Lewis River Hydroelectric Projects

FERC Project Nos. 935, 2071, 2111, 2213



Photo courtesy of Kim McCune, PacifiCorp - June 2018

2018 Annual Report

Annual Summary of License Implementation and Compliance: Aquatic and Terrestrial Resources





Lewis River Hydroelectric Projects

FERC Nos. 935, 2071, 2111, 2213

Annual Summary of License Implementation and Compliance: Aquatic and Terrestrial Resources

2018 Annual Report





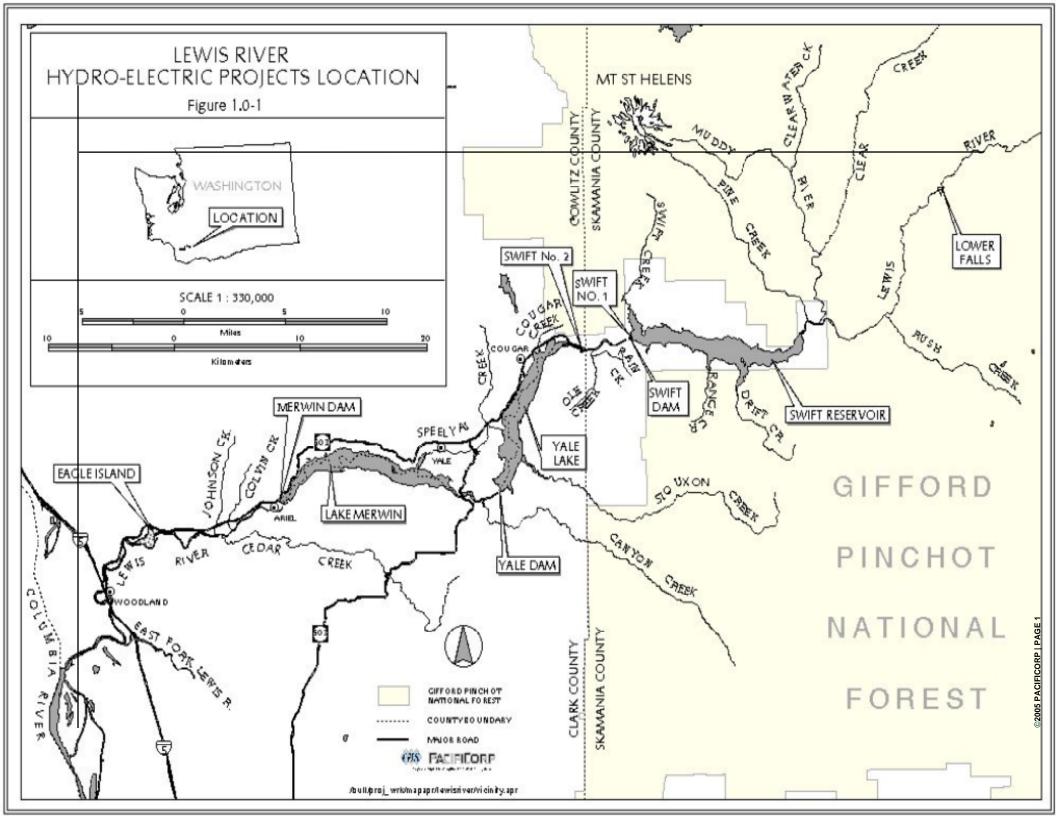


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1.0 INTRODUCTION

This 2018 annual report prepared by PacifiCorp and the Public Utility District No. 1 of Cowlitz County, Washington ("Cowlitz PUD") is provided to the Federal Energy Regulatory Commission (FERC) and the Lewis River Settlement Agreement (SA) Parties to fulfill the reporting requirements of project licenses, articles 402 and 404, and article 14.2.6 of the agreement. It has been prepared in consultation with Terrestrial Coordination Committee (TCC) and Aquatic Coordination Committee (ACC) members. Period of record for this report is from January 1, 2018 to December 31, 2018.

To reflect the settlement Parties' interest in continuing coordination and communication of the implementation of SA and new FERC licenses, Article 14.2.6 of the SA requires PacifiCorp and Cowlitz PUD to prepare annual reports describing the activities of the TCC and the ACC. This SA Article stipulates that the Committee Coordinators for the TCC and ACC shall prepare and file with the FERC detailed annual reports on the fish and wildlife Protection, Mitigation, and Enhancement (PM&E) measures occurring during the prior year as well as plans for the coming year. This annual report fulfills the requirements of Article 14.2.6.

Per the Article language, any comments that were not incorporated into this final report are presented in

This 2018 report is available to the Public on PacifiCorp's website at: http://www.pacificorp.com/es/hydro/hl/lr.html# - License Implementation - Reports

Copies of this report are available from PacifiCorp upon request.



Spencer Creek - Lewis River

1.1 BACKGROUND

Located on the North Fork of the Lewis River in southwestern Washington, the Lewis River Hydroelectric System consists of four operationally coordinated projects. PacifiCorp owns Swift No. 1 (FERC No. 2111), Yale (FERC No. 2071), and Merwin (FERC No. 935) projects which together generate 536 MW of electricity at full capacity. Cowlitz PUD owns the 77 MW Swift No. 2 Project (FERC No. 2213) which lies between Swift No. 1 and Yale. Currently, PacifiCorp operates Swift No. 2 for Cowlitz PUD under contract.

The Lewis Hydroelectric System was developed over a period of approximately 30 years. The first development, the Merwin project, was completed in 1931. The Yale project was completed next in 1953. The Swift No. 1 and Swift No. 2 projects were both completed in 1958.

1.1.1 Lewis River Settlement Agreement

In response to the FERC relicensing of the hydroelectric projects, interested parties collaborated on establishing a settlement agreement concerning future operations and responsive protection, enhancement and mitigation measures. On November 30, 2004, (Effective Date) 26 Parties (including two Licensees, five federal agencies, two state agencies, eight local/county agencies, two tribes, two citizens-at-large, and five non-governmental organizations) signed the Lewis River Settlement Agreement (PacifiCorp and Cowlitz PUD 2004). In December 2004, the Licensees filed with the FERC the SA along with a Joint Explanatory Statement and Supplemental Preliminary Draft Environmental Assessment (PacifiCorp and Cowlitz PUD 2004). The SA reflects the interests of all Parties; provides significant investments in fish and aquatic resources, wildlife and recreation; includes monitoring and evaluation and adaptive management; and includes ongoing coordination with the Parties through the Aquatics and Terrestrial Coordination Committees. The SA included support for 50-year licenses to allow the projects to continue to provide benefits to the Utilities customers. The Lewis River system allows PacifiCorp to maximize the value of its generation assets and power purchases to provide customer benefits. Cowlitz PUD uses its Swift No. 2 power in a similar fashion to provide benefits to its customers.

1.1.2 Environmental Impact Statement

In September 2005, the FERC released the Draft Environmental Impact Statement for the Lewis River Hydroelectric Projects (DEIS) (FERC 2005) for public comment. The DEIS was generally consistent with the SA in that it included most of the SA terms. In November 2005, the Parties filed comments on the DEIS. The FERC released the Final Environmental Impact Statement for the Lewis River Hydroelectric Projects March 24, 2006.

1.1.3 Agency Terms and Conditions

The USFS submitted modified Terms and Conditions in November 2005 (USDA FS 2005). The US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) filed fishway prescriptions February 22, 2006 and February 14, 2006, respectively.

1.1.4 Endangered Species Act Consultations

In January 2005, Cowlitz PUD and PacifiCorp filed with the FERC Biological Evaluations (BEs) covering federally listed fish and wildlife in the Lewis River basin (PacifiCorp and Cowlitz PUD 2005a, PacifiCorp and Cowlitz PUD 2005b). The FERC modified the BEs, included them in the Final EIS and submitted the documents to the Services. The Proposed Action in the BEs is the SA. On September 15, 2006, the USFWS issued a Biological Opinion covering bull trout, northern spotted owls and bald eagles. The National Marine Fisheries Service issued its Biological Opinion covering their respective listed species August 27, 2007.

1.1.5 Water Quality Certifications

Both Licensees applied to the Washington State Department of Ecology (Ecology) for Clean Water Act Section 401 Water Quality Certifications for their respective projects in February 2005. At Ecology's request, both Licensees withdrew and resubmitted those applications in December 2005. Ecology issued a Draft Certification Order for each of the Lewis River projects February 10, 2006. Section 401Water Quality Certifications were issued to the Licensees and filed with the FERC October 9, 2006.

Subsequently, Ecology issued an Order Amendment for the Swift No. 2 project November 3, 2006 followed by a second Order Amendment (No. 4998) December 21, 2007, addressing Conditions 4.6.3.e, 4.6.4.a, and 4.6.5.a. in Administrative Order 3676. Order Amendment No. 3 (No. 5531), issued by DOE January 17, 2008 replaces Condition 3 of Amended Order 4998 (Condition 4.6.5.a of Order 3676). On November 7, 2011, Ecology issued Order Amendment 8832 which replaced conditions of Order No. 3676 relating to water quality standards as provided by RCW 90.48 and WAC 173-210A.

PacifiCorp filed with the FERC an Objection to Inconsistent 401 Certificates Pursuant to Section 15.2 of the Lewis River Settlement Agreement November 16, 2006 and conducted two Alternative Dispute Resolution meetings with SA parties December 11, 2006 and December 15, 2006. Parties reached a resolution at the December 15, 2006 meeting.

On December 21, 2007 the Washington Department of Ecology (Ecology) issued Amended Orders 5000, 4999 and 5001 for the Merwin (Order No. 3678), Yale (Order No. 3677) and Swift No. 1 (Order No. 3679) Certifications respectively. These amendments replaced conditions 4.6.3e, 4.6.4a and 4.6.5a of the Merwin, Yale and Swift No. 1 Certifications, as well as condition 4.6.4e of the Swift No. 1 Certification.

On January 17, 2008, Ecology issued Amended Orders 5329, 5328 and 5330 which replaces condition 4.6.5a as provided in Amended Order 5000 for the Merwin Certification, Amended Order 5328 replacing condition 4.6.5a as provided in Amended Order 4999 for the Yale Certification and Amended Order 5330 replacing condition 4.6.5a as provided in Amended Order 5001 for the Swift No. 1 Certification.

On October 3, 2008, Ecology issued Amended Orders 5743, 5972 and 5974 which replaces condition 4.2(1) and portions of 4.8(3) Table 2 as provided for in Amended order 5329 for the Merwin Certification, Amended Order 5972 replaces portions of 4.8(3) Table 2 as provided in

Amended Order 5328 for the Yale Certification and Amended Order 5974 replaces portions of 4.8(3) Table 2 as provided in Amended Order 5330 for the Swift No. 1 Certification.

On June 22, 2009, Ecology issued Amended Order 6811 which modified the mixing zone for turbidity as it relates to construction of the Upper Release and Constructed Channel implementation.

On February 1, 2010, Ecology issued Amended Order 7325 which modifies Order 3679. Specifically, this amendment extends the expiration dated listed in section D. <u>Duration of Order</u> of amendment 6811 from December 31, 2009, to March 31, 2010.

On November 7, 2011, Ecology issued Amended Orders 8833, 8834 and 8831 which replaced conditions of Administrative Orders 3677,3678, and 3679, respectively, to comply with new water quality standard language modified by Washington Administrative Code (WAC 173-201A-600(1)(a)(ii)).

The Water Quality Certifications and associated amendments for the Swift No. 1, Swift No. 2, Yale and Merwin projects are available for viewing on PacifiCorp's website at http://www.pacificorp.com/es/hydro/hl/lr.html# - (Relicensing Documents).

1.1.6 New FERC Licenses

On June 26, 2008, the FERC provided the Utilities with new operating licenses for the Lewis River hydroelectric projects (Merwin Project No. 935, Yale Project No. 2071, Swift No. 1 Project No. 2111, and Swift No. 2 Project No. 2213). The license periods are each 50 years starting June 1, 2008. Each license includes the respective conditions of the services biological opinions and respective conditions of the Washington Department of Ecology 401 certificates. In general the licenses include terms of the Lewis River Settlement Agreement with few exceptions. Parties to the SA continue to abide by the SA terms including those terms outside the FERC requirements. As such this report may contain information not required by the FERC licenses.

1.1.7 2018 Annual Report and Consultation

PacifiCorp and Cowlitz PUD prepared this 2018 Lewis River Hydroelectric Projects Annual Report (Annual Report) in consultation with the ACC and TCC. A draft report was provided to the ACC and TCC March 4, 2019 for review and comment. Following a 30-day comment period ending April 5, 2019, the Licensees reviewed the ACC and TCC comments and prepared this final Annual Report. This report was provided to the FERC and the Settlement Agreement Parties April 12, 2019 to fulfill the requirements of Section 14.2.6 of the Settlement Agreement.

The period of record for the 2018 Annual Report is January 1, 2018 through December 31, 2018.

The following Plans and Reports were completed in 2018:

- Aquatics Fund Projects Annual Report April 2019
- Wildlife Habitat Management Plan (WHMP Annual Plan for Operation Phase 2019)
- WHMP Annual Progress Report Operations Phase 2018
- Aquatic Coordination Committee/Terrestrial Coordination Committee 2018 Annual Report
- Lewis River Hatchery & Supplementation Program Annual Operations Report 2018
- Lewis River 2018 Fish Passage Program Annual Report
- Lewis River Bull Trout 2018 Annual Operations Report
- Lewis River Bull Trout 2019 Annual Operations Plan
- Yale Reservoir Kokanee 2018 Escapement Report

The water quality monitoring (Section 4) and terrestrial resources (Section 5) sections of this Annual Report have been prepared in cooperation with Cowlitz PUD.

1.2 Annual Report Organization

The 2017 Lewis River Annual Report provides the following information as required under Section 14.2.6 of the SA and the 401 Water Quality Certifications:

Section 2.0 Aquatics and Terrestrial Coordination Committees (ACC, TCC)

Section 2.1 ACC and TCC Membership

Section 3.0 Aquatic Resources

- Section 3.1 ACC Meetings
- Section 3.2 Aquatic Measures Implemented in 2018
- Section 3.3 Aquatics 2018 Annual Plans

Section 4.0 Water Quality

- Section 4.1 PacifiCorp Water Quality Measures Implemented in 2018
- Section 4.2 PacifiCorp Water Quality 2019 Annual Plan
- Section 4.3 Cowlitz PUD Water Quality Measures Implemented in 2018
- Section 4.4 Cowlitz PUD Water Quality 2019 Annual Plan

Section 5.0 Terrestrial Resources

- Section 5.1 TCC Meetings
- Section 5.2 PacifiCorp Terrestrial Measures Implemented in 2018
- Section 5.3 PacifiCorp Terrestrial 2019 Annual Plan
- Section 5.4 Cowlitz PUD Terrestrial Measures Implemented in 2018
- Section 5.5 Cowlitz PUD Terrestrial 2019 Annual Plan

Section 6.0 Law Enforcement

Section 6.1 Motorized Vehicle Issues, Vandalism and Malicious Mischief, Security and Public Safety Support

Section 7.0 Funding Tables

Section 8.0 Literature Cited



Out-migrating spring Chinook smolt captured at the Swift Reservoir Floating Surface Collector Photo courtesy of Christopher M. Karchesky

2.0 AQUATICS AND TERRESTRIAL COORDINATION COMMITTEES

Section 14 of the Lewis River Settlement Agreement includes several measures that define the Parties' roles and obligations. The full text of Section 14 of the Settlement Agreement is provided in **Attachment B**. The structure and process of the ACC and TCC is intended to provide a forum to address time-sensitive matters, early warning of problems, and coordination of member organization actions, schedule, and decisions to save time and expense. The ACC and TCC make decisions based on consensus, while implementing the Settlement Agreement.

More specifically, Section 14:

- Establishes the Aquatics Coordination Committee (ACC) and Terrestrial Coordination Committee (TCC).
- Establishes the Licensees' ACC and TCC Coordinators (Coordinators).
- Describes the coordination and decision making roles of the ACC and TCC.
- Requires the ACC and TCC to coordinate and Consult on development of plans by the Licensees.
- Requires the ACC and TCC to review information and oversee, guide, and make comments and recommendations on implementation and monitoring of the terrestrial and aquatic Protection, Mitigation and Enhancement (PM&E) Measures, including plans.
- Requires the ACC and TCC to establish, among other things:
 - i. Procedures and protocols for conducting committee meetings and deliberations to ensure efficient participation and decision making;
 - ii. Rules for quorum and decision making in the absence of any member;
 - iii. Alternative meeting formats as desired, including phone or teleconference; and
 - iv. The methods and procedures for updating committee members on interim progress of development and implementation of the terrestrial and aquatic PM&E Measures.
- Requires the ACC and TCC to establish subcommittees to carry out specified committee functions and responsibilities and establish the size of, membership of, and procedures for, any such subcommittees.
- Requires the Licensees' Coordinators to prepare and file with the FERC detailed annual reports on the TCC and ACC activities; monitoring and evaluations under the Monitoring and Evaluation Plan (M&E Plan) described in SA Section 9; implementation of the terrestrial and aquatics PM&E Measures occurring during the prior year; and plans for the coming year, and water quality monitoring information.
- Requires the Licensees to consult with the ACC and TCC when preparing the Annual Report.

2.1 ACC and TCC Membership

In December 2004 the Licensees appointed their respective ACC and TCC Coordinators. At the same time, the Licensees established the ACC and TCC, and invited the Parties to designate representatives (and alternates) for membership on these committees. Current Party representation for each committee is shown in Table 1 and Table 2. Fourteen Parties have designated representatives to the ACC and twelve Parties designated representatives to the TCC.

Committee meetings were conducted in every month in 2018. During the year, the ACC met 12 times and the TCC met 8 times.

The purposes of the Coordination Committee meetings were to:

- Develop study and monitoring plans.
- Discuss implementation strategies for PM&E measures.
- Oversee implementation of the PM&E measures.

Sections 3.1, 3.2, and 5.1 of this report summarize major items discussed at the ACC and TCC meetings during the reporting period. Detailed meeting summaries are provided on the PacifiCorp Web site at: http://www.pacificorp.com/es/hydro/hl/lr.html# - ACC or TCC - 2018



Ruffed Grouse - Photo courtesy of Marshall Adams

Table 1. Representatives and Alternates for Membership on the ACC

ACC Representatives	Organization	Alternate		
Jonathan Stumpf	American Rivers	Wendy McDermott		
Public Works Director	City of Woodland	To be named		
No representative at this time	Clark County	To be named		
No representative at this time	Cowlitz County	To be named		
Eli Asher	Cowlitz Indian Tribe	Pete Barber		
No representative at this time	Cowlitz-Skamania Fire District No. 7	To be named		
Jim Malinowski	Fish First	To be named		
No representative at this time	Lewis River Citizens at-large	To be named		
Mariah Stoll-Smith Reese	Lewis River Community Council	To be named		
Steve Manlow	Lower Columbia River Fish Recovery Board	To be named		
Josh Ashline	National Marine Fisheries Service	To be named		
No representative at this time	National Park Service	To be named		
No representative at this time	North County Emergency Medical	To be named		
Erik Lesko	PacifiCorp (PacifiCorp Co-Chair)	To be named		
Amanda Froberg	PUD of Cowlitz County (PUD Co- Chair)	To be named		
No representative at this time	Rocky Mountain Elk Foundation	To be named		
No representative at this time	Skamania County	To be named		
Bill Bakke	The Native Fish Society	To be named		
Jim Bryne	Trout Unlimited	Brice Crayne		
No representative at this time	US Bureau of Land Management	To be named		
Tim Romanski	US Fish & Wildlife	Lindsy Wright		
Ruth Tracy	USDA Forest Service	To be named		
Peggy Miller	Washington Dept. of Fish & Wildlife	Tom Wadsworth		
Adam Cole	Washington State Recreation and Conservation Office, formerly known as Washington Interagency Committee for Outdoor Recreation	Kaleen Cottingham		
No representative at this time	Woodland Chamber of Commerce	To be named		
Bob Rose	Yakama Nation	Joanna Meninick		

Table 2. Representatives and Alternates for Membership on the TCC

TCC Member	Organization	Alternate		
No representative at this time	American Rivers	To be named		
Public Works Director	City of Woodland	To be named		
No representative at this time	Clark County	To be named		
No representative at this time	Cowlitz County	To be named		
Nathan Reynolds	Cowlitz Indian Tribe	Erik White		
No representative at this time	Cowlitz-Skamania Fire District No. 7	To be named		
No representative at this time	Fish First	To be named		
No representative at this time	Lewis River Citizens at-large	To be named		
Mariah Stoll-Smith Reese	Lewis River Community Council	To be named		
Steve Manlow	Lower Columbia River Fish Recovery Board	Amelia Johnson		
Michelle Day	National Marine Fisheries Service	To be named		
No representative at this time	National Park Service	To be named		
No representative at this time	North County Emergency Medical	To be named		
Kendel Emmerson	PacifiCorp (PacifiCorp Co-Chair)	Summer Peterman		
Amanda Froberg	PUD of Cowlitz County (PUD Co-Chair)	To be named		
Bill Richardson	Rocky Mountain Elk Foundation	Ray Croswell		
No representative at this time	Skamania County	To be named		
No representative at this time	The Native Fish Society	To be named		
No representative at this time	Trout Unlimited	To be named		
No representative at this time	US Bureau of Land Management	To be named		
Tim Romanski	US Fish & Wildlife	To be named		
Neil Chartier	USDA Forest Service	Ruth Tracy		
Peggy Miller	Washington Dept. of Fish & Wildlife	Eric Holman		
	Washington State Recreation and Conservation Office, formerly known as Washington Interagency Committee			
Adam Cole	for Outdoor Recreation	Kaleen Cottingham		
No representative at this time	Woodland Chamber of Commerce	To be named		
Bob Rose	Yakama Nation	Joanna Meninick		

3.0 AQUATICS RESOURCES

3.1 ACC Meetings

The purpose and role of the Aquatic Coordination Committee (ACC), as defined in Section 14.1 of the SA is to facilitate coordination and implementation of the aquatic PM&E measures.

The structure and process of the ACC is intended to provide a forum to address time-sensitive matters, early warning of problems, and coordination of member organization actions, schedule, and decisions to save time and expense. The ACC makes decisions based on consensus, while implementing the Settlement Agreement and the FERC license requirements.

3.1.1 ACC Meetings and Conference Calls: Overview

This section summarizes major items discussed at ACC meetings during the 12-month reporting period. Detailed meeting summaries are provided on the PacifiCorp website at: http://www.pacificorp.com/es/hydro/hl/lr.html# - ACC - 2018

- On January 11, 2018 the ACC viewed a 2017/2018 Aquatic Fund PowerPoint presentation for a USFS project titled, Lewis River 21 Phase II.
- On February 8, 2018 he ACC approved the Adult Trap Efficiency Evaluation for Adult Winter Steelhead at Merwin Dam in Spring 2018 Memorandum outlining the 2018 proposed study methods.
- The ACC reached consensus on March 8, 2018 to proceed with funding the USDA Forest Service Aquatic Fund project for \$177,000.
- The ACC decided not to evaluate adult trap efficiency for spring Chinook in spring 2018, and will postpone this evaluation to a later date.
- The 2017 Draft ACC/TCC Annual Report was distributed to the ACC for its 30-day review and comment period March 7, 2018.
- On April 12, 2018 the National Fish and Wildlife Foundation (NFWF) provided a PowerPoint presentation to update the ACC on the In-Lieu Fund and provide the background of the NFWF.
- The 2017 ACC/TCC Annual Report was submitted to the FERC April 10, 2018.
- On May 10, 2018 The ACC approved extending both the Spencer Creek Alluvial Fan and Channel Rehabilitation project and the Lewis River 21 Phase I project to December 31, 2021.

• On June 14, 2018 the ACC approved submitting an extension request to the FERC for

- a revised deadline of December 31, 2019 for the Hatchery & Supplementation Program Independent Comprehensive Review.
- The Utilities distributed the 2018/2019 Lewis River Aquatic Fund announcement materials to all interested parties to August 31, 2018.
- The ACC agreed not to make additional changes to Aquatic Fund Evaluation Criteria document this year but to implement the agreed-upon edits for the 2019/2020 aquatic fund cycle. Edits agreed to thus far will be attached to the September 13, 2018 meeting notes.
- On September 13, 2018 the ACC agreed that the H&S subgroup role should be expanded to include M&E plan review and discussions. The ACC also recommended that bull trout subgroup updates be added to the ACC agenda updates as needed.
- The Utilities received one (1) Aquatic Fund pre-proposals by the due date of September 28, 2018.
- PacifiCorp distributed the 2018/2019 Lewis River Aquatic Fund Pre-Proposal to the ACC October 1, 2018.
- The ACC began its review of the Aquatic Fund 2017/2018 Pre-Proposals with comments and evaluations due by October 11, 2018. An additional 7-day review period was provided to accommodate absentee ACC Representatives with comments due by October 19, 2018.
- On October 22, 2018 the applicant and the ACC were notified of the final decision for full Proposal.
- The ACC received an email dated, December 6, 2018 informing the ACC that the USFS would like to withdraw their proposal for the 2019 funding cycle. They need the year to conduct NEPA to assess the removal of large wood with root wads (great than 20" DBH) from a stand within a reasonable transport distance to the Lewis River Reach 21. The ACC agreed that this project proposal, when resubmitted, will be considered a new project with the submittal of a new/revised project pre-proposal.
- On December 13, 2018 the ACC agreed to another year of ATE study using Blank Wire Tagged winter steelhead in 2019, with the additional focus of comparing trap naïve vs. trap non-naïve fish.

3.1.2 ACC Meeting Notes

The Licensees prepared draft notes for ACC meetings and conference calls. These notes were distributed to ACC members for review and comment approximately one week after the subject meeting. After review, revision and approval by the ACC, the final notes were entered in the public record and posted on the PacifiCorp web site at:

http://www.pacificorp.com/es/hydro/hl/lr.html# - ACC - 2018

3.2 Aquatic Measures Implemented as of the End of 2018

This section presents the actions taken by the Utilities during January 2018 through December 2018 toward Aquatic requirements of the Lewis River Settlement Agreement and the FERC licenses. It also includes previously completed Settlement Agreement actions. The actions are identified by agreement Article number as the agreement is more specific in detailing the requirements than the license orders which in essence, incorporate agreement terms via agency regulatory authority. In some instances previous actions are noted to provide a more comprehensive record.

A description of funding amounts deposited and disbursed during 2018 is provided in Section 7.0 – Funding.

3.2.1 <u>SA Section 4.1 Common Provisions Regarding Fish Collection and Transport</u> Facilities

Studies to Inform Design Decisions (SA 4.1.1)

PacifiCorp has completed the Merwin Tailrace Fish Behavior study to provide information that could assist the planning and design of the Merwin Upstream Collection and Transport Facility. The study plan was developed in coordination with the ACC and was finalized as a revised document June 30, 2005. In 2005 through 2006, the study was conducted and a final report was issued in February 2007.

Adult Trap Efficiency for Salmonids (SA 4.1.4c)

The Adult Trap Efficiency (ATE) standard was first discussed by the ACC at the February 14, 2009 meeting. Bryan Nordlund of NMFS subsequently developed a proposal for the ATE standard along with a matrix for a phased fish trap implementation. This proposal was the topic of nearly every ACC and Engineering subgroup meeting for most of the year accompanied by several offline conversations. An ATE determination methodology and standard was finally accepted by the ACC at their December 11, 2009 meeting with the efficiency set at 98%. Detailed methodology and definitions were delegated to the Draft Monitoring and Evaluation Plan which was submitted to the FERC in June 2009 and approved in December 2010, and later revised and resubmitted to FERC in April 2017 and approved on May 15, 2017 (see Section 3.2.36 below). The Merwin Upstream Collection and Transport facility was not substantially completed until April 2014. Based on this, PacifiCorp proposed and the ACC agreed to suspend the start date of the two year ATE evaluation until spring 2015. ATE evaluation continued in 2018 with the monitoring of late-run winter steelhead and adult coho salmon only (no spring Chinook in 2018). The annual report for each of the 2018 Merwin

ATE Studies can be found in the Lewis River Fish Passage Program 2018 Annual Report (**Attachment F**).

3.2.2 SA Section 4.2 Original Merwin Trap

Original Merwin Trap suspended operation in June 2013.

Merwin Trap Flow Restrictions (SA 4.2b)

To provide a margin of safety for personnel, PacifiCorp limited the 2012 river discharge at Merwin dam/powerhouse to 5,500 cfs or less as river flow conditions warranted when personnel were in the trap. Flow limitations were coordinated with WDFW hatchery staff. With completion of the Merwin Upstream Collection and Transport facility, flow restrictions are no longer needed.

Merwin Trap Upgrades (SA 4.2c)

On November 29, 2005 PacifiCorp provided the Services (USFWS and NOAA Fisheries) and WDFW a letter requesting a meeting to discuss potential upgrades and operational procedures to improve operating conditions for personnel working in the Merwin Trap by providing a greater margin of safety. Attached to the letter was a memo that identified company proposed measures and a supporting Engineering Study (Report No. RES 3000028924).

Final designs were submitted to the FERC February 2, 2007 and acceptance received from the FERC February 12, 2007. Final designs and the FERC correspondence are available upon request.

Interim Merwin Trap Operations (SA 4.2d)

For 2012, the Merwin Trap was operated in coordination with WDFW or PacifiCorp's new Fish Passage crew to collect hatchery fish returning from the ocean and to transport any bull trout collected to Yale reservoir. Per the SA, WDFW increased frequency of trap cleanout to daily during the work week (Monday - Friday) unless flows or inadequate staff prevented such effort. PacifiCorp coordinated with WDFW and made reasonable efforts to operate the Merwin powerhouse to allow fish trapping operations at the trap. Fish other than hatchery fish or wild winter steelhead were returned to the river downstream of Merwin Dam.

3.2.3 SA Section 4.3 Merwin Upstream Collection and Transport Facility

On March 2, 2009, PacifiCorp submitted to the subgroup and the ACC the 60 percent design report. Following comments on the 60 percent design report, the subgroup worked on developing the design to a 100 percent level. On June 26, 2009, the subgroup was provided the 90 percent design report. Following the review period, PacifiCorp worked with the subgroup to finalize the report. A 100 percent design report was submitted to the FERC December 23, 2009. Periodic project updates were provided at monthly ACC meetings until the upstream collection facility was completed.

On September 4, 2012, PacifiCorp assumed operations of the existing adult trap located at Merwin Dam. This included daily (Mon. – Fri.) removal of fish from the trap, vertical adjustment of weir orifice, transportation of target species upstream, and data management.

WDFW remained responsible for transporting all non-target species (i.e., species not identified in PacifiCorp's upstream transport plan) to the hatcheries or to the lower Lewis River.

On June 30, 2013, the existing Merwin Trap was decommissioned to allow for construction of the new facility. The new upstream collection and transport facility resumed operation in late December 2013 and was considered substantially complete in April 2014 The following information is a summary of the Merwin trap operations in 2014. Detailed results of the 2018 operations and M&E evaluations are included in the attached Lewis River Fish Passage Program 2018 Annual Report (**Attachment F**).

In compliance with WDFW standards, all adult salmonids collected were identified to species and sorted based on the following characteristics: missing adipose fin with no coded wire tag detection (AD CLIP ONLY), adipose fin absent and present with a coded wire tag detection (CWT), adipose fin intact with no coded wire tag detection (WILD), and adipose fin intact with blank wire tag present (WILD + BWT). All fish were also identified as male (M), female (F), or jacks (J).

A total 15,328 fish were captured at the Merwin Trap in 2018 (**Table 3**). Among the species collected summer steelhead accounted for the slight majority of fish captured (n=5,567) followed by early run coho (n=2,862), winter steelhead (n=2,722), spring Chinook (n=2,106), late run coho (n=1,343), and fall Chinook (n=623). No bull trout were captured at the Merwin Trap in 2018, or in any previous years.



Lower Lewis River Screw Trap - October 2018

Table 3. 2018 Merwin Trap Capture Data.

Species		AD Clip			CWT			Wild			Wild Recap			BWT		кесар	Not sexed	Total
	М	F	J	М	F	J	М	F	J	М	F	J	М	F	М	F	_	
Spring Chinook	949	736	50	173	159	15	16	7	1									2896
Fall Chinook	144	128	7	13	10	4	108	98	111									575
Early Coho	417	385	1150	107	111	220	79	79	314									3,678
Late Coho	378	335	165	46	54	33	129	121	82									2,999
Summer Steelhead	1425	2337					5	14			1				554	1231		3,593
Winter Steelhead	490	798					47	73		5	8		683	534	47	37		3,706
Sockeye Salmon							12	11		1	4							24
Chum Salmon																		3
Pink Salmon																		4
Cutthroat (>13 inches)																	54	54
Cutthroat (< 13 inches)																		
Rainbow (< 20 inches)																		
Bull Trout (> 13 inches)																		
Bull Trout (< 13 inches)																		
																Total		17,551

A total 9,062 adult salmonids (700 spring Chinook, 7,060 coho salmon, 1,225 winter steelhead, and 77 cutthroat) were transported upstream throughout the migration period in 2018 as part

Table 4. Summary of 2018 Upstream Transport to Swift Reservoir.

of the PacifiCorp's reintroduction program (**Table 4**).

Species	Male	Female	Jack	Not sexed	Female:Male Ratio	Jack:Adult Ratio	Total
Spring Chinook	491	177	32	-	0.34	0.05	700
Early Coho	1,173	662	313	-	0.47	0.18	2,148
Late Coho	2,826	1997	89	-	0.69	0.02	4,912
Winter Steelhead	685	540	-	-	0.79	-	1,225
Cutthroat >13"	-	-	-	77	-	-	77
Bull Trout >13"	-	-	-	-	-	-	0
						Total	9,062

3.2.4 SA Section 4.4 Downstream Transport at Swift No. 1 Dam

Modular Surface Collector (SA 4.4.1)

The Modular Surface Collector, referred to as the Swift Floating Surface Collector (FSC), operated for most of 2018 with a planned shutdown from approximately mid-July through mid-October 2017 for scheduled maintenance. Detailed results of the 2018 operations and M&E evaluations are included in the attached Lewis River Fish Passage Program 2018 Annual Report (Attachment F). A total 57,825 salmonids were captured by the FSC in 2018. Of these fish, 55,336 were transported and released downstream of Merwin Dam. Juvenile coho accounted for the highest proportion of the overall catch (73%), followed by steelhead (14%), spring Chinook (8%) and coastal cutthroat trout (2%). A total 2,087 hatchery rainbow trout and 7 bull trout were collected in 2018 and returned to the reservoir. A full accounting of the required standards, such as injury rate, capture efficiency, Overall Downstream Survival (ODS), and others, is included in the Lewis River Fish Passage Program 2018 Annual Report (Attachment F).

Release Ponds (SA 4.4.3)

In 2006, PacifiCorp notified the ACC representatives that the company was working to secure a site for the Release Ponds. PacifiCorp initially worked with WDFW to secure acquisition of a site just downstream of Woodland, Washington. The site met the criteria established in the SA and the land was available for trade with WDFW.

In 2009, PacifiCorp discovered that the identified WDFW parcel was much smaller than originally recorded with the county and was not of suitable size. PacifiCorp then initiated talks with the adjacent landowner to pursue either purchase or lease. Discussions with continued through to October 2010, at which point the adjacent landowner withdrew from negotiations.

In November 2010, PacifiCorp initiated an effort to find an alternate site upriver from the previously considered location. A site was selected and purchased and final designs updated. The site is on approximately 5 acres near River Mile 9 and the town of Woodland, Washington. PacifiCorp has prepared documentation for formal consultation between NMFS and the FERC on Eulachon smelt (*Thaleichthys pacificus*) and associated critical habitat.

A Biological Opinion from NOAA Fisheries was submitted to the FERC February 3, 2015. With the Biological Opinion complete, progress towards the US Army Corp of Engineers' (USACOE) dredge and fill permit, and the Washington Department of Natural Resources (WDNR) lease for the in-water structure could continue.

In 2015, PacifiCorp received notification from the City of Woodland that the Company would need to resubmit permit applications for construction of the Release Ponds since the previous permits had expired. PacifiCorp staff resubmitted permit applications. Land Use permit approvals were issued by the City of Woodland, USACOE, WDNR and WDFW, with the final approval granted April 16, 2017. Following completion of all the regulatory requirements, PacifiCorp initiated and completed construction of the Release Ponds in December 2017. Operations testing occurred in early-January 2018 with final acceptance later that month. The Woodland Release Pond began daily operation in March 2018. The facility's purpose is to allow for stress reduction and determination of transport survival for out-migrants transported downstream from the Swift Reservoir FSC before volitional release into the lower Lewis River.

3.2.5 SA Section 4.5 Downstream Passage at Yale Dam

Implementation scheduled prior to 13th anniversary of Yale Project License.

3.2.6 SA Section 4.6 Downstream Passage at Merwin Dam

Implementation scheduled prior to 17th anniversary of Merwin Project License.

3.2.7 SA Section 4.7 Upstream Passage at Yale Dam

Implementation scheduled prior to 17th anniversary of Yale Project License.

3.2.8 SA Section 4.8 Upstream Passage at Swift Projects

Implementation scheduled prior to 17th anniversary of Swift No.1 Project License.

3.2.9 SA Section 4.9.1 Interim Bull Trout Collection and Transport Programs

Per Article 402(a) in the FERC licenses and the Lewis River SA section 4.9.1, PacifiCorp annually captures and transports bull trout from the Yale powerhouse tailrace (upper Merwin Reservoir) to the mouth of Cougar Creek, a Yale Reservoir tributary. A total of 162 bull trout have been captured from the Yale tailrace since the program began in 1995.

For Methods, Materials, and Results concerning number of bull trout captured and transported during 2018 Yale Tailrace activities as well as pertinent biological information of individual bull trout captures, please see **Attachment C**, *Bull Trout 2018 Annual Operations Report*.

Investigation of Alternative Collection Methods (SA 4.9.2)

PacifiCorp continues to consider more effective and less intrusive methods to collect bull trout from the Yale tailrace until capital improvements and future fish passage is implemented prior to 2023. Past alternative methods investigated include; beach seines, purse seines, drifting tangle nets when the powerhouse is online, and angling.

In 2018, tangle nets and angling were the only methods used and, to date, remain the most effective. Annual Consultation concerning 2018 bull trout monitoring activities occurred between the Utilities and the USFWS in January 2018 at which time it was agreed that tangle nets would again be utilized in the upcoming field season to attempt to capture bull trout from within the Yale tailrace waters.

Yale and Merwin Bull Trout Entrainment Reduction (SA 4.9.3)

PacifiCorp completed and distributed a revised *Yale Project Entrainment Reduction Plan* to the ACC and the Services May 16, 2008. The plan is available on PacifiCorp's website: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Hydro_Licen_sing/Lewis_River/li/acc/Yale_Hydro_Project_Bull_Trout_Entrainment_Final_Report_and_Bull_Trout_Reduction_Plan_January_2008.pdf

3.2.10 SA Section 4.10 Bull Trout Passage in the Absence of Anadromous Fish Facilities

If Yale Downstream Facility is not constructed, implement prior to 13th anniversary of Yale Project License.

3.2.11 SA Section 5.1 Yale Spillway Modifications

PacifiCorp has nearly completed installation of a spillway barrier net. This net is similar in design and made of material similar to the Entrainment Reduction net in Yale Reservoir. The net is designed to exclude bull trout from the spillway at any spill flow less than 6,000 cfs (the average spill volume for Yale Spillway) meeting the intent of SA 5.1. When spill flows exceed 6,000 cfs, the net floating line is designed to sink to allow large debris to float over the net and exit Yale reservoir via spill. This procedure avoids damaging the net. It is anticipated that the occurrence of spills greater than 6,000 cfs will be rare so bull trout spillway entrainment is consequently expected to be low. As of the end of 2012, some of the floating system parts failed during installation so PacifiCorp solicited approvals from ACC members and the FERC to extend the final installation to March 31, 2013. ACC members, including the Services, approved the extension but the FERC had not responded prior to the end of 2012. The FERC approved the extension in spring 2013 and the spillway entrainment net was completed October 15, 2013.

3.2.12 SA Section 5.2 Bull Trout Habitat Enhancement Measures

PacifiCorp continued to manage the Cougar Creek Conservation Covenant to the benefit of bull trout. Noxious weeds (scotch broom and Himalayan blackberry) were identified and treated along the transmission Right Of Way (ROW) and in previously tree harvested lands along Panamaker Creek.

A habitat improvement project on Panamaker Creek was submitted by PacifiCorp through the 2007/2008 Aquatic Habitat Fund process. This project was completed in August 2008 and had the following benefits:

- Reduced sediment input through the decommissioning of one mile of road;
- Removal of nine culverts and installation of ten cross ditches for runoff control; and
- Re-vegetation of all disturbed soils.

Per the SA, Cowlitz PUD managed the Devil's Backbone Conservation Covenant to benefit bull trout.

3.2.13 SA Section 5.3 Reserved

3.2.14 SA Section 5.4 Reserved

3.2.15 SA Section 5.5 Bull Trout Limiting Factors Analysis

Contract was awarded to Meridian Environmental, Inc. (the Consultant). The Consultant completed the field work and provided a final report in May 2007. The report describes three potential streams that could support bull trout if improvements were made to the habitat. The improvements include shading to reduce stream temperatures and riparian habitat stabilization. An overriding limiting factor in two of the three streams was lack of water during the critical spawning period.

3.2.16 SA Section 5.6 Public Information Program to Protect Listed Anadromous Species

PacifiCorp maintains signage at the Eagle Cliff area to inform the public of specific angling regulations that are designed to protect both bull trout and reintroduced anadromous species (**Figure 1**). Additionally, WDFW has approved new regulations on Swift Reservoir that prohibit the harvest of unclipped adipose fin salmonids or salmon over 15 inches in length. The area upstream of Eagle Cliff Bridge remains catch and release for all species. This effort will help protect transported adults and their progeny migrating through Swift Reservoir.

3.2.17 SA Section 5.7 Public Information Program to Protect Bull Trout

PacifiCorp maintains signage at most reservoir and river access sites that are owned by the company. The company also provides informational flyers to the public at all camping and day use areas the company owns. As of July 2018 Figure 1 content was updated. PacfiCorp will work in coordination with WDFW to update the photos in the 2019 annual report.





Figure 1. Signs posted for public information.

