



Bear Creek-Sauvage Fish Habitat Restoration Project 80% Basis of Design Report

For Grande Ronde Model Watershed and Oregon Department of Fish and Wildlife
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Prepared by Rio Applied Science & Engineering
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LIST OF ACRONYMS

2D – two-dimensional
ac – acres
ARR – Aquatic Resources Report
BDA – beaver dam analogue
BPA – Bonneville Power Administration
cfs – cubic feet per second
DBH – diameter at breast height
Drawings – Design Drawings
DW – diffusion wave
ESA – Endangered Species Act
FHWA – Federal Highway Administration
FM – full momentum
ft – feet
GPDSR – General Project and Data Summary Requirements
GRMW – Grande Ronde Model Watershed
HEC-RAS – Hydraulic Engineering Center’s River Analysis System
HIP – Habitat Improvement Program
mi – miles
NAD 83 – North American Datum of 1983
NAVD 88 – North American Vertical Datum of 1988
NPS – National Park Service
NRCS – National Resource Conservation Service
ODFW – Oregon Department of Fish and Wildlife
OHWM – ordinary high-water mark
OWRD – Oregon Water Resources Department
Partnership – The Wallowa Lake Moraines Partnership
PEM – Palustrine Emergent
PFO – Palustrine Forested
PSS – Palustrine Shrub-Scrub
report – Basis of Design Report
Rio ASE – Rio Applied Science & Engineering
RM – river mile
RRT – Restoration Review Team
SWE – shallow water equation
SWPPP – storm water pollution prevention plan
USACE – U.S. Army Corps of Engineers
USFS – U.S. Forest Service
USGS – U.S. Geological Survey
WOTUS – Waters of the United States
WSE – water surface elevation

1 INTRODUCTION

Rio Applied Science & Engineering (Rio ASE) has prepared this 80 Percent Basis of Design Report (report) for the Grande Ronde Model Watershed (GRMW) and the Oregon Department of Fish and Wildlife (ODFW). This report provides a summary of our findings pertaining to the existing conditions of Bear Creek, a tributary of the Wallowa River near Wallowa, Oregon, and an explanation of the design process, analyses, and outcomes for the proposed enhancement design.

Rio ASE organized the following sections of this report to describe the General Project and Data Summary Requirements (GPDSR) required by the Bonneville Power Administration (BPA) for regulatory compliance coverage under the Habitat Improvement Program (HIP). This report is submitted to satisfy the 80 Percent design review for technical comment as part of the BPA Restoration Review Team (RRT) review process. BPA developed the requirements to effectively communicate that appropriate planning, analysis, design, and resulting construction documentation are met. The conditions of the project area are described in terms of processes that shaped the stream and associated ecosystem. This includes discussions on hydrology, hydraulics, habitat, and geomorphology. The evaluation and consideration of the site conditions provide the basis for the project design.

1.1 Project Responsible Parties

- The project sponsors are the Oregon Department of Fish and Wildlife, project manager Nick Smith, 541-962-1831, and the Grande Ronde Model Watershed, project manager Jesse Steele, 541-663-0570
- The design consultant is Rio ASE and the engineer of record is Jeff Fealko, PE, 208-866-8753

1.2 Site Location

The Bear Creek Fish Habitat Restoration Project area is located on private land, extending from river mile (RM) 3.1 to 5.6 on Bear Creek and RM 0.0 to 2.0 on Little Bear Creek. Bear Creek is a tributary to the Wallowa River, which is a tributary to the Grande Ronde River. Additional mapping is provided in the Design Drawings (Drawings) in Appendix A.

