



# Quality Assurance Project Plan

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## Low-Tech Structure Monitoring for the Restoration Projects in the Wenatchee River Watershed

August 2024

# Publication Information

Each study conducted for the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance Project Plan (QAPP). This QAPP describes the data quality objectives and protocols for Streamflow Monitoring at the Roaring Creek Restoration Project in the Entiat River watershed.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website: <https://fortress.wa.gov/ecy/eimreporting/default.aspx>; at [www.data.wa.gov](http://www.data.wa.gov); and from Cascadia Conservation District. In EIM, search on Study ID WRSRP-2022-0188-002.

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**Cover photo:** View of typical low-tech structure installation, captured by N. Legg

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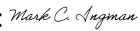




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## Streamflow Monitoring for The Roaring Creek Restoration Project

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# 1.0 Abstract

In 2022, Cascadia Conservation District (CCD) received a Streamflow Restoration Grant from the Ecology’s Water Resources Program (WRSP-2022-CascCD-00188). The project involves instream and floodplain restoration components proposed at a series of sites in the Wenatchee and Entiat River Watersheds. These restoration projects intend to restore instream function, salmon habitat, and streamflow, using a combination of low-tech and full-floodplain restoration techniques. A portion of the grant includes development of a Monitoring and Adaptive Management Plan (MAMP) and proposed monitoring at these sites for effectiveness of restoration measures and in some cases, streamflow monitoring to assess potential changes in water storage resulting from restoration actions. The MAMP, which is available under separate cover, details several distinct protocols geared toward various site conditions, restoration techniques, and monitoring goals. Therefore, not all protocols are applied at all sites.

This Quality Assurance Project Plan (QAPP) details the protocols for “structure-based” stream monitoring at seven sites proposed for low-tech process-based restoration within Chelan County, Washington. The monitoring approach described here is identified as a Core Protocol under the above referenced MAMP. The proposed monitoring approach involves ground-based observation of the performance and stream response to individual structures. The data collected are mostly qualitative and semi-quantitative in nature and intended to inform tracking and adaptive management of installed restoration structures over time. The proposed monitoring is planned to start in summer of 2024 and extend through the grant period ending in 2027. Implementation of restoration measures at the sites will occur in the summer-fall seasons of 2024 and 2025. The protocol involves data collection on structure installations and characteristics at the time of implementation, and is followed by post-implementation monitoring in subsequent seasons.

# 2.0 Background

## 2.1 Introduction

In 2022, Cascadia Conservation District (CCD) received a Streamflow Restoration Grant from the Ecology’s Water Resources Program (WRSP-2022-CascCD-00188). The project involves instream and floodplain restoration components proposed at a series of sites in the Wenatchee and Entiat River Watersheds. These restoration projects intend to restore instream function, salmon habitat, and streamflow, using a combination of low-tech and full-floodplain restoration techniques. A portion of the grant includes development of a Monitoring and Adaptive Management Plan (MAMP) and proposed monitoring at these sites for effectiveness of restoration measures and in some cases, streamflow monitoring to assess potential changes in water storage resulting from restoration actions. The MAMP, which is available under separate cover, details several distinct protocols geared toward various site conditions, restoration techniques, and monitoring goals. Therefore, not all protocols are applied at all sites.

This Quality Assurance Project Plan (QAPP) details the protocols for “structure-based” stream monitoring at six sites proposed for low-tech process-based restoration within Chelan County,

Washington. The monitoring approach described here is identified as a Core Protocol under the above referenced MAMP. The proposed monitoring approach involves ground-based observation of the performance and stream response to individual structures. The data collected are mostly qualitative and semi-quantitative in nature and intended to inform tracking and adaptive management of installed restoration structures over time. The proposed monitoring is planned to start in summer of 2024 and extend through the grant period ending in 2027. Implementation of restoration measures at the sites will occur in the summer-fall seasons of 2024 and 2025. The protocol involves data collection on structure installations and characteristics at the time of implementation, and is followed by post-implementation monitoring in subsequent seasons.

## 2.2 Relevant QAPP

This QAPP drew elements from previous QAPPs where applicable. Those include:

- QAPP developed by Maloney et al. and approved by Ecology in March 2023 for the Icicle Creek Alluvial Water Storage Project Monitoring, with designated Ecology publication number 23-12-005.
- QAPP Developed by Whipple et al and approved by Ecology in October 2021 for the “Restoring Streamflow after Wildfire in Okanogan and Methow River Sub-Basins (agreement # WRSRP-2020-MSRF-00010)

In some cases, procedural descriptions were adapted directly from these previously approved QAPPs.

## 2.3 Study area and surroundings

The project area includes seven distinct restoration project sites in tributaries of the Wenatchee River within Chelan County, WA. The named tributaries include Eagle, Derby, and Little Chumstick Creeks. Each individual project area corresponds with a parcel or series of parcels owned by a single landowner. Figure 1 shows the general locations of these project sites and monitoring locations.

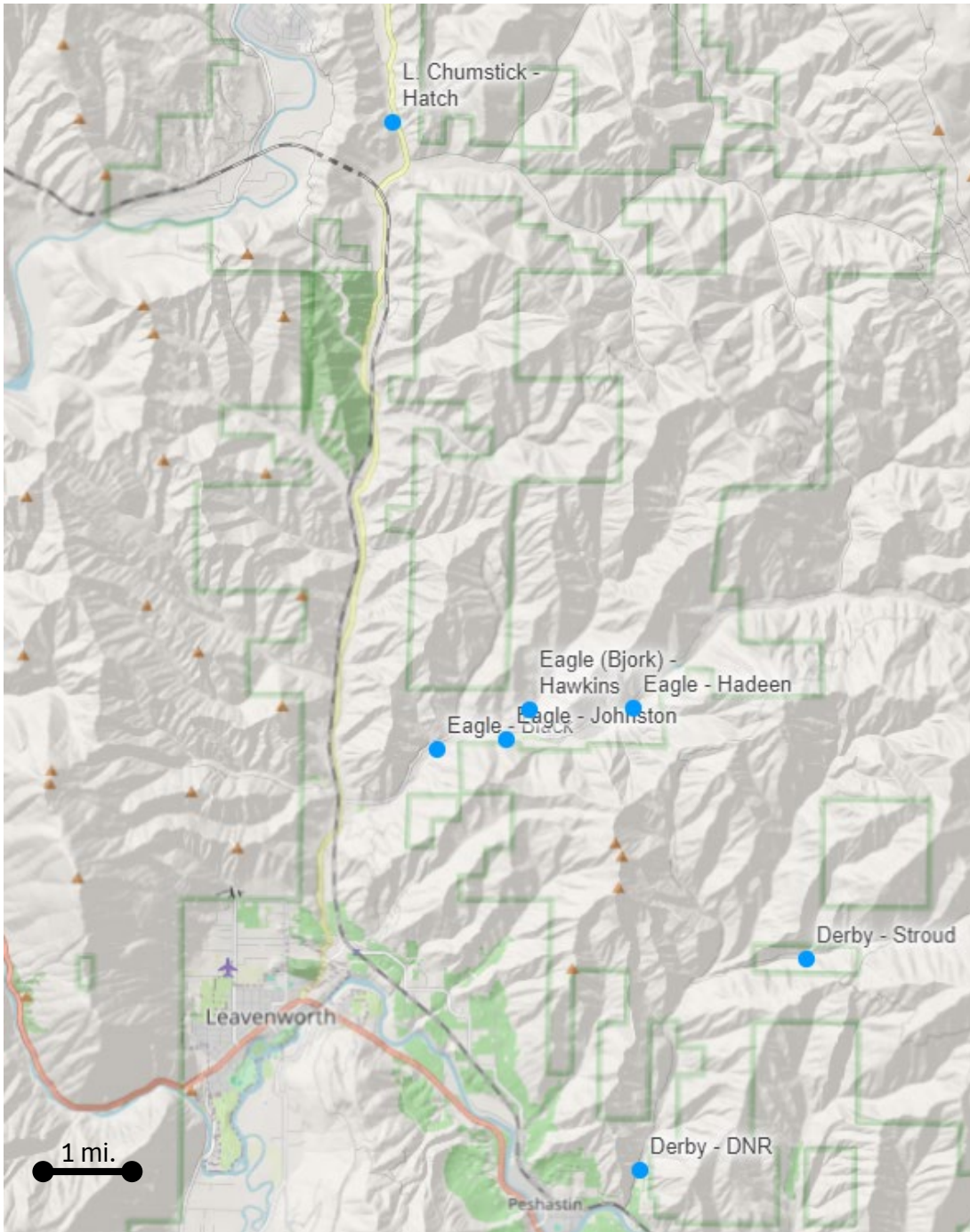


Figure 1. Specific project locations (blue) within the project area within Chelan County and the Wenatchee River watershed.

### 2.3.1 Summary of existing data

Not applicable.

### 2.3.2 Parameters of interest and potential sources

The monitoring parameters of interest for this monitoring protocol address key processes inherent in stream response and success of installed low-tech structures:

- Structure performance and integrity
- Stream widening
- Sediment deposition and bed aggradation
- Complexity development
- Vegetation response
- Floodplain activation
- Water retention
- Beaver activity and occupation

Appendix A details all specific field parameters within these categories. The specific parameters are primarily indicator based and either qualitative or semi-quantitative in nature. The protocol is designed to be rapidly implemented (~5 minutes per structure) based on the number of installed structures and the need for simple data to inform decision-making. The indicator-based protocol is described as follows in the associated MAMP:

Indicators are observed or measured data that imply or signal a particular change (process) in response to restoration actions. As compared to direct measurements of change, indicators will often require lower effort to detect change because they rely on interpretations of change, and in turn require streamlined pre-project data collection, and less back-end effort on data analysis. Specifically, pre-project data collection can be collected in concert with implementation, and it will focus on the specific goals and components of placed structures. Back-end analysis of the collected data is also relatively streamlined because indicator-based monitoring focuses on implicit detection of change, rather than comparative analysis of pre- and post-restoration conditions.

Indicators may be directly linked to a stream process—for instance, observed bank erosion at a placed low-tech structure *indicates* stream widening. Indicators may also be indirectly linked to a stream process—for instance, increased vegetation coverage after restoration *indicates* raised water tables or water availability.

### 2.3.3 Regulatory criteria or standards

Not Applicable

## 3.0 Project Description

### 3.1 Project goals

The overall goal of the proposed monitoring is to efficiently assess the influence of installed low-tech structures on stream and floodplain processes to inform adaptive management needs.

### 3.2 Project objectives

The objectives of this proposed monitoring are to:

- Assess the performance and integrity of installed restoration structures over time.
- Qualitatively assess stream responses to placed structures. This may include changes in stream width, sediment deposition, bed aggradation, vegetation, beaver activity in response to restoration actions.
- Inform adaptive management decisions for ongoing and future restoration efforts.
- Monitor with rapidly collected qualitative and semi-quantitative data.

### 3.3 Information needed and sources

The information needed for this project will be collected through field observations at installed structures and structure complexes. Two main data collection efforts will occur:

- Pre-project (implementation) data collection: Conducted during the installation of restoration structures.
- Post-project monitoring: Conducted at regular intervals following implementation.

### 3.4 Tasks required

Tasks required to collect necessary data include:

1. Develop field databases for pre-project and post-project data collection.
2. Conduct pre-project data collection during structure implementation.
3. Conduct post-project monitoring of structures at specified intervals.
4. Manage and analyze collected data to inform effectiveness and adaptive management measures.

### 3.5 Systematic planning process

This QAPP represents the systematic planning process and include the key elements:

1. Description of the project, goals, and objectives.
2. Project organization, responsible personnel, and approximate schedule.
3. Study design to support the project goals/objectives and procurement of data.
4. Specification of quality assurance (QA) and quality control (QC) activities to assess the quality performance criteria.
5. Data analysis, data storage, and reporting of acquired data.

