



Lewis River Bull Trout (*Salvelinus confluentus*) Annual Operations Plan – Final

North Fork Lewis River – 2022

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

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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), United States Geological Service (USGS), Trout Unlimited, 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 2022, the following eight programs are proposed for action.

1. Swift Reservoir Survival (S) Estimate
2. Yale Tailrace Collection and Transportation
3. Swift Bypass Reach Collection
4. Fixed Passive Integrated Transponder (PIT) Antenna Arrays in Pine and Rush creeks, P8, Rush Creek hole of the Lewis River mainstem, Eagle Cliff pool, and Cougar Creek
5. Cougar Creek Spawning Population Estimate
6. Comprehensive Bull Trout Redd Surveys of Pine Creek, Pine Creek Tributaries P8, P10, Rush Creek. Exploratory redd surveys of the Muddy River
7. Partial weir with underwater video camera in Cougar Creek
8. Temperature monitoring of bull trout spawning streams in the upper Lewis River

A schedule of activities 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.

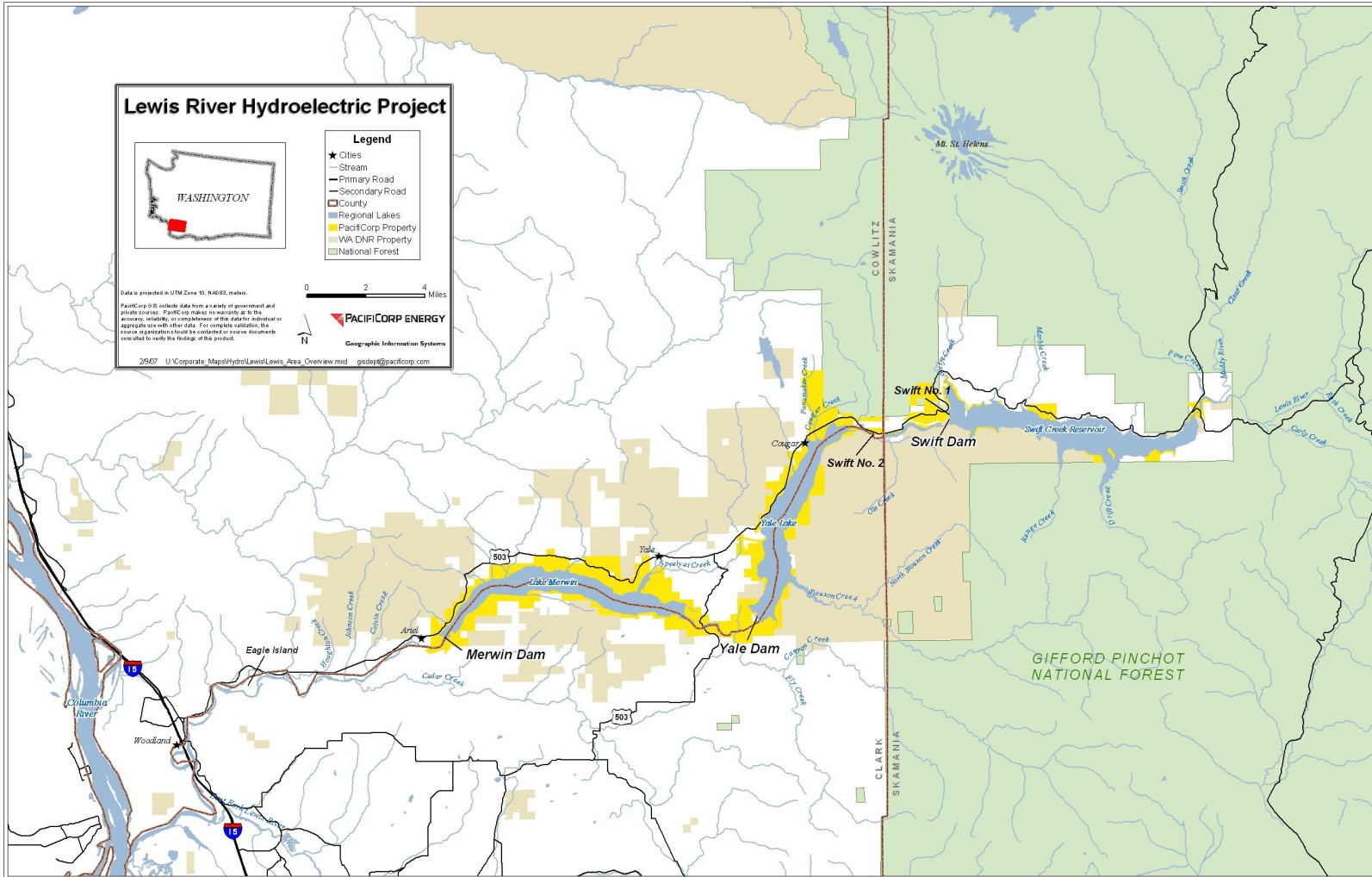


Figure 1.0 – Map of study area

II. PROPOSED MONITORING PROGRAMS

2.1 SWIFT RESERVOIR 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 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. 2022 was supposed to mark the next time these activities would occur.

Formal discussions amongst all members of the Recovery Team occurred on February 18, 2022, concerning the efficacy of the historical NOREMARK migration estimate and the validity of utilizing it moving forward as a monitoring tool in the basin. Questions regarding model assumption violations, the inability to generate an estimate from 2019 data within acceptable confidence bounds, and negative effects to bull trout from excessive handling, were brought forth and weighed against any perceived benefits. It was noted that similar population monitoring was also occurring concurrently with the NOREMARK migration estimate within the Lewis Basin (redd surveys, genetic estimation of breeder abundance) and were these adequate to generate the necessary population data trends. After much discussion, the Group decided with consensus to **move away** from generating a NOREMARK migration estimate every three years, but instead to focus on annual redd surveys throughout the basin as the tool to monitor population trends.

