Bull Run Creek RM 0.5 Fish Habitat Enhancement

15 Percent Basis of Design

Grant County, Oregon

for

Confederated Tribes of the Umatilla Indian Reservation

December 13, 2024

523 East Second Avenue
Spokane, Washington 99202
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GeoEngineers

Cramer Fish Sciences
An Employee Owned Consulting Company

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File No. 2698-036-00
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Prepared for:

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Table of Contents

Appendices

1.0 Project Background/Introduction

GeoEngineers, Inc. (GeoEngineers) has prepared this Basis of Design Report (report) for the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to describe and illustrate the Bull Run Creek RM 0.5 Fish Habitat Enhancement Project (project). This is also intended for the CTUIR to submit to the Bonneville Power Administration (BPA) Restoration Review Team (RRT) for their review. This report provides a summary of our findings pertaining to the existing conditions within the project reach and processes that shaped the stream. The evaluation and consideration of the site conditions provide the basis for the project design and an explanation of the design process, analyses and anticipated outcomes for the proposed enhancements. The conceptual (15 percent) design is included as Appendix A and described below. Additional background, technical data and contract documentation are provided below.

1.1 NAME AND TITLES OF SPONSOR, FIRMS, AND INDIVIDUALS RESPONSIBLE FOR DESIGN

Project Sponsor: Confederated Tribes of the Umatilla Indian Reservation (CTUIR)

- John Zakrajsek, Fisheries Habitat Biologist, Project Manager
- John Clark, Fisheries Habitat Biologist
- Tamara Payton, Fisheries Habitat Biologist

Design Firm: GeoEngineers, Inc. (GeoEngineers)

- Jason Scott, FP-C CESCL, Associate Fisheries Biologist, Principal in Charge
- Becca Miller, PE, Senior River Engineer, Project Manager/Engineer of Record
- Katrina Hyman-Rabeler, PE, River Engineer
- Dave Lauder, PE, Senior Geotechnical Engineer
- Morgan McCarthur, PE, Principal Geotechnical Engineer

Contributing Authors: Cramer Fish Sciences:

- Tyler Rockhill, PE, CFM, Restoration Engineer
- Nicole Farless, Biologist
- Zack DeLuca, Geomorphologist

1.2 PROJECT ELEMENTS THAT HAVE BEEN DESIGNED BY A LICENSED PROFESSIONAL ENGINEER

- Tailing Pile Excavation, Floodplain Grading and Channel Grading
- Large Wood Material Structures (LWM)
- Aquatic Organism Passage Structures
- Temporary Erosion and Sediment Control (TESC), Water Management

1.3 EXPLANATION AND BACKGROUND ON FISHERIES USE (BY LIFE STAGE - PERIOD) AND LIMITING FACTORS ADDRESSED BY PROJECT

The John Day River Watershed is the second longest free-flowing river in the continental United States and its spring chinook salmon and summer steelhead population are two of the last remaining intact wild populations of anadromous fish in the Columbia River Basin (NPCC 2005). Additionally, the watershed has been kept relatively free of hatchery influences, which means projects like this will be primarily for the benefit of native wild populations.

The focus species this habitat enhancement project is intended to address include steelhead, spring Chinook salmon and bull trout. This project reach of Bull Run Creek is identified as primary spawning and rearing use for steelhead and spring Chinook salmon, migration use for bull trout and is a restoration priority for all these focal fish species (NPCC 2005).

Summer steelhead in Bull Run Creek were listed as threatened under the Endangered Species Act (ESA) in 1999 and are part of the Mid-Columbia River (MCR) steelhead Distinct Population Segment (DPS). The North Fork John Day population is part of the John Day Major Population Group (MPG) and is the only viable population throughout the entire Middle Columbia DPS (NMFS 2009).

Bull trout were listed as threatened under the ESA in 1998 and are part of the Columbia River Distinct Population Segment (DPS). The John Day Subbasin is a major drainage within the Mid-Columbia Recovery Unit and the North Fork John Day River (NFJDR) is one of 27 bull trout core areas in this unit. Seven local populations have been identified in the NFJDR Subbasin and Bull Run Creek falls within the upper Granite Creek population (FWS 2015).

Spring Chinook salmon are not currently listed under the ESA in the John Day River Watershed; however, their population is significantly depressed, and no sport harvest has been allowed since 1976.

Limiting factors for the focal species in the project area are largely attributable to the impacts of past mining activities. The John Day Watershed Restoration Strategy (CTWSRO 2014), John Day Subbasin Plan (NPCC 2005) and Mid-Columbia Steelhead Recovery Plan (NMFS 2009) identified the primary limiting factors in Bull Run Creek to be degraded riparian areas, disconnected/degraded floodplains, degraded channel conditions and altered sediment routing. Bull Run Creek was also identified as a priority sub-watershed for restoration by the Wallowa-Whitman National Forest (WWNF) under the U.S. Forest Service's Watershed Condition Framework (USFS 2011) resulting in the creation of the Granite Creek Watershed Restoration Action Plan (WRAP) in 2012. Since then, CTUIR has worked in collaboration with WWNF and the North Fork John Day Watershed Council (NFJDWC) to restore sections of Bull Run Creek. Nearby restoration efforts include the recent completion of the approximate 2-mile long middle Bull Run Creek reach located immediately upstream and the replacement of two Grant County culverts on Granite Hill Road with fish passable structures, which is proposed for construction in 2025.

1.4 PRIMARY PROJECT FEATURES, INCLUDING CONSTRUCTED OR NATURAL ELEMENTS

The 15% Design (Appendix A) contains restoration actions designed to achieve the objectives outlined in Table 1. The proposed project elements are described below and detailed technical analysis supporting design development is included in Section 3.0. Additional details will be provided at 30% design submittal. The project elements include:

1.4.1 Proposed Project Element 1: Floodplain Grading and Mine Tailings Removal

Project Element 1 includes widespread floodplain grading and tailings piles removal to restore part of the historic floodplain. Site constraints including existing infrastructure, landowner participation and excavation quantities limit a full valley reset within the historic floodplain limits. Restored floodplain widths vary between 60 and 300 feet (ft), with widths exceeding 100 ft in most areas. The proposed restored floodplain was set to approximately 2 ft above the existing channel thalweg. A new main channel will be cut into the restored floodplain and include inset floodplains between 1.0 and 1.5 ft above the existing channel thalweg. The floodplain grading and tailing pile removal falls under the HIP III activity category 2a, improving secondary channel reach and wetland habitat.

A full valley wide reset, including reestablishment of the channel elevation was considered during the development of the conceptual design to establish a grading that balanced cut and fill volumes and limited export of materials from the site. The resulting balanced cut/fill approach required the floodplain to be set approximately 5 ft above the existing thalweg elevation and the proposed channel filled to create a new channel approximately 3 ft above the existing. However, following discussions with project partners it was determined that until we have suitable subsurface data, there is too great a risk of summer flows going subsurface. This was, in part, based on water surface elevations in the dredge ponds throughout the reach which may indicate groundwater levels.

The proposed valley grading targets a minimum design floodplain width of 100 ft based on an estimated reference bankfull width condition of approximately 22 ft (based on hydraulic geometry relationships discussed in Section 3.4). Additional details on bankfull width establishment and minimum floodplain width targets are included in Section 3.4. The proposed floodplain grading limits target existing depressions identified in the Relative Elevation Model (REM, see Section 2.2 for details regarding REM development). Floodplain widths were opportunistically expanded beyond the 100 ft minimum where parallel low-lying depressions could be connected through tailing pile removal. We excluded removal of tailings piles that would not result in a reconnection of depressional features to reduce the overall volume of excavation and disturbance footprint associated with the design. The floodplain grading will allow a reconnection of historic floodplains and connect wetlands.

The resulting valley grading will create approximately 150,000 cubic yards (cy) of excavation. Permanent stockpile locations are shown in Appendix A and will be refined based on discussions with project partners during the 30% design development. Additional refinement of the floodplain grading limits may occur at 30% design based on discussion with project partners and could include reduction of grading limits to further reduce excavation volumes and associated costs.

1.4.2 Proposed Project Element 2: Main Channel Reconstruction

Project Element 2 includes the main channel reconstruction and realignment and creation of an inset floodplain throughout the project reach and falls under the HIP IV activity category 2f, channel reconstruction. We designed the main channel reconstruction to provide a sustainable planform and cross-sectional geometry. We have increased main channel sinuosity and developed a pool-riffle geomorphic condition (see Section 3.4 for more detail on channel design). The main channel reconstruction will include structural elements, including roughened channel bed materials in riffle segments. The resulting main channel will improve sediment sorting, velocity variability and depth variability. A description of hydraulic performance will be completed at 30% design and included in Section 3.6.

Project Element 2 includes a series of high flow side channel connections to the main channel throughout the project reach. The side channel enhancements falls under HIP IV activity category 2a, improving secondary channel and wetland habitats and HIP III activity category 2f, channel reconstruction. The proposed side channel enhancements will be designed to activate at peak discharges and promote the spreading and retention of high flows across the floodplain. The side channel enhancements include excavation of the floodplain and installation of wood habitat structures to create off channel habitats, increase hydrologic capacity, provide resting areas for fish and wildlife species and provide protective cover for fish and other aquatic species, including the Columbia spotted frog. Side channel design and hydraulic modeling will occur at 30% design and will be included in Section 3.6.

1.4.3 Proposed Project Element 3: Large Woody Material Habitat Structures

Project Element 3 includes the large woody material (LWM) habitat structures designed throughout the main channel and side channel enhancements through the project reach. Installation of the LWM structures falls under HIP IV activity category 2d, install habit-forming natural material instream structures. LWM will be strategically placed throughout the floodplain and side channels to improve off-channel aquatic habitat. Placement of LWM within the main channel will promote inundation of the enhanced floodplain and side channels. Additional LWM will be placed in the channel to encourage sediment sorting, pool formation and channel complexity. Floodplain roughness in the form of embedded woody material and flood fencing will be incorporated to promote floodplain stability post-construction and support the development of riparian vegetation.

1.4.4 Proposed Project Element 4: Riparian Planting

This action includes native revegetation of disturbed areas on the floodplain. The project aims to increase the riparian buffer on both sides of the creek with planting of native riparian species. The riparian planting falls under HIP IV activity category 2e, Riparian Vegetation Planting.

1.4.5 Proposed Project Element 5: Aquatic Organism Passage Structures

Project Element 5 includes the replacement of three undersized culverts on Bull Run Creek and one undersized culvert on Corral Creek with larger structures that facilitate aquatic organism passage (AOP). Culvert replacement falls under HIP IV activity category 1f Bridge and Culvert Removal or Replacement. The hydraulic opening widths will provide a minimum of 1.5 times the design bankfull width (Section 3.4) and will accommodate floodplain benches. The crossing structures on Bull Run Creek are anticipated to have a hydraulic opening width equal to 35 feet. The crossing structure on Corral Creek is anticipated to have a hydraulic opening width equal to 10 feet. Hydraulic opening widths are preliminary recommendations at the 15% design stage and will be refined following hydraulic modeling and scour analysis in future design submittals.

An additional crossing is proposed within the project to provide access to a residence located on the east side of Corall Creek. This property is currently accessed from the west using a ford crossing of Corral Creek. The proposed design removes the ford crossing and restores an inset floodplain within Corral Creek. A new access route will be provided to the residence by infilling an existing dredge pond and creating a driveway that connects to the adjacent access road. Drainage will be provided through the new access as the dredge pond is hydraulically connected to a pond on the upstream side of USFS RD 7366.

1.5 PERFORMANCE/SUSTAINABILITY CRITERIA FOR PROJECT ELEMENTS AND ASSESSMENT OF RISK OF FAILURE TO PERFORM, RISK TO INFRASTRUCTURE, POTENTIAL CONSEQUENCES AND COMPENSATING ANALYSIS TO REDUCE UNCERTAINTY

The goal of the project is to address the Primary Limiting Factors identified for the North Fork John Day Watershed in the 2008 Fish Accords, incorporate the primary touchstones described in the 2008 Umatilla River Vision (Jones, et al. 2008), and be consistent with the Mid-Columbia Steelhead Recovery Plan (NMFS 2009), Bull Trout Recovery Plan (USFWS, 2015), and the John Day Subbasin Plan (NPCC 2005).

CTUIR's River Vision (Jones, et al. 2008) is the restoration framework, upon which the designs are based. Design objectives will be consistent with all five of the CTUIR's River Vision Touchstones. Specific project objectives aligned with each of the River Vision Touchstones are shown in Table 1.

TABLE 1. GOALS AND OBJECTIVES

RIVER VISION TOUCHSTONE	GOAL	OBJECTIVE
Water Quality and Quantity	Increase base flow through functional connection with the alluvial aquifer and decrease summer stream temperatures.	Increased instream thermal diversity throughout the year.
Geomorphology	Restore natural form; sinuosity; complexity; geomorphic stability; enhance large wood and boulders to increase channel complexity; and improve sediment routing/dispersal.	Increased channel complexity, with channel morphology closer to historical and natural form. Increased quantity and quality of habitat diversity, especially wood and pools to maintain resting areas for returning salmon. Improved sediment mobilization, deposition, sorting and routing. Increased stream velocity diversity at both low and high flows

RIVER VISION TOUCHSTONE	GOAL	OBJECTIVE
Connectivity	Increase lateral connection with the historic floodplain and vertical connection with the alluvial aquifer.	Increased floodplain connectivity and frequency of inundation
Riparian Vegetation	Protect existing riparian vegetation and enhance vegetation to improve geomorphic function and water quality.	Increased riparian function with site-appropriate native vegetation
Aquatic Biota	Increase the quality, quantity and diversity of habitat for resident and anadromous fish of all age classes.	Improved upstream and downstream fish passage Increased area suitable for adult spawning Increased area suitable for juvenile rearing Increased habitat for Columbia spotted frog

Performance of the design in meeting the objectives outlined in Table 1 will be evaluated throughout design development and will include hydraulic modeling of existing and proposed conditions.

1.5.1 Assessment of Risk of Failure to Perform, Risk to Infrastructure, Potential Consequences and Compensating Analysis to Reduce Uncertainty

Within the project reach existing infrastructure constraints, the design and needs to be considered and maintained. This includes retaining access along Granite Hill Road and the private driveways that provide residential access. Overhead and buried utilities will be considered and either maintained or relocated within the areas impacted by valley grading. Risk to infrastructure will be evaluated as the design progresses through hydraulic modeling to compare proposed water surface elevations to the elevations of adjacent roads and residences. A scour analysis will be performed at the AOP crossings to support foundation design and evaluate risk of channel migration.

Additional risks considered in the design development include flow going subsurface following channel construction if intercepted by a highly permeable lens within the reworked tailings. To reduce this risk, we are maintaining the existing channel elevation to avoid raising the channel above the groundwater table and designing inset floodplains with variable heights above the channel to be connected at various flows. We will also complete a subsurface analysis to characterize the composition of tailing materials through borings and test pits. Additional hydrogeologic investigation performing pump and infiltration tests and creating a network of monitoring well may aid in characterization of the groundwater table and hydraulic conductivity of the tailing material and may be used to refine the channel elevations in future design phases.

Through discussions with project partners, we have highlighted additional items that are beyond the level of detail to be presented at 15% design but will be considered as the design progresses. This includes:

- Stability of permanent stockpile locations.
- Channel stability immediately following construction and consideration of a phased approach or modified channel geometry to reduce erosion and over widening.
- Plant establishment and consideration of soil amendments to promote revegetation.
- Changes in landowner participation in the project.
- Mining claims within the USFS reach.

1.6 DISTURBANCE, INCLUDING TIMING AND AREAL EXTENT AND POTENTIAL IMPACTS ASSOCIATED WITH IMPLEMENTATION OF EACH ELEMENT

Project construction is anticipated to begin in summer 2026 during an in-water work window established by regulatory agencies and is anticipated to be from July 15 through August 15 (ODFW 2004a). In-water work will include tailing piles removal and floodplain grading, channel creation, installation of LWM structures and installation of AOP structures. In-water work will be isolated to the extent possible to reduce impacts from sediment to ESA-listed and resident fish species. The conceptual level disturbance and grading limits are shown in Appendix A. CTUIR fisheries staff will provide fish salvage operations in isolated work areas following HIP guidance. A sequencing and work isolation plan and stream diversion plan will be provided at 80% design submittal.

2.0 Resource Inventory and Evaluation/Site Characterization

Bull Run Creek is a tributary to Granite Creek in the North Fork John Day Watershed in Northeast Oregon (Figure 1). Currently, the Bull Run Creek project area consists of a patchwork of private landowners and public parcels with many infrastructure constraints throughout the valley. Bull Run Creek has historically been impacted by placer mining, beaver trapping, livestock grazing and tree clearing (GeoEngineers 2018; Kleinschmidt 2021). Based on the General Land Office (GLO; BLM 2024) map, mining had occurred in Bull Run as early as 1881, which is confirmed by the mining ditches along the riparian zone (Figure 2). Additionally, Blue Mountain Boat company began dredging Bull Run Creek in 1938, and it is estimated that more than 1,000,000 cy of gravel were dredged within a single year (Mining World 1940). Mining throughout Bull Run significantly altered the valley bottom, causing channel straightening, increased channel confinement and incision, reduced channel complexity and limited lateral connection with the floodplain (Figure 3). Based on the 2024 surface data, mining operations resulted in areas that had been dredged as deep as 8.5 ft. The excavation, haul and sediment sorting resulted in a reworking of the entire valley bottom and effectively removed the natural alluvial morphological features that took millennia to develop.

On August 22 and September 12, 2024, we conducted a rapid observational field survey to inventory resources on 1.95 miles of Bull Run Creek. The results of that survey are discussed throughout Section 2.0. Additionally, channel bathymetry and ortho imagery were collected by RSI in 2024 and blended with 2020 Light Detection and Ranging (LiDAR) to create a combined terrain for the Bull Run Creek project area and the valley bottom (refer to Section 3.0 for more detail). The 2024 surface data were used to develop a flow accumulation model and a relative elevation model (REM) for the Bull Run Creek project site (Figure 4).

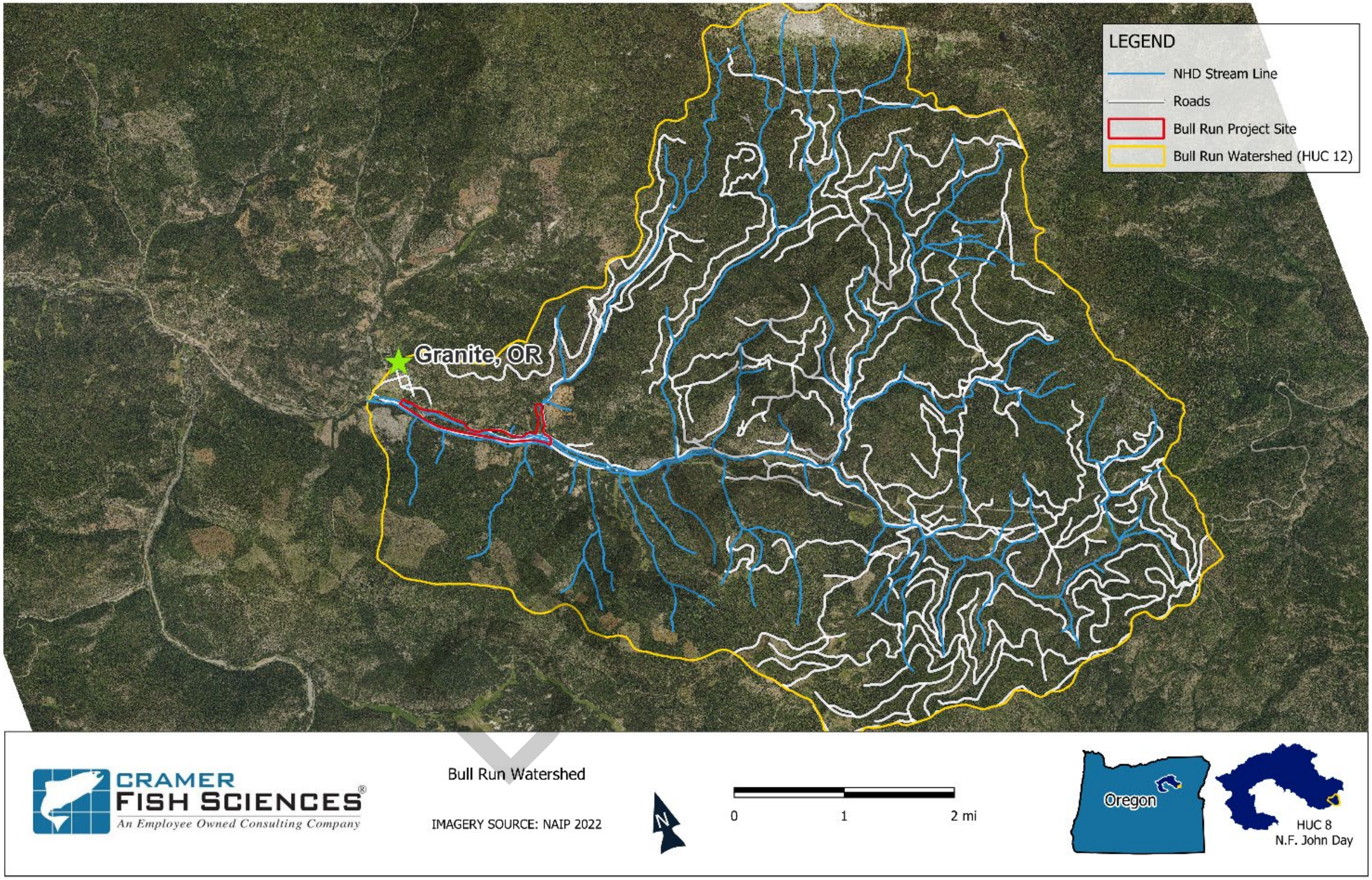


Figure 1. Bull Run project site location and roads and stream flowlines for the watershed.

