BIOLOGICAL ASSESSMENT

WALLOWA FALLS HYDROELECTRIC PROJECT

Wallowa County, Oregon
Upper Wallowa River Watershed – 1706010501 (5th Field HUC)

Bull Trout – Mid-Columbia Recovery Unit

Prepared for:

PACIFICORP ENERGY
A DIVISION OF PACIFICORP

PacifiCorp Energy
825 NE Multnomah, Suite 1500
Portland, OR 97232

Prepared by:

MB&G

Mason, Bruce & Girard, Inc.
707 SW Washington Street, Suite 1300
Portland, Oregon 97205

February 2014

MB&G Project No. 0100762

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

The purpose of this Biological Assessment (BA) is to analyze the effects of continued operations of the Wallowa Falls Hydroelectric Project (Project) on bull trout (*Salvelinus confluentus*) of the Mid-Columbia (MC) Recovery Unit of the Columbia River Distinct Population Segment (DPS) listed as threatened under the federal Endangered Species Act (ESA). As defined below (Section 3.1), the proposed action is the continued operation of the Project under a new 50-year license from the Federal Energy Regulatory Commission (FERC), and under protection, mitigation and enhancement (PM&E) measures intended to avoid, minimize, and mitigate the potential adverse effects of Project operations on listed species and designated critical habitat. The proposed action as presented in PacifiCorp's Final License Application (FLA) (PacifiCorp 2014b) is provided in Section 3.1 below.

This BA, prepared by PacifiCorp in its role as license applicant, addresses the proposed action according to the standards of Section 7 of the ESA, which requires federal agencies to avoid taking actions that would jeopardize the continued existence of listed species or adversely modify designated Critical Habitat. This document also addresses the potential effects of the proposed action on Essential Fish Habitat (EFH) as designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1996 (see Section 8). The Wallowa Falls Hydroelectric Project area is shown below (Figure 1-1.)

2.0 EVALUATION METHODS

Information contained in this document was collected through a series of communications with the project team and resource agency staff, including meetings, site visits, telephone calls, and electronic mailings. Most recently, a site visit on June 13, 2013 was held to assess spring runoff conditions in the Project bypassed reach, to discuss the overall status of relicensing, and to discuss options to reduce tailrace bull trout stranding. Attendees at this visit included Briana Weatherly (PacifiCorp), Russ Howison (PacifiCorp), Gretchen Sausen (U.S. Fish and Wildlife Service [USFWS]), Matt Cutlip (FERC), Jim Harbeck (Nez Perce Tribes); Elizabeth Moats (Oregon Department of Fish

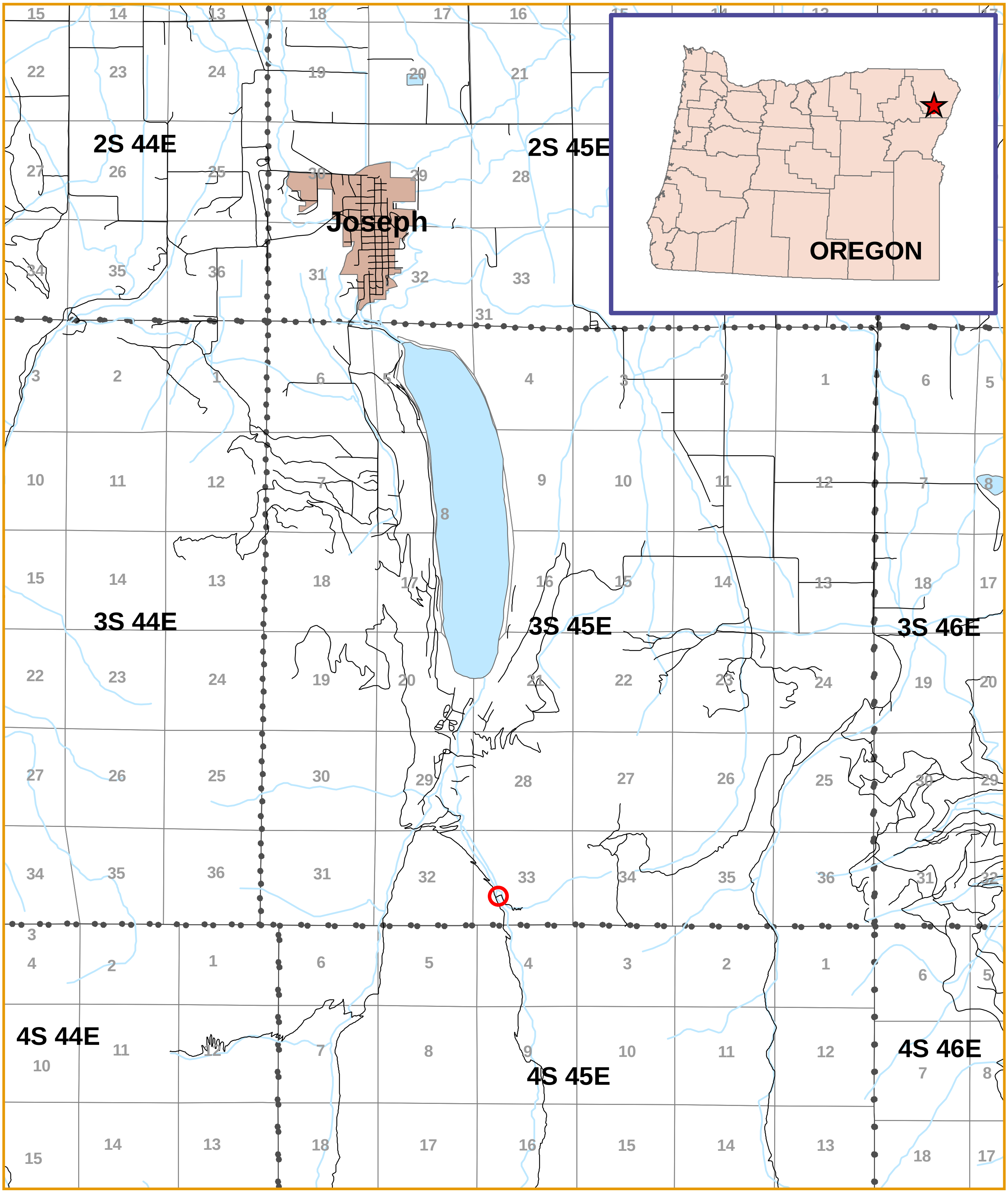


Figure 1-1.
Project Location and Vicinity Map
Wallowa Falls
Wallowa County, Oregon

Project Area
Streams
Township and Range
Section

MB&G
1 inch = 7,000 feet
0 1,750 3,500 7,000 Feet

Source: PLSS grid from MB&G.
Hydrology from US Census Bureau.
Reproduced for infomation purposes and may not be suitable for legal, engineering or surveying purposes.
Conclusions drawn are the responsibility of the user.
. . .\100062_WallowaFalls\1_Vicinity.mxd 9/29/11

and Wildlife [ODFW]), Mike Bonoff (Mason, Bruce & Girard, Inc. [MB&G]), and Kathy Dubé (Watershed GeoDynamics). MB&G biologists also conducted a reconnaissance of the project area on June 16, 2011 to evaluate general habitat conditions for ESA-listed species (including bull trout) and to document baseline environmental conditions. During field efforts, accessible aquatic and riparian areas within and around the action area were examined and photographed (Appendix B). In addition, MB&G biologists recorded vegetation species composition and general site conditions. Aerial photographs were also referenced during a review of the baseline environmental conditions.

In connection with relicensing of the Project, PacifiCorp filed a Notice of Intent and associated Pre-Application Document to commence the FERC Integrated Relicensing Process of the Wallowa Falls Hydroelectric Project on February 22, 2011. In light of existing data gaps on local aquatic resources and potential impacts of the Project on these resources, PacifiCorp developed and implemented a range of studies, including three aquatic studies directly relevant to this BA:

- Relative Abundance, Composition, and Spatial and Temporal Distribution of Fish Species Residing in Waters within the Project Boundary;
- Evaluation of Bull Trout use of the Project Tailrace Channel and Bypassed East Fork Wallowa River; and
- Relative Abundance and Composition of Macroinvertebrate Species Residing in Waters within the Project Boundary.

PacifiCorp's evaluation of the impacts of continued Project operations on bull trout and critical habitat within the Project area relies on results of the above studies, which are contained in a January 2014 Aquatic Resources Technical Report provided by PacifiCorp to relicensing stakeholders (PacifiCorp 2014a). The study area for aquatic resources included the Project forebay, the 2,800-meter bypassed portion of the East Fork Wallowa River, a portion of the East Fork Wallowa River above the anadromous fish barrier, and the Project tailrace.

In addition to the above, PacifiCorp performed an Instream Flow Incremental Methodology (IFIM) study in 2012 to evaluate flow requirements and the effects of various minimum flows on habitat in the East Fork Wallowa River bypassed reach for adult, juvenile, and spawning bull trout, as well as spawning kokanee (*Oncorhynchus nerka*) (Wallowa Falls Habitat Modeling Results Preliminary Report, PacifiCorp 2013a). Additional field investigations were conducted in August - November 2013 to further assess bull trout population dynamics, sediment characteristics throughout the Project area, and kokanee use of the West Fork Wallowa River.

As discussed above, PacifiCorp is submitting a FLA for the continued operation of the Project on February 28, 2014. The purpose of a FLA is to present an applicant's or licensee's proposal for PM&E measures that are intended to address the effects of the continued operation of a project on the existing area resources (18 CFR § 5.17).

3.0 PROJECT DESCRIPTION

The Wallowa Falls Hydroelectric Project is operated as a small, 1,100 kilowatt 'run-of-river' facility, and is comprised primarily of a buttressed rock-filled timber crib dam, steel penstock, powerhouse, and tailrace that discharges to the West Fork Wallowa River. Additional project facilities include an upstream diversion dam and discharge pipe, a de-silting pond (0.2-acre forebay), a transmission line and an access road.

Installation of an automated control system in 1996 allowed unmanned operation through control by a programmable logic controller (PLC). The normal mode of operation is for the plant to be unattended. A local Project operator is located in Enterprise, Oregon and visits the Project on a monthly basis and as requested by PacifiCorp's Hydro Control Center (HCC) located in Ariel, Washington. The HCC monitors the Project operations remotely and notifies the local operator when an issue arises. The penstock pressure, generator load, forebay level, needle valve percent open position, generator stator temperature and front bearing temperature are all monitored by the Supervisory Control and Data Acquisition (SCADA) system at the Wallowa Falls plant and are visible to a HCC operator.

Annual maintenance of the facilities is typically conducted between June and August each year. Activities include vegetation management, erosion control and road maintenance, as needed maintenance on the water conveyance system and generating unit, and forebay flushing to reduce native sediment build-up behind the dam. The latter is required to ensure that the penstock intake remains clear for water passage and to protect against entrainment of built-up sediment through the penstock and project turbines, which could result in damage to the penstock pipe, turbine blades and other mechanical features. Vegetation management activities do not affect riparian shading or stream temperature, and are generally limited to weed management and mowing around existing operational areas around the dam, powerhouse and Pacific Park. As needed, PacifiCorp also removes hazard trees along the Project water conveyance facilities, access roads or public use areas. The timing and scope of annual maintenance activities are coordinated with the Wallowa-Whitman National Forest as authorized in the Special Use Permit issued by the U.S. Forest Service (USFS).

The Project diverts portions of East Fork Wallowa River flows (and lesser diversions from Royal Purple Creek) for use at the Project powerhouse. The project is operated in run-of-the-river mode, with no peaking or flood control capability. However, because of the diversion of flows to the powerhouse, operation of the Project causes a reduction in downstream in-channel flows in the East Fork Wallowa River, below the East Fork diversion dam. This portion of the East Fork Wallowa River is referred to as the "bypassed reach". The bypassed portion of the East Fork Wallowa River is approximately 1.7 miles long, extending from the Project diversion dam to its confluence with the West Fork Wallowa River.

Gradient in the East Fork Wallowa River bypassed reach is high, with the upper 1 mile (1,600 meters) averaging 19 percent and the lower 1,200 meters averaging 8.5 percent. Channel morphology within most of the upper reach is dominated mainly by steep bedrock, vertical waterfalls, and cascades over boulders. Although the upper reaches are steep, the lower 800 meters to the confluence with the West Fork is a shallower gradient consisting of numerous riffles and pools. Over the course of its length, the bypassed East Fork Wallowa River drops approximately 365 meters from the dam to the confluence with the West Fork Wallowa River.

Article 401 of the existing FERC License, issued in March 1986 and extending through February 2016, requires a minimum instream flow in the bypassed reach of the East Fork Wallow River of 0.5 cubic feet per second (cfs), or the natural inflow to the Project, whichever is less, as measured immediately downstream of the diversion dam. However, instream flows in the bypassed reach typically exceed the required minimum instream flow release, given the consistent release of 0.8 cfs from the low level outlet pipe at the diversion, natural accretion/runoff during most times of the year of 1-2 cfs, and most importantly, flows in excess of the 16 cfs hydraulic capacity of the powerhouse. Any project inflows in excess of 16 cfs spill over the dam directly into the bypassed reach.

Proposed project facilities are described below. Avoidance, Minimization, and Conservation Measures are discussed in Section 3.2.

3.1 Proposed Action

As described below, the proposed action for this consultation is the operation of the Wallowa Falls Hydroelectric Project under a new 50-year FERC license with PacifiCorp proposed PM&Es. The Project would continue to be operated in run-of-river mode during all times of generation, diverting no more than PacifiCorp's water right of 16 cfs from the East Fork Wallowa River.

3.1.1 Tailrace Reroute

PacifiCorp proposes to modify the Project tailrace by re-routing it from its current configuration discharging into the West Fork Wallowa River by constructing a buried 30-inch (76.2 cm) diameter, approximately 1,000-foot long (305 m), pipe discharging into the bypassed reach of the East Fork Wallowa River. The new tailrace pipeline will convey the full powerhouse discharge, from the existing concrete lined powerhouse tailrace to the East Fork of the Wallowa River. The conveyance pipeline will consist of a reinforced concrete intake structure, buried pipeline, and reinforced concrete outfall structure. The intake structure will include an isolation gate at the pipeline entrance and a water level indicator connected to the existing forebay headgate control system. In the event the pipe intake becomes clogged and or begins to flood, the level indicator would send an alarm signal to the headgate control closing it and stopping flow down the penstock.

The outfall structure will include a velocity barrier which meets the requirements of Section 5.4 – Velocity Barriers in the 2011 NMFS Anadromous Salmonid Passage Facility Design (NMFS 2011) to prevent all fish species and life stages from entering the pipeline. The barrier structure will be designed to meet NMFS criteria at flows up to the ordinary high water elevation. During higher flows fish are seeking refuge and do not typically migrate. Fish exclusion specific to the species and life stages present during high flows will be evaluated during the final design. The structure will be designed for a minimum drop of 3-feet, 6-inches (1.06 meters). The outfall structure will discharge into an energy dissipation channel consisting of boulders, logs and/or woody debris to reduce erosion and scour in the East Fork Wallowa River side-channel and main channel habitats. The riprap is anticipated to have a maximum size of 12-inches, but the final size and details will be determined during final design. It is anticipated that the hydraulic energy can be dissipated in a newly constructed channel (15-25 feet long), although the improvements may extend into the lower reach of the existing side channel. No work is anticipated in the main channel.

Once the tailrace re-route pipeline is constructed and put into operation, the existing tailrace channels, which discharge to the West Fork Wallowa River, will no longer be needed for hydroelectric operations. The main tailrace channel currently located on the south side of the campground road will be retained to provide stormwater management and drainage in the area. The braided tailrace side channels on the north side of the campground road will be reclaimed and restored to match surrounding contours.

3.1.2. Relocate Gage for Project Flow Monitoring

PacifiCorp proposes to install a new and improved gage to monitor instream flows in the East Fork bypassed reach between the Project Diversion dam and the proposed new tailrace discharge location. The data obtained from the new gage will provide verification that proposed modified instream flow releases to the East Fork bypassed reach are being implemented as planned.

PacifiCorp currently maintains a gage just downstream from the Project Diversion dam that serves as the existing compliance point for monitoring instream flow releases to the East Fork. The new gage will be located in the East Fork bypassed reach approximately 0.7 mi downstream of the Project Diversion dam near the existing forebay access road bridge site (see Exhibit A for map showing the new gage location). Several attributes make this location advantageous and preferable, including that this location: (1) is above the migratory fish barrier and will not entail gage construction or operation in bull trout critical habitat; (2) avoids high-gradient turbulent channel areas where it would be difficult to construct and maintain a gage; (3) provides the most suitable channel geometry for gage installation and accuracy; and (4) is easily accessible for efficient and timely maintenance of the gage and downloading of data.

The new gage will consist of a long-throated open flume installed in the channel. Long-throated open flumes have many advantages compared to other flow measuring devices, including that they are more accurate, have better technical performance, can be computer designed and calibrated to specific site conditions, and more effectively pass sediment and debris (Clemmens et al. 2001, Wahl et al. 2000). When installed, the long-throated open flume will provide a stable trapezoidal-shaped section of channel about 25-ft long and 20-ft wide. The open flume design includes a flat sill or crest that rises from the floor of the flume across the trapezoidal section. The flume's stable trapezoidal shape and crest allows flows passing through the flume to be controlled in a manner that allows flow discharge (in cfs) to be accurately quantified based on rating tables or hydraulic equations for flume structures. The ability to more effectively pass sediment and floating debris (e.g., woody debris) is a particularly important advantage of this type of flume for the East Fork bypassed reach.

Details of the design of the proposed flume are still being finalized. The proposed flume structure will consist of dimensions that are specifically designed to site conditions and that will emphasize flow measurement accuracy. Flow measurement accuracy is particularly important at the lower end of the flow range to verify the proposed modified instream flow release to the East Fork bypassed reach of 4 cfs. The flume installation will include a stilling well fitted with a water level pressure transducer and datalogger for continuous (hourly) recording of water levels and flows.

Details of the construction and implementation of the proposed flume are still being determined. However, in general, construction and implementation activities for flume installation are expected to include (in order): equipment staging; site dewatering; excavation; construction of flume structure forms; concrete workings; backfilling of the completed flume structure; dewatering system removal; monitoring equipment installation (e.g., pressure transducer and datalogger); and post-construction site restoration. These construction and implementation activities will occur over an estimated four to six-week period under low flow conditions.

The site dewatering activity will involve the temporary diversion of channel flows around the construction site. This temporary diversion will isolate the work area from flowing water, but will maintain flow to downstream portions of the stream during construction. The temporary diversion of channel flows will be accomplished by placing a temporary small cofferdam just upstream of the construction site to divert streamflow around the work area for a distance of about 150 ft or less. The cofferdam will be constructed of rock obtained from the immediate area, and the cofferdam’s rock fill will be fitted with a gated pipe (of 18-in diameter or less) to capture and redirect the flows from upstream of and around the site.

The proposed flume will be composed of concrete that is cast in-place inside sealed formed structures until cured (approximately 3-5 days). The cofferdam-dewatering system will ensure that the flume site is isolated from contact with any flowing water during the construction of the forms and the process of pouring, finishing, and curing the concrete.

The extent of and amount of needed excavation is not known at this time. The flume installation will require some excavation to accommodate placement of the overall 25-ft long by 20-ft wide dimensions of the flume structure. It is expected that most excavation will involve cut-off walls surrounding the structure that will go down about 4 ft or to bedrock, whichever is first encountered. The cut-off walls are necessary to prevent erosion or undermining of the completed flume structure during high flows.

PacifiCorp or responsible contractors will obtain necessary approvals and permits for flume construction and implementation. PacifiCorp or responsible contractors will adhere to and implement the requirements of necessary approvals and permits, including (but not necessarily limited to) required or recommended measures or best management practices (BMPs) related to in-channel work, equipment use, materials handling, minimization of riparian and channel disturbance, sedimentation and erosion control, and post-construction site restoration.

3.1.3 Revise Project Boundary

PacifiCorp proposes to revise the Project boundary to include the proposed tailrace alignment and other appropriate Project features that are not in the current boundary such as the Royal Purple diversion and forebay access road. The proposed Project boundary occupies 8 acres (3.2 ha) of private land owned by PacifiCorp and 12.5 acres (5 h) of federal land managed by the Wallowa-Whitman National Forest.

As described in the FLA, PacifiCorp has developed a series of measures designed to avoid and minimize Project impacts to all resource areas potentially affected by continued operation of the Project, including aquatics, terrestrial, recreation, and cultural. Those most relevant to bull trout enhancement and protection are described below (Section 3.2). An assessment of baseline conditions within the Wallowa River Sub-basin is presented in Section 5 and an analysis of effects of the proposed action is presented in Section 6 of this BA.

3.2 Avoidance and Minimization Measures

The proposed action includes significant aquatic resource protection and enhancement measures to be implemented with FERC's approval of a new license that will minimize project effects on and directly benefit bull trout. As described below, these include:

- Implementation of a Sediment Management Program in connection with forebay flushing;
- Increased minimum flows; and
- Rerouting of tailrace discharge flows from the West Fork to the East Fork Wallowa River.

These actions were discussed in Section 3.1 as elements of the proposed action. The following section focuses on these actions in the context of protection, mitigation, and enhancement measures (PM&Es).

3.2.1 Sediment Management Program

As described above, it is necessary to flush accumulated native sediment from the Project forebay to prevent damage to the hydroelectric generating unit and continue operation of the Project under the current FERC license. In as much as forebay flushing will continue under a new license term, it is included in the proposed action for this BA. PacifiCorp is consulting separately with the USFWS on this specific action.

Under the proposed Sediment Management Program (SMP), PacifiCorp proposes to modify the historic practice of flushing entrained native sediment from the forebay during the summer low-flow period to flushing sediment from the forebay during spring-runoff in the month of June. Annual forebay flushing would result in the removal of accumulated sediment from the forebay and the mobilization and transport of that sediment into the bypassed reach of the East Fork Wallowa River. Based on a volumetric survey of native sediment entrained in the forebay in August 2012, conducted by Haner, Ross and Sporseen, P.C, approximately 250 to 500 cubic yards of native material would be flushed annually. It is expected that there will be short-term increases in turbidity during forebay flushing. Monitoring is an important element of the SMP; PacifiCorp would monitor turbidity as described in the Turbidity Monitoring Plan for Maintenance Forebay Flushing included in Appendix C.

Schedule and Timing. Sediment would be flushed routinely, likely annually, from the Project forebay during the month of June when seasonal high-flows would easily transport fine sediment through the bypassed reach. June is also the period identified as having the least potential impacts to fish, as both kokanee and bull trout fry have emerged from the gravels and it is well before the fall spawning period for both species. If the forebay is not flushed during a given year due to low flows, site access issues or operational or maintenance issues it would not be flushed until June of the following year.

There is no real-time stream gaging or communications capabilities at the Project, and given the remoteness of the Project, PacifiCorp does not have the ability to schedule forebay flushing in response to real time flows. However, it is PacifiCorp's intent to flush prior to or during the annual high flow period in the East Fork, which historically occurs in June. To reduce uncertainty around the adequacy of June flows, we propose a threshold flow, above which mobilization of small (<2 mm) particles would be expected to occur within the East Fork Wallowa River bypassed reach.

PacifiCorp's Sediment and Substrate Characterization Report (December 2013d) included an analysis of shear stress and flows necessary to transport given particle sizes. This analysis indicated that a flow of 15 cfs would be sufficient to transport <2 mm particles within the thalweg of the channel. In response to USFWS concerns regarding the proposed June timeframe for forebay flushing, in contrast to flow-based timing, PacifiCorp conducted additional analysis to support development of a minimum flushing flow (Appendix D). This analysis confirmed the adequacy of 15 cfs. Flushing will therefore occur during June, but not at less than 15 cfs, and to the extent possible at flows above 20 cfs. Average flows in the East Fork in June are approximately 60 cfs.

Annual forebay flushing would result in the removal of approximately 250 to 500 cubic yards of accumulated sediment and the mobilization and transport of that sediment into the East Fork Wallowa River bypassed reach. Under the proposed SMP, flushing would also occur relatively quickly, lasting no more than 24 to 72 hours. The effects on aquatic resources and habitat of implementing the proposed SMP for forebay maintenance flushing are discussed in Section 6.