## 4.0 Organization and Schedule

### 4.1 Key individuals and their responsibilities

Table 1. Organization of project staff and responsibilities

Staff	Title	Responsibilities
Mark Ingman Cascadia Conservation District, Project Manager 509-906-1545 Mark Ingman marki@cascadiacd.org	Project Manager, Field Lead	Manages the grant and project. Leads restoration implementation and effectiveness monitoring. Leads field data acquisition and data management.
Ryan Williams Cascadia Conservation District, Executive Director RyanW@cascadiacd.org	Contract Management	Signs contracts and provides organizational oversight
Alex Harwell Cascadia Conservation District, Alex Harwell alexh@cascadiacd.org	Alternate Field Lead	Co-leads restoration implementation and effectiveness monitoring. Leads field data acquisition and data management.
Nick Legg, LG Lichen Land and Water Inc. 763-350-3052 nick@lichenlandwater.com	Technical Advisor, QAPP Author, Geomorphologist	Advises on the technical monitoring components. Drafts and finalizes QAPP. Reviews data. Analyzes and interprets data. Supports entry of data into EIM. May visit field
Jill Scheffer, WA Department of Ecology Water Resources Program jill.scheffer@ecy.wa.gov; (509) 907-1161	Streamflow Grant Manager	Grant administration
Britta Voss, WA Department of Ecology Environmental Assessment Program <a href="mailto:bvos461@ECY.WA.GOV">bvos461@ECY.WA.GOV</a> 360.280.4305	QA Officer	Reviews the draft QAPP and approves the final QAPP.

## 4.2 Special training and certifications

Mark Ingman has a Master’s Degree in Water Policy and Management and has managed water-related projects for over 10 years.

Nick Legg is a licensed geologist in Washington and has been working as a geomorphologist on stream restoration, monitoring, and assessment for over 15 years. He holds a master’s degree in geology (geomorphology emphasis).

## 4.3 Proposed project schedule

Table 2 documents the proposed schedule for monitoring.

**Table 2. Proposed schedule for monitoring**

Task	Target date	Description
<b>Monitoring preparation reports</b>		
Final QAPP	September 1, 2024	Revised completed QAPP, responsive to all comments from Ecology’s Designated Reviewer.
<b>Restoration Implementation and Data Collection</b>		
Install restoration projects and collect pre-project data concurrently	September 2024 to October 2025	Installation of low-tech structures
<b>Post Project Monitoring</b>		
Collect post-project monitoring through grant period end	Summer-Fall 2025-2027	Monitoring frequency based on established rules below
Enter data into EIM database. Post-restoration report summarizes streamflow and temperature gaging data, and changes resulting from restoration	2027	At completion of Streamflow grant funding

## 5.0 Quality Objectives

### 5.1 Data quality objectives

The main data quality objective for this project is to collect structure performance and stream response data representative of the project locations in a manner consistent with the measurement quality objectives described below, and to analyze these data to inform the need and nature of adaptive management.

## 5.2 Measurement quality objectives

Given the qualitative and semi-quantitative nature of most measurements in this protocol, traditional measurement quality objectives (e.g., precision, bias, sensitivity) are less applicable. However, the following objectives will be pursued:

- **Comparability:** Field staff will adhere to common field protocols to improve comparability between this and similar studies. Overlapping team members will conduct duplicate data collection on at least 10 structures per year during any season when field team members change.
- **Representativeness:** Sampling locations will be selected to be representative of the overall project area and restoration actions.
- **Completeness:** A target of 90% completeness will be set for all planned observations and measurements. Field staff will use established field database forms that record location data and observational data. The completeness target does not specify the percentage of structures to be monitored. Rather, it specifies the completeness of data collection for the structures selected for monitoring. Subsequent sections provide guidance on the percentage and/or spacing of structures to be sampled with monitoring protocols.

## 5.3 Acceptance criteria for quality of existing data

Note applicable

## 5.4 Model quality objectives

Not applicable.

# 6.0 Study Design

## 6.1 Study boundaries

See Figure 1 for an overview of the site locations and Appendix B for detailed site layouts.

## 6.2 Field data collection

### 6.2.1 Sampling locations

Sampling locations will be dictated by the as-build structure locations. Table 3 lists the project site locations, the planned number of structures at each site, and the number of monitoring data points at each project site. Appendix B includes planned structure layout maps for each of the project sites.

**Table 3. Summary of restoration site locations and estimated number of data collection points at each site. Data collection points will be collected at points corresponding to installed low-tech structure locations.**

Creek	Reach Name/ Landowner	Coordinates (latitude, longitude)		Planned # Installed Structures	Estimated Minimum # Structure Monitoring Data Points	
		Downstream End	Upstream End		At Installation	Post- Installation
Derby	DNR	47.57542, -120.58412	47.57966, -120.58236	49	49	25
Derby	Stroud	47.60506, -120.54966	47.60670, -120.54217	30	30	15
Eagle	Black	47.63434, -120.62653	47.63520, -120.62201	52	52	26
Eagle (Bjork Creek Trib)	Hawkins	47.63904, - 120.60804	47.64092, - 120.60568	15	15	8
Eagle	Hedeen	47.64029, -120.58558	47.64109, -120.58463	13	13	7
Eagle	Johnston	47.63578, -120.61188	47.63584, -120.61125	4	4	2
Little Chumstick	Hatch	47.72221, -120.63578	47.72395, -120.63654	16	16	8

### 6.2.2 Sampling Frequency (Spatial and Temporal)

Data will be collected at individual structures and structure complexes. Implementation data will be collected at all installed structures to support as-build documentation and to lay the groundwork for post-project monitoring. Post-project monitoring will follow the following guidelines for sample spacing in the scenario where staff resources are not available to sample all structures:

- Sample structures in proportion to structure types
- Sample at least 50% of structures in each complex (as reflected in Table 3 above)
- Sample structures along the stream at a distance equivalent to 5 multiples of bankfull channel width, OR sample every other structure, whichever results in a greater sampling spacing

The timing of post-project monitoring will typically occur in the summer or fall season and will follow the following frequencies:

- Year 1: Summer after implementation
- Years 2-5: Every other year or after estimated 10-year floods
- Years 6-10 (optional): Every fourth year

## 6.2.2 Field parameters and laboratory analytes to be measured

The protocols involve collection of qualitative and “semi-quantitative” observational metrics that are tied to specific processes and responses in the stream. The specific parameters are described in detail within Appendix A and listed in Tables 4 and 5 below.

- The qualitative data typically include observed presence/absence of indicating features at a given structure and its vicinity.
- Semi-quantitative observations will commonly involve bracketed percentage-based observations, and categorized dimensions scaled to bankfull channel width and other features that are readily observable.

Two examples of “semi-quantitative” observations include:

**Scour pool dimension:** User to collect average lateral dimension (average of stream-wise and cross dimensions) of observed scour pools as a proportion of bankfull width. This requires the user to visually compare the average cross-dimension of an observed bar (associated with a placed structure) relative to the approximate bankfull width of the channel at that location.

**Sediment Aggradation Depth:** User to note aggradation directly upstream of the center of the structure as a percentage of the structure height. The user should consider sediment deposits (bars or otherwise) within a longitudinal distance of about 1/2x bankfull width when making this semi-quantitative determination. This determination puts the observed deposit in direct context with the placed structure, thereby informing structure performance and adaptive management needs.

Table 4 and Table 5 list the observations and parameters to be collected at implementation and during post-implementation monitoring. Table 4 in particular recommends the minimum scale at which data should be collected. The relevant scales include:

- Individual structures: Data are collected at individual restoration structures like beaver dam analogues (BDAs) or post-assisted log structures (PALS).
- Complex: Data are collected for a complex of structures placed to interact together.
- Reach: Data are collected at the reach-scale. This may include the entire project reach for small projects, or defined reaches within larger projects.

**Table 4: List of data collected during structure implementation. These data capture structure objectives and pre-project conditions.**

Grouping of Intent	Measurement Name/Description	Recommended Minimum Scale of Data Collection
Reach/Project Info	Project/Reach ID	Structure
	Average Bankfull Channel Width (Reach)	Reach(planning phase)
	Average Slope (Reach)	Reach (planning phase)
Tracking	Complex ID	Structure
	Structure ID	Structure
	Upstream- or Downstream-Most Structure in a Complex?	Structure
Goals	Primary Complex Goals	Complex
	Secondary Complex Goals	Complex

<b>Grouping of Intent</b>	<b>Measurement Name/Description</b>	<b>Recommended Minimum Scale of Data Collection</b>
	Primary Structure Goals	Structure
	Secondary Structure Goals	Structure
Lateral Dimension and Configuration	Structure Type	Structure
	Structure Width	Structure
	% of Bankfull Channel Width Obstructed	Structure
	Lateral Position of Structure	Structure
	Bank Key-In Distance	Structure
	# Posts	Structure
	Confinement Ratio of Existing Floodplain (Width of Existing Floodplain to Channel Width)	Complex
	Confinement Ratio of Target Floodplain Level (Width of Target Floodplain Level to Channel Width)	Complex
Vertical Dimension and Configuration	Height of Posts Above Bed	Structure
	Height of Crest Above Bed	Structure
	Average Height of Target Floodplain Above Bed	Structure
	Structure Ponding Length	Structure
Associated Plantings/Vegetation	Number of Associated Plantings (within adjacent floodplain)	Structure or Complex
	Species Mix of Plantings (notes)	Complex
	Planting Types (notes on seed, cuttings, potted)	Complex
	Existing Vegetation	Complex
Beavers	Observed Signs of Beaver Presence/Activity	Complex
	Beaver Food Source	Complex
Notes	Other Rationale for Placement Configuration	Structure
	Other Site Condition Notes	Structure
Photos	Photographs upstream and downstream	Structure

**Table 5: Summary of structure-based data collected post-implementation and their estimated relationships to stream recovery processes (● = direct; ○ = indirect).**

Measurement Name/Description	Recommended Minimum Scale of Data Collection	Collected at Implementation	Structure Performance & Integrity	Stream Response and Recovery Processes						
				Stream Widening	Sediment Aggradation	Complexity Development	Vegetation Response	Floodplain Activation	Water Storage and Retention	Beaver Activity and (Re)Occupation
Blow-out	Structure		●					○	○	
Sealing	Structure		●						●	
Jump height	Structure		●							
Maintenance needs and & type	Structure		●							
Bank Erosion at Structure and Dimension	Structure		○	●	○	○		○		
Lateral Flanking	Structure		○	●	○	○		○		
Bar Development and Dimensions	Structure	✓	○	○	●	○	○	○		
Structure Height Aggraded	Structure		○		●	○	○	○	○	
Scour Pool Presence and Dimension	Structure	✓				●				
Overhanging Bank Presence	Structure	✓		○		●				
Woody Debris Racking	Structure				○	●		○	○	
Associated Plantings Success	Structure				○	○	●	○	○	○
Woody Deciduous Vegetation Recruitment	Structure or Complex	✓	○		○	○	●	○	○	○
Invasives Species Cover	Structure or Complex						●	○	○	
Floodplain Activation Indicators	Structure	✓	○		○	○	○	●	○	○
Average Height to Target Floodplain		✓	○		○	○	○	●	○	○
Ponding	Structure	✓	○			○	○	○	●	○
Ponding or Backwater Length	Structure	✓	○			○	○	○	●	○
Pond Dimensions at Structure	Structure		○			○		○	●	○
Signs of Active Beaver Presence	Complex	✓			○	○	○	○	○	●
Active Beaver Dam Presence and Depth	Structure or Complex	✓			○	○	○	○	○	●

### 6.3 Modeling and analysis design

Not applicable

## 6.4 Assumptions underlying design

We assume that rapid data collection at each project area will be sufficient to inform the performance and adaptive management needs of structures. The data are not collected in a rigorous manner suitable for scientific research because that level of rigor is not economical for CCD and is also beyond the needs of typical adaptive management decision-making processes.

