# CTUIR GRANDE RONDE SUBBASIN RESTORATION PROJECT ANNUAL REPORT

## A Columbia River Basin Fish Habitat Project

**Northwest Power Planning Council Project # 199608300**

Report covers work performed under BPA contract # 72551
Report was completed under BPA contract #72551
Report covers work performed from: May 1, 2016 to April 30, 2017

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Pendleton, Oregon
Report Created: April, 2017

"This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author's and do not necessarily represent the views of BPA."

**CONFEDERATED TRIBES UMATILLA INDIAN RESERVATION**

**BONNEVILLE POWER ADMINISTRATION**

# TABLE OF CONTENTS

# TABLE OF FIGURES

# Introduction/Background Information

The **Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Grande Ronde Subbasin Restoration Project** was initiated by the Confederated Tribes of the Umatilla Indian Reservation in 1996 to protect, enhance, and restore riparian and instream habitat for natural production of anadromous salmonids in the Grande Ronde River Subbasin. The project works with other agencies and private landowners to promote land stewardship and enhance habitat for focal fish species, primarily spring Chinook salmon, summer steelhead, bull trout, and resident trout. Emphasis is placed on improving juvenile rearing habitat and adult spawning habitat by restoring natural channel morphology and floodplain function, cold water refugia, and complex aquatic habitat that supports required life histories for focal species.

During Fiscal Year 2016 (May 1, 2016-April 30, 2017), the CTUIR was involved in numerous planning processes and projects. Planning efforts included: Expert Panel, Grande Ronde Model Watershed Board and Technical Committees, and ongoing coordination with multiple agencies, organizations, and private landowners associated with fish habitat project development. Additionally, project staff continued BPA-CTUIR Accord land acquisition planning, identification, and development of future site specific fish habitat projects. Project development and initial planning included; baseline field surveys, assessments, development of conceptual project plans, coordination with private landowners, and initiation of environmental planning.

During the reporting period, project staff were focused on: 1) CC44 Southern Cross Conservation Property planning, design, and completion of Year 2 construction; 2) Rock Creek Phase 3 project planning, design, and environmental permitting; 3) Bird Track Springs planning and design; 4) CC42 Catherine Creek project concept planning, and 5) Dark Canyon and Kinsley conservation easements. Additionally, CTUIR staff continued to coordinate with the Wallowa-Whitman National Forest on fish passage and habitat planning in the headwaters of the Grande Ronde Basin.

Construction on the CC44 Southern Cross project was initiated in November 2015 and continued through the project reporting period with construction completed in fall, 2016. CTUIR staff administered the construction contract and construction observation/inspection, conducted spring/fall seeding, mulching, and planting, and provided overall management of the project.

CTUIR staff also conducted monitoring and evaluation, including water temperatures, groundwater elevations, vegetation, geomorphic and instream habitat, biological, and photo points. Work during the reporting period also included coordinating, planning, field surveys, and initial project development/design for upcoming projects along the main-stem of Catherine Creek, Grande Ronde River, Rock Creek, and Lookingglass Creek. Activities included coordinating with project partners and private landowners to develop future project opportunities, baseline field investigations and surveys, development of conceptual plans, initiation of funding proposals, and initiation of environmental compliance planning in preparation for further project development and implementation in 2016 and beyond.

## Background

The CTUIR retains aboriginal and treaty rights related to fishing, hunting, pasturing of livestock, and gathering of traditional plants within the Tribes Ceded Territory, including the Grande Ronde Subbasin. The CTUIR Department of Natural Resources (DNR) has developed and accepted a First Foods organization and approach to ecosystem management based on the cultural traditions and practices of the Longhouse. The organization follows the serving order of food and conceptually "Extends the Table" to manage for sustainability within the Ceded Territory. The First Foods are considered to be the minimum ecological products necessary to sustain CTUIR culture. The order is watershed-based beginning with water as the foundation and progressing to salmon (Pacific lamprey, steelhead, trout, and whitefish), deer, cous, and huckleberry. The First Foods provide clear linkages to treaty rights and natural resources and defines direction and goals that relate to the community culture. In conjunction with the First Food principle, the CTUIR DNR developed the River Vision (Jones K. L., 2008) that describes and organizes ecological processes and functions that provide the First Foods.


The River Vision outlines physical and biological processes encompassing 5 touchstones: **Hydrology, Geomorphology, Connectivity, Riparian Vegetation, and Aquatic biota** which together with the First Foods, provide an overall framework for guiding tribal programs in regards to protecting and restoring ecological processes and functions. Healthy watershed processes and functions are the fundamental elements that create diversity, resiliency, and the ability of our river systems to provide sustenance and natural resources to support our culture and heritage.

The Subbasin historically supported viable and harvestable populations of spring/summer and fall Chinook salmon (*Oncorhynchus tshawytscha)*, coho salmon (*O. kisutch*), sockeye salmon (*O. nerka)*, summer steelhead *(O. mykiss)*, Pacific lamprey (*Entosphenus tridentatus*), bull trout (*Salvelinus confluentus*), rainbow/redband *(O. mykiss sp.)*, and mountain whitefish (*Prosopium williamsoni).* These native fishes are paramount to tribal cultures, economies and the region (CBFWA, 1990) and (CRITFC, 1995). Beginning in the late 1800's, fish populations started to decline with sockeye and coho extirpated in the early 1900’s. The abundance of Chinook, steelhead, bull trout, and other fish species has also been dramatically reduced (NPCCa, 2004) and (NPCCb, 2004). With declining fish populations, Tribal governments and State agencies were obligated to eliminate or significantly reduce subsistence and sport fisheries by the mid 1970's. By the early 1990's, Snake River spring-summer Chinook and summer steelhead populations were suppressed to the point of triggering Federal ESA listings (spring-summer Chinook in 1992 and summer steelhead in 1997, and bull trout in 1998). Other native fish, including Pacific lamprey populations are also highly suppressed and with possible future ESA listing. The following tables illustrate estimated historic and current spring Chinook salmon and summer steelhead returns to the Grande Ronde Subbasin (NPCCa, 2004). Of particular note is an 87 percent decrease in spring Chinook and 70 percent decrease in summer steelhead populations from estimated historic levels.

The **CTUIR Grande Ronde Subbasin Restoration Project** (199608300), funded by Bonneville Power Administration (BPA) through the Northwest Power Planning Council Fish and Wildlife Program (NPPC), is an ongoing effort initiated in 1996 to protect, enhance, and restore fish habitat in the Grande Ronde River Subbasin. The project focuses on the mainstem Grande Ronde and major tributaries that provide spawning and rearing habitat for Threatened Snake River spring-summer Chinook salmon, summer steelhead, and bull trout. The project also provides benefits to other resident fish and wildlife.

The project is an integral component of Subbasin Plan implementation and is well integrated into the framework of the Grande Ronde Model Watershed (GRMW) established by the NPCC in 1992 to coordinate restoration work in the Subbasin. As a co-resource manager in the Subbasin, the CTUIR contributes to the identification, development, and implementation of habitat protection and restoration in cooperation with Federal, State, and local agencies. The CTUIR, ODFW, GRMW, and other participating agencies and organizations have made significant progress towards addressing habitat loss and degradation in the Subbasin (see http://www.grmw.org/).

The project was initiated in 1996 under the NPCC-BPA Early Action Project process. The project was proposed through the GRMW and NPCC program to provide the basis from which to pursue partnerships and habitat grant funds to develop and implement watershed and fish habitat enhancement activities in the Subbasin. Annual project budgets have averaged about $136,000 and ranged from a high of $200,000 in 1999. Annual operating budgets and associated tributary habitat efforts by the CTUIR were increased as a result of the CTUIR-BPA Accord Agreement with an annual average budget of $589,500. The project has historically administered multiple grants from various agencies, including Natural Resource Conservation Service (NRCS) Wetland Reserve Program (WRP), CREP, WHIP, and EQIP, OWEB, EPA-ODEQ 319, GRMW-BPA, CRITFC, NMFS, USFWS, ODOT, and NAWCA and developed an effective working relationship with multiple agencies and organizations.

The project has been successful in the development and implementation of several large-scale, partnership habitat enhancement projects and has developed effective interagency partnerships, working at the policy and technical levels with the Grande Ronde Model Watershed Program (GRMWP), federal and state agencies, and private landowners. A complete project overview and technical approach is described in the 2013 NPPC Project Proposal for the CTUIR Watershed Restoration Project (199608300) incorporated here by reference.

During the 20-year project history, the CTUIR has helped administer and implement a number of projects, enhancing nearly 50 miles of instream habitat. Conservation easements totaling about 1,900 acres on six large ranches/farms have been secured through a combination of NRCS WRP, CREP, and BPA programs. The project has constructed 18 miles of fence, 18 off-channel water developments, and installed over 160,000 trees, shrubs, sedge/rush plugs, and seeded over 800 acres with native/native-like grass seed. Improving habitat trends and biological response can be readily observed at a number of projects. A combination of both passive and active strategies have been developed and implemented, however project areas are in an early stage of recovery. Restoration efforts including: conservation easements, riparian/wetland enclosures, development of off-channel water sources, removal of livestock, re-vegetation, channel restoration, large wood additions and removal of dikes, old roadbeds and railroad prisms have resulted in improving trends.

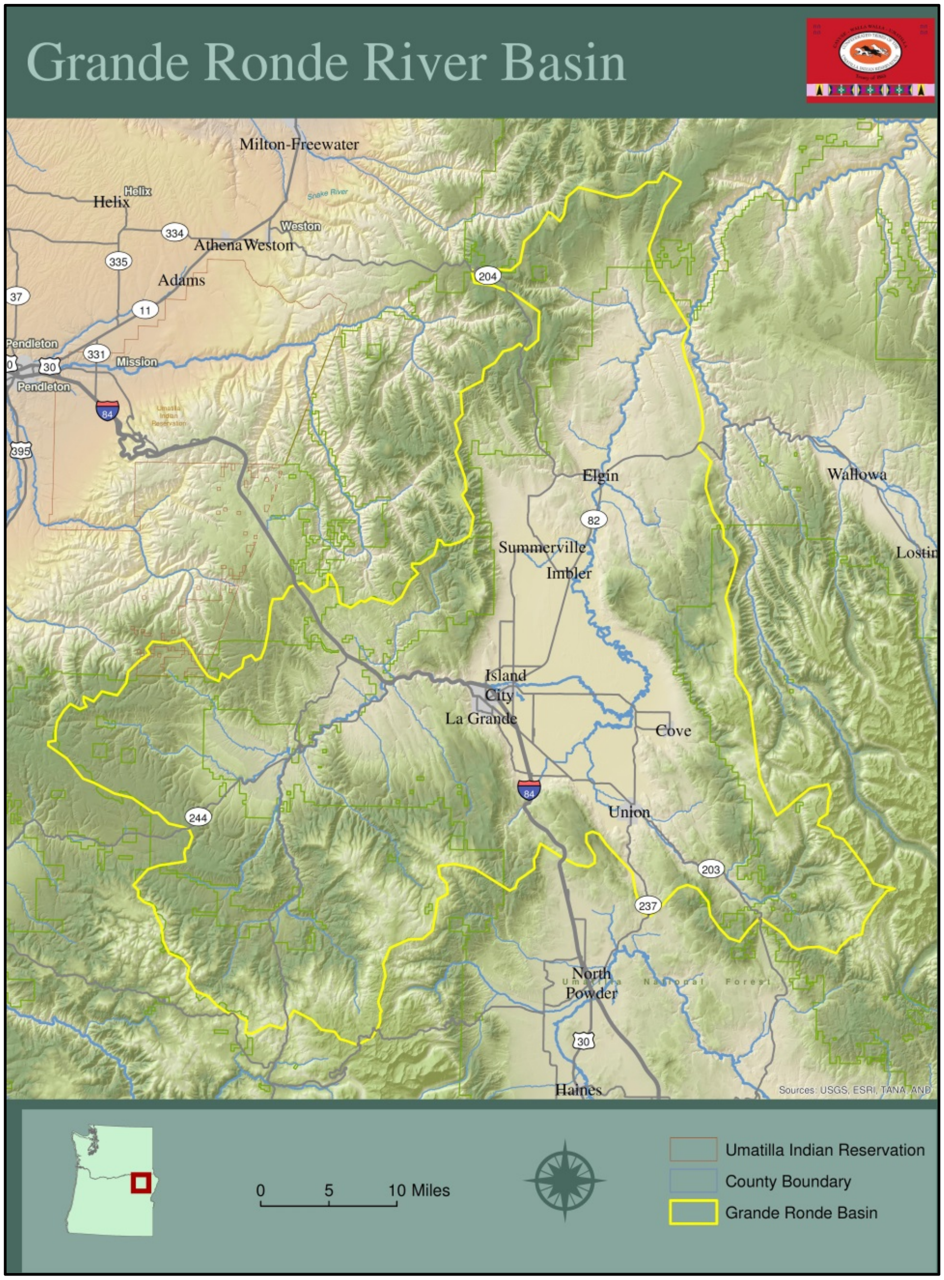
Project results are reported in various forms including Pisces status reports, project completion reports, and annual reports. The GRMW maintains a complete database on project implementation and results through development of project completion reports.

## Description of Project Area

The project is located in the Grande Ronde Subbasin, in the southwest portion of the Blue Mountain Ecological province. The Subbasin encompasses about 4,000 square miles in northeastern Oregon and southeastern Washington. The headwaters of the Grande Ronde River originate near Anthony Lakes in the Elkhorn Mountains and flow northeast for about 212 miles before joining the Snake River in Washington at river-mile (RM) 169.

The Subbasin is divided into three watershed areas—the Lower Grande Ronde, Upper Grande Ronde, and Wallowa watersheds. Approximately 46 percent of the Subbasin is under federal ownership. Historic land uses include timber harvest, livestock grazing, mining, agriculture and recreation.

**FIGURE 1 UPPER GRANDE RONDE SUBBASIN VICINITY**




A comprehensive overview of the Subbasin is contained in the Grande Ronde Subbasin Plan (NPPC, 2004). The CTUIR Grande Ronde Subbasin Restoration Project focuses primarily on the Upper Grande Ronde portion of the Subbasin, which includes approximately 1,650 square miles with 917 miles of stream network (about 221 miles of salmon habitat). However, past project development and success of the program in terms of the types of projects that have been developed and the partnerships that have formed, are leading to watershed restoration project opportunities throughout the Subbasin. Figure 1 illustrates the vicinity of the Grande Ronde Subbasin within the Blue Mountain Province and key projects that have been completed, are underway, or planned under the CTUIR's Grande Ronde Subbasin Restoration Project.

Grande Ronde Subbasin fish populations have declined and habitat degradation is widespread in tributary streams. Mainstem Columbia River harvest, development of Columbia and Snake River hydroelectric projects, and habitat degradation has played an important role in the demise of Grande Ronde Subbasin fisheries (NPCC 2004a and b).

Although hatchery programs currently support subsistence and sport fishing opportunities for steelhead and limited Chinook salmon, there remains significant need to re-build viable and harvestable fish stocks throughout the Subbasin.

**TABLE 1 SUMMARY OF ESTIMATED HISTORIC AND CURRENT GRANDE RONDE SPRING CHINOOK SALMON RETURNS BY POPULATION (DATA PROVIDED BY B. JONNASSON, ODFW PERS. COMM. 2004)**

| | **Estimated Historic Returns** | | **Estimated Current Returns** | | **Miles of spawning habitat** | **Adults /Mile Template** | **Adults /Mile Current** | **% Decrease Historic to Current** |
|---|---|---|---|---|---|---|---|---|
| **Population** | count | % of total | count | % of total | | | | |
| Wenaha Spring Chinook | 1,800 | 15% | 453 | 30% | *45.60* | 39.48 | 9.94 | 75% |
| Minam Spring Chinook | 1,800 | 15% | 347 | 23% | *42.54* | 42.31 | 8.16 | 94% |
| Wallowa-Lostine Spring Chinook | 3,600 | 30% | 211 | 14% | *56.10* | 64.17 | 3.76 | 95% |
| Lookingglass Spring Chinook | 1,200 | 10% | 190 | 12% | *29.82* | 40.24 | 6.37 | 81% |
| Catherine Creek Spring Chinook | 1,200 | 10% | 188 | 12% | *29.82* | 40.24 | 6.30 | 84% |
| Upper Grande Ronde Spring Chinook | 2,400 | 20% | 132 | 9% | *79.11* | 30.34 | 1.67 | 84% |
| **Total** | **12,000** | | **1,521** | | ***283.00*** | **42.4** | **5.37** | **87%** |

**TABLE 2 SUMMARY OF ESTIMATED HISTORIC AND CURRENT GRANDE RONDE SUMMER STEELHEAD RETURNS BY POPULATION (DATA PROVIDED BY B. JONNASSON, ODFW PERS. COMM. 2004)**

| | **Estimated Historic Returns** | | **Estimated Current Returns** | | **Miles of spawning habitat** | **Adults /Mile Template** | **Adults /Mile Current** | **% Decrease Historic to Current** |
|---|---|---|---|---|---|---|---|---|
| **Population** | count | % of total | count | % of total | | | | |
| Lower Grande Ronde | 2,400 | 16% | 608 | 14% | 253.84 | 9.45 | 2.39 | 75% |
| Joseph Creek | 3,600 | 24% | 945 | 21% | 223.10 | 16.14 | 4.24 | 74% |
| Wallowa River | 3,750 | 25% | 1,193 | 27% | 173.45 | 21.62 | 6.88 | 68% |
| Upper Grande Ronde | 5,250 | 35% | 1,755 | 39% | 613.96 | 8.55 | 2.86 | 67% |
| **Total** | **15,000** | | **4,500** | | 1,264.35 | | | **70%** |

Figures 2 and 3 display estimates of historic and current abundance, productivity, and life history diversity predicted through the Ecosystem Diagnosis and Treatment (EDT) Method for Grande Ronde Subbasin Chinook salmon and summer steelhead, respectively (NPCC, 2004a and Mobrand, 2003). Graphs illustrate that current abundance, productivity, and life history diversity for spring Chinook and summer steelhead has been reduced from estimated historic levels.

Chinook and steelhead populations furthest from historic potential are in geographic areas that have experienced the highest levels of anthropogenic influence with significant declines illustrated for Wallowa-Lostine, Catherine Creek, Lookingglass, and Upper Grande Ronde spring Chinook and Upper Grande Ronde, Wallowa, and Joseph Creek summer steelhead. Current productivity and life history diversity for spring Chinook in the Wenaha and Minam watersheds (primarily designated wilderness areas) is similar to estimated historic conditions (NPPC, 2004a).

**FIGURE 2** **EDT ESTIMATES OF ABUNDANCE, PRODUCTIVITY, AND LIFE HISTORY DIVERSITY COMPARED TO THE ESTIMATED HISTORIC POTENTIAL FOR GRANDE RONDE SUBBASIN CHINOOK SALMON (NPCC 2004A, FIGURE 8, PG. 54)**

