Application Name: Poley-Allen Fish Passage Project

Application Number: 222-5017-19921

By: Nez Perce Tribe

Offering Type: Open Solicitation

Application Type: Restoration

OWEB Region: Eastern Oregon
County: Wallowa
Coordinates: 45.47365,-117.42621

Applicant:
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Budget Summary:
OWEB Amount Requested: $215,477
Total Project Amount: $415,388

Administrative Information

Abstract

Provide an abstract statement for the project. Include the following information: 1) Identify the project location; 2) Briefly state the project need; 3) Describe the proposed work; 4) Identify project partners.

The project site is located at a privately-owned irrigation diversion dam that crosses the Lostine River approximately 1 mile south of the town of Lostine, Oregon. More specifically, the project site is located at river mile 4.8 on the Lostine River and generally includes the mainstem Lostine River and the Poley-Allen irrigation diversion dam and intake. Restoration potential is high throughout the Lostine River and the Grande Ronde Subbasin Plan (Nowak 2004) ranks the Wallowa-Lostine highest in the Grande Ronde watershed for comprehensive restoration. At this site, the current diversion structure is an upstream passage barrier for ESA listed spring Chinook Salmon, steelhead and Bull Trout. Therefore, the overall purpose of this project is to provide perennial passage for native salmonids throughout the year.

The goal of this project is to restore fish passage through the Poley-Allen diversion structure while maintaining a minimum water surface elevation upstream of the diversion structure sufficient for the delivery of legal irrigation withdraws for the associated landowners. By modifying the existing channel spanning concrete sill and concrete abutment, installation of a roughened channel downstream of the sill, and enhancing habitat in the adjacent side channel through LWM placement, this project will maximize year-round fish passage and diversify fish habitat for all life history stages of Bull Trout, steelhead, and Chinook Salmon, while maintaining access to irrigation water for current water rights holders.

Project partners include the Grande Ronde Model Watershed and BPA.

Location Information

What is the ownership of the project site(s)?

❑ *Public land (any lands owned by the Federal government, the State of Oregon, a city, county, district or municipal or public corporation in Oregon)*

✓ *Private (land owned by non-governmental entities)*

Please select one of the following Landowner Contact Certification statements:

● I certify that I have informed all participating private landowners involved in the project of the existence of the application, and I have advised all of them that all monitoring information obtained on their property is public record.

❍ I certify that contact with all participating private landowners was not possible at the time of application for the following reasons: Furthermore, I understand that should this project be awarded, I will be required by the terms of the OWEB grant agreement to secure cooperative landowner agreements with all participating private landowners prior to expending Board funds on a property.

Please include a complete list of participating private landowners

Terry Jones

❑ *Not applicable to this project*

❑ *This grant will take place in more than one county.*

Permits

Other than the land-use form, do you need a permit, license or other regulatory approval of any of the proposed project activities?
● Yes
❍ No

For Details Go to Permit Page

I acknowledge that I am responsible for verifying applicable permits, licenses, and General Authorizations required for the project, and can update information at grant agreement execution.
✓ *Yes*

Racial and Ethnic Impact Statement

Racial and Ethnic Impact Statement
❍ The proposed grant project policies or programs could have a disproportionate or unique POSITIVE impact on the following minority persons. (indicate all that apply)
❍ The proposed grant project policies or programs could have a disproportionate or unique NEGATIVE impact on the following minority persons. (indicate all that apply)
● The proposed grant project policies or programs WILL HAVE NO disproportionate or unique impact on minority persons.

Insurance Information

If applicable, select all the activities that are part of your project - These require a risk assessment tool unless otherwise noted (check all that apply).
❑ *Working with hazardous materials (not including materials used in the normal operation of equipment such as hydraulic fluid)*
❑ *Earth moving work around the footprint of a drinking water well*
✓ *Removal or alteration of structures that hold back water on land or instream including dams, levees, dikes, tidegates and other water control devices (this does not include temporary diversion dams used solely to divert water for irrigation)*
❑ *Applicant’s staff or volunteers are working with kids related to this project (DAS Risk assessment tool not required, additional insurance is required)*
❑ *Applicant’s staff are applying herbicides or pesticides (DAS Risk assessment tool not required, additional insurance is required)*
❑ *Insurance not applicable to this project*

Additional Information

❑ *This project affects Sage-Grouse.*

Problem Statement

Describe the watershed problem(s) that this restoration project seeks to address.

The upper Lostine River has been a major focus area for restoration in the Wallowa basin since the early 2000s. With several Lostine irrigation diversions having recently been restored, Poley-Allen represents one of the largest outstanding anthropogenic barriers to ESA listed salmonids (spring/summer Chinook, steelhead, and Bull Trout), as well as reintroduced coho, Pacific lamprey, and rainbow trout in the system. An ongoing long-term radio telemetry study conducted by the Tribe shows adult spring/summer Chinook passage at Poley-Allen poses a significant delay compared to an unobstructed section of the Lostine River during summer low-flow conditions. Remediation of the Poley-Allen diversion would open up more than 10 miles of spawning and rearing habitat, most on protected federal lands located upstream.

The Poley-Allen diversion channel-spanning concrete sill and the channel downstream create significant profile discontinuity. Downstream of the sill, the streambed is armored and there are three locations where boulder steps create water surface elevation drops that exceed one vertical foot during low flow and are fish passage barriers. One boulder step is approximately 10 feet downstream of the sill and another is approximately 60 feet downstream of sill. The third boulder step exists within the main channel, approximately 120 feet downstream of the sill.

A low-flow fish passage channel is located on the west side of the sill and is adjacent to and connected with the irrigation diversion entrance. The passage channel does not appear to be functioning well and likely not able to reliably pass fish during low flows. Due to the orientation of the passage channel, passing fish are encouraged into the apparent velocity refugia of the irrigation forebay, ultimately entraining fish in the irrigation system.

An existing side channel confluence is on the right (eastern) side of the main channel, approximately 180 feet downstream of the sill. The side channel bed and the right bank of the main channel are comprised of angular riprap with material sizes up to 5 feet in diameter. Angular riprap lines the left (western) embankment approximately 170 feet downstream from the sill, which limits floodplain connectivity on the left bank. The concrete abutment and riprap scour protection that exists on the right (eastern) bank at and near the sill limit floodplain connectivity in this location.

The left (western) channel bank, upstream of the sill, is lined with riprap for approximately 270 feet. The channel bedform is plane-bed with boulders exposed above the water surface elevation at low flows and lacks a distinct low-flow thalweg. The left bank channel armoring, upstream of the sill, limits channel migration and prevents floodplain connectivity. A side channel inlet exists approximately 400 feet upstream of the sill on channel right (eastern). Evidence of anthropogenic grade control efforts at the side channel inlet include an exposed sheet pile wall. The side channel appears to activate at flow less than the bankfull event. The existing side channel inlet bed is comprised of rounded boulders and cobble.

A high-flow side channel extends approximately 570 feet on the right (eastern) side of the main channel. The side channel has a defined bed and bank, which suggests flow is present at least annually. However, overall, the side channel lacks complex structure such as Large Woody Material (LWM) and, as a result, low velocity juvenile rearing areas are sparse but potential for restoring them is high.

How have past or current land management practices contributed to the problem?

A total of 11 ditches appropriate water from the Lostine. Low flows and high summer water temperatures, largely a result of irrigation withdrawals, affect juvenile rearing and adult spawning. Low summer flows and physical passage barriers - especially in the Lostine River, Bear Creek, Hurricane Creek, and the upper Wallowa River - limit adult access to spawning areas and juvenile access to quality rearing habitat (NMFS 2017, p. 235).

Regionally, there are numerous contributing causes for species declines, which include hydropower development, overharvest, irrigation development, logging, mining, agriculture conversion, and many others (Nez Perce and Wallowa County 1999, Northwest Power and Conservation Council 2004, NOAA Fisheries 2017, U.S. Fish and Wildlife Service 2015). Locally at this project site, the most significant causes of species declines is fish passage.

Radio telemetry studies identified the Poley-Allen Diversion as a partial migration barrier to adult Chinook, which is restricting access to high quality spawning and rearing habitat upstream (Vatland 2018).

Other primary limiting factors to ESA-listed salmonid abundance and productivity in the Lostine River are due to past agricultural and grazing practices that removed riparian vegetation and channelized streams. Current agricultural practices continue to limit riparian vegetation and contribute sediment and pollution to streams. Lingering effects of past timber harvest and existing roads continue to limit riparian vegetation and floodplain interaction, and contribute sediment to stream channels (NMFS 2017, p. 281).

Project History

Continuation - Are you requesting funds to continue work on a project previously funded by OWEB where that work did not result in a completed project?

❍ Yes
● No

Resubmit - Have you submitted, but were not awarded an OWEB application for this project before?

❍ Yes
● No

Phased - Is proposed work in this application a phase of a comprehensive watershed restoration plan or project?

❍ Yes
● No

Plans

Salmon

Will this project benefit salmon or steelhead?

● Yes
❍ No

✓Snake River Basin - Steelhead
✓Snake River Spring/Summer-run - Chinook Salmon

How will the resulting restoration project benefit salmon or steelhead or their habitat?

By eliminating this partial passage barrier, adult Chinook will experience reduced migration travel times through this stretch of the Lostine River when temperatures are highest and flows are lowest. Through improving habitat conditions in the side channel adjacent to the diversion, juvenile salmonids will have additional rearing area, providing cover, greater feeding opportunities, and velocity refuge during higher flows. Through passage and habitat restoration through this reach, greater habitat connectivity will be achieved for all life stages of salmonids and aquatic species.

Does the project address a restoration action identified in a regional assessment or recovery plan?

● Yes
❍ No

Regional Assessments or Recovery Plans
ESA Recovery Plan for Snake River Spring/Summer Chinook & Snake River Basin Steelhead
Northwest Power and Conservation Council Grande Ronde Subbasin Plan

For each plan chosen above, describe how your project is consistent with specific recovery/restoration actions cited in that plan.

The ESA Recovery Plan for Snake River Spring/Summer Chinook & Steelhead cites limited fish passage and reduced habitat quantity and diversity among the primary habitat-related limiting factors for the Lostine/Wallowa Rivers spring Chinook population (NMFS 2017, p. 234, Table 5-11 p. 237, p. 284, and Table 5-23, p. 287).

The Grande Ronde Subbasin Plan recommends setting objectives for the following attributes: channel condition, riparian function, sediment reduction, low flows, temperature, and passage barriers (Nowak 2004, p. 259).

Does the project address a restoration action identified in a regional assessment or recovery plan?

● Yes
❍ No

Provide name of local plan, Watershed assessment or other locally relevant document.

Wallowa Atlas Implementation Guidelines (BPA 2019)
Atlas Restoration Prioritization Framework: User's Manual (Tetra Tech 2017)

Wallowa County Salmon Plan (Wallowa County 1993; revised 1999)

Does this project address one or both of the following:

✓ *Habitat needs for one or more Endangered Species Act-listed species and/or species of concern*
❑ *Concerns identified on 303(d) listed streams*
❑ *No*

Proposed Solution

Goal, Objectives, and Activities

State your project goal. A goal statement should articulate desired outcomes (the vision for desired future conditions) and the watershed benefit.

The current diversion structure is an upstream passage barrier for ESA listed spring/summer Chinook Salmon, steelhead and Bull Trout. The goal of this project is to restore fish passage through the Poley-Allen diversion structure while maintaining a minimum water surface elevation upstream of the diversion structure sufficient for the delivery of legal irrigation withdraws for the associated landowners.

List specific and measurable objectives. Objectives support and refine the goal by breaking it down into steps for achieving the goal. (NOTE: If you quantify your objectives, ensure all numbers match the metrics listed in your selected habitat types.) Provide up to 7 objectives.

Objective #1

Objective

1. Implement a 150 feet long roughened channel engineered streambed material design suitable for passage of juvenile and adult Bull Trout, steelhead, and spring/summer Chinook Salmon during periods of migration that achieve Oregon Department of Fish and Wildlife (ODFW) and National Marine Fisheries Service (NMFS) fish passage criteria to the greatest extent practical by 2023.

Describe the project activities. Activities explain how the objective will be implemented.

1. Contractors will remove 270 CY of main channel material and install a 620 CY of roughened channel substrate material along 150 feet below the irrigation diversion. 64 habitat boulders and 93 CY of streambed material will be placed throughout the roughened channel. Boulders within the roughened channel will result in increased hydraulic complexity and roughness.

Objective #2

Objective

2. Modify existing channel spanning concrete sill and concrete abutment to an elevation suitable for fish passage that maintains access and use of irrigation water for water rights holders and irrigators by 2023.

Describe the project activities. Activities explain how the objective will be implemented.

2. Contractors will remove a portion of the top of the sill to provide a low flow channel and remove the abutment and grade the bank of the abutment to reduce flow constriction and increase stream stability. Final diversion construction will result in maximized fish passage through the year for all life history stages of Bull Trout, steelhead, and Chinook salmon, while maintaining access to irrigation water for current water rights holders.

Objective #3

Objective

3. Install a series of LWM structures within the side channel east of the diversion structure to increase channel complexity, channel stability, and create diverse fish habitat by 2023.

Describe the project activities. Activities explain how the objective will be implemented.

3. Contractors will install 20 LWM structures in three different configurations, according to the design plan set, within the side channel east of the diversion structure to increase channel complexity, channel stability, and create diverse fish habitat by 2023.

List the major project activities and time schedule for each, including post project implementation.

Element	Description	Start Date	End Date
Implementation Phase	Procure contractor, construct and complete project implementation on-the-ground.	8/2023	9/2023
Site Restoration	Seeding, mulching, and planting	9/2023	11/2023
Permitting	Section 106 ESA, DSL and ACOE submittals	11/2021	5/2022

Element	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023
Implementation Phase									
Site Restoration									
Permitting									

Habitat Types

In which habitat type(s) are you proposing to work?

✓ *Instream Habitat: below the ordinary high water mark (includes in-channel habitat restoration, bank stabilization, flow, fish screening, and fish passage) -- Details will follow.*
✓ *Riparian Habitat: above the ordinary high-water mark of the stream and within the stream's floodplain. -- Details will follow.*
❑ *Upland Habitat: above the floodplain and improves native habitat and watershed function.*
❑ *Wetland Habitat: land or areas covered, often intermittently, with shallow water or have soil saturated with moisture.*
❑ *Estuarine Habitat: tidally influenced areas.*

Instream Habitat

Select all applicable Instream categories.

❑ **Bank stabilization**

✓ **Fish passage improvement**

Select all the actions you propose to implement to address the problem.

❑ *Barriers at Road Crossings: Improve fish passage at road crossings.*
✓ *Non-road Crossing Barriers: Improves fish passage not located at road crossings.*

Types of non-road crossing barriers to be improved or removed for the benefit of fish passage (select all that apply).

✓ *Diversion dam*

Number of structures

1

Size (feet)

45

Structural material

The diversion structure consists of a channel-spanning concrete sill, concrete abutment at the concrete sill along the river right bank, and approximately 170 feet of riprap lining the eft bank, upstream and downstream of the point of diversion. A side channel parallels the river along the river right floodplain. The side channel inlet and outlet are approximately 400 feet upstream and 180 feet downstream of the point of diversion, respectively.

Purpose

The purpose of the diversion dam is to divert water into an irrigation intake and associated ditch for use by water rights holders and irrigators primarily for agricultural use.

❑ *Push-up Dam*
❑ *Non-Diversion Dam*
❑ *Weirs*
❑ *Natural debris jam barriers*
❑ *Tidegates*
❑ *Boulder/Rock barrier*
❑ *Landslide*

Number of non-road crossings to be treated/removed

1

❑ *Fish ladders or engineered bypasses not associated with road crossings*

Total stream miles with improved access

10

Total number of barriers removed or modified

1

Are you coordinating or do you plan to coordinate with ODFW's fish passage program on this project?

● Yes
❍ No

If you have an ODFW project number(s), please enter them below. ODFW fish passage project numbers will be in the form P-XX-XXXX.

N/A

❑ **Fish screening project**
❑ **Instream Flow**

✓Instream habitat restoration

Select all the actions you propose to implement to address the problem.

✓*Placement of materials in channel*

Does the proposed project follow:

✓*ODFW Guidelines*
✓*NOAA Guidelines*
❑*Other*

What types of instream habitat materials are you proposing to install? (select all that apply)

✓*Large wood*

Number of structures.
20

Average number of logs per structure.
1

Average length of logs per structure (feet)
30

Average diameter of logs per structure (feet)
1.09

❑*Boulders*
❑*Combination log/boulder*
✓*Other materials: Materials that stabilize the streambed*

Specify structure type(s):

❑*Beaver dam alternative*
✓*Constructed riffle*
❑*Weirs installed*

Number of structures
1

❑*Channel reconfiguration and connectivity, including alcoves and side channel reconnection*
❑*Spawning gravel placement*
❑*Beaver reintroduction*
❑*Non-native plant control*
❑*Nutrient enrichment*
❑*Animal species removal*

Is the primary purpose of the instream habitat restoration treatment(s) to address water quality limiting factors?
❍ Yes
● No

Total miles of stream to be treated with all instream habitat restoration treatments
0.13

❑**Stockpiling logs**

Riparian Habitat

Select all applicable Riparian categories.

❑**Riparian road activities**
❑**Fencing and other materials for habitat protection**

✓**Vegetation establishment or management**

Select all the actions you propose to implement to address the problem.

✓*Planting*

For Details Go to Plant Page

✓*Non-native plant control*

Specify species

Various invasive weed species commonly present along the Lostine River corridor, such as: knapweed, sulfur cinquefoil, various thistle spp., etc.

Treatment(s) to be applied

❑*Mechanical (cutting, mowing, girdling, etc.)*
✓*Chemical (pesticides, fungicides, etc.)*
❑*Biological (predators, herbivores, pathogens, etc.)*

Acres to be treated

0.8

❑*Prescribed burnings, stand thinning, stand conversions, silviculture*
❑*Juniper treatment*

❑**Livestock management**
❑**Debris and Structure Removal**

Is an objective of the riparian treatment(s) to address water quality limiting factors?

❍ Yes
● No

Total linear stream miles to be treated.

0.05

Total riparian acres to be treated.

0.8

Left streambank miles to be treated.

0

Right streambank miles to be treated.

0.05

Wrap-Up

Watershed Benefit

Describe the watershed or ecosystem function(s) that the project will address through the proposed restoration actions and the resulting benefits to water quality, native fish and wildlife habitat, and/or watershed health. Explain why the project is a priority for investment at this time.

With the partial removal of the sill and abutment, and associated installation of a roughened channel , fish passage and habitat connectivity will be restored at the Poley-Allen diversion. As stated previously, this diversion is one of the greatest remaining anthropogenic passage barriers on the Lostine River, particularly to upstream migrating Spring Chinook during the summer months. As with many anadromous fish populations within the Snake River basin, Spring Chinook on the Lostine River are steadily diminishing in their returns. Enabling them to move up the Lostine River to their spawning grounds without delays in passage, such as the Poley-Allen irrigation diversion, would help maximize both survival and productivity.

Additionally, LWM placement in the adjacent side channel would enhance habitat diversity and low-velocity juvenile rearing for fish in this reach. Ultimately, this combination of restoration actions at this diversion is expected to improve both passage and habitat complexity limiting factors in this location within the Lostine River corridor.

The upper Lostine River has been a focus area for restoration in the Wallowa basin since the early 2000s. Restoration efforts have included a long term Minimum Flow Agreement, two diversion rehabilitation projects, the development of two instream habitat projects, and current efforts to identify and pursue irrigation efficiency projects. In addition to a concerted restoration effort, the Tribe has a robust monitoring program that includes the operation of a weir in the lower Lostine and a long-term telemetry study to track the movement of adult spring Chinook through the system. The monitoring work done by the Tribe has been crucial in identifying and informing priority restoration actions to maximize the benefits to native fish species and has identified the Poley-Allen diversion as a significant passage issue for Chinook at low flows. The proposed project is a stand-alone project that is a critical piece of the long-term restoration efforts in the upper Lostine.

Public Awareness

Does this proposed project include public awareness activities?
❍ Yes
● No

Design

Were design alternatives considered?
● Yes
❍ No

Describe the design alternatives that were considered and why the preferred alternative was selected.

The project design development focused on mitigating fish passage limitations associated with the mechanical manipulation of the channel and providing irrigation water to the water right holders. The design development also included side-channel habitat improvements with LWM structures. Proposed actions were collaboratively developed with the landowners and the NPT and the roughened channel was identified as the preferred alternative for providing fish passage while maintaining the necessary head for irrigation delivery. The proposed actions involve constructing a roughened channel, modifying the existing concrete sill, and removing the existing abutment on the right channel bank. Habitat boulders will be placed within the roughened channel for hydraulic complexity and roughness.

The engineer developed and evaluated alternatives for improving fish passage at the Poley-Allen irrigation diversion. The alternatives identification and selection process included the following steps:
1. Identify project goals, objectives and constraints to guide the development of alternatives.
2. Use the goals, objectives and constraints to establish selection criteria as a basis for a relative comparison of anticipated alternative performance.
3. Identify and develop feasible design alternatives that address the project goals, objectives and constraints.
4. Compare the alternatives based on their effectiveness at meeting the selection criteria.

Alternatives analysis and selection was guided by the following vision, goal, and objectives:

Vision
Restore available habitat for steelhead and spring Chinook within the Wallowa-Lostine watershed by protecting and restoring connectivity of functioning habitats and protecting high quality habitat.

Goal
Restore fish passage through the Poley-Allen diversion structure while maintaining a minimum water surface elevation upstream of the diversion structure sufficient for the delivery of legal irrigation withdraws for the associated landowners. Maintain floodplain and side channel connectivity to limit channel erosive forces during high peak recurrence interval flow events. Promote natural river and floodplain conditions by modifying or removing the diversion structure and constructing a stabilized channel.

Objectives
1. Restore fish passage at an existing irrigation facility with the modification of the Poley-Allen diversion dam.
2. Restore fish passage with the construction of a roughened channel designed to resist headcutting and provide grade stabilization.
3. Improve secondary channel and floodplain interaction with the installation of floodplain and side channel roughness elements including large woody material (LWM).

To evaluate alternatives and make an informed decision, a set of selection criteria were identified to support the goal based on site-specific conditions. The selection criteria identified specific conditions and outcomes to differentiate between alternative actions. The following criteria were used for evaluating alternatives:

1. Provide and maintain passage for steelhead and spring/summer Chinook Salmon during periods of migration to the greatest extent practical.
2. Minimize risk of fish passage barriers over time by increasing floodplain connectivity.
3. Minimize risk of failure at irrigation delivery systems.
4. Minimize construction and operation costs.

ALTERNATIVES DESCRIPTIONS

Alternative 1 (preferred alternative): Removal of Diversion Sill, Eastern Abutment and Replace with Roughened Channel
Alternative 1 involves removing the diversion dam sill and eastern abutment while retaining the western bank abutment at the existing irrigation headgate. The sill would be replaced with a roughened channel extending approximately 150 feet downstream to provide a slope suitable for fish passage. The low-flow channel will be located in the approximate center of the channel and will move the current fish passage away from the irrigation intake. The channel cross section would provide sufficient depth at low-design flow to meet Oregon Department of Fish and Wildlife (ODFW) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries criteria for fish passage. Overall channel and bank stability will be improved by allowing high discharge flows to activate the floodplain east of the channel with the removal of the abutment that currently exists on the eastern channel bank. The roughened channel will raise water surface elevation to allow stream flow to enter the diversion ditch and provide gravity-fed irrigation water to the existing fish screen. Alternative 1 includes the addition of LWM within the side channel (east of the main channel) to improve low velocity juvenile refugia during high-flow events.

Irrigation water will be delivered through the existing headgate by maintaining a water surface elevation upstream of the roughened channel grade control. Sediment transport through the main channel will be impacted with a permanent channel grade that is higher than the current sill base, which requires manual manipulation of channel grade through the installation and removal of boards. Sediment loading within the irrigation forebay will continue to be managed manually.

Alternative 2: Retaining the Diversion Sill and Abutments, Construction of a Rock Ramp
Alternative 2 involves retaining the diversion dam sill and abutments and constructing a fish passable roughened channel downstream of the sill. The diversion structure would operate similarly to existing conditions using boards to manipulate the water surface elevation upstream of the sill to deliver the irrigation water right. The existing low-flow fishway would be relocated away from the irrigation diversion headworks to limit the attraction to the irrigation forebay and meet ODFW and NOAA Fisheries fish passage criteria. Alternative 2 includes LWM within the side channel (east of the main channel) to improve low velocity juvenile refugia during high-flow events. Main channel sediment transport will function similarly to existing conditions with the use of boards.

Select the appropriate level of design for your project.

- ❍ No design is required.
- ❍ 10-30%: Conceptual design (evaluation of alternatives, concept-level plans, design criteria for project elements, rough cost estimates).
- ● 30-85%: Preliminary design (selection of the preferred alternative, draft plans, draft design report, preliminary cost estimates).
- ❍ 85-100%: Final design (final design report, plans, and specifications, contracting and bidding documents, monitoring plan, final cost estimate).

If work remains on the project's design, describe the work that remains to be done and when you expect to have it completed. If no design is required put "N/A"

At this time the project is at 80% design and details all major project components, quantities, and installation methods. To move the project from 80% to 100% design, the following items will be completed, then final design will be stamped and ready for construction contractor solicitation:
1. 80% RRT design review and approval.
2. Cultural resources survey and report completed and submitted (survey scheduled for winter 2021).
3. All environmental permitting completed, submitted, approved, and permits acquired.
4. 100% design finalization that addresses all RRT comments.
5. Clarify construction direction, specification, and quantities as called out on the design sheets.
6. Cross check design specification document with design sheets to assure all construction elements, quantities, and specifications coincide.
7. Final design document review and approval by the RRT and project review team, sign off and T.A. project closeout.

Final design completion and permit acquisition is anticipated NLT March 31, 2022.

Describe the steps you will take to minimize adverse impacts to the site and adjacent lands during and after project implementation.

This project will adhere to all HIP conservation measures and guidelines coordinated through the BPA restoration review team (see plan set/specification for details), in which all required permits will be vetted through the regulatory agencies (NMFS, USFWS, SHPO/THPO, USACE, DSL and DEQ).

Construction will occur during the appropriate in water work window determined for this site by Oregon guidelines. This time frame will be designated to protect all ESA listed species for all life stages.

All temporary access roads and stream crossings will be installed in locations to achieve the least impact to existing mature riparian vegetation and will be removed/obliterated and reseeded following construction.

Prior to entering the site, all equipment will be cleaned according to permit requirements and conservation measures to reduce the potential spread of invasive/noxious weeds on site.

The engineer developed a two-dimensional hydraulic model of the project reach using the U.S. Bureau of Reclamation's Sedimentation and River Hydraulics—Two Dimension (SRH-2D) Version 3.2.3 (USBR 2017) computer program, a two-dimensional hydraulic and sediment transport numerical model (Aquaveo 2018). Existing and proposed hydraulic model results were generated using the SRH-2D hydraulic model for both 1.5-year and 100-year flows.

Side channel LWM structure design details include stability calculations, anchoring details and layering plans to minimize impact to the adjacent property.

Following construction, all disturbed areas, including temporary access routes and staging areas, will be seeded with native seed mix according to the planting plan (see planting plan for details) to reestablish desirable vegetative cover and prevent soil erosion.

An as built survey will be completed to document the final grade and elevation of the roughened channel and all other constructed features upon completion. Resurveys can be conducted, if necessary, to ensure structural stability, or to confirm settling or other changes have occurred overtime, thus allowing adjustments to be made.

Project Management

List the key individuals, their roles, and qualifications relevant to project and post project implementation. At a minimum include the following: project management, project design, project implementation, and project inspection.

Role	Name	Affiliation	Qualifications	Email	Phone
Sponsor/Project Manager	Kathryn Frenyea	Nez Perce Tribe DFRM	Kathryn has a B.S. in Fisheries Management and has worked extensively in eastern Oregon for fisheries agencies for 20 year. She has 10 years of restoration implementation and project management experience.	kathrynf@nezperce.org	(541) 432-2506
Project Sponsor	Montana Pagano	Nez Perce Tribe DFRM	Montana has a B.S. in Fishery Resources and over 10 years of experience working on research and habitat projects in Oregon, Idaho, and Washington. She has 5 years experience assisting in project management, design, implementation, and inspection.	montanap@nezperce.org	(541) 432-2507
Project Partner/Coordinator	Ian Wilson	Grande Ronde Model Watershed	Ian has been the Wallowa County Project Coordinator for the GRMW since August 2019. He has a B.S. in Fisheries and Wildlife with a fisheries concentration. He has 20 years of fisheries experience in eastern Oregon.	ianw@grmw.org	(541) 426-0389 Ext.54142
Project Engineer	Ryan Carnie	GeoEngineers	Ryan has a B.S. and an M.S. in civil engineering with over 25 years of experiences and 10 years as a water resources engineer with GeoEngineers. He has worked river restoration, including fisheries habitat restoration and fish passage in OR, WA & ID.	rcarnie@geoengineers.com	(208) 258-8326

Climate Considerations

Briefly describe your understanding of how the characteristics and functions of the watershed where the proposed project will occur are anticipated to change due to climate impacts in the future. In particular, describe how species, habitat, and/or water quality or water quantity variables relevant to the project site location are expected to be affected. Refer to Technical Resources now available on this webpage, if needed: https://www.oregon.gov/oweb/resources/Pages/Field-Tech-Guidance.aspx

Climate change creates uncertainty in restoration and adaptive management across the Pacific Northwest, northeast Oregon is no exception. The negative effects associated with these emerging dangers have the potential to severely compromise ongoing restoration efforts. In the Northwest, climate change models are predicting a mean annual temperature increase of 2.0 to 2.6°C for 2036 to 2065 and to increase again from 2071 to 2100 by 2.8 to 4.7°C with summer experiencing the greatest temperature fluctuation and extreme heat days (Halofsky, 2020). The focal species (SRB steelhead, spring/summer Chinook salmon, pacific lamprey and bull trout) have the potential to be vulnerable to climate change in the Columbia River (Basin). Predicted responses to climate change in the Basin include a shift from a snow to rain dominated system, diminished snow packs in all but the highest elevations, increased peak stream flow and increased stream temperature (ISAB 2007-2; ISAB 2011-4). Changes in timing of peak flow are also likely to occur and summer base flows are likely to be lower in the future (Peterson, 2018) (Halofsky, 2020). These hydrologic changes can have significant impacts on salmonids. Increased peak flows can scour redds, create changes in flow timing alter smolting out-migration, and lower base flows can lead to increased energy expenditure for migrating adults and reduce potential holding areas. Conservation concerns arise from the emergence of barriers that reduce access to spawning habitat because any changes that reduce the spawning success of fish on the margins of their distributions can reduce their diversity, particularly population and life history diversity, and thus their ability to respond to change (Schindler et al. 2010).

How have you accounted for these climate-impact considerations in your project planning, design or implementation? Please describe briefly.

One key restoration activity to abate adverse effects from climate change is removing barriers in tributaries. As stated by ISAB (2011-4), “[I]t is important to consider the diversity, spatial array, and connectivity of habitats for conserving and restoring the diversity of movement patterns and life histories in this age of climate change. The suitability of different habitats will change due to increasing temperatures in both fresh water and the ocean (ISAB 2007-2). This diversity is therefore a hedge against uncertainty and climate change that threaten the resilience and productivity of many populations.”

The Poley-Allen diversion structure was designed to accommodate the 100-year flow event in anticipation of increased frequency and intensity of flows as well as pass all life stages of focal and migrating aquatic species. Low-flow hydrologic analysis was also conducted by the engineer, leading to the development of a low-flow channel thalwag to accommodate passage at baseflow.

Are there any constraints on your ability to incorporate climate considerations into project planning? For example: Lack of information about climate impacts at the project planning scale; Gaps in understanding what nursery or seed stock to use given potential climate impacts; Gaps in accessing these stocks; Lack of methods to quantify climate benefits; Uncertainty about how to define a baseline for assessing potential change; Metrics for understanding climate resilience are not well-defined.

❍ Yes
● No

Climate benefits from OWEB project activities can broadly be categorized into three types: (1) Carbon sequestration benefits (2) Mitigation benefits and (3) Adaptation benefits. Project activities may offer multiple climate benefits. Please review these categories below, select all the apply, and provide specific examples where possible:

✓ *Carbon sequestration (Capturing, securing and storing carbon dioxide from the atmosphere), including:*

Sequestration benefits from habitats: Project activities that avoid natural habitat conversion, or *increase plant biomass within the habitat area, may contribute sequestration benefits. Select any that apply:*

- ❑ *Upland forest*
- ✓ *Riparian*
- ❑ *Grassland*
- ❑ *Wetland*
- ❑ *Estuary*
- ❑ *Other habitat*

❑ *Sequestration benefit through fire management/fuels reduction. Activities that help manage fire frequency and severity will help provide sequestration benefits, because catastrophic wildfires reduce the sequestration potential of upland habitats.*

✓ *Other sequestration benefit*

Please describe:

The addition of large wood to the adjacent side channel has the potential to sequester carbon in the form of coarse downed wood. Once decomposed, the carbon trapped in organic matter infiltrates the soil and enters the water column through hyporheic exchange thereby providing a source of dissolved oxygen to streams via sub-surface flow.

✓ *Mitigation through reduced emissions*

Please describe climate mitigation benefit:

❑ *Adaptation Benefits. Project activities may offer multiple climate adaptation benefits for species, habitats and communities, and there may be some overlap in the terminology used to describe these benefits. Check all that apply below, and provide additional and more specific description if possible.*

The State of Oregon is committed to identifying ways it can reduce impacts from harmful emissions. While the overall outcomes of OWEB funded projects may have many climate benefits, some necessary activities that occur during projects will result in increased emissions. To help us understand the current situation, please check all of the following that might apply to your project:

- ✓ *Driving gas-powered automobiles, including trucks and All Terrain Vehicles (ATVs)*
- ✓ *Operating gas-powered machinery other than automobiles (for example, chainsaws or other hand-held equipment)*
- ✓ *Operating gas-powered machinery larger than automobiles (for example, excavators)*
- ❑ *Boats*
- ❑ *Other*
- ❑ *Not applicable to project activities*

Are you considering alternative approaches that could reduce emissions (e.g., use of electric chainsaws or motors)?

-

❍ Yes
● No

Optional Monitoring

OPTIONAL: Restoration Project Monitoring

- ✓ *Salmonid Monitoring*
- ❑ *Non-salmonid biological monitoring*
- ❑ *Water (quantity) flow monitoring*
- ❑ *Water quality monitoring*
- ❑ *Rangeland monitoring*
- ✓ *Onsite*
- ❑ *Downstream*
- ❑ *Upstream*
- ❑ *Upslope*

Will effectiveness monitoring be conducted for this project?

● Yes
❍ No

Please describe the monitoring activities and any additional sources of funding (amount and source) to support this effort.

NPT Research is conducting a long-term adult Chinook radio telemetry study in the Lostine river and has several years of established radio telemetry data from pre-implementation monitoring, including discharge data, fish passage success/failure, and passage duration at the Poley-Allen diversion, which is compared to a control site in the Lostine River. Poley-Allen is one of four fixed sites that are monitored annually, in addition to mobile tracking efforts. This program is funded by a combination of BPA, OWEB, and Freshwater Trust monies, which equals approximately $15,000 annually, with a one-time radio tag purchase of roughly $25,000.

Budget

Item	Unit Type	Unit Number	Unit Cost	OWEB Funds	External Cash	External In-Kind	Total Costs
Salaries, Wages and Benefits							
Project Management (NPT Project Leader) - implementation, contract management	Hours	100	$45.00	$0 *	$0	$4,500	$4,500
Project Management (NPT Bio II) Construction oversight	Hours	120	$40.00	$0 *	$0	$4,800	$4,800
Telemetry	Hours	20	$35.00	$0 *	$0	$700	$700
			Category Sub-total	$0	$0	$10,000	$10,000
Contracted Services							
Mobilization and Demobilization	Each	1	$30,000.00	$30,000	$0	$0	$30,000
Erosion and Sediment Control	Each	1	$8,000.00	$8,000	$0	$0	$8,000
Environmental Protections	Each	1	$5,500.00	$5,500	$0	$0	$5,500
Removal of Diversion Structure	Each	1	$80,000.00	$80,000	$0	$0	$80,000
Clearing and Grubbing	Acres	0.8	$8,000.00	$6,400	$0	$0	$6,400
General Excavation	Cubic yards	696	$60.04	$41,788	$0	$0	$41,788
Construction Staking	Days	3	$1,400.00	$4,200	$0	$0	$4,200
Construction Observation	Days	10	$2,000.00	$20,000	$0	$0	$20,000
Fill in Place (Stockpiled Material)	Cubic yards	417	$60.00	$0 *	$25,020	$0	$25,020
Fill in Place (Imported Habitat Boulders)	Cubic yards	208	$279.69	$0 *	$58,176	$0	$58,176
Fill in Place (Imported Streambed Substrate)	Cubic yards	208	$80.13	$0 *	$16,668	$0	$16,668
Temporary Work Zone Isolation	Each	4	$1,500.00	$0 *	$6,000	$0	$6,000
Temporary Stream Diversion	Each	4	$1,500.00	$0 *	$6,000	$0	$6,000
LWM Type A - Rootwad	Each	10	$2,000.00	$0 *	$20,000	$0	$20,000
LWM Type B - Whole Tree	Each	9	$2,000.00	$0 *	$18,000	$0	$18,000
LWM Type C - Sweeper Logs	Each	1	$2,000.00	$0 *	$2,000	$0	$2,000
Permanent Seeding, Fertilizing and Mulching	Acres	0.8	$7,000.00	$0 *	$5,600	$0	$5,600
Weed Control	Acres	0.8	$1,500.00	$0 *	$1,200	$0	$1,200
Planting	Acres	0.8	$14,000.00	$0 *	$11,200	$0	$11,200
As built survey	Each	1	$7,000.00	$0 *	$7,000	$0	$7,000
			Category Sub-total	$195,888	$176,864	$0	$372,752
Travel and Training							
			$0	$0	$0	$0	$0
			Category Sub-total	$0	$0	$0	$0
Materials and Supplies							
			$0	$0	$0	$0	$0
			Category Sub-total	$0	$0	$0	$0
Equipment							
			$0	$0	$0	$0	$0
			Category Sub-total	$0	$0	$0	$0
Other							
TERO	Each	1	$13,047.00	$0 *	$13,047	$0	$13,047
			Category Sub-total	$0	$13,047	$0	$13,047
			Modified Total Direct Cost Amounts	$195,888	$189,911	$10,000	$395,799

Indirect Costs							
Federally Accepted 'de minimis' Indirect Cost Rate (up to 10%)	10%			$19,589	$0		$19,589
			Total	**$215,477**	$189,911	$10,000	$415,388

* = OWEB funds excluded from indirect.

Provide context and justification for how your budget was developed. Explain how project costs and/or rates were determined.

Project engineers provided a cost estimate for construction and oversight. Staff utilized the estimate and compared the costs with recent projects the NPT staff and project partners implemented. Costs were adjusted from the engineers estimate when materials and operator rates were proven to be more costly than estimated. Project staff rates provided for match were calculated based on current wage and fringe rates.

Does the budget identify a contingency amount for specific line item(s) within the Contracted Services and/or Material and Supplies budget category?

❍Yes
●No

Funding and Match

Fund Sources and Amounts

Organization Type	Name	Source Note	Contribution Type	Amount	Description	Status
Tribe	Nez Perce Tribe	Staff time for project management and monitoring	In-Kind - Labor	$10,000	Construction oversight, contract management and monitoring	Secured
Federal	Bonneville Power Administration	Implementation funding	Cash	$189,911	Implementation funding	Pending
Fund Source Cash Total			**$189,911**	**Fund Source In-Kind Total**		**$10,000**

Match

Contribution Source-Type: Description	Amount
Nez Perce Tribe-In-Kind - Labor: Construction oversight, contract management and monitoring	$10,000
Bonneville Power Administration-Cash: Implementation funding	$189,911
Match Total	**$199,911**

Do match funding sources have any restrictions on how funds are used, timelines or other limitations that would impact the portion of the project proposed for OWEB funding?

❍ Yes
● No

Do you need state OWEB dollars (not Federal) to match the requirements of any other federal funding you will be using to complete this project?

❍ Yes
● No

Does the non-OWEB cash funding include Pacific Coast Salmon Recovery Funds?

❍ Yes
● No

Uploads

Map: Map - Poley-Allen Fish Passage.pdf - Project location

Risk Assessment: r-RAform_OWEB_PA_app_Fall_2021.pdf - Risk Assessment

Photos: Poley-Allen_80PercentBOD_Site_Photos.pdf - Site Photographs

Reports: Poley-Allen_80PercentBOD.pdf - 80% BOD Report

Project Design: Poley-Allen_80Percent_Design_Drawings.pdf - 80% Design Drawings/Plan Set

Project Design: Poley-Allen_80PercentBOD_Various_Design_Analysis.pdf - 80% Design Hydrologic, Hydraulic, Sediment Mobility & LWM Stability Analysis

Land Use Form: NPT_PA_LandUse110121.pdf - Land Use Form

Secured Match Forms: PA_Match-Form_102921_NPT.pdf - Match Form

Plant Page

Planting Questions

Relationship to other conservation programs

❑ *This project will use OWEB funds to increase the planting density on CREP acres.*

Planting Activities

Describe the current condition of the site(s) to be planted.

The current conditions of the planting site is along the river right (east) bank adjacent to the existing irrigation diversion. The current surface material is comprised of a concrete abutment and rip rap/rock.

Describe how you will prepare the site(s) prior to planting and how those activities are appropriate considering the site conditions described in the previous question.

Following removal of the right bank abutment and rip rap, and grading of the bank landward, riparian revegetation will be conducted with willow stake plantings installed in trenches at approximately the OHWM line where the right bank will be restored (260 ft.).

Seeding as per the plan set/specifications will occur in all disturbed areas in the fall following construction.

Fill out the table below. Identify the vegetation communities you plan on planting in, the acres each vegetation community encompasses, and the density of your planting.

Vegetation Community	Acres	Density
Floodplain	0.01	260 stem/acre
Upland	0.8	10 lbs/acre

Fill out the table below for each vegetation community listed in the table above, provide the common and scientific names of up to five plants that will be planted, the form(tree, shrub, grass), type of plant (bare root, cutting, etc) and the planting timing.

Vegetation Community	Plants: Common Name	Plants: Scientific Name	Form	Type	Year	Month
Floodplain	Willow	Salix sp.	Tree	Cutting	2023	November
Upland	Annual Ryegrass	Lolium multiflorum	Grass	Seeds	2023	November
Upland	Idaho Fescue	Festuca idahoensis	Grass	Seeds	2023	November
Upland	Blue Wildrye	Elymus glaucus	Grass	Seeds	2023	November
Upland	Mountain Brome	Bromus carinatus	Grass	Seeds	2023	November

Plant Stewardship

After the plantings are installed, will you conduct plant stewardship ("free to grow")?

- ● Yes
- ❍ No

Are you requesting OWEB funds for plant stewardship activities?

- ❍ Yes
- ● No

Explain how you plan to carry out activities to help the plantings survive and grow over time.

The project will be inspected each spring annually for a minimum of 5 years post-implementation. Photo points, aerial photography, and annual on-site observations by the project sponsor will be employed to determine the success of the plantings. Additional seeding and planting will be conducted as early as the fall 3 years post-implementation and on an as needed annual basis to obtain optimal ground coverage with desirable species.

Locally sourced willows will be used for the cuttings.

Measures of Planting Success

Use the table below to explain how you will document and determine success for the plantings.

Vegetation Community	Parameter	Percentages
Upland	Percent Cover	70
Riparian	Percent Survival	70

If, in the course of the 3-5 years following planting, the success rate falls below your standard, what is your plan?

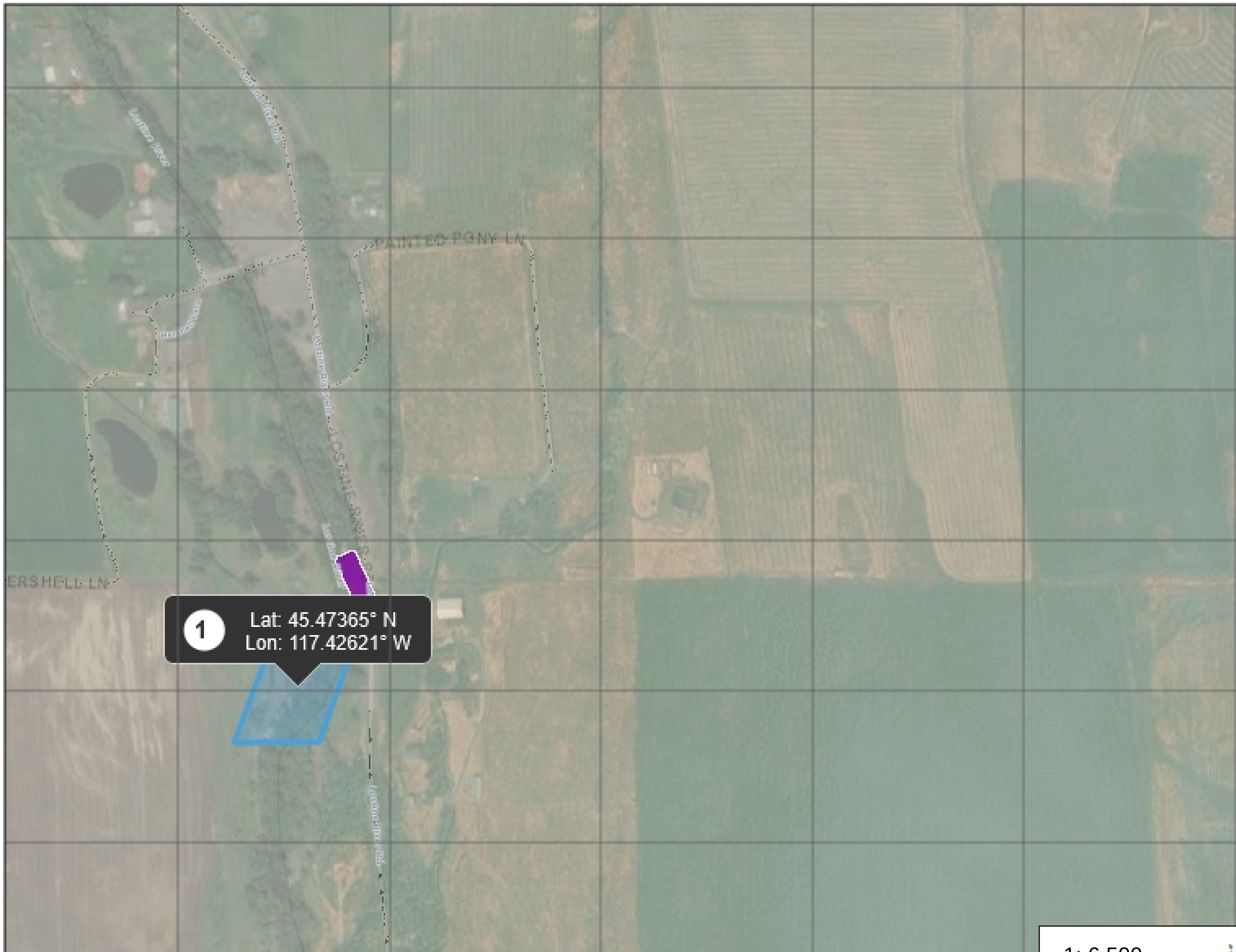
As stated above, the project sponsor will replant and/or reseed in any deficient areas as early as the fall 3 years post-implementation (2026), as needed.

