Memo

Date:	Monday, November 15, 2021
Project:	Chehalis Basin Strategy
To:	FCZD
From:	Matt Prociv PE, HDR
Subject:	WA Ecology: Information from FCZD Related to SEPA Final EIS, 5. Fish Passage Design – Response to Requested Information

The information requested by WA Department of Ecology (Ecology) is repeated in **bold** below. Responses to the information requests are provided below the requests in un-bolded type.

- **For construction, include:**
  - **Criteria for permanent fish passage, per WDFW.**
    - In general, the biological, technical, and ecohydraulic criteria for design and operation of the temporary fish passage will mimic that already established for permanent fish passage, as noted in the Description of Construction-Phase Fish Passage Facility technical memorandum, dated August 20, 2021, developed by HDR for the FCZD and provided to Ecology. Fish passage criteria are outlined in *Chehalis Basin Strategy - Fish Passage: CHTR Preliminary Design Report*. Prepared for the Washington State Recreation and Conservation Office and Chehalis Basin Work Group. Feb 2018. (CHTR Report). . Should a technology be chosen that is different than that of the permanent facilities, supplemental criteria will be established concurrent with WDFW and NMFS engineering guidelines.
    - Design River Flows: 16 cfs (95% exceedance) – 2,200 cfs (5% exceedance)
      - Per Section 2.1.1.2 in CHTR Report.
    - Biological Criteria: per Section 2.2 in CHTR Report.
    - Technical Criteria: per Section 2.3 in CHTR Report.
    - Operating Criteria:
      - The facility will operate 24 hours per day, 7 days a week during the construction period.
      - If the flow of the river is able to be diverted through the flood control structure conduits and back to the main river channel prior to completion of construction, volitional passage past the temporary fish passage facility will be restored and operation of the temporary fish passage facility will cease.
      - At a minimum, the fish passage facility will operate between the 95% and 5% river exceedance flows.
  - **A design to at least the 10% level.**
    - The Chehalis Basin Flood Control Zone District (FCZD) is currently executing an alternative development, evaluation, and selection process for the selection of a temporary fish passage technology to be implemented during construction. The selected technology will be developed to a 10% level by end of year 2021. Unfortunately, this effort will not be complete in time to provide a 10% design to

Ecology by Nov. 12, 2021. The 10% design will be provided to Ecology when it is completed. The 10% is anticipated to be complete approximately January 3, 2022.

- **Identification of all species or life stages used by the construction fish passage.**
  - Alternative selection and preliminary design of the construction fish passage is based on data developed during preliminary design of the CHTR facility and consultation with the Fish Passage Subcommittee (Subcommittee) that occurred in 2016 and 2017 (see additional bulleted information provided below). New data regarding aquatic species and life stages in the project area has been made available since the Subcommittee stopped meeting. A review of new data will be conducted early in the design process for the construction fish passage. Species and life stages used in design of the construction fish passage will be revised accordingly.
  - Upstream fish passage during construction will be designed to accommodate the same species and life stages as the permanent CHTR facility. "Life stages of specific species were selected if they have been observed moving – or are believed to move – through the dam site (either upstream or downstream)" (Section 2.2.1, CHTR Report). Table 2-5 of the CHTR report, reproduced below, identifies the species and life stages.

Table 2-5

Target Fish Species and Life Stages Selected for Collect, Handle, Transfer, and Release Design

SPECIES	UPSTREAM
Spring-run Chinook salmon	Adult, juvenile
Fall-run Chinook salmon	Adult, juvenile
Coho salmon	Adult, juvenile
Winter-run steelhead	Adult, juvenile
Coastal cutthroat trout	Adult, juvenile
Pacific lamprey	Adult
Western brook lamprey	Adult
Resident fish, including: river lamprey, largescale sucker, Salish sucker, torrent sculpin, reticulate sculpin, riffle sculpin, prickly sculpin, speckled dace, longnose dace, peamouth, northern pikeminnow, redside shiner, rainbow trout, mountain whitefish	Adult

  - Downstream fish passage during construction will be designed to accommodate the same species and life stages as the flood control structure conduits. Table 2-1 in Appendix G: Fish Passage Design of the 2017 Combined Dam and Fish Passage Conceptual Design Report (Appendix G), reproduced below, identifies the species and life stages. In addition, downstream fish passage will also be designed to accommodate adult and juvenile resident species identified in Table 2-5 of the CHTR report.

