8. Appendices

A. *MAMP*

Coquille Working Landscapes Project Monitoring and Adaptive Management Plan

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1. Introduction

1.1 Background

The U.S. Fish and Wildlife Service Wildlife and Sport Fish Restoration Program (Service), Oregon Watershed Enhancement Board (OWEB), and partners seek to restore habitat to benefit federally-listed Oregon Coast coho salmon through the Coquille Working Landscapes Project (Project). The primary intent of the Project is to restore tidally-influenced palustrine emergent and scrub-shrub wetlands through the replacement of a failing multiple tide gate water control structure and the construction of a large dendritic network of tidally influenced channels. These efforts improve the ability to manage water movements on the landscape yearlong, including the critical period during late fall and winter flooding. The Project is anticipated to provide substantive ecological benefits for fish and wildlife species using the Project area reach within the Coquille River Valley floodplain.

Beginning in the late 19^{th} and early 20^{th} centuries, the Project site was cleared, bermed, and drained for agriculture. Land was substantially altered from its historical state as a freshwater tidal, forested marsh into a drained pasture used seasonally for grazing. Due to the low elevation topography of the Project area and high fluctuations in water surface levels of the Coquille River from a combination of tidal influence and river flows, China Camp Creek was channelized into straight drainage networks and substantial infrastructure was installed throughout the site to make sites usable for agricultural purposes. This resulted in reduced habitat diversity, reduced floodplain connectivity, and altered thermal regimes.

Project partners and the community want to maintain current land use practices and private ownership, but also recognize the need to improve fish and wildlife conditions. To achieve both of those objectives, this Project uses a ‘Working Landscape’ model, which integrates agricultural activities with ecosystem services. The proposed Project would largely restore the 400-acre Winter Lake area owned by Oregon Department of Fish and Wildlife (ODFW) and the China Creek Gun Club (CCGC) (Unit 2), and improve the river floodplain connectivity in the remaining 1,300 acres of privately owned pastures in Units 1 and 3 (Figures 1 and 2). The overarching goal is to reestablish tidal processes to all three management units in the winter months, and gain the ability to manage water flows independently throughout the year.

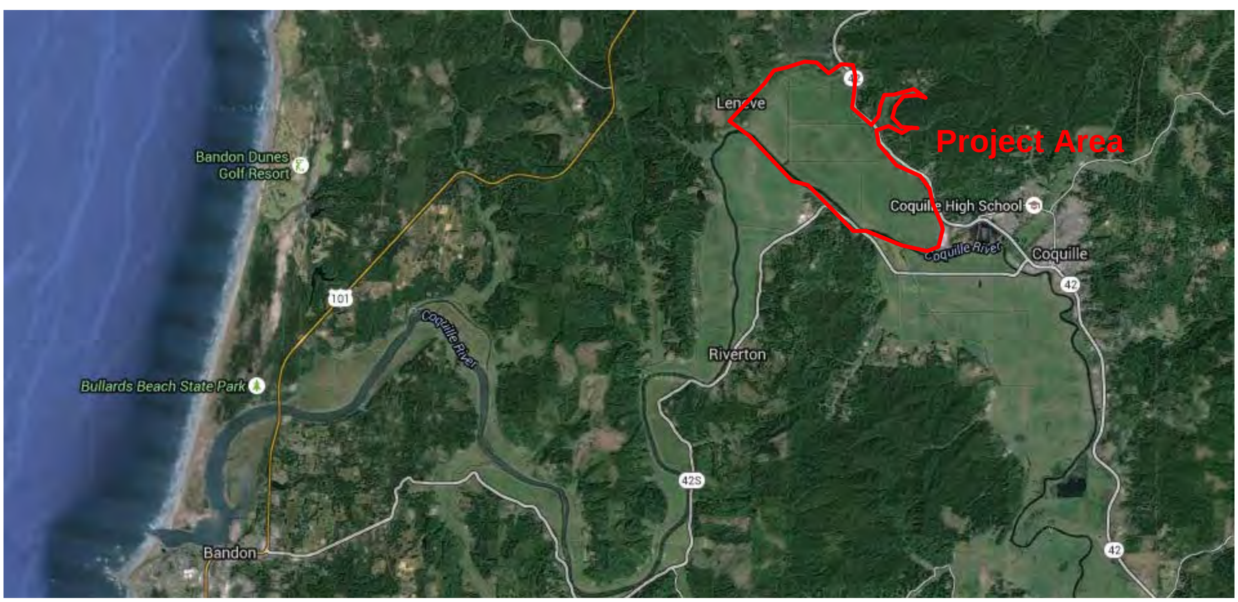

Figure 1. Project Vicinity Map including the project area and the larger Coquille River Valley.

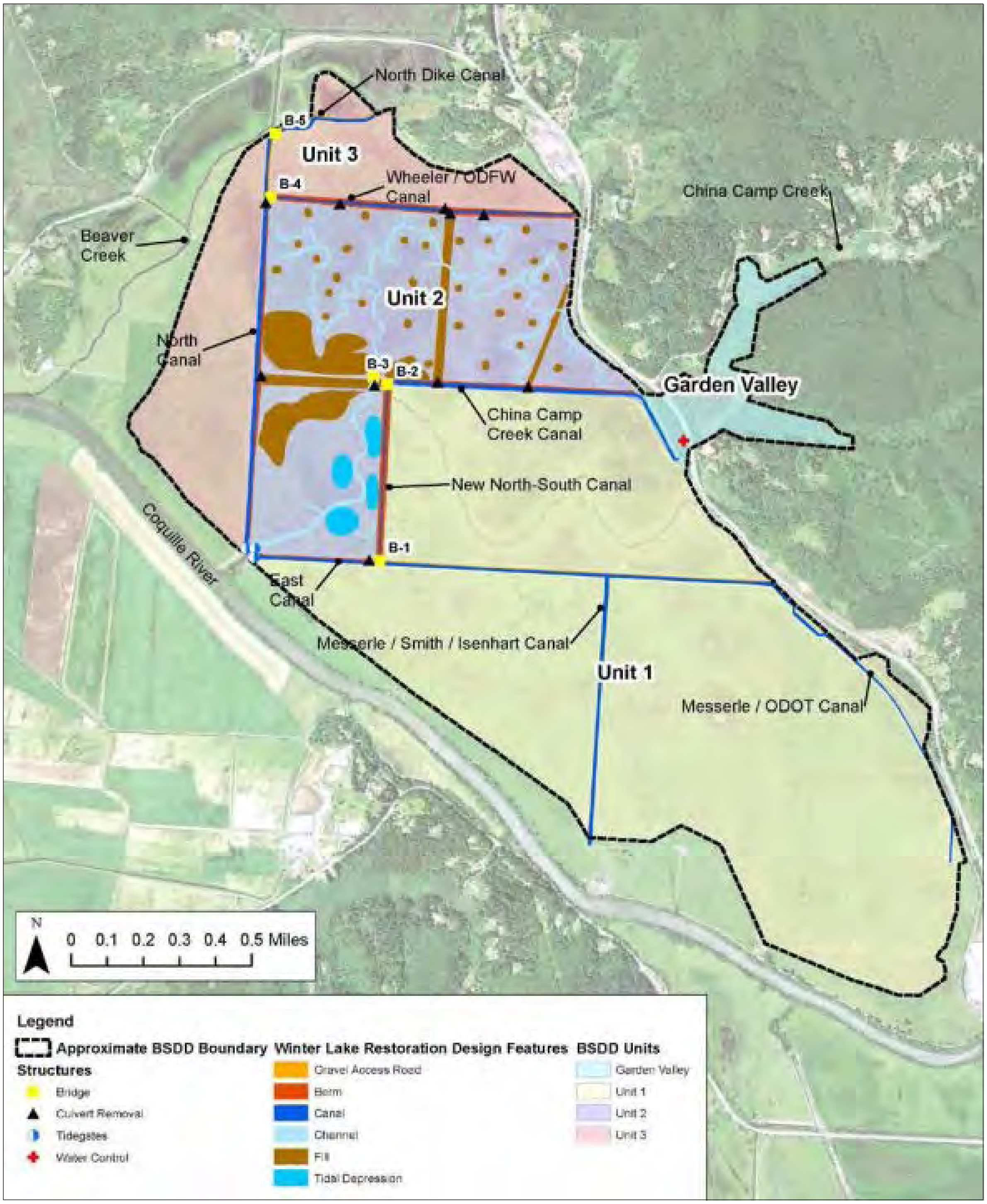

Figure 2. Project area with respective individual Units with respective Project actions.