Permit Page

Project Activity Requiring a Permit or License	Name of Permit or License	Entity Issuing Permit or License	Status
Roughened Channel Installation	HIP 401 Certification Removal-Fill 404 Section 106	NMFS & USFWS ODEQ ODSL ACOE SHPO	Not yet initiated
Concrete Sill and Abutment Removal/Modification	HIP 401 Certification Removal/Fill 404 Section 106	NMFS & USFWS ODEQ ODSL ACOE SHPO	Not yet initiated
Side Channel LWM Structure Placement	HIP 401 Certification Removal-Fill 404 Section 106	NMFS & USFWS ODEQ ODSL ACOE SHPO	Not yet initiated

Poley-Allen Fish Passage Project

-117°25'40" -117°25'30" -117°25'20" -117°25'10" -117°25' -117°24'50"



45°28'45" 45°28'40" 45°28'35" 45°28'30" 45°28'25" 45°28'20"

-117°25'40" -117°25'30" -117°25'20" -117°25'10" -117°2

1: 6,500

Legend

OWRI Features (1992-2017)

- Combined
- Estuarine
- Fish Passage
- Fish Screen
- Instream
- Instream Flow
- Riparian
- Road
- Upland
- Urban
- Wetland

Notes

Add your notes here

0.2 0 0.10 0.2 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere

State of Oregon – DAS Risk Management

Risk Assessment Toolkit

Risk Assessment Form

1. What is the specific activity?

The Nez Perce Tribe (Tribe) is applying for an Oregon Watershed Enhancement Board (OWEB) grant for stream restoration. All restoration activities proposed in the grant fall within permitted stream restoration action parameters. The removal of a diversion structure (sill) and installation of a roughened channel are the main project components. Large wood material (LWM) structure installation, channel excavation, seeding and riparian planting are other activities.

2. Does this activity fit the agency's mission, goals, objectives? Yes No
Describe:

This activity both OWEB's and the Tribe's mission, goals, and objectives. The Tribe's mission, as stated in the Nez Perce Tribe's Department of Fisheries Resources Management Plan (NPT DFRM Plan), is to "…protect and restore aquatic resources and habitats." This includes, but is not limited to, providing year round passage for the the benefit of multiple life stages of ESA listed species and their recovery.

Also, in the NPT DFRM Management Plan management goals, the Tribe aims to: Achieve and maintain in-stream physical habitat structure and function to support populations self-sustained by natural reproduction and consistent with historic conditions.

Installing LWM structures, a roughened channel and ensuring passage are consistent with the following project specific objective: Improve stream structure and channel complexity to increase juvenile salmonid rearing habitat; ensure fish passage.

3. Identify the risks associated with the activity. What are the potential loss exposures? See Risk Identification and Evaluation for assistance. For **contractual activities**, go to the Contracting Toolkit.

- What could go wrong?
- Who could be harmed?
- Identify each thing that could go wrong and enter each potential loss exposure into the table below.

Potential Loss Exposure	Severity	Likelihood	Risk Rating
Personal Injury	Insignificant	Rare	L

Property Damage	Minor	Unlikely	L

4. **Rate the severity of each potential loss exposure. How bad can it be? What could it cost?** Enter your decisions into the table above.
   1. Insignificant
   2. Minor
   3. Moderate
   4. Major
   5. Critical
5. **What is the likelihood that each of these potential loss exposures will happen?** Enter your decisions into the table above.
   1. Rare
   2. Unlikely
   3. Possible
   4. Likely
   5. Almost Certain

6. **Using the grid below, determine the risk rating for each potential loss exposure.** Enter your decision into the table above.

SEVERITY:	**Insignificant**	**Minor**	**Moderate**	**Major**	**Critical**
LIKELIHOOD:					
Almost Certain	**M**	**H**	**E**	**E**	**E**
Likely	**M**	**M**	**H**	**E**	**E**
Possible	**L**	**M**	**H**	**E**	**E**
Unlikely	**L**	**L**	**M**	**H**	**E**
Rare	**L**	**L**	**M**	**H**	**H**

Risk Rating:

- **Extreme Risk** – Involve senior management immediately, emergency situation, consider not doing the activity.
- **High Risk** – Management attention required for business and policy decisions, risk control, insurance types and limits, etc.
- **Moderate Risk** – Management should be kept informed of risk control, insurance types and limits, etc.
- **Low Risk** – Manage by routine procedures, insurance types and limits could be flexible.

7. **Consider and weigh the value of opportunities. What opportunities will be missed if the activity is not done? What is the upside and downside of these opportunities?**

Rating	Value	Description (Opportunity)
1	Insignificant	Minor budgetary, funding, or resource gain; Little or no gain in public and/or client relations.
2	Minor	Low budgetary, funding, or resource gain; Some gain in public and/or client relations.
3	Moderate	Moderate budgetary, funding, or resource gain; Adequate public and/or client relations.
4	Major	Major budgetary, funding, or resource gain; Good public and/or client relations.
5	Critical	Huge budgetary, funding, or resource gain; Excellent public and/or client relations.

8. **Based upon your risk assessment and the risk rating for each potential loss exposure, what tools are available to mitigate or manage the risks? Consider these options:**

- **Immunities:**
  - Does the agency have any statutory immunity? Yes No
  - Does the statutory immunity apply to the activity? Yes No
  - Do you have a legal opinion on the statutory immunity? Yes No
  - What are the limitations and/or exclusions of the statutory immunity?

OWEB is best able to address issues associated with state immunity.

The Tribe is a federally-recognized Indian tribe with inherent sovereign immunity acknowledged by federal and state courts. The Tribe chooses to grant limited waivers of its inherent governmental sovereign immunity.

- **Risk Control Measures** - See Risk Control Methods and Measures for assistance.
  - Which measures can be used to minimize the potential loss exposures identified in your risk assessment based upon its risk rating and your mission?
  - How can measures be implemented?
  - Who will be responsible for implementation, follow-up, and/or monitoring?

Risk Control Measure	How can the measure be implemented?	Who will implement, follow-up and monitor?

- **State Self-Insurance or Commercial Insurance Coverage for State Activities:**
  - Does the state's self-insurance policies or additional commercial insurance cover the activity? (Consider all functions necessary to accomplish the activity.)

OWEB is best able to address issues of state self-insurance or commercial insurance for state activities.

If there are any questions concerning the Tribe's insurance, please contact Julie Kane, Managing Attorney, Nez Perce Tribe Office of Legal Counsel, 208-843-7355.

Note: If the coverage applies, document your answers to the following questions for each coverage: Are there any special requirements that the agency must follow to obtain coverage? What are the limits of coverage? Are there any coverage exclusions or limitations that apply?

- Workers' Compensation Yes No
- Property Self-Insurance Policy Yes No
- Agency Liability Self-Insurance Policy Yes No
- Employee Liability Self-Insurance Policy Yes No
- Employee Dishonesty Policy Yes No
- Volunteer Injury Coverage Yes No

- Alcohol Risk Control Policy   Yes   No

- Additional Commercial Coverage   Yes   No

  - If no self-insurance or commercial coverage apply, does agency management want DAS Risk Management to explore the option to purchase commercial insurance for the activity? Yes   No - If yes, contact DAS Risk Management 503-373-7475.

APPENDIX B
Site Photographs

Photograph 1. Existing Poley-Allen irrigation forebay.

Photograph 2. Existing Poley-Allen irrigation headgate.

Site Photographs
Lostine River Poley-Allen Fish Passage Design Lostine, Oregon

GEOENGINEERS | **Figure B-1**

00571-021-00 Date Exported: 05/07/2021

Photograph 3. Existing Poley-Allen diversion sill, irrigation intake, and abutment.

Site Photographs

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers

Figure B-2

Photograph 4. Existing boulder steps downstream of Poley-Allen diversion sill.

Photograph 5. Existing boulder steps downstream of Poley-Allen diversion sill.

Site Photographs

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GEOENGINEERS

Figure B-3

Photograph 6: Upstream reach looking upstream at sill and the plane bed morphology and left-bank channel armoring.

Photograph 7. Side channel inlet upstream of sill. Photo facing downstream.

Site Photographs

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers

Figure B-4

Photograph 8: Right bank high-flow side channel.

Site Photographs

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers

Figure B-5

80 Percent Basis of Design Report

Lostine River Poley-Allen Fish Passage
Lostine, Oregon

for
Nez Perce Tribe

September 24, 2021

GeoEngineers

80 Percent Basis of Design Report

Lostine River Poley-Allen Fish Passage
Lostine, Oregon

for
Nez Perce Tribe

September 24, 2021

GeoEngineers

523 East Second Avenue
Spokane, Washington 99202
509. 363.3125

80 Percent Basis of Design Report

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

File No. 0571-021-00

September 24, 2021

Prepared for:

Nez Perce Tribe
P.O. Box 909
Joseph, Oregon 97846

Attention: Kathryn Frenyea

Prepared by:

GeoEngineers, Inc.
523 East Second
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Alex K, Morton, PE
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Ryan S. Carnie, PE, CFM
Senior Water Resources Engineer

Jason R. Scott, FP-C
Associate Fisheries Scientist

AKM:RSC:JRS:mls

GeoEngineers

Table of Contents

APPENDICES

LIST OF ACRONYMS

BPA – Bonneville Power Administration

cfs – cubic feet per second

ESA – Endangered Species Act

HIP – Habitat Improvement Program

LWM – large woody material

NMFS – National Marine Fisheries Service

NPT – Nez Perce Tribe

ODFW – Oregon Department of Fish and Wildlife

OWRD – Oregon Water Resources Department

POD – Point of Diversion

RRT – Restoration Review Team

RSI – Resource Specialists, Inc.

USACE – U.S. Army Corps of Engineers

USGS – Unites States Geological Society

1.0 INTRODUCTION

GeoEngineers, Inc. (GeoEngineers) has prepared this 80 Percent Basis of Design report (report) for the Nez Perce Tribe (NPT). This report provides a summary of our findings pertaining to the existing conditions of the Lostine River Poley-Allen project site near Lostine, Oregon, and an explanation of the design process, analyses, and preliminary outcomes for the proposed enhancement design.

GeoEngineers organized the following sections of this report to describe the General Project and Data Summary Requirements 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 step 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 reach are described in terms of processes that shaped the stream and associated ecosystem within the context of various ecological disciplines. This includes discussions on hydrology, hydraulics, habitat, and geomorphology. The evaluation and consideration of the site conditions provide the basis for the project design.

- Appendix A—80 Percent Design Drawings
- Appendix B—Site Photographs
- Appendix C—Hydrologic and Hydraulic Analyses
- Appendix D—Sediment Mobility Analysis
- Appendix E—Large Woody Material Stability Analysis
- Appendix F— Construction Quantities and Estimate of Anticipated Costs
- Appendix G—Restoration Review Team Comment and Response Form
- Appendix H—Report Limitations and Guidelines for Use

1.1. Project Responsible Parties

- The project sponsor is the NPT, and the project manager is Kathryn Frenyea, 541.432.2506.
- The prime design consultant is GeoEngineers, Inc. and the engineer of record is Ryan S. Carnie, PE, 208.258.8326.

1.2. Site Location

The project site is located at a privately owned irrigation diversion structure that crosses the Lostine River approximately 1 mile south of the town of Lostine, Oregon (Figure 1, Vicinity Map). More specifically, the project site is located at river mile 4.8 on the Lostine River and generally includes the mainstem Lostine River and the Poley-Allen irrigation diversion structure and intake (see Drawings 1.1 and 2.1 in Appendix A, 80 Percent Design Drawings). Notable features of the site include:

- An existing fish drum screen downstream of the point of diversion (within the upland area west of the river).
- A channel-spanning concrete sill with a low-flow fishway at the point of diversion.

- A concrete abutment at the concrete sill along the river right bank.
- Approximately 170 feet of existing riprap lining the left bank, upstream and downstream of the point of diversion.
- A high-flow side channel along the river right floodplain. The side channel inlet and outlet are approximately 400 feet upstream and 180 feet downstream of the point of diversion, respectively.

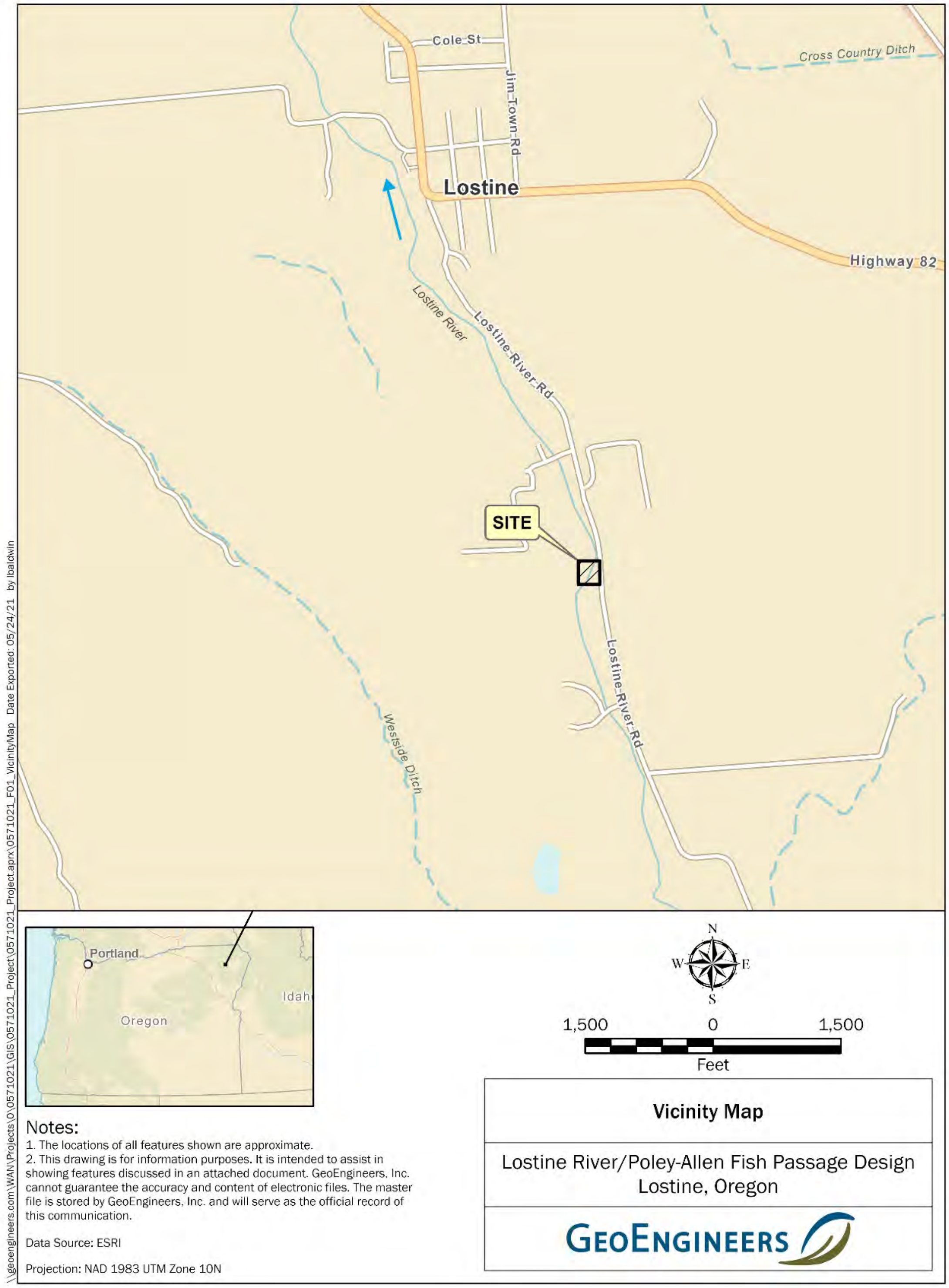


Figure 1. Vicinity Map

2.0 PROJECT BACKGROUND

The existing Poley-Allen irrigation diversion is located on the west side of the Lostine River and consists of a headgate intake structure, a forebay with a second headgate that provides the irrigation water to a gravity-driven open channel (Photos 1 and 2, Appendix B, Site Photographs). A drum screen is located approximately 470 feet north of the irrigation diversion with a piped fish return. The diversion includes a sill located between two concrete abutments on each channel bank and holds a series of boards in the vertical slots in six concrete piers (Photo 3, Appendix B). The boards are used to maintain a minimum water surface elevation that provides the hydraulic head required to deliver between 9 and 11 cubic feet per second (cfs) into the irrigation ditch.

A low-flow fish passage channel is located on the west side of the sill and is adjacent to and connected with the irrigation diversion entrance. The passage channel does not appear to be functioning well and likely not able to reliably pass fish during low flows. The passage channel is oriented such that passing fish are encouraged into the apparent velocity refugia of the irrigation forebay and fish entrainment within the irrigation system further discourages fish passage.

The Poley-Allen diversion sill and the channel downstream are a profile discontinuity. Downstream of the sill, the streambed is armored and there are three locations where boulder steps create water surface elevation drops that exceed one vertical foot during low flow and are fish passage barriers. One boulder step is approximately 10 feet downstream of the sill and another is approximately 60 feet downstream of sill (Photos 4 and 5, Appendix B). The third boulder step exists within the main channel, approximately 120 feet downstream of the sill.

The confluence of the main channel and an existing side channel is on the right (eastern) side of the main channel, approximately 180 feet downstream of the sill. At the confluence, the side channel bed and the right bank of the main channel are comprised of angular riprap with material sizes up to 5 feet in diameter. Angular riprap also lines the left (western) embankment approximately 170 feet downstream from the sill, which limits floodplain connectivity on the left bank. The concrete abutment and riprap scour protection that exists on the right (eastern) bank at and near the sill limit floodplain connectivity in this location.

The left (western) channel bank upstream of the sill is lined with riprap for approximately 270 feet. The channel bedform upstream of the sill is plane-bed with boulders exposed above the water surface elevation at low flows and lacks a distinct low-flow thalweg (Photo 6, Appendix B). The left bank channel armoring upstream of the sill limits channel migration and prevents floodplain connectivity. The side channel inlet exists approximately 400 feet upstream of the sill on channel right (eastern) (Photo 7, Appendix B). Evidence of anthropogenic grade control efforts at the side channel inlet include an exposed sheet pile wall. The side channel appears to activate at flows less than the bankfull event but does not convey flow during low-flow periods. The existing side channel inlet bed is comprised of rounded boulders and cobble (Photo 7, Appendix B).

The side channel extends approximately 570 feet on the right (eastern) side of the main channel. The side channel has a defined bed and bank, which suggests flow is present at least annually (Photo 8, Appendix B). Overall, however, the side channel lacks complex structure such as large woody material (LWM) and as a result, low velocity juvenile rearing areas are sparse, but potential for restoring them is high.

2.1. Project Goals, Objectives and Constraints

The outcome of this project will maximize year-round fish passage for all life history stages of Bull Trout, steelhead, and Chinook Salmon, while maintaining access to irrigation water for current water rights holders.

2.1.1. Goal

The current diversion structure is an upstream passage barrier for Endangered Species Act (ESA)-listed spring/summer Chinook Salmon, steelhead and Bull Trout. The goal of this project is to restore fish passage through the Poley-Allen diversion structure while maintaining a minimum water surface elevation upstream of the diversion structure sufficient for the delivery of legal irrigation withdraws for he associated landowners.

2.1.2. Objectives

1. Develop and select a fish passage design for juvenile and adult Bull Trout, steelhead, and spring/summer Chinook Salmon during periods of migration that achieve Oregon Department of Fish and Wildlife (ODFW) and National Marine Fisheries Service (NMFS) fish passage criteria to the greatest extent practical.
2. Develop a fish passage design that maintains access and use of irrigation water for water rights holders and irrigators.
3. Provide a sustainable, permittable, and easily maintained proposed condition at a reasonable cost.

2.1.3. Constraints

- Management of the timing and quantity of water delivery to the water rights holder will be unchanged.
- Limited stream flow during the late-summer irrigation period.
- Rural residential infrastructure within the floodplain.
- Non-engineered levees along both banks of the main channel.
- Significant bedload transport and deposition throughout the project extent.
- Vertical channel incision downstream of the existing diversion sill.

3.0 EXISTING CONDITIONS

3.1. Hydrology

The Lostine River drains a portion of the Eagle Cap Wilderness of the Wallowa Mountains. It generally flows from southeast to northwest to the confluence with the Wallowa River, downstream of the project site (Figure 2). The upper watershed includes Minan Lake at the headwaters at an approximate elevation of 7,400 feet above mean sea level. Discharge in the Lostine River is impacted by irrigation diversions. The United States Geologic Survey's (USGS) online application "StreamStats" was used to delineate watershed area for both the project site and Oregon Water Resources Department's (OWRD) gage ID 13330000 (USGS 2019). The estimated drainage basin area at the project site was 83.9 square miles and the estimated drainage basin area at the OWRD gage was 71.5 square miles.

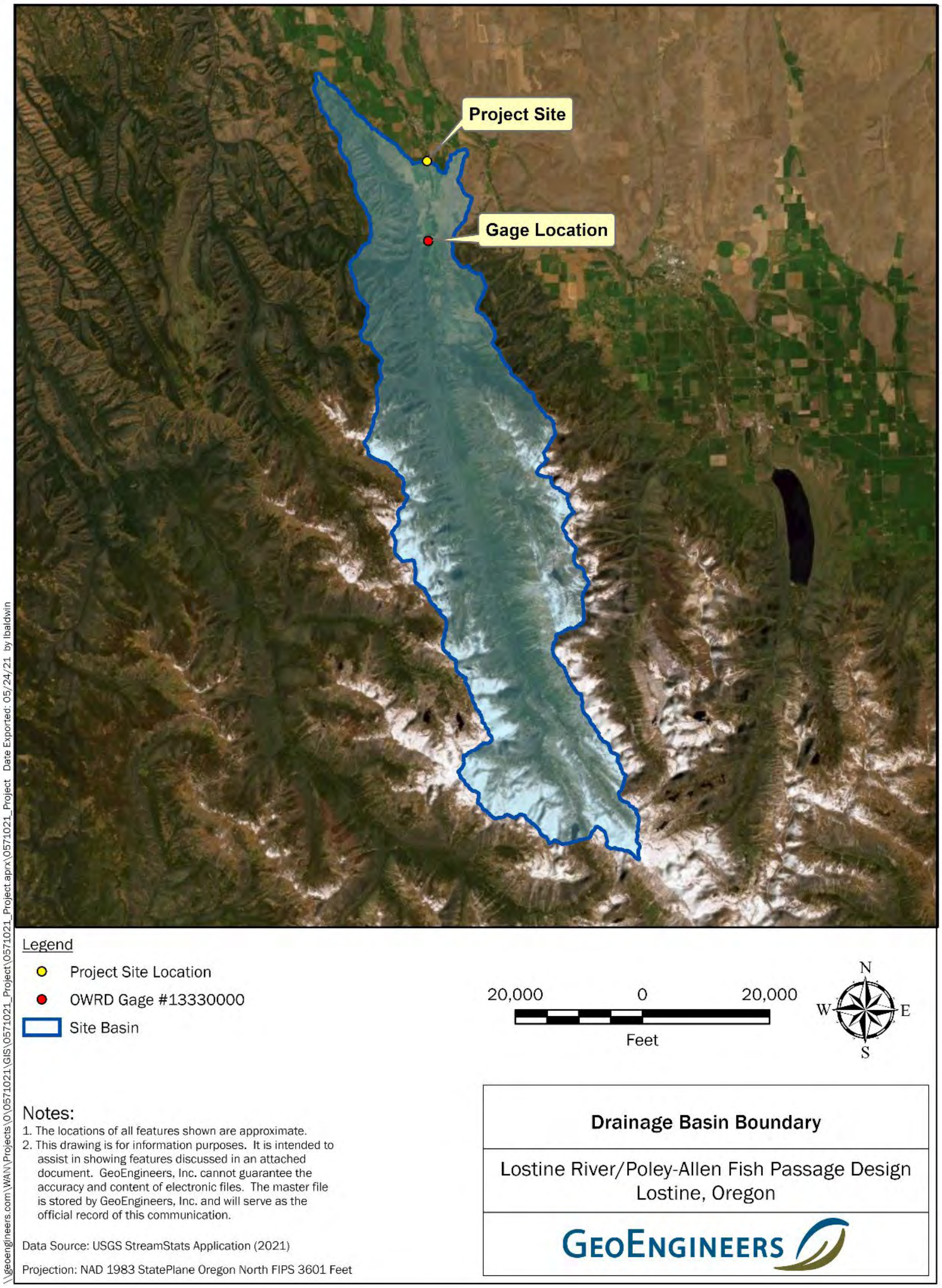


Figure 2. Drainage Basin Boundary

3.1.1. Peak Recurrence Interval Flows

GeoEngineers performed a hydrologic assessment of the Lostine River at Poley-Allen irrigation diversion. Annual peak flows at the project site were estimated using the nearby OWRD gage. OWRD gage ID 13330000 is located along the Lostine River, approximately 2.5 miles upstream of the project site. The peak flow analysis included the record of historical annual peak flows between 1913 and 2012 and instantaneous measurements from October 1, 2014 through April 20, 2021. OWRD's historical data set was missing water years 1914 through 1925 as well as 1992 through 1995. These years were not included in the analysis. Instantaneous flow data during water year 2021 was also not included due to the incomplete data set at the time of hydrologic analysis.

The U.S. Army Corps of Engineers, Hydrologic Engineering Center's (HEC) Statistical Software Package (HEC-SSP) version 2.2 was used to perform a Log Pearson III (LP3) Bulletin 17C analysis (flow frequency analysis) for the Lostine River at the OWRD gage 13330000 location. HEC-SSP fits the stream gage record data to a LP3 statistical distribution to estimate peak flows at specified recurrence intervals (USACE 2019). The drainage area at the Poley-Allen site is larger than the drainage area at the Lostine River's stream gage. To account for this, the resulting flows were scaled to the project area using OWRD's Region 3 scaling equation (Cooper 2006). Peak flow results at the project site are summarized in Table 1.

3.1.2. Low-Flow Hydrology

GeoEngineers also performed a low-flow hydrologic analysis for Lostine River at the Poley-Allen irrigation diversion using the historical average daily flow data from the same OWRD gages. We calculated the median (50 percent) flow exceedances for each month of the year using the daily average flow data beginning on September 1, 1912 through September 30, 2012.

Low-flow design flows, used to assess habitat conditions, were selected from the monthly flow exceedance data. The August 95 percent exceedance flow was selected to assess the upstream fish passage conditions for Chinook Salmon (Northwest Power and Conservation Council 2004, ODFW 2006). The 95 percent exceedance flow rate for April and May (for simplicity, this report will refer to flow as April) was selected to assess the fish passage conditions for spawning steelhead (Northwest Power and Conservation Council 2004). Basin scaling was applied to the exceedance flows to account for the differences in contributing area between the project site and the gage (Cooper 2006) (Table 1).

TABLE 1. DESIGN FLOWS

Annual Chance Probability (%)	Return Period (years)	Project Site Flow (cfs)
67	1.5	1,584
50	2	1,787
10	10	2,389
2	50	2,735
1	100	2,850
Chinook Salmon Low-Fish Passage Flow – August 95% Exceedance[1]		38
Steelhead Low-Fish Passage Flow - April 95% Exceedance[1]		107

Notes:

[1] Mean daily average stream discharge that is exceeded 95 percent of the time during the period when ODFW determines that native migratory fish require fish passage.

3.2. Geomorphology

The project reach of the Lostine River is situated in an unconfined floodplain. The valley is comprised of geologic units mapped as Quaternary-age alluvial deposits of the Quaternary Surficial Deposits Group of mixed grain sediments (DOGAMI 2015). These surficial terrace deposits provide moderate confinement of the Lostine River and floodplain.

Lateral channel migration and floodplain connectivity are limited by channel modifications through the project reach. Upstream of the existing head gate, the river and floodplain are moderately confined by angular riprap on the left channel bank. Lateral migration and floodplain connectivity are severely limited at the existing sill and headgate location due to the existence of the concrete abutments and riprap embankments located on both sides of the main channel. Downstream of the irrigation facility, both sides of the main channel include placed riprap limiting lateral migration. The riprap on the left channel bank is higher than the riprap on the right bank and extends downstream at a greater distance. Therefore, the effects on lateral migration and high-flow containment are greater on the left bank than on the right bank. The channel is unconfined on the right bank and the existing side channel conveys water during bankfull conditions and higher.

The Lostine River is predominantly single thread upstream and downstream of the project site. The channel bed through the project reach lacks a distinct low-flow thalweg. The bankfull width, based on hydraulic model results of the 1.5-year flow, is approximately 50 feet. The location of the bankfull width calculation was upstream of the sill and downstream of the inlet of the existing side channel.

The sub-reach through the project site includes a side channel that is located to the east of the main channel. The side channel inlet is approximately 400 feet upstream of the sill and conveys flow during bankfull discharge events. Grade control at the inlet of the side channel exists in the form of a driven sheet pile wall and the top of the wall is at the existing side channel inlet elevation.

The project reach, upstream of the existing sill, is a plane-bed response reach with a longitudinal slope of approximate 1.9 percent and appears to be in sediment transport equilibrium. Transported bedload is supplied to the reach in quantities that match the transport capacity. This condition is dependent on the operation of the irrigation diversion and removal of the boards is required to convey the upstream bedload. Vertical stability of the reach is dependent on the channel spanning concrete sill and vertical degradation downstream of the sill is evident.

Surface grain sizes were sampled on a gravel bar approximately 150 feet upstream of the sill to approximate the grain sizes that are mobilized during bank forming discharge events (Table 2).

TABLE 2. GRAVEL BAR SUBSTRATE GRAIN-SIZE SUMMARY STATISTICS

Grain Size Statistic	Grain Size (in)
D_{100}	7.8
D_{85}	5.4
D_{50}	3.1
D_{15}	1.5
D_{5}	0.9

3.3. Fish Use and Habitat Availability

The Lostine River and this project area historically included abundant populations of spring/summer and fall run Chinook Salmon (*Oncorhyncus tsawytscha*), Sockeye Salmon (*O. nerka*), Coho Salmon (*O. Kisutch*), summer run steelhead/Rainbow Trout (*O. mykiss*), Bull Trout (*Salvelinus confluentus*) and Pacific Lamprey (*Lampetra tridentata*) (Nez Perce and Wallowa County 1999, Northwest Power and Conservation Council 2004). Fish populations began declining in the watershed beginning with the extirpation of Sockeye Salmon in 1905. By the 1980's Coho Salmon were declared extinct, and rapidly declining Chinook Salmon led to an ESA-threatened listing in 1992 (Nez Perce and Wallowa County 1999, Northwest Power and Conservation Council 2004, NOAA Fisheries 2017, Vatland 2018). In 1997, Snake River steelhead were listed as threatened, and in 1998 Bull Trout were listed threatened (NOAA Fisheries 2017, U.S. Fish and Wildlife Service 2015).

Despite fish population declines, the Lostine River still supports Chinook, steelhead, Bull Trout and reintroduced Coho Salmon. In the case of spring/summer Chinook Salmon, populations have shown improvement. Vatland and Maxwell (2018) reported that between 1997 and 2017, returning Chinook Salmon varied annually but generally increased. Prior to the supplementation program (1986–2000) redd counts in the Lostine River averaged 55 (range 11 to 182). After supplementation (2001–2017) redd counts averaged 274 (range 104 to 696). Bull Trout populations appear to be relatively stable (Sausen 2019) and steelhead are present through the project reach and upstream.

Regionally, there are numerous contributing causes for species declines which include hydropower development, overharvest, irrigation development, logging, mining, agriculture conversion, and many others (Nez Perce and Wallowa County 1999, Northwest Power and Conservation Council 2004, NOAA Fisheries 2017, U.S. Fish and Wildlife Service 2015). Locally at this project site, fish passage is the most significant cause of species declines. Radio telemetry studies identified the Poley-Allen Diversion as a partial migration barrier to adult Chinook, which is restricting access to high-quality spawning and rearing habitat upstream (Vatland 2018).

3.4. Irrigation Use and Intake Summary

The existing point of diversion delivers a water right of approximately 9 to 11 cfs to an existing rotating drum screen approximately 470 feet downstream of the diversion. The irrigation facility includes a flow measuring gage approximately 130 feet downstream of the diversion.

4.0 DESIGN DEVELOPMENT

The project design development focused on mitigating fish passage limitations associated with the mechanical manipulation of the channel and providing irrigation water to the water right holders. The design development also included side-channel habitat improvements with LWM structures. Proposed actions were collaboratively developed with the landowners and the NPT and the roughened channel was identified as the preferred alternative for providing fish passage while maintaining the necessary head for irrigation delivery. The proposed actions involve constructing a roughened channel, modifying the existing concrete sill, and removing the existing abutment on the right channel bank. Habitat boulders will be placed within the roughened channel for hydraulic complexity and roughness.

4.1. HIP 4 Biological Opinion Considerations

The proposed actions for the Poley-Allen Fish Passage Restoration project include the following categories of action as defined by the BPA HIP Guidelines (Bonneville Power Administration 2021).

- Category of Action: Fish Passage Restoration
  - HIP Category 1a—Dams or Control/Legacy Structures Removal
  - HIP Category 1b—Consolidate or Replace Irrigation Structures
  - HIP Category 1c—Headcut and Grade Stabilization
- Category of Action: River, Stream, Floodplain and Wetland Restoration
  - HIP Category 2a—Improve Floodplain Connectivity
  - HIP Category 2d—Install Habitat-Forming Natural Structures

The following subsections describe the project elements designed under the responsible charge of an engineer licensed in the state of Oregon. Each project element description will be summarized in more detail in subsequent design stages. The general conservation measures are included within the design drawings in Appendix A.

4.1.1. Proposed Project Element 1: Modification of Existing Concrete Sill and Abutment

Modifying the existing channel spanning concrete sill and the concrete abutment is shown on the design drawings in Appendix A. The project proposes to remove approximately 2 feet of concrete from the top of the sill. Concrete should be roughened to help promote retention of sediment. A low flow channel will be developed during construction through the usage of habitat boulders. The right bank concrete abutment causes a flow contraction. Removal of the abutment and grading of the bank landward of the abutment as shown in Appendix A will reduce the flow contraction at this location and improve streambed stability. The depth of the existing sill and abutment footings are not known at this time. Removal of the abutment and grading of the embankment at this location will also improve floodplain connectivity in the reach.

4.1.2. Proposed Project Element 2: Roughened Channel

A roughened channel will be comprised of an engineered streambed material designed to transport bedload sediment and remain stable during the 100-year discharge. Boulders will be placed within the roughened channel for hydraulic complexity and roughness. The roughened channel has approximately 150 feet of length at a longitudinal slope of 5.8 percent. Segments of the mainstem channel upstream and downstream of the roughened channel include an engineered streambed mix and allow for a gradual transition to the background channel slope. Collectively, these transition segments include approximately 30 feet downstream and 30 feet upstream of the roughened channel. A transition is proposed downstream of the 5.8 percent slope section to absorb hydraulic energy and reduce the risk of a head cut propagating at the transition reach. A low-flow channel thalweg will be constructed in the field through grading and the placement of habitat boulders. Proposed habitat boulders are designed to match or be larger than the proposed sediment gradation's D100 (Table 3). The roughened channel and proposed cross sections are shown in the design drawings in Appendix A. Irrigation water will continue to be collected through the existing concrete forebay on the western side of the channel, also shown in the design drawings in Appendix A.

Roughened channel gradation was designed to remain stable up to the 100-year flow event and is coarser than the existing sediment gradation (Bonneville Power Administration 2021). The proposed gradation is composed of 20 percent Streambed Sediment; 40 percent 12- to 18-inch Streambed Cobbles; and an additional 40 percent 28- to 48-inch Streambed Cobbles (Appendix D, Sediment Mobility Analysis). Table 3 presents the combined design sediment gradation of the proposed roughened channel.

TABLE 3. COMBINED ROUGHENED CHANNEL DESIGN SEDIMENT GRADATION

Grain Size Statistic	Grain Size (in)
D_{100}	48.0
D_{85}	35.2
D_{50}	16.5
D_{16}	2.0

4.1.3. Proposed Project Element 3: Large Wood Habitat Structures

A series of LWM structures is proposed within the side channel east of the diversion structure. The LWM structures are comprised of several log types designed to increase channel complexity and create diverse fish habitat. Stability calculations for individual logs were analyzed and can be seen in Section 5.2.1 and Appendix E. The LWM structure types proposed through the side channel are described below and quantified in Tables 4 and 5.

- **Single Log/Side Channel Roughness Structures**—Single logs will be placed within the side channel to add complexity and diverse habitat. These structures will also increase roughness within the side channel.
- **Sweeper Logs**—Sweeper logs will be placed on the left bank of the side channel. Sweeper logs will be placed within or alongside other LWM structures to add additional hydraulic diversity by locally redirecting flow and creating scour.
- **Buried Snag**—Buried snags, or full trees, will be placed within the active side channel and along the banks. Buried snags help to slow stream velocities, develops resting refuge and cover.

TABLE 4. PROPOSED LARGE WOODY MATERIAL STRUCTURE TYPES

Structure Type	Description	No. of Structures	Log Type 1	Log Type 2	Log Type 3
A	Rootwad	10	1		
B	Whole Tree	4			1
C	Sweeper Logs	1		2	
	Total	15	10	2	4

TABLE 5. PROPOSED LARGE WOODY MATERIAL LOG SCHEDULE

Log Type	Length (ft)	Min. Dia. (in)	Max. Dia. (in)	Avg. Dia. (in)	Rootwad[1] (Y/N)
1	30	12	18	15.0	Y
2	30	9	12	10.5	N
3	30	12	18	15.0	Y

Note:

[1] Rootwads must be at least two times the log's diameter at breast height (DBH)

4.1.4. Proposed Project Element 4: Riparian Vegetation Planting

The proposed revegetation plan is shown on the design drawings in Appendix A. Construction of the roughened channel and removal of the right bank abutment will result in relatively minimal riparian disturbance, particularly for trees and shrubs. Side channel wood placement will be done in a manner that avoids damage to existing riparian vegetation. Therefore, riparian revegetation will be conducted with stake plantings installed in trenches at approximately the OHWM line where the right bank will be restored. There will be disturbance associated with site access and staging; however, those areas will largely be in field type areas dominated grasses and forbs. As such, these disturbed areas will be reseeded with a native seed mix shown on Drawings 7.1 and 7.2 in Appendix A.

5.0 HYDRAULIC MODELING AND ANALYSIS

5.1. Model Development

GeoEngineers developed a two-dimensional hydraulic model of the project reach using the U.S. Bureau of Reclamation's Sedimentation and River Hydraulics—Two Dimension (SRH-2D) Version 3.2.3 (USBR 2017) computer program, a two-dimensional hydraulic and sediment transport numerical model (Aquaveo 2018).

5.1.1. Model Domain

The model encompasses an approximate 1,000-foot reach of the Lostine River including the project site. Laterally the model spans roughly 500 feet. Appendix C, Hydrologic and Hydraulic Analysis, shows the model domain.

5.1.2. Model Elevation Surface

SRH-2D requires a topographic surface to represent bathymetric and overbank areas in the model. We obtained bathymetric survey data from Resource Specialists, Inc. (RSI) that was completed in November 2020. RSI used the survey data to develop a two-dimensional surface. We used the two-dimensional surface to prepare the existing conditions model elevation surface. GeoEngineers developed the proposed conditions model elevation surface by modifying the existing two-dimensional model elevation surface to reflect conditions described as the proposed project elements (Sections 4.1.1, 4.1.2, 4.1.3 and 0).

5.1.3. Mesh Development

SRH-2D requires development of a mesh, which is a network of triangles and quadrilaterals that make up the computational cells (elements) of the model in which model results are computed. Element size is dictated through definition of node spacing within breaklines. Breaklines are created in the mesh to define important features in the surface (e.g., roads, the river channel, riverbanks, levees, etc.). GeoEngineers created an existing conditions model mesh with breaklines at the top and toe of banks to better model rapid elevation changes. Each point in the mesh (node) has an elevation associated with it, which is defined from the topographic surface input. The existing conditions mesh at the sill replicated a condition without boards in place and the mesh node elevations matched the surveyed sill surface elevation.

5.1.4. Model Roughness

Manning's n is a parameter used in the model to represent roughness of surfaces. Manning's n values are defined within SRH-2D using coverages that define Manning's n regions with polygons. Manning's n regions throughout the existing model domain include the channel, side channel, floodplain, concrete diversion elements, and the proposed conditions channel and LWM. Manning's n roughness values were estimated using roughness values published in V.T. Chow's Open Channel Hydraulics Manning's reference table (Chow 1959). Manning's n coverage values and extents are shown in Table 6 and Appendix C, respectively.

TABLE 6. MANNING'S N VALUES

Category	Manning's n Value
Existing Channel Bottom	0.040
Existing Riprap Banks	0.070
Existing Side Channel Bottom	0.050
Existing Concrete Structure	0.013
Existing Downstream Boulder Structures	0.070
Existing Wooded Floodplain	0.100
Existing Channel Banks	0.060
Proposed Roughened Channel	0.070
Proposed LWM	0.200

5.1.5. Boundary Conditions

The SRH-2D hydraulic model requires upstream and downstream boundary conditions. Upstream boundary conditions were defined as an inflow boundary that introduced flow into the model (Table 7). Downstream boundary conditions were defined as a normal depth water surface elevation calculated by SRH-2D using the surface, a composite Manning's n, the downstream channel slope, and the flow.

TABLE 7. MODELED FLOW VALUES

Model Condition	Purpose	Return Interval	Discharge (cfs)
Existing and Proposed	Sediment Mobility / Bankfull Width	1.5-year flow	1,584
Existing and Proposed	Material Stability / Floodplain Inundation	100-year flow	2,850
Proposed	Fish Passage (Chinook)	August 95% Exceedance	38
Proposed	Fish Passage (Steelhead)	April 95% Exceedance	107

5.1. Existing Model Results

Existing hydraulic model results for this report include visual and tabular results for two peak annual flows including the 1.5-year and the 100-year flow (Table 7). Visual plan-view hydraulic results for water depth, velocity, and shear stress are presented in Appendix C. Tables 8 and 9 and reflect cross sectional average water surface elevation, maximum water depth, average velocity, and average shear stress values for existing model conditions. Cross sectional data was extracted upstream of the point of diversion and downstream of the existing irrigation diversion within the existing boulder step section. Specific data extraction locations can be seen in Appendix C.

TABLE8. PEAK ANNUAL FLOW EXISTING CONDITIONS MODEL RESULTS 1.5-YEAR FLOW

Cross Section Location	Average Water Surface Elevation (ft, NAVD88)	Maximum Depth (ft)	Average Velocity (ft/s)	Average Shear Stress (lb/sf)	Top Width (ft)
Upstream of Point of Diversion (POD)	3435.2	5.3	6.1	1.4	50
Boulder Steps (Roughened Channel)	3429.6	6.0	6.1	3.7	49

TABLE 9. PEAK ANNUAL FLOW EXISTING CONDITION MODEL RESULTS 100-YEAR FLOW

Cross Section Location	Average Water Surface Elevation (ft, NAVD88)	Maximum Depth (ft)	Average Velocity (ft/s)	Average Shear Stress (lb/sf)	Top Width (ft)
Upstream of POD	3436.8	7.1	5.9	1.6	64
Boulder Steps (Roughened Channel)	3430.9	7.4	7.4	5.1	55

5.2. Proposed Model Results

Tables 10 and 11 present the proposed model peak annual flow output at the same cross section locations as the existing model conditions. Visual plan-view hydraulic results for water depth, velocity, and shear stress are presented in Appendix C.

Maximum water depth increased at the cross section upstream of the POD between the existing and proposed models for both the 1.5- and 100-year design flows. This increase of depth can be attributed to the increase in channel elevation at the crest of the roughened channel. Maximum velocities between the proposed and existing conditions models decreased at the cross section upstream of the POD due to subsequential increase in water depth and increase in Manning's roughness.

The downstream cross section results show an opposite trend compared to the upstream cross section location. A decrease in water depth and increase in velocity can be attributed to the steeper slope that is created on the downstream side of the roughened channel.