Flushing Method. Sediment retained in the Project forebay would be flushed through or over the dam, via the low-level outlet pipe or the dam spillway respectively, into the bypassed reach of the East Fork Wallowa River. To facilitate flushing, the penstock intake gate would be closed and the slide gate on the low-level pipe at the base of the diversion dam would be fully opened. Project inflow, up to the hydraulic capacity of the pipe, would pass through the low-level outlet pipe. Project inflows in excess of the hydraulic capacity of the low-level outlet pipe would spill over the dam. Several people operating hydraulic pumps (fire pumps) with hoses affixed to rigid poles would be stationed around the perimeter of the forebay. The pump hoses would be used to hydraulically mobilize and suspend forebay sediments in the water column to facilitate sediment transport through the low-level outlet pipe or over the dam into the bypassed reach. Flushing would not exceed 72 hours. At the end of the flushing period, the low-level outlet pipe slide gate would be closed and the penstock gate re-opened to resume generation and normal Project operation.

Short-term increases in turbidity are expected throughout this period. As noted above, PacifiCorp will monitor turbidity per the attached Turbidity Monitoring Plan (Appendix C).

3.2.2 Increased Streamflows

PacifiCorp proposes increased instream flow releases in the East Fork Wallowa River bypassed reach, consisting of: (1) a year-around flow of 4 cfs as measured at the relocated compliance gage, or inflow, whichever is less; and (2) rerouting of the powerhouse tailrace so that all powerhouse flows are returned to the East Fork Wallowa River bypassed reach. The goal of this measure is to manage flows in the East Fork

Wallowa River in a manner that provides habitat suitable for the production of healthy and sustainable fish populations, while continuing to maintain PacifiCorp's ability to generate hydroelectric power. Flow related actions are described below; effects on existing flows and aquatic resources are discussed in Section 6.

Instream Flows

The Project would continue to be operated in run-of-river mode during all times of generation (i.e., the Powerhouse return flows are not subject to storage and would fluctuate naturally according to East Fork Wallow River inflow conditions). The automated control system equipment would be set to divert no more than PacifiCorp's water right of 16 cfs from the East Fork Wallowa River. Average monthly flows in the East Fork Wallowa River are shown in Section 5.

Under Article 401 of the current license, PacifiCorp is required to maintain a minimum flow of 0.5 cfs in the East Fork Wallowa River bypassed reach. To ensure continuous compliance with the existing minimum flow provision of 0.5 cfs or the natural inflow to the reservoir, whichever is less, PacifiCorp typically releases an additional discharge of 0.3 cfs. Accordingly, actual flow released may range between 0.5 and 0.8 cfs depending on season. In the upstream portion of the East Fork Wallowa River bypassed reach between the dam and the new tailrace discharge location, flows would be increased by 3.5 cfs (i.e., the difference between the proposed 4 cfs minimum instream flow release and the minimum of 0.5 cfs currently released). The effect of this action would therefore result in flows upstream of the rerouted tailrace (described below) of 4 cfs as measured at the relocated FERC-compliance gage, or inflow, whichever is less. In the downstream portion of the East Fork Wallowa River bypassed reach between the new tailrace discharge location and the mouth, flows would be increased by the returned powerhouse diversion amounts (which are currently discharged to the West Fork Wallowa River). In the West Fork between the current tailrace discharge location and the confluence with the East Fork, flows would be decreased by the powerhouse diversion amounts (that would be discharged to the East Fork Wallowa River). In the Wallowa River downstream of the confluence of the East Fork and West Fork, no changes in flow would occur because the effects of Project operations on flows dissipate as the East Fork and West Forks join.

Tailrace Reroute

As described above, under the new FERC license PacifiCorp will reroute the powerhouse tailrace from its current point of discharge into the West Fork Wallowa River, to the East Fork Wallowa River lower bypassed reach. The tailrace reroute provides two benefits to aquatic resources. First, it will significantly reduce the risk and vulnerability of stranding bull trout, kokanee, and other aquatic species in the existing tailrace due to dewatering events from unit trips when the headgate closes. Second, the tailrace reroute will increase the amount of aquatic habitat available in the bypassed reach below the new discharge location on the East Fork Wallowa River. Reintroducing the natural, unimpeded flow furthers the goal of restoring the river's natural form and function in the lower bypassed reach. The tailrace reroute would affect approximately 0.5 miles of accessible habitat in the East Fork Wallowa River, from the point of entry (approximately RM 0.5) to the mouth of the East Fork Wallowa River (RM 0).

As noted above, reduced risk of stranding is a clear benefit of the tailrace reroute. The existing main tailrace channel has historically presented a risk of fish stranding and subsequent desiccation due to unit trips that result in the penstock headgate closing. Relative to the West Fork Wallowa River, colder water temperatures in the tailrace are common throughout the summer low flow period, exacerbating the stranding risk to bull trout and other fish species utilizing the approximately 300 meter tailrace (brook trout (*Salvelinus fontinalis)*, rainbow trout (*Oncorhynchus mykiss)*, kokanee, mountain whitefish (*Prosopium williamsoni)*, and sculpin (*Cottus ssp.)*) (PacifiCorp 2013c).

PacifiCorp believes that the risk of stranding bull trout in the existing tailrace outweighs the loss of habitat that would result in rerouting the tailrace to the East Fork Wallowa River. Agency staff voiced agreement with this approach during the June 2013 site visit. Regarding the issue of potential bull trout stranding in the tailrace when the penstock head gate closes, notes from this meeting indicate that a strategy that relies upon fish salvage or a tailrace barrier that still leaves part of the tailrace vulnerable to dewatering will not be acceptable to the USFWS (PacifiCorp 2013f). The risk of stranding in the East Fork Wallowa River, though possible, is considered highly unlikely. Unit trips leading to headgate closures may continue, leading to temporary loss of flows to the powerhouse

(16 cfs). However, in contrast to the tailrace, the residual baseflow of 4 cfs will continue to provide water to the bypassed reach, plus penstock leakage. Channel geometry (lower width to depth ratio) also acts to reduce stranding in side channel habitat adjacent to the East Fork Wallowa River. During a shutdown, depressions within the side-channel would offer refuge for the short period of time it would take for spill to resume flows.

The proposed rerouted Project tailrace facilities would include construction of a new intake structure near the existing powerhouse tailrace, a new buried conveyance pipeline consisting of a 76.2-centimeter diameter, 305-meter long pipe, and a reinforced concrete outfall structure that would discharge powerhouse flows back to the East Fork Wallowa River. PacifiCorp would implement a number of BMPs for erosion, sediment, and spill prevention and control during proposed construction activities. All work below the ordinary high water mark of the East Fork Wallowa River would be done in the dry. The work area would be isolated from the river by a cofferdam constructed of non-fine containing material.[1] There would be no water contact with green concrete. BMPs would be determined in consultation with and approved by applicable regulatory agencies, including the Oregon Department of Environmental Quality (DEQ) (related to applicable 401 Water Quality Certification) and the U.S. Army Corps of Engineers and Oregon Department of State Lands (DSL) (related to applicable Section 404 and DSL Removal-Fill Permits).

3.2.3 Interim Operations

PacifiCorp will continue to operate the Wallowa Falls Hydroelectric powerhouse with the current tailrace configuration until June following the third anniversary of FERC license issuance. During this time, PacifiCorp will design, permit and construct the proposed tailrace reroute pipeline project. PacifiCorp plans to construct the tailrace reroute pipeline and associated intake and outfall structures between June and September of the third year

[1] Cofferdam material would be brought onsite and removed from the river for offsite disposal or reuse. A cofferdam would be either an impermeable water filled bladder or constructed of stacked sandbags covered with a visqueen barrier.

following license issuance. However, to minimize effects to water quality and aquatic species, the pipeline will not be put into operation until the following seasonal high-flow period (June) after construction is completed.

During the approximately three-year ‘interim operations’ period, when the current tailrace configuration will be used, PacifiCorp will continue to conduct a fish salvage of the tailrace channels anytime there is a planned or unplanned dewatering of the tailrace. As described in PacifiCorp’s Final License Application, there are limited operational scenarios under which the tailrace channels become completely dewatered. To further protect bull trout and kokanee during the interim period, a fish exclusion weir will be installed annually prior to September 1 at the confluence of the tailrace with the West Fork Wallowa River to prevent fish spawning in the tailrace channels. The fish exclusion weir will be left in place through November 15 and will be monitored twice per week for the duration of the installation period to assure performance. In the event that a fish exclusion weir is not installed in a given year, the tailrace channels will be dewatered and the powerhouse not operated between September 1 and November 15 to prevent fish spawning in the tailrace channels. Prior to any shutdown a fish salvage of the tailrace channels will be conducted.

Beginning in June following the third anniversary of license issuance, the proposed tailrace reroute pipeline will be used for the discharge of all generation flows to the East Fork Wallowa River under normal operating conditions. While it is technically possible for the reroute intake structure or pipe to become clogged with ice or debris, an operational failure or emergency situation of this nature is very unlikely and is expected to occur 0-to-1 times in the new license period.

To address operational failures or emergency situations, a water level indicator will be installed in the tailrace reroute collection basin that is connected to the existing forebay headgate control system. In the event the pipe intake became clogged, the level indicator would send an alarm signal to the headgate control, closing it and stopping any flooding or damage to the generation equipment, powerhouse, and its immediate environment. This system would eliminate the need for the emergency spillway channel that was described in PacifiCorp's Preliminary Licensing Proposal.

3.3 Action Area

The action area includes all areas directly or indirectly affected by the proposed action. The action area is not limited to the actual physical project footprint, but includes all areas that could reasonably be affected by the proposed action (50 CFR 402). Considering the proposed action and existing site conditions, the Project action area encompasses the East Fork Wallowa River from the Project forebay to the confluence with the West Fork Wallowa River, and the mainstem Wallowa River channel from the falls near the mouth of BC Creek downstream to Wallowa Lake (Figure 3-1). This area is expected to encompass all reasonably foreseeable direct and indirect impacts of the proposed action—including forebay flushing activities within the river's active channel and resulting temporary downstream turbidity and sediment redistribution—and temporary construction impacts resulting from the tailrace reroute. The action area described above is within the 6th field Hydrologic Unit Code (HUC) of the Upper Wallowa River sub-basin.

4.0 NATURAL HISTORY AND SPECIES OCCURRENCE

4.1 Bull Trout Distribution and Life History

Historically, bull trout have occurred throughout the Columbia River Basin, the Klamath Basin, western Montana, northern Nevada, northern California, Alberta, British Columbia, and possibly southeastern Alaska (USFWS 1998b). Today bull trout are found primarily in upper tributary streams, lakes, and reservoir systems, and have generally been eliminated from the main stems of most large rivers. The main populations remaining in the United States today are in Montana, Idaho, Oregon, and Washington, with a small population in northern Nevada. Bull trout are now extinct in northern California (USFWS 1998b).

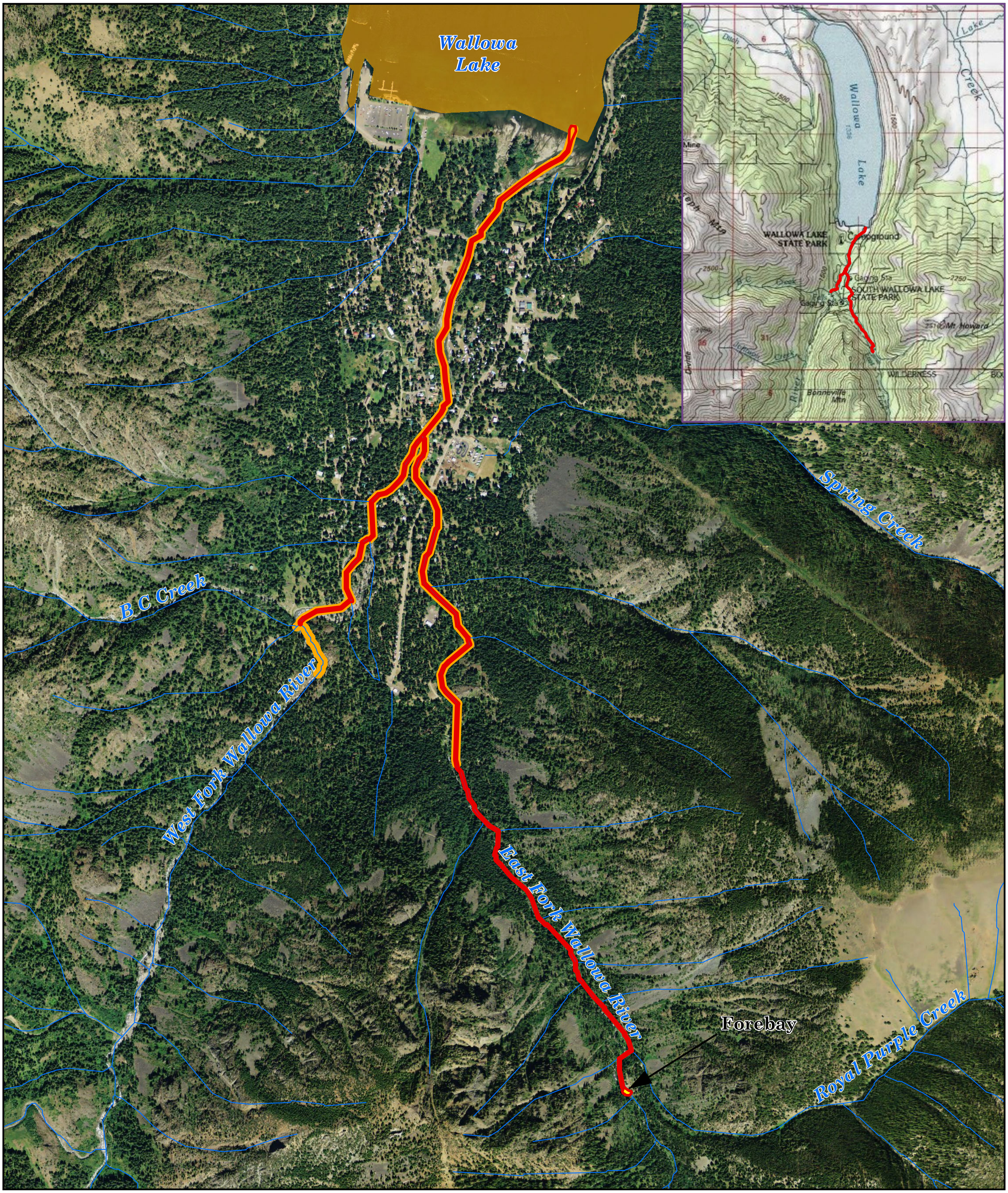


Figure 3-1
Action Area Map
Wallowa Falls
Wallowa County, Oregon

- **Action Area**
- **Bull Trout Critical Habitat**
- **Stream**
- **Forebay**

MB&G

N

0 250 500 1,000 1,500 2,000 Feet

Source: Aerial from NAIP 2012, HUC data provided by USGS, all other layers provided by MB&G. Reproduced for infomation purposes and may not be suitable for legal, engineering or surveying purposes. Conclusions drawn are the responsibility of the user.

3-1_Figure_ActionArea 2/25/2014

Bull trout are known to exhibit four distinct life-history forms throughout their range, including anadromous, resident, adfluvial and fluvial. Anadromous forms utilize a wide range of habitats and generally rear in natal streams before moving to the ocean to mature. Resident forms complete their entire life cycle in the streams in which they spawn and rear. Adfluvial bull trout rear from one to four years in their natal stream and then migrate to lakes, returning only to spawn. Fluvial forms also mature in their natal streams but move to large streams and rivers after maturation (Fraley and Shepard 1989).

Bull trout prefer relatively pristine water, low temperatures, clean substrate with loose gravel, and low gradient streams to spawn. Preferred spawning areas are therefore associated with cold water springs, groundwater infiltration, and the coldest reaches of tributary streams in a watershed (Rieman and McIntyre 1993). Temperatures required to initiate spawning in adults vary from 4 °C to 11 °C (39 °F to 52 °F) during late August through October (Fraley and Shepard 1989; Buchanan and Gregory 1997). Optimal temperatures for juvenile rearing range from 4 °C to 10 °C (39 °F to 50 °F) (Buchanan and Gregory 1997).

Preferred bull trout spawning habitat typically consists of lower gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, Pratt 1992, Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992). For additional information on the habitat requirements, life history, and limiting factors for recovery of bull trout see the Federal Register published on June 10, 1998 (63 FR 31647).

4.2 Federal Listing Status and Designated Critical Habitat

Bull trout were first listed as threatened under the ESA on June 10, 1998 (63 FR 31647). This original listing included the Columbia River and Klamath River DPSs. The USFWS later added the Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River DPSs to the listing. A final ruling was issued on November 1, 1999 that assigned threatened status to all populations of bull trout within the coterminous United States (64 FR 58910, 58933). The USFWS considers bull trout threatened because of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species (63 FR 31647).

Critical Habitat was originally designated for the Columbia River and Klamath River DPSs on October 6, 2004 (69 FR 59996). On January 13, 2010, the USFWS proposed to revise its designation of Critical Habitat for bull trout (75 FR 2270). In total, the USFWS proposed designating approximately 22,679 miles of streams and 533,426 acres of lakes and reservoirs in Idaho, Oregon, Washington, Montana and Nevada, and 985 miles of marine shoreline in Washington as Critical Habitat for bull trout. A final ruling on Critical Habitat for bull trout in the coterminous United States was designated on October 18, 2010, and included lower portions of the East Fork and West Fork Wallowa Rivers (75 FR 63898) (see Figure 3-1). As a result of the final Critical Habitat designation, bull trout populations within the Columbia River DPS were divided into six Recovery Units based on "assemblages of bull trout core areas (metapopulations, or interacting breeding populations) that retain genetic and ecological integrity and are significant to the distribution of bull trout throughout the conterminous United States" (75 FR 63898). The East Fork Wallowa River is located within the MC Recovery Unit.

4.3 Species Occurrence within the Action Area

Most native stock bull trout in the Wallowa River Basin were thought to be extirpated by the late 1950's during an eradication effort to reduce predation and competition on rainbow trout within Wallowa Lake. This local extirpation led to a hatchery reintroduction program in 1968, when bull trout and Dolly Varden (*Salvelinus malma*) from an Alaskan hatchery were released into Wallowa Lake. This reintroduction program was believed to have failed and was discontinued in 1978 (Buchanan et al. 1997).

In 1997, 600 bull trout ranging in size from 69.85 – 379.2 millimeters (mm) were salvaged from a decommissioned hydroelectric plant's power canal located on Big Sheep Creek in the Imnaha River drainage and transplanted into Wallowa Lake (PacifiCorp

2011a). Big Sheep Creek bull trout typically exhibit a resident or fluvial life-history (Al-Chockhachy et al. 2005). Due to lack of available resources to monitor this population after the reintroduction, the status and life-history exhibited by these fish is currently unknown (PacifiCorp pers. comm. with Bill Knox, ODFW, September 2010). Based on lack of empirical data and no sightings of bull trout since 2004 during angler creel checks, [pers. comm. Bill Knox, ODFW, September 2010], bull trout were listed in the 2005 ODFW Oregon Native Fish Status Report as extirpated in Wallowa Lake and its tributaries (ODFW 2005).

No bull trout had been observed or reported upstream of the irrigation dam at the outlet of Wallowa Lake for six years until June 9, 2010, when a PacifiCorp biologist caught a bull trout when angling near the Wallowa River inlet to Wallowa Lake (PacifiCorp 2011a). Bull trout were first documented within the Project area on July 12, 2010, during a salvage of the tailrace due to a planned dewatering event (PacifiCorp 2011a). The tailrace carries water from the powerhouse to the West Fork Wallowa River as it flows out of the 1,734 meters-long penstock and hydroelectric generating unit (see Appendix A). Two individuals were captured 91 meters downstream of the powerhouse, prior to the channel being de-watered, and were subsequently released into the West Fork Wallowa River, per the conditions of PacifiCorp’s Oregon State Fish Collection Permit #15214 (PacifiCorp 2011a).

During a September 15, 2010 snorkel survey, one bull trout was observed within the tailrace approximately 18 meters downstream of the turbine discharge (PacifiCorp 2011a). Later during that same survey, two adult bull trout were observed in the bypassed reach of the East Fork Wallowa River, approximately 229 meters upstream from the confluence with the West Fork Wallowa River. The two bull trout were observed paired-up near a partially completed redd (PacifiCorp 2011a). Bull trout were again observed on June 16, 2011 during an electro-fishing survey of the East Fork Wallowa River. During the survey, five charr juveniles exhibiting all the meristics of bull trout were captured. The five juvenile charr ranged in size from 81.28 – 88.9 mm inches (pers. comm. with Jeremiah Doyle, PacifiCorp, October 2011, Doyle 2011). Genetic analysis confirmed that all five charr juveniles captured during the June 2011 sampling effort were bull trout.

PacifiCorp surveyed the Project area for fish presence, relative abundance, and distribution during the summer of 2012. Areas sampled included the tailrace channel, forebay, bypassed East Fork Wallowa River and Wallowa Lake. The East Fork Wallowa River was surveyed from its confluence with the West Fork Wallowa River upstream to a waterfall that appears to be a complete fish passage barrier, and also in the reach between the aforementioned passage barrier and the larger waterfall located immediately upstream of the first project penstock trestle. Sampling methods included use of tangle nets throughout Wallowa Lake and at the head of the lake near the terminus of the West Fork Wallowa River, hook and line, and electro-fishing to document bull trout presence or absence. The project forebay was also sampled for fish presence on August 22 and September 25, 2012. During the August 22 survey the entire forebay was seined and no fish were captured. On September 25 the forebay was snorkeled and no fish were observed. A total of 52 bull trout were observed during the 2012 sampling efforts; 47 in the East Fork Wallowa River downstream of the aforementioned waterfall, three in the tailrace channel, and one bull trout at the head of Wallowa Lake. No bull trout were observed in the reach of the East Fork Wallowa River between the waterfalls or in the hydroelectric project forebay.

In August 2013 PacifiCorp conducted a fish presence/absence snorkel survey of the Project forebay; four brook trout parr were observed. In addition, two fish were observed and then captured within the fenced area of the Project tailrace, downstream of the turbine discharge during August 2013 sampling efforts. Both fish were PIT tagged and found to be recaptures from 2012 activities; one was a genetically verified bull trout/brook trout hybrid captured in the tailrace during the salvage for the maintenance outage in 2012. The second was a bull trout previously captured and tagged in the uppermost portion of the available habitat within the East Fork, 100 meters below the anadromous barrier.

The East Fork Wallowa River was again electro-fished in 2013 with the intent of recapturing what was thought to be resident adult bull trout PIT tagged during 2012 activities. The electro-fishing survey started at the highway bridge and proceeded upstream. A total of 56 bull trout were captured, none of which had been previously captured. This compares to 47 bull trout captured during the more rigorous 2012 survey. Of note during the 2013 survey was the capture of two large migratory-sized individuals 20 meters below the anadromous fish barrier.

Due to the presence of large migratory fish at the terminus of available habitat within the East Fork Wallowa River bypassed reach, lack of recaptures of previously thought resident individuals, and the recapture of a previously thought resident-sized East Fork Wallowa River bypassed reach bull trout in the Project tailrace, it is now clear that migratory bull trout are a component of the East Fork Wallowa River bull trout population. The 2013 survey results suggest that most of the bull trout captured are likely rearing progeny of fish exhibiting a migratory life-history.

PacifiCorp has directly observed bull trout spawning activity within the Project area. In September 2010, PacifiCorp biologists observed a pair of adult bull trout actively constructing a redd in the lower 200 meters of the bypassed section of the East Fork Wallowa River (PacifiCorp 2014a). In addition, capture of two adult (male and female) bull trout within the Project tailrace in 2012 and the timing of subsequent PIT tag detections in the East Fork Wallowa River suggested spawning at that time as well, although no redds were observed.

Bull trout have not been observed within the Project forebay or within the upper 1,372 meters of the bypassed section of the East Fork Wallowa River, given a natural barrier (waterfall) that exists approximately 1,372 meters downstream of the Wallowa Falls dam. The waterfall appears to define the upstream limit of designated Critical Habitat for bull trout on the East Fork Wallowa River (USFWS 2011).

A generalized life stage/seasonal activity table for bull trout that may occur in the Wallowa River and its tributaries is shown below (Table 4-1, from ODFW 2011). Conversations with local USFWS staff regarding bull trout life stages within the East Fork Wallowa River suggests that peak spawning can begin in early September and continue through October. In addition, peak egg incubation can continue through March and fry emergence can continue through May (pers. comm. with Gretchen Sausen, USFWS, November 16, 2011).

Table 4-1. Wallowa River fish timing table for bull trout (ODFW 2011).