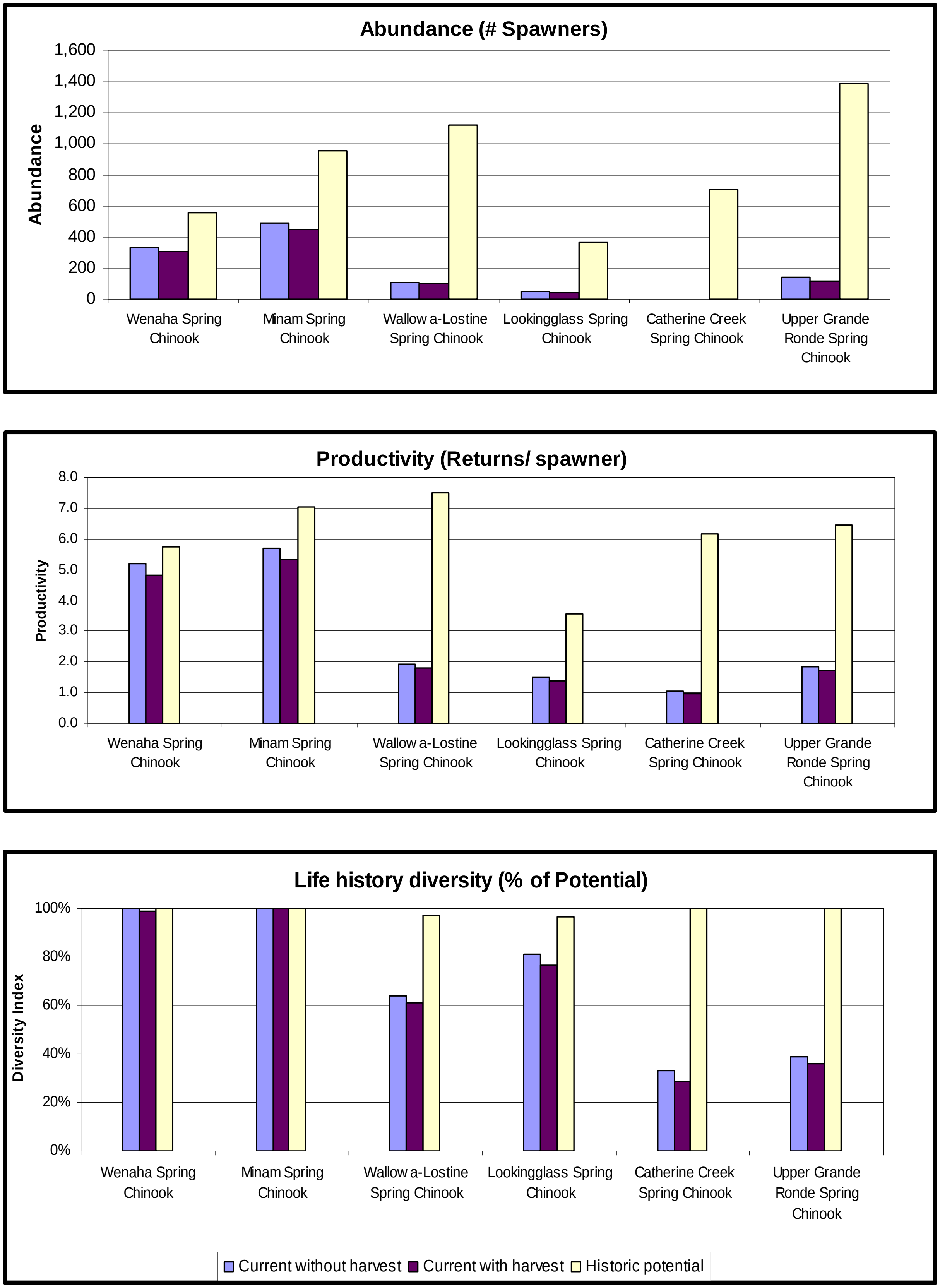
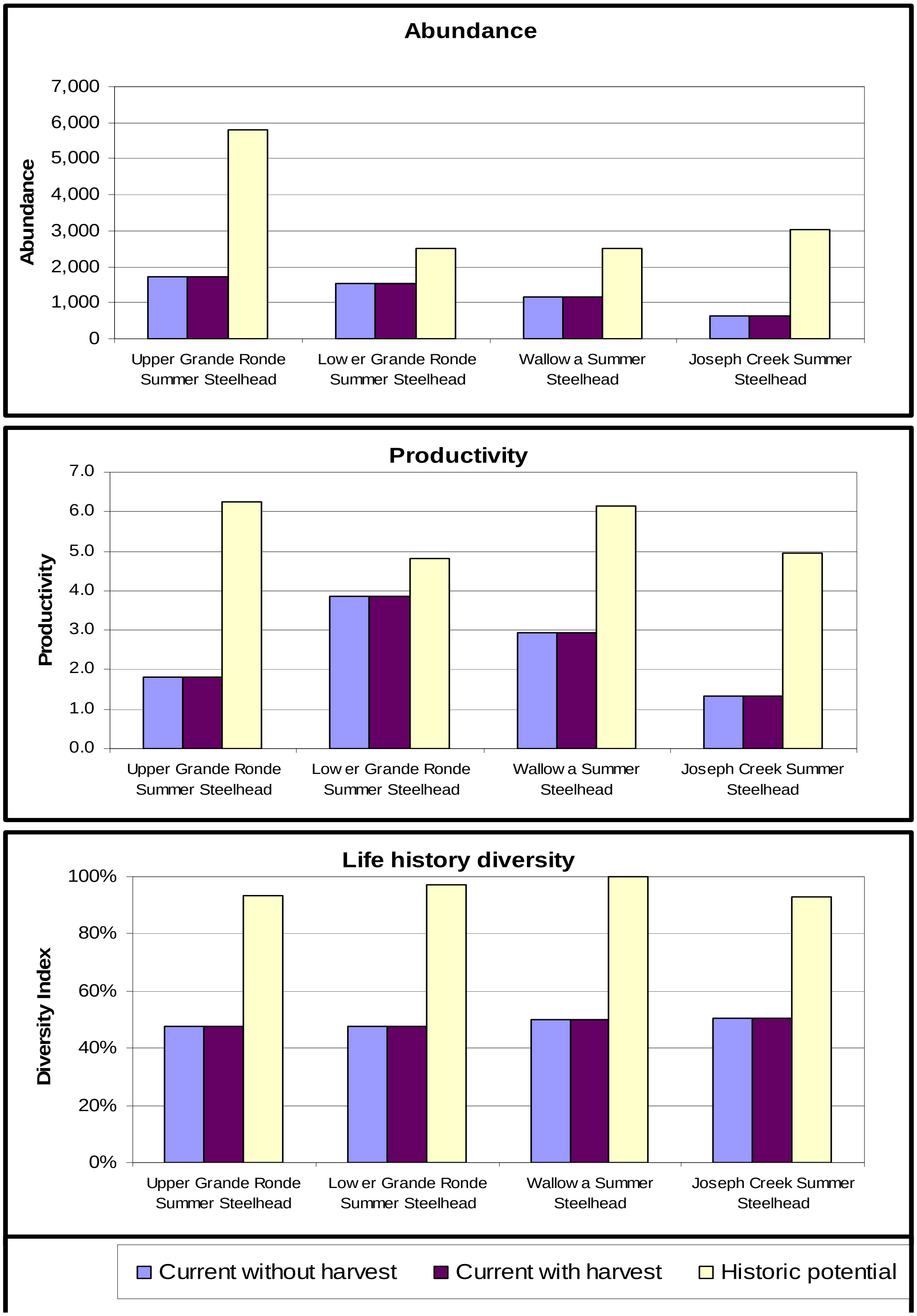


**FIGURE 3 EDT ESTIMATES OF ABUNDANCE, PRODUCTIVITY, AND LIFE HISTORY DIVERSITY COMPARED TO ESTIMATED HISTORIC POTENTIAL FOR GRANDE RONDE SUBBASIN SUMMER STEELHEAD (NPCC 2004A, FIGURE 22, PG. 72)**



Degradation of instream and riparian habitat in the Subbasin has been the dominant cause of salmon and steelhead decline (NPCC, 2004). The adverse effects of poorly managed logging, grazing, mining, dams, irrigation withdrawals, urbanization, exotic species introductions, and other human activities have been documented in all of Columbia River tributaries (ISG 1996). Riparian and instream habitat degradation has most severely impacted spring Chinook production potential in the Grande Ronde Subbasin (ODFW and CTUIR 1990, NPCC 2004a) and habitat loss and degradation has been widespread with the exception of road-less and wilderness areas (Anderson et al. 1992; CTUIR 1983; Henjum et al.1994; McIntosh et al. 1994).

Approximately 379 miles of degraded stream miles have been identified in the Subbasin (ODFW et al. 1990), with an estimated 80 percent of anadromous fish habitat in a degraded condition (Anderson et al. 1992). McIntosh (1994) documented a 70 percent loss of large pool habitat in the Upper Grande Ronde River since 1941. Riparian shade on low gradient streams was found to be less than 30 percent (Huntington, 1993). Stream channelization, diking, wetland drainage, and use of splash dams were common and widespread practices until the 1970's resulting in severe channel incision and degradation in some locations. The Oregon Department of Environmental Quality (ODEQ) listed over 60 stream reaches in the Subbasin on the State's list of water quality limited water bodies 303 (d). Of these stream segments, 24 are listed for habitat modification, 27 for sediment, and 49 for temperature. Table 3 illustrates priority areas for water quality treatment in the Subbasin (ODEQ, 2000).

**TABLE 3 GEOGRAPHIC PRIORITY AREAS FOR WATER QUALITY TREATMENT IN THE UPPER GRANDE RONDE WATERSHED DEVELOPED THOURSOUGH TMDL PROCESS (H=HIGH, M=MEDIUM, L=LOW) (NPCC 2004A, TABLE 18, ODEQ, 2000)**

| Watershed | Temperature | Sediment | Flow |
|---|---|---|---|
| | | | |
| Lookingglass | L[1] | L | L |
| Lower Grande Ronde | L | L | L |
| Willow/Philips | H | H | H |
| Indian/Clark | M | M[2] | M |
| Catherine Creek | H | H | H |
| Beaver | M | M | L[3] |
| GRR Valley | H | H | H |
| Ladd Creek | H | H | H |
| Upper Grande Ronde | H | H | H[4] |
| Meadow Creek | H | H | H[4] |
| Spring/Five Pts. | H | M | M |

Watershed analysis through the EDT (NPCC, 2004a and Mobrand, 2003) and synthesis through the Subbasin Plan Management Plan development process, identified instream habitat condition, high water temperature, sediment loads, and flow modification as primary limiting factors for Chinook and steelhead (pg. 11 NPCC 2004c, pg. 3 NPCC 2004d). Primary habitat degradation includes:

- **Channel Habitat Conditions –** Channel instability associated with removal of streamside cover and channelization has resulted in channel incision/down cutting, increased gradient, reduced channel length, elevated erosion, increased width-to-depth ratios, and loss of channel complexity. The quality of instream habitat has correspondingly been altered throughout much of the Subbasin.

- **Sediment** – Loss of upland and streamside vegetative cover has increased the rates of erosion. Soils lost from upland areas has overwhelmed hydraulic processes resulting in decreased availability of large pool habitat, spawning areas, riffle food production, and hiding cover.
- **Riparian Function** – Riparian habitat degradation is the most serious habitat problem in the subbasin for fish (McIntosh 1994, ICBEMP 2000). The loss of floodplain connectivity resulting from road/dike construction and channel incision, in addition to reduced habitat suitability for beaver, have altered dynamically stable floodplain environments and contributed to degradation and limited habitat recovery." This loss leads to secondary effects that are equally harmful and limiting, including increased water temperature, low summer flows, excessive winter runoff, and sedimentation.
- **Low Flow** – Water resources in many streams have been over-appropriated resulting in limited summer and fall base flow, development of fish passage barriers, and increased summer water temperatures.

Table 4 illustrates key habitat limiting factors by geographic priority area. The table has been edited from the Subbasin plan to depict only those geographic areas addressed under this proposal. These watersheds have been identified as the three highest priority areas to conduct habitat restoration with the greatest response in Chinook salmon and steelhead production potential (NPCC, 2004a, Supplement, Pgs 49-50, Table 5-6).

**TABLE 4 GRANDE RONDE SUBBASIN PRIORITY GEOGRAPHIC AREAS AND HABITAT LIMITING FACTORS (NPCC, 2004A)**

| Watershed | Fish Population(s) | EDT Priority Geographic Area(s) highlighted areas are priorities for multiple pops. | Habitat Limiting Factors |
|---|---|---|---|
| **Wallowa River (including Lostine River)** | Wallowa Steelhead<br>Wallowa-Lostine Chinook<br>Lostine/ Bear Ck Bull Trout | **Steelhead Priorities**<br>Prairie Creek<br>Upper Wallowa River –Wallowa Chinook<br>Hurricane Ck , Whiskey Ck<br>Lower Wallowa (1-3) -Minam Steelhead<br>**Chinook Priorities**<br>Lower Lostine – Wallowa Steelhead<br>Mid-Wallowa – Wallowa Steelhead | ➢ Key Habitat Quantity (reduced wetted widths)<br>➢ Habitat Diversity (reduced wood, riparian function)<br>➢ Sediment<br>➢ Temperature<br>➢ Flows |
| **Upper Grande Ronde** | Upper GR Steelhead<br>Upper GR Chinook<br>Upper GR Complex Bull Trout | Mid GR 4 (GR 37 - 44) - Chinook<br>Mid GR Tribs 4 (Whiskey, Spring, Jordan, Bear, Beaver, Hoodoo…)<br>Phillips Creek<br>Upper GR Ronde 1 (45-48) - Chinook<br>Mid GR 3 (GR – 34-36) Valley<br>Sheep Ck, Fly Ck, Lower Meadow Ck - Chinook | ➢ Sediment<br>➢ Flow<br>➢ Temperature<br>➢ Key Habitat Quantity (reduced wetted widths) |
| **Catherine Creek/ Middle Grande Ronde** | Upper GR Steelhead<br>Catherine Ck Chinook<br>Catherine Ck Bull Trout<br>Indian Ck Bull Trout | Mid Catherine Creek (2-9) – UGR Sthd<br>SF, NF Catherine Creek<br>Lower Grande Ronde R. 2 | ➢ Key Habitat Quantity (reduced wetted widths)<br>➢ Habitat Diversity (reduced wood, riparian function)<br>➢ Sediment<br>➢ Flow<br>➢ Temperature |

Habitat protection and restoration needs in the Subbasin have been recognized in numerous reviews, planning processes, and reports (CTUIR, 1983), Noll and Boyce 1988, (ODFW, 1990), Wallowa-Whitman et.al. 1992, (Huntington, 1993) GRMWP (1994), (Mobrand, 2003), (NPCC, 2009), and (NPCCa, 2004). NPCC (2004a) Appendix 5 (pg 254) provides a relatively complete list of habitat protection and restoration strategies that can be applied to achieve goals and objectives. The NMFS proposed recovery plan for Snake River Chinook salmon recognized the importance of tributary habitat restoration and protection of habitat on both federal and private lands to Chinook and steelhead recovery (NMFS, 1997). NMFS has recently restarted the recovery planning effort for Chinook salmon and steelhead and tributary habitat restoration is expected to play a prominent role in the final NMFS recovery plan. NRC, (1996) has also noted the importance of protecting and rehabilitating freshwater habitat as part of salmon recovery. They specifically note the importance of riparian areas and recommend that habitat reclamation or enhancement should emphasize rehabilitation of ecological processes and function. The USFWS draft bull trout recovery plan recognized the importance of habitat protection and restoration as well (USFWS, 2002), specifically noting the need to improve water quality, reduce or eliminate fish passage barriers, and restoring impaired instream and riparian habitat.

## Noteworthy Accomplishments during FY2016

- Implemented fish habitat enhancement activities on the Catherine Creek (CC 44) Southern Cross Phase III project, which permanently protects 1 mile mainstem and 64 acres of historic floodplain.
- Installed 40 foot bridge on perennial side channel on Catherine Creek (CC 44) Southern Cross Phase III project.
- Conducted pre-construction fish salvage operations on the Phase III Catherine Creek (CC44) Creek Fish Habitat Enhancement Project.
- Maintained and monitored conservation easements on Catherine Creek, Rock Creek, Meadow Creek and Dark Canyon Creek.
- Conducted baseline and post project morphological surveys along 2 miles of Catherine Creek.
- Initiated planning, field surveys, and design on projects planned for construction through 2018 including:
    - Catherine Creek (CC42) Project covers 2 miles of mainstem Catherine Creek.
    - Continued planning and design on Rock Creek Phase 3 project.
    - Bird Track Springs Project in cooperation with the Bureau of Reclamation (BOR) and the U.S. Forest Service, covering over 4 miles of the mainstem Grande Ronde River and several side channel habitats.
- Constructed riparian conservation easement fence (approximately 4200 ft.) for the Kinsley property (CC44), protecting approximately 7.5 acres of riparian areas and approximately .5 miles of Catherine Creek.
- Constructed permanent conservation easement fence (approximately 25,000 feet) on the Cunha ranch along Dark Canyon Creek and Meadow Creek.
- Project Leader participated on the Grande Ronde Model Watershed Board of Directors and Technical Team to review and develop projects, including BiOp/Remand Projects.
- Project Leader and Assistant Biologist participated in the Technical Advisor Committee for the Atlas Process.
- Project Leader and Assistant Biologist participated in NRCS Local Working Group and Regional conservation Partnership Program planning.

- Project Staff attended relevant trainings and classes (River Restoration Northwest, CHAMPS snorkel training, PSU River Restoration Environmental Professional Program).
- Staff conducted monitoring and evaluation activities on project areas.
- Pursued future restoration efforts by continuing discussions with both state and private landowners about restoration opportunities along Catherine Creek, Grande Ronde River, Dry Creek, Whiskey Creek, Indian Creek, and Rock Creek.
- Project staff coordinated with landowners, NRCS, and UCSWCD to provide technical assistance for restoration project enrollment in EQIP, CREP, and OWEB small grants. This work included:

  Rock Creek (For the Girls LLC)
  Bird Track Springs (Jordan Creek Ranch)
  Catherine Creek CC42
- Project staff participated in public outreach activities including:
  - Newspaper article about the CC44 Project for the Grande Ronde Model Watershed Ripples newsletter.
  - Newspaper article about the Southern Cross Project for the East Oregonian.
  - Accepted award from the Oregon State Land Board in Salem, Oregon for the Catherine Creek (CC 44) Southern Cross Phase III project.

# Discussion of Completed Work

## Catherine Creek RM 44 Southern Cross

The project is located along Catherine Creek with the Atlas Biological Significant Reach (BSR) CCC3b1 which is identified as a high priority BSR with Tier 1 (highest priority) actions. The Phase 3 reach is located on the Southern Cross Ranch, recently conserved by fee acquisition through the CTUIR's Accord agreement with BPA. The purpose of the acquisition is to protect the property in perpetuity for the conservation and restoration of salmon and steelhead habitat. The property includes about ¾ of a mile of Catherine Creek and 68 acres of historic floodplain which was channelized and confined valley left in the early 1940's.

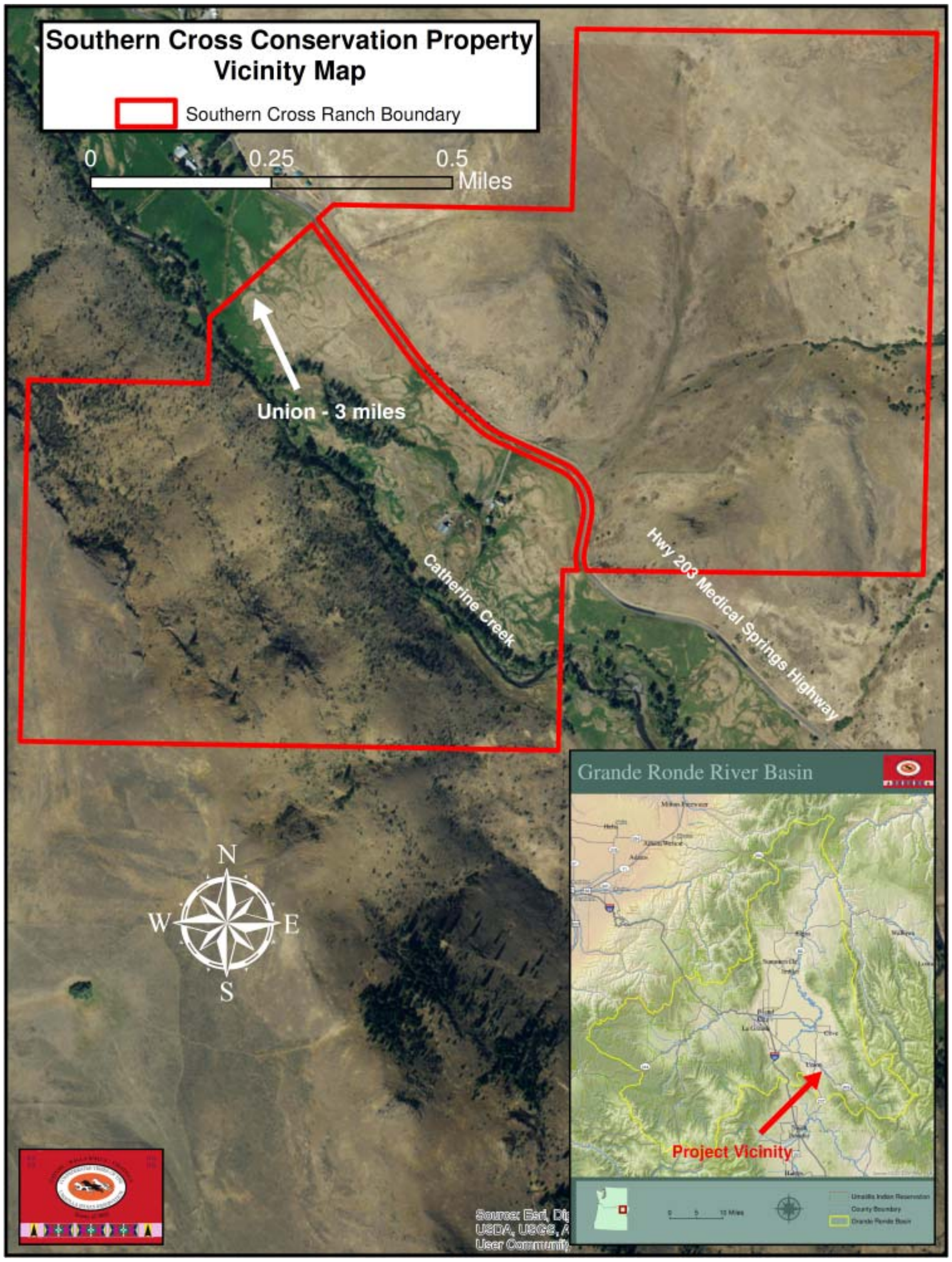
The project is located approximately 3 miles southeast of the City of Union, Oregon along Highway 203 (Medical Springs Highway) (T5SR40E, Sections 28 and 33) at RM44, 59716 Highway 203, Union, OR 97883.

The project included construction of approximately 4,200 linear feet of new main channel (including four confluences with the existing channel); construction/excavation of approximately 955 linear feet of perennial side channel; construction of approximately 425 linear feet of new ephemeral side channel; construction of approximately 1,425 linear feet of alcoves and spring channels; construction of approximately 9,200 linear feet of floodplain swale complexes; construction of 15 riffles in the main channel; construction of 142 main channel wood structure components; construction of approximately 570 linear feet of edge roughness; construction of approximately 1,075 feet of brush mattress; construction/placement of 336 floodplain roughness features (primarily large and small wood structures and whole trees); and the excavation of over 50,000 cubic yards of material (design quantity) over a two year construction period.

Design changes from 75% to 100% on the CC44, Southern Cross phase III were incorporated to maximize adult spawning and juvenile rearing habitat uplift along an approximate 0.78 mile reach of mainstem Catherine Creek. The property presents the largest and most significant opportunity to expand, create, and enhance core spawning and rearing habitat for ESA spring-summer Chinook salmon and summer steelhead within the Catherine Creek Atlas Tier 1 Biological Significant Reach, CCC3b1.

The Construction Design Drawings and Technical Specifications can be accessed at Web Address: http://data.ctuir.org/fisheries/.

**FIGURE 4 PROJECT VICINITY MAP**




## Project Vision

The vision of the project is to restore degraded riparian and floodplain habitat, improve instream habitat diversity, and improve water quality for adult and juvenile summer steelhead and juvenile Chinook salmon. This vision follows the Tribes "First Foods" concept, which manages the ecosystem based on protection of water, fish, deer and elk, roots, and berries. The First Foods provide clear linkages to treaty rights and natural resources and defines direction and goals that relate to the community culture. In conjunction with the First Food principle, the CTUIR DNR developed the River Vision (Jones et. al., 2008) that describes and organizes ecological processes and functions that provide the First Foods.

