

Spokane Conservation District

LTPBR for Lazy A Farms (Little Hangman Creek Tributaries) Planning and Design

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Executive Summary

The Spokane Conservation District (SCD) connects landowners with technical and financial assistance to manage natural sources. The majority of the technical assistance in the Hangman Creek Watershed is related to excessive water turbidity. Beginning in 2021, the SCD began to implement a riparian vegetation buffer program, the Hangman Creek Riparian Restoration and Conservation Pilot Program. The goal of the program is to reduce stream temperature and turbidity in the watershed. This is accomplished by converting agricultural fields to native riparian vegetation buffers along perennial streams in the Washington portion of the Hangman Creek Watershed. The maintenance of watering, weeding, and supplemental plantings requires significant labor, tools, and materials.

This project proposes installing beaver dam analogs at one such buffer along 0.4 miles of unnamed tributaries to Little Hangman Creek to provide a low-cost, low-labor means to increase water availability to riparian plantings while capturing sediment and improving riparian activity within the valley bottom. An evaluation of site suitability is presented and subsequent treatment described. Expected outcomes from this proposal are increased sediment resident time, increased ground water availability, decreased flood peaks, and reduced manual watering of riparian plantings.

Introduction

Little Hangman Creek originates mostly in northern Idaho and flows west into Washington. It is a major tributary to the upper portion of Hangman Creek, the focus of turbidity and temperature water quality issues. Land use in the watershed is dominated by dryland wheat farming. The geologic history of loess and volcanic ash has resulted in fertile, easily erodible soil making the region highly productive. In the latter half of the 20th century, the Natural Resources Conservation Service (NRCS) paid producers to straighten stream channels to increase agricultural land. The current culture in the region values faster water conveyance that fosters earlier planting.

Hangman Creek is located in the Upper Columbia River Basin where upstream fish passage is currently blocked by four dams including Chief Joseph and Grand Coulee. However, the Spokane Tribe of Indians and The Coeur d'Alene Tribe are in the process of re-establishing chinook salmon in the Spokane Watershed. As a tributary to the Spokane River, this project site is under consideration for anadromous fish habitat projects. The recently established [Spokane Salmon Restoration Collaborative \(SSRC\)](#) is in the process of assessing current and potential salmonid habitat in the Spokane River. However, watershed scale perturbations have rendered much of the current habitat in Hangman Creek as highly degraded. Projects that are able to reduce water temperature, turbidity, erosion due to land use practices, riparian habitat, phosphorus reduction, and create hydraulic complexity are greatly needed in this watershed.

Project Background

Little Hangman Creek is a tributary to Hangman Creek, one of the most polluted streams in Washington. A settlement between the Washington Department of Ecology (Ecology) and the Spokane Riverkeeper included the stipulation that Ecology would install riparian buffers along Hangman Creek and tributaries to reduce pollution.

Ecology created the Hangman Creek Riparian Pilot Program to fund and install these buffers. Ecology identifies parcels on which to install buffers and notifies the landowner that they may be responsible for pollution originating on their land and thus out of compliance with the Clean Water Act. To come into compliance, the landowner must sign an agreement with Ecology to install riparian buffers. To offset the financial loss of productive agricultural land, the landowner is paid a set rate per acre. However, Ecology developed a relationship with the SCD in which the SCD will install, maintain, and administer payments to the landowner. The project proposed here is within one of these buffers.

Problem

This site is lacking in mature riparian vegetation, exhibits a flashy hydrologic regime, has a straightened channel that is attempting to establish multiple threads, and the simplified cross-sectional geometry reveals a stream largely disconnected from its historic floodplain. These perturbations contribute to a reach that both experiences and transports excess sediment erosion while providing minimal riparian or instream habitat, and experiences decreased summer flows comprising warm water.

Description of Restoration Project

The site is already part of a riparian buffer implementation that this project seeks to build upon. This project seeks to use low-tech process-based restoration techniques to implement beaver dam analog structures along unnamed tributaries to Little Hangman Creek within the riparian buffer project.