Life Stage/Activity	J	F	M	A	M	J	J	A	S	O	N	D
Adult fluvial/adfluvial migration				Lesser	Peak	Peak	Lesser	Lesser				
Adult spawning									Lesser/Peak	Peak/Lesser		
Adult/sub-adult rearing	Peak	Peak	Peak	Lesser	Lesser	Lesser/–			–/Lesser	Lesser	Peak	Peak
Egg incubation / fry emergence	Peak	Peak	Peak/Lesser	Lesser	Lesser/–				Lesser	Peak	Peak	Peak
Juvenile rearing	Presence	Presence	Presence	Presence	Presence	Presence	Presence	Presence	Presence	Presence	Presence	Presence

Peak = Represents peak use; Lesser = Represents lesser use; Presence = Represents presence

Life stage periodicity reflects migration of fluvial/adfluvial forms from Wallowa Lake in May and June. As noted above regarding 2013 field observations, the capture and observation of two large migratory individuals 20 meters below the anadromous fish barrier, and absence of recaptures (among 56 bull trout captured) point to an adfluvial population that likely has a significant portion of its life history carried out in Wallowa Lake. Further analysis of the East Fork Wallowa River local population, and additional migration data collected in 2013 from the East Fork Wallowa River natural channel fixed PIT antenna array will contribute to the life-history assessment of this population.

5.0 ENVIRONMENTAL BASELINE CONDITIONS

5.1 Upper Wallowa River Watershed

The Wallowa River originates in the Eagle Cap Wilderness in the Wallowa Mountains of eastern Oregon, and is approximately 88.5 kilometers long. The Wallowa River is the largest tributary to the Grande Ronde River, a Snake River tributary. There are two forks to the Wallowa River – East and West. The confluence of the East and West Forks of the Wallowa River is located approximately 5 river miles south of Joseph, Oregon and approximately 1 river mile upstream of Wallowa Lake.

As discussed later in this section of the BA, the USFWS's guidance document for BAs (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)* recommends that analysis of the proposed action be conducted at the 5th or 6th field HUC watershed scale (USFWS 1998a). At the 5th field HUC, the Wallowa River watershed encompasses approximately 148,540 acres, and includes several major sub-drainages at the 6th field scale (Figure 5-1). Relative watershed area for 6th field HUCs are summarized below (Table 5-1.)

Table 5-1. Subwatersheds (6th field HUCs) within the Upper Wallowa River Watershed (HUC 1706010501).

Subwatershed	Acres	Percent of 5th field HUC
Hurricane Creek	21,851	15%
Lower North Fork Prairie Creek	10,443	7%
Spring Creek	15,698	11%
Trout Creek	21,791	15%
Upper North Fork Prairie Creek	20,556	14%
Upper Prairie Creek	14,213	10%
Upper Wallowa River	27,272	18%
Wallowa River-Wallowa Lake	16,715	11%
Totals	**148,540**	**100%**

The proposed action is located within the Upper Wallowa River 6th field HUC, which includes both the East and West Forks of the Wallowa River and drains approximately 18 percent of the 5th field Upper Wallowa River watershed. Major tributaries within this sub-basin include Bug Creek, BC Creek, Johnson Creek, Adam Creek, and Lake Creek (tributaries to the West Fork Wallowa River), and Royal Purple Creek, a tributary to the East Fork Wallowa River (Figure 5-2).

The Upper Wallowa River watershed is located within Wallowa County, Oregon, a rural county with less than one percent of urban land use. Major population centers include Enterprise (the county seat) and Joseph. Land use within the county has historically been, and is currently, dominated by agriculture (Wallowa County 2009). Federal land ownership and management throughout the county (predominantly by the USFS) accounts for approximately 57 percent of the total land use (Wallowa County 2009). Private agricultural land uses, including croplands, pasturelands, rangelands and forest lands accounts for approximately 41 percent of land use in the county.

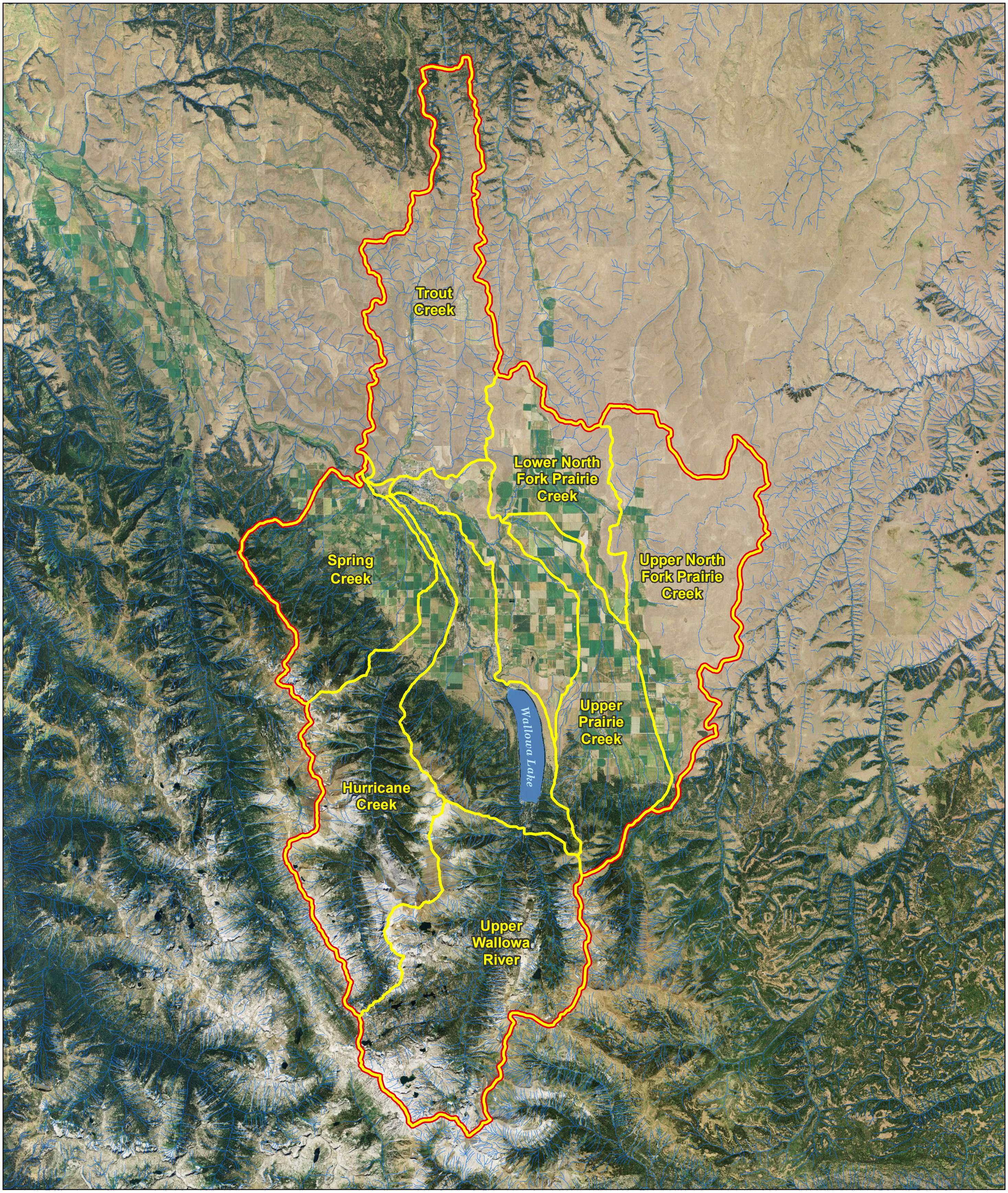


Figure 5-1
Upper Wallowa River Watershed
Wallowa and Union Counties, Oregon

5th Field Upper Wallowa River Watershed
6th Field Subwatershed
Stream

MB&G

Miles
0 0.25 0.5 1

Source: Aerial from NAIP 2012, HUC data provided by USGS, all other layers provided by MB&G. Reproduced for infomation purposes and may not be suitable for legal, engineering or surveying purposes. Conclusions drawn are the responsibility of the user.

5_Figure_HUCMap 12/3/2013

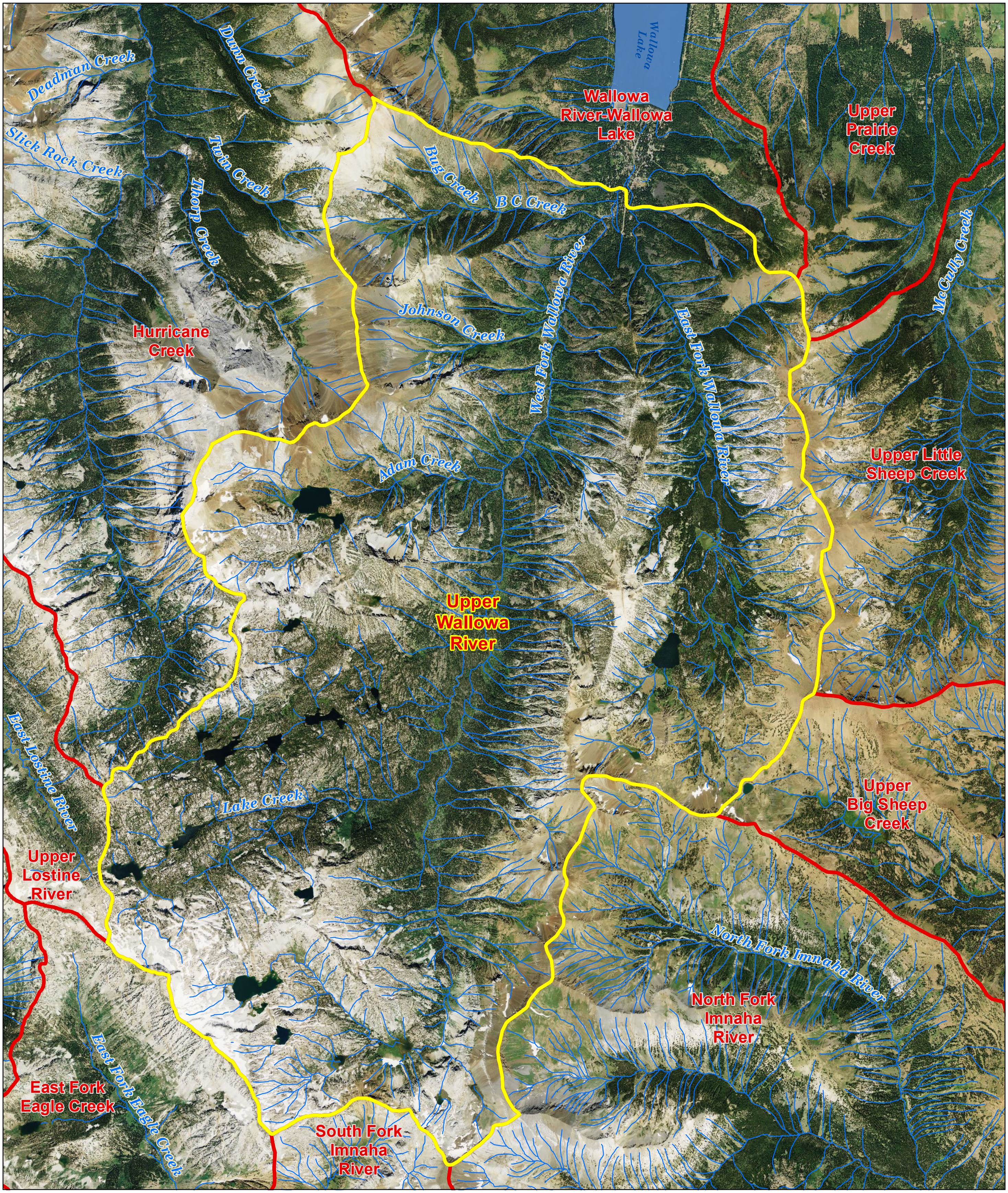


Figure 5-2
Upper Wallowa River Subwatershed
Wallowa and Union Counties, Oregon

Upper Wallowa River Subwatershed
Other Subwatershed
Stream

MB&G

0 0.25 0.5 1 Miles

N

Source: Aerial from NAIP 2012, HUC data provided by USGS, all other layers provided by MB&G.
Reproduced for infomation purposes and may not be suitable for legal, engineering or surveying purposes.
Conclusions drawn are the responsibility of the user.

5-2_Figure_HUCMap 12/4/2013

The Upper Wallowa River watershed is predominantly undeveloped forest lands, with a mix of residential development and small industry, mostly mining and livestock grazing. Land use within the watershed has affected water resources in a variety of ways. The Eagle Cap Wilderness is at a northern margin of a belt of metalliferous geologic deposits, with the principal metals being gold, copper, and silver, with minor lead deposits (Weis et al. 1976). There is a history of mining in the Eagle Cap Wilderness, although mining claims in the vicinity of the project are not well documented. Copper, molybdenum, tungsten, gold and silver are known to be in the quartz veins and tactite zones of the Wallowa batholith or along its margins (Weis et al. 1976).

Fire suppression within federal and private forest lands has led to high fuel densities throughout the upper reaches of the watershed. In addition, the spruce bark beetle has damaged and/or killed a large number of trees, resulting in large amounts of downed wood and high fuel loading (Wallowa County 2002). The resulting dense patches of dead trees and downed wood prevents precipitation from reaching and infiltrating the ground, resulting in increased evaporation and decreased stream flows (Wallowa County 2009). Furthermore, the Wallowa Lake dam, located just south of Joseph, Oregon, prevents upstream and downstream fish passage, and prevents anadromous salmonids and other species from reaching valuable spawning grounds.

The Upper Wallowa River watershed is typified by its location within the Wallowa Mountains. The topography of the area is steep, and includes narrow mountain valleys below sharp mountain peaks. Valley floors and lower slopes are predominately forested, with upper slopes characterized by ridges, rock outcrops and talus slopes. Mixed montane forests in the area are dominated by conifers such as grand fir (*Abies grandis*), subalpine fir (*A. lasiocarpa*), western larch (*Larix occidentalis*), Engelmann spruce (*Picea englemannii*), lodgepole (*Pinus contorta*) and ponderosa (*P. ponderosa*) pines, and Douglas-fir (*Pseudotsuga menziesii*); deciduous trees include black cottonwood (*Populus balsamifera*) and quaking aspen (*P. tremuloides*) (PacifiCorp 2011a).

The East Fork Wallowa River is a snowmelt runoff stream. Peak runoff occurs generally from May through mid-July, and by late July, little snow is left in the Wallowa Mountains. Runoff recedes to low flows by August and September. Flows may increase in fall in response to autumn rains, but relatively low flows generally persist from late fall through winter due to freezing conditions in the contributing high-elevation watershed areas, which result in little or no direct runoff during this time. The Upper Wallowa River watershed is predominantly undeveloped forest lands, with a mix of residential development and small industry, mostly mining and livestock grazing.

As described in the FLA (PacifiCorp 2013c), historic flow information for the Project area is based on two U. S. Geological Survey (USGS) gaging stations in the Project vicinity over a 58-year period from October 1924 through September 1983; one located in the Project tailrace (USGS Station 13324500) and another in the East Fork one quarter mile (402 meters) upstream of the confluence with the West Fork (USGS Station 13325000). The USGS also developed flow data for a third "reporting station" (USGS Station 13325001) that is a summation of data collected at the two gage sites. The data for the reporting station (USGS Station 13325001) represents the best data available for characterizing the hydrology of the East Fork in the Project vicinity. Based on the 58-year period of record, average monthly minimum flows in the East Fork ranged from 7.7 cfs in March to 25.2 cfs in June, and average monthly maximum flows ranged from 14.6 cfs in March to 142.2 cfs in June. Average mean monthly flows in the East Fork Wallowa River ranged from 11 cfs in February and March to 61 cfs in June. During the period of record, monthly flows met or exceeded 10 cfs 90 percent of the time, 14 cfs 50 percent of the time, and 45 cfs 10 percent of the time.

The East Fork Wallowa River bypassed portion of the river is approximately 2,816 meters long, stretching from the diversion dam to the confluence with the West Fork Wallowa River. Steep slopes confine this reach and its hydrologic influence to a narrow channel, resulting in a narrow riparian area. The reach of the river located from the diversion dam to approximately 1 river mile downstream is high gradient (19 percent) and characterized by numerous vertical waterfalls and cascades; substrate is dominated by bedrock and boulders. Downstream from this reach, to the confluence of the West

Fork Wallowa River, the East Fork Wallowa River is characterized by a gentler gradient (8.5 percent) and numerous riffles and pools (PacifiCorp 2011a). Average monthly flows recorded for the East Fork Wallowa River and tailrace from 1924 to 1983 are shown below (Table 5-2).

Table 5-2. Average monthly flow at USGS gaging station 13325001 (East Fork Wallowa River and tailrace) from 1924 – 1983.

Month	Average Minimum Flow (cfs)	Average Mean Flow (cfs)	Average Maximum Flow (cfs)
January	8.4	12	16.8
February	8.02	11	15
March	7.67	11	14.6
April	8.59	13	18.4
May	14.9	30	59.1
June	25.2	61	142.2
July	11.8	44	98.2
August	9.62	20	37.3
September	9.68	16	26.5
October	9.97	15	24.8
November	9.26	14	20.9
December	9.06	13	18.9

5.2 Baseline Conditions Pathways and Indicators

In *A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale*, the USFWS provides a method by which bull trout habitat baseline conditions can be assessed using diagnostic pathways and indicators. Outcomes, i.e., whether habitat is “functioning appropriately”, “at risk”, or at “unacceptable risk”, are defined as follows (USFWS 1998a):

- ***Functioning Appropriately:*** when they maintain strong and significant populations that are interconnected and promote recovery of proposed or listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations.
- ***Functioning at Risk:*** they provide for persistence of the species but in more isolated populations and may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts

- ***Functioning at Unacceptable Risk:*** suggests the proposed or listed species continues to be absent from historical habitat, or is rare or being maintained at a low population level.

Properly functioning, habitat-based biological requirements for bull trout generally include the essential physical features that support spawning, incubation, rearing, feeding, sheltering, migration and other behaviors; including adequate instream flow, appropriate water temperature, loose gravel for spawning, unimpeded fish passage, deep pools, and abundant large tree trunks and root wads.

The USFWS checklist for documenting environmental baseline conditions is shown below, along with an assessment of function using the above criteria, and a "crosswalk" to related Primary Constituent Elements (PCEs) of bull trout critical habitat (Table 5-3) (USFWS 2010). All components of the matrix have been rated based on available data and guidance provided by the USFWS for evaluating each of the pathways and indicators (USFWS 1998a). A discussion of those indicators most relevant to the proposed action is presented below. As depicted in Table 5-3, the USFWS matrix of pathways and indicators can be used to evaluate the function of related PCEs. A matrix showing direct effects of the proposed action on bull trout and bull trout critical habitat PCEs is discussed in Section 6.

5.2.1 Subpopulation Characteristics

The USFWS guidance for evaluation of bull trout sub-population characteristics is based on an assessment of four principal sub-population indicators:

- Subpopulation Size;
- Growth and Survival;
- Life History Diversity and Isolation; and
- Persistence and Genetic Integrity.

Table 5-3. Summary of environmental baseline indicators for bull trout within the Upper Wallowa River watershed (from USFWS, 1998a) and relationships to bull trout PCEs.

DIAGNOSTICS/ PATHWAYS INDICATORS	POPULATION AND ENVIRONMENTAL BASELINE			Related PCEs
	Functioning Appropriately	Functioning At Risk	Functioning at Unacceptable Risk	
<u>Subpopulation Characteristics:</u> Subpopulation Size		X		
Growth and Survival		X		
Life History Diversity and Isolation		X		
Persistence and Genetic Integrity			X	
<u>Water Quality:</u> Temperature		X		Springs/Seeps/Groundwater (1) Migratory Habitats (2) Abundant Food Base (3) Water Temperature (5) Substrate Features (6) Water Quality/Quantity (8)
Sediment		X		
Chem.Contam./Nutrients	X			
<u>Habitat Access:</u> Physical Barriers			X	Springs/Seeps/Groundwater (1) Migratory Habitats (2) Abundant Food Base (3) Predators/Competitors (9)
<u>Habitat Elements:</u> Substrate Embeddedness	X			Springs/Seeps/Groundwater (1) Migratory Habitats (2) Abundant Food Base (3) Complex Habitats (4) Water Temperature (5) Substrate Features (6) Predators/Competitors (9)
Large Woody Debris	X			
Pool Frequency and Quality	X			
Large Pools	X			
Off-channel Habitat	X			
Refugia	X			
<u>Channel Cond. & Dynamics:</u> Wetted Width/Max. Depth Ratio	X			Springs/Seeps/Groundwater (1) Migratory Habitats (2) Abundant Food Base (3) Complex Habitats (4) Water Temperature (5) Substrate Features (6) Natural Hydrograph (7) Water Quality/Quantity (8) Predators/Competitors (9)
Streambank Condition	X			
Floodplain Connectivity	X			
<u>Flow/Hydrology:</u> Change in Peak/Base Flows		X		Springs/Seeps/Groundwater (1) Migratory Habitats (2) Water Temperature (5) Natural Hydrograph (7) Water Quality/Quantity (8)
Drainage Network Increase	X			
<u>Watershed Conditions:</u> Road Density & Location	X			Springs/Seeps/Groundwater (1) Abundant Food Base (3) Complex Habitats (4) Water Temperature (5) Natural Hydrograph (7) Water Quality/Quantity (8) Predators/Competitors (9)
Disturbance History	X			
Riparian Conservation Areas	X			
Disturbance Regime	X			
<u>Integration of Species and Habitat Conditions</u>		X		

Subpopulation Size. Data and observations reported by PacifiCorp from 2010-2013 are insufficient for a finding of Functioning Appropriately for this indicator, which would assume a mean population size or local habitat capacity of more than several thousand individuals, with all life stages evenly represented. Unacceptable Risk assumes less than 50 individuals. Largely as a result of the lack of data elsewhere in the upper Wallowa River or its tributaries, Subpopulation Size is deemed **Functioning at Risk**, with between 50 and 500 adults.

Growth and Survival. The population is likely functioning appropriately with respect to Growth and Survival (stable or increasing population with resilience to recover from short term disturbances). However, 10 years of data are required to support this estimate. Given the lack of data, current function of the Growth and Survival indicator is deemed **Functioning at Risk**.

Life History Diversity and Isolation. The Life History Diversity and Isolation indicator reflects whether migratory bull trout occur in the subpopulation, and if so the proximity to other spawning populations. Functioning Appropriately would require that migratory fish are not only present but that neighboring subpopulations are large and produce surplus individuals or straying adults.

As noted earlier in this BA, observations by PacifiCorp in 2013 concerning presence and extent of the migratory life history status suggest that this life history form is represented in the East Fork Wallowa River. Status of bull trout within the West Fork Wallowa River or other tributaries to the Upper Wallowa River is largely unknown (pers. comm. with Jim Harbeck, Nez Perce Tribe, September 24, 2013). However, PacifiCorp captured a bull trout in BC Creek, 250 m upstream from its confluence with the West Fork Wallowa River in 2012. BC Creek is a small tributary of the West Fork Wallowa River located upstream of both the Project tailrace channel and the East Fork Wallowa River.

No bull trout captured and tagged during electrofishing surveys of the East Fork Wallowa River bypassed reach in 2012 were encountered during similar surveys of the same area in 2013. Given the lack of recaptures during the 2013 bypassed reach electrofishing survey, the recapture of 2012 bypassed reach bull trout within the Project tailrace channel in 2013, the capture of large migratory-sized bull trout just below the anadromous fish barrier in the bypassed reach in both the 2012 and 2013 surveys, and the 2013 interrogation of 2012 headwater bull trout captures at downstream PIT antenna sites, it appears the upper East and West Fork Wallowa River local bull trout population exhibits a migratory life history. While migratory corridors and rearing habitat within and upstream of Wallowa Lake are in good to excellent condition, the extent and status of neighboring subpopulations is unknown. This indicator is therefore considered **Functioning at Risk**.

Persistence and Genetic Integrity. The Persistence and Genetic Integrity indicator reflects the degree of subpopulation connectivity and hybridization. Appropriate functioning assumes connectivity with five or more subpopulations—each with several thousand fish—and low to non-existent hybridization. Indicators for unacceptable risk would be a declining population with little or no connectivity, and high probability of hybridization.

