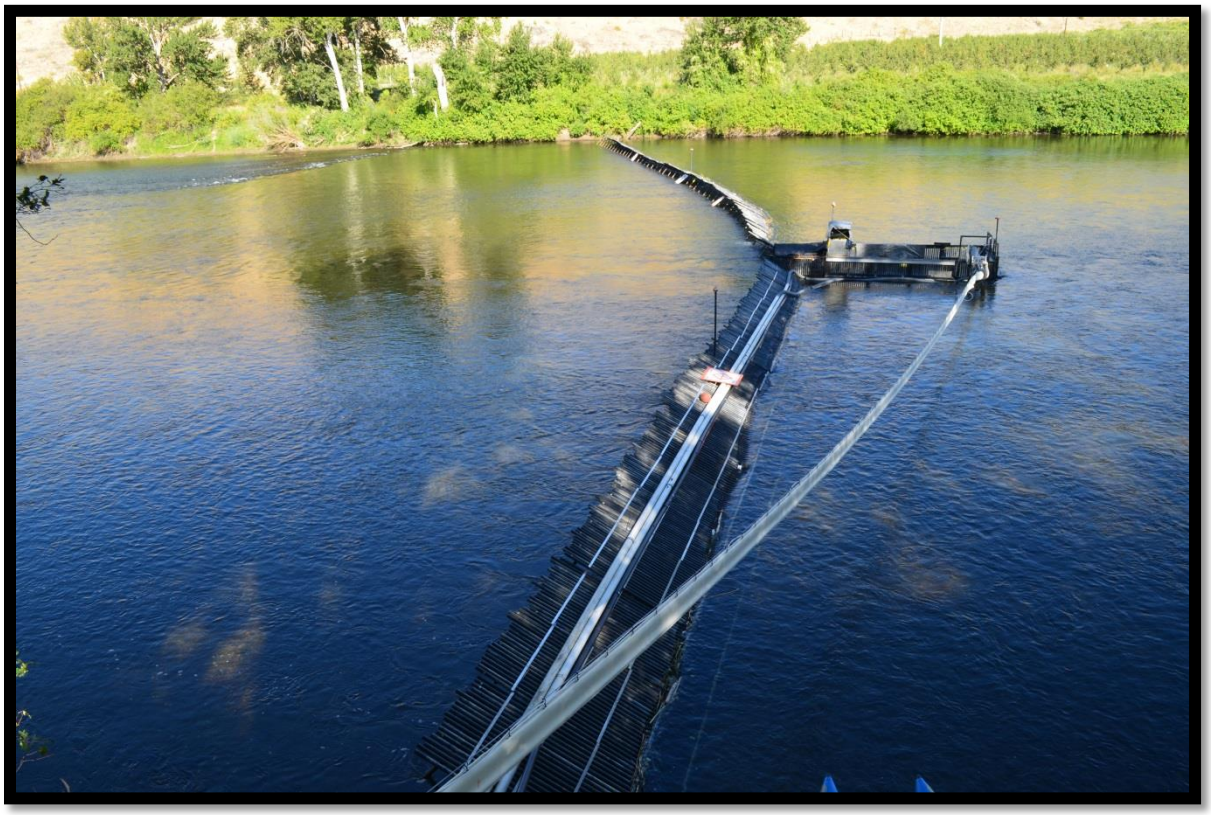
The Chief Joseph Hatchery Program

Okanogan River Adult Fish Pilot Weir
2019 Actions & Operations Plan



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Primary changes to the 2019 Okanogan River Adult Fish Pilot Weir Actions & Operations Plan compared to previous years operations plans

- Installation of two deflection wings from the side of the trap box to provide additional water through the entrance chute

ACKNOWLEDGEMENTS

The Okanogan Adult Fish Pilot Weir is managed by the Colville Tribes Fish and Wildlife Program and is jointly implemented through a collaborative agreement between the Chief Joseph Hatchery Science Program and the Bonneville Power Administration. The Colville Tribes Business Council and its Natural Resources Committee provides policy guidance and oversight.

The Confederated Tribes of the Colville Reservation (Colville Tribes, Tribes, or CCT) wish to thank the following entities and people for their contributions to this report and their support of the Okanogan adult weir pilot project: Ed Zapel, Pacific Engineers, Jeff Grizzel, Tom Dresser and David Duvall, Grant County Public Utility District (GPUD), Dave Roberts, Maureen Kavanagh, Peter Lofy and Lori Bodi, Bonneville Power Administration (BPA), and Jeff Korth, Connie Iten and Carmen Andonaegui from the Washington Department of Fish and Wildlife (WDFW).

CCT Fish and Wildlife Program participants include: Randy Friedlander, Kirk Truscott, Matt McDaniel, Mike Rayton, Charles Brushwood, Charissa Eichman, Pete Palmer, John Mayer, Therilyn Williams, Michelle Campobasso, Cindy McCartney and Billy Gunn.

Finally, during 2019 testing of the weir, technical and management representatives from state and federal agencies and the Okanagan Nations Alliance (ONA) have the opportunity to provide input for the project. Their comments and interest contribute significantly to the development of this plan and will guide activities during 2019 and beyond. Additional individuals and entities are also acknowledged by reference throughout this document.

BACKGROUND

The Okanogan adult fish pilot weir, hereafter referred to as the "weir", is a key component of the Chief Joseph Hatchery Program (CJHP) and the goals and objectives of the Tribes' Fish and Wildlife Program. Continued operation and improvements to the weir are a central part of the Tribes' strategy for conservation of summer/fall Chinook Salmon (*Onchorynchus tsawytscha)* and the implementation of the CJHP. Research, monitoring, and evaluation activities during previous years of weir operations have led to improvements in design elements and trapping protocols. Weir test results are essential for updating CJHP key assumptions, operations, and design of the weir.

This plan provides operational detail that will continue to evaluate the need, value and utility of this pilot weir and/or assess the need for a potential future permanent structure. The primary goal of the project is to have a functional weir capable of meeting program objectives through 2019 and beyond. If a conforming structure can be achieved through incremental improvements and optimization, a permanent weir designation may be made. However, if testing determines that a different design approach is necessary, the working weir must still meet CJHP biological objectives during the subsequent scoping, environmental compliance, and budget and construction phases.

To ensure regional continuity and consistency with other hatchery and fish management programs, we continue to foster involvement of the upper Columbia Public Utility Districts and state, federal and other tribal (i.e., First Nations) fish experts and engineers.

Finally, this project is part of the CJHP and was initially funded through an Agreement between GPUD, BPA, and the CCT (Agreement #: 430-3128 – Amendment 3). The Operations Plan will be updated annually. Results and plans for 2019 and beyond will be presented at the 10th Annual Chief Joseph Hatchery's Program Review and in each year's CJHP Annual Program Report.

OBJECTIVES

The primary objective for weir operations in 2019 is to test the weir as an adult Summer/Fall Chinook Salmon management tool, to meet broodstock needs of the CJHP, and to meet pHOS and PNI targets for the population. CJHP Monitoring and Evaluation staff will collect data to assess weir effects on the immediate environment and on target and non-target species.

The fate of fish captured in the weir trap consists of the following:

1. Hatchery-origin Chinook will be; (a) retained to reduce escapement of hatchery fish and reduce pHOS and increase PNI to achieve population goals[1] (b) retained for use in Chief Joseph Hatchery segregated or integrated program broodstock if needed; or (c) released upstream of the weir for continued migration to the spawning grounds if overall run size is relatively low (<5,000) and pHOS is also low (<20%)[2].
2. Natural-origin Chinook will be; (a) released upstream of the weir for continued migration to the spawning grounds; or (b) retained for use in Chief Joseph Hatchery integrated program broodstock.
3. Non-native species will be killed, all other non-target species, including steelhead and Sockeye, shall be released unharmed.

A key objective of this project during 2019 operations is to refine the trap configuration. This includes continued testing of weir configurations, fish removal and handling methods, and data collection methods. This means that the weir should be operating in a manner capable of helping meet the CJHP's biological and brood-take goals during the period 2019-2020 as work continues on design, permitting, funding, and construction for a permanent weir.