The purpose of this Monitoring and Adaptive Management Plan (MAMP) is to provide Project monitoring management guidance from the point of implementation through final monitoring and Project closure. By developing a robust MAMP that is linked to Project objectives and goals, the assurance of Project success and minimization of negative impacts to aquatic habitat is greatly increased. The following section provides details for the MAMP.

1.2 Monitoring and Adaptive Management Plan Goals

The Project's Restoration Review Team (RRT) has representatives from the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and the Service. The Service is providing funding and technical review, conducting the National Environmental Policy Act (NEPA) compliance process, and working with NOAA Fisheries to comply with the Endangered Species Act (ESA). A Section 7 consultation will be conducted under the Programmatic Restoration Opinion for Joint Ecosystem Conservation by the Services (PROJECTS) Biological Opinion (BiOp), which requires the development of a MAMP. OWEB, The Nature Conservancy (TNC), Beaver Slough Drainage District (BSDD), and ODFW will provide restoration planning, assessment, design, and construction oversight for the Project. The RRT has collaborated on the development of this MAMP and will continue to provide review and evaluation of the plan and its findings as monitoring data becomes available and as described Section 4 (Project Review Team Triggers) and Section 7 (Data Storage and Analysis).

The MAMP is provided to ensure the project meets the intended outcomes of restoring ecological conditions that facilitate fish passage and natural stream corridor processes that sustain ecosystem functions. Long-term monitoring of the site is critical to assure these goals are met after the property is restored and tide gate is replaced.

1.2.1 Project Elements

Unit 2 Restoration

1. Fill approximately 1.5 miles of existing interior drain ditches and remove of approximately three miles of interior berms to restore functional wetland hydrology.
2. Reconnect/construct 7-10 miles of historic tidal channels to the Coquille River to improve tidal exchange and fish passage.
3. Reconfigure four open water habitat sites totaling 40 acres in three areas to increase overwinter refugia.
4. Modify Unit 2 berms to a uniform height for improved water management specifically within this unit.
5. Excavate the North-South canal between Unit 1 and 2 and construct new dikes to prevent impacts to neighboring landowners.
6. Replace nine interior culverts with five bridges to improve hydrologic connectivity and fish passage.
7. Plant approximately 240 acres of wetland shrub vegetation of Unit 2 ODFW parcel.
8. Remove invasive plant species.

Tide Gate Replacement

9. Replace existing tide gate with side hinged tide gates, mounted on vertical slide frames, controlled by Muted Tidal Regulator technology to improve fish passage, reduce velocities, and increase the amount of time that gates are open.
10. Realign tide gate channels in order to accommodate four 10 ft. wide x 8 ft. high tide gates for Unit 2 and the three similar gates for Units 1 and 3.
11. Remove old gates, unneeded pilings/clean up existing infrastructure.
12. Implement approved water management plan.

1.2.2 Project Goals

1. *Restore 400 acres of tidally-influenced palustrine emergent and scrub-shrub wetlands.*

   Objectives:

   A. Increase Channel Complexity and Stability
   Project Element: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

   B. Improve/Altered Water Quality
   Project Element: 1, 2, 3, 5, 6, 7, 8, 9

   C. Restore Riparian and Floodplain Vegetation
   Project Element: 1, 2, 3, 5, 6, 7, 8, 9

   D. Improve Fish Passage
   Project Element: 1, 2, 3, 5, 6, 9

2. *Provide substantial improvement in the productive capacity of 1,700 acres of over-wintering habitat for coho salmon through water management.*

   Objectives:

   E. Maintain Water Level and Improve Tidal Hydrology and Connectivity
   Project Element: 9, 10, 11, 12

2. Existing Monitoring Protocols

Several monitoring and performance protocols have been developed and used in Oregon for monitoring restoration projects. Table 1 describes the most popular protocols and what they are intended to monitor.

Table 1. Summary of popular protocols used for monitoring restoration projects in the northwest.

Protocol	Description
Aquatic Riparian Effectiveness Monitoring Program (AREMP)	Designed to assess the condition of aquatic, riparian, and upslope ecosystems under the jurisdiction of the Northwest Forest Plan
PACFISH/INFISH Biological Opinion (PIBO)	Designed to determine whether a suite of biological and physical attributes, processes, and functions of upland, riparian, and aquatic systems are being degraded, maintained, or restored, particularly in reference to livestock grazing and other federal land management practices
Environmental Monitoring and Assessment Program (EMAP)	Designed by the Environmental Protection Agency (EPA) to produce unbiased estimates of the ecological condition of surface waters across a large geographic area of the West (Peck et al. 2001)
ODFW Aquatic Inventories Project (ODFW)	Assesses aquatic habitat, conducts fish presence/absence surveys, monitors fish populations, establishes salmonid watershed prioritization, monitors habitat restoration projects, and reconstructs historical salmonid life history.
Scientific Protocol for Salmonid Habitat Surveys within the Columbia Habitat Monitoring Program (CHaMP)	Designed to assess the quantity and quality of stream habitat for salmonids. Draws together methods from several protocols to collect and analyze channel geomorphic data (i.e. topographical features, channel units, and geomorphic reaches).

Each of the protocols provide means and methods for obtaining physical field data for monitoring and assessing habitat. Roper et al. (2010) evaluated the performance and data compatibility of these monitoring protocols while being used by various field data collection groups. They found that these five protocols led to high internal consistency within monitoring groups. This supports the idea that each of the protocols has adequate means and methods for collecting habitat metrics, especially when used by experienced personnel. Methods used for the MAMP are drawn for the above protocols based on their repeatability, effectiveness at detecting change, and ease of data collection techniques.

3. Project Effectiveness Monitoring Plan

Effectiveness monitoring for this Project is designed to measure progress toward achieving the five Project objectives, inform maintenance needs, and help determine if the restoration project is trending towards or away from achieving Project goals. Based on the Project goals and compliance with the PROJECTS BiOp, parameters will be monitored using standard field techniques that will produce data compatible with the various protocols previously mentioned in Section 2.

3.1 Increase Channel Complexity and Stability

The proposed channel restoration aims to reconnect remnant Unit 2 channels to occupy historical locations as determined from historical photos and field data. Increasing channel length and habitat complexity would increase the amount of available over-wintering habitat for juvenile coho salmon. Proposed monitoring uses a combination of drone aerial photography and videography (Table 2). The drone will follow a computer-programmed flight path to take pictures and videos at the same locations each year.

Table 2. Summary of channel complexity monitoring metrics.

Project Objective	Monitoring Technique	Monitoring Metrics	Existing Channel	Design Channel (as-built)	Desired Condition	Frequency/ Duration	Responsible Party
Increase Channel Complexity and Stability	Aerial photo/drone-video or ground based GPS	Channel Length	0 feet	22,050 feet	Historic Alignment	Once a year in the fall for four years.	ODFW

3.2 Improve Altered Water Quality

Absence of channels, alterations to the floodplain, and water management practices have decreased the water quality in the project reach. Data loggers will be deployed to monitor maximum water temperatures, temperature trends, dissolved oxygen and other important parameters throughout the year as summarized in Table 3.

Table 3. Summary of water quality monitoring metrics.