## Project Goals and Objectives

- Restore and conserve salmonid spawning and rearing habitat
- Improve passage for all life stages and season's
- Increase flow and groundwater
- Improve water quality
- Restore natural channel and floodplain processes
- Increase habitat and hydraulic complexity and diversity
- Restore riparian and wetland habitat
- Control noxious weeds

**FIGURE 5 ORTHOMOSAIC AND THE CORRESPONDING SPARSE DIGITAL SURFACE MODEL (DSM).**

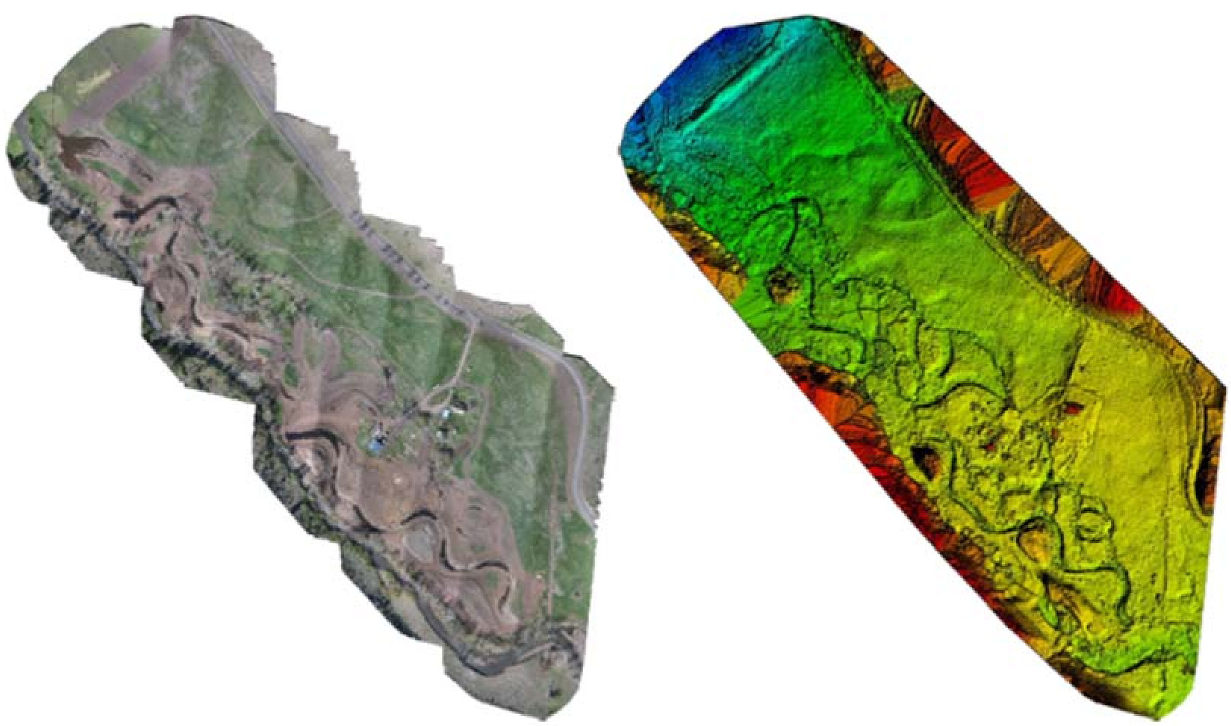
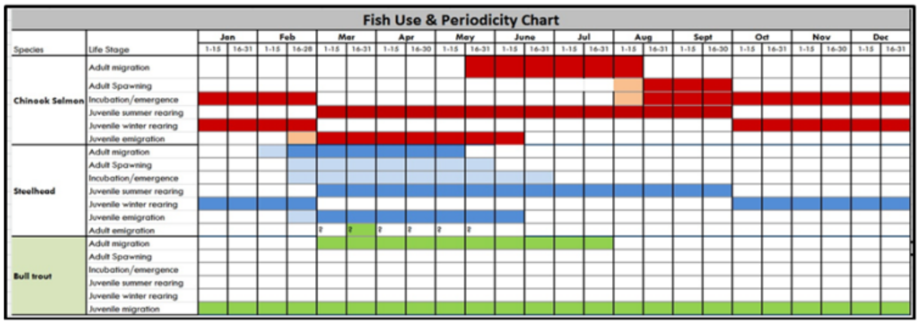


**FIGURE 6** **CATHERINE CREEK CC44 FISH HABITAT RESTORATION COMPLEX ATLAS STRATEGIC IMPLEMENTATION PLAN.**

## CATHERINE CREEK CC44 FISH HABITAT RESTORATION COMPLEX
## Biological Significant Reach CCC3b1 (Atlas Strategic Implementation Plan)




| Fish Use & Life Stage Utilization | | |
|---|---|---|
| **Fish Utilization** | **Score** | **Comments** |
| Adult Migration | H | No complete barriers, flow likely not affecting migration. However, there are three partial barriers (push up dams) that will be addressed in 2014. Revisit ranking once addressed. Holding habitat is limited. |
| Juvenile Outmigration | H | No complete barriers, but juvenile outmigration being affected due to unknown causes. Potential flow, hydrology, fitness affects. |
| Holding/Spawning / | M | Spawning occurring, but not the critical need due to density dependence needing to be addressed 1st |
| Summer Rearing | H | Critical summer rearing to help address density dependance |
| Winter Rearing | M | Winter/Summer rearing overlap. |

| Limiting Factors | | | | |
|---|---|---|---|---|
| **EP Weight** | **Description** | | **Score** | **Comments** |
| 2% | 1.1 | Habitat Quantity: Anthropogenic Barriers | H | Limited barriers, however addressing would increase summer rearing habitat/capacity. |
| 7% | 4.1 | Riparian Condition: Riparian Condition | H | Beneficial to address, but restoration benefit will be realized into future, combine with other LF to be most effective |
| 7% | 4.2 | Riparian Condition: LWD Recruitment | H | Beneficial to address, but restoration benefit will be realized into future, combine with other LF to be most effective |
| 15% | 5.1 | Peripheral and Transitional Habitats: Side Channel and Wetland Conditions | H | Important for summer rearing during spring run offperiod |
| 10% | 5.2 | Peripheral and Transitional Habitats: Floodplain Condition | H | Important for rearing during spring run offperiod. Erosion reduction, healthy floodplain contributes to ground water recharge, delayed release of cool water. |
| 10% | 6.1 | Channel Structure and Form: Bed and Channel Form | H | Improved channel form needed to benefit summer rearing and density dependance |
| 15% | 6.2 | Channel Structure and Form: Instream Structural Complexity | H | Improved complexity needed to benefit summer rearing and density dependance |
| 5% | 7.2 | Sediment Conditions: Increased Sediment Quantity | L | Limited sediment input |
| 10% | 8.1 | Water Quality: Temperature | H | High temps affect summer rearing |
| 20% | 9.2 | Water Quantity: Decreased Water Quantity | H | Flow affecting summer rearing habitat |
| | | | | |
| Source (above data): Expert Panel [X] Sub-Basin [ ] Recovery Plan [ ] | | | | |

## Key Habitat Elements

- Incorporation of channel design criteria to facilitate stable channel form with decreased width to depth ratios, riffle cross sectional area, increased sinuosity with right radius pools and profile conducive to improving floodplain connectivity with activation of peripheral juvenile rearing habitat
- An increase in large wood complexes related to incorporation of different structures types along outside meander pools (Original BO and 75% counted meander wood as single units where 100% counts them as multiple units on each bend)
- Incorporation of floodplain roughness to encourage sediment deposition and riparian vegetation response
- Incorporation of edge roughness and brush mattress to maintain channel dimension and decrease streambank erosion and sediment delivery and provide rapid vegetation regrowth and bank cover
- Incorporation of peripheral habitat (floodplain complexes and side channels) to increase juvenile rearing habitat, wetland development and hyporheic connectivity

| CC-44 Parcel 3 Southern Cross Habitat Feature Comparison | | | |
|---|---|---|---|
| | 30% Design | 75% Design | 100% Design |
| Main Channel (LF) | 4900 | 5000 | 5000 |
| Perennial Side Channel (LF) | 2562 | 2575 | 2317 |
| Ephemeral Side Channel (LF) | 1228 | 0 | 425 |
| Floodplain Swale Complexes (LF) | 0 | 9219 | 9200 |
| Alcoves and Spring Channels (LF) | 1551 | 264 | 1425 |
| Large Wood Complexes (EA) | 50 | 25 | 142 |
| Floodplain and Side Channel Wood Complexes (EA) | 42 | 44 | 336 |
| Channel Margin Roughness (LF) | Undecided | Undecided | 570 |
| Channel Bank Live Brush Bank (LF) | Undecided | Undecided | 1075 |
| Constructed Riffles (EA) | 13 | 13 | 16 |
| Boulder Complexes (EA) | 4 | 4 | 4 |

Habitat uplift associated with the 100% design compared to the 30% design is expected to be significant. A combination of an increase in the planned Catherine Creek channel length, incorporation of additional large wood complexes in into meander pools, point bars, channel transitions, side channels and floodplain swales, increased peripheral habitat, and an increase in channel margin complexity are expected to more fully address habitat limiting factors and increase the overall capacity for spawning and summer-winter rearing habitat within the project area.

**FIGURE 7 SOUTHERN CROSS GRADING PLAN AT STATION 33+00 TO 50+00.**

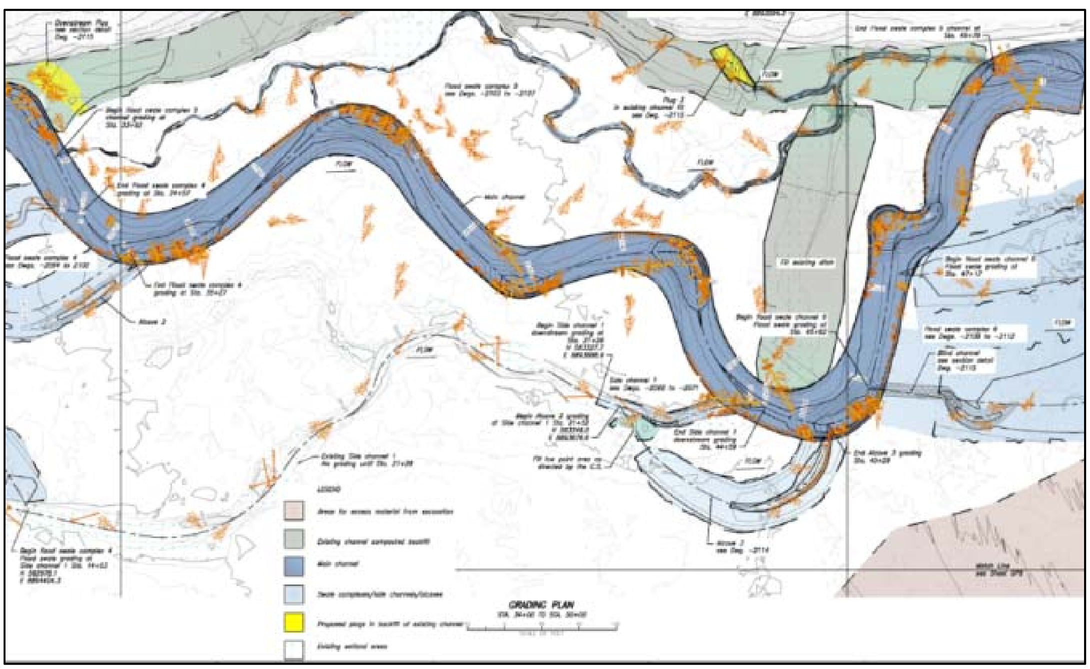


**TABLE 5 CC44 SUMMARY TABLE**

| Project Name | Streams | Year | Assessment Unit steelhead | Assessment Unit Chinook | River Vision Touchstones | BiOP Limiting Factor ID | Snake River Basin Draft Recovery Plan/BiOP Identified Limiting Factors | Eco Concern Sub-Cat ID | Ecological Concern-Sub Category | Project Goals | Project Objectives | Implementation Actions/Metrics | Monitoring Metrics |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek RM44 Fish Habitat Enhancement Project (Project in planning stage) | Catherine Creek | 2014 2017 | UGS10B | CCC3B | Biota-Connectivity | 1 | Habitat Quantity | 1.1 | Anthropogenic Barriers | Improve diversion structures. Subbasin Plan Reference: Channel Conditions. (page 260) | **Protect Habitat:** Develop riparian easement with 8 landowners (CTUIR/BPA/ODFW easement and/or CREP). **Enhance riparian habitat conditions:** Increase riparian plant communities through planting and seeding and natural recruitment. **Enhance Floodplain Connectivity:** Remove channel confinement structures. **Enhance in-stream structural diversity and complexity:** Re-activate historic channel meanders to increase sinuosity and place large wood within active channel. **Reduce excessive sediment:** Manage riparian grazing with exclusion fences, stabilize existing erosion sites with wood structures and re-establishment of vegetation. **Decrease summer peak temperatures:** Improve/increase vegetative cover/shade to decrease summer stream temperatures and increase winter temperatures. **Decreased Water Quantity;** Consolidate points of diversion. Purchase water rights. | Conceptually includes: 2 miles restoration channel, 3-4 miles of side channel habitat, 5.5 miles habitat complexity. Removal of irrigation push up dams (4) Planting within riparian area. Seeding disturbed ground. Construct riparian fence. Off-channel water to be developed | **Enhance Floodplain Connectivity:** Topographical GPS points collected pre project using Trimble R8 GPS. **Enhance in-stream structural diversity and complexity:** Longitudinal profile and cross-sections pre project surveyed using Trimble R8 GPS. **Reduce excessive sediment:** Pebble counts at permanent cross-sections pre project. **Decrease summer peak temperatures:** Water temperature - hourly data - Hobo Pendant loggers - April to November starting 2012. |
| | | | | | Riparian Vegetation | 4 | Riparian Condition | 4.1 | Riparian Condition | Protect Habitat. Subbasin Plan Reference: Habitat Protection (page 258). | | | |
| | | | | | | | | 4.2 | LWD Recruitment | Enhance riparian habitat conditions. Subbasin Plan Reference: Riparian Conditions (page 262). | | | |
| | | | | | Connectivity | 5 | Peripheral and Transitional Habitats | 5.1 | Side Channel and Wetland Conditions | Enhance Floodplain Connectivity. Subbasin Plan Reference: Channel Conditions (page 260). | | | |
| | | | | | | | | 5.2 | Floodplain Condition | | | | |
| | | | | | Geomorphology | 6 | Channel Structure and Form | 6.1 | Bed and Channel Form | Enhance in-stream structural diversity and complexity. Subbasin Plan Reference: Channel Conditions (page 260). | | | |
| | | | | | | | | 6.2 | Instream Structural Complexity | | | | |
| | | | | | | 7 | Sediment Conditions | 7.2 | Increased Sediment Quantity | Reduce excessive sediment. Subbasin Plan Reference: Sediment Conditions (page 261). | | | |
| | | | | | Hydrology | 8 | Water Quality | 8.1 | Temperature | Decrease summer peak temperatures. Subbasin Plan Reference: Riparian Conditions (page 262). | | | |
| | | | | | | 9 | Water Quantity | 9.2 | Decreased Water Quantity | Increase summer water quantity. Subbasin Plan Reference: Low Flow Conditions (page 263). | | | |

**FIGURE 8 SOUTHERN CROSS GRADING PLAN OVERVIEW**

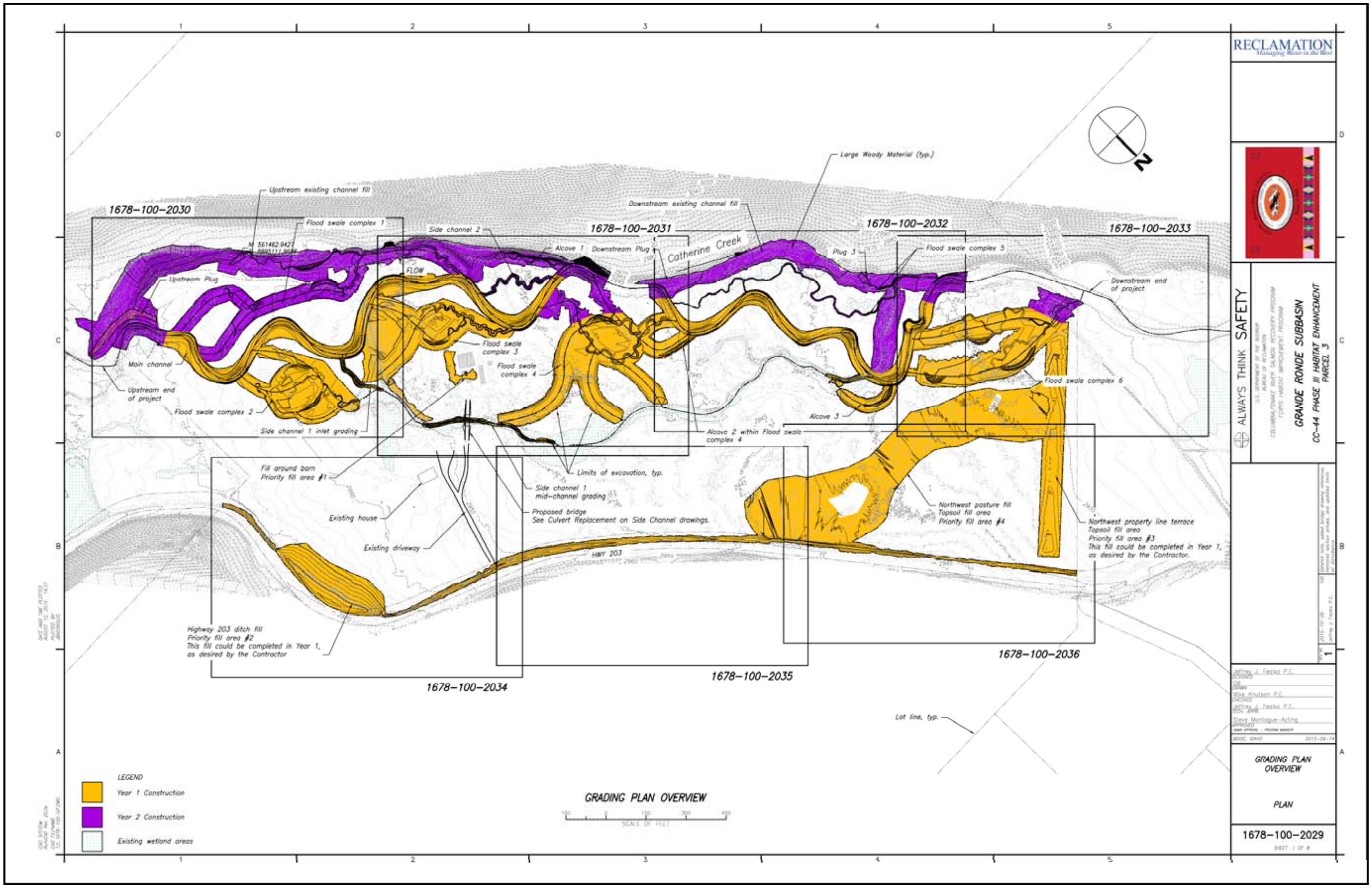


**FIGURE 9 TWO PHOTOGRAPHS OF SOUTHERN CROSS CONSTRUCTION AT THE UPPER AND MID PROJECT AREAS JUNE 2016 AND SEPTEMBER 2016.**

**FIGURE** 10 **CONSTRUCTION OF LARGE WOOD STRUCTURE AT LOWER PROJECT AREA.**


**FIGURE** 11 **CONSTRUCTION OF LARGE WOOD STRUCTURE AT UPPER PROJECT AREA.**

**FIGURE 12 TWO AERIAL PHOTOPOINTS OF THE SOUTHERN CROSS PROPERTY MID-PROJECT AREA. THE UPPER PHOTO WAS TAKEN IN APRIL, 2009 AND THE LOWER PHOTO WAS TAKEN IN MARCH 2016.**

## Southern Cross Planting Plan

The long-term goal of the Southern Cross planting plan is to restore natural riparian and wetland plant communities. Black cottonwood, Alder, and River birch dominated riparian forests and native sedge communities currently exist on the property, but have been suppressed or modified from historical conditions. Tree and shrub species planted within the project area include: Mountain alder, Serviceberry, Water birch, Red osier dogwood, Black hawthorn, Cascara, Mock orange, Ninebark, Black cottonwood, Chokecherry, Golden currant, Woods and Nutka rose, Booth willow, Coyote willow, Blue elderberry, Snowberry, and Ponderosa pine. Upland areas, access roads, and disturbed areas were planted with locally-adapted grass species which include Idaho fescue, Bluebunch wheatgrass, Basin wildrye, and Tufted hairgrass. Swale complexes and side channels were planted with sedges which include Nebraska sedge and Beaked sedge. The planting plan is divided into 6 zones, with each zone having different species composition, planting methods, and locations.

- Zone 1 is composed of live willow cuttings and willow clumps, with 4' variable width spacing, located on point bars within inside meander bends.
- Zone 2 is composed of 1-gallon containerized trees and shrubs, with 8' variable width spacing, located above bank full elevation on outside meander bends and within areas of the 1.25 year flood inundation level.
- Zone 3 is composed of 1-gallon containerized trees and shrubs, with 8' variable width spacing, primarily Mountain alder, Red osier dogwood, Black cottonwood, and Water Birch located above the bank full elevation along riffles.
- Zone 4 is composed of 1-gallon upland containerized trees and shrubs, primarily Ponderosa Pine, Ninebark, and Snowberry located on filled upland areas.
- Zone 5 is composed of 1-gallon containerized trees and shrubs and live willow cuttings, located above bank full elevation within the 1.25 year flood inundation level. Trees were planted on the north and west sides of installed floodplain trees to provide shade.
- Zone 6 is composed of live willow cuttings, with 2' to 4' variable width spacing, located within large wood structures, side channels, and swale channels.