## 6.5 Possible challenges and contingencies

### 6.5.1 Field challenges

Logistical problems that interfere with measurement collection are likely to occur during field work. These problems may include inability to measure streamflow due to:

- Deep or high velocity water that pose a risk for personnel safety, although in most cases observations will be possible from the bank.
- Vegetation may obscure the observation of the stream.
- Stream conditions may be variable and difficult to observe consistently. Field crews will gain consistency through redundant observations as specified above

We will make measurements only where/when safe and effective to do so (USGS, 2014).

### 6.5.2 Practical constraints

Practical constraints that can interfere with project monitoring may include scheduling problems with personnel or availability of adequate resources, both human and budgetary.

### 6.5.3 Schedule limitations

CCD is an organization who is focused primarily on implementation of natural resources related projects. The purpose of this monitoring is to rapidly assess the effectiveness of those actions. The qualitative and rapid nature of this protocol is designed to work within those capacity constraints, although they may still arise and need to be managed at that time.

# 7.0 Field Procedures

## 7.1 Invasive species evaluation

Field staff will follow the Ecology Environmental Assessment Program (EAP's) SOP EAP070 on minimizing the spread of invasive species (Parsons et al. 2012). At the end of each field visit, field staff will clean field gear in accordance with the SOP for minimizing the spread of invasive species for areas of both moderate and extreme concern. Areas of extreme concern have or may have invasive species, such as New Zealand mud snails, which are very difficult to clean off equipment and are especially disruptive to native ecological communities.

Field staff will minimize the spread of invasive species after conducting field work by:

- Inspecting and cleaning all equipment by removing any visible soil, vegetation, vertebrates, invertebrates, plants, algae, or sediment. If necessary, a scrub brush will be used and then

rinsed with clean water either from the site or brought for that purpose. The process will be continued until all equipment is clean.

- Draining all water in samplers or other equipment that may harbor water from the site. This step will take place before leaving the sampling site or at an interim site. If cleaning after leaving the sampling site, field staff will ensure that no debris will leave the equipment and potentially spread invasive species during transit or cleaning.

Staff will follow established Ecology procedures if an unexpected contamination incident occurs.

## **7.2 Measurement and sampling procedures**

The basic procedure is for field staff to collect data on a structure basis by walking the reach and making observations at the installed structures. The implementation data collection will occur during installation of the structures. And post-project monitoring will occur according to the spacing and frequency guidelines described elsewhere in this QAPP and also in the MAMP.

In general the user should refer to Appendix A of this QAPP and/or Appendix A of the MAMP (these two appendixes are identical) for specific considerations with each parameter. They will enter the data into the electronic field database detailed below.

The field users will need to identify bankfull channel extents and relative dimensions, referring to Harrelson et al (1994) for specific bankfull indicators. Bankfull elevation is technically defined as the elevation at which seasonal high stream flows overflow onto adjacent channel floodplains (Harrelson et al. 1994). However, bankfull elevation can be difficult to determine in degraded and incised channels, as bankfull flows may be disconnected from the floodplain due to deepening of the channel. In these channels, bankfull indicators such as changes in peripheral channel substrate size, bank vegetation composition, evidence of organic debris or bank scarring from high flows, bank undercutting, and water staining on crustose lichens within the channel can be used to consistently estimate bankfull stage, as was done in this study (Harrelson et al. 1994).

## **7.3 Containers, preservation methods, holding times**

Not applicable

## **7.4 Equipment decontamination**

Not applicable

## **7.5 Sample ID**

Not applicable

## **7.6 Chain of custody**

Not applicable

## **7.7 Field log requirements**

Data will be recorded in an electronic GIS-based database that allows users to record data consistently, completely, and in a geolocated format. The MAMP developed in concert with this QAPP included the development of a field database template in ESRI® Field Maps. This template allows for consistent data management and streamlined export/storage.

## 7.8 Other activities

No other activities not included in previous sections are anticipated at this time.

# 8.0 Laboratory Procedures

## 8.1 Lab procedures table

Not applicable

## 8.2 Sample preparation method(s)

Not applicable

## 8.3 Special method requirements

Not applicable

## 8.4 Laboratories accredited for methods

Not applicable

# 9.0 Quality Control Procedures

Implementing quality control (QC) procedures provides the information needed to assess the quality of the data that is collected. These procedures also help identify problems or issues associated with data collection while the project is underway.

Quality control for this project will focus on consistent application of the protocol and thorough documentation of observations.

## 9.1 Field and laboratory quality control

Staff will perform the following activities to support consistency and quality control:

- Field leads will review all collected data for completeness and consistency at the end of each field day.
- At the beginning of each monitoring season, or when field staff change, a set of replicate data (10 data points) will be collected independently by field staff for comparison and quality control of data collection procedures. The project manager will maintain involvement in this QC effort in all cases.

## 9.2 Corrective action processes

QC results may indicate problems with data during the course of the project. Corrective action processes will be used if any of the following occur:

- Activities are inconsistent with the QAPP.
- Results do not meet MQOs or performance expectations.

- Missing data fields

In general these errors will be addressed through re-collection of data, where necessary to inform project-level decision making. In some cases, data collection may be deferred to the following year depending on the visual recollection of observed stream changes and/or needed adaptive management.

## **10.0 Data Management Procedures**

Field technicians will record all field data in electronic collection platform described above, which is the electronic database in ESRI Field Maps. Before leaving each site, staff will check the database for missing or improbable measurements. Field technicians will ensure these data sync with CCD's online ESRI account when returning from the field. This online platform provides backup. At the end of each field season, the staff will download all field data from the online database for storage and analysis. Raw data files will be stored separate from processed data files.

Staff will keep all final spreadsheet files, paper field notes, and final products created as part of the data collection and data QA process with the project data files.

### **10.1 Data recording and reporting requirements**

Data collected under this QAPP will be transferred annually to Ecology's EIM database via coordination with Ecology staff. Data will be reviewed for accuracy prior to submission to EIM by graphing the data to assess outliers; querying the data to detect ranges, averages, and other statistical quantification to assess the accuracy of the data against itself and other data loggers.

### **10.2 Laboratory data package requirements**

Not applicable.

### **10.3 Electronic transfer requirements**

This process involves simple download of field data from the ESRI online application.

### **10.4 EIM data upload procedures**

Staff will formulate and submit all applicable data funded by Ecology into Ecology's EIM data system. Staff will use EIM templates found in the EIM help center (<https://apps.ecology.wa.gov/eim/help/HelpDocuments>) to submit data including, location of monitoring data points and the associated structure-based parameters collected at each structure or complex, as described in Appendix A.

### **10.5 Model information management**

Not applicable.

## **11.0 Audits and Reports**

### **11.1 Field, laboratory, and other audits**

No formal audits will be conducted.

### **11.2 Responsible personnel**

Not applicable.

### **11.3 Frequency and distribution of reports**

Results of the field data collection, data quality assessment, and any data analysis will be documented in annual and final (end of grant) reports and submitted to the project grant page in Ecology's Administration of Grants and Loans (EAGL) system. Staff will also distribute all final reports to all other stakeholders involved or interested in the study as determined by CCD and Ecology.

### **11.4 Frequency and distribution of reports**

The Field Lead (Table 1) will be responsible for analyzing data and preparing the draft final report. The Field Lead will also be responsible for verifying data completeness and usability before the data are used in the technical report and entered into EIM. The Project Manager will review the draft and coordinate internal review. The Project Manager will be responsible for assigning a peer reviewer with the appropriate expertise for the technical report. The final report will go through an internal (CCD) and external (Ecology) review process. The peer reviewer is responsible for working with the report author to resolve or clarify any issues with the report.

## **12.0 Data Verification**

### **12.1 Field data verification, requirements, and responsibilities**

CCD staff will check field notebooks and electronic information storage for missing or improbable measurements and verify initial data before leaving each site. This process involves checking the data sheet (written or electronic) for omissions or outliers. If measurement data are missing or a measurement is determined to be an outlier, the measurement will be flagged in the data sheet and repeated if possible. The field lead is responsible for in-field data verification.

Upon returning from the field, staff will either manually enter (data recorded on paper) or download from instruments all data and then upload it into the appropriate database or project folder (see Data Management Section). Manually entered data will be verified/checked by a staff member who did not enter the data. Downloaded electronic data files will also be checked for completeness and appropriate metadata (e.g., filename, time code).

### **12.2 Laboratory data verification**

Not applicable.

## 13.0 Data Quality (Usability) Assessment

### 13.1 Process for determining if project objectives were met

The field lead will assess all data (qualified and unqualified), results or verification, compliance with MQOs, and the overall quality of the data set to provide a final determination regarding usability in the context of the project-specific goals and objectives. The final report will document whether the final, acceptable-quality data set meets the needs of the project (i.e., allows desired conclusions/decisions to be made with the desired level of certainty).

### 13.2 Data analysis and presentation methods

Data found to be of acceptable quality for project objectives will be analyzed before being summarized. Any relevant and interesting data analysis will be presented in the final report using a combination of tables and plots of various kinds, such as time series plots, histograms, and box plots.

Data analysis will include calculation of summary statistics and creation of visualizations to track changes over time. Because the monitoring approach relies on indicators of change, as opposed to detailed change detection, the summary statistics will not necessarily require direct comparability between repeat monitoring datasets.

### 13.3 Sampling design evaluation

The project manager will assess whether (1) the data package meets the MQOs, and criteria for completeness, representativeness, and comparability and (2) meaningful conclusions can be drawn from data visualizations and summary statistics.

Given that the monitoring effort is designed to rapidly and coarsely provide data to inform effectiveness tracking and adaptive management decision making, the burden of data quality is not as high as research-grade studies and evaluations.

Compliance with this QAPP helps ensure that data collected during this project, will be satisfactory to support use of future modeling tools and will meet project goals and objectives.

### 13.4 Documentation of assessment

Team members will document the data usability assessment in the final report for the project.

## 14.0 References

Harrelson, C. C. (1994). *Stream channel reference sites: an illustrated guide to field technique* (Vol. 245). US Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Lichen Land and Water Inc., 2024. Monitoring and Adaptive Management Plan for Process-Based Stream Restoration Projects. Submitted to Cascadia Conservation District. Draft version dated June 2024.

Maloney, B.; Holland, M; and Dickerson-Lange, 2023. Quality Assurance Project Plan for the icicle Creek Alluvial Water Storage Project, EIM Study ID: WROCR-2123-00025, Ecology publication No. 23-12-005, March 2023

Parsons J., D. Hallock, K. Seiders, B. Ward, C. Coffin, E. Newell, C. Deligeannis, and K. Welch. 2012. Standard Operating Procedure to Minimize the Spread of Invasive Species. Version 2.0. Washington State Department of Ecology, Olympia, WA. SOP Number EAP070.

USGS, 2014, Safety and Health for Field Operations, Handbook 445-3-H;  
<https://www.usgs.gov/media/files/445-3-h-safety-and-health-field-operations>

Whipple, A. 2021. Quality Assurance Project Plan for the Restoring Streamflow after Wildfire in Okanogan and Methow River Sub-Basins, Agreement ID: WRSRP-2020-MSRF-00010, October 2021

## 15.0 Appendices

Appendix A – Detailed Description of Monitoring Parameters

Appendix B – Project Site Maps showing Planned Structure Layouts

# APPENDIX A – CORE METHODS FOR MONITORING DATA COLLECTION – STRUCTURE-BASED PROJECTS

This appendix provides detailed descriptions of the data collection process for the core, structure-based protocol.

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# 1 Implementation (Pre-Project) Data Collection

Pre-project data are collected in concert with implementation of structures. The data collection in effect serves as as-built documentation and also captures relevant conditions in the vicinity of each structure to contextualize post-project monitoring.