TABLE 10. PEAK ANNUAL FLOW PROPOSED CONDITIONS MODEL RESULTS 1.5-YEAR FLOW

Cross Section Location	Average Water Surface Elevation (ft, NAVD88)	Maximum Depth (ft)	Average Velocity (ft/s)	Average Shear Stress (lb/sf)	Top Width (ft)
Upstream of POD	3436.2	6.4	4.5	1.9	59.0
Roughened Channel	3430.2	3.1	9.0	8.8	57.0

TABLE 11. PEAK ANNUAL FLOW PROPOSED CONDITIONS MODEL RESULTS 100-YEAR FLOW

Cross Section Location	Average Water Surface Elevation (ft, NAVD88)	Maximum Depth (ft)	Average Velocity (ft/s)	Average Shear Stress (lb/sf)	Top Width (ft)
Upstream of POD	3437.3	7.6	6.1	3.3	71.0
Roughened Channel	3431.2	4.1	10.4	10.6	61.0

TABLE 12. ROUGHENED CHANNEL FISH PASSAGE RESULTS

Low-Fish Passage Design Flow	Maximum Depth (ft)	Average Velocity (ft/s)
August 95 Percent Exceedance	0.4	2.5
April 95 Percent Exceedance	0.7	3.5

5.2.1. Bedload Transport

Sediment mobility of the surface grain sizes sampled on gravel bars upstream of the in-stream irrigation structure (Table 2) was analyzed using the Critical Shear Method (United States Forest Service 2008). The Critical Shear Method of sediment transport calculations is appropriate for channels with well-graded sediment and longitudinal slopes less than 4 percent. The location of focus upstream of the proposed roughened channel has a channel gradient of 1.9 percent. Therefore, the Critical Shear Method for analyzing bed mobility is applicable to this bedload transport assessment. Average modeled shear stress values were extracted from SRH-2D model for the 1.5- and 100-year flows. Based on results of the Critical Shear Method assessment, the existing bedload grain sizes sampled upstream are mobilized during the existing and proposed conditions, 1.5-year flow (Table 13). These results suggest the proposed condition channel grading will not increase aggradation upstream of the point of delivery. See Appendix D for the sediment mobility analysis.

TABLE 13. RELATIVE BED STABILITY 1.5-YEAR FLOW UPSTREAM OF POD

Grain Size Statistic	Existing Condition	Proposed Condition
D_{100}	No motion	No motion
D_{85}	Mobile	Mobile
D_{50}	Mobile	Mobile

5.2.2. Proposed Conditions Roughened Channel Stability

The HIP IV design guidelines recommend roughened channels be designed to withstand a 100-year flow event without progressing a headcut (Bonneville Power Administration 2021). Stability of the proposed roughened channel's design gradation (Table 3) was analyzed using two methods—Bathurst Critical Unit Discharge and a Critical Shear Analysis (Appendix D). The Critical Unit Discharge method analyzes the entrainment of a particle size (D50) using a modeled unit discharge along a given cross section and the critical unit discharge on the particle of interest (United States Forest Service 2008). For the proposed roughened channel and based on the proposed conditions hydraulic model results (Table 11), the Critical Unit Discharge analysis reported a stable D50 particle size of 16.5 inches. This size was considered for the overall proposed sediment gradation.

5.2.1. Proposed Conditions Large Woody Material Stability

GeoEngineers completed a risk assessment for all proposed LWM greater than 15 feet in length and 12 inches in diameter located within the project site (Appendix E). Guidance from the Bureau of Reclamation's Large Woody Material—Risk Based Design Guidelines was used to determine appropriate factor of safety (FOS) (Bureau of Reclamation 2014). Structure safety factors and reach safety factors were combined to evaluate the overall public safety risk. A risk category was based on the combined Reach User plus Structure-Specific scores. The proposed LWM structures were rated as low public safety risk. Property damage risk was evaluated using stream response potential and adjacent property and project characteristics. The proposed LWM structures were rated as low property risk due to its proposed location along the forested existing side channel (Appendix E).

TABLE 1. DESIGN FACTOR OF SAFETY OF LWM STRUCTURE MEMBERS

Stability Calculation	Factor of Safety
$FOS_{sliding}$[1]	1.25
$FOS_{bouyancy}$[2]	1.5
$FOS_{rotational}$[3]	1.25

Notes:

[1] Sliding factor of safety is calculated as the ratio of resistant forces (bed friction, passive soil resistance) over driving forces (drag, rotational moment).

[2] Buoyancy factor of safety is calculated as the ratio of resistant forces (weight of log, ballast) over driving forces (buoyancy, lift force).

[3] Rotational factor of safety is calculated as the ratio of resistant forces (friction, passive soil resistance, bed friction) over driving forces (rotational moment).

Structures were designed to either be self-ballasting (stabilized by their own weight); ballasted using boulders; or ballasted with bank overburden. Buoyancy was evaluated by comparing uplift forces from the logs with the weight of the structure including the weight of the wood, the weight of the logs, and soil ballast. Resistance against buoyancy from pile skin friction was calculated using methods described in Large Woody Material—Risk Based Design Guidelines (Bureau of Reclamation 2014). Stability calculations were completed using workbooks included in Appendix E, Large Woody Material Stability Analysis. Locations where cross-sectional data was extracted for the LWM stability calculation can be seen in Appendix D. Stability calculation results indicate all structures resist motion according to the recommended factors of safety up to the 100-year flow event.

5.3. Proposed Conditions Fish Passage

The BPA HIP Guidelines consider the proposed roughened channel an acceptable facility under Category 1c, Headcut and Grade Stabilization (Bonneville Power Administration 2021). The BPA HIP Guidelines reference the National Marine Fisheries Service (NMFS) Anadromous Salmonid Passage Facility Design passage criteria regarding roughened channel fish passage design (NMFS 2011). Those criteria limit the total length of the roughened channel to 150 feet; limit the longitudinal slope to 6 percent; and require a minimum of 1 foot of depth for upstream adult salmonid passage. We calculated the proposed conditions depth of flow for the low-fish passage design flows (Section 3.1.2) and reported the hydraulic results above.

The Lostine River experiences significant irrigation losses upstream of the project site. Due to limited available flow within the main channel, model results demonstrating compliance with the NMFS requirements for a minimum of 1 foot of depth to accommodate adult passage during the design low-fish passage flow may not be possible. To mitigate the limited available depth during the design low-fish passage flow, the project proposes inherent diversity of rock sizes within the proposed roughened channel and the addition of habitat boulders

6.0 CONSTRUCTION

6.1. Disturbance Areas and Conservation Measures

Project disturbance areas are defined and shown on the Design Drawings in Appendix A. Conservation measures applicable to all actions are also shown on the Design Drawings in Appendix A.

Modification of the existing channel spanning concrete sill and the concrete abutment is shown on the design drawings in Appendix A. The project proposes to remove approximately 2 feet of concrete from the top of the sill and the right bank abutment that constricts flow. To reduce the jump height at the three rock steps and concrete sill to maintain passage, a roughened channel will be constructed from the existing sill location downstream 150 feet. Additionally, the roughened channel will be constructed to an elevation matching the existing sill when the control boards are in, so up to 11 cfs can be delivered to water users. Key elements of the roughened channel include:

- A channel length of 150 feet long with a slope of 5.8 percent, which meets NMFS (2011) passage criteria.
- It will be constructed with an engineered streambed mix that will resist mobility at the 100-year recurrence flow.
- Habitat boulders will be embedded in the streambed mix to provide complexity and support passage.
- There will be 30-foot transition segments constructed at the upstream and downstream ends of the roughened channel that will provide a gradual transition to the natural channel slope.

6.2. Construction Quantities and Estimate of Anticipated Construction Costs

GeoEngineers calculated construction quantities and applied unit costs based on recent project experiences, engineering judgment, and published documentation (Oman Systems 2020). We included a summary of the anticipated construction costs in Appendix F, Construction Quantities and Estimate of Anticipated Costs.

7.0 LIMITATIONS

We have prepared this report for the Nez Perce Tribe and their authorized agents for the Lostine River Poley-Allen Fish Passage 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.

8.0 REFERENCES

Aquaveo. 2018. *Surface-water Modeling Software (SMS), Version 13.1.10.*

Bonneville Power Administration . 2021. *FY 2021 HIP Handbook Guidance of Programmatic Requirements and Process (Draft).* Portland, Oregon: Bonneville Power Administration.

Bureau of Reclamation. 2014. " Large Woody Material – Risk Based Design Guidelines ." https://www.usbr.gov/pn/fcrps/documents/lwm.pdf.

Chow, V.T. 1959. *Open Channel Hydraulics.* McGraw-Hill, New York.

Cooper, R. 2006. "Estimation of Peak Discharges for Rural, Unregulated Streams in Eastern Oregon." *Open File Report SW 06-001.* State of Oregon Water Resources Department.

DOGAMI. 2015. *Geologic Map of Oregon.* Accessed May 14, 2021. https://gis.dogami.oregon.gov/maps/geologicmap/.

Nez Perce and Wallowa County. 1999. "Wallowa Salmon Recovery Plan." *Salmon Habitat Recovery Plan with Multi-Species Habitat Strategy.* Accessed May 13, 2021. https://scholarsbank.uoregon.edu/xmlui/bittream/handle/1794/5388/Wallowa_Salmon_Recovery_Plan.pdf?sequence=1&isAllowed=y.

NMFS. 2011. "Anadromous Salmonid Passage Facility Design." Portland, Oregon: National Marine Fisheries Service, Northwest Region, July.

NOAA Fisheries. 2017. *ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha) & Snake River Basin Steelhead (Oncorhynchus mykiss).* Portland, Oregon: US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Services West Coast Region.

Northwest Power and Conservation Council. 2004. "Grande Ronde Subbasin Plan." Accessed May 13, 2021. https://www.grmw.org/static/documents/data/assessment_documents/Grande%20Ronde%20Subbasin%20Plan.pdf .

ODFW. 2006. "Oregon Admnistrative Rules Section 635-412-0005." Salem, Oregon: Oregon Department of Fish and Wildlife, September.

Oman Systems. 2020. *BidTabs.NET.* Nashville, August.

Sausen, G. 2019. *2018 Bull Trout Redd Monitoring in the Wallowa Mountains.* La Grande, Oregon: U.S. Fish and Wildlife Service La Grande Field Office.

U.S. Fish and Wildlife Service. 2015. "Recovery Plan for the Conterminous United States Population of Bull Trout (Salvelinus Confluentus)." Portland, Oregon.

United States Forest Service. 2008. "Stream Simulation: An Ecological Appracoh to Providing Passage for Aquatic Organisms at Road-Stream Crossings." San Dimas, CA.

USACE. 2019. "Hydrologic Engineering Center Statistical Software Package Version 2.2." United States Army Corps of Engineers.

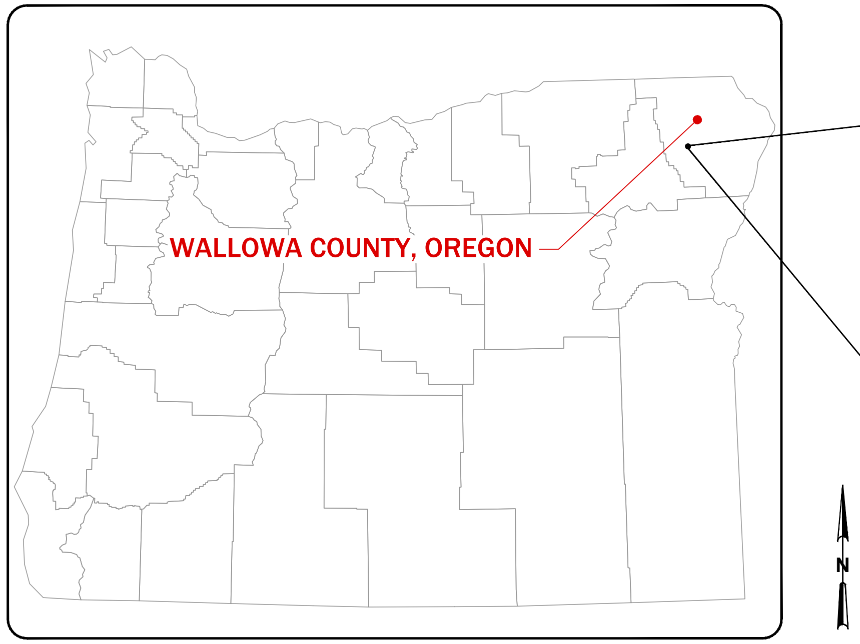
USBR. 2017. "SRH-2D VErsion 3.2.4." United States Department of the Interior Bureau of Reclamation.

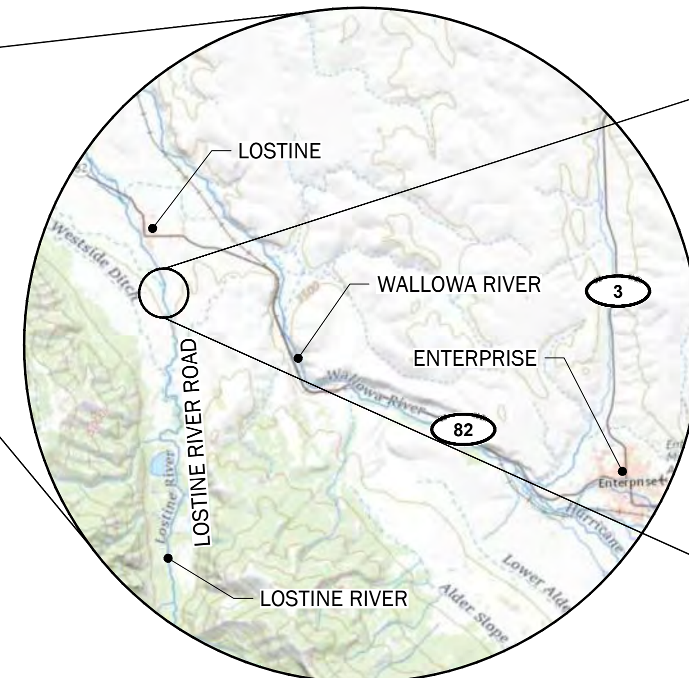
USGS. 2019. *StreamStats: Streamflow Statisticsl and Spatial Analysis Tools for Water-Resources Applications.* September 13. http://streamstats.usgs.gov.

Vatland, S. and A. Maxwell. 2018. *Evaluation of Spring Chinook Slamon Supplementation in the Lostine River, Oregon 2017 Annual Progress Report.* Portland, Oregon: Bonneville Power Administration, Project 1998-007-02.

APPENDIX A
80 Percent Design Drawings

LOSTINE RIVER POLEY ALLEN FISH PASSAGE
80 PERCENT DESIGN
WALLOWA COUNTY, OREGON





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SHEET INDEX

Sheet Number	Drawing Number	Sheet Title
1	1.1	Cover Sheet
2	1.2	General Notes, Quantities and Legends
3	2.1	Existing Conditions Plan
4	2.2	Existing Conditions Long Profile
5	3.1	Excavation, Demolition, and Erosion Control Plan - Roughened Channel
6	3.2	Excavation, Demolition, and Erosion Control Plan - Side Channel
7	3.3	Erosion and Sediment Control Details
8	4.1	Proposed Conditions Roughened Channel Plan
9	4.2	Proposed Conditions Roughened Channel Profile and Typical Section
10	4.3	Proposed Conditions Side Channel Plan
11	5.1	Concrete Sill Modifications
12	5.2	Typical LWM Details
13	5.3	Typical LWM Details
14	6.1	Phase 1 Construction Access, Staging, and Sequencing Plan
15	6.2	Phase 2 Construction Access, Staging, and Sequencing Plan
16	7.1	Revegetation Plan
17	7.2	Revegetation Details
18	8.1	HIP IV - General Conservation Measures
19	8.2	HIP IV - General Conservation Measures

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BOISE, IDAHO 83706
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Know what's below. Call before you dig.

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80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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PREPARED FOR: NEZ PERCE TRIBE

LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

COVER SHEET

DRAWING NUMBER: 1.1

SHEET: 1 OF 19

GENERAL NOTES:

1. THESE DESIGNS AND DRAWINGS HAVE BEEN PREPARED FOR THE EXCLUSIVE USE OF THE NEZ PERCE TRIBE (NPT) 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 LOSTINE RIVER POLEY ALLEN FISH PASSAGE AS SHOWN IN THE PROJECT AREA LOCATED ON DRAWING 1.1.
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. NPT IS ADVISED 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 IMPROVEMENTS ARE INTENDED TO ADDRESS FISH PASSAGE CONSTRAINTS. THESE STRUCTURES ARE INHERENTLY DANGEROUS TO PEOPLE IN OR AROUND THEM. NPT AND THE PROPERTY OWNER SHOULD ADDRESS SAFETY CONCERNS APPROPRIATELY.
7. POTENTIAL REGULATORY CHANGES TO FLOOD ELEVATIONS AND FLOOD EXTENTS RESULTING FROM THE PROPOSED ENHANCEMENTS HAVE NOT BEEN ADDRESSED BY GEOENGINEERS AS PART OF THIS PROJECT.
8. 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.
9. DESIGN SPECIFICS FOR STRUCTURES SHALL BE CONFIRMED AND/OR VERIFIED BY A QUALIFIED ENGINEER PRIOR TO OR DURING CONSTRUCTION AT EACH PROPOSED STRUCTURE LOCATION.
10. THESE FIGURES WERE ORIGINALLY PRODUCED IN COLOR.

VISION

MAXIMIZE FISH PASSAGE AT THE POLEY ALLEN DIVERSION FOR ALL LIFE HISTORY STAGES OF BULL TROUT, STEELHEAD, AND CHINOOK SLAMON, WHILE MAINTAINING ACCESS TO IRRIGATION WATER FOR CURRENT WATER RIGHTS HOLDERS.

GOAL

PROMOTE NATURAL RIVER AND FLOODPLAIN CONDITIONS WHILE MAINTAINING IRRIGATION ACCESS THROUGH CONSTRUCTION OF A ROUGHENED CHANNEL WITH BANK STABILIZATION PROVIDED BY LARGE WOODY MATERIAL STRUCTURES. BOULDERS WITHIN THE ROUGHENED CHANNEL WILL INCREASE HYDRAULIC COMPLEXITY AND ROUGHNESS.

OBJECTIVES

1. DEVELOP AND SELECT FISH PASSAGE DESIGN FOR JUVENILE AND ADULT BULL TROUT, STEELHEAD AND SPRING CHINOOK SALMON DURING PERIODS OF MIGRATION THAT ACHIEVE OREGON DEPARTMENT OF FISH AND WILDLIFE (ODFW) AND NATIONAL MARINE FISHERIES SERVICE (NMFS) FISH PASSAGE CRITERIA TO THE GREATEST EXTENT PRACTICAL.
2. DEVELOP FISH PASSAGE DESIGNS THAT MAINTAIN ACCESS AND USE OF IRRIGATION WATER FOR WATER RIGHTS HOLDERS AND IRRIGATORS.
3. PROVIDE A SUSTAINABLE, PERMITTABLE, AND EASILY MAINTAINED PROPOSED CONDITION AT A REASONABLE COST.

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 NPT. 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, 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 BE ON-SITE DURING CONSTRUCTION TO HELP THE CONTRACT INTERPRET THE DESIGN PLANS AND INTENT.

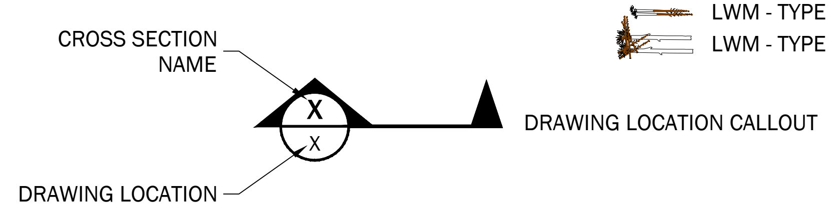
Item Description	Units	No. of Units
Mobilization and Demobilization	LS	1
Erosion and Sediment Control - Permit Preparation - Best Management Practices	LS	1
Environmental Protections	LS	1
Removal of Structures (Concrete Sill and Abutment)	LS	1
Clearing, Grubbing, Stockpile and Disposal	AC	0.8
General Excavation (Excavation and Stockpile)	CY	696
Fill in Place (Stockpiled Material)	CY	417
Fill in Place (Stockpiled Habitat Boulders)	CY	209
Fill in Place (Imported Habitat Boulders)	CY	208
Fill in Place (Imported Streambed Sediment)	CY	208
Temporary Work Zone Isolation	EA	2
Temporary Stream Diversion	EA	2
LWM Type A - Rootwad	EA	10
LWM Type B - Whole Tree	EA	9
LWM Type C - Sweeper Logs	EA	1
Permanent Seeding, Fertilizing and Mulching	AC	0.8
Weed Control	AC	0.8
Planting	AC	0.8

LEGEND (EXISTING)

- EXISTING MAJOR (5-FT) CONTOUR LINE
- EXISTING MINOR (1-FT) CONTOUR LINE
- LOSTINE RIVER ALIGNMENT
- PARCEL BOUNDARY
- EXISTING IRRIGATION DITCH
- EXISTING SIDE CHANNEL
- EXISTING APPROXIMATE OHW (1.5-YR)
- EXISTING APPROXIMATE 100-YR
- SURVEY BENCHMARK
- FLOW DIRECTION

LEGEND (PROPOSED)

- PROPOSED MAJOR (10-FT) CONTOUR LINE
- PROPOSED MINOR (2-FT) CONTOUR LINE
- EXCAVATION LIMITS
- PROPOSED ROUGHENED CHANNEL
- TEMPORARY CONSTRUCTION ACCESS
- TEMPORARY CONSTRUCTION STAGING
- DEMOLITION LIMITS
- TEMPORARY STREAM ISOLATION
- PROJECT DISTURBANCE LIMITS
- TEMPORARY STOCKPILING LOCATION
- PROPOSED WILLOW STAKES
- PROPOSED NATIVE SEED MIX
- LWM - TYPE A - ROOTWAD
- LWM - TYPE B - WHOLE TREE
- LWM - TYPE C - SWEEPER
- LWM - TYPE D - BANK ROOTWAD



PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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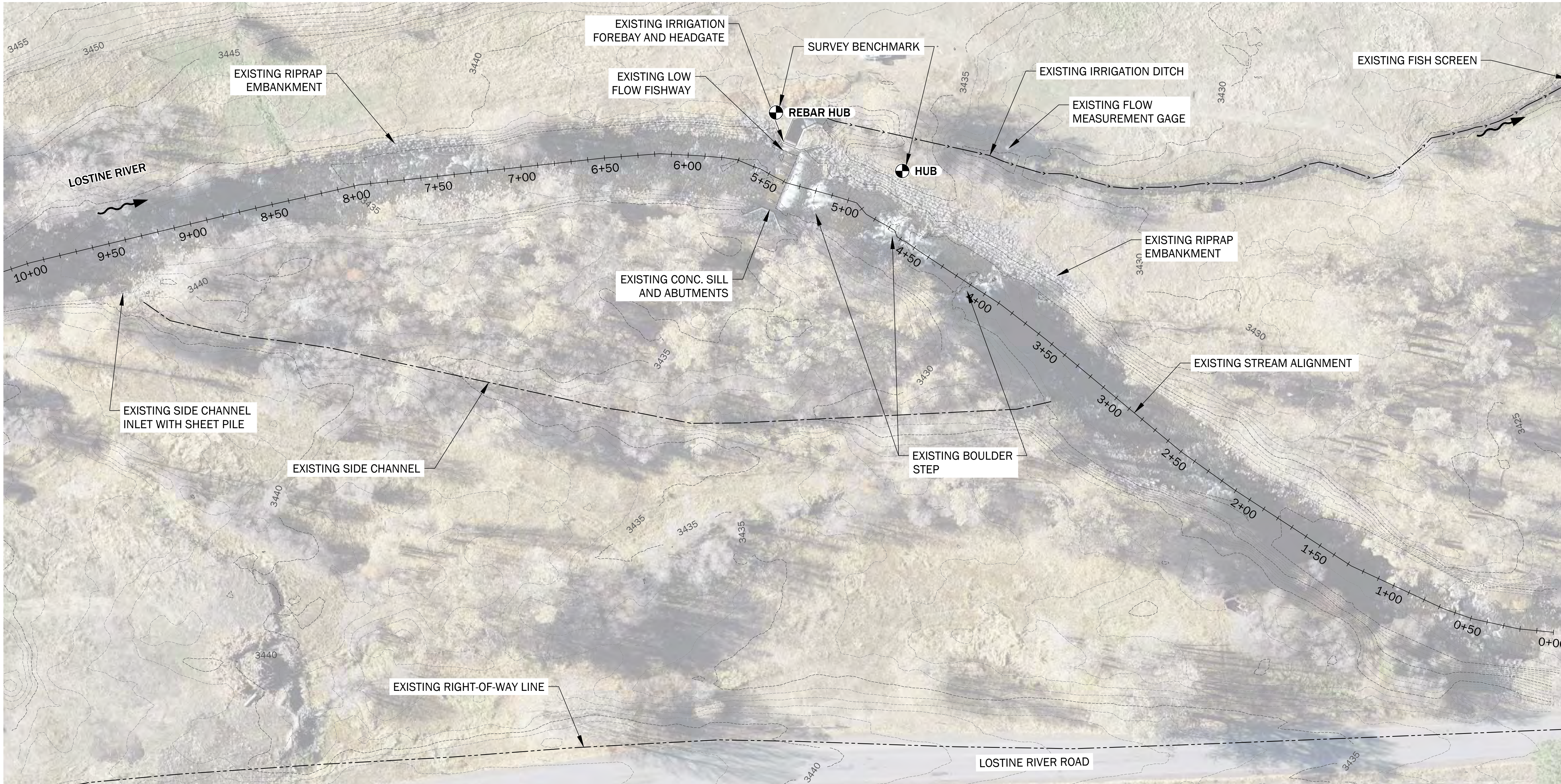
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

GENERAL NOTES, QUANTITIES AND LEGENDS

DRAWING NUMBER: 1.2
SHEET: 2 OF 19



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SCALE IN FEET

SURVEY BENCHMARKS

POINT #	ELEVATION	NORTHING	EASTING	DESCRIPTION
100	3436.95	673593.62	8990262.14	REBAR HUB
101	3437.06	673668.79	8990296.93	HUB

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WALLOWA COUNTY, OREGON

EXISTING CONDITIONS PLAN

DRAWING NUMBER:
2.1
SHEET: 3 OF 19

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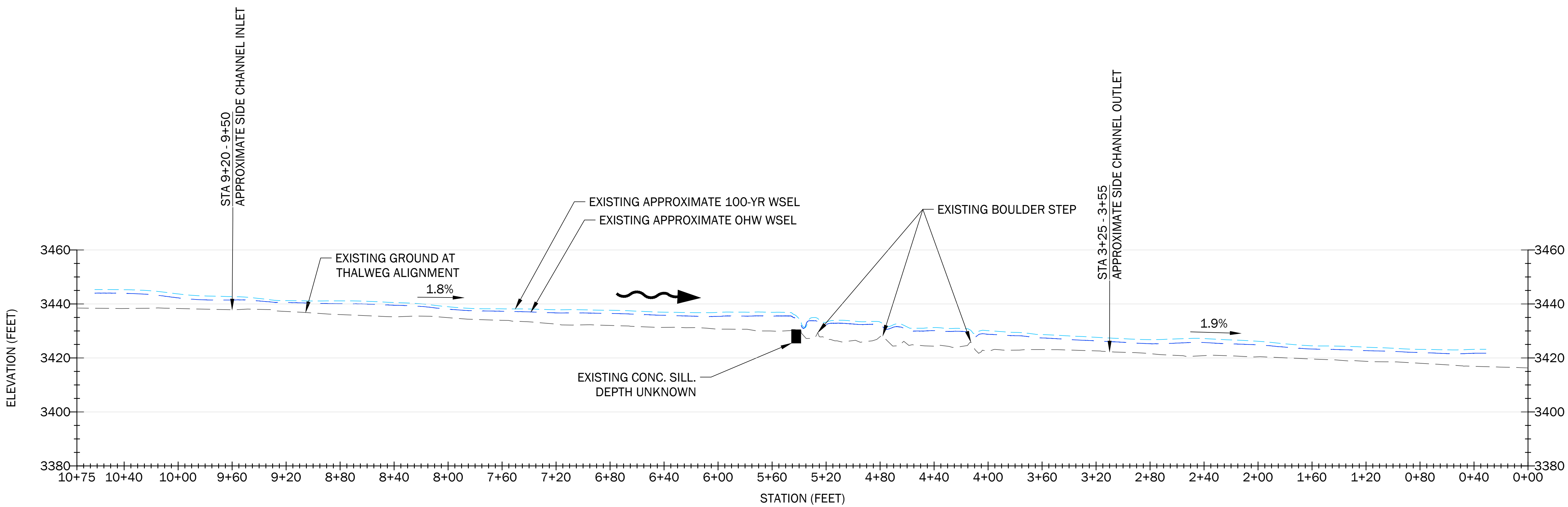

EXISTING CONDITIONS LONG PROFILE

2X VERT. EXAGGERATION

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WALLOWA COUNTY, OREGON

EXISTING CONDITIONS LONG PROFILE

DRAWING NUMBER:
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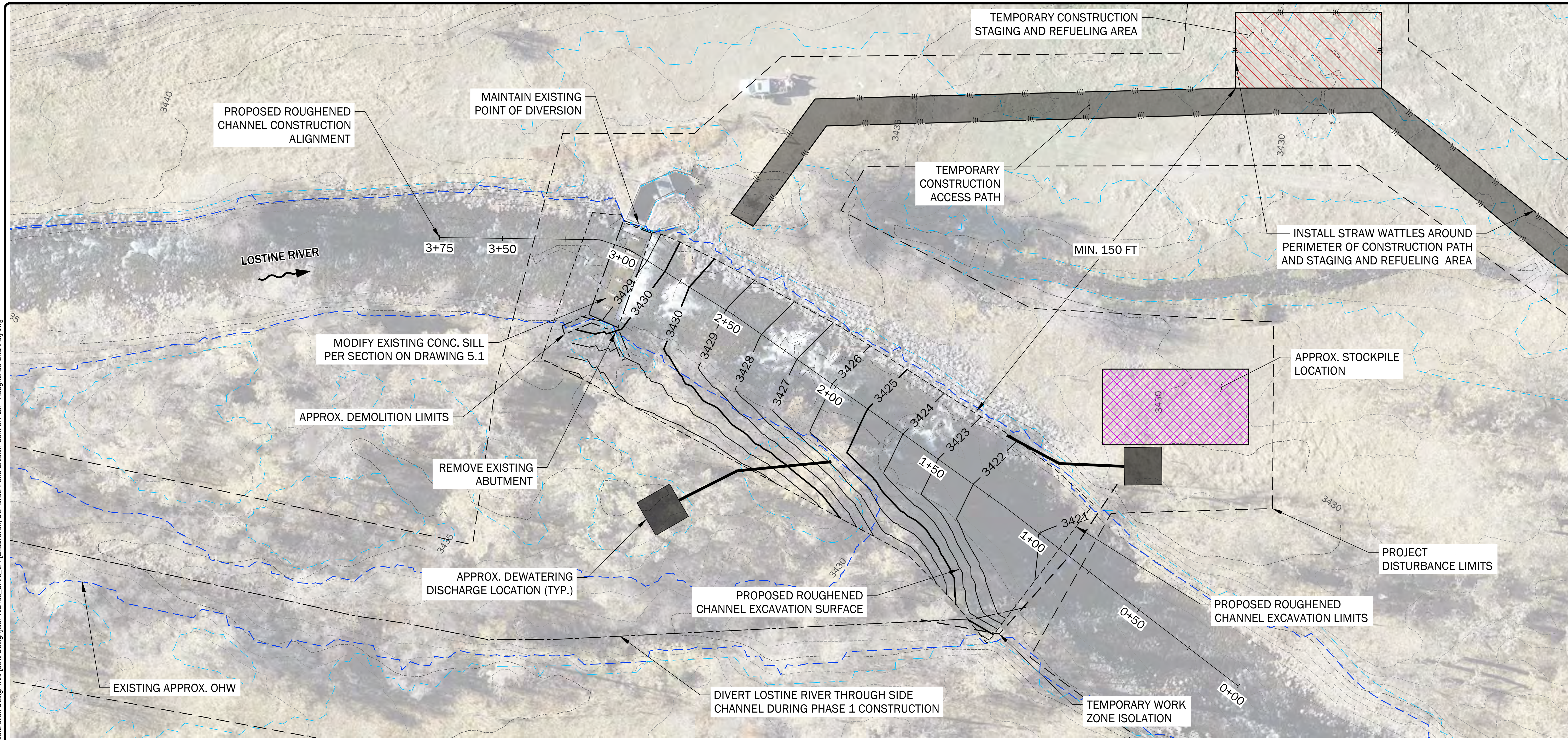
SHEET: 4 OF 19



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PRELIMINARY

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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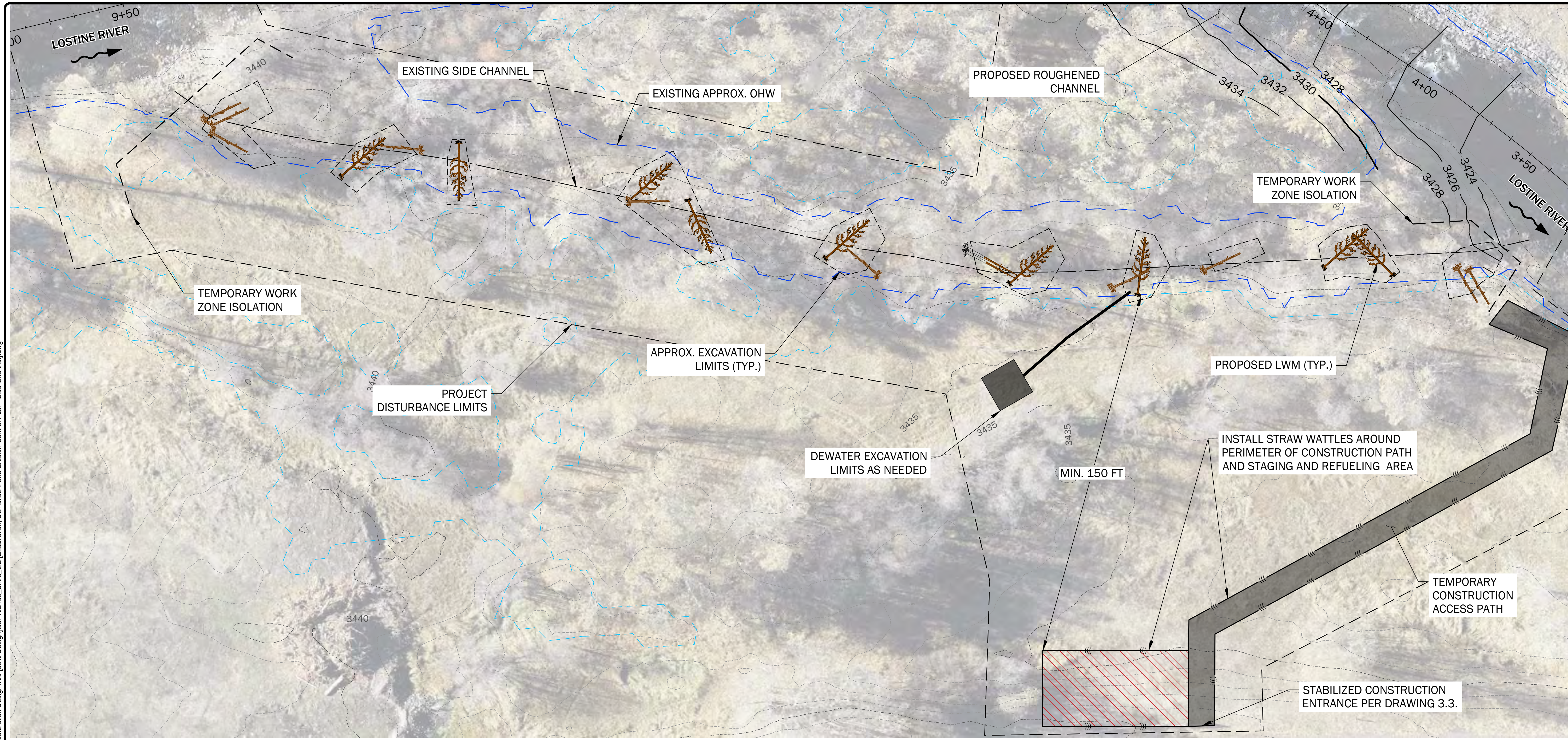
WALLOWA COUNTY, OREGON

EXCAVATION, DEMOLITION, AND EROSION CONTROL PLAN - ROUGHENED CHANNEL

DRAWING NUMBER:
3.1
SHEET: 5 OF 19



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PRELIMINARY

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
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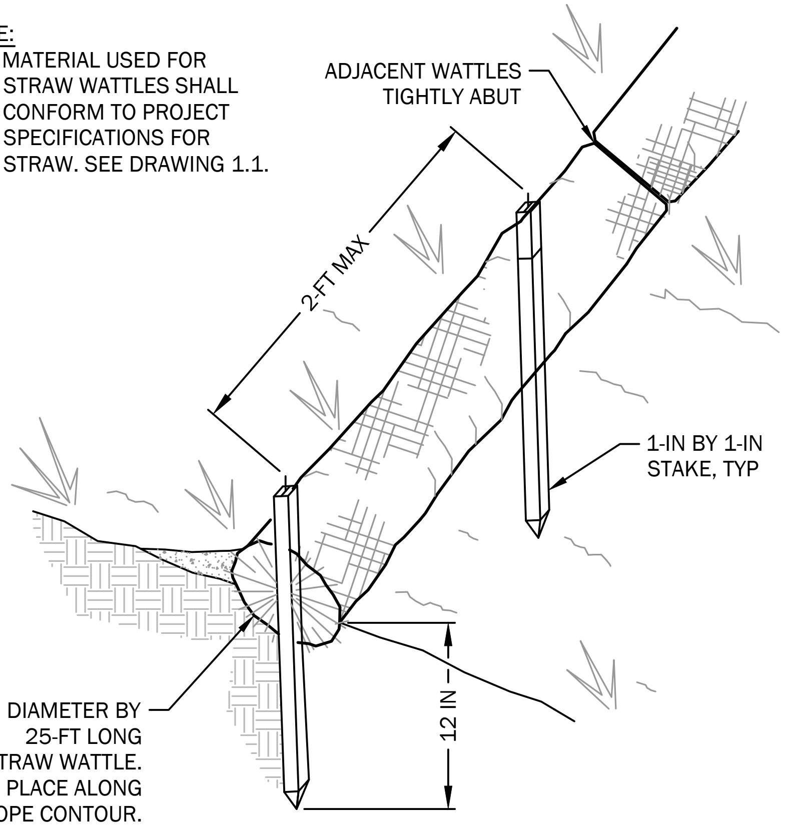
WALLOWA COUNTY, OREGON

EXCAVATION, DEMOLITION, AND EROSION
CONTROL PLAN - SIDE CHANNEL

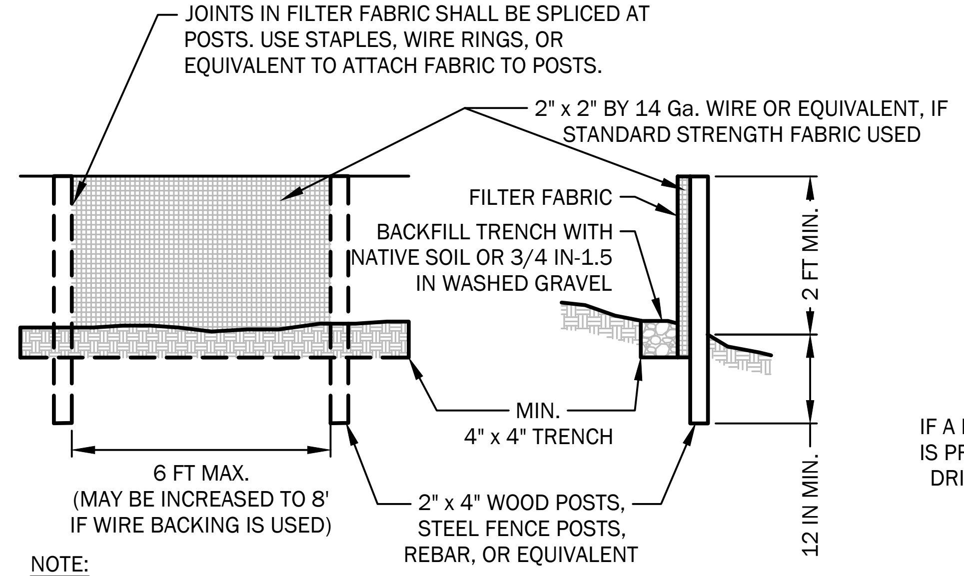
DRAWING NUMBER:
3.2
SHEET: 6 OF 19

STRAW WATTLE (1 / 3.3)



STRAW WATTLE 1
SCALE: NOT TO SCALE 3.3

SEDIMENT FENCE DETAIL (2 / 3.3)

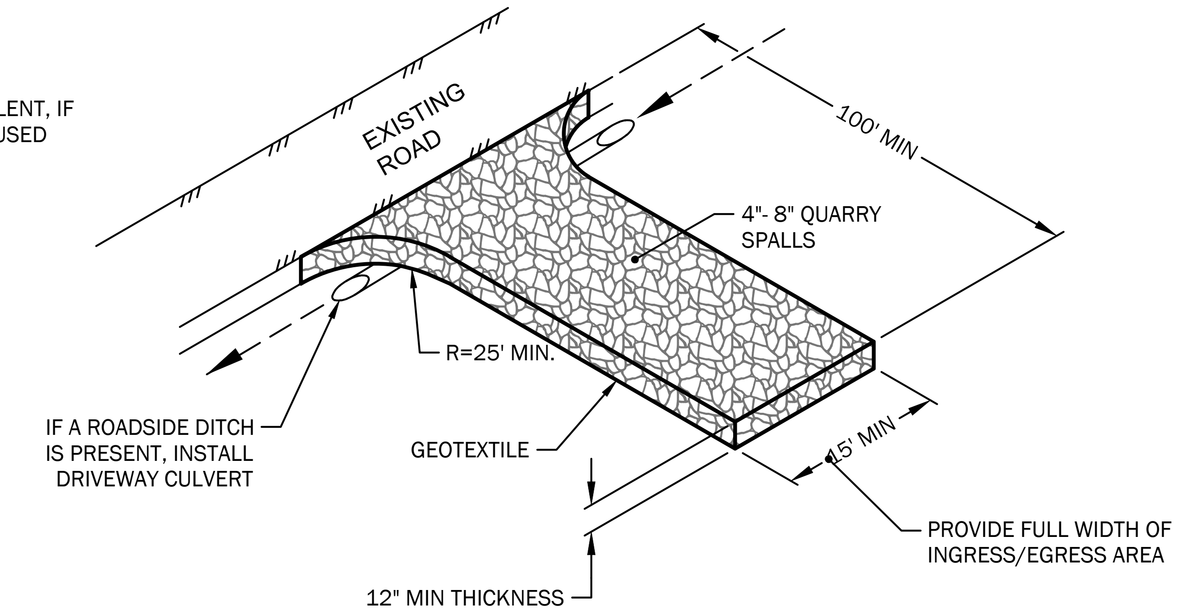


NOTE:
1. FILTER FABRIC FENCES SHALL BE INSTALLED ALONG CONTOUR WHENEVER POSSIBLE.

SEDIMENT FENCE DETAIL 2
SCALE: NOT TO SCALE 3.3

NOTES:
1. SEDIMENT FENCE TO HAVE STITCHED LOOPS AROUND 2" x 2" POSTS.
2. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
3. 3'MINx2"x 2" FIR, PINE OR STEEL FENCE POSTS.
4. POSTS TO BE INSTALLED ON UPHILL SIDE OF SLOPE.
5. COMPACT BOTH SIDES OF FILTER FABRIC TRENCH.

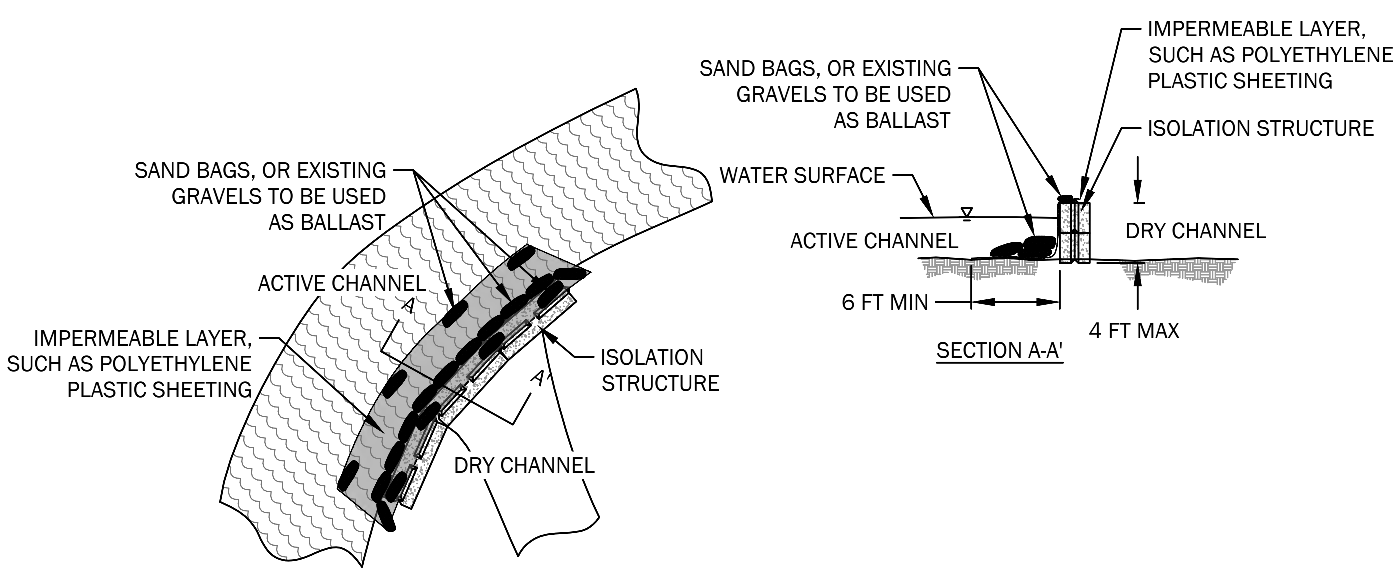
STABILIZED CONSTRUCTION ENTRANCE DETAIL (3 / 3.3)



STABILIZED CONSTRUCTION ENTRANCE DETAIL 3
SCALE: NOT TO SCALE 3.3

NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF- WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. WHERE RUNOFF CONTAINING SEDIMENT LADEN WATER IS LEAVING THE SITE VIA THE CONSTRUCTION ENTRANCE, OTHER MEASURES SHALL BE IMPLEMENTED TO DIVERT RUNOFF THROUGH AN APPROVED FILTERING SYSTEM.

