenting and monitoring coarse sediment, depending on the water year type
- Adding gravel based on how much water is available to mobilize it
- Continuing monitoring and assessment projects

Flow Management

Environmental Compliance

Restoration activities continue to evolve through adaptive management as new information is collected and evaluated.

TRRP continues its consultation with NOAA Fisheries and the USFWS under Section 7 of the ESA. As the consultation progress, the Program is working to broaden the area of the analysis so that BAs may be used to support restoration activities on federally managed lands throughout the Trinity River watershed.

Stakeholder Involvement

Outreach and other forms of stakeholder involvement will continue through:

- Developing educational brochures and pamphlets on TRRP efforts.
- Updating the TRRP website, www.trrp.net, completed in 2017. Continuing to enhance the website to share Program information in an effective and timely manner.
- Holding public informational meetings and river restoration educational activities.
- Working with river-front property owners and private landowners on rehabilitation projects.
- Reaching out to students through field days and environmental camps.
- Hosting informational booths at fairs and festivals such as the Trinity County Fair and the Trinity River Salmon Festival in Weaverville.

TRRP's goal is to improve fish health and survival.

Implementation Monitoring

TRRP continues to expand its approaches to monitor gravel movement, physical habitat attributes, and juvenile rearing to track the effectiveness of sediment management and channel rehabilitation projects.

Channel Rehabilitation

In 2018, TRRP will focus its efforts on developing channel rehabilitation project designs, compliance and stakeholder involvement proposed for the following years. The lower canyon suite of projects upstream of Junction City and downstream of Douglas City include:

- Dutch Creek
- Chapman Ranch
- Sky Ranch
- Oregon Gulch

These channel rehabilitation projects are intended to add complexity and function to the river system. The projects are designed to interact with ROD restoration release flows to create more diverse habitat for all life stages of salmonids across a range of flows.

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References

Reports and Publications

AECOM. 2013. Historic Context for Mining along the Trinity River. http://odp.trrp.net/library/document/?id=2153.

Boyce, J., D. H Goodman, N.A Som, J. Alvarez, and A. Martin. 2018. Trend analysis of salmon rearing habitat restoration in the Trinity River at summer base streamflow, 2005 - 2015. Arcata Fisheries Technical Report Number TR 2018-31 for the Trinity River Restoration Program (TRRP). U.S. Fish and Wildlife Service, Arcata, California.

Cardno Entrix and CH2MHill. 2011. Trinity River Large Wood Analysis and Recommendation Report. Report to the U.S. Bureau of Reclamation, Trinity River Restoration Program. Cardno Entrix, South Lake Tahoe, California.

California Department of Fish and Wildlife (CDFW). 2017. Klamath River basin fall chinook salmon spawner escapement, in-river harvest and run-size estimates, 1978-2016. CDFW, Arcata, California. www.trrp.net/library/document/?id=2314.

California Department of Water Resources, 2018. California Cooperative Snow Surveys, B120, (04/1/2018). http://cdec.water.ca.gov/snow/bulletin120/b120apr18.pdf.

Department of Interior (DOI). 2000. Record of Decision, Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/ Environmental Impact Report. Decision by the U.S. Department of Interior, December 2000. www.trrp.net/library/document/?id=227

ESSA Technologies, Ltd. 2017. Klamath basin integrated fisheries restoration and monitoring (IFRM) synthesis report. Report. ESSA Technologies, Vancouver, British Columbia. Available: www.trrp.net/library/document?id=2351.

Gaeuman, D. and R.L. Stewart. 2017. Geomorphic Response to Gravel Augmentation and High-Flow Dam Release in the Trinity River, California. Earth Surface Processes and Landforms. doi:10.1002/esp.4191.

Goodman, D.H., J. Alvarez, N.A. Som, A. Martin, and K. De Juilio. 2016. The Effects of Restoration on Salmon Rearing Habitats in the Restoration Reach of the Trinity River at an Index Streamflow, 2009 to 2013. Arcata Fisheries Technical Report Number TR 2017-25, Report to the Trinity River Restoration Program (TRRP). U.S. Fish and Wildlife Service, Arcata, California.