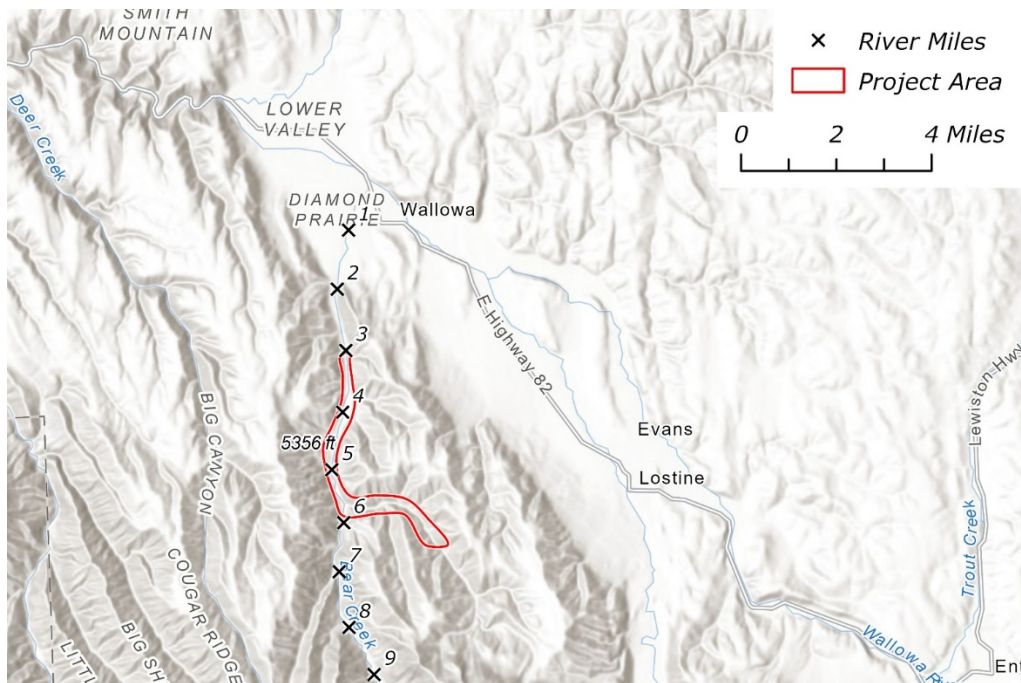


Figure 1-1. Project vicinity map.

2 PROJECT BACKGROUND

GRMW and ODFW, with cooperation from landowners, have been developing designs to improve fish habitat on sections of Bear Creek and Little Bear Creek that provide important spawning and rearing habitat for spring Chinook salmon (*Oncorhynchus tshawytscha*) and summer steelhead (*Oncorhynchus mykiss*), both species listed under the Endangered Species Act (ESA). The project area is also used by important native fish species, including ESA-listed bull trout (*Salvelinus confluentus*), Oregon Sensitive Species redband trout (*Oncorhynchus mykiss newberrii*), and lamprey (*Entosphenus tridentatus*). The key limiting factors within the project area include a lack of habitat quantity and diversity, high water temperatures, diminished streamflow, disconnected floodplains, and poor riparian communities (GRMW, 2024). Prior to bringing on Rio ASE for the project, ODFW developed an early, conceptual restoration design that was shared with landowners and included large wood structures, side channels, channel fill, beaver complexes, riparian restoration, and floodplain enhancement. Rio ASE was encouraged to utilize as much or as little of this conceptual design as necessary in developing a restoration design for the project area.

2.1 Environmental Setting

The project area is located in the Grande Ronde subbasin, which lies in the Blue Mountains ecological province and is bounded on the west and northwest by the Blue Mountains and on the southeast by the Wallowa Mountains. The subbasin covers approximately 4,000 square miles (mi) in northeast Oregon and southeast Washington and comprises three watershed areas: Upper Grande Ronde, Lower Grande Ronde, and Wallowa. The smallest of the three, the Wallowa watershed, drains about 950 mi² across elevations ranging from over 8,000 feet (ft) where the Wallowa River originates in the Eagle Cap Wilderness Area down to 2,288 ft where it joins the Grande Ronde River. The West and East Forks of the Wallowa River flow from a snowy, steep headwater area down to Wallowa Lake at the foot of the Wallowa Mountains. The mainstem Wallowa River flows from there to the northwest, collecting several major tributaries—including Bear Creek—before its confluence with the Grande Ronde.