[1] Hatchery Chinook removed at the weir that are of edible flesh quality will be utilized for tribal subsistence and/or ceremonial use similar to other hatchery operations that remove surplus hatchery fish.

[2] Regressions of past years conversion from Wells Dam to the spawning grounds, in-season PIT tag detections at the lower Okanogan array, and the purse seine catch will be used to inform decisions about the appropriate rate of hatchery fish removal at the weir.

1. INTRODUCTION

This document provides a guide to conducting research, monitoring and evaluation actions and developing long-term standard operating criteria for the Okanogan adult fish weir. Daily operations of the weir and other supporting activities are also described.

This program has been developed by the Colville Confederated Tribes Chief Joseph Hatchery Program. Elements of the program have been refined in collaboration with CJHP Monitoring & Evaluation (M&E), Hatchery Production and the CCT Selective Harvest program. Past funding and support for this project came from the Grant County Public Utility District and Bonneville Power Administration through 2013. Current O&M and M&E funding is provided by Bonneville Power Administration. The Washington Department of Fish and Wildlife and the National Oceanic and Atmospheric Administration (NOAA Fisheries) are involved in permitting and general aspects of the program developed in coordination with the Northwest Power and Conservation Council, the Bonneville Power Administration and the Hatchery Science Review Group.

The CJHP will oversee the planning, construction and testing of a weir on the Okanogan River, located between the town of Malott and Chiliwist Creek, approximately 16 river miles from the confluence of the Okanogan and Columbia Rivers. The 2019 season's test will allow the CJHP to assess the feasibility of constructing and operating a permanent weir in the proposed location and to test potential operation and maintenance procedures and monitoring and evaluation protocols.

1.1 Goal of the Weir Project

The Okanogan adult fish weir project is used by the CJHP to collect brood to meet Summer/Fall Chinook production objectives, reduce the proportion of hatchery Summer/Fall Chinook escaping to the spawning grounds and monitor and evaluate Chinook populations in the Okanogan River Basin. For example, the annual CJHP production plan is not based on the ability to meet the same fixed smolt output or the same escapement goal each year; it is based on the program's ability to meet biological goals for the population and validate key assumptions within a program-wide analytical structure. For these reasons, the weir is operated in a manner where actions are based on testing and each year's activities are monitored and evaluated in an adaptive management framework.

The CJHP leads the effort to assess the feasibility of the weir, its biological and physical effects and the management of the weir contracts, engineering, permitting and reporting. Additional activities include research, monitoring and evaluation for safe and effective fish capture, handling, release, and impacts to non-target species. Hatchery Production and Selective Harvest staff participate in developing significant portions of the project, especially protocols for trapping, capture and transport actions and the configuration and overall evaluation of the weir to meet the CJHP's biological targets and evaluating the key assumptions used in annual review and decision processes.

This document is intended to describe the Operations and Activities for 2019 and thus provides information on what will occur to meet our goals and objectives; examples include:

1. Conduct annual pilot testing to arrive at a weir configuration that is most effective at directing and trapping target fish while minimizing passage delay for non-target species;
2. Provide data sufficient to inform decisions regarding a permanent weir;
3. Provide data sufficient for environmental compliance reviews and for future funding of a permanent weir;
4. Refine protocols and methods for live capture, live release of non-target fish;
5. Refine protocols and methods for capture of summer/fall Chinook for use in meeting adult fish management goals (i.e., biological targets for pHOS and PNI) and helping to meet brood stocking needs targeting the Okanogan River stock;
6. Collect sufficient environmental and project data to assess the effects of the weir.
7. Utilize the weir during the summer/fall Chinook run to assess passage timing, PIT tag detection, run size, sex and origin composition, and;
8. Provide information to assess the utility of the weir (i.e., how effective is the weir at meeting CJHP program goals by providing information to update Key Assumptions and other Biological Targets described in the CJHP's Implementation Plan and Annual Program Reviews and Annual Reports.

1.2 Technical Oversight Group

An informal Technical Oversight Group (TOG), comprised of representatives of the CCT, WDFW, and NOAA Fisheries will collaborate to implement the adaptive management aspects of the weir project. More specifically, the TOG will evaluate impacts of the weir project on aquatic resources and may provide timely recommendations to the CCT on project modifications to safeguard aquatic resources and maintain compliance with applicable permits and authorizations. Such recommendations may include, but are not limited to, mitigation measures, termination of weir operations, resumption of weir operations, alternate approaches to accomplishing the goals of the weir project, and modification to numerical adaptive management criteria. A standard protocol for communicating, evaluating, and resolving potentially critical situations through the TOG is presented in Section 5.1. Further, the TOG will be kept abreast of regular activities including notification of weir installation, the beginning and end of trapping periods, and of general observations regarding implementation of the plan. CCT will chair the TOG and manage communications with the group. TOG membership for 2019 is listed in Appendix D.

2. GENERAL SPECIFICATIONS

2.1 Species and Timing

Target species for capture: Summer/Fall Chinook

Non-target species: Anticipated bycatch includes Mountain Whitefish, Carp, Sockeye, Smallmouth Bass, Suckers, Northern Pikeminnow and steelhead.

Timing: In-stream structure in place for up to July-September, with deployment and removal dependent on environmental conditions, biological considerations, and staff availability. The

weir will be operational up to 24-hours per day, seven days per week during suitable environmental conditions (see Section 3.7).

Target dates:

- Weir installation: Post-freshet (≤ 2,500 cfs), in 2019 we anticipate mid- to late - July as the earliest feasible installation date.
- Begin trapping: Post-thermal barrier (stream temperature < 22.5^{O}C; generally mid- to late August or early September with potential short periods(1-3 days) sooner if there is a temporary breakdown of the thermal barrier;
- Water discharge: Target installation at ≤ 2,500 cfs. Operate to a maximum of approximately 3,000 cfs. Both targets to be confirmed in the field based on the ability to safety service the weir and process fish.
- Fish migration timing: Target weir operation for trapping when Chinook are actively migrating up the Okanogan from the Columbia. To be determined based on catch at the purse seine, PIT detection at the lower Okanogan array, visual observations at the weir site, and underwater video monitoring at the weir site.
- Water temperature: Migration timing will be influenced by water temperature. Temperatures less than 21^{O}C usually promote active migration, while higher temperatures will slow or stop migration.
- Weir removal: 30 September

2.2 Standard Operating Configurations

1. Weir covers most of the wetted width of channel. A block net or flexible side apron will be used on the West side (river right) within approximately 20 feet of shore to allow for boat portage around the weir.
2. One and a half and two inch picket gap panels are used on the east side (river left) wing of the weir to facilitate passage of non-target species. One inch (1") picket gap panels are used on the west side of the trap. Trap entrances consist of one or two 25" gates, each with an adjustable fyke on the downstream side of the trap. Trap gates can be temporarily closed to ensure retention of fish after they enter the trap.
3. If handling and processing of trapped fish causes fish to escape the trap through the downstream trap entrances then the gates will be closed during trap processing.
4. If additional attraction flow is needed through the migration corridor of the weir, install strategically placed solid barrier such as a tarp on the bank side panels of the weir, or additional picket panels to direct flow through the trap and entrance chute, or additional 1" panels upstream of the weir to direct more flow towards the trap.
5. If additional attraction flow is needed through the trap, strategically remove pickets and/or open the upstream gate. Gates will be closed simultaneously to trap fish.
6. If additional attraction flow is needed through the trap, well water will be added at the trap door.
7. If gilled/stuck fish occur in panels, adjust the gap size appropriately as based on observations to prevent further instances of gilling. Any gilled fish will be released by pulling out adjacent pickets (rather than pushing/pulling fish through the pickets).
8. Flow deflector panels may be placed on either side of the weir to reduce water

velocity and prevent/minimize erosion.

9. The Whooshh™ fish transport system may be installed prior to broodstock collection. A 160 foot long tube hangs over the river and is connected to an accelerator on the east, upstream side of the trap and at a mobile trailer fitted with a decelerator, tower, tube reel, and blower housing. A diesel generator provides remote power to run the pump that generates power for the pneumatic portions of the system. The mobile trailer and generator are located above the OHWL.
10. The Whooshh™ system airlines are supported by steel tripod frames with a support bracket that will rest on the river bed and are stabilized by gravel-filled burlap sacks (see Sheet 30, Whooshh Tube Support). These frames are similar in design to our current weir tripod panels.