Two suspected bull trout/brook trout hybrids were caught in the Project tailrace in August 2012 and later confirmed by the USFWS Abernathy Conservation Genetics Lab (PacifiCorp 2014a). Additional hybrids were confirmed in 2013; of the 38 putative bull trout collected in the Wallowa River system and analyzed by the lab noted above, 30 fish had genotypes consistent with pure bull trout and eight fish had genotypes consistent with F1 bull trout x brook trout hybrids. These data confirm that bull trout are currently present in the Wallowa system, and that non-native brook trout represent a potential threat to bull trout in the system. Wallowa Lake Dam blocks upstream movement from lower basin subpopulations, e.g., Spring, Trout, and Prairie Creeks, to Wallowa Lake and the East and West Forks of the Wallowa River, magnifying the effect of hybridization on upstream tributaries. This indicator is therefore deemed **Functioning at Unacceptable Risk**.

5.2.2 Water Quality

Overall water quality in the Wallowa River watershed is excellent, due to the relatively pristine condition of the watershed within the Eagle Cap Wilderness Area (Nowak and Kuchenbecker 2004; PacifiCorp 2013e). Because the East and West Fork Wallowa Rivers are supplied by direct snowmelt runoff or groundwater baseflow, they are consistently cold throughout the year. For bull trout, USFWS indicators of water quality include temperature, sediment and chemical contaminants/nutrients. Current functioning of water quality baseline conditions using these indicators and available data is discussed below.

Temperature. Appropriately functioning water temperatures (measured as 7-day average daily maximum; 7-DADmax) for bull trout range from 2-5 ºC for incubation (January - March), 4-12 ºC for rearing (essentially year round), and 4-9 ºC for spawning (September and October). A summary of 2012 and 2013 temperature data collected at representative Project sites is shown below (Figure 5-3, PacifiCorp 2013e). Spawning and rearing temperatures were near optimal for all sites, with the exception of the lower bypassed reach (Site BPL), where temperatures in August were 13-14 ºC, and colder than 2 ºC from January through March during bull trout incubation. East Fork Wallowa River inflow temperatures were also colder than optimal at that time.

West Fork Wallowa River 7DADmax temperatures upstream of the tailrace discharge (Site WFI, PacifiCorp 2013e) were approximately 2 ºC higher than temperatures at East Fork Wallowa River sites during summer. It is likely that the higher 7-DADmax water temperature values at WFI are the result of a larger watershed area draining to the WFI site in contrast to East Fork Wallowa River sites, with smaller drainage area, comparatively higher mean elevation and gradient, and lower stream width. Based primarily on lower than optimal temperatures from January through March at sites within the East Fork Wallowa River bypassed reach, water temperatures are deemed **Functioning at Risk**.

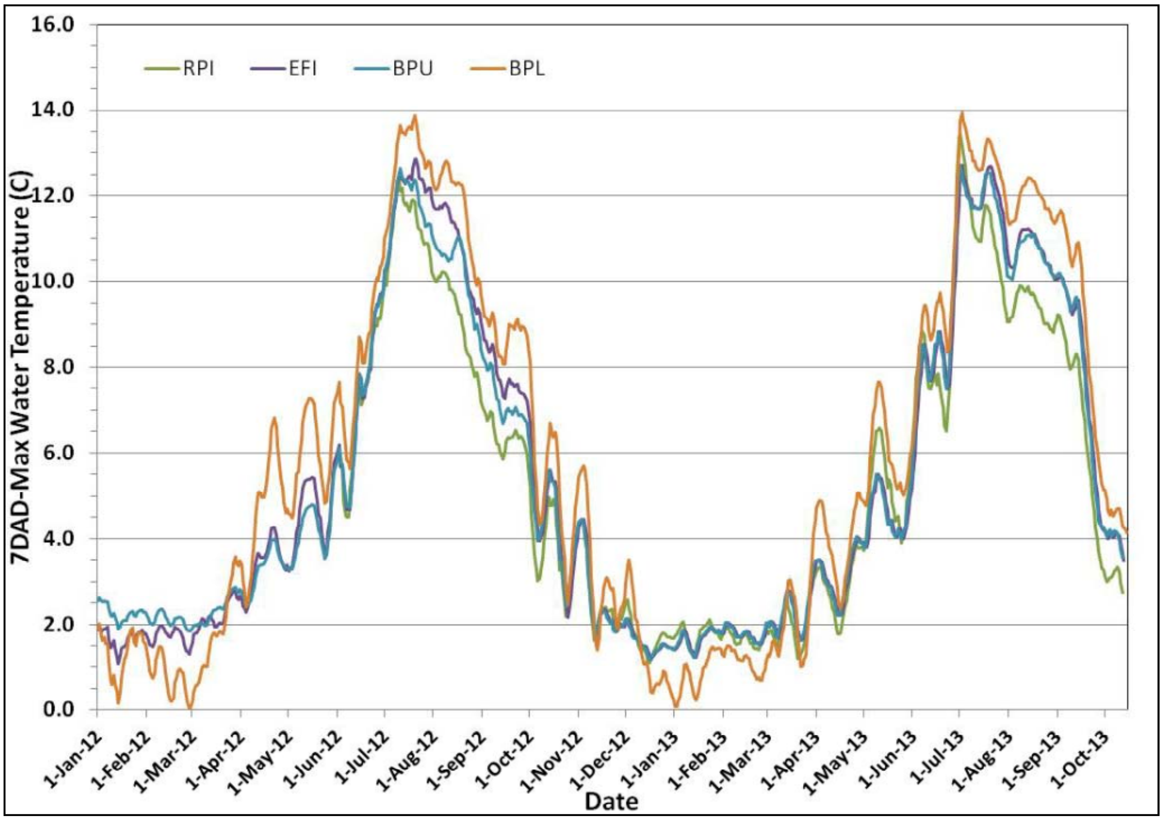


Figure 5-3. 7-DAD Max water temperature at upper and lower bypassed reach sites on the East Fork Wallowa River (BPU, BPL), Royal Purple Creek inflow (RPI), and East Fork Wallowa River inflow to the project forebay (EFI); January through October 2013 (PacifiCorp 2013e).

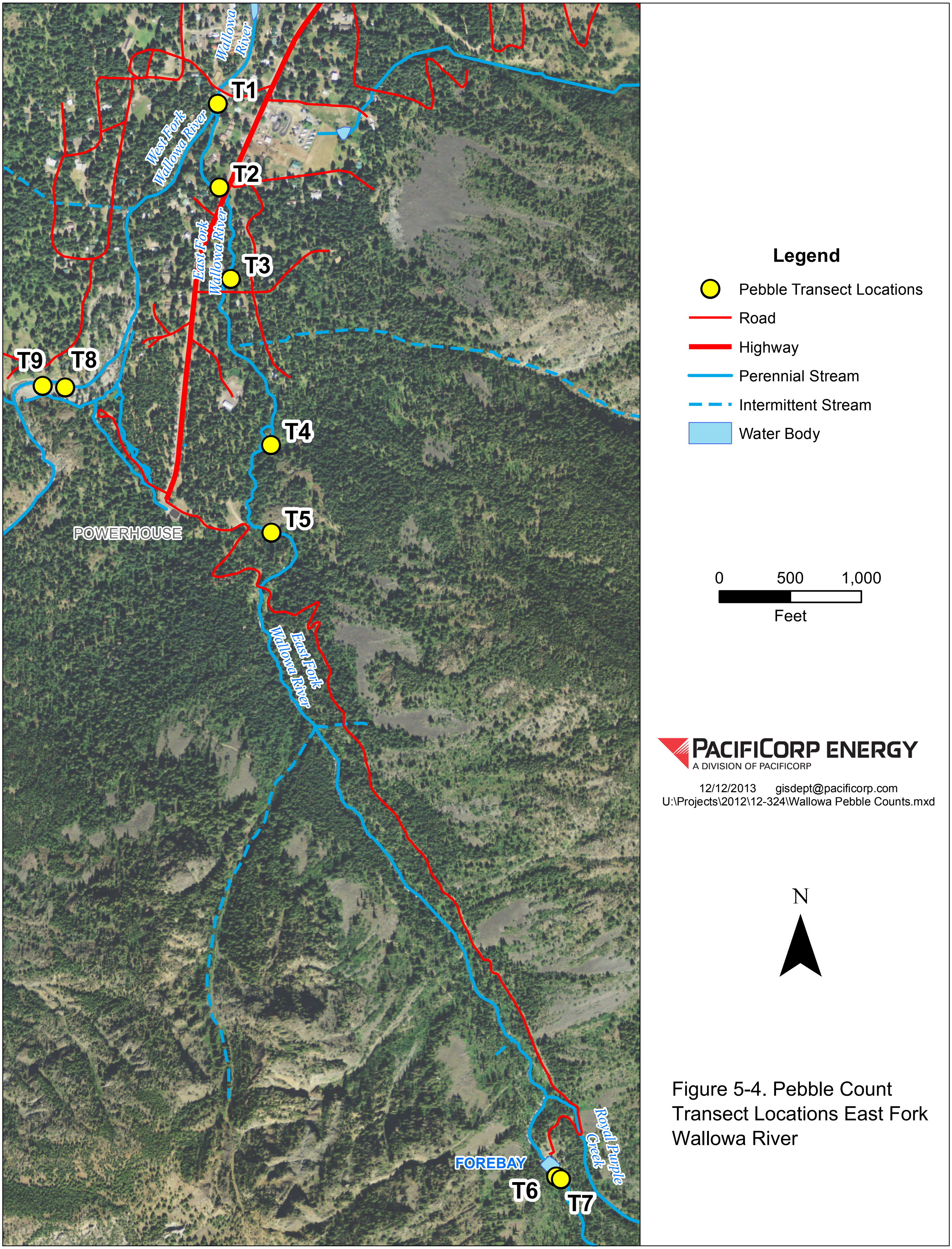
Sediment. The sediment indicator focuses on percent fines that can reduce or hinder spawning and incubation. Sediment effects on rearing are addressed through embeddedness (see *Habitat Elements, Section 5.2.4* later in this section).

During October 2012, five transect sites within the lower 1,237 m of the bypassed reach were sampled for streambed grain size. These same locations were sampled again in August 2013. The 2012 pebble counts were completed after the Project forebay was drained for surveying in August of 2012. During the draining of the forebay approximately 316 cubic yards of sediment was unintentionally evacuated from the forebay through the low level outlet pipe. The 2012 pebble count data reflect streambed surface conditions after this sediment input to the bypassed reach. Pebble count data collected in August 2013 represent conditions one year after the sediment release.

In addition to the bypassed reach, two sites just upstream of the forebay (Transects 6 and 7) and two sites in the West Fork Wallowa River upstream of the Project tailrace (Transects 8 and 9) were also sampled in August 2013 to provide data on substrate size in geomorphically similar areas not affected by forebay flushing. Transect locations are shown below (Figure 5-4). PacifiCorp used a Wolman pebble count technique at all transects. Results of these and other sediment characterization studies are contained in a Final Sediment and Substrate Characterization Report, provided to stakeholders in December 2013 (PacifiCorp 2013d).

To meet a functioning appropriately characterization for bull trout, sediment fines (0.85 mm particle size) should comprise 12 percent or less of surface sediments; between 12 and 17 percent is considered Functioning at Risk, and greater than 17 percent Functioning at Unacceptable Risk (USFWS 1998a). Percent fines at Transect 1 at the lower end of the East Fork Wallowa River bypassed reach, above the West Fork Wallowa River confluence were 10 percent in both 2012 and 2013. Percent fines at all transects averaged 26 percent in 2012, and 16 percent in 2013. The bypassed reach transect with the highest levels of fine-grained sediment during both years, Transect 4, is likely being influenced by a very low gradient side channel contributing primarily fine-grained substrate. Results upstream of the project forebay at Transects 6 and 7, unaffected by forebay flushing, were 20 percent and 15 percent, respectively (Figure 5-5). Data collected in 2013 show a marked decrease in percent fines, with an average similar to that found upstream of the project forebay.

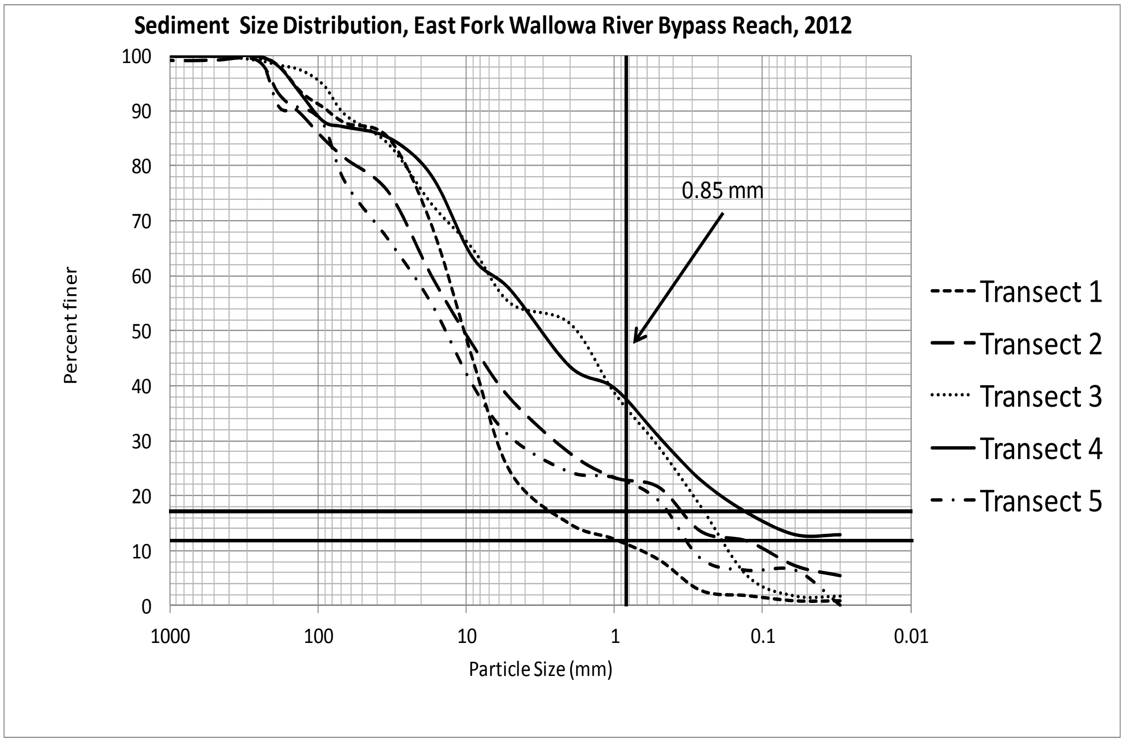
Percent fines within the two West Fork Wallowa River transects, Transects 8 and 9, were lower than East Fork transects in both 2012 and 2013 (five and one percent, respectively). Considering both 2012 and 2013 bypassed reach and West Fork Wallowa River data, and results of pebble counts upstream of the forebay, sediment baseline conditions are deemed **Functioning at Risk**.



PACIFICORP ENERGY
A DIVISION OF PACIFICORP

12/12/2013 gisdept@pacificorp.com
U:\Projects\2012\12-324\Wallowa Pebble Counts.mxd

Figure 5-4. Pebble Count Transect Locations East Fork Wallowa River



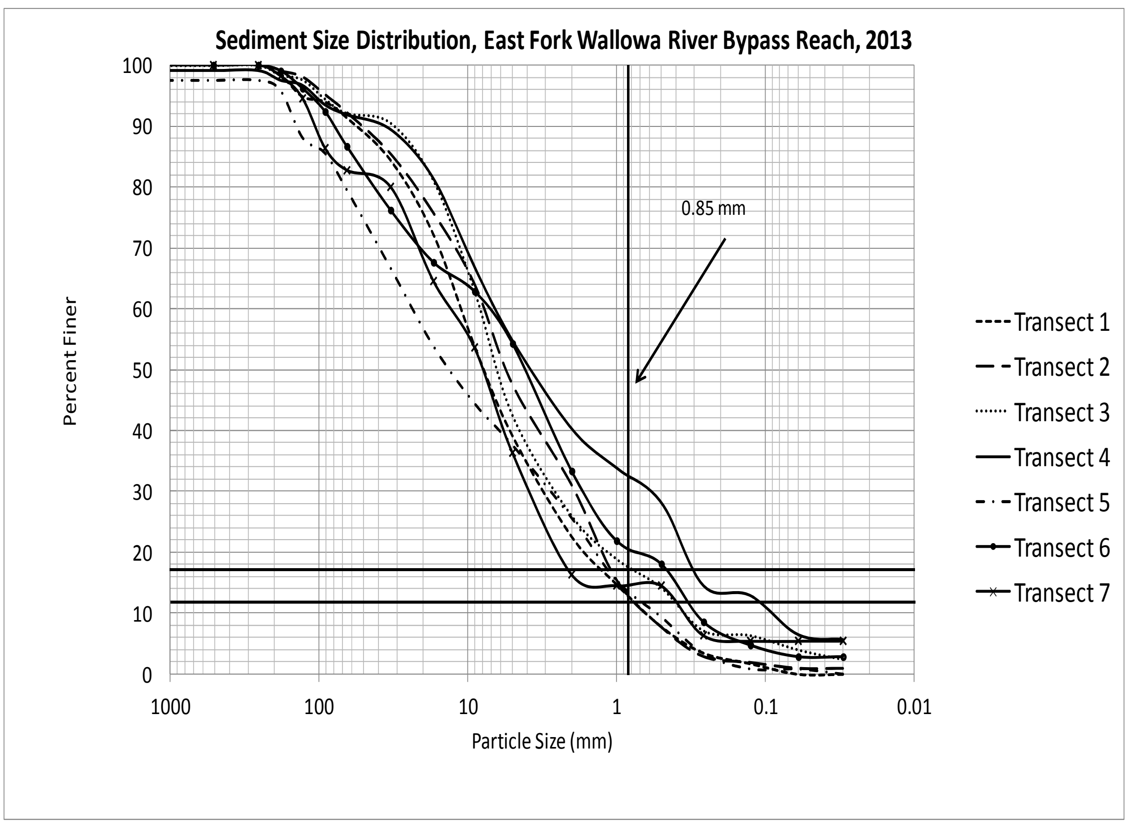


Figure 5-5. Particle size measurements at transects in the lower East Fork Wallowa River bypassed reach, October 2012 (top) and August 2013 (bottom). Horizontal lines show 12% and 17% USFWS guidelines for 0.85 mm size class.

Turbidity and streamflow monitoring conducted by PacifiCorp during June 2012 illustrate the influence of early season high flows on fine sediment transport. These data were collected near a stream gage located in the lower bypassed reach of the East Fork Wallowa River (PacifiCorp 2013d). The purpose of this monitoring was to develop a record of background turbidity and flow for a typical June runoff period prior to future forebay flushing events. Turbidity and flow levels for the June 2012 monitoring effort are shown below (Figure 5-6).

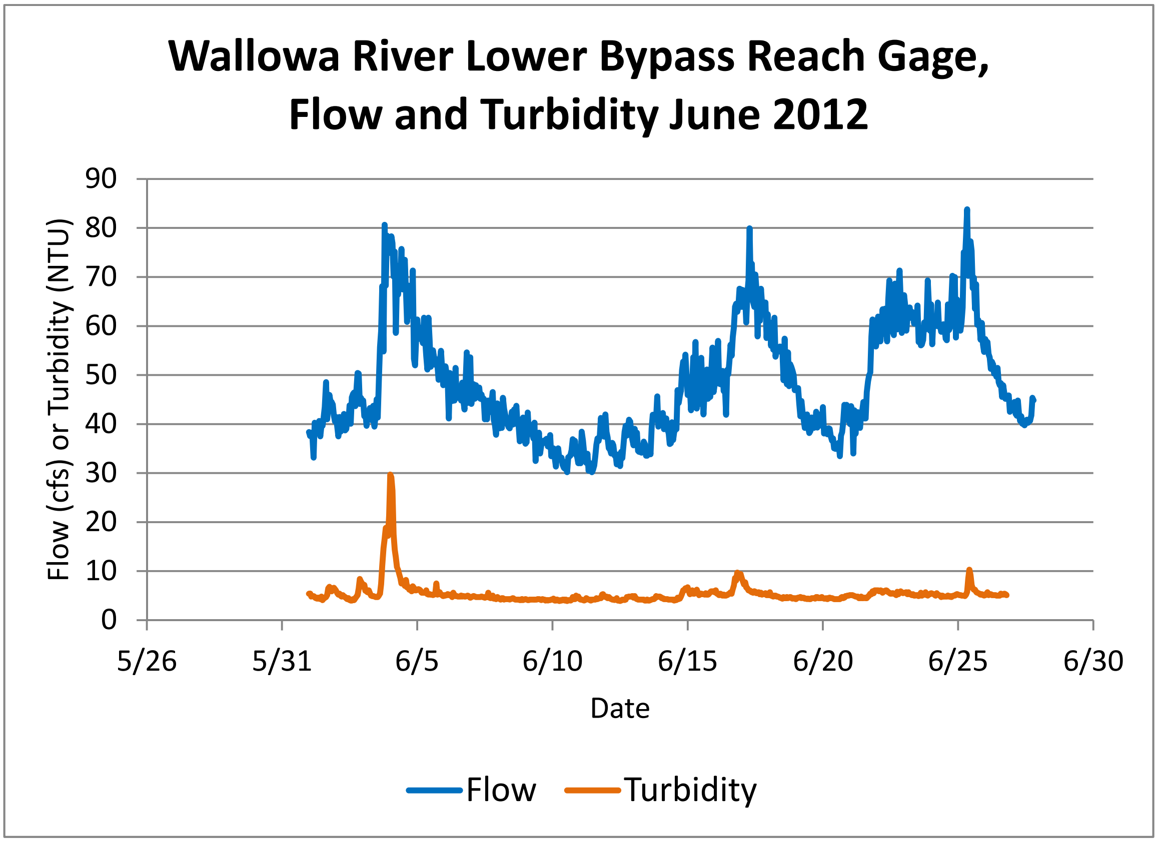


Figure 5-6. Continuous turbidity and flow monitoring results for the bypassed reach of the East Fork Wallowa River, June 2012.

Comparison of the June 2012 turbidity and flow data indicate that turbidity peaked with initial high flows (first flush) and later returned to baseline conditions despite two additional high flow events that occurred later in the month; these flows reached levels equal to or greater than the June 5th event. These data strongly support PacifiCorp's shift to high flow flushing in June to reduce effects on downstream turbidity resulting from forebay sediment flushing events.

Chemical Contaminants/Nutrients. Given the location of the Project forebay in close proximity to the Eagle Cap Wilderness Area, agricultural and industrial chemical contamination is expected to be negligible, with nutrients derived from natural sources. A mineral resource analysis of the area (Weis et al. 1976) indicates the primary source rock types are granodiorite, limestone and argillite. There are a few small mining claims within the watershed; the main potential for mining commodities are silver, lead, gold and copper.

PacifiCorp sampled sediments accumulated in the Project forebay for metals in 2012. Sediment samples were collected from three locations within the forebay (Units A, B, and C from upstream to downstream) and analyzed as prescribed in the Sediment Evaluation Framework for the Pacific Northwest (RSET 2006). Results are shown below (Table 5-4).

Table 5-4. Metals content in sediment samples collected at Wallowa Falls Hydroelectric Project forebay, August 2012. ND=non-detect, RL=reporting limit; all values mg/kg.

Metal	**Sample Result**			**RL**	**DEQ 2007 Ambient Sediment Levels**[1]	**DEQ Screening Levels**[2]	**DEQ/EPA Toxicity Screening JSCS**[3]
	Unit A	Unit B	Unit C				
Antimony	ND	ND	ND	6	0.9	3	64
Arsenic	ND	ND	ND	6	2.8	6	33
Cadmium	ND	ND	ND	2.4	0.16	0.6	5
Chromium	8.1	12	9	2.4	25.1	37	111
Copper	22	38	38	2.4	23	36	149
Lead	ND	ND	ND	6	10	35	128
Mercury	0.14	ND	ND	0.11	0.06	0.2	1
Selenium	ND	ND	ND	6	None	None	5
Silver	ND	ND	ND	6	0.38	4.5	5
4Zinc	38	53	44	12	68	123	459

[1]Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment (Table F-1, DEQ 2007).
[2]Screening Level values in Guidance for Ecological Risk Assessment (DEQ 1998).
[3]McDonald et al., 2000, *in* Portland Harbor Joint Source Control Strategy (DEQ 2005).

Chromium, copper and zinc were detected in all three forebay sediment samples, and mercury in one of three. All other metals were below instrument reporting limits (RL).