3.2.18 SA Section 6.1 Flow Releases in the Bypass Reach: Upper Release and Constructed Channel

Upper Release Point (SA 6.1.2)

Upper Release Point water flowed continuously throughout 2018. The upper release flow was in excess of the required minimum flow for the duration of the year. There were no spill events at the Swift project in 2018.

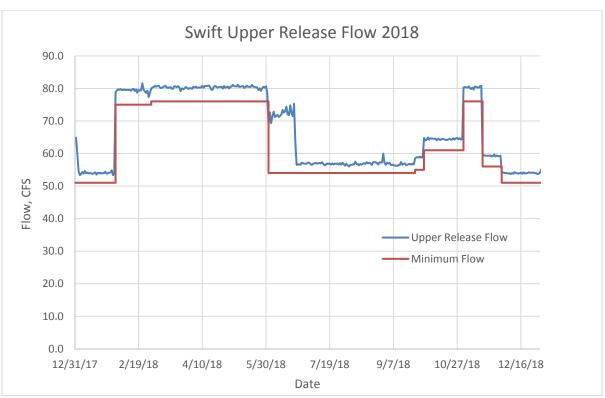


Figure 2. Daily Minimum Release flows from December 31, 2017 to December 31, 2018.

Constructed Channel (SA 6.1.3b)

Beginning in fall 2011, a flow monitoring gage was installed at the canal drain outlet to provide a minimum flow alarm system and enhanced flow measurement. Minimum flow from the canal drain is set at 14 cfs year round. The system is performing well and there were no minimum flow excursions recorded for 2018 (**Figure 3**).

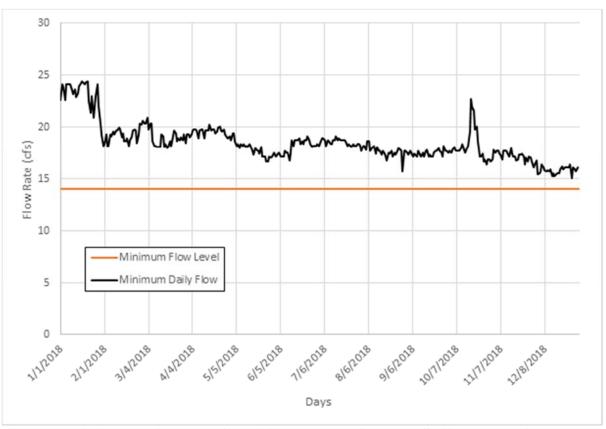


Figure 3. Minimum daily water flow (cfs) measured from the Swift canal drain - 2018.

Maintenance of the Constructed Channel (SA 6.1.3e)

As of December 31, 2018 all structures are in place and functioning.





3.2.19 SA Section 6.2 Flow Fluctuations and Ramp Rates below Merwin Dam

Minimum Flows

During calendar year 2018, flows for the Merwin Project were met or exceeded as stipulated in the June 26, 2008 FERC license with the following exception. Two short duration minimum flow deviations occurred at the Merwin Project on November 7, 2018. The following top of the hour average flows, as measured at the USGS Ariel Gage No. 14220500, were less than the FERC license required minimum instream flow of 1900 cubic feet per second (cfs).

Date/time	Top of Hour Average Flow (cfs)
11/7/18 05:00	4,048
11/7/18 06:00	4,185

On November 7, 2018 the main Programmable Logic Control (PLC) at Merwin began experiencing issues around midnight (00:23). A plant operator was dispatched to Merwin to monitor the plant until a communication technician could get there to trouble shoot. At a little before 04:43 generating units 2 and 3 began to shed their generation loads. Because communications to the PLC were not operating properly, real-time data, like tail race elevation and river stage at Ariel gage, were not coming into the control system and it took a few minutes for the on-duty hydro control operator to realize the units had unloaded. At 04:50 the units were placed in manual and ramped up using the controls at the plant.

Ramp Rates

There was one ramp rate excursion downstream of Merwin Dam, as measured at the USGS Ariel Gage No. 14220500, on May 23, 2018.

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On Wednesday May 23, 2018, at 1034 hours, the Merwin powerhouse experienced a unit trip when transferring Unit 3's power source from the uninterruptible power supply (UPS) to station service power source for planned inspection and troubleshooting of the UPS. At 10:34 AM, Merwin powerhouse experienced a unit trip when transferring Unit 3's power source from the uninterruptible power supply (UPS) to station service power source for planned inspection and troubleshooting of the UPS. At the time of the Unit 3 trip, both Units 1 and 2 were offline. The reason for the inspection was that the day before, on May 22, 2018, a UPS minor alarm had come in and then a critical alarm came in that caused the loss of SCADA communication with several of the systems.

When the power source for Unit 3 was transferred at May 23, 2018 at 1034 hours all communications were lost, preventing the Hydro Control Operator from seeing that Unit 3 had tripped offline. The loss of communications also prevented the water management system from automatically opening a spill gate.

With the loss of communications, per protocol, the plant operator drove to the top of the dam to manually open a spill gate to offset the drop in river flow. When he arrived, he had to wait for scaffolding workers, working in the spillway on Gate 4, to exit the spillway prior to opening a spill gate. Gate 5 was opened at 1040 hours and Unit 1 began to ramp up at 1044 hours. Both Gate 5 and Unit 1 were utilized to bring the Lewis River stage back up to pre-Unit 3 trip conditions. The hourly average river stage change as measured at the Ariel gage at 1100 hours was of 0.185 feet.

3.2.20 SA Section 7.1 Large Woody Debris Program

PacifiCorp provided funding to the Fish First, Friends of East Fork Lewis River for transporting logs for habitat enhancement projects in 2018. The remaining balance as of December 31, 2018 is \$2,013.42.

3.2.21 <u>SA Section 7.2 Spawning Gravel Study and Gravel Monitoring and Augmentation</u> Plan

In 2006, PacifiCorp completed a Spawning Gravel Report for downstream of Merwin dam and proposed to monitor gravel movement for two years before making recommendations and developing a final gravel augmentation plan. A summary report was provided to the ACC December 20, 2007, regarding completion of two tasks for the Lewis River Spawning Gravel Evaluation. In 2008, the third year of mapping the spawning gravel areas and analyzing the accumulated data was completed. Some of the key findings were that spawning habitat is likely limiting to the local Chinook salmon population. Available spawning gravel does not appear to be diminished in the upper reach and the gravel appears to be stable. Adding more spawning gravel would not necessarily increase the spawning area due to the effect of the confined canyon geomorphology.

PacifiCorp provided an annual report to the ACC and monitored the gravel sites in the fall of 2008 in order to provide more refinement to the model for gravel movement and an applicable trigger or gravel augmentation. A final report update and recommendations was submitted in January 2009. Per the assessment plan a recommended monitoring-trigger occurs when flows below Merwin exceed 42,000 cfs as measured at the Ariel gage. Since completion of the

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assessment report, flows of that magnitude have not occurred. The highest flow since the completion of this study occurred in January 2010 at just over 37,000 cfs.

3.2.22 SA Section 7.3 Predator Study

A predator analysis was initiated as part of the New Information process and was reported in the document titled, *New Information Regarding Fish Transport into Lake Merwin and Yale Lake* which was provided by the USGS and University of Washington June 24, 2016 (PacifiCorp 2016).

3.2.23 SA Section 7.4 Habitat Preparation Plan

PacifiCorp's obligation under the Habitat Preparation Program for Swift Reservoir ended in 2012. Formal reintroduction of fish collected at Merwin Trap replaced the Habitat Preparation Program for all reintroduction species into Swift. The Habitat Preparation Program may be initiated at Merwin and Yale reservoirs pending the decision to reintroduce salmon and steelhead into those reservoirs.

3.2.24 SA Section 7.5 Aquatics Fund

PacifiCorp continues to annually make funds available for Aquatic resource projects in accordance with the *Aquatics Fund – Strategic Plan and Administrative Procedures*.

On August 31, 2018 the Licensees notified Settlement Agreement Parties, ACC, TCC and interested parties of the availability of Funds for the 2018/2019 funding cycle. The total amount available as of December 31, 2018 was \$2,949,259.22 (see Section 7.0). The Licensees will continue to provide additional money to the Aquatic Fund on an annual basis as stipulated in the SA.

3.2.25 SA Section 7.6 In Lieu Fund

Implementation is to be determined by NOAA Fisheries and USFWS following the Services' evaluation of new information on fish passage at Merwin and Yale projects by year nine of the licenses. Interested parties met several times to discuss the fish passage and in-lieu of fish passage alternatives. Outcome of the discussions is available in the report titled "Fish Passage Decision Support Document" which was prepared by the facilitator and provided to the ACC July 28, 2017 (link provided below).

Progress on the evaluation of new information continued throughout 2018. (http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Hydro_Licensing/Lewis_River/li/acc/Final_Decision_Support_July_28_2017%20(website).pdf).

On December 22, 2018, certain agencies within the federal government shutdown due to budgetary restrictions. In view of the federal government shutdown, and to accommodate the Services, the Utilities requested an additional extension of time for the final decision by the FERC until January 18, 2019.

3.2.26 SA Section 7.7 Management of Aquatics Fund and In Lieu Fund

At the end of 2018, PacifiCorp's total available fund amount was \$2,183,431.50 for Resource Projects and \$765,827.72 for Bull Trout Projects.

Fund account information is provided in Section 7.0.

3.2.27 SA Section 7.8 Execution of Projects and Mitigation Measures

The ACC approved to proceed to full proposal for the project referenced below but an email was received on December 6, 2018 informing the ACC that the USFS would like to withdraw their proposal for the 2019 funding cycle. An additional one year is needed to conduct NEPA to assess the removal of large wood with root wads (great than 20" DBH) from a stand within a reasonable transport distance to the Lewis River Reach 21. The ACC agreed that this project proposal, when resubmitted, will be considered a new project with the submittal of a new/revised project pre-proposal.

- USDA Forest Service
 - o 2018 Lewis River 21: Phase III \$227,000

3.2.28 SA Section 8.1 Hatchery and Supplementation Program

On December 20, 2010, the FERC issued an order approving the *Hatchery and Supplementation Plan*, which was originally submitted December 23, 2009. On January 22, 2015, the FERC issued an order approving the updated Lewis River Hatchery and Supplementation Plan that was submitted December 16, 2014.

3.2.29 SA Section 8.2 Hatchery and Supplementation Plan and Report

The Licensees have completed the H&S Annual Report for 2018 (See **Attachment E**). The Hatchery and Supplementation Subgroup is currently working on finalizing the 2019 Annual Operations Plan with a target completion date of December 2019. During the interim, implementation of the H&S monitoring activities will be guided by the existing working draft. This timeline was agreed to by the H&S Subgroup in early 2017. The Licensees will continue to schedule planning meetings to ensure that modifications to the AOP are drafted and approved. Once the 2018 plan is approved, the Subgroup will begin work on 2019 planning efforts and documents.

3.2.30 SA Section 8.3 Anadromous Fish Hatchery Adult Ocean Recruit Target by Species

The development of a precise and acceptable methodology for calculation of ocean recruits is an ongoing process. PacifiCorp and their contractors began evaluating methods and identifying data acquisition concerns and needs. This work continued in 2015 and was presented as part of the Monitoring and Evaluation Plan dated April 3, 2017. NOTE: As part of the Hatchery and Supplementation Plan update, development of methods to calculate ocean recruits was moved to the Monitoring and Evaluation Plan (as Objective 12) to reduce redundancy between the two plans and because many of the objectives in the Monitoring and Evaluation rely on this estimate.

3.2.31 SA Section 8.4 Anadromous Fish Hatchery Juvenile Production

Juvenile production targets as provided in the H&S Plan have been met for 2018.

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3.2.32 SA Section 8.5 Supplementation Program

The Supplementation Program is included in the *Hatchery and Supplementation Plan* submitted to the FERC in December 2014. The Utilities have followed and met the provisions of this plan during 2018 as adaptively managed by the Hatchery and Supplementation Subroup. The annual report of operations under this program is provided as **Attachment E**.

3.2.33 SA Section 8.6 Resident Fish Production

PacifiCorp and Cowlitz PUD funded the operation of the Lewis River Hatchery Complex to meet current FERC license obligations for resident fish production.

3.2.34 SA Section 8.7 Hatchery and Supplementation Facilities, Upgrades, and Maintenance

The Licensees have fulfilled their obligation with respect to SA Section 8.7 hatchery upgrades. The Licensees will continue to implement hatchery facility upgrades in collaboration with the hatchery managers, hatchery engineers and in Consultation with the ACC. The completion schedule for SA 8.7 upgrades was provided in **Attachment E** of the 2015 ACC/TCC Annual Report.

3.2.35 SA Section 8.8 Juvenile Acclimation Sites

However, it was found that naïve adult spring Chinook adults transported above Swift Dam in 2017 (n=1,110) spawned widely across the available habitat (throughout the upper Lewis River, Muddy River watershed, and Swift Reservoir tributaries). Since the primary purpose of acclimating spring Chinook juveniles released in to the upper basin above Swift Dam was to promote the distribution of returning adults spawners throughout the available spawning habitat upstream of Swift Dam, it appeared that this primary acclimation program goal was being accomplished. Therefore the ACC Hatchery & Supplementation (H&S) Subgroup recommended releasing the 100,000 juvenile spring Chinook salmon (formerly allocated for the upper basin acclimation sites) downstream of Merwin Dam in 2018 and into the near future. The H&S subgroup recommended that beginning in 2019, all juvenile spring Chinook formally allocated to the upper basin release ponds would be fully integrated into the existing Lewis River hatchery spring Chinook program; thereby increasing the overall annual program goal from 1.25 to 1.35 million per year. By increasing hatchery production in the lower river and ultimately returning adults, more adults would likely be available to be taken upstream as part of the reintroduction efforts. This action was discussed and approved at the June 14, 2018 Lewis River Aquatic Coordination (ACC) Meeting. A full description of acclimation releases in 2018 and revised program plan for the next 5-years (2019 – 2024) can be found in the Lewis River Fish Passage Program 2018 Annual Report (**Attachment F**).

3.2.36 SA Section 9.1 Monitoring and Evaluation Plan

On March 31, 2010, PacifiCorp provided a draft Monitoring and Evaluation (M&E) Plan to the ACC for review. After receiving comments, the M&E Plan was finalized and submitted to the FERC June 16, 2010. The FERC approved the final plan November 3, 2010. A 5-year update of the M&E Plan occurred during 2015-2016, and a final draft version was submitted to the ACC for a 90-day review period September 2, 2016. Based on discussions with NMFS and with concurrence from WDFW, PacifiCorp requested an Extension of Time request from the FERC and provided stakeholders an additional 45 day period to review the completed final draft of the M&E Plan by February 2017. The document was updated and submitted to the

Commission in April 2017. The final Plan was approved by the FERC May 15, 2017. Implementation of the M&E Plan requirements continued through 2018.

3.2.37 SA Section 9.2 Monitoring and Evaluation Related to Fish Passage

Implementation of the M&E Plan as it relates to anadromous reintroduction continued in 2018 and included monitoring of upstream and downstream migrants. Coho salmon, spring Chinook salmon, and wild winter steelhead adults were available for transportation upstream so spawning surveys took place for these species. In terms of fish passage, the 2018 Annual fish Passage report (Lewis River Fish Passage Program 2018 Annual Report) is included as **Attachment F**. This report specifically addresses Settlement Agreement sections 4.1.4 and 9.2.1 through 9.2.2.

3.2.38 SA Section 9.3 Wild Fall Chinook and Chum (lesko)

Implementation of the fall Chinook monitoring that includes chum continued in 2018 per the H&S Plan approved by the FERC. NOTE: Fall Chinook and chum salmon monitoring activities and objectives in the lower Lewis River were part of the M&E Plan but are now part of the Hatchery and Supplementation Plan as part of the updated plan approved by the FERC in January 2015.

3.2.39 SA Section 9.4 Water Quality Monitoring

See section 4.1.2 under Water Quality

3.2.40 SA Section 9.5 Monitoring of Hatchery and Supplementation Program

The FERC approval of the updated *Hatchery and Supplementation Plan* was provided January 22, 2015. Monitoring of the H&S program is the responsibility of the H&S subgroup created by the ACC. Each year, the H&S subgroup develops annual operating plans (AOP) to adaptively manage and implement components of the H&S Plan.

3.2.41 SA Section 9.6 Bull Trout Monitoring

PacifiCorp, on behalf of the Utilities, completed actions according to the 2018 Bull Trout Annual Operations Plan. Results from activities performed and data obtained under SA Section 4.9.2 and 9.6 are provided in **Attachment C**, Bull Trout 2018 Annual Operations Report.

3.2.42 SA Section 9.7 Resident Fish Assessment

Given the spatial and temporal overlap of preferred spawning habitat and periodicity between coho and bull trout, there is concern that later spawning coho may superimpose redds over redds newly constructed by bull trout. To evaluate any superimposition, bull trout redd surveys were completed in Pine Creek and Pine Creek tributary P8 in September and October. All identified bull trout redds were labeled by Global Positioning Satellite, as well as physically marked within the stream for ease of identification at a later date. Coho redd surveys were subsequently performed of the same stream in October and November to evaluate any redd superimposition by the two species. No coho redds were observed to be superimposed over bull trout redds in 2018. We will continue to watch for any encroachment of coho into critical spawning streams for bull trout.

This evaluation was not conducted within Cougar Creek in 2018 as no reintroduced anadromous species were released into Yale Reservoir this year. Habitat Preparation Plan species were scheduled to be released into Yale Reservoir in 2016 but that has been delayed pending decision on passage into Yale Lake.

Kokanee spawner abundance was evaluated within Yale Reservoir and estimates are included within the Yale Reservoir Kokanee 2018 Escapement Report located in **Attachment J**.

3.2.43 SA Section 9.8 Monitoring of Flows

Monitoring of Merwin flows and the Upper Release and the Constructed Channel flows has occurred on a continuous basis and will continue per the M&E Plan.

3.3 Aquatic 2019 Annual Plan

3.3.1 SA Section 4.2 Merwin Trap

Since the new trap was installed in December 2013 this section no longer applies.

3.3.2 SA Section 4.3 Merwin Upstream Collection and Transport Facility

The new upstream collection and transport facility was considered substantially complete in April 2014. And will continue to operate with some minor modifications anticipated that will improve operations. Major modifications are potential but, pending results of the Adult Trap Efficiency studies for each of the three transport species, will not be put in place until a determination of need occurs. The intent of the modifications made to the existing collection facility at Merwin Dam were to provide safe, timely, and effective passage of adult salmonids being transported upstream.

The new facility is designed to be modified in phases, offering the ability to incrementally improve fish passage performance (if needed) in the future to meet biological performance goals. Depending on the biological monitoring of the facility's performance (which began spring 2015), there are up to four additional phases that will increase flow into the fishway attraction pools, and add a second fishway with additional attraction flow, if necessary.

3.3.4 SA Section 4.4 Downstream Transport at Swift No. 1 Dam

PacifiCorp completed and submitted the final design for the Swift Downstream Facility in December 2009 and the facility was put into service December 26, 2012. PacifiCorp purchased the land needed for the downstream Release Pond and the pond facility was constructed in December 2017. The Release Pond facility began full operation in March 2018.

3.3.3 SA Section 4.9 Interim Bull Trout Collection and Transport

PacifiCorp and Cowlitz PUD are to investigate alternative Bull Trout collection methods in consultation with the ACC. The 2019 Bull Trout Annual Operations Plan (Attachment D) has been incorporated into this Annual Report and submitted to the ACC including USFWS and NMFS in March 2019.

3.3.4 SA Section 5.2 Bull Trout Habitat Enhancement Measures

PacifiCorp will continue to manage the Cougar Creek Conservation Covenant and Cowlitz PUD will continue to manage the Devil's Backbone Conservation Covenant to benefit bull trout.

3.3.5 SA Section 5.7 Public Information Program to Protect Bull Trout

PacifiCorp will continue to provide flyers with the same information at recreation park entrance booths. The Utilities will also provide such flyers to enforcement personnel for distribution.

3.3.6 SA Section 6.1 Flow Releases in the Bypass Reach; Constructed Channel

PacifiCorp and Cowlitz PUD will continue to adhere to the Swift bypass reach and constructed channel flow release schedule specified in the 401 Water Quality certifications.

3.3.7 SA Section 6.2 Flow Fluctuations below Merwin Dam

PacifiCorp will continue to implement the operational flow regimes as identified in the SA and the Merwin FERC License.

3.3.8 SA Section 7.1 Large Woody Debris Project

PacifiCorp will continue to maintain the available funds in a Tracking Account per the SA to help defray the costs of LWD transport.

3.3.9 SA Section 7.2 Spawning Gravel Study and Gravel Monitoring and Augmentation Plan

Periodic monitoring will continue pursuant to determining the need for gravel supplementation if flows exceed 42,000 cfs.

3.3.10 SA Section 7.4 Habitat Preparation Plan

PacifiCorp's obligation under the Habitat Preparation Program for Swift Reservoir ended in 2012. Formal reintroduction of fish collected at Merwin Trap replaced the Habitat Preparation Program for all reintroduction species. The Habitat Preparation Program will again be initiated for Yale Reservoir (5 years prior to proposed implementation of downstream collection facilities at Yale Dam) pending a decision on passage into Yale Lake (now referred to as the In-Lieu Decision).

3.3.11 SA Section 7.5 Aquatics Fund

The ACC accepted one (1) project proposed by US Forest Service staff for implementation beginning in 2019, but the project was withdrawn December 2018.

Attachment K provides a copy of recent Lewis River Aquatic Fund Projects (SA 7.5.3.2) Project Closeout Reports, if any, which provides a summary of those aquatic fund projects completed as of December 31, 2018.

3.3.12 SA Section 8.2 Hatchery and Supplementation Plan

On January 22, 2015, the FERC issued an order approving the updated Lewis River Hatchery and Supplementation Plan that was submitted December 16, 2014. The utilities continue to

develop annual operating plans with the H&S Subgroup to guide implementation and adaptively manage the H&S program based on the objectives contained in the updated H&S Plan.

3.3.13 SA Section 8.3 Anadromous Fish Hatchery Adult Ocean Recruit Target by Species

The development of a precise and acceptable methodology for calculation of ocean recruits is an ongoing process. PacifiCorp and their contractors developed methods to estimate Ocean Recruits, worked with WDFW and others in the M&E Plan subgroup, and included these revised methods in the Monitoring and Evaluation Plan issued in May 2017. The methods for determining Ocean Recruits is complicated and will continually require adjustments to find the right mix of inputs to come up with a reliable measure. In addition, there are still not enough returning adults to evaluate Ocean Recruits for either the Hatchery or the Natural component. An alternative exists that is much simpler and faster and that could be easily applied to coho and steelhead. It has been suggested by Lars Mobrand that, if adult returns to the Merwin trap and the Lewis River hatchery ladder reach or exceed the by-species recruit number, then the goal is reached for that year. For example in 2014, the combined adult return numbers for hatchery coho reached 66,304 (the goal is 60,000) so, if that were to continue and be consistently over the goal then the hatchery Ocean Recruit number for coho would be considered achieved. More importantly, the natural returns need to reach the collective target of 20,000 adult returns (2,977 spring Chinook, 13,953 coho, and 3,070 late winter wild steelhead) which has not been achieved as of 2017. NOTE: As part of the Hatchery and Supplementation Plan update, development of methods to calculate Ocean Recruits was moved to the Monitoring and Evaluation Plan to reduce redundancy between the two plans and because many of the objectives in the Monitoring and Evaluation rely on this estimate. Evaluation of Ocean Recruit performance will continue in 2019.

3.3.14 SA Section 8.4 Anadromous Fish Hatchery Juvenile Production

Per the SA and the *Hatchery and Supplementation Plan* and depending on the adult returns of spring Chinook, the Licensees will provide for the production of spring Chinook salmon smolts, steelhead smolts, and coho salmon smolts at levels specified ("Juvenile Production").

3.3.15 SA Section 8.6 Resident Fish Production

Subject to Section 8.6.3, the Licensees will continue to provide for the production of 20,000 pounds of resident rainbow trout (to Swift reservoir) and 12,500 pounds of kokanee (to Merwin reservoir) each year following per the FERC licenses.

3.3.16 SA Section 8.7 Hatchery and Supplementation Facilities, Upgrades, and Maintenance

The Licensees have fulfilled their obligation with respect to SA Section 8.7 hatchery upgrades.

3.3.17 SA Section 8.8 Juvenile Acclimation Sites

With damages that occurred to the acclimation facilities caused by flood flows in December 2015, work will begin to permit deconstruction of the Muddy River in 2018. The ACC members agreed to remove the Crab Creek and Clear Creek facilities so permitting for those projects will begin in 2018 with a projected removal in 2020. The ACC agreed that acclimation releases would be suspended until futher notice. Spring Chinook targeted for acclimation sites

in 2018 will be released downstream of Merwin Dam as part of rearing and release strategies being evaluated as part of the Hatchery and Supplementation program. It is expected that spring Chinook releases will continue to be released as part of the hatchery program downstream of Merwin Dam until the ACC recommends reinitiating the upstream acclimation program.

3.3.18 SA Section 9.6 Bull Trout Monitoring

The Licensees will continue to monitor and evaluate bull trout populations in the Lewis River basin following approval of the Bull Trout Annual Operating Plan (AOP). Overarching long-term bull trout monitoring objectives were included within the FERC approved M&E Plan. Specific monitoring tasks, including methods and locations, will continue to be developed and included within the bull trout AOP and submitted to the USFWS and ACC annually.

3.3.19 Monitoring and Evaluation Post-Season Incidental Take

Each year PacifiCorp handles and processes numerous ESA-listed fish species. As part of the NOAA Fisheries Biological Opinion, PacifiCorp is to use an Incidental Take Form (**Table 5**) provided by NOAA Fisheries to report on species taken during the previous year of scientific activity.



Table 5. Aquatic species Incidental Take form for 2018.

ESU Species and	Life	Origin	Take Activity	Number of	Actual	Authorized	Actual	Evaluation	Evaluation
population group if specified in your	Stage			Fish	Number of	Unintentional	Unintentional	Location	Period
permit				Authorized	Listed Fish	Mortality	Mortality		
				For Take	Taken				
Lower Columbia River (LCR) Chinook	Juv.	NOR	Screwtrap, Mark, Release	N/A	13,585	0	0	NF Lewis River, WA	Mar 1 – June 30
Lower Columbia River (LCR) Chinook	Juv.	HOR	Screwtrap, Mark, Release	N/A	1,834	N/A	N/A	NF Lewis River, WA	Mar 1 – June 30
LCR Steelhead	Juv.	NOR	Screwtrap, Mark, Release	N/A	236	0	0	NF Lewis River, WA	Mar 1 – June 30
LCR Steelhead	Juv.	HOR	Screwtrap, Mark, Release	N/A	8	N/A	N/A	NF Lewis River, WA	Mar 1 – June 30
LCR Steelhead	Adult	NOR	Tangle Net, Mark, Release	N/A	41	0	1	NF Lewis River, WA	Feb 22 – May 2
LCR Steelhead	Adult	HOR	Tangle Net, Mark, Release	N/A	33	N/A	N/A	NF Lewis River, WA	Feb 22 – May 2
Oregon Coast Coho	Juv.	NOR	Screwtrap, Mark, Release	N/A	3,314	0	0	NF Lewis River, WA	Mar 1 – June 30
Lower Columbia River (LCR) Chinook	Adult	HOR	Merwin Adult Fish Trap	N/A	2,017	0	0	NF Lewis River, WA	Mar 1 – July 30
Lower Columbia River (LCR) Chinook	Adult	NOR	Merwin Adult Fish Trap	N/A	23	0	0	NF Lewis River, WA	Mar 1 – July 30

ESU Species and population group if specified in your permit	Life Stage	Origin	Take Activity	Number of Fish Authorized For Take	Actual Number of Listed Fish Taken	Authorized Unintentional Mortality	Actual Unintentional Mortality	Evaluation Location	Evaluation Period
LCR Steelhead	Adult	HOR	Merwin Adult Fish Trap	N/A	6,267	0	0	NF Lewis River, WA	Mar 1 – July 30
LCR Steelhead	Adult	NOR	Merwin Adult Fish Trap	N/A	139	0	0	NF Lewis River, WA	Mar 1 – July 30
Oregon Coast Coho	Adult	HOR	Merwin Adult Fish Trap	N/A	1,833	0	0	NF Lewis River, WA	Mar 1 – July 30
Oregon Coast Coho	Adult	NOR	Merwin Adult Fish Trap	N/A	408	0	0	NF Lewis River, WA	Mar 1 – July 30
Lower Columbia River (LCR) Chinook	Juv.	NOR	Swift Floating Surface Collector	N/A	4,750	0	0	NF Lewis River, WA	Mar 1 – July 30
LCR Steelhead	Juv.	NOR	Swift Floating Surface Collector	N/A	7,900	0	0	NF Lewis River, WA	Mar 1 – July 30
Oregon Coast Coho	Juv.	NOR	Swift Floating Surface Collector	N/A	41,999	0	0	NF Lewis River, WA	Mar 1 – July 30

4.0 WATER QUALITY

4.1 PacifiCorp Water Quality Measures Implemented in 2018

4.1.1 <u>PacifiCorp Application for 401 Water Quality Certificate for Yale, Swift No. 1 and Merwin Hydroelectric Projects</u>

On October 9, 2006, Ecology provided 401 Water Quality certificates for the Merwin, Yale, and Swift No. 1 hydroelectric projects. These 401 Certifications have subsequently been amended several times. Until the FERC issued licenses for the Lewis River Hydroelectric Project June 26, 2008, PacifiCorp Energy implemented those measures contained in the 401 Certifications that were not FERC license-specific, and has implemented all the 401 requirements since June 26, 2008.

4.1.2 SA Section 9.4 Water Quality Monitoring

The following section covers water quality monitoring activities performed in accordance with Ecology's Lewis River 401 water quality certifications. Some monitoring parameters are ongoing from previous years, such as Total Dissolved Gas (TDG) monitoring in Swift No. 1 and Yale tailraces; while other activities such as Merwin, Yale, and Swift forebay temperature profiles were implemented for the first time in 2007 and continued in 2018.

Per the 401 water quality certificates, monitoring of projects' spillway TDG levels continued through 2018. Tailrace TDG monitoring has been ongoing since 1995 and will continue per the direction of the 401 requirement. Until it is shown that a temperature issue does not exist, PacifiCorp will also continue to monitor water temperature in the forebays and tailraces of each project and, in cooperation with Cowlitz PUD, monitor water temperature in the Swift Bypass Reach.

2018 Total Dissolved Gas Analysis for Yale, Swift No. 1 and Merwin Hydroelectric Project Spills

Upon issuance of the 401 water quality certificates, PacifiCorp began monitoring of spillway TDG in the fall of 2006. Previous TDG monitoring sites near the Swift No. 1, Yale and Merwin spillways were reactivated at the beginning of the 2017/2018 high run-off period.

During 2018 only 2 minor spill events (less than 5,000 cfs) occurred due to either a unit trip (in which case spill gates were opened to maintain Merwin minimum flow) or small storm events that filled Lake Merwin faster than anticipated. In all cases TDG in the Merwin tailrace did not exceed 110 percent. In 2018 Swift 1 had one minor spill in April (less than 1,500 cfs) resulting in no TDG exceedances. No spill occurred at Yale Dam during 2018. As a result no TDG exceedances due to spill occurred at Swift 1, Yale, or Merwin during 2018.

Yale Tailrace TDG:

Total dissolved gas data in the Yale tailrace (**Attachment G**) were gathered hourly in 2018 using a HydroLab Series 5 miniSonde (MS5). A stainless steel tube is permanently attached to the Yale powerhouse wall and submerged to a depth of 15 feet. The HydroLab is deployed within this tube to protect the probe and maintain consistent depth at 15 feet. In 2018, 8,657 hourly data points were recorded in the Yale tailrace, of which no data points exceeded the state standard of 110% (**Attachment G**). Total dissolved gas levels greater than 110% have been observed in the past and are produced during times of motoring operations and at low generation levels. Motoring Operations involves spinning a turbine using grid power in order to have the unit ready to engage at a moment's notice in case of a power plant outage in another area of the Western Grid or in the case of a surge in power demand. During times of normal generation, elevated levels of tailrace TDG are not typically observed.

During 2018, PacifiCorp continued evaluating measures at the Yale tailrace to control TDG during monitoring operations. These measures include automated "flushing" of the tailrace periodically. Flushing is defined as ramping one unit to 5 MW for ten minutes. The frequency of this event depends on real-time dissolved gas measured in the tailrace with the MS5 and is fully automated through the Programmable Logic Control (PLC). This measure was first implemented October 20, 2007 and continues to be an effective procedure in reducing TDG levels in the Yale tailwaters.

In addition to flushing flows, automated air valves have been in place since 2009 to limit the volume of air entering the turbine throughout the operating range of each unit. This investment provides control of excessive TDG in the Yale tailwaters during normal operations of the units.

Swift No. 1 Tailrace TDG

TDG data (**Attachment H**) were gathered hourly in the Swift No. 1 tailrace using two HydroLab Series 5 minisondes (MS5). The second meter is used for comparison and quality control as well as determining if differences in TDG exist based on individual unit operation. Similar to the Yale tailrace, meters are deployed within steel tubes permanently attached to the powerhouse wall. Meter No. 1 is located between the draft tubes of Units 11 and 12 while Meter No. 2 is located between the draft tubes of Units 12 and 13. The meters gather data hourly from a water depth of 15 feet. Data between the two meters are averaged and provided in graphic form (**Attachment H**). Of the 8,633 data points collected in 2018, no data points exceeded the 110% state standard. Similar to Yale tailrace, data points greater than 110% are produced during times of project motoring operation or prolonged periods of inefficient operation between 20 and 40 MW per unit. During times of normal generation, elevated levels of TDG are not typically observed.

To reduce TDG within Swift No. 1 tailrace during periods of normal generation and load following operations, air intake modifications and automation were made in 2005 that limit the volume of air entering the units over their generation range based on a predefined air volume curve. This measure, while effective at normal generation levels, is not effective during periods of motoring. If flushing procedures currently being evaluated at Yale continue to be effective, then this procedure will also be implemented at Swift No. 1 in 2019 to help alleviate remaining TDG issues. Modifications were made in late October 2012, to ensure that air

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entrainment would not be possible during periods of motoring operation. This programming change to the PLC should help alleviate elevated TDG levels during periods of motoring.

Swift No. 1 Forebay TDG

TDG data was gathered hourly in the Swift No. 1 forebay from February 7, 2008 to May 31, 2008 using a HydroLab Series 5 datasonde (DS5). The meter was deployed to a water depth of 15 feet from the dam intake deck via steel cable. During the period, 2,747 data points were recorded. Of those data points none were found to exceed 110% TDG saturation. Based on Table 2 in section 4.8 of the 401 water quality certification for the Swift No. 1 hydroelectric facility, TDG monitoring in the project forebay is "Ongoing if exceedances occur until three months after such exceedances are corrected". No exceedances were recorded in the four month monitoring period for the Swift No. 1 forebay, therefore monitoring activities were suspended as of May 31, 2008.

2018 Temperature Profiles for Merwin, Yale, and Swift No. 1 Forebays and Corresponding Temperature Comparison between Forebay Intake Depth and Tailrace For Each Project

Graphs representing forebay temperature profiles from the surface to reservoir bottom and graphs comparing forebay intake depth temperatures to the tailrace temperatures for Merwin, Yale, and Swift No. 1 during 2018 are included in **Attachment G, Attachment H** and **Attachment I**. Data points for forebay temperature profiles are two-week averages of hourly temperature readings taken at each specified depth.

Data points for intake depth/tailrace comparison were taken hourly from a depth of 15 feet in project tailraces, and at specified intake depth in project forebays. This hourly data was then converted to seven-day averages of the daily maximum temperature (7DADmax). Temperature data were gathered using Onset HOBO prov2 Temp Loggers®. Prior to deployment, each temperature thermograph was verified and calibrated using a National Institute of Standards and Technology (NIST) certified reference thermometer.

Yale

Temperature stratification was observed in the Yale forebay during the entire period monitored (**Attachment G**). The coldest recorded two-week temperature was 7.0°C in early May at 100 feet below the surface. The warmest two-week average temperature was 23.0°C in August near the reservoir surface.

The Yale tailrace 7DADmax temperature graph is presented in **Attachment G**. The tailrace temperatures are comparable to what has historically been observed.

Swift No. 1

Temperature stratification was observed in Swift No. 1 forebay for the entire period of analysis May through October 2018 (**Attachment H**). The warmest two-week average temperature, 22.0°C, was observed in early August three feet below the surface. The coldest observed temperature was 5.6°C and was recorded at a depth of 122 feet in early May. In 2018 the Swift thermograph string was attached to a vertically fixed position due to construction activities in the forebay, temperature loggers could not be held at constant water depths. To address this issue, fluctuating reservoir levels were correlated to each temperature loggers fixed elevation.

Bi-weekly average logger depths were calculated and assigned to corresponding bi-weekly average temperatures.

Hourly temperature readings were taken from the Swift No. 1 tailrace from a depth of 15 feet using HydroLab Series 5 miniSonde. Hourly temperatures were then converted to 7DADmax readings in order to get an intake depth temperature to tailrace temperature comparison per the direction of the 401 certification (**Attachment H**). Many different environmental factors influenced the intake depth to tailrace water temperature comparison, namely; reservoir elevations, powerhouse operations, configuration of the water withdrawal system, and placement of the forebay thermistors.

The bathymetry of Swift Reservoir in the vicinity of the penstock intakes is unusual. Instead of the entrance of the intakes lying on the reservoir bottom, drawing water from all angles, they are at the downstream end of a deep and narrow trench notched into the hillside during construction of the dam. The intakes influence the mixing of stratified water columns as they draw water through the trench. It is difficult to deploy thermographs that spatially align and represent the temperature regime occurring near the intake (**Attachment H**) as it relates to the Swift No. 1 tailrace temperature.

Merwin

As in prior years, temperature stratification was observed in Merwin Reservoir from May through October 2018, with the reservoir getting progressively warmer until turn-over in the latter half of October (**Attachment I**). The coldest two-week temperature average, 7.0°C, was recorded in May at intake depth of 178 feet. The warmest two-week average temperature was 22.3°C at the reservoir surface in August. Since PacifiCorp considers the reservoir conditions as baseline, there were no observed temperature exceedances for Merwin Reservoir in 2018.

An Onset HOBO Pro v2 Temp Logger® temperature recorder was positioned within the Merwin tailrace at a depth of approximately 15 feet and hourly temperature recordings were taken for the duration of 2018 (**Attachment I**). Hourly readings were converted to seven-day averages of the daily maximum temperature (7DADmax). During the June 15 through September 15 time period, fourteen 7DADmax data points were recorded and zero were observed to be greater than the state standard of 16° C. During the Jan 1 through June 14 and September 15 to December 31 time frames; thirty-two 7DADmax data points were recorded. Of these, eleven were observed to be greater than the state standard of 13° C (**Attachment I**). 7DADmax temperatures over 13° C were first observed in the project tailrace during the second week of September and persisted through the third week of November. PacifiCorp will continue to monitor this condition through the pending Water Quality Temperature Attainment Plan (WQTAP).

2018 Dissolved Oxygen Comparison between Merwin Forebay Intake Depth and Merwin Tailrace in September and October

Hourly dissolved oxygen levels in milligrams per liter (mg/l) were measured in the Merwin forebay at an approximate depth of 160 feet and in Merwin tailrace at an approximate depth of 15 feet from September through October 2018 (**Attachment I**). Measurements in the forebay were recorded with a HydroLab Series 5 datasonde (DS5) and with a HydroLab Series 5 miniSonde (MS5) in the project tailrace.

The Merwin forebay DO meter experienced a malfunction during the entire monitoring period, consequently, no forebay DO data for 2018 is available. The tailrace DO meter also experienced malfunctions resulting in 700 dissolved oxygen hourly data points collected from September, 21 2018 through October 19, 2018 (Attachment I). Of these 700 data points collected in the tailrace 418 of them were lower than the minimum state standard of 9.5 mg/L. The minimum dissolved oxygen level observed in Merwin forebay was 7.7 mg/l on September 27, 2018.

2018 Temperature Comparison in the Swift Bypass Reach between Waters Upstream and Downstream of the mouth of Ole Creek

In 2018, 8,760 hourly temperature readings were taken of the Swift Bypass Reach 50 feet upstream of the Ole Creek confluence and 7,741 corresponding temperatures reading were taking approximately 200 feet below the confluence. These hourly data points were converted to 7DADmax values (**Attachment G**). Temperatures were recorded using Onset HOBO pro v2 Temp Loggers®. As with previous years Ole Creek seems to have a slight cooling effect on the Swift Bypass Reach.

2018 Redd and Biological Surveys of the Lewis River Bypass Reach, Upper Release Point and Canal Drain Constructed Channels

In compliance with section 4.2(10)(a) and 4.2(11) of the Washington Department of Ecology issued 401 Water Quality Certificate for Swift 1 Hydroelectric Project, PacifiCorp will conduct quarterly biological surveys and bi-weekly redd surveys (during Sept. 15th- Nov. 15th) of the Lewis River Bypass Reach, Upper Release Point and Canal Drain Constructed Channels on a set schedule as stipulated within Section 4.2(10)a-e) of the 401 Water Quality Certificate.

According to the schedule defined within section 4.2(10)(a-e) of the 401 Water Quality Certificate, PacifiCorp was not required to perform any biological or redd surveys of the Lewis River Bypass Reach, Upper Release Point or Canal Drain Constructed Channels in 2018.

4.2 PacifiCorp Water Quality 2019 Annual Plan

PacifiCorp will implement the following water quality measures in 2019.

4.2.1 Water Quality Management Plan

Implement an Ecology-approved Water Quality Management Plan (WQMP) describing how PacifiCorp will meet the terms of the 401 Water Quality Certificate. An updated WQMP was approved by Ecology September 20, 2013. PacifiCorp has been implementing the monitoring portions of the WQMP since the license was issued in 2008.

4.2.2 Flow Monitoring

PacifiCorp will continue to monitor flows in the Swift bypass reach (Upper Release flow and Constructed Channel flow) and flow/ramp rates downstream of Merwin dam.

4.2.3 <u>Bypass Reach Gravel Replacement</u>

PacifiCorp and Ecology met onsite at the Swift project Bypass reach to view gravel conditions following the December 2015 high flow event. That event resulted in spill exceeding 10,000 cfs that completely scoured the replaced spawning gravel out of the channel. Based on this occurrence and other spill events in the past, Ecology provided PacifiCorp a determination dated December 14, 2016 to cease gravel augmentation at the Bypass Reach until further notice.