Figure 1. The configuration of the Whooshh™ tube system and the Okanogan weir trap. The tube is connected to the east, upstream side of the trap box and a stationary trailer on the east shore. Adult fish that are transported through the tube are directed into a 300 gallon tanker truck.

2.3 Weir Panel Failure Mechanism

Each weir picket panel is designed to support a working load of up to one foot of unbalanced hydraulic head differential, such as might occur if the pickets were clogged with debris. Manual cleaning will be the usual method of removing such debris, by raking up and over the top of the panel or by removing individual pickets as necessary until debris clears the panel. In the event that the panel cannot be accessed manually, a failure mode controlled collapse of the panel has been designed to permit the panel to settle to the stream bed, which will sweep any remaining debris from the picket surfaces without damaging or destroying the panel itself.

The failure mode is designed into the rear leg tripod joint by means of a hitch pin connection. In normal operation, the hitch pin is not overloaded and the panel stands as designed, with the rear leg capable of rotating upstream or downstream as needed to install the panel in a stable configuration. When the hitch pin fails under excessive load, the rear leg connection will be released and the leg will be driven up and out of the connection joint by the weight of the panel and the causative hydraulic load, allowing the two front legs supporting the pickets and picket panel to settle to the stream bed. The rear leg, which is safety-chained to the two front legs, will fall out of the way, but still be attached to the panel so that recovery is straightforward and no damage to the assembly can occur. The panel would be raised back into position and secured by simply replacing the hitch pin once the panel is raised and the rear support leg is repositioned under the connection joint.

3. DAILY ACTIVITIES

3.1 Maintenance

Purpose: After the Okanogan weir has been installed, maintenance becomes important to assure that the weir remains functional and in accord with permitting requirements while minimizing its environmental influence and impact on recreation. Outlined below are several activities that must be completed to maintain the weir. Maintenance activities will happen on a daily basis unless otherwise noted.

1. Most of the activities can occur simultaneously by attendants visually inspecting the weir as they wade along the upstream and downstream sides of the weir and along the trap. While attendants are inspecting the weir, the following actions will be taken:
    a. Damaged pickets (2" ABS pipe) will be replaced and pickets that have risen off the river bottom will be forced into the substrate again.
    b. Warning signs, buoys, and lights that are affixed to the weir must be in place, visible, and functional. Nonfunctional or missing items will be replaced (dead batteries, etc.), broken zip-tie connections will be reattached, and if visibility has been affected, it will be restored.
    c. Adjacent weir panels and trap panels must abut. Gaps between panels will be patched with metal grating, filled with gravel-filled burlap sacks, or panels will be repositioned to reduce the gap so that the probability of fish passage between weir panels becomes reduced.
    d. Weir and trap panel zip-tie connections must be secure. In the event of broken or weakened panel connections, new zip-ties will be applied.
    e. Weir and trap panel inclination and shape should remain consistent. If weir or trap panels have moved (due to river flow, debris washing up on the weir, etc.), they will be restored to their original positions.

2. Occasionally[3], recreational boat traffic will require assistance during the act of weir passage. In the event of recreational boaters needing assistance, the responsibilities of weir attendants are as follows:
    a. Attendants will provide assistance in weir passage to recreationalists making passage around the weir.

[3] Recreational boaters/tubers have only been observed passing the weir 14 times in 7 years of pilot weir operation.

b. Attendants will provide information as to the weir project to recreationalists or visitors to the weir.

3.2 Pollution Control Plan

Purpose: Protect aquatic and adjacent upland environment at the weir from deleterious substances or conditions.

At all times during installation and operation of the weir and trap facility, the CCT will adhere to the water quality standards required under the WAC-173-201A Water Quality Standards for the State of Washington. Specifically, no petroleum-fueled equipment will be refueled within 150 feet of surface water on the site, and an appropriate spill kit will be provided at a prominent and convenient location where it is immediately accessible in the event of a spill. All machinery or equipment to be used near or in the water will be approved for such use, and will be maintained in proper order to prevent spills or leaks of petroleum-based fluids into surface waters. Any heavy equipment operated within the Ordinary High Water Line or within 10 feet of the active stream channel will be provided with biodegradable hydraulic fluids, and kept in clean working order with no leaks. At the end of each workday, all petroleum-fueled equipment (except boats) will be removed from exposure to surface water to a location at least 150 feet away from the active stream channel.

The only waste anticipated at the site is packaging materials, which will be recycled or disposed of at the local waste management facility.

Shoreline and river bank stability and erosion due to river flow altered by the weir will be monitored daily to ensure the impact of the weir remains minimal. If necessary, panels with 1-inch spacing may be deployed near the upstream side of the weir to deflect water away from the east bank of the river (Figure 2). The banks on the upstream side of the weir will be stabilized with geo-textile cloth during the period of weir operation Additionally a ramp and stairs will be installed upstream and downstream of the weir during deployment for staff accessibility to the river.

Figure 2. The deployed weir in 2014. The water deflecting panels are visible in the foreground.

A sediment plume during deployment has not been observed in past years. Nevertheless, turbidity shall not exceed 5 NTU's above background levels at 200 feet downstream of the project location. If the differential exceeds the allowable range, the particular construction activity that is responsible for introducing turbidity will be terminated until mitigating measures can be developed and implemented. A daily log of turbidity measurements will be updated and maintained on site (Datasheet #9)

3.3 Debris & Sediment Removal Plan

Purpose: Provide a mechanism to minimize the accumulation or suspension of debris and sediment in proximity to the weir.

Debris Removal

1. Macrophytes and small "beaver" branches are the most substantial form of debris at the weir.
2. The weir will be cleaned as needed, and no less than once per day. While cleaning the weir, attendants will wade along the weir and the trap and take the following actions:
    a. All natural debris that has accumulated on the upstream side of the weir or the trap will be removed and passed to the downstream side of the weir.
    a. Any garbage impinged on the weir will be removed and placed in a proper waste bin for later disposal off site.

b. All underwater cameras, lights, and cables will be cleaned, and securing connections will be examined to ensure functionality.

Sediment Removal

No sediment removal is anticipated for this project. Operation of the weir has never caused a need for sediment removal as all sediment passes through the site as fully suspended load. If hydraulic eddies form in proximity to the weir, it may be necessary to redistribute or re-suspend excessive bed sediments after high flow events (which are not anticipated to occur during the period of operation).

3.4 Fish Injury and Mortality

Purpose: To evaluate the effect of the weir on fish health.

1. During weir cleaning and debris removal, and opportunistically throughout the day, weir attendants will record any instances of fish that are impinged (forced up against) the upstream side of the weir, gilled between pickets, or washed up on the weir. The following data will be collected:
    a. Date and time of the detection
    b. Fish will be identified to species
    c. Any apparent injuries will be noted
    d. Condition of the fish will be recorded (gilled between weir pickets, impinged between weir pickets, washed up on weir, or other)
    e. Sex and gonad maturation level, based on a visual qualitative assessment will be noted for salmonid species if the carcass condition condones it.
    f. Other notable information will be recorded
2. Additionally, the following information will be collected on Chinook and steelhead carcasses:
    a. Fork Length
    b. POH
    c. Coded wire tag presence/absence (for coded wire present fish, snouts will be collected for later extraction and reading of the tag).
    d. PIT tag interrogation
3. After recording the relevant data for a fish carcass, it will be passed downstream. To avoid double counting during other observation activities, the tails will be cut off of all fish carcasses passed below the weir.

3.5 Water Temperature Assessment

Purpose: To evaluate whether fish trapping and handling can be conducted.

Water temperature is recorded continuously by the USGS water data station at Malott, WA. Due to its proximity to the weir site, USGS-provided water temperature data from the Malott station will act as a surrogate for water temperature at the Okanogan weir. Comparisons were made in 2012 and 2013 which confirmed the assumption that water temperature is the same at Malott as it is at the weir. The weir and trap will be operated through 22.4^{o}C (72.3^{o}F). When water temperature meets or exceeds 22.5^{o}C (72.5^{o}F), trapping will cease and weir pickets at 2 or more panels on each side of the trap will be raised to allow for fish passage. We will also use an assessment of fish condition and any evidence of related mortality to decide if the temperature guideline is appropriate, or if revision of the temperature threshold is needed.