A number of reference data sets and screening levels for sediment metals concentrations have been developed and are currently in use by DEQ and the U.S. Environmental Protection Agency (EPA). These include ambient (background) levels of several metals (DEQ 2007), screening values for ecological risk assessment (DEQ 1998), and screening levels that DEQ and EPA have jointly developed in connection with the Portland Harbor Joint Source Control Strategy (JSCS) (DEQ 2005). Comparison of Wallowa Falls forebay sediment metals data to these values indicates that detected metals (chromium, copper, zinc) were well below toxicity screening values reported in Oregon DEQ's JSCS (DEQ 2005), and were near or below published ambient levels (DEQ 2007). The JSCS values can be considered upper level toxicity thresholds (pers. comm. with Jennifer Peterson, DEQ, March 6, 2013). Two of the three copper samples were slightly higher than DEQ's 2001 screening levels for freshwater sediment developed for ecological risk assessment.

The sediment metals data suggest that metals concentrations in Wallowa Falls forebay sediments are low; below screening values set by DEQ and/or EPA. Two of the three sediment copper levels exceeded DEQ's 2001 screening levels for ecological risk assessment. However, a mineral resource analysis of the area identifies copper as the most abundant metal in the Eagle Cap Wilderness with significant concentrations documented in the Aneroid Basin directly upstream of the Wallowa Falls Dam and forebay (Weis et. al. 1976). Based on this information, concentrations of copper detected in sediments collected from the forebay do not represent an ecological risk.

In several cases RLs themselves were higher than screening levels. However, as noted above, given the remoteness of the Project and lack of agricultural and industrial inputs, metals contamination is expected to be negligible, and if present derived from natural sources. However, given the potential for the project forebay to elevate metals, particularly copper, water quality parameters for chemical contamination/nutrients within the watershed and action area are **Functioning at Risk**.

5.2.3 Habitat Access

The Wallowa Falls Dam is approximately 1,370 meters upstream of a natural migratory fish passage barrier on the East Fork Wallowa River. Fish surveys conducted in the East Fork Wallowa River upstream of the barrier have not yielded bull trout (PacifiCorp 2014a). Man-made barriers present in the Upper Wallowa River watershed (5^{th} field HUC) include PacifiCorp's diversion dam on the East Fork Wallowa River, and the currently impassable irrigation dam at the terminus (north end) of Wallowa Lake. The latter effectively blocks upstream passage to both Wallowa River-Wallowa Lake and Upper Wallowa River 6^{th} field HUCs, representing 29 percent of the Upper Wallowa River 5^{th} field watershed. All habitat upstream of this barrier (excluding areas upstream of the natural passage barrier on the East Fork), including Wallowa Lake and tributaries to the Wallowa River, is accessible. Nonetheless, Wallowa Lake Dam prevents upstream access to historical habitat. From the standpoint of recovery and connectivity of the Upper Wallowa River bull trout subpopulation with other subpopulations in the Grande Ronde River Recovery Unit, this parameter is **Functioning at Unacceptable Risk.**

5.2.4 Habitat Elements

Diagnostic pathways and indicators for Habitat Elements include substrate embededdness, large woody debris, pool frequency/quality, off channel habitat, and refugia. PacifiCorp conducted a habitat survey in the lower East Fork Wallowa River bypassed reach in connection with the Instream Flow study (PacifiCorp 2013b). Study results relevant to Habitat Elements pathway and indicators are discussed below.

Substrate Embeddedness. As mentioned in Section 2.0 of this BA, PacifiCorp conducted several studies in 2012 and 2013 to characterize sediment and substrate conditions in the Project forebay, downstream in the bypassed reach of the East Fork Wallowa River, and within the West Fork Wallowa River upstream of the East Fork confluence. These studies were completed to meet the following objectives: 1) determine volume of sediment material entrained in the Project forebay; 2) characterize sediment in the forebay – particularly grain size and metals content; 3) obtain baseline sediment and water quality conditions within the forebay and within the bypassed reach downstream of the dam during spring high flow; and 4) characterize surface and subsurface grain size distribution in the lower bypassed reach using standard geomorphic characterization techniques after sediment release from the forebay. Sediment surveys conducted within the action area are shown below (Table 5-5).

Results of particle size measurements in the East Fork Wallowa River bypassed reach, upstream of the project forebay, and within the West Fork Wallowa River were discussed earlier in Section 5.2.2. The latter focused on percent fines and assessment of suitability of sediments for spawning. This section presents data and results of sediment composition and grain size analysis that can more broadly assess substrate characteristics in the Project forebay, East Fork Wallowa River bypassed reach, and West Fork Wallowa River.

Table 5-5. Data Types - East Fork Wallowa River sediment and substrate characterization.

Data Type	Source of Information
Sediment volumetric survey	Professional surveyor surveyed surface and base of fine grain sediment deposit of drained forebay.
Sediment bulk metal concentrations (mg/kg)	Sediment samples were collected from the forebay; results were obtained from the analytical testing at a Test America laboratory.
Sediment particle size distribution (ASTM D422 standard sieve sizes plus hydrometer)	Sediment samples were collected from the forebay; results were obtained from the analytical testing at a Test America laboratory.
Suspended sediment concentrations (mg/L)	Surface water samples were collected in the lower bypassed reach in June 2012; results were obtained from the analytical testing at a Test America laboratory.
Continuous turbidity monitoring in the lower bypassed reach	Turbidity monitoring was collecting for the entire month of June 2012 in the lower bypassed reach using a sonde.
Streambed grain size analysis in the lower bypassed reach	Surface pebble counts were conducted using the Wolman pebble count method in 2012 and 2013; subsurface bulk samples were collected at three sites in 2012 and analyzed for grain size at a Test America laboratory.

Sediment sampling methods are described in PacifiCorp’s 2013 Sediment and Substrate Characterization Technical Report (PacifiCorp 2013d). Medium sand was the primary sediment type/size present in the forebay during sampling in August 2012, followed by fine sand, suggesting that the forebay is a depositional area for material ranging in size from gravel to fine sand. Silt and clay size particles were a minor fraction of the material sampled from the forebay (Table 5-6).

Table 5-6. Size classifications for sediment samples collected in the Project forebay, August 14, 2012.

Category	Size Class (mm)	Unit A	Unit B	Unit C
Cobble	>64	0%	0%	0%
Gravel	2-64	14.5%	8.6%	8.3%
Coarse Sand	0.5 – 2	18.3%	14.1%	18.5%
Medium Sand	0.25 – 0.5	43.5%	20.3%	45.1%
Fine Sand	0.063 – 0.25	18.9%	43.2%	17.8%
Silt and Clay	<0.063	4.8%	13.8%	10.3%

During October, 2012, and again in August 2013, PacifiCorp assessed the streambed surface sediment layer at five transect locations within the East Fork Wallowa River bypassed reach (downstream of the natural fish passage barrier). In 2013 substrate measurements were also collected at two transects in the West Fork Wallowa River upstream of the East Fork confluence, and at two transects upstream of the Project forebay. Percent fines associated with these measurements were discussed previously in Section 5.2.2. Substrate composition is discussed below.

On average more than 50 percent of the substrate samples from both 2012 and 2013 were gravel sized material. In 2012, sampled substrate in the bypassed reach ranged from 12 to 38.7 percent sand and finer. In 2013, sand and finer at each bypassed reach sample site was generally less than during 2012 and ranged from 14.8 to 33.9 percent. The percent sand and finer in samples upstream of the forebay ranged from 14.5 to 21.9 percent, similar to the 2013 sampling in the bypassed reach, suggesting that fines and general sediment characteristics in the bypassed reach are similar to areas not being influenced by forebay flushing (PacifiCorp 2013d).

The primary substrate size classification observed at the five Wolman pebble count transects in the bypassed reach of the East Fork Wallowa River was gravel. As noted previously, the 2012 Wolman pebble counts in the bypassed reach of the East Fork Wallowa River occurred two months after the Project forebay was drained (August 2012), when sediment was unintentionally released from the forebay through the low level outlet pipe to downstream reaches. The 2012 pebble count data therefore reflect streambed surface conditions after recent sediment input to the lower reaches. Results from 2013 suggest that bypassed reach sediment characteristics were similar to those upstream of the project forebay (Figure 5-7).

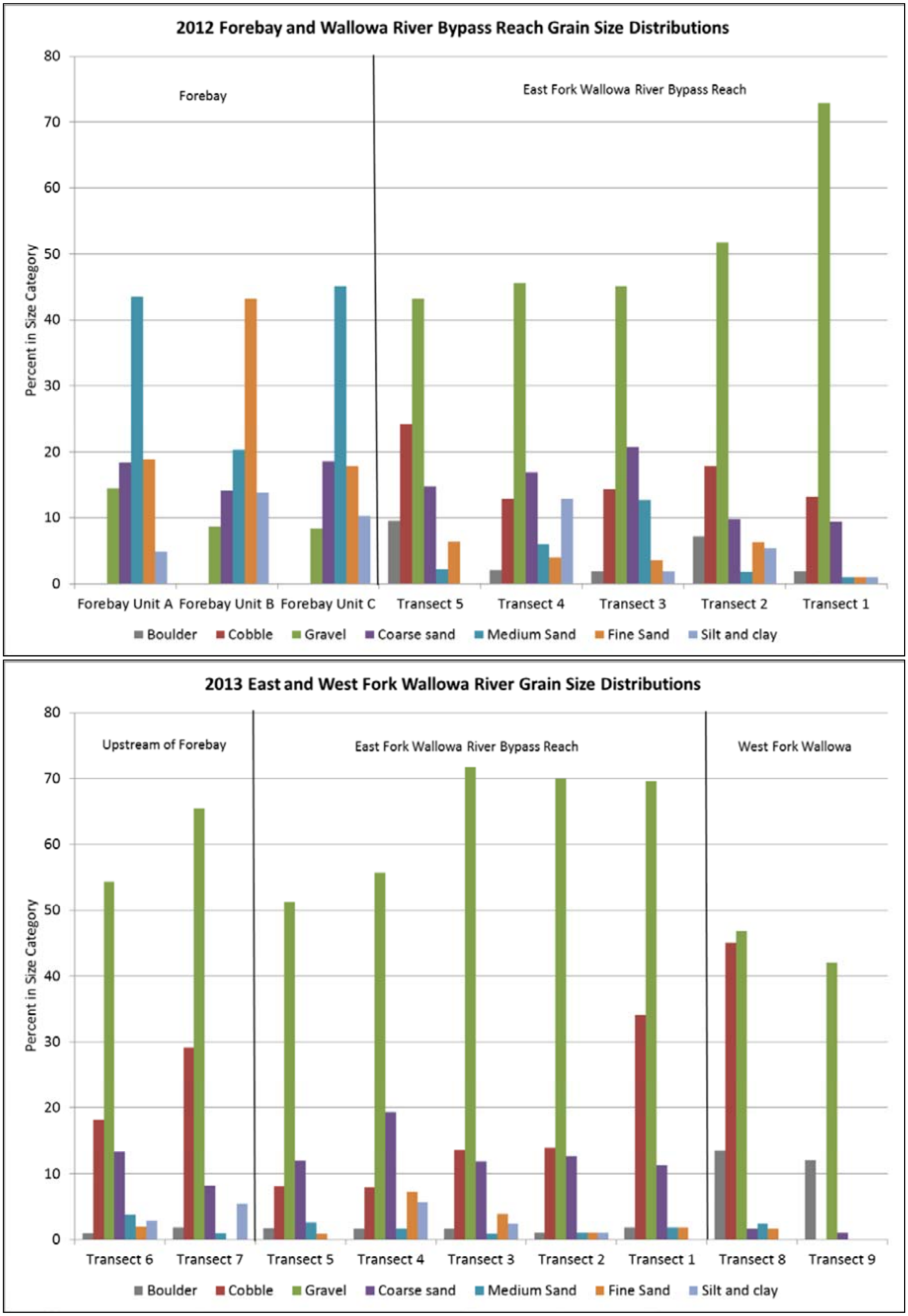


Figure 5-7. Particle size distributions, 2012 and 2013 substrate samples.

PacifiCorp did not directly measure embededdness during field studies conducted in 2012 and 2013. However, based on the results of sediment and substrate monitoring in 2012, the limited human activity within the upper watershed, the high gradient of theEast Fork Wallowa River (discussed below), an in-water substrate with a broad distribution of size classes, and a forebay sediment composition dominated by medium sand, Substrate Embeddedness in the action area is considered to be **Functioning Appropriately**.

Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat, Refugia. Stream habitat surveys conducted by PacifiCorp in 2012 provide baseline information that can be used to assess other habitat elements of this indicator (large wood, pool frequency/quantity, off channel habitat, and refugia). PacifiCorp surveyed pools, runs, and riffles, beginning at the mouth of the East Fork Wallowa River and extending to approximately 300 meters downstream of the impassable falls at approximately RM 0.8. The bypassed reach has a steep gradient, with the upper mile at 18.9% and the lower 0.75 mile at 8.5%. The channel is a combination of steep bedrock sections, waterfalls, and large boulders with high quantities of large woody debris. Individual pools are present in the lower bypassed reach, but they are infrequent (approximately 10 percent of total habitat). The upper bypassed reach is approximately 0.9 miles long and has an average slope between 19 and 20 percent. Steep cascades with turbulent flow over boulders and bedrock chutes characterize the upper segment. The impassable fish barrier noted throughout this BA separates upper and lower sections of the bypassed reach.

The predominant habitat type in the approximately 0.8 mile lower bypassed reach is fast, turbulent, rapid (53 percent). The U.S. Forest Service (2009) defines a fast turbulent rapid as “a riffle with stream gradient greater than 3 percent but less than 10 percent”. The secondary habitat type is fast, turbulent, riffle (29 percent), defined as a riffle with a gradient of less than 3 percent. Fast, turbulent, cascades, which are riffles with gradients greater than 10 percent, comprise 16 percent of habitat in the lower bypassed reach. The remaining 2 percent of the bypassed reach is comprised of slow scour plunge pools, typically associated with human-built flow obstructions or transverse substrate bars (PacifiCorp 2013f). Given the lack of disturbance throughout the East Fork Wallowa

River bypassed reach and proximity to Eagle Cap Wilderness Area, large wood, pool frequency/quantity, large pools, off channel habitat and refugia are considered to be **Functioning Appropriately.**

5.2.5 Channel Conditions and Dynamics

Channel Conditions and Dynamics represent geomorphic functions, in particular width to depth ratio, streambank condition and floodplain connectivity. The East Fork Wallowa River bypassed reach is stable, with low width to depth ratios and a healthy riparian community. Stream/floodplain connectivity in the lower bypassed reach was apparent based on field observations during the June 2013 site visit. Given lack of development, the Upper Wallowa River watershed (6^{th} field HUC) is **Functioning Appropriately** with respect to the parameters of wetted width/max depth ratio, streambank conditions and floodplain connectivity.

5.2.6 Flow and Hydrology

The principal factor used in evaluating Flow and Hydrology is whether the watershed hydrograph exhibits characteristics of an unaltered, undisturbed watershed of similar size and geology. If the environmental baseline reflects altered peak flow, baseflow, or flow timing, this indicator is deemed At Risk or At Unacceptable Risk.

Change in Peak/Base Flows. The Project diverts portions of East Fork Wallowa River flows (and lesser diversions from Royal Purple Creek) for use at the Project powerhouse. The project is operated in run-of-the-river mode, with no peaking or flood control capability. However, because of the diversion of flows to the powerhouse, operation of the Project causes a reduction in downstream in-channel flows in the East Fork bypassed reach.

The Project FERC license requires a minimum instream flow in the bypassed reach of the East Fork of 0.5 cfs, or the natural inflow to the project, whichever is less, as measured immediately downstream of the diversion dam. However, instream flows in the bypassed reach typically exceed the required minimum instream flow release, given the consistent release of 0.8 cfs from the low level outlet pipe at the diversion, natural accretion/runoff during most times of the year of 1-2 cfs, and most importantly, flows in excess of the 16 cfs hydraulic capacity of the powerhouse. Any Project inflows in excess of 16 cfs spill over the dam directly into the bypassed reach. As shown below for Site EFI, this can occur in many months, but is particularly prevalent during May, June, and July (Figure 5-8). During these months, tailrace flows (PHT below), representing flows diverted to the powerhouse, may be a small fraction of flows in the East Fork. However, diverted flows during the fall and winter months are a much greater fraction of total flows coming into the East Fork Wallowa River.

As noted above, the Project is run-of-river, with no ability to alter timing or magnitude of peak flows at the scale evaluated in this BA (6^{th} field HUC). However, diversion of flows from the bypassed portion of the East Fork Wallowa River has altered hydrological conditions relative to an undisturbed watershed. This parameter is therefore deemed **Functioning at Risk**.

Drainage Network Increase. In addition to changes in peak or base flows, a second indicator with respect to the Flow/Hydrology pathway is an Increase in Drainage Network; whether increases in active channel length (i.e., channelization) have occurred as a result of human-caused disturbance. Minimal impact to active channel length has occurred in the Upper Wallowa River watershed (6^{th} field HUC); this indicator is **Functioning Appropriately.**

A number of indicators are used in assessing the environmental baseline relative to watershed conditions, including road density and location, disturbance history, riparian conservation areas, and disturbance regime. As previously noted, the watershed's proximity to the Eagle Cap Wilderness Area and lack of development throughout the upper watershed results in high quality upland and riparian habitat, cold water temperatures, and generally stable natural processes. All four of the Watershed Conditions indicators are deemed **Functioning Appropriately.**

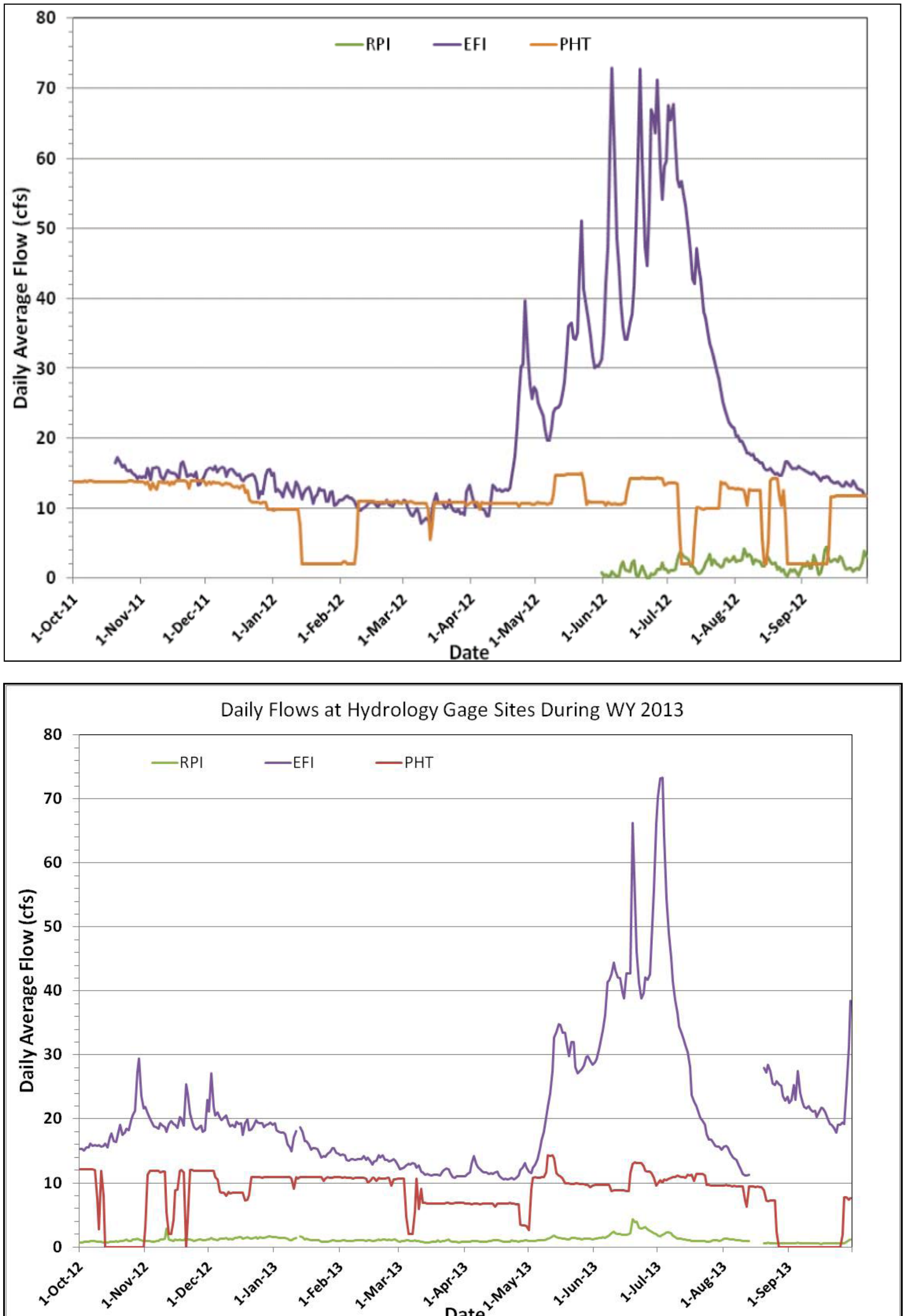


Figure 5-8. Hydrographs of average daily flows during WY 2012 (top) and 2013 (bottom) for Sites EFI (East Fork Wallowa River Inflow), RPI (Royal Purple Creek Inflow), and PHT (Powerhouse tailrace) (from PacifiCorp 2013e).

5.2.7 Watershed Conditions

A number of indicators are used in assessing the environmental baseline relative to watershed conditions, including road density and location, disturbance history, riparian conservation areas, and disturbance regime. As previously noted, the watershed's proximity to the Eagle Cap Wilderness Area and lack of development throughout the upper watershed results in high quality upland and riparian habitat, cold water temperatures, and generally stable natural processes. All four of the Watershed Conditions indicators are deemed **Functioning Appropriately.**

5.2.8 Integration of Species and Habitat Conditions

The Integration of Species and Habitat Conditions pathway reflects cumulative environmental baseline conditions in the watershed as they relate to bull trout, based on the range of indicators noted above. In general, indicators and supporting data reflect high quality aquatic and riparian habitat conducive to a stable or increasing bull trout population.

The Upper Wallowa River watershed is essentially pristine, and data collected in 2013 point to a bull trout adfluvial life history. However, uncertainty exists regarding size of the bull trout subpopulation within the Upper Wallowa River 6th field HUC, and connectivity with neighboring subpopulations throughout the larger 5th field watershed, particularly in light of Wallowa Lake Dam. These factors warrant a **Functioning at Risk** determination**.**

6.0 ANALYSIS OF EFFECT OF THE ACTION

This section addresses direct, indirect and interrelated/interdependent effects on bull trout diagnostic pathways and indicators and Critical Habitat PCEs that are likely to result from implementation of the proposed action, given the conservation measures to be employed. In addition, this section describes anticipated cumulative effects from non-federal actions that are reasonably certain to occur in the action area. The effects analysis is based on the best scientific and commercial data available concerning the impact of the proposed project on bull trout and their Critical Habitat. The analysis of effect discussed below is based on USFWS guidance (USFWS 1998a), and on relevant data and observations reported by PacifiCorp on the affected resources and habitat.

6.1 Direct Effects to Bull Trout Indicators

This section addresses potential direct effects of the proposed action on bull trout indicators, including adverse and beneficial impacts from Project-related actions. The USFWS *Checklist for Documenting Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators* (USFWS 1998a) is designed to be used for this analysis in conjunction with the environmental baseline matrix shown in Section 5. The checklist combines the assessment of baseline conditions with anticipated effects of the proposed action(s) on each indicator. For purposes of this checklist, "restore" means to improve, e.g., change Functioning at Risk to Functioning Appropriately. “Maintain” means that the proposed action does not change function of an indicator, while "degrade" means to change the function of an indicator for the worse. Effects of continued operation of the Project on the various bull trout pathways and indicators are assessed below (Table 6-1).

Proposed PM&Es (increased instream flows, rerouting of the tailrace, and shifting the timing of sediment flushing) will enhance habitat and minimize project impacts to bull trout. These actions are restorative in nature; however, within the framework of this analysis they are unlikely to change the environmental baseline of the Upper Wallowa River 6^{th} field HUC subpopulation. Continued operation of the project with proposed PM&Es therefore maintains bull trout pathways and indicators at their respective baseline condition assessment discussed in Section 5.