Though the Group decided to forego the NOREMARK migration estimate, it was still decided to continue to collect bull trout at Eagle Cliffs on a three-year cycle, albeit at a much reduced level, in the late Spring/early summer to continue to put PIT-tags out within the population. Keeping a portion of the population PIT-tagged would allow the continued assessment of temporal and spatial migration patterns, as well as assessment of Survival within the population from detections at stationary PIT antennas. PIT-tagging activities at Eagle Cliffs will follow the same previously established three-year cycle agreed upon by the Group in 2017, and will occur in 2022.

In 2022, to facilitate increased PIT-tags within the population, pre-migrant bull trout will be captured 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 2.4-1) 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. These activities will occur on a bi-weekly basis beginning May 15 and continue to July 15 for a total of five occurrences.

Upon capture of a bull trout, it is freed into a live well and assessed for any prior marks or tags. Recaptured fish will be interrogated for their unique tag code and the code recorded. All fish will be measured to their caudal fork. Maiden bull trout captures will be sampled for genetic material by means of a hole punch from the upper caudal lobe and the sample preserved in labeled vials filled with 95 percent ethanol. Maiden captures greater than 300 mm fork-length (FL) will be tagged with a 23 mm half-duplex PIT-tag in the dorsal sinus, while maiden captured bull trout 90 mm to 299 mm fork length will be tagged with a 12 mm FDX PIT-tag, also in the dorsal sinus.

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.

Annual Swift Reservoir Adult Bull Trout Survival (S) Estimate

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

Swift and Yale Reservoir Genetic Estimation of Breeder Population (Nb) Evaluation

Evaluation of Genetic Estimation of Breeder Population was put on a 3-year cycle starting in 2018. 2020 marked the first year of this analysis since it was put into this temporal cycle. A check in every 3rd year is expected to be sufficient in eventually assessing Effective Population as the temporal cycle will never skip a generation. Age 0 juvenile bull trout samples from previously established areas within Pine, Rush and Cougar creeks (Figures 2.1-2 through Figure 2.1-4) will continue to be collected on an annual basis to further relative abundance trend data as well as have samples on hand to retroactively analyze if the need arises. 2023 is the next year this laboratory analysis will occur. Methods for **relative abundance data collection** in 2022 are below.

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. Captured bull trout greater than 100 millimeter fork length will also be tagged with an 11 millimeter PIT tag via syringe insertion.

Also, during juvenile bull trout collection, all captured coho juveniles 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.