3.6 Weather & Water Assessment

Purpose: Anticipate water discharge conditions that could put fish, staff, or weir in jeopardy.

Weather and River Condition Forecasting

1. Review weather forecast, looking specifically for potential rain events and high temperatures.
2. Review USGS water data for river discharge and water temperature at Malott and Nighthawk for pattern/trend.
3. Review NOAA river discharge forecast at Malott, Tonasket, and Nighthawk for possible future high flow events.
4. Review Canadian WSD Okanogan River release forecast at Penticton for possible high flow events.
5. Senior staff will be notified of any predicted river or weather conditions which may affect weir operations.

Water Velocity and Trap Depth

Average operating river velocity shall not exceed 3.5 ft. /s and shall be lower than the velocity at the trap entrance.

1. Water velocity (ft./sec) will be recorded once daily with a Rickley hydrological current meter from 7 locations:
    a. 20-feet upstream of the weir, 25-feet to river right of the weir trap
    b. 20-feet upstream of the weir, 25-feet to river left of the weir trap
    c. 20-feet downstream of the weir, 25-feet to river right of the weir trap
    d. 20-feet downstream of the weir, 25-feet to river left of the weir trap
    e. 20-feet upstream of the weir, in-line with the center of the weir trap
    f. 20-feet downstream of the weir, in-line with the center of the weir trap
    g. Inside the center of the weir trap
2. To collect water velocity readings, the current meter will be placed atop the river substrate in the appropriate locations. Readings must be collected from a location with laminar flow. If there are large rocks or other irregular objects in the immediate vicinity clearly affecting the current in the vicinity of the flow meter, altering the position from which the measurement will be taken by up to one meter is acceptable. If the position is changed, direction and distance of the alteration will be noted.
3. Once the base of the flow meter is on the river bed and stationary, and the flow meter is positioned vertically, the measuring attendant will wait for 15 seconds to allow the instrument to stabilize. Then the flow meter will be activated, and will record revolutions for a 40-second period, such that water velocity can be calculated. Water velocity readings will be recorded in the YUMA.
4. After recording water velocity from within the trap, trap depth will also be recorded. At the center of the weir trap, the measuring attendant will place a measuring stick or stadia rod, positioned vertically, atop the floor of the trap. Water depth at this location will be recorded and stored in the YUMA.

5. NOAA guidelines stipulate that the difference in water velocity upstream and downstream of the weir be no greater than 1.25 ft./sec. If a difference in velocity greater than this is detected, the weir must be immediately cleaned and water velocity measurements will be taken again afterwards. If the difference remains greater than 1.25 ft./sec, the CCT representative of the TOG will be notified, who may then alert the rest of the TOG.

Dissolved Oxygen and Total Dissolved Solids

1. Measurements of Dissolved Oxygen (DO), total dissolved solids (TDS), and turbidity (NTU) are recorded from within the weir trap daily. DO will be measured in mg./L, TDS will be measured in mg./L.
2. Attendant 1 will wade out to the weir trap with a Hanna multimeter. While standing in the center of the trap, Attendant 1 will suspend the recording end by its cable above the trap floor and at a depth at which it is fully submerged.
3. Wait for 1 minute so that measurements can stabilize.
4. Reported values for DO and TDS displayed on the screen are recorded in the YUMA.

Head Differential

The maximum head differential across the pickets will not exceed 0.3 ft. (10.15 cm). If this differential is exceeded, the pickets shall be cleaned immediately.

1. Head differential will be recorded in centimeters once daily. Attendants 1 and 2 will wade along the weir, carrying two stadia rods and a level. Head differential will be measured at up to 5 different locations:
    a. At panels with 2 in. picket spacing, to river left of the weir trap.
    b. At panels with 2.5 in. picket spacing, to river left of the weir trap.
    c. At panels with 3 in. picket spacing, to river left of the weir trap.
    d. At panels with 1.5 in. picket spacing, to river left of the weir trap.
    e. At panels with 1 in. picket spacing, to river left of the weir trap.
2. To measure head differential, two attendants will position themselves up- and downstream of the weir. Each will place a stadia rod atop the river substrate and position it vertically. One stadia rod will be at least 35 cm. upstream of where the weir pickets enter the river. The other stadia rod will be at least 35 cm. downstream of where the weir pickets enter the river.
3. The stadia rods are stabilized and a level is held in place such that it is contacting each stadia rod and level to the ground.
4. Attendants each measure the distance from the base of the level to where the stadia rod enters the water.
5. The difference in distance is equal to the head differential. Head differential values are recorded in the YUMA.
6. NOAA guidelines allow for a maximum head differential of 10.15 cm. If at any location head differential exceeds 10.15 cm., the weir will be immediately cleaned and head differential will be measured again. If head differential continues to exceed 10.15 cm., the CCT representative of the TOG will be notified.

3.7 Trapping

Purpose: Conduct effective and fish-friendly capture, handling, and release of fish to meet adult fish management targets based on pre- and in-season CJHP implementation planning at the APR and afterwards. This includes all fish species regardless of origin (natural vs. hatchery), and for all final dispositions (retained for broodstock, released, or retained for tribal subsistence and/or ceremonial use).

1. While in use, the weir trap will be continuously monitored to ensure that the maximum trap holding capacity (Figure 3) is not exceeded. When the number of fish approaches holding capacity, or when fish are in the trap and more fish are not actively entering the trap or holding below the trap gates, a trap check is triggered.
2. A minimum of two weir attendants will access the trap box by wading across the river. If high flows make wading untenable, the trap can be accessed by walking atop the weir panels or by motorized vessel.
3. Attendant 1 enters the trap box and closes the gates. The time that they are closed is recorded.
4. Attendant 2 remains on the catwalk and takes control of the counter board.
5. Attendant 1 uses the fish crowder, if installed, to partition the trap into two working spaces, effectively reducing the trap area in which fish are held. The partitioned space allows for natural origin fish to be placed upstream of the crowder, but still within the trap itself. The upstream gates are opened to allow natural origin fish in the upstream partition to escape the trap (through the upstream gates/PIT tag array) and continue upstream. If the crowder is not installed then fish will be handled and placed over the top of the trap and back to the river.
6. If additional staff participate in the trap check, they should also enter the trap to assist with working up fish.
7. Attendants working up fish from within the trap capture fish for the purpose of data collection. When there are more than 5 Chinook in the trap, fish capture is most easily done by hand. However, when Chinook numbers are lower, capturing fish is most easily accomplished with a dip net.
8. All captured fish are examined for an adipose fin, identified to species, and their fate (release, broodstock and, tribal subsistence and/or ceremonial use) is recorded. Fish handlers will relay these data to Attendant 2 (e.g. "Wild Chinook released!"), who will enumerate and record the data on the counter board. Adipose-present Chinook will be considered natural-origin, and adipose-absent Chinook will be considered hatchery-origin[4].