The Wallowa valley was historically populated by the Nez Perce people, who moved between the valley in the summer and the warmer canyon areas of the Snake, Imnaha, and Grande Ronde Rivers in the winter, both following food resources and practicing resource management, including timed harvests, cultivation, raising livestock, and prescribed fire (The Wallowa Lake Moraines Partnership [Partnership], 2022). The high mountains and canyons surrounding the Wallowa valley at first kept the area isolated from European settlement. In 1855 the territorial governor met with representatives from a number of tribes in the area resulting in a treaty forcing tribal members from their land and onto reservations, paving the way for Euro-American settlement and impacts that were felt throughout the valley. In 1860, gold was discovered on the boundaries of the reservation and the ensuing years saw both an influx of Euro-American settlers and an increase in conflict, culminating in the Nez Perce Flight of 1877, the reduction of the reservation by 90%, and the expulsion of tribes from the Wallowa valley altogether (National Park Service [NPS], 2022; Horner & Butterfield, 1949). Since the beginning of Euro-American settlement, the land has largely been used for ranching and grazing, agricultural production, tillage farming, and some sporadic mining and sawmilling (Horner & Butterfield, 1949; Partnership, 2022).

The upper half of the Bear Creek watershed falls within the Eagle Cap Wilderness area, while the lower half of the watershed comprises a mix of U.S. Forest Service (USFS) land and private land. The land-use impacts within the upper watershed are minimal when compared to many watersheds in the region due to the designated wilderness protections. Downstream of the wilderness area, Bear Creek flows through non-wilderness USFS property for 3 miles before intersecting private property. Land-use impacts generally increase in severity downstream of USFS property and become even more pronounced as Bear Creek leaves its confined valley (RM 2.0) and flows across a broad alluvial fan as it approaches the Wallowa River. The impacts in the downstream half of the watershed are primarily from cattle grazing, irrigation withdrawals, logging, and the presence of

roads. Within the project area, the primary landowner (Sauvage family) has discontinued grazing of the property, which will help improve riparian vegetation, especially the natural recruitment of willows and cottonwoods. There are no significant irrigation withdrawals upstream or within the project area; however, downstream of the project area at RM 2.1 there is a substantial irrigation withdrawal that was capturing all flows in Bear Creek when observed in October 2024.

2.2 Project Goals and Objectives

This project is focused on improving the limiting habitat factors that are critical to multiple life stages of ESA-listed spring Chinook salmon, summer steelhead, and bull trout as well as redband trout, lamprey, and other native fish species. The primary goal is to enhance aquatic habitat diversity through the restoration of natural river function and processes, including floodplain connectivity, to create and maintain a complex riverine corridor.

Site-specific project objectives are to:

- Increase the quantity and complexity of high-quality habitat by utilizing the placement of instream wood to improve hydraulic diversity, increase pool quantity and quality, improve sediment sorting, and increase cover.
- Distribute stream flow and energy through a range of hydrologic conditions by increasing water surface elevations (WSE) to reconnect or create seasonally active secondary channels.
- Increase seasonal floodplain connection and function to dissipate flood energy and improve flood water storage, hyporheic exchange, sediment storage, and in-channel sediment sorting.
- Where possible, maintain and enhance existing spring channels and create habitat features that can be utilized by beaver to expand their habitat and influence within the riverine corridor.
- Protect, establish, and maintain a robust native riparian plant community along channel banks and floodplain, thus increasing shade and improving bank structure and habitat.
- Protect and/or modify existing infrastructure to maximize fish habitat uplift throughout the project area.

3 EXISTING CONDITIONS

3.1 Hydrology

The region is considered a continental climate characterized by cold, wet winters and warm, dry summers. The valley floor (3,000 ft in elevation) receives average annual precipitation of 15-20 inches per year, most of which falls from November to March as snow. Due to orographic effects, the peaks in the upper watershed (8,000 ft) can receive over 100 inches of snow per year. The estimated mean annual precipitation for the basin is 35 inches (U.S. Geological Survey [USGS], 2025). The dry summer months see relatively little rainfall, and the region is subject to multi-year drought cycles. The snowpack is sensitive to warming trends, which impact how and when spring runoff occurs and water availability throughout the dry season.

The watershed upstream of the project is estimated to drain 71.4 mi² with a relief of 5,000 ft, from a maximum elevation of 8,800 ft to a minimum of 3,200 ft. The Oregon Water Resources Department (OWRD) maintains a gage (Bear Cr near Wallowa, OR 13330500) at the downstream end of the project that has a record beginning in 1915. This gage was utilized to estimate hydrologic discharges for the project area utilized in both design and safety analyses.