4.2.4 <u>Yale Tailrace Temperature Attainment Plan</u>

Implement Yale Tailrace Temperature attainment plan as proposed in the final WQMP approved by Ecology.

4.2.5 Swift and Merwin Spill TDG Attainment Plan

Implement Merwin Spill TDG Attainment Plan as proposed in the final WQMP approved by Ecology.

4.2.6 <u>Lewis River Project Temperature Model</u>

The model was completed and a report was submitted to Ecology in 2015.

4.2.7 Yale-Swift Turbine TDG Attainment Plan

Continue implementation and monitoring of Turbine TDG attainment plan for the Yale and Swift projects. A copy of the attainment plan is included in the final WQMP. However, since PacifiCorp has been able to demonstrate compliance with TDG standards related to turbine operation at the Yale and Swift plants, Ecology has removed these sites from the 303(d) list of sites requiring a Total Maximum Daily Load (TMDL) procedure.

4.3 Cowlitz PUD Water Quality Measures Implemented as of the End of 2018

On October 9, 2006, Ecology issued a Clean Water Act Section 401 Certification (Order No. 3676) to Cowlitz PUD for the continued operation of the Swift No. 2 Hydroelectric Project under a new FERC license (Ecology 2006). The Section 401 Certification, as amended 1,2,3,4, includes a number of conditions and general requirements directing Cowlitz PUD to comply with applicable water quality standards codified in 173-201A WAC. As of December 31, 2018, Cowlitz PUD has completed all of the requirements in the 401 Certification.

This section of the 2018 Annual Report lists the completed measures. Additional Settlement Agreement and amended Section 401 Certification requirements relating to instream flows, the

¹ http://www.ecy.wa.gov/programs/WO/ferc/existingcerts/order3927.pdf

² http://www.ecy.wa.gov/PROGRAMS/wq/ferc/existingcerts/swift2amend2.pdf

³ http://www.ecy.wa.gov/PROGRAMS/wq/ferc/existingcerts/swift2amend3.pdf

⁴ http://www.ecy.wa.gov/programs/wq/ferc/draftcerts/CowlitzCntyPUDAmendOrder8832toOrder3676-110711.pdf

constructed channel, gravel augmentation, salmonid monitoring, and water temperature monitoring in the Lewis River bypass reach are implemented together with PacifiCorp.

4.3.1 Swift No. 2 Project Water Temperature Monitoring

The water temperature monitoring program in the Swift No. 2 canal and forebay was completed in 2012 and fully satisfied the requirement of the amended Section 401 Certification to monitor a total of 10 qualifying periods. Final results were included in the 2012 Annual Report (PacifiCorp and Cowlitz PUD 2013).

4.3.2 Swift No. 2 Project Tailrace Water Quality Monitoring

On August 15, 2013, with Ecology's written approval, Cowlitz PUD discontinued water quality monitoring in the Swift No. 2 tailrace. Final results of this monitoring were included in the 2013 Annual Report (PacifiCorp and Cowlitz PUD 2014).

4.3.3 Swift No. 2 Tailrace Total Dissolved Gas (TDG) Monitoring (401) Certification Section 4.8.3

The initial Water Quality Certification Section 4.8.3 study was completed in 2008 and included in the 2008 Annual Report.

In September 2014, Cowlitz PUD replaced the original (1956) air intake valves for both turbines (Unit 21 and Unit 22) with new automated air intake valves. This modification triggered additional monitoring in 2014. Consistent with 401 Water Quality Certification Sections 4.3.4 and 4.8.3, Cowlitz PUD monitored TDG in the Swift No. 2 forebay and tailrace from June 24 to November 20, 2014. Final results of this monitoring were included in the 2014 Annual Report (PacifiCorp and Cowlitz PUD 2015).

4.3.4 <u>Swift No. 2 Surge Arresting Structure Total Dissolved Gas (TDG) Monitoring (401)</u> Certification Section 4.3.5 as amended

The TDG study required in Certification Section 4.3.5, as amended, was completed in 2007 and included in the 2007 Annual Report.

4.3.5 SA Section 9.4 Water Quality Monitoring

Ecology approved the Swift No. 2 Water Quality Management Plan September 20, 2013.

4.4 Cowlitz PUD Water Quality 2019 Annual Plan

Cowlitz PUD will implement the following water quality measures in 2019.

4.4.1 Water Quality Management Plan

Cowlitz PUD has completed all monitoring required under the Water Quality Management Plan. No future monitoring is anticipated unless an operational change triggers additional monitoring as required in the 401 Certification Order as amended.

5.0 TERRESTRIAL RESOURCES

5.1 TCC Meetings

The purpose and role of the TCC, as defined in Section 14.1 of the Settlement Agreement, is to facilitate coordination and implementation of the Terrestrial PM&E measures.

The structure and process of the TCC is intended to provide a forum to address time-sensitive matters, early warning of problems, and coordination of member organization actions, schedule, and decisions to save time and expense. The TCC makes decisions based on consensus, while implementing the Settlement Agreement.

5.1.1 Meetings and Conference Calls: Overview

This section summarizes major items discussed at TCC meetings during the 12-month reporting period. Detailed meeting summaries are provided on the PacifiCorp website at: http://www.pacificorp.com/es/hydro/hl/lr.html# - TCC - 2018

- On February 7, 2018 the TCC reviewed proposed budgets and project overviews for PacifiCorp's 2017 Wildlife Habitat Management Plan (WHMP) Annual Report, PacifiCorp 2018 WHMP Annual Plan and the Cowlitz PUD WHMP 2018 Annual Plan for its 30-day review period.
- On February 7, 2018 PacifiCorp provided the Terrestrial Fund 2017 year end accounting to the TCC.
- The 2017 Draft ACC/TCC Annual Report was distributed to the TCC for its 30-day review and comment period March 7, 2018.
- On March 14, 2018 the TCC conducted a field tour to visit Unit 1 to review the 2017 timber harvest areas and proposed road use permit areas by the Department of Natural Resources.
- On March 21, 2018 the Cowlitz PUD filed its WHMP 2018 Annual Plan with the FERC.
- The 2017 ACC/TCC Annual Report was submitted to the FERC April 10, 2018.
- On April 11, 2018 the TCC agreed that PacifiCorp is to provide matching funds (\$20,091.00) for the 2018 RMEF grant project.

• On April 11, 2018 the TCC conducted a field tour to Units 14 (2017 completed harvest area) and Unit 15 (2018 proposed harvest areas). In Unit 14 the TCC agreed to plant a mix of conifer and deciduous trees.

- On April 11, 2018 the TCC approved the clear-cut and commercial thin for Unit 15 Comb Over and Mullet as described in the 2018 Annual Plan.
- On May 9, 2018 the TCC agreed that an e-bike is a motorized vehicle and its use will not be allowed on Lewis River WHMP lands.
- On May 9, 2018 the TCC agreed that it will continue its review and adaptive management to determine how to proceed long term with Lower Hanley Curry Meadow.
- On May 9, 2018 the TCC reviewed the May 2, 2018 Higsly I and II timber harvest memorandum and approved the proposal as written.
- On May 9, 2018 the Cowlitz PUD conducted a field tour to Devils Backbone management and The TCC agreed to the proposed approximate 5-acre patch cut. The TCC further agreed to reduce the WHMP guidelines of leaving a combination of snags and green recruitment trees of 8 per acre to 2 per acre leave trees at the edge of the patch cut to create as large of an opening as possible. In addition, PacifiCorp conducted a field tour to review pre-commercial thinning (PCT) for wildlife vs forestry in Management Unit 37 & Elk Potential. The TCC agreed to let Unit 37 grow until it is merchantable and then clearcut to start over implementing WHMP practices. This will be approximately 15-20 years before it can be clearcut.
- A tour to the Cougar Quarry was also visited on May 9, 2018 and the TCC agreed this area is the best location for the Swift Drift Removal ash deposit. The TCC approved moving forward if the Washington Department of Ecology approves.
- On June 13, 2018 the TCC agreed to relocate Yale Dam orchard in Management Unit 11 as proposed by PacifiCorp.
- On June 13, 2018 the TCC visited Management Unit 7 (2017 timber harvest area), Unit 7 & 8 (2017 timber harvest areas), Unit 7 review of osprey meadow progress following 2016 clearcut to meadow conversion and Oak Site 5-2 in Management Unit 5. The TCC agreed to open up the Unit 5 Oak sites as much as terrain and safety conditions allow by giving the nearest oak tree to the parameter a 50-100 foot clearing.
- On July 11, 2018 PacifiCorp staff visited Unit 38 (2018 timber harvest areas) to provide photos to the TCC in the meeting notes. In addition, The TCC agreed to the Devil's Backbone Goshawk survey rational and to complete the survey in 2019 as the logging will take place Fall 2019.

- On August 14, 2018 PacifiCorp informed the TCC via email that a hunting access map illustrating closed or restricted hunting areas, roads, and gates was posted to its Lewis River website and available to the general public.
- The TCC agreed to cancel the August 2018 and September 2018 meetings and reconvene October 10, 2018.
- On October 10, 2018 the TCC agreed to complete tree removal in Site 5-1 and 5-2 only at this time in accordance with PacifiCorp's suggestion and monitor for success. If successful, the TCC will consider implementing this type of management on other oak sites.
- On October 10, 2018 PacifiCorp provided a detailed review of a draft memo titled, Lewis River Wildlife Habitat Management Plan (WHMP) Lands Timber Harvest and Silviculture Planning, October 2, 2018. TCC comments were due on or before November 30, 2018.
- On November 14, 2018 the TCC requested the PUD absorb the logging, stumps and grubbing costs for the Devil's Backbone Unit 1 elk forage plot treatment and to resubmit the budget to the TCC for its review and request a quick turnaround for approval.
- The TCC agreed to cancel the December 2018 meeting and reconvene January 9, 2019.

5.1.2 Meeting Notes

The Licensees prepared draft notes for TCC meetings and conference calls. These notes were distributed to TCC members for review and comment approximately one week after the subject meeting. After review, revision and approval by the TCC, the final notes were entered in the public record and posted on the PacifiCorp web site at:

http://www.pacificorp.com/es/hydro/hl/lr.html# - TCC - 2018

5.2 PacifiCorp Terrestrial Measures Implemented as of the End of 2018

This section presents the actions taken during January 2018 through December 2018 toward PacifiCorp terrestrial requirements in the Lewis River Settlement Agreement. It also includes previously completed Settlement Agreement actions. **Attachment M** provides a copy of the *Lewis River Wildlife Habitat Management Plan Annual Report*, which provides a summary of the terrestrial protection, mitigation, and enhancement measures that were implemented in this area during 2018.

A discussion of the activities associated with each of the measures is presented by SA Article for the report period. A description of funding amounts deposited and disbursed during 2018

is provided in Section 7.0 – Funding.

5.2.1 SA Section 10.1 Yale Land Acquisition and Habitat Protection Fund

PacifiCorp completed its settlement agreement and the FERC license commitment under the Yale Land Acquisition Fund for acquiring land in 2010 with the purchase of 490 acres (198.3 ha) of land near Saddle Dam

5.2.2 SA Section 10.2 Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Fund

PacifiCorp did not acquire any additional Swift No. 1 and Swift No. 2 lands in 2018.

PacifiCorp contributed \$655,182.00 to the fund per the Settlement Agreement schedule, this is the 9th and final contribution to this fund. As of December 31, 2018 the fund is \$1,941,598.36.

Because of confidentialities in acquiring other lands, specific discussion is not included in this annual report other than to indicate that opportunities continue to be discussed.

5.2.3 SA Section 10.3 Lewis River Land Acquisition and Habitat Protection Fund

- a) In April 2017 the 10.3 funds were used in their entirety, which was \$1,170,009.20, and there are no further contributions.
- b) In addition to contributions made under 10.3.1 PacifiCorp provided additional matching funds of \$15,000 for the Swift Creek Forage Enhancements project in 2013, \$16,500 to WDFW for the Eagle Island project in 2017 and \$20,093.00 for the Marble Mountain Forage Enrichment and Effectiveness Monitoring project in 2018. All matching funds provided by PacifiCorp are not to exceed \$100,000 per year, and not to exceed \$500,000 in any ten consecutive years. Fund account information is provided in Section 7.0.

5.2.4 SA Section 10.4 Transaction Costs

No transaction costs incurred in 2018.

5.2.5 SA Section 10.5 Management of Funds

PacifiCorp made interest contributions to Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Funds in 2018. The Funds continue to be tracked in an account and is inclusive of accrued interest pending any transactions (see Section 7.0).

5.2.6 SA Section 10.6 Completed Implementation Advanced Purchases

As identified in the Settlement Agreement article 10.6.2, PacifiCorp acquired 770 acres (in 2000) of wildlife habitat near Cougar and Panamaker Creeks and established a 213 acre conservation covenant on those lands for the protection of bull trout. Routine maintenance of culverts, existing road closures, forestry management assessments, and invasive plant species control continued in 2018.

5.2.7 SA Section 10.7 Conservation Easements

PacifiCorp continued management of the 16 acres of land managed under a conservation easement with the Cowlitz Indian Tribe. In the past PacifiCorp has treated (herbicide spraying) for invasive scotch broom control in a meadow area and the Cowlitz Tribe also hand-pulled scotch broom in the 2011 timber harvest area. The scotch broom continues to be monitored.

PacifiCorp continued inspections of a vegetation exclosure established on this easement for purposes of monitoring forage establishment and use by wildlife. Ocular assessments of vegetation within the exclosures and the surrounding area will be conducted for another 5 years (2023) by PacifiCorp biologists to assist in determining success of program treatments. Forage establishment as a result of the 2011 forest management actions and subsequent seeding has been successful especially in terms of releasing understory shrubs from excessive shade. Wildlife use in the conservation easement area is evidenced from browsing, grazing and deer or elk pellet groups throughout the easement.

5.2.8 SA Section 10.8 Wildlife Habitat Management Plan

PacifiCorp completed the WHMP and submitted it to the FERC December 23, 2008. The Utilities each received a FERC approval for their respective WHMP's May 29, 2009.

Article 403 of the Merwin, Yale, and Swift No. 1 licenses and Section 14.2.6 of the Settlement Agreement directs PacifiCorp to prepare and file with the FERC a detailed Annual Report (Federal Energy Regulatory Commission 2008a, 2008b, and 2008c, PacifiCorp et al. 2004). **Attachment M** provides a copy of the *Lewis River Wildlife Habitat Management Plan 2018 Annual Report*.

5.3 PacifiCorp Terrestrial 2019 Annual Plan

This section presents PacifiCorp's Terrestrial Resources Annual plan which identifies planned 2018 activities as organized by the Settlement Agreement measures.

5.3.1 SA Section 10.2 Swift No. 1 and Swift No. 2 Land Acquisition and Habitat Protection Fund

PacifiCorp will continue work initiated in 2018 in coordination with the TCC regarding the acquisition of interests in land in the vicinity of Swift Reservoir. Fund account information is provided in Section 7.0.

5.3.2 SA Section 10.3 Lewis River Land Acquisition and Habitat Protection Fund

All funds were expended in 2017 for the 2^{nd} and final phase of land acquisition. There are no additional contributions, so this fund and action is completed.

5.3.3 SA Section 10.4 Transaction Costs

Transaction costs incurred in 2019 will be managed in accordance with SA language and reported in the 2018 Annual Report.

5.3.4 SA Section 10.5 Management of Funds

Funds provided by PacifiCorp in 2018 will be managed in a tracking account and in accordance with SA language. Contribution amounts and interest gained will be identified in the 2018 Annual Report. See Fund account information provided in Section 7.0 for end of 2018 amounts.

5.3.5 SA Section 10.6 Completed Implementation Advanced Purchases

PacifiCorp will continue to manage the Cougar Creek Conservation Covenant lands and the company lands on the Swift Creek Arm for the long-term benefit of fish, wildlife, and native plants. These lands are managed under the WHMP as described in SA 10.8.

5.3.6 SA Section 10.7 Conservation Easements

Guidelines for the selection and acquisition of conservation easements will be considered in the acquisition of Interests in Lands to be purchased with Funds described in SA 10.1 through 10.3.

5.3.7 SA Section 10.8 Wildlife Habitat Management Plans

The 2019 Annual Plan fulfills PacifiCorp's obligations for the license's Article 403 and Settlement Agreement 10.8.3 and is provided in **Attachment L**. The plan details the terrestrial protection, mitigation, and enhancement measures to be implemented on PacifiCorp WHMP lands in the following year (i.e., January 1 to December 31, 2019).

5.3.8 SA Section 10.8.5.5 Mitigation for Impacts on Wildlife Habitat

Following consultation with the TCC, PacifiCorp received \$5,931.23 for mitigation funding dollars for proposed adverse impacts to WHMP lands from PacifiCorp Transmission & Distribution (T&D) operations due to the Cowlitz PUD Interconnect Project. This fund also received \$1,238.51 and \$603.58 from the Washington Department of Natural Resources for impacts from constructing temporary access roads across PacifiCorp lands in management units 11 and 16. Finally this fund received \$1,190.57 for a judgment payoff from a property trespass. This fund does not accrue interest, which PacifiCorp will account for in a separate funding account, See Section 7.0, Funding. These funds may be used to acquire additional WHMP lands and/or implement management or monitoring on WHMP lands.

5.4 Cowlitz PUD Terrestrial Measures Implemented in 2018

5.4.1 <u>SA Section 10.6 Completed Implementation: Advance Purchases [Devil's Backbone Conservation Covenant]</u>

Cowlitz PUD managed the Devil's Backbone Conservation Covenant to benefit bull trout.

5.4.2 SA Section 10.8.1 Development of the Wildlife Habitat Management Plan (WHMP)

Cowlitz PUD filed the Swift No. 2 WHMP with the FERC December 23, 2008. The FERC issued an Order Modifying and Approving the Habitat Management Plan March 31, 2009. The FERC's Order approved the WHMP and added the following requirements:

- file an Annual Habitat Management Report by April 30 of each year; and
- In the event changes are made to the WHMP, file these changes with the Commission and the TCC.

This Section 5.4 fulfills Cowlitz PUD's obligation to file the WHMP Annual Report.

5.4.3 SA Section 10.8.2 WHMP Fund

On December 26, 2017, Cowlitz PUD made \$18,814 available for Year 10 2018 WHMP activities, \$19,245 in carry forward, and \$1,581 in interest earned from 2017 for a total of \$39,640. Table 2.1-1 in the March 21, 2018, Year 10 2018 WHMP Annual Plan included a list of proposed actions and estimated costs based on the 2018 budget. **Table 5a** below illustrates the 2018 Budget, including estimated costs, year-end costs and the difference between the two. At year-end, \$14,903 remained in the budget, as itemized in **Table 5b**. **Table 6** provides the WHMP Tracking Account summarizing the WHMP budget and expenditures for each year.

Table 5a. Cowlitz PUD WHMP Year 10 2018 Budget.

WHMP Activity	2018 Budget	2018 Actual	Difference
Administration	\$ 5,000	\$ 2,205	\$ 2,795
Annual inspection to monitor and manage public access	\$0	\$ 0	\$ 0
Invasive plant surveys at high priority sites	\$ 3,850	\$ 2,002	\$ 1,848
Invasive Species Control	\$ 5,000	\$ 2,383	\$ 2,617
2018 Timber Management Fund	\$ 6,585	\$ 0	\$ 6,585
Planning for Devil's Backbone Patch Cut	\$ 9,000	\$ 11,564	(\$ 2,564)
Estimated cost of management activities	\$ 29,435	\$ 18,153	\$ 11,282
Estimated amount remaining in 2018 Budget at year-end	\$ 10,205	\$ 21,487	\$ 11,282
Total	\$ 39,640	\$ 39,640	

Table 5b. Cowlitz PUD WHMP Year 10 2018 Carry Forward

Carry Forward		Running Total
2015 Timber Fund Carry Forward	\$ 7,441	\$ 7,441
2016 Timber Fund Carry Forward	\$ 6,375	\$ 13,816
2017 Timber Fund Carry Forward	\$ 6,471	\$ 20,287
2018 Timber Fund Carry Forward	\$ 6,585	\$ 26,872
2018 Amount remaining at year-end not including		
Timber Funds	\$14,903	\$ 41,775

Table 6. Cowlitz PUD WHMP Tracking Account.

Year	Year Beginning Date	WHMP Beginning Balance	WHMP Annual Payment at Year Beginning	WHMP Beginning Balance + Annual Payment	WHMP Funds Dispersed at Year-End	Year-End WHMP Funds Remaining	Interest Accrued Year- End WHMP Funds	WHMP Ending Balance	Year- End Date	WSJ Prime Rate Apr 1
1	26-Dec-2008	\$ -	\$ 16,321	\$ 16,321	\$ 18,855	\$ (2,535)	\$ -	\$ (2,535)	26-Dec-2009	0.0325
2	26-Dec-2009	\$ -	\$ 16,659	\$ 16,659	\$ 18,230	\$ (1,571)	\$ -	\$ (1,571)	26-Dec-2010	0.0325
3	26-Dec-2010	\$ -	\$ 16,773	\$ 16,773	\$ 12,822	\$ 3,951	\$ 128	\$ 4,080	26-Dec-2011	0.0325
4	26-Dec-2011	\$ 4,080	\$ 16,959	\$ 21,039	\$ 7,949	\$ 13,091	\$ 425	\$ 13,516	26-Dec-2012	0.0325
5	26-Dec-2012	\$ 13,516	\$ 17,408	\$ 30,924	\$ 31,094	(\$ 170)	\$-	(\$ 170)	26 Dec-2013	0.0325
6	26 Dec-2013	\$-	\$ 17, 715	\$ 17,715	\$14,530	\$3,185	\$103	\$3,288	26 Dec-2014	0.0325
7	26 Dec-2014	\$ 3,288	\$ 17,971	\$ 21, 259	\$ 7,078	\$ 14,181	\$ 461	\$ 14,642	26 Dec-2015	0.0325
8	26 Dec-2015	\$ 14,462	\$ 18,214	\$ 32, 856	\$4,762	\$28,094	\$983	\$29,077	26 Dec-2016	0.0350
9	26 Dec-2016	\$ 29,077	\$18,488	\$47,565	\$8,033	\$39,532	\$1,581	\$41,114	26 Dec-2017	0.04
10	26 Dec-2017	\$41,144	\$18,814	\$59,928	\$18,153	\$41,775	\$1,984	\$43,759	26 Dec-2018	0.0475
11	26 Dec-2018	\$43,759	\$19,158	\$62,917						

In 2018, Cowlitz PUD completed the 2018 WHMP Annual Report without charge as an inkind service. On December 26, 2018, the WHMP fund included \$41,775 in unspent funds, which generated \$1,984 interest. On December 26, 2018, Cowlitz PUD made \$19,158 available for the Year 11 2019 WHMP activities. Therefore, the total available for the Year 11 2019 WHMP is \$62,917.

5.4.4 <u>SA Section 10.8.3 Management of the Plan [Implementation of the Annual Plan]</u> After consultation with the TCC, Cowlitz PUD filed the Swift No. 2 Year 10 2018 WHMP Annual Plan with the FERC March 21, 2018. Specific wildlife management activities implemented under the Year 10 2018 Annual Plan are described in the following sections.

5.4.4.1 Invasive Plant Surveys

The invasive plant surveys are designed to focus on areas identified in the WHMP as high priority due to 1) known concentrations of invasive plants; 2) presence of ecologically sensitive resources, such as wetlands; or 3) soil disturbance or traffic that could pose a risk of introduction or spread of invasive plants. Surveys do not cover the transmission line right of way (ROW) or revegetated habitat south of the maintenance road, because these areas are treated under on-going operation and maintenance programs separate from the WHMP.

The surveys are conducted according to standard operating procedures (SOPs) outlined in the WHMP (Section 5.8, Invasive Plant Management SOPs). Survey routes are documented using a hand-held GPS unit, and the boundaries of new survey areas are flagged. GPS data points are transferred into the project GIS and used to prepare maps of areas surveyed or selected for weed treatment. **Figures 4 and 5** illustrate weed survey areas that have been delineated in the Devil's Backbone and Project Works management units (MUs) to date.

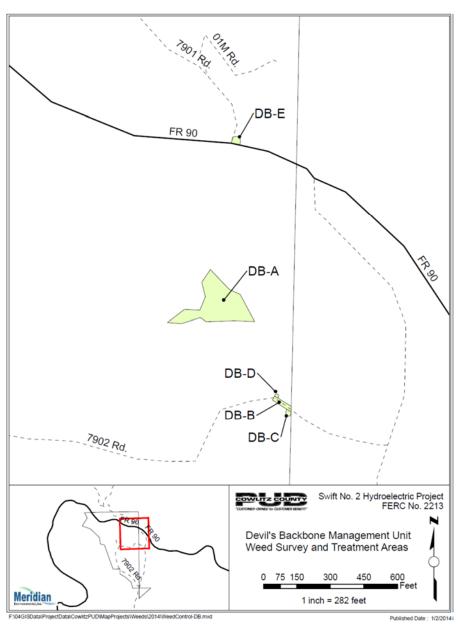


Figure 4. Devil's Backbone Management Unit Weed Survey and Treatment Areas

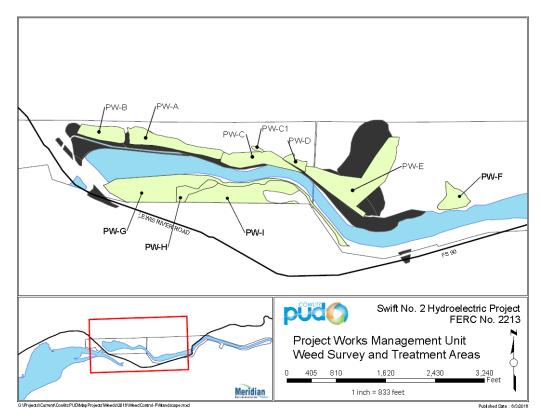


Figure 5. Project Works Management Unit Weed Survey and Treatment Areas

Updated noxious weed lists are obtained annually from the Cowlitz County and Washington State noxious weed control boards (Skamania County follows the state listings). The current classifications of target weed species observed in the Swift No. 2 Wildlife Management Area (WMA) as of 2018 are shown in **Table 7** below. Weeds shown in bold are species Cowlitz County has selected as high priorities for control.

Class B Weeds: Non-native species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.

Class C Weeds: These are noxious weeds typically widespread in WA State or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired.

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Table 7. Non-native invasive plants classified as noxious weeds in Cowlitz or Skamania County that have been observed in the Swift No. 2 WMA as of 2018.

Common Name (Scientific Name)	Cowlitz County	Skamania County (Washington State)
Bull thistle (Cirsium vulgare)	C	С
Canada thistle (Cirsium arvense)	C	C
Common catsear (Hypochaeris radicata)		С
Common groundsel (Senecio vulgaris)	C	С
Common St. Johnswort (Hypericum perforatum)	C	С
Evergreen blackberry (Rubus laciniatus)	C	С
Himalayan blackberry (Rubus armeniacus)	C	С
Oxeye daisy (Leucanthemum vulgare)	C	С
Perennial sowthistle (Sonchus arvensis ssp. arvensis)		С
Robert's geranium (Geranium robertianum)	В	В
Scentless mayweed (Matricaria perforata)	C	C
Scotch broom (Cytisus scoparius)	В	В
Tansy ragwort (Senecio jacobaea)	В	В

Other non-native invasive species that are not classified in either county as noxious weeds are also recorded when observed. These include foxglove (*Digitalis purpurea*), self-heal (*Prunella vulgaris*), brackenfern (*Pteridium aquilinum*), and common dandelion (Taraxacum officinale).

5.4.4.1.1 <u>Initial Invasive Plant Surveys</u>

Meridian Environmental, Inc. (Meridian) completed initial invasive plant surveys in all high priority areas of the Devil's Backbone MU in 2009. These areas are shown in **Figure 4**, above.

Meridian completed initial invasive plant surveys of high priority areas in the Project Works MU in 2013. These areas are shown in **Figure 5**.

5.4.4.1.2 Invasive Plant Species Follow-up Surveys

Meridian conducted follow-up surveys May 30, 2018. The purpose of the surveys was to determine the effectiveness of herbicide applications and/or manual removal efforts to date and to identify future treatment needs. **Tables 8 and 9** list the target species observed during the follow-up surveys and summarize their distribution and estimated cover in the Devil's Backbone and Project Works MUs.

Table 8. Survey areas, target species, distribution, and estimated cover in the Devil's Backbone MU (2018).

Survey	Survey	Target Species	2018	2018
Area	Acres		Distribution	Estimated Cover
DB-A	0.9	Canada thistle	Scattered	0-5%
		Bracken fern	Scattered	0-5%
		Foxglove	Scattered	0-5%
		Common cat's-ear	Scattered, patchy	0-5%

Survey	Survey	Target Species	2018	2018	
Area	Acres		Distribution	Estimated Cover	
		Birdsfoot trefoil	Scattered, patchy	0-5%	
		Tansy ragwort	Scattered, patchy	0-5%	
DB-B,	0.06	Bracken fern	Scattered	0-5%	
C, D					
		Common cat's-ear	Scattered, patchy	0-5%	
		Foxglove	Scattered	0-5%	
7902	Road	Common cat's-ear Scattered		0-5%	
		Tansy ragwort	Clumped	0-5%	
7901	Road	No invasive species. Dominant species mixed grass, moss, sedges, sword fern, miner's lettuce, and bare ground.			

Table 9. Survey areas, target species, distribution, and estimated cover in the Project Works MU (2018).

Survey	Survey	Target Species	2018	2018
Area	Acres	get z p	Distribution	Estimated Cover
PW-A	6.5	Himalayan blackberry	Scattered, patchy	0-5%
		Foxglove	Scattered	0-5%
		Canada thistle	Scattered	0-5%
		Common cat's-ear	Scattered	0-5%
		Scentless mayweed	Scattered, even	5-25%
		Birdsfoot trefoil	Scattered	0-5%
		Scotch broom	Scattered	0-5%
PW-C	5.5	Himalayan blackberry	Clumped	0-5%
		Robert's geranium	Scattered	5-25%
		Common cat's-ear	Scattered, patchy	0-5%
		Bracken fern	Clumped	0-5%
PW-D	1.1	Scotch broom	Clumped	0-5%
		Common cat's-ear	Scattered/even	5-25%
		Bracken fern	Clumped	0-5%
		Oxeye daisy	Clumped	0-5%
		Foxglove	Scattered	0-5%
PW-H	2.1	Scotch broom	Scattered	0-5%
		Common cat's-ear	Scattered, even	0-5%
		Evergreen blackberry	Clumped	0-5%
		Robert's geranium	Clumped	0-5%
		Himalayan blackberry	Clumped	0-5%
PW-I	9.8	Scotch broom	Clumped	0-5%
		Common cat's-ear	Scattered	0-5%
		Robert's geranium	Clumped	0-5%

Devil's Backbone MU

During the 2018 follow-up survey in DB-A, it was determined that the overall cover of Canada thistle has increased since 2017 and will need continuing treatment. Grass and forb cover is dense and healthy and Birdsfoot trefoil is less than 2017, likely due to browsing. Foxglove was hand-pulled and is now under good control, but still needs monitored. Other invasive nonnative species observed in DB-A include Bracken fern, Common cats'-ear and Tansy ragwort. During the follow-up survey in DB-B, C, and D, there was no Scotch broom observed inside the WMA boundary. The Scotch broom that was beginning to encroach on the site boundary in 2017 was treated and regrowth was not observed. Foxglove and Tansy ragwort were hand-pulled during the survey. A patch of Common cats'-ear and Bracken fern was observed. One Foxglove rosette was observed and pulled along the 7901 Road.

Project Works MU

The May 2018 follow-up surveys indicated good control of Scotch broom in PW-A, but sprouts and flowering plants were present. In PW-A, Foxglove is developing throughout the site and Common cat's-ear is spreading along the pond. Himalayan blackberry was treated in 2017, but is regenerating and expanding around the pond. PW-B was not surveyed in 2018. Miner's lettuce is surviving the continuous treatments of Robert's geranium in PW-C. After treatment, Robert's geranium was reduced but there is some regrowth. Himalayan blackberry is reduced but regenerating within treated clumps. In PW-D, Scotch broom control has been successful, only five plants were found regenerating and four were pulled during the survey. During the 2018 survey, an Oxeye daisy clump was found, which was first reported in 2016 but not evident in 2017. Common cat's-ear appears stable, but Foxglove and Bracken fern is increasing throughout the site.

In PW-H and PW-I, the flowering Scotch broom appears eradicated with no regeneration seen on treated plants, but a few isolated sprouts were present. Himalayan blackberry and Evergreen blackberry along the road appears partially treated as new plants and regenerating plants remain.



Figure 6. PW-H Treated Scotch Broom



Figure 7. PW-C Rough-skinned newts

5.4.4.2 Invasive Plant Species Control

In January 2017, Cowlitz PUD signed a 1-year interlocal agreement (with an option for 3 additional years) with Skamania County to perform weed control in the WMA.

At various dates throughout June and September 2018, the Skamania County weed control crew applied VastlanTM in DB-A, B, C, and D to control Canada thistle, Common cat's-ear, Foxglove, and Tansy ragwort. During the same time period, the crew applied VastlanTM in PW-A, B, C, C-1, D, H, and I to control invasive species including Scotch broom, Evergreen blackberry, Himalayan blackberry, and Robert's geranium.

5.4.4.3 PWMU-PUB Wetland Restoration

During a heavy rain event in January 2009, a landslide buried the PWMU-PUB wetland in mud and large woody debris. The following summer, Cowlitz PUD re-contoured the wetland, reseeded the area, and planted willow (*Salix spp.*) stakes. Crews planted additional willow and red osier dogwood (*Cornus sericia*) stakes and rooted stock of several species in 2010 to further increase the species and structural diversity of wildlife habitat around the wetland. The 2018 survey indicates that the pioneering native species, such as red alder, hardstem bulrush (*Scirpus acuminatus*), soft rush (*Juncus effusus*) and numerous other sedges, rushes, and hydrophytic forbs and grasses are continuing to colonize the site. Three amphibian species have been observed to date, including red-legged frogs (*Rana aurora*), Pacific chorus frogs (*Pseudacris regilla*), and rough-skinned newts (*Taricha granulosa*). Elk (*Cervus elaphus*) were not observed, but use is evident from grazing, tracks and pellets. The area of open water continues to decrease as soft rush increases.



Figure 8. Open water continues to decrease into wetland.



Figure 9. Animal tracks surrounding the PW-PUB wetland.

5.4.4.4 Devil's Backbone Forest Management

In 2018, the TCC set aside a total of \$6,585 for the 2018 Timber Management Fund. This amount plus the 2015-2017 Timber Management Fund totals \$26,872. These funds were not expended in 2018 and will be carried forward, with interest, to the Year 11 2019 budget. It is anticipated that the Timber Management Fund could be used in 2019 or 2020.

5.4.4.4.1 Devil's Backbone Elk Forage Plot

In 2018, planning activities, including site layout and silvicultural prescriptions, were completed for the creation of one 5-acre patch cut in the mid-successional forest in the Devil's

Backbone MU (DBMU-2). During the May 9, 2018 TCC Meeting, it was agreed to proceed with the approximate 5.8 acre patch cut as illustrated in Figure 11. The TCC further agreed to reduce the WHMP guidelines of leaving a combination of snags and green recruitment trees from 8 per acre to 2 per acre. The TCC recommended placing the leave trees at the edge of the patch cut to create as large of an opening as possible. At the meeting, the TCC also suggested that Cowlitz PUD apply for certain RMEF grant monies this year to offset some of the expenses for seeding and scarification.

On November 27, 2018, Cowlitz PUD submitted a RMEF PAC Project Proposal requesting \$13,735 to fund stump-pulling, scarification, forage seeding and burning stumps/slash. If obtained, \$13,735 in matching funds will be provided by PacifiCorp.

On December 4, 2018, Cowlitz PUD received notice from the Washington State Department of Natural Resources that the submitted Alternative Plan for the 5.8-acre Devil's Backbone patch cut was approved with no additional conditions.

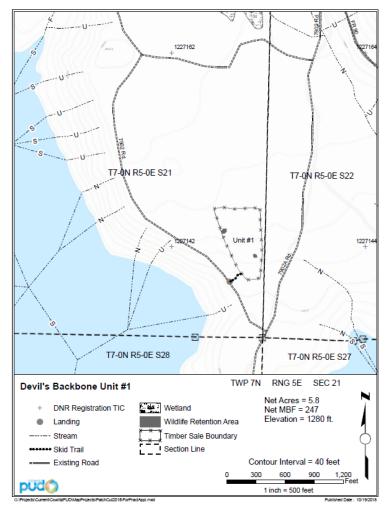


Figure 10. Devil's Backbone Elk Forage Plot

5.4.4.5 Public Access Monitoring

Public access surveys were conducted concurrently with invasive plant species surveys May 30, 2017. The purpose of the surveys is to document the condition of roads, gates, and signs; evidence of authorized (i.e., non-motorized) or unauthorized (i.e., motorized) public access; and screening between the roads and adjacent habitat. The surveys included roads that lead into the Devil's Backbone MU and the Project Works MU maintenance road, shown in **Figures 4 and 5**, respectively.

Devil's Backbone MU

Public access surveys were conducted concurrently with invasive plant species surveys on May 30, 2018. The purpose of the surveys is to document the condition of roads, gates, and signs; evidence of authorized (i.e., non-motorized) or unauthorized (i.e., motorized) public access; and screening between the roads and adjacent habitat. The surveys included roads that lead into the Devil's Backbone MU and the Project Works MU maintenance road, shown in **Figures 4 and 5**, respectively.

The 7901/01M Road leads north into the Devil's Backbone MU from Forest Road 90 (FR 90). It traverses DBMU sites 7, 8, 9, 10 and 12, passing through riparian deciduous and mid-successional conifer stands with a sparse shrub layer. But because there is no traffic, visual screening is a low concern. The road condition remains fair except at the site of a shallow slope failure that occurred just south of the road barrier. The slope failure led to several trees falling across the road and blocking it. However, during the survey, it was found that the trees were cut and the wood removed. The barrier constructed in July 2012 to block the 7901 Road to motorized traffic is in good repair and there is new blowdown uphill of the barrier. There were truck tire tracks on the road along with beer cans and other trash, and two new fire pits were present. There were elk and other animal trails at both ends of the barrier.



Figure 11. Blow down cut and wood removed

Figure 12. New campfire on 7901 road

The 01M Road is passable only to ATVs or motorcycles. Alders and bigleaf maple (*Acer macrophyllum*) are encroaching into the roadbed along its entire length. This road was not surveyed in 2018.

The 7902 Road leads south from FR 90, crossing adjacent property before turning west and entering the Devil's Backbone MU, where it passes through DBMU sites 2, 3, and 4. The adjacent property owner maintains a steel swing-gate near the intersection with FR 90 and attempts to keep the gate locked, but reports that the locks are often removed in an unauthorized manner. At the time of the May 2018 survey, the gate was closed and there was no lock or chain. The segment of the road just south of the gate is rough. There was no evidence of unauthorized motorized access or non-motorized access within the last year. No gates or signs have been installed on the 7902 Road at either the east or south entrances to the Devil's Backbone MU. Dense conifers crowd the east entrance to the property. The northern part of the road is in good condition, with no erosion or drainage concerns and only minor amounts of blowdown. At the southeast end, trees continue to encroach on the road. Mid-successional conifer stands and a sparse shrub layer provide little vegetative screening between the roadway and adjacent habitat. However, the risk of wildlife disturbance is low, due to the presence of the gate near the intersection of FR 90 and the steep, rocky segment of the road just south of the gate. There was elk scat observed on the road.



Figure 13. Encroaching trees and vegetation at the southeast end of the 7902 Road

Project Works MU

The Project Works MU maintenance road was inspected May 30, 2018. This road is closed to public access, with locked gates at both the east and west ends. Both gates (chain link at the east end; steel swing gate at the west end) have padlocks which are in good condition. "No Trespassing" signs installed on the gates are also in good condition. No evidence of unauthorized entry or use of Project Works MU lands was observed during the public access surveys.

5.4.4.6 Fisher Candidate Conservation Agreement with Assurances

On May 6, 2016 Cowlitz PUD received confirmation from the Washington Department of Fish and Wildlife of enrollment of the Devil's Backbone and Project Works MU lands in the Candidate Conservation Agreement with Assurances (CCAA) for the Fisher in the State of Washington. This agreement is designed to promote fisher conservation while also addressing concerns about future regulatory restrictions if fishers were to ever become a listed species under the federal Endangered Species Act (ESA). As an enrolled landowner, Cowlitz PUD is entitled to regulatory assurances against future land-use restrictions on its enrolled lands.

5.4.5 SA Section 10.8.4 Habitat Evaluation Procedures

Implementation scheduled for 2025 (Year 17) of the Swift No. 2 License.

5.4.6 SA Section 10.8.4.2 Review of Effectiveness of WHMP

Implementation scheduled for 2025 (Year 17) of the Swift No. 2 License.

5.4.7 SA Section 10.8.3 Cowlitz PUD 2019 Annual Plan

Cowlitz PUD will begin preparation of the 2019 WHMP Annual Plan in January 2019.

5.5 Cowlitz PUD Terrestrial 2019 Annual Plan

5.5.1 SA Section 10.6 Cowlitz PUD Completed Implementation: Advance Purchases [Devil's Backbone Conservation Covenant]

These lands will be managed under the WHMP.

5.5.2 SA Section 10.8.1 Cowlitz PUD Development of the Wildlife Habitat Management Plan (WHMP)

The WHMP will be implemented via the 2019 Annual Plan upon the FERC approval.

5.5.3 SA Section 10.8.2 Cowlitz PUD WHMP Fund

The Timber Management Fund, carry forward, interest, and the Year 11 2018 annual funding amount will be available in 2019. Cowlitz PUD will make approximately \$19,732 available for WHMP activities December 26, 2019.

5.5.4 <u>SA Section 10.8.3 Management of the Plan [Annual Plan]</u>

Following consultation with the TCC, Cowlitz PUD will file the 2019 Annual Plan with the FERC. Upon the FERC approval, Cowlitz PUD will implement the 2019 Annual Plan.