WORK ZONE ISOLATION STRUCTURE (4 / 3.3)



WORK ZONE ISOLATION STRUCTURE 4
SCALE: NOT TO SCALE 3.3

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

Plotted: 09/23/2021, 13:41 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\057102100_Sht 7_3.3 [Erosion and Sediment Control Details].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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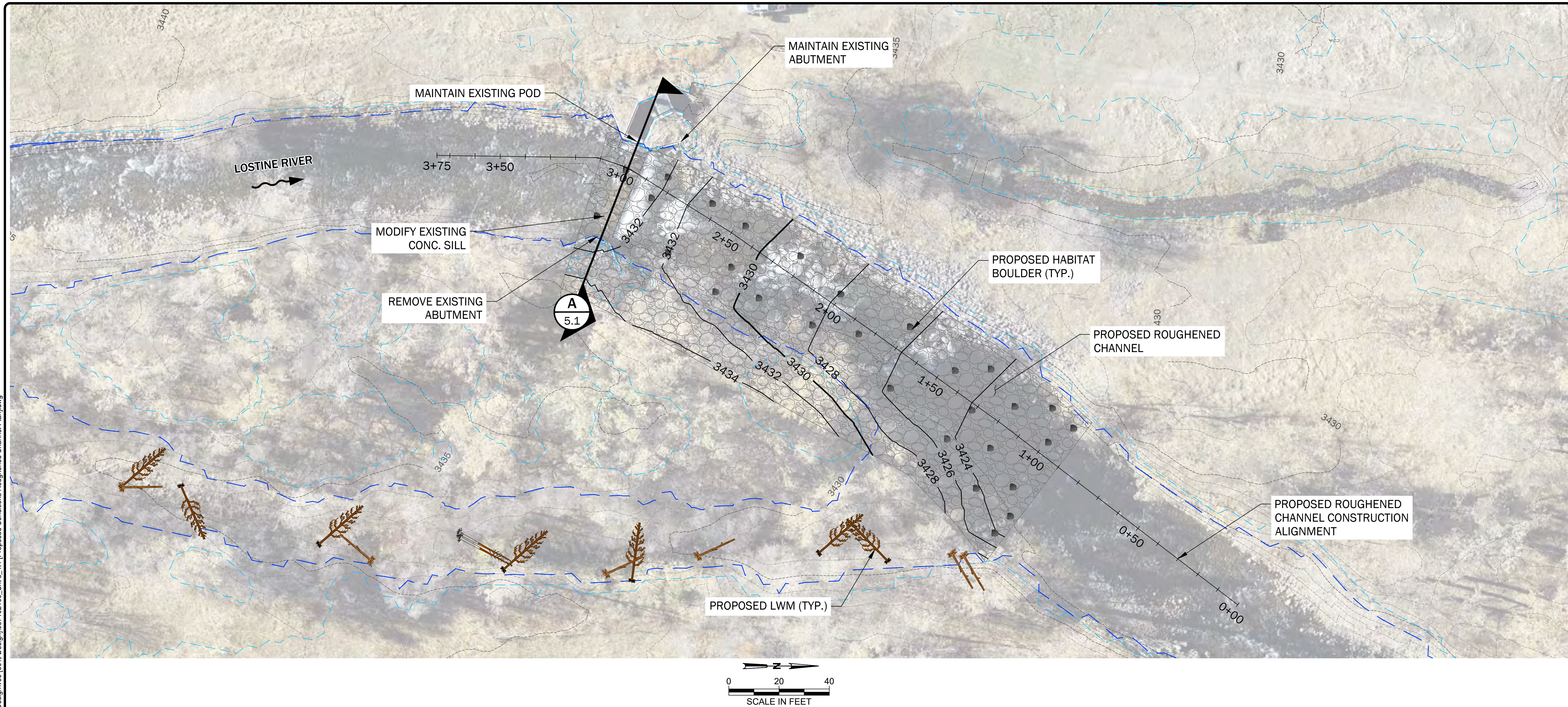
PREPARED FOR: NEZ PERCE TRIBE

LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

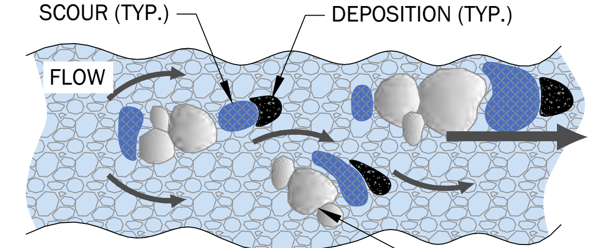
EROSION AND SEDIMENT CONTROL DETAILS

DRAWING NUMBER: 3.3
SHEET: 7 OF 19



START STATION	START NORTHING (FT)	START EASTING (FT)	LINE/CHORD DIRECTION	CURVE RADIUS	LENGTH	END STATION
0+00	673842.1	8990465.7	S37° 28' 46.13"W		117.9	1+18
1+18	673748.5	8990394.0	S35° 34' 27.55"W		61.3	1+79
1+79	673698.7	8990358.3	S35° 02' 11.39"W		70.7	2+50
2+50	673640.8	8990317.7	S32° 05' 43.40"W		43.0	2+93
2+93	673604.4	8990294.9	S25° 20' 03.31"W	50	11.8	3+05
3+05	673593.7	8990289.8	S18° 34' 23.21"W		4.1	3+09
3+09	673589.8	8990288.5	S09° 41' 38.18"W	15	4.6	3+13
3+13	673585.2	8990287.7	S00° 48' 53.15"W		61.7	3+75

CONSTRUCTION ALIGNMENT STAKING TABLE



ROUGHNESS BOULDER DETAIL

SCALE: NOT TO SCALE

DESIGN SPECIFICS:

- EMBED BOULDERS 2/3 IN CHANNEL BED
- BOULDER DIAMETER 24 TO 48 INCHES.

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

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APPROVED BY: RSC
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DATE: 09/24/21

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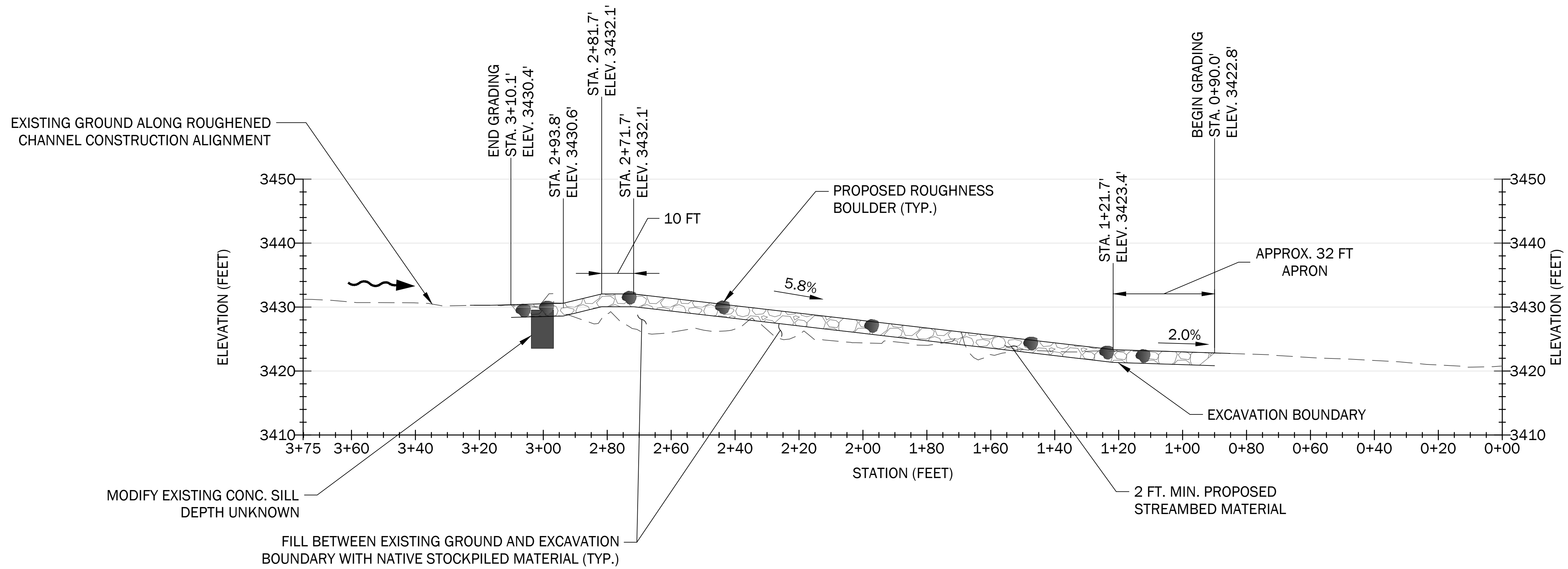
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

PROPOSED CONDITIONS ROUGHENED CHANNEL PLAN

DRAWING NUMBER: 4.1
SHEET: 8 OF 19

Plotted: 09/23/2021, 13:42 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\057102100_Sht 8_4.1 [Proposed Conditions Roughened Channel Plan].dwg

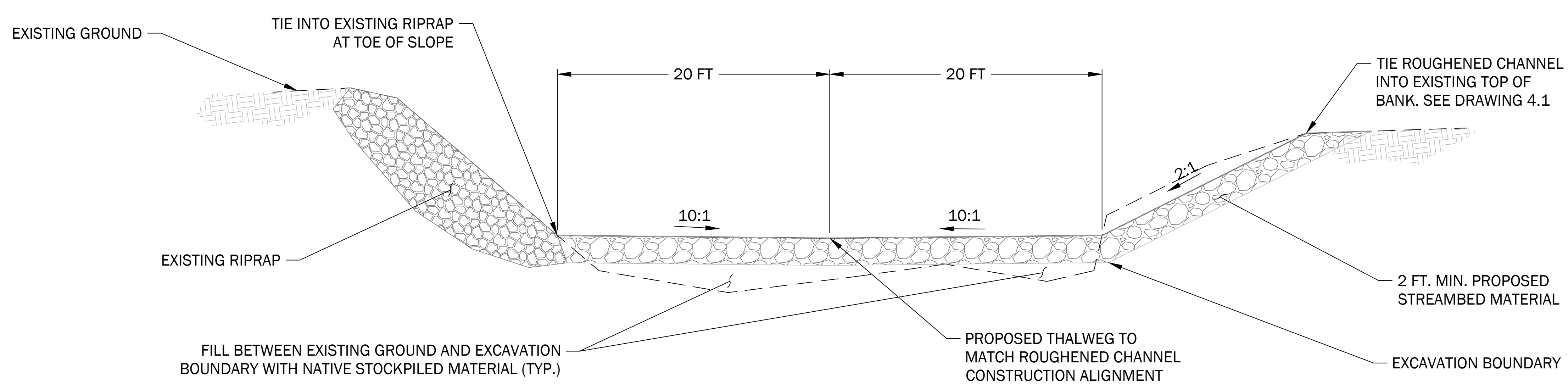


PROPOSED CONDITIONS ROUGHENED CHANNEL PROFILE

2X VERT. EXAGGERATION

0 20 40

SCALE IN FEET



TYPICAL ROUGHENED CHANNEL SECTION

NOT TO SCALE

NOTE: TYPICAL SECTION VIEW IS LOOKING DOWNSTREAM

PRELIMINARY

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
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APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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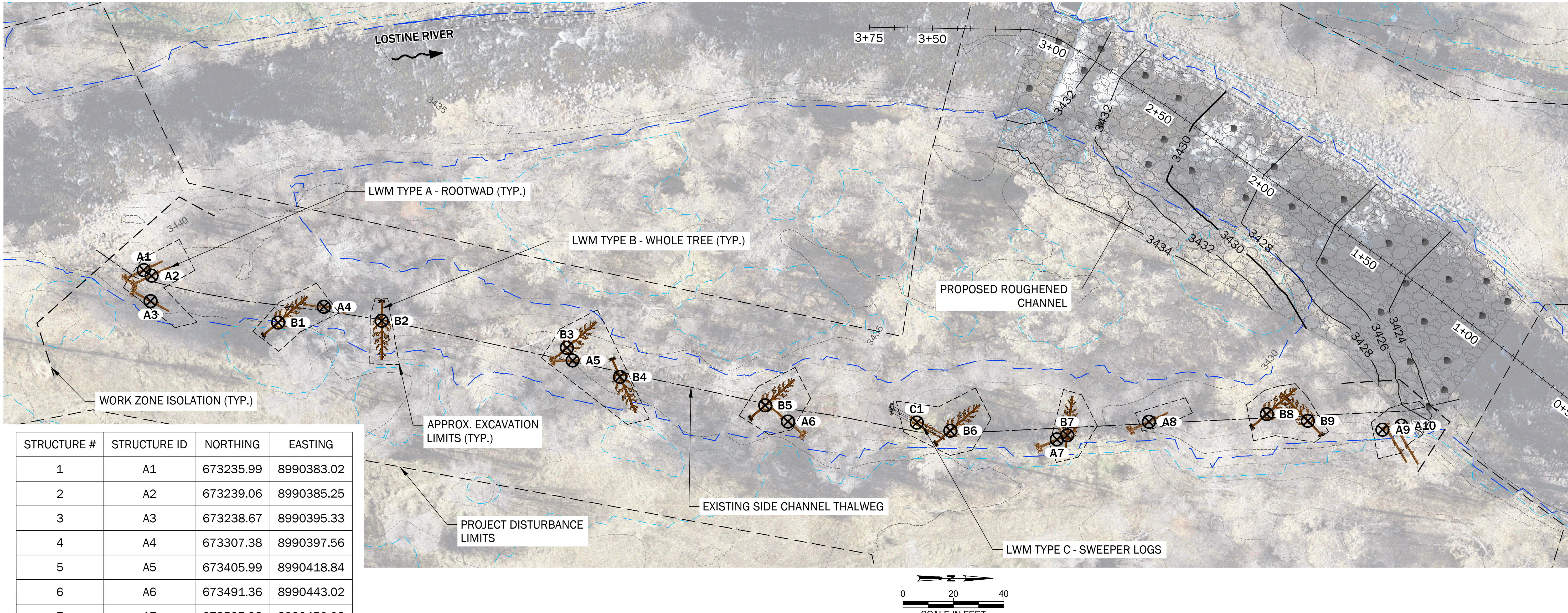
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

PROPOSED CONDITIONS ROUGHENED CHANNEL PROFILE AND TYPICAL SECTION

DRAWING NUMBER: **4.2**
SHEET: 9 OF 19

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

Plotted: 09/23/2021, 13:42 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\057102100_Sht 9_4.2 [Proposed Conditions Roughened Channel Profile and Typical Section].dwg



STRUCTURE #	STRUCTURE ID	NORTHING	EASTING
1	A1	673235.99	8990383.02
2	A2	673239.06	8990385.25
3	A3	673238.67	8990395.33
4	A4	673307.38	8990397.56
5	A5	673405.99	8990418.84
6	A6	673491.36	8990443.02
7	A7	673597.98	8990450.08
8	A8	673634.47	8990443.10
9	A9	673727.04	8990446.25
10	A10	673734.53	8990444.64
11	B1	673289.23	8990403.81
12	B2	673330.30	8990403.10
13	B3	673403.74	8990413.82
14	B4	673424.76	8990425.33
15	B5	673482.34	8990436.60
16	B6	673555.74	8990446.65
17	B7	673602.09	8990448.45
18	B8	673681.22	8990440.06
19	B9	673697.47	8990442.73
20	C1	673542.45	8990443.42

STRUCTURE STAKING TABLE

STRUCTURE TYPE	STRUCTURE DESCRIPTION	NO. OF STRUCTURES	LOG TYPE 1	LOG TYPE 2	LOG TYPE 3
A	ROOTWAD	10	1		
B	WHOLE TREE	9			1
C	SWEEPER LOGS	1		2	
	TOTAL	20	10	2	9

LWM SCHEDULE

LOG TYPE	LENGTH (FT)	MIN. DIA (IN)	MAX. DIA (IN)	AVG. DIA (IN)	ROOTWAD (Y/N)
1	30	12	18	15.0	Y
2	30	9	12	10.5	N
3	30	12	18	15.0	Y

LOG SIZING TABLE

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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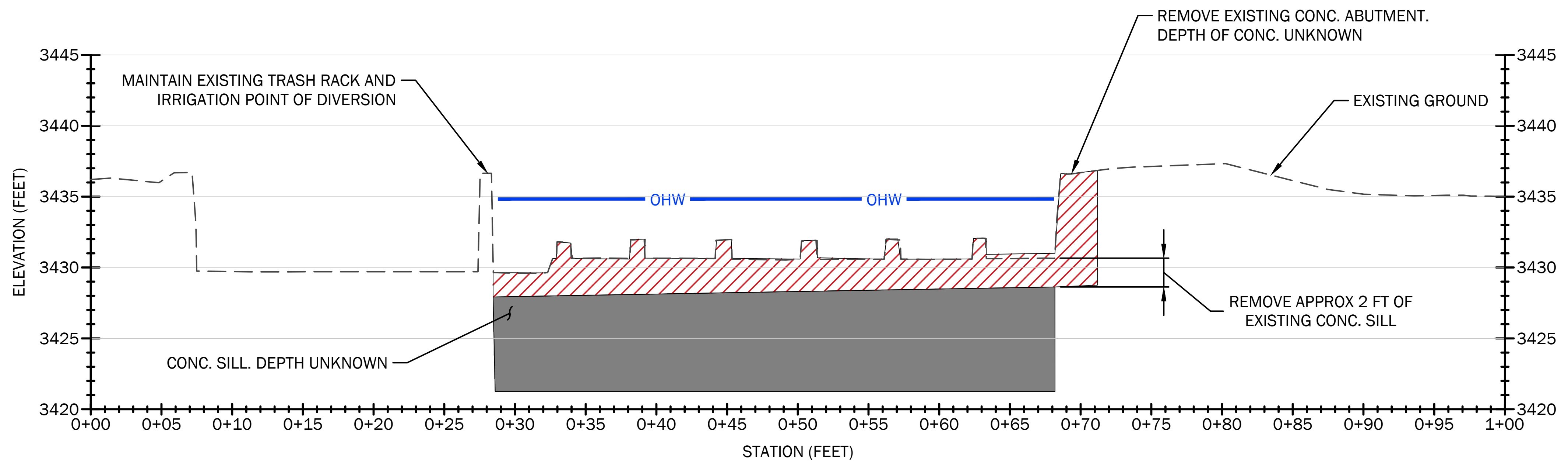
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

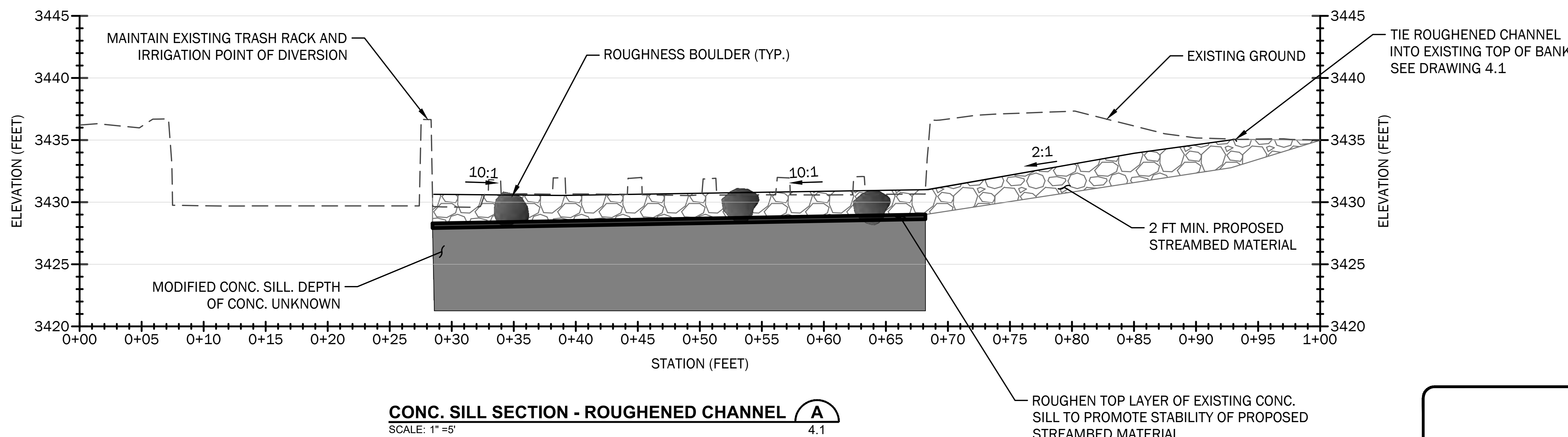
PROPOSED CONDITIONS SIDE CHANNEL PLAN

DRAWING NUMBER: 4.3
SHEET: 10 OF 19

Plotted: 10/07/2021, 15:23 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\057102100_Sht 10_4.3 [Proposed Conditions Side Channel Plan].dwg



CONC. SILL SECTION - DEMOLITION A 4.1
SCALE: 1" =5'



CONC. SILL SECTION - ROUGHENED CHANNEL A 4.1
SCALE: 1" =5'

NOTE: SECTION VIEWS ARE LOOKING DOWNSTREAM.

PRELIMINARY

NO.	DATE	BY	ISSUE / DESCRIPTION

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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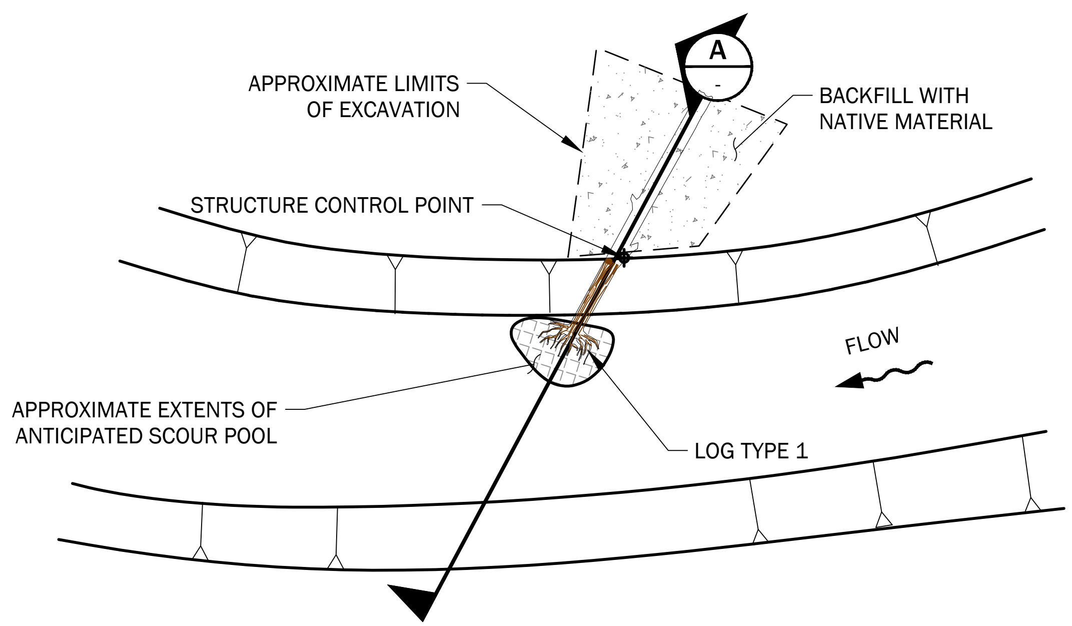
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

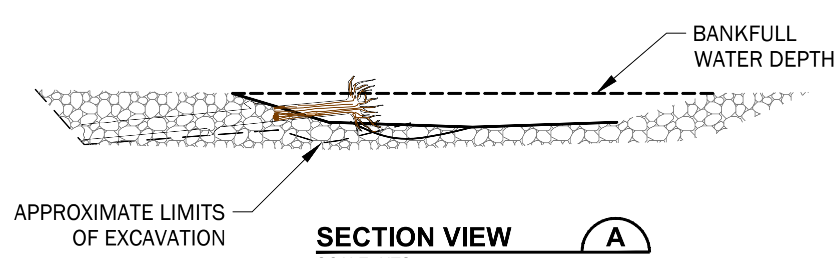
CONCRETE SILL MODIFICATIONS

DRAWING NUMBER: 5.1
SHEET: 11 OF 19

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

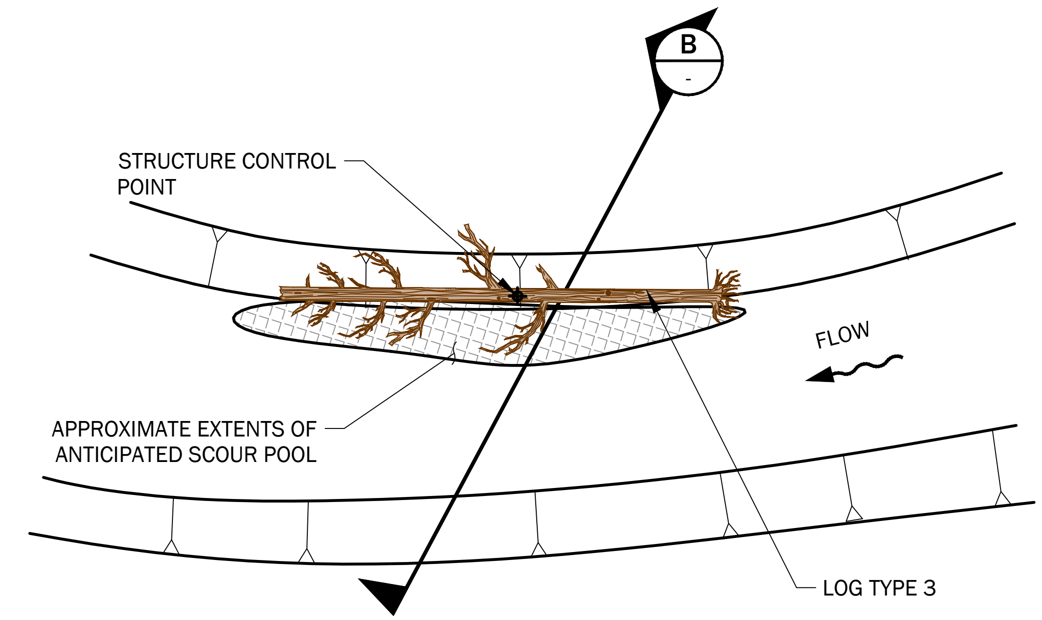


PLAN VIEW
SCALE: NOT TO SCALE

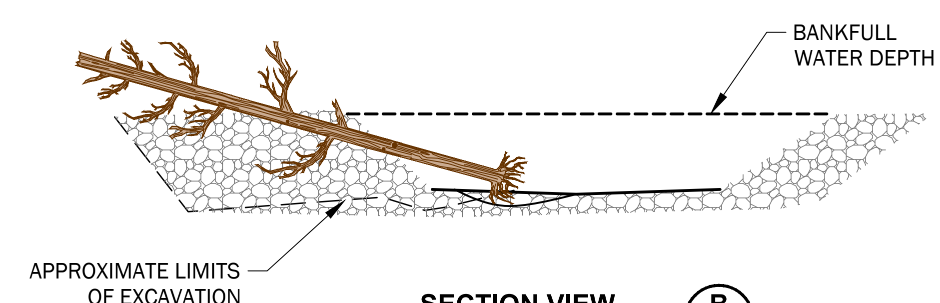


SECTION VIEW A -
SCALE: NTS

LWM TYPE A - ROOTWAD DETAIL



PLAN VIEW
SCALE: NOT TO SCALE



SECTION VIEW B -
SCALE: NTS

LWM TYPE B - WHOLE TREE DETAIL

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

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NO.	DATE	BY	ISSUE / DESCRIPTION

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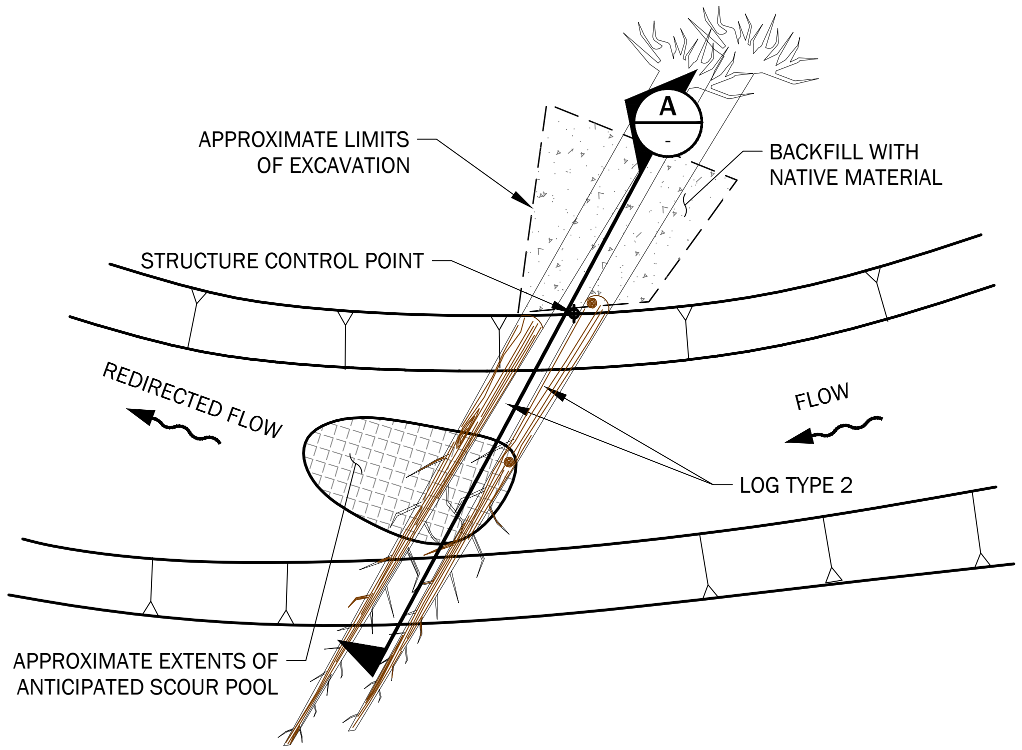
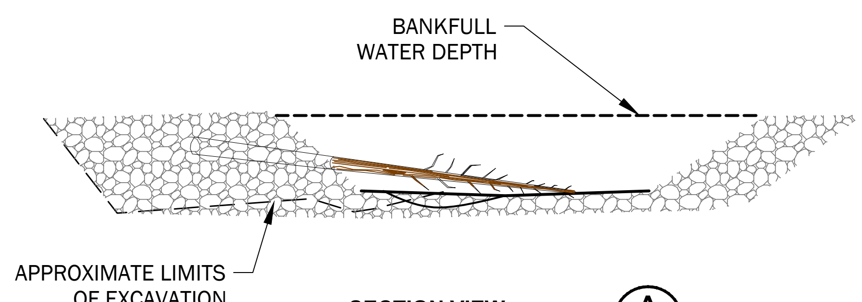
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

TYPICAL LWM DETAILS

DRAWING NUMBER:
5.2
SHEET: 12 OF 19



PLAN VIEW
SCALE: NOT TO SCALE



SECTION VIEW A / -
SCALE: NTS

LWM TYPE C - SWEEPER DETAIL

PRELIMINARY

NO.	DATE	BY	ISSUE / DESCRIPTION

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DATE: 09/24/21

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LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

TYPICAL LWM DETAILS

DRAWING NUMBER:
5.3
SHEET: 13 OF 19

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

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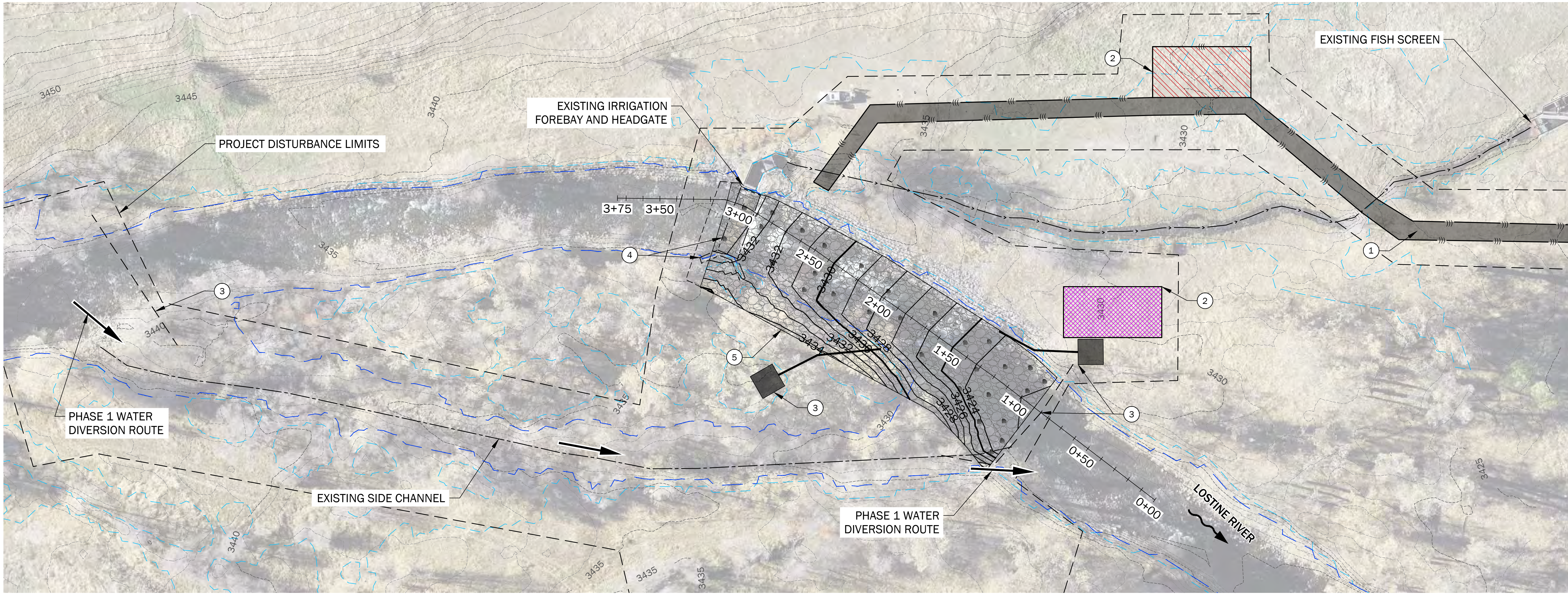
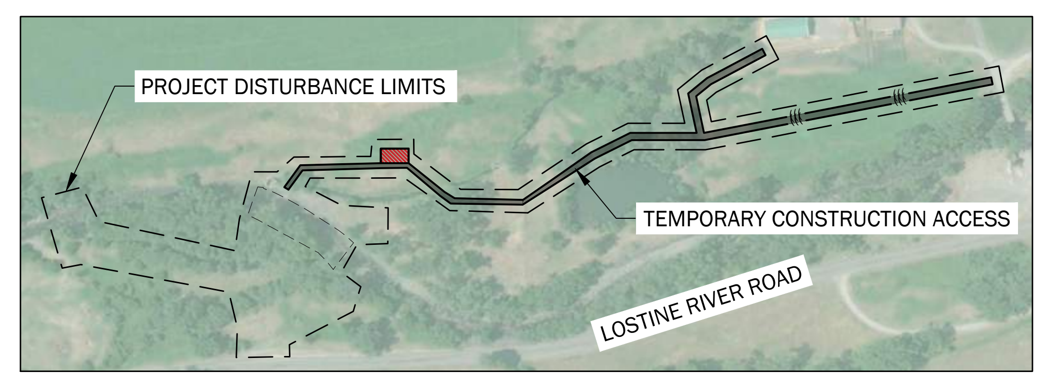


CONSTRUCTION SEQUENCING AND DEWATERING GENERAL NOTES

ALL IN-WATER WORK SHALL OCCUR BETWEEN JULY 15 - AUGUST 15 OR AS OTHERWISE SPECIFIED IN ENVIRONMENTAL PERMITS.

1. (1.1) ACCESS SITE FROM PRIVATE PROPERTY. (1.2) ESTABLISH TEMPORARY ACCESS ROUTES THROUGHOUT THE SITE AS SHOWN. TEMPORARY ACCESS ROUTES SHALL MINIMIZE DISTURBANCE TO NATIVE VEGETATION AND THE PRIVATE LAND OWNERS PROPERTY. PRIVATE ROADS MUST BE CLEAR OF ALL CONSTRUCTION DEBRIS AT ALL TIMES. (1.3) ROADS SHALL BE RESTORED TO EXISTING CONDITION OR BETTER PRIOR TO COMPLETION OF THE PROJECT.
2. (2.1) ESTABLISH STAGING AND STOCKPILE LOCATIONS AS SHOWN. ALL FUEL STORAGE AND REFUELING ACTIVES SHALL OCCUR AT A MINIMUM OF 150 FEET FROM THE EDGE OF WATER. (2.2) INSTALL PERIMETER SEDIMENT CONTROLS AROUND STAGING AREAS AND STABILIZE ANY TEMPORARY STOCKPILES.
3. (3.1) ISOLATE WORK ZONE FOR CONSTRUCTION OF ROUGHENED CHANNEL. (3.2) CONDUCT FISH SALVAGE WITHIN THE MAIN CHANNEL PRIOR TO DEWATERING. (3.3) DEWATER THE MAIN CHANNEL AND ALLOW FOR CONTINUOUS DOWNSTREAM PASSAGE THROUGH THE DURATION OF ISOLATION. AFTER FISH SALVAGE WATER WITHIN THE WORK AREA SHALL BE PUMPED OUT AND DISCHARGED IN AN UPLAND LOCATION TO AVOID EXCESS TURBIDITY.
4. (4.1) REMOVE CONCRETE ABUTMENT AND MODIFY CONCRETE SILL PER DRAWINGS 4.1 THROUGH 5.1. (4.2.) EXCAVATE ROUGHENED CHANNEL FOOTPRINT TO EXCAVATION LIMITS, FILLING IN VOIDS WITH NATIVE MATERIAL. (4.3.) HAUL ALL REMOVED MATERIALS OFF-SITE AND DISPOSE ACCORDINGLY.
5. (5.1) CONSTRUCT ROUGHENED CHANNEL PER DRAWINGS 4.1 THROUGH 5.1.
6. (6.1) RESTORE DISTURBED AREAS WITHIN THE FLOODPLAIN GRADING LIMITS ACCORDING TO THE REVEGETATION PLAN ON DRAWING 7.1. (6.2) STABILIZE WITH NATIVE SEED MIX AND LIVES STAKES AFTER CHANNEL EXCAVATION AND LOG STRUCTURE INSTALLATION IS COMPLETE. RESTORE ALL DISTURBED AREAS WITHIN PRIVATE PROPERTY TO EXISTING CONDITIONS OR BETTER.

N
0 30 60
SCALE IN FEET



TEMPORARY CONSTRUCTION ACCESS - OVERVIEW

N
0 200 400
SCALE IN FEET

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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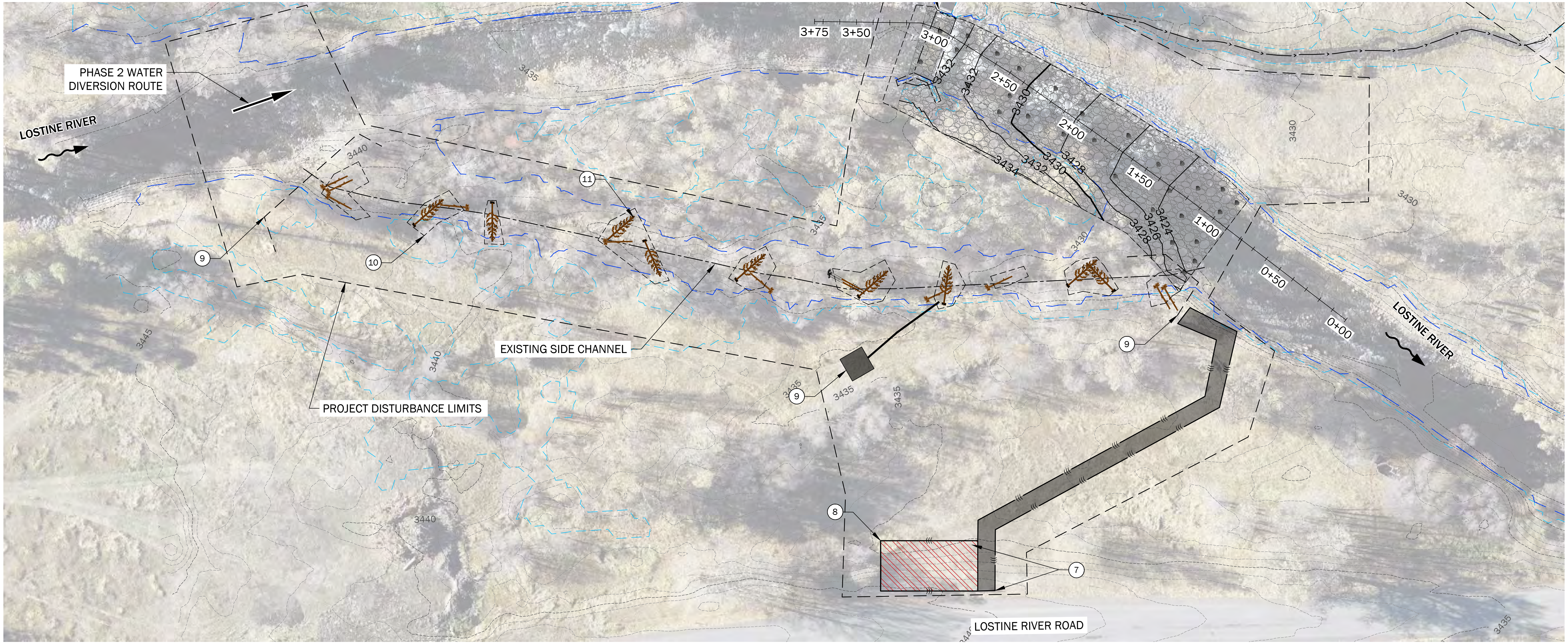
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

PHASE 1 CONSTRUCTION ACCESS, STAGING, AND SEQUENCING PLAN

DRAWING NUMBER:
6.1
SHEET: 14 OF 19

Plotted: 09/23/2021, 13:43 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\0571021 00_Sht 14_6.1 [Phase 1 Construction Access, Staging, and Sequencing Plan].dwg



0 30 60
SCALE IN FEET

CONSTRUCTION SEQUENCING AND DEWATERING GENERAL NOTES

ALL IN-WATER WORK SHALL OCCUR BETWEEN JULY 15 - AUGUST 15 OR AS OTHERWISE SPECIFIED IN ENVIRONMENTAL PERMITS.

7 (1.1) ACCESS SITE FROM LOSTINE RIVER ROAD. (1.2) ESTABLISH TEMPORARY ACCESS ROUTES THROUGHOUT THE SITE AS SHOWN. TEMPORARY ACCESS ROUTES SHALL MINIMIZE DISTURBANCE TO NATIVE VEGETATION AND THE PRIVATE LAND OWNERS PROPERTY. PRIVATE ROADS MUST BE CLEAR OF ALL CONSTRUCTION DEBRIS AT ALL TIMES. (1.3) ROADS SHALL BE RESTORED TO EXISTING CONDITION OR BETTER PRIOR TO COMPLETION OF THE PROJECT.

8 (2.1) ESTABLISH STAGING AND STOCKPILE LOCATIONS AS SHOWN. ALL FUEL STORAGE AND REFUELING ACTIVES SHALL OCCUR AT A MINIMUM OF 150 FEET FROM THE EDGE OF WATER. (2.2) INSTALL PERIMETER SEDIMENT CONTROLS AROUND STAGING AREAS AND STABILIZE ANY TEMPORARY STOCKPILES.

9 (3.1) ISOLATE WORK ZONE FOR CONSTRUCTION OF LARGE WOOD STRUCTURES. (3.2) CONDUCT FISH SALVAGE WITHIN THE SIDE CHANNEL PRIOR TO DEWATERING. (3.3) DEWATER THE SIDE CHANNEL AND ALLOW FOR CONTINUOUS DOWNSTREAM PASSAGE THROUGH THE DURATION OF ISOLATION. AFTER FISH SALVAGE WATER WITHIN THE WORK AREA SHALL BE PUMPED OUT AND DISCHARGED IN AN UPLAND LOCATION TO AVOID EXCESS TURBIDITY.

10 (4.1) EXCAVATE EXISTING MATERIAL FOR LARGE WOODY MATERIAL STRUCTURES AS INDICATED ON THE DESIGN DRAWINGS.

11 (5.1) CONSTRUCT LARGE WOOD STRUCTURES PER DRAWINGS 4.1 THROUGH 3.3.

12 (6.1) RESTORE DISTURBED AREAS WITHIN THE FLOODPLAIN GRADING LIMITS ACCORDING TO THE REVEGETATION PLAN ON DRAWING 7.1. (6.2) STABILIZE WITH NATIVE SEED MIX AND LIVES STAKES AFTER CHANNEL EXCAVATION AND LOG STRUCTURE INSTALLATION IS COMPLETE. RESTORE ALL DISTURBED AREAS WITHIN PRIVATE PROPERTY TO EXISTING CONDITIONS OR BETTER.