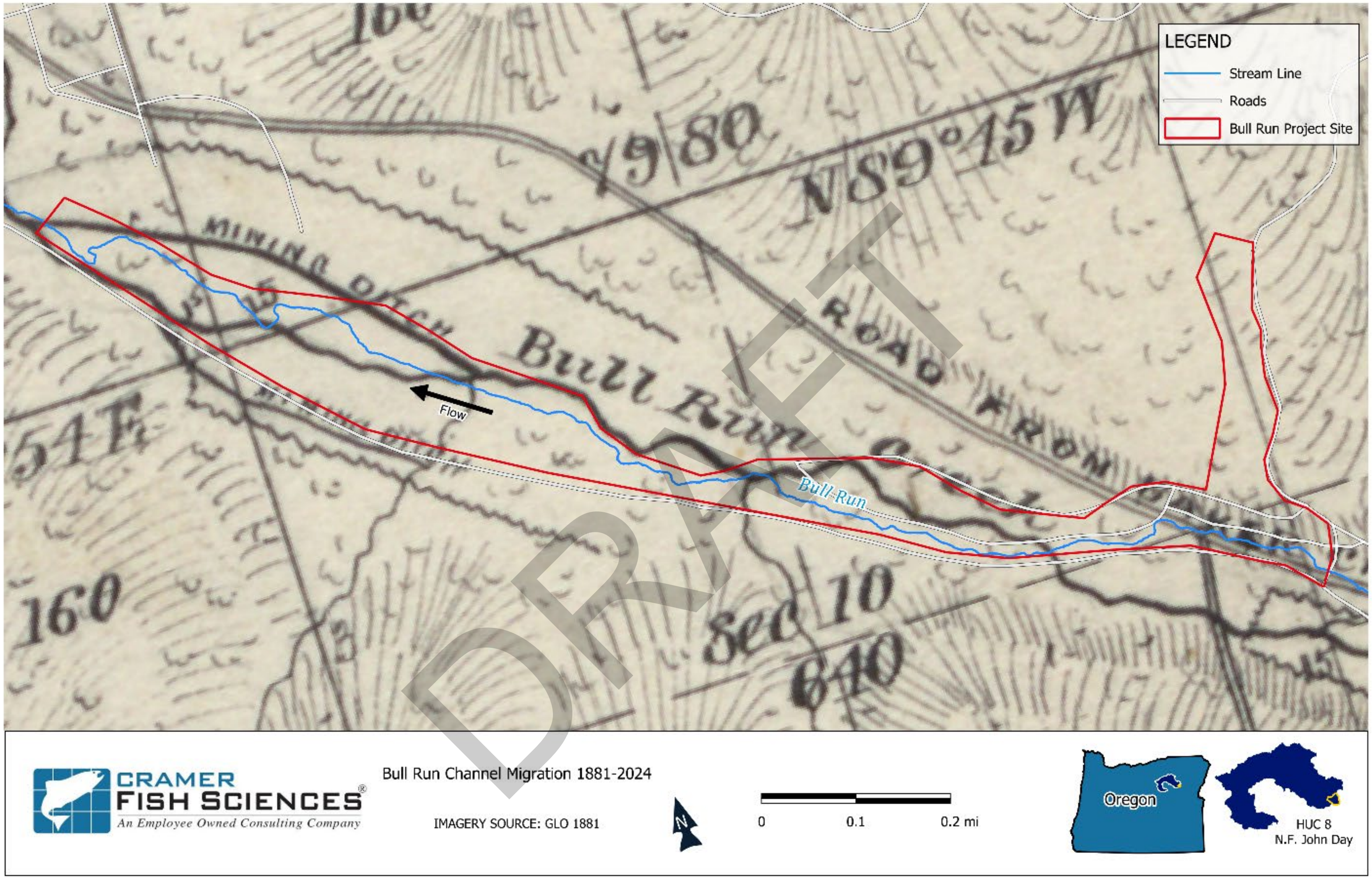


Figure 2. GLO map from 1881 and stream flow line derived from flow accumulation model developed from 2024 LiDAR.

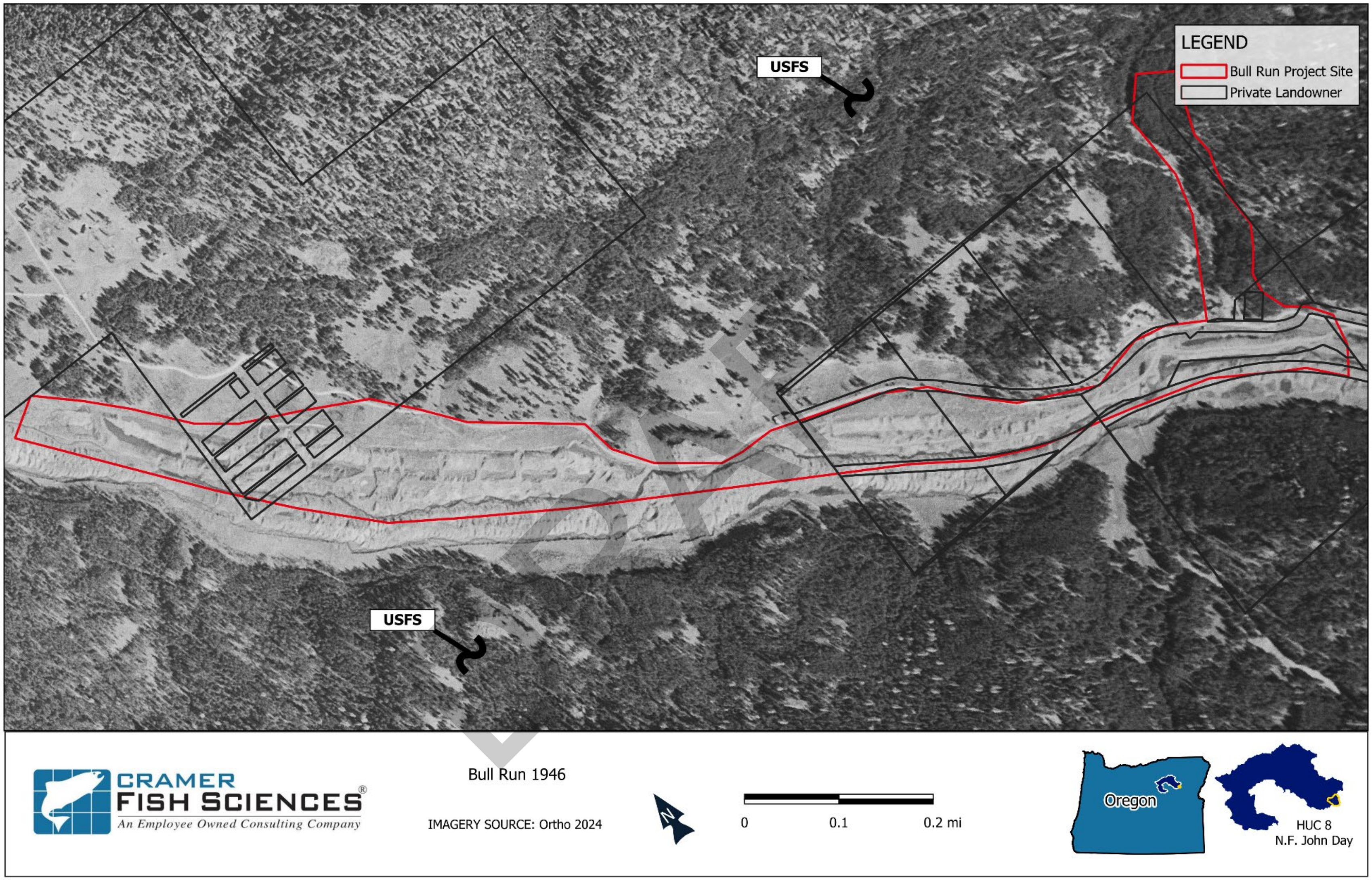


Figure 3. Aerial imagery of Bull Run Creek project site from 1946.

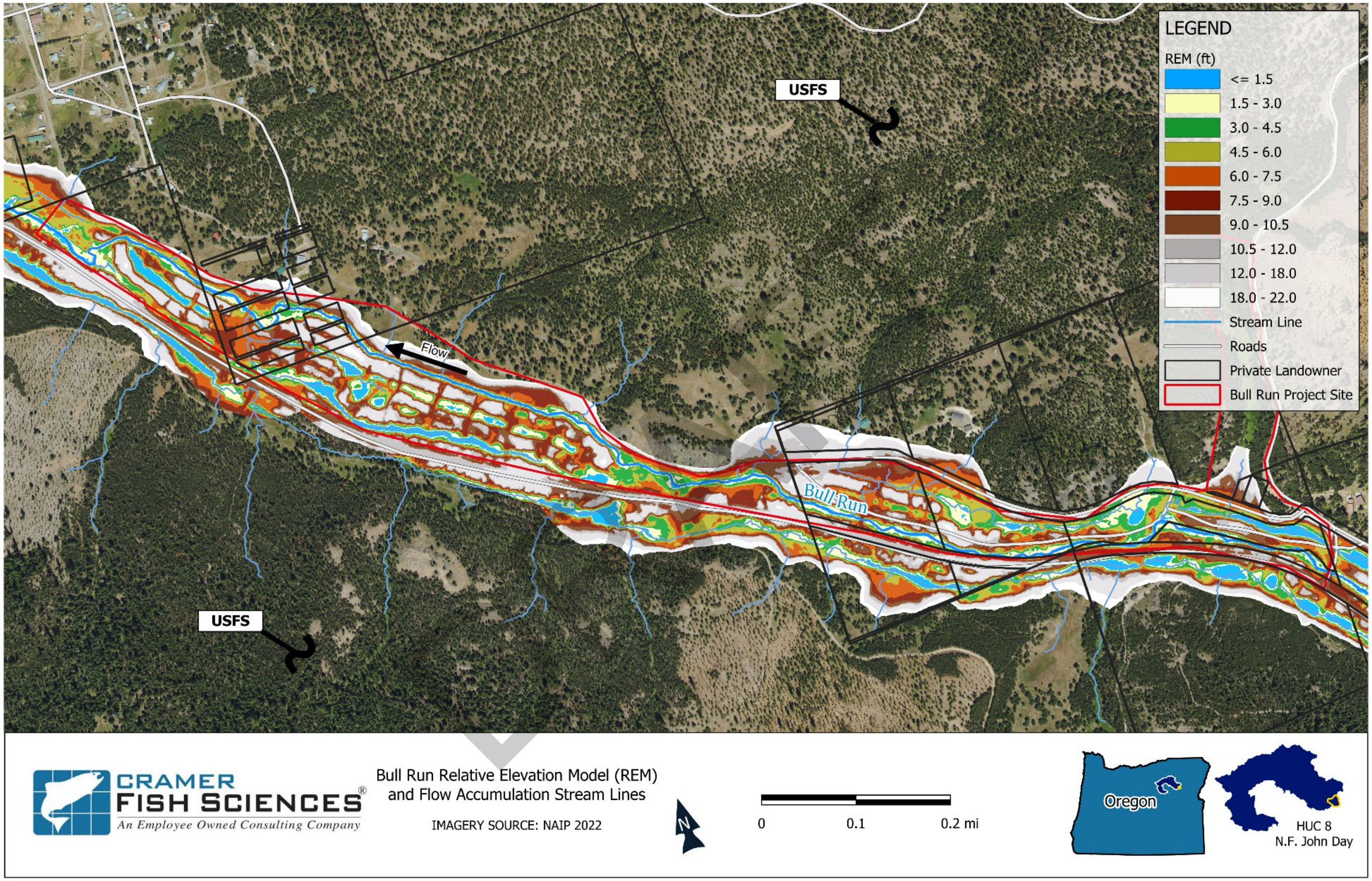


Figure 4. Relative Elevation Model (REM) and stream flowlines derived from flow accumulation model of Bull Run Creek project area.

2.1 PAST AND PRESENT IMPACTS ON CHANNEL, RIPARIAN AND FLOODPLAIN CONDITIONS

Historic dredge and placer mining in the Bull Run Creek valley has caused extensive degradation to the floodplain and channel. Placer mining involved using a dredge to carve approximately eight ft into the valley bottom, sorting the alluvial material while on the dredge, separating the gold and leaving the spoils piled up behind the machine. This occurred throughout most of the valley bottom, reorganizing the entirety of Bull Run Creek and leaving the valley bottom covered with mine tailings (Figure 5). By excavating into the floodplain, Bull Run Creek effectively became confined to the path of the dredge and was largely disconnected from the historic floodplain. Throughout the project area, Bull Run Creek has been relocated to the northern side of the valley bottom where it is pinned between tailings piles to the south and the cut banks created by the dredging to the north. In some locations, tailings piles within the dredged area stand more than 18 ft above the banks of Bull Run Creek. Examining the REM shows that the linear nature of the tailings piles creates parallel regions of the valley bottom at relatively low elevations (Figure 4) that are 10 to 15 ft lower in elevation than the corresponding tailings pile. In addition to the impacts associated with mining, Granite Hill Road runs parallel to Bull Run Creek further dissecting the valley bottom and limiting channel migration and floodplain connection.

Infrastructure is present throughout the project site that impacts the natural processes of Bull Run Creek's channel and floodplain. A variety of residential buildings, roads and river crossings occupy the valley bottom, all of which limit the area available for fluvial and riparian processes and habitat for the biota that rely on these environments. Three culverts are located within the 1.95-mile reach of Bull Run Creek and one culvert is located downstream of the project site (Figure 6 and Figure 7). According to Oregon Department of Fish and Wildlife (ODFW), culverts 2 and 3 are partial fish passage barriers (ODFW 2024b). There is also a ford crossing located near the middle of the reach and a boulder armored bank protecting a road near the downstream end of the reach (Figure 8 and Figure 9). Fish passage can be impaired due to increased water velocities inside of culverts during high discharge events (Frankiewicz et al., 2021). Additionally, stream habitat downstream of culverts and fords can be impaired, resulting in increased fine sediment and reduced macroinvertebrate indexes. The crossing structures depicted in Figure 6 include:

1. Grant County Road Crossing, 120-inch x 84-inch pipe arch corrugated metal pipe (CMP)
2. Residential Crossing, 36-inch, 72-inch, and 30-inch round CMPs
3. Residential Crossing, deformed 84-inch round smooth metal pipe
4. USFS 7366 Crossing, 120-inch x 84-inch pipe arch CMP

The primary cause for riparian degradation within the project area is directly related to past mining activities. Existing riparian vegetation was removed to allow dredges to dig freely. Moreover, turning over the valley bottom to extract gold completely altered the stratification of soils across the alluvial plain. The relict mine tailings piles are higher than the contemporary water table making it impossible for riparian vegetation to establish in many locations. Lodgepole pine (*Pinus contorta*) has been able to establish on the tailings piles because it is primarily an upland drought tolerant species. Although it is beneficial to have canopy species such as lodgepole pine within the valley bottom, they provide little benefit to the stream channel and aquatic biota because they are rarely near enough to the channel to provide shade or act as a wood recruitment source. Most of the channel has a narrow-inset floodplain with limited floodplain pockets where riparian species can establish. The most common riparian species are willow (*Salix* sp.), red alder (*Alnus rubra*), black hawthorn (*Crataegus douglasii*), bull rush (*Typha* sp.), sedges, and various grasses and forbs. Willow and red alder commonly overhang the channel, providing erosion protection, shade, and are a source of terrestrial macroinvertebrates for aquatic species. Signs of beaver chews, bank lodges and food caches were present, but appeared to be at least 5 years old.

Figure 5. Images of mine tailing piles along Bull Run Creek. The tailings piles confine Bull Run Creek channel and prevent riparian vegetation establishment throughout the valley bottom, limiting much of the riparian vegetation to grass and forbs species.

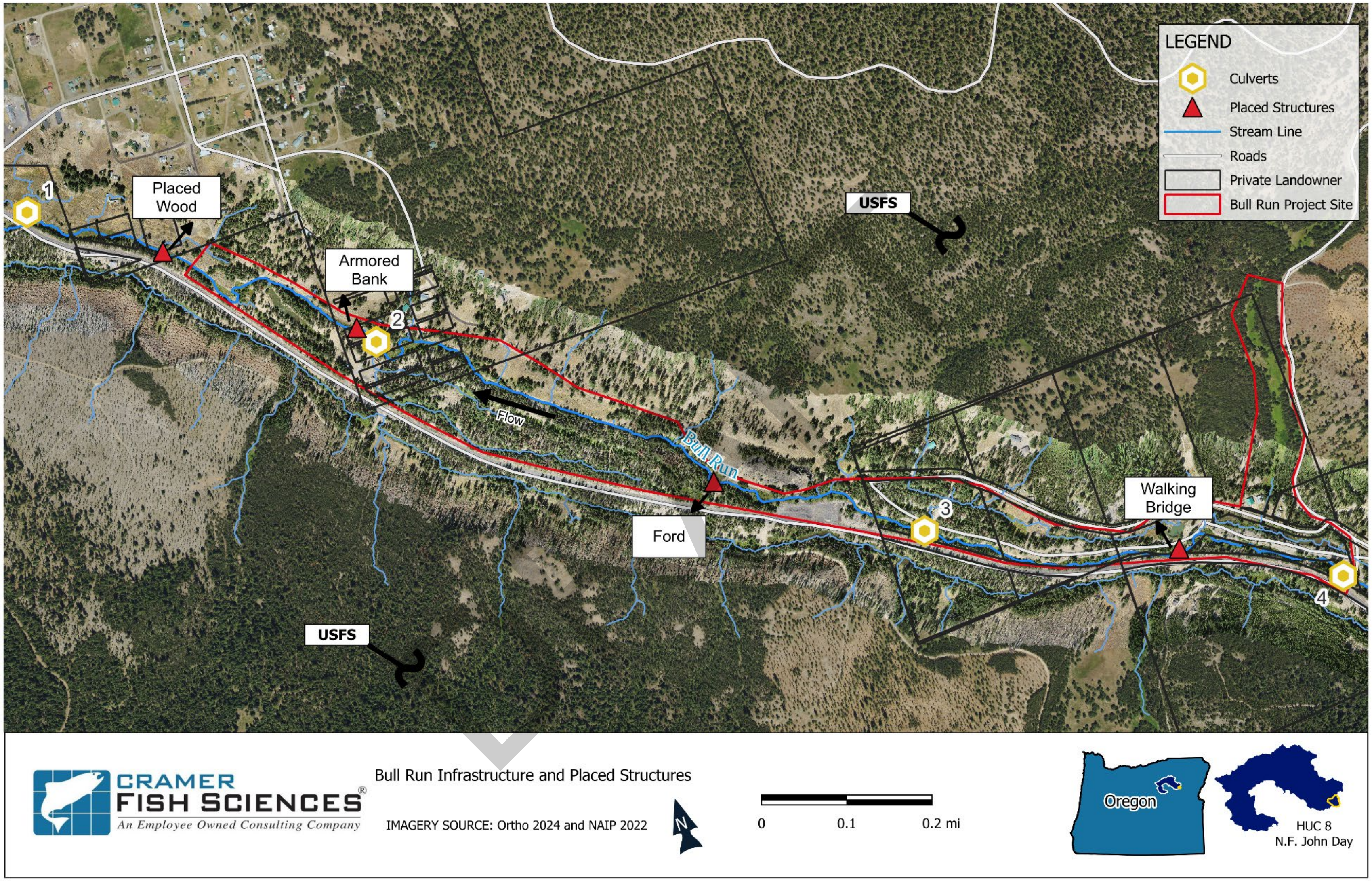


Figure 6. Location of infrastructure and placed structures along Bull Run Creek.