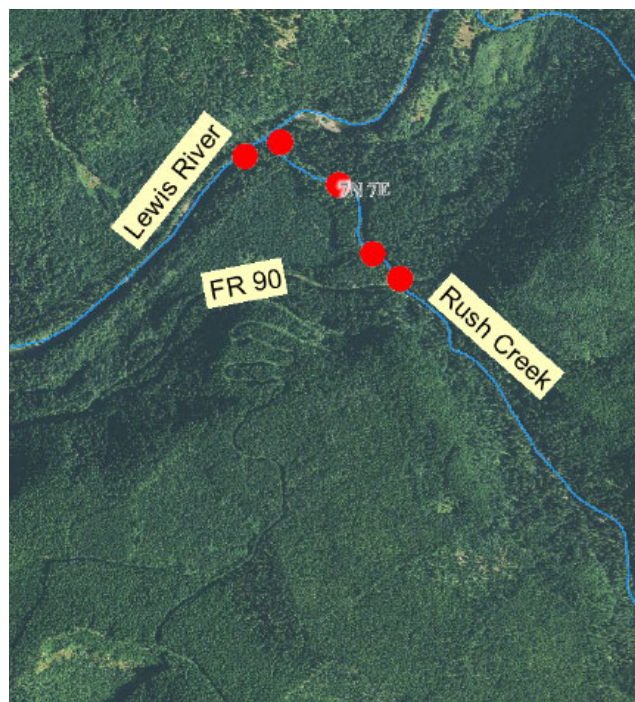


Figure 2.1-2. Juvenile bull trout electrofishing sites within Rush Creek.

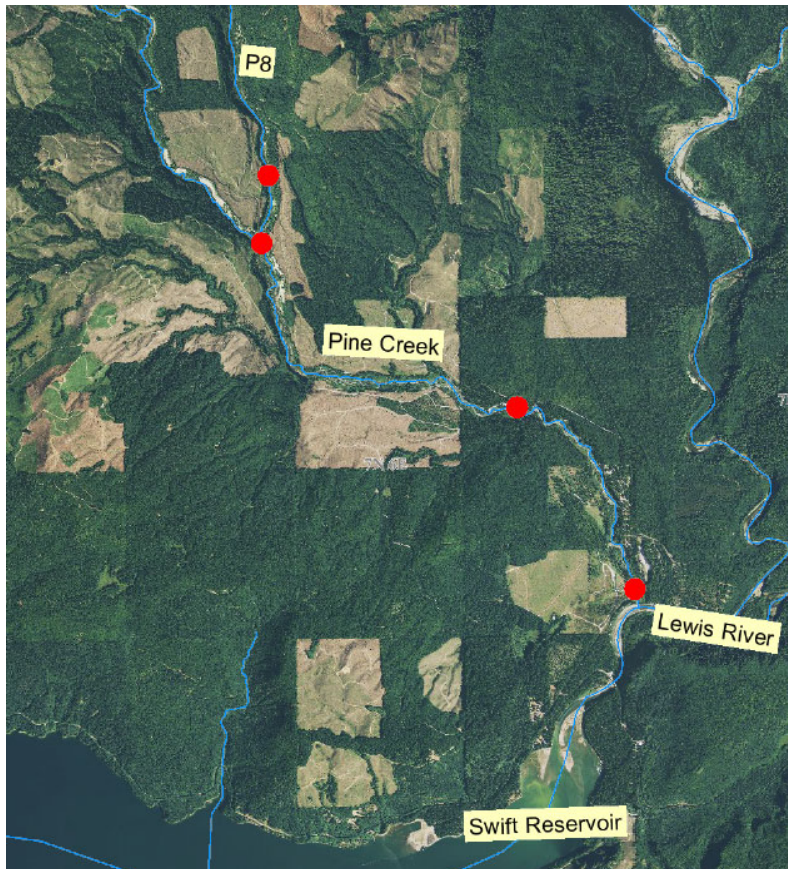


Figure 2.1-3. Juvenile bull trout electrofishing sites within the Pine Creek drainage.