Project Objective	Monitoring Technique	Monitoring Metrics	Baseline Value	Design Channel (as-built)	Desired Condition	Frequency/ Duration	Responsible Party
Improved Altered Water Quality	Data loggers	Maximum Weekly Maximum Temperatu re (MWMT)	Pre-project data collection (surface temps have been measured as high as 80˚ in summer months in canals	Survey post implement ation	Decreasing trend with desired summer peak temperature less than 68˚ 10 years post project (C. Claire, ODFW, personal communication 2016)	Continually for four years.	ODFW
	Data loggers	Dissolved Oxygen	N/A	Survey post implement ation	>9 mg/L DO (Carter 2005)	Continually for four years.	ODFW
	Data loggers	Total Nitrogen (TN)	N/A	Survey post implement ation	TBD*	Continually for four years.	ODFW
	Data loggers	Total Phosphoro us (TP)	N/A	Survey post implement ation	TBD*	Continually for four years.	ODFW
	Data loggers	Organic Matter/Biol ogical particulates	N/A	Survey post implement ation	TBD*	Continually for four years.	ODFW

* ODFW will use the Beaver Slough as a reference site for to determine the desired conditions for N, P, and organic matter (C. Claire, ODFW, personal communication 2016).

3.3 Restore Riparian and Floodplain Vegetation

Historical photos of the project site show a significant canopy of trees and shrubs surrounding the stream throughout Unit 2, which included willow (*Salix sp*), Oregon ash (*Fraxinus latifolia*), red alder (*Alnus rubra*), red osier (*Cornus sericea occidentalis*), and other shrubby species with black cottonwood (*Populus tricharpa*) and Sitka spruce (*Picea sitchensis*) overstory on higher elevations (Benner 1992). Proposed conditions include an increase in riparian canopy cover, leading to a greater amount of shade and a higher instance of cover. Species to be planted include Oregon ash, red alder, willow, Sitka Spruce, black cottonwood, Oregon crabapple and myrtle. The target objective for tree survival at the Winter Lake site is 300 trees per acre as summarized in Table 4. The planting plan calls for planting approximately 500 trees per acre, which will allow for some mortality and loss due to floods, natural mortality or beaver browse.

Table 4. Summary of riparian and floodplain vegetation monitoring metrics.

Project Objective	Monitoring Technique	Monitoring Metrics	Existing Channel Riparian Zone	Design Channel (As-Built) Riparian Zone	Desired Conditions	Frequency/ Duration	Responsible Party
Restore Riparian and Floodplain Vegetation*	Survival Plots	Percent Survival	N/A	~131,000 native plants and shrubs (~500/acre)	300 trees per acre (60% survival)	Seasonally for three years.	TNC

*Following OWEB Guidelines

3.4 Improve Fish Passage

Current levels of fish passage will be improved. Fish passage monitoring will be conducted twice yearly. This will occur during (1) highest predicted annual tide during daylight hours and (2) lowest predicted annual tide during daylight hours. Monitoring will include separate monitoring for each of the three tide gate units.

Monitoring will include observing the staff gauge for a depth measurement on each side of the bay and taking a velocity measurement at the outlet for each bay (thus the "outlet" will switch bay sides as the tide reverses). These measurements are taken every 30 minutes from the daily low to high tide, or vice versa. Monitoring will also ensure the slack tide at high and low tides are captured (this should be zero velocity in the pipe).

Additionally, visual inspections will be used to determine if there are fish passage concerns for Unit 2 during periods of low water and/or malfunction of replaced tide gate as summarized in Table 5.

Table 5. Summary of fish passage monitoring metrics.

Project Objective	Monitoring Technique	Monitoring Metrics	Baseline Value	Design (as-built)	Desired Condition	Frequency/ Duration	Responsible Party
Improve Fish Passage	Visual Inspection; and monitoring of juvenile coho salmon (migratory salmonid) densities/overall abundance in channel networks in Unit 2	Connectivity	N/A	Surface channel connectivity	Surface connectivity	Annual, low, and high for four years	ODFW
		Depth	N/A	Survey post implementation	Continuous flow (low-flow depth) of at least 2-3" (Pass)	Annual, low for four years	ODFW
		Velocity	N/A	Survey post implementation	TBD after tide gate installation	Continuously for four years	ODFW
		Tide Gate Door Open	N/A	Survey post implementation	How far tide gate doors are open during the velocity measurement	Continuously for four years	ODFW

3.5 Maintain Water Level and Improve Tidal Hydrology and Connectivity

The current tide gate is a traditional design with top-hinged flaps that open when the water pressure is higher on the upstream side and close as the river levels rise and water pressure becomes greater on the riverside. The new muted tidal regulator and slide gates will allow unrestricted outflow/inflow and provide redundancy for the system in contingency situations. In addition, it will significantly improve fish passage and allow adjustable water management operations, specifically independent operations for Units 1-3. The ability of the tide gate frames, controlled by the muted tide gate mechanism, to move vertically, creating an unrestricted opening at the bottom of the culvert, will enable the system to achieve the open time, velocity, fish passage, and access conditions specified in the ODFW and NOAA Fisheries approved fish passage plan.

BSDD has collected water level information since March of 2011 from seven sites within the project area (Figure 3). Through this MAMP, additional water level loggers will be installed to continue collecting data on water depth. As tidal hydrology is a controlling factor for all tidal wetland functions, the data collected will also allow for additional analysis. Data will be collected before and after each seasonal water level change, as defined in the water management plan (Table 6). Data will be collected from inside the tide gate.