Figure 7. Images of culverts located along Bull Run Creek project area (1 through 4).

Figure 8. Images of placed wood and an armored bank located on Bull Run Creek.

Figure 9. Images of a ford crossing and walking bridge located on Bull Run Creek.

2.2 INSTREAM FLOW MANAGEMENT AND CONSTRAINTS IN THE PROJECT REACH

Bull Run Creek has an existing instream flow requirement per the Oregon Water Resources Department (OWRD) detailed below (Table 2):

TABLE 2. INSTREAM FLOW REQUIREMENTS ON BULL RUN CREEK.

MONTH	INSTREAM FLOW REQUIREMENT (CFS)
Oct	2.95
Nov	4.09
Dec	6.00
Jan	7.10
Feb	8.90
Mar	11.40
Apr	22.00
May	22.00
June	6.00
July	4.00
Aug	2.31
Sep	2.04

Note: cfs = cubic feet per second

2.3 EXISTING GEOMORPHIC CONDITIONS AND CONSTRAINTS ON PHYSICAL PROCESSES

The geology of Bull Run Creek consists primarily of Pennsylvanian to Triassic Elkhorn Ridge Argillite on ridgelines and upper elevations of valley walls. Elkhorn Ridge Argillite is overlain by Tertiary silicic lava flows consisting of porphyritic dacite, silicic dacite and rhyodacite flows and Tertiary basalt (Ferns et al. 1982). Basaltic and silicic lava flows occurred contemporaneously and may alternately overlap. Within the valley bottom, the bedrock geology is generally concealed by Quaternary alluvium, except for a few localized bedrock exposures within the channel.

The stream channel through the project reach primarily consists of a confined, low sinuosity, and plane-bed channel with an average gradient of 0.63 percent and predominantly gravel/cobble substrate. Physical processes in Bull Run Creek are constrained by mine tailings piles, roads, roadway crossings and other artificial structures. Mining operations effectively limit the space available for geomorphic processes in two ways. First, is the result of the dredge excavation. By excavating the valley bottom, the base level for the Bull Run Creek's bed elevation is reduced and the creek is cut off from the surrounding floodplain and valley bottom area that typically defines the transition from the active channel zone to the valley margins. Second, the extensive tailings piles that are present within the dredged area further restrict physical processes. Given the duration of time after dredging, the existing channel morphology and stream power demonstrate limited indicators of being able to erode, transport and/or sort the deposited tailings materials, which is evident from comparing historic imagery. The historic floodplain to the south has been lowered and then filled with tailings piles, the Granite Hill Road prism and other built infrastructure.

In addition to topographic constraints, there is a lack of LWD throughout Bull Run Creek. The LWD survey conducted on 1.95 miles (10,338 ft) of Bull Run showed that there were only 11 pieces of wood in the TWF (Timber, Fish, and Wildlife; Schuett-Hames et al., 1999) size classes and 15 pieces that were in the fine size class (Table 3; Figure 10 and Figure 11). According to regional recommendations for wood densities by Fox and Bolton (2007), a median number of 26 woody debris pieces are predicted to occur within the small to large size classes per 328 ft (100 meters). These results showed that Bull Run Creek is very limited in LWD, especially for the larger size classes. Although LWD is limited in Bull Run Creek, due to the frequent mine tailings in the floodplain confining the channel, adding LWD without addressing the mine tailings will not increase floodplain connectivity. The frequent mine tailings in the floodplain prevent Bull Run Creek from eroding out of the channel and migrating into the floodplain. However, increasing LWD density would lead to greater morphological diversity within the channel to improve spawning and rearing habitat for salmonids (Fox and Bolton 2007).

TABLE 3. LARGE WOODY DEBRIS (LWD) SIZE CLASSIFICATION AND ASSOCIATED DIAMETER (INCHES) AND LENGTH (FT).

LWD SIZE	LARGE	MEDIUM	SMALL	TFW	FINE
Diameter (in)	> 36	> 24	> 12	> 4	> 1
Length (ft)	> 50	> 50	> 25	> 6.5	>1.5

The simplified-straightened channel of Bull Run Creek has evident effects on the in-channel habitat (Figure 12 and Figure 13). Most of Bull Run Creek consists of shallow riffle-pool complexes comprised of gravel and cobble substrate. There are a few meander bends throughout the reach where the stream was able to create deeper scour pools with simplified morphologies and limited fish cover. Although there were a few small backchannels, gravel bars and vegetated islands that created quality habitat, they were rare due to the channel's confinement by the mine tailings.

There are various levels of horizontal erosion occurring along Bull Run Creek in the project area (Figure 11 through Figure 17). Some sections have cutbanks that were less than 1 foot in height occurring along the meadow habitats and along low-lying floodplain habitat. There were sections of the creek that were eroding into mine tailings piles that were between 1 and 3 ft in height. There were also sections where the creek was eroding into terraces creating cutbanks in excess of 4 ft in height.

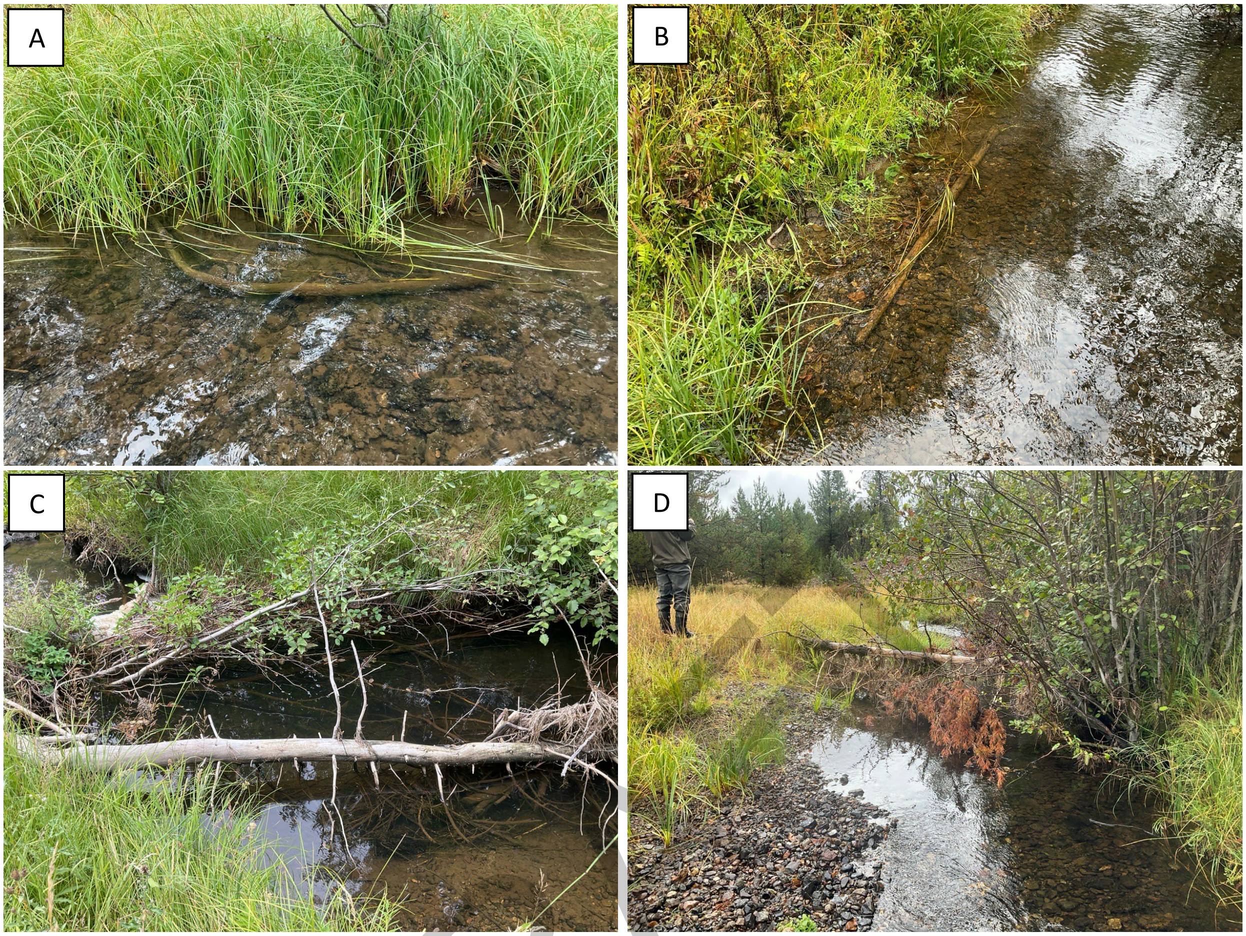


Figure 10. Example of TFW (A and B) and FWD (C and D) along Bull Run Creek.

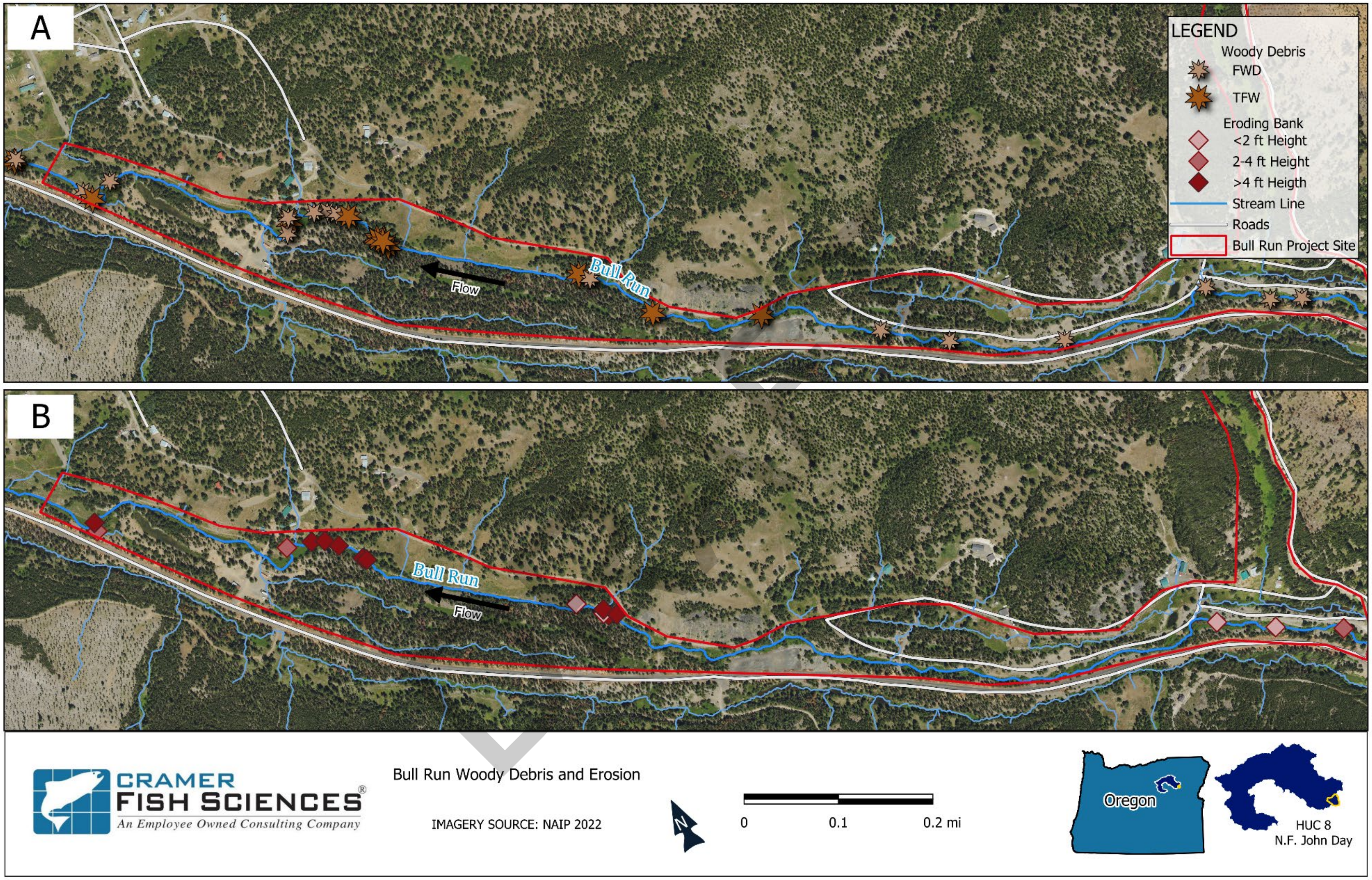


Figure 11. Location of woody debris (A) and eroding banks (B) along Bull Run Creek.

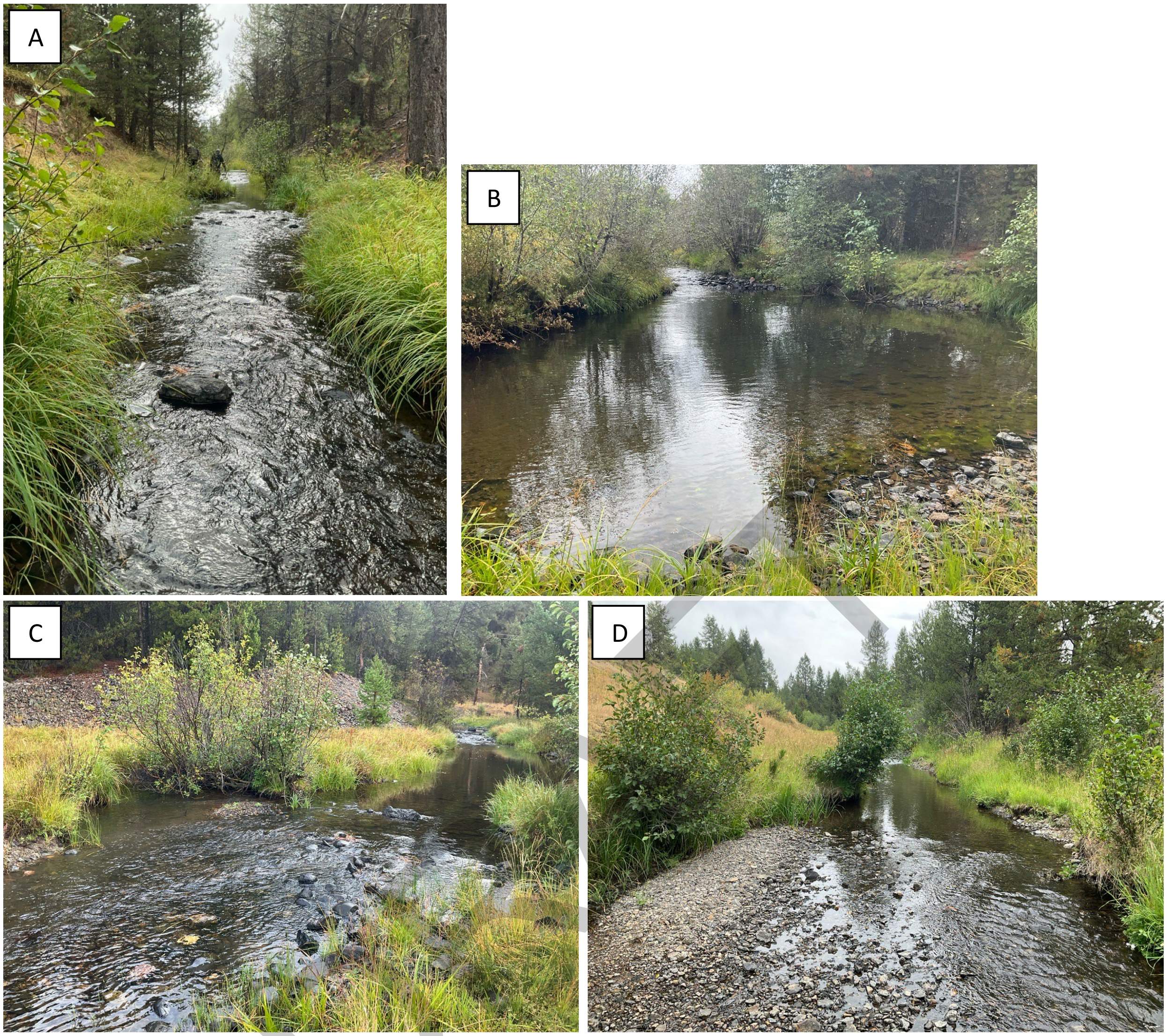


Figure 12. Photos showing available habitat along Bull Run Creek project area, including riffle-pool complexes (A), deeper pools along meander bends (B), small backchannels (C), and small gravel bars (D).

Figure 13. Example of vegetated gravel bars that create split flow channels on Bull Run Creek.

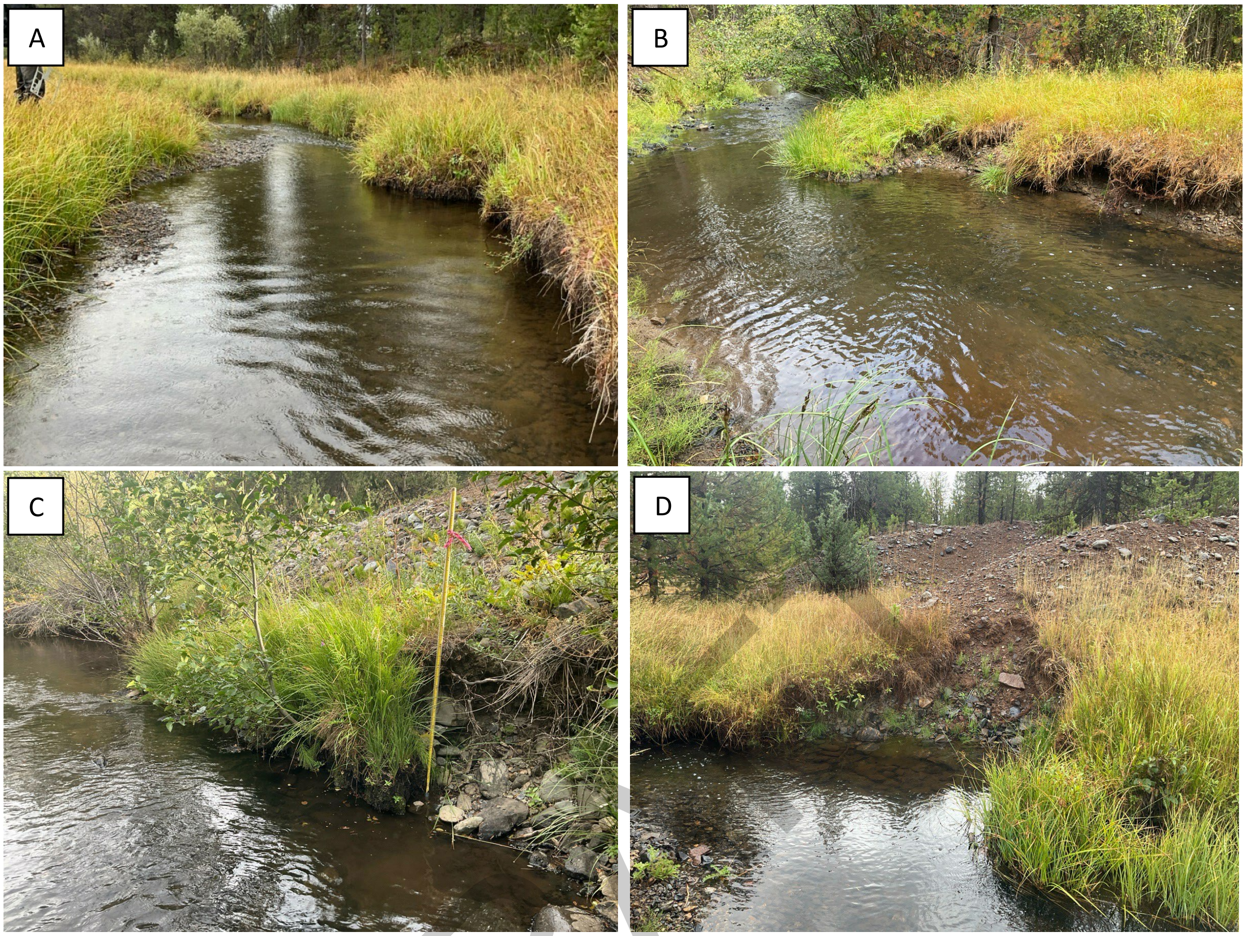


Figure 14. Example of eroding banks leading into inset floodplain (A and B) and leading into mine tailings (C and D) on Bull Run Creek.