6.2 Effects to Bull Trout Critical Habitat Primary Constituent Elements

In conjunction with the 2010 designation of bull trout Critical Habitat, the USFWS changed many of the existing PCEs originally defined in 2005. This section of the BA assesses the effect of the proposed action on these modified PCEs.

Table 6-1. Evaluation of effects of continued operation of the Wallowa Falls Hydroelectric Project on Wallowa River bull trout subpopulation environmental baseline (from USFWS 1998a).

DIAGNOSTICS/ PATHWAYS INDICATORS	POPULATION AND ENVIRONMENTAL BASELINE					
	Functioning Appropriately	Functioning At Risk	Functioning at Unacceptable Risk	Restore	Maintain	Degrade
<u>Subpopulation Characteristics:</u> Subpopulation Size		X			X	
Growth and Survival		X			X	
Life History Diversity and Isolation		X			X	
Persistence and Genetic Integrity			X		X	
<u>Water Quality:</u> Temperature		X			X	
Sediment		X			X	
Chem.Contam./Nutrients	X				X	
<u>Habitat Access:</u> Physical Barriers			X		X	
<u>Habitat Elements:</u> Substrate Embeddedness	X				X	
Large Woody Debris	X				X	
Pool Frequency and Quality	X				X	
Large Pools	X				X	
Off-channel Habitat	X				X	
Refugia	X				X	
<u>Channel Cond. & Dynamics:</u> Wetted Width/Max. Depth Ratio	X				X	
Streambank Condition	X				X	
Floodplain Connectivity	X				X	
<u>Flow/Hydrology:</u> Change in Peak/Base Flows		X			X	
Drainage Network Increase	X				X	
<u>Watershed Conditions:</u> Road Density & Location	X				X	
Disturbance History	X				X	
Riparian Conservation Areas	X				X	
Disturbance Regime	X				X	
<u>Integration of Species and Habitat Conditions</u>		X			X	

6.2.1 *Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.*

Increased minimum flows may affect existing hyporheic flow conditions in the East Fork Wallowa River. To the extent that existing subsurface water connectivity provides thermal refugia, such benefits may be reduced by an increased ratio of surface to groundwater flows. However, the proposed action would not be expected to alter seeps and groundwater connectivity, and is therefore **not likely to adversely affect this PCE**.

6.2.2 *Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*

The Wallowa Falls Dam is approximately 1.75 miles upstream of a natural migratory fish passage barrier. Fish surveys conducted in the East Fork Wallowa River upstream of the barrier have not yielded bull trout. However, bull trout have been observed and captured in the East Fork Wallowa River below the passage barrier, and bull trout spawning activity has been observed in the lower portion of the East Fork Wallowa River (PacifiCorp 2014a). An abandoned USGS gage approximately 300 meters upstream of the mouth of the East Fork Wallowa River does not appear to impede adult bull trout passage. Within the Upper Wallowa Lake subbasin, Wallowa Lake Dam at the outlet to Wallowa Lake, which will be unaffected by project operations, e prevents connectivity of bull trout subpopulations. Despite timing designed to minimize short and long-term impacts to bull trout and other aquatic resources, turbidity resulting from construction of the tailrace reroute or forebay flushing may act as a short-term impediment to fish movement within the project area. These potential effects are **likely to adversely affect this PCE**.

6.2.3 *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

The proposed action will not affect existing riparian vegetation or other allochthonous inputs to the East Fork Wallowa River. PacifiCorp's fish sampling in 2012 and 2013 revealed healthy forage fish populations in the East Fork Wallowa River downstream of the natural passage barrier (PacifiCorp 2014a).

Benthic macroinvertebrate sampling was conducted in August 2013 at three sites in the East Fork Wallowa River:

- **Lower**: East Fork Wallowa River bypassed reach just upstream of the confluence with West Fork Wallowa River.
- **Middle**: East Fork Wallowa River bypassed reach 500 meters upstream of the confluence with the West Fork Wallowa River.
- **Upper**: Unregulated control reach just upstream of the Project forebay and upstream of forebay sediment releases.

Benthic invertebrate samples were also collected in 2012 although protocols were insufficient to characterize the benthic community. The 2013 results were typical of montane streams with regard to altitudinal and longitudinal gradient within the East Fork Wallowa River. Overall abundance and richness was greatest at the lower elevation station and declined progressively upstream and at higher elevations at Middle and Upper stations. A more limited benthic community consisting primarily of cold water taxa was found at the Upper/Control station. EPT (Ephemeroptera+Plecoptera+Trichoptera), some of the most sensitive macroinvertebrates to stressors such as fine sediment, were considered moderate. As expected, percent tolerant taxa and tolerant taxa richness (warm water biota) were low at all three stations, and intolerant taxa (cold-water biota) richness was very high and comprised a very high proportion of the benthic community at all three stations.

Aspects of the 2013 benthic invertebrate sampling suggest greater sediment accumulation in the lower reaches of the bypassed reach, as expected. Semivoltine taxa, which require more than one year to complete their life cycle and are often sensitive to physical disturbance of substrates, were relatively low. In addition, Oligochaeta (segmented worm) abundance was moderate to high at the Lower and Middle stations. Oligochaetes are most often associated with stable fine sediment or filamentous algae accumulations. Whether these data reflect natural trends in sediment deposition, or disturbance associated with the 2012 forebay maintenance is unknown. A combination of these factors is likely; however, given these uncertainties, the proposed action **is likely to adversely affect this PCE**.

6.2.4 Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.

Continued operation of the Project under higher instream minimum flows will increase the physical complexity and instream habitat quality of the East Fork Wallowa River bypassed reach, e.g., with expanded side channels, deeper pools and greater range of velocities.

As discussed below (6.2.7) the tailrace reroute will reduce West Fork Wallowa River flows for a distance of approximately 0.5 miles between the existing tailrace and East Fork Wallowa River confluence. Impacts to habitat within this reach have not been quantified; however, tailrace flows represent over 30 percent of West Fork Wallowa River flows during the summer low flow period (see Figure 6-1 later in this section). Given the probable reduction in habitat availability within this reach of the West Fork Wallowa River, continued operation of the Project **may affect, but is not likely to adversely affect this PCE.**

6.2.5 Water temperatures ranging from 2 to 15 degrees Celsius (°C) (36 to 59 degrees Fahrenheit (°F)), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; streamflow; and local groundwater influence.

Water temperature within the action area reflects the relatively high elevation of the Project, snow melt-driven peak flow periods, groundwater inputs, and healthy riparian vegetation. As noted previously, 2012 lower bypassed reach temperatures in late winter were near or less than the desired 2 °C minimum. The proposed tailrace reroute will substantially increase flows in the East Fork Wallowa River, downstream of the proposed tailrace reroute during the late fall/winter lower flow period, on average from 0.9 to 10.9 cfs. Higher flows will reduce night time cooling in this reach, likely increasing minimum temperatures.

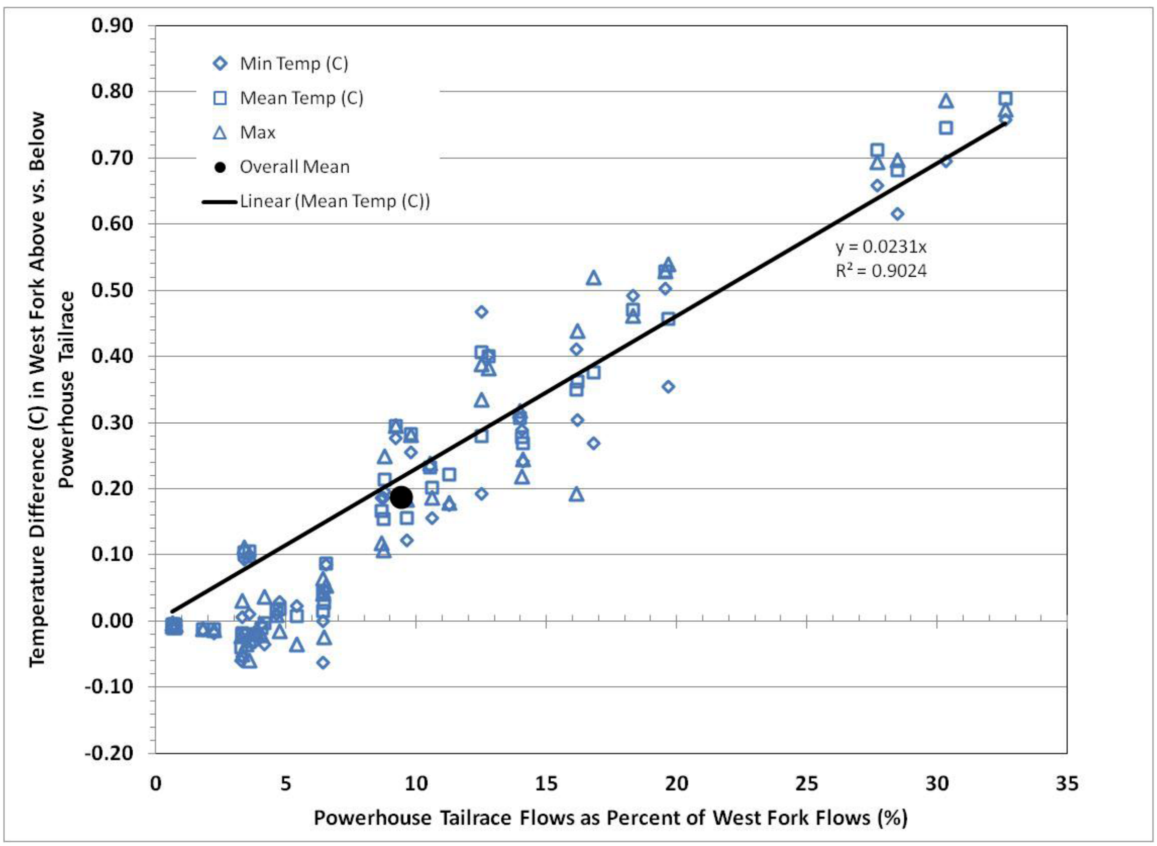


Figure 6-1. Differences in calculated water temperature values for the West Fork upstream and downstream of the Powerhouse tailrace location (TUS – TDS) as a function of the percent of flow in the West Fork comprised of Powerhouse tailrace flows (from PacifiCorp 2013e).

In contrast, absent powerhouse tailrace flows (16 cfs), flows in the West Fork Wallowa River in the 0.5-mile reach between the existing powerhouse tailrace and East Fork Wallowa River confluence will decrease. Effects of the tailrace reroute on West Fork water temperatures are a function of the contribution of the tailrace to total West Fork flows. On average, tailrace flows can make up 10 percent of West Fork flows, and during summer low flow periods may contribute over 30 percent. Based on a mixing zone analysis, West Fork average water temperatures would increase by approximately 0.20 ºC, and during the summer low flow period by as much as 0.8 ºC.

As discussed in Section 6.2.7, reroute of the project tailrace eliminates the risk of stranding bull trout or other fish species, particularly during summer flow periods when fish may be seeking thermal refugia. PacifiCorp believes that benefits of the reroute (reduced stranding, increased East Fork flows) outweigh the loss of habitat in the existing tailrace, and the increased water temperatures that may occur during summer low flow periods in the West Fork Wallowa River. Removal of riparian vegetation, undercut banks, or other thermal refugia elements will not occur. In total, the proposed action **may affect, but is not likely to adversely affect this PCE**.

6.2.6 In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

Substrate analysis of the action area below the natural fish passage barrier in 2012 revealed that, on average, more than 50 percent of the substrate sampled was gravel, with a size range of 2-64 mm. As noted in Section 5, five transect sites within the lower 1,237 meters of the bypassed reach were sampled for streambed grain size during October 2012. These same locations were sampled again in August 2013. The 2012 pebble counts were completed after the Project forebay was drained for surveying in August 2012. During the draining of the forebay approximately 316 cubic yards of sediment was unintentionally evacuated from the forebay through the low level outlet pipe. The 2012 pebble count data therefore reflect streambed surface conditions after this sediment input to the bypassed reach. Pebble count data collected in August 2013 represent conditions one year after the sediment release.

In addition to the bypassed reach, August 2013 sampling occurred upstream of the forebay and at two sites in the West Fork Wallowa River upstream of the Project tailrace. Percent fines at Transect 1 at the lower end of the East Fork Wallowa River bypassed reach, above the West Fork Wallowa River confluence, were 10 percent in both 2012 and 2013. Percent fines at all transects averaged 26 percent in 2012, and 16 percent in 2013. Data collected in 2013 show a marked decrease in percent fines, with an average similar to that found upstream of the project forebay. Percent fines within the two West Fork Wallowa River transects were lower than East Fork transects in both 2012 and 2013. Over 70 percent of the substrate sampled in the East Fork Wallowa River bypassed reach was comprised of boulder/cobble/gravel size classes, with sand size particles accounting for an average of 20 percent of the measurements (0.063 – 1 mm). In contrast, sand comprised an average of 80 percent of the forebay samples. Release of sediment from the Project forebay in August 2012 (two months earlier) may have slightly shifted particle size distribution in the lower bypassed reach, increasing the percentage of smaller size class material.

Forebay flushing and construction of the tailrace reroute and flume will cause short-term increases in turbidity that will negatively affect PCE 6. As noted in Section 3, flushing will only occur at flows sufficient to mobilize fine sediment (< 2mm particle sizes). PacifiCorp's Sediment and Substrate Characterization Report (December 2013d) included an analysis of shear stress and flows necessary to transport given particle sizes. This analysis indicated that a flow of 15 cfs would be sufficient to transport <2 mm particles within the thalweg of the channel (between 67-77 percent of the sampled sediment within the forebay was finer than 2 mm; 34-61 percent was finer than 0.63 mm).

In response to USFWS comments regarding the proposed June timeframe, PacifiCorp conducted additional analysis to support development of a minimum flushing flow, i.e., the flow required to mobilize small (<2 mm) particles across the channel, not only in the thalweg (Appendix D). Using cross-sectional data from 14 locations throughout the bypassed reach, this analysis confirmed that 15 cfs would mobilize the majority (<2 mm) of flushed forebay sediment. At this flow, average shear stress at the channel margin among all transects was 0.56 lb/sq ft., vs. the required 0.09 – 0.32 lbs./sq. ft. Based on this analysis, flushing will occur during June, but not at less than 15 cfs, and to the extent possible at flows above 20 cfs. Average flows in the East Fork in June are approximately 60 cfs.

The construction and operation of the proposed cast-in-place long-throated open flume in the East Fork Wallowa River immediately above the forebay access road bridge would have direct effects on sediment and substrate conditions in the Project area. Excavation and disturbance of stream channel substrate would result in short-term construction and water quality related impacts, including increased turbidity and sedimentation associated with temporary placement and removal of a cofferdam. Long-term effects would include the permanent addition of fill, i.e., the concrete structure itself, to the East Fork Wallowa River bypassed reach.

The construction and operation of the rerouted tailrace may also have short-term, direct effects on sediment and substrate conditions in the Project area. The outfall structure would discharge into a newly constructed energy dissipation channel consisting of boulders, logs and/or woody debris to reduce erosion and scour in the East Fork Wallowa River side-channel and main channel habitats. It is anticipated that the hydraulic energy can be dissipated in the constructed 15-25 foot long channel; however, the improvements may extend into the lower reach of the existing side channel west of the main channel of the East Fork Wallowa River. This would potentially involve replacing small areas of cobble, gravel or sand with larger riprap material or concrete. No work is anticipated in the main channel.

The existing side channel to the west of the main channel of the East Fork Wallowa River has an approximate gradient of two percent, with small substrate size categories ranging from silt/clay to course gravel and a fair amount of small downed wood and organic material. The introduction of generation flows into the side channel habitat would likely have the short term effect of localized erosion and scouring through the side channel and at the confluence of the side channel and the main channel of the East Fork Wallowa River for the first one or two years of operation.

Although erosional impacts are unavoidable, they are not expected to adversely impact overall substrate conditions within the bypassed reach due to the small area of impact. In addition, the pipeline would not become operational until the onset of seasonal high flows, minimizing sediment deposition downstream. The proposed action **is likely to adversely affect this PCE**.

6.2.7 A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.

The combined instream flow measures described in Section 3 (increased releases at the compliance point and tailrace reroute) would increase flows in the East Fork Wallowa River bypassed reach, and decrease flows in the West Fork Wallowa River between the current tailrace inflow and the East Fork confluence, a distance of 0.5 miles. Within the East Fork Wallowa River upstream of the rerouted tailrace, flows would increase by about 3.5 cfs (the difference between the proposed 4 cfs minimum instream flow release and the 0.5 cfs currently required). Increased East Fork Wallowa River bypassed reach flows downstream of the rerouted tailrace, and corresponding decreases in West Fork Wallowa River flows are summarized as follows:

East Fork Bypassed Reach. The proposed minimum flow release of 4 cfs year-round, in combination with the tailrace reroute, would result in the following changes in the magnitude of overall flows within the East Fork Wallowa River bypassed reach when compared to existing conditions:

- *April-July (bull trout adult migration)*:
    - an average increase from 20 cfs to 21 cfs (6 percent) in the upstream portion of the reach and 20 to 35 cfs (73 percent) in the downstream portion of the reach during the spring runoff higher-flow period.
- *August-October (adult spawning):*
    - An average increase from 1.8 to 4.4 cfs (140 percent) in the upstream portion of the reach and 1.8 to 14.7 cfs (over 7-fold) in the downstream portion of the reach during the summer/early fall low-flow period.
- *November-March (egg incubation/fry emergence):*
    - An average increase from 0.9 to 4.4 cfs (390 percent) in the upstream portion of the reach and 0.9 to 10.9 cfs (over 10-fold) in the downstream portion of the reach during the late fall/winter lower-flow period.

West Fork Wallowa River. As noted above, West Fork Wallowa River flows would decrease by powerhouse diversion amounts. PacifiCorp used historic daily USGS flow data to calculate the percentage of flow in the West Fork Wallowa River contributed by the Project powerhouse tailrace (PacifiCorp 2013c). The historic USGS data consist of a 15-year period-of-record (1925-1941) when USGS gages were simultaneously operating at: (1) the Wallowa Falls Powerplant Tailrace Near Joseph (USGS Gage No. 13324500); (2) East Fork Wallowa River Near Joseph (USGS Gage No. 13325000); and (3) Wallowa River Above Wallowa Lake Near Joseph (USGS Gage No. 13325500). West Fork Wallowa River flows were determined by subtracting the daily flows at the first and second gages from the third. Assuming that historic data are indicative of current conditions, changes in the magnitude of overall flows within the West Fork Wallowa River (below the current tailrace discharge location) when compared to existing conditions would be:

- An overall average decrease (over the period-of-record) of 27 percent;
- An average decrease of 8 percent during the spring runoff higher-flow period (April-July);

- An average decrease of 30 percent during the summer/early fall low-flow period (August-October);
- An average decrease of 42 percent during the late fall/winter lower-flow period.

Based on calculated flows as described above, contributions of tailrace flows to the West Fork Wallowa River are shown below for the summer/late fall period (Figure 6-2).

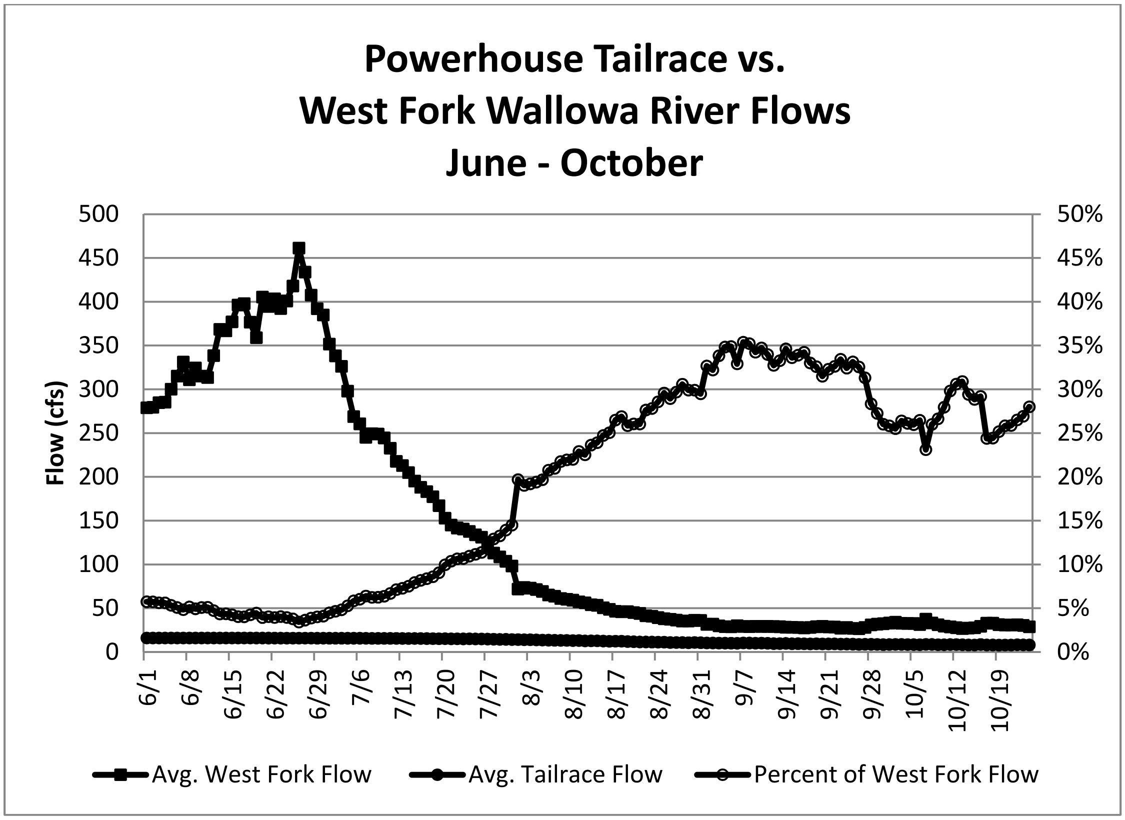


Figure 6-2. Percent reduction of West Fork Wallowa River flows under the proposed Tailrace Reroute, June - October. Flows calculated based on available gage data.

The flow reductions shown above apply to the West Fork Wallowa River between the Project tailrace and the confluence with the East Fork Wallowa River, a distance of approximately 1,200 meters. The West Fork Wallowa River is a high energy, high velocity river and substrate in this section is dominated by large boulders and cobble. As noted above, Powerhouse flows (up to 16 cfs) make up about 30 percent on average of the total flow of the West Fork Wallowa River during the late summer period. While bull trout use of the West Fork Wallowa River is largely unknown (Jim Harbeck, Nez Perce

Tribe, pers. comm., September 24, 2013), flow reduction resulting from the tailrace reroute will reduce habitat availability for kokanee, and potentially bull trout, within this reach. In addition, the reroute would effectively remove 300 meters of available fish habitat in the tailrace itself (between the powerhouse and West Fork Wallowa River). While the existing tailrace channel is assumed to provide cold water refugia for bull trout during the summer months, it presents the significant risk of fish stranding and subsequent desiccation due to unit trips that result in the penstock headgate closing (PacifiCorp 2013c). PacifiCorp believes the risk of stranding ESA listed bull trout outweighs the benefit of existing habitat conditions in the current tailrace, and within the West Fork Wallowa River between the tailrace and East Fork Wallowa River confluence. As noted above, the USFWS expressed support for the tailrace reroute during the June 2013 site visit (PacifiCorp 2013f).

The increased minimum flow release of 4 cfs at the compliance point below the dam would increase the availability and usability of aquatic habitat in the East Fork Wallowa River bypassed reach. This is particularly the case for the portion of the bypassed reach between the natural fish barrier (falls) and the location where the rerouted tailrace would discharge into the bypassed reach. This length represents a third of the accessible habitat within the bypassed reach, or approximately 4,457 meters.

Approximately 50 percent of the 119 bull trout captured since 2010 have occurred in the upper portion of the bypassed reach (PacifiCorp 2013c). Given the documented presence of large numbers of bull trout at roughly a tenth of proposed flows, the proposed increase to a year-round minimum flow of 4 cfs would be expected to fully support bull trout in the upper portion of the bypassed reach for two reasons. First, the bull trout population has been self-sustaining in this location at the present minimum flow release of 0.5 cfs. Second, as stated above, IFIM-based flow recommendations for the lower portion of the bypassed reach would also maintain or enhance conditions in the upper portion of the bypassed reach. The results of the IFIM modeling indicated that a minimum instream flow of 4 cfs would benefit all life-stages of bull trout in terms of enhancing the availability of usable habitat in the assessed lower portion of the bypassed reach (PacifiCorp 2013a).