6.0 Law Enforcement

6.1 SA Section 13.2.1 Law Enforcement

Throughout the year the Lewis River Basin was patrolled by a full time Washington Department of Fish and Wildlife officer, a part time Skamania County Deputy (May through October) and a full time Cowlitz County Deputy. During some periods, additional patrols were provided by other officers. For these officers the focus is protection of fish and wildlife, cultural resources, and public safety and security.

The following table presents the WDFW Fish and Wildlife Police <u>actions taken</u> during January through December 2018 toward fish and wildlife law enforcement requirements in the Lewis River Settlement Agreement:

Table 10. WDFW Actions taken 2018 (All fishing)

Incident Type	Total
BOATING SAFETY INSP./VIOLATION	4
ESA - COL. RIVER SALMON/STEELHEAD	
STAMP	27
ESA/PROTECTED SPECIES VIOLATION	12
FRESHWATER FISH VIOLATION	8
GENERAL AUTHORITY INVESTIGATION	8
Grand Total	59

Table 11. WDFW Actions taken 2018 (Non-fishing related)

Incident Type	Total
ABANDONED VEHICLE	
INVESTIGATION/VIOL.	1
BIG GAME VIOLATION	12
HPA INVESTIGATION - PERMITTED	1
INJURED WILDLIFE REPORT	3
LANDS INCIDENT/VIOLATION	1
OFF ROAD VEHICLE INCIDENT/VIOLATION	1
PROBLEM WILDLIFE REPORT	1
REC. LICENSE FRAUD INVESTIGATION	1
SNOWMOBILE	
VIOLATION/INVESTIGATION	94
TAXIDERMIST/MEAT PROCESSOR	
INVESTIGATION	1
TRAFFIC INCIDENT/VIOLATION	15
WARRANT ARREST/HIT	2
Grand Total	133

The following table presents the WDFW Fish and Wildlife Police <u>charges/citations</u> during January through December 2018 toward fish and wildlife law enforcement requirements in the

Table 12. WDFW Charges/Citations 2018 (fishing related)

Lewis River Settlement Agreement:

	Criminal	Criminal	Infraction	Infraction	Grand
Incident Type	Non-traffic	Traffic	Non-traffic	Traffic	Total
BOATING SAFETY					
INSP./VIOLATION	1		5		6
ESA - COL. RIVER					
SALMON/STEELHEAD					
STAMP	17		24		41
ESA/PROTECTED					
SPECIES VIOLATION	4		13		17
FRESHWATER FISH					
VIOLATION	3		5		8
GENERAL AUTHORITY					
INVESTIGATION	2	2		3	7
Grand Total	27	2	47	3	79

Table 13. WDFW Charges/Citations 2018 (Non-fishing related)

	Criminal	Criminal	Criminal	Infraction	Infraction	Grand
Incident Type	Felony	Nontraffic	Traffic	Nontraffic	Traffic	Total
BIG GAME VIOLATION	1	14				15
OFF ROAD VEHICLE						
INCIDENT/VIOLATION				1		1
REC. LICENSE FRAUD						
INVESTIGATION		3		2		5
SNOWMOBILE						
VIOLATION/INVESTIGATION				182	1	183
TRAFFIC						
INCIDENT/VIOLATION			10		14	24
Grand Total	1	17	10	185	15	228

The following table represents WDFW Fish and Wildlife Police <u>arrests/bookings</u> during January through December 2018 toward Fish and Wildlife law enforcement requirements in the Lewis River Settlement Agreement:

Table 14. WDFW Arrests/Bookings 2018

Incident Type	Total
ESA - COL. RIVER SALMON/STEELHEAD	
STAMP	2
FRESHWATER FISH VIOLATION	2
GENERAL AUTHORITY INVESTIGATION	2
TRAFFIC INCIDENT/VIOLATION	1
WARRANT ARREST/HIT	5
Grand Total	12

7.0 FUNDING

This section presents an accounting to date of the funding obligations for the Lewis River Settlement Agreement section 7.5.



Lewis River License Implementation

Lewis River Aquatics Fund - Resource Projects Sections 7.5.1, 7.5.3, 7.5.3.1 & 7.7

		Funds		_				
Release Date		Received		Expense		Interest	Balance	Notes
12/31/2017							\$ 2,089,106.52	
4/30/2018	\$	163,543.55	\$	1-	69	-	\$ 2,252,650.07	
12/31/2018	\$	-	\$	1-	69	107,781.43	\$ 2,183,431.50	
Total Spent to Date:					al S	pent to Date:	\$ (2,229,281.00)	
			Balance Remaining:			\$ 2,183,431.50		

Lewis River License Implementation

Lewis River Aquatics Fund - Bull Trout Sections 7.5, 7.5.1, 7.5.3, 7.5.3.1, & 7.7

Release Date	Funds Received	Expense	Interest	Balance	Notes
12/31/2017				\$ 728,323.34	
12/31/2018	\$ -	\$ -	\$ 36,964.38	\$ 765,287.72	
		Total Spent to Date:		\$ (234,547.92)	
		Bal	lance Remaining:	\$ 765,287.72	

Lewis River License Implementation

Lewis River WHMP Fund (Conservation Easement Lands)

Section 10.8.2

Release Date	Funds Received	Funds Expended	Balance	Notes
1/1/2018			\$ 283.00	
12/31/2018	\$ -	\$ (283.00)	\$ -	Expenditure for 2018
	Tota	I Spent to Date:	\$ (2,409.94)	
	Balar	nce Remaining:	\$ 288.20	

Lewis River License Implementation

Lewis River WHMP Fund (Fee Simple Lands)

Section 10.8.2

Release Date	Funds Received	Expense	Interest	Balance	Notes
1/1/2018				547,194.12	
12/31/2018	-	(648,257.80)	-	(80,046.73)	
1/1/2019	-	-	-	479,630.06	As of 12/27/2018, current WHMP acreage is; total 15,162 acres
	•	Total Spent to Date:		\$ (4,359,743.35)	
		Balance Remaining:		\$ 479,630.06	

Lewis River License Implementation

Lewis River LWD Fund - Haul

Section 7.1.1

Release Date	Funds Received	Funds Dispersed	Balance	Notes
9/11/2017			\$ 13.42	
4/30/2018	\$ 2,000.00	\$ -	\$ 2,013.42	7.1.1 Large Woody Debris Program, ILR-LWD
	Tota	I Spent to Date:	\$ (19,986.58)	
	Bala	nce Remaining:	\$ 2,013.42	

Lewis River License Implementation

Lewis River LWD Fund - Resource

Section 7.1.1

	Funds	Funds		
Release Date	Received	Dispersed	Balance	Notes
12/26/2018			\$ 91,500.00	7.1.1 Large Woody Debris Program, ILR-LWD
	Tota	I Spent to Date:	\$ (18,500.00)	
	Bala	nce Remaining:	\$ 91,500,00	

Lewis River License Implementation

Swift No. 1 & Swift No. 2 Land and Habitat Protection Fund Section 10.2, 10.2.1

Release Date	Funds Received	Expense	Balance		Notes	
12/26/2017			\$ 1,880,386.65			
12/31/2018	\$ -	\$ -	\$ 1,941,598.36			
•		Tot	al Spent to Date:	\$ (7,929,974.69)		
		Bal	ance Remaining:	\$ 1,941,598.36		

Lewis River License Implementation Dispersed Camping Management Funding Section 11.2.12 & 11.3.5

	Pacificorp Funds	Cowlitz PU Funds						
Release Date	Provided	Provided	I M	lisc. Expense	Fu	nds Dispersed	Balance	Notes
6/26/2017							\$ (7,709.61)	
6/26/2018	\$ 6,829.57	\$ 1,020	.52 \$	ī	\$	(7,850.09)	\$ 0.00	10th anniversary of license issuance - USDA FS
6/27/2018	\$ 26.91	\$ -	\$	ī	\$	-	\$ 26.91	USFS refund; unused funds
•				To	otal	Spent to Date:	\$ (52,549.32)	
				Balance Remaining:			\$ 26.91	

Lewis River License Implementation Mitigation for Impacts on Wildlife

Section 10.8.5.5

Release Date Expense Received Balance 12/31/2017 10,172.00 10/17/2018 \$ 19,135.89 WDNR timber value; 1630 Road Temp Use Permit 603.58 \$ \$ \$ **Total Spent to Date:** \$ Running Total: 19,135.89

Lewis River License Implementation Additional Matching Funds

Section 10.3.3					
Release Date	Funds Received	Expense	Interest	Balance	Notes
Release Date	Received	⊏xpense	interest	Balance	Notes
2/25/2017				\$ 16,500.00	
	\$ -	\$ (38,078.25)	\$ -		2017 Marble Mountain Forage Enrichment and Effectiveness
11/1/2018				\$ 2,105.75	Monitoring
		Tot	al Spent to Date:	\$ (84,578.25)	
			Running Total:	\$ 2,105.75	

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Attachment A ACC / TCC Comments

Commenter	Comment Number	Location	Comment	Utilities Response
Neil Chartier, USFS	1	Section 5.1.1 Meetings and Conference Calls	Add closing parenthesis to "(2017 completed harvest area)" in entry "On April 11, 2018 the TCC conducted a field tour to Units 14 (2017 completed harvest area and Unit 15 (2018 proposed harvest areas). In Unit 14 the TCC agreed to plant a mix of conifer and deciduous trees.	Corrected in master document
Neil Chartier, USFS	2	Section 5.1.1 Meetings and Conference Calls	Change "are" to "were" in entry "On October 10, 2018 PacifiCorp provided a detailed review of a draft memo titled, Lewis River Wildlife Habitat Management Plan (WHMP) Lands Timber Harvest and Silviculture Planning, October 2, 2018. TCC comments are due on or before November 30, 2018.	Corrected in master document
Neil Chartier, USFS	3	Section 5.4.4.1, Invasive Plant Surveys	Invasive Plant surveys: section's last sentence, italicize scientific names: "These include foxglove (Digitalis purpurea), self-heal (Prunella vulgaris), brackenfern (Pteridium aquilinum), and common dandelion (Taraxacum officinale).	Corrected in master document
Neil Chartier, USFS	4	Table 6, Invasive Plant Surveys	What do "C" and "B" representDB subunits where invasives were found?	Add Class description before Table. Note: Table 6 should be labeled as Table 7. Class B Weeds: Non-native species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal. Class C Weeds: These are noxious weeds typically widespread in WA State or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired."
Tom Wadsworth, WDFW	5	Section 1.0	Suggest adding an Executive Summary with key points from the report (including all the appendices).	PacifiCorp will take this into consideration for the 2019 Annual Report.
Tom Wadsworth, WDFW	6	Figure 1		PacifiCorp added the following text to the master document - As of July 2018 Figure 1 content was updated. PacfiCorp will work in coordination with WDFW to update the photos in the 2019 annual report.
Tom Wadsworth, WDFW	7	Figure 2. Daily Minimum Release flows from December 31, 2017 to December 31, 2018.	What is red line? Add to figure legend. 'Upper' is spelled wrong in legend	Corrected in master document.

Section 14 of the Lewis River Settlement Agreement

SECTION 14: COORDINATION AND DECISION MAKING

- 14.1 <u>Coordination and Decision Making</u>. The provisions of this Section 14 describe the processes for coordination and decision making among the Parties for the implementation of the terrestrial and aquatic PM&E Measures provided for in this Agreement. As provided for in Section 14.2 below, the Licensees shall convene a Terrestrial Coordination Committee ("TCC") to coordinate implementation of the terrestrial PM&E Measures described in Section 10 (including any exhibits, schedules, and appendices related to Section 10), and shall accomplish the purposes set forth in Section 14.1.1 below. The Licensees shall convene an Aquatics Coordination Committee ("ACC") to coordinate implementation of the aquatics PM&E Measures described in Sections 3 through 9 (including any exhibits, schedules, and appendices related to those Sections), referred to below as terrestrial and aquatic PM&E Measures.
- 14.1.1 <u>Purposes of the TCC</u>. The TCC is intended to accomplish the purposes set forth below:
 - a. Provide a forum for coordination between the Licensees and the other Parties on terrestrial resources PM&E Measure implementation.
 - b. Oversee the development by the Licensees of an objective-oriented WHMP prior to the Issuance of the New Licenses.
 - c. Monitor implementation of that WHMP.
 - d. Oversee the HEP study in the 17th year after Issuance of the New Licenses, and modify the WHMP if necessary based on the HEP's results.
 - e. Oversee and make decisions regarding the: (1) Yale Fund; (2) the Swift Fund; and (3) the Lewis River Fund.
 - f. Oversee the annual budget for the WHMP.
- 14.2 <u>Coordination Committees</u>. Within 60 days after the Effective Date, PacifiCorp and Cowlitz PUD shall convene the TCC and the ACC.
 - 14.2.1 <u>Committee Coordinators</u>. Within 30 days after the Effective Date, PacifiCorp Energy and Cowlitz PUD each shall designate one Committee Coordinator for the TCC and one Committee Coordinator for the ACC. PacifiCorp Energy and Cowlitz PUD shall make their designations by notice to the Parties in accordance with the notice provisions in Section 16.6. The PacifiCorp Energy Committee Coordinator(s) shall be employed or retained by PacifiCorp Energy and may represent PacifiCorp Energy on the TCC and the ACC. The Cowlitz Committee Coordinator(s) shall be employed or retained by Cowlitz PUD and may represent Cowlitz PUD on the TCC and the ACC. The PacifiCorp Energy Committee Coordinator(s) shall, as their primary responsibilities, oversee the coordination and implementation of the terrestrial and aquatics PM&E Measures that are the responsibility of PacifiCorp

Energy as provided in this Agreement. The Cowlitz PUD Committee Coordinator(s) shall oversee the coordination and implementation of the terrestrial and aquatics PM&E Measures that are the responsibility of Cowlitz PUD as provided in this

Agreement. PacifiCorp Energy and Cowlitz PUD Committee Coordinators together shall oversee the coordination and implementation of terrestrial and aquatics PM&E Measures for which PacifiCorp Energy and Cowlitz PUD have joint responsibility as provided in this Agreement.

14.2.2 TCC and ACC Membership. Within 30 days after the Effective Date, or at any time thereafter with 30 days' notice to the Licensees, each Party, at its own discretion and cost, may designate one representative for membership on the TCC and may designate one representative for membership on the ACC and may designate one or more alternates. The Party shall make its designation(s) by notice to the Parties in accordance with Section 16.6. A Party not participating on the TCC, the ACC, or both may request, by notice to the Parties in accordance with Section 16.6, to be placed on a contact list to receive notices of committee meetings and releases of information, including annual reports and other interim reports that the TCC or the ACC may issue.

14.2.3 TCC and ACC Functions. The TCC and the ACC will:

- a. Coordinate and Consult on development of plans by the Licensees as provided in this Agreement;
- b. Review information and oversee, guide, and make comments and recommendations on implementation and monitoring of the terrestrial and aquatic PM&E Measures, including plans;
- c. Consult with the Licensees on their respective reports prepared under this Agreement regarding implementation of the terrestrial and aquatic PM&E Measures as referred to in Section 14.2.6 below;
- d. Make decisions, grant approvals, and undertake any additional duties and responsibilities expressly given to the TCC or the ACC with respect to the terrestrial and aquatic PM&E Measures;
- e. Establish, among other things, (i) procedures and protocols for conducting committee meetings and deliberations to ensure efficient participation and decision making; (ii) rules for quorum and decision making in the absence of any member; (iii) alternative meeting formats as desired, including phone or teleconference; and (iv) the methods and procedures for updating committee members on interim progress of development and implementation of the terrestrial and aquatic PM&E Measures;
- f. As deemed necessary and appropriate by the TCC or the ACC, establish subcommittees to carry out specified committee functions and responsibilities described in this Section 14.2.3, and establish the size of,

membership of, and procedures for any such subcommittees; and

g. Discuss the protocols and the content of public information releases; provided that each Party retains the right to release information to the public at any time without such discussion.

- 14.2.4 <u>TCC and ACC Decision-Making Process and Limitations</u>. The TCC and the ACC shall make comments, recommendations, and decisions in a timely manner as provided below:
 - a. Each Party represented on the TCC and the ACC will have the authority to participate in all committee discussions relating to, and to provide input and advice on, decisions regarding implementation of the terrestrial or aquatics PM&E Measures;
 - b. The TCC and the ACC shall strive to operate by Consensus. Whether or not the TCC or the ACC has final authority over decisions on terrestrial and aquatic PM&E Measures, the Licensees and other Parties may proceed with actions necessary to implement the New Licenses or this Agreement, even though Consensus is not achieved; provided that in such cases the responsible Licensee or Licensees shall notify the Commission of the comments of the ACC or TCC members and the areas of disagreement. If the TCC or ACC does not reach Consensus, then any member of the TCC or ACC, respectively, may initiate the ADR Procedures as provided in Section 15 below.
 - c. Where one or more Parties have approval authority under this Agreement, Licensees shall notify the Commission of any approvals that were not obtained, include the relevant comments of the Parties with approval authority, describe the impact of the lack of approval on the schedule for implementation of PM&E Measures, and describe proposed steps to be taken to gain the approval, including dispute resolution.
 - d. In no event shall the TCC or the ACC increase or decrease the monetary, resource, or other commitments made by PacifiCorp Energy and Cowlitz PUD in this Agreement; override any other limitations set forth in this Agreement; or otherwise require PacifiCorp Energy to modify its three Projects' facilities without PacifiCorp Energy's prior written consent or require Cowlitz PUD to modify its Project's facilities without Cowlitz PUD's prior written consent, which consent may be withheld in the applicable Licensee's discretion.
 - e. At any juncture where discussion or other contact with the ACC or TCC is required by this Agreement, when requested by the Services or as required by the Agreement, the ACC or TCC Committee Coordinator, respectively, shall schedule an opportunity to discuss the relevant issue with the ACC or TCC. This event shall consist of a conference call, in-person meeting, or other appropriate forum to enable full consideration of the issue.

14.2.5 TCC and ACC Meetings. Commencing in the first year after the Effective Date and each year thereafter for the terms of the New Licenses, the TCC and ACC Committee Coordinators shall arrange and provide an agenda for an annual meeting of their respective committees. The TCC and ACC Committee Coordinators also shall arrange and provide an agenda for any additional meetings deemed necessary by either coordinator for a committee or at the request of any two Parties on that committee, which request shall be sent simultaneously to all members of that committee. Members of the TCC and the ACC shall be given a minimum of 30 days' notice prior to any meeting, unless otherwise agreed to by the members of the applicable committee.

14.2.6 TCC and ACC Reports

The Committee Coordinators for the TCC and the Committee Coordinators for the ACC shall prepare and file with the Commission detailed annual reports on the TCC and ACC activities, monitoring and evaluations under the M&E Plan, and implementation of the terrestrial and aquatics PM&E Measures occurring during the prior year, as well as plans for the coming year as required in this Agreement. The annual reports may also include plans and reports required pursuant to Sections 4.9.1, 7.7.1, 8.2.3, 8.2.4, 10.5, and 10.8.3. Copies of such reports will be made available to each Party. The annual reports shall be prepared in Consultation with the TCC and ACC committee members and shall be submitted to the committees for review each year, commencing after the Effective Date. Committee members shall have a minimum of 30 days to review and provide comment on a draft report before a final report is prepared and filed with the Commission. The Licensees shall submit the final report to the Commission not later than 30 days after the close of the ACC and TCC comment periods. To the extent that comments are not incorporated into the final report, an explanation will be provided in writing, and such explanation shall be included in the report.

Attachment C
Lewis River Bull Trout
2018 Annual Operations Report



Lewis River Bull Trout (Salvelinus confluentus) Annual Operations Report



P8 bull trout - 2018

North Fork Lewis River - 2018

Merwin	FERC No. 935
Yale	FERC No. 2071
Swift No. 1	FERC No. 2111
Swift No. 2	FERC No. 2213

Jeremiah Doyle, PacifiCorp

April 2019

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1.0 INTRODUCTION

PacifiCorp and the Public Utility District No. 1 of Cowlitz County, Washington (Cowlitz PUD) (collectively the Utilities) are involved in various bull trout (*Salvelinus confluentus*) and salmonid monitoring programs on the North Fork Lewis River in southwest Washington. These monitoring programs and this Report are designed to meet requirements pursuant to Article 402 in the Utilities' Federal Energy Regulatory Commission (FERC) operating licenses for the Merwin, Yale, Swift No. 1 and Swift No. 2 hydroelectric projects as well as requirements pursuant to sections 4.9, 9.6 and 14.2.6 of the Lewis River Settlement Agreement (SA). This Report and listed monitoring programs also serve to meet requirements contained in the 2006 Biological Opinion issued to PacifiCorp and Cowlitz PUD by the U.S. Fish and Wildlife Service (USFWS).

All activities are developed in consultation with the USFWS. This Report provides results from programs that are either ongoing or have been completed in 2018. For methods and general descriptions of all programs please refer to the Bull Trout Annual Operating Plan for the North Fork Lewis River 2018 that was submitted to the USFWS, members of the Lewis River Aquatic Coordination Committee (ACC) and FERC within the ACC/TCC Annual Report in April 2018.

2.0 STUDY AREA

Bull trout monitoring activities are performed on the North Fork Lewis River and its tributaries upstream of Merwin Dam commencing at river mile (RM) 19.5 and ending at Lower Falls, a complete anadromous and resident fish barrier at RM 72.5. The North Fork Lewis River above Merwin Dam is influenced by three reservoirs created by hydroelectric facilities; 4,000 acre Merwin Reservoir, 3,800 acre Yale Reservoir, and the largest and furthest upstream 4,600 acre Swift Reservoir. From Lower Falls downstream, the North Fork Lewis is free-flowing for approximately 12 miles until the river reaches the head of Swift Reservoir at RM 60. A map of the study area for all programs is shown in Figure 2.0-1.

Bull trout are found in all three reservoirs as well as the Swift No. 2 Power Canal, with the bulk of the population residing in Swift Reservoir. Only three known bull trout spawning streams are found in the study area; Rush and Pine Creeks, tributaries to the North Fork Lewis River upstream of Swift Reservoir, and Cougar Creek a tributary to Yale Reservoir. Recent genetic analysis performed in 2011 identified three distinct local populations residing within the basin; Rush, Pine, and Cougar Creek bull trout (Dehaan and Adams 2011).

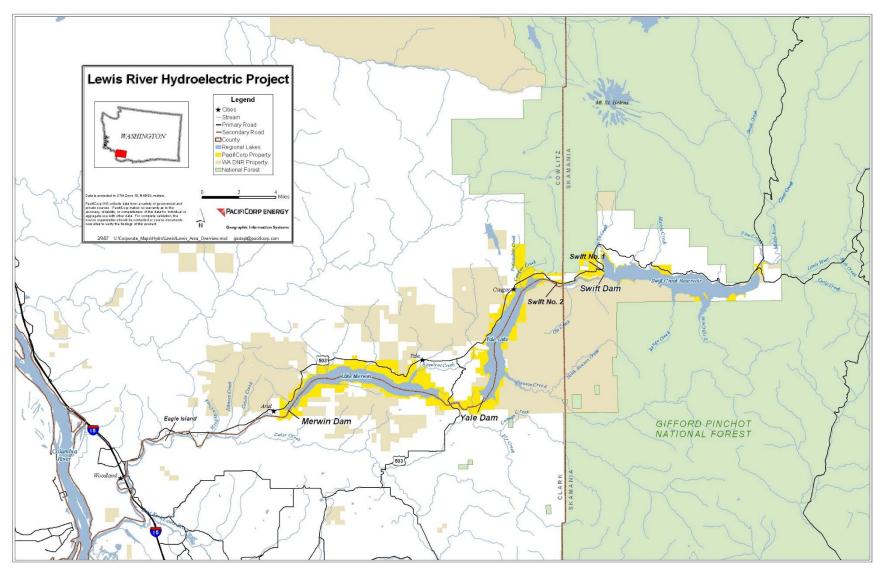


Figure 2.0-1. Map of North Fork Lewis River study area.

3.0 RESULTS FROM 2018 PLANNED ACTIVITIES

During 2018 the Utilities participated in, funded, or initiated six monitoring programs.

- 1. Swift Reservoir adult migration snorkel surveys, Survival (S), and juvenile relative abundance surveys
- 2. Half-duplex Passive Integrated Transponder (PIT) tag antenna arrays in Cougar, Pine, P8, and Rush creeks
- 3. Yale tailrace collection and transport
- 4. Underwater video camera operation to enumerate bull trout migrants in P8 Creek
- 5. Bull trout redd surveys of Cougar, Pine, P8 and Rush creeks with associated observer error study
- 6. Summer and fall stream temperature monitoring of bull trout pertinent sites upstream of Eagle Cliff
- 3.1 FERC PROJECT LICENSE ARTICLE 402(B) AND LEWIS RIVER SETTLEMENT AGREEMENT SECTION 9.6 SWIFT RESERVOIR BULL TROUT POPULATION EVALUATION

3.1.1 ESTIMATE OF THE NUMBER OF STAGING BULL TROUT THAT MIGRATED UP THE NORTH FORK LEWIS RIVER FROM THE HEAD OF SWIFT RESERVOIR

EAGLE CLIFFS BULL TROUT COLLECTION (MARK):

In light of compelling data presented in 2016 that highlighted the numerous handling opportunities that could befall bull trout within Swift and Yale reservoirs and the negative impact this handling is presumed to have on long-term survival, no capture and marking activities were conducted within Swift Reservoir for the second straight year. The Utilities in Consultation with the USFWS and the Lewis River Bull Trout Recovery Team, which is a group comprised of representatives from the Washington Department of Fish and Wildlife (WDFW), United States Department of Agriculture-Forest Service (USDA-FS), United States Geological Survey (USGS) and USFWS, decided in 2016 to place a two year research handling moratorium on all bull trout monitoring activities in Swift and Yale reservoirs. The next year these activities could commence would be in 2019.

SNORKEL SURVEYS OF THE CONFLUENCE AREAS OF MUDDY RIVER, PINE, AND RUSH CREEKS WITH THE NORTH FORK LEWIS RIVER:

Snorkel surveys of the three confluence areas occurred from July 20 to October 3 for a total of eight instances (Table 3.1-1).

Snorkel surveys of the Muddy, Pine, and Rush confluence areas began upstream of each confluence in the North Fork Lewis and continued downstream until bull trout were no longer observed, usually a distance of approximately 100m. Given the short distance between the mouth of Pine Creek and the Muddy River, this area was also surveyed for bull trout during each confluence survey day (Figure 3.1-2).

Table 3.1-1. 2018 bull trout snorkel survey results for the Muddy River, Rush and Pine creeks confluence areas with the North Fork Lewis River.*Poor water clarity in Rush confluence. ^River otters working Muddy confluence, not snorkeled. Y Most all observed bull trout post-spawn.

Data	Confluence location			Total
Date	Pine	Rush	Muddy	Observed >450mm
20-Jul	29	26	11	66
31-Jul	46	14	14	74
10-Aug	25	6*	10	41
22-Aug	14	29	13	56
30-Aug	11	24	12	47
10-Sep	8	13	13	34
24-Sep	16	16	n/a^	32
3-Oct	14 ^V	7 ^v	16 ^V	37
TOTAL	162	135	89	387

Continued in 2018, due to the lack of newly marked bull trout from the handling moratorium put in place after 2016 activities, no separate tagged group of bull trout were identified during snorkel surveys. All bull trout observed were pooled into one total count by survey date. Thus no NOREMARK® estimate was generated in 2018.

Historically, Swift Reservoir bull trout migration data was analyzed and a migration estimate obtained using program NOREMARK®. NOREMARK® computes an estimate of population size for a closed population with a known number of marked animals and one or more re-sighting events (White 1996). Program NOREMARK® utilizes four mark-resight estimators of population abundance; for all four estimators, the marked fish are assumed to have been drawn randomly from the population. That is, the marked fish are a representative sample of the population (White 1996). With no marking activities occurring in 2018 it was not possible to generate an estimate with this program; instead snorkel information was pooled for each survey and a peak count was established.

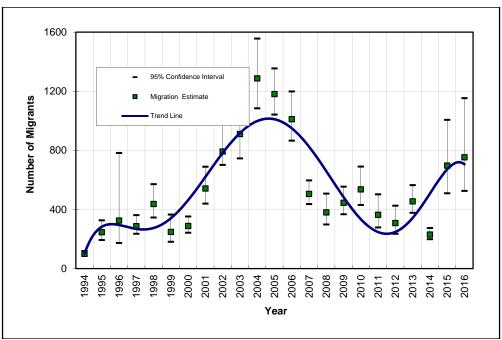


Figure 3.1-1. Estimates of bull trout that migrated from Swift Reservoir up the North Fork Lewis River for the years 1994 through 2016. (1994-2000 Peterson Estimator, 2001- 2016 Program NOREMARK®, Smith 1996)

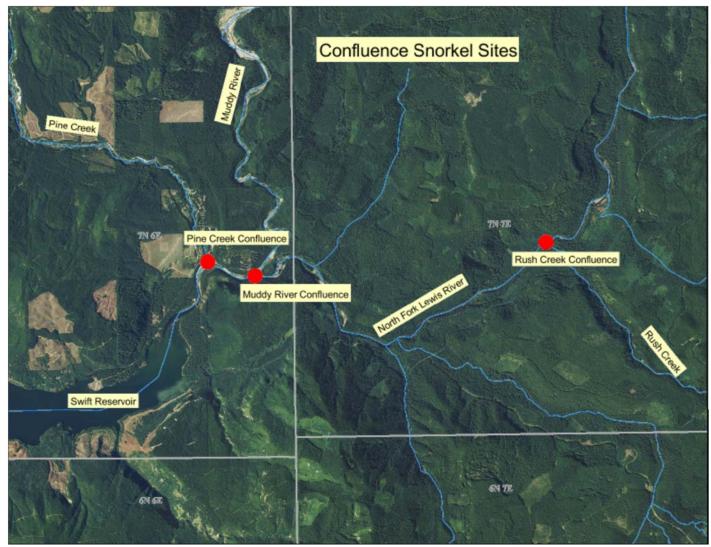


Figure 3.1-2. Snorkel sites (for recapture) associated with the Swift Reservoir bull trout migration estimate

3.1.2 EVALUATION OF SURVIVAL (S) OF SWIFT BULL TROUT POPULATIONS THROUGH THE USE OF PIT TAG DETECTIONS

Analysis of this data was still pending at the time of submission of this Report. As results and associated memo become available it will be made accessible and included within a later filing of this Report.

3.1.3 EVALUATION OF THE SWIFT RESERVOIR BULL TROUT EFFECTIVE POPULATION (NE)

Activities pursuant to the eventual annual assessment of an Effective Population (N_e) size of bull trout within Swift Reservoir were performed in 2018. N_e is performed as part of the bull trout demographic characteristics evaluation objective within Section 17 of the Monitoring and Evaluation Plan. New in 2018, per the direction of the LRBTRT, no lab analysis of gathered genetic tissue for genetic estimation of spawner abundance for eventual Effective Population estimation was performed. Though no lab analysis was scheduled for 2018, juvenile surveys were still conducted in order to assess relative abundance of bull trout and reintroduced anadromous juvenile fish species and their associated interaction. Tissue samples were also taken of all captured age 0 bull trout for possible future N_e analysis.

Estimation of effective population size can provide information on the level of genetic variation within a population and how fast genetic variation may be lost through genetic drift (Luikart et al. 2010). The effective population size represents the size of an ideal population that would have the same rate of loss of genetic variation as the observed population (Wright 1931). Although general guidelines for minimum effective population sizes have been suggested (e.g., the 50/500 rule; Franklin 1980), evaluating temporal trends in estimates of N_e are often more useful than determining whether a population meets some minimum threshold number. For example, a population that shows a large decrease in N_e over the course of one or two generations could be experiencing a genetic bottleneck or decline in abundance. Alternatively, an increase in effective size following implementation of new management actions could be one indication that the population is responding positively (Pers. Comm. Pat DeHaan, USFWS).

To evaluate N_e , genetic tissue from juvenile bull trout from the same cohort (presumably age 0) was attained from utilized spawning tributaries (Rush, Pine, and Cougar Creeks, Figures 3.1.3-1 to 3.1.3-3). In order to get maximum genetic representation, fish captures were spatially balanced as much as practical along the length of usable habitat within each stream. Surveys were timed such to ensure capture of prior year's brood fish, with less than 70 mm fork length the cut-off used to determine age 0 bull trout (Fraley/Shepard 1989).

Areas within Rush Creek were sampled with a backpack electrofishing unit on July 9 and July 18 (Figure 3.1.3-1). In all, 21 juvenile bull trout were captured and sampled for genetic tissue. 17 of the captures were less than 70 mm fork length and assumed to be of 2017 brood year origin. The length range of the age 0 bull trout was 39 mm - 55 mm, with an average fork length of 49 mm.

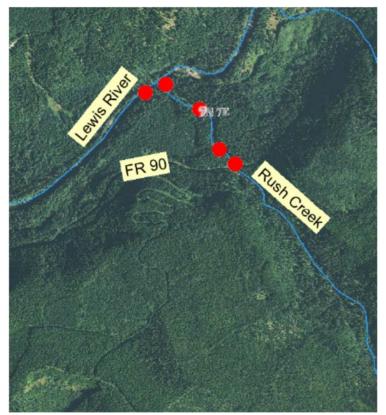


Figure 3.1.3-1. Electrofishing sites within Rush Creek during 2018 juvenile bull trout collection.

Areas within Pine Creek and tributary P8 were sampled for juvenile bull trout with a backpack electrofisher on June 10 and 13, and June 19 (Figure 3.1.3-2). In all, 36 juvenile bull trout were captured from within P8 ranging from 27-55 mm fork length with an average fork length of 41 mm. 70 juvenile bull trout were captured from within areas of Pine Creek mainstem ranging in size from 40-74 mm fork length with an average of 59 mm.

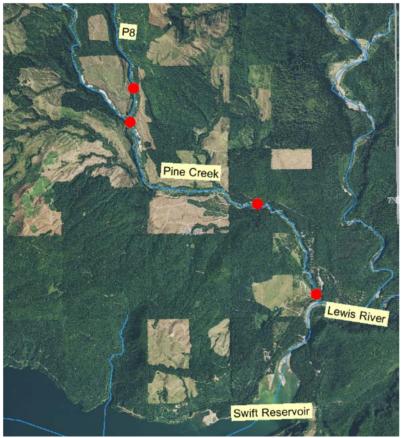


Figure 3.1.3-2. Electrofishing sites within the Pine Creek system during 2018 juvenile bull trout collection.

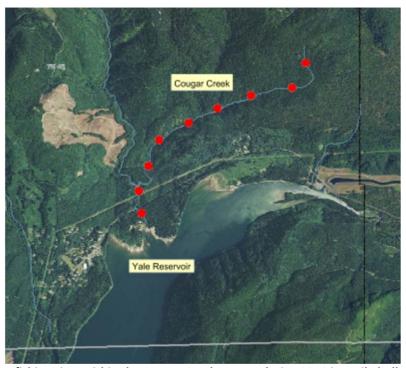


Figure 3.1.3-3. Electrofishing sites within the Cougar Creek system during 2018 juvenile bull trout collection.

Areas within Cougar Creek were sampled with a backpack electrofishing unit on July 5 (Figure 3.1.3-3). In all, 46 juvenile bull trout were captured and sampled for genetic tissue. The length range of captured age 0 bull trout was 43 - 68 mm, with an average fork length of 54 mm (Figure 3.1.3-4).

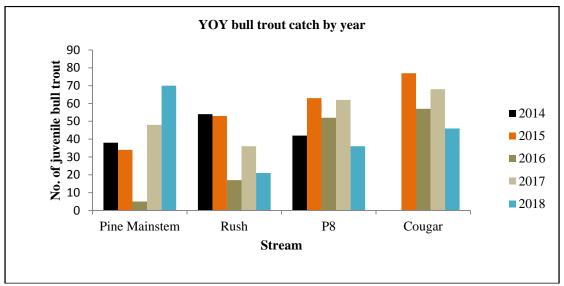


Figure 3.1.3-4. Trend bull trout juvenile catch during stream electrofishing surveys. Cougar Creek was not surveyed in 2014.

Juvenile bull trout/coho interactions

Numerous young of the year (YOY) coho were also found to be occupying the same habitat as YOY bull trout in the Rush and Pine creek systems in Swift Reservoir and as such were inadvertently captured during electrofishing surveys. These coho were quantified and measured to their caudal fork as part of activities pursuant to Objective 18 within the M&E Plan, evaluation of resident/anadromous fish interactions. Juvenile coho captured within the Rush and Pine creek drainages were progeny of adults released above Swift Reservoir as part of the ongoing anadromous reintroduction program.

Coho YOY dominated the catch in all areas electrofished upstream of Swift Reservoir; no coho were encountered or observed within Cougar Creek in 2018. Pine Creek mainstem had a total coho catch of 332, P8 a total coho catch of 59 and Rush a total coho catch of 75. There was a paucity of other species encountered, with the occasional steelhead (*Oncorhynchus mykiss*) or coastal cutthroat trout (*Oncorhynchus clarkii*). This coho catch corresponds to a YOY bull trout catch of 70 and a difference in overall collected of 83 percent more YOY coho captures in Pine Creek mainstem. A similar theme was observed in P8 and Rush creeks, where 36 and 21 YOY bull trout were captured with a difference in overall collected of 62 and 78 percent more coho captured in P8 and Rush creeks (Figure 3.1.3-5).

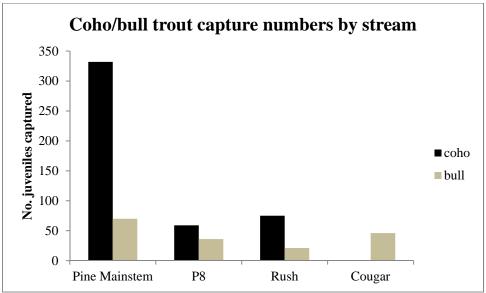


Figure 3.1.3-5. Coho and bull trout juvenile capture numbers by stream of capture in 2018.

Size of coho YOY in terms of average fork length was also assessed and compared to that of YOY bull trout occupying the same habitat within the Pine and Rush creek systems. Across the board bull trout YOY were marginally larger than coho YOY except in P8 Creek (Figure 3.1.3-6).

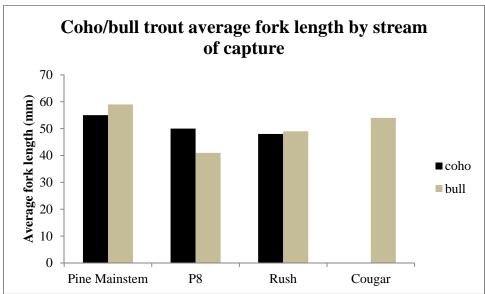


Figure 3.1.3-6. Juvenile coho and bull trout captures average fork length observed in 2018.

3.2 LEWIS RIVER PASSIVE INTEGRATED TRANSPONDER TAG ANTENNA ARRAYS

3.2.1 EVALUATION OF SWIFT AND YALE RESERVOIR BULL TROUT THROUGH THE USE OF STREAM-WIDTH HALF-DUPLEX PASSIVE INTEGRATED TRANSPONDER ANTENNAS IN RUSH, P8, PINE AND COUGAR CREEKS

Stream-width half-duplex PIT tag antennas were placed in Pine, P8, Rush, and Cougar creeks in the late summer through fall time period (Figures 3.2.1-1 and 3.2.1-2). The remote PIT antenna array in Pine Creek was stream-spanning and located in a shallow riffle approximately 300 m upstream from the confluence with the North Fork Lewis River. The Rush Creek antenna array was located in a narrow shoot approximately 100 m upstream from the confluence with the North Fork Lewis River. The array in P8 was stream-spanning and located approximately 150 m upstream from the confluence with Pine Creek. The array in Cougar Creek was also stream spanning and located approximately 200 m upstream from its confluence with Yale Reservoir.

Historically each half-duplex antenna site consisted of two antennas (for directionality) that were multiplexed (synchronized) and spaced approximately two meters apart. Continued in 2018 and for the second season in a row in order to conserve power, extend antenna life, and increase tag detection efficiency all antennas at all sites were only a single loop and not multiplexed. Antennas consisted of 10-gauge copper wire looped along the stream bottom starting from one stream bank, spanning the entire wetted-width of the stream along the stream bottom to the opposite bank, and then along the stream surface back to the original starting point creating a large swim thru rectangle shape. Each antenna wire or cable was connected to an Oregon RFID RI-Acc-008B antenna tuner unit. Copper twinax was then run from each tuner unit to an Oregon RFID RI-RFM-008 reader board and data logger. The antenna reader board and data logger were located in secure Joboxes near the stream bank and were powered by two large 12 volt deep-cycle marine batteries run in parallel. Batteries at the Pine Creek site were charged via 120w solar panels hooked to a charge controller.

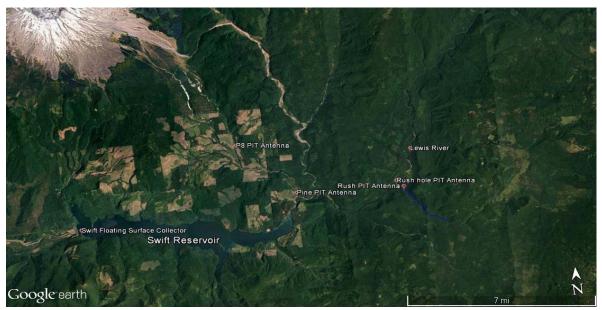


Figure 3.2.1-1. Half-duplex stream-width PIT tag antenna locations in the Upper Lewis River Basin – 2018.



Figure 3.2.1-2. Half-duplex stream-width PIT tag antenna locations in the Yale Reservoir Basin – 2018.

In 2018 there were 57 unique PIT tag detections at stationary antennae in tributaries to Yale and Swift reservoirs. The breakdown of detections by stream, as well as timing and spawning frequency is as follows:

Cougar Creek

The PIT antenna at the mouth of Cougar Creek was in operation from August 8 – October 28, at which time the antenna loop was destroyed by a high water event. Continuous operation was experienced during this sampling timeframe with no loss of power. During the migration period 41 detections occurred at the antenna resulting in 8 unique bull trout. All of the 41 upstream and downstream movement events occurred during the crepuscular period. Peak migration of two bull trout was observed on multiple occasions. In general, no defined migration pattern was observed at this PIT antenna location (Figure 3.2.1-3).