Figure 15. Example of eroding banks leading into relict floodplain deposits and ancient terraces on Bull Run Creek that are greater than 4 ft in height.

2.4 EXISTING RIPARIAN CONDITION AND HISTORICAL RIPARIAN IMPACTS

Extensive dredge mining removed all of the riparian vegetation in the project area and left mine tailings across the entire valley bottom. Currently, the riparian area of Bull Run Creek consists of a narrow ribbon along the channel margin and small floodplain pockets where riparian species can establish. The riparian area consists of small patches of willows and alders interspersed with low growing emergent grasses, rushes, sedges and other forbs. This results in patches of canopy cover, shade and structure along the channel margin, but the center of the channel is mostly open and fully exposed to solar radiation (Figure 16). Additionally, there are very few mature trees within the riparian area which will continue to limit the recruitment of LWD to the system. Some of the conifers growing on the tailings piles may be able to reach the channel, but it is unlikely they will be naturally recruited through fluvial processes without intervention. In several locations there are areas of low elevation between the tailings piles that act as depressions that trap rainwater. Although these areas are disconnected from the channel, there are riparian species present. These areas support riparian and wetland species and are possibly connected to the water table during flood events. A subsurface investigation will occur at later stages of the design and may be used to better describe the hydrogeologic connection between these features and the main channel.

Figure 16. Example of stream structure, cover and shading along Bull Run Creek.

2.5 LATERAL CONNECTIVITY TO FLOODPLAIN AND HISTORICAL FLOODPLAIN IMPACTS

Past mining activity and culvert construction on Bull Run Creek has diminished the total area available for floodplain processes and connectivity throughout the project site (Figure 17 and Figure 18). Prior to anthropogenic impacts, some of which date as far back as 1881 (Figure 2), the floodplain likely extended from valley wall to valley wall. Extensive mining throughout the region obfuscate the pre-impact condition of the valley. Based on topographic analysis of 10 valley bottom transects within the project area and within the downstream meadow area, the historic floodplain width likely ranged from 300 to 800 ft with an average width of 500 ft. Currently, the approximate floodplain width ranges from 150 to 500 ft with an average width of 300 ft. The historic area of the valley bottom was 134 acres, and the current valley bottom is 72 acres, which is a 46 percent reduction in available floodplain connectivity. The overall reduction in floodplain area is the result of tailings piles with sufficient height to stand above existing inset terraces in the valley bottom, and other confining features associated with the built environment.

Historic imagery and channel scars within the meadow south of Granite, Oregon suggest that this area was less impacted by mining activity and provides insight into the pre-disturbance floodplain character (Figure 19). Based on this small area of preserved (unexcavated) valley-bottom, it appears that Bull Run Creek was a low gradient system consisting of multiple channels that saturated the meadow, possibly from valley-wall to valley-wall, during periods of high flow. Unfortunately, without a larger area of intact stream, it is difficult to determine additional details that could be used to produce stream design metrics. In addition, the valley bottom space required to fully restore the stream and floodplain does not currently exist, yet it is a valuable glimpse into the pre-disturbance conditions Bull Run Creek may have flowed through.

Figure 17. Examples of meadow habitat (A), confined reach (B), small floodplain pocket (C) and confining infrastructure (D) along Bull Run Creek project area.

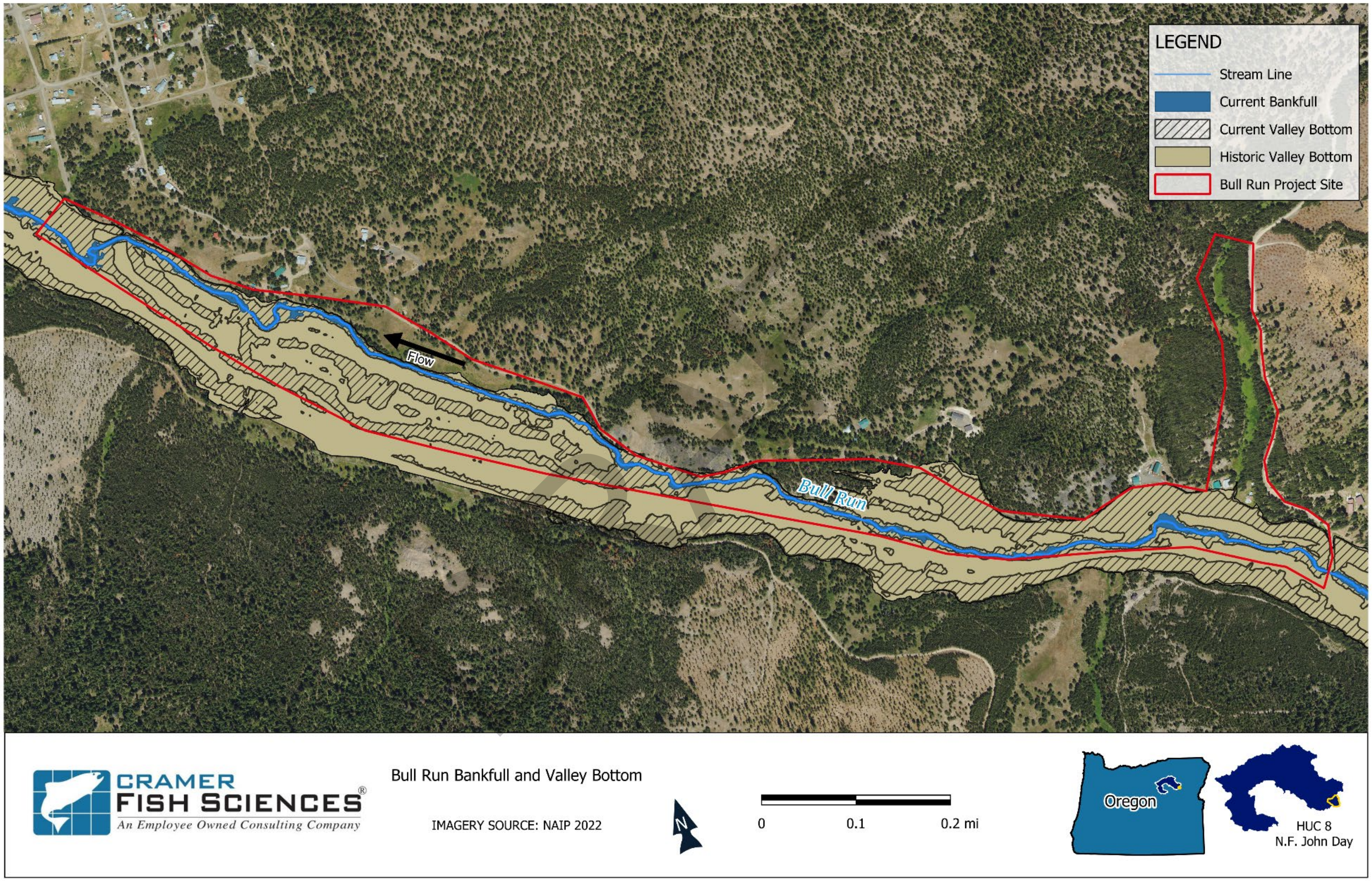


Figure 18. The current bankfull, current valley bottom and estimated historic valley bottom of Bull Run Creek determined by the relative elevation model.

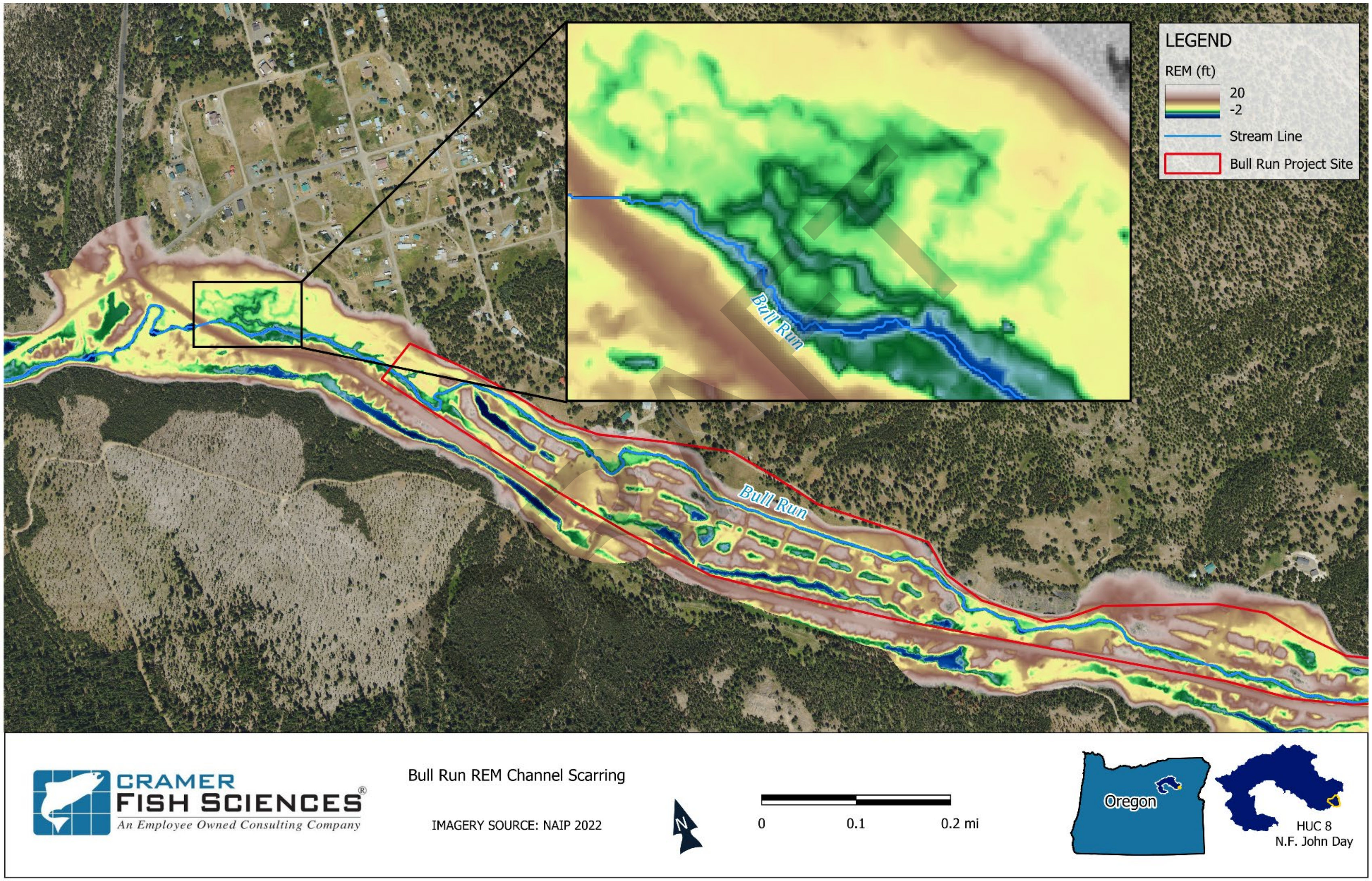


Figure 19. Relative elevation model of Bull Run Creek project area showing area without mining impact and channel scarring.

Although there is limited floodplain available within the project site, there are waterbodies and wetlands located throughout the valley. There are three types of wetlands identified by the National Wetland Inventory (NWI) occurring within the Bull Run Creek project area (USFWS 2024; Figure 20). Additionally, many ponds were delineated by the National Hydrography Dataset (USGS 2018; NHD). However, based on recent aerial imagery, it appears some of the ponds and wetlands do not currently exist with perennial surface water. Additionally, there were some waterbodies that appear on the aerial imagery that were not detected by NHD or NWI. Based on this information, we used more recent data from the ortho imagery to determine what waterbodies were present within the project site (Figure 21). Many of the waterbodies in the project sites are dredge ponds due to past mining (Kleinschmidt 2021). Additionally, there are several long ponds north of Bull Run Creek within the upstream half of the project area. Corral Creek enters one of these ponds, but Corral Creek does not have a direct connection to the mainstem of Bull Run Creek. These basins and ponds provide opportunities to connect and expand the riparian area for Bull Run Creek while minimizing mine tailing excavation and sediment removal.

Current infrastructure places additional confinement on the channel that limits lateral connectivity. However, the parallel roads run along the tops of relict tailings piles and the bridge and culvert crossings are located between tailings piles. Therefore, the tailings piles remain the primary constraint on lateral connectivity. Consolidating road and stream crossings where feasible will provide more opportunities for restoration of the channel and floodplain, but any improvements will need to coincide with modifications or removal of the tailings piles.

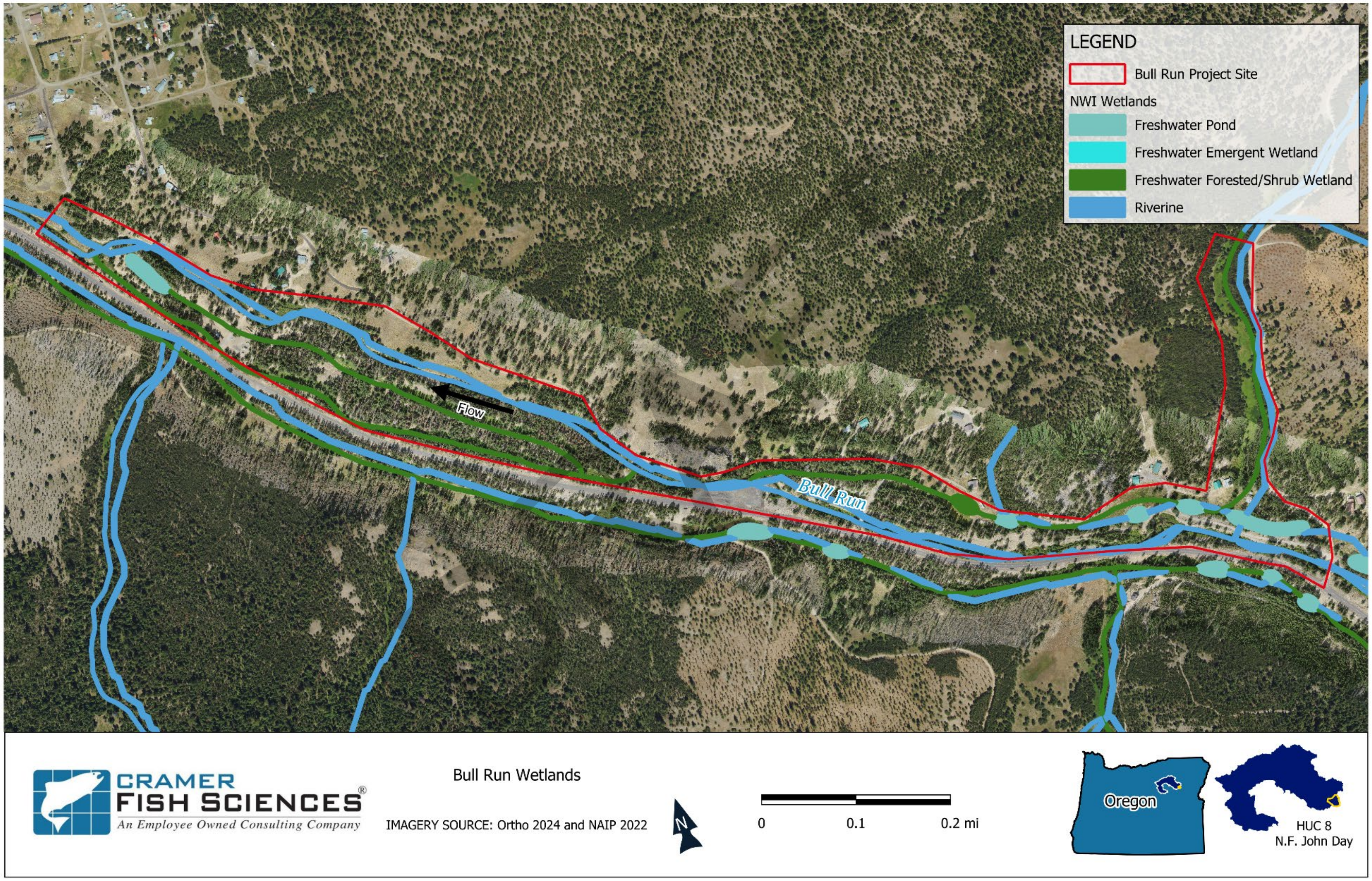


Figure 20. National wetland inventory (NWI) of wetlands throughout Bull Run Creek project site.

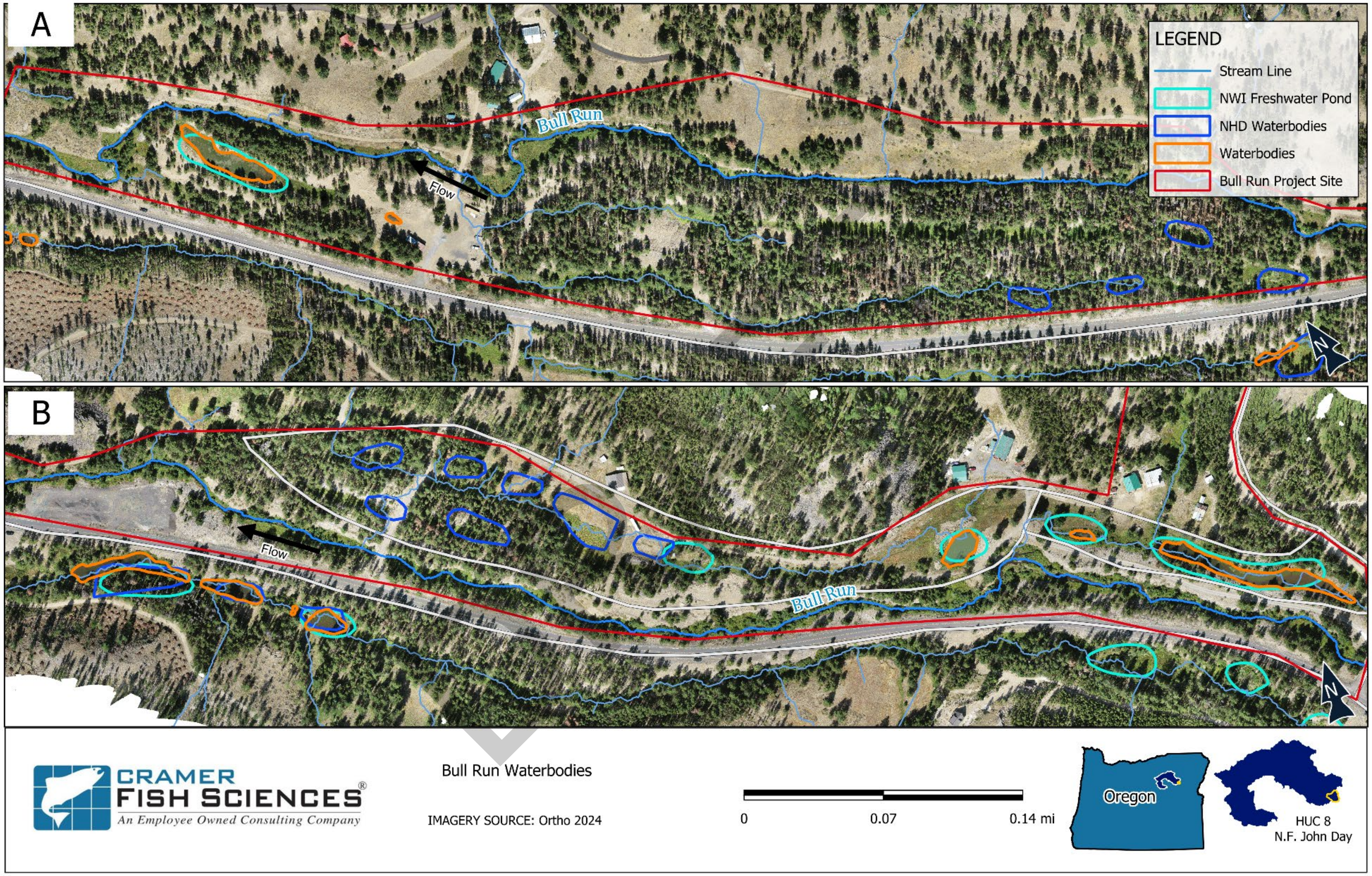


Figure 21. Waterbodies and freshwater ponds located near Bull Run project site identified via NWI, NHD and ortho imagery.