3.1.1 Annual Peak Flows

Annual peak flows for the Bear Creek watershed are controlled by snowmelt processes. USGS and OWRD have been operating gage 13330500 intermittently starting from 1915; it is still in operation at the time of this report. Throughout the period of record, 94% of the peak flows recorded occurred in April through June. Within the last 30 years, peak flows have occurred across a wider timeframe: 90% still occur in April through May, but some events have occurred in November through March, likely due to rain-on-snow events. This transition in flow timing could be a result of slow weather changes in the region. In accordance with USGS Bulletin 17C (England et al., 2019), a log Pearson type III distribution was used to estimate peak flood flow recurrence discharges at various intervals both with the full record and in the most recent 30-year period. A summary of peak flow recurrence intervals for the various timeframes is shown below in Table 3.1. For our modelling purposes we are evaluating the most recent 30-year data as it produced the highest discharge values.

Table 3.1. Peak Flow Discharges for Various Time Periods and Various Recurrence Intervals

Recurrence Interval (year)	Exceedance Probability	1925-1954	1955-1984	1925-1985	1996-2024
500	0.002	2309	1960	2403	2850
200	0.005	2058	1902	2173	2673
100	0.01	1874	1846	1999	2527
50	0.02	1695	1777	1826	2369
20	0.05	1462	1658	1593	2134
10	0.1	1286	1538	1411	1932
5	0.2	1105	1378	1217	1696
2	0.5	836	1048	918	1282
1.50	0.6667	729	878	794	1094
1.25	0.8	642	725	692	930
1.05	0.95	506	463	527	658
1.01	0.99	418	292	419	474

3.1.2 Seasonal Flows

Based on the annual flow hydrograph, there are four typical seasons observed throughout the year: winter flows (December–February), spring freshet (May–July), summer base flow (August–September), and fall rains (October–November). Figure 3-1 shows the average daily discharge for gage 13330500 over the water year (October–September). In addition to annual seasonal flows, the four seasonal flows were analyzed and estimated for flows at the downstream end of the project site (Table 3.2).