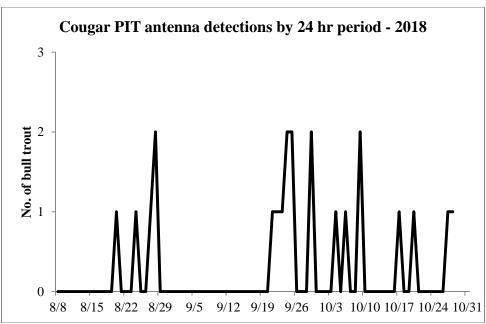


Figure 3.2.1-3. PIT detections by date in Cougar Creek in 2018.

The number of unique bull trout detections in 2018 as compared to historical detections at this site is expressed in Figure 3.2.1-4. 2018 experienced the least amount of detections on record with eight. Of these eight detections, seven (87 percent) were consecutive spawners with one fish being detected for the last seven consecutive years. One bull trout migrant (13 percent) was a maiden detection at Cougar Creek in 2018. Of note, the one maiden detection at this site in 2018 was initially captured within the Swift Bypass Reach of Yale Reservoir in 2016, at which time it was held at Merwin Hatchery while rapid response genetic assignment was conducted. Genetic analysis identified this bull trout as being of Pine Creek ancenstry, and as such this fish was transported upstream and released into Swift Reservoir on June 3, 2016. Three months later it was detected moving upstream past the Pine Creek PIT antenna of Swift Reservoir on September 10, 2016. No more detections of this fish occur until September 28, 2018 at which time it is detected moving upstream past the Cougar PIT antenna located in Yale Reservoir.

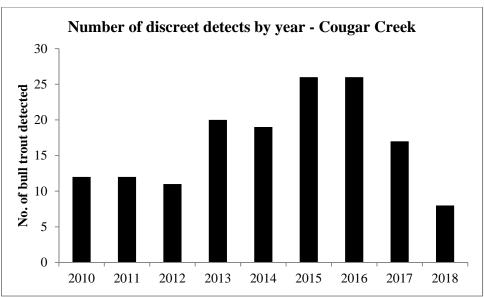


Figure 3.2.1-4. Historical PIT detections by year in Cougar Creek.

Pine Creek

The PIT antenna at the mouth of Pine Creek was in operation from August 1 to October 28. Power loss was experienced for three days during the study period, October 6 – October 8. The antenna loop was destroyed on October 28 due to a high water event. 75 detections were experienced during the period of operation resulting in 37 discrete bull trout tags. Peak migration past this antenna was observed in the ten-day period between September 18 and September 28 when 19 bull trout volitionally swam past (Figure 3.2.1-5).

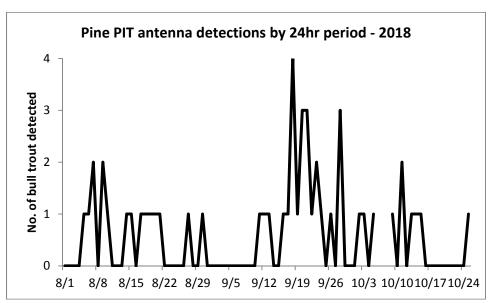


Figure 3.2.1-5. PIT detections by date at the Pine Creek PIT antenna in 2018.

The number of historical discrete detects at the Pine Creek site is expressed in Figure 3.2.1-6. Of the 37 bull trout that migrated upstream past this antenna, 51 percent showed evidence of

consecutive year migrations (2, 3, 4 or 5 year consecutive), 43 percent were maiden detections, and 6 percent showed evidence of biennial migrations.

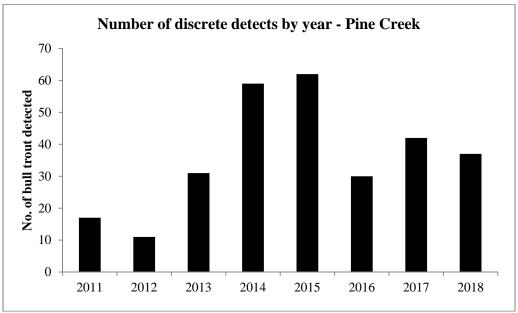


Figure 3.2.1-6. Historical PIT detections observed in Pine Creek by year.

Pine Creek Tributary P8

The PIT antenna at the mouth of Pine Creek tributary P8 was in operation from August 17 to October 8. Power loss was experienced for six days, September 6 - 11, due to a drained battery. Problems with the antenna motherboard and ability to tune the antenna to read a tag at suitable ranges prohibited start-up and contributed to the late date of initial operation. This antenna was taken out of service prematurely by a power surge that wiped the memory from the antenna motherboard and caused an inability to write a tag code to memory. 272 detections were recorded during the period of operation resulting in 17 discrete bull trout tags. Peak migration was observed on September 17 when four bull trout volitionally swam past the antenna (Figure 3.2.1-7).

14

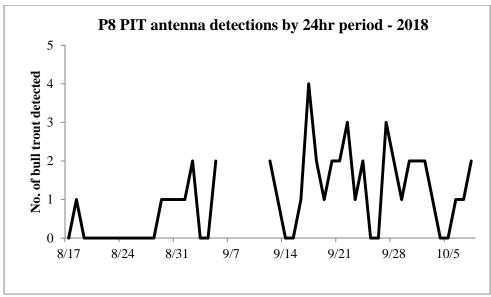


Figure 3.2.1-7. PIT detections by date in P8 during 2018.

Historical discrete detections at this site are expressed in Figure 3.2.1-8. Of the 17 bull trout detected at this antenna in 2018, 30 percent showed evidence of consecutive year migrations to this site, 11 percent evidence of biennial migrations, while 59 percent were maiden detections. 15 of the 17 bull trout detected at the P8 antenna were also detected downstream at the Pine Creek mainstem antenna.

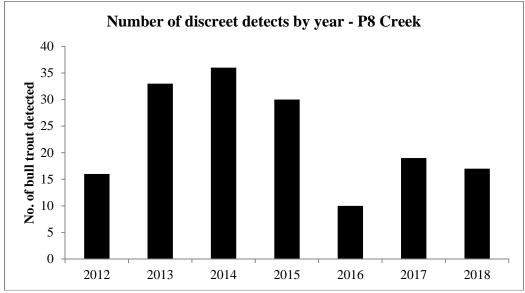


Figure 3.2.1-8. Historical PIT detections by year in P8.

Rush Creek

The PIT antenna near the mouth of Rush Creek was in operation from July 25 to October 22 at which time the antenna was destroyed by a high flow event. Power loss was experienced for six days, from September 27 – October 2, due to a drained battery. 13 detections were recorded during

the period of operation resulting in nine discrete bull trout tags. Peak migration of two bull trout was observed on August 6 (Figure 3.2.1-9).

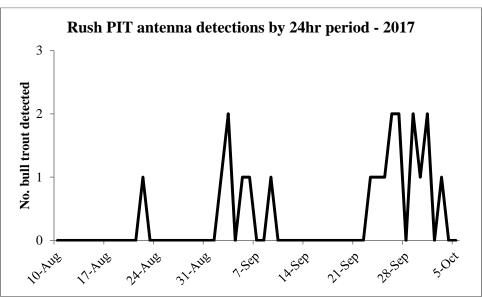


Figure 3.2.1-9. PIT detections by date observed in Rush Creek in 2018.

Historical discrete detections at this site are expressed in Figure 3.2.1-10. Of the nine bull trout detected at this antenna location in 2018, 67 percent showed evidence of consecutive year migrations, 11 percent biennial migration pattern, and 22 percent were maiden detections. For one bull trout, 2018 was the eighth consecutive year it was interrogated within Rush Creek.

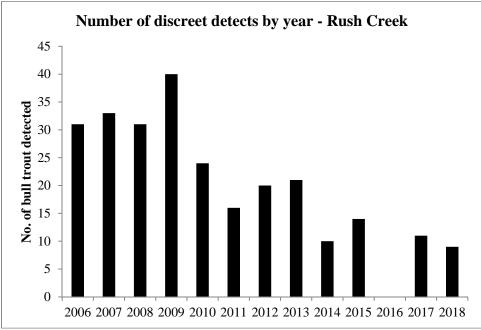


Figure 3.2.1-10. Historical PIT detections by year in Rush Creek.

Rush Creek Pool

A PIT antenna was intended and attempted on multiple occasions within Rush Creek Pool. This antenna was constructed as a hardened loop made from polyvinylchloride pipe with a diameter of two meters. The intent was to secure the antenna loop to the stream bottom in the middle of the pool, a distance of approximately fifteen meters from the ordinary high water mark. Due to the large geographical and fluvial area of the mainstem Lewis River at this site, no stream-spanning antenna was proposed. The idea was to place the small antenna in a conspicuous spot for bull trout holding in the pool to come volitionally into read-range. After the antenna was constructed and secured to the most likely spot within the pool, researchers were unable to get the antenna to read a tag. It was deemed that the antenna was too large and beyond the capabilities of the technology.

All Detection Analysis

Spawning frequency for the last four years from all detections at all streams combined was analyzed and is expressed in Figure 3.2.1-11. It is noted that a shift from maiden detection to multiple year detection is observed from 2015 to 2018, this shift is expected to become more pronounced as additional data is collected and individual fish are followed through their lifecycle. Of note in 2018 was the detection of two separate bull trout at both the Rush Creek and Pine Creek antenna locations. This is the first time during the period of study that a bull trout has been detected in both spawning tributaries within the same spawning season.

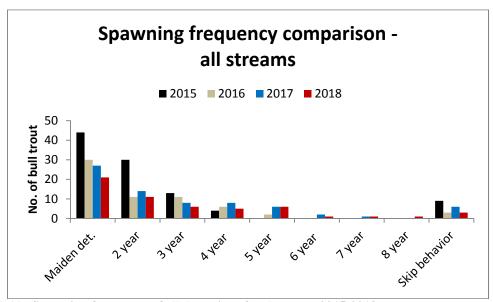


Figure 3.2.1-11. Spawning frequency of all detections for the years 2015-2018.

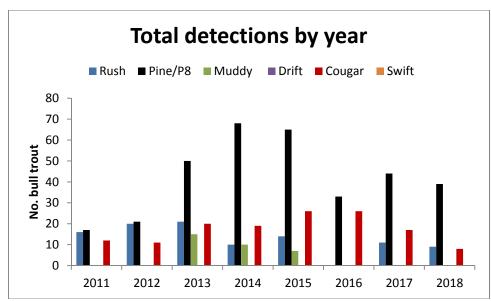


Figure 3.2.1-12 compares annual detections from all sites for all years on record.

Figure 3.2.1-12. Total detections by year from all sites from years 2011-2018.

3.3 LEWIS RIVER BULL TROUT CAPTURE AND TRANSPORT ACTIVITIES

3.3.1 FERC Project License Article 402(a) and Lewis River Settlement Agreement Sections 4.9.1 & 4.9.2 - Swift Bypass Reach Capture and Transport Activities

The Swift Bypass Reach is the former Lewis River channel between the Swift No. 1 and Swift No. 2 hydroelectric projects. Since 2010, a minimum flow of 65 cubic feet per second (cfs) has flowed in the Bypass Reach through what the SA termed the "Upper Release Point" and the "Canal Drain". The Upper Release Point flows from the Swift No. 2 Power Canal directly upstream from the Swift No. 1 spill plunge pool and provides 51 – 76 cfs of water depending on the time of year. The Canal Drain flows from the Swift No. 2 Power Canal into an approximately 350 m long reach (termed the Constructed Channel) that is relatively unaffected by Swift No. 1 spill events and provides a continual 14 cfs of water flow. This Constructed Channel then joins the main channel Bypass Reach. Along with Ole Creek, these two water release points provide most of the flow into the Bypass Reach.

In 1999, The Utilities began netting the Swift No. 2 powerhouse tailrace as part of requirements contained in amendments to Article 51 of the former Merwin license. The tailrace was not netted from 2001 to 2005 because of the Swift No. 2 canal failure in 2001 and subsequent reconstruction. Capture efforts were then restarted in 2006 pursuant to sections 4.9.1 and 4.9.2 of the Lewis River

Settlement Agreement and in 2008 pursuant to Article 402(a) of the new FERC licenses for Swift No. 1 and No. 2.

At the 2007 annual bull trout coordination meeting (attended by USFWS, WDFW, and PacifiCorp), the Utilities proposed to discontinue netting the Swift No. 2 tailrace (since only two fish had been captured since 1999) and move the collection site to an area near the International Paper (IP) Bridge within the Swift Bypass Reach (Figure 3.3.2-1). As noticed in past Swift Bypass Reach snorkel surveys, this area was found to contain adult bull trout between the months of June thru October. The USFWS and those in attendance at the 2007 coordination meeting approved this recommendation (see Utilities 2007 Annual Bull Trout Monitoring Plan for meeting notes http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Hydro_Licensing/Lewis_River/Annual_Bull_Trout_Monitoring_Plan_2007.pdf).

In light of compelling data presented in 2016 that highlighted the numerous handling opportunities that could befall bull trout within Swift and Yale reservoirs and the negative impact this handling is presumed to have on long-term survival, no capture and marking activities were conducted within Swift Reservoir in 2018. The Utilities in Consultation with the USFWS and the Lewis River Bull Trout Action Team, which is a group comprised of representatives from the Washington Department of Fish and Wildlife (WDFW), United States Department of Agriculture-Forest Service (USDA-FS), and USFWS, decided in 2016 to place a two year research handling moratorium on all bull trout activities in Swift and Yale reservoirs. The next year these activities could commence would be in 2019. Figure 3.3.1-2 and Table 3.3.1-2 illustrate historical total capture and transport numbers.

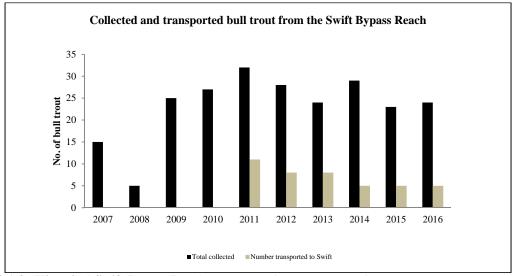


Figure 3.3.1-2. Historical Swift Bypass Reach capture and transport numbers.

Table 3.3.1-2. Number of bull trout collected from the Swift Bypass Reach (Yale Reservoir) and transferred to Swift Reservoir: 2007 – 2016.

YEAR	No. captured at the Swift Bypass Reach	No. transferred to Swift Reservoir	No. released back into Yale Reservoir	MORTALITIES	
2007	15	0	15	0	
2008	6	0	6	0	
2009	25	0	25	0	
2010	27	0	27	0	
2011	32	15	17	0	
2012	29	8	20	1	
2013	24	8	16	0	
2014	30	5	25	0	
2015	21	5	15	1	
2016	24	5	17	2	

3.3.2 FERC Project License Article 402(a) and Lewis River Settlement Agreement Sections 4.9.1 & 4.9.2 - Yale Tailrace Capture and Transport Activities

184

46

TOTAL

233

Per Article 402(a) in the FERC licenses and the Lewis River SA section 4.9.1, PacifiCorp annually captures bull trout from the Yale powerhouse tailrace (upper Merwin Reservoir). All bull trout captures are transported to and held at Merwin Hatchery while rapid response genetic analysis is performed following methods outlined in Section 3.3.2 of this Report. Depending on the outcome of the analysis, bull trout are either transported for release into Yale or Swift reservoirs. A total of 162 bull trout have been captured from the Yale tailrace since the program began in 1995 (Table 3.3.2-1).

To capture bull trout from the Yale tailwaters, monofilament mesh tangle nets are used (typically 40 m long, 2 m deep, and consisting of 6.5 cm stretch mesh). Depending on catch rates, netting occurs for the most part on a monthly basis beginning in June and ending mid-August. Netting usually occurs between the hours of 0900 and 1200. During this time, the powerhouse generators are taken off-line to facilitate deployment and handling of the nets. Nets are tied to the powerhouse wall and then stretched across the tailrace area using a powerboat. The nets are then allowed to sink to the bottom. Depending on conditions or capture rate, the nets are either held by hand on one end or allowed to fish unattended. The maximum time nets are allowed to fish is 10 minutes.

Upon capture of a bull trout, it is immediately freed of the net (usually by cutting the net material) and placed in a live well. Captured fish are measured to their caudal fork, weighed with a handheld scale to the nearest gram, and if a maiden capture inserted with a uniquely coded HDX or FDX PIT tag (size dependent). All fish are scanned with a hand-held PIT tag detector to check for previous tags prior to inserting a PIT tag. Along with fork length information, the weights of captured bull trout will be used to assess the condition factor (K-factor) of fish residing in Lake Merwin.

Use of Alternative Capture Methods

PacifiCorp continues to consider more effective and less intrusive methods to collect bull trout from the Yale tailrace. Past alternative methods investigated include; beach seines, purse seines, drifting tangle nets when the powerhouse is online, and angling.

In 2018, tangle nets and angling were the only methods used. To date, tangle nets remain the most effective. PacifiCorp continues research on possible alternative methods of effective capture and transport. However, upon investigation of each concept or pilot test conducted at other Northwestern dams, PacifiCorp has not been successful in finding a better alternative than the current method.

Yale Netting Results

At the Yale powerhouse tailrace in 2018, three capture attempts were completed; June 12, July 23, and August 15 yielding no bull trout captures.

Table 3.3.2-1. Number of bull trout collected from Yale tailrace (Merwin Reservoir) and transferred to the mouth of Cougar Creek (Yale tributary) or Swift Reservoir: 1995 – 2017.

YEAR	No. captured at the Yale tailrace	No. transferred to mouth of Cougar Creek	No. transferred to Swift Reservoir	No. released back into Merwin Reservoir	MORTALITIES
1995	15	9	0	6	0
1996	15	13	0	2	0
1997	10	10	0	0	0
1998	6	6	0	0	0
1999	6	0	0	6	0
2000	7	7	0	0	0
2001	0	0	0	0	0
2002	6	5	0	1	0
2003	19	8	0	1	10^
2004	8	3	0	5	0
2005	5	5	0	0	0
2006	5	5	0	0	0
2007	13	13	0	0	0
2008	15	15	0	0	0
2009	5	5	0	0	0
2010	1	0	0	0	1
2011	6	5	0	0	1
2012	3	3	0	0	0
2013	6	4	2	0	0
2014	0	0	0	0	0
2015	1	0	0	0	1
2016	8	7	0	0	1
2017	3	3	0	0	0
2018	0	0	0	0	0
TOTAL	162	122	2	21	14

^Please refer to the 2003 PacifiCorp Threatened and Endangered Species Monitoring Report for a description of mortalities

3.4 UNDERWATER VIDEO CAMERA OPERATION IN PINE CREEK TRIBUTARY P8 – PILOT STUDY

To better correlate numbers of bull trout spawners to each observed bull trout redd, a partial weir with an associated underwater video camera was installed and put into operation within P8 Creek near its confluence with Pine Creek in 2018. The intent of this study was to have the camera operate and record all bull trout migrations during the entire bull trout spawning period, August-October, in order to get a total spawner migration count. This total migration count would then be divided by the total number of redds observed for the year within this stream for an accurate number of fish per redd. It was also anticipated that data pertaining to sex ratios, as well as general size of bull trout migrants, would also be collected from video recordings of migrating fish.

On July 30, 2018 an aluminum fish swim-thru box 38 centimeters (cm) high x 91 cm wide x 71 cm long was installed in the creek immediately adjacent to the stream margin. The swim-thru box housed one color underwater video camera and four light emitting diodes (LED). Fish passage through the aluminum box was kept at a fixed distance of 43 cm from the underwater video camera lens (Figure 3.4-1). The underwater video camera was connected to a SecuMate® mini Digital Video Recorder (DVR) set to motion detection. Sensitivity of motion detection was set in the field, and for the most part sensitivity was set high so as to not miss any fish migration. The camera, light, and DVR were powered by two large deep cycle 12volt batteries. Additional batteries were kept near the site in an additional jobox and were connected to a charge controller and two 140 watt solar panels for continuous trickle charge.



Figure 3.4-1. Swim-thru box that housed underwater video camera.

Looking upstream, a partial weir made from 1.2 meter high x 1 meter long cyclone fencing sections was attached to the upstream corner of the box and opposite side of the stream, as well as to the downstream corner of the box to the opposite side of the stream. The constructed weir

created a "V" that shunted all upstream and downstream fish passage through the fixed slot in the aluminum box and passed the underwater video camera (Figure 3.4-2).



Figure 3.4-2. Swim-thru box and V weir deployed within P8.

The box and weir were in place from July 30, 2018 until the weir blew out on October 1, 2018 due to heavy debris load. There were four periods of power loss experienced during this time-period. The first loss of power occurred for five days during the first week of August and was due to the underwater swim-thru aluminum box breaking free of its constraints and washing downstream. The three other periods of power loss were in late September and were due to copious leaves and debris flowing passed the video camera and triggering non-stop DVR recordings which pre-maturely drained the batteries. The time the camera and DVR were off during the three periods of power loss in late September ranged from 1-3 days.

In all, over 3,000 short video recordings were collected during the period of camera operation (July 30 – October 1). Of these 3,000 recordings, 45 were found to be of bull trout migrating either upstream or downstream pass the underwater video camera (Figures 3.4-4 - 3.4-6). The first instance of bull trout migration was recorded on August 10 as a fish moved upstream. Of the 45 recordings of bull trout migrants, gender was determined of 10 males and 8 females by dimorphic body characteristics. Due to the truncated operation timeframe from the weir blowing out and the four periods of power loss, no empirical total bull trout migration into P8 Creek is available for 2018.



2018/08/10 01:54:06

Figure 3.4-4. Still photo from video recording of upstream bull trout migration. Video recording taken within P8 Creek.



Figure 3.4-5. Still photo from video recording of upstream bull trout migration. Video recording taken within P8 Creek.



Figure 3.4-6. Still photo from video recording of upstream bull trout migration. Video recording taken within P8 Creek.

3.5 LEWIS RIVER BULL TROUT SPAWNING SURVEYS

3.5.1 FERC Project License Article 402(b) and Lewis River Settlement Agreement section 9.6 - Cougar Creek Spawning Estimate

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee in Cougar Creek. Along with the kokanee, surveyors also count the number of bull trout and bull trout redds observed within the creek. In 2018, the Utilities conducted six Cougar Creek bull trout redd surveys from September 19 to October 31. Surveys begin at the mouth of the creek and end at the creek's spring source, a distance of approximately 2100 m.

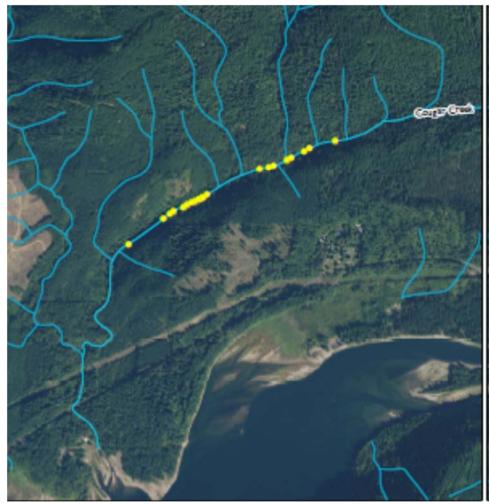


Figure 3.5.1-1. GPS locations of bull trout redds in Cougar Creek in 2018. Each yellow dot represents an individual bull trout redd (n=21).

Due to the wide range use of redd counts to quantify bull trout spawner abundance, multiple research studies have been performed in an effort to gauge the precision of this methodology and also to question the efficacy of redd counts as a population estimator (Dunham et al. 2001, Muhlfeld et al. 2006). Most often, redd surveys are conducted in large river systems with multiple different observers. The large systems necessitate the need for index areas mainly due to time and logistical constraints. The use of indices has been questioned based on their reliance of fish coming back to the same area at the same time every year to spawn. In addition, the use of multiple observer teams and a variety of observers on the same project, is considered to cause inaccuracies based on the variability between observers' experience with identifying redds.

The redd count methodology employed within Cougar Creek differs from most large-scale redd surveys in that the stream is small enough to feasibly cover the entire length during each survey, and currently is the only known bull trout spawning stream in Yale Reservoir. Cougar Creek also lends itself nicely to these types of surveys in that the water is extremely clear and has stable flow for most of the survey period. Also, redd life, the amount of time a redd remains visible, has an exceptionally long duration. Most, if not all, observed redds remain visible during the entire time-frame of the surveys.

In 2018, biologists walked the entire 2100 m of Cougar Creek during each redd survey. Surveys are completed over an extended period of time to address potential error associated with spawn-timing, and to alleviate inter-observer variability, all surveys in 2017 were performed by the same experienced biologists. Dunham et al. (2001) specified that a sampling effort should not rely on indices and should use the same surveyors as effective ways of improving the reliability of bull trout redd counts.

The real challenge of using bull trout redds to quantify the bull trout spawning population size lies in determining the relationship between redd counts and actual numbers of fish (Budy et al. 2003). Much past and present research has been conducted that attempts to correlate the number of spawning adult bull trout per redd. These numbers range widely by basin (1.2 to 4.3 fish per redd) and it seems the number of bull trout per redd is most likely basin or watershed specific.

At this time, given that the exact number of bull trout that ascended Cougar Creek in 2018 to spawn is unknown, there is no reliable way to get an approximate number of fish per redd.

During each 2018 redd survey, new redds were flagged and identified by Global Positioning Satellite (GPS) coordinates. The date, location of redd in relation to the flag, and GPS coordinates were all written on the flagging (Figure 3.5.1-1). Subsequent surveys inspected each redd to see if they were still visible. If a redd was still visible, that information was written on the flagging with the date, until the redd was no longer visible, at which time this was noted on the flagging. Biologists also counted any bull trout observed within the vicinity of each redd.

21 individual bull trout redds were observed in Cougar Creek in 2018. As in past years, all bull trout redds were observed in the upper half of the creek upstream of a log jam that in most years is impassable to kokanee (Figure 3.5.1-1).

A recent concern in Cougar Creek, first observed in 2008, are bull trout redds found to be superimposed over one another. During redd counts in 2018, no bull trout redds were observed superimposed over a previously excavated bull trout redd.

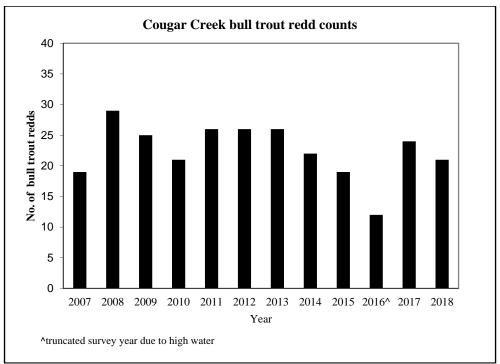


Figure 3.5.1-2. Annual Cougar Creek bull trout cumulative redd counts, 2007-2018.

3.5.2 BULL TROUT REDD SURVEYS OF PINE CREEK, PINE CREEK TRIBUTARY P8 & P10, AND RUSH CREEK

P8

Tributaries to Pine Creek are counted from the mouth of Pine Creek upstream. P8 (Figure 3.5.2-1) is the eighth and largest of these tributaries. Based on surveys performed in 1999 and 2000 to document the extent of available anadromous fish habitat within the North Fork Lewis River basin, P8 contains approximately 6400 m of accessible anadromous fish habitat and has relatively low gradient for the first 1600 m. P8 is a relatively small stream, with an average wetted width of 3.5 m, but it contains abundant annual flow and cold water (PacifiCorp and Cowlitz PUD 2004).

Redd surveys (consistent with methodology utilized on Cougar Creek) were performed on Pine Creek tributary P8 six times from September 5 – October 24 during the 2018 bull trout spawning season. In all, GPS coordinates were collected from 45 bull trout redds during the survey period. Redds were observed and counted from the mouth of P8 to 2100 m upstream (Figure 3.5.2-1 and 3.5.2-2). Intraspecies redd superimposition was observed of three previously flagged bull trout redds during the 2018 survey period within P8 Creek.

Spawning coho had been observed within P8 during the 2014 and 2015 bull trout spawning season. No coho or coho redds were observed within P8 in 2016, 2017, or 2018.

Pine Creek and tributary P10

Redd surveys on a weekly rotation of all available spawning habitat were performed within Pine Creek mainstem during the months of September and October in 2018 (river mile 0 to river mile 8). In all, eight surveys were completed and 88 redds were recorded and GPS'd. 36 percent of

redds were recorded in the lower third of available spawning habitat (32 redds from river mile 0 to river mile 3), 51 percent of redds were recorded in the middle third of available habitat (45 redds from river mile 3.1 to river mile 6), and 13 percent of bull trout redds were recorded and observed in the upper third of available habitat (11 redds from river mile 6.1 to river mile 8).

Due to low water for the duration of the spawning season that prohibited upstream bull trout migration, no bull trout redds were observed within tributary P10 in 2018 (Figure 3.5.2-1).

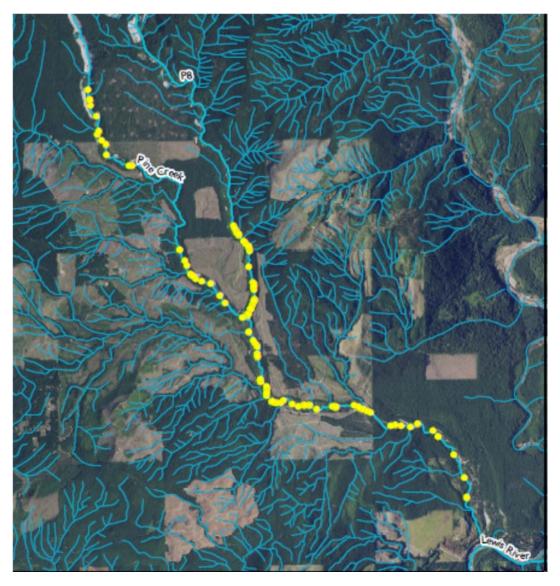


Figure 3.5.2-1. GPS locations of bull trout redds in Pine and P8 creeks in 2018. Each yellow dot represents an individual bull trout redd (n=132).

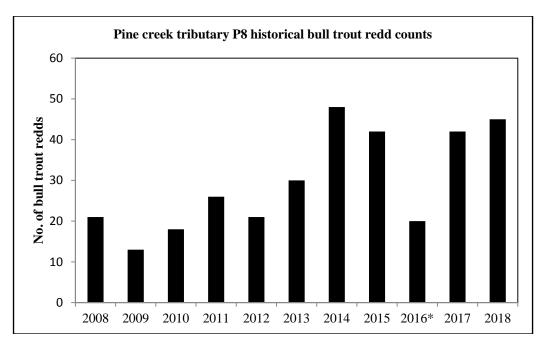


Figure 3.5.2-2. Pine Creek tributary P8 historical bull trout redd counts (2008 and 2009 data courtesy of WDFW).

Rush Creek

Rush Creek was surveyed on four occurrences between September 25 and October 22. 20 redds were observed and marked by flagging and GPS (Figure 3.4.2-3). Redd surveys were completed from the stream mouth upstream to the Forest Road 90 bridge, a distance of approximately 1,600 m. Historical redd counts are expressed in Figure 3.4.2-4.

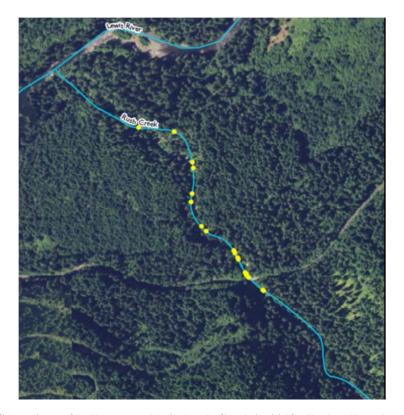


Figure 3.5.2-3. GPS locations of bull trout redds in Rush Creek in 2018. Each yellow dot represents an individual bull trout redd (n=20).

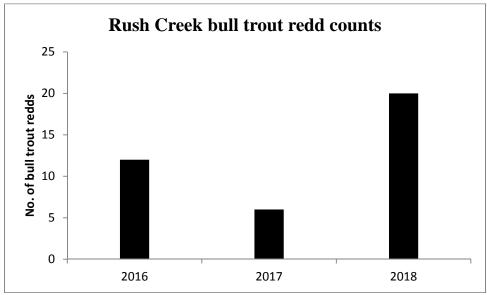


Figure 3.5.2-4. Rush Creek historical bull trout redd counts.

Observer Error Redd Surveys

In order to evaluate and incorporate the inherent error associated with surveyor subjectivity during stream-type redd surveys, numerous observer error redd surveys were performed of each bull trout spawning stream in 2018. Analysis of this data was still pending at the time of submission of this Report. As results and associated memo become available it will be made accessible and included within a later filing of this Report.

3.6 SUMMER AND FALL STREAM TEMPERATURE MONITORING OF BULL TROUT PERTINENT SITES UPSTREAM OF EAGLE CLIFF

In order to better understand bull trout spawn migration timing and how it correlates to stream temperature, Onset Tidbit® temperature data loggers were remotely deployed on June 15 in Pine, P8, P10, and Rush creeks and in the mainstem Lewis River at Eagle Cliffs and just upstream from Rush Creek in 2018. Thermographs were quality assured/quality controlled by the manufacturer prior to deployment and were set to record continuous hourly temperature readings at each identified location. Thermographs operated until October 31 at which time they were recovered and taken out of each stream location. Graphical representation of data collected from each site is shown below (Figures 3.6-1-3.6-7). All sites experienced continuous data collection at each location during the stipulated time-frame.

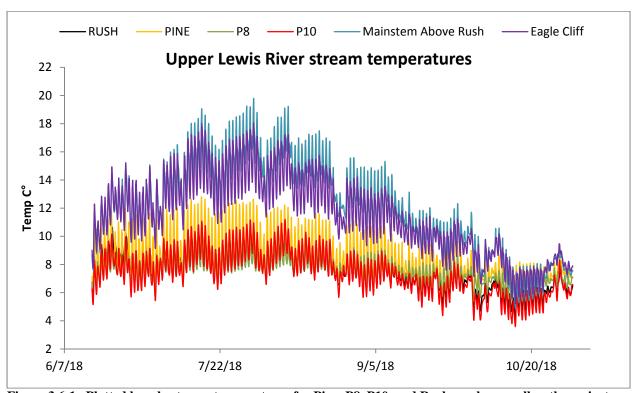


Figure 3.6-1. Plotted hourly stream temperatures for Pine, P8, P10, and Rush creeks as well as the mainstem Lewis River at Eagle Cliff and just upstream of Rush Creek from June 15 – October 31, 2018.

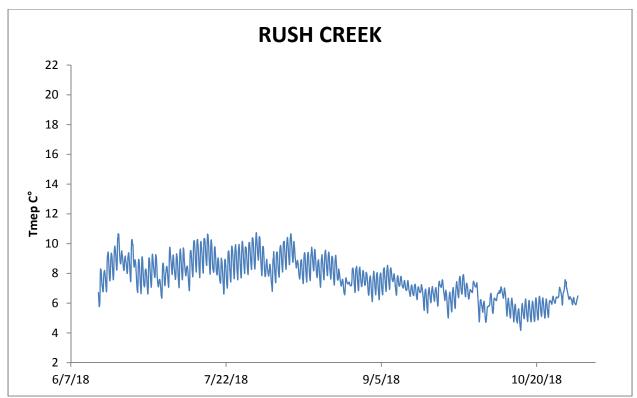


Figure 3.6-2. Plotted hourly stream temperature for Rush Creek from June 15 – October 31, 2018.

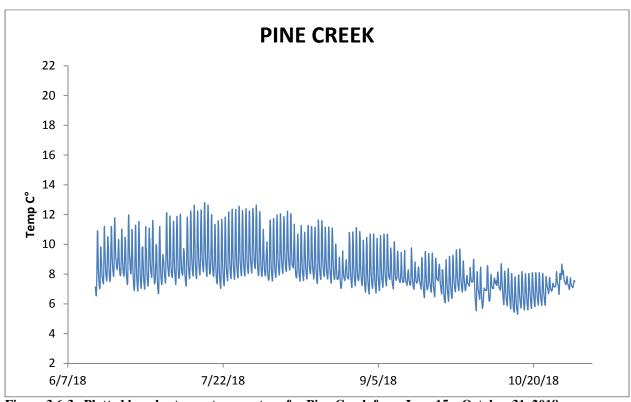


Figure 3.6-3. Plotted hourly stream temperature for Pine Creek from June 15 – October 31, 2018.

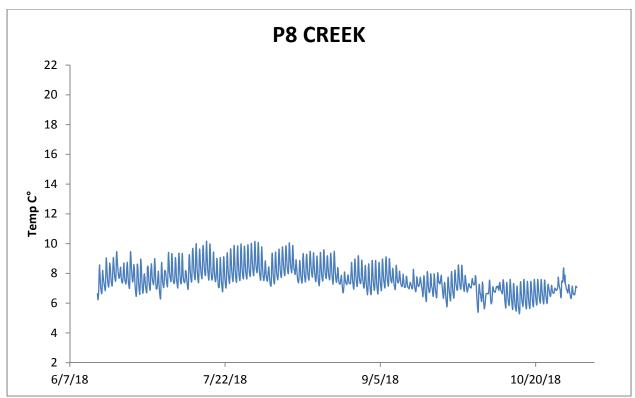


Figure 3.6-4. Plotted hourly stream temperature for Pine Creek tributary P8 from June 15 – October 31, 2018.

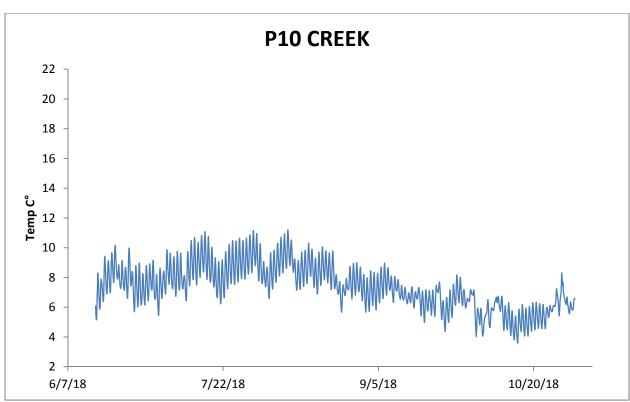


Figure 3.6-5. Plotted hourly stream temperature for Pine Creek tributary P10 from June 15 – October 31, 2018.

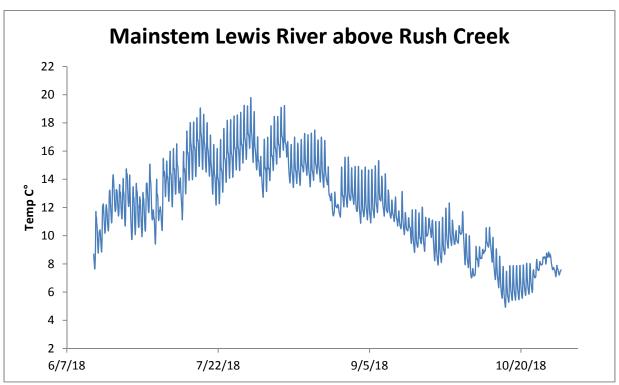


Figure 3.6-6. Plotted hourly stream temperature for the mainstem Lewis River upstream of Rush Creek from June 15 – October 31, 2018.

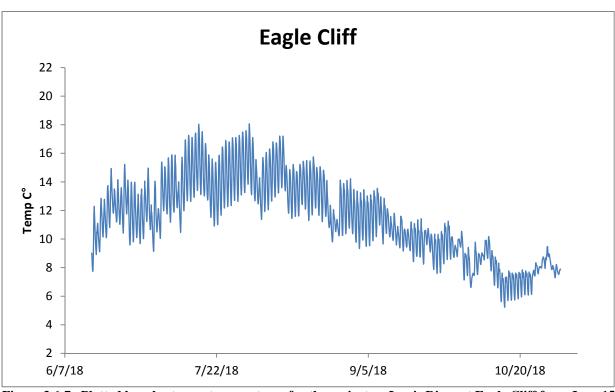


Figure 3.6-7. Plotted hourly stream temperatures for the mainstem Lewis River at Eagle Cliff from June 15 – October 31, 2018.

4.0 ACKNOWLEDGEMENTS

The Utilities would like to thank Dr. Robert Al-Chokhachy from USGS for his analysis of bull trout PIT tag data and subsequent Survival and abundance estimates.

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APPENDIX A

"PATTERNS OF BULL TROUT SALVELINUS CONFLUENTUS DEMOGRAPHY, LIFE-HISTORY AND ABUNDANCE IN THE NORTH FORK LEWIS RIVER"

DR. ROBERT AL-CHOKHACHY, UNITED STATES GEOLOGICAL SURVEY

Patterns of bull trout <i>Salvelinus confluentus</i> de the North Fork Lewis River—2018 Annual Rep	

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Introduction

Declines in the distribution and abundance of bull trout *Salvelinus confluentus* across much of the historic range in the Pacific Northwest region of Canada and the USA have been well documented (Post and Johnston 2002; Rieman et al. 1997). Recent estimates of population trends appear to vary considerably across regions with large numbers of migratory and resident populations exhibiting significant declines in adult abundance (Al-Chokhachy et al. 2016; Kovach et al. 2018), while others remain stable or potentially increasing (Erhardt and Scarnecchia 2014; Meyer et al. 2014). For example, 61% of the core populations in Alberta are considered declining, while 39% are stable or increasing (Alberta Sustainable Resource Development 2012). The variability in population status and trends highlights the importance of population-specific data.

Much of our understanding of bull trout life-history has stemmed from a few, well-studied populations, and continuing to improve our knowledge of the variability in life-history expressions (e.g., Starcevich et al. 2012) is important in directing local and regional conservation efforts (sensu Schindler et al. 2010). Here, we consider the life-history and demographic patterns for an adfluvial population of bull trout in the North Fork Lewis River Basin in Washington. We synthesize recent monitoring efforts and field studies to refine our understanding of bull trout life-history expressions (i.e., migration patterns) and demographics. In addition, we consider temporal trends in abundance of bull trout using contemporary monitoring data. Within this context, we also evaluate how sampling error may affect the ability to detect changes in abundance to better understand patterns from recent monitoring data and inform future monitoring efforts.

Methods

Study area

The majority of this study focuses on bull trout populations in the North Fork Lewis River upstream of Swift Dam (Figure 1). The climate is typical of the lower elevation Cascade Mountains with relatively mild, wet winters and warm, dry summers. Annual precipitation within the basin commonly exceeds 2 m with higher amounts as elevation increases; precipitation predominantly falls as rain at lower elevations and snow at higher elevations. The vegetation is dominated by maritime species with forests dominated by Douglas-fir and western hemlock. Land ownership in the North Fork Lewis River (upstream of dams) varies including federal ownership (70%), state lands (11%), and the remainder under private ownership. The majority of private ownership is through timber harvest corporations and ongoing timber harvest by public and private landowners occurs within the basin, including the Pine Creek drainage.