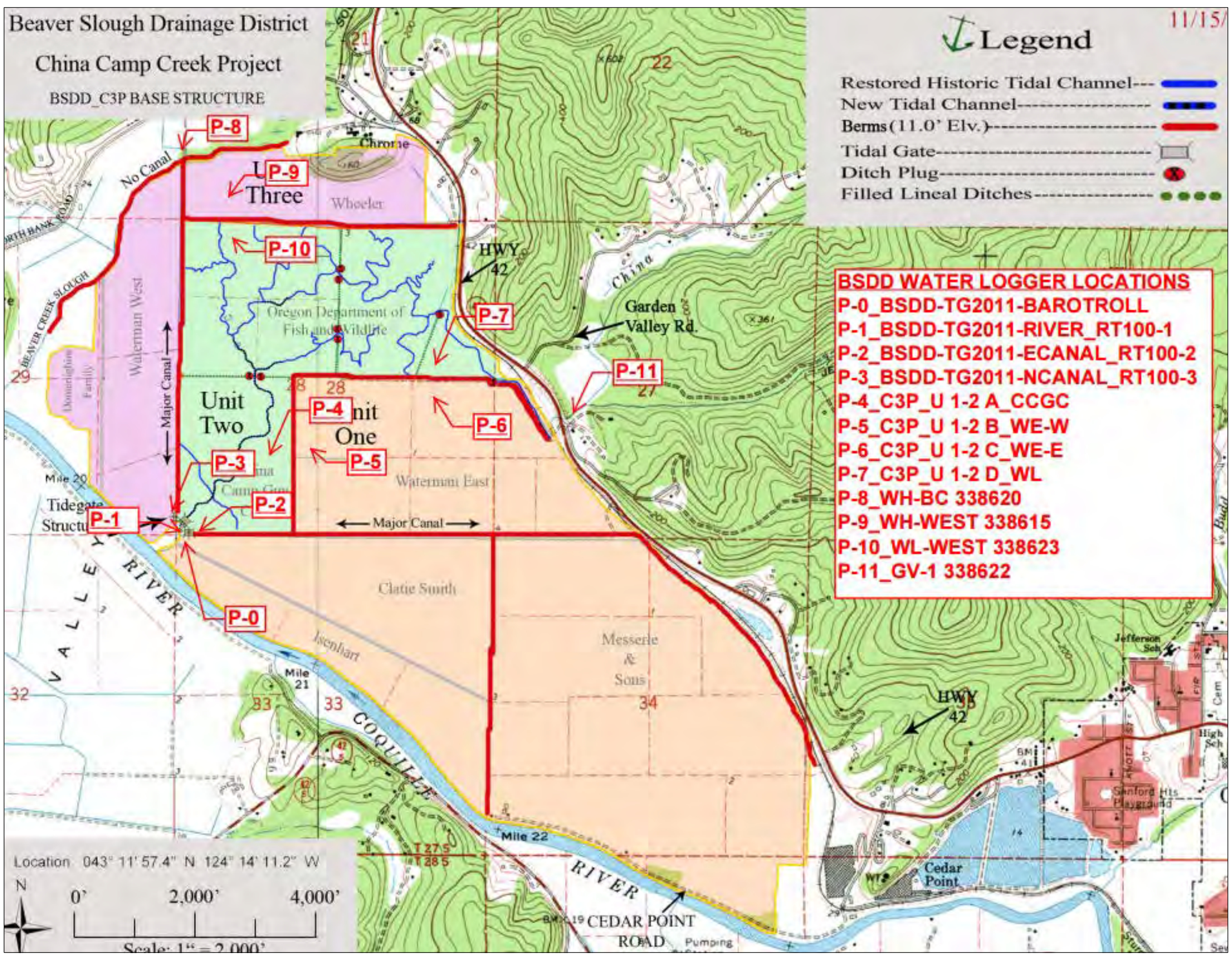

Figure 3. Map denoting data logger locations from 2011-2016.

Table 6. Summary of water level monitoring metrics.

Project Objective	Unit	Monitoring Technique	Monitoring Metrics	Water Level	Desired Conditions	Frequency/ Duration	Responsible Party
Maintain Water Level – Winter (October to March)	1, 3	Water Level Data Logger	Water Depth	Basic flush level until first flood event or cattle are pulled	3.0 to 3.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
	1, 3	Water Level Data Logger	Water Depth	After first flood event transition to over-winter habitat level	4.5 to 5.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
	2	Water Level Data Logger	Water Depth	Complete transition to over-winter habitat level	4.5 to 5.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
Maintain Water Level – Spring Drain Out (April to May)	1, 3	Water Level Data Logger	Water Depth	Maximum dry out – maximum elevation	2.0 to 4.0 Feet NAVD88	1 pre-post / continually for four years	BSDD
	1, 3	Water Level Data Logger	Water Depth	Transition to basic flush level as conditions allow	3.0 to 3.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
	2	Water Level Data Logger	Water Depth	Transition back to basic flush level	3.5 to 4.0 Feet NAVD88	1 pre-post / continually for four years	BSDD
Maintain Water Level – Summer (June to September)	1, 3	Water Level Data Logger	Water Depth	Complete transition from maximum dry out to basic flush level	3.0 to 3.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
	1, 3	Water Level Data Logger	Water Depth	Irrigation level – every 10 to 14 days as per coordinated request from landowners	4.0 to 4.5 Feet NAVD88	1 pre-post / continually for four years	BSDD
	2	Water Level Data Logger	Water Depth	Basic flush level	3.5 to 4.0 Feet NAVD88	1 pre-post / continually for four years	BSDD
	2	Water Level Data Logger	Water Depth	Sept to October begin transition to over-winter habitat level	4.5 to 5.5 Feet NAVD88	1 pre-post / continually for four years	BSDD

4. Project Review Team Triggers

Restoration of coastal wetlands is an evolving science that seeks to combine natural processes with engineering and construction techniques to develop a stable system while maintaining natural dynamic equilibrium, which is particularly challenging within Working Landscapes that incorporate multiple uses. The MAMP includes key monitoring attributes that will provide a feedback loop of the trends and trajectory of the restoration and management efforts.

The following section outlines the field methods that will be used to perform the described monitoring surveys. This section is largely developed from field techniques described in past monitoring plans summarized in Table 2-1. The RRT will be notified if monitoring demonstrates values outside of outlined thresholds as described in Table 7 below. If a Monitoring Metric is a “Pass”, then there is no action required *or* there is an option to reduce the length of monitoring. If, however, the Monitoring Metric is a “Fail”, then the project review team will make an evaluation of the failure and a determination of potential maintenance and/or corrective actions depending upon the severity and type of failure. Some metrics must be determined after tide gate installation. These are noted as TBD.

Table 7. Monitoring data trends, conclusions and responses for selected metrics.

Monitoring Technique	Monitoring Metrics	Threshold	Decision Pathway	Applicability
Aerial photo/drone-video or ground based GPS	Channel Length	20,000 feet	1. > 20,000 feet (Pass) 2. < 20,000 feet (Fail)	Entire channel
Data loggers	Maximum Weekly Temperature	72˚ by year four post project. 68˚maximum during summer at year 10	1. < 72 F (Pass) 2. > 72° (Fail)	Entire channel
Data loggers	Dissolved Oxygen	9 mg/L DO	1. >9 mg/L DO (Pass) 2. <9 mg/L DO (Fail)	Entire channel
Data loggers	Total Nitrogen	TBD*	TBD	Entire channel
Data loggers	Total Phosphorous	TBD*	TBD	Entire channel
Data loggers	Organic Matter	TBD*	TBD	Entire channel
Survival plots	Percent Survival	60% survival	1. > 60% survival required (Pass) 2. < 60% survival (Fail)	Unit 2 Banks and Wetlands
Visual inspection	Connectivity	Surface connectivity	1. Side channel providing fish passage/flow between channel and pond (Pass) 2. Side channel not providing fish passage/flow between channel and pond (Fail)	Side channels
Visual inspection	Stranding/Trapping	Depth of main channel thalweg of sufficient depth to allow passage of fish present / tidal depressions	1. Continuous flow (low-flow depth) of at least 2-3” (Pass) 2. Discontinuous or very shallow flow depth (Fail)	Thalweg

Water Level Data Logger	Water Depth – Unit 1-3 Oct.-March; Basic Flush Level until first flood event or cattle are pulled	3.0 to 3.5 Feet NAVD88	1. >3.0 and <3.5 (Pass) 2. <3.0 or >3.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 1-3 Oct.-March; After first flood event transition to Over Winter Habitat Level	4.5 to 5.5 Feet NAVD88	1. >4.5 and <5.5 (Pass) 2. <4.5 or >5.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 2 Oct.-March; Complete transition to Over Winter Habitat Level	4.5 to 5.5 Feet NAVD88	1. >4.5 and <5.5 (Pass) 2. <4.5 or >5.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 1-3 April to May; Maximum Dry Out – maximum elevation	2.0 to 4.0 Feet NAVD88	1. >2.0 and <4.0 (Pass) 2. <2.0 or >4.0 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 1-3 April to May; Transition to Basic Flush Level as conditions allow	3.0 to 3.5 Feet NAVD88	1. >3.0 and <3.5 (Pass) 2. <3.0 or >3.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 2 April to May; Transition back to Basic Flush Level	3.5 to 4.0 Feet NAVD88	1. >3.5 and <4.0 (Pass) 2. <3.5 or >4.0 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 1-3 June to September;	3.0 to 3.5 Feet NAVD88	1. >3.0 and <3.5 (Pass) 2. <3.0 or >3.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 1-3 June to September;	4.0 to 4.5 Feet NAVD88	1. >4.0 and <4.5 (Pass) 2. <4.0 or >4.5 (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 2 June to September; Basic Flush Level	3.5 to 4.0 Feet NAVD88	1. >3.5 and <4.0 Ft (Pass) 2. <3.5 or >4.0 Ft (Fail)	Inside tide gate
Water Level Data Logger	Water Depth – Unit 2 June to September; Sept to October begin transition to Over Winter Habitat Level	4.5 to 5.5 Feet NAVD88	1. >4.5 or <5.5 Ft (Pass) 2. <4.5 or >5.5 Ft (Fail)	Inside tide gate

* ODFW will use the Beaver Slough as a reference site for to determine the desired conditions for N, P, and OM (C. Claire, ODFW, personal communication 2016).