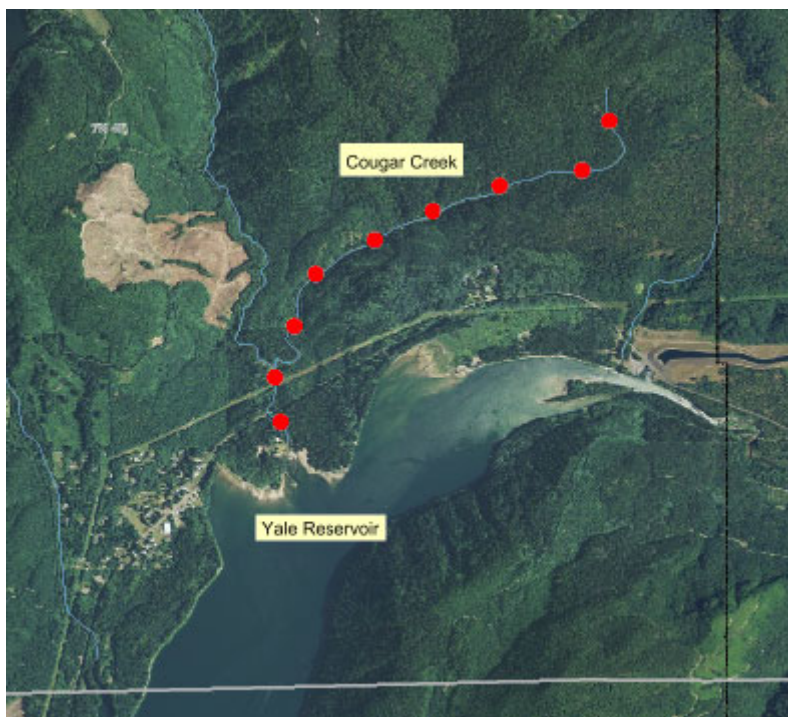


Figure 2.1-4. Juvenile bull trout electrofishing sites within Cougar Creek.

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 12 millimeter PIT-tag is inserted into the dorsal sinus, 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 2022 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 2022 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

Currently 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, 238 bull trout have been captured and PIT-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.

Though the fish transportation aspect of these activities will be on-hold, bull trout in the vicinity of the Swift Bypass Reach are still proposed to be actively captured and PIT-tagged during the summer months of 2022. PIT-tags will help to facilitate the identification of individual bull trout at the Cougar underwater video camera, add a quality control measure, and give the ability to assess delay caused by the weir.

To capture bull trout from the Swift Bypass Reach, monofilament tangle nets (6.5 millimeter stretch) are deployed in strategic locations and allowed to soak for up to 10 minutes. Strategic hook and line techniques are also utilized early in the season to maximize catch rates. Once a bull trout is captured and freed of the netting into a live well, biological information is gathered, and it is scanned with a PIT wand. The PIT code is recorded from previously captured bull trout.

All maiden captured bull trout are sampled for genetic material and the tissue preserved in labeled vials filled with 95% ethanol. Maiden captures greater than 300 mm fork-length (FL) will be tagged with a 23 mm half-duplex PIT-tag in the dorsal sinus, while maiden captured bull trout 90 mm to 299 mm fork length will be tagged with a 12 mm FDX PIT-tag, also in the dorsal sinus.

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.

These activities will occur May-July for a total of six sampling events.



Figure 2.3-1 Area map showing location of bull trout capture sites within the Swift Bypass Reach.

2.4 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 Eagle Cliff pool and Rush Creek pool of the upper Lewis River mainstem in 2022 (Figures 2.4-1 and 2.4-2).

Due to greater dependability, efficiency, ability to read both full and half-duplex tags, and longer deployment times from lower power consumption, 1.6 meter diameter Biomark® submersible antennas will continue to be utilized at PIT antenna sites. 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, to capture the entire bull trout spawn time-frame.