PacifiCorp's fish surveys conducted between 2010 and 2013 indicate that the bulk of migratory fish other than bull trout inhabiting the East Fork Wallowa River bypassed reach below the anadromous fish barrier are confined to the lower 300 meters of stream. An abandoned USGS stream gage site approximately 300 meters from the West Fork Wallowa River confluence is an upstream migration barrier to certain sizes and species of fish, as evidenced by the high numbers of fish captured below this point, and by lack of migratory mountain whitefish or kokanee above it. However, 89 percent of bull trout captured within the East Fork Wallowa River bypassed reach were upstream of the USGS gage. Observation in August 2013 of two adfluvial sized bull trout near the base of the fish barrier confirms that bull trout can and do access the maximum amount of habitat to be affected by the higher instream flows. The proposed action **may affect, but is not likely to adversely affect this PCE**.

6.2.8 Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Temperature and water quality throughout the East Fork Wallowa River Basin are fully supportive of bull trout. Proposed actions potentially affecting water quality and quantity include flushing of the Project forebay and rerouting of the tailrace to the East Fork Wallowa River bypassed reach.

Proposed timing of flushing early in the season (June) will take advantage of the "first flush effect", more closely mimicking natural sediment deposition and reducing the duration of the turbidity increase. Comparison of the turbidity and flow data collected in June 2012 shows a clear link between flow and turbidity. As noted, a maximum turbidity level of 29.7 NTU was recorded on June 5, 2012, coinciding with a sharp increase in flow driven by increased snowmelt. Turbidity levels returned to baseline conditions quickly despite a longer duration for flows to decrease. Two additional high flow events occurred later in the month that reached flow levels equal to or greater than the June 5th event; however, turbidity levels during these two later events remained relatively low compared to those recorded on June 5th. This suggests that the high turbidity levels at the beginning of the month were associated with a “first flush” of sediment and suspended material with the onset of the annual high flow period, and that turbidity levels can be expected to be relatively uniform despite flow peaks after the initial annual flush of sediment.

With respect to water quality and temperature, it is possible that increased flows in the East Fork Wallowa River bypassed reach may result in cooler temperatures in summer and slightly warmer (non-freezing) temperatures in winter, although the magnitude of such temperature changes would likely be minor. The decrease in flow in the West Fork Wallowa River could have the opposite effect, resulting in warmer temperatures in summer and colder temperatures in winter, although such temperature changes, if any, would also likely be minor.

With the exception of possible effects on temperature in the affected reach of the West Fork Wallowa River, effects of the reroute on other water quality constituents are not anticipated. Dissolved oxygen (DO) and total dissolved gas (TDG) are also parameters that can be affected by changes in flow quantity, depths and velocities. However, no effects on DO and TDG are expected from the increased minimum flows and tailrace reroute. PacifiCorp’s monitoring data indicate that DO and TDG are consistently at or near full saturation (100 percent). The proposed action, inclusive of sediment flushing and increased streamflows **is likely to adversely affect this PCE**.

6.2.9 Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

Given brook trout presence within the East Fork Wallowa River, the proposed action may promote their expansion in the action area, and consequently increase the risk of hybridization. The proposed action **may affect, but is not likely to adversely affect this PCE**.

6.3 Indirect Effects

The ESA consultation regulations require consideration of the direct and indirect effects of an action, as well as the effects of any interrelated or interdependent actions. "Indirect effects" are the effects of actions which are "caused by the proposed action and are later in time, but still are reasonably certain to occur" (50 CFR 402.02). In the case of the proposed action, indirect effects may include continued downstream sediment dispersal and deposition during and following forebay flushing, and, as needed, bull trout surveys or monitoring.

With respect to forebay flushing, the proposed SMP has been developed to time sediment flushing to coincide with high flows and maximum transport potential through the East Fork Wallowa River bypassed reach, and during a time when background turbidity levels are at relatively high levels. In combination with turbidity monitoring, this shift in timing of released sediment will minimize indirect effects on bull trout and their habitat. However, bull trout exposed to high turbidity may temporarily be at increased risk of predation, an indirect effect of forebay flushing.

Though currently unscheduled, PacifiCorp may at times conduct bull trout surveys or monitoring in the East Fork Wallowa River bypassed reach or West Fork Wallowa River. Such monitoring will be conducted or supervised by a fishery biologist to ensure the safe handling of all ESA listed fish. The work will comply with requirements in the USFWS Biological Opinion issued with the new license, and PacifiCorp’s State Scientific Collection Permit issued by ODFW. In addition, such surveys, if conducted, will meet USFWS requirements applicable for Section 10 Incidental Take Permits, including:

- All takings must be incidental,
- Impacts must be minimized and mitigated "to the maximum extent practicable,"
- There must be both adequate funding, and provisions to address "unforeseen circumstances,"

- The taking must "not appreciably reduce the likelihood of the survival and recovery of the species in the wild,"
- PacifiCorp will ensure that additional measures required by federal regulators will be implemented.

6.4 Cumulative Effects

Cumulative effects are defined as all "non-federal" actions (i.e., state, local, private and tribal) reasonably certain to occur in the foreseeable future. Such actions may include, but are not limited to additional development, maintenance and upgrading of existing infrastructure and watershed enhancement.

Review of agency comments and FERC staff analysis described in Scoping Document II for the Wallowa Falls Hydroelectric Project (PacifiCorp 2011b) indicates that anadromous fish reintroductions within Wallowa River and Wallowa Lake in the vicinity of the project are reasonably foreseeable actions that could be affected by the Project. With PM&E's described in this BA it is anticipated that no significant impacts to potential future anadromous fish populations will occur as a result of relicensing the Project.

6.5 Summary of Effects

Continued operation of the Wallowa Falls Hydroelectric Project with associated PM&Es will improve habitat for listed bull trout in contrast to existing conditions. Increased instream flows, eliminated risk of stranding in the Project tailrace and reduced impacts of forebay flushing are significant enhancements to bull trout and aquatic resources in Project affected reaches of the East Fork Wallowa River. However, construction of the flume and tailrace reroute, forebay flushing, and any future fish salvages may result in localized, short-term adverse effects. In addition, given the extended duration of the proposed action (50-year license), incidental "take" of juvenile or adult bull trout, e.g., temporary sedimentation or mortality resulting from fish surveys, cannot be ruled out.

Reroute of the Project tailrace will cause reductions in West Fork Wallowa River flows, and loss of habitat that the tailrace itself provides. While the existing tailrace channel is assumed to provide cold water refugia for bull trout during the summer months, it presents the significant risk of fish stranding and subsequent desiccation due to unit trips that result in the penstock headgate closing. PacifiCorp believes the risk of stranding ESA listed bull trout outweighs the benefit of existing habitat conditions in the current tailrace, and within the West Fork Wallowa River between the current tailrace and East Fork Wallowa confluence.

Recent surveys of bull trout in the watershed below the impassible waterfall on the East Fork Wallowa River indicate that a migratory life history exists in these fish (PacifiCorp 2014a). This suggests that, in contrast to strictly resident fish, operation of the Project under a new license term will enhance a bull trout subpopulation with greater likelihood to promote recovery of the Mid-Columbia River population as a whole.

7.0 FINDING OF EFFECT

7.1 Mid-Columbia Bull Trout

Evaluation of potential effects of continued operation of the Wallowa Falls Hydroelectric Project on Mid-Columbia River bull trout concludes that the proposed action will result in more than negligible probability of "take" of juvenile and adult bull trout. We therefore find a determination of **may affect, likely to adversely affect** for the species as defined in *A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale* (USFWS 1998a).

7.2 Designated Critical Habitat

Impacts to critical habitat as a result of the proposed action include flow reduction and increased temperature during summer low flow conditions in the West Fork Wallowa River as a result of the proposed tailrace reroute. These impacts will occur between the existing tailrace and East Fork Wallowa River confluence. In addition, proposed construction of the flume and tailrace reroute, and annual forebay flushing will cause short-term, localized increases in background turbidity and sedimentation. As described in this BA, the proposed SMP and increased flows in the East Fork Wallowa River will minimize project impacts on bull trout critical habitat. In total, the proposed action **may affect, and is likely to adversely affect** designated Critical Habitat for bull trout. Determinations of effect to specific bull trout Critical Habitat PCEs resulting from the proposed action are summarized below (Table 7-1).

Table 7-1. Determination of effects to bull trout Critical Habitat PCEs.

PRIMARY CONSTITUENT ELEMENTS[1]	DETERMINATION OF EFFECT
1) Springs, seeps and groundwater sources	May Affect, Not Likely to Adversely Affect
2) Migratory habitats	Likely to Adversely Affect
3) Abundant food base	Likely to Adversely Affect
4) Complex aquatic environments	May Affect, Not Likely to Adversely Affect
5) Water temperature	May Affect, Not Likely to Adversely Affect
6) Substrates	Likely to Adversely Affect
7) Natural hydrograph	May Affect, Not Likely to Adversely Affect
8) Permanent water quality and quantity	Likely to Adversely Affect
9) Non-native predatory species presence	May Affect, Not Likely to Adversely Affect

[1]75 FR 63898

7.3 Request for Consultation

Due to the findings of effect, FERC requests formal consultation on bull trout and bull trout critical habitat in accordance with Section 7 of the ESA. This effect determination is based on an evaluation of the best data available from the Applicant, USFWS, ODFW, and other appropriate sources.

8.0 ESSENTIAL FISH HABITAT CONSULTATION

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1996 established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. The MSA requires federal agencies to consult with the National Marine Fisheries Service (NMFS) on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (MSA Section 305(b)(2)).

Adverse effect means any impact that reduces quality and/or quantity of EFH, and may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species fecundity), site-specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH means those waters and substrate necessary for spawning, breeding, feeding, or growth to maturity (MSA Section 3). This definition of EFH "waters" includes aquatic areas and their associated physical, chemical and biological properties and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.110).

Consultation under Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

1. Federal agencies must consult with NMFS on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;

2. NMFS shall provide conservation recommendations for any federal or state activity that may adversely affect EFH;

3. Federal agencies shall, within 30 days after receiving conservation recommendations from NMFS, provide a detailed response in writing to NMFS regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations of NMFS, the federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within, and those outside of EFH, e.g., upstream of the impassable barrier approximately one mile downstream of the Wallowa Falls Dam. Any reasonable attempt to encourage conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities. Therefore, EFH consultation with NMFS is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of their location.

8.1 Identification of Essential Fish Habitat

EFH for the Pacific Coast Salmon fishery means those waters and substrate necessary to support a long-term sustainable fishery and salmon contributions to a healthy ecosystem (i.e., properly functioning habitat conditions necessary for the long-term survival of the species through the full range of environmental variation). To achieve that level of production, EFH must include all streams, lakes, ponds, wetlands and other currently viable water bodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho and California, except above the impassable barriers identified by the Pacific Fisheries Management Council (PFMC 1999). Chief Joseph Dam, Dworshak Dam and the Hells Canyon Complex (Hells Canyon, Oxbow, and Brownlee Dams) are among the listed man-made barriers that represent the upstream extent of the Pacific Coast Salmon fishery EFH. Wallowa Lake Dam is not among these listed dams; and Wallowa River is considered EFH for Pacific Salmon (spring Chinook salmon and coho salmon) under the Magnuson-Stevens Fishery Conservation and Management Act (PFMC 1999). In estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (230.2 miles) offshore of Washington, Oregon and California north of Point Conception (PFMC 1999).

8.2 Analysis of Effects

Section 6 of this document provides an analysis of effects to bull trout and bull trout critical habitat within the action area that is also designated EFH for Pacific Salmon. Analysis of effects of continued operation of the Wallowa Falls Hydroelectric Project on nine PCEs within the action area found that continued operation of the Wallowa Falls Hydroelectric Project **may affect, and is likely to adversely affect** designated Critical Habitat for bull trout. The analysis is not directly relevant to an assessment of potential effects on Pacific Salmon EFH in all cases. However, shifting of forebay flushing to the

June high flow period and increased minimum flows in the bypassed reach will benefit Pacific Salmon EFH. Based on this analysis, PacifiCorp concludes that, under PM&Es described in this BA, continued operation of the Wallowa Falls Hydroelectric Project will have **minimal adverse effect to EFH.**

8.3 Conclusion

PacifiCorp believes that continued operation of the Wallowa Falls Hydroelectric Project, under Protection, Mitigation and Enhancement Measures (PM&E's) described in this BA (Section 3), **will have minimal adverse affect** to EFH for Pacific Salmon.

9.0 REFERENCES

Al-Chockhachy. R. Budy, P., Schaller, H. 2005. Understanding the Significance of Redd Counts: a Comparison between Two Methods for Estimating the Abundance of and Monitoring Bull Trout Populations. North American Journal of Fisheries Management 25:1505-1512, 2005.

Buchanan, D.V. and S.V. Gregory, 1997. Development of Water Temperature Standards to Protect and Restore Habitat for Bull Trout and Other Cold Water Species in Oregon. Pages 119 - 126 in Mackay, W.C., M.K. Brewin, and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Clemmens, Albert J., Tony L. Wahl, Marinus G. Bos, and John A. Replogle, 2001, *Water Measurement with Flumes and Weirs*, ILRI Publication 58, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands, 382 p.

Doyle, Jeremiah. October 2011. Personal communication with Eric Campbell (MB&G). PacifiCorp Fish Biologist. Portland, Oregon.

Doyle, Jeremiah. 2011. Threatened and Endangered Species Annual Report: East Fork Wallowa River. PacifiCorp Energy, November 2011.

Federal Register for June 10, 1998 (63 FR 31647). Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Final Rule.

Federal Register for November 1, 1999 (64 FR 58910, 58933). Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States. Final Rule.

Federal Register for October 6, 2004 (69 FR 59996). Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Final Rule.

Federal Register for January 13, 2010 (75 FR 2270). Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States. Proposed Rule.

Federal Register for October 18, 2010 (75 FR 63898). Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States. Final Rule.

Fraley, J.J. and B.B. Shepard, 1989. Life History, Ecology, and Population Status of Migratory Bull Trout (Salvelinus confluentus) in the upper Flathead Lake and River System, Montana. Northwest Science 63(4):133-143.

Goetz, F. 1989. Biology of the bull trout, Salvelinus confluentus, literature review Willamette National Forest, Eugene, OR.

Harbeck, James. September 24, 2013. Personal communication (telephone) between Jim Harbeck, Nez Perce Tribe, Field Supervisor, Joseph, OR, and Mike Bonoff (MB&G Biologist, Portland, OR) concerning bull trout status in the West Fork Wallowa River.

Knox, Bill. September 2010. Personal communication with PacifiCorp. ODFW Fish Biologist. Enterprise, Oregon.

NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

Nowak, M.C. and L. Kuchenbecker. 2004. Grande Ronde Subbasin Plan. Prepared for the Northwest Power and Conservation Council. Prepared by Cat Tracks Wildlife Consulting and the Grande Ronde Model Watershed Program. May 28, 2004.

Oregon Department of Environmental Quality (DEQ). 1998. Guidance for Ecological Risk Assessment: Levels I, II, III, IV.

Oregon Department of Environmental Quality (DEQ). 2005. Portland Harbor Joint Source Control Strategy.

Oregon Department of Environmental Quality (DEQ). 2007. Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment.

Oregon Department of Fish and Wildlife (ODFW). 2011. Wallowa Falls Hydroelectric Project (FERC No. P-308): Comments on Preliminary Application Document and Scoping Document; and Study Results. June 23, 2011.

Oregon Department of Fish and Wildlife (ODFW). 2005. Final Oregon Native Fish Status Report. Volume II. Assessment Methods and Population Results.

PacifiCorp. 2011a. Wallowa Falls Hydroelectric Project (FERC No. P-308) Pre-application Document. February 2011.

PacifiCorp. 2011b. Wallowa Falls Hydroelectric Project (FERC No. P-308) Scoping Document II. August 2011.

PacifiCorp. 2013a. Wallowa Falls Habitat Modeling Preliminary Results. Available at: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Hydro_Licensing/Wallowa%20Falls/04252013_WF_IFIM_Mod_Results.pdf

PacifiCorp. 2013b. Wallowa Falls Hydroelectric Project (FERC No. P-308) Instream Flow Technical Report. December 2013.

PacifiCorp. 2013c. Wallowa Falls Hydroelectric Project (FERC No. P-308) Preliminary Licensing Proposal. October 2013.

PacifiCorp. 2013d. Wallowa Falls Hydroelectric Project (FERC No. P-308) Sediment and Substrate Characterization Technical Report. December 2013.

PacifiCorp. 2013e. Wallowa Falls Hydroelectric Project (FERC No. P-308) Water Resources Technical Report. December 2013.

PacifiCorp 2013f. Wallowa Falls Relicensing, IFIM Agency Meeting Summary. June 13, 2013. Joseph, OR. Available at: http://www.pacificorp.com/content/dam/pacificorp/doc/Energy_Sources/Hydro/Hydro_Licensing/Wallowa%20Falls/61313_IFIM_FINAL_Meeting_Summary.pdf

PacifiCorp. 2014a. Wallowa Falls Hydroelectric Project (FERC No. P-308) Aquatic Resources Technical Report. January 2014.

PacifiCorp. 2014b. Wallowa Falls Hydroelectric Project, Final License Application for Minor Water Power Project, Filed with FERC on February 28, 2014.

PFMC (Pacific Fishery Management Council). 1999. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. Appendix A to Amendment 14, Pacific Coast salmon fishery management plan. Available at: http://www.pcouncil.org/salmon/fishery-management-plan/adoptedapproved-amendments/amendment-14-to-the-pacific-coast-salmon-plan-1997/.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 in Howell, P.J. and D.V.Buchanan, eds. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Ratliff, D.E. and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 in Howell, P.J. and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

Regional Sediment Evaluation Team (RSET). 2006. Northwest Regional Sediment Evaluation Framework Interim Final. Prepared by U.S. Army Corps of Engineers – Seattle District, Portland District, Walla Walla District, and Northwestern Division; Environmental Protection Agency Region 10; Washington Department of Ecology; Washington Department of Natural Resources; Oregon Department of Environmental Quality; Idaho Department of Environmental Quality; National Marine Fisheries Service; and the U.S. Fish and Wildlife Service.

Rieman, B.E. and J.D. McIntyre, 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. General Technical Report INT-302. Intermountain Research Station, Ogden, Utah.

Rieman, B.E. and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. North American J. of Fisheries Manage. 16: 132-146.

Sausen, Gretchen. November 16, 2011. Personal communication (phone call) in November 2011 with Eric Campbell (MB&G Biologist, Portland, OR). USFWS Biologist. La Grande, Oregon.

U.S. Fish and Wildlife Service. 1998a. A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale. February 1998.

U.S. Fish and Wildlife Service. 1998b. Bull Trout Facts. Portland, Oregon. May 1998.

U.S. Fish and Wildlife Service. 2010. Crosswalk between the Bull Trout Matrix of Pathways and Indicators (MPI) and Primary Constituent Elements (PCEs) of Critical Habitat. Region 1, Portland, USFWS.

U.S. Fish and Wildlife Service. 2011. Critical Habitat Mapper. http://criticalhabitat.fws.gov/crithab/. Accessed September 2011.

U.S. Forest Service. 2009. Stream inventory handbook, Version 2.9. Pacific Northwest Region (Region 6). Retrieved from http://www.fs.fed.us/r6/water/fhr/sida/handbook/Stream-Inv-2009.pdf

Wahl, Tony L., Albert J. Clemmens, John A. Replogle, and Marinus G. Bos, 2000, "WinFlume — Windows-Based Software for the Design of Long- Throated Measuring Flumes". Fourth Decennial National Irrigation Symposium, American Society of Agricultural Engineers, Nov. 14-16, 2000, Phoenix, Arizona.

Wallowa County. 2002. Wallowa County Nez Perce Tribe Salmon Habitat Recovery Plan and Multi-Species Strategy. Wallowa County, Enterprise, Oregon. Accessed September 29, 2011 at: http://extension.oregonstate.edu/wallowa/salmon-plan

Wallowa County. 2009. Comprehensive Plan. Wallowa County, Enterprise, Oregon. Accessed September 29, 2011 at: http://www.co.wallowa.or.us/community_development/land_use_planning/comprehensive_plan.html.

Weis, P.L, et al. 1976. Mineral Resources of the Eagle Cap Wilderness and Areas, Oregon. US Geological Survey Bulletin 1385-E, 100 p.

APPENDIX A

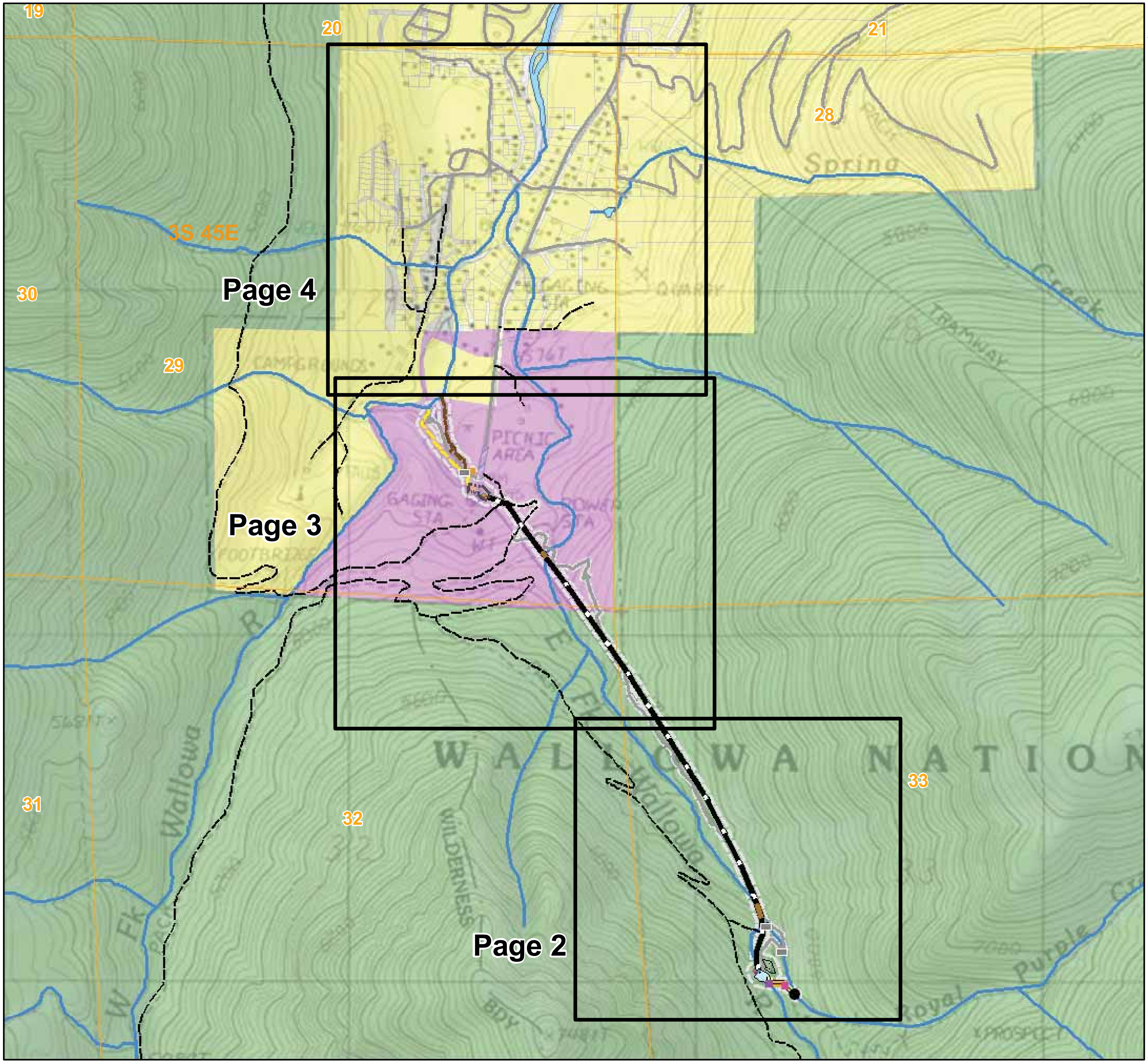
WALLOWA FALLS HYDROELECTRIC PROJECT MAPS

WALLOWA FALLS HYDROELECTRIC PROJECT

Wallowa County, Oregon

Appendix A
Wallowa Falls Project and Vicinity

Page 1



Legend

- Proposed Project Boundary
- Road
- Trail
- Trailhead Parking
- CULVERT
- anchor block
- royal purple pipe outlet