**TABLE 1: DATA TO BE COLLECTED AT RESTORATION IMPLEMENTATION. THESE DATA WILL CHARACTERIZE THE STRUCTURES PLACED AND CONDITIONS IN THEIR VICINITY**

Intent	Measurement Name/Description	Recommended Scale of Data Collection	Data Also Collected in Post-Project Monitoring	Description
Reach/Project Info	Project/Reach ID	Structure	✓	Project name, or unique reach ID if multiple reaches within project
	Average Bankfull Channel Width (Reach)	Reach – at planning phase		Bankfull channel width for reach. This will be approximate and may be an average of multiple locations
	Average Slope (Reach)	Reach – at planning phase		Stream slope, measured pre-implementation in LiDAR
Tracking	Complex ID	Structure	✓	Unique complex ID, entered for all structures within a complex
	Structure ID	Structure	✓	Unique structure ID
	Upstream or Downstream-Most Structure in a Complex?	Structure		Note whether structure is on either end of a complex
Structure and Complex Goals	Target Floodplain	Complex		Note target floodplain level, if different from broader reach or project. User selects inset or pre-incision floodplain
	Primary Complex Goals	Complex		Select primary complex goals (desired processes)
	Secondary Complex Goals	Complex		Select secondary complex goals (desired processes)
	Primary Structure Goals	Structure		Select primary structure goals (desired processes), if more specific than complex, or if not within a complex
	Secondary Structure Goals	Structure		Select secondary structure goals (desired processes), if more specific than complex, or if not within a complex
Lateral Dimension and Configuration	Structure Type	Structure	✓	Select type of structure
	Structure Width	Structure		Note structure width, measured along long axis of structure
	% of Channel Width Obstructed	Structure		Note proportion of the bankfull channel obstructed, along cross-sectional dimension of the stream
	Lateral Position of Structure	Structure		Note lateral positioning and configuration of structure (channel spanning, left bank attached, right bank attached, mid-channel)
	Bank Key-In Distance	Structure		Note bank key-in distance of structure
	# Posts	Structure		Note number of vertical posts installed
	# Lateral Members	Structure		Note number of lateral members installed

<b>Intent</b>	<b>Measurement Name/Description</b>	<b>Recommended Scale of Data Collection</b>	<b>Data Also Collected in Post-Project Monitoring</b>	<b>Description</b>
	Confinement Ratio	Complex		Note confinement ratio of existing stream (at current floodplain level) and at target floodplain level, if different.
Vertical Dimension and Configuration	Height of Posts Above Bed	Structure		Note average height of vertical posts above bed
	Height of Structure Crest Above Bed	Structure		Note average height of structure crest above bed
	Average Height of Target Floodplain	Structure	✓	Select height range of target floodplain above bankfull channel indicators. See post-project monitoring description
	Structure Ponding Length	Structure	✓	Note ponding length relative to proportional distance to upstream structure
Associated Plantings/Vegetation	Number of Associated Plantings (within adjacent floodplain)	Structure or Complex		Note plantings within observational extent defined in figure
	Species Mix of Plantings (notes)	Complex		Note species mix
	Planting Types (notes on seed, cuttings, potted)	Complex		Note planting types
	Existing Vegetation	Complex		General notes about existing vegetation
Beavers	Observed Signs of Beaver Presence/Activity	Complex	✓	See post-project monitoring description
	Beaver Food Source	Complex		Apply WDFW Beaver Scorecard protocol ( <a href="#">link</a> )
Notes	Other Rationale for Placement Configuration	Structure		Other notes about structure placement
	Other Site Condition Notes	Structure		Other notes about structure placement
Photos	Photographs upstream and downstream	Structure	✓	Capture photographs of structure, looking up and downstream
Site Conditions for Comparison with Post-Project Monitoring	Bar Development and Dimensions	Structure	✓	See post-project monitoring description
	Scour Pool Presence and Dimension	Structure	✓	See post-project monitoring description
	Overhanging Bank Presence	Structure	✓	See post-project monitoring description
	Woody Deciduous Vegetation Recruitment	Structure	✓	See post-project monitoring description
	Floodplain Activation Indicators	Structure	✓	See post-project monitoring description
	Invasives Species Presence and Extent	Structure or Complex	✓	See post-project monitoring description

## 2 Post-Project Data Collection

The following are the data to be collected as part of this protocol. The descriptions are organized by primary process group.

### 2.1 Field Methods (Applicable to Multiple Measures)

Figures 1-3 supplement the methodological descriptions below.

#### 2.1.1 Extent of Observation for Floodplain and Vegetation Data

For data that require observation outside of the channel (i.e. in the floodplain), the user should bound their observations according to the following features:

- The lateral extent defined by outer margins of target floodplain (inset floodplain or pre-incision floodplain, depending on target established for the project or reach),
- Longitudinally observe  $\frac{1}{2}$  the distance to structure immediately upstream and downstream. For complex-based observations, these same criteria would be applied from the upstream- and downstream-most structures in the complex.

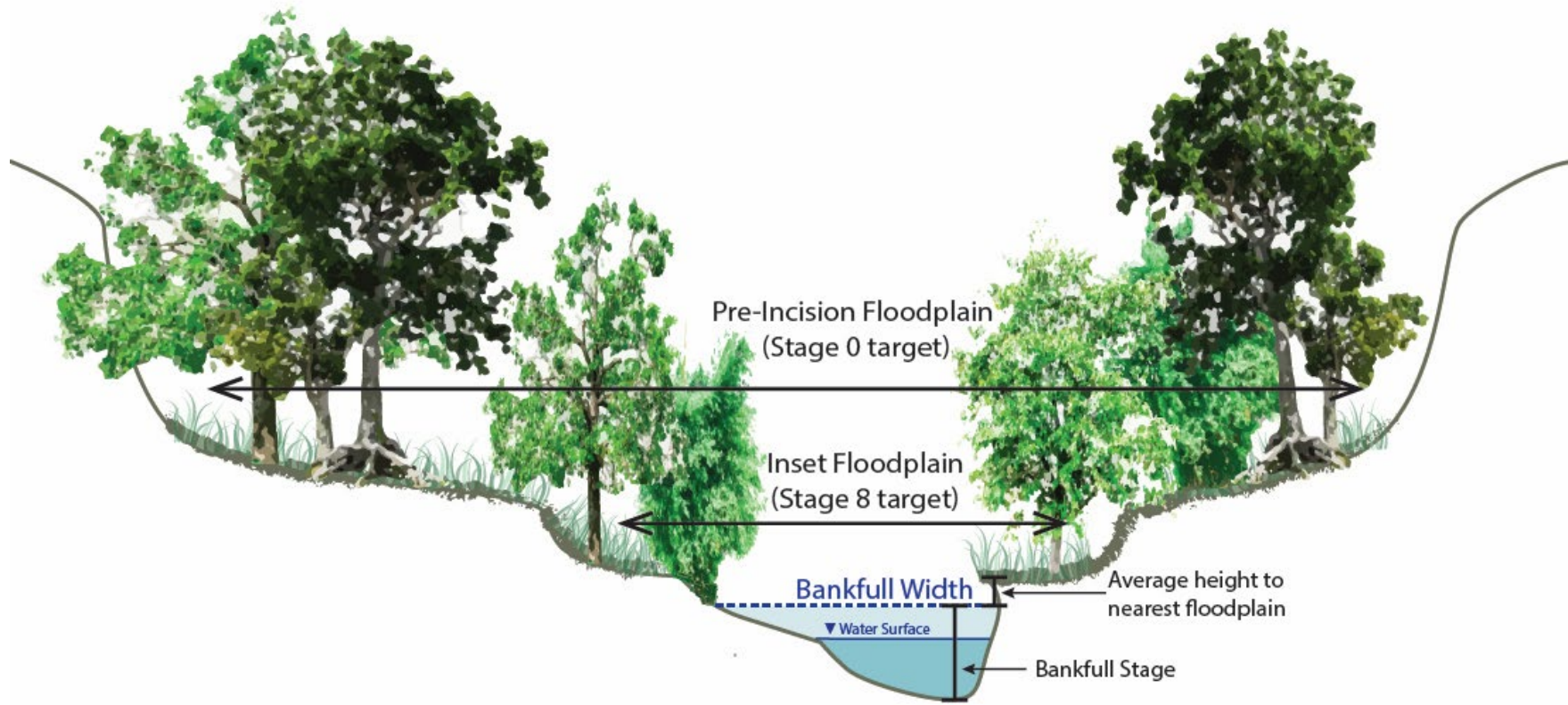
#### 2.1.2 Semi-Quantitative Dimensions – Scaling Relative to Bankfull Channel Dimensions

The protocol below includes several semi-quantitative dimensions that require the user to visually scale features to an observed bankfull channel dimension or structural element. In these instances, the user visually identifies (does not measure) a channel section that will become the visual reference of approximate bankfull channel width for that structure or complex. The visual reference for the bankfull width will be one of the following:

1. Visually identified channel cross-section, located at a riffle crest or where flow is relatively uniform and has no floodplain channels
2. Where option 1 above is not available, visually identify a channel section with the minimum observed bankfull width of the main channel

Once a user has selected a bankfull width dimension from above, they will use it to assign relative dimensions of features like lateral bank erosion, bars, and scour pools.

Harrelson 1994 defines detailed criteria for identifying the bankfull channel and stage, based on multiple field indicators. In general, the bankfull stage coincides with the top of regularly scoured channel areas and the bottom of observed perennial vegetation like mosses, ferns, and woody shrubs/trees. The bankfull indicators may not correspond to the top of bank, especially where the stream is incised.



**FIGURE 1: CROSS-SECTION SHOWING KEY CHANNEL AND FLOODPLAIN DIMENSIONS. ASPECTS OF SYMBOLOGY WERE ADOPTED FROM FIGURES BY CRAMER FISH SCIENCES (SHARED BY R. CAMP)**