Planting on the Southern Cross Property began in March, 2016, with approximately 8,000 trees and shrubs planted March-May, and over10,000 planted in fall 2016 using CTUIR staff, Union SWCD staff, and the Powder River Correctional Facility inmate work crew. Trees and shrubs were planted using hand augers, a mini-excavator (trenching), and a 9" diameter hydraulic auger attached to a skid steer. Grass seeding was conducted by hand seeding or by an ATV mounted spreader, and was harrowed post-seeding. An irrigation system was installed after spring planting and plants will be irrigated throughout the summer. Plants will likely be hand watered 2017 and beyond due the instream transfer of the water right in 2018.

**FIGURE 13 CTUIR UMATILLA FISH HABITAT CREW ASSISTING WITH PLANTING EFFORTS, JUNE 2016.**

**FIGURE 14 CTUIR GRANDE RONDE FISH HABITAT CREW SPREADING STRAW MULCH, APRIL 2016.**

**FIGURE 15 SOUTHERN CROSS YEAR TWO PLANTING PLAN MAP 1**

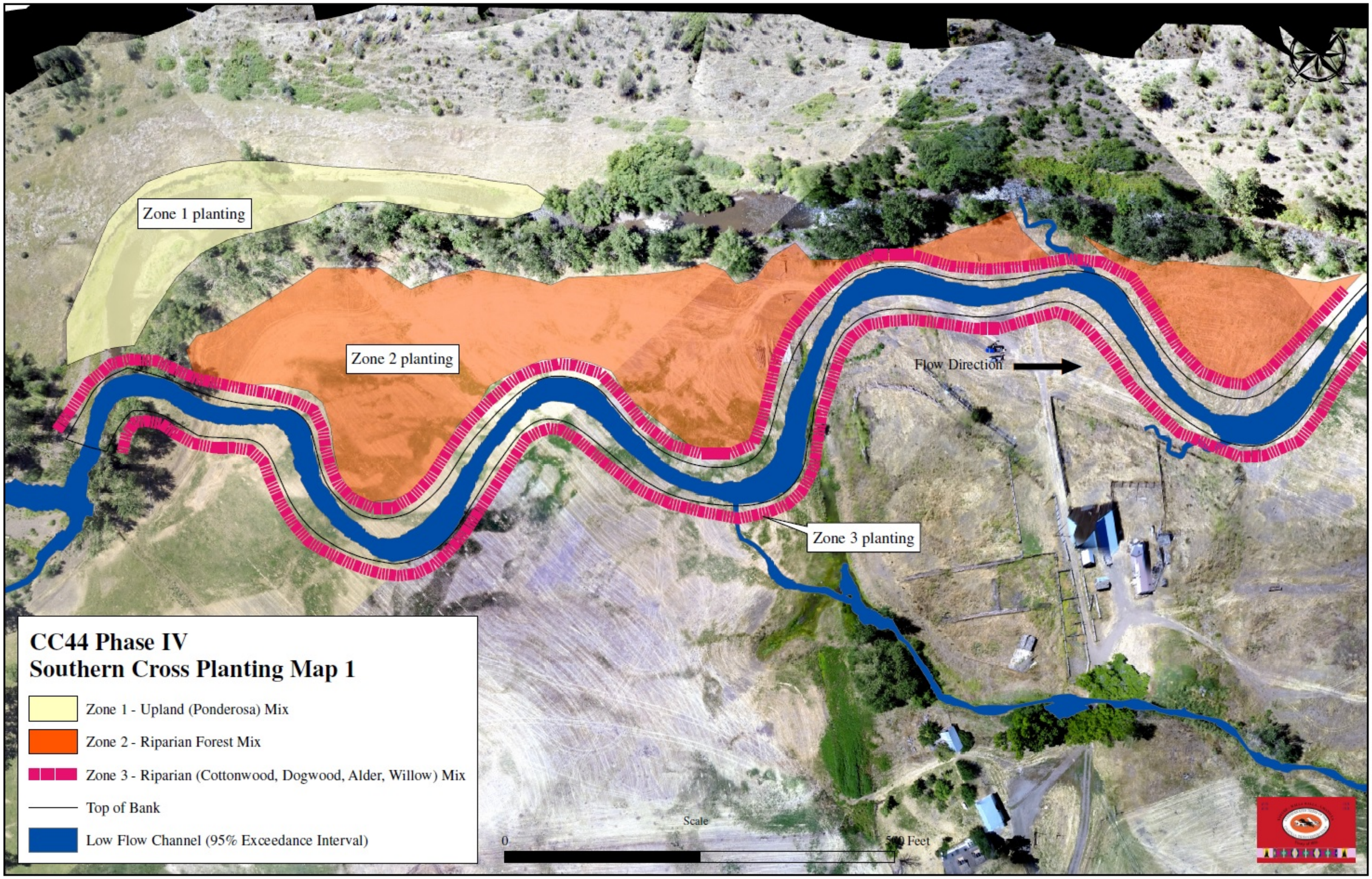


**FIGURE 16 SOUTHERN CROSS YEAR 2 PLANTING PLAN MAP 2**

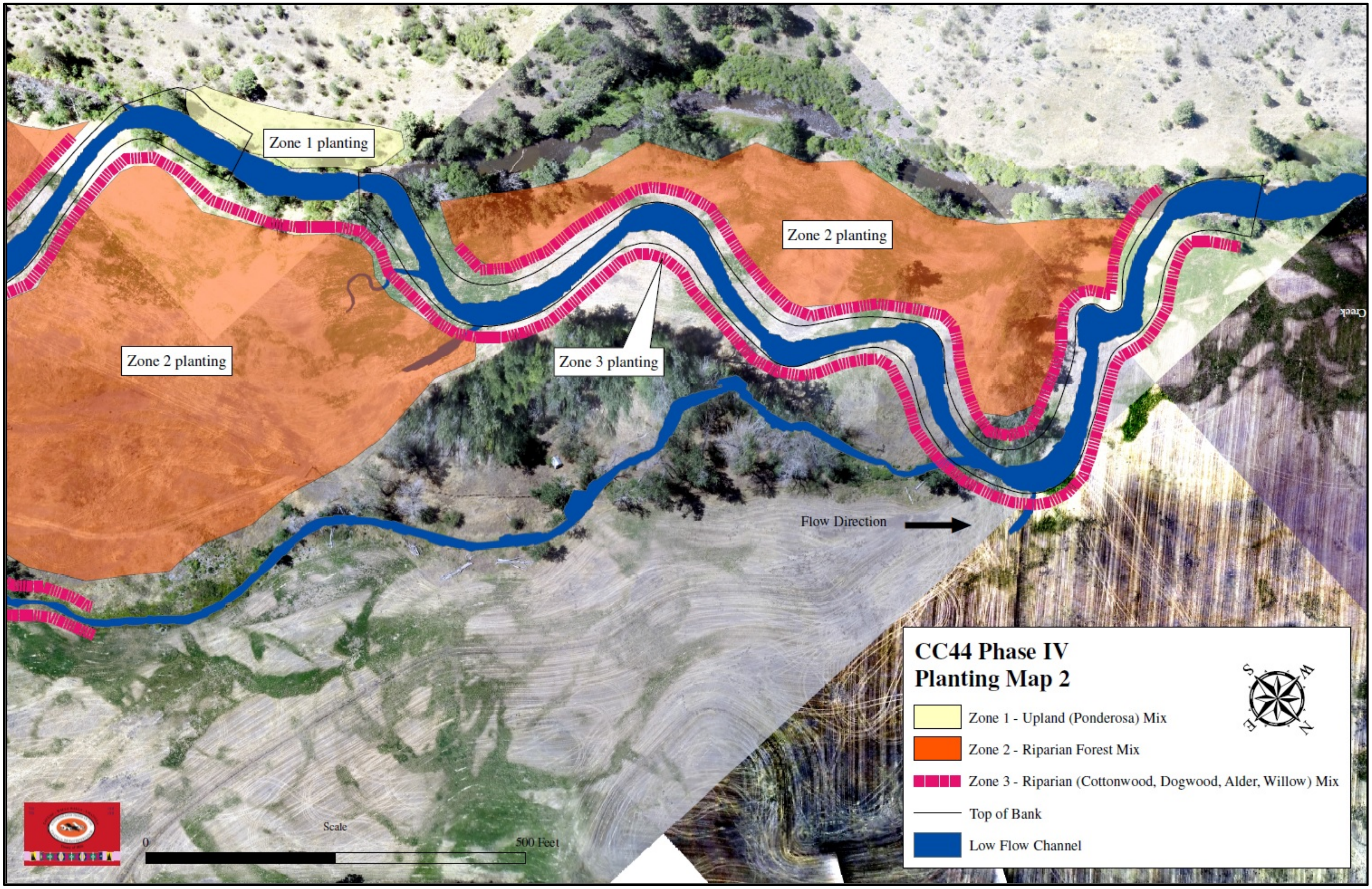
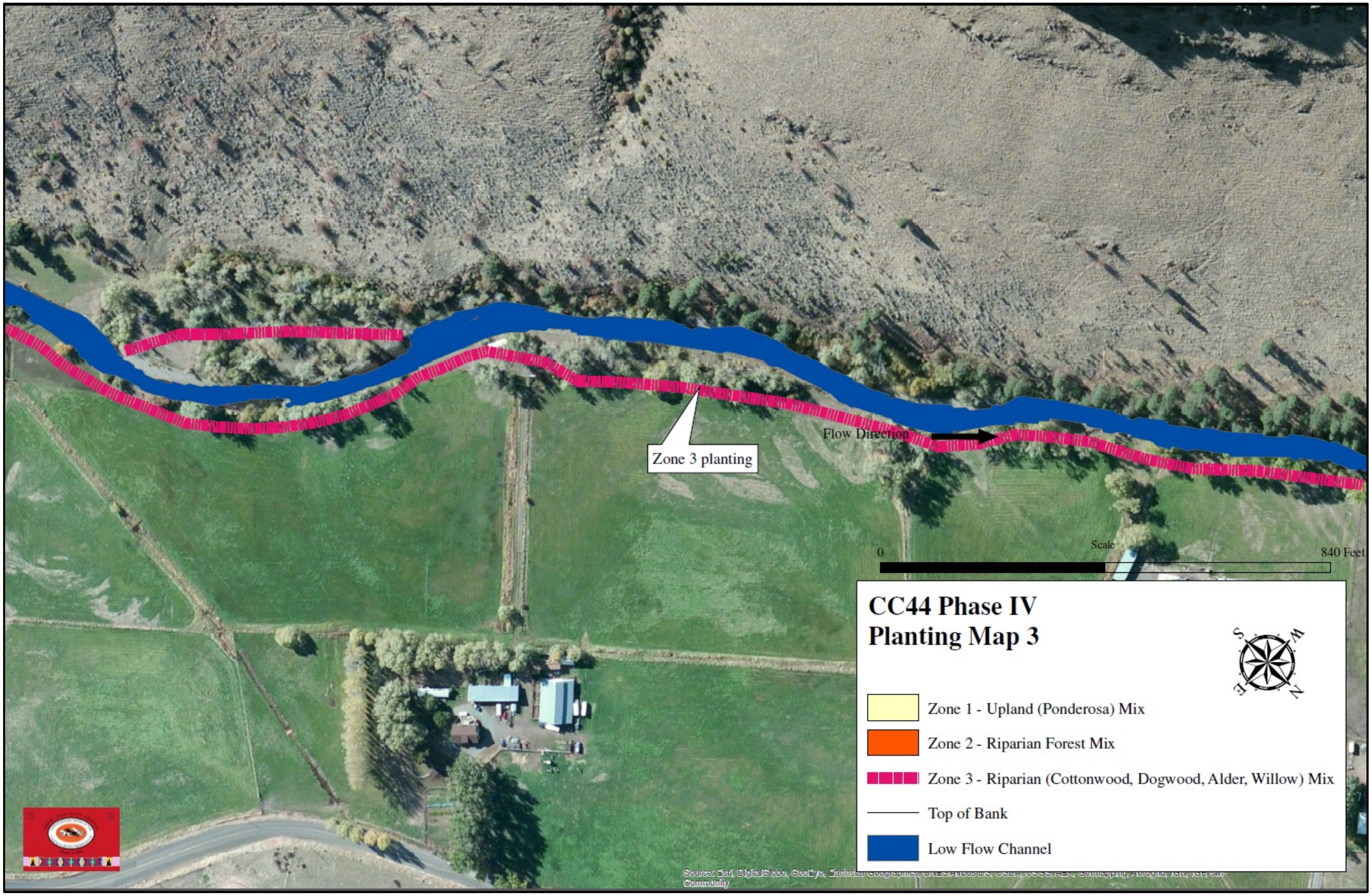


**FIGURE 17 SOUTHERN CROSS YEAR 2 PLANTING PLAN MAP 3**



## CC44 Phase III Fish Salvage 2016

From July 5 to July 27, fish salvage operations were conducted on Phase III of the Catherine Creek 44 (Southern Cross) Fish Habitat Enhancement Project by staff from CTUIR, ODFW, BOR, UCSWCD, and the Grande Ronde Model Watershed using Smith-Root electro-fishers and beach seines. The National Marine Fisheries Service "Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" document was used as a guideline for salvage.

Reach-scale isolation and salvage was favored over isolating individual sites due to the vast area requiring dewatering prior to constructing the numerous engineered large wood structures and extensive channel grading specified in the project design. Two engineered large wood structures at the bottom end of the project area, however, did require individual isolation prior to construction due to their location downstream of where the new channel returns back to the old alignment. In these cases sites were isolated from the main channel by placing large sand bags and eco-blocks around the perimeter of the site and allowing an opening at the downstream end of the site, which was then blocked by a seine net on the day of the salvage.

The project area was divided into upper and lower reaches, where each contained both the old channel alignment and the newly constructed channel. In addition, one bypass channel was constructed mid-project to divert water around a short vestige of old channel that would be retained as part of the final new channel alignment. Salvage efforts began with isolation of the lower old channel in preparation for dewatering and backfill. Once fish were removed, the main channel of Catherine Creek was forced in to the temporary bypass channel, connecting the active upper old and new channels to the lower new channel.

Upper reach salvage efforts continued similarly with isolation of the upper old channel in preparation for dewatering and backfill. At this point the main channel of Catherine Creek was diverted from its old alignment and turned into the upper new channel, as flows had been split between the two since June to allow for excess sediment flushing and the introduction of macroinvertebrates and organic compounds into the newly constructed channel.

The final salvage activity within the project area occurred as the temporary bypass channel was to be abandoned and filled. Once fish were removed from the bypass, all flow was turned into the short mid-project reach, retained from the old channel alignment, and connected to the lower new channel.

**FIGURE 18 FISH SALVAGE OF BYPASS CHANNEL, JULY 2016.**

Salvage work was generally done in the morning when stream temperatures were less than 18º C, and sites were salvaged until depletion was achieved or temperatures reach 18º C. Sites were considered depleted when 2 consecutive passes with the electro-fisher were made with zero salmonid spp. captured on each pass. The number of passes that individual sites or bypassed reaches needed to meet depletion criteria (using both seine nets and/or electro-fisher) ranged from a minimum of 3 passes in one day to a maximum of 7 in one day. Efforts to deplete the larger bypassed reaches occasionally required crew to halt salvage once stream temperature reached 18º C and resume again the next morning when temperatures were cooler.

Table 6 contains records from four consecutive years of fish salvage on CC44 Phase I-III from 2013-2016. Included are number of O.mykiss and Chinook salvaged, and number of mortalities for each species per year. O.mykiss mortalities averaged 2.74% and Chinook 1.68 % for combined phases I-III.

**TABLE 6 TOTAL NUMBERS OF SALVAGED FISH-CC44 2013-2016**

| CC44 salvage year | Area (m2) | O.mykiss salvaged | Chinook salvaged | O.mykiss morts | Chinook morts | %O.mykiss morts | %Chinook morts |
|---|---|---|---|---|---|---|---|
| 2013 | 295.8 | 298 | 529 | 4 | 3 | 1.34% | 0.57% |
| 2014 | 3639.9 | 1275 | 357 | 67 | 4 | 5.25% | 1.12% |
| 2015 | 7199.8 | 4204 | 1476 | 47 | 21 | 1.12% | 1.42% |
| 2016 | 13455 | 1511 | 862 | 49 | 31 | 3.24% | 3.60% |
| **Total 2013-2016** | **24590.5** | **5777** | **2362** | **118** | **28** | **Average=2.74%** | **Average=1.68%** |

**FIGURE 19 FISH SALVAGE OF MAIN CHANNEL, JULY 2016.**

# Ongoing Work Elements

The following sections present work elements followed by discussion of accomplishments for the project during the contract period.

## Manage and Administer Projects

This work element includes a suite of management actions required to administer the project, including preparation of annual operations and maintenance budgets, managing and preparing statements of work and budgets, and milestone and metrics reporting in Pisces, supervising and directing staff activities, conducting vehicle and equipment maintenance and management, payroll, purchasing, subcontracting for services, and administering/inspecting habitat enhancement activities. CTUIR staff administered the CC44 Southern Cross Project and assisted with the Catherine Creek CC44 Project, including construction subcontract solicitation, field stakeout, and observation and inspection. CTUIR administered all aspects of construction subcontracting, materials acquisition, and administration for the CC44 Southern Cross Project during 2015-2016.

The Project Leader supervised 4 permanent employees and a seasonal crew of 2 90-day e-hire employees to accomplish fish salvage and riparian planting project activities. Staff training included 2016 River Restoration Northwest Symposium (Project Leader, Biologists and lead Technician).

**Environmental Compliance and Permits**

Environmental compliance methods include development of appropriate documentation under various federal and state laws and regulations governing federally funded project work. Methods involve coordination with various federal and state agencies and development, oversight, and submittal of permit applications, biological assessments, cultural resource surveys, etc.

Primary accomplishments during the reporting period included coordination with BPA environmental compliance personnel to prepare supplemental documentation and reporting for ongoing and planned management actions.

Additionally, CTUIR staff continued EC compliance on projects planned for implementation beginning in 2017 including the Rock Creek Project Phase III and Bird Track Springs Project. Activities included preparation of maps illustrating the Area of Potential Effect (APE) to initiate cultural resource investigations and compilation of ESA species information for incorporation into ESA compliance documentation. EC compliance activities will be ongoing for the Rock Creek Project III in FY2017with completion scheduled for late summer in preparation to construction initiation.

**Coordination and Public Outreach/Education**

Coordination and public education were undertaken to facilitate development of habitat restoration and enhancement on private lands, participate in subbasin planning, ESA recovery planning, BiOp/Remand project development and selection processes, and assist with providing watershed restoration education. CTUIR technical staff coordinates through the GRMW on the Board of Directors and Technical Committee to help facilitate development of management policies and strategies, project development, project selection, and priorities for available funding resources.

The Project Biologist participates in multiple basin programs and processes associated with project prioritization and selection, funding, and technical review. Focus during FY2016 included work on the Catherine Creek Atlas process, initiation of the Upper Grande Ronde Atlas, and participation on the GRMW technical review team to evaluate and select projects for funding recommendations through the GRMW Step-Wise Process. Additionally, CTUIR staff continued working on look forward projects with close coordination between BPA and BOR to develop core project complexes and initiate concept planning in conjunction with CTUIR-BPA Accord land acquisition strategies.

CTUIR staff also participated in a several educational and public outreach activities which included a newspaper article about the CC44 Project for the Grande Ronde Model Watershed Ripples newsletter, a newspaper article about the Southern Cross Project for the East Oregonian, and several tours of the Southern Cross project with OWEB, BOR, CTUIR, and BPA staff.

**Planting and Maintenance of Vegetation**

The CTUIR habitat program annually participates and/or assumes the lead role in re-vegetation activities on individual habitat restoration and enhancement projects. Planting and seeding methods are developed to address site specific conditions and vegetation objectives. Natural colonization and manual techniques are utilized.

Staff efforts associated with planting during the reporting period included installation of approximately 10,000 containerized trees (Black Cottonwood, Hawthorne, Ponderosa Pine, Douglas Fir, Elderberry, Salmonberry, and Red-Osier Dogwood) and live willow whips on point bars, riffle margins, side channels, and floodplains of the CC44 Southern Cross Project. Disturbed areas were also seeded and mulched with a native grass seed mix consisting of Basin Wild Rye (33.06%), Rosanna Western Wheat Grass (19.07%), Snake River Wheat Grass (9.34%), Tufted Hairgrass (10.41%), Idaho Fescue (16.51%), Big Blue Grass (9.94%). Plants were installed using hand-held augers, a mini-excavator, and a compact tracked loader with an auger attachment.

**Identify and Select Projects**

Habitat protection, restoration and enhancement project opportunities were identified and developed during FY 2016. Activities included land and easement acquisition project identification and planning (Southern Cross Land Acquisition, Tsiatsos Ranch Conservation Easement, and Cunha Ranch Conservation Easement, and the Lookingglass Neilson Property), coordination and planning with State, Federal, local partners, and private landowners, and participation on Grande Ronde Model Watershed (GRMW) Board and Technical Committee to evaluate projects for BPA funding through the Step-Wise Process.

Project staff continued contact with landowners on 5 miles of Rock Creek (a contiguous section upstream of the current Rock Creek Project), and 1 mile of Dry Creek (a contiguous section upstream of the Willow Creek Oregon Ag Foundation Property) to discuss fish habitat restoration projects.

**Operate and Maintain Habitat & Structures**

Project maintenance includes conducting custodial responsibilities on individual projects to ensure that developments remain in functioning repair and habitat recovery is progressing towards meeting projects goals and objectives. Activities included maintenance of plant enclosures and riparian fence along McCoy Meadows Project area, water gaps on Meadow Creek (Habberstad) and Catherine Creek (CC37), and repairs to fences along the Catherine Creek (CC37) Project, the Rock Creek Project, and the Catherine Creek (CC44) Project.