Table 2-1
Target Fish Species and Life Stages Selected for Design

SPECIES	DOWNSTREAM
Spring Chinook	Juvenile
Fall Chinook	Juvenile
Coho	Juvenile
Winter Steelhead	Adult, Juvenile
Coastal Cutthroat	Adult, Juvenile
Pacific Lamprey	Ammocoetes, Macropthalmia
Western Brook Lamprey	Ammocoetes, Macropthalmia

- "These primary species and their known swimming and leaping abilities were used to influence development of specific technical design criteria" (Section 2.2.1, CHTR Report). See Table 2-7 of the CHTR Report for a list of the species and life stages for which locomotive and biological data are known.
- The construction fish passage "is being designed to accommodate trap and transport of these resident species listed in Table 2-7 to the extent possible, and without adversely affecting facility performance for listed priority species (salmonids, cutthroat trout, and lamprey)" (Section 2.2.3, CHTR Report).
- *Trap and transport of resident species will be accommodated through incorporation of a [*coincident or*] separate low volume, low velocity entrance, fish ladder, hopper, and transport tank* [as required to achieve fish passage objectives during construction]*. Based on known swim speeds for resident species, the species will be able to enter the low volume, low velocity entrance and continue migrating upstream in the juvenile fish ladder via orifices. The design team was unable to locate data to inform how many resident or juvenile fish may enter the low volume, low velocity entrance and ascend the fish ladder. Therefore, it was decided that the hopper and transport tank for the juvenile/resident fish ladder will be sized to match the hopper for adult salmonids. Similarly, there is little data available regarding trap and holding requirements for the target resident fish species. Therefore, the juvenile and resident fish hopper and transport tank were sized using adult salmonid criteria, which are provided in Section 2.2.4.* (Section 2.2.3, CHTR Report). Alternative strategies for collection of resident fish may be selected during the 10% design phase to accomplish the objectives more effectively following review of new pertinent biological data and a more thorough understanding of the biological requirements and anticipated operating environment.

- **If a picket weir will not be used, identify what method will be used with support for choosing the method.**
  - A velocity barrier meeting design criteria and guidance listed in National Marine Fisheries Service (NMFS) 2011 Anadromous Salmonid Passage Facility Design Anadromous Salmonid Passage Facility Design document (NMFS 2011) will be utilized as part of the construction fish passage facility, as identified in the Description of Construction-Phase Fish Passage Facility technical memorandum, dated August 20, 2021, developed by HDR for the FCZD and provided to Ecology.
  - This technical memorandum provides the documentation for choosing this barrier technology that has been developed to-date. Additional design information supporting selection of this barrier technology is currently being developed as part of the construction fish passage alternative development, evaluation, and selection

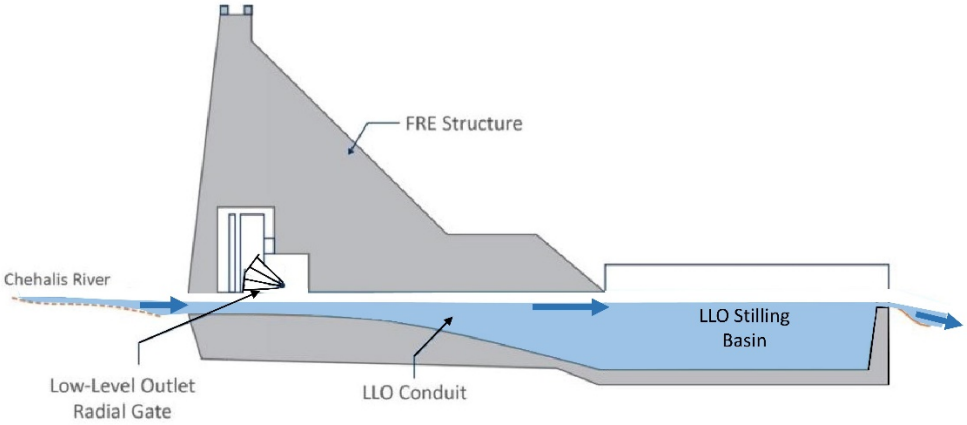
process. Early efforts in this process support the selection of a velocity barrier for the barrier technology, however, this supporting data will not be ready for release by Ecology's requested November 12, 2021 deadline. Early findings regarding selection of a velocity barrier are summarized as follows:

- Velocity barriers are operational over a wider range of targeted flows anticipated at the project location compared to other barrier types;
- Velocity barriers are operational over a wider range of sediment and debris loading conditions anticipated throughout construction at the project site compared to other barrier types;
- Velocity barriers are more resilient to debris, impact, and abrasion compared to other barrier types;
- Velocity barriers require a lower level of operation and maintenance effort compared to other barrier types, as they have no mechanical systems or power requirements that need to be operated or maintained; and
- Velocity barriers have a long history of effectiveness with many like examples in operation.
- Velocity barriers are a common technology used in applications all over the US and Canada. Design guidance is published by NMFS.

- **Clarify the approach for water management plan during heavy/high flows during construction and the need/use of "pumped water" to operate the construction phase trap and haul during the summer low flow conditions.**
  - During heavy/high flows during construction:
    - Fish collection will cease.
    - Attraction water will be turned off.
    - Floating debris and sediment will pass over the velocity barrier unobstructed.
    - After heavy/high flows have receded, large debris remaining on the velocity barrier that may pose a danger to fish or reduce the barrier's effectiveness will be removed by maintenance staff when it is safe to do so.
    - Once river flows recede, attraction flow will be turned on and fish collection will resume between the 5% and 95% exceedance river flows.
  - To operate the construction phase trap and transport facility, water must be supplied to attraction water system, adult fish ladder, juvenile fish ladder, lamprey ramp, sorting building, holding gallery, backwash screen cleaning system (if used), and ancillary systems, such as a water-to-water truck transfer system. The approach to water supply for the construction phase trap and transport facility is intended to be similar to that of the permanent CHTR facility. See CHTR Report, section 3.1.5. Pumped water will be necessary to operate the construction phase trap and haul facility during summer low flow conditions. Where possible, water will be supplied to the trap and haul facility via gravity during periods of the year when river flow allows. When water levels upstream are too low to supply water via gravity, gravity-supplied water to the trap and haul facility is suspended and water is supplied to the facility via pumping. A pump station will be located near the facility to draw water from the tailwater pool. The facility is supplied by a single pump or a set of pumps, depending on the amount of pumped flow required. Backup pumps are anticipated to be included in the design of the pump station. A single pump will be provided to

supply water to the backwash screen cleaning system for the pump station intake screens.

