# MEMORANDUM

**TO:** PacifiCorp

**FROM:** Kleinschmidt Associates

**DATE:** July 13, 2016

**RE:** Design Criteria for Conceptual Design of an Upstream Fishway at the Weber Hydroelectric Project

The intent of this memorandum is to provide a summary of the design criteria for the conceptual design of an upstream fishway at PacifiCorp's Weber Hydroelectric Project. The Weber Project is located on the Weber River, in Weber, Morgan, and Davis counties in Utah. The project is partially on federal lands managed by the Wasatch-Cache National Forest and partially on lands owned by the Union Pacific Railroad Company. The project's license from the Federal Energy Regulatory Commission (FERC) expires in May of 2020, and PacifiCorp is in the process of relicensing the project using the Alternative Licensing Process (ALP) pursuant to 18 CFR Part 5. The ALP is highly collaborative and relies on development of consensus-based protection, mitigation, and enhancement (PM&E) measures that will be evaluated by the Federal Energy Regulatory Commission (FERC) during its National Environmental Policy Act (NEPA) review.

Scoping Document 1 completed as part of the ALP, and the subsequent scoping meeting with stakeholders, identified upstream fish passage for Bonneville cutthroat trout and bluehead sucker as a PM&E measure likely to be required in any new license issued for the project. Bonneville cutthroat trout and bluehead sucker are species of concern present in the Weber River both upstream and downstream of the project. PacifiCorp intends to design and build an upstream fish passage facility to pass Bonneville cutthroat trout and bluehead sucker at the Weber Hydroelectric Project diversion dam.

Kleinschmidt has been retained to perform the conceptual design of the proposed upstream fish passage facility at the Weber Diversion Dam. During the upstream fish passage conceptual design kick-off meeting held on March 7, 2016 at SWCA's office in Salt Lake City, Kleinschmidt met with the members of the Fisheries Working Group (FWG) which includes individuals representing the U.S. Fish and Wildlife Services, U.S. Forest Service, Utah Division of Wildlife Resources, Utah Division of Water Quality, Trout Unlimited, FERC, and PacifiCorp. The primary purpose of the meeting was to establish the design criteria for the proposed upstream fish passage facility. Below is the table of design criteria that was discussed during the meeting, and finalized at the May 4, 2016 meeting at UDWR's Northern Region office:

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| 1.) | Target Species | Bonneville Cutthroat Trout (BCT)<br>Bluehead Sucker |
| 2.) | Life Stage of Target Species | Fishway is intended primarily for adult fish, however it is anticipated that all life stages 150 mm and larger will be capable of using the fishway. |

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| 3.) | Fishway Water Velocity Targets (Based on Fish Swim Speed) | Bonneville Cutthroat Trout – 3-5 ft/sec (sustained speed)<br>Bluehead Sucker – 4 ft/sec (sustained speed) or less preferable |
| 4.) | Design Population | No set design population criteria |
| 5.) | Station Hydraulic Capacity | 320-365 cfs |
| 6.) | Minimum Flow | 34-50 cfs |
| 7.) | Low Level Gate Hydraulic Capacity | • Approximately 200 cfs under normal pond conditions<br>• When head pond is dewatered the low level gate will pass approximately 100 cfs before water starts to spill over the concrete invert of the open spillway gates. |
| 8.) | Spillway Radial Gate Hydraulic Capacity | Each gate (two total) has a capacity in the range of 2,300 to 2,700 cfs under normal pond conditions. |
| 9.) | Period of Operation of Fishway | Fishway will be in operation anytime the headpond is full. The headpond is dewatered during winter freezing conditions when the river flow is below the turbine operating range. In order for the turbine to operate the river flow must be in the range of 85-95 cfs. The fishway will not be operated during periods when the headpond is dewatered. When the headpond is dewatered the low level outlet gate will be opened to allow fish passage. The following water velocities have been calculated for various flow conditions through the low level outlet gate:<br>Q = 34 cfs ➔ V = 2.7 fps<br>Q = 40 cfs ➔ V = 3.2 fps<br>Q = 50 cfs ➔ V = 4.0 fps<br>Q = 60 cfs ➔ V = 4.8 fps<br>Q = 70 cfs ➔ V = 5.6 fps<br>Q = 80 cfs ➔ V = 6.4 fps<br>Q = 90 cfs ➔ V = 7.2 fps<br>Q = 100 cfs ➔ V = 8.0 fps |