## Monitoring & Evaluation

Monitoring and evaluation (M&E) of individual projects is conducted either independently by the CTUIR or jointly with project partners, Fish Habitat Enhancement Biological Effectiveness Monitoring 2016 Annual Progress Report (project #2009-014-00; BPA contract #71934) depending on the project. Monitoring and evaluation efforts include annual photo-points, installation of water and air temperature probes, stream channel cross sections and longitudinal profiles, pebble counts, juvenile fish population and habitat surveys, stocking/census surveys on re-vegetation efforts, and groundwater monitoring. Public tours, workshops, and presentations of individual projects will continue to be conducted. These activities provide for the discussion of various approaches, restoration techniques, successes, failures, and ultimately adaptive management.

Project staff conducted presence/absence snorkel surveys on side channels as part of the pre-project data collection efforts for the Bird-Track Springs Project.

Following are descriptions of the various M&E components of the project followed by project specific monitoring results.

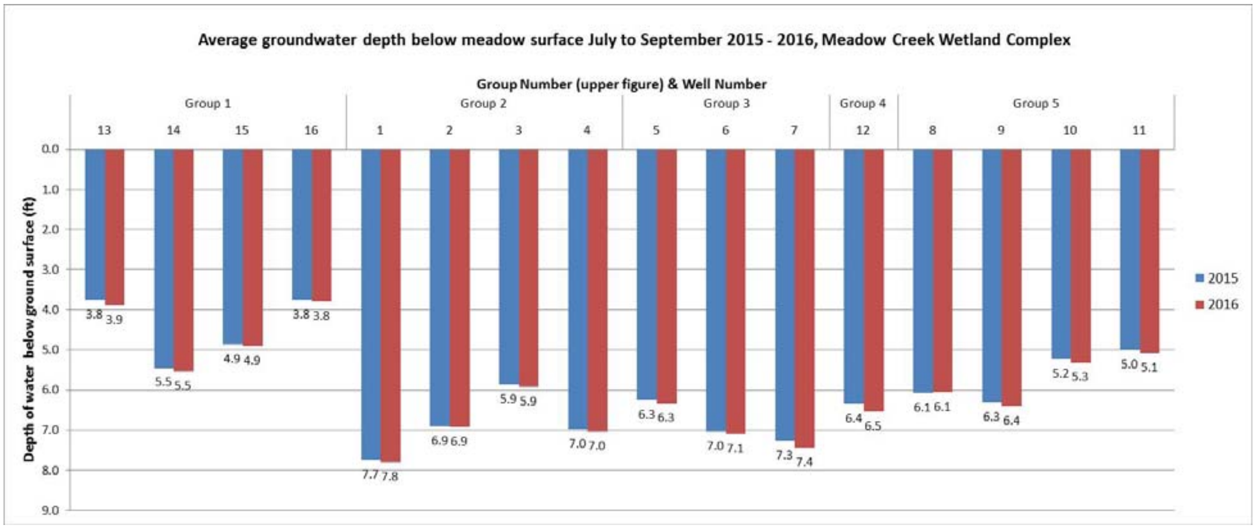
## Groundwater Monitoring

*Meadow Creek Groundwater*

There were 16 shallow groundwater wells monitored in 2016 by CTUIR along the Meadow Creek Wetland complex on the McCoy Meadows Ranch. Data is plotted in relation to the meadow surface elevations at each monitoring well site in order to evaluate seasonal and annual changes in groundwater depths. Wells are grouped for these plots into 5 units that represent their position within the meadow system, with Group 1 located at the most upstream portion of the project (wells 13 to 16) and Group 5 being the most downstream group (wells 8 to 11).

When comparing average groundwater elevations from depths measured in months July to September 2015 with records from July to September 2016 there appears to be little difference in the summer averages between these two years (Figure 20). 8 of the 16 wells measured in July through September 2016 had the same average summertime depth below meadow surface compared to their corresponding wells measured during the same months the previous year. The remaining 8 wells measured in summer 2016 each show a decrease in groundwater elevation of 0.1 ft. compared to the previous year.

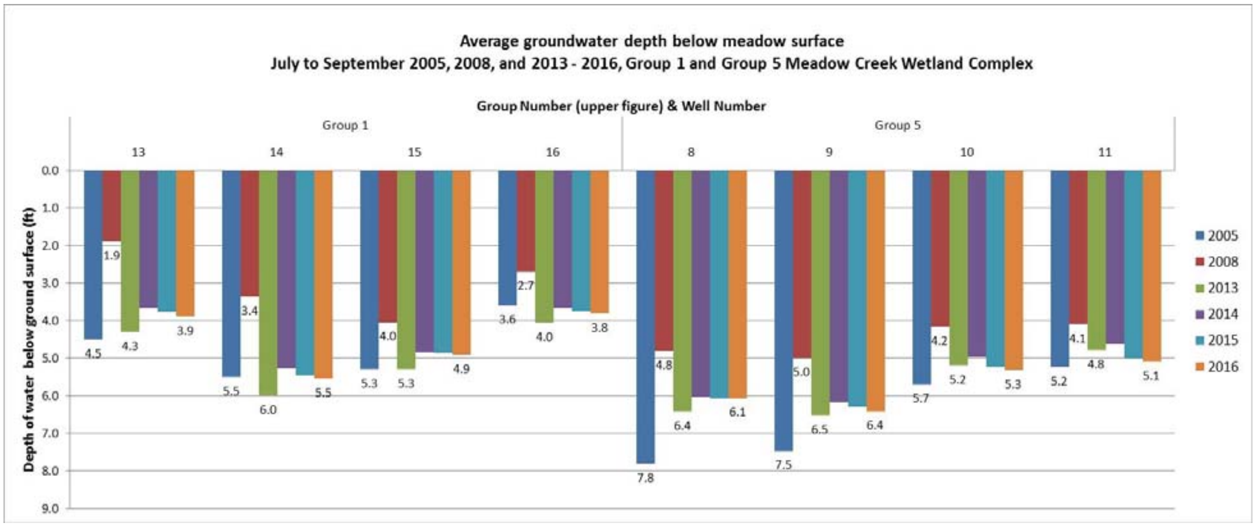
**FIGURE 20 AVERAGE GROUNDWATER ELEVATIONS ALONG MEADOW CREEK WITHIN THE MCCOY MEADOWS RANCH.**




Average summer groundwater depths within the Meadow Creek Wetland Complex from months July to September 2008, 2013- 2016 for the most upstream wells (Group 1) and most downstream wells (Group 5) were graphed (Figure 21). In addition, pre-project measurements taken in 2005 during the same months are also shown for comparison. There is a six-year trend in decreasing groundwater elevation from 2008 to 2013. Groundwater records from 2013 are the furthest below meadow surface since 2005 pre-project levels. It is possible that sediment build up at the Meadow Wetland Intake prevented desired flows from main channel Meadow Creek to access the wetland channel and contributed to this drop in groundwater elevation. A possible down-cutting of Meadow Creek, and coinciding dropping of the water table, may also have been a factor in these groundwater differences.

Groundwater depth measurements taken in 2014 indicate a consistent increase in groundwater elevation when comparing to summer seasonal average depths recorded from 2013 for Group 1 and Group 5 wells. The average increase in groundwater elevation in 2014 for these eight well sites was +0.4 feet. A possible explanation for the increase in groundwater elevation could be that mainstream Meadow Creek flows were allowed more access to floodplain and side channels, or that high flow diversion from the main channel persisted longer in these areas. All but one of the 8 wells (well #16) from Groups 1 and 5 showed groundwater elevations higher than pre-project levels in 2014. The average increase in groundwater elevation in 2014 compared to 2005 pre-project levels was +0.7 feet, which could be the result from seasonal high flows accessing the constructed Meadow Creek Wetland side channel. From 2014 to 2016 there has been a slight, but consistent, decline in average summertime groundwater elevation. The combined average drop in groundwater elevation among all wells from Group 1 is 0.13 feet. For Group 5 wells the combined average decline in groundwater elevation is 0.28 feet. One well (well #16) had an average summer 2016 groundwater depth below that of the 2005 pre-project level, and well #14 was measured in 2016 to be at the same groundwater elevation as pre-project records.

**FIGURE 21 2005 (PRE-PROJECT), 2008, 2013 - 2016 AVERAGE GROUNDWATER ELEVATIONS ALONG MEADOW CREEK WITHIN THE MCCOY MEADOWS RANCH.**




*McCoy Creek Groundwater*

Groundwater well data was collected every two weeks beginning March 31, 2016 and ending November 30, 2016. A total of 18 surveys were conducted to measure the groundwater depth below meadow surface during these months. There were 34 groundwater wells monitored along the McCoy Creek restoration project in 2016. The percent of well measurements when wet versus when dry were recorded and plotted (Figure 22) and shows a trend in increased groundwater elevation within the project area from 2007 to 2011, a decrease from 2011 to 2012, and no significant change from 2012 through 2014. Records from 2015 show a 4% decrease in wet well measurements compared to the previous year, but measurements from 2016 show a 2% increase in wet wells versus dry. Of the 612 samples taken during 2016, 63% occurred when wells contained water (wet).

**FIGURE 22 PLOT OF WET VERSUS DRY WELL MEASUREMENTS ALONG MCCOY CREEK 1997 TO 2016.**

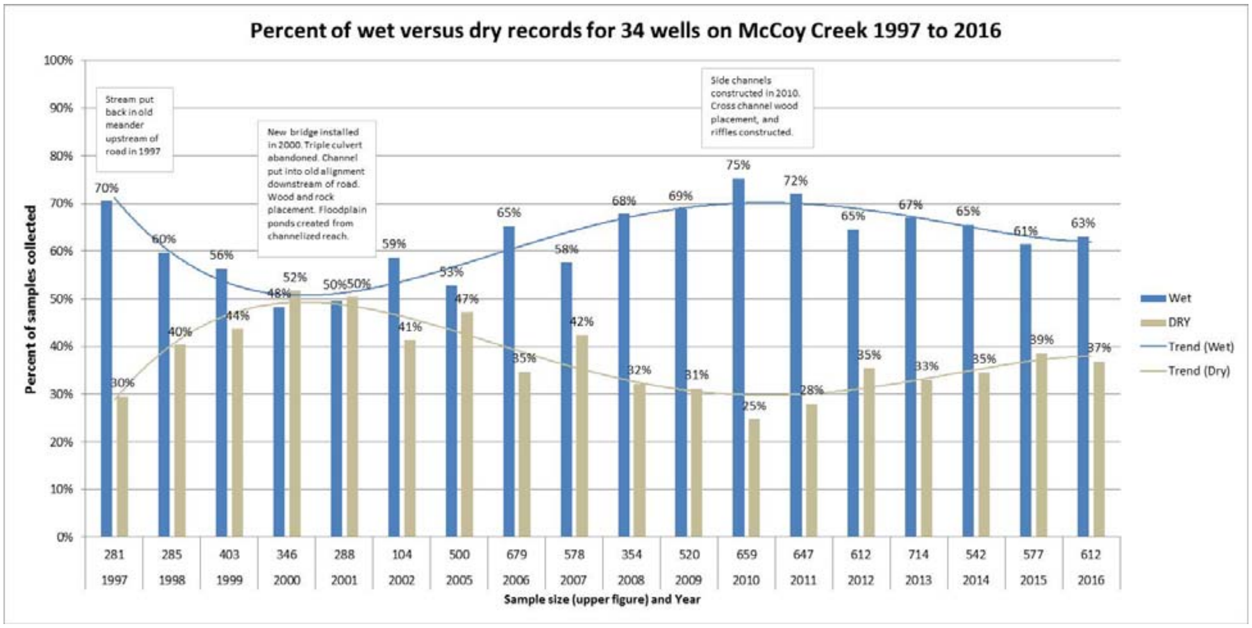



Figure 23 shows 16 wells that remained wet for at least 3 surveys during the months July through September in 2009, 2014 - 2016. Wells located where water table levels dropped below the bottom of the well during July through September were not considered for annual comparison. 9 of the 16 wells sampled for these years contained average summer groundwater at a level that never dropped below 3 feet of the meadow surface, and in 2016 six of these wells did not get below the preferred max target depth of 2.5 feet below the meadow surface during the months July through September. Only two of these wells measured in 2016 recorded an average summer groundwater depth of below 4 feet from the meadow surface.

**FIGURE 23 PLOT OF AVERAGE SUB-SURFACE WATER ELEVATIONS JULY TO SEPTEMBER 2009, 2014-2016 ALONG MCCOY CREEK.**

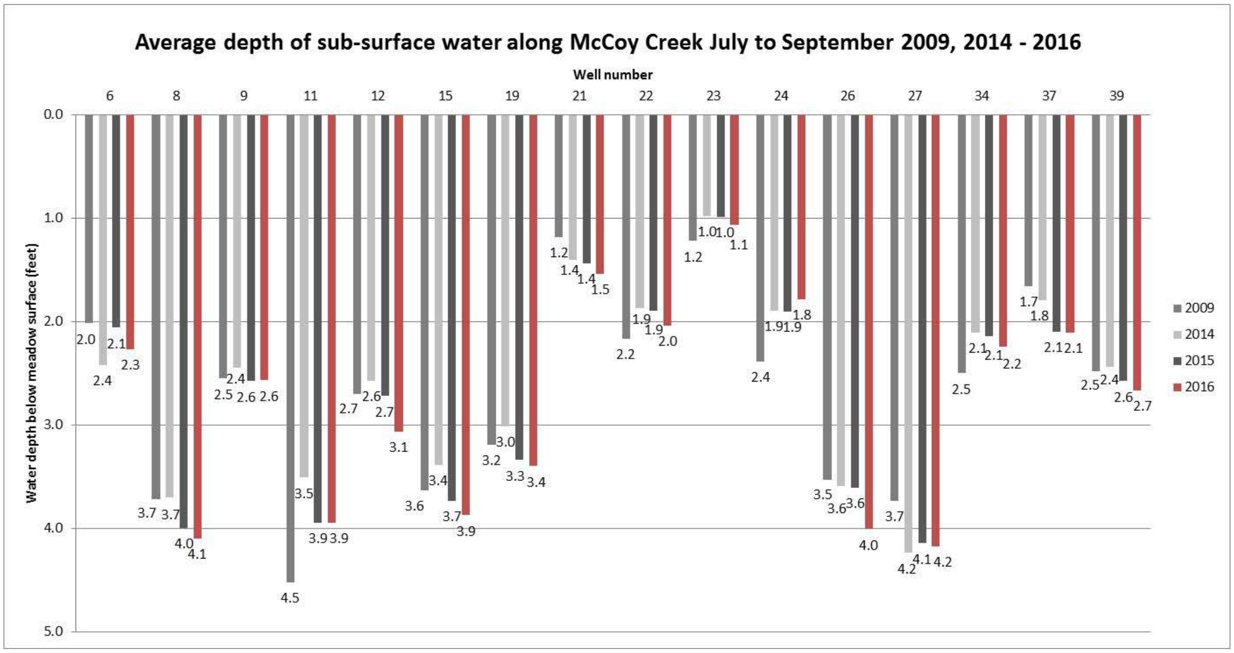
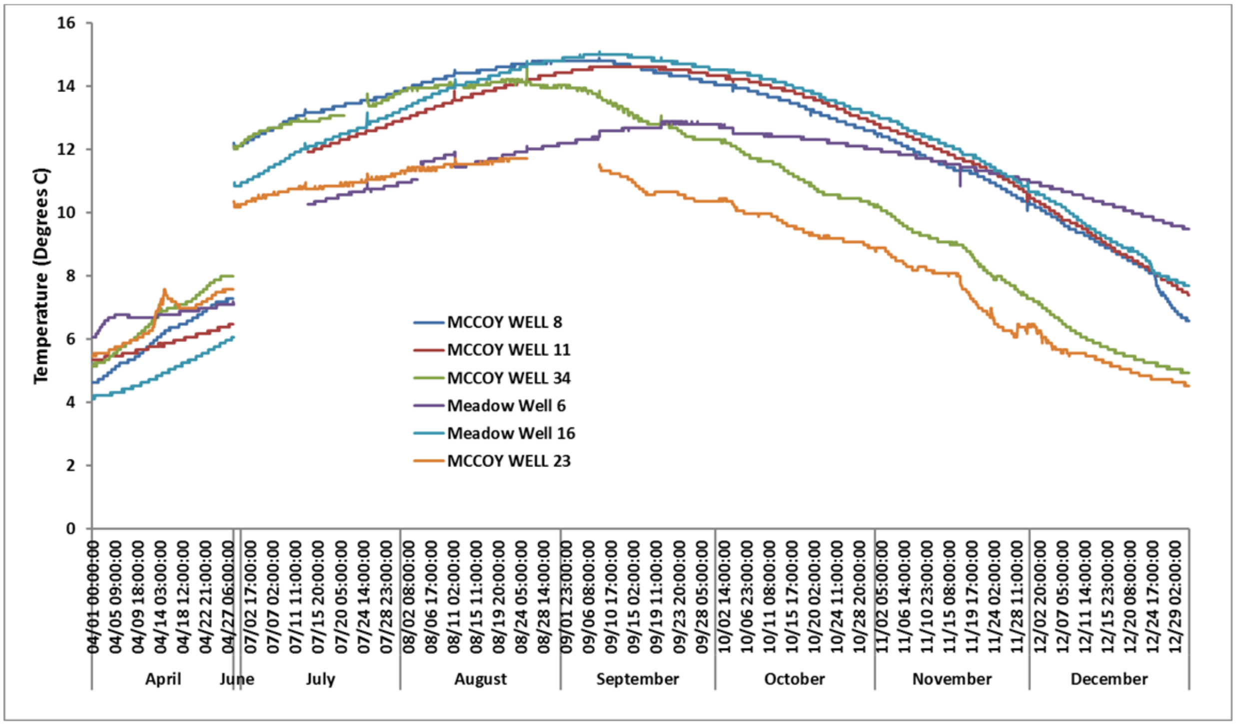



**FIGURE 24 GROUNDWATER TEMPERATURE DATA FOR 6 OF THE 50 WELLS MONITORED IN 2016 IN MCCOY AND MEADOW CREEK.**



*Groundwater Summary*

Following the restoration efforts there appears to be some increase in the average sub-surface water elevation within the project area. Increased groundwater elevations are most evident near the upstream log structure (above the McIntyre road bridge), but is also evident within all the wells. There is a widespread increase in sub-surface water and the rising trend seen after 2000 is continuing. This trend of a sudden increase in sub-surface water followed by a gradual 'settling' has also been recorded along Meadow Creek. It is anticipated that with the activation of the McCoy Creek side channels, greater floodplain access at high flows, and the backing up of water within proximity to the log and riffle structures the sub-surface water within the well network will continue to be at a level greater than the lows of 2000 and 2001.

In contrast to McCoy Creek the sub-surface water within the Meadow Creek Wetland Complex has continued to decrease and is further down from the meadow surface in 2013 than any year since the activation of the wetland channel network. This reduction has reached the pre-project levels seen in 2005 at wells 4, 5, 14, 15 and 16 and is within 2 – 3 tenths of a foot of those levels for 3 other wells when comparing summer groundwater depths July – September.

Groundwater temperatures were monitored in 6 of the 50 wells in 2016. However, there was a period between late April and early July when the data was compromised and not useable. Beginning in 2016, temperature monitoring will extend to include the entire calendar year. Overall, trends show lower temperatures in the downstream wells on McCoy Creek (wells 23 & 34) compared to the two upstream wells (8 & 11; Figure 24). A similar trend is evident in Meadow Creek with the upstream well (16) and the downstream well (6; Figure 24).

## Photo Point Monitoring

Photo points are an effective monitoring method used to document morphological changes on restoration projects. Representative photos are taken at intervals throughout each project, the number being determined by the project size and complexity. A master photo point notebook is used to align each subsequent year's photo with the image taken the previous year. Ideally, images are captured in the exact location as the earlier image, with landmarks (trees, hillsides, etc.) used to align the photo. Images are taken during midday for optimal lighting conditions with a Nikon D3100 camera and jpeg images are saved into a master photo point file. Aerial photos are also taken at varying intervals along several project locations.

During 2016 photo points were taken at 4 separate projects. A total of 76 photos were taken, and GPS coordinates were recorded at each photo point site. Each photo point site is marked with a green T-133 post or a 1 foot rebar stake. Photo points are located at sites along project reaches with good visibility of stream-bank vegetation and areas where morphological changes are likely to occur. Photo points are typically taken every year; however, some project photo points are taken every other year. 16 photo points were taken at CC 44 Southern Cross, McCoy Creek, Meadow Creek, and McCoy/Meadow Creek enclosures. Representative samples are provided in figure 27. Of particular note are stark differences in recruitment of riparian vegetation between enclosed and exposed areas in the McCoy Creek/Meadow Creek complex. This project is subject to intense browsing pressure from wild ungulates resulting in extremely limited release of riparian vegetation in untreated areas. This contrast is readily seen when comparing photo points of protected and unprotected areas of the project (Figures 25 and 26).

FIGURE 25 UNPROTECTED REACH ON MCCOY CREEK, AUGUST 2016.


FIGURE 26 PROTECTED ELK ENCLOSURE ON MCCOY CREEK, AUGUST 2016.

**FIGURE 27 PRE AND POST PROJECT PHOTO POINTS.**

**Southern Cross Pre Project 2015** **Southern Cross Post Project 2016**

## Southern Cross Pre Project 2015

## Southern Cross Post Project 2016

## McCoy Meadows Pre Project 2011

## McCoy Meadows Post Project 2016


## 2016 Water Temperature Monitoring

### Water Temperature 2016 Summary

During 2016, fifty two temperature probes were deployed within the Grande Ronde Basin, all recording at 1-hour intervals. Fifteen of these loggers were new deployments for 2016 within the Southern Cross project on Catherine Creek and at the Bird Track Springs planned project area. The primary objectives of monitoring stream temperatures are to track changes at existing or proposed habitat restoration projects before and after work are completed. In addition, temperature monitoring was expanded to year round monitoring in 2016.