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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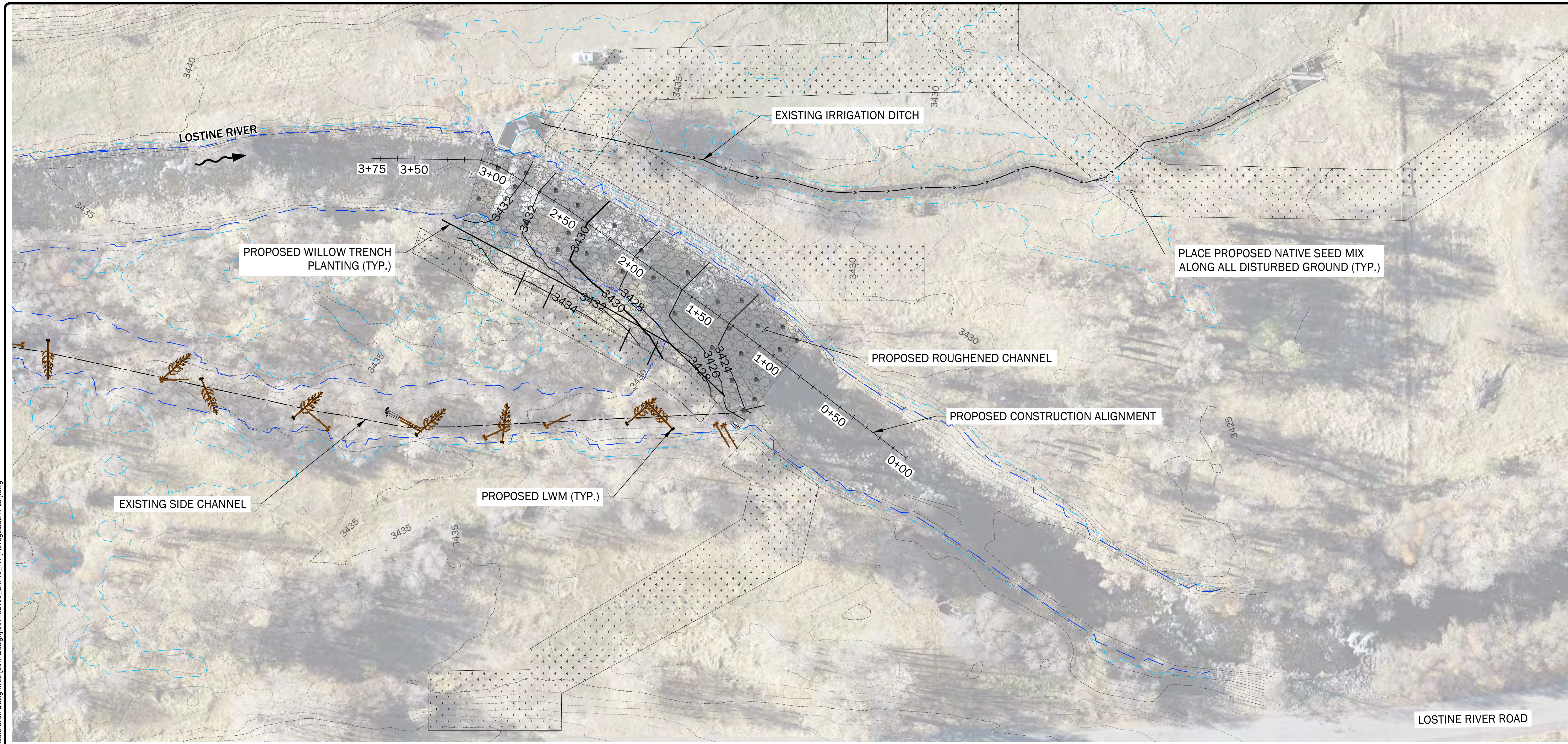
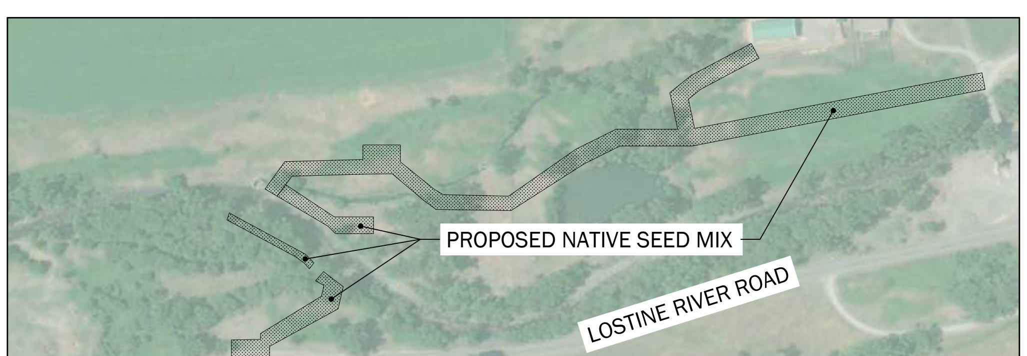
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

PHASE 2 CONSTRUCTION ACCESS, STAGING, AND SEQUENCING PLAN

DRAWING NUMBER:
6.2
SHEET: 15 OF 19



N
0 30 60
SCALE IN FEET



REVEGETATION PLAN - OVERVIEW

N
0 200 400
SCALE IN FEET

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

Plotted: 09/23/2021, 13:43 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\v03 [80% Design]\057102100_Sht 16_7.1 [Revegetation Plan].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

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DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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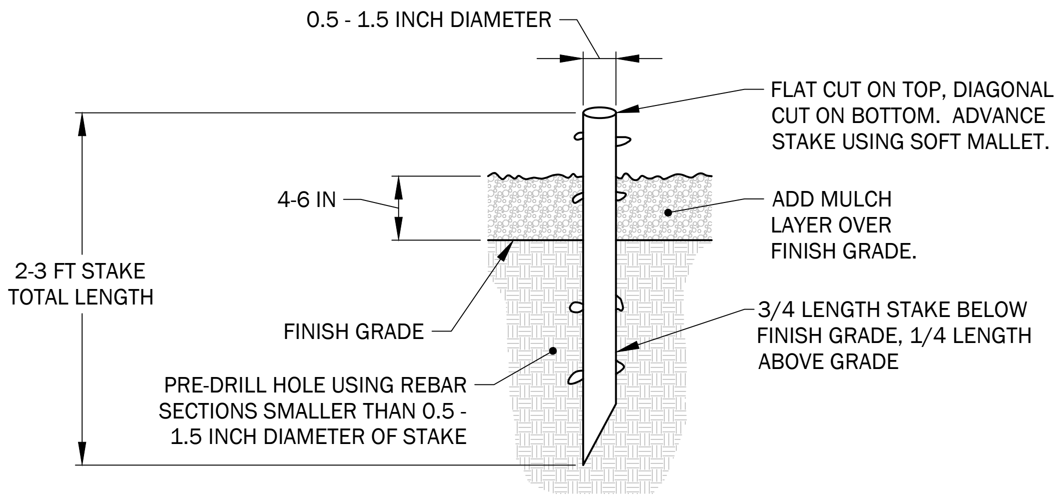
LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

REVEGETATION PLAN

DRAWING NUMBER:
7.1
SHEET: 16 OF 19

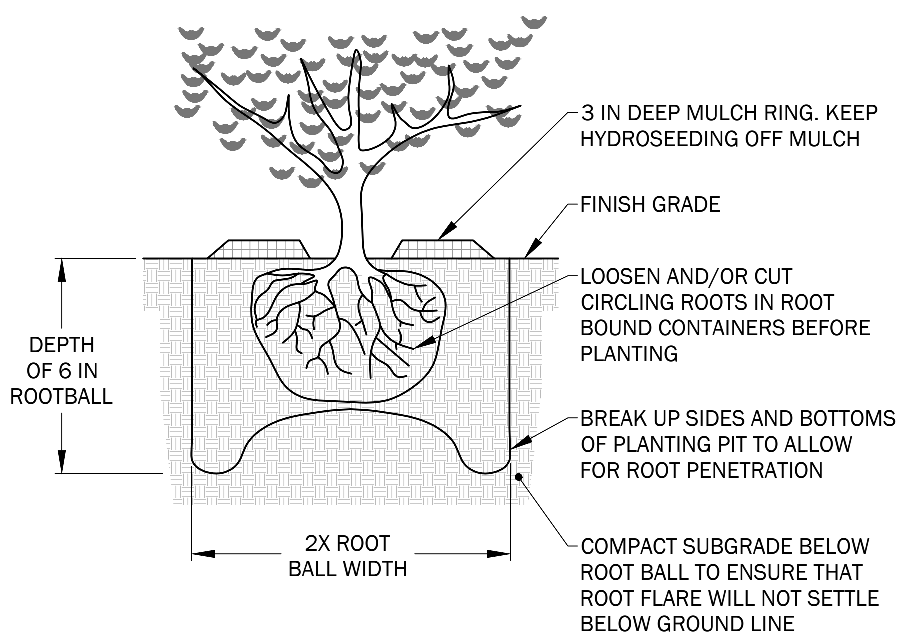


TYPICAL WILLOW STAKE DETAIL

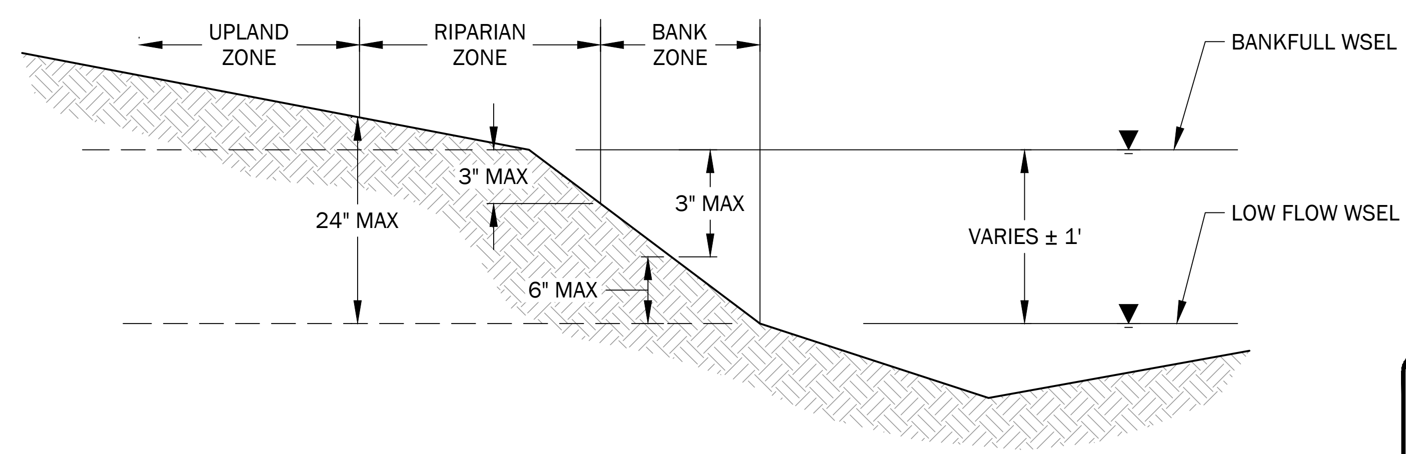
Seed Mix Includes Approximately 0.8 Acres			
Species	**Size**	**lbs/acre**	**Quantity**
Annual Ryegrass	Seed	10	8.0
Idaho Fescue	Seed	3	2.4
Blue Wildrye	Seed	10	8.0
Mountain Brome	Seed	12	9.6

SEEDING NOTES:
1) THE SEED MIX IS SUGGESTED BASED ON PAST WORK BUT CAN BE SUBSTITUTED WITH SIMILAR MIX AS APPROVED BY THE NEZ PERCE TRIBE
2) INSTALL CUTTINGS ABOVE THE 1.01-YEAR WSEL AND BELOW THE 2 -YEAR WSEL SO STEM INTERCEPT SHALLOW GROUNDWATER AT LOW-FLOW CONDITIONS.

Willow Trench Planting					
Species	**Total Trench Length (ft)**	**Stake Size**		**Spacing (ft.)**	**Quantity**
		Length (ft.) (Min)	**Diameter (inch) (Min/Max)**		
Willow (Salix sp.)-Floodplain	260	4	0.5/1.5	1	260



TYPICAL PLANT DETAIL



PLANTING ZONE SECTION

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

Plotted: 09/23/2021, 13:43 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\03 [80% Design]\057102100_Sht 17_7.2 [Revegetation Details].dwg

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

REVEGETATION DETAILS

DRAWING NUMBER:
7.2
SHEET: 17 OF 19

HIP 4 GENERAL AQUATIC CONSERVATION MEASURES APPLICABLE TO ALL ACTIONS

THE ACTIVITIES COVERED UNDER THE HIP IV ARE INTENDED TO PROTECT AND RESTORE FISH AND WILDLIFE HABITAT WITH LONG-TERM BENEFITS TO ESA-LISTED SPECIES. TO MINIMIZE THESE SHORT-TERM ADVERSE EFFECTS AND MAKE THEM PREDICTABLE FOR THE PURPOSES OF PROGRAMMATIC ANALYSIS, BPA WILL INCLUDE IN ALL PROJECTS IMPLEMENTED UNDER THIS HIP IV PROPOSED ACTION THE FOLLOWING GENERAL CONSERVATION MEASURES (DEVELOPED IN COORDINATION WITH USFWS AND NMFS).

PROJECT DESIGN AND SITE PREPARATION.

1) STATE AND FEDERAL PERMITS. ALL APPLICABLE REGULATORY PERMITS AND OFFICIAL PROJECT AUTHORIZATIONS WILL BE OBTAINED BEFORE PROJECT IMPLEMENTATION. THESE PERMITS AND AUTHORIZATIONS INCLUDE, BUT ARE NOT LIMITED TO, NATIONAL ENVIRONMENTAL POLICY ACT, NATIONAL HISTORIC PRESERVATION ACT, AND THE APPROPRIATE STATE AGENCY REMOVAL AND FILL PERMIT, USACE CLEAN WATER ACT (CWA) 404 PERMITS, AND CWA SECTION 401 WATER QUALITY CERTIFICATIONS.

2) TIMING OF IN-WATER WORK. APPROPRIATE STATE (OREGON DEPARTMENT OF FISH AND WILDLIFE (ODFW), GUIDELINES FOR TIMING OF IN-WATER WORK WINDOWS (IWWW) WILL BE FOLLOWED.

A) BULL TROUT - WHILE UTILIZING THE APPROPRIATE STATE DESIGNATED IN-WATER WORK PERIOD WILL LESSEN THE RISK TO BULL TROUT, THIS ALONE MAY NOT BE SUFFICIENT TO ADEQUATELY PROTECT LOCAL BULL TROUT POPULATIONS. THIS IS ESPECIALLY TRUE IF WORK IS OCCURRING IN SPAWNING AND REARING AREAS BECAUSE EGGS, ALEVIN, AND FRY ARE IN THE SUBSTRATE OR CLOSELY ASSOCIATED HABITATS NEARLY YEAR ROUND. SOME AREAS MAY NOT HAVE DESIGNATED IN-WATER WORK WINDOWS FOR BULL TROUT OR IF THEY DO, THEY MAY CONFLICT WITH WORK WINDOWS FOR SALMON AND STEELHEAD. IF THIS IS THE CASE, OR IF PROPOSED WORK IS TO OCCUR WITHIN BULL TROUT SPAWNING AND REARING HABITATS, PROJECT PROPONENTS WILL CONTACT THE APPROPRIATE USFWS FIELD OFFICE TO INSURE THAT ALL REASONABLE IMPLEMENTATION MEASURES ARE CONSIDERED AND AN APPROPRIATE IN-WATER WORK WINDOW IS BEING USED TO MINIMIZE PROJECT EFFECTS.

B) LAMPREY - THE PROJECT SPONSOR AND/OR THEIR CONTRACTORS WILL AVOID WORKING IN STREAM OR RIVER CHANNELS THAT CONTAIN PACIFIC LAMPREY FROM MARCH 1 TO JULY 1 IN LOW TO MID ELEVATION REACHES (<5,000 FEET). IN HIGH ELEVATION REACHES (>5,000 FEET), THE PROJECT SPONSOR WILL AVOID WORKING IN STREAM OR RIVER CHANNELS FROM MARCH 1 TO AUGUST 1. IF EITHER TIMEFRAME IS INCOMPATIBLE WITH OTHER OBJECTIVES, THE AREA WILL BE SURVEYED FOR NESTS AND LAMPREY PRESENCE, AND AVOIDED IF POSSIBLE. IF LAMPREYS ARE KNOWN TO EXIST, THE PROJECT SPONSOR WILL UTILIZE DEWATERING AND SALVAGE PROCEDURES OUTLINED IN US FISH AND WILDLIFE SERVICE BEST MANAGEMENT PRACTICES TO MINIMIZE ADVERSE EFFECTS TO PACIFIC LAMPREY (2010).

C) EXCEPTIONS TO ODFW, WDFW, MFWP, OR IDFG IN-WATER WORK WINDOWS WILL BE REQUESTED THROUGH THE VARIANCE PROCESS (PAGE 2).

3) CONTAMINANTS. THE PROJECT SPONSOR WILL COMPLETE A SITE ASSESSMENT WITH THE FOLLOWING ELEMENTS TO IDENTIFY THE TYPE, QUANTITY, AND EXTENT OF ANY POTENTIAL CONTAMINATION FOR ANY ACTION THAT INVOLVES EXCAVATION OF MORE THAN 20 CUBIC YARDS OF MATERIAL:

A) A REVIEW OF AVAILABLE RECORDS, SUCH AS FORMER SITE USE, BUILDING PLANS, AND RECORDS OF ANY PRIOR CONTAMINATION EVENTS;

B) A SITE VISIT TO INSPECT THE AREAS USED FOR VARIOUS INDUSTRIAL PROCESSES AND THE CONDITION OF THE PROPERTY;

C) INTERVIEWS WITH KNOWLEDGEABLE PEOPLE, SUCH AS SITE OWNERS, OPERATORS, AND OCCUPANTS, NEIGHBORS, OR LOCAL GOVERNMENT OFFICIALS; AND

D) A SUMMARY, STORED WITH THE PROJECT FILE THAT INCLUDES AN ASSESSMENT OF THE LIKELIHOOD THAT CONTAMINANTS ARE PRESENT AT THE SITE, BASED ON ITEMS 4(A) THROUGH 4(C).

4) SITE LAYOUT AND FLAGGING. PRIOR TO CONSTRUCTION. THE ACTION AREA WILL BE CLEARLY FLAGGED TO IDENTIFY THE FOLLOWING:

A) SENSITIVE RESOURCE AREAS, SUCH AS AREAS BELOW ORDINARY HIGH WATER, SPAWNING AREAS, SPRINGS, AND WETLANDS;

B) EQUIPMENT ENTRY AND EXIT POINTS;

C) ROAD AND STREAM CROSSING ALIGNMENTS;

D) STAGING, STORAGE, AND STOCKPILE AREAS; AND

E) NO-SPRAY AREAS AND BUFFERS.

5) TEMPORARY ACCESS ROADS AND PATHS.

A) EXISTING ACCESS ROADS AND PATHS WILL BE PREFERENTIALLY USED WHENEVER REASONABLE, AND THE NUMBER AND LENGTH OF TEMPORARY ACCESS ROADS AND PATHS THROUGH RIPARIAN AREAS AND FLOODPLAINS WILL BE MINIMIZED TO LESSEN SOIL DISTURBANCE AND COMPACTION, AND IMPACTS TO VEGETATION.

B) TEMPORARY ACCESS ROADS AND PATHS WILL NOT BE BUILT ON SLOPES WHERE GRADE, SOIL, OR OTHER FEATURES SUGGEST A LIKELIHOOD OF EXCESSIVE EROSION OR FAILURE. IF SLOPES ARE STEEPER THAN 30%, THEN THE ROAD WILL BE DESIGNED BY A CIVIL ENGINEER WITH EXPERIENCE IN STEEP ROAD DESIGN.

C) THE REMOVAL OF RIPARIAN VEGETATION DURING CONSTRUCTION OF TEMPORARY ACCESS ROADS WILL BE MINIMIZED. WHEN TEMPORARY VEGETATION REMOVAL IS REQUIRED, VEGETATION WILL BE CUT AT GROUND LEVEL (NOT GRUBBED).

D) AT PROJECT COMPLETION, ALL TEMPORARY ACCESS ROADS AND PATHS WILL BE OBLITERATED, AND THE SOIL WILL BE STABILIZED AND REVEGETATED. ROAD AND PATH OBLITERATION REFERS TO THE MOST COMPREHENSIVE DEGREE OF DECOMMISSIONING AND INVOLVES DECOMPACTING THE SURFACE AND DITCH, PULLING THE FILL MATERIAL ONTO THE RUNNING SURFACE, AND RESHAPING TO MATCH THE ORIGINAL CONTOUR.

E) TEMPORARY ROADS AND PATHS IN WET AREAS OR AREAS PRONE TO FLOODING WILL BE OBLITERATED BY THE END OF THE IN-WATER WORK WINDOW.

6) TEMPORARY STREAM CROSSINGS.

A) EXISTING STREAM CROSSINGS WILL BE PREFERENTIALLY USED WHENEVER REASONABLE, AND THE NUMBER OF TEMPORARY STREAM CROSSINGS WILL BE MINIMIZED.

B) TEMPORARY BRIDGES AND CULVERTS WILL BE INSTALLED TO ALLOW FOR EQUIPMENT AND VEHICLE CROSSING OVER PERENNIAL STREAMS DURING CONSTRUCTION. TREATED WOOD SHALL NOT BE USED ON TEMPORARY BRIDGE CROSSINGS OR IN LOCATIONS IN CONTACT WITH OR OVER WATER.

C) EQUIPMENT AND VEHICLES WILL CROSS THE STREAM IN THE WET ONLY WHERE:

I. THE STREAMBED IS BEDROCK; OR

II. MATS OR OFF-SITE LOGS ARE PLACED IN THE STREAM AND USED AS A CROSSING.

D) VEHICLES AND MACHINERY WILL CROSS STREAMS AT RIGHT ANGLES TO THE MAIN CHANNEL WHEREVER POSSIBLE.

E) THE LOCATION OF THE TEMPORARY CROSSING WILL AVOID AREAS THAT MAY INCREASE THE RISK OF CHANNEL RE-ROUTING OR AVULSION.

F) POTENTIAL SPAWNING HABITAT (I.E., POOL TAILOUTS) AND POOLS WILL BE AVOIDED TO THE MAXIMUM EXTENT POSSIBLE.

G) NO STREAM CROSSINGS WILL OCCUR AT ACTIVE SPAWNING SITES, WHEN HOLDING ADULT LISTED FISH ARE PRESENT, OR WHEN EGGS OR ALEVINS ARE IN THE GRAVEL. THE APPROPRIATE STATE FISH AND WILDLIFE AGENCY WILL BE CONTACTED FOR SPECIFIC TIMING INFORMATION.

H) AFTER PROJECT COMPLETION, TEMPORARY STREAM CROSSINGS WILL BE OBLITERATED AND THE STREAM CHANNEL AND BANKS RESTORED.

7) STAGING, STORAGE, AND STOCKPILE AREAS.

A) STAGING AREAS (USED FOR CONSTRUCTION EQUIPMENT STORAGE, VEHICLE STORAGE, FUELING, SERVICING, AND HAZARDOUS MATERIAL STORAGE) WILL BE 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND, OR ON AN ADJACENT, ESTABLISHED ROAD AREA IN A LOCATION AND MANNER THAT WILL PRECLUDE EROSION INTO OR CONTAMINATION OF THE STREAM OR FLOODPLAIN.

B) NATURAL MATERIALS USED FOR IMPLEMENTATION OF AQUATIC RESTORATION, SUCH AS LARGE WOOD, GRAVEL, AND BOULDERS, MAY BE STAGED WITHIN THE 100-YEAR FLOODPLAIN.

C) ANY LARGE WOOD, TOPSOIL, AND NATIVE CHANNEL MATERIAL DISPLACED BY CONSTRUCTION WILL BE STOCKPILED FOR USE DURING SITE RESTORATION AT A SPECIFICALLY IDENTIFIED AND FLAGGED AREA.

D) ANY MATERIAL NOT USED IN RESTORATION, AND NOT NATIVE TO THE FLOODPLAIN, WILL BE REMOVED TO A LOCATION OUTSIDE OF THE 100-YEAR FLOODPLAIN FOR DISPOSAL.

8) EQUIPMENT. MECHANIZED EQUIPMENT AND VEHICLES WILL BE SELECTED, OPERATED, AND MAINTAINED IN A MANNER THAT MINIMIZES ADVERSE EFFECTS ON THE ENVIRONMENT (E.G., MINIMALLY-SIZED, LOW PRESSURE TIRES; MINIMAL HARD-TURN PATHS FOR TRACKED VEHICLES; TEMPORARY MATS OR PLATES WITHIN WET AREAS OR ON SENSITIVE SOILS). ALL VEHICLES AND OTHER MECHANIZED EQUIPMENT WILL BE:

A) STORED, FUELED, AND MAINTAINED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM ANY NATURAL WATER BODY OR WETLAND OR ON AN ADJACENT, ESTABLISHED ROAD AREA;

B) REFUELED IN A VEHICLE STAGING AREA PLACED 150 FEET OR MORE FROM A NATURAL WATERBODY OR WETLAND, OR IN AN ISOLATED HARD ZONE, SUCH AS A PAVED PARKING LOT OR ADJACENT, ESTABLISHED ROAD (THIS MEASURE APPLIES ONLY TO GAS-POWERED EQUIPMENT WITH TANKS LARGER THAN 5 GALLONS).

C) BIODEGRADABLE LUBRICANTS AND FLUIDS SHALL BE USED ON EQUIPMENT OPERATING IN AND ADJACENT TO THE STREAM CHANNEL AND LIVE WATER.

D) INSPECTED DAILY FOR FLUID LEAKS BEFORE LEAVING THE VEHICLE STAGING AREA FOR OPERATION WITHIN 150 FEET OF ANY NATURAL WATER BODY OR WETLAND; AND

E) THOROUGHLY CLEANED BEFORE OPERATION BELOW ORDINARY HIGH WATER, AND AS OFTEN AS NECESSARY DURING OPERATION, TO REMAIN GREASE FREE.

9) EROSION CONTROL. EROSION CONTROL MEASURES WILL BE PREPARED AND CARRIED OUT, COMMENSURATE IN SCOPE WITH THE ACTION, THAT MAY INCLUDE THE FOLLOWING:

A) TEMPORARY EROSION CONTROLS.

I. TEMPORARY EROSION CONTROLS WILL BE IN PLACE BEFORE ANY SIGNIFICANT ALTERATION OF THE ACTION SITE AND APPROPRIATELY INSTALLED DOWNSLOPE OF PROJECT ACTIVITY WITHIN THE RIPARIAN BUFFER AREA UNTIL SITE REHABILITATION IS COMPLETE.

II. IF THERE IS A POTENTIAL FOR ERODED SEDIMENT TO ENTER THE STREAM, SEDIMENT BARRIERS WILL BE INSTALLED AND MAINTAINED FOR THE DURATION OF PROJECT IMPLEMENTATION.

III. TEMPORARY EROSION CONTROL MEASURES MAY INCLUDE FIBER WATTLES, SILT FENCES, JUTE MATTING, WOOD FIBER MULCH AND SOIL BINDER, OR GEOTEXTILES AND GEOSYNTHETIC FABRIC.

IV. SOIL STABILIZATION UTILIZING WOOD FIBER MULCH AND TACKIFIER (HYDRO-APPLIED) MAY BE USED TO REDUCE EROSION OF BARE SOIL IF THE MATERIALS ARE NOXIOUS WEED FREE AND NONTOXIC TO AQUATIC AND TERRESTRIAL ANIMALS, SOIL MICROORGANISMS, AND VEGETATION.

V. SEDIMENT WILL BE REMOVED FROM EROSION CONTROLS ONCE IT HAS REACHED 1/3 OF THE EXPOSED HEIGHT OF THE CONTROL.

VI. ONCE THE SITE IS STABILIZED AFTER CONSTRUCTION, TEMPORARY EROSION CONTROL MEASURES WILL BE REMOVED.

B) EMERGENCY EROSION CONTROLS. THE FOLLOWING MATERIALS FOR EMERGENCY EROSION CONTROL WILL BE AVAILABLE AT THE WORK SITE:

I. A SUPPLY OF SEDIMENT CONTROL MATERIALS; AND

II. AN OIL-ABSORBING FLOATING BOOM WHENEVER SURFACE WATER IS PRESENT.

10) DUST ABATEMENT. THE PROJECT SPONSOR WILL DETERMINE THE APPROPRIATE DUST CONTROL MEASURES BY CONSIDERING SOIL TYPE, EQUIPMENT USAGE, PREVAILING WIND DIRECTION, AND THE EFFECTS CAUSED BY OTHER EROSION AND SEDIMENT CONTROL MEASURES. IN ADDITION, THE FOLLOWING CRITERIA WILL BE FOLLOWED:

A) WORK WILL BE SEQUENCED AND SCHEDULED TO REDUCE EXPOSED BARE SOIL SUBJECT TO WIND EROSION.

B) DUST-ABATEMENT ADDITIVES AND STABILIZATION CHEMICALS (TYPICALLY MAGNESIUM CHLORIDE, CALCIUM CHLORIDE SALTS, OR LIGNINSULFONATE) WILL NOT BE APPLIED WITHIN 25 FEET OF WATER OR A STREAM CHANNEL AND WILL BE APPLIED SO AS TO MINIMIZE THE LIKELIHOOD THAT THEY WILL ENTER STREAMS. APPLICATIONS OF LIGNINSULFONATE WILL BE LIMITED TO A MAXIMUM RATE OF 0.5 GALLONS PER SQUARE YARD OF ROAD SURFACE, ASSUMING A 50:50 (LIGNINSULFONATE TO WATER) SOLUTION.

C) APPLICATION OF DUST ABATEMENT CHEMICALS WILL BE AVOIDED DURING OR JUST BEFORE WET WEATHER, AND AT STREAM CROSSINGS OR OTHER AREAS THAT COULD RESULT IN UNFILTERED DELIVERY OF THE DUST ABATEMENT MATERIALS TO A WATERBODY (TYPICALLY THESE WOULD BE AREAS WITHIN 25 FEET OF A WATERBODY OR STREAM CHANNEL; DISTANCES MAY BE GREATER WHERE VEGETATION IS SPARSE OR SLOPES ARE STEEP).

D) SPILL CONTAINMENT EQUIPMENT WILL BE AVAILABLE DURING APPLICATION OF DUST ABATEMENT CHEMICALS.

E) PETROLEUM-BASED PRODUCTS WILL NOT BE USED FOR DUST ABATEMENT.

11) SPILL PREVENTION, CONTROL, AND COUNTER MEASURES. THE USE OF MECHANIZED MACHINERY INCREASES THE RISK FOR ACCIDENTAL SPILLS OF FUEL, LUBRICANTS, HYDRAULIC FLUID, OR OTHER CONTAMINANTS INTO THE RIPARIAN ZONE OR DIRECTLY INTO THE WATER. ADDITIONALLY, UNCURED CONCRETE AND FORM MATERIALS ADJACENT TO THE ACTIVE STREAM CHANNEL MAY RESULT IN ACCIDENTAL DISCHARGE INTO THE WATER. THESE CONTAMINANTS CAN DEGRADE HABITAT, AND INJURE OR KILL AQUATIC FOOD ORGANISMS AND ESA-LISTED SPECIES. THE PROJECT SPONSOR WILL ADHERE TO THE FOLLOWING MEASURES:

A) A DESCRIPTION OF HAZARDOUS MATERIALS THAT WILL BE USED, INCLUDING INVENTORY, STORAGE, AND HANDLING PROCEDURES WILL BE AVAILABLE ON-SITE.

B) WRITTEN PROCEDURES FOR NOTIFYING ENVIRONMENTAL RESPONSE AGENCIES WILL BE POSTED AT THE WORK SITE.

C) SPILL CONTAINMENT KITS (INCLUDING INSTRUCTIONS FOR CLEANUP AND DISPOSAL) ADEQUATE FOR THE TYPES AND QUANTITY OF HAZARDOUS MATERIALS USED AT THE SITE WILL BE AVAILABLE AT THE WORK SITE.

D) WORKERS WILL BE TRAINED IN SPILL CONTAINMENT PROCEDURES AND WILL BE INFORMED OF THE LOCATION OF SPILL CONTAINMENT KITS.

E) ANY WASTE LIQUIDS GENERATED AT THE STAGING AREAS WILL BE TEMPORARILY STORED UNDER AN IMPERVIOUS COVER, SUCH AS A TARPAULIN, UNTIL THEY CAN BE PROPERLY TRANSPORTED TO AND DISPOSED OF AT A FACILITY THAT IS APPROVED FOR RECEIPT OF HAZARDOUS MATERIALS.

12) INVASIVE SPECIES CONTROL. THE FOLLOWING MEASURES WILL BE FOLLOWED TO AVOID INTRODUCTION OF INVASIVE PLANTS AND NOXIOUS WEEDS INTO PROJECT AREAS:

A) PRIOR TO ENTERING THE SITE, ALL VEHICLES AND EQUIPMENT WILL BE POWER WASHED, ALLOWED TO FULLY DRY, AND INSPECTED TO MAKE SURE NO PLANTS, SOIL, OR OTHER ORGANIC MATERIAL ADHERES TO THE SURFACE.

B) WATERCRAFT, WADERS, BOOTS, AND ANY OTHER GEAR TO BE USED IN OR NEAR WATER WILL BE INSPECTED FOR AQUATIC INVASIVE SPECIES.

C) WADING BOOTS WITH FELT SOLES ARE NOT TO BE USED DUE TO THEIR PROPENSITY FOR AIDING IN THE TRANSFER OF INVASIVE SPECIES.

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

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PREPARED FOR:
NEZ PERCE TRIBE

LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

HIP IV - GENERAL CONSERVATION MEASURES

DRAWING NUMBER:
8.1
SHEET: 18 OF 19

Plotted: 09/23/2021, 13:43 | amorton \\geoengineers.com\wan\Projects\0\0571021\CAD\00\River Restoration Design\v03 [80% Design]\057102100_Sht 18_8.1 [HIP IV - General Conservation Measures].dwg

WORK AREA ISOLATION & FISH SALVAGE.

ANY WORK AREA WITHIN THE WETTED CHANNEL WILL BE ISOLATED FROM THE ACTIVE STREAM WHENEVER ESA-LISTED FISH ARE REASONABLY CERTAIN TO BE PRESENT, OR IF THE WORK AREA IS LESS THAN 300-FEET UPSTREAM FROM KNOWN SPAWNING HABITATS. WHEN WORK AREA ISOLATION IS REQUIRED, DESIGN PLANS WILL INCLUDE ALL ISOLATION ELEMENTS, FISH RELEASE AREAS, AND, WHEN A PUMP IS USED TO DEWATER THE ISOLATION AREA AND FISH ARE PRESENT, A FISH SCREEN THAT MEETS NMFS'S FISH SCREEN CRITERIA (NMFS 2011, OR MOST CURRENT). WORK AREA ISOLATION AND FISH CAPTURE ACTIVITIES WILL OCCUR DURING PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS AND DEATH OF SPECIES PRESENT.

- NATIONAL MARINE FISHERIES SERVICE. 2011. ANADROMOUS SALMONID PASSAGE FACILITY DESIGN. NORTHWEST REGION. AVAILABLE ONLINE AT: HTTP://WWW.NWR.NOAA.GOV/SALMON-HYDROPOWER/FERC/UPLOAD/FISH-PASSAGE-DESIGN.PDF

- U.S. FISH AND WILDLIFE SERVICE. 2010. BEST MANAGEMENT PRACTICES TO MINIMIZE ADVERSE EFFECTS TO PACIFIC LAMPREY. HTTP://WWW.FWS.GOV/PACIFIC/FISHERIES/SPHABCON/LAMPREY/PDF/BEST%20MANAGEMENT%20PRACTICES%20FOR%20PACIFIC%20LAMPREY%20APRIL%202010%20VERSION.PDF

FOR SALVAGE OPERATIONS IN KNOWN BULL TROUT SPAWNING AND REARING HABITAT, ELECTROFISHING SHALL ONLY OCCUR FROM MAY 1 TO JULY 31. NO ELECTROFISHING WILL OCCUR IN ANY BULL TROUT OCCUPIED HABITAT AFTER AUGUST 15. BULL TROUT ARE VERY TEMPERATURE SENSITIVE AND GENERALLY SHOULD NOT BE ELECTROSHOCKED OR OTHERWISE HANDLED WHEN TEMPERATURES EXCEED 15 DEGREES CELSIUS. SALVAGE ACTIVITIES SHOULD TAKE PLACE DURING PERIODS OF THE COOLEST AIR AND WATER TEMPERATURES POSSIBLE, NORMALLY EARLY IN THE MORNING VERSUS LATE IN THE DAY, AND DURING CONDITIONS APPROPRIATE TO MINIMIZE STRESS TO FISH SPECIES PRESENT.

SALVAGE OPERATIONS WILL FOLLOW THE ORDERING, METHODOLOGIES, AND CONSERVATION MEASURES SPECIFIED BELOW IN STEPS 1 THROUGH 6. STEPS 1 AND 2 WILL BE IMPLEMENTED FOR ALL PROJECTS WHERE WORK AREA ISOLATION IS NECESSARY ACCORDING TO CONDITIONS ABOVE. ELECTROFISHING (STEP 3) CAN BE IMPLEMENTED TO ENSURE ALL FISH HAVE BEEN REMOVED FOLLOWING STEPS 1 AND 2, OR WHEN OTHER MEANS OF FISH CAPTURE MAY NOT BE FEASIBLE OR EFFECTIVE. DEWATERING AND REWATERING (STEPS 4 AND 5) WILL BE IMPLEMENTED UNLESS WETTED IN-STREAM WORK IS DEEMED TO BE MINIMALLY HARMFUL TO FISH, AND IS BENEFICIAL TO OTHER AQUATIC SPECIES. DEWATERING WILL NOT BE CONDUCTED IN AREAS KNOWN TO BE OCCUPIED BY LAMPREY, UNLESS LAMPREYS ARE SALVAGED USING GUIDANCE SET FORTH IN US FISH AND WILDLIFE SERVICE (2010)3.

1) ISOLATE.

A) BLOCK NETS WILL BE INSTALLED AT UPSTREAM AND DOWNSTREAM LOCATIONS AND MAINTAINED IN A SECURED POSITION TO EXCLUDE FISH FROM ENTERING THE PROJECT AREA.

B) BLOCK NETS WILL BE SECURED TO THE STREAM CHANNEL BED AND BANKS UNTIL FISH CAPTURE AND TRANSPORT ACTIVITIES ARE COMPLETE. BLOCK NETS MAY BE LEFT IN PLACE FOR THE DURATION OF THE PROJECT TO EXCLUDE FISH.

C) IF BLOCK NETS REMAIN IN PLACE MORE THAN ONE DAY, THE NETS WILL BE MONITORED AT LEAST DAILY TO ENSURE THEY ARE SECURED TO THE BANKS AND FREE OF ORGANIC ACCUMULATION. IF THE PROJECT IS WITHIN BULL TROUT SPAWNING AND REARING HABITAT, THE BLOCK NETS MUST BE CHECKED EVERY FOUR HOURS FOR FISH IMPINGEMENT ON THE NET. LESS FREQUENT INTERVALS MUST BE APPROVED THROUGH A VARIANCE REQUEST.

D) NETS WILL BE MONITORED HOURLY ANYTIME THERE IS INSTREAM DISTURBANCE.

2) SALVAGE. AS DESCRIBED BELOW, FISH TRAPPED WITHIN THE ISOLATED WORK AREA WILL BE CAPTURED TO MINIMIZE THE RISK OF INJURY, THEN RELEASED AT A SAFE SITE:

A) REMOVE AS MANY FISH AS POSSIBLE PRIOR TO DEWATERING.

B) DURING DEWATERING, ANY REMAINING FISH WILL BE COLLECTED BY HAND OR DIP NETS.

C) SEINES WITH A MESH SIZE TO ENSURE CAPTURE OF THE RESIDING ESA-LISTED FISH WILL BE USED.

D) MINNOW TRAPS WILL BE LEFT IN PLACE OVERNIGHT AND USED IN CONJUNCTION WITH SEINING.

E) IF BUCKETS ARE USED TO TRANSPORT FISH:

I. THE TIME FISH ARE IN A TRANSPORT BUCKET WILL BE LIMITED, AND WILL BE RELEASED AS QUICKLY AS POSSIBLE;

II. THE NUMBER OF FISH WITHIN A BUCKET WILL BE LIMITED BASED ON SIZE, AND FISH WILL BE OF RELATIVELY COMPARABLE SIZE TO MINIMIZE PREDATION;

III. AERATORS FOR BUCKETS WILL BE USED OR THE BUCKET WATER WILL BE FREQUENTLY CHANGED WITH COLD CLEAR WATER AT 15 MINUTE OR MORE FREQUENT INTERVALS.

IV. BUCKETS WILL BE KEPT IN SHADED AREAS OR WILL BE COVERED BY A CANOPY IN EXPOSED AREAS.

V. DEAD FISH WILL NOT BE STORED IN TRANSPORT BUCKETS, BUT WILL BE LEFT ON THE STREAM BANK TO AVOID MORTALITY COUNTING ERRORS.

F) AS RAPIDLY AS POSSIBLE (ESPECIALLY FOR TEMPERATURE-SENSITIVE BULL TROUT), FISH WILL BE RELEASED IN AN AREA THAT PROVIDES ADEQUATE COVER AND FLOW REFUGE. UPSTREAM RELEASE IS GENERALLY PREFERRED, BUT FISH RELEASED DOWNSTREAM WILL BE SUFFICIENTLY OUTSIDE OF THE INFLUENCE OF CONSTRUCTION.

G) SALVAGE WILL BE SUPERVISED BY A QUALIFIED FISHERIES BIOLOGIST EXPERIENCED WITH WORK AREA ISOLATION AND COMPETENT TO ENSURE THE SAFE HANDLING OF ALL FISH.

3) ELECTROFISHING. ELECTROFISHING WILL BE USED ONLY AFTER OTHER SALVAGE METHODS HAVE BEEN EMPLOYED OR WHEN OTHER MEANS OF FISH CAPTURE ARE DETERMINED TO NOT BE FEASIBLE OR EFFECTIVE. IF ELECTROFISHING WILL BE USED TO CAPTURE FISH FOR SALVAGE, THE SALVAGE OPERATION WILL BE LED BY AN EXPERIENCED FISHERIES BIOLOGIST AND THE FOLLOWING GUIDELINES WILL BE FOLLOWED:

A) THE NMFS'S ELECTROFISHING GUIDELINES (NMFS 2000).

B) ONLY DIRECT CURRENT (DC) OR PULSED DIRECT CURRENT (PDC) WILL BE USED AND CONDUCTIVITY MUST BE TESTED.

I. IF CONDUCTIVITY IS LESS THAN 100 MS, VOLTAGE RANGES FROM 900 TO 1100 WILL BE USED.

II. FOR CONDUCTIVITY RANGES BETWEEN 100 TO 300 MS, VOLTAGE RANGES WILL BE 500 TO 800.

III. FOR CONDUCTIVITY GREATER THAN 300 MS, VOLTAGE WILL BE LESS THAN 400.

C) ELECTROFISHING WILL BEGIN WITH A MINIMUM PULSE WIDTH AND RECOMMENDED VOLTAGE AND THEN GRADUALLY INCREASE TO THE POINT WHERE FISH ARE IMMOBILIZED.

D) THE ANODE WILL NOT INTENTIONALLY CONTACT FISH.

E) ELECTROFISHING SHALL NOT BE CONDUCTED WHEN THE WATER CONDITIONS ARE TURBID AND VISIBILITY IS POOR. THIS CONDITION MAY BE EXPERIENCED WHEN THE SAMPLER CANNOT SEE THE STREAM BOTTOM IN ONE FOOT OF WATER.

F) IF MORTALITY OR OBVIOUS INJURY (DEFINED AS DARK BANDS ON THE BODY, SPINAL DEFORMATIONS, DE-SCALING OF 25% OR MORE OF BODY, AND TORPIDITY OR INABILITY TO MAINTAIN UPRIGHT ATTITUDE AFTER SUFFICIENT RECOVERY TIME) OCCURS DURING ELECTROFISHING, OPERATIONS WILL BE IMMEDIATELY DISCONTINUED, MACHINE SETTINGS, WATER TEMPERATURE AND CONDUCTIVITY CHECKED, AND PROCEDURES ADJUSTED OR ELECTROFISHING POSTPONED TO REDUCE MORTALITY.

4) DEWATER. DEWATERING, WHEN NECESSARY, WILL BE CONDUCTED OVER A SUFFICIENT PERIOD OF TIME TO ALLOW SPECIES TO NATURALLY MIGRATE OUT OF THE WORK AREA AND WILL BE LIMITED TO THE SHORTEST LINEAR EXTENT PRACTICABLE.

A) DIVERSION AROUND THE CONSTRUCTION SITE MAY BE ACCOMPLISHED WITH A COFFER DAM AND A BY-PASS CULVERT OR PIPE, OR A LINED, NON-ERODIBLE DIVERSION DITCH. WHERE GRAVITY FEED IS NOT POSSIBLE, A PUMP MAY BE USED, BUT MUST BE OPERATED IN SUCH A WAY AS TO AVOID REPETITIVE DEWATERING AND REWATERING OF THE SITE. IMPOUNDMENT BEHIND THE COFFERDAM MUST OCCUR SLOWLY THROUGH THE TRANSITION, WHILE CONSTANT FLOW IS DELIVERED TO THE DOWNSTREAM REACHES.

B) ALL PUMPS WILL HAVE FISH SCREENS TO AVOID JUVENILE FISH IMPINGEMENT OR ENTRAINMENT, AND WILL BE OPERATED IN ACCORDANCE WITH NMFS'S CURRENT FISH SCREEN CRITERIA (NMFS 20114, OR MOST RECENT VERSION). IF THE PUMPING RATE EXCEEDS 3 CUBIC FEET SECOND (CFS), A NMFS HYDRO FISH PASSAGE REVIEW WILL BE NECESSARY.

C) DISSIPATION OF FLOW ENERGY AT THE BYPASS OUTFLOW WILL BE PROVIDED TO PREVENT DAMAGE TO RIPARIAN VEGETATION OR STREAM CHANNEL.

D) SAFE REENTRY OF FISH INTO THE STREAM CHANNEL WILL BE PROVIDED, PREFERABLY INTO POOL HABITAT WITH COVER, IF THE DIVERSION ALLOWS FOR DOWNSTREAM FISH PASSAGE.

E) SEEPAGE WATER WILL BE PUMPED TO A TEMPORARY STORAGE AND TREATMENT SITE OR INTO UPLAND AREAS TO ALLOW WATER TO PERCOLATE THROUGH SOIL OR TO FILTER THROUGH VEGETATION PRIOR TO REENTERING THE STREAM CHANNEL.

4 NATIONAL MARINE FISHERIES SERVICE. 2011. ANADROMOUS SALMONID PASSAGE FACILITY DESIGN. NORTHWEST REGION. AVAILABLE ONLINE AT: HTTP://WWW.NWR.NOAA.GOV/SALMON-HYDROPOWER/FERC/UPLOAD/FISH-PASSAGE-DESIGN.PDF

5) SALVAGE NOTICE. MONITORING AND RECORDING OF FISH PRESENCE, HANDLING, AND MORTALITY MUST OCCUR DURING THE DURATION OF THE ISOLATION, SALVAGE, ELECTROFISHING, DEWATERING, AND REWATERING OPERATIONS. ONCE OPERATIONS ARE COMPLETED, A SALVAGE REPORT WILL DOCUMENT PROCEDURES USED, ANY FISH INJURIES OR DEATHS (INCLUDING NUMBERS OF FISH AFFECTED), AND CAUSES OF ANY DEATHS.