[4] A small percentage of adipose present fish could be hatchery origin. Rather than increasing handling time and stress on the fish and the staff, we will apply (ad-hoc) the results from the spawning ground survey evaluation of ad-present/CWT Chinook

9. If the crowder is in place, natural-origin Chinook will be passed to the upstream side of the crowder gates so they can escape the trap and continue migration to the spawning grounds. Mounted to the upstream gates is a PIT antenna, which will interrogate the fish for PIT tags upon passage through the exit gates. (i.e. Do not release Chinook directly to river, instead place them in the upstream trap partition. Fish reluctant to exit the upstream partition of their own volition can be forced out through the upstream gate using the crowder. This allows for PIT tag interrogation of all natural-origin Chinook as they exit the trap). A third attendant with a hand PIT tag detection wand will be used if the upstream PIT antennas are not functioning properly or if the crowder is not installed.
10. A sample of natural-origin Chinook may be measured for POH to the nearest centimeter and marked with a dorsal floy tag prior to release. These data will be used for a mark- recapture study to assess possible size bias in carcass recovery rate on the spawning grounds.
11. Natural-origin and hatchery-origin Chinook retained for use as broodstock will be sexed, enumerated, and immediately taken from the trap to a holding tank located on shore for later transportation to the CJH. The Whooshh™ (pressure transport tube) system may be used to transport broodstock from the trap to the hatchery truck (Figure 2). If a Whooshh™ system is not available then the broodstock will be handled as they were in the past; placed head down in a rubber tube and walked to shore.
12. Hatchery-origin Chinook captured by fish handlers will be either harvested for tribal subsistence and/or ceremonial purposes or in some cases, released upstream for continued migration to the spawning grounds, based on assessment of program management targets (e.g. pHOS, PNI). If harvested, they will be removed from the trap and placed in a raft tied to the weir for transportation to the shore after the trap check has ended. If a Whooshh™ system is available then some of the harvested fish may be transported to shore via the Whooshh™ tube[5].
13. Native non-target species captured in the trap will be communicated to Attendant 2, recorded, and then immediately passed unharmed to the upstream side of the crowder or over the top of the trap box and back to the river for release.
14. Non-native non-target species captured in the trap will be killed and either removed for ceremonial and subsistence purposes or will have their tails removed and be discarded downstream of the weir. Trapping and video from 2012-2018 indicated that a relatively small number of bass and carp can be expected, all other non-native species were extremely rare.
15. Once the trap is clear of fish, the upstream gates will be closed and the crowder moved to the highest upstream position within the trap. If the downstream gates were closed, they will be reopened and the time of reopening is recorded.
16. When the trap is vacant and ready to continue trapping, attendants will return to shore with the raft containing hatchery-origin carcasses, unless a Whooshh™ system is utilized.

[5] If the Whooshh transport system is set up its priority is to transport broodstock to the hatchery truck. If brood are not needed or the hatchery truck is not available then hatchery fish intended for harvest may be sent to shore in the Whooshh tube. Only live fish should be moved through the Whooshh tube to avoid getting blood on the inside of the tube.

17. The following metrics will be collected on hatchery-origin carcasses:
    a. Fork length
    b. POH
    c. Coded wire tag presence/absence (for coded wire present fish, snouts will be collected for later extraction and reading of the tag).
    d. Sex
    e. Date/time of collection
    f. PIT tag interrogation
    g. Egg retention will be estimated for all female Chinook
18. If a sampled hatchery-origin fish has a coded wire tag, the snout will be removed and preserved, for later extraction and reading of the coded wire tag.

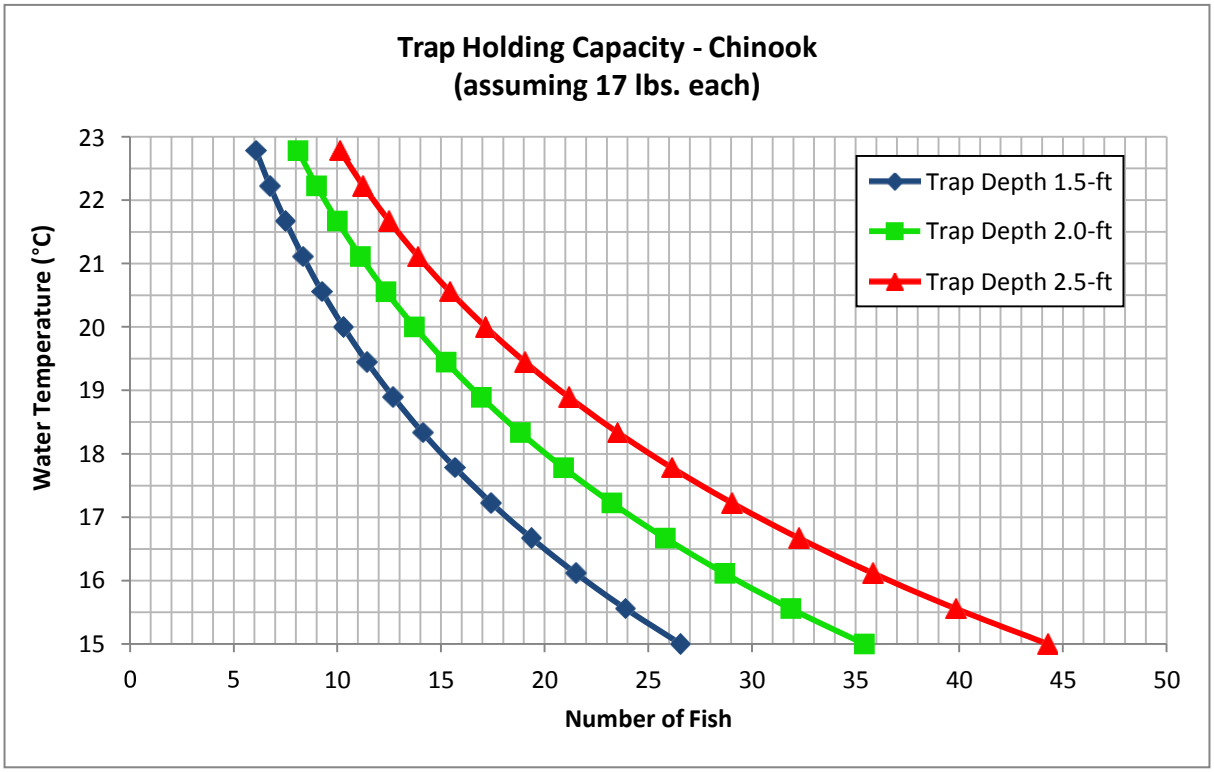

Figure 3. Trap holding capacity for Chinook salmon. This chart reflects the increased size of the weir trap in 2014 and beyond, and assumes each Chinook weighs 17 lbs.

3.8 Tower and Bank Observations

Purpose: Document an estimated number of fish holding below the weir.

Tower Observation:

Estimation of the number of Chinook immediately downstream of the weir will occur from an 18-ft. tripod tower stationed approximately 12 ft. downstream of the weir on the east bank. Estimates will be taken three times daily:

- Between 0600 and 0800, at least 30 minutes after sunrise
- Between 1200 and 1400, early afternoon
- Between 1700 and 2000, at least 30 minutes prior to sunset,

A weir attendant will ascend the tower and initiate a 5-minute observation period. Based on observation of the river during this time, the attendant will estimate the number of fish observable below the weir. This number will be recorded in the YUMA for later reporting. If fish are seen moving through the pickets, the picket spacing and (if possible) fish species will be recorded.

Supplemental observations may be made at times other than the 3 daily observations. Any unusual or noteworthy observations will be recorded on a supplemental observation data sheet in the YUMA. Examples of supplemental observations may include; fish seen pacing or holding above the weir, jumping over the panels or out of the trap, excessive fish presence and activity below the weir, fish moving through the panels, unusual or unexpected species (e.g., sturgeon), predation events by birds or mammals in the vicinity of the weir, etc.

Bank Observation:

Estimation of the number of Chinook downstream of the weir in and around the two pools downstream of the weir (Figure 4) will occur from the East bank of the Okanogan River approximately 0.8 river km. downstream of the weir.

1. Estimates will be taken daily, at times when fish have not been actively moving into the trap for at least 30 minutes:
2. A weir attendant will walk to the observation area and begin a 10-minute observation period. Based on observation of the river during this time, the attendant will estimate the number of fish observable in or around the 2 pools below the weir. This number will be recorded in the YUMA.

Figure 4. Map of the Okanogan River 1 km. below the weir. Observations from the bank will be directed in and around the two circled areas.

3.9 Boat Survey

Purpose: Look for fish or fish carcasses in the vicinity of the weir.

1. If determined necessary and achievable, boat surveys will occur Mondays, Wednesdays, and Fridays. However, if 3 or more Chinook, Sockeye, or steelhead carcasses are detected, surveys will occur daily until the survey does not result in the detection of 3 additional Chinook, Sockeye, or steelhead carcasses.
2. Two weir attendants will float downstream from the weir to the mouth of Chiliwist Creek, searching for fish and fish carcasses. All detected carcasses will be recovered.
3. While searching for carcasses, weir attendants will also record the location and species of all live fish observed.
4. After reaching the mouth of Chiliwist Creek, the weir attendants will return to the weir by travelling along the east bank of the river, continuing to collect carcasses and enumerate fish.
5. Upon completion of the survey, data will be collected from the carcasses according to the protocol in section 3.5 (fish injury and mortality).
6. If ten carcasses are detected on three consecutive surveys, or twenty-five carcasses are detected in any single survey, the CCT representative to the TOG will be consulted.
7. If river flows are such that boats are unable to float the river, the surveys will be conducted on foot, walking along the river banks or wading close to shore.