5. Monitoring Frequency, Timing, and Duration

ODFW will conduct and coordinate monitoring with other project partners (BSDD and TNC) at a level and frequency sufficient to capture change that could result in significant reduction in desired conditions. Intensive monitoring as outlined in this document is proposed to occur over a period of four years after restoration and tide gate replacement. The following sections provide the monitoring setup and protocol.

5.1 Baseline Data Collection

TNC and BSDD have used InSitu Rugged Troll 100 data loggers since 2011 to collect information on water temperature and elevation level at 15 minute intervals (Figure 3). The barometric sensor was located at P-0. P-1 to P-3 were installed in March 2011. P-4 to P-7 were installed in November 2011. P-8 to P-11 were installed in November 2013. P-4 to P-7, P-9, and P-10 measure ground water levels in the field away from the canals. Data is available from installation to present. Baseline topography is provided by LiDAR and a physical survey that was conducted in 2014. ODFW has conducted up to four ground waterfowl and bird surveys annually for the past two years and will continue those counts to document changes from pre to post project. ODFW also has conducted mark recapture of juvenile coho salmon from 2014-2016 to provide population information and is committed to continue to monitor juvenile coho salmon populations before and after project completion. A vegetation survey was completed in 2014 on ODFW lands within Unit 2 of the project area by the Natural Resources Conservation Service and ODFW to document existing plant species pre-project. Plans are to duplicate this survey post project to document vegetation changes. Plans for 2016 include an amphibian and reptile survey on ODFW lands within Unit 2 as part of the pre-project monitoring.

5.2 As-Built Survey

Immediately upon completion of the tidal channel construction, an as-built survey, which documents the channel length, grade, and bank sloping, will be conducted. The purpose of this survey is for future comparative purposes of total channel length. Survey methods may include aerial photography, LiDAR, and/or visual ground based incorporating GPS locations. Following the first year of tidal channel connection, ODFW will visually evaluate if there have been any major channel realignments by walking the length of the created channels. If there are apparent channel changes, ODFW will complete a more thorough evaluation, using the survey methods listed above. If after year four there have been no visual indicators of channel change, ODFW will complete a survey so there is at least one post-project channel length survey for the entire network for a quantitative comparison with the as-built condition in Unit 2.

5.3 Future Surveys

Following restoration, monitoring will be completed for each metric for four years. If during this time a monitoring metric does not meet the requirements of the decision pathway, additional monitoring will be required. Future surveys will be determined on an as-needed basis.

6. Monitoring Technique Protocols

The following section outlines the field methods that will be used to perform the above described monitoring surveys. This section is largely developed from the field techniques described in the established monitoring protocols described in Table 1.

6.1 Photo and Video Documentation

To track the general project trend and changes over time for channel network stability and vegetative changes, photography and videography will be an annual part of the MAMP. Aerial imagery is the most expedient method to compare future conditions to the as-built condition, but a variety of methods would be adequate.

The following protocol will be used annually for visual documentation of those parameters that are applicable:

1. The drone will take aerial pictures at the established GPS locations, and will follow a flight pattern to take video during fall channel monitoring.
2. Establish multiple and sufficient photo points at high points along the interior berms and mark them with rebar and flagging and save a GPS point of the location. Take at least one photo looking into the restoration site from each of these locations.
3. Establish photo points at the tide gate from multiple angles to assess berm stability, vegetative recovery, erosion issues, and general channel stability at inflow/outflow points.

6.2 Ground Based GPS

Channel length, location, and stability are parameters that can be analyzed through visual ground based methods documenting location with GPS (and also aerial photography). Because these are tidal channels, monitoring is focused on the total length of the channel network rather than on specific channel geometry. The relative size of the tidal channels will change over time in response to hydrology and sediment inputs, and the size and frequency of flood events.

6.3 Visual Inspection

Anecdotal observations of fish and wildlife presence, habitat feature utilization, and other qualitative assessments of site condition as observed by trained/professional ODFW staff will be recorded and included within the monitoring report as relevant.

6.4 Survival Plots for Trees/Shrubs Planted

Monitoring will be conducted annually for three years, as required by OWEB, after which it is expected the trees will be in a "free to grow" stage, established, and able to out-compete other surrounding vegetation, particularly pasture grasses.

Monitoring will follow the protocols outlined in the Coos Riparian Monitoring Guide (Coos Watershed Association 2003). The plant establishment criteria were based on the Riparian Monitoring Guide located at http://www.oregon.gov/OWEB/docs/pubs/riparianmonitoringguide.pdf which was developed by the Coos Watershed Association for the South Coast of Oregon and was based on project goals determined by site characteristics, condition of a nearby reference site that still retains historic and pre-settlement vegetation composition. The planting and establishment guidelines from this document were used for site prep, meeting project goals, plant species selection, plant stocks, sizes, target densities/spacing, fencing/protection and monitoring.

The monitoring will also use Coquille Watershed Association Riparian Project Guidelines for use in the Coquille River Basin. Together these two documents outline monitoring guidelines using line transects or circular plots that sample the planted area to determine survival and tree densities. The monitoring form example in the Coquille Watershed Association Riparian Project Guidelines describes the information gathered and documented at each monitoring site.

If plant monitoring determines that plant survival falls below the targets described below at the two sites, plants will be purchased by ODFW and planted by volunteers, including students from two local high schools as part of an educational opportunity on riparian/wetland restoration work. Photo points will be established using the OWEB Photo Point Guidelines, which describe how to set up permanent photo points and use to document changes to the planting site over time.

The following protocol will be used to determine vegetation establishment:

1. Survival plots will be established with a 25 foot diameter circle after planting.
2. Identify and count all woody plants in all plots by species and record the following:
    a. Live or dead
    b. Natural or planted
    c. Plant vigor
3. Standing at the rebar, photo document the plot and the conditions of the plants within the plot.

6.4 Data Loggers

1. Data loggers will deployed at locations as identified on Figure 3, except for the thermographs currently installed or within the new tide gate.
2. Data loggers should be secured in a steel pipe and connected to a permanent anchor point with a length of steel cable.
3. Data loggers will record the monitoring metric, date, and time of day when the data logger begins logging.
4. Data loggers should be downloaded at least once per year.

6.5 Fish Passage

Headcutting of the newly constructed channel has the potential to create hydraulic drops that exceed statewide standards for fish passage for both juvenile and adult salmonids. If unnatural barriers of greater than six inches are present within the reach at the time of the survey, a site assessment and evaluation of potential maintenance actions will occur.

Tidal depressions are designed to be perennially connected to the main active channel, and provide year round rearing habitat for juvenile fish. Discontinuous flow between pond and channel during tidal exchange may cause fish to be trapped in marginal habitat.

7. Data Storage and Analysis

7.1 Data Storage

Monitoring data will be stored and maintained by ODFW and will be maintained in standard database(s) (e.g. Excel digital database), which will be presented to the RRT within 30 days upon request. Data tables will be normalized to avoid redundant data structures and to ensure consistent data formats among sampling events.

The BSDD tide gate controller server will have the capability to store data and report data to the Coquille Working landscapes website for controlled access or viewing in real time.

7.2 Data Analysis and Reporting

7.2.1 Annual Report

The monitoring year will be annually from October 1 to September 30. At the end of each monitoring season, an annual report will be prepared for the RRT that includes:

- Summary for each monitoring event, site action memorandum;
- Monitoring metric conclusions based on metrics target thresholds observed over the season as a whole; and
- Recommended Maintenance/Corrective actions.
- Overall succinct discussion on measures that could be taken to improve monitoring tactics, methods, types of monitoring, etc.
- Short review of the general restoration project parameters progression towards goals and reasons for success or lack of success.

ODFW will submit these reports to the Service annually by October 15. The Service will review for completion before submitting to the RRT.

If significant issues or concerns are identified, the ODFW and the Service will convene the RRT to discuss any comments, recommendation and future actions with sufficient time for planning and permitting prior to the ODFW "in water" work window.