2.6 TIDAL INFLUENCE IN PROJECT REACH AND INFLUENCE OF STRUCTURAL CONTROLS (DIKES OR GATES)

The project is not located within a tidally influenced setting.

3.0 Technical Data/Design Considerations and Analyses

3.1 INCORPORATION OF HIP SPECIFIC ACTIVITY CONSERVATION MEASURES FOR ALL INCLUDED PROJECT ELEMENTS

The Bull Run Creek project includes HIP IV specific activity conservation measures associated with:

- Action Category 1: Fish Passage Restoration
  - 1F – Bridge and Culvert Removal or Replacement
- Action Category 2: River, Stream, Floodplain and Wetland Restoration, including:
  - 2A – Improve Secondary Channel and Floodplain Interactions
  - 2D – Install Habitat-Forming Natural Material Instream Structures
  - 2E – Riparian Vegetation Planting
  - 2F – Channel Reconstruction

HIP Conservation measures will be included in the design drawings at 30% Design. The plans will include separate sheets outlining HIP conservation measures, which cover general conservation measures, fish protection and water quality protection measures. Additional sheets that detail project-specific measures for temporary erosion and sediment control, water management, and access and staging requirements will also be provided at 30% Design.

3.2 SUMMARY OF SITE INFORMATION AND MEASUREMENTS (SURVEY, BED MATERIAL, ETC.) USED TO SUPPORT ASSESSMENT AND DESIGN

GeoEngineers and Cramer Fish Sciences completed a site reconnaissance on August 22 and September 12, 2024 to document existing geomorphic and riparian conditions and identify areas for floodplain reconnection and habitat uplift. Field observations are included within Section 2.0. The sections below describe the site information and measurements informing design.

3.2.1 Topographic Data

The site was surveyed by Resource Specialists, Inc. (RSI) in September 2024. RSI created an existing conditions surface of the project area by blending a detailed RTK GPS topo/bathymetric survey of the creek with orthorectified point data collected via unmanned aerial system (UAS), along with 2020 LiDAR data available from the Oregon Department of Geology and Mineral Industries (DOGAMI). The resulting existing conditions surface provides a basis for planform and geometric measurements and existing terrain for use in grading and hydraulic modeling. The longitudinal profile is shown in Figure 22.

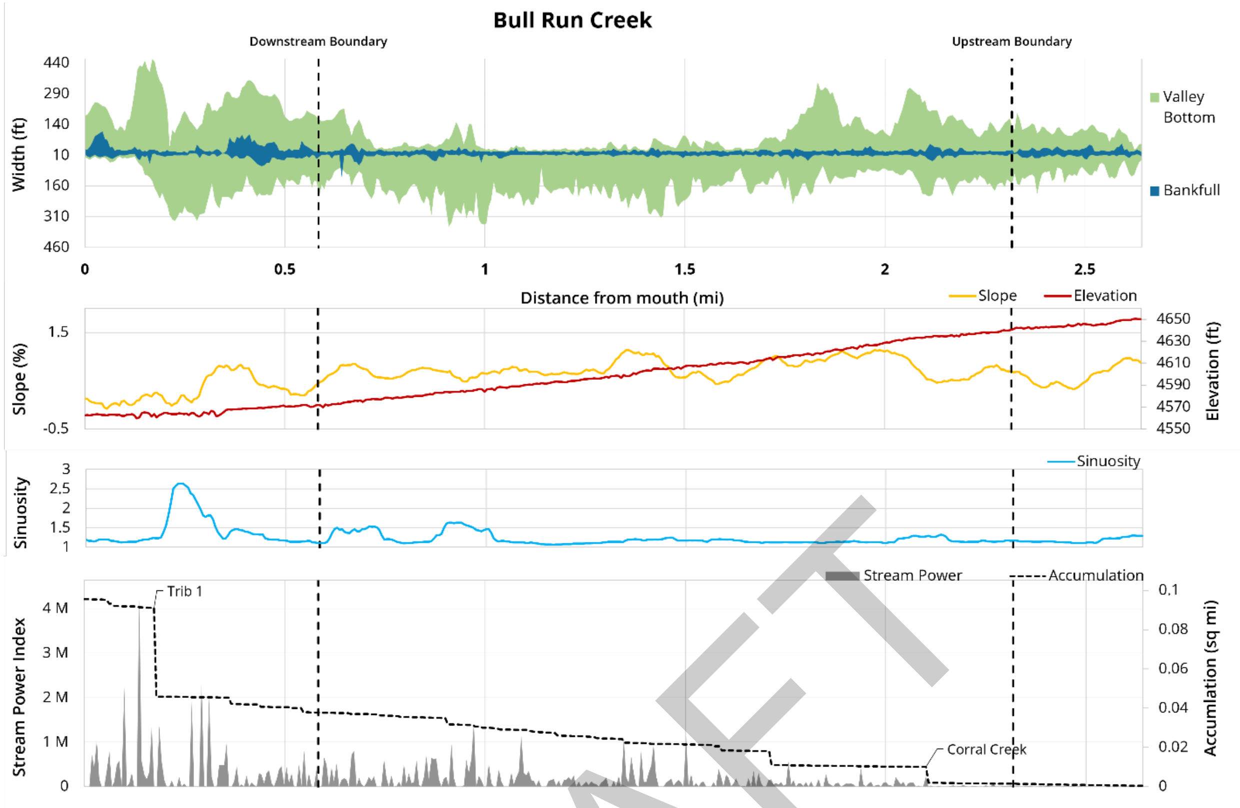


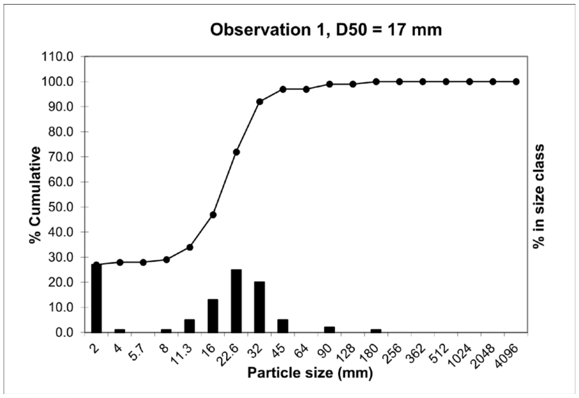
Figure 22. Longitudinal profile of Bull Run Creek

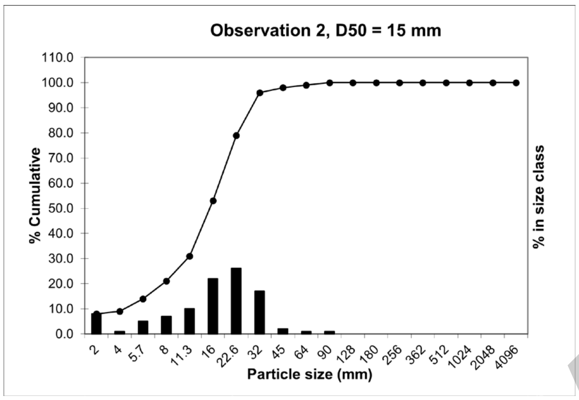
3.2.2 *Bed Material*

During the site reconnaissance, Cramer Fish Sciences collected streambed gradation data at six locations using Wolman pebble-count sampling methods (Table 4, Figure 23, Figure 24 and Figure 27). Additional observation of bed composition will be provided at 30% design (Figure 25 and Figure 26).

TABLE 4. SUBSTRATE GRAIN-SIZE SUMMARY STATISTICS

GRAIN-SIZE STATISTIC	PEBBLE COUNT 1 (INCHES)	PEBBLE COUNT 2 (INCHES)	PEBBLE COUNT 3 (INCHES)	PEBBLE COUNT 4 (INCHES)	PEBBLE COUNT 5 (INCHES)	PEBBLE COUNT 6 (INCHES)
D_{16}	0.08	0.25	0.32	0.38	0.56	0.38
D_{50}	0.67	0.61	0.92	1.7	1.95	0.8
D_{84}	1.12	1.0	2.33	4.42	4.21	1.41
D_{95}	1.23	1.14	2.95	4.95	4.68	1.59
D_{100}	7.1	3.54	7.1	10.08	7.1	3.54





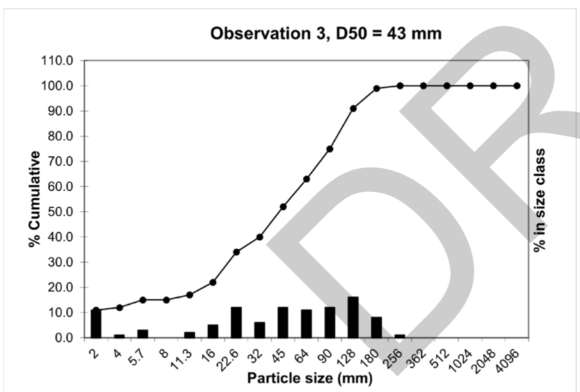


Figure 23. Cumulative particle size distribution and habitat image of the Wolman pebble count surveys 1 through 3 conducted on Bull Run Creek.

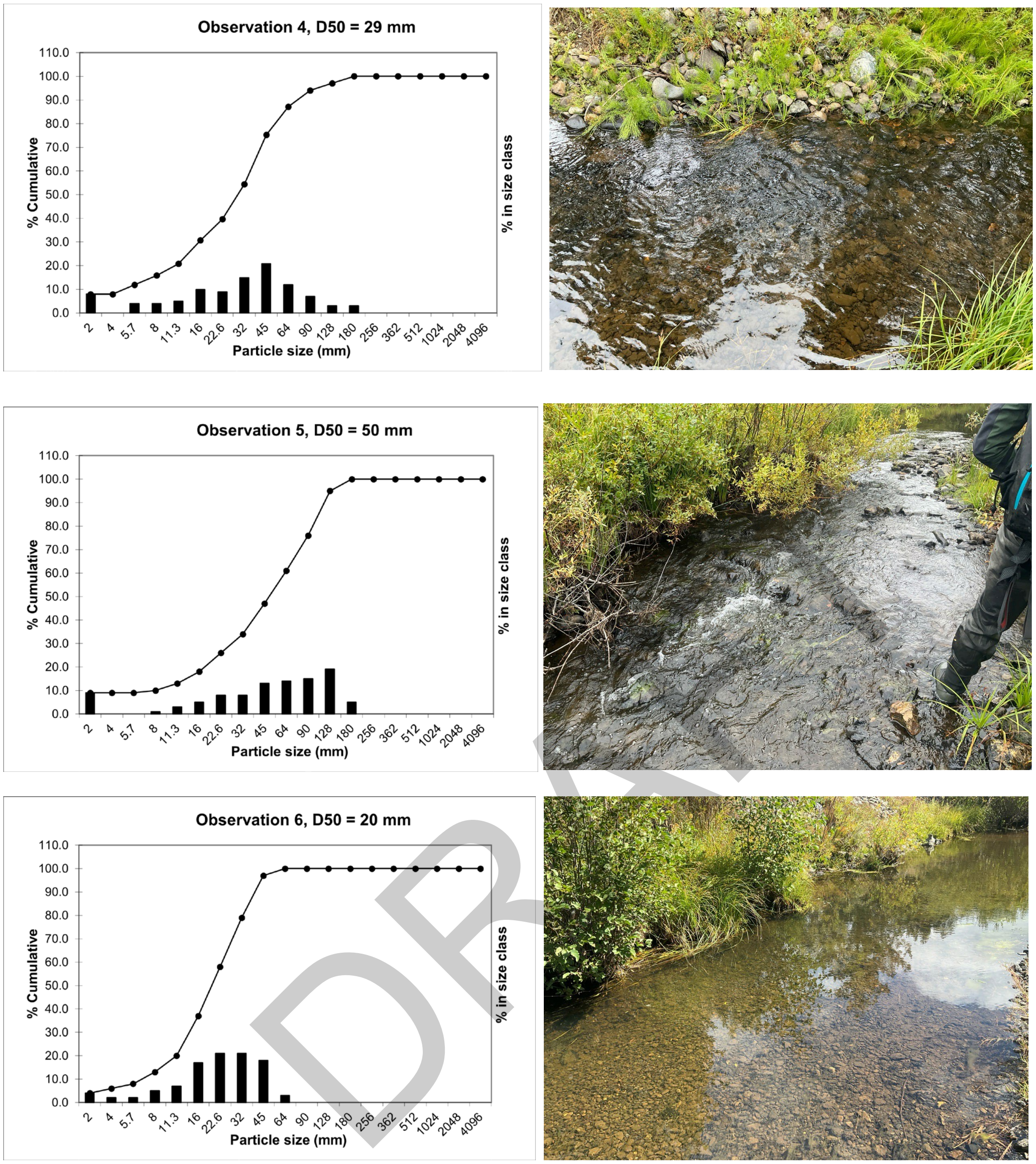


Figure 24. Cumulative particle size distribution and habitat image of the Wolman pebble count surveys 4 – 6 conducted on Bull Run Creek.

Figure 25. Exposed alluvial base on Bull Run Creek.

Figure 26. Bedrock dominated reach of Bull Run Creek.

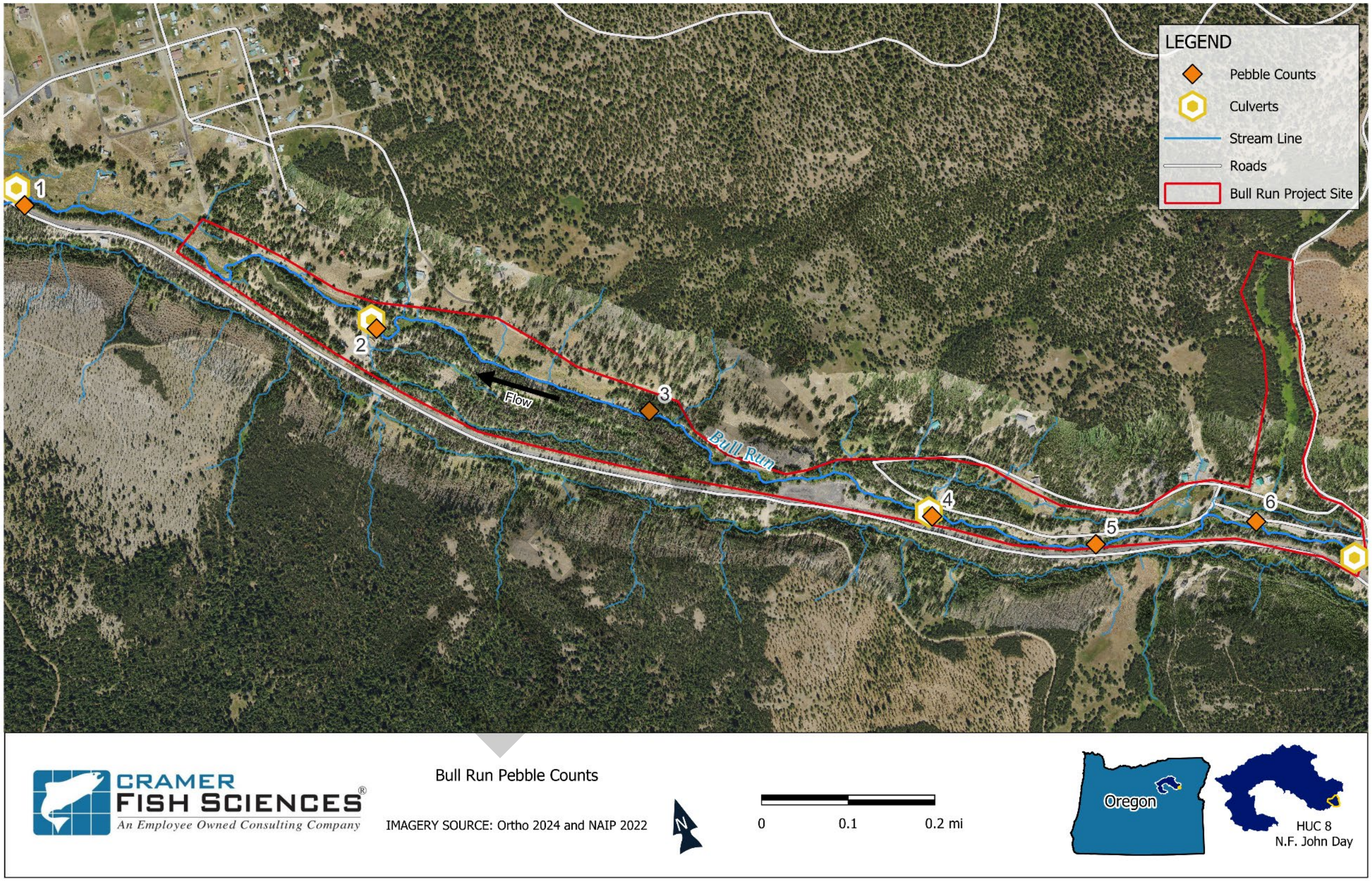


Figure 27. Location of Wolman pebble count surveys and culverts along Bull Run Creek.

3.3 SUMMARY OF HYDROLOGIC ANALYSES CONDUCTED, INCLUDING DATA SOURCES AND PERIOD OF RECORD, INCLUDING A LIST OF DESIGN DISCHARGE (Q) AND RETURN INTERVAL (RI) FOR EACH DESIGN ELEMENT

Bull Run Creek is a predominantly snowmelt driven high-elevation stream characterized by a heavily forested watershed with wet-low/moderate permeability (Leibowitz et al. 2014). The approximately 30 square mile watershed extends from 5540 ft to 8300 ft in elevation (North American Vertical Datum of 1988 [NAVD88]) and is nearly 80 percent conifer forest. There is no existing stream gage on Bull Run Creek; therefore, Cramer Fish Sciences completed a hydrologic assessment of Bull Run Creek primarily relying on regression analyses, remote sensing and best available scientific literature. The methodology from Risley et al. (2009) was used to determine flow duration and low flows. Bull Run Creek hydrology generally peaks in May as a result of upper basin snowmelt, declining throughout June – July and reaching the low flow period between August and Ocober. Winter rain and snow and rain storms typically result in elevated flows through November to March, with the potential for rain on snow events. The 7-day 2-year and 10-year low flow are 3.55 and 2.57 cfs, respectively.

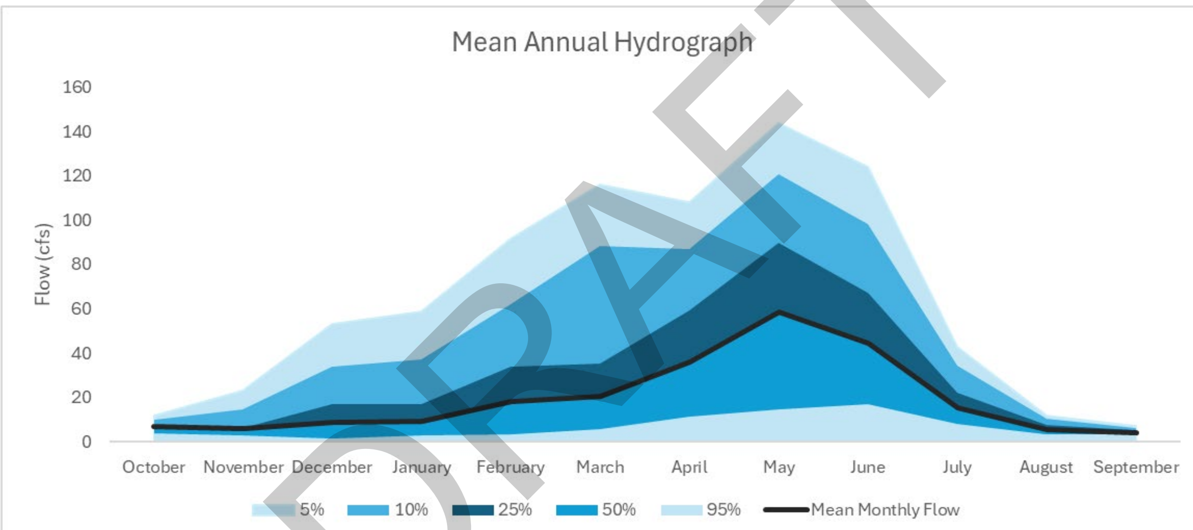


Figure 28. Mean annual monthly hydrograph of Bull Run Creek at the study area.