—continued

— Reports and Publications continued

Hoopa Valley Tribal Fisheries Department and McBain Associates. 2017. Water Year 2016 Trinity River Restoration Program Riparian Monitoring Report. Report to the Trinity River Restoration Program (TRRP), Hoopa Valley Tribal Fisheries Department, Hoopa, California. www.trrp.net/library/document?id=2322.

NMFS. See U.S. National Marine Fisheries.

North Coast Regional Water Quality Control Board (North Coast RWQCB) and Reclamation. 2009. Channel rehabilitation and sediment management for remaining phase 1 and phase 2 sites, final master environmental impact report, final environmental impact report.

North Coast RWQCB, Reclamation and Bureau of Land Management (BLM). 2017. Trinity River channel rehabilitation site: Deep Gulch (river mile 82.4-82.9) and Sheridan Creek (river mile 81.6-82.4) environmental assessment/initial study. DOI-BLM-CA-N060-2017-014-EA and TR-EA0117. Trinity River Restoration Program, Weaverville, California. www.trrp.net/library/document/?id=2318.

North Coast RWQCB. 2011. Water Quality Control Plan for the North Coast Region (Basin Plan). May 2011. Santa Rosa, California. www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/basin_plan_documents.

Perry, R.W., J.M. Plumb, E.C. Jones, N.A. Som, N.J. Hetrick, and T.B. Hardy. 2018. Model structure of the stream salmonid simulator (S3)—A dynamic model for simulating growth, movement, and survival of juvenile salmonids: U.S. Geological Survey Open-File Report 2018-1056, 32 p. https://doi.org/10.3133/ofr20181056.

Petros, P., W.D Pinnix, and N.J Harris. 2017. Juvenile salmonid monitoring on the mainstem Trinity River, California, 2016. Report for the Trinity River Restoration Program (TRRP). U.S. Fish and Wildlife Service, Arcata, California. www.trrp.net/library/document?id=2345.

Pittman, S. 2017. 2016 Trinity River sediment transport monitoring final report. Report to the Trinity River Restoration Program (TRRP) and Reclamation under contract R14C00122. GMA Hydrology, Inc., Placerville, California. http://odp.trrp.net/library/document?id=2317.

Reclamation and BLM. 2017. Finding of no significant impact, Trinity River Channel Rehabilitation Site Deep Gulch (River Mile 82.4-82.9) and Sheridan Creek (River Mile 81.6-82.4). Bureau of Reclamation, Trinity River Restoration Program, Weaverville, California. http://odp.trrp.net/library/document?id=2319.

Reid, S.B. 2017. The lampreys of the Grass Valley drainage: distribution and passage barriers, 2016; including an assessment of Buckhorn Dam as a barrier to pacific lamprey. Report for the Trinity River Restoration Program (TRRP). Stewart B. Reid, Ph.D., Ashland, Oregon. www.trrp.net/library/document?id=2355.

—continued

— Reports and Publications continued

Reid, S.B. and D.H Goodman. 2017. Habitat use by lamprey ammocoetes in the Hamilton Ponds Grass Valley Creek (Trinity Basin, California), including management recommendations to reduce impacts on lamprey. Report for the TRRP. Stewart B. Reid, Ph.D., Ashland, Oregon. www.trrp.net/library/document?id=2356.

Rupert, D.L., C.D. Chamberlain, S.A. Gough, N. A. Som, N. J. Davids, B. C. Matilton, A. M. Hill, and E. R. Wiseman. 2017. Mainstem Trinity River Chinook Salmon spawning distribution 2012-2014. Report to the TRRP. Arcata Fisheries Data Series Report Number DS 2017–52. U.S. Fish and Wildlife Service. Arcata Fish and Wildlife Office, Arcata, California.