Summary statistics were calculated for each probe that included the number of records when temperatures were at or exceeded the DEQ lethal limit of 25ºC, the number of records when temperatures were at or exceeded 20ºC, and when temperatures were within a range of 10ºC to 15.6ºC (the preferred temperature range of juvenile Chinook salmon – as cited by Yanke et. al. 2003). The number of days when the mean temperature was at or exceeded the DEQ standard of 17.8ºC was also calculated. Diurnal fluctuations in water temperature were also plotted.

Temperature probes deployed are Onset HOBO© Pendant 64k or TidbiTv2 loggers set to record at 1-hour intervals. Pendant 64K probes are housed in a metal tube that is anchored to the streambed and cabled to a post or tree on the bank, while Tidbit v2 probes are housed in a PVC bushing and cap and installed with underwater epoxy (Isaak, Horan, & Wollrab, 2013). Probe locations have been consistent from 2009 to 2016 and when possible, the same probes are deployed at each site during this period. Each year prior to deployment probes are tested using a NIST certified thermometer.

The following summary of water temperature data will be broken down into an overview of each sub-watershed area which includes: the Upper Grande Ronde River, Meadow Creek, McCoy Creek, Dark Canyon Creek, Rock Creek, and Catherine Creek. A summary of temperature metrics for the Upper Grande Ronde and sub-watersheds can be seen in Table 9.

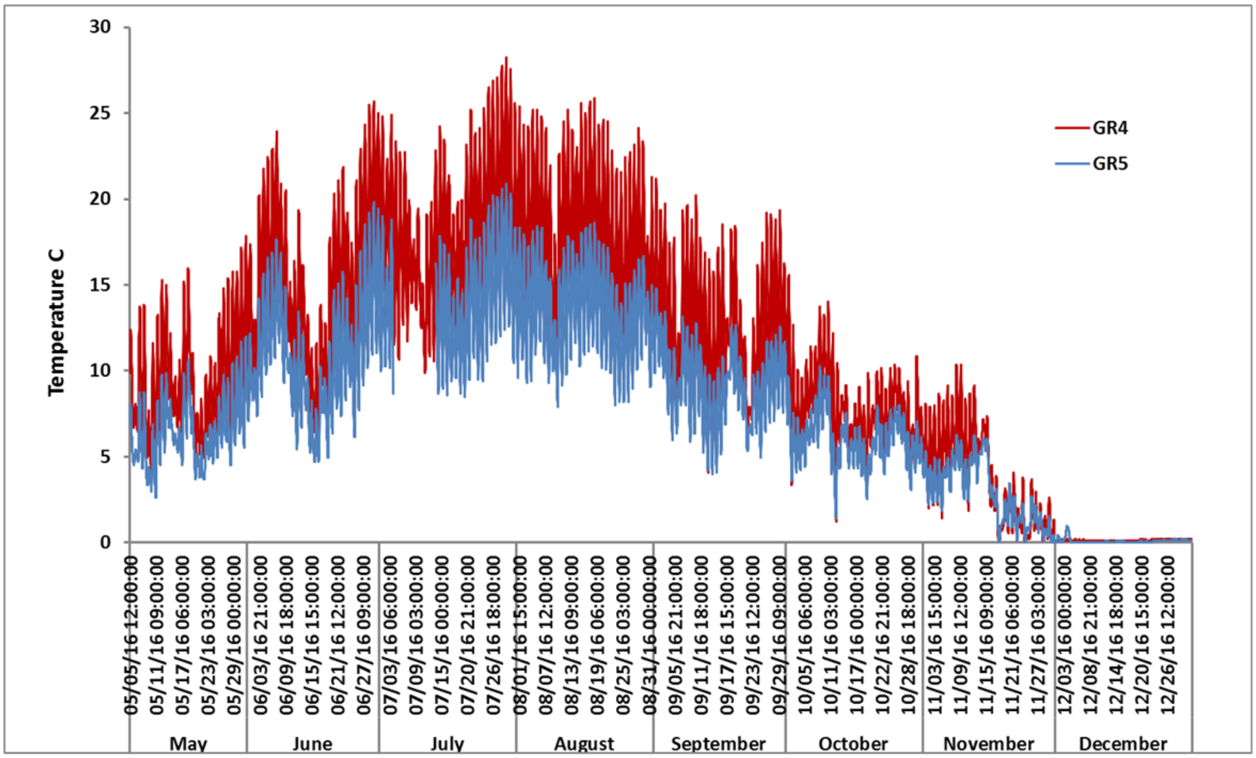
### Grande Ronde Watershed

Fourteen probes were deployed along the Upper Grande Ronde River from Hilgard State Park to Starkey Meadows. During 2016 these probes recorded data for 131-247 days (between 4/28/2016 and 12/31/2016). There were 6,825 records removed from the dataset due to either a probe being out of the water or similar reported problems, leaving 64,535 hours logged for analysis. During 2016 there were 59 records at the lower site below Vey Meadows (GR4) for temperatures >= 25°C. There were 575 records of temperatures >= 20°C at the same site.

- The probe below the Vey Ranch (GR4) had 59 hours of lethal limits recorded compared to 0 at the probe above the acclimation facility (GR5). There were 575 records of temperatures >=20°C at GR4 and 0 records at GR5. Approximately 26.1% of the deployment period at GR4 site was in 10-15.6 °C range compared to 24.8% at GR5, and GR4 had 34 days recorded with a mean >= 17.8 °C compared to 0 at GR5.
- Comparisons with other years show:

1. GR4 had the second highest number of lethal limit and temperature >=25ºC since 2010 (highest was in 2013). GR4 had the lowest percent of time in the 10-15.6ºC range (highest was in 2011). There were 34 day with a mean daily temperature >=17.8ºC since 2010 which is in the middle of the range since data collection began in 2010.
2. GR5 had 14 hours with temperatures >=20ºC in 2016 compared to 60 hours in 2015 and 0-9 in other years. The percentage of time in the 10-15.6ºC range was the lowest in 2016 than all other years since records began in 2010.

**FIGURE 28 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG THE GRANDE RONDE RIVER DURING 2016.**




## Meadow Creek Watershed

The CTUIR Fish Habitat Project had 11 probes deployed in 2016 within the Meadow Creek Watershed covering 4 streams – Battle Creek, Meadow Creek, McCoy Creek, and Dark Canyon Creek. The probe data was then grouped by project for this report. The projects were:

- Dark Canyon (landowner Joe Cunha), with 2 probes – DC1 and 2 at river miles 0.06 and 1.9 respectively.
- McCoy Meadows Ranch (landowner Mark and Lorna Tipperman) McCoy Creek, with 3 probes – MCCOY1, 6, 7 at river miles 2.7, 1.5, and 0.1 respectively.
- McCoy Meadows Ranch (landowner Mark and Lorna Tipperman) Meadow Creek and the Wetland Complex, with 2 probes – MEADOW1 and 2 on mainstem Meadow Cr at river mile 2.9 and 1.5 respectively.

- Meadow Creek Habberstad (landowner John Habberstad), with 3 probes – MEADOW5 and 6 at river mile 7.53 and 6.77 respectively and BATTLE1 on Battle Creek at river mile 0.04.

**Dark Canyon Creek - Summary of CTUIR stream monitoring within the lower 2 miles of 2009 to 2016**

In late July 2010, fish habitat enhancements were implemented by CTUIR along 1.9 miles of Dark Canyon Creek and 1 mile of Meadow Creek within the boundaries of the Cunha Ranch. The project area is located near Starkey, Oregon in the Upper Grande Ronde Subbasin. The project legal description is Township 3 South, Range 35 East, portions of Sections 24, 25, and 36, Willamette Meridian, Union County Tax Lot 500. Approximately 150 pieces of large wood were added to Dark Canyon Creek and Meadow Creek in existing pools, or placed in a manner to create pool habitat and provide in-stream habitat complexity. The objective of the large wood additions was to contribute to floodplain formation and stability by increasing roughness, slowing water velocities, and trapping sediment. Furthermore, large wood was used in order to increase pool habitat quality and quantity and to provide thermal and predatory refuge for aquatic species including the aforementioned ESA listed fish species.

In 2012 CTUIR, in cooperation with the landowner and NRCS, developed four off-channel springs for livestock watering, and constructed 3.6 miles of pasture fence. Additional riparian corridor fencing is scheduled for fall/winter 2016-2017 along Dark Canyon Creek and Meadow Creek to exclude livestock and protect riparian habitat. The 3,000 acre ranch, along with 2 miles of Dark Canyon Creek and 1 mile of Meadow Creek was protected under a permanent conservation easement in 2015 under the CTUIR-BPA Accord in cooperation with Blue Mountain Land Trust.

Since August 2009, the CTUIR Grande Ronde Fish Habitat program has monitored water temperature at two locations within Dark Canyon Creek – an upper probe site (DC2) at river mile 1.9 and a lower probe site (DC1) at river mile 0.06. Temperatures at these two sites with the exception of 2009 were monitored from April to October each year and starting in 2016 temperatures will be monitored throughout the year.

Diurnal fluctuations in water temperature are less in 2016 than those recorded in 2010, pre-project, during construction and immediately following construction) at the lower probe site (river mile 0.06), but are similar at the upper probe site (river mile 1.9). This may indicate a possible cooling effect through the project area seen in 2016 that is not present in 2010 (see Figure 29 & 30).

A possible cooling trend is also evident when exploring summary values for stream temperatures in Tables 8 & 9. In 2010 the 308 records of temperatures >=20°C were recorded with similar distribution of values at both upper and lower sites with 52.6% of those records recorded at the upper site compared to 47.4% at the lower. This similarity is not present by 2016 where the upper site records 100 % of the 175 >=20°C records.

From the temperature data collected since 2009, it is evident that water entering the project area has been increasing in the number of >=20°C records (see Figure 31). However, it is beyond the scope of this monitoring effort and these data to explain why this is occurring. The scope of inference for these data is restricted to the project area (the lower 1.9 miles of Dark Canyon Creek), but within that scope it can be demonstrated that following fish habitat restoration actions there is a cooling trend through the project area.

**FIGURE 29 PLOT OF DIURNAL FLUCTUATIONS IN WATER TEMPERATURE AT THE UPPER PROBE SITE (RIVER MILE 1.9) FOR 2010 AND 2016. ALTHOUGH THERE IS A SLIGHT SKEW IN TIMING OF PEAK TEMPERATURES THE DIURNAL FLUCTUATION ARE VERY SIMILAR FOR THESE TWO YEARS.**

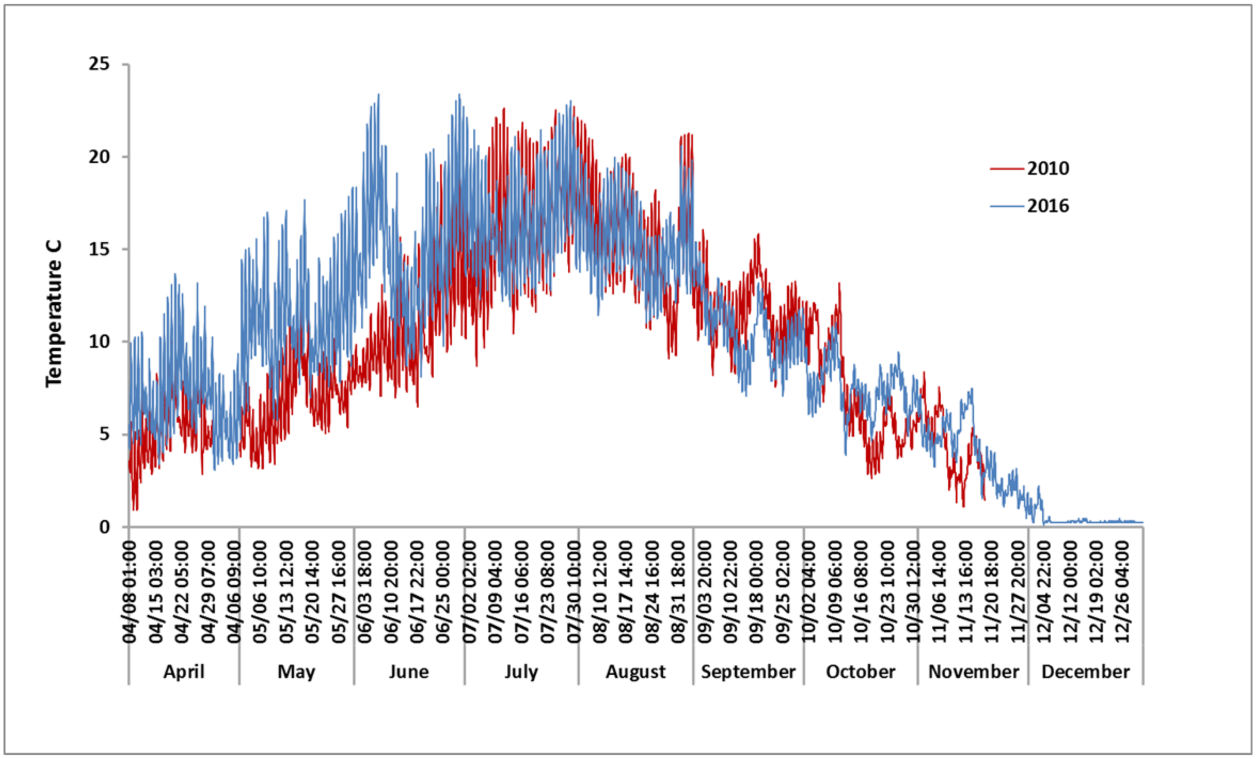


**FIGURE 30 PLOT OF THE DIURNAL FLUCTUATION IN WATER TEMPERATURE AT THE LOWER PROJECT SITE (RIVER MILE 0.06) FOR 2010 AND 2016. PLOT SHOWS THE REDUCTION IN DIURNAL FLUCTUATIONS OF WATER TEMPERATURE RECORDED AT THIS SITE IN 2016 COMPARED TO THE PRE-PROJECT/ DATA OF 2010.**

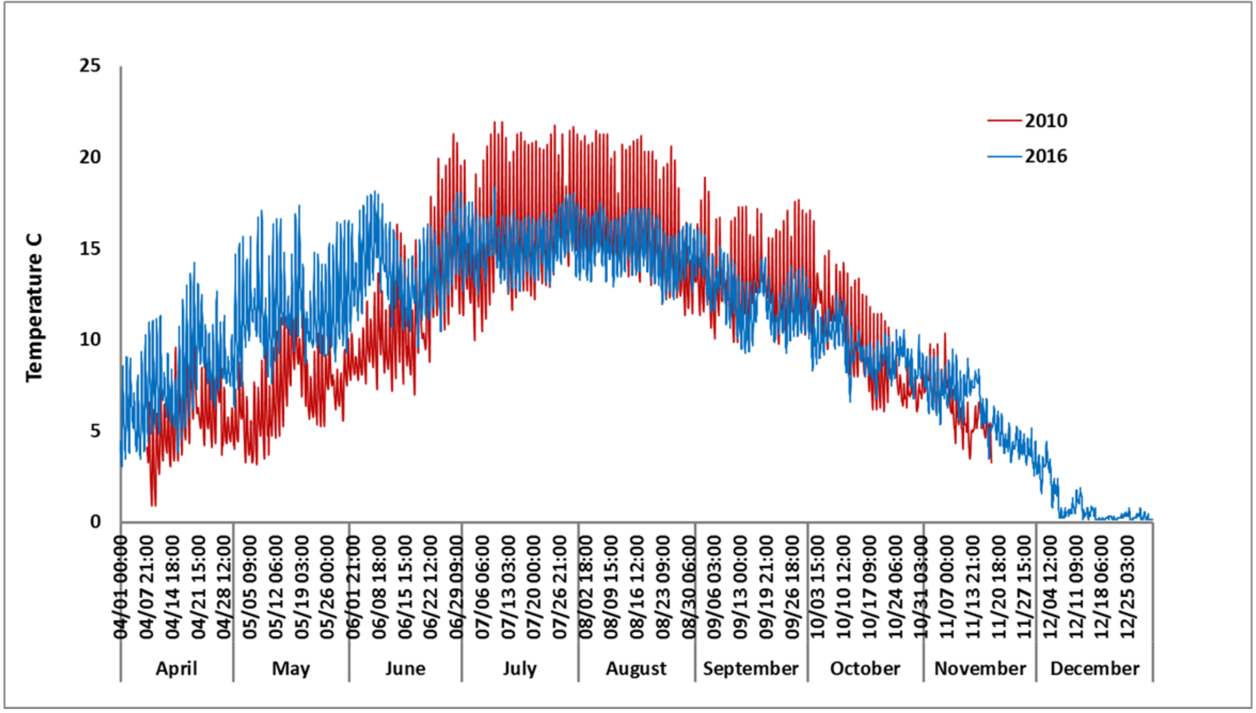



**TABLE 7 SUMMARY METRIC FOR WATER TEMPERATURE PROBES AT TWO SITES ALONG DARK CANYON CREEK FROM 2010 TO 2016. SHADED AREA IS THE LOWER PROJECT SITE.**

| Stream | Location Name | River mile | Year | # of Days Deployed | # of Hours for Analysis | Max Temperature (° C) | Hours >=25 ° C | Hours >=20 ° C | Hrs. at 10 - 15.6 ° C | % at 10 - 15.6 ° C | Mean daily >=17.8 ° C (# days) | % of deployment when Mean daily >=17.8 ° C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dark Canyon Creek | DC1 | 0.06 | 2009 | 106 | 2544 | 23.1 | 0 | 93 | 874 | 34.4 | 1 | 0.9 |
| Dark Canyon Creek | DC1 | 0.06 | 2010 | 226 | 5398 | 22 | 0 | 146 | 2156 | 39.9 | 0 | 0.0 |
| Dark Canyon Creek | DC1 | 0.06 | 2011 | 145 | 3480 | 20.9 | 0 | 36 | 2120 | 60.9 | 0 | 0.0 |
| Dark Canyon Creek | DC1 | 0.06 | 2012 | 191 | 4536 | 24.2 | 0 | 75 | 2204 | 48.6 | 2 | 1.0 |
| Dark Canyon Creek | DC1 | 0.06 | 2013 | 215 | 5161 | 24.4 | 0 | 154 | 1988 | 38.5 | 5 | 2.3 |
| Dark Canyon Creek | DC1 | 0.06 | 2014 | 217 | 5184 | 20.3 | 0 | 11 | 2345 | 45.2 | 3 | 1.4 |
| Dark Canyon Creek | DC1 | 0.06 | 2015 | 166 | 3984 | 20.8 | 0 | 22 | 1969 | 49.4 | 3 | 1.8 |
| Dark Canyon Creek | DC1 | 0.06 | 2016 | 275.5 | 6612 | 18.4 | 0 | 0 | 3033 | 45.9 | 0 | 0.0 |
| Dark Canyon Creek | DC2 | 1.9 | 2009 | 106 | 2544 | 22.3 | 0 | 43 | 789 | 31.0 | 2 | 1.9 |
| Dark Canyon Creek | DC2 | 1.9 | 2010 | 226 | 5399 | 22.7 | 0 | 162 | 1761 | 32.6 | 6 | 2.7 |
| Dark Canyon Creek | DC2 | 1.9 | 2011 | 145 | 3480 | 22.0 | 0 | 85 | 1618 | 46.5 | 4 | 2.8 |
| Dark Canyon Creek | DC2 | 1.9 | 2012 | 191 | 4535 | 23.8 | 0 | 227 | 1702 | 37.5 | 20 | 10.5 |
| Dark Canyon Creek | DC2 | 1.9 | 2013 | 215 | 5161 | 24.9 | 0 | 257 | 1632 | 31.6 | 17 | 7.9 |
| Dark Canyon Creek | DC2 | 1.9 | 2014 | 217 | 5184 | 24.7 | 0 | 307 | 1704 | 32.9 | 29 | 13.4 |
| Dark Canyon Creek | DC2 | 1.9 | 2015 | 166 | 3984 | 24.4 | 0 | 180 | 1460 | 36.6 | 14 | 8.4 |
| Dark Canyon Creek | DC2 | 1.9 | 2016 | 276 | 6611 | 23.4 | 0 | 175 | 2087 | 31.6 | 11 | 4.0 |

**FIGURE 31 PLOT OF THE NUMBER OF WATER TEMPERATURES >=20°C ON DARK CANYON CREEK. PLOTTED TREND LINE DEMONSTRATES THAT OVERALL WARMER WATERS ARE ENTERING THE PROJECT AREA EACH YEAR (RED BARS), BUT THIS WATER IS COOLING AS IT MOVES THROUGH THE PROJECT AREA TO THE LOWER PROBE SITE (BLUE BARS).**