Flood frequency analysis for Bull Run Creek was conducted using regression analysis from the Cooper et al. 2006 *Estimation of Peak Discharges for Rural, Unregulated Stream in Eastern Oregon* methodology. Flood frequency results were accessed at https://apps.wrd.state.or.us/apps/sw/peak_discharge_map/ on October 2, 2024 and are presented in Table 5. It should be noted that confidence interval flows for Bull Run Creek present a wide range of potential flood flows and that accuracy of regression equations should be considered during the design process. In order to validate flood frequency analysis, the OWRD regression for Bull Run Creek was adjusted based on comparison of OWRD gage 133167850 Bulletin 17C flood frequency analysis (England et al. 2019) and OWDR regression (Cooper 2006). Comparisons to a similar basin with a gage record of sufficient duration for flood frequency statistical assessment resulted in an average adjustment factor of 0.81(recurrence interval adjustment factors shown in Table 5), which was applied to the OWRD (Cooper 2006) regression for Bull Run Creek. Comparison to prior hydrologic analysis completed (Kleinschmidt 2021) indicates that results are approximately consistent with prior findings, when adjusted for basin area.

TABLE 5. FLOOD FREQUENCY ANALYSIS RESULTS FOR BULL RUN CREEK AT THE STUDY AREA. VALUES IN BOLD WERE USED IN THIS STUDY.

RECURRENCE INTERVAL	PEAK FLOW (CFS)	ADJUSTED PEAK FLOW (CFS)	ADJUSTMENT FACTOR	95% CONFIDENCE LOWER LIMIT (CFS)	95% CONFIDENCE UPPER LIMIT (CFS)
2-year	152	**131.6**	0.866	58.6	394
5-year	229	**185.9**	0.812	98.7	529
10-year	282	**223.9**	0.794	125	638
25-year	354	**278.7**	0.787	157	794
50-year	408	**321.6**	0.788	180	926
100-year	464	**366.3**	0.789	201	1070
500-year	601	**486.4**	0.809	245	1470

The Bull Run Creek watershed hydrology is likely to experience a shift due to the impacts of climate change. It is anticipated that winter snowpack will decrease with generally warmer winters, resulting in higher winter peak flows from rain on snow events and lower summer base flows (Halofsky et al. 2018; Clifton et al. 2018). Wegner et al. (2010) results from downscaling global climate projections for the end-of-century conditions indicate a 126 percent increase in winter streamflow and an 8.3 percent reduction in summer streamflow. These projected changes will also occur coincidentally with higher summer temperatures, increasing thermal stress on salmonids and other aquatic organisms during low flow conditions. The reduction in winter snowpack is also linked to earlier snowmelt onset and earlier and longer base flow conditions (Halofsky et al. 2018; Clifton et al. 2018). The transition to a more rainfall dominated climate is also projected to increase the number and frequency of winter storms (+81%) and the amplitude of peak runoff (+14.2% for the 25-year event). Climate change predictions for the watershed indicate that riparian areas, wetlands and other groundwater features will be at an elevated level of risk for ecological disturbance and shift to more drought tolerant conifer and shrubs (Dwire et al. 2017). These ecosystems play a critical role in providing habitat and cold-water refuge for salmonids and other aquatic organisms. Protecting, restoring and/or enhancing these areas is a high priority for this project.

3.4 CHANNEL RECONSTRUCTION DESIGN

Restoration opportunities exist within Bull Run Creek, with the greatest potential lying in slope reduction, floodplain restoration and addition of large woody material to enhance channel complexity both vertically and laterally. However, developing alternative channel alignments for the restored project reach using historical information presents significant challenges due to the extensive history of logging and mining in the Bull Run Creek watershed. These activities have obliterated much of the original geomorphic and ecological context, leaving few, if any, nearby river reaches that can serve as appropriate analogs for the project site. Consequently, instead of relying on a reference reach approach for channel design, we employed a combination of hydraulic geometry principles and analytical methodologies tailored to alluvial channel design (NRCS 2007). Results of the analysis will be refined at 30% design.

Prior work in the downstream Granite Creek reach and the upstream middle Bull Run reach suggests that the channel planform for Bull Run Creek was likely a single-thread meandering channel with a diversity of side channels and wetland features connected during periods of high flow (GeoEngineers 2018; Kleinschmidt 2021). As a starting point for the 15% design, we used alluvial channel design approach to generate channel planform, including meander wavelength, meander belt width (amplitude) and radius of curvature based on a target bankfull width and evaluated multiple analytical methods to determine a design bankfull width and depth. Additional analysis of the valley and sediment supply will be used to confirm channel planform assumptions in future design phases. Future phases will also refine channel geometry to incorporate the conveyance provided by side channel and floodplain features in planform geometry.

3.4.1 Bankfull Width and Depth

Castro and Jackson (2001) found that the bankfull discharge, or the discharge that shapes average morphological characteristics of a channel, typically corresponds to a 1.4 to 1.5-year event for streams in Eastern Oregon and Eastern Washington (Castro and Jackson 2001). They also present equations that relate bankfull discharge to bankfull width and depth. We evaluated bankfull width and depth using methods presented by Castro and Jackson (2001), NRCS (2007) and Parker (2007) using the 2-year flow and the 2-year flow reduced by 15 percent for a value more representative of a 1.4 to 1.5-year flow (Table 6). Median grain size data sampled within the reach was also included in the hydraulic geometry relationships developed by Parker 2007 to predict bankfull width and depth (Table 6). The resulting bankfull widths vary between 16 and 30 feet and bankfull depth vary between 1.3 and 1.7. We selected a design bankfull width equal to 22 feet and design bankfull depth equal to 1.5 feet, resulting in a width to depth ratio equal to 14.7.

TABLE 6. BANKFULL WIDTH AND DEPTH ESTIMATES BASED ON HYDRAULIC GEOMETRY RELATIONSHIPS

GEOMETRY (METHOD)	GEOMETRY PREDICTED USING 2-YEAR ADJUSTED PEAK FLOW (131.6 CFS)	GEOMETRY PREDICTED USING 2-YEAR ADJUSTED PEAK FLOW, REDUCED BY 15% (111.9 CFS)
Bankfull Width (NRCS 2007)	23.3	21.5
Bankfull Width (Castro and Jackson 2001)	17.9	16.3
Bankfull Width (Parker 2007)	29.8	27.6
Bankfull Depth (Castro and Jackson 2001)	1.6	1.6
Bankfull Depth (Parker 2007)	1.3	1.3
Design Bankfull Width (ft)	**22 ft**	
Design Bankfull Depth (ft)	**1.5 ft**	

3.4.2 Channel Planform

We followed methods for alluvial channel design to determine target meander wavelengths, belt width (amplitude) and radii of curvature (Table 7). We used these target parameters to create a proposed channel alignment within the valley regrade extents. We further refined the alignment to accommodate the three AOP crossing proposed on Bull Run Creek within the project reach.

TABLE 7. TARGET PARAMETERS FOR CHANNEL PLANFORM

PLANFORM METRIC	DESIGN TARGET (FT)
Average Meander Wavelength	261
Meander Wavelength (minimum)	248
Meander Wavelength (maximum)	274
Meander Belt Width (amplitude)	81
Radius of curvature (minimum)	33
Radius of curvature (maximum)	99

3.4.3 Profile

The length of the valley regrade is approximately 7,750 ft and the average valley slope is 0.89 percent. The length of the proposed channel is 9,700 ft, resulting in a reach-average slope of 0.71 percent and sinuosity of 1.25. Additional detail on profile development, including incorporation of pool-riffle grade breaks and slope transitions near the upstream and downstream tie-ins, will be added at 30% design.

3.4.4 Floodplain Geometry

Restoration of the historic Bull Run Creek floodplain width, which likely ranged from 300 to 800 ft historically and is 150 ft to 500 ft wide in its current conditions, is not feasible due to site constraints that include existing infrastructure, landowner participation and socio-economic factors. We developed a minimum recommendation for floodplain width based on Nelson et al. (2024) and Fryirs et al. (2016) who define the minimum space required to maintain the processes governing channel and floodplain formation. Channels categorized as being laterally unconfined have a confinement ratio of 4.6 time the bankfull width (Nelson, et al. 2024, Fryirs, Wheaton and Brierley 2016). Using the design bankfull width of 22 ft, this results in a minimum floodplain width equal to approximately 100 ft. This width was the starting point for developing the floodplain width within the valley grading. Floodplain widths were opportunistically expanded beyond the 100 ft minimum where parallel low-lying depressions could be connected through tailing pile removal. Additional details on floodplain geometry, including wetland enhancement, relic oxbow features and backwater and side channel features, will be provided at 30% design.

3.5 SUMMARY OF SEDIMENT SUPPLY AND TRANSPORT ANALYSES CONDUCTED, INCLUDING DATA SOURCES INCLUDING SEDIMENT SIZE GRADATION USED IN THE STREAMBED DESIGN

This section will be completed during 30% design.

3.6 SUMMARY OF HYDRAULIC MODELING OR ANALYSES CONDUCTED AND OUTCOMES – IMPLICATIONS RELATIVE TO PROPOSED DESIGN

Existing Conditions Hydraulic Modeling will be added in the final 30% design submittal. Proposed conditions hydraulic modeling will be included in the 30% design submittal.

3.7 STABILITY ANALYSES AND COMPUTATIONS FOR PROJECT ELEMENTS, AND COMPREHENSIVE PROJECT PLAN

This section will be completed during 30% design and 80% design.

3.8 DESCRIPTION OF HOW PRECEDING TECHNICAL ANALYSIS HAS BEEN INCORPORATED INTO AND INTEGRATED WITH THE CONSTRUCTION – CONTRACT DOCUMENTATION

This section will be completed during 30% design.

3.9 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A LONGITUDINAL PROFILE OF THE STREAM CHANNEL THALWEG FOR 20 CHANNEL WIDTHS UPSTREAM AND DOWNSTREAM OF THE STRUCTURE SHALL BE USED TO DETERMINE THE POTENTIAL FOR CHANNEL DEGRADATION

This section will be completed during 30% design.

3.10 FOR PROJECTS THAT ADDRESS PROFILE DISCONTINUITIES (GRADE STABILIZATION, SMALL DAM AND STRUCTURE REMOVALS): A MINIMUM OF THREE CROSS-SECTIONS – ONE DOWNSTREAM OF THE STRUCTURE, ONE THROUGH THE RESERVOIR AREA UPSTREAM OF THE STRUCTURE, AND ONE UPSTREAM OF THE RESERVOIR AREA OUTSIDE OF THE INFLUENCE OF THE STRUCTURE) TO CHARACTERIZE THE CHANNEL MORPHOLOGY AND QUANTIFY THE STORED SEDIMENT

This section will be completed during 30% design.

4.0 Construction – Contract Documentation

Construction – Contract Documentation will be compiled during 30% Design

4.1 INCORPORATION OF HIP GENERAL AND CONSTRUCTION CONSERVATION MEASURES

4.2 DESIGN – CONSTRUCTION PLAN SET INCLUDING BUT NOT LIMITED TO PLAN, PROFILE, SECTION AND DETAIL SHEETS THAT IDENTIFY ALL PROJECT ELEMENTS AND CONSTRUCTION ACTIVITIES OF SUFFICIENT DETAIL TO GOVERN COMPETENT EXECUTION OF PROJECT BIDDING AND IMPLEMENTATION

4.3 LIST OF ALL PROPOSED PROJECT MATERIALS AND QUANTITIES/COST ESTIMATE

4.4 DESCRIPTION OF BEST MANAGEMENT PRACTICES THAT WILL BE IMPLEMENTED AND IMPLEMENTATION RESOURCE PLANS INCLUDING:

4.4.1 Site Access Staging and Sequencing Plan

4.4.2 Work Area Isolation and Dewatering Plan

4.4.3 Erosion and Pollution Control Plan

4.4.4 Site Reclamation and Restoration Plan

4.4.5 List Proposed Equipment and Fuels Management Plan

4.5 CALENDAR SCHEDULE FOR CONSTRUCTION/IMPLEMENTATION PROCEDURES

4.6 SITE OR PROJECT SPECIFIC MONITORING TO SUPPORT POLLUTION PREVENTION AND/OR ABATEMENT

5.0 Monitoring And Adaptive Management Plan

Monitoring and Adaptive Management Plan will be compiled during 80% Design

5.1 INTRODUCTION

5.2 EXISTING MONITORING PROTOCOLS

5.3 PROJECT EFFECTIVENESS MONITORING PLAN

5.4 PROJECT REVIEW TEAM TRIGGERS

5.5 MONITORING FREQUENCY, TIMING, AND DURATION

5.6 MONITORING TECHNIQUE PROTOCOLS

5.7 DATA STORAGE AND ANALYSIS

5.8 MONITORING QUALITY ASSURANCE PLAN

6.0 Limitations

We have prepared this report for CTUIR for the Bull Run Creek RM 0.5 Fish Habitat Enhancement project located near Granite, Oregon. CTUIR may distribute copies of this report to their agents and regulatory agencies as may be required for the project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of stream and river habitat enhancement, stabilization and restoration design engineering in this area at the time this report was prepared. The conclusions, recommendations and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to our services and this report.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

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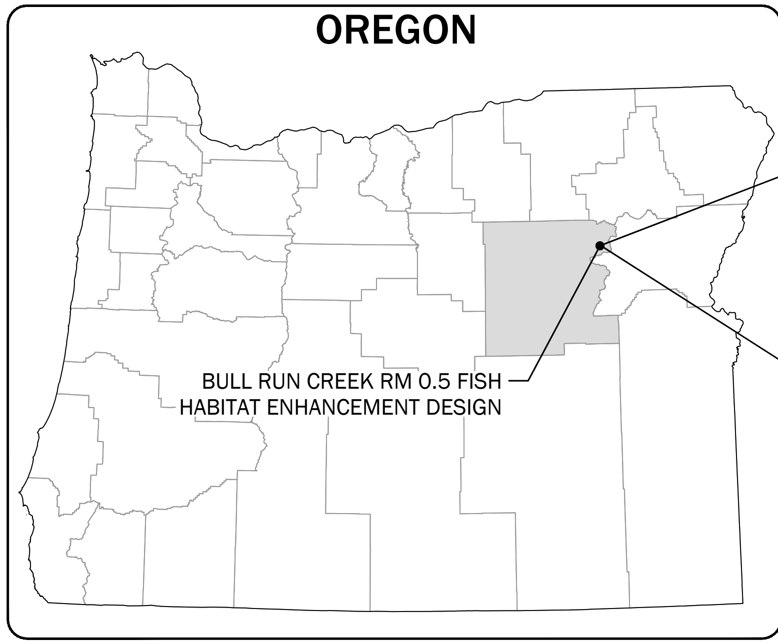
Appendices

Appendix A

Bull Run Creek RM 0.5 Fish Enhancement Project

15 Percent Design Drawings

BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
15% DESIGN
GRANITE, GRANT COUNTY, OREGON



PROJECT LOCATION
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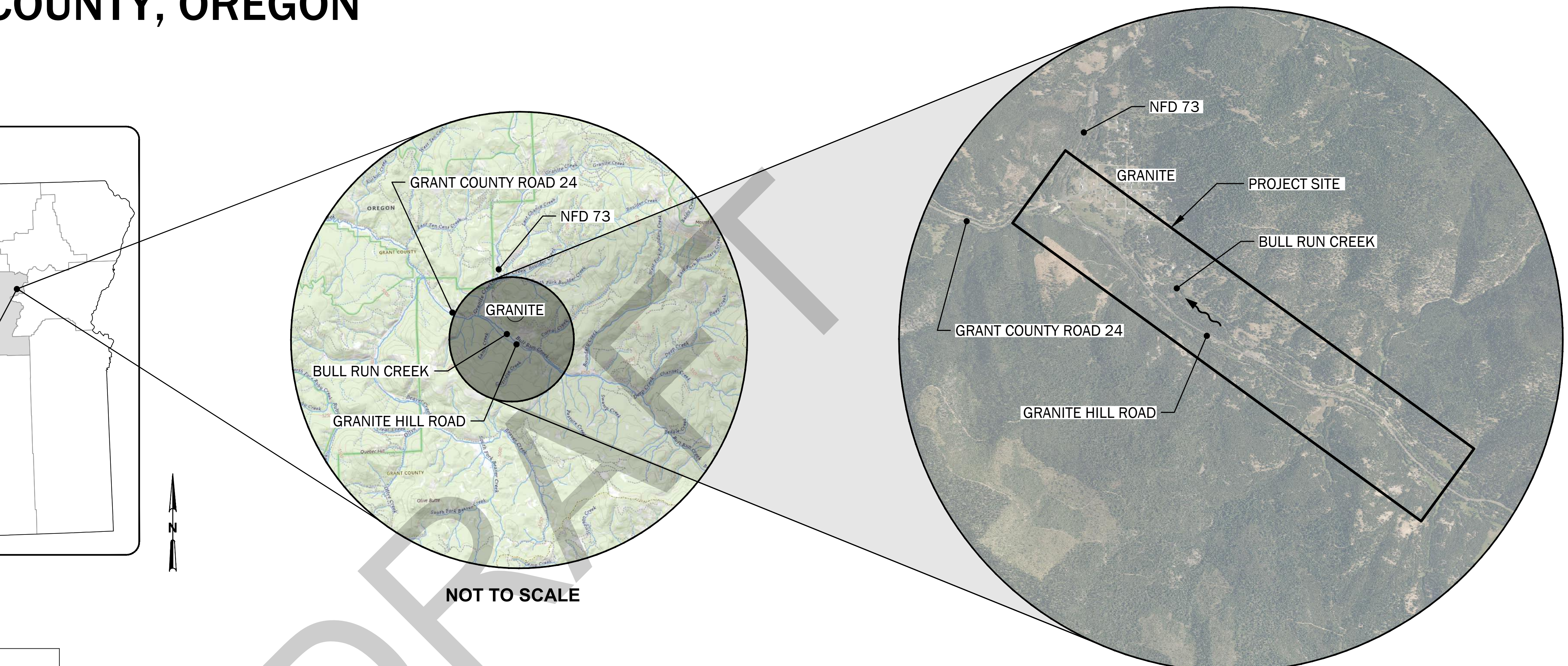

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Sheet Index		
Sheet Number	Drawing Number	Sheet Title
1	1.0	Cover Sheet
2	1.1	General Construction Notes and Legend
3	2.0	Existing Overview and Reach Layout
4	3.0	Reach 1 Plan View
5	3.1	Reach 2 Plan View
6	3.2	Reach 3 Plan View
7	3.3	Reach 4 Plan View
8	3.4	Reach 5 Plan View
9	3.5	Reach 6 Plan View
10	3.6	Reach 7 Plan View
11	3.7	Reach 8 Plan View
12	4.0	Floodplain Sections
13	4.1	Floodplain Sections

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BECCA H. MILLER, PE
5820 S. KELLY AVE. B
PORTLAND, OREGON 97239
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811 Know what's below. Call before you dig.

REGISTERED PROFESSIONAL ENGINEER
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NOV 17, 2017
REBECCA H. MILLER
EXPIRES: DEC. 31, 2024

PRELIMINARY

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APPROVED BY:	JS
REVISION NO.:	----
DATE:	12/13/24

GEOENGINEERS

PREPARED FOR: CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION

BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

COVER SHEET

DRAWING NUMBER: 1.0
SHEET: 1 OF 13

GENERAL NOTES:

1. These designs and drawings have been prepared for the exclusive use of the Confederated Tribes of Umatilla Indian Reservation (CTUIR) and their authorized agents. No other party may rely on the product of our services unless GeoEngineers Inc. (GeoEngineers) agrees in writing in advance of such use.
2. The drawings contained within should not be applied for any purpose or project except the Bull Run Creek RM 0.5 Fish Habitat Enhancement as shown in the Project Area located on Sheet 1.0.
3. These designs and drawings are copyrighted by GeoEngineers, Inc. Any use, alteration, deletion, or editing of this document without explicit written permission from GeoEngineers, Inc. is strictly prohibited. Any other unauthorized use of this document is prohibited.
4. CTUIR is advised to contact and to obtain the necessary permits and approvals from all appropriate regulatory agencies (local, state, and federal) prior to construction.
5. Geomorphic conditions can change and these designs are based on conditions that existed at the time the design was performed. The results of these designs may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying these designs to determine if they remain applicable.
6. All rivers, streams, rocks and fish passage structures are potentially dangerous. These proposed stream improvements are intended to address fish habitat. These structures are inherently dangerous to people in or around them. CTUIR and the property owner should address safety concerns appropriately.
7. In general, the proposed enhancements are intended to result in more stable streambeds, banks and floodplains. However, channel erosion, channel migration and/or avulsions can be expected to occur over time. These channel processes are natural and appropriate for these stream systems.
8. Design specifics for structures shall be confirmed and/or verified by a qualified GeoEngineers staff member prior to or during construction at each proposed structure location.
9. These figures were originally produced in color.
10. Background aerial, survey points and existing topography from RSI, collected September 2024. Additional topography sampled from DOGAMI 2020 LiDAR .
11. All work shall be done in accordance with the HIP IV conservation measures (to be included at 30% design).