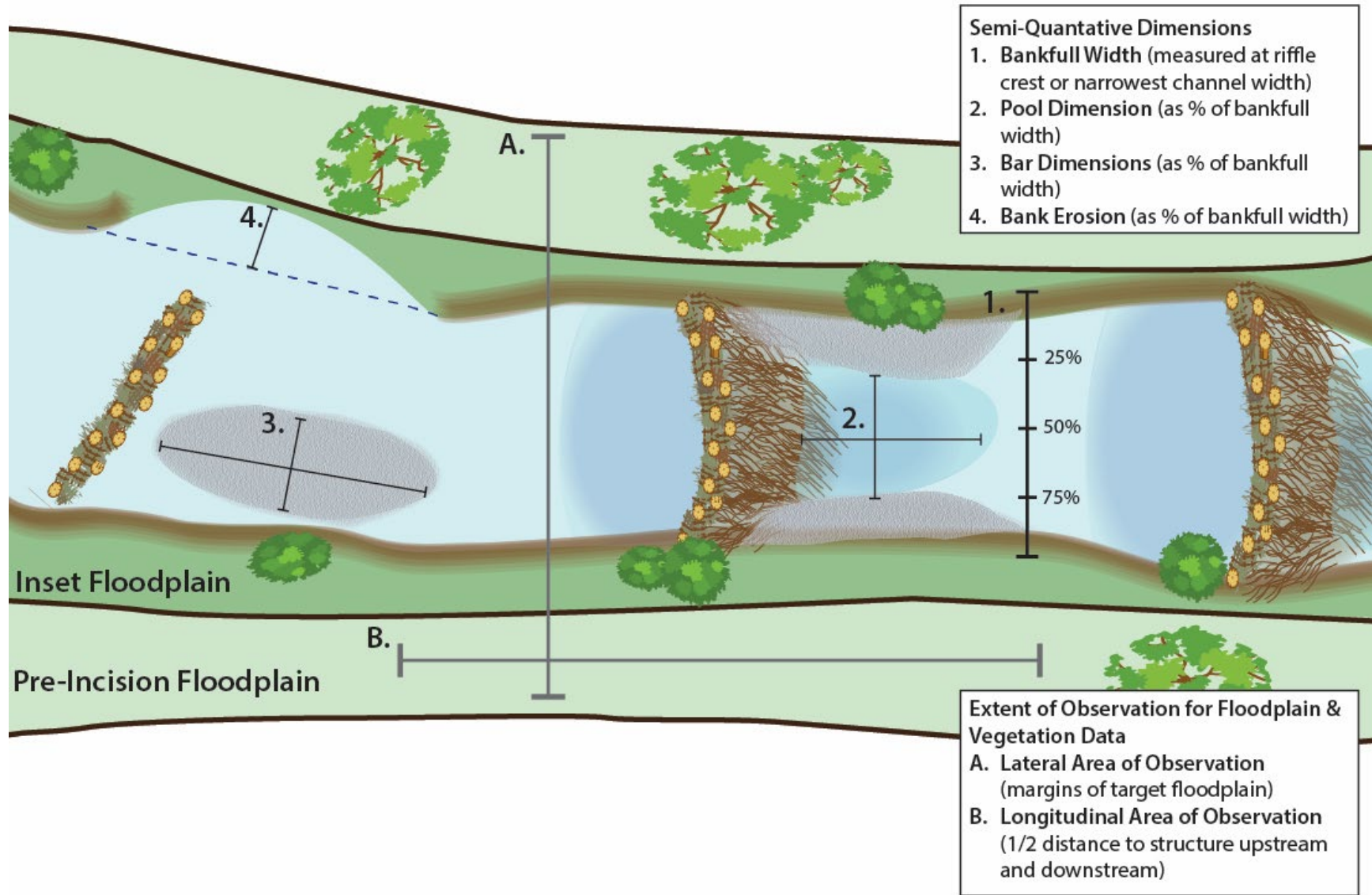
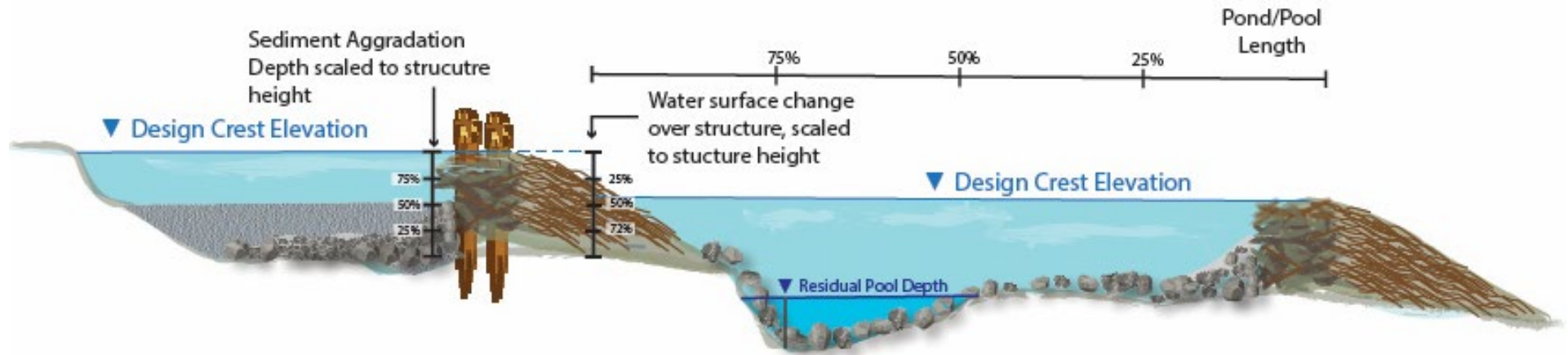


FIGURE 2: PLANFORM VIEW OF SEMI-QUANTITATIVE DIMENSIONAL DATA COLLECTED FOR THE PROTOCOL. ASPECTS OF SYMBOLOGY WERE ADOPTED FROM FIGURES BY CRAMER FISH SCIENCES (SHARED BY R. CAMP)



**FIGURE 3: PROFILE VIEW OF SEMI-QUANTITATIVE DIMENSIONAL DATA COLLECTED FOR THE PROTOCOL. ASPECTS OF SYMBOLOGY WERE ADOPTED FROM FIGURES BY CRAMER FISH SCIENCES (SHARED BY R. CAMP)**

## 2.2 Data to Collect (and What to Consider)

### 2.2.1 Performance of Restoration Measures

**General Description:** The performance of installed restoration measures can be assessed based on observed changes to the structure. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Blow-out	Semi-Quantitative	<p><i>Intent of Data:</i> To assess the success of the structure through time and the level of maintenance and repair the structure may need</p> <p><i>What to collect:</i> User selects the presence and dimension of blowout:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No blow-out</li> <li><input checked="" type="checkbox"/> Blow-out &lt; 25% channel width</li> <li><input checked="" type="checkbox"/> Blow-out 25%-50% channel width</li> <li><input checked="" type="checkbox"/> Blow-out 50%-75% channel width</li> <li><input checked="" type="checkbox"/> Complete blowout</li> </ul>
Sealing	Semi-Quantitative	<p><i>Intent of Data:</i> To determine performance and maintenance needs of structures intended to pond water. To track water retention benefits of placed structures.</p> <p><i>What to collect:</i> User to collect the level of structure inundation as a proportion of the structure height.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No obvious water surface raising (complete flow-through)</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is &lt;25% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is 50-25% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is 75-50% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is &gt;75% of structure height</li> <li><input checked="" type="checkbox"/> Water surface meets the crest height of the structure</li> </ul> <p><i>What to consider:</i> Structure height is defined as the average distance from the channel bed to the lowest part of the structure crest. For example, if Beaver Dam Analogue (BDA) structures are not raising the water surface the structure is not acting as intended and may need maintenance. Not all structures are intended to retain and pond flow. Post-assisted log structures (PALS) may not cause significant ponding.</p>

Data Name	Data Type	Details of Data Collection
Jump-Height	Qualitative	<p><i>Intent of Data:</i> To determine if the structure has potential to act as a low-flow fish passage barrier.</p> <p><i>What to collect:</i> User collects minimum jump height measured along the stream transect in alignment with the placed structure</p> <p><i>What to consider:</i> This observation will provide an initial indication of potential fish passage impediments at a structure. A value of zero will reflect there being observed pathways for the fish to swim through or around the structure. When there is no flow in the channel, this measurement is not applicable.</p> <p>Final determination of fish passage impediments will require more in depth consideration of the priority fish species and lifestages, and timing and flow levels of use. WDFW and other fish passage criteria should be applied in these scenarios.</p>
Maintenance Needed	Qualitative	<p>User assesses whether maintenance is needed on the structure:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Maintenance is likely needed</li> <li><input checked="" type="checkbox"/> Maintenance maybe needed</li> <li><input checked="" type="checkbox"/> Maintenance not needed</li> </ul> <p><i>What to consider:</i> Maintenance may be needed because the structure is beginning to fail, but it may also need maintenance because the structure has met its design objectives and needs to be expanded. For example, if the water level behind a BDA has reached dam crest height, secondary BDAs may be added to stop flow around newly formed auxiliary channels. If PAL structures designed to induce bank erosion have caused significant bank erosion, they may need to be expanded towards the migrated bank.</p>

Data Name	Data Type	Details of Data Collection
Maintenance Type	Qualitative	<p>User identifies type of maintenance needed on the structure:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No obvious maintenance needed</li> <li><input checked="" type="checkbox"/> Address blow-out</li> <li><input checked="" type="checkbox"/> Address flanking</li> <li><input checked="" type="checkbox"/> Extend structure</li> <li><input checked="" type="checkbox"/> BDA filled with sediment. Add new BDA upstream.</li> <li><input checked="" type="checkbox"/> Address sealing or scour issues</li> <li><input checked="" type="checkbox"/> Address flooding or erosion risk to adjacent infrastructure</li> <li><input checked="" type="checkbox"/> Other</li> </ul> <p>User may add notes</p> <p><i>What to consider:</i> Note priority and nature and maintenance. The highest priority maintenance may include noted risks to infrastructure.</p>

## 2.2.2 Stream Widening

**General Description:** Stream widening can be assessed based on indicators of stream bank erosion at structures. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Bank Erosion at Structure	Qualitative	<p><i>Intent of Data:</i> To track whether structures are causing bank erosion and channel widening.</p> <p><i>What to collect:</i> User identifies presence or absence of bank erosion</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No observed evidence of bank erosion on the left or right bank</li> <li><input checked="" type="checkbox"/> Observed evidence of erosion only on the right bank</li> <li><input checked="" type="checkbox"/> Observed evidence of erosion only on the left bank</li> <li><input checked="" type="checkbox"/> Observed evidence of erosion on both the left and right bank</li> </ul> <p><i>What to consider:</i> evidence of bank erosion may include undercut banks, presence of exposed roots, soil sluffing, scarp formation, and tree tilting or collapse. The most obvious sign of bank erosion will be bank scallops (carve-outs) in direct association with a structure.</p>
Lateral Flanking of Structure	Qualitative	<p><i>Intent of Data:</i> To track whether the channel is widening due to lateral flanking and bank erosion around the structure.</p> <p><i>What to collect:</i> User identifies presence or absence of bank erosion</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No observed evidence of lateral flanking on the left or right bank</li> <li><input checked="" type="checkbox"/> Observed evidence of lateral flanking on the right bank</li> <li><input checked="" type="checkbox"/> Observed evidence of lateral flanking on the left bank</li> <li><input checked="" type="checkbox"/> Observed evidence of lateral flanking on both the left and right bank</li> </ul> <p><i>What to consider:</i> Flanking occurs when bank erosion has progressed around a structure intended to span the active channel. Flanking is not a negative (harmful) response in all instances.</p>

Data Name	Data Type	Details of Data Collection
Bank Erosion Dimensions	Semi-Quantitative	<p><i>Intent of data:</i> Determine magnitude of lateral bank erosion.</p> <p><i>What to Collect (left and right banks individually):</i> User to collect the magnitude of bank erosion as a percentage of bankfull width.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Negligible bank erosion</li> <li><input checked="" type="checkbox"/> Bank erosion &lt; 33 % channel width</li> <li><input checked="" type="checkbox"/> Bank erosion 33%-67% channel width</li> <li><input checked="" type="checkbox"/> &gt;67% of channel width</li> </ul> <p><i>What to consider:</i> User visually compares the dimension of estimated erosion to observable bankfull channel width within proximity of the sampling site. Lateral bank erosion distance is measured perpendicular to the bank line.</p> <p>To affect stream geomorphology, the structure should obstruct at least 1/3 of bankfull width. If the structure spans &lt;1/3 of channel width and the additional widening is desired, consider extension and maintenance.</p>

## 2.2.3 Sediment Deposition and Bed Aggradation

**General Description:** Sediment deposition and streambed aggradation will be assessed through the formation and establishment of bar formations and the depth of sediment deposition. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Bar Development	Semi-Quantitative	<p><i>Intent of data:</i> To track sediment deposition through time. Bar development can indicate stream aggradation and sediment recruitment from bank erosion and widening.</p> <p><i>What to collect (record separately for bars immediately upstream and downstream of structure:</i> User to note dominant grain size of bar formation upstream/downstream of structure, if present.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Silt &amp; Clay (&lt;0.06 mm)</li> <li><input checked="" type="checkbox"/> Sand (0.06 – 2mm)</li> <li><input checked="" type="checkbox"/> Gravel (2 – 64 mm)</li> <li><input checked="" type="checkbox"/> Cobbles (64 – 256 mm)</li> <li><input checked="" type="checkbox"/> No bar is present upstream/downstream of structure or complex</li> </ul> <p><i>What to consider:</i> Bars are deposits of typically well-sorted sediment. The sediment may be loose if the bar has been recently deposited. The features are generally convex (mounded) in shape.</p>
Vegetated Bars	Semi-Quantitative	<p><i>Intent of data:</i> Record vegetation colonization and stabilization of bar surfaces through time. Vegetation establishment on bars can be indicative of bar stability and/or age, channel narrowing, and the formation of instream complexity (e.g. multiple threads). User should consider any portion of bars vegetated with woody stems and shrubs (or larger) as being vegetated. Areas vegetated with grass will not be considered vegetated, unless the grass is interpreted to be a perennial feature on the bar.</p>
Recorded in separate fields for upstream and downstream vegetated bars		<p><i>What to collect:</i> User to collect percentage of upstream bar surface covered in vegetation.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No bar present</li> <li><input checked="" type="checkbox"/> Bar is bare of vegetation</li> <li><input checked="" type="checkbox"/> &lt;25% of bar covered by vegetation</li> <li><input checked="" type="checkbox"/> 25 – 50% of bar covered by vegetation</li> <li><input checked="" type="checkbox"/> 50 – 75% of bar covered by vegetation</li> <li><input checked="" type="checkbox"/> &gt;75% of bar covered by vegetation</li> </ul>
Bar area dimensions	Semi-Quantitative	<p><i>Intent of data:</i> To track bar development and size through time and along a project reach.</p>
Recorded in separate fields for upstream and downstream bars		<p><i>What to collect:</i> User to observe average length and width as fractions of the bankfull width.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No bar exists</li> <li><input checked="" type="checkbox"/> Bar is present, average dimension is &lt; 25% of bankfull width</li> <li><input checked="" type="checkbox"/> Bar is present, average dimension is 25%-50% bankfull width</li> <li><input checked="" type="checkbox"/> Bar is present, average dimension exceeds 50% of bankfull width</li> </ul>