Broad Management Goals

The management goals on Lazy A Farm are to facilitate the continued viability of agriculture, reduce turbidity, decrease summer water temperatures, and establish riparian habitat.

Specific Project Goals

The specific goals of this project are to reduce the magnitude of peak flood discharges, reduce channel incision, and to facilitate riparian plant establishment by increasing subsurface water availability.

Project Location, Description & Scope

This project is located within the headwaters of Little Hangman Creek the eastern side of Tekoa Mountain in southeastern Spokane County. All of the land is owned by Lazy A Farm and included in the riparian planting project implemented by the Spokane Conservation District. The primary purpose of this project is to increase groundwater availability for the riparian plantings and capture suspended sediment as a means of reducing turbidity.

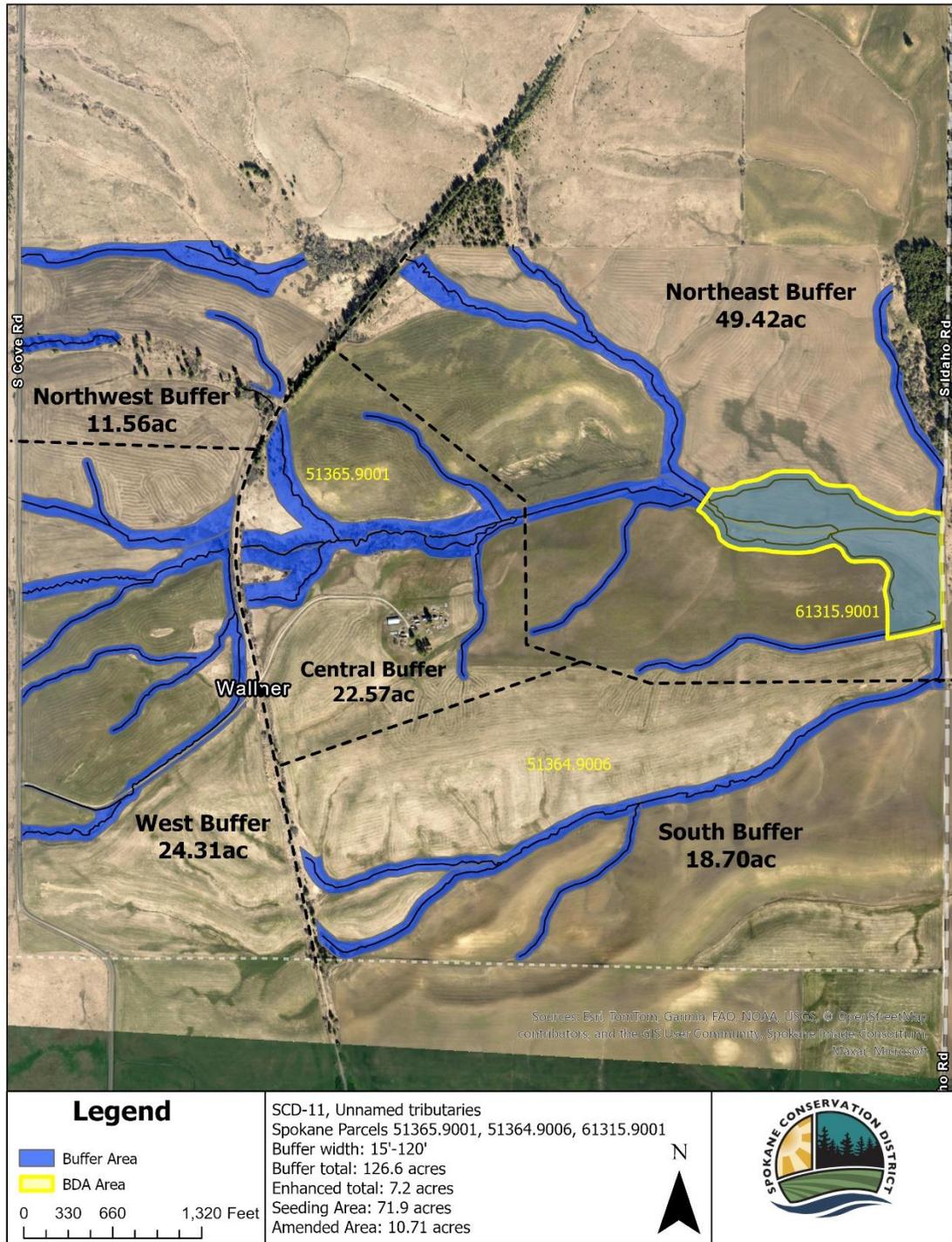


Figure 1. Project Location. Unnamed tributaries flow in a generally eastward direction through the site.

Planning & Design Methods

Planning Process

Planning begins with identifying problems at the site. This was executed by an in-person walk through followed by mapping the site using a drone. The Low-Tech Process-Based Restoration of Riverscapes Design Manual Chapters 3 and 5 were used to guide the planning and are adapted from the NRCS planning process.

Problems & Opportunities

The dominant problem on this site is that the straightened channels have incised and the riparian vegetation is almost entirely comprised of reed-canary grass or is currently in agriculture. The incision has led to excess erosion that degrades water quality. The opportunity at this site is that it is enrolled in a 15-year riparian buffer, allowing space and time for rehabilitation work.

Assessment of Structural Starvation and Appropriateness of Low-Tech

Flows in the relatively straight, incised channels are only modulated by the amount and location of invasive reed canary grass. Some reaches have already begun regularly flowing overbank as reed canary grass fills the channel showing a need for improved floodplain connection. Upstream from the project, minimal woody vegetation is present and most that is present is quite young. These young stands are also detached from the project site by a county road. This results in an almost complete lack of potential for woody debris recruitment on the site and lower in the watershed. The incised channel hinders woody vegetation establishment by lowering the water table while agricultural practices remove