SURVEY DATUM:

Horizontal Datum: Oregon State Plane, North (International Feet).

Vertical Datum: North American Vertical Datum 1988 (International Feet).

CONSTRUCTION NOTES:

1. All contractors working within the project boundaries are responsible for compliance with all applicable safety laws. The contractor shall be responsible for all barricades, safety devices and control of traffic within and around the construction area.
2. All material and workmanship furnished on or for the project must meet the minimum requirements of project permits, approving agencies, specifications as set forth herein, or whichever is more restrictive.
3. All federal, state and local permits shall be obtained by the Client prior to construction activity commencement.
4. The contractor shall install and maintain appropriate erosion and sediment control devices throughout the whole project site, including those associated with construction access, staging and stockpile areas throughout the project's construction period. Temporary construction and permanent erosion control measures shall be designed, constructed and maintained in accordance with all applicable local, state and federal regulations.
5. Construction activity shall be limited to the construction areas and access routes to minimize disturbance of the existing vegetation and landscape. All public and private property either inside or outside the construction limits impacted by construction shall be restored to a condition equal to or better than that which existed prior to the construction. No construction-related materials, debris, garbage, equipment, fuel, provisions of any kind shall remain on site after construction. No stockpiles or excavations are to remain after construction unless authorized by the landowner. The site will be graded to appear natural and conform to the natural topography.
6. Construction shall minimize disturbance to, and maximize reuse of, existing riparian vegetation to remain and salvage.
7. Only appropriate approved native riparian vegetation shall be used for cuttings and transplanting. Vegetation cutting, transplanting, planting and irrigation shall be managed by an appropriate professional.
8. Construction records and as-built information shall be accurately recorded by the contractor and supplied to the owner and GeoEngineers for reference and monitoring. Submittal of record information is a condition of final acceptance.
9. This design has been performed and these plans have been prepared with the express understanding that GeoEngineers will provide guidance to the contractor during construction.

LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- BULL RUN CREEK ALIGNMENT
- THALWEG — EXISTING THALWEG
- SITE BOUNDARY
- PARCEL BOUNDARY
- EXISTING OHWM BOUNDARY
- SURVEY BENCHMARK
- FLOW DIRECTION

LEGEND (PROPOSED)

- PROPOSED MAJOR (5-FT) CONTOUR LINE
- PROPOSED MINOR (1-FT) CONTOUR LINE
- APPROXIMATE LIMITS OF VALLEY REGRADE
- PROPOSED MAIN CHANNEL
- PROPOSED SIDE CHANNEL
- PROPOSED WETLAND ENHANCEMENT
- PERMANENT STOCKPILE LOCATION
- PROPOSED CROSSING STRUCTURE

CROSS SECTION NAME

X

X

DRAWING LOCATION

SECTION LOCATION CALLOUT

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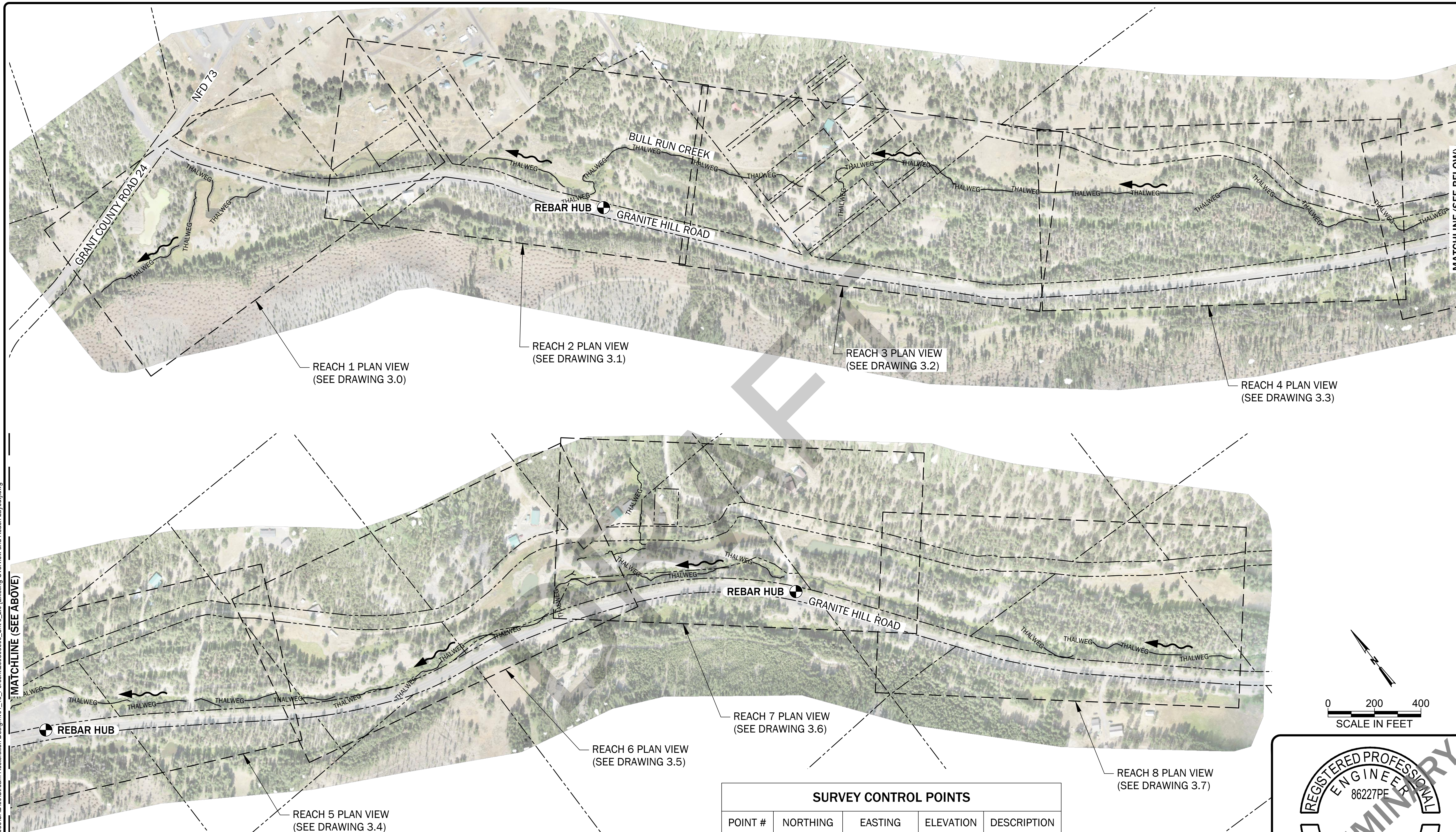
BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

GENERAL CONSTRUCTION NOTES AND LEGEND

DRAWING NUMBER: 1.1

SHEET: 2 OF 13



SURVEY CONTROL POINTS

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	422031.85	8742309.05	4588.35	REBAR HUB
2	419690.50	8745379.46	4617.99	REBAR HUB
4	418270.12	8748338.35	4649.06	REBAR HUB

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

EXISTING OVERVIEW AND REACH LAYOUT

DRAWING NUMBER:
2.0
SHEET: 3 OF 13

0 50 100
SCALE IN FEET

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 1 PLAN VIEW

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SHEET: 4 OF 13

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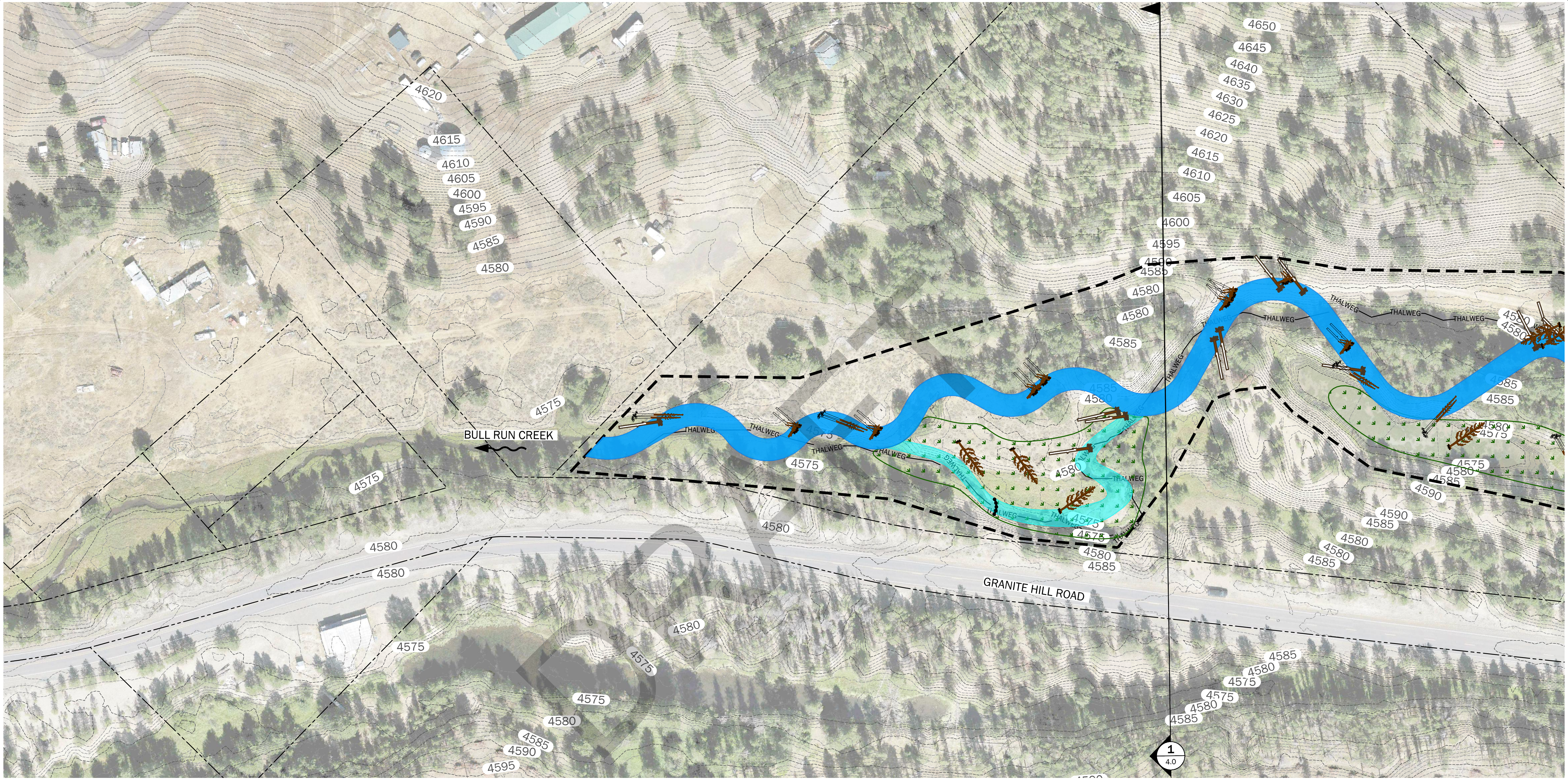

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 2 PLAN VIEW

DRAWING NUMBER:
3.1
SHEET: 5 OF 13

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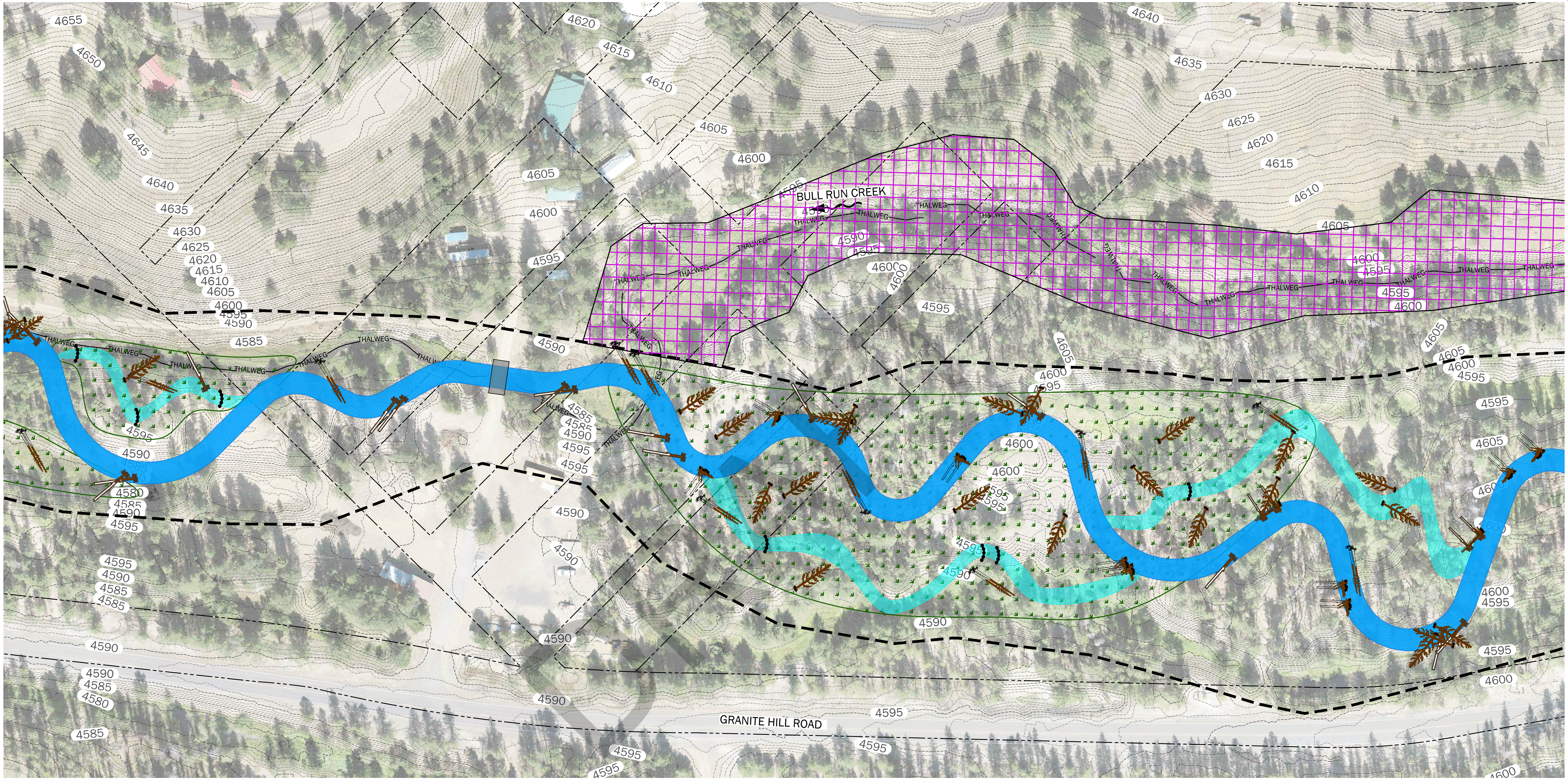

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GRANITE, GRANT COUNTY, OREGON

REACH 3 PLAN VIEW

DRAWING NUMBER:
3.2
SHEET: 6 OF 13

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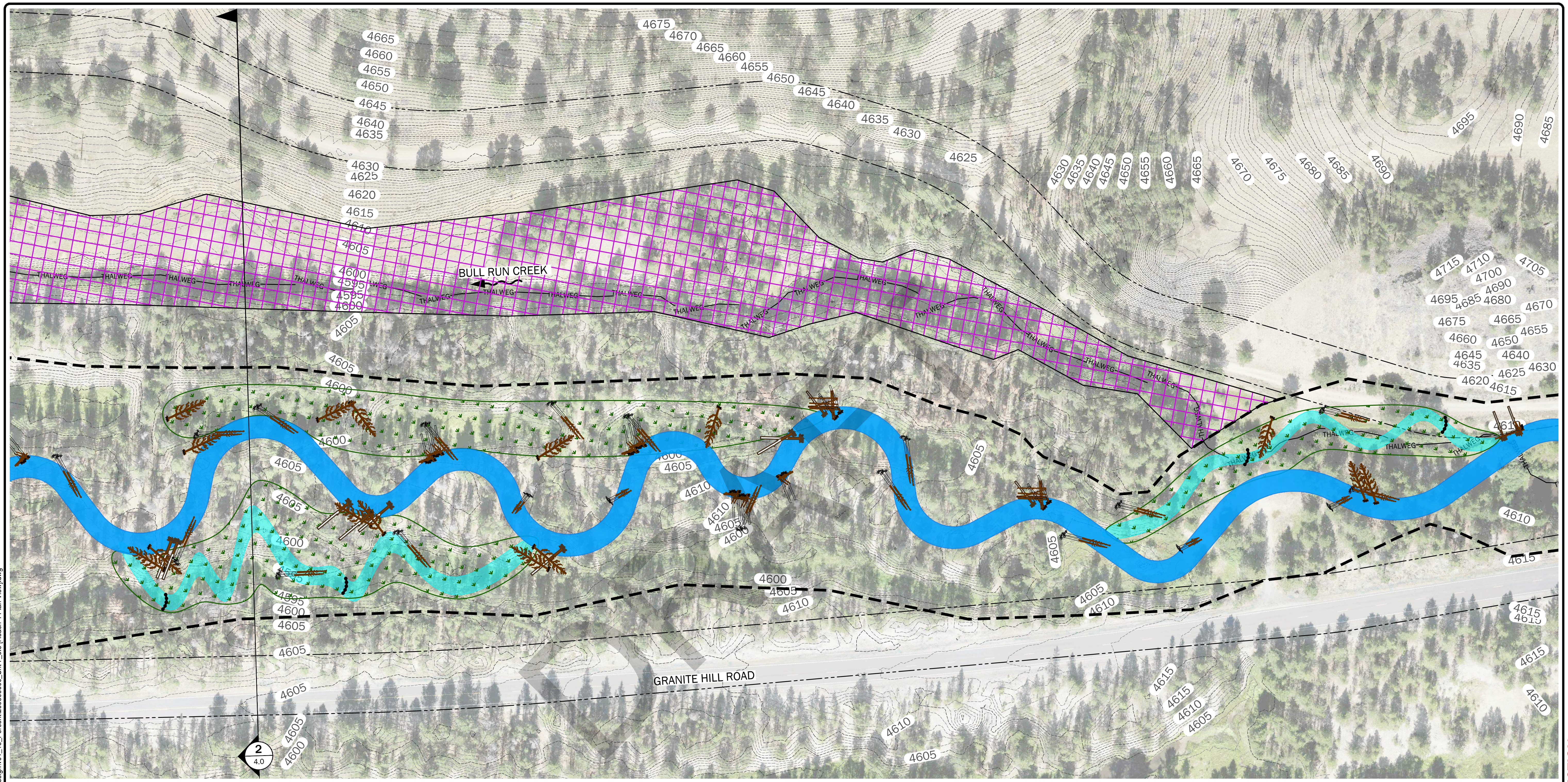