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| 10.) | River Flow Operating Range | When the headpond is full the fishway will remain in operation for river flows of 34 cfs to approximately 2,500 cfs. As river flow increases above the turbine capacity the south spillway gate will be opened to pass excess flow. Once the south spillway gate reaches its maximum capacity the north spillway gate will be opened to pass increasing river flows. The fishway entrance will likely be inaccessible to fish once the north spillway gate is opened, due to high velocity and turbulence from the north spillway gate discharge. The north spillway gate is currently used to control the headpond level. Modifications will be made to the south spillway gate operator to allow it to act as the primary gate used to control headpond level. |
| 11.) | Headpond Operating Range | Typical headpond level fluctuation is in the range of 1-3 inches, but may fluctuate as high as 7 inches. |
| 12.) | Diversion Dam Tailwater Operating Range | The normal water surface elevation in the tailwater immediately downstream of the spillway gates is El. 4785.9. Additional information is being gathered to confirm the full range of tailwater elevations across the river flow operating range. The range of tailwater elevations will be available for the final design of the fishway and will not affect the selection of the preferred fishway alternative or the conceptual design of the fishway. |
| 13.) | Entrance Location | North side of river immediately downstream of spillway. Reuse existing opening in retaining wall where min flow is currently discharged. |
| 14.) | Exit Location | North side of river within 60 feet upstream of the spillway. Locating the exit further upstream could require additional excavation of sediment in the headpond to provide adequate water depth. |
| 15.) | Minimum Water Depth in Fishway | The minimum water depth at the fishway entrance and exit will be 2.0 ft. Likewise, if a pool type fishway is selected, the minimum water depth in the pools will be 2.0 ft. |
| 16.) | Fish Entrance Gate | Downward opening gate for adjusting attraction flow depth is preferred if tailwater depth is adequate. |
| 17.) | Fishway Entrance Invert Related to Adjacent River Bottom | Fishway entrance will be perched in water column. |
| 18.) | Attraction Flow | 34-50 cfs<br>Attraction flow will match the minimum flow requirement. |

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| 19.) | Supplemental Attraction Flow System | If fishway is selected that has a conveyance flow capacity less than the 34-50 cfs attraction flow, then a supplemental attraction flow system will be needed. |
| 20.) | Sampling Facility | Fishway will be designed to accommodate a temporary sampling facility (i.e. a removable trap). |
| 21.) | Viewing Window | A viewing window for public outreach may be desired pending feasibility. Considerations will include space constraints, security, ADA accessibility, and cost (shared cost??). Potential alternative would be an underwater camera within the fishway. Final determination to be made at the July FWG meeting. |
| 22.) | Slope of Fishway | Denil (chute type) Fishway - 1:10 slope<br>Pool & Weir and Vertical Slot Fishways - 1:10 to 1:20 slope, pending flow & drop/pool<br>Natural Channel Fishway - 1:20 slope<br>Velocity criteria will control the slope of the fishway. For pool & weir and vertical slot type fishways the drop per pool will be 9" or less. |
| 23.) | Energy Dissipation Factor (EDF=$\gamma Qh/V$) | If a pool type fishway is selected, then the pools will be sized such that the calculated energy dissipation factor will not be greater than 4.0. |
| 24.) | Debris Handling | Look into feasibility – floating/skirted boom.<br>Angled bar racks |
| 25.) | Fishway Access | A means of access into the fishway is preferred if feasible. |
| 26.) | Grating Covering Fishway | Serrated bar grating across the top of the fishway is preferred if a structural type fishway is selected. |