7.2.2 Monitoring Threshold Email

Due to the high amount of data collection, ODFW will use discretion to contact the Services with an email if a monitoring threshold is not being met. The memorandum will include:

- Overview of site conditions observed/detected/reviewed;
- Monitoring metric conclusions based on metrics target thresholds; and
- Any maintenance/corrective actions necessary.

7.2.3 Final Report

A final monitoring report will be generated to summarize monitoring data collected and adaptive management actions taken over the four years of monitoring including:

Metrics for which data were collected; including any adjustments made to monitoring program,

- Summary of all monitoring data collected using tables and figures to depict observed trends over four years of monitoring;
- Individual monitoring metric conclusions based of target thresholds observed over four years;
- Narrative discussions to explain results in the context of projects goals, success criteria, and performance standards; and
- Final recommended maintenance/corrective actions.

ODFW will submit this document to the Service for submission to the RRT as final documentation of the completion of the MAMP at the Project site.

8. Monitoring Quality Assurance Plan

To ensure the quality of the monitoring program, ODFW will implement quality assurance (QA) and control (QC) procedures. QA and QC procedures will be applied to the following aspects of the monitoring plan:

1. Data collection
2. Data storage
3. Data analysis and reporting

9. Literature Cited

Benner, P.A. 1992. Historical reconstruction of the Coquille river and surrounding landscape. Sections 3.2 and 3.3 in: Oregon Department of Environmental Quality (ed.). Near coastal waters national pilot project: The Coquille river, Oregon. Action plan for Oregon coastal watersheds, estuary, and ocean waters, 1988-1991. Oregon Department of Environmental Quality, Portland.

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(PACFISH) U.S. Department of Agriculture, Forest Service and U.S. Department of Interior, Bureau of Land Management. 1995. Strategies for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho, and portions of California. Washington DC: U.S. Department of Agriculture, Forest Service and U.S. Department of Interior Bureau of Land Management.

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B. *Data Quality Matrix*

Data Quality Matrix
DEQ04-LAB-0003-QAG
Version 5.0

Oregon Department of Environmental Quality
May 03, 2013
Page 1 of 2

Data Validation Criteria for Water Quality Parameters Measured in the Field

Data Quality Level	Quality Assurance Plan	Water Temperature Methods	pH Methods	Dissolved Oxygen Methods	Turbidity Methods	Conductivity Methods	Bacteria Methods	Data Uses
A	Approved QAPP	Thermometer Accuracy checked with NIST standards A ≤ ± 0.5°C P ≤ ± 0.5°C	Calibrated pH electrode A ≤ ± 0.2 S.U. P ≤ ± 0.3 S.U.	Winkler titration A ≤ ± 0.2 mgL P ≤ ± 0.3 mgL Calibrated oxygen meter/LDO Accuracy: ≤ + 0.4 mgL ≥ - 0.3 mgL P ≤ ± 0.3 mgL	Nephelometric Turbidity meter A ≤ ± 10% Standard value P ≤ ± 20% (± 3 NTU if NTU < 20)	Meter with temp correction to 25°C A ≤ ± 7% of standard value P ≤ ± 10%	DEQ Approved Methods Absolute difference between log-transformed values P ≤ 0.6 log	Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments)
B	Minimum Data Acceptance Criteria Met	Thermometer Accuracy checked with NIST standards A ≤ ± 1.0°C P ≤ ± 2.0°C	Any Method A ≤ ± 0.5 S.U. P ≤ ± 0.5 S.U.	Winkler titration or Calibrated oxygen meter/LDO A ≤ ± 1 mgL P ≤ ± 1 mgL	Any Method A ≤ ± 30% P ≤ ± 30%	Meter with temp correction to 25°C A ≤ ± 10% of standard value P ≤ ± 15%	DEQ Approved Methods Absolute difference between log-transformed values P ≤ 0.8 log	Regulatory, permitting, compliance (e.g., 303(d) and 305(b) assessments) <u>with professional judgment</u>
C		A > ± 1.0°C P > ± 2.0°C	A > ± 0.5 S.U. P > ± 0.5 S.U.	A > ± 2 mgL P > ± 2 mgL	A > 30% P > 30%	A > ± 10% P > ± 15%	Absolute difference between log-transformed values P > 0.8 log	**<u>Not</u> to used for 303(d) and 305(b) assessments** Based on project manager judgment, the data may be Voided with a DQL of D.
D		Missing or voided data	Missing or voided data	Missing or voided data	Missing or voided data	Missing or voided data	Missing or voided data	Missing or voided data
E	No QAPP provided	No precision or accuracy checks available	Any Method No precision or accuracy checks available	Any Method No precision or accuracy checks available	Any Method No precision or accuracy checks available	Meter without routine calibration No precision or accuracy checks available	Any Method No precision or accuracy checks available	Informational purposes only
F	See definitions table	See definitions table	See definitions table	See definitions table	See definitions table	See definitions table	See definitions table	See definitions table

Data Validation Criteria for Water Quality Parameters Measured in the Field

Notes:

QA definitions of Data Quality Levels

A –	**Data of known quality**; meets QC limits established in a DEQ approved QAPP.
B –	**Data of known but lesser quality**; Data may not meet established QC but is within marginal acceptance criteria; or data value may be accurate, however controls used to measure Data Quality Objective (DQO) elements failed (e.g., batch failed to meet blank QC limit); the data is generally usable for most situations or in supporting other, higher quality data. **(Equivalent to the "J" (estimated) qualifier used by EPA).** **Note:** Statistics for **turbidity, conductivity,** and **bacteria** are concentration-dependent; thus low-concentration B level data may be considered acceptable for all uses.
C –	**Data of unacceptable quality;** Generally due to QC failures but may be related to other known information about the sample. Data should not be used for quantitation purposes but may have qualitative use. (Equivalent to the "R" (rejected) validation qualifier used by EPA)
D –	**No data available**; No sample collected or no reportable results. Samples are either voided or canceled.
E –	**Data of unknown quality;** Insufficient QA/QC or other information available to make determination. Data could be acceptable; however, no evidence is available to prove either way. Data is provided for Educational Use Only.
F –	**Exceptional event;** "A" quality data (data is of known quality), but not representative of sampling conditions as required by the project plan.(e.g., a continuous water quality monitor intended to collect background environmental conditions collects a sample impacted by a fire that created anomalous conditions to the environment).

Data Quality Level Grading Criteria:

A = Accuracy as determined by comparison with standards, e.g., during equipment calibration or pre- and post-deployment checks

P = Precision as determined by replicate measurements, e.g., during field duplicates, field audits, or split samples