3.10 Video Review

Purpose: Document events that show how fish are interacting with the weir.

1. 3-4 underwater cameras with LED lights mounted inside the trap and along the weir chute to identify species, run timing, and behavior. Cameras will be operating 24 hours per day/7 days per week. Video will be watchable in real time, and will be monitored to assess the number of fish in the weir trap and approaching the trap entrances.
2. Terrestrial security cameras will be mounted near the observation tower and at the weir access ramp on the east bank operating 24 hours per day/7 days per week.
3. During occasions when trap gates are open, review underwater imagery of available cameras for previous 24 hours for fish events, and
4. Conduct assessment of behavior to infer if the operation is working appropriately.

3.11 Communications

Purpose: Inform all project staff and the TOG of present operations status.

1. Field crew completes the data sheets for daily review by staff biologists
2. Weekly weir reports, including fish injury, mortality, water data, and trap data may be distributed by e-mail
3. The M&E Lead will be immediately informed of any observations that indicate a potential negative impact to fish health. Critical situations and observations will then be relayed to the CCT representative of the TOG the same day, for communication to other TOG members.

4. EVALUATIONS

The purpose of the weir is to assess the feasibility of safe and effective fish capture, handling, release, and by-pass, and to assess the structural integrity and efficiency of the trap and guidance system. Hence, there are several specific questions that need to be investigated relative to the operation. These questions are partitioned into three topic areas:

1. Structural design (Table 1)
2. Operational design (Table 2)
3. Fish behavior and passage (Table 3)

The goal is to collect data that will answer these questions, confirm adequate performance, or indicate inadequate performance. Specific data sheets will be completed for each type of activity conducted by the weir project (see Appendix B).

Table 1. Structural design of the 2019 Okanogan weir

Issue Statement	Characterization or Measurement	Method / Approach	Discussion
What are the water velocities in proximity to the weir and trap? (**Datasheet #8**)	Measure water velocity at various points along the weir on the upstream and downstream side, and in the trap.	Electronic or hand held water velocity meter	• NOAA guidelines indicate 1.25 ft./sec maximum • Non-compliance would require adjustment of panel structure, or request for variance
What is the best mechanism and location to provide Free-pass conditions?	Evaluate picket removal, panel removal, gates on trap.	Direct observation	• Need to ID the easiest way to provide unabated passage of fish past the weir
What should the gap between pickets measure?	Install test panels of different gap and observe what works best (i.e., pass SO, bar CK, no gilling). 24 hrs. of close observation after any major change to confirm no negative impact.	1) Underwater video 2) Tower observation	• NOAA guidelines indicate 1 in. • Nez Perce has used wider gap (2 in.) @ Lostine River facility to pass juveniles • WDFW used wider gaps (1.5 and 3.0 in) on several systems (NOAA approved). 1.5 gilled some fish. (E. Kinne, pers comm.) • Okanogan weir panels need to freely pass Sockeye, but guide Chinook • Three inch and 2.5″ clearly passed some adult Chinook in 2014 and 2015 and lots of Sockeye were observed passing through 2.5″
Is the size of the trap appropriate for the fish abundance encountered?	Actual trapping experience – too little or too much space?	Direct observation and crew feedback	• Includes assessment of gate size • It's too small if fish are getting stressed by abundance • It's too big if we are only trapping a couple at a time

Issue Statement	Characterization or Measurement	Method / Approach	Discussion
Does the picket frame assembly maintain proper tension and picket contact between adjacent frames and with bed substrate?	Observe gap between adjacent picket frame sections. Observe tension on tensioning cable system. Observe picket frame position and inclination. Observe picket base in substrate	Record observations of gap size, misalignment, etc. Record picket frame inclination if it changes over time in response to water/debris load.	• Adjust tensioning cable as necessary, if possible • Keep debris off pickets • Replace displaced anchors • Push pickets deeper into substrate
Is trap structure stable and integral? Do panels retain shape? Are structural members adequate?	Observe trap structure stability when loaded with weight of staff/fish being processed.	Note instability and identify cause, if possible	• Adjust or reattach structural members as necessary and if possible • Check connections between panels
Is the weir in the best hydraulic position to encourage volitional passage?	Evaluate water velocities and hydraulic transition in proximity to weir, especially downstream.	Direct observation	• Will require assessment over a range of flows • Is there excessive holding at the entrance to the trap? • Is there excessive holding and searching activity downstream of the weir?

Table 2. Operational design of the 2019 Okanogan weir

Issue Statement	Characterization or Measurement	Method / Approach	Discussion
Does the weir cause passage problems for human traffic?	Observe whether signage and portage area provide safe passage around weir for recreationalists	1) Direct observation 2) Surveillance video	• Document number of events and outcome • Consider results relative to a permanent weir
Does the weir cause local erosion to the substrate?	Observe for conveyance, compaction. Assess utility of anchor system as mitigation	Direct observation	• Document specific locations if persistent or severe • Consider results relative to a permanent weir (partial sill? complete sill?)
Is the size & layout of the trap facilitating efficient processing of catch?	Actual trapping experience	Direct observation and crew feedback	• Considers trapping accessories such as dip nets, troughs, gate locations, crowders, access etc.
Can staff safely and effectively operate (trap, clean, monitor) the weir over the range conditions encountered?	Actual experience of safe wading and fish processing through complete 24 hr. period	Direct observation and crew feedback	• Consider results relative to a permanent weir and what could be done to improve operations

Table 3. Fish behavior and passage at the 2019 Okanogan weir

Issue Statement	Characterization or Measurement	Method / Approach	Discussion
Are upstream moving fish effectively guided along the weir to the trap?	Observation for patterns of fish moving along the downstream side of the weir.	1) Direct observation 2) Tower observation 3) Underwater video	• Aggregation, line ups, drifting? • Differences between species?
Do Chinook or Sockeye enter the trap?	Observation for patterns of fish moving into the trap.	1) Direct observation 2) Tower observation 3) Underwater video	• Document behavioral characteristics of entering and non-entering fish. • Numbers by species
What picket gap width allows Sockeye to pass through the weir, but hold up Chinook?	Observation for patterns of fish moving through the by- pass.	1) Direct observation 2) Tower observation 3) Underwater video	• Document behavioral characteristics of fish attempting to get through the pickets. (E.g. congregate in specific hydraulic conditions such as high/low velocity, depth, near cover, etc.).
To what extent does the weir delay migration or cause a buildup of Chinook or Sockeye downstream?	Observation of fish numbers and activity downstream of the weir.	1) Tower observation 2) Bank and boat observations downstream to Chiliwist Creek	• High abundance aggregation or persistent aggregation or mortality of either species may indicate holdup, particularly when compared to passage through the trap on subsequent days. • Presence of a high abundance of pre-spawn carcasses could indicate stress caused by the weir.