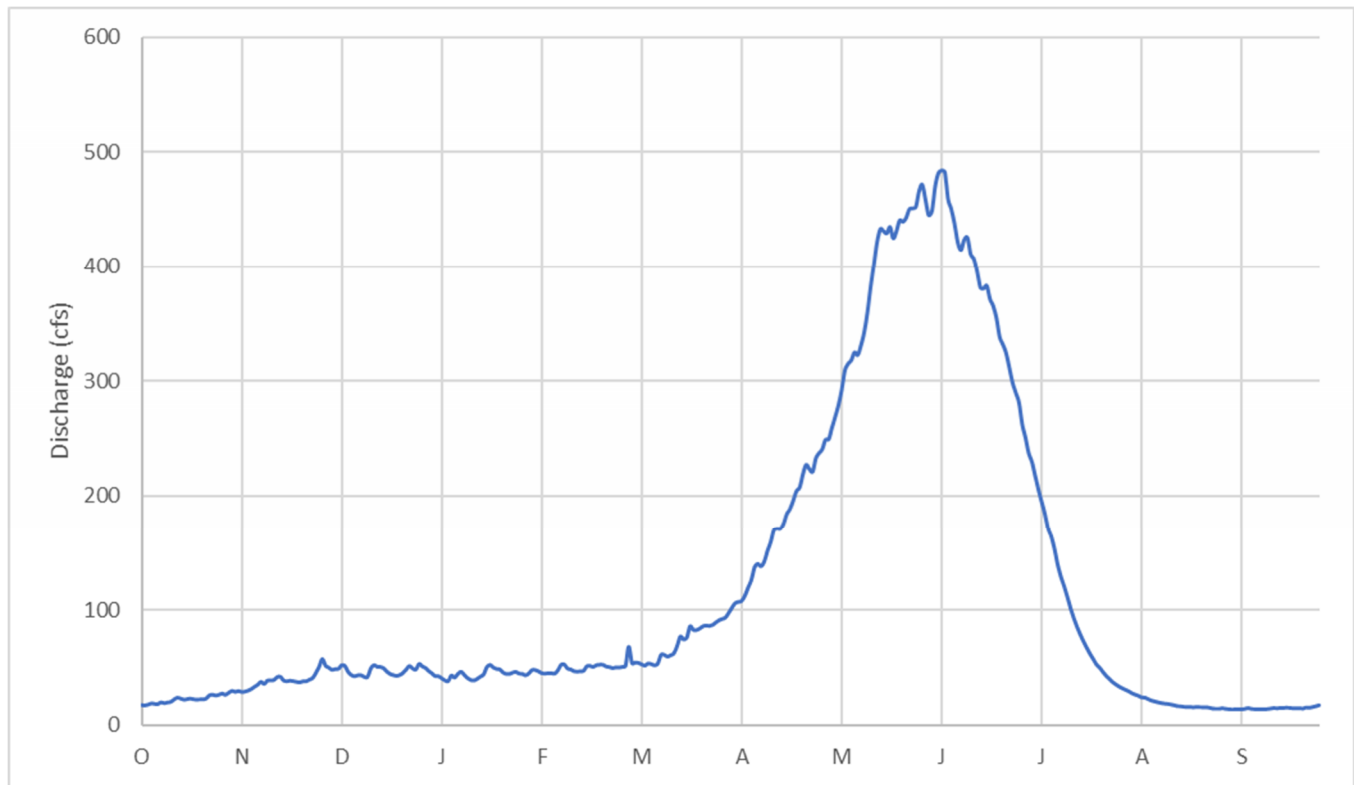


Figure 3-1. Average daily discharge for the period of record for gage 13330500.

Table 3.2. Annual and Seasonal Exceedance Discharges Based on Data from Gage 13330500

Season	Probability of Exceedance						
	0.05	0.1	0.25	0.5	0.75	0.9	0.95
Annual	488	331.8	140	38	18.7	11.9	9.7
Fall	74	51	32	19	13	10	8
Winter	139	93	53	32	23	17	15
Spring	657	523	320	167	68	34	24
Summer	32	25	18	13	10	8.4	7.7

3.2 Geomorphology

Bear Creek flows generally northward, emanating from the steep, confined Wallowa Mountains comprising largely Cretaceous (145-66 million years old) granitic lithology. As the stream descends from the high peaks of the Wallowa Mountains, it passes onto Miocene (23-5 million years old) Columbia River basalts (Walker, 1979) surrounding the entirety of the project area. During the last ice age, valley glaciers formed in the high Wallowa Mountains extending down the Bear Creek Valley to a point roughly three miles upstream of the Little Bear Creek confluence (interpreted by Rio ASE from LiDAR topography). Glacial influence within the watershed

increased both stream discharge and sediment yield during the last ice age, resulting in large-scale deposition partially filling Bear Creek valley with glacial outwash consisting of poorly graded silt, sand, gravel, cobble, and boulders within the project area. As discharge and sediment availability diminished following the ice age (approximately 12,000 years ago), Bear Creek slowly winnowed away finer material, resulting in natural channel incision and the formation of a boulder-cobble armored, modern stream channel inset within terraces along the valley margins.

The project area remains heavily influenced by its geological and glacial past. The granitic intrusion forming the Wallowa Mountains created relatively steep topography and high-gradient streams, resulting in high stream energy and sediment transport capacity. In areas where concentrated flow and stream energy is effectively dissipated by large and periodically channel-spanning log jams, sediment transport capacity is diminished and fine-grained (sand/gravel) alluvial sediment has been deposited. These areas are characterized by diverse, multi-threaded channel formations with complex riffle-pool morphology. Channel evolution within these areas is driven by a combination of migration and avulsion. The largest obstructions abruptly redirect the channel through the adjacent floodplain, creating a new channel via avulsion, while smaller obstructions tend to influence bank erosion, resulting in relatively gradual migration and meander formation. Both avulsion and migration processes result in dynamic channel planforms, the recruitment of woody debris and gravel sediment, and the creation of highly variable hydraulic conditions and complex habitat. These areas were treated as reference reaches during project development (Figure 3-2, Figure 3-3, and Figure 3-4).