Data Name	Data Type	Details of Data Collection
Sediment aggradation depth (scaled to structure height)	Semi-Quantitative	<p><i>Intent of data:</i> Assess depth of aggradation as a proportion of structure height.</p> <p><i>What to collect:</i> User to note aggradation directly upstream of the center of the structure as a percentage of the structure height. The user should consider sediment deposits (bars or otherwise) within a longitudinal distance of about 1/2x bankfull width when making this semi-quantitative determination.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Negligible sediment deposition</li> <li><input checked="" type="checkbox"/> Sediment depth is &lt;25% of structure height</li> <li><input checked="" type="checkbox"/> Sediment depth is 25-50% of structure height</li> <li><input checked="" type="checkbox"/> Sediment depth is 50-75% of structure height</li> <li><input checked="" type="checkbox"/> Sediment depth is &gt;75% of structure height</li> </ul> <p><i>What to consider:</i> Selection should be made based on average depth of sediment relative to structure height, as defined by its crest. The user should consider sediment deposits (bars or otherwise) within a longitudinal distance of about 1/2x to 1x bankfull width when making this semi-quantitative determination. Aggradation &gt;50% of structure height may indicate structure height needs to be raised.</p>

## 2.2.4 Complexity Development

**General Description:** The success of restoration structures at increasing channel complexity can be assessed based on multiple indicators within the channel. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Scour pool dimension (area)	Semi-Quantitative	<p><i>Intent of data:</i> To understand the area of scour pools</p> <p><i>What to collect:</i> User to collect average lateral dimension (average of stream-wise and cross dimensions) of observed scour pools as a proportion of bankfull width</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> &lt;10% of bankfull width</li> <li><input checked="" type="checkbox"/> 10 – 25% of bankfull width</li> <li><input checked="" type="checkbox"/> 25 – 50% of bankfull width</li> <li><input checked="" type="checkbox"/> &gt;50 % of bankfull width</li> <li><input checked="" type="checkbox"/> No scour pool present</li> </ul> <p><i>What to consider:</i> Scour pools noted in this survey should have a residual depth at least 1 foot. If multiple pools are noted, the user makes their selection based on the sum of average dimensions determined for the individual pools.</p>
Woody debris	Qualitative	<p><i>Intent of data:</i> To track the accumulation of wood recruitment at structures. Wood accumulation indicates woody debris is effectively being captured by the structures. It may include small or large wood for the purposes of this monitoring protocol</p> <p><i>What to collect:</i> User to note presence or absence of wood deposition and approximate channel area covered by racked debris. The user decides based on visually estimating whether woody debris is naturally racked or placed. The user should note the presence of either small and/or large wood. The user the compares the area of the channel covered in racked woody debris, relative to the area of original structure</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Negligible evidence of natural wood accumulation</li> <li><input checked="" type="checkbox"/> &lt;1x structure volume</li> <li><input checked="" type="checkbox"/> 1-2x structure volume</li> <li><input checked="" type="checkbox"/> &gt;3x structure volume</li> </ul>

## 2.2.5 Vegetation Response

**General Description:** Vegetation response to restoration can be assessed through the success of riparian plantings and the establishment of woody vegetation and wetland indicator species. The table below outlines the specific data to collect and considerations and methods for data collection. This MAMP also has an optional protocol to assess the survival and growth of plantings in defined areas, which is detailed in a separate appendix.

Data Name	Data Type	Details of Data Collection
Success of plantings	Semi-Quantitative	<p><i>Intent of data:</i> Monitor success of planted riparian vegetation in direct association with installed structures or complexes, based on observation area defined in Figure 2.</p> <p><i>What to collect:</i> User selects the percentage of planted riparian vegetation within the area of observation.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> &gt;75% planting survival</li> <li><input checked="" type="checkbox"/> 50%-75% planting survival</li> <li><input checked="" type="checkbox"/> 25%-50% planting survival</li> <li><input checked="" type="checkbox"/> &lt;25% planting survival</li> </ul> <p><i>What to consider:</i> If plant mortality is present, note the apparent cause mortality (e.g. animal browse, low water levels, crowding by invasives). For larger planting areas, consider the optional protocol defined in this MAMP.</p>
Woody deciduous vegetation recruitment	Semi-Quantitative	<p><i>Intent of data:</i> Monitor recruitment of woody vegetation from seedlings. As riparian seedlings require specific hydrologic requirements, their presence is an indicator of greater water retention in the stream, floodplain, and alluvial aquifer. This observation focuses on regeneration and recruitment that does not result from direct plantings.</p> <p><i>What to collect:</i> Estimate the percentage of ground covered by young woody vegetation within the area of observation.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No young woody plant recruitment evident</li> <li><input checked="" type="checkbox"/> Recruitment and regeneration present along &lt;25% bank length</li> <li><input checked="" type="checkbox"/> Recruitment and regeneration present along 25-50% bank length</li> <li><input checked="" type="checkbox"/> Recruitment and regeneration present along 50-75% bank length</li> <li><input checked="" type="checkbox"/> Recruitment and regeneration present along &gt;75% bank length</li> </ul> <p><i>What to consider:</i> Young woody plants refer to those that have been recruited since project implementation. The percentage of bank length should consider both banks along the observation area defined in figure 2. Regeneration along the bank or adjacent floodplain should be included.</p>

Data Name	Data Type	Details of Data Collection
Invasive species extent	Qualitative	<p><i>Intent of data:</i> Monitor coverage of invasive species following implementation disturbance. The presence of invasive species can lead to degraded habitat and may indicate poor health of the native riparian vegetation array.</p> <p><i>What to collect:</i> Estimate the percentage of ground covered by invasive species within the area of observation.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No invasive species present</li> <li><input checked="" type="checkbox"/> Invasive species present along &lt;25% of bank</li> <li><input checked="" type="checkbox"/> Invasive species present along 25-50% of bank</li> <li><input checked="" type="checkbox"/> Invasive species present along 50-75% of bank</li> <li><input checked="" type="checkbox"/> Invasive species present along &gt;75% of bank</li> </ul>

## 2.2.6 Floodplain Activation

**General Description:** Floodplain activation will be assessed based on changes to the floodplain, evidence of sheetwash across the floodplain and creation of additional channels. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Evidence of floodplain activation	Qualitative	<p><i>Intent of data:</i> To monitor whether the stream is overflowing onto the floodplain during high flow events.</p> <p><i>What to collect:</i> User to select all observed evidence of floodplain activation</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Floodplain scour</li> <li><input checked="" type="checkbox"/> Floodplain sediment deposition</li> <li><input checked="" type="checkbox"/> Side channel development or formation of multiple threads</li> <li><input checked="" type="checkbox"/> High-water marks in adjacent vegetation</li> <li><input checked="" type="checkbox"/> No evidence of floodplain activation</li> </ul>
Avulsion and/or flanking via floodplain erosion	Qualitative	<p><i>Intent of data:</i> To understand whether the side channels developing in response to the structure are leading toward avulsion and may require adaptive management.</p> <p><i>What to collect:</i> User evaluates the degree of avulsion or flanking potential</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> No side channels are observed</li> <li><input checked="" type="checkbox"/> Side channels appear to be developing with minimal flanking potential</li> <li><input checked="" type="checkbox"/> Side channels appear to be erosive and may flank the original structure or series of structures</li> <li><input checked="" type="checkbox"/> Side channels are actively eroding and are likely to result in flanking of the original structure or series of structures</li> </ul> <p><i>What to consider:</i> The presence and extent of erosive features within the observed side channel inform its evolution. Side channels with high avulsive potential are found on the inside of meander bends and show extensive signs of erosion, typically focused toward the lower ends.</p>
Average height from the stream bed to nearest floodplain level	Semi-Quantitative	<p><i>Intent of data:</i> To measure vertical height to floodplain.</p> <p><i>What to collect:</i> The vertical distance from observed bankfull stage to the nearest floodplain level in relation to the structure height. This should be observed upstream of the structure, within a longitudinal distance of 0.5-1x bankfull width.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> &lt;0.5x structure height</li> <li><input checked="" type="checkbox"/> 0.5 – 1x structure height</li> <li><input checked="" type="checkbox"/> 1 – 2x structure height</li> <li><input checked="" type="checkbox"/> &gt;2x structure height</li> </ul> <p>User should also note whether the identified floodplain is “inset” or “pre-incision”, if discernable.</p>

## 2.2.7 Water Retention

**General Description:** The success of low-tech structures at ponding water can be assessed based on dimensions of the created pond. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Ponding	Qualitative	<p><i>Intent of Data:</i> To determine whether ponding structures are satisfying design goals and if structures require maintenance.</p> <p><i>What to collect:</i> User to collect the level of structure inundation as a proportion of the structure height.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Water surface meets the crest height of the structure</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is &gt;75% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is 75-50% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is 50-25% of structure height</li> <li><input checked="" type="checkbox"/> Ponded water surface elevation is &lt;25% of structure height</li> <li><input checked="" type="checkbox"/> No obvious water surface raising (complete flow-through)</li> </ul> <p><i>What to consider:</i> This observation is only applicable to channel-spanning structures.</p>
Pond or Pool Length	Semi-Quantitative	<p><i>Intent of data:</i> To track ponding length and longitudinal influence of the structure.</p> <p><i>What to collect:</i> User to collect pond or pool length as a proportion of the distance to the structure immediately upstream</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> &gt;75% of distance to structure immediately upstream</li> <li><input checked="" type="checkbox"/> 50-75% of distance to structure immediately upstream</li> <li><input checked="" type="checkbox"/> 25-50% of distance to structure immediately upstream</li> <li><input checked="" type="checkbox"/> &lt;25% of distance to structure immediately upstream</li> </ul>
Water surface change over structure, scaled to structure height	Semi-Quantitative	<p><i>Intent of data:</i> To determine whether the structure is ponding water and the magnitude of ponding.</p> <p><i>What to collect:</i> User to note change in water surface elevation directly upstream and downstream of the structure (head difference) and report as a percentage of the structure height.</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Head difference is &gt;75% of the structure height</li> <li><input checked="" type="checkbox"/> Head difference is 75-50% of the structure height</li> <li><input checked="" type="checkbox"/> Head difference is 25-50% of the structure height</li> <li><input checked="" type="checkbox"/> Head difference is &lt;25% of the structure height</li> <li><input checked="" type="checkbox"/> Negligible head difference</li> </ul>

## 2.2.8 Beaver Activity and Occupation

**General Description:** Beaver colonization of structure-based process-based restoration projects, as beaver presence can ensure continued monitoring and expansion of dam and ponding complexes. The table below outlines the specific data to collect and the specific considerations and methods for data collection.