PacifiCorp Facility

- Recreation Storage Shed
- Royal Purple Diversion
- WALLOWA FALLS PLANT FENCE
- 7.2 KV TRANSMISSION LINE
- ELEVATED TRESTLE
- LOW LEVEL OUTLET
- ROYAL PURPLE DIVERSION CHANNEL
- ROYAL PURPLE FLOWLINE - BURRIED
- ROYAL PURPLE FLOWLINE - EXPOSED
- SPILLWAY CATWALK
- WALLOWA FALLS PENSTOCK
- LINED TAILRACE
- TAILRACE - UNLINED
- UNLINED TAILRACE - MAIN CHANNEL
- TAILRACE SIDE CHANNEL - NORTHERN BORDER
- TAILRACE SIDE CHANNEL CENTERLINE
- INTAKE AND CONTROL STRUCTURE
- LAYDOWN AND STORAGE AREA
- SPILLWAY
- STORAGE SHED
- SUBSTATION
- WALLOWA FALLS FOREBAY
- WALLOWA FALLS POWERHOUSE
- PLSS-Section
- SDEADMIN.ADM_TOWNSHIP
- Waterbody
- Stream

Land Ownership - County Data

- Other
- PACIFICORP
- USA

0 500 1,000 Feet

N

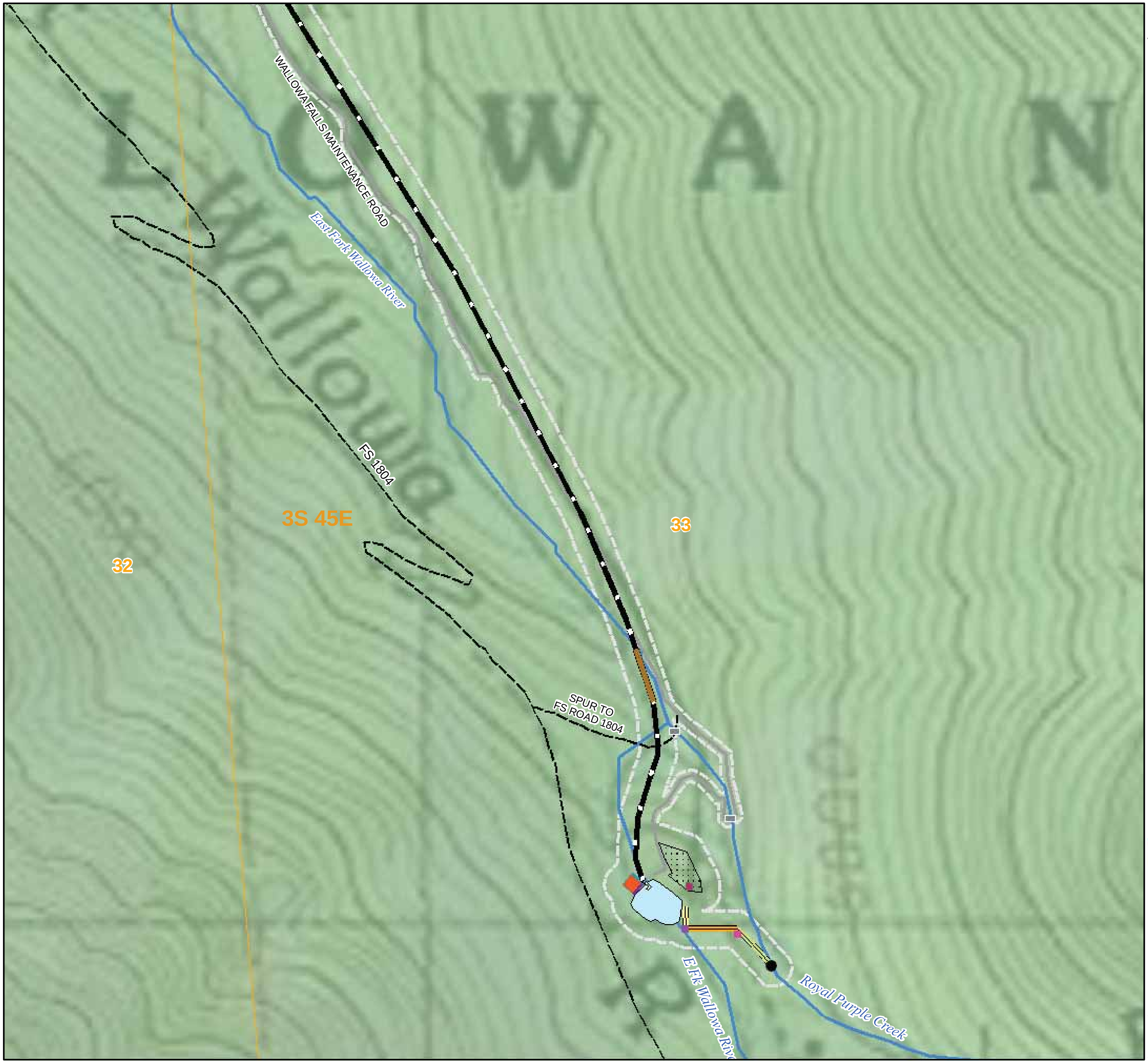
PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

GIS Support Services
Solutions Group
gisdept@Pacificorp.com

Data are projected in UTM Zone 10, NAD83, meters.

No Warranty: With respect to any information, including but not limited to the Confidential Information, which a Party furnishes or otherwise discloses to another Party for the purpose of evaluating Compliance, it is understood and agreed that the Disclosing Party does not make any representations or warranties as to the accuracy, completeness or fitness for a particular purpose thereof. It is further understood and agreed that no Party or its Representatives shall have any liability or responsibility to another Party or to any other person or entity resulting from the use of any information so furnished or otherwise provided pursuant to this Agreement.

02/07/2011 gisdept@pacificorp.com U:\Projects\2010\10-176\WallowaFallsArea.mxd



Appendix A
Wallowa Falls Project and Vicinity

Page 2

Legend

- Proposed Project Boundary
- Road
- Trail
- Trailhead Parking
- CULVERT
- anchor block
- royal purple pipe outlet

PacifiCorp Facility

- Recreation Storage Shed
- Royal Purple Diversion
- WALLOWA FALLS PLANT FENCE
- 7.2 KV TRANSMISSION LINE
- ELEVATED TRESTLE
- LOW LEVEL OUTLET
- ROYAL PURPLE DIVERSION CHANNEL
- ROYAL PURPLE FLOWLINE - BURRIED
- ROYAL PURPLE FLOWLINE - EXPOSED
- SPILLWAY CATWALK
- WALLOWA FALLS PENSTOCK
- LINED TAILRACE
- TAILRACE - UNLINED
- UNLINED TAILRACE - MAIN CHANNEL
- TAILRACE SIDE CHANNEL - NORTHERN BORDER
- TAILRACE SIDE CHANNEL CENTERLINE
- INTAKE AND CONTROL STRUCTURE
- LAYDOWN AND STORAGE AREA
- SPILLWAY
- STORAGE SHED
- SUBSTATION
- WALLOWA FALLS FOREBAY
- WALLOWA FALLS POWERHOUSE
- PLSS-Section
- SDEADMIN.ADM_TOWNSHIP
- Waterbody
- Stream

Land Ownership - County Data

- Other
- PACIFICORP
- USA

0 250 500 Feet

N

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

GIS Support Services
Solutions Group
gisdept@Pacificorp.com

Data are projected in UTM Zone 10, NAD83, meters.

No Warranty: With respect to any information, including but not limited to the Confidential Information, which a Party furnishes or otherwise discloses to another Party for the purpose of evaluating Compliance, it is understood and agreed that the Disclosing Party does not make any representations or warranties as to the accuracy, completeness or fitness for a particular purpose thereof. It is further understood and agreed that no Party or its Representatives shall have any liability or responsibility to another Party or to any other person or entity resulting from the use of any information so furnished or otherwise provided pursuant to this Agreement.

02/07/2011 gisdept@pacificorp.com U:\Projects\2010\10-176\WallowaFallsArea.mxd

Appendix A
Wallowa Falls Project and Vicinity

Page 3

Legend

- Proposed Project Boundary
- Road
- Trail
- Trailhead Parking
- CULVERT
- anchor block
- royal purple pipe outlet

PacifiCorp Facility

- Recreation Storage Shed
- Royal Purple Diversion
- WALLOWA FALLS PLANT FENCE
- 7.2 KV TRANSMISSION LINE
- ELEVATED TRESTLE
- LOW LEVEL OUTLET
- ROYAL PURPLE DIVERSION CHANNEL
- ROYAL PURPLE FLOWLINE - BURRIED
- ROYAL PURPLE FLOWLINE - EXPOSED
- SPILLWAY CATWALK
- WALLOWA FALLS PENSTOCK
- LINED TAILRACE
- TAILRACE - UNLINED
- UNLINED TAILRACE - MAIN CHANNEL
- TAILRACE SIDE CHANNEL - NORTHERN BORDER
- TAILRACE SIDE CHANNEL CENTERLINE
- INTAKE AND CONTROL STRUCTURE
- LAYDOWN AND STORAGE AREA
- SPILLWAY
- STORAGE SHED
- SUBSTATION
- WALLOWA FALLS FOREBAY
- WALLOWA FALLS POWERHOUSE
- PLSS-Section
- SDEADMIN.ADM_TOWNSHIP
- Waterbody
- Stream

Land Ownership - County Data

- Other
- PACIFICORP
- USA

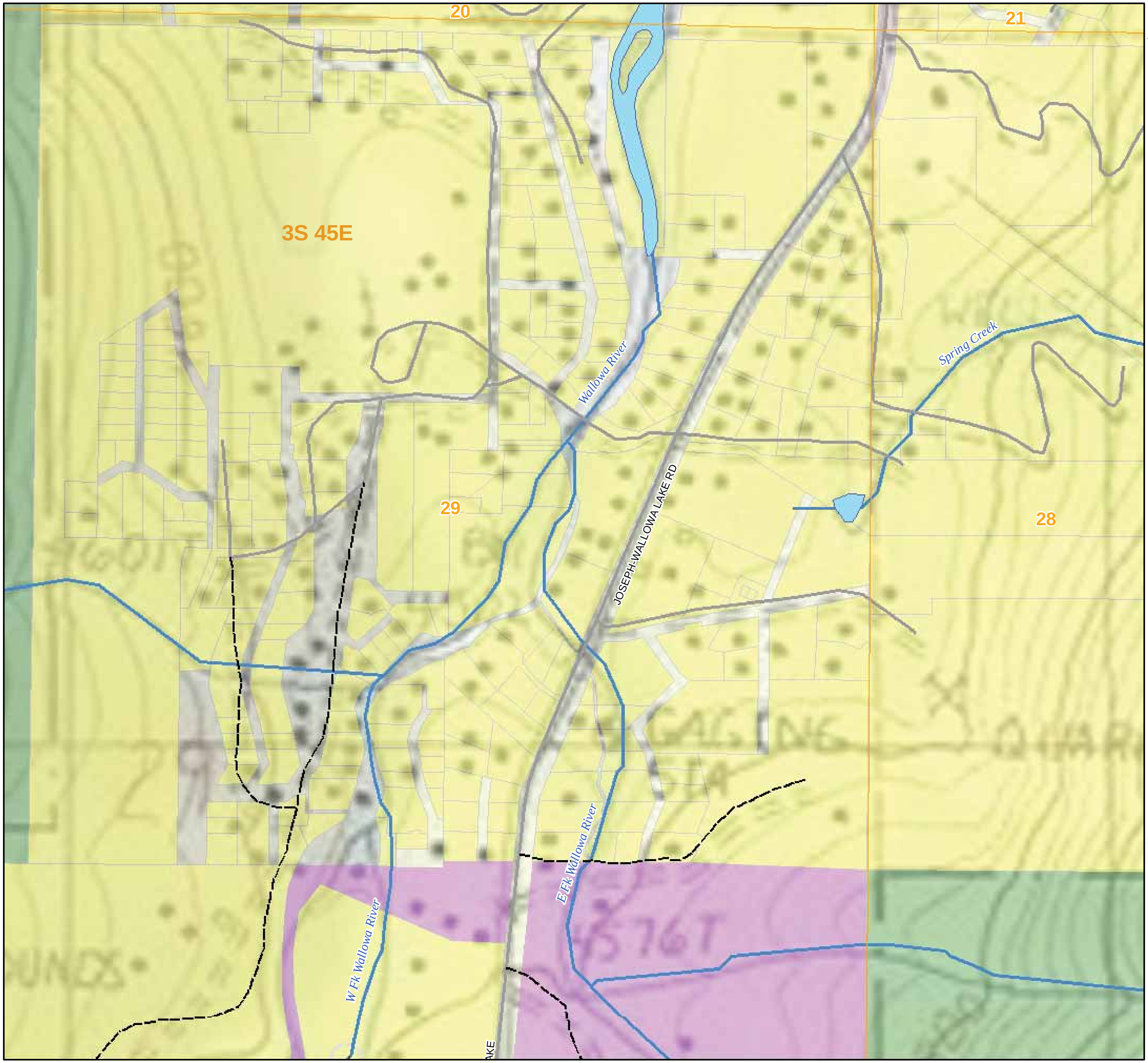
0 250 500 Feet

N

GIS Support Services
Solutions Group
gisdept@Pacificorp.com

Data are projected in UTM Zone 10, NAD83, meters.

No Warranty: With respect to any information, including but not limited to the Confidential Information, which a Party furnishes or otherwise discloses to another Party for the purpose of evaluating Compliance, it is understood and agreed that the Disclosing Party does not make any representations or warranties as to the accuracy, completeness or fitness for a particular purpose thereof. It is further understood and agreed that no Party or its Representatives shall have any liability or responsibility to another Party or to any other person or entity resulting from the use of any information so furnished or otherwise provided pursuant to this Agreement.



Appendix A
Wallowa Falls Project and Vicinity

Page 4

Legend

- Proposed Project Boundary
- Road
- Trail
- Trailhead Parking
- CULVERT
- anchor block
- royal purple pipe outlet

PacifiCorp Facility

- Recreation Storage Shed
- Royal Purple Diversion
- WALLOWA FALLS PLANT FENCE
- 7.2 KV TRANSMISSION LINE
- ELEVATED TRESTLE
- LOW LEVEL OUTLET
- ROYAL PURPLE DIVERSION CHANNEL
- ROYAL PURPLE FLOWLINE - BURRIED
- ROYAL PURPLE FLOWLINE - EXPOSED
- SPILLWAY CATWALK
- WALLOWA FALLS PENSTOCK
- LINED TAILRACE
- TAILRACE - UNLINED
- UNLINED TAILRACE - MAIN CHANNEL
- TAILRACE SIDE CHANNEL - NORTHERN BORDER
- TAILRACE SIDE CHANNEL CENTERLINE
- INTAKE AND CONTROL STRUCTURE
- LAYDOWN AND STORAGE AREA
- SPILLWAY
- STORAGE SHED
- SUBSTATION
- WALLOWA FALLS FOREBAY
- WALLOWA FALLS POWERHOUSE
- PLSS-Section
- SDEADMIN.ADM_TOWNSHIP
- Waterbody
- Stream

Land Ownership - County Data

- Other
- PACIFICORP
- USA

0 250 500 Feet

PACIFICORP
A MIDAMERICAN ENERGY HOLDINGS COMPANY

N

GIS Support Services
Solutions Group
gisdept@Pacificorp.com

Data are projected in UTM Zone 10, NAD83, meters.

APPENDIX B

PROJECT AREA PHOTOGRAPHS

WALLOWA FALLS HYDROELECTRIC PROJECT

Wallowa County, Oregon

1

2

MB&G	WALLOWA FALLS HYDROELECTRIC PROJECT: FOREBAY MAINTENANCE FLUSHING
Mason, Bruce & Girard, Inc. Photo Date: June 16, 2011	1. View to the east showing the project forebay. 2. View to the northeast showing the Wallowa Falls dam and spillway. Note the outfall pipe located at the base of the dam (photo left).

3

4

MB&G	WALLOWA FALLS HYDROELECTRIC PROJECT: FOREBAY MAINTENANCE FLUSHING
Mason, Bruce & Girard, Inc. Photo Date: June 16, 2011	3. View to the southwest showing the outfall pipe located at the base of the dam. Flushed sediment will outfall from this pipe back into the East Fork Wallowa River. 4. View to the northwest showing granitic sediment deposits within the river.

5

6

MB&G	WALLOWA FALLS HYDROELECTRIC PROJECT: FOREBAY MAINTENANCE FLUSHING
Mason, Bruce & Girard, Inc. Photo Date: June 16, 2011	5. View to the south showing a natural waterfall located along the bypassed segment of the East Fork Wallowa River. 6. View to the south showing the steep gradient of the bypassed segment of the East Fork Wallowa River.

APPENDIX C

TURBIDITY MONITORING PLAN FOR MAINTENANCE FOREBAY FLUSHING

WALLOWA FALLS HYDROELECTRIC PROJECT

Wallowa County, Oregon

Turbidity Monitoring Plan for Maintenance Forebay Flushing

Wallowa Falls Hydroelectric Project, FERC No. P-308

Purpose

The purpose of this Turbidity Monitoring Plan is to describe actions that PacifiCorp will undertake to monitor short-term turbidity increases in the portion of the East Fork Wallowa River below the Wallowa Falls dam (bypassed reach) associated with the routine maintenance flushing of the Wallowa Falls Hydroelectric Project (Project) forebay. The Turbidity Monitoring Plan will be implemented during all Project forebay flushing events.

Background

It is necessary to flush accumulated native sediment form the Project forebay to prevent damage to the hydroelectric generating unit and continue operation of the Project. PacifiCorp proposes to modify the historic practice of flushing entrained native sediment from the forebay during the summer low flow period to flushing sediment from the forebay during the peak-spring runoff in the month of June. Annual forebay flushing would result in the removal of accumulated sediment from forebay and the mobilization and transport of that sediment into the bypassed reach of the East Fork Wallowa River. Based on a volumetric survey of native sediment entrained in the forebay in August 2012, conducted by Haner, Ross and Sporseen, P.C, approximately 250 to 500 cubic yards of native material would be flushed annually. Forebay flushing is expected to occur relatively quickly, lasting no more than 24 to 72 hours.

Turbidity Monitoring

It is expected that there will be short-term increases in turbidity during forebay flushing events; monitoring of turbidity levels prior to, during, and following the flushing event will provide information on the magnitude and duration of increased turbidity levels in comparison to normal background levels.

Turbidity will be monitored continuously, using datasondes that record hourly values. Datasondes will be deployed at two monitoring points as follows:

- Representative Background Point (M1): A datasonde will be deployed in a relatively undisturbed area in the East Fork Wallowa River at least 100 feet upstream of the Project forebay. This datasonde will be deployed at least 24 hours prior to forebay flushing to record background turbidity levels in the East Fork Wallowa River. The datasonde will remain deployed for five days to ensure that background turbidity is recorded prior to, during and after the forebay flushing event.

- Downstream Monitoring Point (M2): A datasonde will be deployed in the lower bypassed reach of the East Fork Wallowa River at the current lower stream gaging site. This datasonde will be deployed prior to the onset of forebay flushing and will remain continuously deployed for four days to ensure that turbidity effects during and after the forebay flushing event are recorded.

Reporting

For every forebay flushing event, PacifiCorp will prepare a brief Forebay Flushing Report that summarizes the dates that forebay flushing occurred, duration of the event, flushing methods used and turbidity monitoring results. This report will be submitted the Federal Energy Regulatory Commission and the Oregon Department of Environmental Quality within 60 days of a forebay flushing event.

APPENDIX D

MEMORANDUM ON REQUIRED FLOWS TO MOBILIZE SAND DURING FLUSHING

WALLOWA FALLS HYDROELECTRIC PROJECT

Wallowa County, Oregon

Memorandum

To: Briana Weatherly, PacifiCorp

From: Kathy Dubé

Date: February 13, 2014

Re: East Fork Wallowa River – flow required to mobilize sand during flushing

---

Briana requested an analysis of the flow required to mobilize coarse sand sized particles (2mm) across the stream width in all areas of the East Fork Wallowa River bypass reach in response to resource agency comments on proposed flushing timing.

The East Fork Wallowa River is a step-pool, cobble/boulder bedded stream. In streams such as these, flow hydraulics and sediment transport calculations are extremely complex. There are areas of high velocity in deeper, unobstructed portions of the channel where sediment is easily transported and eddies/areas of low velocity behind obstructions such as boulders or large woody debris and along channel margins where sediment can accumulate. In order to determine actual flows necessary to move sand through all areas/eddies/obstructions in the bypass reach, a two-dimensional model would be needed. There are some areas in the channel (e.g., behind obstructions/along shallow margins) where sand-sized particles will accumulate no matter how high the flow.

Data available for an analysis of sand-sized particle transport in the bypass reach includes 14 instream flow cross sections located in the lower bypass reach, from the confluence with the East Fork Wallowa River to approximately 1,500 feet upstream of the confluence. These transects are located within areas of fish use in the lower-gradient area of the bypass reach; flows that transport sand through these reaches should transport sand through upstream, higher gradient reaches.

Basal shear stress (shear stress on the bed of the stream resulting from flow) was calculated for the location of the margin of the 5 cfs channel (e.g., water's edge transect station under measured 5 cfs flow) for flows of 15, 20, 30, 40, 50, and 60 cfs using Manning's equation to estimate flow depth at each transect (Table 1).

14145 97TH AVE. NE, KIRKLAND, WA 98034 (425)823-7918 KDUBE@WATERSHEDGEODYNAMICS.COM

Table 1. Calculated Basal Shear Stress (lb/sq ft) for Instream Flow Transects.

Transect	Shear Stress at Margin of 5 cfs Channel (Water's Edge Station at 5 cfs)					
	Q = 15 cfs	Q = 20 cfs	Q = 30 cfs	Q = 40 cfs	Q = 50 cfs	Q = 60 cfs
1	0.24	0.42	0.74	1.00	1.25	1.58
2	0.36	0.49	0.88	1.20	1.46	1.78
3	0.57	0.93	1.52	2.11	2.70	3.29
4	0.74	1.08	1.81	2.53	3.26	3.84
5	0.51	0.92	1.72	2.52	3.09	3.90
6	0.39	0.71	1.12	1.66	2.07	2.43
7	0.07	0.11	0.20	0.30	0.37	0.45
8	0.40	0.87	1.61	2.50	3.24	3.98
9	0.51	0.71	1.55	2.56	3.24	4.08
10	0.72	1.01	1.54	2.06	2.46	2.99
11	0.86	1.05	1.72	2.39	2.90	3.40
12	0.64	1.11	2.07	2.87	3.68	4.64
13	1.18	2.24	5.00	7.49	9.99	12.50
14	0.70	0.93	1.76	2.42	2.76	2.76

The basal shear stress can be compared to the critical shear stress needed to mobilize sand-sized (2 mm) particles. In theory, if basal shear stress is above the critical shear stress, a bed made of 2 mm particles should be mobilized. In reality, the bed of a stream is composed of a mixture of different sized particles that are mobilized at different shear stresses/flows, so surficial sand may be effectively hiding behind larger particles. Shear stress to move 2 mm particles is estimated to be 0.04 pounds/square foot using Shield's criteria for uniform-size streambeds. Andrews (1983) criteria for mixed-grain-size streambeds was used to estimate shear stress to move 2 mm particles on a bed with a sub-armor D50 grain size of 3.5 mm (T3 sub-armor sample) and 15 mm (T4 sub-armor sample); the required shear stress to move 2 mm particles ranged from 0.09 to 0.32 pounds/square foot.

Based on the estimated basal shear stress at the edge of the low flow (5 cfs) channel station shown in Table 1, sand-sized particles should be able to be entrained from within the mixed grain-size substrate at the majority of the instream flow transects at flows of 15-20 cfs. Transect 7, in a very low gradient location, is the only location analyzed that would require higher flows (50-60 cfs) to mobilize sand from a mixed-size bed.

The flow to keep sand in motion once it is mobilized is much less than the flow to entrain it. Therefore, once sand-sized particles are mobilized, or if flows during the flushing event are high enough to keep sand moving through the system, sand particles could be transported through much of the stream without being deposited (keeping in mind, as discussed previously, that some particles will be deposited behind obstructions even under high flow conditions).