Conversely, in areas that remain relatively unobstructed by large woody debris, concentrated flow and high stream energy limit new sediment deposition. The channel substrate consists largely of glacial lag (boulders and cobbles) that is sufficiently coarse to limit further incision, thereby forcing excess channel energy against the banks and creating an over-widened channel geometry and limited floodplain connection, further concentrating flow. This positive feedback loop tends to prolong the duration and expand the spatial extent of these relatively homogeneous and morphologically plane-bed stream reaches such that this is now the dominant channel type with the project area. These channel segments lack large wood, hydraulic diversity, pool formation, and a defined low-flow channel (Figure 3-5 and Figure 3-6).

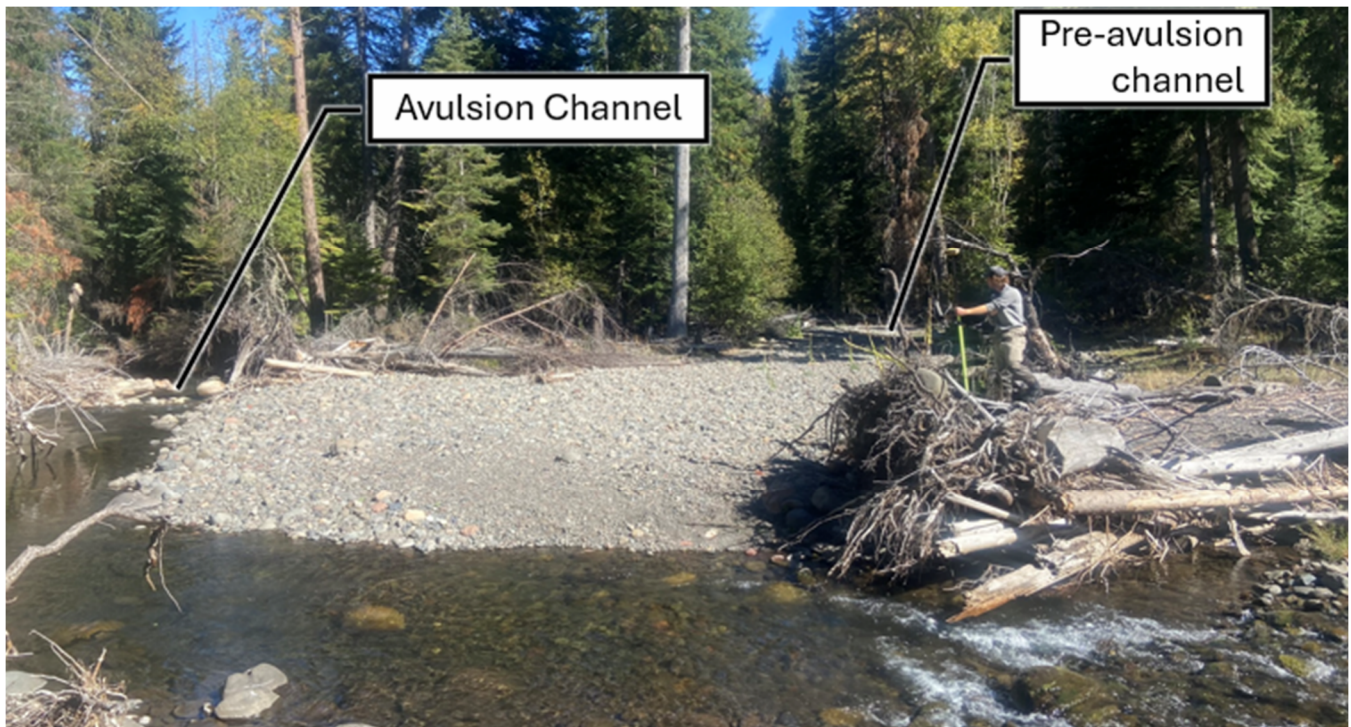


Figure 3-2. Photo of reference reach at a recent channel avulsion (RM 4.5). Note the smaller sediment size deposited in this reach, the large wood, and the varied hydraulics.