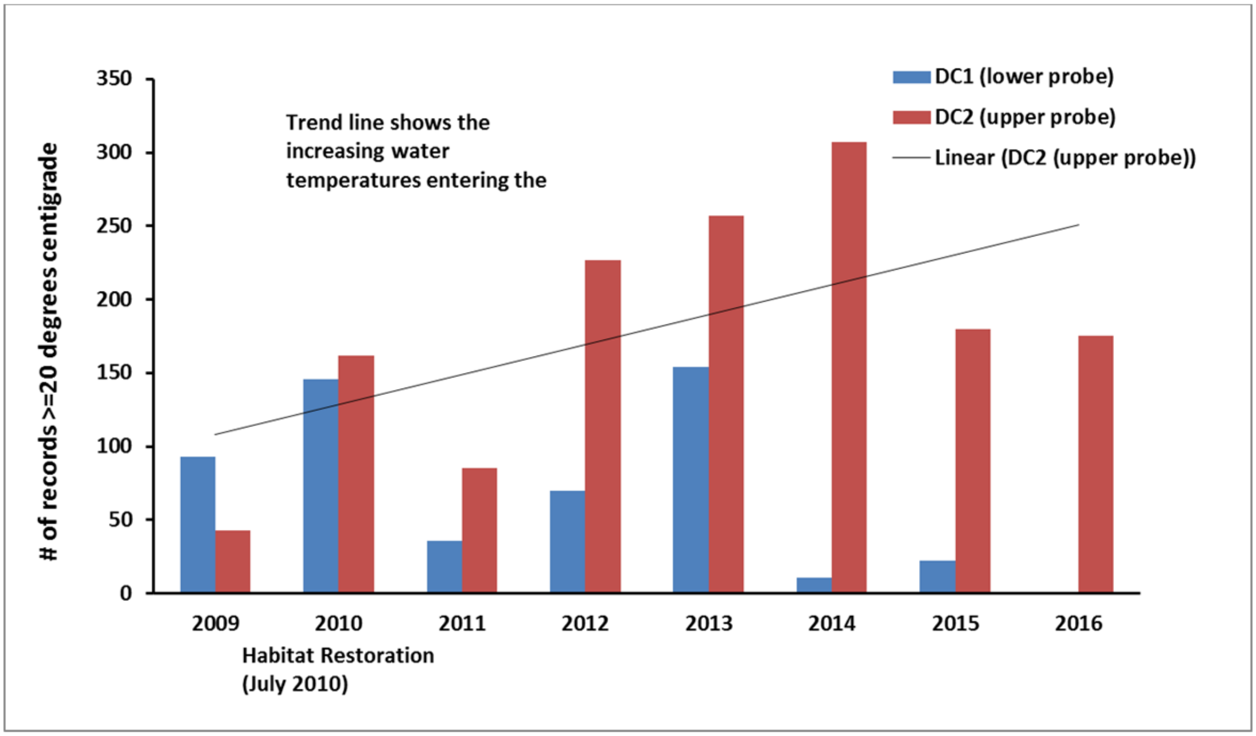
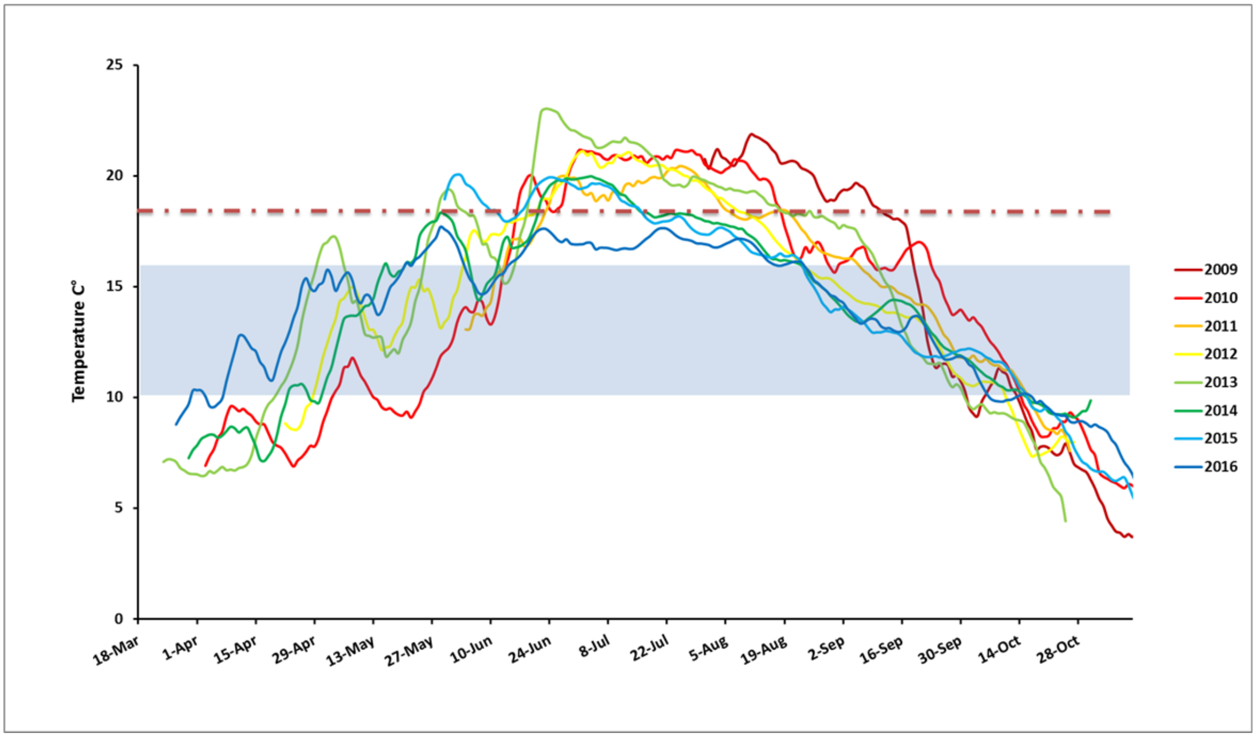


**FIGURE 32 7 DAY AVERAGE DAILY MAXIMUM TEMPERATURES (7DADM) FOR DARK CANYON (LOWER), YEARS 2009 TO 2016.. COLOR GRADIENT INDICATES PRE-PROJECT (2009-2010; RED) TO POST PROJECT CONDITIONS (2010-2016; BLUE). BLUE BOX IS IDEAL TEMPERATURES FOR JUVENILE CHINOOK (10-15.6°C) AND RED DASHED LINE IS UPPER LIMIT FOR JUVENILE REARING AND MIGRATION (18°C).**




## McCoy Creek

There were a total of 16,042 hours of data from 3 probes for the analysis collected between 4/28/2016 and 12/31/2016. Combining the data for the probes gave a total of 4,011 hours when water temperature was between 10ºC and 15.6ºC (an average of 24.8% of the data). Data for the upper (McCoy 1) and middle site (McCoy 6) were corrupt and removed for the months of May and June.

- A total of 250 hours logged when temperatures reached 25ºC or higher.
  - The upper site on McCoy Creek in 2016 had the highest maximum temperature (29.3 ºC), the greatest number of records at lethal limits (200 hrs), the greatest number of records where temperatures were >=20 °C (911 hrs) and the greatest percent time in 10-15.6 °C range compared to the other 2 sites (27.9%).
  - The upper site had the second highest maximum temperature since 2010 (2013 being the one year that was warmer), while the middle site had the lowest maximum and the lower site had the second lowest maximum since 2010
  - The most downstream site had the third highest number of temperature records >=20ºC and the second highest >=25ºC since 2010 (2013 being the one year that lower and middle sites respectively had a higher number of records).

- The mid property site had the lowest percent time in 10-15.6ºC range compared to records from that site since 2010.
- The upper site had the lowest number of days with a daily mean >=17.8ºC, while the middle site had the second lowest and the lower site had the third highest number of days with a daily mean >=17.8°C since 2010
- There were a total of 1,893 records of temperatures >= 20°C,
  - MCCOY1 recording 400 hours,
  - MCCOY6 recording 582 hours,
  - MCCOY7 recording 911 hours.
- Mean daily temperatures were >=17.8ºC on a maximum of 65 days at river mile 0.1 (see Table 9).

**FIGURE 33 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG MCCOY CREEK DURING 2016.**

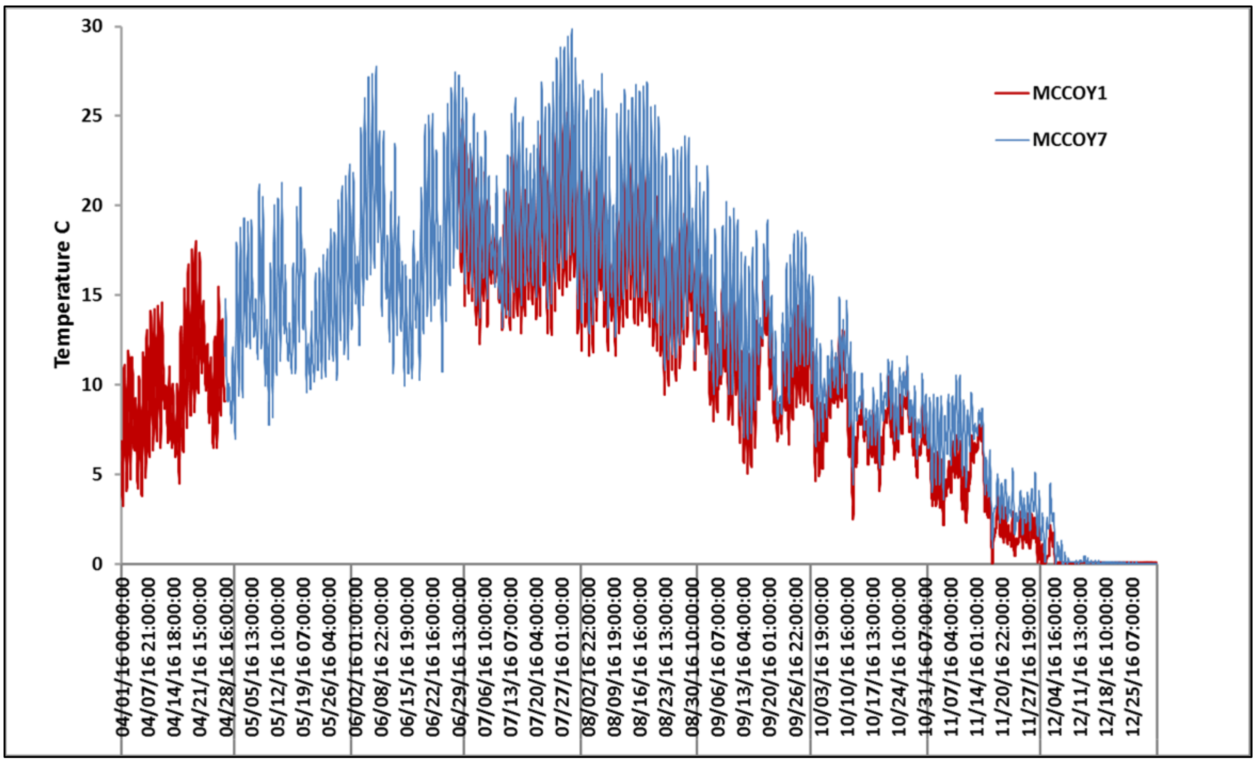
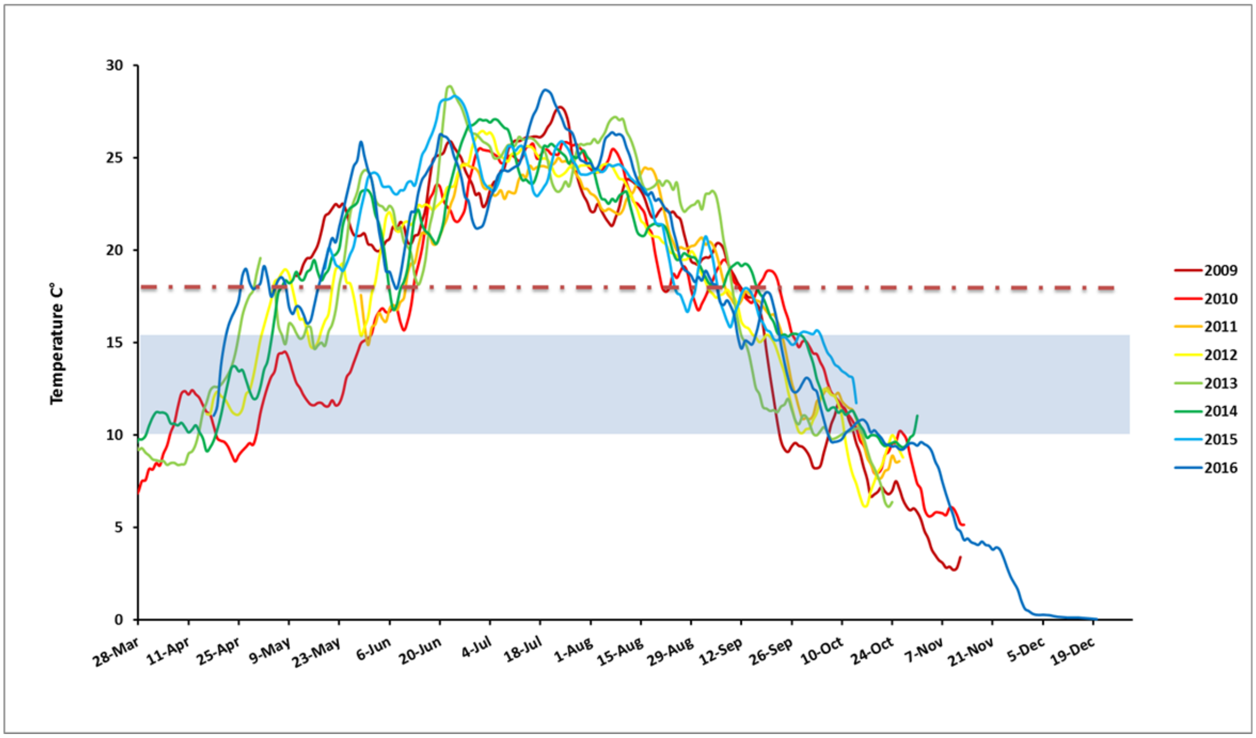


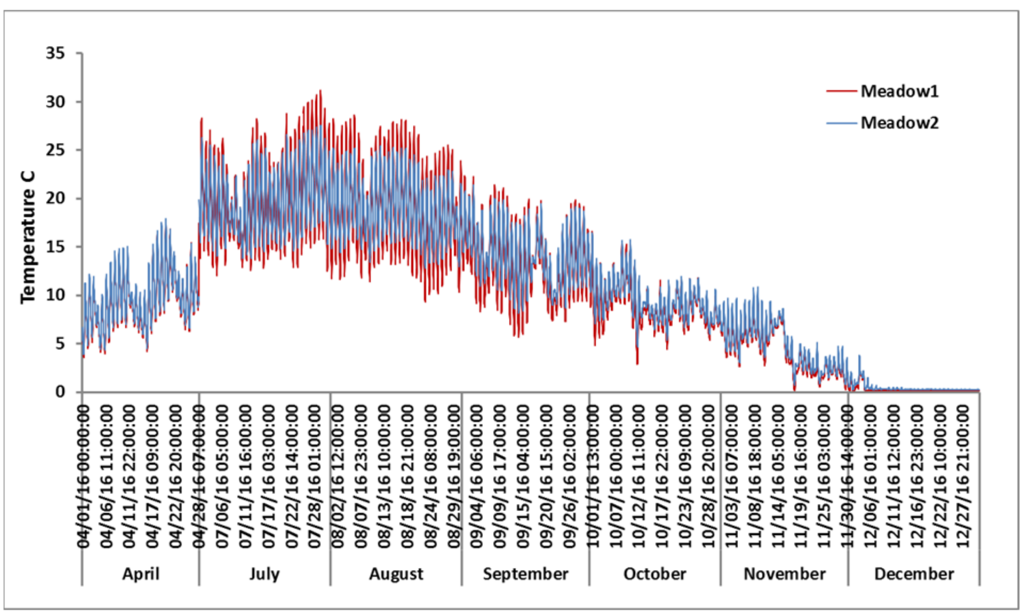
**FIGURE 34** **7 DAY AVERAGE DAILY MAXIMUM TEMPERATURES (7DADM) FOR MCCOY CREEK (RIVER MILE 0.1), YEARS 2009 TO 2016.. COLOR GRADIENT INDICATES PRE-PROJECT (2009-2010; RED) TO POST PROJECT CONDITIONS (2010-2016; BLUE). BLUE BOX IS IDEAL TEMPERATURES FOR JUVENILE CHINOOK (10-15.6°C) AND RED DASHED LINE IS UPPER LIMIT FOR JUVENILE REARING AND MIGRATION.**




## Meadow Creek

The probe at river mile 2.9 (MEADOW1) was deployed for 275 days between 3/31/2016 and 12/31/2016 and the probe at river mile 1.5 (MEADOW2) was deployed for 275 days between 3/31/2016 and 12/31/2016. They recorded a total 10,232 hours of data for the analysis.

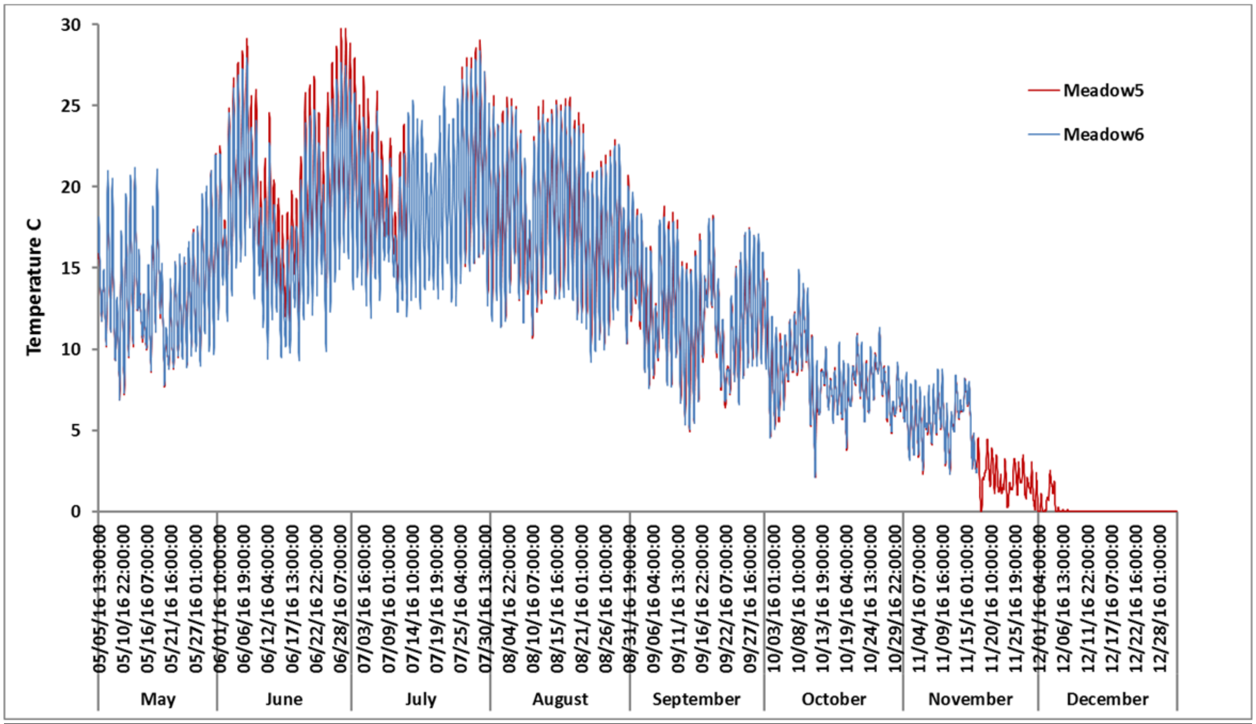
**FIGURE 35** **DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ALONG MEADOW CREEK DURING 2016.**



*Meadow Creek Habberstad Property*

Two probes were deployed on Meadow Creek within the Habberstad restoration project. These probes were at river mile 7.53 (MEADOW5), and 6.77 (MEADOW6) and were deployed for 240 and196 days respectively from 5/5/2016 to 11/17/2016 for a total of 10,187 hours for analysis.

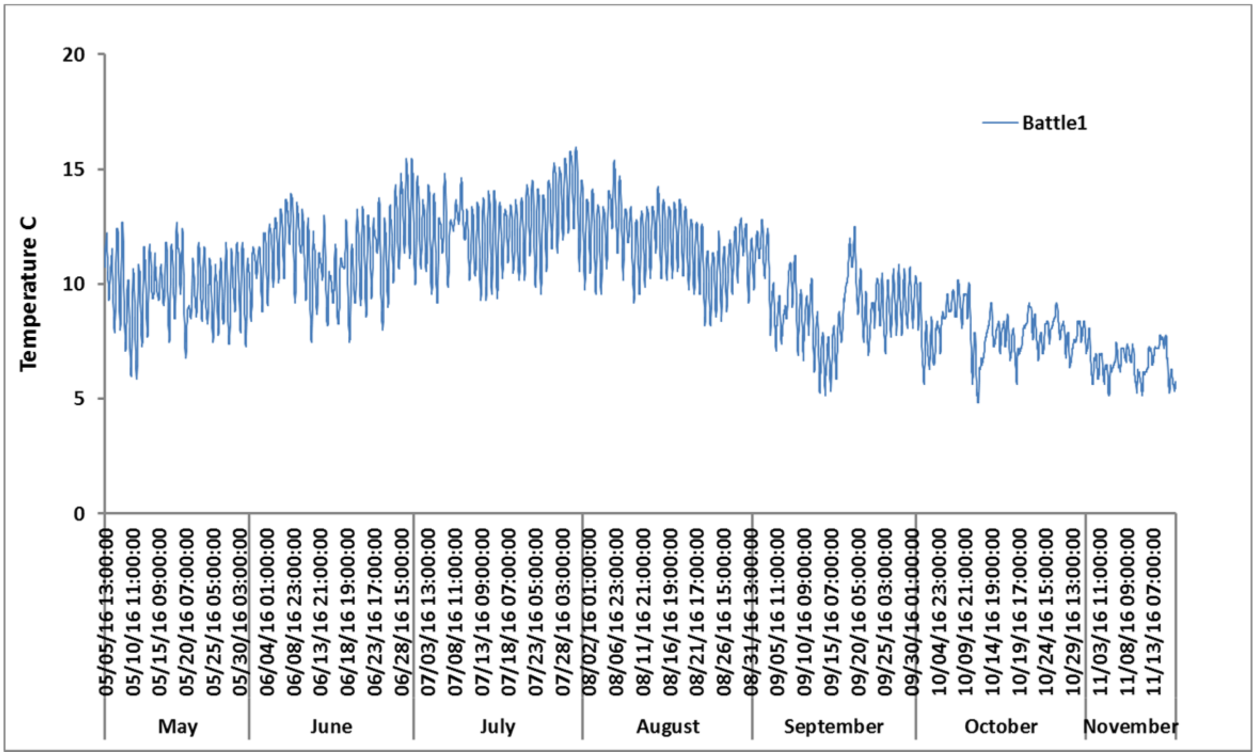
**FIGURE 36 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE AT TWO LOCATIONS ON MEADOW CREEK DURING 2016 WITHIN THE HABBERSTAD PROJECT AREA.**



*Battle Creek - Habberstad*

There was one probe deployed on Battle Creek during 2016 at river mile 0.04 between 5/5/2016 and 11/17/2016 for a total of 4,702 hours for analysis.