For a regional perspective, only 16 local bull trout populations exist within the entire Lower Columbia Recovery Unit for the species (USFWS 2015) and numerous existing threats have been documented to the majority of these populations. The extant bull trout populations in the Lewis River Basin are likely to act as regional strongholds under anticipated trends in climate warming (Mote et al. 2003) given the cold stream temperatures and access to reservoirs that thermally stratify (sensu Al-Chokhachy et al. 2018). The major bull trout spawning tributaries in the study area include Pine Creek, a tributary to Pine Creek (P8), and Rush Creek. Rush Creek is a steep, large tributary (bankfull width = 24 m) to the North Fork Lewis River, Pine Creek is a medium-sized tributary (bankfull width = 13.5 m) to the Lewis River, and P8 is considerably smaller (bankfull width = 8.3 m). Although a resident bull trout component is possible within the North Fork Lewis River, the populations are considered primarily migratory (Hudson et al. In review). Similar to numerous other bull trout populations (e.g., Erhardt and Scarnecchia 2014; Johnston et al. 2007; Ratliff et al. 2015), bull trout in the Lewis River study population occur as an adapted adfluvial life-history due to the historic flooding of the Lewis River valley and creation of a reservoir.

Bull trout spawning migrations

As part of a larger abundance, movement, and demographic study, bull trout were captured using predominantly gill nets (varying lengths 25 – 40 m, dyed green 6# monofilament line, varying mesh sizes 2.5 – 7.5 cm, 2 m in depth) drifted down through the pool to entangle fish at Eagle Cliff (Figure 1) during the late spring and summer from 1992 to 2016. Once captured bull trout were anesthetized with Tricaine Methanesulfonate (MS-222), checked for any previous marks, measured in fork length, and marked with an individual-specific tag. All fish during this study were marked with an external anchor tag (Floy) at the base of the dorsal fin for estimates of adult abundance (not considered herein; see Hudson et al. *In review*). Beginning in 2002, fish were also marked with 12-mm full duplex passive integrated transponder (PIT) tags in the dorsal sinus, a switch to 23-mm half duplex PIT-tags occurred in 2011. Upon full recovery where fish regained equilibrium, individuals were released near the point of capture.

The individual PIT-tags were used to provide individual growth, movement, and survival information (see Hudson et al. *In review*). However, due to recent changes in monitoring strategies, no new marking of bull trout occurred in 2017 or 2018 (new fish will be marked every 3rd year beginning in 2019). As such, no new estimates of growth are presented herein (see Al-Chokhachy et al. *In review*). Despite the lack of marking events, we used information from previously marked bull trout and passive instream antennas to evaluate bull trout movement patterns and provide estimates of annual survival (see below). Bull trout migration patterns were quantified using capture information at Eagle Cliff and passive detections at instream PIT-tag antennas. Each year PIT-tag antennas were installed near the mouth of Pine Creek (since 2011) and near the mouth of P8 (since 2012) and operated from mid-summer through mid-autumn.

The antennas spanned the individual channel widths and were powered continuously through the spawning season each year, but we acknowledge that some years high discharge altered the exact data of installation as well as when the antennas were taken out of operation.

We used the dates of recaptures at the antennas, and the layout of the antennas to interpret the directionality and timing of bull trout movements. We combined the data from 2018 with previous mark-recapture data (Al-Chokhachy et al. *In review*) to quantify estimates of the number of spawning events per individual, where we assumed that upstream migrations indicated spawning events. We also quantified the timing and duration of spawning migrations. Here, we used known recaptures at Pine Creek and P8 to quantify the duration of upstream spawning migrations (Pine Creek to P8), the duration of downstream spawning migrations (P8 to Pine Creek), and the overall duration (Pine Creek to Pine Creek). In addition, we quantified the proportion of fish entering Pine Creek that utilized P8 (presumably for spawning activities). For each metric we considered interannual differences and present the results graphically.

Previous research indicated upstream bull trout migration patterns were not correlated with hydrologic regimes (Al-Chokhachy et al. *In review*). However, here we evaluated if interannual differences in air temperature (as a surrogate for stream temperature) were correlated with upstream bull trout migrations. We summarized air temperature data from the June Lake Snotel site (Station MRBW1; 46.133, -122.15; http://www.climate.washington.edu/maps/map.php) to quantify average monthly air temperatures from July through September. We then correlated these annual values with the median date of upstream migration using Pearson's correlation coefficient.

Bull trout survival analyses

We combined the mark-recapture information from the PIT-tag antennas in 2018 with previous mark-recapture data (2011 – 2017) to estimate subadult (<450 mm) and adult bull trout (≥450 mm) survival. Given the need to account for complex movement patterns in survival estimates and to avoid bias associated with apparent survival estimates (e.g., Cormack-Jolly-Seber; Bowerman and Budy 2012; Conner et al. 2015), we estimated survival using the Barker model which accounts for emigration and thus provides estimates of "true" survival. The Barker model allows for recapture information from additional sources (e.g., antenna recaptures) that occur between sampling events (active annual gill-net sampling), which often leads to reduced bias and increased precision in survival estimates (Conner et al. 2015). The Barker model is described in detail elsewhere (Conner et al. 2015) and has been used to estimate survival of salmonids with high precision. Here, we included all PIT-tag recapture information available from antennas as well as recaptures during any collections associated with the Swift Dam operations. We used an age-structured model where we included all bull trout >300 mm at marking and transitioned all individuals to adults (>450 mm) based on previous growth analyses (Al-Chokhachy et al. In review). We used multi-model

framework to calculate survival (Burnham and Anderson 2002) and considered survival models differing by time and age (sub-adult and adult).

Annual population monitoring

Two indices of abundance commonly used to monitor bull trout populations (Kovach et al. 2018; Meyer et al. 2014) were conducted each year to evaluate temporal trends in the population above Swift Dam.

Snorkel surveys. —Snorkel counts were conducted each summer at known staging areas on the Lewis River proximate to the major spawning tributaries including near the mouth of Pine Creek, Rush Creek, and the Muddy River and the section between the Muddy River and Pine Creek. Each year, snorkel surveys are conducted approximately weekly beginning in mid-summer and continuing through mid-Autumn. Based on previous analyses and the timing of bull trout migration (see below), snorkel counts in 2018 began earlier than previous years (year day 201; 20-July) and continued until 3-October. During these surveys, 3 snorkelers floated downstream staying lateral and equidistant to each other and enumerating fish in their lanes (Brenkman et al. 2012). During surveys all adult bull trout >450 mm were enumerated and recorded on underwater slates.

We considered two separate metrics for the snorkel survey data as it remains unclear as to the most robust metric for evaluating trends. First, we evaluated the trend of the maximum total number of bull trout observed across sections on a survey date by year. In addition, we calculated the temporal trends of the median counts across all weekly surveys within a year. Given that snorkel surveys have only been consistently completed since 2011, we simply evaluated trends using linear regression models (GLM, Program MASS; Venables and Ripley 2002).

Redd count surveys. —We also evaluated the temporal trends of the bull trout population using data from annual redd count surveys. Annual redd surveys were conducted using standard approaches for salmonid and bull trout monitoring. Surveys were conducted approximately weekly, depending upon available personnel. During each survey one or two surveyors proceeded upstream enumerating and georeferencing all redds. Newly constructed redds were marked with flagging, making note of previously flagged old redds to assess visibility of redds. If redds were no longer visible, flags were removed.

We focused our analyses on P8 as redd count surveys have been consistently completed in P8 since 2008. We employed the redd data from P8 to estimate bull trout population growth rate (λ) using the exponential growth state space model (EGSS) with restricted maximum likelihood (Humbert et al. 2009). The EGSS is a flexible approach

that allows for estimating population trends from data that can span short time periods (i.e., <10 years). The confidence intervals in the EGSS models are generally more accurate compared with simple, exponential trend analyses (Humbert et al. 2009; Meyer et al. 2014). State space models have been effective in quantifying trends for bull trout populations in numerous studies (Al-Chokhachy et al. 2016; Meyer et al. 2014). For all analyses we used a conservative significance value (α = 0.10) due to the potential implications of Type II errors for a species such as bull trout, which is listed under the Endangered Species Act (Brosi and Biber 2009).

Because of the potential difficulties of identifying bull trout redds (Al-Chokhachy et al. 2005) and implications of observer errors in trend analyses (Muhlfeld et al. 2006), we conducted an observer error study during 2018. Here, we used repeat redd surveys in each of the spawning tributaries including P8, Pine Creek from P3 to P8, Rush Creek, and Cougar Creek (Yale Lake). Surveys were conducted by two personnel each visit. The first surveyor proceeded upstream based on standard redd monitoring procedures enumerating all new redds (see above), but this first surveyor did not mark redds with flagging. A second surveyor proceeded a minimum of 30 minutes after the first surveyor to ensure that the first surveyor was not in visual contact. The survey methods for second surveyor were identical to the standard redd survey methods.

Given the hydrologic and geomorphic differences of the streams, we quantified observer error by stream and considered both the coefficient of variation (CV) and signal to noise (Kaufmann et al. 1999). Here we calculated the signal to noise as the ratio of the variance of the average counts (across observers) over all surveys in a stream divided by the variance of the counts across as observers and surveys in a stream (Whitacre et al. 2007). In general, higher signal to noise values are better in monitoring with signal to noise values <2 indicate low precision to detect change and values approaching 6 and higher indicate noise is unlikely to affect ability to detect change. We then used the CV values to determine the power to detect changes in abundance through time. We integrated the CV values in a power analysis (Gerrodette 1987) to consider the statistical power to detect different changes (% change) over twenty years in each of the streams ($\alpha = 0.10$; two-tailed; Package fishmethods, R CoreTeam 2012).

Results and Discussion

Bull trout spawning migrations

During 2018, a total of 40 individual PIT-tagged bull trout were detected in Pine Creek. Similar to 2017, over half (55%) of the fish were detected only in Pine Creek and 45% were detected in P8 (Figure 2). Since 2012, the proportion of bull trout only detected in Pine Creek has varied from 30% in 2012 and 2013 to 71% in 2016.

The date of upstream spawning migration into Pine Creek has varied across years (Figure 3A). In 2018, the median date of upstream migration was 18-August (Day of year = 231), which is similar to the overall median across years. The median date of upstream migration was strongly correlated with average August air temperature (r = 0.80), suggesting that during warmer years bull trout migration is later in the season—a pattern generally consistent with recent research indicating that the timing of bull trout spawning is influenced by stream temperature (Austin et al. 2019). We found no apparent relationship with July or September air temperature and median date of upstream bull trout migration (r = 0.41, -0.09, respectively). The median date of downstream migration was 28-September (Day of year = 271; Figure 3B) which again was similar to the median across years (Day of year = 269). The total duration of time bull trout remained in Pine Creek appears to vary across years (Figure 4). In 2018, the average time spent in Pine Creek by migrating bull trout was 52 days (range = 21 – 69 days), which was higher than the overall median (39.5 days).

Using bull trout that spawned in P8 as an indicator of time spent pre- and post-spawning, it is clear that bull trout migrate into Pine Creek likely to "stage" well before migrating into P8 and/or spawning. Across years, bull trout used 25 days (median; range = 3 - 39) to migrate from Pine Creek to P8 (Figure 5A). However, downstream migration was considerably more rapid (median = 1 day; range = 0 – 16; Figure 5B), a pattern consistent with large adfluvial bull trout in Idaho (Monnot et al. 2008). The rapid migration pattern is in contrast to spawning migration studies of fluvial bull trout (Nelson 2014) in Washington, where bull trout can remain in streams for months. It remains unclear what influences downstream spawning migrations, but may be driven by a combination of biotic and abiotic factors (Al-Chokhachy et al. *In review;* Barnett and Paige 2013) as well as the ability to recover post spawning.

Merging the migration data from 2018 with previous years, we found very few bull trout to spawn multiple times (Figure 6). Since 2011, 46% of the marked fish have never been detected migrating, while 26.7% only spawned once. Of the 338 PIT-tagged bull trout, only 13.7% have migrated more than two times.

Bull trout survival

Mark-recapture analyses suggested 2 plausible models (i.e., \triangle AlCc <4) describing bull trout survival (Table 1). The top model with the most weight (Wi = 0.73) indicated survival to vary by year, but no differences in survival between subadults and adults. The next best model (\triangle AlCc = 2.1, Wi = 0.26) suggested differences in survival across subadults and adults that varied additively across years. The results from the top model are presented, given it is more parsimonious (Burnham and Anderson 2002). The results from this analysis are subtly different than recent estimates (Al-Chokhachy et al. *In review*), which suggested differences in survival between subadults and adults. The disagreement in survival by groups may be due to inherent differences in the mark-recapture datasets (i.e., active marking and antenna data) as well as the time series of data, which is considerably shorter here than in Al-Chokhachy et al. (*In review*).

Survival estimates varied significantly through time with survival during 2013 and 2015 significantly lower than 2011, 2012, and 2014 (Figure 7). The high variation in survival is surprising, given the stable reservoir environment (*sensu* Kovach et al. 2016). Across years with reasonable confidence intervals (SE< 0.10; 2011 – 2015), bull trout survival varied from 0.50 to 0.92. Adult survival in Swift Reservoir population is higher than found for fluvial populations (Al-Chokhachy and Budy 2008). Estimates from 2011, 2012, 2014, and 2016 were consistent with estimates of adfluvial bull trout in Canada (Johnston and Post 2009), but survival during 2013 and 2015 were markedly lower. At this point it is unclear what may be causing the observed fluctuations in survival, and further investigations are warranted. As expected, recent survival estimates (2017 – 2018) demonstrate wide confidence intervals, which will likely improve with additional years of data to extend encounter histories and update capture probabilities.

Annual monitoring

Snorkel surveys. —Results from annual snorkel surveys indicate median counts were higher in 2018 than in 2017 in all sections except the Lewis River from Muddy River to Pine Creek (Figure 8A). Considering the maximum counts suggested higher maximum number of adults in Pine Creek, with similar counts for Rush Creek and Muddy River as 2017 (Figure 8B). For both indices, the number of adult bull trout observed in the section from the Muddy River to Pine Creek was lower in 2018; counts within this section are consistently the lowest among sections. Across both metrics, there are generally declining trends at Rush Creek, highly variable trends at Pine Creek and the Muddy River to Pine Creek section, and no clear trend across metrics at the Muddy River. The median annual counts indicate considerable interannual variability in Pine Creek (CV = 51) and Rush Creek (CV = 41), but much lower interannual variability at the Muddy River site (CV = 15). At least part of this variability may be driven by the large differences in the number of bull trout observed during any given survey (Figure 9). Indeed, bull trout movements during the spawning season can be complex (e.g., Barnett and Paige 2013) and it remains unclear how fish move among the different sites to feed or stage for spawning.

Global trends of snorkel surveys from 2011 to 2018 suggested different patterns based on the monitoring metric. Annual median counts (i.e., median across all weekly snorkel surveys within a year) did not suggest any trends in relative abundance (slope = -0.16, SE = 0.88, P = 0.87; Figure 10A). However, maximum counts (i.e., the maximum total number of bull trout observed across sections on a snorkel survey date by year) suggested a declining trend in relative abundance during the same period (slope = -6.43, SE = 3.0, P = 0.08; Figure 10B). The difference in trends across the metrics illustrates the uncertainty in identifying which metric is the most robust for monitoring and the need for continued corroboration among monitoring methods (i.e., redd counts, abundance monitoring). However, we acknowledge the challenges of cross-walking data types. For example, redd surveys represent the number of known spawning events, whereas snorkel surveys represent potential spawners as not all bull trout may

spawn in a given year (Johnston and Post 2009). In the Lewis River, it appears that the proportion of adult bull trout (i.e., >450 mm) that spawns within a given year generally increases with size and age (Al-Chokhachy et al. *In review*). This discrepancy may hinder the inferences of cross-walking different monitoring data types and suggests the consideration of multiple metrics.

In addition, continuing to refine monitoring methods to reduce bias and increase precision is warranted. For example, closer examination of the date of upstream and downstream emigration suggests temporal overlap in pre- and post-spawn bull trout may confound snorkel surveys (Figure 11). Minimizing the potential of double-counting bull trout, which affects median count estimates, would limit the duration of snorkel surveys to where most adults are counted prior to upstream migration and relatively few post-spawning adults are present. Based on data from PIT-tagged individuals suggests constraining snorkel surveys to dates prior to year day 251 (8-Sepember), which is where 90% of bull trout historically have migrated upstream (Figure 12A) and <10% of downstream migrations have occurred (Figure 12B). Given the plethora of historical data in the Lewis suggests ample amount of information to improve monitoring approaches.

Redd counts. —In 2018, 45 bull trout redds were documented in P8, and annual counts since 2008 suggest substantial increases. We eliminated data from 2016 in our trend analyses where counts were cut short by high discharge and low water clarity. Temporal trend analyses indicated bull trout redd counts have increased significantly (λ = 1.11; 95% CI = 1.03 – 1.21; Figure 13). Despite the increasing trends in P8, there is uncertainty regarding the trend in the total number of spawners in the Swift population as long term redd counts are not available in Pine Creek and Rush Creek. During 2018 88 bull trout redds were counted in Pine Creek and 20 redds were detected in Rush Creek totaling 153 bull trout redds for the population above Swift Dam. Continued monitoring in each of the spawning tributaries will provide more comprehensive estimates of trends at the population level.

Considering the redd count trends in P8 with trends from migration data and snorkel surveys suggest there is uncertainty in the most robust metric for monitoring the overall bull trout population. For example, the P8 redd data since 2012 were weakly correlated (r = 0.32) with the number of migrants to P8 (Figure 2). However, no bull trout have been PIT-tagged since 2016, thus comparisons are not valid. Concomitantly, the snorkel survey trends (Figures 10A, B) also do not align with the increasing trends observed in P8. These differences illuminate the need for continued monitoring of multiple metrics to identify the appropriate monitoring methods (sensu Falcy et al. 2016).

Observer error studies for bull trout redd surveys suggest sampling error can be high and differ by stream (Dunham et al. 2001), a pattern consistent with our results. Estimates of signal to noise (S:N) suggested that observer error (noise) was most prohibitive to detecting trends in Pine Creek (S:N = 0.9), considerable in Rush Creek

and Cougar Creek (S:N = 1.1 and 1.2, respectively), and lowest in P8 (S:N = 5.1; Table 2). However, the low S:N values in Cougar Creek are likely driven by the similarity in counts across surveys and we urge caution in interpreting these results. Estimates of CV also indicated differences in observer error across streams with the highest variation between observers (excluding zero-count surveys) in Pine Creek (median CV = 39) and Rush Creek (CV = 40) but less variation in P8 and Cougar Creek (CV = 18 and 13, respectively; Table 2; Figure 14). The differences in observer error by stream suggest the power to detect changes in relative abundance will vary as well. Indeed, analyses suggest the power to detect 50% declines in Cougar Creek and P8 Creek over 20 years would be 1 and 0.99, respectively (i.e., there is a 0 and 0.01 probability of a type II errorthe failure to detect a change, when a change has occurred), but would drop to only 0.59 for Pine Creek and Rush Creek (Figure 15). The observer errors in the Lewis were generally lower than observed by Dunham et al. (2001), but together with the high interannual variability found in many bull trout populations (Kovach et al. 2016; Rieman and Myers 1997) suggests detecting even modest changes in Pine Creek and Rush Creek may be difficult. Maintaining consistent, well-trained observers will certainly increase the ability to detect changes through time (Muhlfeld et al. 2006).

Acknowledgments

We would like to acknowledge the Lewis River Bull Trout Recovery Team whose guidance has driven much of the monitoring and data collection within the Lewis River basin. We also would like to thank Jim Byrne (WDFW) for data collection. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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Table 1. The results from the mark-recapture analyses (Barker model) including model structure, Akaike Information Criterion scores (corrected for small sample size), model weights (Wi), the number of parameters (K), and deviance considering the survival of subadult and adult bull trout in the North Fork Lewis River upstream of Swift Dam, Washington. Note: S is survival, p is capture probability during field sampling, R is the probability that a fish survived and was resighted alive between capture events; R' is the probability that a fish died but was resighted alive between capture events before dying, F is the probability that an animal at risk of capture at time i is at risk of capture at time i (i.e., has not emigrated), and F' is the probability that an animal not at risk of capture at time i is at risk of capture at time i + 1 (e.g., temporary emigration.

Model [†]	AICc	ΔAICc	Wi	K	Deviance
$S_{(t)}$, $p_{(t+length)}$, $R_{(g+t+length)}$, $R'_{(g)}$, $f_{(.)}$, $f'_{(.)}$	2,018.5	0	0.73	31	1,954.2
$S_{(g+t)}$, $p_{(t+length)}$, $R_{(g+t+length)}$, $R'_{(g)}$, $f_{(.)}$, $f'_{(.)}$	2,020.6	2.1	0.26	32	1,954.1
$S_{(g)}$, $p_{(t+length)}$, $R_{(g+t+length)}$, $R'_{(g)}$, $f_{(.)}$, $f'_{(.)}$	2,026.6	8.1	0.01	23	1,979.3

[†]*t* is time (year), *g* is stage (i.e., subadult or adult), "." indicates no differences across time or stage, and *length* is length at marking.

Table 2. The average new bull trout redds detected in counts and the median CV of counts across both observers and the number of survey dates (n) by stream and section in bull trout spawning tributaries in the North Fork Lewis River basin, Washington.

-		Average	Median CV		Signal to
Stream	Section	counts	counts	n	noise
Pine Creek	P3 to P8	9	39	4	0.9
P8	Entire stream	6.5	18	3	5.1
Rush Creek	Entire section	4	40	2	1.1
Cougar Creek	Entire Section	5.5	13	2	1.2

Figure 1. The study area of the North Fork Lewis River upstream of Swift reservoir indicating the known major bull trout spawning tributaries Pine Creek, P8, P3, and Rush Creek. Also shown is the location of Eagle Cliff where bull trout are sampled for mark-recapture analyses. Black box in the inset illustrates the location of the study area within the Pacific Northwest, USA.

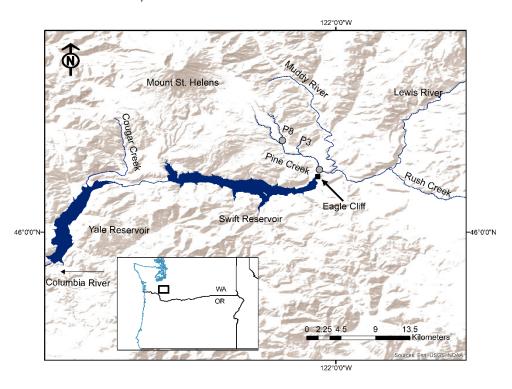


Figure 2. The proportion of PIT-tagged bull trout detected at P8 (white) and Pine Creek (black) antennas from 2011 -2018 in the North Fork Lewis River, Washington.

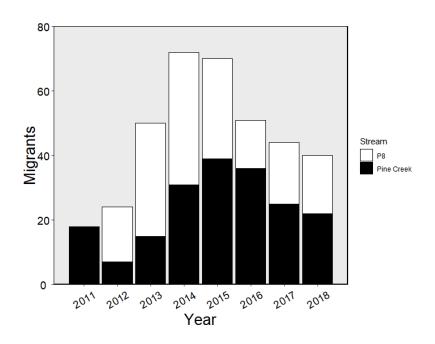


Figure 3. The day of upstream (A) and downstream (B) migration of PIT-tagged bull trout in Pine Creek (2011-2018) in the North Fork Lewis River, Washington. For reference 1-August is the 212^{th} day and 1-November is the 305^{th} day of the year. Note: the small sample size in downstream migration in 2012 was due to the criteria used to quantify movement direction, and the few numbers of bull trout detected where downstream direction could clearly be identified by antenna detections.

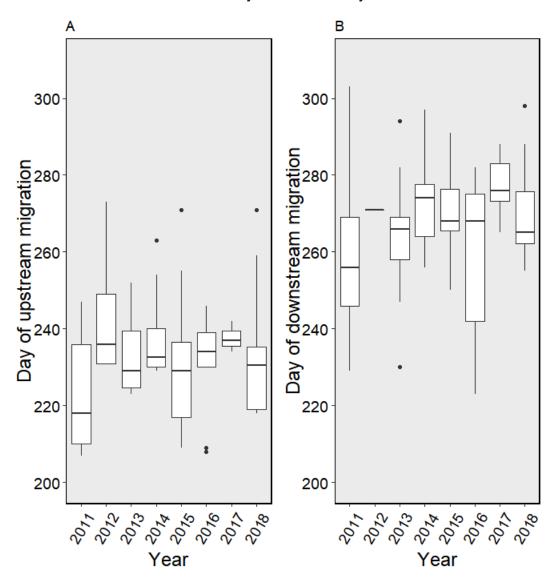


Figure 4. The total duration of time (days) by year that PIT-tagged bull trout remain in Pine Creek, a tributary to the North Fork Lewis River, Washington, during the spawning season.

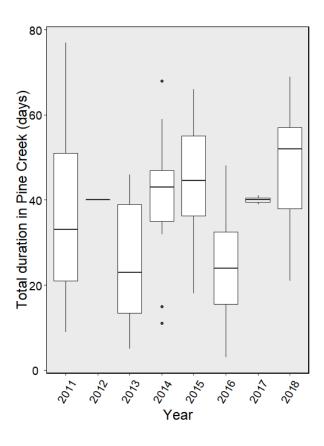


Figure 5. Yearly estimates of the duration of spawning migrations of PIT-tagged bull trout from antennas on lower Pine Creek upstream to P8 (i.e., pre-spawn migration; A) and from P8 downstream to Pine Creek (i.e., post-spawn migration; B), a tributary to the North Fork Lewis River, Washington.

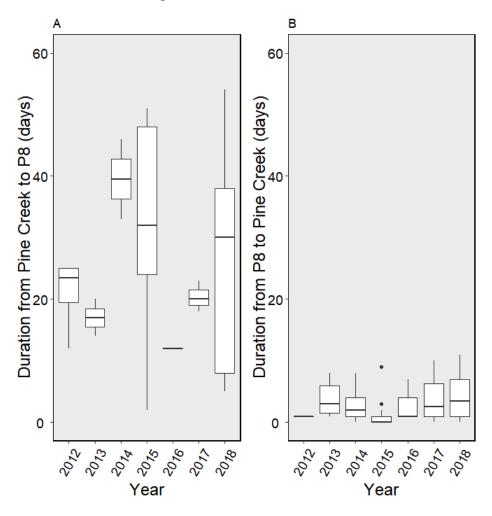


Figure 6. The frequency of the number of spawning migrations of bull trout into Pine Creek in the North Fork Lewis River from PIT-tagged individuals and antenna recaptures (2011-2018)

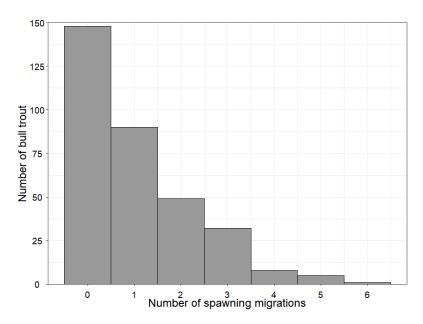


Figure 7. Estimates of annual bull trout survival (adults and subadults) from mark-recapture data from Eagle Cliff sampling and antennas within Pine Creek and Rush Creek, tributaries to the North Fork Lewis River, Washington.

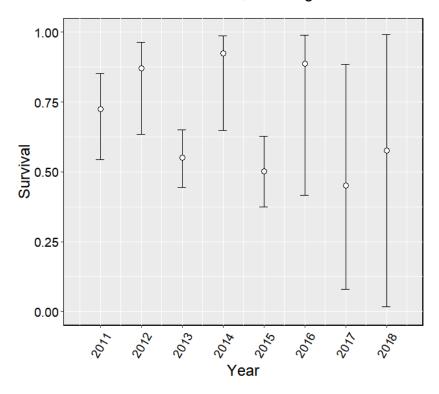


Figure 8. Median (A) and maximum snorkel counts (B) by year of adult bull trout (>450 mm) from the confluence of the North Fork Lewis River and the Muddy River (light grey), the North Fork Lewis River from Muddy River to Pine Creek (black), the confluence of the North Fork Lewis River and Pine Creek (blue), and the confluence of the North Fork Lewis River and Rush Creek (dark grey) in Washington.

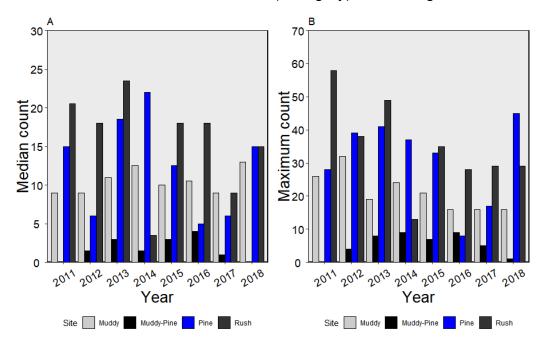


Figure 9. Boxplots of the weekly counts of adult bull trout during snorkel surveys at the Rush Creek site (A), Muddy River site (B), and at Pine Creek (C) in the North Fork Lewis River, Washington.

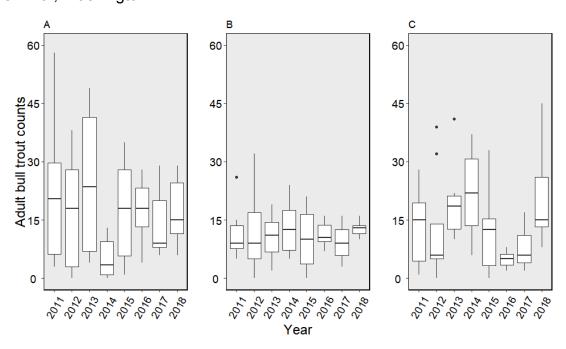


Figure 10. Trends of adult bull trout abundance from median (A) and maximum (B) snorkel counts (totaled across sites for each survey date) from the North Fork Lewis River, Washington from 2011 – 2018.

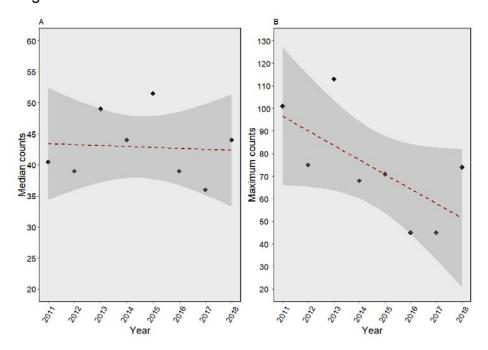


Figure 11. Histograms of the day of year of upstream (green) and downstream (red) bull trout migrations from 2011 to 2018 of PIT-tagged individuals at the PIT-tag antenna near the mouth of Pine Creek in the North Fork Lewis River basin, Washington. For reference, day of year 240, 250, and 260 are 28-August, 7, September, and 17-September, respectively.

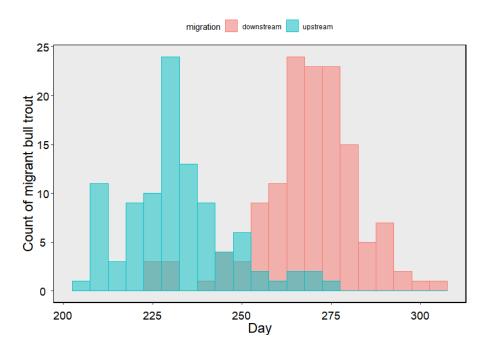


Figure 12. Cumulative frequency histograms for the day of year of upstream (A) and downstream (B) migration of PIT-tagged bull trout past the antenna near the mouth of Pine Creek, a tributary to the North Fork Lewis River, Washington.

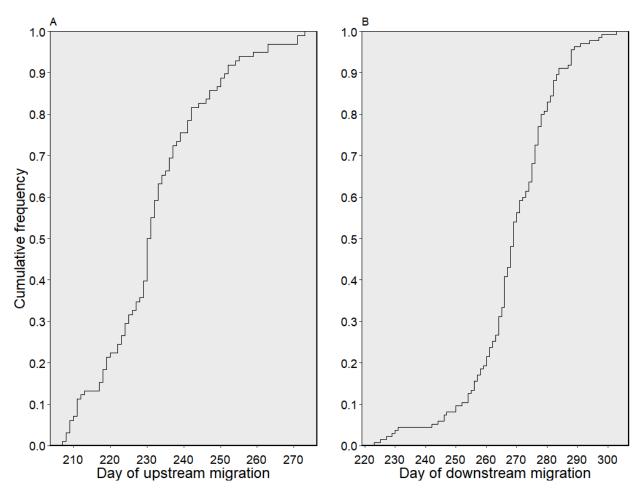


Figure 13. Annual bull trout redd counts from P8, a tributary to Pine Creek in the North Fork Lewis River basin, Washington.

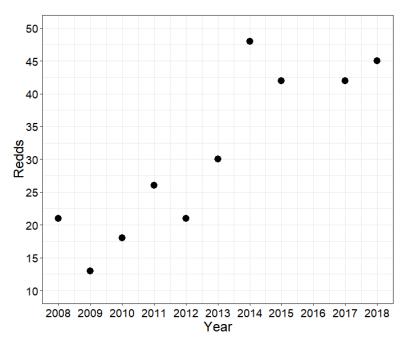


Figure 14. The coefficient of variation (CV) from repeat bull trout redd surveys to quantify observer error at different mean redd counts in Cougar Creek (black), P8 (dark grey), Pine Creek (P3 to P8 section; blue), and Rush Creek (light grey)—tributaries to the North Fork Lewis River, Washington.

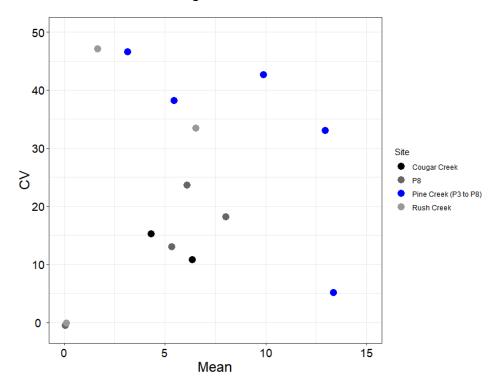
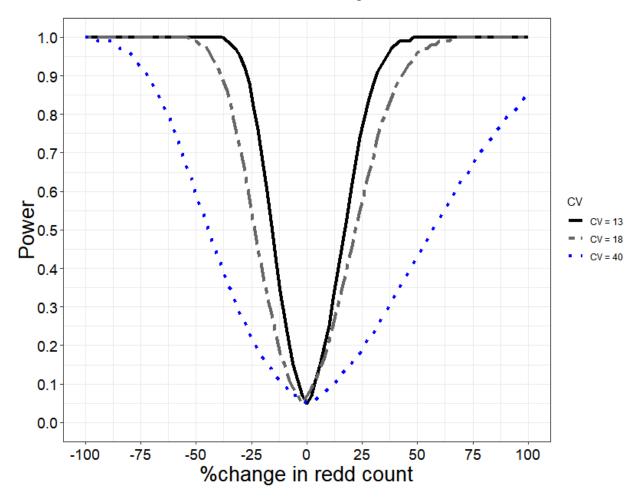


Figure 15. The power to detect different changes in bull trout redd counts over 20 years with CV values from observe error studies for Cougar Creek (CV = 13; black solid), P8 (CV = 18; grey dashed), and Pine Creek and Rush Creek (CV = 40; blue dotted)—tributaries to the North Fork Lewis River, Washington.



Attachment D Lewis River Bull Trout 2019 Annual Operations Plan





Lewis River Bull Trout (Salvelinus confluentus) Annual Operations Plan

North Fork Lewis River - 2019

Merwin Hydroelectric Project (P-935) Yale Hydroelectric Project (P-2071) Swift No. 1 Hydroelectric Project (P-2111) Swift No. 2 Hydroelectric Project (P-2213)

> Prepared by: Jeremiah Doyle, PacifiCorp April 12, 2019

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I. INTRODUCTION

Monitoring of bull trout populations in the North Fork Lewis River (Figure 1.0) has occurred annually since 1989. Monitoring activities are a collaborative effort between PacifiCorp and the Public Utility District No. 1 of Cowlitz County, Washington (Cowlitz PUD), federal, and state resource agencies.

On September 15, 2006, the U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BiOp) including associated Incidental Take Statement for the operation of the Lewis River hydroelectric projects. Though there are no specific Annual Operating Plan requirements included within the BiOp, there are specified annual monitoring activities and reporting requirements with respect to bull trout within the basin.

On June 26, 2008 (effective date), the Federal Energy Regulatory Commission (FERC) issued new 50-year operating licenses for all Lewis River hydroelectric projects. Article 401(a) of the new licenses requires completion of an all-encompassing Monitoring & Evaluation Plan (M&E Plan) for the North Fork Lewis River. The M&E Plan was finalized and implementation begun in 2010. Recently the M&E Plan underwent a five year evaluation and rewrite. New bull trout monitoring mandates were established and those are listed below. Within this M&E Plan are provisions for the annual monitoring of bull trout specifically addressed by 9.6.2 of the Lewis River Settlement Agreement (SA) which states,

"The Licensees shall include in the M&E Plan elements to monitor and evaluate PM&E Measures relating to bull trout, including specific methods and measures to be used in monitoring bull trout populations, including, but not limited to, tagging and snorkel surveys."

As required under section 2.17, Objective 17 of the Lewis River M&E Plan, the Utilities are to develop an Annual Operating Plan (AOP) that contains at minimum, specific elements to address the following five objectives:

- Demographic Characteristics.
- Vital Rates
- Spatial Distribution
- Movement Patterns
- Genetic Diversity

This AOP and the contents found therein was collaboratively developed by the Utilities and representatives from the USFWS, Washington Department of Fish and Wildlife (WDFW), and United States Forest Service (USDA-FS) as members of the Lewis River

Bull Trout Recovery Team (LRBTRT), and may adaptively change in the future per their direction or as new scientific information becomes available.

For 2019, the following nine programs are proposed for action, and one program proposed for hold.

- 1. Swift Reservoir Bull Trout Migration Snorkel Peak Count and Survival (S) Estimates
- 2. Yale Tailrace Collection and Transportation
- 3. Swift Bypass Reach Collection and Transportation on hold
- 4. Fixed Half-duplex Passive Integrated Transponder (PIT) Antenna Arrays in Pine, Rush, Rush Creek hole of the Lewis River mainstem, P8, and Cougar Creeks
- 5. Cougar Creek Spawning Population Estimate
- 6. Comprehensive Bull Trout Redd Surveys of Pine Creek, Pine Creek Tributary P8, P10, and Rush Creek
- 7. Partial weir with underwater video camera in Cougar Creek
- 8. Temperature monitoring of bull trout spawning streams in the upper Lewis River
- 9. Assessment to Estimate Observer Error within Monitoring Methods in the Lewis River

A schedule of activities and estimated effort to complete each task is provided in the task descriptions below. Many of the tasks or programs are designed to estimate the number of bull trout present in either known spawning locations (e.g. Cougar Creek) or in tailrace areas (e.g. Yale). Spawner survey data are used to identify population risks (e.g., sharp declines in numbers) and, if necessary, to help develop appropriate management actions to protect these populations and stem any declines.

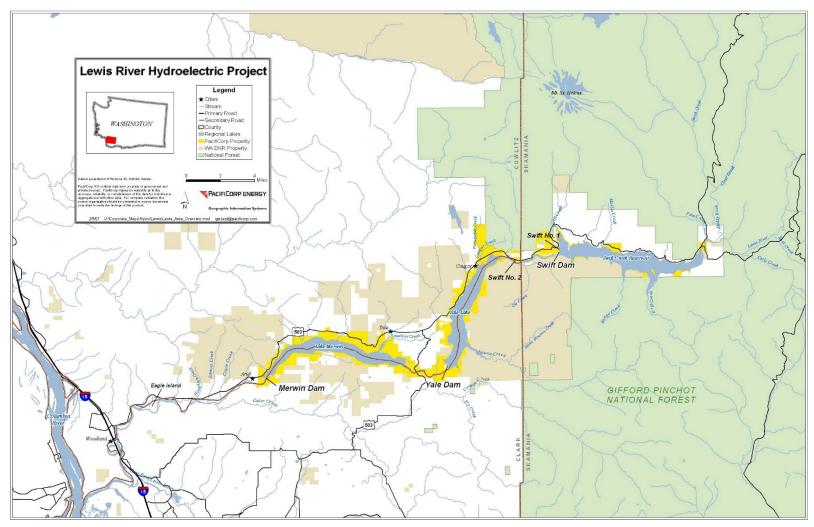


Figure 1.0 – Map of study area

II. PROPOSED MONITORING PROGRAMS

2.1 SWIFT RESERVOIR ADULT BULL TROUT ESTIMATES

Swift Reservoir Adult Bull Trout Migration Estimate

Radio tracking studies in 1990, 1991 and 1994 revealed a pre-migrant congregation of bull trout at the Swift Reservoir headwaters (Eagle Cliffs). The studies further indicated that most tagged bull trout migrated into either Rush or Pine Creeks (tributaries to the Lewis River mainstem), with Rush Creek being preferred. These behavioral patterns have allowed the use of a Peterson type estimator to document the number of migrants ascending the North Fork Lewis River (Lewis River) from the Eagle Cliffs area. Historically the annual estimate of bull trout migrants has been a joint effort between PacifiCorp, the U.S. Forest Service (USFS), the Washington Department of Fish and Wildlife (WDFW) and the USFWS. In 2017, based on compelling evidence of scientific handling having a detrimental effect on overall survival, the LRBTRT decided to limit pre-spawn handling of bull trout adults and sub-adults. As part of that, it was decided then that the Swift Reservoir adult bull trout migration estimate be conducted on a once every 3-year rotation. 2019 will mark the first time since 2016 that these activities have occurred.