- **Clarify the design of FRE outlets to the channels and if a stilling basin below the outlets is planned.**
  - Clarifications provided below are in reference to the permanent facility; they do not address fish passage during construction.
  - A stilling basin is planned downstream of the FRE conduit outlets. The stilling basin is detailed on drawings FRE-S-3, FRE-S-7, FRE-S-8, and G-6 in Appendix H of the 2018 Combined Dam and Fish Passage Conceptual Design Report. Supplemental Design Report – FRE Dam Alternative (FRE Report).
  - **Clarify if a weir is included that submerges the outlets and its location relative to the CHTR entrances.**
    - The downstream end of the stilling basin, also referred to as the endsill, acts as a submerged weir but does not submerge the conduit outlets. The conduits are not surcharged, and the entrance of each conduit is not submerged during normal fish passage flows (16 cfs – 2,200 cfs). The conduits can pass up to 12,500 cfs, or just under a 10-year flood event, in an open channel flow condition (Section 5.6 of the FRE Report; Table 4-1 of the 2017 Combined Dam and Fish Passage Conceptual Design Report [Combined Report]).
    - The endsill of the stilling basin is located roughly 230 feet downstream of the conduit outlets. The endsill has a crest elevation of EL 417.0. (See FRE-S-7 of the FRE Report). The invert of the 12' W x 20' H conduit is at EL 408. The inverts of the 10' W x 16' H conduits are at EL 411. (See Section 5.6 of the FRE Report). As shown in Figure 2-23 of Appendix I of the FRE Report, the water surface elevation over the endsill at the maximum fish passage flow (2,200 cfs) is just under WSEL 422. This corresponds to conduits about 70% full.
    - The relative elevation of the bottom of the river channel in relation to the endsill crest elevation and stilling basin floor is shown in Section C-C of Figure 5-2 of the FRE Report. The design intent is that there will not be a hydraulic drop from the stilling basin endsill to the river channel downstream, as depicted in the figure of the conduit section provided to Ecology in January/February 2020 (reproduced below).



    - The stilling basin is located adjacent to the fish ladder and lamprey entrance gates of the proposed permanent facility. The entrance gates are located on the south wall of the stilling basin. The auxiliary water pump station is located at the upstream

end of the stilling basin. The juvenile, resident, and lamprey entrance is located at the downstream end of the stilling basin, just upstream of the endsill. The four adult fish ladder entrances are evenly spaced between the pump station screens and juvenile/resident/lamprey entrance. The relative locations of the CHTR entrances are shown on sheets G-5 through G-7 and Detail 2 on C-4 of the CHTR Report. The elevations of the entrances and stilling basin floor are shown in Sections F and G on sheet C-4 of the CHTR Report.

- **How the weir will work in conjunction with the CHTR and facility for juvenile salmon and resident fish**
  - The amount of downstream flow over the stilling basin endsill is managed during CHTR operation by the auxiliary water system and conduit gates.
  - The minimum outflow during the early portion of the impoundment period is 300 cfs. All water from the impoundment during this period is routed through the fish ladders, lamprey ramp, and auxiliary water system. By providing a single source of attraction water from the ladder entrances into the stilling basin the fish passage performance of the facility is improved given that it represents the only navigable pathway for fish to ascend upstream (Section 2.1.2.2; CHTR Report).
  - The entrances to the CHTR facility are located as far upstream in the river as possible (immediately downstream of the conduit outlets/at the stilling basin) to improve the performance of the facility by minimizing the potential for false attraction. Multiple entrances are located within the stilling basin to prevent fall back.
    - All the water entering the river during CHTR operation, both coming from the fish entrances and from the conduits, passes over the weir (stilling basin endsill), reducing the potential for false attraction.
  - The stilling basin performs as a large volume of water to still the discharge from the conduits and fish entrances, reducing the potential for flow bulking or concentrated flow over the weir. Uniform flow over the full width of the weir provides better hydraulic conditions for fish passage (e.g. – lower velocity, less turbulence, etc.).
  - During CHTR operation the minimum depth over the weir will be 1 foot.
  - The channel downstream of the endsill will be designed in a configuration that does not exhibit a hydraulic drop, hydraulic jump, or excessive velocity creating an impediment to fish access to the stilling basin and CHTR entrances.
    - The design of the endsill is not yet detailed to show accommodation of the low fish passage design flow (16 cfs). The endsill design will be detailed in future design development phases to provide fish passable depth and velocity at the low fish passage flow.
    - The design will also be developed to reduce the potential for channel erosion and low water depth at low river flow due to subsurface flow. Stable elements such as large rock will be used to set a stable cross-section downstream of the endsill to suit the purpose of the intended hydraulic design.
  - Juvenile and resident fish are the weakest swimmers of the target species (e.g. – lower burst speeds, less energetic, etc.) therefore the juvenile/resident/lamprey entrance is located closest to the weir.