Issue Statement	**Characterization or Measurement**	**Method / Approach**	**Discussion**
Do Chinook and Sockeye co-migrate to the weir in time or space?	Counts by species approaching or passing the weir. Observation of approach line.	1) Trap counts, by time 2) Free-pass counts, by time, using underwater video 3) Tower observation to map approach lines	• Co-migration will make separation at trap more difficult • Separated migration would make separation at trap easier • Free-pass counts with camera using white board • May vary from year to year
Within a given time frame, does the number of fish (by species) observed below the weir appear to translate into a similar number of fish passing the weir?	Number of salmon below the weir compared to number of salmon passing the weir.	Number of salmon below the weir will be estimated by tower observation and bank and boat surveys; number passing the weir according to visual counts of by-pass and trapped	• A reasonable time frame for comparative purposes may be 24 hrs. • Relatively similar numbers may indicate suitable passage conditions. • Increasing numbers of fish below the weir may indicate inadequate passage conditions.
Does fish vigor at release decline with increasing water temperature?	Classify level of fish vigor after trapping and handling at trap. Watch for fish impingement on weir after release upstream.	Direction observation	• Note fish holding, struggling, or pacing upstream of the weir after release from the trap.
Is there acute mortality of fish that have been trapped, handled and released at the weir?	Number of dead or moribund fish that impinge on the weir.	Direct observation	

5. ADAPTIVE MANAGEMENT

5.1 Standard Protocol

It is possible that critical situations or conditions may develop in which operation of the weir as a functional trapping system needs be terminated or modified to prevent or minimize negative effects on migrating salmon or other aquatic resources. This may include data or observations that indicate the weir or its' operations may be causing delay in passage, bodily injury or mortality to fish. In these cases, the process of adaptive management for operation of the weir will be conducted through the TOG and guided by five primary steps:

1. Observation – field crew immediately reports a critical situation to the M&E Lead and provides documentation of a potential negative impact to fish:
    a. passage delay (e.g., approach and regress)
    b. bodily injury (e.g., gilling)
    c. mortality (e.g., moribund or dead fish impinged or gilled at weir)
2. M&E Lead reports the critical situation to the Colville Tribes TOG representative who provides a recommendation for mitigative action;
3. Colville Tribes TOG representative coordinates with TOG to discuss what mitigative action best suits the situation. Consensus may be to:
    a. concur with M&E Lead's recommended action
    b. request additional information from the M&E Lead
    c. recommend an alternative action which could include:
        i. no change to operation and continue monitoring
        ii. modify operation and continue monitoring
        iii. temporarily terminate operations, modify operation, and the resume operations with continued monitoring
        iv. terminate the operation for the season
4. The M&E Lead will implement the TOG recommendation(s), and monitor the effect.

All available information will be considered in defining a critical situation and developing a response. Counts of salmon passing Wells Dam will be considered with respect to the potential relative impact of the weir on the population.

5.2 Situations that require initiation of TOG consultation

1. The majority of fish estimated during daylight tower, bank, and boat observations approach the weir, but return downstream (drop back), with no relative passage during night trapping hours in a 48 hour operational period;
2. The majority of fish estimated during daylight tower, bank, and boat observations approach the weir and hold directly below the weir for an extended period of time (e.g., 48 hours);
3. 5 fish of any species are impinged (forced up against) the weir on the upstream side or gilled between pickets of the weir from the downstream side. Based on the size class of the fish (Chinook adult, Chinook jack, large Sockeye, small Sockeye) and the specific picket spacing of panel, the TOG may recommend replacement with an alternate picket spacing.
4. 10 salmon mortalities on 3 consecutive surveys or 25 salmon mortalities on any one survey below the weir. Note: presently, no information exists on natural mortality in this

area for this time of year.

5. Trap depth falls below 8 inches
6. After the majority of sockeye have passed the weir CCT may consult the TOG and then proceed with eliminating the 2 inch picket spacing (by replacing panels or by adding metal grating).

5.3 Situations that require immediate termination of operations

Termination includes closing the trap and opening up weir panels (raising pickets) for unabated fish passage. Any incident in this category is reported to the TOG.

1. When water temperature meets or exceeds 22.5^{o}C (72.5^{o}F).
2. The M&E Lead, in consultation with the hatchery lead, harvest lead and the CCT TOG representative may terminate operations anytime they believe that fish survival and/or staff safety are at unacceptable risk levels.

Regular weir operations can be resumed subsequent to termination when recommended by the TOG and approved by the M&E Lead.

5.4 Steelhead

It is possible that adult steelhead could be encountered at the weir. From 2012 to 2016 the weir operated under a 'not likely to adversely affect' informal consultation letter issued by NOAA Fisheries on 11 July 2013. As of March 2017, weir operations and effects on ESA-listed Upper Columbia River spring Chinook salmon and steelhead are covered by CCT's Tribal Resource Management Plan (TRMP) and pursuant to NOAA's Tribal 4(d) Rule (50 C.F.R. § 223.209). NOAA evaluated CCT's TRMP and supplemental materials and concluded that the activities described therein, including weir operations, qualify for limitation of take prohibitions provided those activities are implemented in accordance with the terms and reporting requirements described in a NOAA TRMP determination letter dated 2 March 2017. Prior to September 30, the emphasis will be to preempt encounters, minimize contact, and expedite passage in the direction of movement. Preemptive measures will include tower and bank observations and boat surveys below the weir during operational periods to look for approaching steelhead, and staff will also watch the vicinity of the weir for approaching steelhead. The TOG will be notified immediately of any steelhead observed. Weir operations will continue until or unless a TOG member requests a meeting and that meeting results in the TOG making a decision to cease weir operations. Steelhead will be provided passage at the weir in the direction of their approach movement by opening gates or raising pickets.

Information collected on Sockeye and Chinook interactions with the weir will inform the operation regarding options for steelhead, and relevant data will be shared with the TOG on a routine basis. Data will be summarized appropriately to assist in trend analysis. Initial data may support that no change in operations is necessary. Steelhead take limits are described in CCT's TRMP (NMFS 2017), Examples of incidents involving steelhead which would result in temporary termination of weir operations:

1. Three steelhead are impinged or gilled/stuck on the weir during a sampling interval of 7 days, weir operations are terminated, TOG representative is notified, who will then notify

all other TOG members.

REFERENCES

NMFS. 2017. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation . NMFS Consultation No. WCR-2014-388. Prepared by the NMFS and Bonneville Power Administration for the Confederated Tribes of the Colville Reservation, Fish & Wildlife Department, Nespelem, WA.

Nass, B. L., E. Zapel, and E. Rowland 2006. A conceptual proposal for a salmon enumeration facility on the Okanogan River. Report prepared by LGL Limited, Ellensburg, WA for Confederated Tribes of the Colville Reservation, Fish & Wildlife Department, Omak, WA.

JARPA. 2011. Okanogan River adult salmon weir JARPA application. Prepared by LGL Limited, Ellensburg,WA for Confederated Tribes of the Colville Reservation, Fish & Wildlife Department, Omak, WA.

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APPENDIX A - STANDARD OPERATING CRITERIA

NOAA Criteria*	Criteria value	2019 Okanogan River weir value	Meet Criteria	Explanation
5.3.2.1 Picket Openings	≤ 1 inch	1 in to 2.0 inch	No	Okanogan weir is designed to evaluate if Sockeye can pass through pickets while excluding Chinook.
5.3.2.2 Average Design River Velocity	<1 fps, w/ max <1.25 fps through pickets	0.9 to 3.5 fps average; 2.5 to 5.7 fps thru pickets	No	River cross section not large enough to facilitate picket area sufficient to achieve velocity criteria at design flows.
5.3.2.3 Head Differential	<0.3 ft.	<0.3 ft. (max = 0.1 ft. in 2016)	Yes	Pickets will be cleaned regularly to maintain head loss within guidelines. Low flow situations may require water barricading adjacent to trap to maintain attraction flows.
5.3.2.4 Debris and Sediment	Plan	Plan	Yes	Debris and sediment will be controlled continuously during trapping periods. The weir will be inspected once per day during non-trapping periods, or more frequently if discharge increases substantially.
5.3.2.5 Picket Barrier Orientation	Lead fish	Angled lead	Yes	Weir designed with 10 to 20 degree lead to trap location. Also takes advantage of shallow right bank vicinity to force fish to deeper water on vicinity of trap.
5.3.2.6 Picket Freeboard	2 feet	≥ 2 feet	Yes	Pickets designed to provide at least 2 ft. of freeboard at high design flow.
5.3.2.7 Submerged Depth	2 ft. for at least 10% of river cross section	≥ 2 ft.	Yes	Weir stretches from exposed bar at low flow to deeper thalweg at trap location. Depth depends on flow, but at lowest flow, depth at trap is at least 2 ft.
5.3.2.8 Picket Porosity	40% open area	37% @1" spacing, 64%@ 3" spacing (10.5% open area with 2016 configuration)	No	Okanogan weir is designed to evaluate if Sockeye can pass through pickets while excluding Chinook. Different gapped panels will be used.