The Peterson type estimator uses software program NOREMARK® developed by Gary White of Colorado State University to estimate migratory abundance. NOREMARK® computes estimates of population size for a closed population with a known number of marked animals and one or more re-sighting surveys (White 1996). To fulfill the marking aspect of the estimator, pre-migrant bull trout are captured and tagged in May, June, and July using tangle nets consisting of dyed green 6# monofilament, with depths of approximately 2 meters (m), varying lengths of 25 – 40 m, and varying mesh sizes of 2.5 – 7.5 centimeter (cm) stretch. With the use of boats, nets are either drifted along the bottom in the Eagle Cliffs area (Figure 2.1-1) or set and allowed to passively fish unattended for up to 10 minutes. Angling, when appropriate, may also be employed to capture staging bull trout.

Once a bull trout becomes entangled in the net, the net is retrieved and the captured bull trout is released from the net and placed in a live well. In 2019, to further address potential bias of non-migrating tagged fish, only bull trout **450 mm** or larger will be marked with **two** chartreuse colored 3-inch Floy® anchor tags. Historically bull trout as small as 360 mm have been Floy® tagged as part of this Program. Through the use of instream Passive Integrated Transponder (PIT) tag antennas at various sites throughout the basin since 2002, researchers now know that the occurrence of bull trout less than 450 mm in fork length making spawning migrations is extremely infrequent, yet the addition of the 360 mm – 449 mm size-class within the migration estimate can greatly skew the estimates precision from one year to the next. Care will be taken during re-sight snorkel surveys to only count marked and unmarked bull trout that are greater than 450 mm in fork length.

The goal of the two Floy® tags is to test the assumption of tag loss and the rate at which it occurs. During snorkel activities, sample crews will pay special attention to the amount of

chartreuse tags observed on bull trout (NOREMARK® recapture survey methodology) to directly assess any in-season tag loss.

The goal of these activities is to capture and Floy® tag 100 individual bull trout larger than 450mm. This collection goal may be adaptively managed mid-season based on extenuating circumstances or collection constraints (e.g. surveys called off based on high number of inseason recaptures or high water volume in collection area limiting the number of bull trout available to be caught for tagging purposes). Depending on unforeseen factors, the 100-fish collection goal may not be achieved from one year to the next.

In addition to Floy® tagging, the WDFW initiated a PIT-tagging program for captured bull trout in 2002. Historically, bull trout larger than 120 mm were tagged with a full-duplex (FDX) 12 mm PIT-tag in the dorsal sinus. Since 2011, to coincide with half-duplex (HDX) PIT antennas installed in upper North Fork Lewis River tributaries, all captured bull trout larger than 300 mm have been tagged with a half-duplex PIT-tag. Bull trout greater than 300 mm fork-length (FL) will be tagged with a 23 mm half-duplex PIT-tag in the dorsal sinus, while bull trout 120 mm to 299 mm fork length will be tagged with a 12 mm FDX PIT-tag in the dorsal sinus in hopes of later recapture.

To tag bull trout greater than 300 mm FL with a 23 mm HDX PIT tag, a small incision just wide enough to accommodate the diameter of the tag (appr. 3.85 mm) will be made with a scalpel just anterior to the dorsal sinus and the tag will then gently be pushed toward the caudal peduncle into the sinus (Tranquilli et. al 2003). Captured bull trout less than 300 mm FL will be tagged with a 12 mm FDX PIT tag in the dorsal sinus by means of a syringe type PIT tag injector.

Bull trout recaptures greater than 300 mm previously tagged with a full-duplex PIT tag in their dorsal sinus will be tagged with an additional half-duplex PIT tag in the sinus on the opposite side of the fish and posterior to the original FDX tagging location. This tagging location has been identified since 2010 as being a suitable long-term tagging location where the two different types of PIT tag signals will not interfere with one another. If the recaptured FDX PIT tagged bull trout is less than 300 mm no additional tag will be inserted. PIT-tags are an alternative marking tool for captured bull trout with the intent to provide long-term survival, abundance, biological, and migratory data for individual fish.

In conjunction with tangle netting activities, PacifiCorp will weigh each captured bull trout larger than 120 mm. This information will serve three purposes: First, weight-length ratios can be calculated (K factors) for each fish (Fulton 1902); secondly, this information can be compared to previous years to determine if changes in the annual average K-factor exist and whether these changes can be correlated with any population trends observed; and thirdly, with previously PIT-tagged bull trout, researchers will be able to determine individual length and weight gain which may provide information on reservoir conditions and productivity since an individual's last capture.

Also, as part of the biological data handling process, captured bull trout in 2019 will be assessed for gender and sexual maturity by means of a portable veterinarian ultrasound system. This vital demographic information will be used in conjunction with spawning tributary PIT antennas as currently no sex ratio of migrating bull trout on the Lewis River exists.

Depending on river flow conditions, weekly snorkel surveys will be conducted eight times from July through September of the confluences of Rush Creek, Muddy River, and Pine Creek with the North Fork Lewis River (Figure 2.1-1). During each snorkel count, biologists will be equally spaced and trained to follow the methods used to snorkel the "Rush Creek Hole" to alleviate double-counting fish.

Annual Swift Reservoir Adult Bull Trout Survival (S) Estimate

Detections of previously tagged bull trout at fixed PIT antenna arrays located in Rush, Pine, and P8 Creeks, the Swift Floating Surface Collector (FSC), and Rush Creek hole of the mainstem upper Lewis River will be used to assess migration patterns, preferred habitat and to generate estimates of the following using the population structure software program MARK (White and Burham 1999):

- Probability of participating in a spawning migration
- Probability of detection during spawning
- Annual Survival (S)

Swift and Yale Reservoir Effective Population (Ne) Size Evaluation

It was decided collectively by the Lewis River Bull Trout Group during the planning meeting phase of construction of this document to no longer evaluate Effective Population Size and Genetic Estimation of Breeder Population on an annual basis. Instead, in order to better maximize time and resources, this analysis will be performed on a 3-year cycle with the next date of completion occurring in 2020. This 3-year check-in is expected to be sufficient in assessing Effective Population as the temporal cycle proposed will never skip a generation. Age 0 juvenile bull trout samples will continue to be collected from established sampling locations on an annual basis to further relative abundance trend data as well as have samples on hand to retroactively analyze if the need arises. Methods for data collection to possibly evaluate N_e at a future date are below.

Estimation of effective population size can provide information on the level of genetic variation within a population and how fast genetic variation may be lost through genetic drift (Luikart et al. 2010). The effective population size represents the size of an ideal population that would have the same rate of loss of genetic variation as the observed population (Wright 1931). Although general guidelines for minimum effective population sizes have been suggested (e.g., the 50/500 rule; Franklin 1980), evaluating temporal trends in estimates of N_e are often more useful than determining whether a population meets some minimum threshold number. For example, a population that shows a large decrease in N_e over the course of one or two generations could be experiencing a genetic bottleneck or decline in abundance. Alternatively, an increase in effective size following implementation of new management actions could be one indication that the population is responding positively (Pers. Comm. Pat DeHaan, USFWS).

To evaluate N_e it is anticipated genetic tissue from 30-50 juvenile bull trout from the same cohort (presumably age 0) will need to be attained from utilized spawning tributaries (Cougar, Pine and Rush creeks, Figure 2.1-1). In order to get maximum genetic representation, fish captures will

also need to be spatially balanced along the length of usable habitat within the stream (Pers Comm. Pat DeHaan, USFWS).

To collect tissue samples from juvenile bull trout, two biologists will conduct electrofishing surveys with a Smith-Root® model LR-24 backpack electrofisher. All electrofishing activities will follow protocols as recommended by the electrofishing unit manufacturer and the National Marine Fisheries Service's (NMFS) Guidelines for Electrofishing Waters Containing Salmonids listed under the Endangered Species Act (NOAA 2000). To minimize impact and incidental injury to collected juvenile bull trout, the electrofisher will be set to straight DC current and voltage settings will be turned to the lowest output possible to capture fish.

A small clip of tissue from the upper lobe of each bull trout's caudal fin will be preserved in labeled vials filled with 95 percent ethanol. The size of fin clip will be relative to the size of fish captured. Regardless of fish size, at no time will the tissue sample be greater than 1 square centimeter. All captured fish will also be measured to their caudal fork and capture location recorded. Tissue samples will then be sent to the USFWS Abernathy Conservation Genetics Lab for genotypic and N_e analysis.

Also, during bull trout juvenile collection, all encountered coho juveniles captured during electrofishing surveys will be enumerated and recorded to get a proportion of coho juveniles to bull trout juveniles residing within the same habitat. A sub-sample of captured coho will also be measured to their caudal fork.

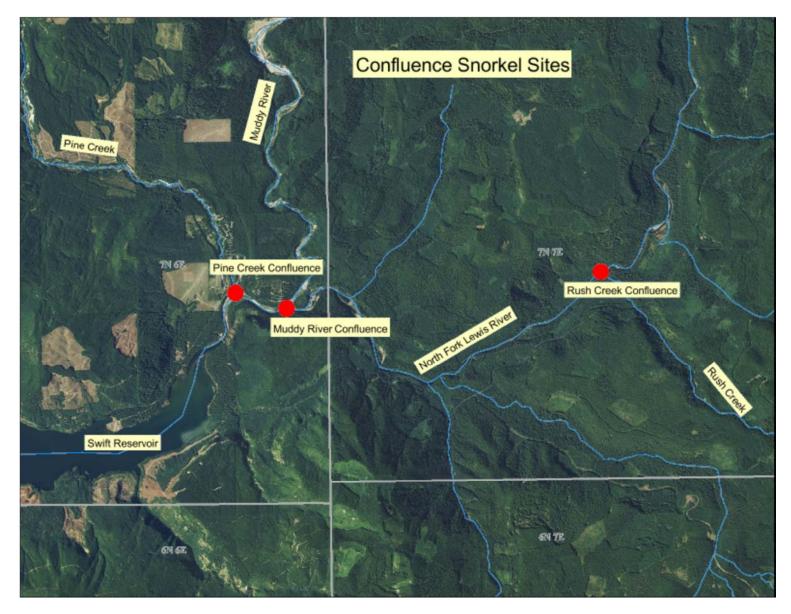


Figure 2.1-1. Snorkel sites (recapture) associated with the Swift Reservoir bull trout migration estimate

2.2 YALE TAILRACE COLLECTION AND TRANSPORTATION

PacifiCorp annually collects and transports bull trout from the Yale powerhouse tailrace (Merwin Reservoir) to the mouth of Cougar Creek, a Yale Reservoir tributary. A total of 162 bull trout have been captured at the Yale tailrace since the program began in 1995. Of these, 126 have been transferred to Cougar Creek, twenty were left in Merwin Reservoir for various monitoring efforts, nine were mortalities while being held at Merwin Hatchery during 2003 capture efforts and two were transported to Swift Reservoir per their laboratory assessed genetic assignment.

To capture bull trout from the Yale tailwaters, monofilament tangle nets (6.5 cm stretch), trammel nets, beach seines, and angling have all been used. Tangle nets have proven to be the most effective and remain the method employed to date. Tangle nets are tied to the powerhouse wall or shoreline and then stretched across the tailrace area using a jet boat. The nets are then allowed to sink to the bottom (about 30 feet). Depending on conditions or capture rate, the nets are held by hand on one end or allowed to fish passively. The maximum time nets are allowed to fish is 10 minutes.

Upon capture of a bull trout, the fish is immediately removed from the net (usually by cutting the monofilament strands) and placed in a live well. Once biological information is gathered (length, weight, general fish condition) and a PIT-tag is inserted using the same methods and protocols as described in Section 2.1 of this Plan, the bull trout is placed in either an aerated holding box, or a live cart in the stream. After collection activities are completed for the day, the captured bull trout are transported to a waiting truck with transport tank.

All maiden Yale tailrace bull trout captures in 2019 will be transported upstream and released into Yale Reservoir. Encountered recaptures (verified by PIT tag) will be transported to their genetically identified reservoir of origin.

It is proposed for 2019 to continue netting during the same historical time-frame of June – August, but only net at the frequency of once per month for a total of three bull trout netting events (Table 2.2-1).

Netting typically occurs between the hours of 0800 and 1200; however, powerhouse generation schedules may cause netting activities to occur in the afternoon. During fish collection, powerhouse generators are taken off-line to enable deployment of nets. In years past biologists have netted for longer periods, however, capture efficiency drops substantially and very few if any fish are captured after about two hours of effort in the tailrace.

Alternative Capture Methodology

At this time no other capture method has been as feasible or efficient as tangle nets in capturing bull trout from the Yale tailrace waters. PacifiCorp continues research on possible alternative methods of effective capture and transport. However, upon investigation of each concept or pilot tests conducted at other Northwestern dams, PacifiCorp has not been successful in finding a better alternative to the current method. Therefore, future capture techniques will continue to use tangle nets as the preferred method unless a better method emerges or formal fish passage is constructed at Yale dam.

2.3 SWIFT BYPASS REACH COLLECTION AND TRANSPORTATION

In 1999, PacifiCorp and the WDFW began netting the Swift No. 2 powerhouse tailrace as part of Yale enhancement measures filed with the Yale license application to FERC in April 1999. However, due to the canal breach in May 2002 and subsequent low reservoir conditions, there was no netting at the Swift No. 2 powerhouse from 2001-2005; netting resumed in 2006. Due to the low capture numbers at Swift No. 2 (two fish in 1999 and zero since then) and large numbers of bull trout in the Swift Bypass Reach from July through October, the Swift No. 2 tailrace netting effort was relocated to the Swift Bypass Reach in 2007. Since the onset of netting activities in the Swift Bypass Reach (Figure 2.3-1) in 2007, 209 bull trout have been captured and tagged.

Based in part on the previously mentioned compelling evidence of negative handling effects, and the fact that upstream and downstream bull trout passage from Yale Reservoir to Swift Reservoir and vice versa will be implemented at the very latest by year 2025, the LRBTRT advised that this collection and haul program be halted indefinitely moving forward. No bull trout will be captured and handled from the Swift Bypass Reach and held at Merwin hatchery while awaiting genetic assignment in 2019.

2.4 HALF-DUPLEX PASSIVE INTEGRATED TRANSPONDER TAG - FIXED ANTENNA ARRAYS

Fixed PIT tag antenna arrays will be used to further evaluate Lewis River bull trout spatial and temporal distribution, migration patterns related to spawning events, survival (S), and spawning site fidelity. Arrays will be constructed near the mouths of Pine, Rush, P8, and Cougar Creeks, as well as in the Rush Creek hole of the upper Lewis River mainstem in 2019 (Figures 2.4-1 and 2.4-2).

Due to the greater read-range, flexible antenna construction scenarios, lower power consumption, and more affordable cost, a stream-width HDX system will be utilized in each identified spawning tributary location, except for in Rush Creek hole where a small, proximity antenna will be strategically placed. Depending on stream flow conditions, antennas will be placed in each creek in July and taken out of the creek the first week of November, in an attempt to capture the entire bull trout spawn time-frame.

Each stream PIT antenna system will consist of one stream-width HDX PIT tag antenna. Conducive to higher detection efficiencies and as much as practically possible, antennas will be placed in a shallow area of each stream. Each stream antenna will consist of a rubber-coated 1/0-gauge welding cable or 10 gauge speaker wire. All stream antennas will be designed as stream-spanning swim thru loops. An Oregon RFID RI-Acc-008B antenna tuner box will be attached to the 1/0-gauge copper welding cable or 10-gauge copper wire. Copper coax from the tuner box will then connect to an Oregon RFID RI-RFM-008 reader board and data logger. The antenna at Cougar Creek will be hooked up to electricity on-site which will then be passed through a 110-volt AC to 12-volt DC converter for continuous power. The antennas at the remaining stream sites will be powered by two or three 12-volt deep-cycle batteries in parallel which will require

replacement every two-three weeks. Some sites, if location is conducive, will also receive power from one or two 90-120 watt solar panels. Solar panels will be run to a charge controller which will then be connected to 12-volt batteries.

Due to the large spatial area encompassing the Rush Creek hole, no stream-width antenna like those located in Pine, Rush, P8, and Cougar creeks are possible at this location. Instead, a Biomark® 1.6 m diameter wagon wheel proximity antenna will be utilized at this location. This type of antenna reads both HDX and FDX tags and has a nominal read-range of 30-45 cm. Unlike the stream-width antennas that cover the entire stream-width and interrogate all tagged bull trout that ascend and descend the stream at that location, the proximity antenna will simply be anchored on the bottom centrally within the Rush Creek hole, in hopes that tagged fish will at some point in their holding residency at this location come into close proximity of the antenna. Given the known behavior of bull trout in the basin to congregate in large numbers in this area, and given their propensity to benthically orient themselves within the stream, researchers hope that a small unobtrusive antenna in this location will garner numerous tag interrogations.

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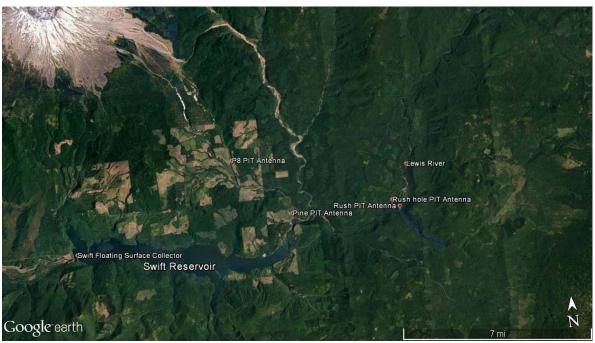


Figure 2.4-1. Fixed PIT-tag antenna stream sites upstream of Swift dam planned for 2019



Figure 2.4-2. Fixed PIT-tag antenna sites downstream of Swift Reservoir planned for 2019

2.5 COUGAR CREEK SPAWNING ESTIMATE

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee (*Oncorhynchus nerka*) in Cougar Creek, a tributary to Yale Reservoir. Along with the kokanee counts, bull trout (since 1979) and bull trout redds (since 2007) are also counted, as their spawn-time overlaps with that of kokanee.

Surveys are performed by one or two biologists, and the entire length of Cougar Creek is surveyed – a distance of about 2400 m (Figure 2.5-1). Bull trout spawner population estimates have ranged from 0 to 40 fish from foot surveys (since 1979) and between 38 and 58 fish based on redd counts (since 2007). This variability is due in part to sampling error, but is also indicative of a low spawning run size. Results of Cougar Creek kokanee surveys are reported annually and provided in the Aquatic Coordination Committee/Terrestrial Coordination Committee Annual Report.

Sampling effort in 2019 will be consistent with historical efforts to date. Depending on high water levels or other environmental issues (water turbidity), surveys will consist of bull trout redd counts every 10 days from September thru October; or until bull trout or new redds are no longer observed (Table 2.6-1). Live bull trout within the stream will continue to be enumerated, but the surveys will focus on locating redds. Redds will be mapped using a GPS and flagged until no longer visible to avoid double counts. Along with a population estimate, these surveys will also allow for a better understanding of bull trout spawning habitat characteristics.



Figure 2.5-1. Bull trout redd survey start and end points within Cougar Creek.

2.6 REDD SURVEYS OF PINE CREEK TRIBUTARY P8 AND P10, PINE CREEK MAINSTEM AND RUSH CREEK

The Utilities propose to continue bull trout redd surveys within P8 (Figure 2.6-1) in 2019 in order to build upon existing abundance trend data. Surveys will be conducted within the first one mile of the stream. Depending on high water levels or other environmental issues (water turbidity), surveys will plan to be performed once every ten days in September and October (Table 2.6-1). All redd surveys will be consistent with methodologies performed on Cougar Creek for bull trout (Section 2.5).

Along with the ten day rotation of surveys within P8, and depending on high water levels or other environmental issues (water turbidity) Rush, P10 and Pine creeks will also be surveyed on a ten day rotation for bull trout redds (Figure 2.6-1). Pine Creek and P10 surveys will encompass the entire creek to its anadromous fish barrier, while surveys within Rush Creek will extend from the stream mouth upstream to the Forest Road Bridge at approximately river mile 0.5. As this will be a census count of redds, survey methodology will follow methods identified within Section 2.5 of this Plan.

Though no barrier exists on Rush Creek at the Forest Road 90 Bridge, upstream of this point the habitat becomes mainly bedrock and river gradient greatly increases. With this change of gradient survey conditions become exceedingly more difficult and concerns for surveyor safety become an issue.

Objective 19 of the Monitoring and Evaluation Plan highlights the need for information to be collected concerning resident and anadromous fish interactions. A portion of Objective 19 specifically seeks an assessment of later spawning coho (*O. kisutch*) superimposing redds over previously constructed bull trout redds. To evaluate this, bull trout redds observed during P8 redd surveys in 2019 will be uniquely visually marked in order to assess if and any disturbance occurs to the bull trout redd egg pocket by later spawning coho.

Along with standard flagging and taking of a GPS point of each identified bull trout redd during 2019 surveys, detailed notes and additional flagging spatially demarcating bull trout redd egg pockets (redd mound) will also be taken and hung. The detailed notes and additional flagging will give a visual cue to where within the stream the egg pocket lies even after natural hydrologic and biological processes have returned the stream bottom to a more natural appearance.

Redd surveys of P8, depending on high water levels or other environmental issues (water turbidity), will be extended through November to encompass the early and late-run coho spawn timeframe and each bull trout redd recorded from earlier surveys will be re-visited and assessed for new excavation over the egg pocket.



Figure 2.6-1. Bull trout redd survey reaches within the Pine Creek system and Rush Creek for 2019.

2.7 UNDERWATER VIDEO CAMERA IN COUGAR CREEK DURING THE SPAWNING MIGRATION PERIOD

In order to get a true count of bull trout that ascend Cougar Creek during the bull trout spawn timeframe, a partial weir with an associated underwater video camera will be installed within the creek the second week of July and attempt to stay in operation through October 31, 2019. This information will be correlated to redd surveys performed of this reach to finely tune the number of bull trout associated with each redd.

In order to funnel bull trout nearer to the underwater camera lens, a partial weir consisting of polyvinyl chloride pickets will be constructed in Cougar Creek near its confluence with Yale Reservoir (Cougar Creek PIT antenna site, Figure 2.4-2). The weir will consist of multiple separate panels that will terminate to either side of a swim thru box. The underwater video camera will be housed in this swim thru box located near the center of the channel. The weir will divert migrating bull trout in the direction of the swim thru box and into the cameras field of vision. An underwater light will be utilized in conjunction with the underwater camera in order to better identify fish.

All video footage will be recorded by either a motion detecting or standard Digital Video Recorder (DVR) and saved to either an external hard drive or Secure Digital memory card (SD card). If

motion detection is utilized, sensitivity on the DVR will be set to capture all expected migrating fish size-ranges in the study area (60mm +). The camera, lights, and recording instruments will be powered on-site by 110v hard power.

Recorded video footage will be viewed; upstream and downstream bull trout movement and the associated count of bull trout that ascended Cougar Creek during the recording time-frame will be assessed. The background within the cameras field of vision in the swim thru box that houses the underwater camera will be solid white with solid black vertical lines spaced equidistant apart. The distance between each solid black line will be known and in this way approximate length of each migrating bull trout will also be assessed.

2.8 TEMPERATURE MONITORING OF BULL TROUT SPAWNING STREAMS IN THE UPPER LEWIS BASIN

In order to better understand bull trout spawn migration timing and how it correlates to stream temperature, Onset Tidbit® temperature data loggers will be remotely deployed in strategic locations of the Upper Lewis River basin in 2019.

Starting June 15, temperature data loggers will be deployed at the mouth of Pine Creek, P8, P10, Rush Creek, Eagle Cliff hole of the Lewis River mainstem and the mainstem upper Lewis River just upstream of its confluence with Rush Creek. Thermographs will be quality assured/quality controlled by the manufacturer prior to deployment and will be set to record continuous hourly temperature readings at each identified location. Thermographs will be recovered and taken out of each stream location by the first week of November.

2.9 ASSESSMENT TO ESTIMATE OBSERVER ERROR WITHIN MONITORING METHODS ON THE LEWIS RIVER

In order to understand how sampling error may influence metrics of bull trout abundance across different survey methods, an estimate of observer error within bull trout redd and snorkel surveys will be generated during the 2019 field season. Key to this assessment will be to identify how observer error differs across different levels of bull trout abundance and across different streams, particularly given inherent differences in stream characteristics and water clarity.

Methods to assess observer error with concern to redd surveys will comprise of the following:

- Study will occur on all major bull trout spawning tributaries in the basin, Cougar, Rush, P8, P10, and Pine creeks.
- All flagging indicating locations of redds from previous years or previous surveys will be removed prior to study surveys.
- Assessment will occur across three separate time periods to capture the range of bull trout abundance, one survey during an early period and one during the typical peak spawning period, and one towards the latter half of the migration period.
- Streams will be broken down into distinct reaches based on historical spawning information with reaches delineated by flagging.

- Surveys will be conducted by observers on the same day or consecutive days to minimize additional redds being constructed.
- Each observer will walk each reach/stream and take GPS coordinates and notes of location of each redd. No flagging will be used.

Methods to assess observer error with concern to snorkel surveys will comprise of the following:

- Assessment will occur at areas where bull trout stage prior to spawning including Eagle Cliffs and the confluences of Muddy River and Pine and Rush creeks.
- Study will occur across three time periods to capture the range of bull trout abundance at these locations, time periods will be driven by previous snorkel data.
- Boundaries of areas to be snorkeled will be clearly demarcated by flagging.
- Three experienced bull trout snorkelers will conduct the study. Snorkeler will proceed to snorkel entire section and estimate the size of all bull trout observed by 100 mm increments and record on an underwater slate. Data from each snorkeler will not be reviewed by other snorkelers until after the study survey.
- Each snorkeler will conduct survey of a specific site within the same day and separated by approximately one hour.

Both sets of data will be analyzed using mixed model approaches (Zuur et al. 2007). Through this approach, estimates of signal noise ratio will be estimated to identify the most robust and precise approach for monitoring. In addition, variance decomposition methods will be used to identify the magnitude of different sources of error (e.g., observer, density, etc.). By delineating sampling efforts by stream/location, it will be also possible to identify how sampling error varies by population. Contrasting the two measures of abundance will provide insights into the effectiveness of different approaches to detect changes in bull trout abundance, provide benchmarks to compare such measures with the effectiveness of previous abundance monitoring data (i.e., mark-recapture), and allow managers to refine monitoring approaches to focus on the most effective approach for monitoring multiple bull trout populations in the Lewis River.

III. Reporting

An Annual Report detailing all activities and corresponding data gathered concerning this 2019 Annual Bull Trout Operating Plan, will be included in the Aquatic Coordination Committee/Terrestrial Coordination Committee Annual Report submitted to FERC in the spring of 2020.

IV. References

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V. Agency Comments

No agency comments were received by the due date of April 5, 2019.

Attachment E is saved as a separate file.

Attachment E

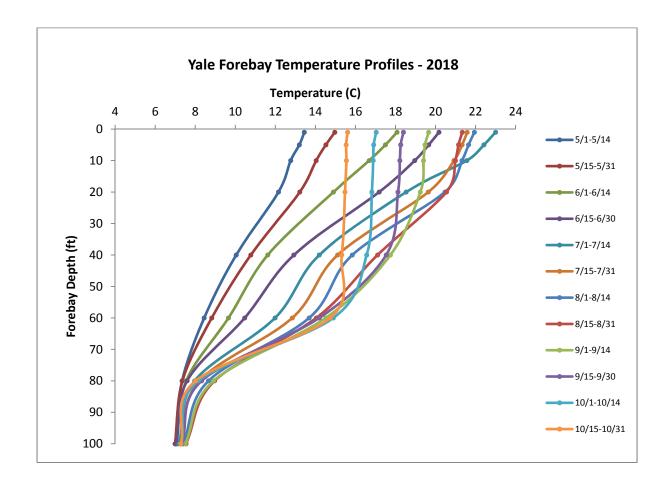
Hatchery and Supplementation Plan 2018 Annual Operations Report

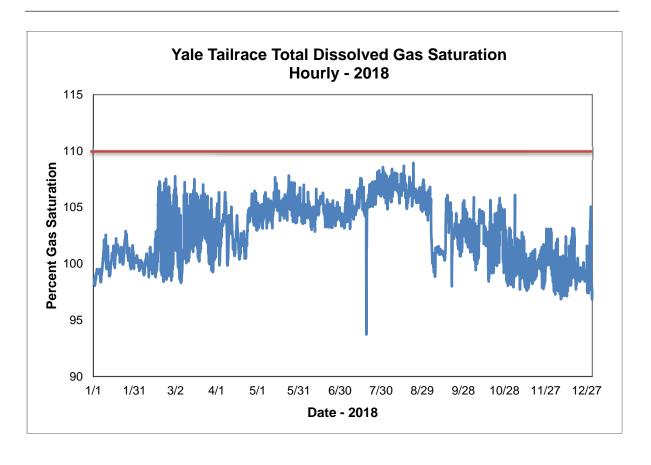
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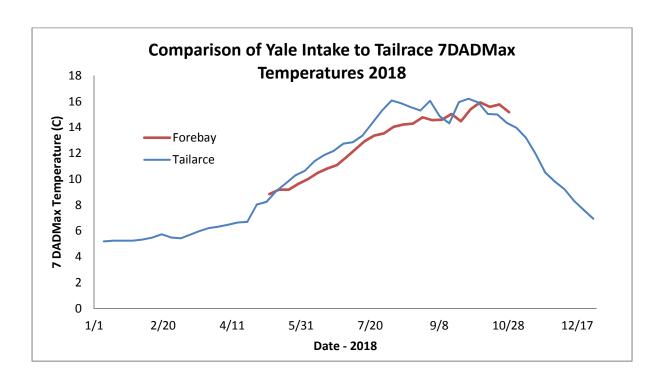
Attachment F

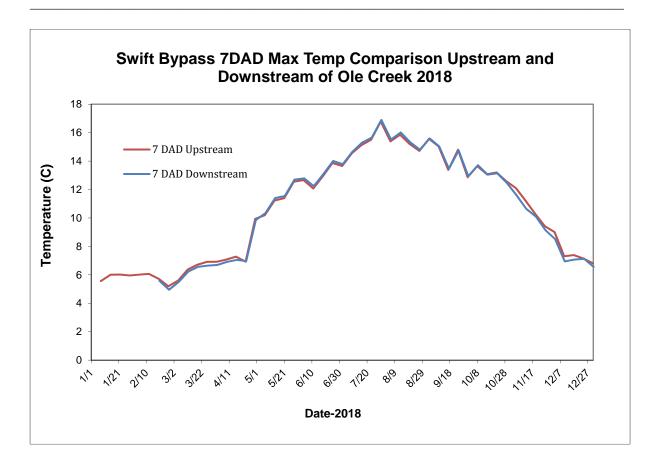
2018 Lewis River Fish Passage Program
Annual Report

Attachment G
Yale Water Quality Graphs

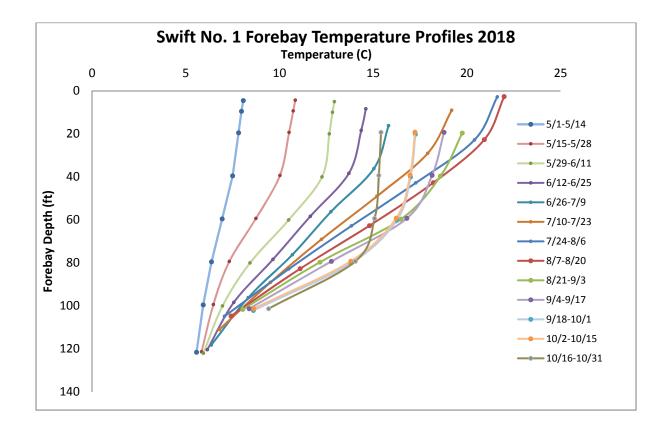


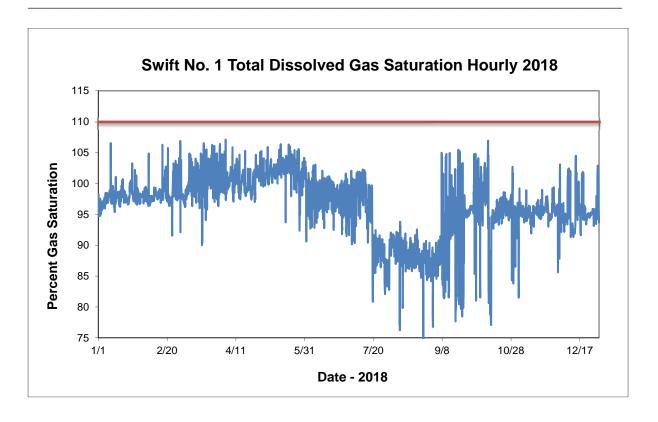


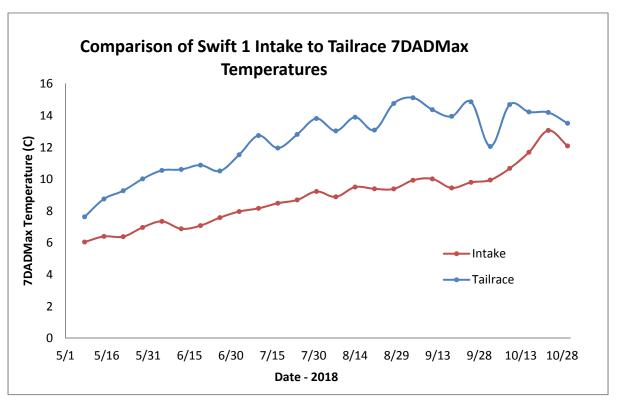




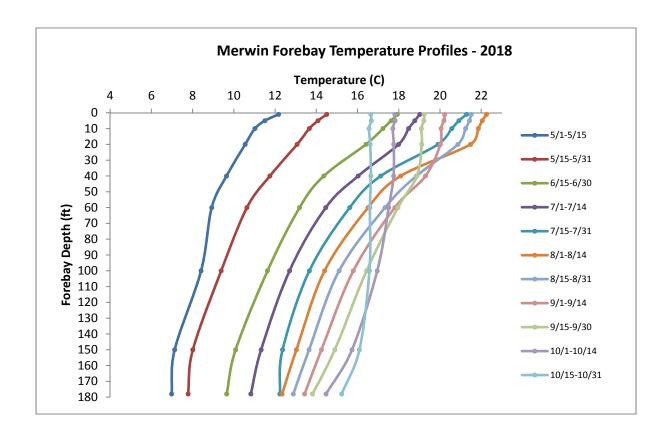
Attachment H
Swift No. 1 Water Quality Graphs

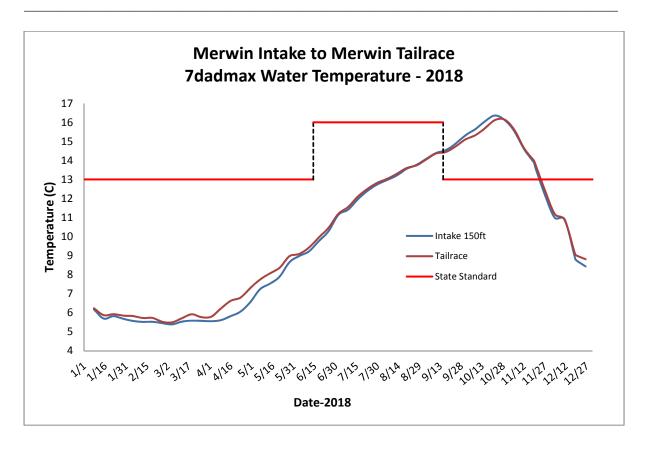


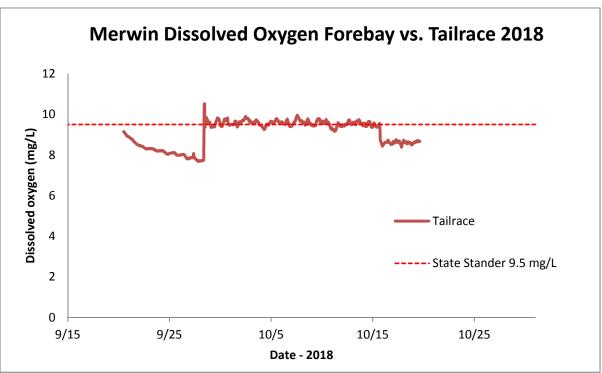




Attachment I Merwin Water Quality Graphs







Yale Reservoir Kokanee 2018
Escapement Report

Yale Reservoir Kokanee (Oncorhynchus nerka) Escapement Report

2018





North Fork Lewis River Hydroelectric Project Yale FERC No. 2071

Prepared by:

Jeremiah Doyle, PacifiCorp

April 12, 2019

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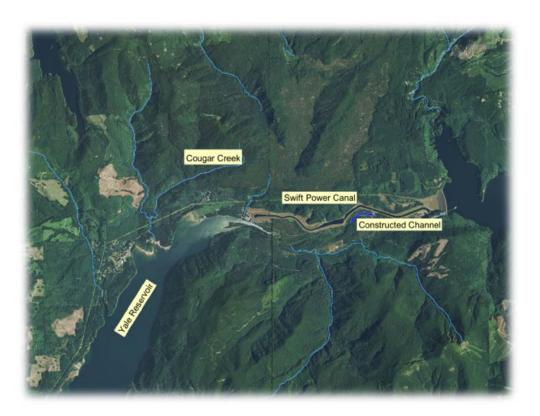
1.0 INTRODUCTION

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee in Cougar Creek, a tributary to Yale Reservoir. This report presents results of kokanee spawner surveys conducted on Cougar Creek and the Constructed Channel within the Swift Bypass Reach in 2018. Surveys are performed per Article 402(b) of the Yale and Swift Federal Energy Regulatory Commission (FERC) operating licenses and Article 402(c) of the Merwin FERC operating license.

2.0 STUDY AREA

Surveys for kokanee spawners were performed on Cougar Creek and the Constructed Channel in 2018. Cougar Creek is a third order stream and tributary to Yale Reservoir in Southwest Washington. The creek pours directly from an underground lava tube for approximately 1,700 meters before flowing into Yale Reservoir.

The Constructed Channel flows from a valve off of the Swift Power Canal for approximately 200 meters before entering the Lewis River channel within the Swift Bypass Reach. The valve that controls flow into the Constructed Channel is set to a level to contribute a constant flow of 14 cubic feet per second (cfs) (*Figure 1*).



3.0 METHODS

To enumerate kokanee spawners two biologists, one on each side of the stream, walked together from the stream mouth upstream to its anadromous fish barrier. Each biologist counts spawning and holding kokanee on his/her side of the stream, including side-channels. This process is repeated on three to four occasions over the course of the kokanee spawn time-frame, mid-September through early-November, in order to garner a count at the peak of the spawning run. The highest count during the survey period is considered the peak, and is preceded and followed by surveys with a lower kokanee count.

4.0 RESULTS

Cougar Creek

Peak kokanee escapement estimates decreased slightly from 2017 (7,429) to 2018 (6,118). The 2018 spawning estimate of 6,118fish (*Figure 2*) is the third lowest count on record (1978-2018) and follows a trend of low population estimates since 2016.

As in previous years, Cougar Creek was surveyed on foot with two surveyors. Kokanee were enumerated from the stream mouth upstream to its origin, a distance of approximately 1,700 meters. For survey purposes, the accessible anadromous fish habitat in Cougar Creek is broken into five survey reaches. There are a series of three major log jams in Reach 2 and 3 of Cougar Creek. In 2018, the upper extent of kokanee spawning was observed to be just above the first log jam in Reach 2 which is the first of three major log jams encountered.

Cougar Creek was surveyed for kokanee three times in 2018 (*Table 1*). Survey conditions during the sampling time period (Sep – Nov) were ideal and water clarity very good throughout the survey season.

4.1 Distribution and Timing

The peak kokanee count was recorded on October 25, 2018 (*Table 1*). This peak timing of kokanee abundance in 2018, though late on the timing spectrum, is within historical timeframes on record (1978-2018). Most kokanee were observed in Reach 2, which is consistent with prior years. This largest concentration of kokanee occurs just below the first log jam encountered on their travel upstream.

Table 1. Distribution and peak counts of kokanee in Cougar Creek in 2018

^{*} Estimate uses a 2.3 multiplier of the peak count (Graves unpublished data, 1982)

Reach	Survey Date			
Keacii	10/10	10/25	10/31	
1	820	830	290	
2	800	1830	1,950	
3	0	0	290	
4	0	0	0	
5	0	0	0	
Spawning Estimate	3,726	6,118	5,198	

4.2 Escapement

The kokanee spawning escapement in 2018 is estimated at 6,118 fish (*Figure 2*). This is the third lowest spawner count on record, and a decrease from the peak observed in 2017 (7,429). Kokanee escapement into Cougar Creek has been less than the historical running average of 71,897 since 2003. This year's estimate is also well below the ten-year average of 23,784 fish (*Table 3*).

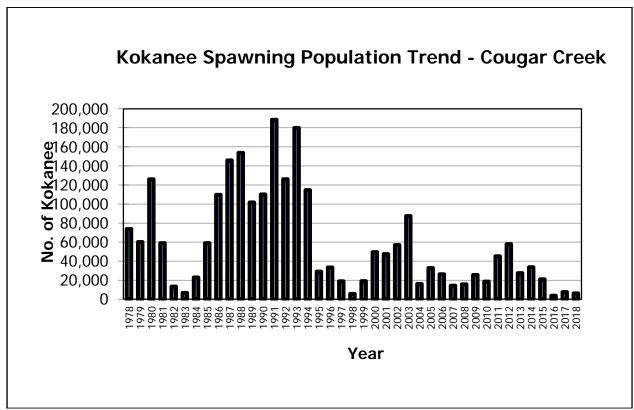


Figure 2. Kokanee spawning estimates for Cougar Creek, 1978-2018

4.3 Length Distribution

Due to low escapement numbers, kokanee carcasses were difficult to find in 2018, therefore lengths were only measured from 11 male and 14 female kokanee (*Figure 3*). Lengths came from both Cougar Creek and Constructed Channel kokanee. Lengths of kokanee in both reaches were similar to each other in 2018, and due to the low numbers of recovered carcasses, were pooled. The average lengths of male and female kokanee in 2018 were 320 and 316 millimeters, respectively.

Combined mean fork length of all kokanee observed in 2018 (318 millimeters) was slightly larger than what was observed during 2017 (317 millimeters). Historically, mean fork length is a general indicator of number of spawners. The larger the fish, the less spawners observed; conversely, the smaller the mean fork length of spawners, the higher the spawner escapement.