Each stream PIT antenna system will consist of one to five submersible PIT tag antennae, however many necessary to attain as close as possible stream-width coverage. 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 fully self-contained 1.6m diameter Biomark® submersible antenna. This type of antenna is wheel-shaped and made of rigid polyvinyl chloride (PVC). The antenna is designed to lay flat on the bottom of the stream, and when lying flat rises a total of approximately 20cm off the stream bottom. The antenna is fully self-contained with no leads or wires running to the stream bank. The attached submersible lithium iron phosphate batteries

provide approximately one month of continuous operation. Nominal read-range of both full and half-duplex PIT tags with this type of antenna is 30-45cm depending on tag size. The antenna also comes equipped with an internal test tag that verifies operation every hour, on the hour when the antenna is in operation. Each antenna will be anchored to the stream bottom via a wire lead connected to a piece of rebar driven into the stream bottom, as well as large rocks, with a small safety wire attached to an object on the stream bank to catch the antenna in case of it breaking free during a high flow event.

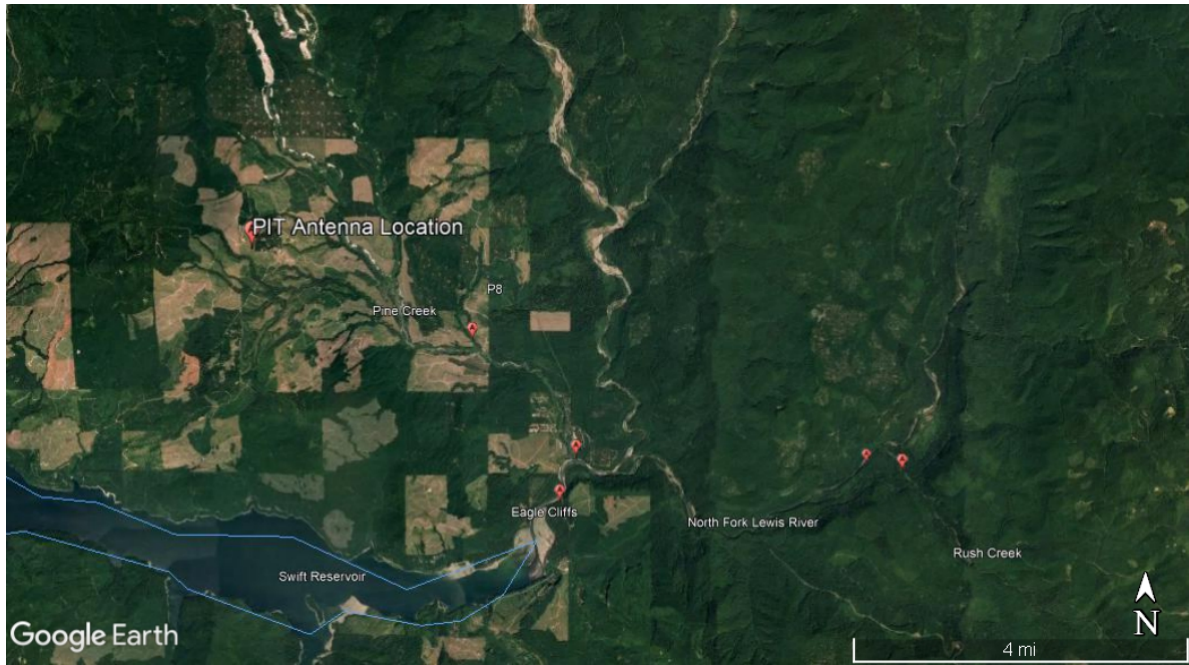


Figure 2.4-1. Fixed PIT-tag antenna stream sites upstream of Swift dam planned for 2022



Figure 2.4-2. Fixed PIT-tag antenna sites downstream of Swift Reservoir planned for 2022.

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 2022 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 Global Positioning Satellite (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 TRIBUTARIES P8 AND P10, PINE CREEK MAINSTEM AND RUSH CREEK; EXPLORATORY SURVEYS OF THE MUDDY RIVER

The Utilities propose to continue bull trout redd surveys within P8 (Figure 2.6-1) in 2022, 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.

Also in 2022, during the bull trout spawn timeframe of September and October, redd surveys of all or a portion of the Muddy River will be conducted to assess bull trout spawning usage within this watershed. Duration, frequency, and geographic survey area within the Muddy watershed of these surveys was still in development at the time of submission of this Plan.