Data Name	Data Type	Details of Data Collection
Beaver presence in vicinity	Qualitative	<p><i>Intent of Data:</i> To track the presence of beaver within the restoration area indicating sufficient woody vegetation to support beaver colonization.</p> <p><i>What to collect:</i> User to note the level of beaver activity within visual site distance of the structure</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Common signs of beaver activity</li> <li><input checked="" type="checkbox"/> Sparse signs of beaver activity</li> <li><input checked="" type="checkbox"/> No signs of beaver activity</li> </ul> <p><i>What to consider:</i> Beaver sign may include fresh (unweathered) chews, canals, dens, beaver footprints, scent mounts, and dam and lodge building. The user should exclude aged and weathered signs of beaver in this determination</p>
Active dam building at structure or complex	Qualitative	<p><i>Intent of Data:</i> To understand if beavers have colonized the restoration area.</p> <p><i>What to collect:</i> User to note the presence or absence of beaver dam building at or in vicinity of the structure or complex.</p> <p><i>What to consider:</i> This may include beaver ‘maintenance’ of BDA structures or the creation of new beaver dams or lodges within proximity of the observation point.</p>

## 2.2.9 Quantitative Measurements (Optional Elements of the Core Protocol)

Users can choose to collect additional quantitative data to inform deeper understanding and/or create a linkage to previous monitoring protocols.

Data Name	Data Type	Details of Data Collection
<i>Sediment Deposition and Aggradation</i>		
Bar sediment thickness	Quantitative	<i>Intent of data:</i> To measure depth of sediment deposition.
Collected at sediment deposits upstream or downstream of structure		<i>What to collect:</i> User to collect the sediment thickness deposited on bar based on hand driven rebar. User to insert rebar into the center of the bar formation by hand until refusal and note the insertion depth. This will include hand-driving with a mallet.
Monitoring stake	Quantitative	<i>Intent of data:</i> Measure depth of sediment deposited since structure installation.
		<i>What to collect:</i> User to collect depth measurement on monitoring stake installed a distance of 1x bankfull width upstream of the structure during implementation. Users measure down from the top of the stake to the top of the bed sediment at each monitoring iteration.
<i>Water Retention</i>		
Wetted width at structure	Quantitative	<i>Intent of data:</i> To track the width of the pond and channel through time.
		<i>What to collect:</i> User to collect wetted width directly upstream of structure
Pond depth at structure	Quantitative	<i>Intent of data:</i> To track the width of the pond and channel through time.
		<i>What to collect:</i> User to collect pond depth 1x bankfull width upstream of the structure
Wetted width upstream of structure	Quantitative	<i>Intent of data:</i> To track channel width and widening over time.
		<i>What to collect:</i> User to collect wetted width 1x bankfull width upstream of the structure
Pond depth upstream of structure	Quantitative	<i>Intent of data:</i> To track pond depth through time.
		<i>What to collect:</i> User to collect average pond depth 1x bankfull width upstream of the structure
		<i>What to consider:</i> Pond depth decreasing through time may indicate structure maintenance is needed.
<i>Beaver Activity and Occupation</i>		
Beaver pond depth	Quantitative	<i>Intent of Data:</i> Track the size of beaver dams present at the site over time.
		<i>What to collect:</i> If beaver ponds are present, measure the depth of the beaver pond at the center of the dam crest.

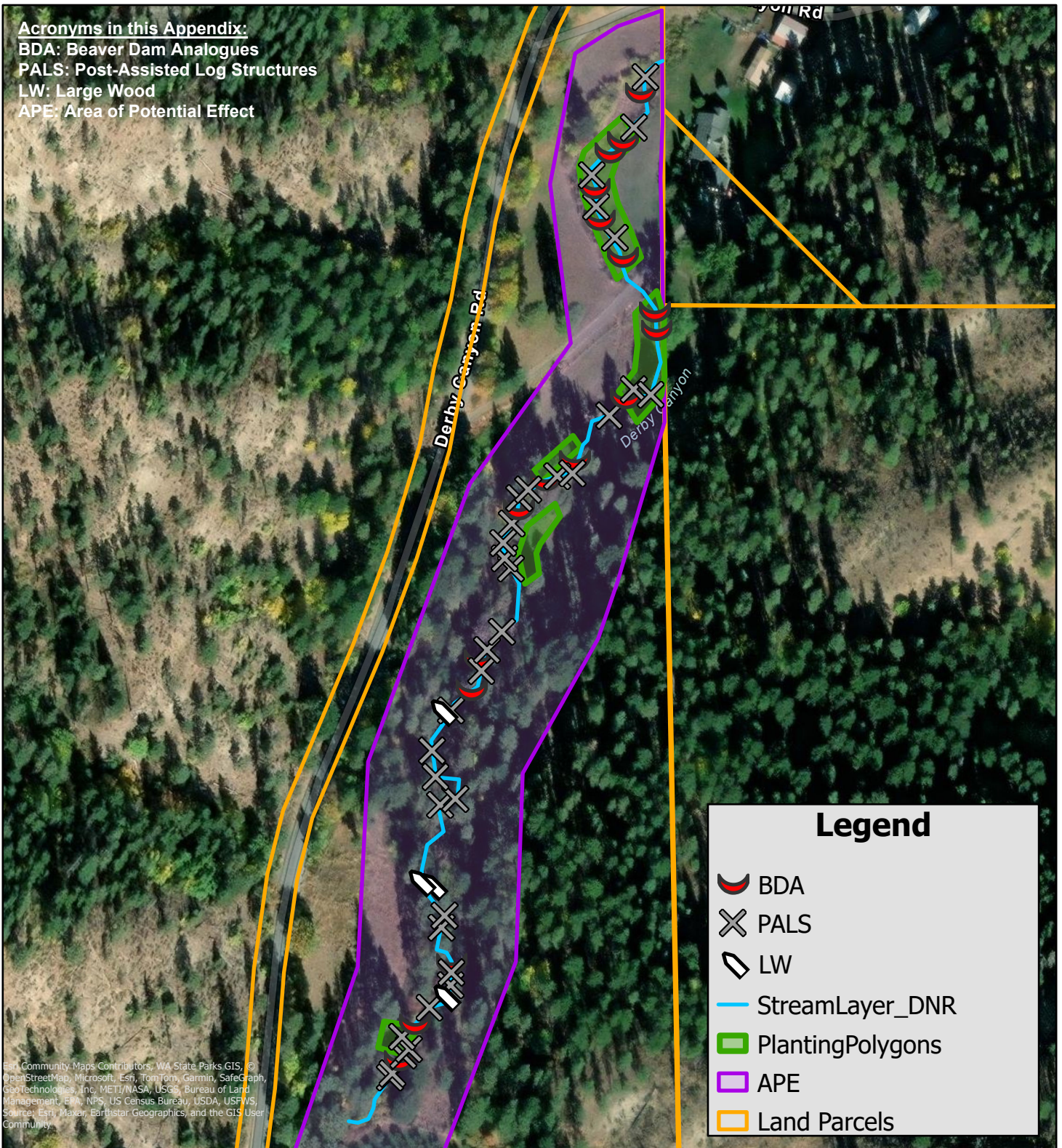
**Acronyms in this Appendix:**

**BDA:** Beaver Dam Analogues

**PALS:** Post-Assisted Log Structures

**LW:** Large Wood

**APE:** Area of Potential Effect

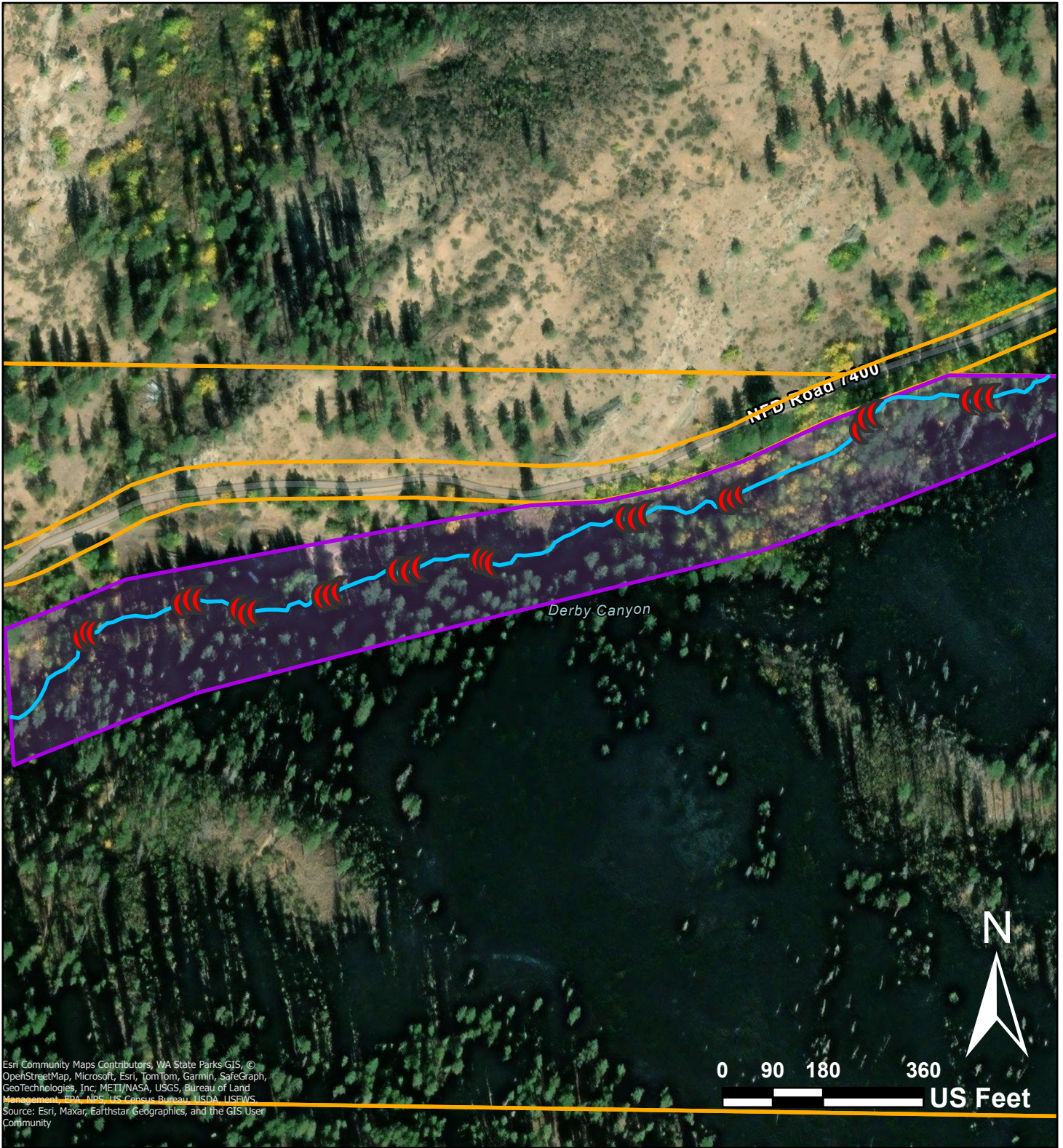


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# DNR Parcel- Planting and LTPBR Concept Map 2024