C. *Channel Cross-Sectional Surveys*

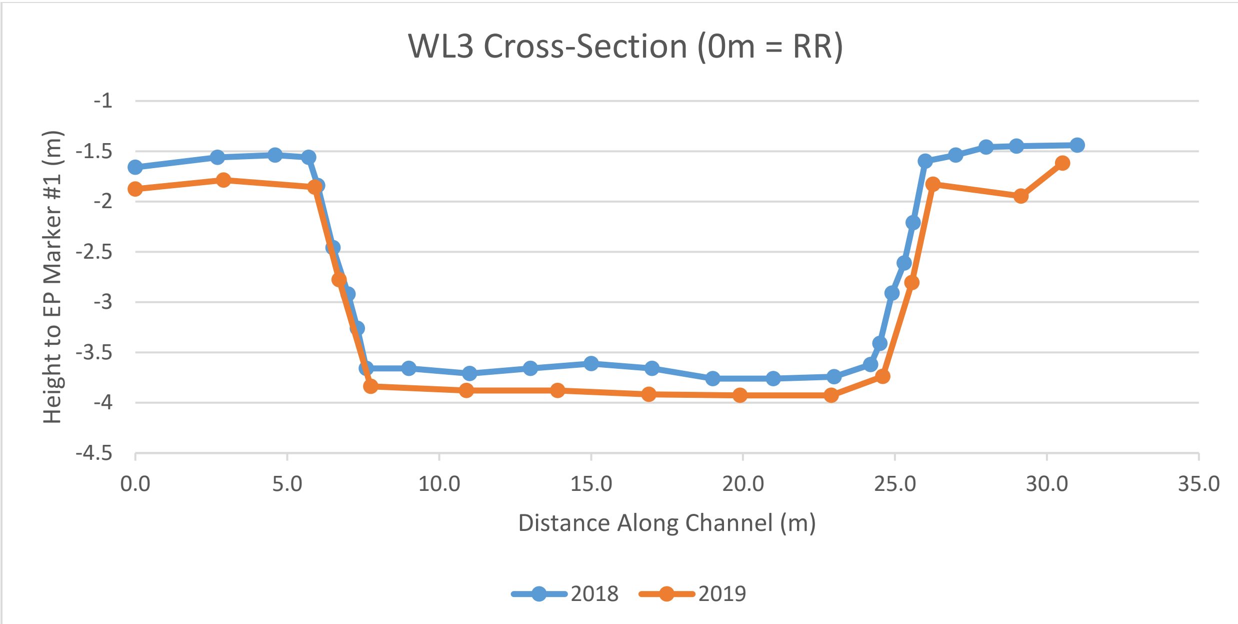

Figure 33. Cross-sectional survey of location WL3 in Unit 2 of the Winter Lake Restoration Project Area. Start of survey at distance 0.0m is on river right when facing downstream.

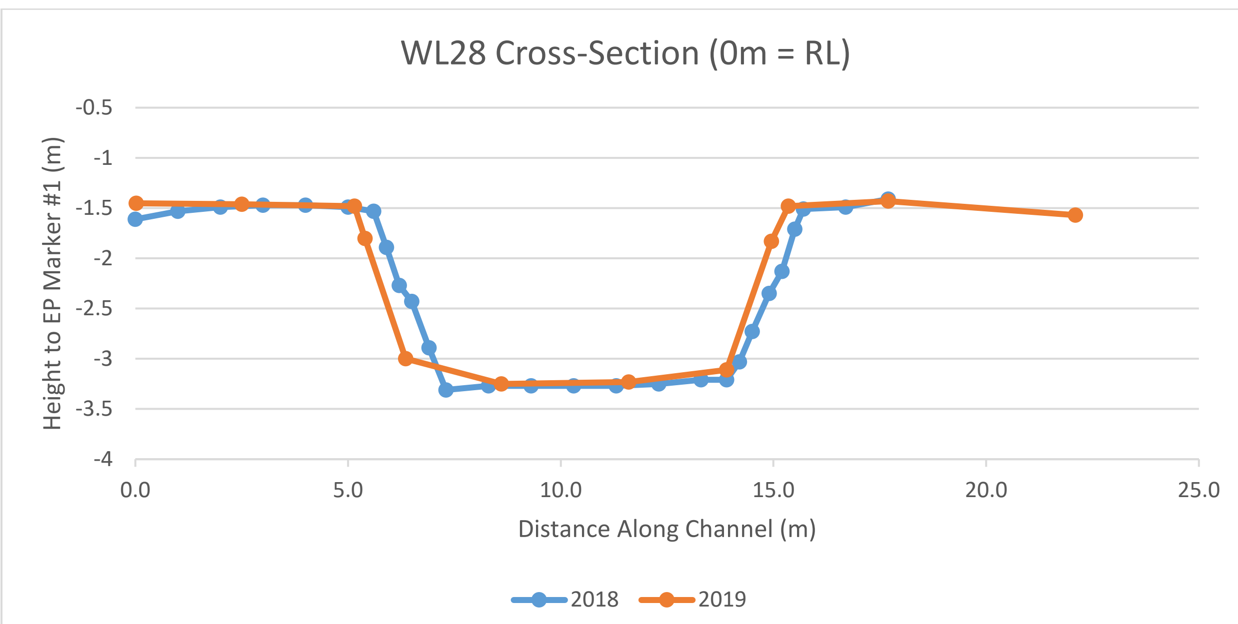

Figure 34. Cross-sectional survey of location WL3 in Unit 2 of the Winter Lake Restoration Project Area. Start of survey at distance 0.0m is on river left when facing downstream.

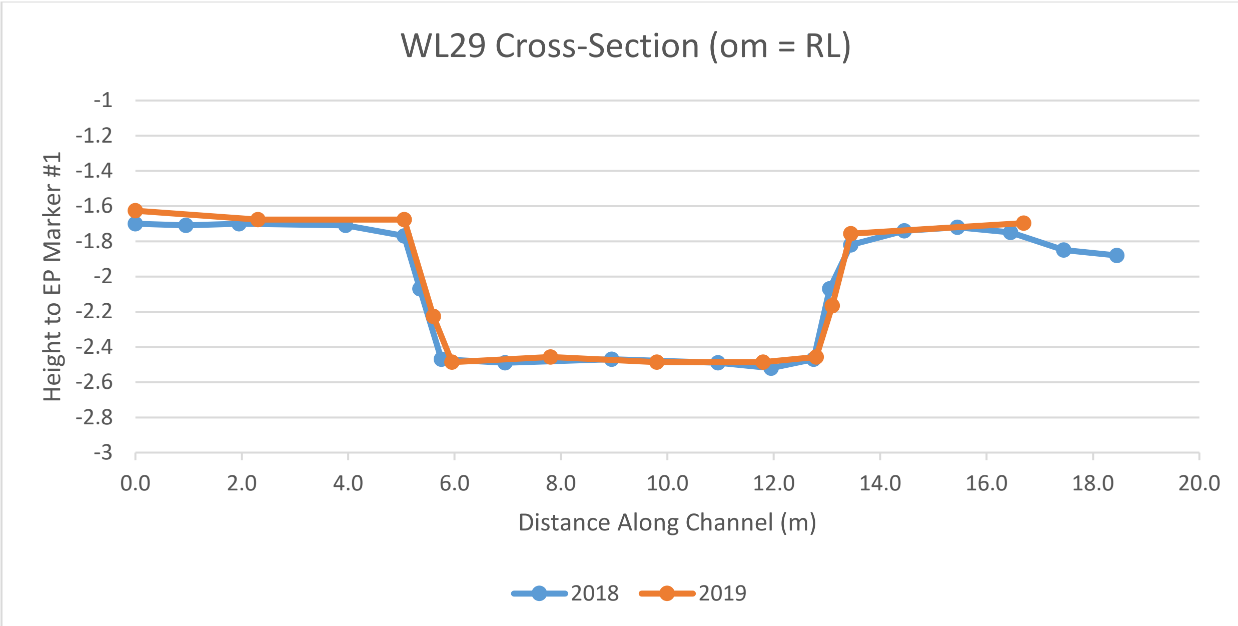

Figure 35. Cross-sectional survey of location WL3 in Unit 2 of the Winter Lake Restoration Project Area. Start of survey at distance 0.0m is on river left when facing downstream.