CONSTRUCTION AND POST-CONSTRUCTION CONSERVATION MEASURES.

1) FISH PASSAGE. FISH PASSAGE WILL BE PROVIDED FOR ANY ADULT OR JUVENILE FISH LIKELY TO BE PRESENT IN THE ACTION AREA DURING CONSTRUCTION, UNLESS PASSAGE DID NOT EXIST BEFORE CONSTRUCTION OR THE STREAM IS NATURALLY IMPASSABLE AT THE TIME OF CONSTRUCTION. IF THE PROVISION OF TEMPORARY FISH PASSAGE DURING CONSTRUCTION WILL INCREASE NEGATIVE EFFECTS ON AQUATIC SPECIES OF INTEREST OR THEIR HABITAT, A VARIANCE CAN BE REQUESTED FROM THE NMFS BRANCH CHIEF AND THE FWS FIELD OFFICE SUPERVISOR. PERTINENT INFORMATION, SUCH AS THE SPECIES AFFECTED, LENGTH OF STREAM REACH AFFECTED, PROPOSED TIME FOR THE PASSAGE BARRIER, AND ALTERNATIVESCONSIDERED, WILL BE INCLUDED IN THE VARIANCE REQUEST.

2) CONSTRUCTION AND DISCHARGE WATER.

A) SURFACE WATER MAY BE DIVERTED TO MEET CONSTRUCTION NEEDS, BUT ONLY IF DEVELOPED SOURCES ARE UNAVAILABLE OR INADEQUATE.

B) DIVERSIONS WILL NOT EXCEED 10% OF THE AVAILABLE FLOW.

C) ALL CONSTRUCTION DISCHARGE WATER WILL BE COLLECTED AND TREATED USING THE BEST AVAILABLE TECHNOLOGY APPLICABLE TO SITE CONDITIONS.

D) TREATMENTS TO REMOVE DEBRIS, NUTRIENTS, SEDIMENT, PETROLEUM HYDROCARBONS, METALS AND OTHER POLLUTANTS LIKELY TO BE PRESENT WILL BE PROVIDED.

PRELIMINARY

80 PERCENT DESIGN - NOT FOR CONSTRUCTION

NO.	DATE	BY	ISSUE / DESCRIPTION

DESIGNED BY: AKM
DRAWN BY: AKM/SCY
APPROVED BY: RSC
REVISION NO.: --
DATE: 09/24/21

GEOENGINEERS
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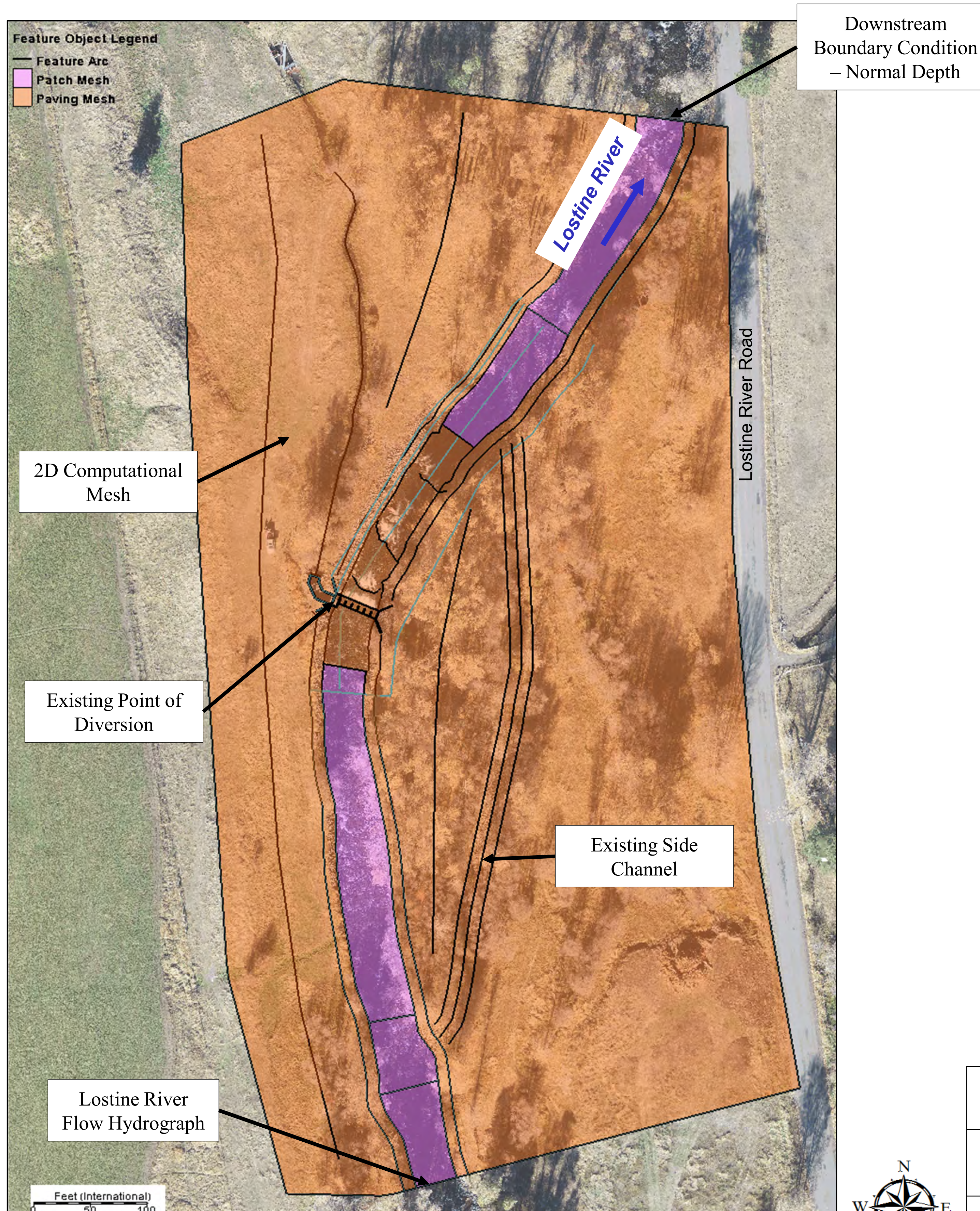
PREPARED FOR: NEZ PERCE TRIBE

LOSTINE RIVER POLEY ALLEN FISH PASSAGE
WALLOWA COUNTY, OREGON

HIP IV - GENERAL CONSERVATION MEASURES

DRAWING NUMBER: 8.2

APPENDIX C
Hydrologic and Hydraulic Analysis



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3. Data Source: SMS Version 13.1
4. Background aerial and existing surface from RSI (2021)
5. Horizontal Projection: OR State Plane, N Zone, NAD83, International Feet
6. Vertical Projection: NAVD88

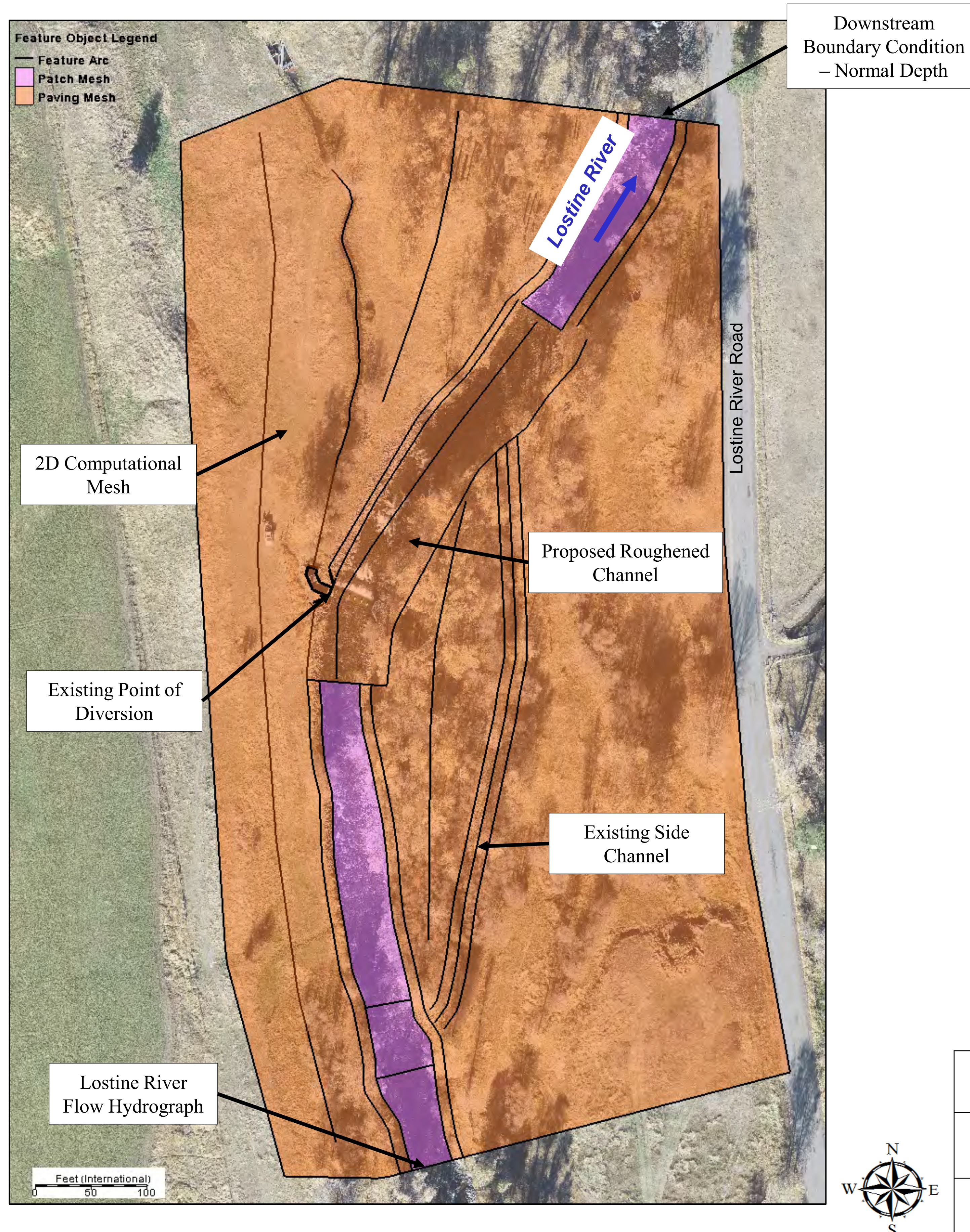
Existing Conditions Mesh

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers

Figure C-1

00571-021-00 Date Exported: 09/17/2021



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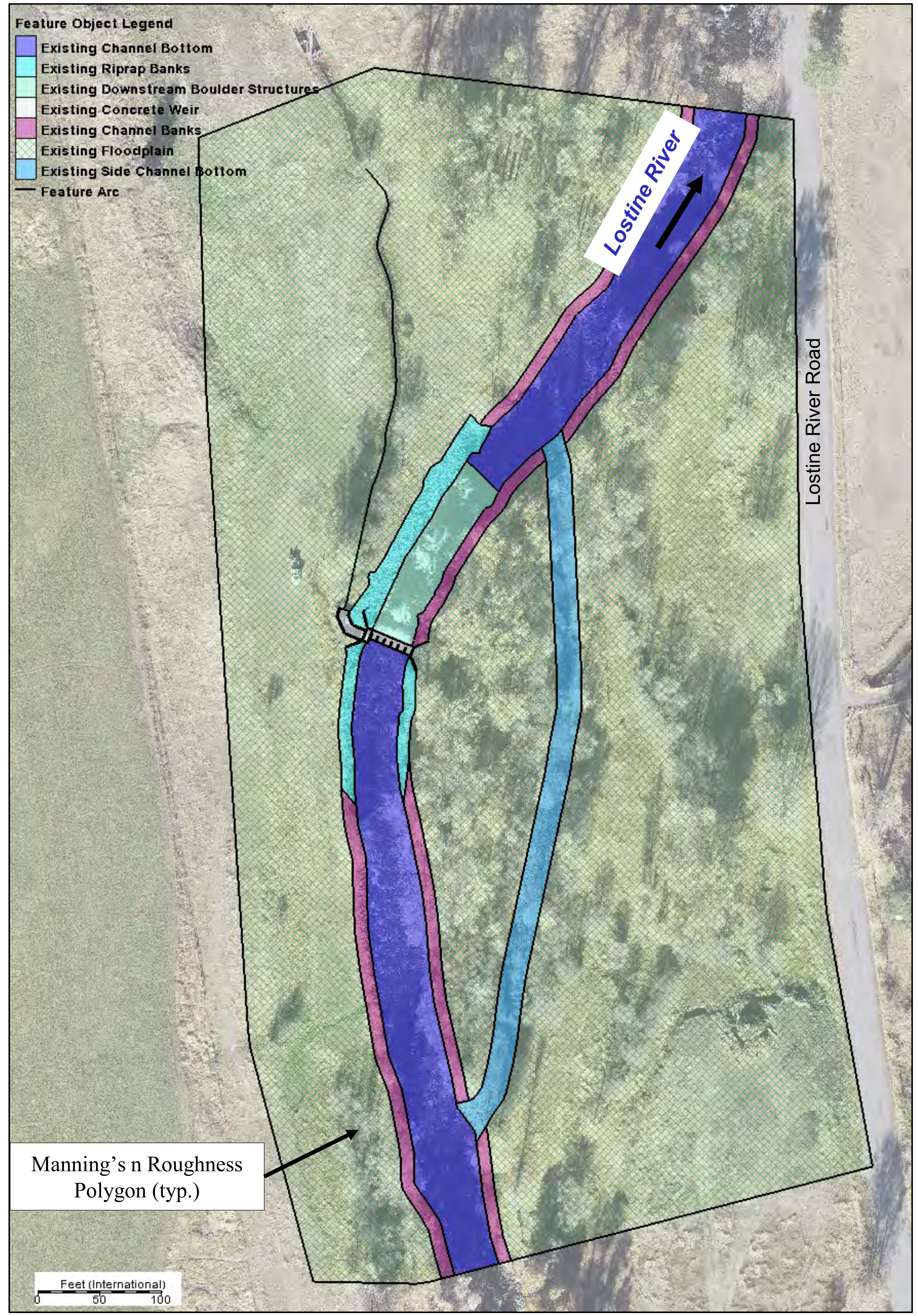
Proposed Conditions Mesh

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers

Figure C-2



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Existing Conditions Manning's Roughness Values

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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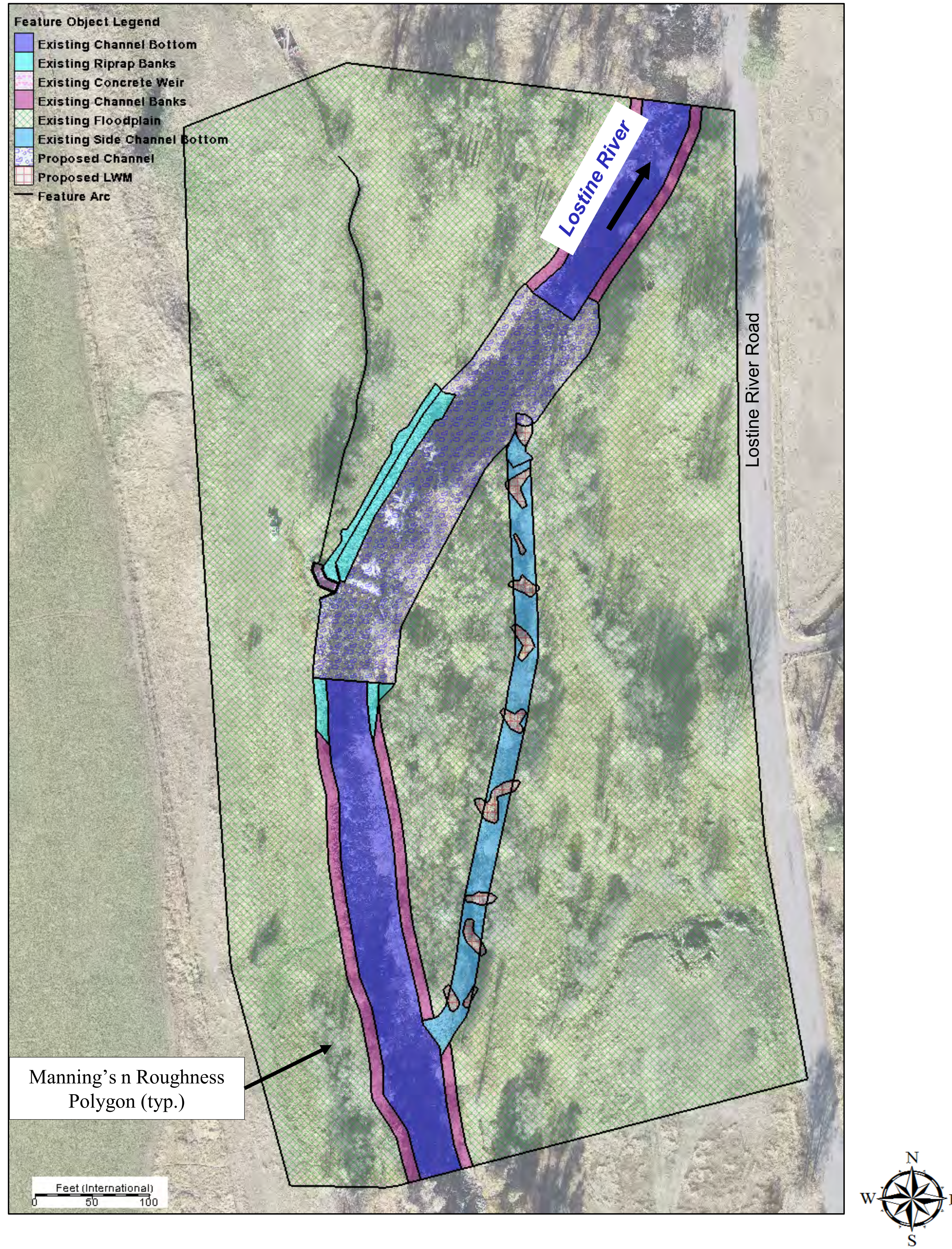
Figure C-3



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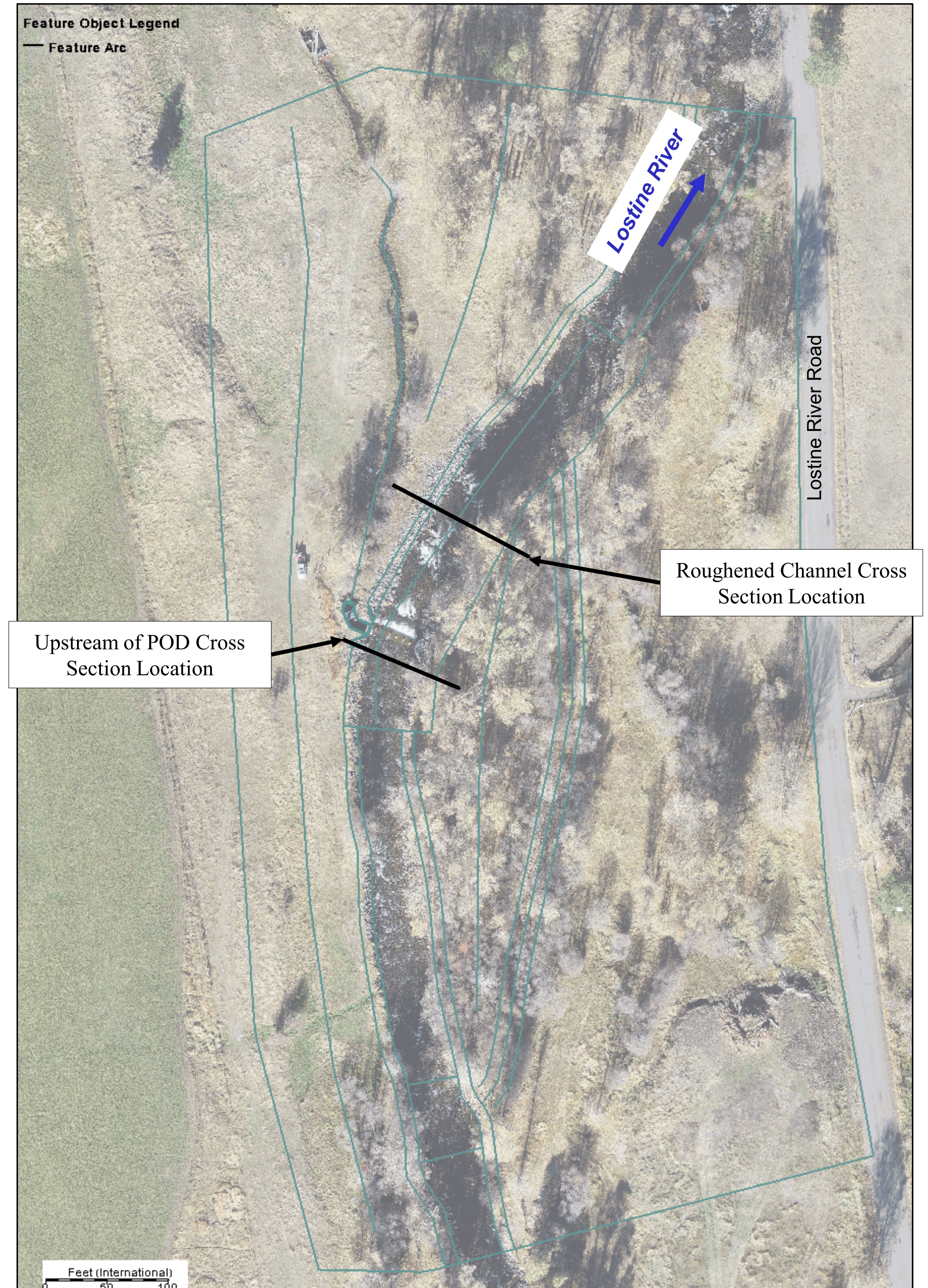
00571-021-00 Date Exported: 09/17/2021

Proposed Conditions Manning's Roughness Values

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

GeoEngineers | **Figure C-4**



00571-021-00 Date Exported: 09/17/2021

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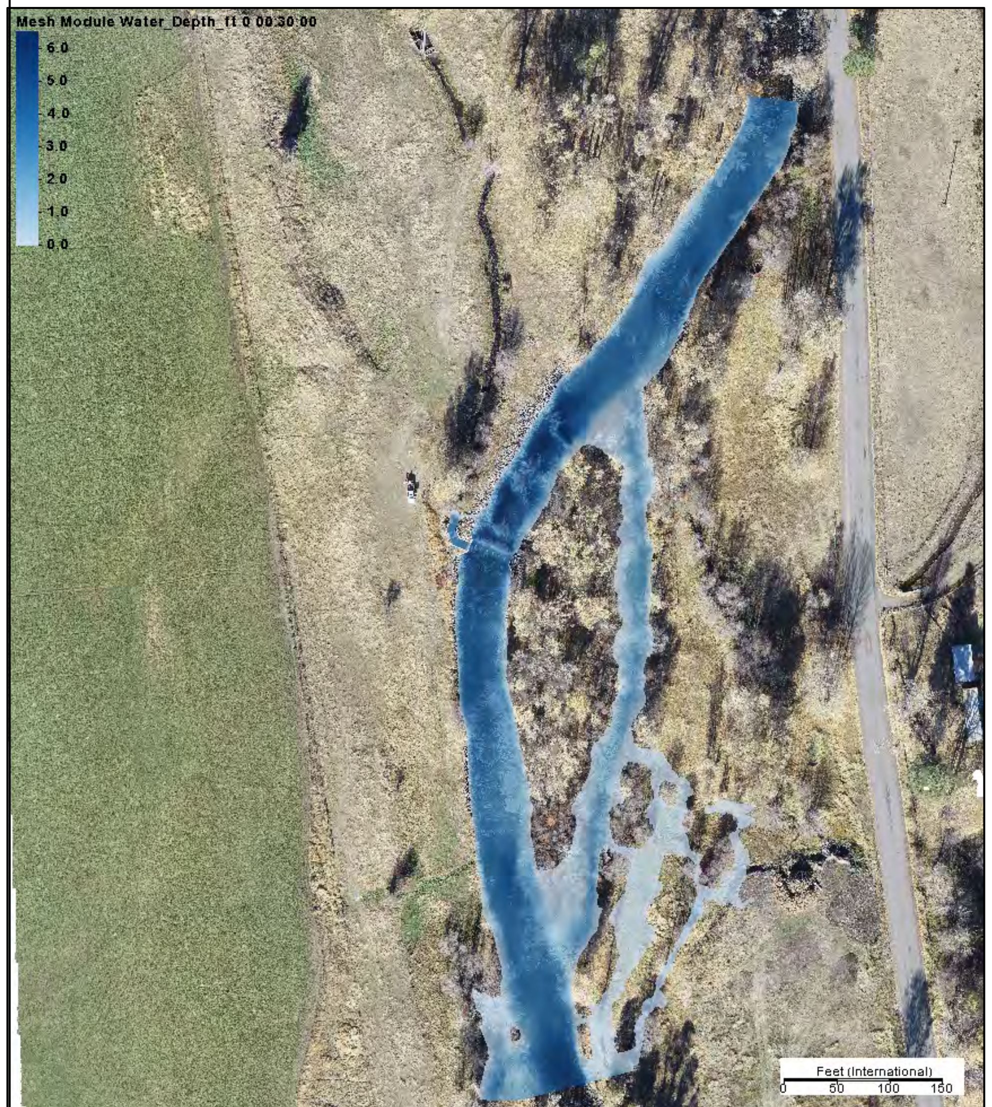
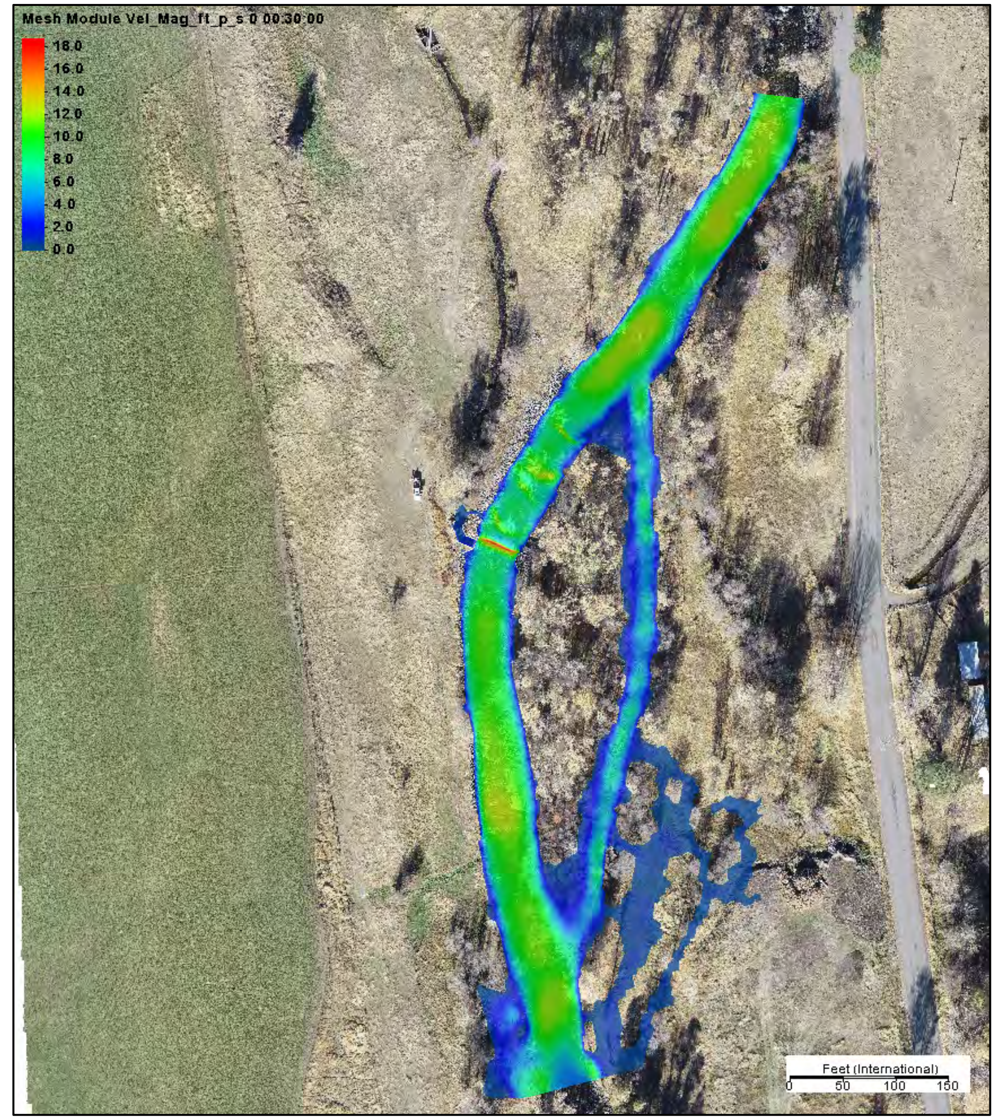
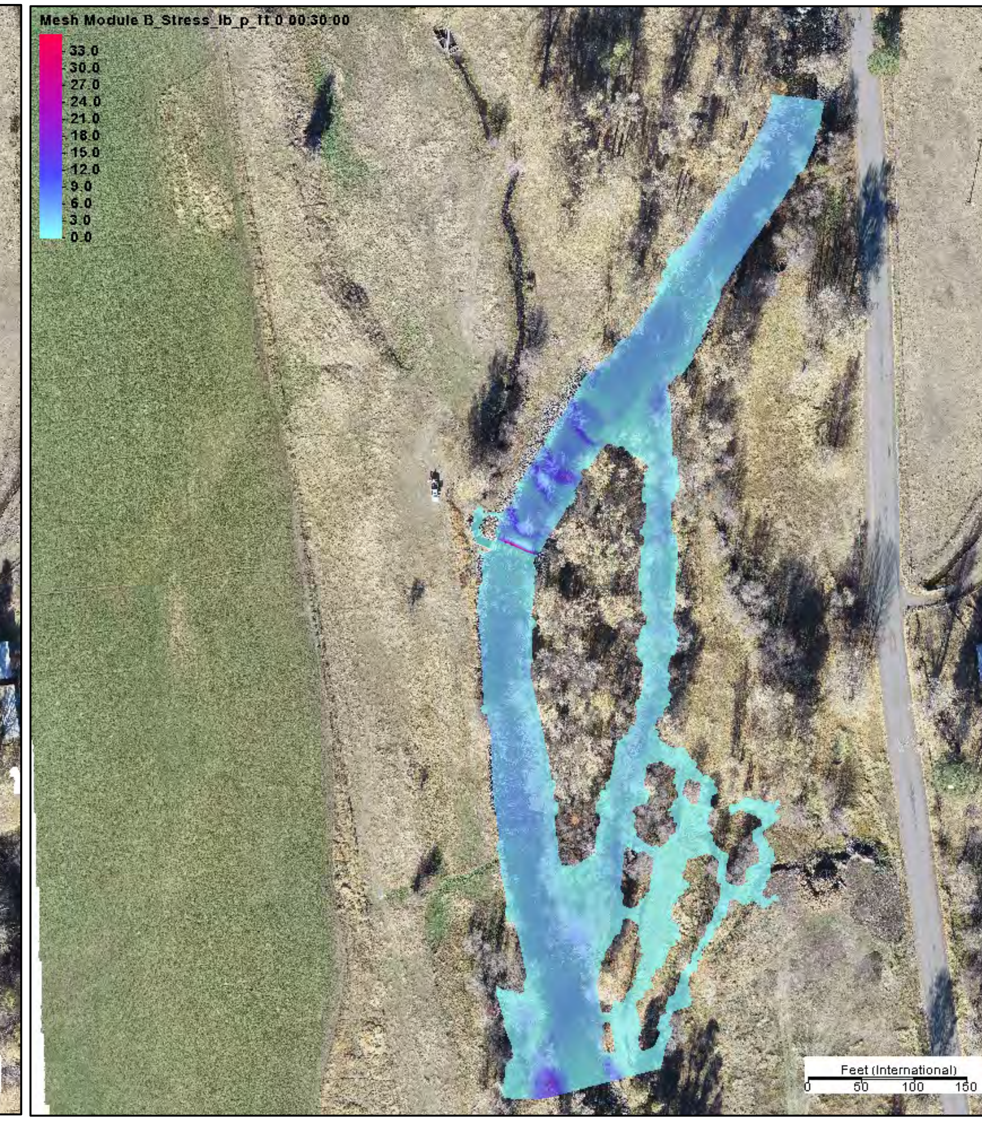
1D Cross Section Locations	
Lostine River Poley-Allen Fish Passage Design Lostine, Oregon	
GeoEngineers	Figure C-5



Water Depth (feet)



Velocity (feet / second)



Shear Stress (pounds / square foot)

00571-021-00 Date Exported: 09/17/2021

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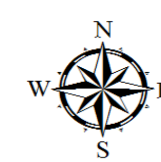

Existing Conditions
Flow: 1.5-year (1,584 cfs)

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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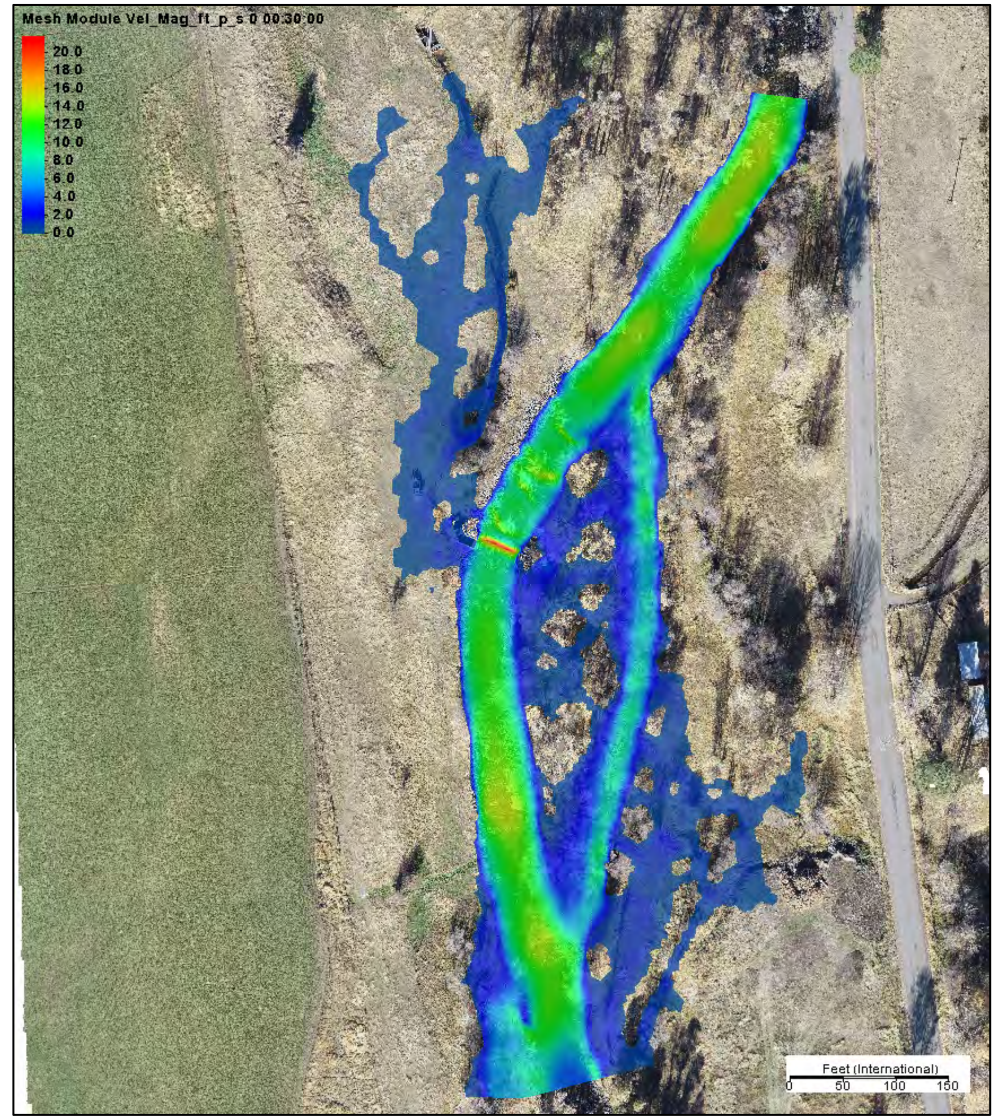
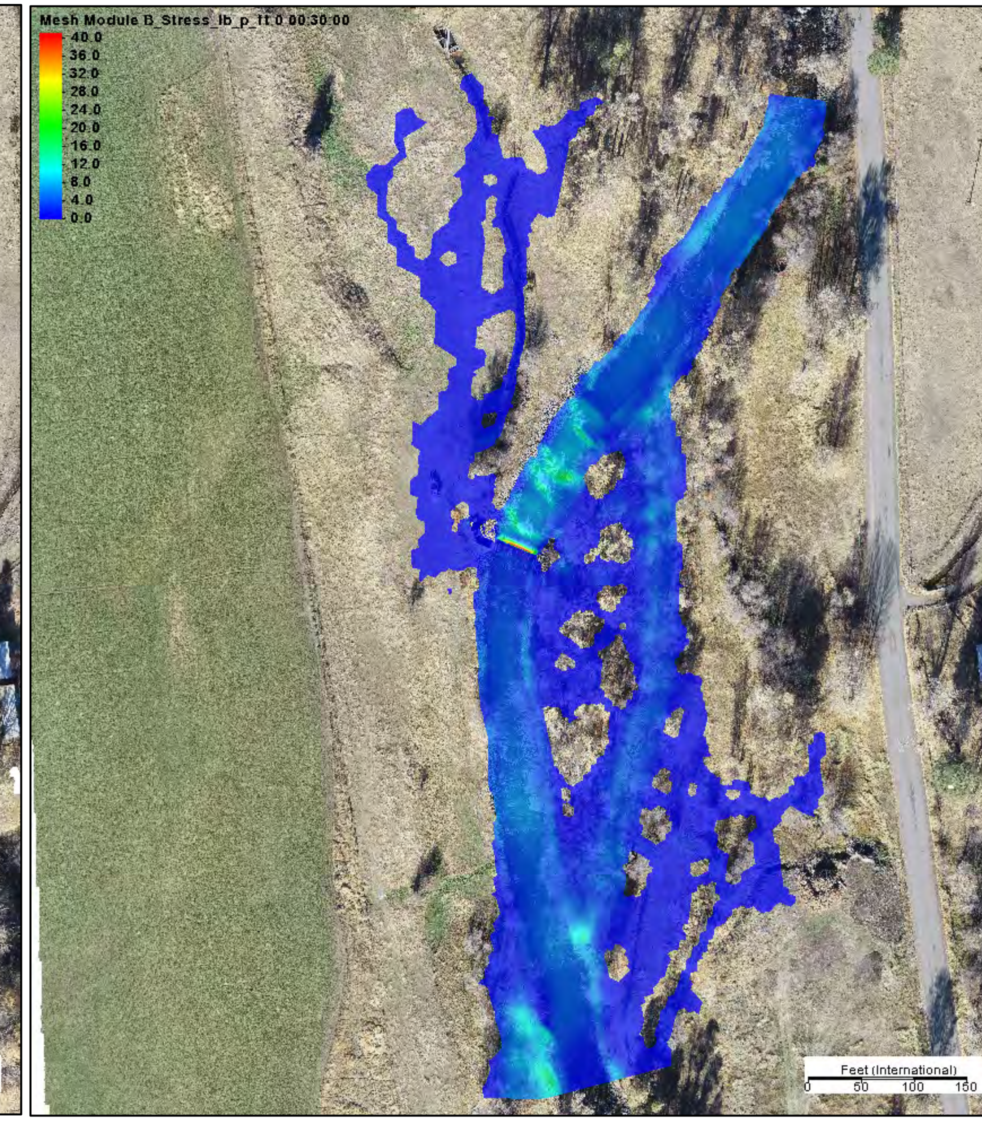
Figure C-6

Water Depth (feet)



Velocity (feet / second)



Shear Stress (pounds / square foot)

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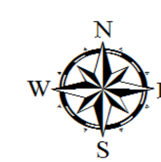

Existing Conditions
Flow: 100-year (2,850 cfs)

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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Figure C-7

00571-021-00 Date Exported: 09/17/2021

Water Depth (feet)

Velocity (feet / second)

Shear Stress (pounds / square foot)

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6. Vertical Projection: NAVD88

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Proposed Conditions
Flow: August 50% Exceedance (39 cfs)

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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Figure C-8

Water Depth (feet)

Velocity (feet / second)

Shear Stress (pounds / square foot)

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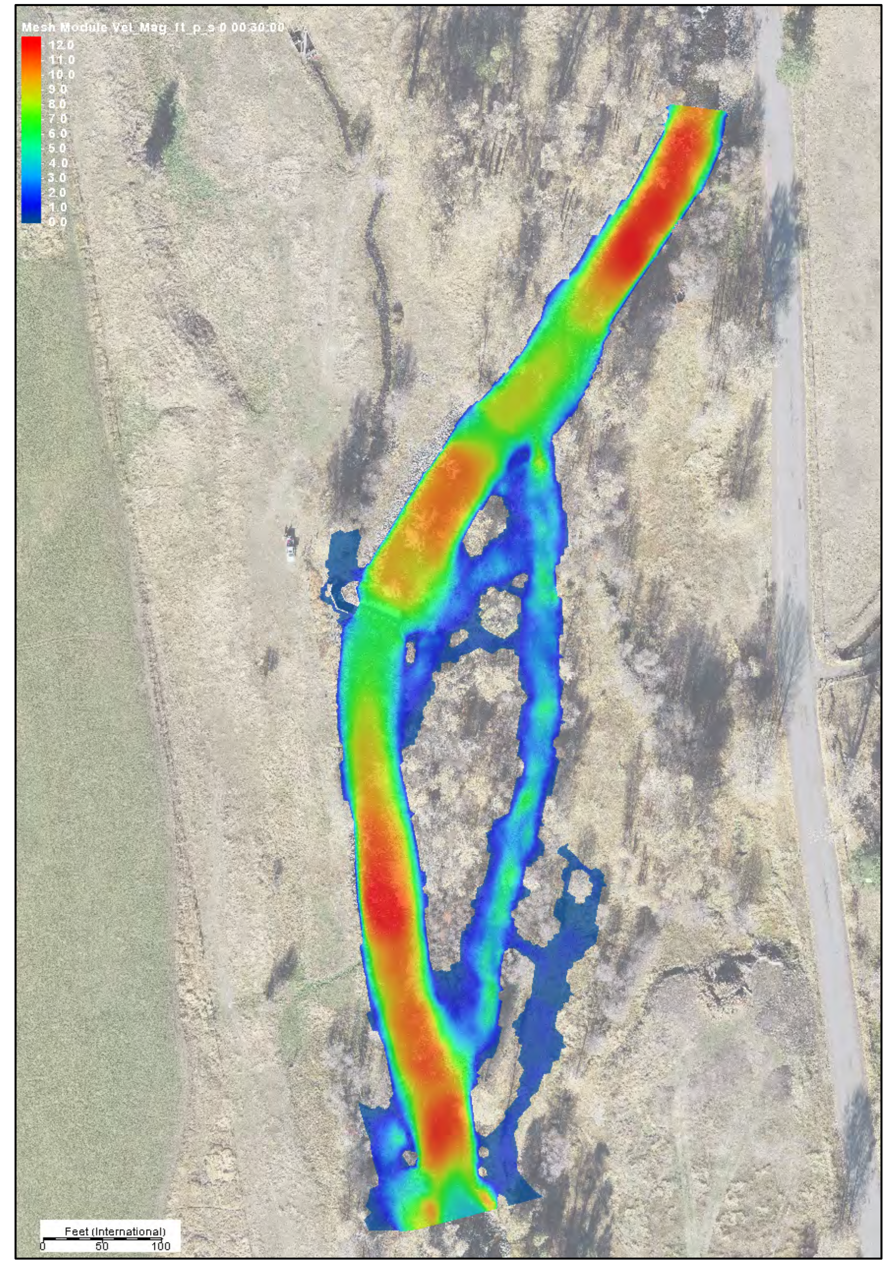
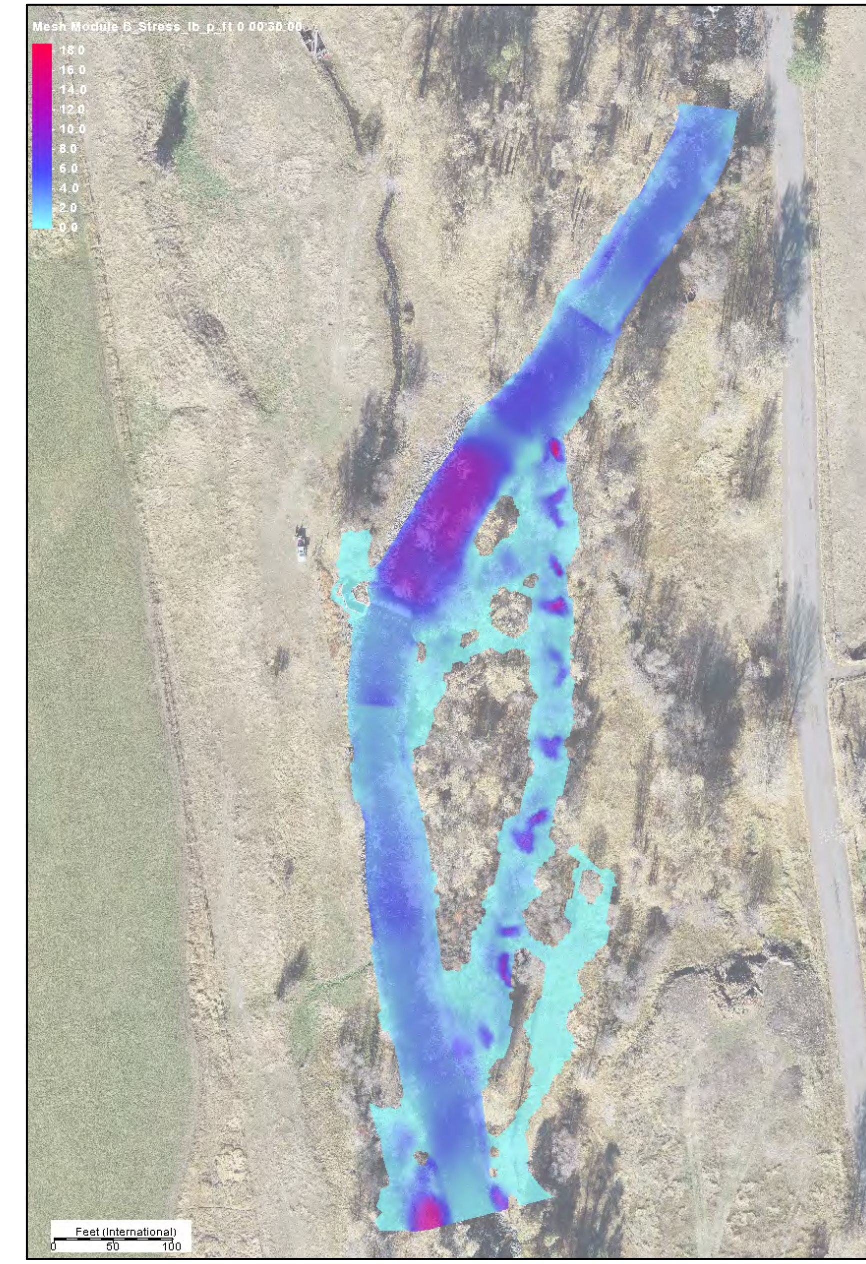
00571-021-00 Date Exported: 09/17/2021