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 4 PLAN VIEW

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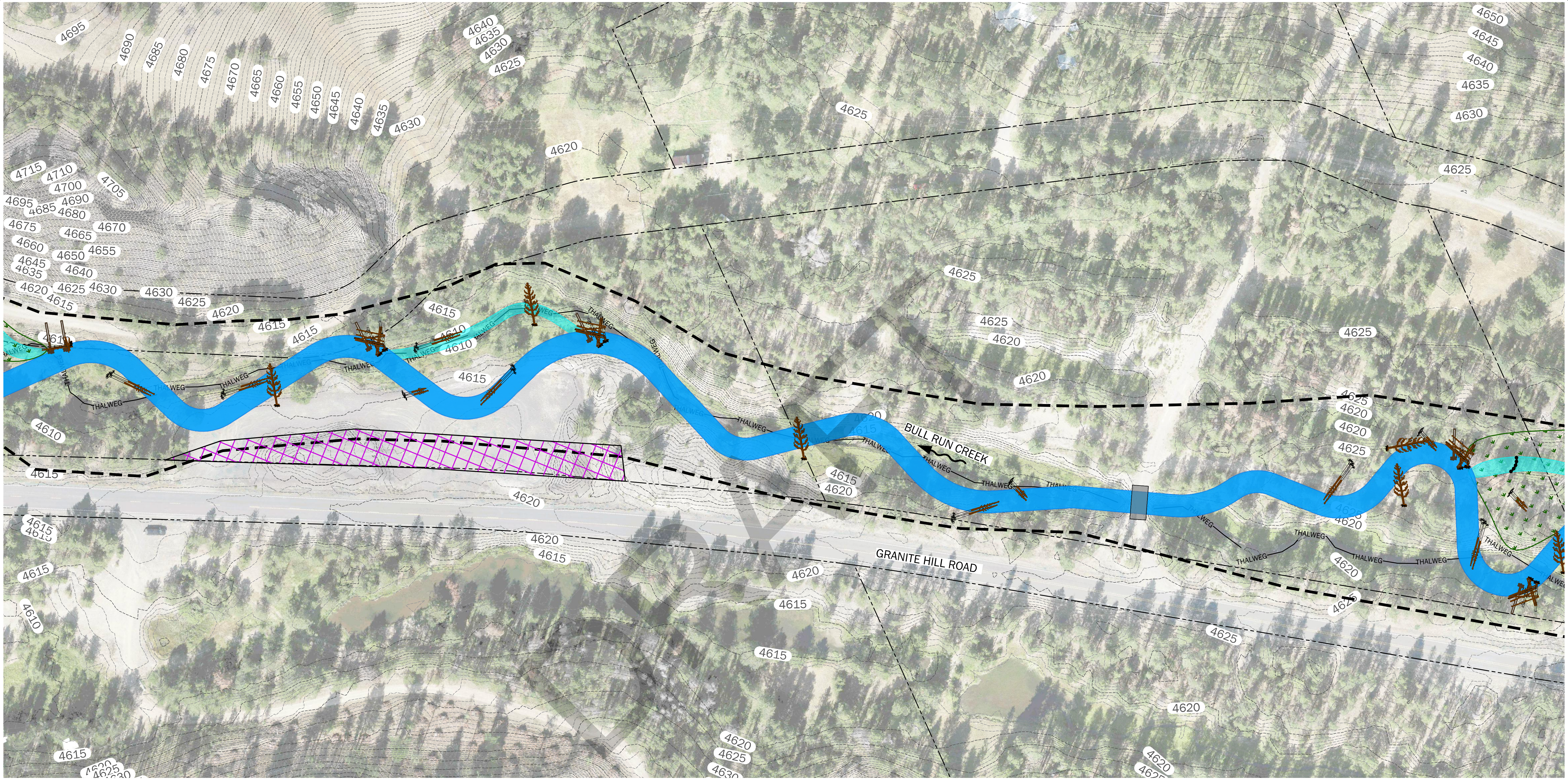
SHEET: 7 OF 13



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SCALE IN FEET

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 5 PLAN VIEW

DRAWING NUMBER:
3.4
SHEET: 8 OF 13

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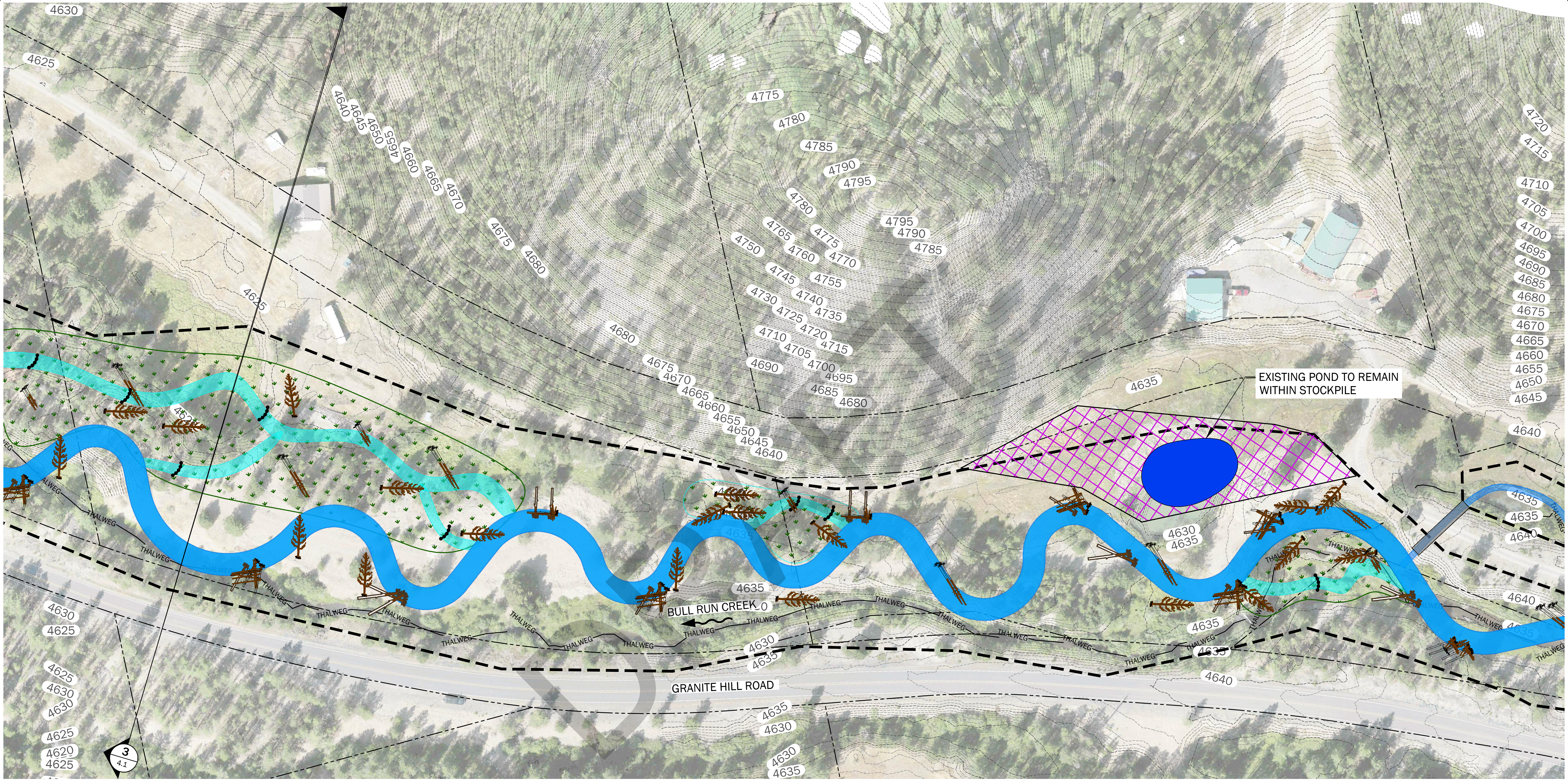

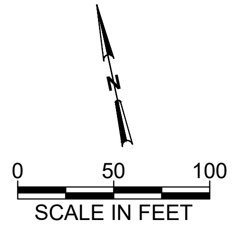

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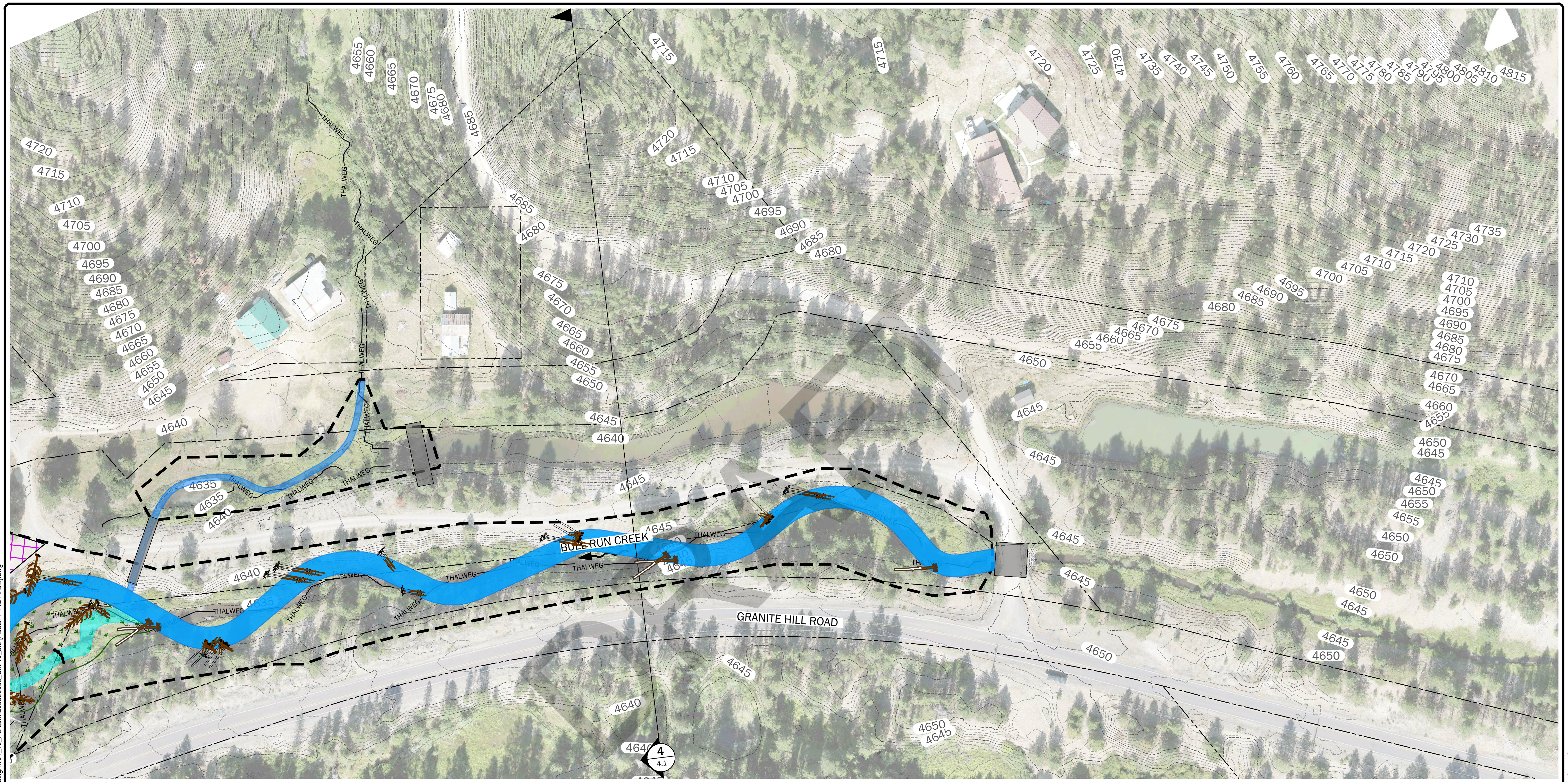
BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 6 PLAN VIEW

DRAWING NUMBER:
3.5
SHEET: 9 OF 13



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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 7 PLAN VIEW

DRAWING NUMBER:
3.6
SHEET: 10 OF 13

0 50 100
SCALE IN FEET

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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

REACH 8 PLAN VIEW

DRAWING NUMBER:
3.7
SHEET: 11 OF 13

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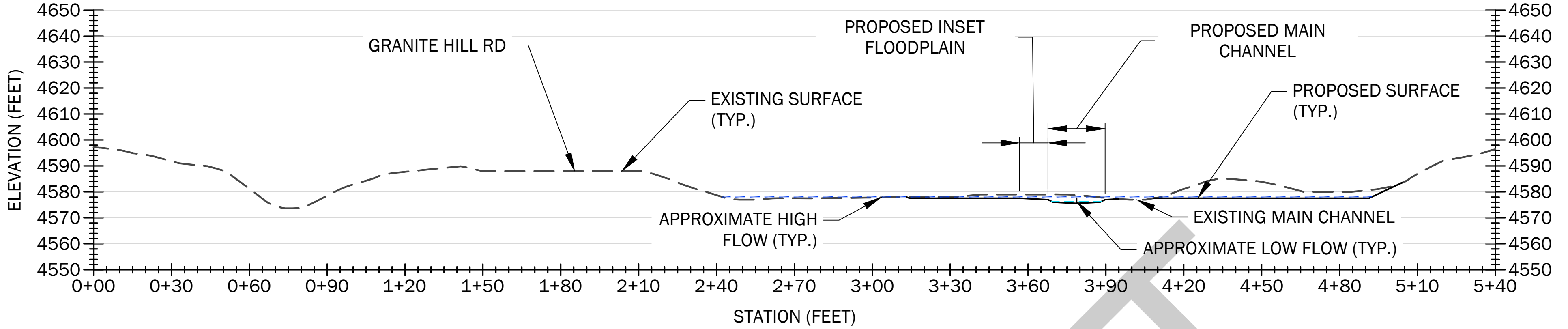

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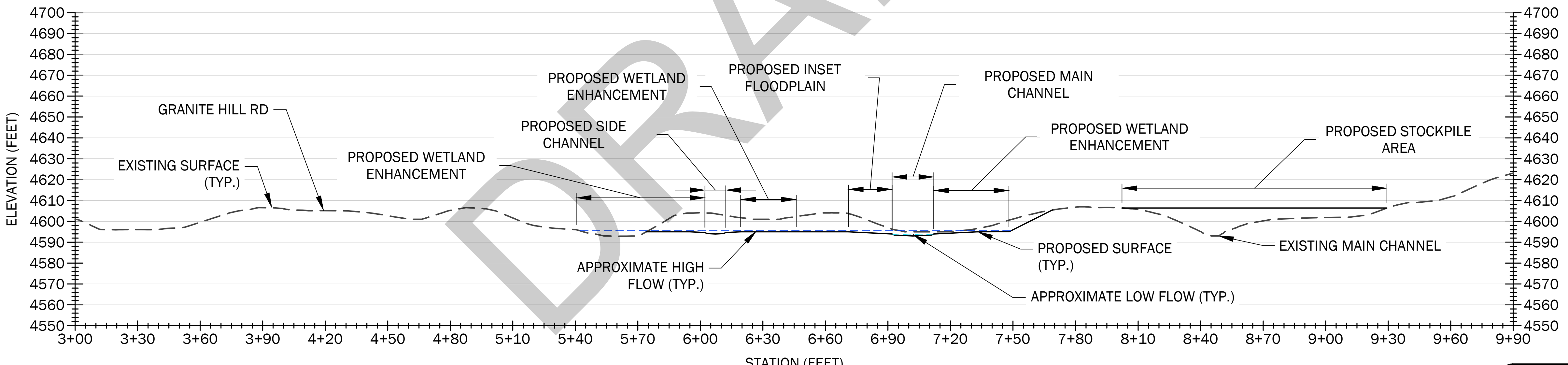

MIDDLE SECTION 1 2
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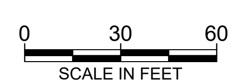

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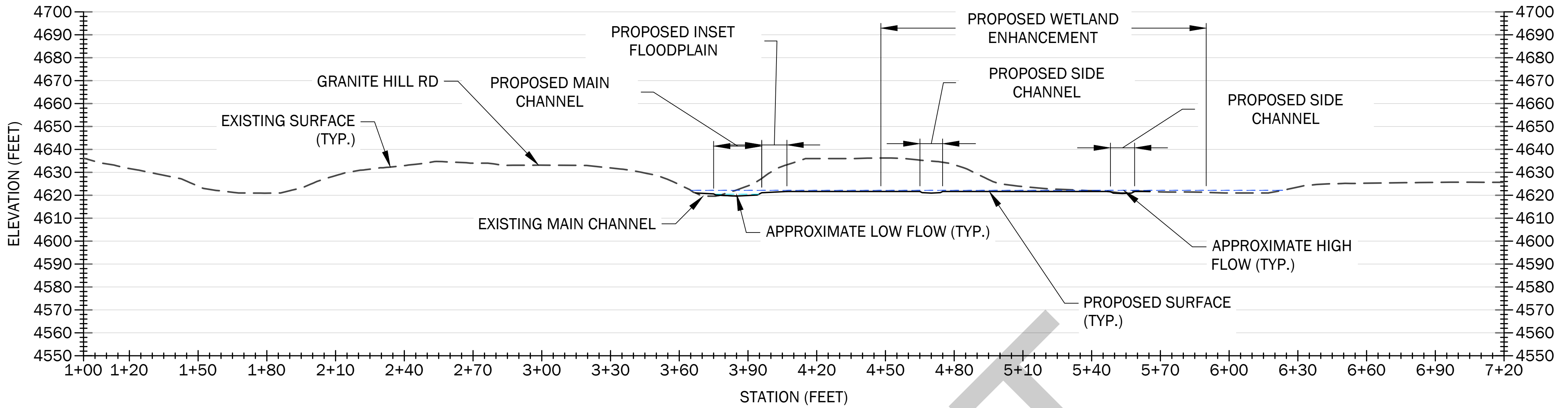
BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

FLOODPLAIN SECTIONS

DRAWING NUMBER:
4.0
SHEET: 12 OF 13

DRAFT SUBMITTAL - NOT FOR CONSTRUCTION



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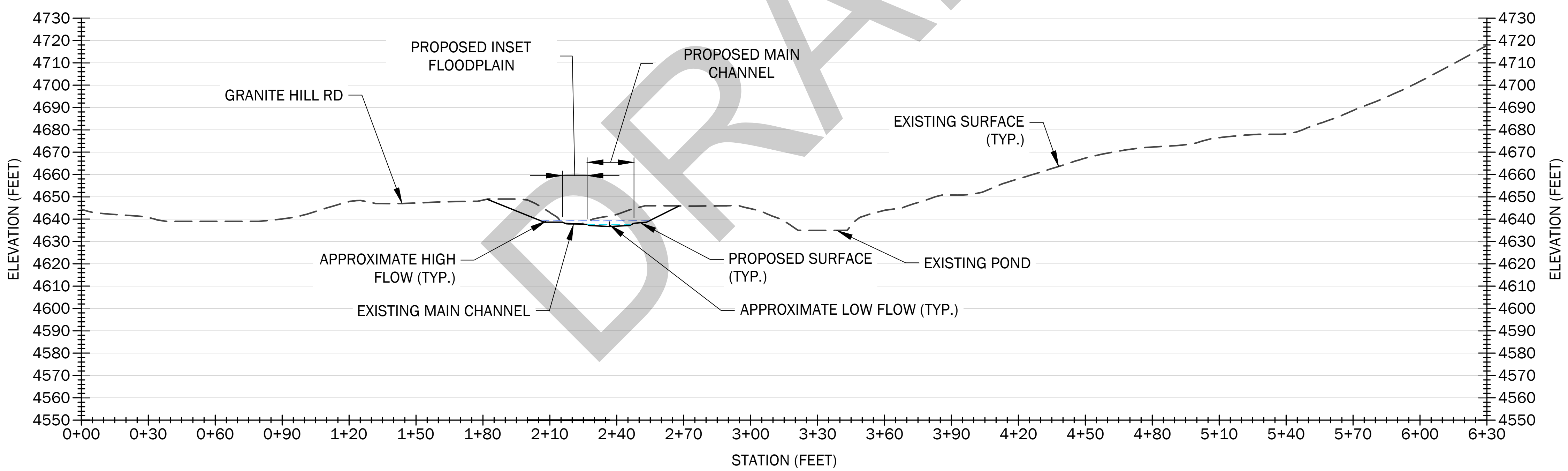

UPSTREAM SECTION 4 / 3.6

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SCALE IN FEET

NO.	DATE	BY	ISSUE / DESCRIPTION

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REVISION NO.:	----
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BULL RUN CREEK RM 0.5 FISH HABITAT ENHANCEMENT
GRANITE, GRANT COUNTY, OREGON

FLOODPLAIN SECTIONS

DRAWING NUMBER:

4.1

SHEET: 13 OF 13