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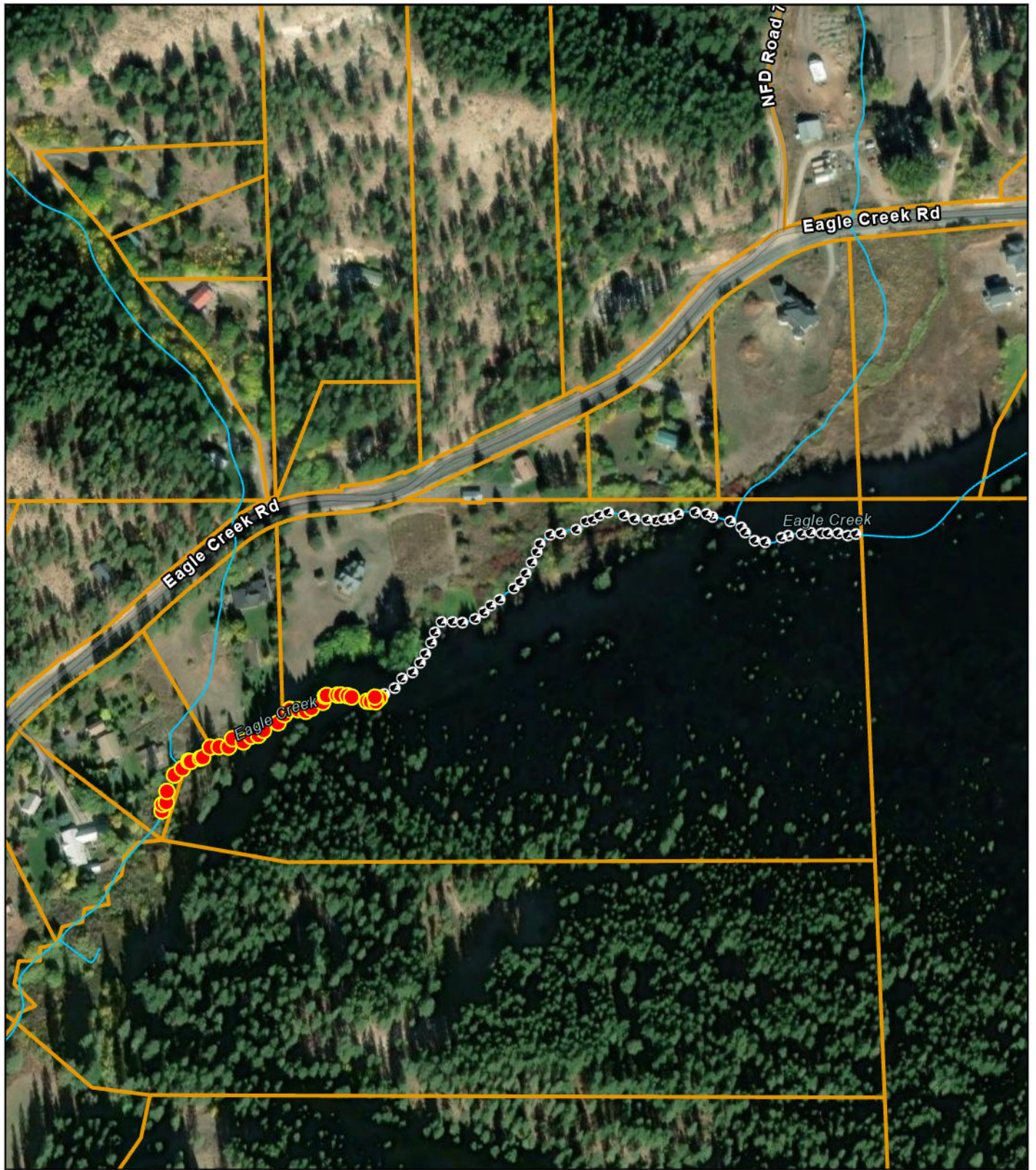


# Stroud Property- LTPBR Concept Map 2024

## Legend

-  Stroud-BDA/PALS
-  StreamLayer\_Stroud
-  APE
-  Land Parcels

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0 75 150 300 US Feet



# Black Property Concept Map



**CASCADIA**  
CONSERVATION DISTRICT

2024

## Legend

- Streams\_CCNRD
- Parcels
- Planned BDAs
- Existing Structures

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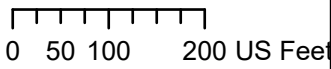
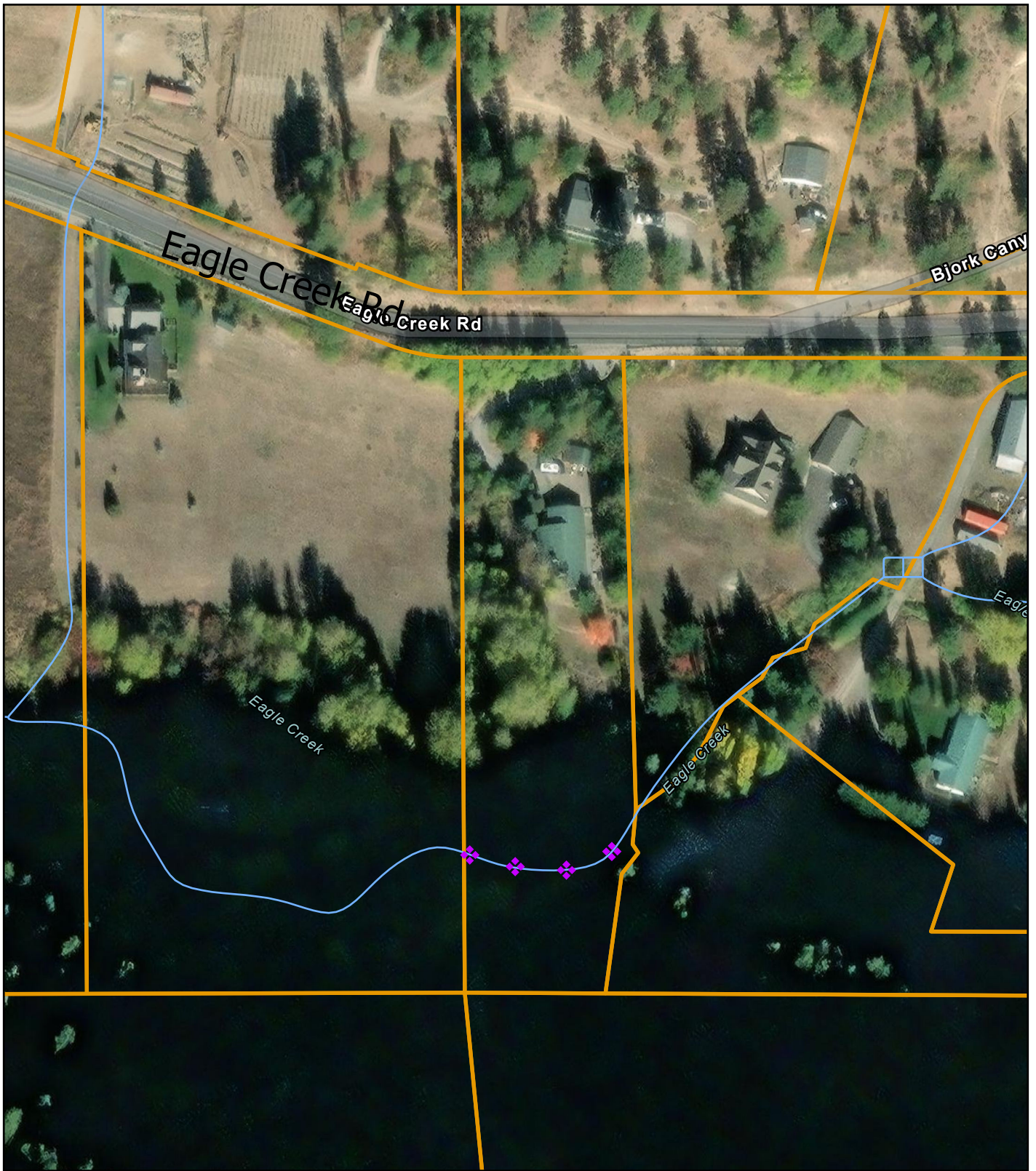


0 40 80 160 Feet

**Legend**

- Eagle Creek
- HedeemParcel
- BDAs

**Hedeem Parcels**  
**Eagle Creek Restoration**  
**Cascadia Conservation District**



# Eagle Creek- Johnston Property Concept Map



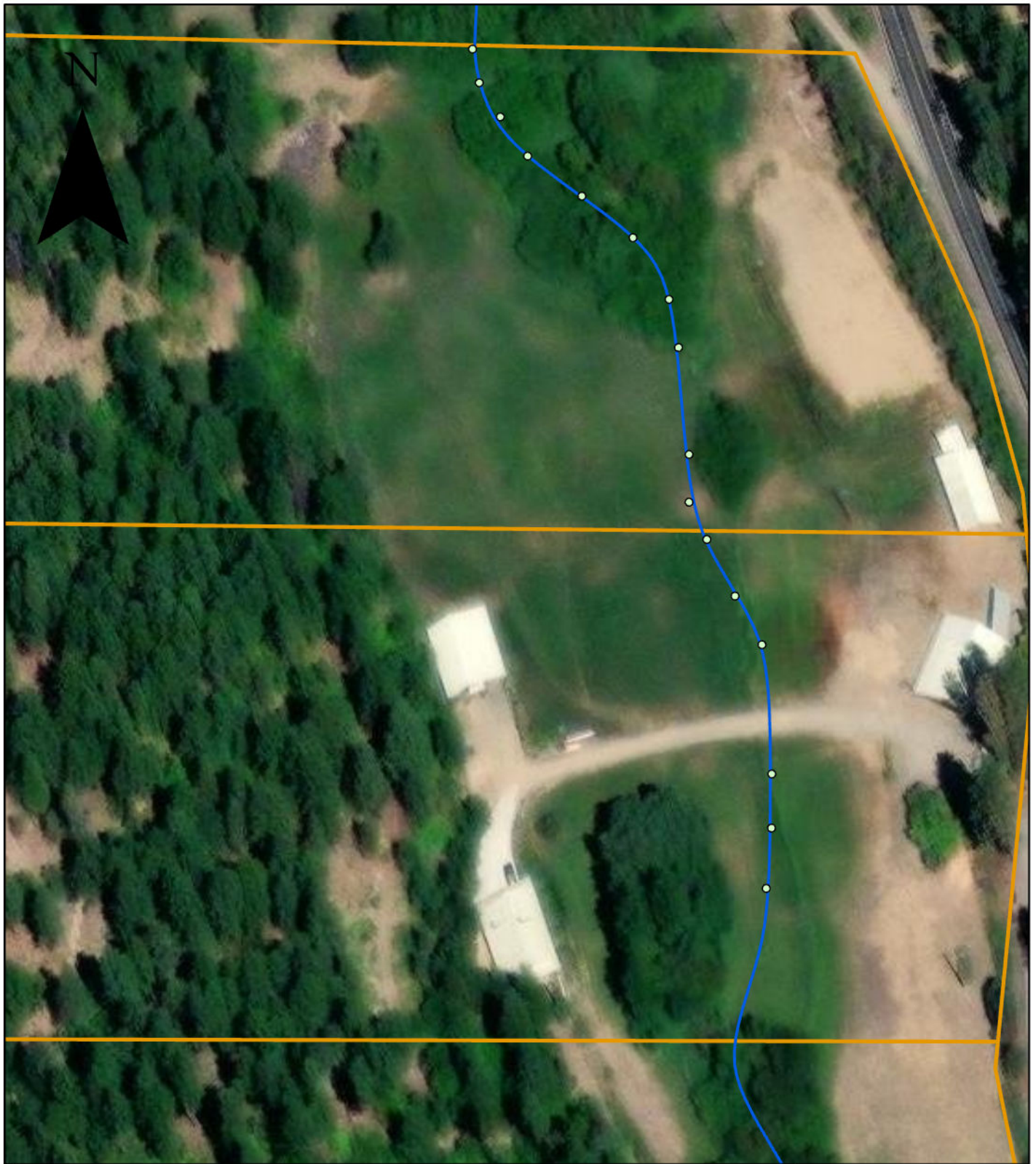
2024

## Legend

- Creek
- APE
- Parcels
- ◆ PALS

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# BDA and Planting Project Hatch



2024

0 30 60 120 US Feet

## Legend

-  Little Chumstick Creek
-  Hatch
-  BDAs

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# QAPP - CCD Structure-Based Monitoring


Final Audit Report


2024-09-09


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