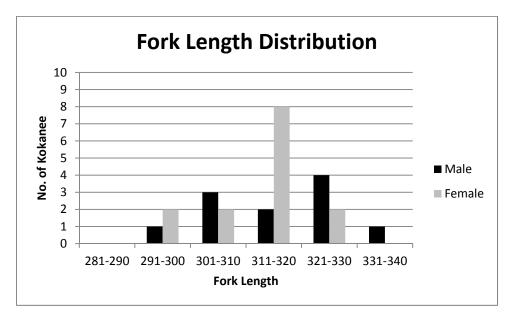


Figure 3. Length frequency histogram of male (n=11) and female (n=14) kokanee lengths (FL) sampled in Cougar Creek and the Constructed Channel, Washington -2018

The average length of this year's female kokanee (316 mm) was approximate to the average female length observed in 2017 (316 mm). The average female fork length in 2018 is greater than the historical running average of 288 millimeters (1978-2018).

With the regression line established in *Figure 4*, the average fork length size for females in 2018 is under-estimated from the equation by two percent. The fitted line suggests that given the spawning population estimate the female average length should be 311 millimeters, instead of the observed average of 316 millimeters, an underestimate of 5 millimeters. This observed difference in estimation of two percent is neglible and may indicate that during the reservoir life-cycle of this brood year that productivity was ideal for proper fish growth and development for this brood escapement estimation.

The size at spawning estimate may be a good indication of reservoir production in terms of food availability and fish growth. When kokanee are smaller than anticipated (based on size at spawning and spawning escapement) it may be an indication that reservoir productivity was limited at some point during their residency in Yale Reservoir.

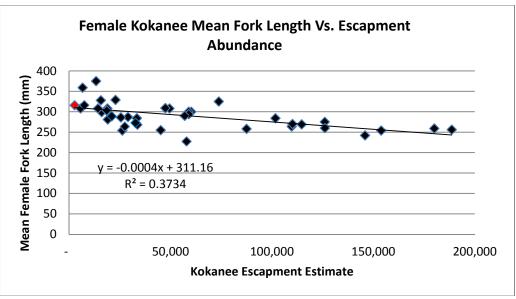


Figure 4. Relationship between mean kokanee fork length (female) and spawning escapement in Cougar Creek (1978-2018). Red dot represents 2018.

4.4 Constructed Channel

One Constructed Channel kokanee spawner survey was completed on October 24, 2018 from its confluence with the Swift Bypass Reach upstream to its anadromous fish barrier, a distance of approximately 200 meters. A peak count of 1,380 kokanee spawners was recorded, this compares to a peak count of 1,190 kokanee spawners recorded in 2017 (*Table* 2).

The escapement estimate in 2018 (3,174) is very similar to what was estimated in 2017 (2,553) (*Table 2*). It is important to note that the flows within the Constructed Channel come straight off the Swift Power Canal via a mechanically controlled stem valve that is set to release a constant 14 cfs. Habitat improvements to the Constructed Channel were completed by PacifiCorp in 2010, and the constant flow rate of 14 cfs has been in effect since that time.

Table 2. Historical Constructed Channel peak counts and estimated spawning escapement.

Constructed Channel			
Year	Peak Count	Estimated Spawning Escapement	
2010	410	943	
2011	500	1,150	
2012	3,400	7,820	
2013	450	1,035	
2014	450	1,035	
2016	890	2,047	
2017	1,190	2,553	
2018	1,380	3,174	

Table 3. Summary of data collected from Cougar Creek kokanee surveys from 1978 to 2018.

						Mean	Ĭ		Egg-to-Adult
Spawn	Peak		Estimated	Moving	Number of	Length (mm)	Mean	Total	%
Year	Count	Date	Escapement*	Average	Females**	Females	Fecundity+	Eggs	Survival^
1978	32,064		73,747	35,930	36,874	325	582	21,468,547	
1979	26,136		60,113	66,930	30,056	300	515	15,485,658	
1980	54,782		125,999	86,620	62,999	275	448	28,237,546	0.25
1981	25,614		58,912	79,693	29,456	300	515	15,176,372	0.27
1982	5,750		13,225	66,399	6,613	375	716	4,736,005	0.09
1983	2,875		6,613	56,435	3,306	359	673	2,226,230	0.02
1984	9,915		22,805	51,630	11,402	329	593	6,760,850	0.15
1985	25,623	9/25/1985	58,933	52,543	29,466	294	499	14,707,884	1.24
1986	47,680	10/10/1986	109,664	58,890	54,832	264	419	22,960,352	4.93
1987	63,406	9/30/1987	145,834	67,584	72,917	242	360	26,234,042	2.16
1988	66,865	10/3/1988	153,790	75,421	76,895	254	392	30,138,128	1.05
1989	44,199	10/11/1989	101,658	77,608	50,829	284	472	24,008,499	0.44
1990	47,859	10/9/1990	110,076	80,105	55,038	270	435	23,931,558	0.42
1991	81,993	10/7/1991	188,584	87,854	94,292	256	397	37,462,192	0.63
1992	54,801	10/2/1992	126,042	90,400	63,021	260	408	25,713,890	0.52
1993	78,260	10/6/1993	179,998	95,999	89,999	259	405	36,480,195	0.75
1994	49,830	9/21/1994	114,609	97,094	57,305	269	432	24,763,567	0.31
1995	12,590	10/12/1995	28,957	93,309	14,479	287	480	6,955,182	0.11
1996	14,508	10/9/1996	33,368	90,154	16,684	284	472	7,880,615	0.09
1997	8,169	10/23/1997	18,789	86,586	9,394	308	537	5,041,572	0.08
1998	2,435	10/6/1998	5,601	82,729	2,800	308	537	1,502,782	0.08
1999	8,260	10/22/1999	18,998	79,832	9,499	281	464	4,410,386	0.24
2000	21,495	10/13/2000	49,439	78,511	24,719	308	537	13,265,833	0.98
2001	20,611	9/24/2001	47,405	77,215	23,703	309	539	12,783,787	3.15
2002	24,750	10/17/2002	56,925	76,403	28,463	290	488	13,901,654	1.29
2003	38,004	10/9/2003	87,409	76,827	43,705	258	403	17,598,094	0.66
2004	6,964	10/8/2004	16,017	74,574	8,009	299	513	4,104,728	0.13
2005	14,226	10/7/2005	32,720	73,080	16,360	273	443	7,245,145	0.24
2006	11,383	10/23/2006	26,181	71,462	13,090	254	392	5,130,671	0.15
2007	6,175	10/17/2007	14,203	69,554	7,101	308	537	3,810,957	0.35
2008	6,780	10/3/2008	15,594	67,813	7,797	328	590	4,602,257	0.22
2009	11,075	9/29/2009	25,473	66,490	12,736	286	478	6,084,107	0.50
2010	8,030	10/4/2010	18,469	65,035	9,235	303	523	4,832,044	0.48
2011	19,610	10/11/2011	45,103	64,449	22,552	254.9	394	8,893,229	0.98
2012	25,150	10/8/2012	57,845	64,260	28,923	227	320	9,243,053	0.95
2013	11,910	10/14/2013	27,393	63,236	13,697	264	419	5,735,272	0.57
2014	14,620	10/3/2014	33,626	62,435	16,813	269	432	7,265,570	0.38
2015	9,105	10/29/2015	20,942	61,008	10,471	289	486	5,086,062	0.23
2016	1,580	10/24/2016	3,634	59,864	1,817	315	555	1,009,198	0.06
2017	3,230	10/17/2017	7,429	58,553	3,715	316	558	2,073,062	0.10
2017	2,660	10/17/2017	6,118	57,274	3,059	316	558	1,707,228	0.10
MEAN	24,902	10/23/2010	57,274	71,897	28,637	289	488	13,804,823	

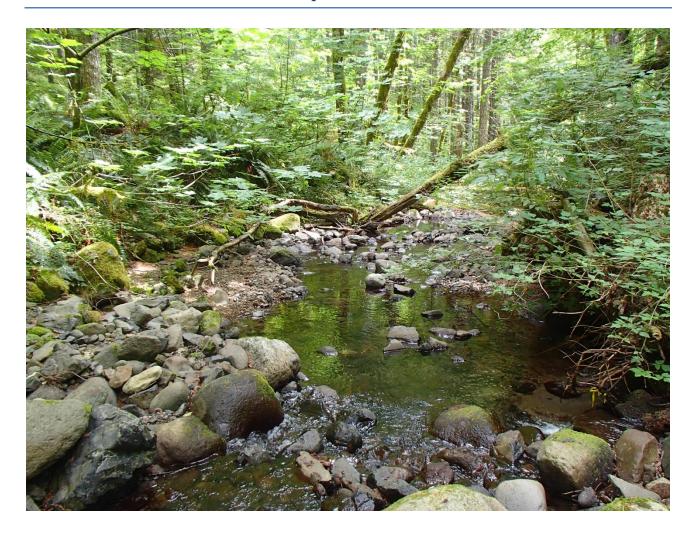
^{*}Peak Count x 2.3 (Graves unpublished data, 1983)

^{**}Assuming a 1:1 ratio

- + From the model: Fecundity = -288.78 + 2.68 x Length of Females (Graves unpublished data, 1983) $^{\wedge}$ Estimated Escapement of Adults (3 year-olds) / estimated number of eggs

Attachment K Aquatic Fund Project Close-Out Reports

Spencer Creek Alluvial Fan and Channel Rehabilitation Status Report 2018



Partnership between Mount St. Helens Institute (MSHI) and USFS Gifford Pinchot National Forest

Prepared by Katie Fielding, Kylie Sahota MSHI Fisheries Technicians and Abigail Groskopf,
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Reviewed by the Gifford Pinchot National Forest



August 2018



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Project Summary

The Spencer Creek Fish Habitat Restoration Project consists of the construction of 7 complex Large Woody Debris (LWD) structures within Spencer Creek using 100 pieces of LWD and a larger structure immediately upstream of the confluence with the North Fork Lewis River using 100 pieces of LWD. The LWD structures are designed to increase habitat complexity and diversity, provide refugia during winter flows for juvenile salmonids, and provide increased spawning opportunities for adult salmonids. The project targets ESA listed species including coho and Chinook salmon, steelhead trout and bull trout.

The Forest Service hired a contractor to harvest trees with the root wad intact and haul the LWD to the project site. An excavator and skidder were used to place wood in strategic locations. The tracked excavator and rubber mounted skidder accessed the project area via a closed logging road.

The pre-implementation monitoring included three types of surveys. Longitudinal profiles, cross-section profiles, and Wolman Pebble Counts were conducted prior to structure installation in 2018. In 2019,

one year after implementation, a longitudinal profile, cross sections and Wolman Pebble Counts will be repeated to analyze the change in channel morphology and sediment deposition after winter flows. Photographs were also taken to provide further documentation.

Site Location and Description

The project site is located in the Gifford Pinchot National Forest approximately 10 miles upstream from Swift Reservoir. Spencer Creek is situated on the west (river right) side of the North Fork Lewis River.

Approximately 200 pieces of LWD were harvested during thinning operations from a nearby timber sale unit which allowed for the use long stems (60+ feet) with attached root wads. The site was accessed by reopening 9000480 road, and LWD was trucked to the 9000480 road and stockpiled. From there, the LWD was transported to the project site using a skidder where an excavator constructed the structures. The FR 9000480 was closed after all activities were completed, by re-establishing drainage and blocking vehicular access.

Approximately 100 pieces of LWM were used to create a large structure immediately upstream of the Spence Creek alluvial fan to encourage high flow scour, salmonid refuge, and gravel retention in the North Fork Lewis River. An additional 7 structures were installed in Spencer Creek between the Lewis River and the Lewis River trail #31 using 100 pieces of LWD to form complex habitat. These additional structures are designed to increase the number of pools over 1-foot deep and spawning gravel retention which will increase salmonid spawning and rearing opportunities. The overall design will appear natural and meet scenery management objectives.

Spencer Creek is a small tributary to the North Fork of the Lewis River in which water flows year-round. The stream extends 700 feet from the Lewis River to Trail #31 with an elevation increase of 45 feet and varies in width between 15 and 30 feet. Surface substrate consists of substantial fines, with a D50 of 9, mixed with some spawning gravel and cobble. Prior to habitat restoration implementation, there were 11 pools with a cumulative pool length of 210.75 feet and an average residual pool depth of 0.76 feet. The channel is deeply entrenched where cross sections were conducted with banks averaging 10 feet in height. The alluvial fan at the confluence of Spencer Creek and the North Fork Lewis River are dominated by Alder and Big leaf Maple while the upland is a mixed conifer stand of mature Hemlock and Douglas-fir with some Vine Maple.

The longitudinal profile and cross sections from 2018 conducted before implementation show the channel's baseline geomorphology. Structures were installed in August 2018 but post-implementation surveys were not conducted. A 1-year post-Implementation survey will be conducted in 2019 to analyze changes to stream geomorphology resulting from the combination of habitat restoration and winter flow interaction with installed structures.

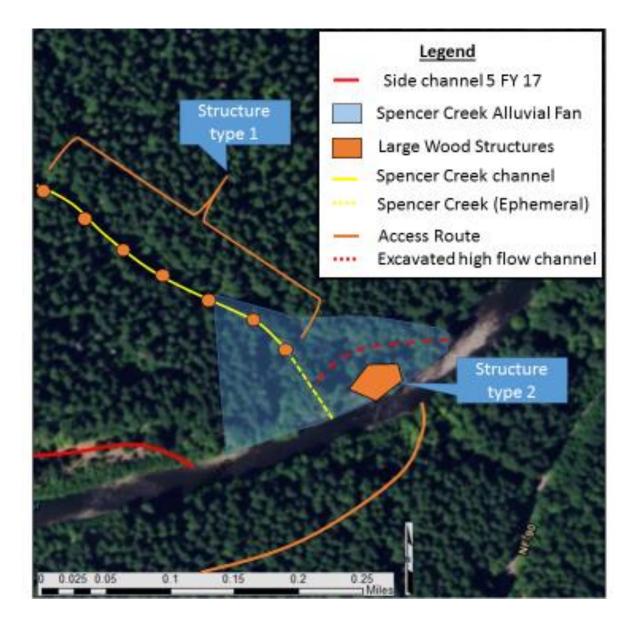


Image 1: Spencer Creek Alluvial fan and channel rehabilitation project design.

Priorities and Goals

The Aquatic Coordination Committee (ACC) three priorities for restoration projects in the Lewis River Basin are:

- 1. Benefit fish recovery throughout the North Fork Lewis River, with priority to federal ESA-listed species.
- 2. Support the reintroduction of anadromous fish throughout the basin.
- 3. Enhance fish habitat in the Lewis River Basin, with priority given to the North Fork Lewis River.

The project site was chosen as a fitting location to address these Lewis River Basin restoration priorities based on ACC identified priority reaches. When this tributary of the North Fork Lewis River is

restored it will act as refugia from winter flows for juveniles and increase carrying capacity of summer rearing habitat. Enhancing the habitat with woody structures will benefit multiple ESA listed species by increasing the number and size of pools over 1-foot as well as increase spawning gravel retention. As such, this project helps to ensure that fish reintroduction efforts into the upper North Fork Basin are successful and directly benefit other salmonids not included in reintroduction efforts.

The lack pools over one foot deep and quality instream LWD prior to this project were the biggest issues preventing the site from acting as functional salmonid habitat. To address this, four primary goals were given for this project:

- 1. Improve habitat complexity and diversity using LWD
- 2. Provide refugia during winter flows for juvenile salmonids
- 3. Provide rearing opportunities for juvenile salmonids during summer months
- 4. Provide increased spawning opportunities for adult salmonids

Community Outreach

The Mount St. Helens Institute provides internships for undergraduate students studying fisheries science. Interns gain experience surveying and monitoring restoration projects. This experience is a stepping stone for a career in fisheries management. In addition, the Mount St. Helens Institute trains approximately 300 school age youth each year in watershed dynamics, monitoring and water quality analysis. During the 2018 field work season, one intern from a local community college was employed to assist in the monitoring of the side channels.

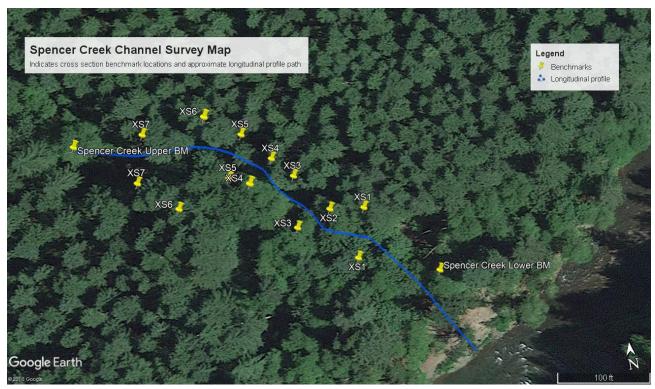


Image 2: Spencer Creek survey map indicating the location of benchmarks and approximate channel.

Monitoring Methodology

A series of monitoring surveys were conducted to quantify changes in the stream channel. A baseline longitudinal and cross section profiles were created using methodology adapted from Harrelson et al. (1994), and Wolman Pebble Counts were conducted prior to project implementation in 2018. In 2019, the same three surveys will be conducted again to determine how the structures have changed stream morphology. Photographs over two years will further document the project.

Cross Section Profiles

To monitor the effects of each LWM structure, cross section profiles were created immediately at the proposed location of each structure. The methods for measuring these cross sections were adapted from methods described by Harrelson et al. (1994). Some structures were installed to increase cover habitat and were not expected to alter geomorphology (pools, gravel beds), and as such only structures that were designed to alter geomorphology were monitored with a cross section.

Cross-sectional benchmarks (an aluminum nail protruding from lath secured to a tree) were placed in locations such that the cross section was directly perpendicular to the angle of water flow. Lath was labeled to identify each structure and improve visibility. A total of 7 structures were surveyed - numbered 1, 2, 3, 4, 5, 6, and 7, 1 being closest to the confluence with the North Fork Lewis River and 7 furthest upstream.

To conduct the survey a measuring tape was stretched tightly across the channel and attached to each benchmark. A laser level were used to map the topography of the bank and stream bed along the measuring tape. Measurements were taken as frequently as needed to capture all significant topographical

features. The height from the ground to the nail was recorded in the notes so that the nail could be used as the fixed reference point. In addition to mapping the topography of the stream bed, the survey also recorded the water level, locations of water edges, and bankfull elevations.

Wolman Pebble Count

A Wolman Pebble Count (WPC) was conducted at the approximate location of each structure, where gravel recruitment is expected to occur. The surveyor walked back and forth between the two bankfull locations in a consistent zig-zag pattern picking up substrate from the top of the stream bed. Some of the substrate picked up was inside the bankfull location but out of the water. The substrate was picked up systematically (for example, every 6 inches) and without looking at the spot prior to touching it in order to eliminate bias. A gravelometer was used to measure the substrate. Substrate too large to be picked up was measured with a ruler on the side of the gravelometer. A minimum of 100 pieces of substrate were counted for each WPC. The surveyor ended each pebble count at one of the bankfull locations and never stopped part way into the channel.

Longitudinal Profile

A longitudinal profile was created for Spencer Creek using methods closely adapted from Harrelson et al. (1994). The longitudinal profile measures the elevation changes of the thalweg - the deepest continuing line in the stream channel. From the longitudinal profile, one can assess stream type, pool depth, and pool:riffle ratio. Due to thalweg meandering the longitudinal profile is not only a measure of distance and elevation, but also of sinuosity.

The upper benchmark is a nail in a well-established large Douglas-fir. Coordinates are 10T 0584334, 5110059. The lower benchmark is a piece of rebar at the base of a large Douglas-fir on the high terrace. Coordinates are 10T 0584145, 5109957.

A laser level was used to measure changes in elevation. The distances covered between the measuring points varied depending on changes in the thalweg. Sections of frequent changes were measured more densely while sections with little change were measured less densely. Generally, as many measurements as needed were taken to record all significant changes in elevation of the thalweg. A range finder was used to measure the distance between the points. When the laser level was no longer in sight, it was moved to a new location and a reading was taken in the same location before and after the relocation in order to calculate and account for the change. In addition to measuring changes in elevation, the water level and habitat unit (pool head, pool max and pool tail, with the assumption of riffle in between pools) were recorded at each point. When the longitudinal profile intersected a cross sectional profile the measuring point was recorded in the notes.

Photos

Photos were taken at each cross section looking downstream, looking upstream, from right bank looking to left bank, and from left bank looking to right bank. Additional photos were taken when required, such as when a structure was damaged or destroyed. Select photos are included in this report but all photos are available on request.

Results and Analysis

A seven hundred long longitudinal profile was established along Spencer Creek prior to implementation (Figure 1) and a habitat analysis summary was conducted (Table 2).

Longitudinal Profile

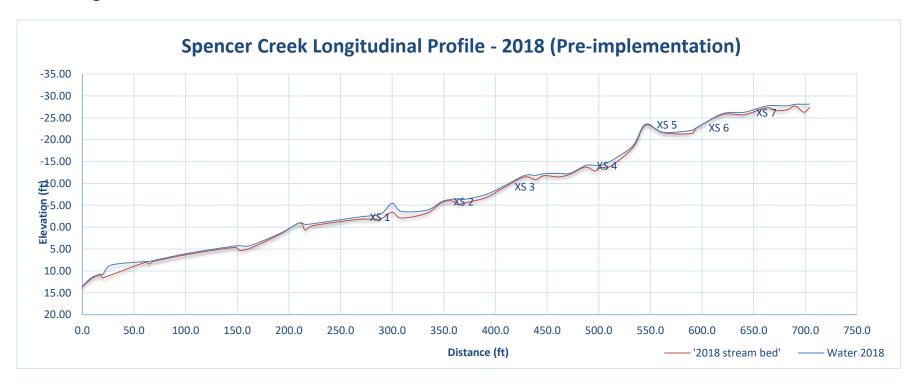


Figure 1: Longitudinal Profile for Spencer Creek analyzing pre-implementation geomorphology from survey conducted in 2018.

Table 1: Analysis of habitat units in Spencer Creek prior to habitat restoration implementation showing pool habitat in the stream between the North Fork Lewis River and trail #31.

Longitudinal Profile Statistics	2018
Number of pools	11
Cumulative pool length in feet	210.75
Mean Residual Pool depth in feet	0.76
Cumulative riffle length in feet	489.25

Wolman Pebble Counts

Substantial amounts of fines along with spawning gravel and cobble exist in Spencer Creek prior to implementation (Figure 2) and the D50 at the cross sections ranged from 6-14 (Table 2).

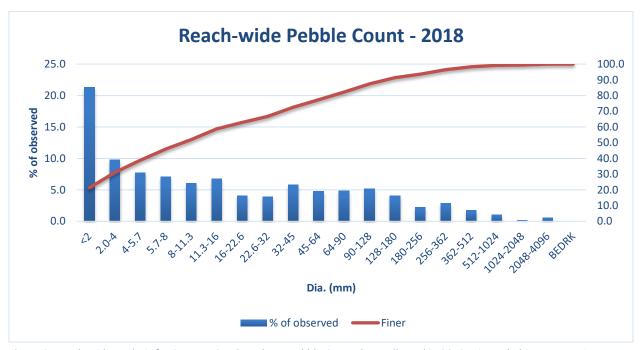


Figure 2: Reach-wide analysis for Spencer Creek Wolman Pebble Count data collected in 2018 prior to habitat restoration implementation indicating substantial fines mixed with some spawning gravel and cobble.

Table 2: Analysis of the Wolman Pebble Count including Reach-Wide and individual structure data comparing the average diameter of the most abundate substrate sizes in Spencer Creek.

2018				
ST	D50	D84		
1	7	123		
2	12	90		
3	7	110		
4	7	51		
5	11	75		
6	14	148		
7	6	73		
Reach-wide	9	88		

Cross Section Profiles

Cross-section profiles are found in Appendix A with corresponding photos and structure-level pebble counts.

Conclusions

The Spencer Creek Alluvial Fan and Channel Rehabilitation project goals were to:

- 1. Improve habitat complexity and diversity in the side channel using LWM
- 2. Provide refugia during winter flows for juvenile salmonids
- 3. Provide rearing opportunities for juvenile salmonids during summer months
- 4. Provide increased spawning opportunities for adult salmonids.

The installation of 7 LWM structures inherently provide habitat complexity and diversity. The structures diversify the stream channel by altering channel morphology which includes creating refugia pools during winter flows for juvenile salmonids and rearing opportunities in the summer months. Additionally, structures provide cover in the side channel allowing full use of the channel by juvenile salmonids. Gravel will be sorted during winter flows increasing spawning opportunities.

Evidence for these accomplishments will be documented by the post-implementation monitoring survey conducted in 2019. The longitudinal profiles indicate that the stream contains 11 pools less than 1 foot deep that span 210 feet of the 700 feet surveyed between the Lewis River Trail #31 and the Spencer Creek Alluvial fan. The 7 instream structures were designed to increasing the number and depth of these pools.

Cross-section profile analysis indicates that during winter flows Spencer creek is approximately 1.5 to 2.5 feet deep based on bankfull elevations.

Reach-wide analysis of Wolman Pebble Counts shows that Spencer Creek surface substrate is roughly 40% fines (<6.4mm), 40% spawning gravel and 20% cobble. In addition to increasing habitat diversity, structures are also expected to increase spawning gravel retention. Pebble counts were not conducted in the Spencer Creek alluvial fan where a very large structure was constructed just upstream on the bank of the North Fork Lewis River with a roughened channel excavated to encourage high flow scours and increase sediment transport through the alluvial fan, large wood roughness was also added to both sides throughout the entire fan. The lower reaches of Spencer Creek are ephemeral which limits fall spawning opportunities for adult coho salmon. These actions will increase the sediment transport capability of the lower ephemeral reach by concentrating high flows and will provide fall spawning opportunities for coho salmon.

In the coming years, we expect to see an increase in the abundance of gravel sizes appropriate for spawning and reduction of fines increasing spawning opportunities for reintroduced salmonids and improving intra-gravel survival and emergence of juveniles in the Lewis River Basin. Instream structures will increase the number of pools and residual depth providing greater rearing opportunities in the summer months and refugia from winter flows for juvenile salmonids.

Appendix A: Site Level Cross Sections, Pebble Counts and Photos

Raw data and additional site photos are available on request.

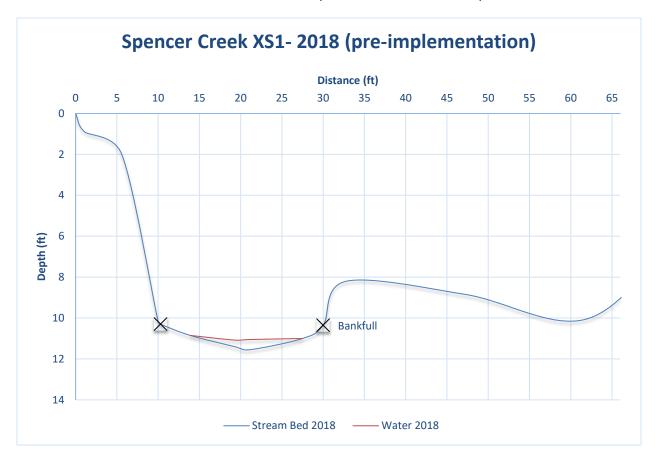


Figure 3: Cross section channel profile at proposed location of Structure 1 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a high terrace left bank and lower terrace floodplain right bank.

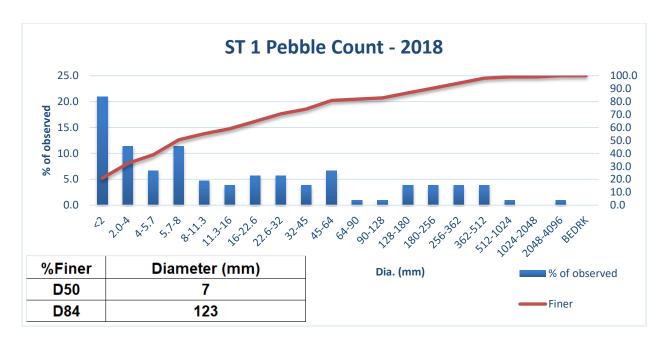


Figure 4: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 1 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines.



Image 5: XS 1 Looking Upstream



Image 6: XS 1 Right Bank to Left Bank



Image 3: XS 1 Looking Downstream



Image 4: XS 1 Left Bank to Right Bank

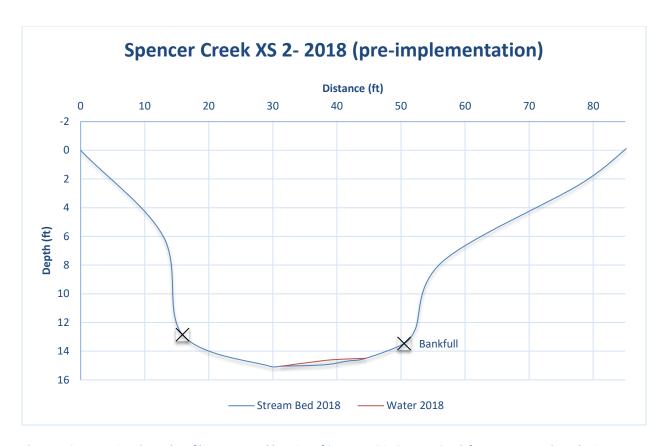


Figure 5: Cross section channel profile at proposed location of Structure 2 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a high terrace left bank and lower terrace floodplain right bank.

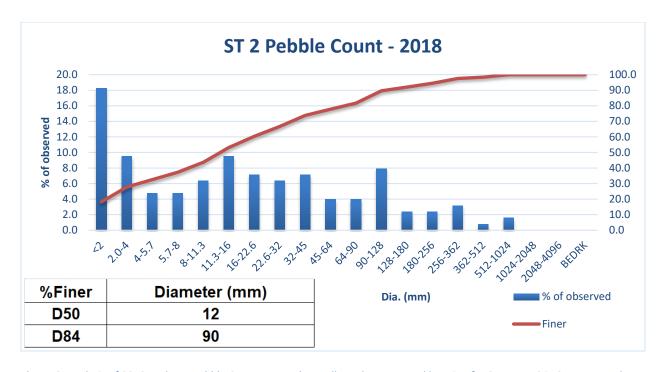


Figure 6: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 2 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines.



Image 10: XS 2 Looking Upstream



Image 8: XS 2 Right Bank to Left Bank



Image 9: XS 2 Looking Upstream



Image 7: XS 2 Left Bank to Right Bank

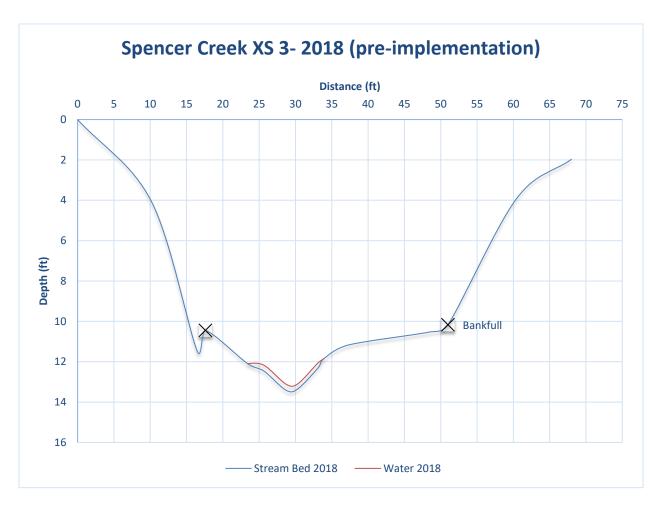


Figure 7: Cross section channel profile at proposed location of Structure 3 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a high terrace left bank and lower right bank with steep elevation increase to the floodplain.

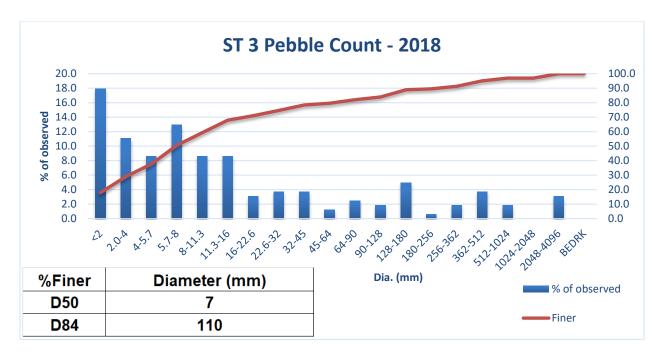


Figure 8: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 3 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines.



Image 12: XS 3 Looking Upstream



Image 13: XS 3 Right Bank to Left Bank



Image 11: XS 3 Looking Downstream



Image 14: XS 3 Left Bank to Right Bank

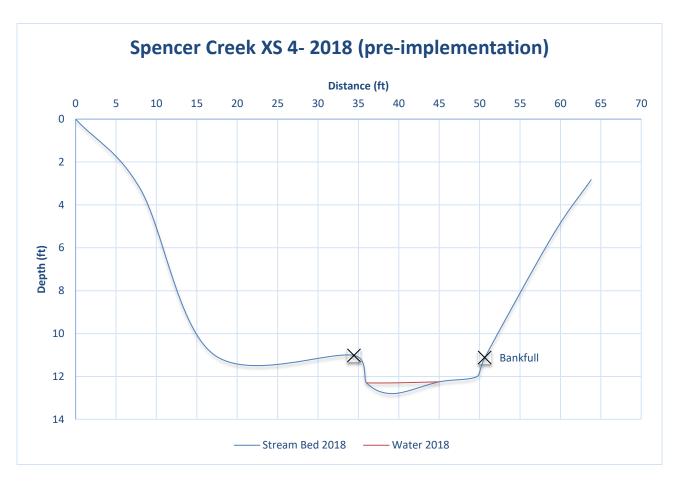


Figure 9: Cross section channel profile at proposed location of Structure 4 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a lower left bank with a steep elevation increase to the high terrace and lower right bank increasing in elevation to the floodplain.

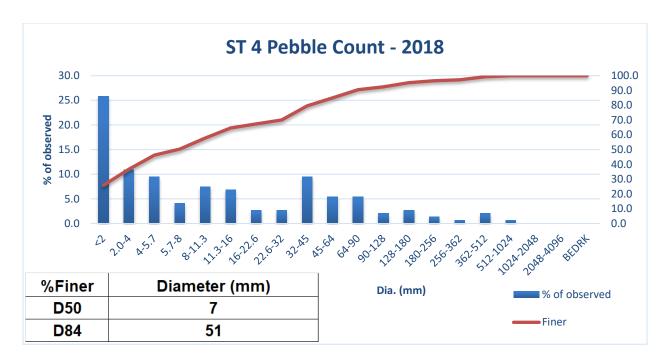


Figure 10: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 4 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines.



Image 15: XS 4 Looking Upstream



Image 16: XS 4 Looking Downstream



Image 18: XS 4 Right Bank to Left Bank



Image 17: XS 4 Left Bank to Right Bank

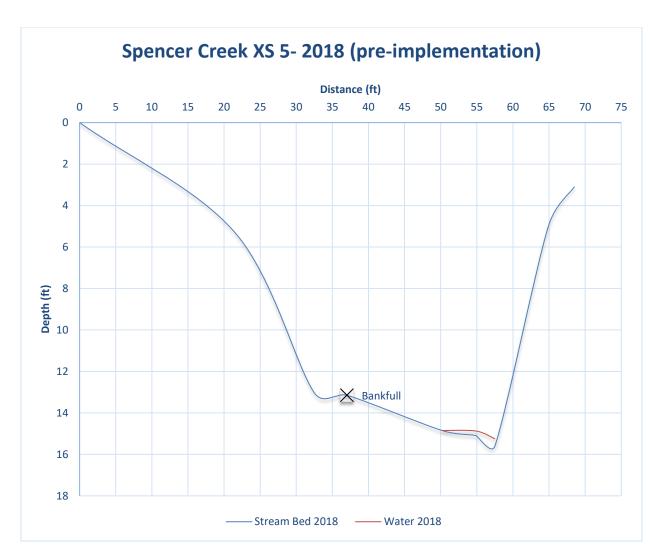


Figure 11: Cross section channel profile at proposed location of Structure 5 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a lower left bank increasing in elevation to the high terrace and a steep right bank increasing in elevation to the floodplain. Note right bank is undercut making REW and bankfull indeterminable.

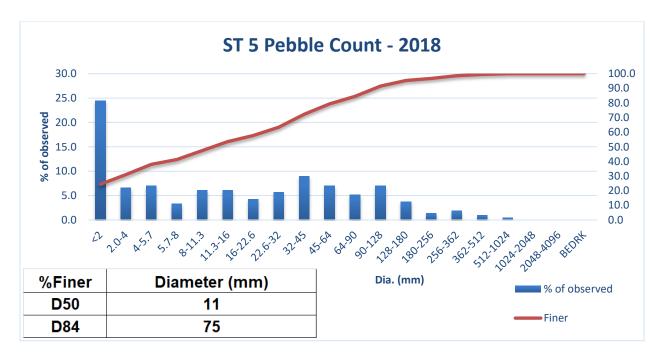


Figure 12: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 5 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines mixed with moderate levels of spawning gravel.





Image 22: XS 5 Right Bank to Left Bank



Image 19: XS 5 Looking Downstream



Image 21: XS 5 Left Bank to Right Bank

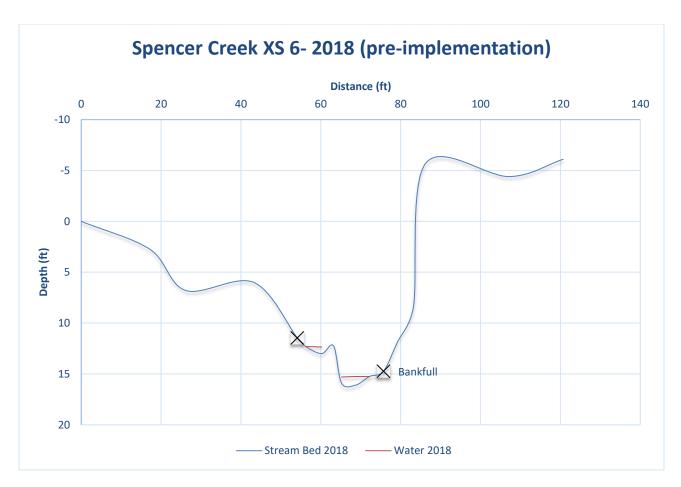


Figure 13: Cross section channel profile at proposed location of Structure 6 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a stepping left bank caused by in stream LWM increasing the accumulation of boulders and cobble and creating a unique channel feature as well as the channel elevation meeting the elevation of the high terrace while the right bank has a steep elevation increase to the high terrace.

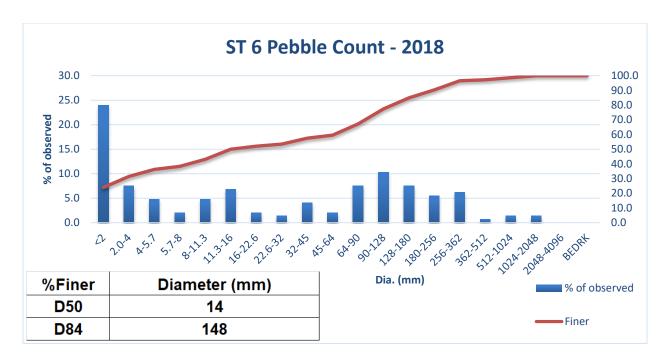


Figure 14: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 6 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines mixed with cobble.



Image 26: XS 6 Looking Upstream



Image 25: XS 6 Looking Downstream



Image 24: XS 6 Right Bank to Left Bank



Image 23: XS 6 Left Bank to Right Bank

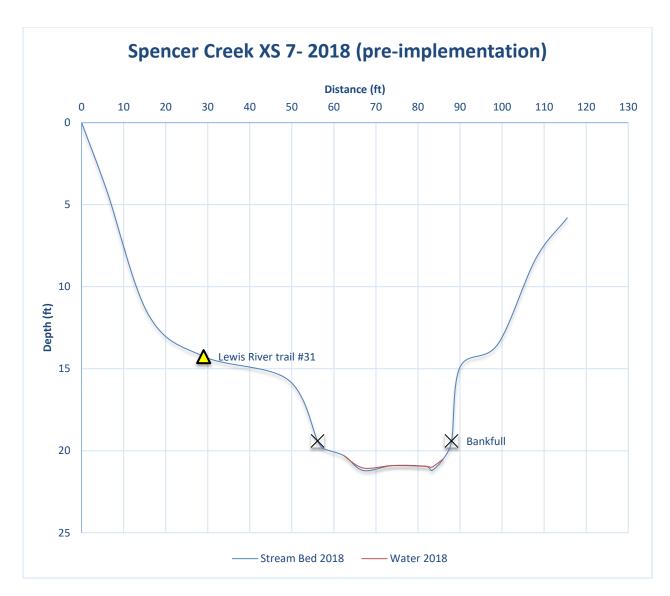


Figure 15: Cross section channel profile at proposed location of Structure 7 in Spencer Creek from survey conducted prior to habitat restoration implementation in 2018 demonstrating a low left bank resulting from channel elevation meeting the elevation of the high terrace while the right bank has a steep elevation increase to the high terrace.

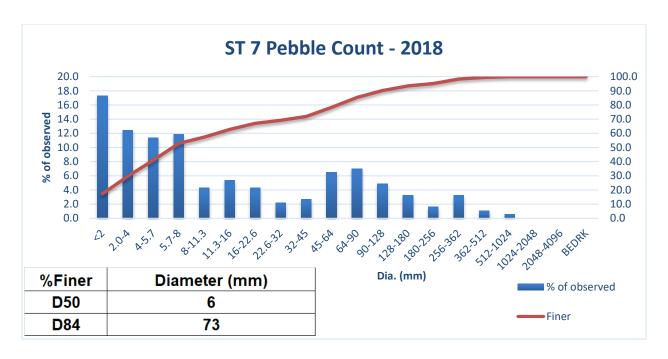


Figure 16: Analysis of 2018 Wolman Pebble Count survey data collected at proposed location for Structure 6 in Spencer creek prior to habitat restoration implementation indicating significant deposition of fines.



Image 28: XS 7 Looking Upstream



Image 30: XS 7 Right Bank to Left Bank



Image 27: XS 7 Looking Downstream



Image 29: XS 7 Left Bank to Right Bank

Attachment L is saved as a separate file.

Attachment L

Lewis River Wildlife Habitat Management Plan 2019 Annual Plan Attachment M is saved as a separate file.

Attachment M Wildlife Habitat Management Plan Annual Progress Report for Operation Phase 2018