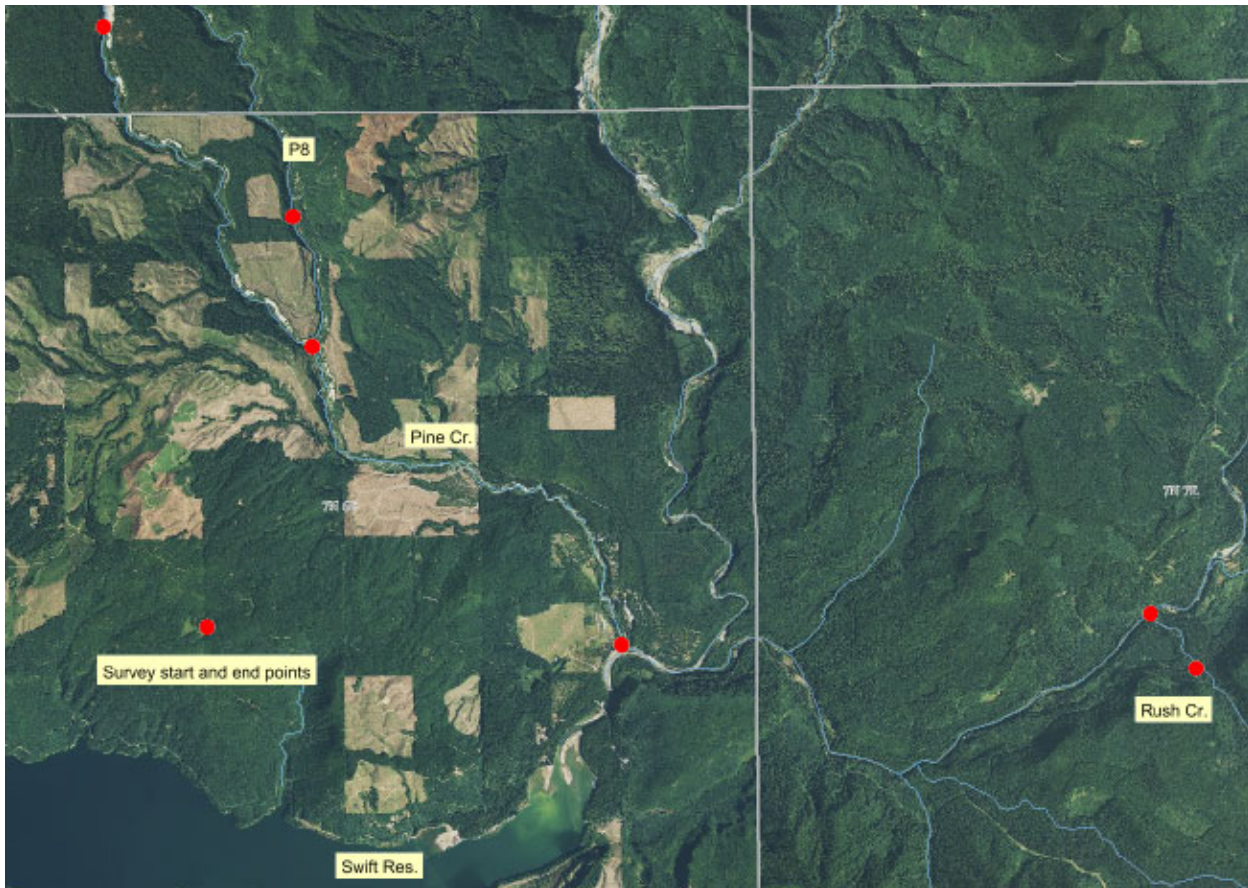


Figure 2.6-1. Bull trout redd survey reaches within the Pine Creek system and Rush Creek for 2022.

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 similar to the weir operated at this location in 2019, 2020, and 2021 will again be installed within the creek the second week of July and attempt to stay in operation through October 31, 2022. 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 floating resistance weir consisting of polyvinyl chloride pickets (PVC) 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 one stream spanning floating resistance panel, with a swim-thru box located near the stream margin, outside of the thalweg. The underwater video camera will be housed in this swim thru box. The weir will divert migrating bull trout to 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 2022.

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.

III. Reporting

An Annual Report detailing all activities and corresponding data gathered concerning this 2022 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 2023.

IV. References

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V. Agency Comments