Proposed Conditions **Flow: April 50% Exceedance (107 cfs)**	
Lostine River Poley-Allen Fish Passage Design Lostine, Oregon	
GeoEngineers	**Figure C-9**

Water Depth (feet)



Velocity (feet / second)



Shear Stress (pounds / square foot)

00571-021-00 Date Exported: 09/17/2021

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Proposed Conditions
Flow: 1.5-year (1,584 cfs)

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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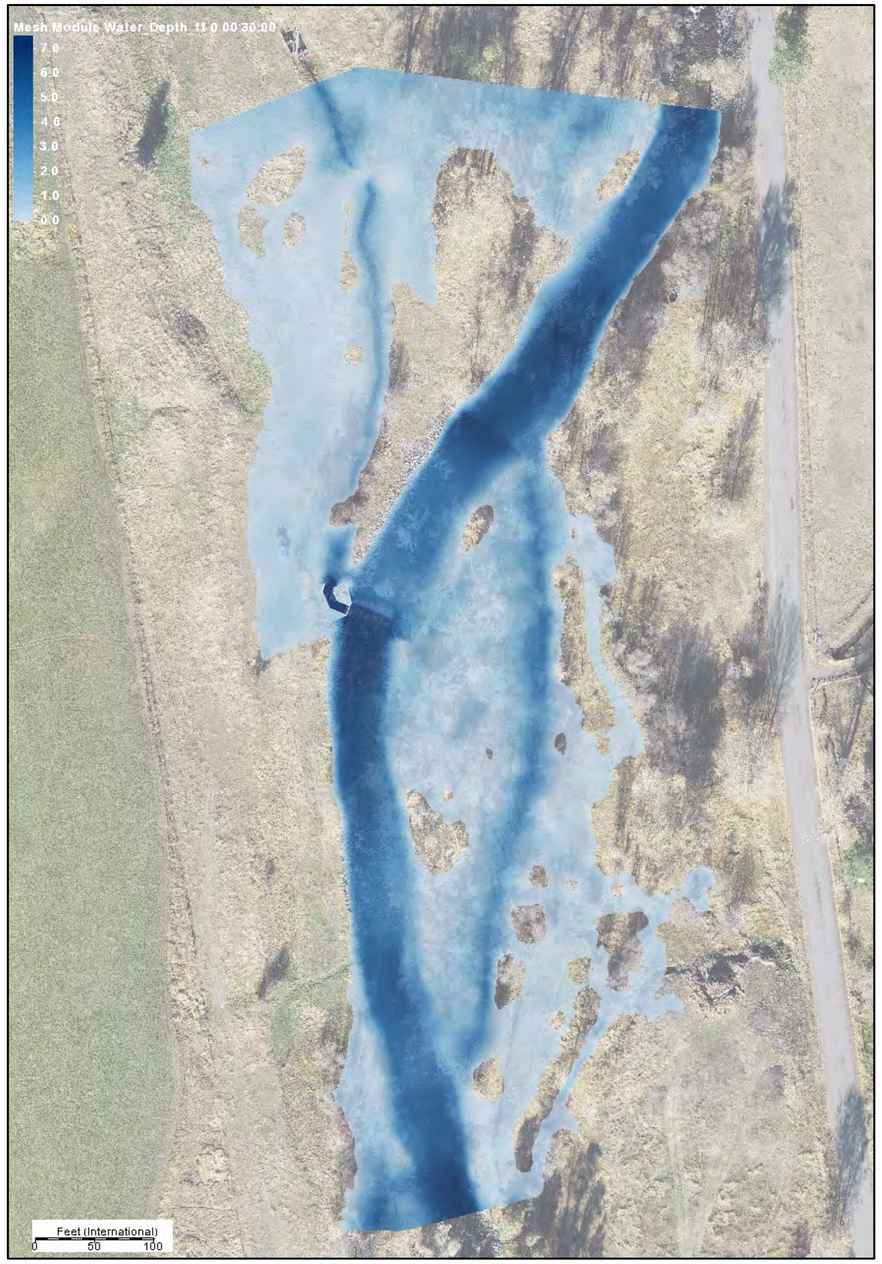
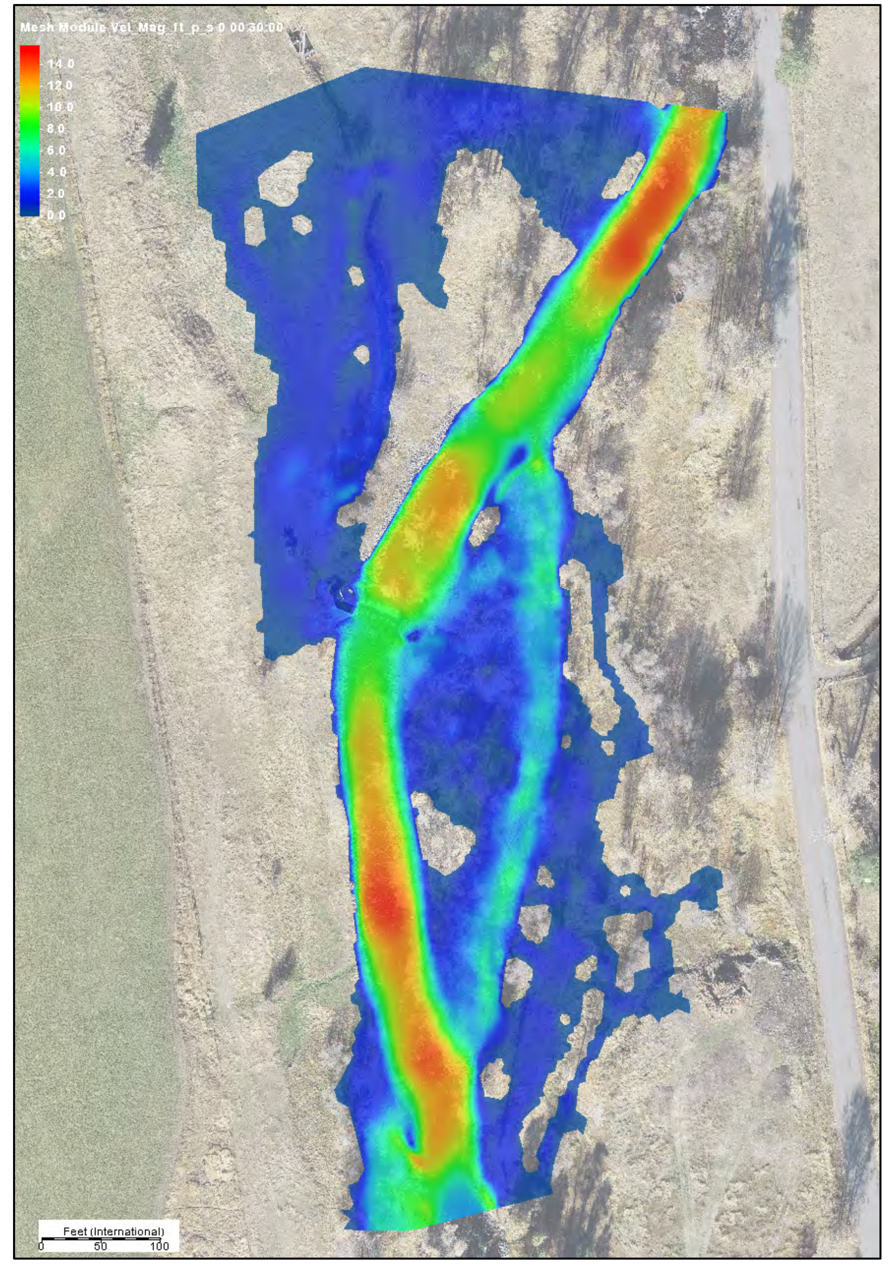
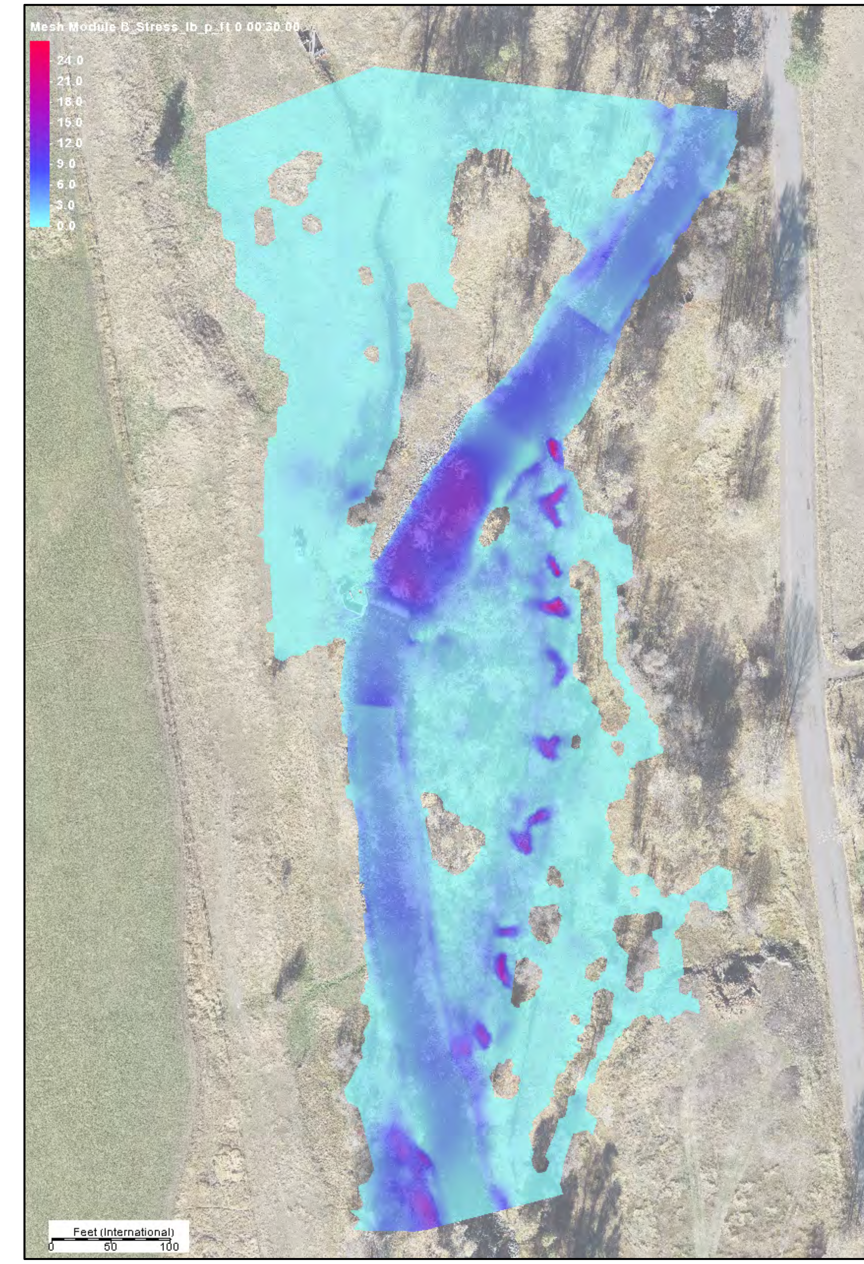
Figure C-10



Water Depth (feet)



Velocity (feet / second)



Shear Stress (pounds / square foot)

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Proposed Conditions
Flow: 100-year (2,850 cfs)

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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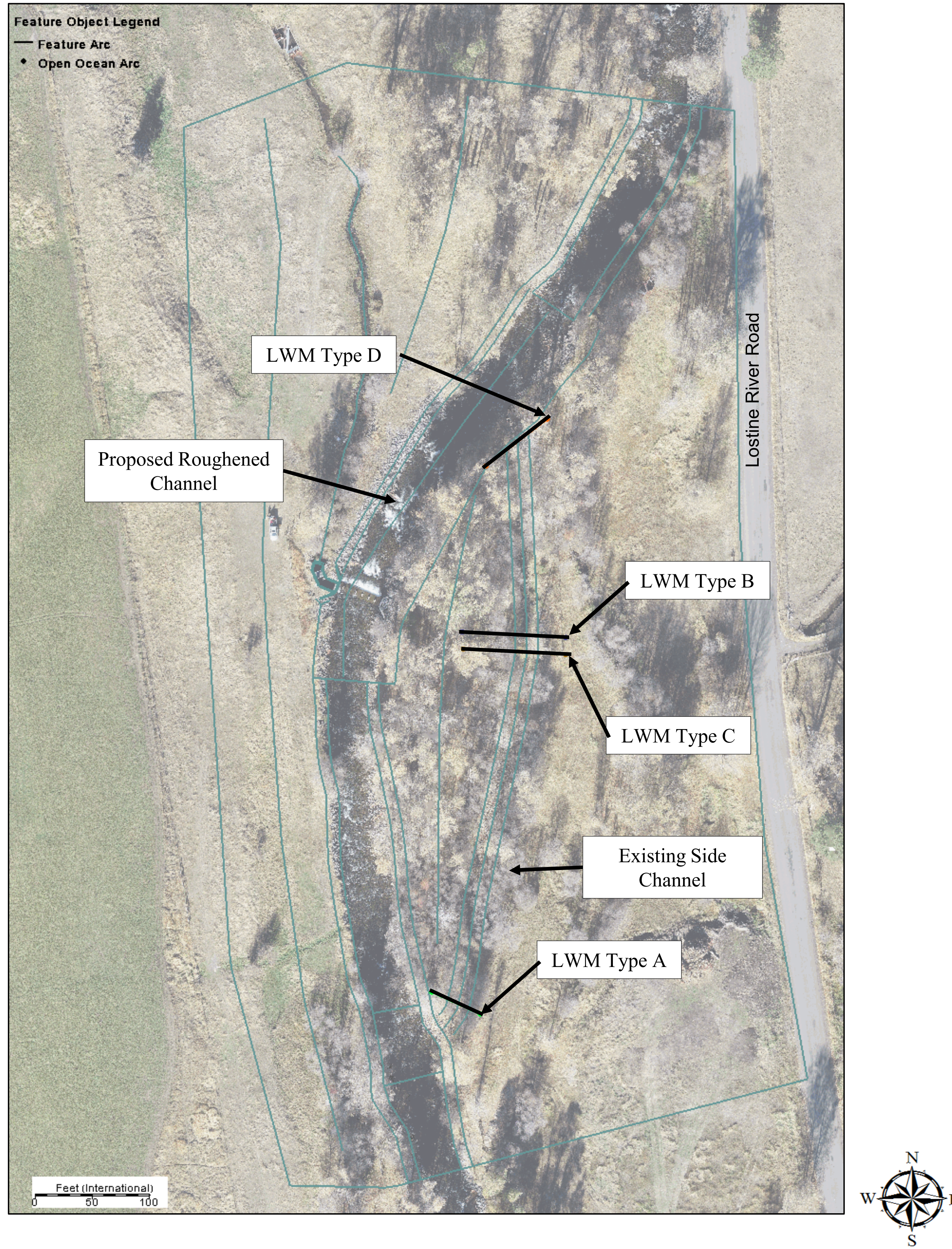
Figure C-11



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Large Woody Material Cross Section Locations

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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Figure C-12

Lostine River Gage

```
<< Frequency Curve >>
Lostine River-Lostine-AnnualPeakFlow
--------------------------------------------------------------------------------
|   Computed        Variance     |   Percent    |        Confidence Limits      |
|     Curve         Log(EMA)     |   Chance     |          0.05          0.95   |
|          FLOW, cfs             |  Exceedance  |           FLOW, cfs           |
|--------------------------------|--------------|-------------------------------|
|       2,725.9        0.00132   |    0.200     |       3,121.6       2,361.6   |
|       2,621.7        0.00089   |    0.500     |       2,931.0       2,329.3   |
|       2,531.5        0.00062   |    1.000     |       2,782.8       2,295.7   |
|       2,429.0        0.00041   |    2.000     |       2,629.5       2,249.2   |
|       2,268.5        0.00022   |    5.000     |       2,414.1       2,151.4   |
|       2,120.7        0.00015   |   10.000     |       2,232.9       2,028.4   |
|       1,937.5        0.00014   |   20.000     |       2,026.4       1,850.5   |
|       1,584.2        0.00018   |   50.000     |       1,669.7       1,504.5   |
|       1,403.9        0.00021   |   67.000     |       1,483.7       1,324.4   |
|       1,079.5        0.00045   |   90.000     |       1,158.4         977.2   |
|         951.0        0.00077   |   95.000     |       1,037.3         823.9   |
|         733.2        0.00221   |   99.000     |         837.7         551.1   |
|--------------------------------|--------------|-------------------------------|
```

HEC SSP Output Data

Basin	Drainage Area	
	Square Miles	Square Feet
Poley-Allen	83.9	53695.8
Lostine River Gage	71.5	45759.8

$$Q_u = Q_g \left(\frac{A_u}{A_g}\right)^a$$

Qu= ungauged watershed estimated discharge
Qg= gauged watershed discharged from LP3 analysis
Au= ungauged watershed area
Ag= gauged watershed area

HEC-SSP Output (Lostine Gage)

Percent Exceedance	Design Flood Event	Flow (cfs)	Value Used
0.2	500	2,725.9	2,726
0.5	200	2,621.7	2,622
1	100	2,531.5	2,532
2	50	2,429.0	2,429
5	20	2,268.5	2,269
10	10	2,120.7	2,121
20	5	1,937.5	1,938
50	2	1,584.2	1,584
67	1.5	1,403.9	1,404
90	1.11	1,079.5	1,080
95	1.05	951.0	951
99	1.01	733.2	733

Basin Scaling (Lostine Gage to Poley-Allen Site)

Percent Exceedance	Design Flood Event	Flow (cfs)	Value Used
0.2	500	3,067.89	3,068
0.5	200	2,950.85	2,951
1	100	2,850.20	2,850
2	50	2,734.52	2,735
5	20	2,554.68	2,555
10	10	2,388.65	2,389
20	5	2,183.54	2,184
50	2	1,787.17	1,787
67	1.5	1,584.09	1,584
90	1.11	1,218.53	1,219
95	1.05	1,072.98	1,073
99	1.01	827.02	827

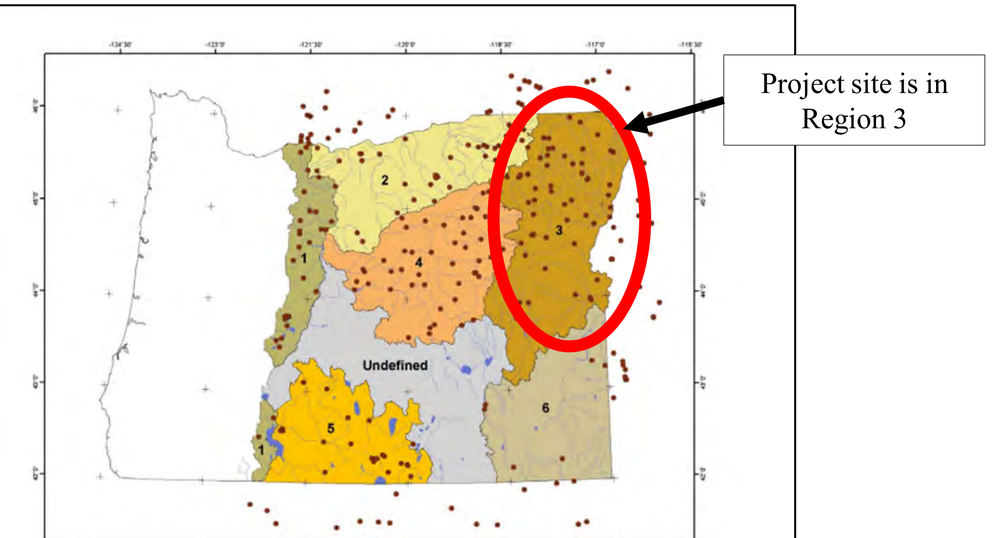

Figure 14. Flood regions of eastern Oregon. The dots represent gaging station locations. Note the poor stream development and lack of gaging stations in the undefined area.

41

Region 3 Scaling Equation

Recurrence Interval	Exponent a
2-year	0.7546
5-year	0.7459
10-year	0.7431
25-year	0.7415
50-year	0.7408
100-year	0.7402
500-year	0.7388

Equation from: "Estimation of Peak Discharges for Rural, Unregulated Streams in Eastern Oregon"
Published by: State of Oregon Water Resource Department
Authored by: Richard M. Cooper

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Hydrologic Analysis

Lostine River Poley-Allen Fish Passage Design
Lostine, Oregon

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Figure C-13

APPENDIX D
Sediment Mobility Analysis

Existing Gradation				
Location:	Lostine River - Gravel Bar			
	D_{100}	D_{84}	D_{50}	D_{16}
ft	0.65	0.45	0.26	0.13
in	7.8	5.4	3.1	1.5
mm	196.9	137.9	78.5	38.9

Location:				
	D_{100}	D_{84}	D_{50}	D_{16}
ft				
in				
mm				

Location:				
	D_{100}	D_{84}	D_{50}	D_{16}
ft				
in				
mm				

Location:				
	D_{100}	D_{84}	D_{50}	D_{16}
ft				0.00
in				
mm				

Existing Gradation: https://projects.geoengineers.com/sites/0057102100/Technical%20Analysis/Sediment/Poley-Allen_ExistingGrad

References:

8:10

Appendix E--Methods for Streambed Mobility/Stability Analysis

Limitations:

D_{84} must be between 0.40 in and 10 in

Uniform bed material (Di < 20-30 times D50)

Slopes less than 5%

Sand/gravel streams with high relative submergence

1.5yr-depth	5.3	ft
Relative Submergence:	0.6	
γ_s	165	specific weight of sediment particle (lb/ft^3)
γ	62.4	specific weight of water (1b/ft^3)
τ_{D50}	0.045	dimensionless Shields parameter for D50, use table E.1 of USFS manual or assume 0.045 for poorly sorted channel bed

Link to Model Results: https://projects.geoengineers.com/sites/0057102100/Technica

Determining Aggregate Proportions

Per WSDOT Standard Specifications 9-03.11

	Rock Size [in]	[mm]	Streambed Sediment	Streambed Cobbles 4"	6"	8"	10"	12"	Streambed Boulders 12"-18"	18"-28"	28"-36"	D_{size}	τ_{ci}	Flow 1.5-YR	100-YR
													Average Modeled Shear Stress (lb/ft^2)	1.40	1.60
	36.0	914									100	0.0	2.48	No Motion	No Motion
	32.0	813									50	0.0	2.40	No Motion	No Motion
	28.0	711								100		0.0	2.30	No Motion	No Motion
	23.0	584								50		0.0	2.17	No Motion	No Motion
	18.0	457							100			0.0	2.02	No Motion	No Motion
	15.0	381							50			0.0	1.91	No Motion	No Motion
	12.0	305						100				0.0	1.79	No Motion	No Motion
	10.0	254					100	80				0.0	1.69	No Motion	No Motion
	8.0	203				100	80	68				0.0	1.58	No Motion	Motion
	6.0	152			100	80	68	57				0.0	1.45	No Motion	Motion
	5.0	127			80	68	57	45				0.0	1.37	Motion	Motion
	4.0	102		100	71	57	45	39				0.0	1.28	Motion	Motion
	3.0	76.2		80	63	45	38	34				0.0	1.18	Motion	Motion
	2.5	63.5	100	65	54	37	32	28				0.0	1.12	Motion	Motion
	2.0	50.8	80	50	45	29	25	22				0.0	1.04	Motion	Motion
	1.5	38.1	73	35	32	21	18	16				0.0	0.96	Motion	Motion
	1.0	25.4	65	20	18	13	12	11				0.0	0.85	Motion	Motion
	0.75	19.1	50	5	5	5	5	5				0.0	0.78	Motion	Motion
No. 4	0.19	4.75	35									0.0			
o. 40	0.02	0.425	16									0.0			
. 200	0.00	0.0750	7									0.0			
% per category												--> 0%			
% Cobble & Sediment												0.0%			

D16	1.5	in
D50	3.1	in
	0.3	ft
D84	5.4	in
D100	7.8	in

Design Gradation: Bathurst qc				
Location: Roughened Channel - Design Gradation				
	D_{100}	D_{84}	D_{50}	D_{16}
ft	4.0	2.9	1.4	0.2
in	48.0	35.2	16.5	2.0
mm	1219.2	894.1	419.1	50.8

Existing Gradation				
Location: Upstream of POD - Gravel Bar				
	D_{100}	D_{84}	D_{50}	D_{16}
ft	0.6	0.5	0.3	0.1
in	7.8	5.4	3.1	1.5
mm	196.9	137.9	78.5	38.9

Location:				
	D_{100}	D_{84}	D_{50}	D_{16}
ft	0.00	0.00	0.00	0.00
in				
mm	0	0	0.0	0.0

Location:				
	D_{100}	D_{84}	D_{50}	D_{16}
ft	0.00	0.00	0.00	0.00
in				
mm	0	0	0.0	0.0

Existing Gradation: https://projects.geoengineers.com/sites/0057102100/Technical%20Analysis/Sediment/Pc

Determining Aggregate Proportions

Per WSDOT Standard Specifications 9-03.11

	Rock Size [in]	[mm]	Streambed Sediment	Streambed Cobbles 4"	6"	8"	10"	12"	Streambed Boulders 12"-18"	18"-28"	28"-48"	D_{size}
	48.0	1219									100	100.0
	32.0	813									50	80.0
	28.0	711								100		60.0
	23.0	584								50		60.0
	18.0	457							100			60.0
	15.0	381							50			40.0
	12.0	305						100				20.0
	10.0	254					100	80				20.0
	8.0	203				100	80	68				20.0
	6.0	152			100	80	68	57				20.0
	5.0	127			80	68	57	45				20.0
	4.0	102		100	71	57	45	39				20.0
	3.0	76.2		80	63	45	38	34				20.0
	2.5	63.5	100	65	54	37	32	28				20.0
	2.0	50.8	80	50	45	29	25	22				16.0
	1.5	38.1	73	35	32	21	18	16				14.5
	1.0	25.4	65	20	18	13	12	11				13.0
	0.75	19.1	50	5	5	5	5	5				10.0
No. 4	0.19	4.75	35									7.0
No. 40	0.02	0.425	16									3.2
No. 200	0.00	0.0750	7									1.4
	% per category		20	0	0	0	0	0	40	0	40	--> 100%
	% Cobble & Sediment											

	D-values per Aggregate Proportion Table in	mm	D-values Bathurst Bed Mobility in	mm	D-values Bathurst q-critical in	mm
D16	2.0	50.80	2.3	59.19	5.2	131.06
D50	16.5	419.10	7.5	189.42	16.5	419.39
D84	35.2	894.08	18.6	473.54	41.3	1048.48
D100	48.0	1219.20	46.6	1183.85	103.2	2621.21

Bathurst Bed Mobility

Hydraulical Sciences Pub. Vol. 165.

$$D_{84} = 3.45 * S^{0.747} * \frac{(1.25 * q_c)^{\frac{2}{3}}}{g^{\frac{1}{3}}} \qquad cfs = \frac{ft^3}{s}$$

Input Data

Cross Section Name/Station:				
Flow Event:		*100*	yr	
Energy Slope (S) - ft/ft:	S =	**0.058**	ft/ft	Design slope
100-yr Flow in Main Channel (Q):	Q =	**2000.0**	cfs	From hydrology analysis
Stream Width (W):	W =	**60.0**	ft	
Specific Discharge (q_c) - (cfs/ft):	q_c =	*33.3*	ft^2/s	

$$q_c = \frac{Q}{W}$$

$$D_{84} = 3.45 * S^{0.747} * \frac{(1.25 * q_c)^{\frac{2}{3}}}{g^{\frac{1}{3}}}$$

D_{84} =	1.6 ft	18.6 in	473.54
$D_{16} = \frac{D_{84}}{8}$	0.2 ft	2.3 in	59.19
$D_{50} = \frac{D_{84}}{2.5}$	0.6 ft	7.5 in	189.42
$D_{100} = \frac{D_{84}}{0.4}$	3.9 ft	46.6 in	1183.85

Bathurst Critical Unit Discharge

References:

Stream Simulation and Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings

Appenix E (USDA 2008)

$$q_{c-D50} = \frac{0.15 g^{0.5} D_{50}{}^{1.5}}{S^{1.12}} \qquad D_{50} = \left(\frac{S^{1.12} q_{c-D50}}{0.15 g^{0.5}}\right)^{\frac{2}{3}} \qquad cfs = \frac{ft^3}{s}$$

Input Data

Cross Section Name/Station:				
Flow Event:		*100*	yr	
Energy Slope (S) - ft/ft:	S =	**0.058**	ft/ft	Design slope
100-yr Flow in Main Channel (Q):	Q =	**2000.0**	cfs	From hydrology analysis
Stream Width (W):	W =	**60.0**	ft	
Specific Discharge (q_c) - (cfs/ft):	q_c =	*33.3*	ft^2/s	

$$q_c = \frac{Q}{W}$$

D_{84} =	3.4 ft	41.3 in	1048.48
$D_{16} = \frac{D_{84}}{8}$	0.4 ft	5.2 in	131.06
$D_{50} = \frac{D_{84}}{2.5}$	1.4 ft	16.5 in	419.39
$D_{100} = \frac{D_{84}}{0.4}$	8.6 ft	103.2 in	2621.21

1: General Information

Project:	Poley-Allen Fish Passage Design	**Site:**	Poley-Allen
Project Number:	00571-021-00	**Analyst:**	A. Morton
Watercourse:	Lostine River	**Latest Revision:**	9/14/2021

Workbook Description

- This workbook is proprietary to GeoEngineers, Inc.
- This wookbook contains spreadsheets that facilitate the analysis of bed stability.
- This spreadsheet lists the General Project Information that is consistent throughout the workbook.
- It also lists the titles of the spreadsheets contained in this workbook.

Filename: *https://projects.geoengineers.com/sites/0057102100/Technical Analysis/Sediment/[Poley-Allen_SedimentMobilityAnalysis.xlsx]1 General*

Sheet Titles:

1: General Information
2: Existing Gradation
3: Proposed Gradation
4: Equation References

2: Existing Gradation

Project:	**Poley-Allen Fish Passage Design**	**Site:**	Poley-Allen
Project Number:	**00571-021-00**	**Analyst:**	A. Morton
Watercourse:	**Lostine River**	**Latest Revision:**	9/14/2021

Spreadsheet Description

- This spreadsheet calculates the critical velocity and critical shear stress for a channel's bed material.
- It also compares the critical velocity and critical shear stress to the values calculated in a hydraulic model of the channel. This comparison is represented in the Relative Bed Stability (RBS) factor. Incipient motion occurs when the RBS is 1.0. If the RBS is < 1.0, the material is mobile. A channel's bed material becomes more stable as the RBS increases (above 1.0).
- The velocity analysis below uses a channel's D_{50}, while the shear stress analysis uses the D_{84}.
- Several equations are used for comparison.
- Note, these equations are generalizations, and should be used with caution and judgement.
- The velocity equations assume the specific gravity of the bed material is 2.65.
- **Only input information into the shaded cells.**
- **This spreadsheet checks to make sure the upstream bedload can be conveyed through the proposed channel.**

Filename: *https://projects.geoengineers.com/sites/0057102100/Technical Analysis/Sediment/[Poley-Allen_SedimentMobilityAnalysis.xlsx]2 Ex Gradation*

Velocity Analysis (Using D_{50})

Direct Input

	mm	cm	in	ft	
Cobble	78.5	7.8	3.1	0.3	= D_{50} = Mean Diameter of Bed Material
Cobble	137.9	13.8	5.4	0.5	= D_{84}

Hydraulic Input

1.5-yr	100-yr	
9.0	10.3	= V = Velocity (fps)
3.1	4.0	= Channel Depth (ft)
8.7	10.5	= t = Shear Stress in Channel (lbs/sf)

Results (Neill's Equation)

1.5-yr	100-yr	
7.5	7.7	= Vc = Critical Velocity (fps)
0.8	0.7	= RBS = Relative Bed Stability (dimensionless)
D50 is mobile.	**D50 is mobile.**	

Results (Laursen's Equation)

8.6	9.0	= Vc = Critical Velocity (fps)
1.0	0.9	= RBS = Relative Bed Stability (dimensionless)
D50 is mobile.	**D50 is mobile.**	

Shear Stress Analysis (Using D_{84})

Typical Constants (Input)

1.5-yr	100-yr	
0.3	0.3	= D_{50} = Mean Diameter of Bed Material (From Above) (ft)
0.5	0.5	= D_{84} = 84th percentile grain size of bed material (ft)
62.4	62.4	= γ_w = Specific weight of water (lbs/ft^3)
165.0	165.0	= γ_p = Specific Weight of Sediment (lbs/ft^3)

Results (Shield's Equation)

1.5-yr	100-yr	
0.05	0.05	$= \tau_* =$ Shields Number: $\tau_* = 0.0834(D_{84}/D_{50})^{-0.872}$
2.4	2.4	$= \tau_c =$ Q25 Critical Shear Stress: τc = τ*(γp-γw)D84 (lbs/sf)
0.3	**0.2**	= RBS = Relative Bed Stability (dimensionless)
D84 is mobile.	**D84 is mobile.**	
1.3	1.3	$= \tau_c =$ Q25 Critical Shear Stress: τc = τ*(γp-γw)D50 (lbs/sf)
0.2	**0.1**	= RBS = Relative Bed Stability (dimensionless)
D50 is mobile.	**D50 is mobile.**	

3: Proposed Gradation

Project:	**Poley-Allen Fish Passage Design**	**Site:**	Poley-Allen
Project Number:	**00571-021-00**	**Analyst:**	A. Morton
Watercourse:	**Lostine River**	**Latest Revision:**	9/14/2021

Spreadsheet Description

- This spreadsheet calculates the critical velocity and critical shear stress for a channel's bed material.
- It also compares the critical velocity and critical shear stress to the values calculated in a hydraulic model of the channel. This comparison is represented in the Relative Bed Stability (RBS) factor. Incipient motion occurs when the RBS is 1.0. If the RBS is < 1.0, the material is mobile. A channel's bed material becomes more stable as the RBS increases (above 1.0).
- The velocity analysis below uses a channel's D_{50}, while the shear stress analysis uses the D_{84}.
- Several equations are used for comparison.
- Note, these equations are generalizations, and should be used with caution and judgement.
- The velocity equations assume the specific gravity of the bed material is 2.65.
- **Only input information into the shaded cells.**
- **This spreadsheet checks to make sure the upstream bedload can be conveyed through the proposed channel.**

Filename: *https://projects.geoengineers.com/sites/0057102100/Technical Analysis/Sediment/[Poley-Allen_SedimentMobilityAnalysis.xlsx]3 Prop Gradation*

Velocity Analysis (Using D_{50})

Direct Input

	mm	cm	in	ft	
Boulder	894.1	89.4	35.2	2.9	= D_{50} = Mean Diameter of Bed Material
Boulder	1219.2	121.9	48.0	4.0	= D_{84}

Hydraulic Input

1.5-yr	100-yr	
9.0	10.3	= V = Velocity (fps)
3.1	4.0	= Channel Depth (ft)
8.7	10.5	= t = Shear Stress in Channel (lbs/sf)

Results (Neill's Equation)

1.5-yr	100-yr	
19.8	20.4	= Vc = Critical Velocity (fps)
2.2	2.0	= RBS = Relative Bed Stability (dimensionless)
D50 is very stable.	D50 is stable	

Results (Laursen's Equation)

1.5-yr	100-yr	
19.4	20.2	= Vc = Critical Velocity (fps)
2.2	2.0	= RBS = Relative Bed Stability (dimensionless)
D50 is very stable.	D50 is stable	

Shear Stress Analysis (Using D_{84})

Typical Constants (Input)

1.5-yr	100-yr	
2.9	2.9	= D_{50} = Mean Diameter of Bed Material (From Above) (ft)
4.0	4.0	= D_{84} = 84th percentile grain size of bed material (ft)
62.4	62.4	= γ_w = Specific weight of water (lbs/ft^3)
165.0	165.0	= γ_p = Specific Weight of Sediment (lbs/ft^3)

Results (Shield's Equation)

1.5-yr	100-yr	
0.06	0.06	$= \tau_* =$ Shields Number: $\tau_* = 0.0834(D_{84}/D_{50})^{-0.872}$
26.1	26.1	$= \tau_c =$ Q25 Critical Shear Stress: τc = τ*(γp-γw)D84 (lbs/sf)
3.0	**2.5**	= RBS = Relative Bed Stability (dimensionless)
D84 is very stable.	D84 is very stable.	
19.2	19.2	$= \tau_c =$ Q25 Critical Shear Stress: τc = τ*(γp-γw)D50 (lbs/sf)
2.2	**1.8**	= RBS = Relative Bed Stability (dimensionless)
D84 is very stable.	D50 is stable	

APPENDIX E
Large Woody Material Stability Analysis

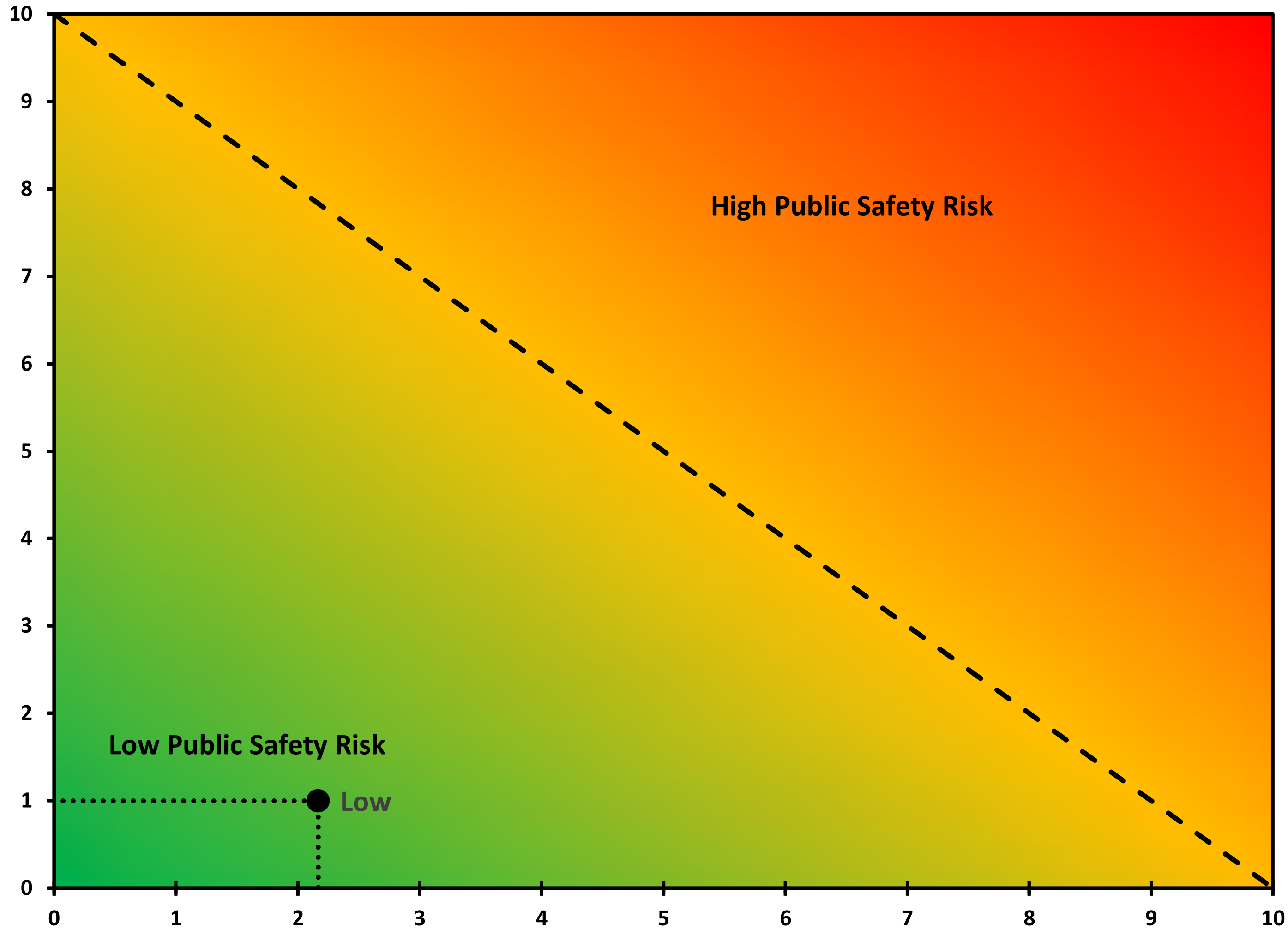
Public Safety Risk Matrix

Structure Description: Proposed LWM

Reach-User Characteristics

			Score
Low	Frequency of Use	High	1
Advanced	Skill Level	Beginner	1
Poor	Access	Good	1
Never	Child Presence	Often	1
		Total	4.0

Average Score = 1.0



Structure Characteristics

			Score
No	Active Channel?	Yes	1
No	Outside of Bend?	Yes	1
Low	Strainer Potential	High	4
High	Egress Potential	Low	2
High	Sight Distance	Low	2
Low	Depth x Velocity	High	3

Average Score = 2.2

Total Score = 13.0

Project:
Poley-Allen Fish Passage Design

Evaluator:
A. Morton

Concurrence:

Date:
7/29/2021

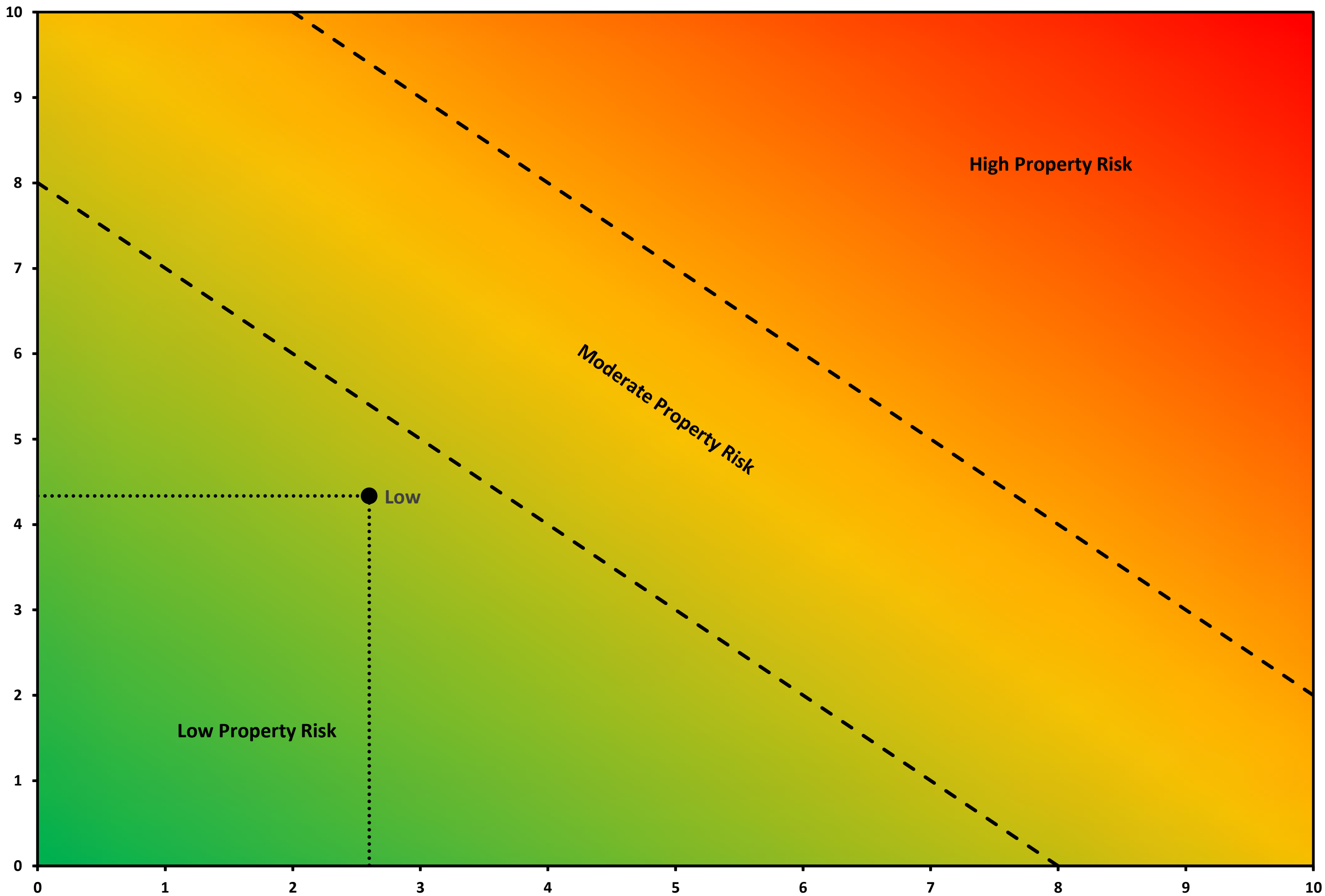
Property Damage Risk Matrix

Structure Description: Proposed LWM

Property/Project Characteristics

			Score
No Structures	In-Channel Structures	Multiple	3
No Buildings	Floodplain Structures	Multiple	5
National Forest	Land Use	Residential	5
		Total =	13.0

Average Score = 4.3



Stream Response Potential

						Score
Stream Type:	Bedrock (source >10%)		Transport (3-10%)		Response (<3%)	2
Riparian Corridor:	Continuous/Wide		Discontinuous/narrow		Urbanized/Levee Confined	3
Bed Scour:	Boulder/Clay bed		Gravel/Cobble		Sand/Silt	2
Hydrologic Regime:	Spring-fed	Snowmelt	Rain	Rain-on-Snow	Thunderstorm	3
Bank Erosion:	Naturally Non-erodible		Erosion Resistant		Highly Erodible	3

Average Score = 2.6

Total Score = 13.0

Project:
Poley-Allen Fish Passage Design

Evaluator:
A. Morton

Concurrence:

Date:
7/29/2021

Poley-Allen
Hydrologic and Hydraulic Inputs

Spreadsheet developed by
Michael Rafferty, P.E.