Rupert, D. L., S.A Gough, N.A. Som, N.J Davids, B.C Matilton, A.M Hill, and J.L Pabich. 2017. Mainstem Trinity River chinook salmon spawning survey, 2015 and 2016. Arcata Fisheries Data Series Report Number DS 2017-56 for the TRRP. U.S. Fish and Wildlife Service, Arcata, California. www.trrp.net/library/document?id=2344.

Rytuba, J.J. 2017. Mercury and methylmercury concentrations in water and sediment in the Trinity River watershed: implications for sediment and water quality objectives in Trinity River restoration project areas, Trinity County, California. Report for the TRRP. U.S. Geological Survey. www.trrp.net/library/document?id=2338.

State Water Resources Control Board (SWRCB). 1990. Order WR 90-5h. Order Setting Terms and Conditions for Fishery Protection and Setting a Schedule for Completion of Tasks.

Trinity River Restoration Program (TRRP). 2009. Conceptual Models and Hypotheses for the Trinity River Restoration Program. Trinity River Restoration Program, Weaverville, California. http://odp.trrp.net/library/document?id=1203.

TRRP and ESSA Technologies Ltd. 2009. Integrated Assessment Plan, Version 1.0– September 2009. Draft report prepared for the TRRP. Weaverville, California.

U.S. Fish and Wildlife Service (USFWS) and Hoopa Valley Tribe (HVT). 1999. Trinity River Flow Evaluation Final Report. U.S. Fish and Wildlife Service, Arcata Fish and Wildlife Office, Arcata, California. www. fws.gov/arcata/fisheries/reports/technical/Trinity_River_Flow_Evaluation_-_Final_Report_Full_Version.pdf.

USFWS, Reclamation, Hoopa Valley Tribe, and Trinity County. 2000. Trinity River Mainstem Fishery Restoration Final Environmental Impact Statement/ Environmental Impact Report.

U.S. National Marine Fisheries Service (NMFS). 2000. Biological Opinion, Trinity River Mainstem Fishery Restoration. Endangered Species Act - Section 7 Consultation. NMFS, Southwest Region, Long Beach, California. www.trrp.net/library/document?id=1240.

Web Sources

www.trrp.net/background The TRRP website with information on the Trinity River and the Program.

www.trrp.net/program-structure/foundational-documents/ A chronological list with links to foundational and other pertinent documents.

www.fws.gov/arcata/fisheries/activities/habRestoration/default.html Describes the TRRP on the Arcata Fish and Wildlife Service web site.

www.usbr.gov/mp/cvp The Bureau of Reclamation's website for the Central Valley Project.

http://en.wikipedia.org/wiki/Central_Valley_ Project A description of the Central Valley Project available on Wikipedia.

www.trrp.net/program-structure/background/rod Record of Decision and Legislative history on TRRP website.

www.fws.gov/arcata/fisheries/reports/technical/Trinity_River_Flow_Evaluation_-_Chapter_1-2.pdf Legislative history from Chapter 2 of the Flow Study.

www.fws.gov/arcata/fisheries/reports/technical/treis/draft/trin_eir/ch_1.pdf Legislative history from Sec 1.4 of the Draft EIS/EIR.

www.trrp.net/program-structure/program-structure/trinity-management-council Trinity Management Council information.

www.fws.gov/arcata/fisheries/reports/tamwg/Charter&Bylaws/Signed_Charter_Jan_8_2013.pdf Trinity Adaptive Management Working Group Charter.

www.fws.gov/arcata/fisheries/reports/tamwg/Charter&Bylaws/Bylaws_Revised_ June_25_2013.pdf Trinity Adaptive Management Working Group Bylaws.

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On the back cover: *Captions from left to right (clockwise): Restoration flow releases in April 2017 at the 2016 Bucktail channel rehabilitation site, which featured lowered floodplains to increase connectivity to the river. Meander and gravel bar above an alcove constructed at the upper end of the Deep Gulch and Sheridan Creek project (gravel bar is seen in the upper right and the alcove entrance is seen in the lower right). Native cedar trees were part of the revegetation plantings at Deep Gulch and Sheridan Creek site, which included several log jams. Revegetation began immediately after construction was completed and will continue for several years to promote vegetation survival.*