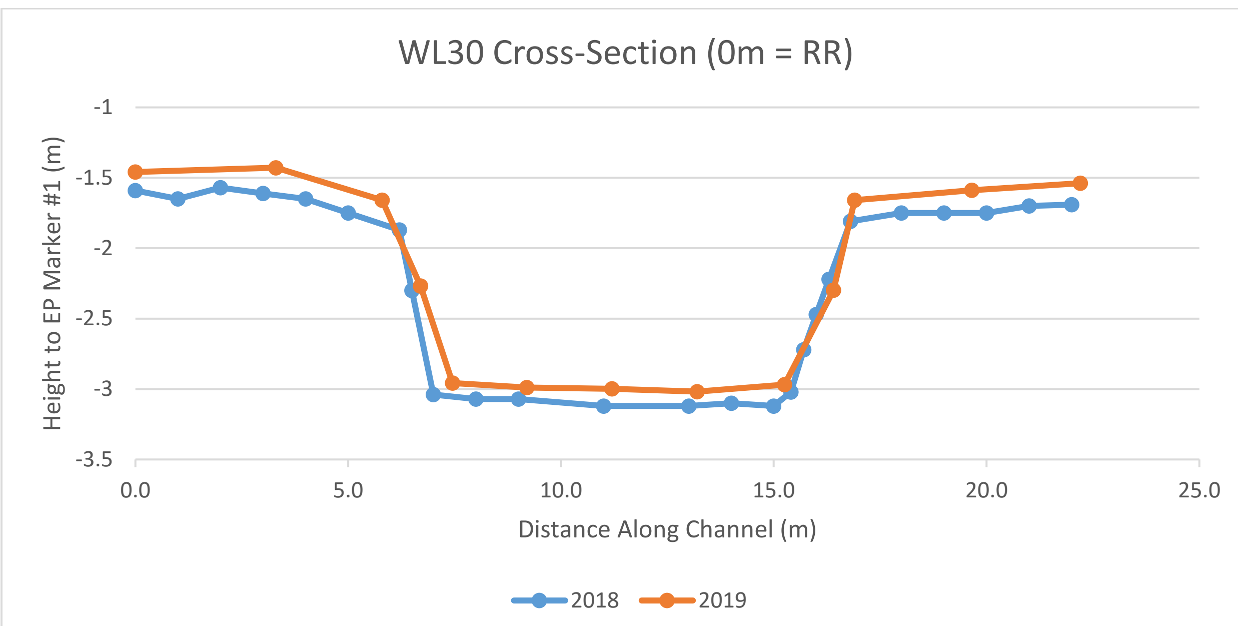

Figure 36. Cross-sectional survey of location WL3 in Unit 2 of the Winter Lake Restoration Project Area. Start of survey at distance 0.0m is on river right when facing downstream.

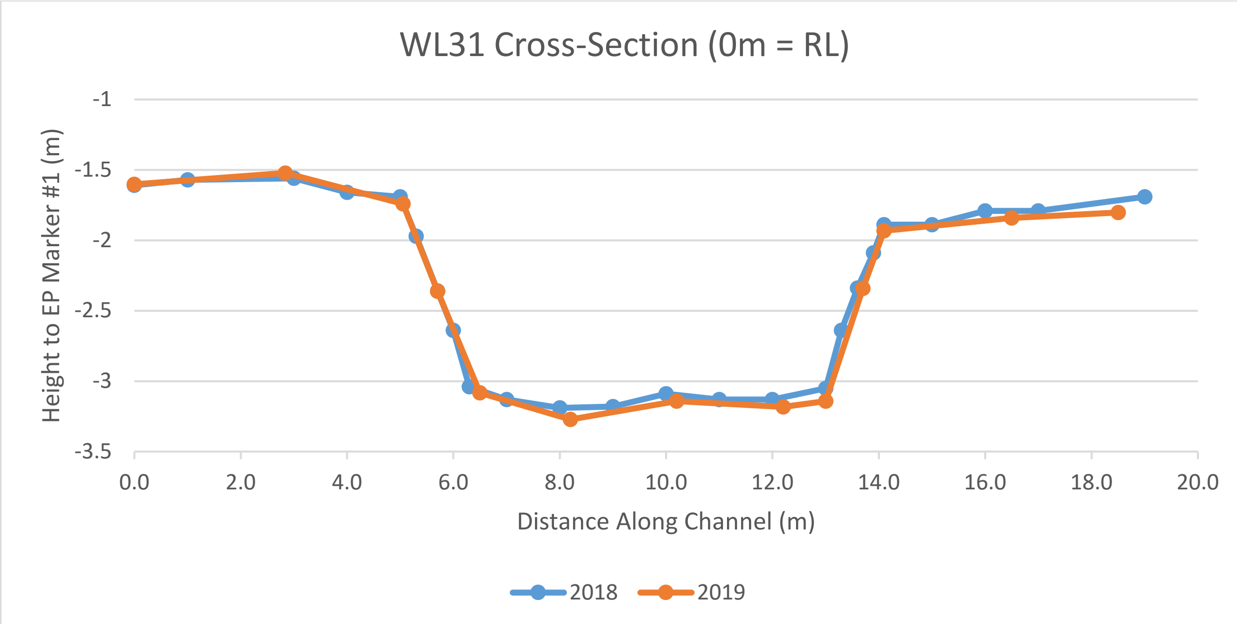

Figure 37. Cross-sectional survey of location WL3 in Unit 2 of the Winter Lake Restoration Project Area. Start of survey at distance 0.0m is on river left when facing downstream.

D. *Photo Points*

Figure 38. Winter Lake Restoration Unit (Unit 2) photo point WL3A, taken October 2018.

Figure 39. Winter Lake Restoration Unit (Unit 2) photo point WL3A, taken September 2019.

Figure 40. Winter Lake Restoration Unit (Unit 2) photo point WL29B, taken October 2018.

Figure 41. Winter Lake Restoration Unit (Unit 2) photo point WL29B, taken September 2019.

Figure 42. Winter Lake Restoration Unit (Unit 2) photo point WL30C, taken October 2018.

Figure 43. Winter Lake Restoration Unit (Unit 2) photo point WL30C, taken September 2019.

E. *Relative Fish Abundance*

Table 10. Total fish abundance data for the 2018-2019 sampling season at Winter Lake and Beaver Creek sites.

		Unit 3	Unit 2								Unit 1			Reference
	Total Count	Shakemill (WL 46)	WL 43	WL 44	WL 45	Boat Launch Area	WL 29 (3')	WL 32 (3')	WL 33 (3')	Swale (3')	WL 5	Cedar Pt 1 (3')	Cedar Pt 2 (3')	Beaver Creek
Total Sampling Events		11	8	8	2	1	2	1	1	1	1	1	2	10
Species (native)														
Coho	1460	28	13	17	-	-	-	-	4	-	-	-	-	1398
Cutthroat trout	21	3	-	-	-	-	-	-	2	-	-	-	-	16
Lamprey (Western Brook)	7	-	1	2	-	-	-	-	-	-	-	-	-	4
Newts	153	27	-	-	-	-	-	1	1	-	-	-	-	124
Northwest Salamander	18	-	1	-	-	-	-	-	-	-	-	-	-	17
Pacific Lamprey	18	4	3	2	1	-	-	1	-	-		-	2	5
Adult Lamprey	2	-	-	-	-	-	-	-	-	-	1	-	1	-
Red legged frog	20	-	-	-	-	1	-	-	-	-	-	-	-	19
Sculpin sp.	37	3	1	-	-	-	-	-	-	-	-	-	1	32
Steelhead	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Sucker	5	-	-	-	-	-	-	-	-	-	-	-	-	5
Three spine stickleback	3180	27	26	14	4	1	28	20	36	1	1	-	10	3012
Treefrog	1	-	-	-	-	-	-	-	-	-	-	-	1	-
Species (non-native)														
Adult Bullfrog	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Black Crappie	1868	1473	33	170	10	1	5	126	3	1	18	-	-	28
Bluegill	853	233	67	101	6	-	39	210	32	1	35		3	126
Brown Bullhead	2431	446	223	232	21	7	9	217	24	1	50		1	1200
Bullfrog Tadpole	1134	103		1	-	-	-	-	-	2	2	-	-	1026
Crayfish sp.	525	344	4	18	-	-	10	17	13	5	5	-	4	105
Gambusia	24	4	-	-	-	-	-	-	-	-	-	-	-	20
Goldfish	132	71	6	6	-	-	-	16	2	-	-	-	-	31
Largemouth Bass	70	12	3	5	-	-	3	6	2	-	-	-	-	39
Unknown tadpole	826	185	-	7	-	-	20	92	81	-	-	-	1	440
Yellow Perch	237	101	29	22	-	-	3	30	1	2	28	-	-	21