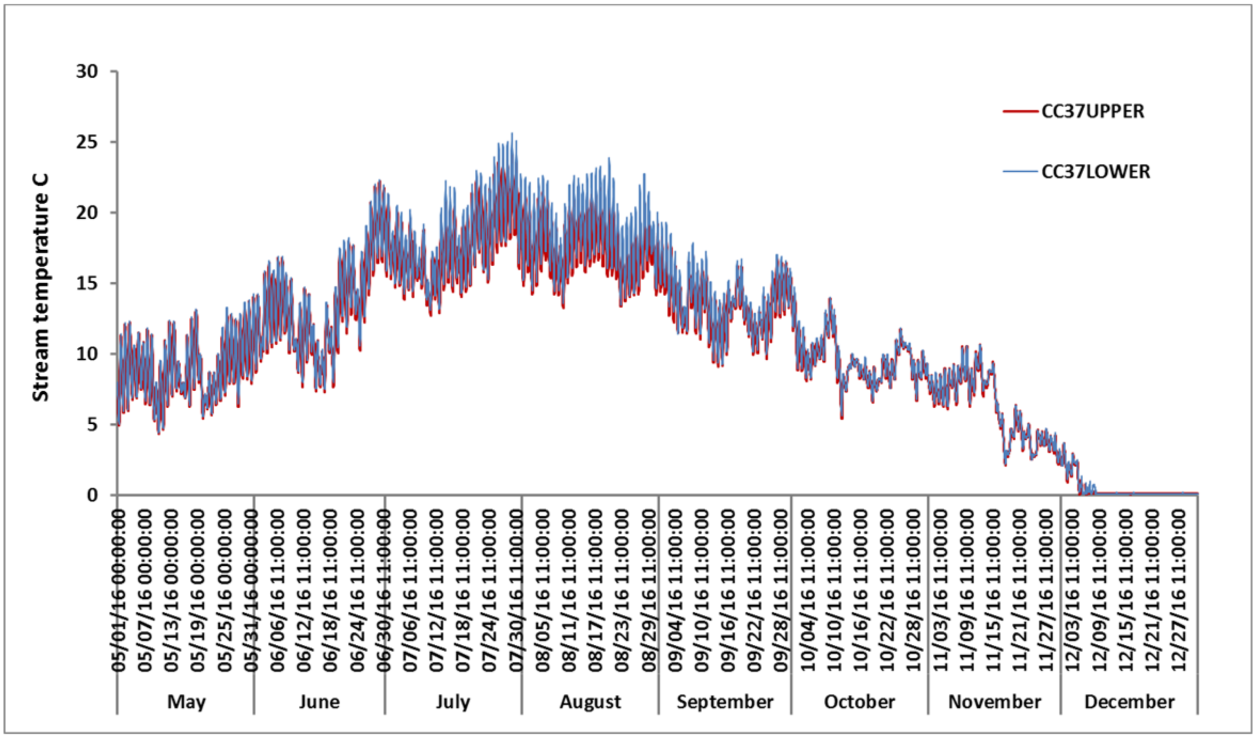
**FIGURE 37 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON BATTLE CREEK DURING 2016 WITHIN THE HABBERSTAD PROJECT AREA.**



## Catherine Creek 37

Two probes were deployed within the boundaries of the Catherine Creek (RM37) project in order to monitor the CC37 Fish Habitat Enhancement Project, constructed July-August, 2012. The upper probe at river mile 37 had 6,013 hours for analysis compared to the lower probe at river mile 36 (6,003 hours). Lethal limits were recorded for 0hours at the upper probe and 6 hours at the lower probe.

**FIGURE 38 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON CATHERINE CREEK (CC37) DURING 2016.**



## Catherine Creek 44

To monitor water quality (temperature) within the Catherine Creek River Mile 44 (CC44) Project area, CTUIR deployed 13 Hobo Pendant temperature probes within the boundaries of several property owners. The 13 probes were deployed from 3/30/2016 to 12/31/2016 with a range of 142-276 days and a total of 65,412 hours recorded for analysis. There were no lethal hours recorded in 2016.

**FIGURE 39 DIURNAL FLUCTUATIONS IN WATER TEMPERATURE ON CATHERINE CREEK (CC44) DURING 2016.**

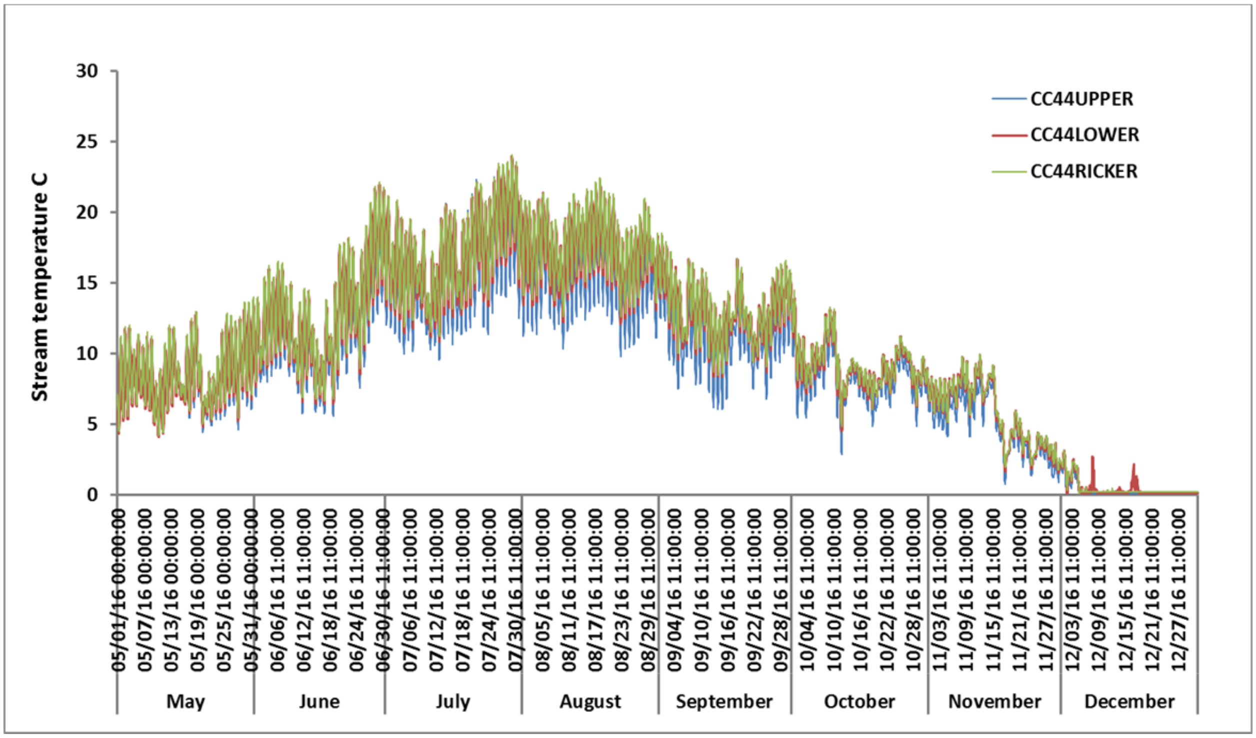



**FIGURE 40 MEAN STREAM TEMPERATURE IN CATHERINE CREEK (SOCROWLOWER) AND FLOODPLAIN FEATURE (ALCOVE) IN FIRST YEAR OF ACTIVATION WITH JUVENILE REARING PERIODS HIGHLIGHTED SHOWING STREAM TEMPERATURE ATTENUATION AT THE SOUTHERN CROSS PROJECT IN 2016.**

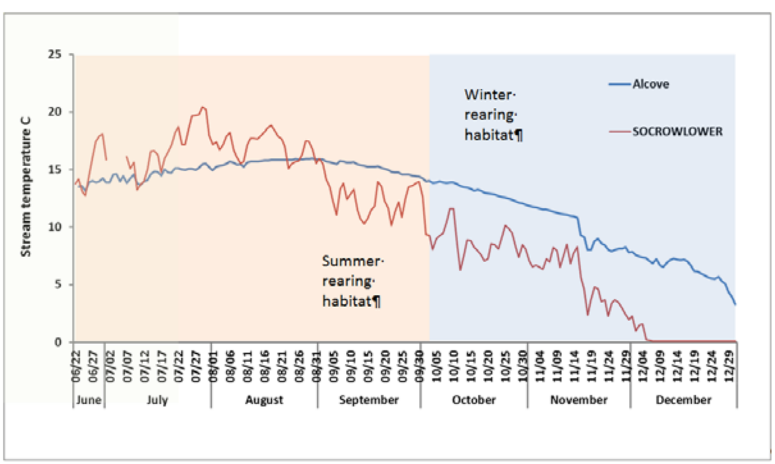


TABLE 8 WATER TEMPERATURE PROBE METRICS FOR 45 SITES IN THE UPPER GRANDE RONDE, MAINSTEM GRANDE RONDE, ROCK CREEK, MEADOW CREEK, DARK CANYON CREEK, MCCOY CREEK, AND CATHERINE CREEK SUB-WATERSHEDS DURING 2016.

| Stream | Location Name | River mile | Year | Start date | End date | # of Days Deployed | # Hours in Deployment Period | # of Hours for Analysis | Max Temperature (° C) | Hours >=25 ° C | Hours >=20 ° C | Hrs. at 10 - 15.6 ° C | % at 10 - 15.6 ° C | Mean daily >=17.8 ° C (# days) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Battle Creek | BATTLE1 | 0.0 | 2016 | 5/5/2016 | 11/17/2016 | 196 | 4704 | 4702 | 16.0 | 0 | 0 | 2396 | 51.0 | 0 |
| Catherine Creek | CC37LOWER | 36.0 | 2016 | 4/25/2016 | 12/31/2016 | 250 | 6000 | 6003 | 25.6 | 0 | 457 | 1710 | 28.5 | 42 |
| Catherine Creek | CC37UPPER | 37.0 | 2016 | 4/25/2016 | 12/31/2016 | 250 | 6000 | 6013 | 24.2 | 0 | 302 | 1829 | 30.4 | 32 |
| Catherine Creek | CC44LOWER | 40.0 | 2016 | 4/25/2016 | 12/31/2016 | 250 | 6000 | 6012 | 24.0 | 0 | 261 | 1818 | 30.2 | 23 |
| Catherine Creek | CC44RICKER1 | 38.0 | 2016 | 4/25/2016 | 12/31/2016 | 250 | 6000 | 6012 | 24.1 | 0 | 310 | 1780 | 29.6 | 27 |
| Catherine Creek | CC44UPPER | 44.0 | 2016 | 5/16/2016 | 12/31/2016 | 229 | 5496 | 5508 | 23.9 | 0 | 166 | 1786 | 32.4 | 5 |
| Catherine Creek | LowerNewChannel | 41.0 | 2016 | 6/6/2016 | 12/31/2016 | 208 | 4992 | 4998 | 24.2 | 0 | 270 | 1543 | 30.9 | 19 |
| Catherine Creek | SCMID | 41.2 | 2016 | 6/22/2016 | 12/31/2016 | 192 | 4608 | 4355 | 24.3 | 0 | 256 | 1198 | 27.5 | 20 |
| Catherine Creek | SCPool#1 | 41.3 | 2016 | 7/20/2016 | 12/31/2016 | 164 | 3936 | 3944 | 24.2 | 0 | 202 | 1032 | 26.2 | 15 |
| Catherine Creek | SCPool#2 | 40.9 | 2016 | 8/11/2016 | 12/31/2016 | 142 | 3408 | 3425 | 22.5 | 0 | 70 | 874 | 25.5 | 6 |
| Catherine Creek | Side_Channel1 | 41.0 | 2016 | 6/21/2016 | 12/31/2016 | 193 | 4632 | 4618 | 22.2 | 0 | 124 | 1528 | 33.1 | 8 |
| Catherine Creek | SOCROWLOWER | 40.9 | 2016 | 3/30/2016 | 12/31/2016 | 276 | 6624 | 6490 | 24.2 | 0 | 250 | 1748 | 26.9 | 19 |
| Catherine Creek | SOCROWUPPER | 41.6 | 2016 | 3/30/2016 | 12/31/2016 | 276 | 6624 | 6622 | 24.0 | 0 | 233 | 1850 | 27.9 | 12 |
| Catherine Creek | Swale2Pool | 41.4 | 2016 | 6/6/2016 | 12/31/2016 | 208 | 4992 | 5004 | 18.1 | 0 | 0 | 1661 | 33.2 | 1 |
| Catherine Creek | Swale6Pool | 41.0 | 2016 | 6/6/2016 | 12/31/2016 | 208 | 4992 | 4164 | 19.7 | 0 | 0 | 1205 | 28.9 | 3 |

| Stream | Location Name | River mile | Year | Start date | End date | # of Days Deployed | # Hours in Deployment Period | # of Hours for Analysis | Max Temperature (° C) | Hours >=25 ° C | Hours >=20 ° C | Hrs. at 10 - 15.6 ° C | % at 10 - 15.6 ° C | Mean daily >=17.8 ° C (# days) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catherine Creek | UpperNewChannel | 41.4 | 2016 | 6/6/2016 | 12/31/2016 | 208 | 4992 | 4260 | 24.0 | 0 | 233 | 1577 | 37.0 | 15 |
| Dark Canyon Creek | DC1 | 0.1 | 2016 | 3/31/2016 | 12/31/2016 | 276 | 6612 | 6612 | 18.4 | 0 | 0 | 3033 | 45.9 | 0 |
| Dark Canyon Creek | DC2 | 1.9 | 2016 | 3/31/2016 | 12/31/2016 | 276 | 6612 | 6611 | 23.4 | 0 | 175 | 2087 | 31.6 | 11 |
| Grande Ronde River | BTS1 | 169.3 | 2016 | 6/22/2016 | 10/31/2016 | 131 | 3143 | 3144 | 30.6 | 242 | 834 | 835 | 26.6 | 64 |
| Grande Ronde River | BTS2 | 169.1 | 2016 | 6/22/2016 | 10/31/2016 | 131 | 3142 | 3136 | 30.0 | 236 | 847 | 801 | 25.5 | 64 |
| Grande Ronde River | BTS3 | 168.7 | 2016 | 6/22/2016 | 12/31/2016 | 192 | 4605 | 4616 | 27.5 | 23 | 472 | 1245 | 27.0 | 45 |
| Grande Ronde River | BTS4 | 168.6 | 2016 | 6/22/2016 | 12/31/2016 | 192 | 4605 | 4616 | 27.8 | 63 | 594 | 1213 | 26.3 | 48 |
| Grande Ronde River | BTS5 | 168.6 | 2016 | 6/22/2016 | 12/31/2016 | 192 | 4605 | 4616 | 30.2 | 245 | 880 | 818 | 17.7 | 64 |
| Grande Ronde River | BTS6 | 0.1 | 2016 | 6/22/2016 | 12/31/2016 | 191 | 4591 | 4615 | 18.9 | 0 | 0 | 2255 | 48.9 | 0 |
| Grande Ronde River | GR1 | 176.2 | 2016 | 4/28/2016 | 12/31/2016 | 247 | 5928 | 4495 | 29.9 | 98 | 426 | 1138 | 25.3 | 29 |
| Grande Ronde River | GR10 | 169.6 | 2016 | 5/2/2016 | 12/31/2016 | 243 | 5832 | 5841 | 30.0 | 247 | 1058 | 1483 | 25.4 | 72 |
| Grande Ronde River | GR11 | 186.6 | 2016 | 5/5/2016 | 12/31/2016 | 241 | 5773 | 5773 | 27.1 | 33 | 472 | 1708 | 29.6 | 32 |

| Stream | Location Name | River mile | Year | Start date | End date | # of Days Deployed | # Hours in Deployment Period | # of Hours for Analysis | Max Temperature (° C) | Hours >=25 ° C | Hours >=20 ° C | Hrs. at 10 - 15.6 ° C | % at 10 - 15.6 ° C | Mean daily >=17.8 ° C (# days) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Grande Ronde River** | GR12 | 186.0 | 2016 | 5/5/2016 | 12/31/2016 | 240 | 5760 | 4769 | 29.4 | 55 | 392 | 1213 | 25.4 | 28 |
| **Grande Ronde River** | GR3 | 174.7 | 2016 | 4/28/2016 | 12/31/2016 | 247 | 5928 | 2820 | 30.3 | 157 | 498 | 781 | 41.2 | 35 |
| **Grande Ronde River** | GR4 | 194.2 | 2016 | 5/5/2016 | 12/31/2016 | 240 | 5760 | 5772 | 28.3 | 59 | 575 | 1509 | 26.1 | 34 |
| **Grande Ronde River** | GR5 | 199.7 | 2016 | 5/5/2016 | 12/31/2016 | 240 | 5760 | 5538 | 20.9 | 0 | 14 | 1376 | 24.8 | 0 |
| **Grande Ronde River** | GR9 | 182.5 | 2016 | 4/28/2016 | 12/31/2016 | 247 | 5928 | 4784 | 28.7 | 81 | 482 | 1197 | 25.0 | 33 |
| **McCoy Creek** | MCCOY1 | 2.7 | 2016 | 3/31/2016 | 12/31/2016 | 275 | 6600 | 5118 | 25.7 | 11 | 400 | 1278 | 25.0 | 31 |
| **McCoy Creek** | MCCOY6 | 1.5 | 2016 | 3/31/2016 | 12/31/2016 | 275 | 6600 | 4985 | 26.8 | 39 | 582 | 1075 | 21.6 | 49 |
| **McCoy Creek** | MCCOY7 | 0.1 | 2016 | 4/28/2016 | 12/31/2016 | 247 | 5928 | 5939 | 29.9 | 200 | 911 | 1658 | 27.9 | 65 |
| **Meadow Creek** | Meadow1 | 2.9 | 2016 | 4/1/2016 | 12/31/2016 | 274 | 6576 | 5115 | 31.2 | 235 | 654 | 1203 | 23.5 | 50 |
| **Meadow Creek** | MEADOW2 | 1.5 | 2016 | 4/1/2016 | 12/31/2016 | 274 | 6576 | 5117 | 27.6 | 87 | 664 | 1151 | 22.5 | 55 |
| **Meadow Creek** | MEADOW5 | 7.5 | 2016 | 5/5/2016 | 12/31/2016 | 240 | 5760 | 5485 | 29.8 | 176 | 742 | 1415 | 25.8 | 52 |
| **Meadow Creek** | MEADOW6 | 6.8 | 2016 | 5/5/2016 | 11/17/2016 | 196 | 4704 | 4702 | 28.4 | 106 | 811 | 1594 | 33.9 | 57 |
| **Meadow Creek** | MEADOW4 | 0.2 | 2016 | 3/31/2016 | 7/21/2016 | 112 | 2688 | 858 | 22.8 | 0 | 40 | 260 | 30.3 | 1 |
| **Rock Creek** | RockAllen | 7.0 | 2016 | 5/16/2016 | 10/16/2016 | 153 | 3672 | 3672 | 31.5 | 222 | 653 | 1430 | 38.9 | 40 |
| **Rock Creek** | ROCK1 | 0.2 | 2016 | 5/4/2016 | 12/31/2016 | 241 | 5784 | 5697 | 33.3 | 348 | 896 | 1724 | 30.3 | 63 |

| Stream | Location Name | River mile | Year | Start date | End date | # of Days Deployed | # Hours in Deployment Period | # of Hours for Analysis | Max Temperature (° C) | Hours >=25 ° C | Hours >=20 ° C | Hrs. at 10 - 15.6 ° C | % at 10 - 15.6 ° C | Mean daily >=17.8 ° C (# days) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rock Creek** | ROCK2 | 1.7 | 2016 | 5/4/2016 | 8/2/2016 | 90 | 2160 | 2166 | 24.4 | 0 | 226 | 944 | 43.6 | 20 |
| **Rock Creek** | ROCK3 | 3.0 | 2016 | 5/4/2016 | 6/30/2016 | 57 | 1368 | 1364 | 25.9 | 7 | 104 | 785 | 57.6 | 4 |
| **Rock Creek** | ROCK4 | 4.5 | 2016 | 5/4/2016 | 12/31/2016 | 241 | 5784 | 5473 | 24.1 | 0 | 81 | 2278 | 41.6 | 4 |

## Lessons Learned/Adaptive Management

The Grande Ronde Subbasin is one example of efforts to learn and adapt management programs through time. Historically, basin partners developed projects in an opportunistic approach. Projects were largely identified and developed with willing landowners based on course scale planning established through the Grande Ronde Subbasin plan completed in 2004. In 2013, basin partners initiated a strategic planning process (ATLAS) for Catherine Creek and the upper Grande Ronde watershed based on salmon and steelhead life history requirements to stratify the watersheds by biological significant reaches, assign relative importance of limiting factors, define key actions to address limiting factors, and develop a ranking and prioritization system to clearly identify geographic and reach priorities and both short and long term strategies to focus watershed restoration actions in areas with the most biological need and the highest probability of benefit. The process engaged multiple basin partners and leveraged the best available science and local expertise available to develop a road map that all partners can utilize to identify, develop, and implement strategic watershed and fish habitat restoration and enhancement projects. Transitioning opportunistic to strategic planning may be one of the most important adaptive management changes employed in the basin for prioritizing and strategizing work in Catherine Creek and the Grande Ronde river to address survival gaps for Snake River Spring-Summer Chinook and Summer Steelhead populations in the Grande Ronde Subbasin.

Additionally, the CTUIR Grande Ronde Fish Habitat Project continues to monitor and evaluate performance of projects and conservation measures developed to improve watershed and fishery resources in the Grande Ronde Subbasin. Post project construction and monitoring data, along with staff experience and collaboration with basin partners, collectively informs and helps improve our understanding of how different techniques and approaches to watershed and habitat restoration respond as well as develop new and innovative approaches to addressing habitat limiting factors for salmon and steelhead populations.

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