Average Return Interval (ARI) of Design Discharge: 100 yr

Site ID	Proposed Station	Design Discharge, Q_{des} (cfs)	Maximum Depth, d_w (ft)	Average Velocity, u_{avg} (ft/s)	Bankfull Width, W_{BF} (ft)	Wetted Area, A_W (ft^2)	Radius of Curvature, R_c (ft)
Type A	0+30	850	4.3	3.2	28.6	72.2	2,000.0
Type B	3+40	850	4.1	2.3	55.2	134.7	2,000.0
Type C	3+35	850	4.2	2.3	47.9	121.5	2,000.0
Type D	5+20	850	3.1	5.5	37.7	77.0	2,000.0

Poley-Allen
Stream Bed Substrate Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Site ID	Proposed Station	Stream bed D_{50} (mm)	Stream Bed Substrate Grain Size Class	Bed Soil Class	Dry Unit Weight[1], γ_{bed} (lb/ft^3)	Buoyant Unit Weight, γ'_{bed} (lb/ft^3)	Friction Angle, ϕ_{bed} (deg)
Type A	0+30	78.74	Small Cobble	4	135.4	84.3	41
Type B	3+40	78.74	Small Cobble	4	135.4	84.3	41
Type C	3+35	78.74	Small Cobble	4	135.4	84.3	41
Type D	5+20	78.74	Small Cobble	4	135.4	84.3	41

Source: Compiled from Julien (2010) and Shen and Julien (1993); soil classes from NRCS Table TS14E–2 Soil classification

[1] γ_{bed} (kg/m^3) = 1,600 + 300 log D_{50} (mm) (from Julien 2010)

1 kg/m^3 = 0.062 1 lb/ft^3

Poley-Allen
Bank Soil Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Site ID	Proposed Station	Bank Soils (from field observations)	Bank Soil Class	Dry Unit Weight, γ_{bank} (lb/ft^3)	Buoyant Unit Weight, γ'_{bank} (lb/ft^3)	Friction Angle, ϕ_{bank} (deg)
Type A	0+30	**Gravel/cobble**	4	137.0	85.3	41
Type B	3+40	**Gravel/cobble**	4	137.0	85.3	41
Type C	3+35	**Gravel/cobble**	4	137.0	85.3	41
Type D	5+20	**Gravel/cobble**	4	137.0	85.3	41

Poley-Allen
Large Wood Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Project Location: Mountain West

Timber Unit Weights			Air-dried[1] γ_{Td} (lb/ft^3)	Green[2] γ_{Tgr} (lb/ft^3)
Selected Species	**Common Name**	**Scientific Name**		
Tree Type #1:	Douglas-fir, Interior north	Pseudotsuga menziesii var. glauca	33.5	38.0
Tree Type #2:				
Tree Type #3:				
Tree Type #4:				
Tree Type #5:				
Tree Type #6:				
Tree Type #7:				
Tree Type #8:				
Tree Type #9:				
Tree Type #10:				

[1] **Air-dried unit weight,** γ_{Td} = Average unit weight of wood after exposure to air on a 12% moisture content volume basis. Air-dried unit weight is used in the force balance calculations for the portion of wood that is above the proposed thalweg elevation (assuming unsaturated conditions).
[2] **Green unit weight,** γ_{Tgr} = Average unit weight of freshly sawn wood when the cell walls are completely saturated with water. Green unit weight is used in the force balance calculations as a conservative estimate of the unit weight for the portion of wood that is below the proposed thalweg elevation (assuming saturated conditions). For comparison, Thevenet, Citterio, & Piegay (1998) determined wood unit weight typically increases by more than 100% after less than 24 hours exposure to water.

Source for timber unit weights:

U.S. Department of Agriculture, U.S. Forest Service. (2009) Specific Gravity and Other Properties of Wood and Bark for 156 Tree Species Found in North America. Research Note NRS-38. Table 1A.

Poley-Allen
Notation, Units, and List of Symbols

Notation

Symbol	Description	Unit
A_W	Wetted area of channel at design discharge	ft^2
A_{Tp}	Projected area of wood in plane perpendicular to flow	ft^2
c_D	Centroid of the drag force along log axis	ft
c_{Am}	Centroid of a mechanical anchor along log axis	ft
c_{Ar}	Centroid of a ballast boulder along log axis	ft
c_{Asoil}	Centroid of the added ballast soil along log axis	ft
$c_{F\&N}$	Centroid of friction and normal forces along log axis	ft
c_L	Centroid of the lift force along log axis	ft
c_P	Centroid of the passive soil force along log axis	ft
c_{soil}	Centroid of the vertical soil forces along log axis	ft
$c_{T,B}$	Centroid of the buoyancy force along log axis	ft
$c_{T,W}$	Centroid of the log volume along log axis	ft
c_{WI}	Centroid of a wood interaction force along log axis	ft
C_{Lrock}	Coefficient of lift for submerged boulder	-
C_{LT}	Effective coefficient of lift for submerged tree	-
C_{Di}	Base coefficient of drag for tree, before adjustments	-
C_D*	Effective coefficient of drag for submerged tree	-
C_{Di}	Base coefficient of drag for tree, before adjustments	-
C_W	Wave drag coefficient of submerged tree	-
$d_{b,avg}$	Average buried depth of log	ft
$d_{b,max}$	Maximum buried depth of log	ft
d_w	Maximum flow depth at design discharge in reach	ft
D_{50}	Median grain size in millimeters (SI units)	mm
D_r	Equivalent diameter of boulder	ft
D_{RW}	Assumed diameter of rootwad	ft
D_{TS}	Nominal diameter of tree stem (DBH)	ft
DF_{RW}	Diameter factor for rootwad ($DF_{RW} = D_{RW}/D_{TS}$)	-
e	Void ratio of soils	-
$F_{A,H}$	Total horizontal load capacity of anchor techniques	lbf
$F_{A,HP}$	Passive soil pressure applied to log from soil ballast	lbf
$F_{A,Hr}$	Horizontal resisting force on log from boulder	lbf
F_{Am}	Load capacity of mechanical anchor	lbf
$F_{A,V}$	Total vertical load capacity of anchor techniques	lbf
$F_{A,Vr}$	Vertical resisting force on log from boulder	lbf
$F_{A,Vsoil}$	Vertical soil loading on log from added ballast soil	lbf
F_B	Buoyant force applied to log	lbf
F_D	Drag forces applied to log	lbf
$F_{D,r}$	Drag forces applied to boulder	lbf
F_F	Friction force applied to log	lbf
F_H	Resultant horizontal force applied to log	lbf
F_L	Lift force applied to log	lbf
$F_{L,r}$	Lift force applied to boulder	lbf
F_P	Passive soil pressure force applied to log	lbf
F_{soil}	Vertical soil loading on log	lbf
$F_{W,H}$	Horizontal forces from interactions with other logs	lbf
$F_{W,V}$	Vertical forces from interactions with other logs	lbf

Notation (continued)

Symbol	Description	Unit
F_V	Resultant vertical force applied to log	lbf
Fr_L	Log Froude number	-
FS_V	Factor of Safety for Vertical Force Balance	-
FS_H	Factor of Safety for Horizontal Force Balance	-
FS_M	Factor of Safety for Moment Force Balance	-
g	Gravitational acceleration constant	ft/s^2
K_P	Coefficient of Passive Earth Pressure	-
$L_{T,em}$	Total embedded length of log	ft
L_{RW}	Assumed length of rootwad	ft
L_T	Total length of tree (including rootwad)	ft
L_{Tf}	Length of log in contact with bed or banks	ft
L_{TS}	Length of tree stem (not including rootwad)	ft
$L_{TS,ex}$	Exposed length of tree stem	ft
LF_{RW}	Length factor for rootwad ($LF_{RW} = L_{RW}/D_{TS}$)	-
M_d	Driving moment about embedded tip	lbf
M_r	Driving moment about embedded tip	lbf
N	Blow count of standard penetration test	-
p_o	Porosity of soil volume	-
Q_{des}	Design discharge	cfs
R	Radius	ft
R_c	Radius of curvature at channel centerline	ft
SG_r	Specific gravity of quartz particles	-
SG_T	Specific gravity of tree	-
u_{avg}	Average velocity of cross section in reach	ft/s
u_{des}	Design velocity	ft/s
u_m	Adjusted velocity at outer meander bend	ft/s
V_{dry}	Volume of soils above stage level of design flow	ft^3
V_{sat}	Volume of soils below stage level of design flow	ft^3
V_{soil}	Total volume of soils over log	ft^3
V_{RW}	Volume of rootwad	ft^3
V_S	Volume of solids in soil (void ratio calculation)	ft^3
V_T	Total volume of log	ft^3
V_{TS}	Total volume of tree	ft^3
V_V	Volume of voids in soil	ft^3
V_{Adry}	Volume of ballast above stage of design flow	ft^3
V_{Awet}	Volume of ballast below stage of design flow	ft^3
$V_{r,dry}$	Volume of boulder above stage of design flow	ft^3
$V_{r,wet}$	Volume of boulder below stage of design flow	ft^3
W_{BF}	Bankfull width at structure site	ft
W_r	Effective weight of boulder	lbf
W_T	Total log weight	lbf
x	Horizontal coordinate (distance)	ft
y	Vertical coordinate (elevation)	ft
$y_{T,max}$	Minimum elevation of log	ft
$y_{T,min}$	Maximum elevation of log	ft

Greek Symbols

Symbol	Description	Unit
β	Tilt angle from stem tip to vertical	deg
γ_{bank}	Dry specific weight of bank soils	lb/ft^3
$\gamma_{bank,sat}$	Saturated unit weight of bank soils	lb/ft^3
γ'_{bank}	Effective buoyant unit weight of bank soils	lb/ft^3
γ_{bed}	Dry specific weight of stream bed substrate	lb/ft^3
γ'_{bed}	Effective buoyant unit weight of stream bed substrate	lb/ft^3
γ_{rock}	Dry unit weight of boulders	lb/ft^3
γ_s	Dry specific weight of soil	lb/ft^3
γ'_s	Effective buoyant unit weight of soil	lb/ft^3
γ_{Td}	Air-dried unit weight of tree (12% MC basis)	lb/ft^3
γ_{Tgr}	Green unit weight of tree	lb/ft^3
γ_w	Specific weight of water at 50ºF	lb/ft^3
η	Rootwad porosity	-
θ	Rootwad (or large end of log) orientation to flow	deg
μ	Coefficient of friction	-
ν	Kinematic viscosity of water at 50ºF	ft/s^2
Σ	Sum of forces	-
ϕ_{bank}	Internal friction angle of bank soils	deg
ϕ_{bed}	Internal friction angle of stream bed substrate	deg

Units

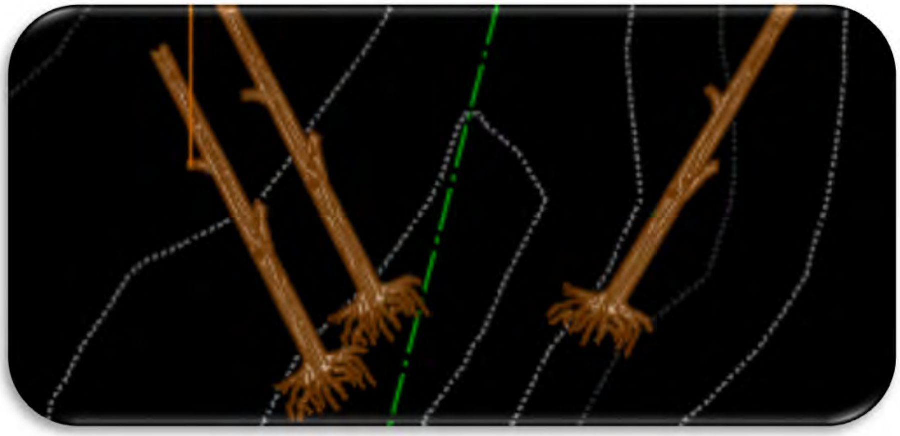
Notation	Description
cfs	Cubic feet per second
ft	Feet
lb	Pound
lbf	Pounds force
kg	Kilograms
m	Meters
mm	Millimeters
s	Seconds
yr	Year

Abbreviations

Notation	Description
ARI	Average return interval
Avg	Average
DBH	Diameter at breast height
deg	Degrees
Dia	Diameter
Dist	Distance
D/S	Downstream
ELJ	Engineered log jam
Ex	Example
Fldpln	Floodplain
H&H	Hydrologic and hydraulic
ID	Identification
i.e.	That is
LB	Left bank
LW	Large wood
Max	Maximum
MC	Moisture content
Min	Minimum
ML	Multi-log
SL	Single log
N/A	Not applicable
no	Number
Pt	Point
rad	Radians
RB	Right bank
RW	Rootwad
SL	Single log
Thw	Thalweg (lowest elevation in channel bed)
Typ	Typical
U.S.	United States
WS	Water surface
WSE	Water surface elevation
↑	Above
↓	Below

Poley-Allen

LWM Type A Stability Analysis



Date of Last Revision: September 9, 2021

Designer:
A. Morton, PE

Reviewed by:
R. Carnie, PE

Large Wood Structure Stability Analysis Spreadsheet was developed by Michael Rafferty, P.E.
Version 1.1

Reference for Companion Paper:
Rafferty, M. 2016. *Computational Design Tool for Evaluating the Stability of Large Wood Structures.* Technical Note TN-103.1. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center. 27 p.

Poley-Allen

Spreadsheet developed by
Michael Rafferty, P.E.

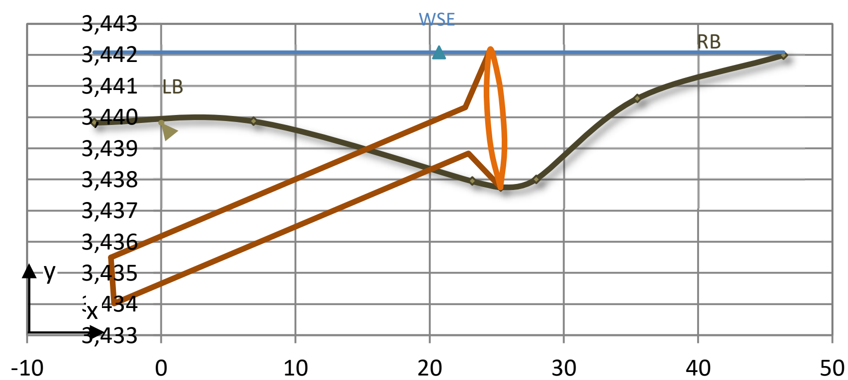
Single Log Stability Analysis Model Inputs

Site ID	Structure Type	Structure Position	Meander	Station	d_w (ft)	R_c/W_{BF}	u_{des} (ft/s)
Type A	Rootwad	Left bank	Straight	0+30	4.33	69.96	3.21

Multi-Log Structures	Layer	Log ID
	N/A	N/A

Channel Geometry Coordinates		
Proposed	x (ft)	y (ft)
Fldpln LB	-5.0	3,439.8
Top LB	6.9	3,439.9
Toe LB	23.2	3,437.9
Thalweg	25.3	3,437.8
Toe RB	27.9	3,438.0
Top RB	35.5	3,440.6
Fldpln RB	46.4	3,442.0

Proposed Cross-Section and Structure Geometry (Looking D/S)

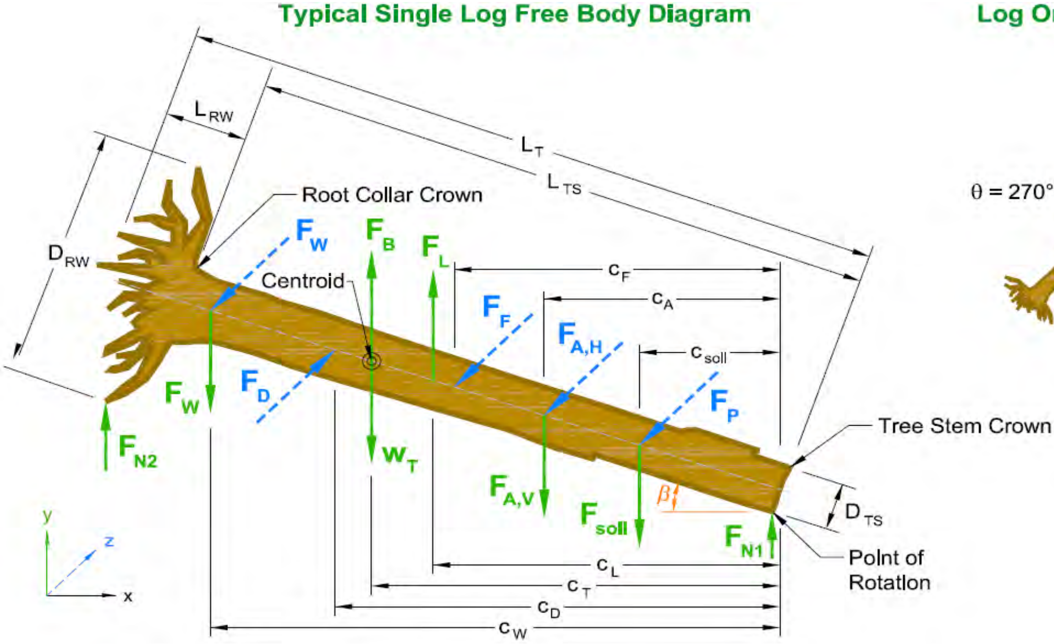


Wood Species	Rootwad	L_T (ft)	D_{TS} (ft)	L_{RW} (ft)	D_{RW} (ft)	γ_{Td} (lb/ft^3)	γ_{Tgr} (lb/ft^3)
Douglas-fir, Interior north	Yes	30.0	1.50	2.25	4.50	33.5	38.0

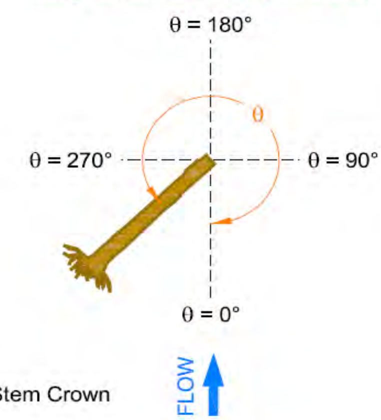
Structure Geometry	θ (deg)	β (deg)	Define Fixed Point	x_T (ft)	y_T (ft)	$y_{T,min}$ (ft)	$y_{T,max}$ (ft)	A_{Tp} (ft^2)
	75.0	-10.0	Rootwad: Bottom	25.28	3,437.75	3,434.02	3,442.18	15.69

Soils	Material	γ_s (lb/ft^3)	γ'_s (lb/ft^3)	ϕ (deg)	Soil Class	$L_{T,em}$ (ft)	$d_{b,max}$ (ft)	$d_{b,avg}$ (ft)
Stream Bed	Small Cobble	135.4	84.3	41.0	4	0.00	0.00	0.00
Bank	Gravel/cobble	137.0	85.3	41.0	4	19.67	4.33	2.44

Typical Single Log Free Body Diagram



Log Orientation (Plan View)



Vertical Force Analysis

Net Buoyancy Force

Wood	V_{TS} (ft^3)	V_{RW} (ft^3)	V_T (ft^3)	W_T (lbf)	F_B (lbf)
↑WSE	0.0	0.0	0.0	0	0
↓WS↑Thw	18.6	13.8	32.4	1,085	2,019
↓Thalweg	30.5	0.0	30.5	1,158	1,901
Total	49.0	13.8	62.8	2,243	3,920

Lift Force

C_{LT}	0.06
F_L (lbf)	9

Vertical Force Balance

F_B (lbf)	3,920	↑
F_L (lbf)	9	↑
W_T (lbf)	2,243	↓
F_{soil} (lbf)	6,152	↓
$F_{W,V}$ (lbf)	0	
$F_{A,V}$ (lbf)	0	
ΣF_V (lbf)	4,466	↓
FS_V	2.14	✓

Soil Ballast Force

Soil	V_{dry} (ft^3)	V_{sat} (ft^3)	V_{soil} (ft^3)	F_{soil} (lbf)
Bed	0.0	0.0	0.0	0
Bank	0.0	72.1	72.1	6,152
Total	0.0	72.1	72.1	6,152

Horizontal Force Analysis

Drag Force

A_{Tp} / A_W	Fr_L	C_{Di}	C_w	C_D*	F_D (lbf)
0.22	0.46	1.14	0.39	2.51	395

Horizontal Force Balance

F_D (lbf)	395	→
F_P (lbf)	14,810	←
F_F (lbf)	3,882	←
$F_{W,H}$ (lbf)	0	
$F_{A,H}$ (lbf)	0	
ΣF_H (lbf)	18,298	←
FS_H	47.38	✓

Passive Soil Pressure / Friction Force

Soil	K_P	F_P (lbf)	L_{Tf} (ft)	μ	F_F (lbf)
Bed	4.81	0	2.00	0.87	289
Bank	4.81	14,810	24.82	0.87	3,593
Total	-	14,810	26.82	-	3,882

Moment Force Balance

Driving Moment Centroids / Resisting Moment Centroids

$c_{T,B}$ (ft)	c_L (ft)	c_D (ft)	$c_{T,W}$ (ft)	c_{soil} (ft)	$c_{F\&N}$ (ft)	c_P (ft)
17.0	26.2	24.9	17.0	9.8	12.4	13.1

*Distances are from the stem tip

Point of Rotation: Stem Tip

Moment Force Balance

M_d (lbf)	75,683
M_r (lbf)	389,964
FS_M	5.15 ✓

Anchor Forces

Additional Soil Ballast

V_{Adry} (ft^3)	V_{Awet} (ft^3)	c_{Asoil} (ft)	$F_{A,Vsoil}$ (lbf)	$F_{A,HP}$ (lbf)
			0	0

Mechanical Anchors

Type	c_{Am} (ft)	Soils	F_{Am} (lbf)
			0
			0

Boulder Ballast

Position	D_r (ft)	c_{Ar} (ft)	$V_{r,dry}$ (ft^3)	$V_{r,wet}$ (ft^3)	W_r (lbf)	$F_{L,r}$ (lbf)	$F_{D,r}$ (lbf)	$F_{A,Vr}$ (lbf)	$F_{A,Hr}$ (lbf)
								0	0
								0	0
								0	0

Interaction Forces with Adjacent Logs

Log ID	Position	Link	c_{WI} (ft)	$F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)	Applied Forces from other Logs $F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)
						0	0
						0	0
						0	0
						0	0

Poley-Allen

LWM Type B Stability Analysis

Date of Last Revision: **September 10, 2021**

Designer:
A. Morton, PE

Reviewed by:
R. Carnie, PE

Large Wood Structure Stability Analysis Spreadsheet was developed by Michael Rafferty, P.E.
Version 1.1

Reference for Companion Paper:
Rafferty, M. 2016. *Computational Design Tool for Evaluating the Stability of Large Wood Structures.* Technical Note TN-103.1. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center. 27 p.

Poley-Allen

Spreadsheet developed by
Michael Rafferty, P.E.

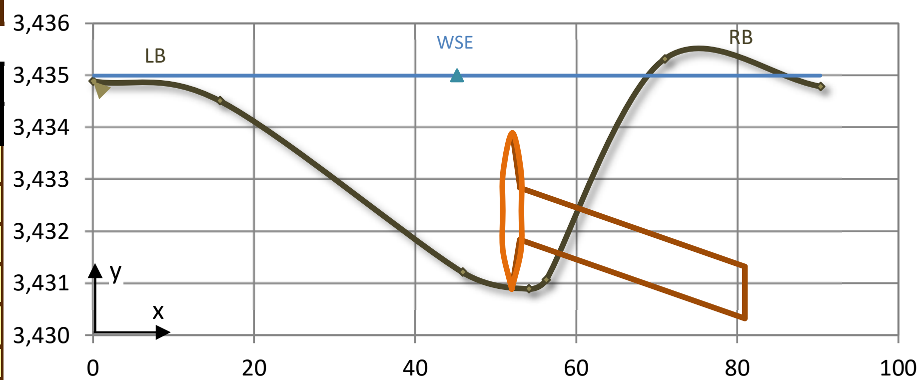
Single Log Stability Analysis Model Inputs

Site ID	Structure Type	Structure Position	Meander	Station	d_w (ft)	R_c/W_{BF}	u_{des} (ft/s)
Type B	Rootwad	Right bank	Straight	7+70	4.10	36.20	2.34

Multi-Log Structures	Layer	Log ID
	N/A	N/A

Channel Geometry Coordinates		
Proposed	x (ft)	y (ft)
Fldpln LB	0.00	3,434.88
Top LB	15.74	3,434.51
Toe LB	45.88	3,431.21
Thalweg	54.14	3,430.89
Toe RB	56.27	3,431.07
Top RB	70.99	3,435.31
Fldpln RB	90.33	3,434.78

Proposed Cross-Section and Structure Geometry (Looking D/S)

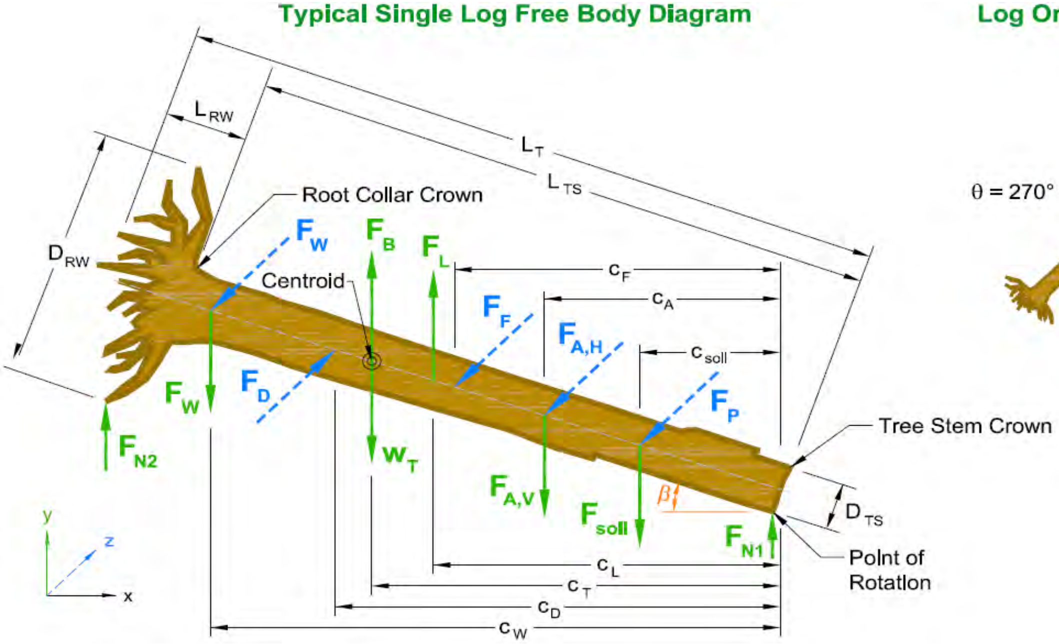


Wood Species	Rootwad	L_T (ft)	D_{TS} (ft)	L_{RW} (ft)	D_{RW} (ft)	γ_{Td} (lb/ft^3)	γ_{Tgr} (lb/ft^3)
Douglas-fir, Interior north	Yes	45.0	1.00	1.50	3.00	33.5	38.0

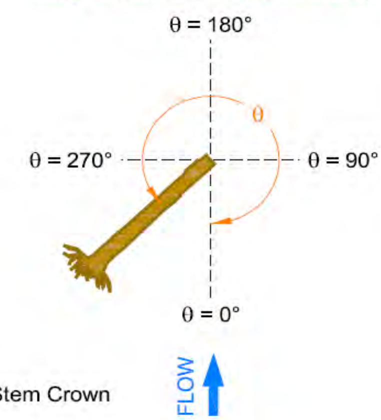
Structure Geometry	θ (deg)	β (deg)	Define Fixed Point	x_T (ft)	y_T (ft)	$y_{T,min}$ (ft)	$y_{T,max}$ (ft)	A_{Tp} (ft^2)
	220.0	-2.0	Rootwad: Bottom	52.00	3,430.89	3,430.32	3,433.89	12.77

Soils	Material	γ_s (lb/ft^3)	γ'_s (lb/ft^3)	ϕ (deg)	Soil Class	$L_{T,em}$ (ft)	$d_{b,max}$ (ft)	$d_{b,avg}$ (ft)
Stream Bed	Small Cobble	135.4	84.3	41.0	4	0.00	0.00	0.00
Bank	Gravel/cobble	137.0	85.3	41.0	4	31.19	3.72	2.66

Typical Single Log Free Body Diagram



Log Orientation (Plan View)



Vertical Force Analysis

Net Buoyancy Force

Wood	V_{TS} (ft^3)	V_{RW} (ft^3)	V_T (ft^3)	W_T (lbf)	F_B (lbf)
↑WSE	0.0	0.0	0.0	0	0
↓WS↑Thw	30.9	4.1	35.0	1,174	2,183
↓Thalweg	3.3	0.0	3.3	124	204
Total	34.2	4.1	38.2	1,298	2,387

Lift Force

C_{LT}	0.04
F_L (lbf)	3

Vertical Force Balance

F_B (lbf)	2,387	↑
F_L (lbf)	3	↑
W_T (lbf)	1,298	↓
F_{soil} (lbf)	7,214	↓
$F_{W,V}$ (lbf)	0	
$F_{A,V}$ (lbf)	0	
ΣF_V (lbf)	6,122	↓
FS_V	3.56	✓

Soil Ballast Force

Soil	V_{dry} (ft^3)	V_{sat} (ft^3)	V_{soil} (ft^3)	F_{soil} (lbf)
Bed	0.0	0.0	0.0	0
Bank	3.1	79.6	82.7	7,214
Total	3.1	79.6	82.7	7,214

Horizontal Force Analysis

Drag Force

A_{Tp} / A_W	Fr_L	C_{Di}	C_w	C_D*	F_D (lbf)
0.09	0.41	1.10	0.02	1.37	92

Horizontal Force Balance

F_D (lbf)	92	→
F_P (lbf)	17,368	←
F_F (lbf)	5,322	←
$F_{W,H}$ (lbf)	0	
$F_{A,H}$ (lbf)	0	
ΣF_H (lbf)	22,598	←
FS_H	245.52	✓

Passive Soil Pressure / Friction Force

Soil	K_P	F_P (lbf)	L_{Tf} (ft)	μ	F_F (lbf)
Bed	4.81	0	2.00	0.87	283
Bank	4.81	17,368	35.66	0.87	5,040
Total	-	17,368	37.66	-	5,322

Moment Force Balance

Driving Moment Centroids / Resisting Moment Centroids

$c_{T,B}$ (ft)	c_L (ft)	c_D (ft)	$c_{T,W}$ (ft)	c_{soil} (ft)	$c_{F\&N}$ (ft)	c_P (ft)
24.1	36.8	38.1	24.1	15.5	17.8	20.7

*Distances are from the stem tip

Point of Rotation:	Stem Tip

Moment Force Balance

M_d (lbf)	61,223
M_r (lbf)	705,851
FS_M	11.53

Anchor Forces

Additional Soil Ballast

V_{Adry} (ft^3)	V_{Awet} (ft^3)	c_{Asoil} (ft)	$F_{A,Vsoil}$ (lbf)	$F_{A,HP}$ (lbf)
			0	0

Mechanical Anchors

Type	c_{Am} (ft)	Soils	F_{Am} (lbf)
			0
			0

Boulder Ballast

Position	D_r (ft)	c_{Ar} (ft)	$V_{r,dry}$ (ft^3)	$V_{r,wet}$ (ft^3)	W_r (lbf)	$F_{L,r}$ (lbf)	$F_{D,r}$ (lbf)	$F_{A,Vr}$ (lbf)	$F_{A,Hr}$ (lbf)
								0	0
								0	0
								0	0

Interaction Forces with Adjacent Logs

Applied Forces from other Logs

Log ID	Position	Link	c_{WI} (ft)	$F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)	$F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)
						0	0
						0	0
						0	0
						0	0

Poley-Allen

LWM Type C Stability Analysis

Date of Last Revision: **September 10, 2021**

Designer:
A. Morton, PE

Reviewed by:
R. Carnie, PE

Large Wood Structure Stability Analysis Spreadsheet was developed by Michael Rafferty, P.E.
Version 1.1

Reference for Companion Paper:
Rafferty, M. 2016. *Computational Design Tool for Evaluating the Stability of Large Wood Structures.* Technical Note TN-103.1. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center. 27 p.

Poley-Allen

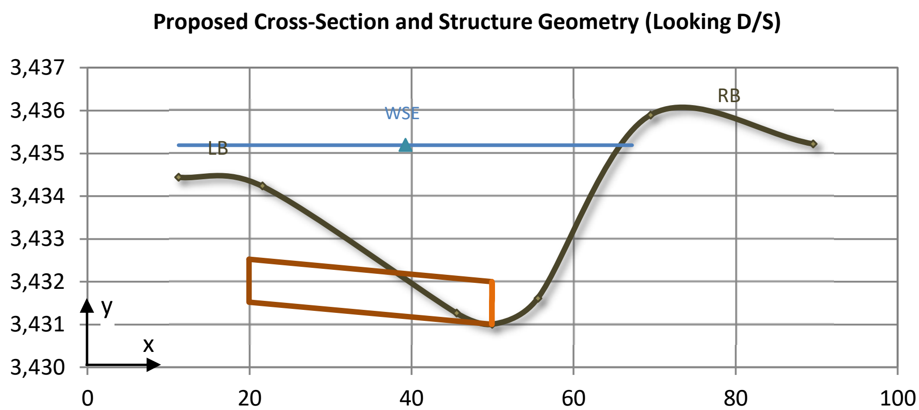
Spreadsheet developed by
Michael Rafferty, P.E.

Single Log Stability Analysis Model Inputs

Site ID	Structure Type	Structure Position	Meander	Station	d_w (ft)	R_c/W_{BF}	u_{des} (ft/s)
Type C	Log Vane	Left bank	Straight	3+35	4.19	41.74	2.28

Multi-Log Structures	Layer	Log ID
	N/A	N/A

Channel Geometry Coordinates		
Proposed	x (ft)	y (ft)
Fldpln LB	11.2	3,434.4
Top LB	21.6	3,434.2
Toe LB	45.5	3,431.3
Thalweg	49.9	3,431.0
Toe RB	55.6	3,431.6
Top RB	69.5	3,435.9
Fldpln RB	89.5	3,435.2

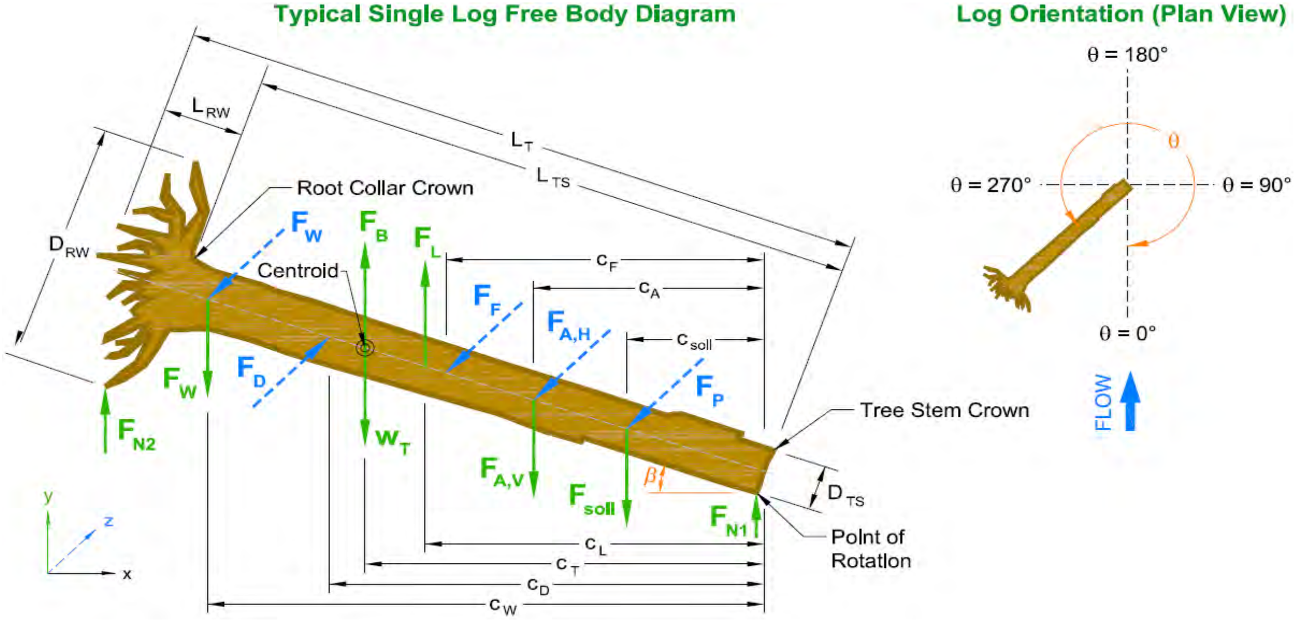


Wood Species	Rootwad	L_T (ft)	D_{TS} (ft)	L_{RW} (ft)	D_{RW} (ft)	γ_{Td} (lb/ft^3)	γ_{Tgr} (lb/ft^3)
Douglas-fir, Interior north	No	30.0	1.00	-	-	33.5	38.0

Structure Geometry	θ (deg)	β (deg)	Define Fixed Point	x_T (ft)	y_T (ft)	$y_{T,min}$ (ft)	$y_{T,max}$ (ft)	A_{Tp} (ft^2)
	91.0	1.0	Root collar: Bottom	49.9	3,431.0	3,431.00	3,432.52	7.01

Soils	Material	γ_s (lb/ft^3)	γ'_s (lb/ft^3)	ϕ (deg)	Soil Class	$L_{T,em}$ (ft)	$d_{b,max}$ (ft)	$d_{b,avg}$ (ft)
Stream Bed	Small Cobble	135.4	84.3	41.0	4	0.00	0.00	0.00
Bank	Gravel/cobble	137.0	85.3	41.0	4	17.97	1.74	0.95

Typical Single Log Free Body Diagram **Log Orientation (Plan View)**



Vertical Force Analysis

Net Buoyancy Force

Wood	V_{TS} (ft^3)	V_{RW} (ft^3)	V_T (ft^3)	W_T (lbf)	F_B (lbf)
↑WSE	0.0	0.0	0.0	0	0
↓WS↑Thw	23.6	0.0	23.6	790	1,470
↓Thalweg	0.0	0.0	0.0	0	0
Total	23.6	0.0	23.6	790	1,470

Lift Force

C_{LT}	0.00
F_L (lbf)	0

Vertical Force Balance

F_B (lbf)	1,470
F_L (lbf)	0
W_T (lbf)	790
F_{soil} (lbf)	1,452
$F_{W,V}$ (lbf)	0
$F_{A,V}$ (lbf)	0
ΣF_V (lbf)	772
FS_V	1.53

Soil Ballast Force

Soil	V_{dry} (ft^3)	V_{sat} (ft^3)	V_{soil} (ft^3)	F_{soil} (lbf)
Bed	0.0	0.0	0.0	0
Bank	0.0	17.0	17.0	1,452
Total	0.0	17.0	17.0	1,452

Horizontal Force Analysis

Drag Force

A_{Tp} / A_W	Fr_L	C_{Di}	C_w	C_D*	F_D (lbf)
0.06	0.40	0.93	0.00	1.05	37

Horizontal Force Balance

F_D (lbf)	37
F_P (lbf)	3,495
F_F (lbf)	671
$F_{W,H}$ (lbf)	0
$F_{A,H}$ (lbf)	0
ΣF_H (lbf)	4,129
FS_H	112.89

Passive Soil Pressure / Friction Force

Soil	K_P	F_P (lbf)	L_{Tf} (ft)	μ	F_F (lbf)
Bed	4.81	0	6.43	0.87	135
Bank	4.81	3,495	25.57	0.87	536
Total	-	3,495	32.00	-	671

Moment Force Balance

Driving Moment Centroids / Resisting Moment Centroids

$c_{T,B}$ (ft)	c_L (ft)	c_D (ft)	$c_{T,W}$ (ft)	c_{soil} (ft)	$c_{F\&N}$ (ft)	c_P (ft)
15.0	0.0	24.0	15.0	8.9	15.0	11.9

*Distances are from the stem tip

Point of Rotation:	Stem Tip

Moment Force Balance

M_d (lbf)	22,936
M_r (lbf)	88,039
FS_M	3.84

Anchor Forces

Additional Soil Ballast

V_{Adry} (ft^3)	V_{Awet} (ft^3)	c_{Asoil} (ft)	$F_{A,Vsoil}$ (lbf)	$F_{A,HP}$ (lbf)
			0	0

Mechanical Anchors

Type	c_{Am} (ft)	Soils	F_{Am} (lbf)
			0
			0

Boulder Ballast

Position	D_r (ft)	c_{Ar} (ft)	$V_{r,dry}$ (ft^3)	$V_{r,wet}$ (ft^3)	W_r (lbf)	$F_{L,r}$ (lbf)	$F_{D,r}$ (lbf)	$F_{A,Vr}$ (lbf)	$F_{A,Hr}$ (lbf)
								0	0
								0	0
								0	0

Interaction Forces with Adjacent Logs

						Applied Forces from other Logs	
Log ID	Position	Link	c_{Wl} (ft)	$F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)	$F_{W,V}$ (lbf)	$F_{W,H}$ (lbf)
						0	0
						0	0
						0	0
						0	0

Land Use Information Form

This information is needed to determine if the proposed project complies with statewide planning goals and is compatible with local comprehensive plans (ORS 197.180). The completed and signed form must be submitted before OWEB releases grant funds. OWEB will release grant funds only if the project either is not regulated by, or is compatible with, the local comprehensive plan and zoning ordinance. If a project is regulated by the local comprehensive plan and zoning ordinance, OWEB will void grant agreements for projects the county determines to be incompatible with the local comprehensive plan and zoning ordinance. If the county requires additional local approvals for a project regulated by the local comprehensive plan and zoning ordinance, OWEB will not release grant funds until these conditions are satisfied.

1. To Be Completed by the Applicant/Grantee

Applicant/Grantee Name: Nez Perce Tribe

Project Name: Poley Allen Fish Passage

2. To Be Completed by City/County or Tribal Planning Official

Complete this section only **after** section 1, above, has been completed. Check the box below that applies:

☐ This project is not regulated by the local comprehensive plan and zoning ordinance.

☒ This project has been reviewed and is compatible with the local comprehensive plan and zoning ordinance.

☐ This project has been reviewed and **IS NOT** compatible with the local comprehensive plan and zoning ordinance.

☐ Compatibility of this project with the local planning ordinance cannot be determined until the following local approvals are obtained:

- ☐ Conditional Use Permit
- ☐ Development Permit
- ☐ Plan Amendment
- ☐ Zone Change
- ☐ Other

An application ☐ has ☒ has not been made for the local approvals checked above.

[signature]
Signature of Local Official*

Date: 11.1.2021

Print Name: Jean Jancaitis

Phone: 541-426-4543 ext 1170

Title: Planning Dept Sp.

Email: plansec@co.wallowa.or.us

***Must be an authorized signature from your local City/County or Tribal Planning Department, regardless of which box is checked above.**

Match Funding Form

Document the match funding shown on the budget page of your grant application.

OWEB accepts all non-OWEB funds as match. An applicant may NOT use another OWEB grant to match an OWEB grant; this includes ODA Weed Board projects because they are funded through OWEB grants. However, an applicant who benefits from a pass-through OWEB agreement with another state agency, by receiving either staff expertise or a grant from that state agency, may use those benefits as match for an OWEB grant. (Example: A grantee **MAY** use as match the effort provided by ODFW restoration biologists because OWEB funding for those positions is the result of a pass-through agreement).

At the time of application, match funding for OWEB funds requested does not have to be secured, but you must show that **at least 25% of match funding has been sought**. On this form, you do not necessarily need to show authorized signatures ("secured match"), but the more match that is secured, the stronger the application. Identify the type of match (cash or in-kind), the status of the match (secured or pending), and either a dollar amount or a dollar value (based on local market rates) of the in-kind contribution.

If you have questions about whether your proposed match is eligible or not, see Allowable Match document in OGMS https://apps.wrd.state.or.us/apps/oweb/fiscal/nologin.aspx under Technical Assistance application or contact your local OWEB regional program representative (contact information available in the instructions to this application).

Project Name: Poley-Allen Fish Passage Project

Applicant: Nez Perce Tribe

Match Funding Source	Type	Status*	Dollar Value	Match Funding Source Signature/Date*
Nez Perce Tribe	in-kind	pending	$10,000	E. Taylor Jr.
Grande Ronde Model Watershed	cash	pending	$189,911	Jesse Steele 10/27/21
	(select)	(select)		
	(select)	(select)		
	(select)	(select)		
	(select)	(select)		
	(select)	(select)		

*** IMPORTANT:** If you selected "secured" in the Status column for any match funding source, you must provide either the signature of an authorized representative of the match source in the Match Funding Source Signature/Date column, or attach a letter of support from the match funding source that specifically mentions the dollar amount you show in the Dollar Value column.