5.3.2.9 Picket material	Flat, round, aluminum, or plastic	ABS 1 ½" in pipe	Yes	Pickets are 1 ½" ABS plastic pipe (black).
5.3.2.10 Picket sill	Uniform concrete or other approved	Option to stabilize with anchor system (as necessary)	No (N/A)	Weir designed as temporary test facility, not permanent. Permanent sill not part of design, nor part of test facility plan. Chain link will be used to stabilize bed if necessary.
6.5.1.2 Trap Capacity	0.25 cu ft. / lb. of fish @ <50^{o}F, minus 5% every ^{o}F above	Same as NOAA criteria for trap capacity	Yes	Trap holding capacity dependent on water temperature and water depth in trap. Trap checks occur at maximum every 2 hrs., or more frequently if video monitoring shows trap is approaching capacity. Trap capacity may be periodically exceeded but only for < 2 hrs. Trap is monitored 24/7.
6.9.2.1 Trap Volume	Equation based; or "relatively stable hydraulic conditions"	Volume changes with river stage.	Yes	Trap is porous to the river through pickets and will have similar conditions. Reduced velocity conditions can be achieved by partial blocking at upstream end of trap. Trap is 10 ft. wide x 20 ft. long with minimum water depth in trap of 1.5′ (in 2014)
6.9.2.1 (4.3.3) Trap intake	Fine trash rack <7/8in	Well water used (if necessary)	No (N/A)	Trap is porous to the river through pickets and will have similar conditions. If cold water entrainment is utilized, source will be well water.
6.9.2.1 Trap freeboard	4 ft. above trap pool water surface at max design	≥2.5 ft. (2.7 ft. freeboard at max flow in 2016)	Yes	Mean depth of water in trap was 2.2 ft. (in 2016).
6.6.2.1 & 6.9.2.1 Trap surfaces	smooth	smooth	Yes	All metal edges rounded or ground smooth.

***** "Anadromous Salmonid Passage Facility Design", NOAA Fisheries, 2008

APPENDIX B – DATA SHEETS

☑

DATASHEET #1. Daily check list to be completed everyday (including non-sampling days). Task can be "✓" if completed with no additional action or "N/A" if the task does not apply for the day (i.e. no panels are in place on non-sampling days). Describe the action taken if one is required. One data sheet per day.

DATE: CREW:

Task	☑	Observation and actions taken (if needed)
Ensure plastic pickets are driven into substrate and undamaged		
Ensure access bridge connections are secure		
Ensure minimal shoreline erosion		
Ensure facility warning signs, buoys & lights are in place and functional		
Ensure that lifesaver is accessible and all employees are wearing a PFD		
Ensure adjacent panels are abutting		
Ensure panel cable connections are secure		
Ensure no change in panel inclination and shape		
Ensure no debris accumulation on pickets		
Ensure gravel filled bags are secure		
Ensure trap connections are secure		
Provide assistance to recreationalists portaging around the weir		
Provide project information to recreationalists and visitors		
Ensure impinged fish are removed from the upstream side of the weir		
Clean all underwater cameras, lights and cables and ensure all components are secure		

Datasheet #2. **On-river person traffic observed**. One person/group per line. **Locomotion**: Means of transportation vessel (Canoe, Drift Boat, Kayak, Motorboat, Raft) and description. **Direction**: Moving upstream or downstream (US/DS). **Successful**: Y/N. Completed portage around weir panels on river right. Observations will be recorded as they happen and video data can be added upon review.

Date	Time	Crew	Locomotion	Direction	Description	Successful

Datasheet #3. **Fish gilled (G), impinged in weir (I), or on weir (W)**. All species. One fish per line including sex (M/F) and origin (H/W). **State**: Current state of existence. Live (L), Dead (D) Prespawn **Mortality:** If state is dead and sex is female, note egg retention (>50%, <50%, undetermined) **Cause of death (COD):** Obvious causes of death. (Ex: Fungus, gilled between pickets, impinged on panel, lacerations, predations marks, other).

Date & Time	Crew	Species	Gilled (G) Impinging (I) On Weir (W)	Sex	Origin	State	Egg Retention	COD

Datasheet #4. **Behavior of Chinook (CH), Sockeye (SO), and Steelhead (SH)** approaching the weir. One data sheet per day. Conducted three times a day for 5 minutes at 0700, 1300 and 1700. Number of fish Left of thalweg, Center, Right of thalweg. **Searching/Milling**: Estimate number of fish that spend majority of time milling in an apparent attempt to pass the weir (Y/N). **Swam DS:** Estimate number of fish that immediately or eventually swim back downstream (Y/N) **Jump/Contact**: Number times jumping or contacting weir. **Swam US:** Passed through a weir panel (Y/N) and, if so, which panel spacing (3", 2.5", 2", 1.5")

DATE: **CREW:**

		Left (looking upstream)			Center (looking upstream)			Right (looking upstream)			Swam US
Time	Species	Jump/Contact	Milling	Swam DS	Jump/Contact	Milling	Swam DS	Jump/Contact	Milling	Swam DS	Panel Spacing
Comments:											
Comments:											
Comments:											
Comments:											

Datasheet #5**. Weir Trapping**. All species. **Origin**: Need only be determined of Chinook and Steelhead. Natural or hatchery (NOR/HOR). Chinook, Sockeye, Steelhead, and Other harvested, released or used for broodstock.

Date	Crew	Trap Check Time	Chinook Adult				Chinook Jack				Sockeye		Steelhead		Other Non-Anadromous				Other Non-Anadromous Release	Notes
			NOR Release	HOR Release	HOR Harvest	NOR Brood	NOR Jack Release	HOR Jack Release	HOR Jack Harvest	NOR Jack Brood	Release	Harvest	NOR Release	HOR Release	MWF Release	Carp Release	LMB Release	SMB Release		

Datasheet #6. **Chinook (CH), Sockeye (SO), and Steelhead (SH)** tally downstream between the weir and Chiliwist Creek (~1 km). One data sheet per day. Surveys will be conducted by boat every other day. **Live**: Number live salmonids observed. **Dead:** Number of carcasses collected and/or observed. **Comments**: General behavior of live fish.

DATE: CREW:

Downstream to Chiliwist		Chinook		Sockeye		Steelhead		
Time	Transect (m)	Live	Dead	Live	Dead	Live	Dead	Comments
	0-300							
	300-700							
	700-1000							

Datasheet #8. **Daily water velocity (ft./sec) measurements**. One day per line. **A1** = Upstream of weir, river left. **B1** = Upstream of trap, center. **C1** = Upstream of weir, river right. **A2** = Downstream of weir, river left. **B2** = Downstream of trap, center. **C2** = Downstream of weir, river right. **Trap Depth** = Measured at center of trap. NOAA guidelines indicate 1.25 ft./sec maximum. Non-compliance would require adjustment of panel structure, or request for variance.

		Velocity (ft./sec)							
Date	Time	A1	B1	C1	A2	B2	C2	B3	Trap Depth (ft.)

Datasheet #9. **Water quality data.** Dissolved oxygen, total dissolved solids, turbidity, river discharge and temperature.						
Date	Time	Dissolved Oxygen (mg/L)	Total Dissolved Solids (TDS)	Turbidity (NTU)	River Discharge (CFS) from USGS Malott	Temperature (^{o}C)

APPENDIX C – UPDATES FOR 2019 OPERATIONS

In March 2019, the CJHP Science Program staff convened a post- season review group to discuss operations and recommendations for improvements/changes. The entire season was reviewed and subsequently, data were reviewed with results appearing in the text of this document. A summary of the 2018 weir operations was presented at the 9th Annual Chief Joseph Hatchery Program's Annual Review. This presentation is posted on the programs website at https://cctfnw.squarespace.com/2019-apr

The following list of changes has been built into this Plan. We envision both pre and post-season weir meetings being called in the same manner as 2018, to occur this year.

The following recommendations are derived from the 2018 post- season analysis and the subsequent findings from CCT's research, monitoring and evaluation activities:

1. Additional video and lighting at the downstream end of the trap entrance chute
2. Install weir panels adjacent to trap box and direct water velocity through the trap

APPENDIX D – 2019 TECHNICAL OVERSIGHT GROUP AND M&E LEAD

In 2019, the TOG will be comprised of the following members:

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