stems beginning establishment. These conditions necessitate a significant rehabilitation effort to address the feedback between the stream and riparian vegetation.

Channel modification utilizing machinery could re-establish channel form and function. However, doing so would be disruptive to agricultural practices and detrimental to existing riparian plantings. Therefore, the current lack of structures and need for minimal impact make low-tech methods attractive.

Inventory of Resources

Riverscape Extent - Valley Bottom Mapping

The geologic history of this site as the location of loess hills has resulted in subtle to indiscernible breaks in topography from hilltops to valley floors. Consequently, identifying the accurate and precise valley bottom margins is complicated and inherently imprecise. Further, the agricultural land use obscures vegetation that could otherwise be used for such a delineation. Instead, winter wheat is present below bankfull elevation to the top the highest local hills. Near and in the active channel, invasive reed canary grass is present on surfaces not actively farmed.

In this context, the valley bottom was approximated using the Riverscapes Consortium Valley Bottom Extrapolation Tool (VBET) to provide a consistent protocol along the site (Figure 2). Additionally, the active channel was mapped as the extent of its incision into the valley floor. Current floodplain extent was assumed and mapped by the presence of reed canary grass, a facultative species for wetland delineations and regionally known to approximate floodplains.

Identified Risks within & Adjacent to Riverscape

Risks within the project site were evaluated based on infrastructure and agricultural land (Figure 2). The agricultural land use requires consideration of the potential for crop loss due to channel migration into productive lands. This loss of crop is a financial loss to the producer and landowner as well as loss of trust. BDA's are not known to be implemented in Hangman Creek and a new project such as this could quickly develop a poor reputation both for the SCD and the LTPBR.

With these considerations, risk is described in three general categories: low, moderate, and high described below and identified in Figure 2.

Low. These areas are far from infrastructure and have at least one or more confining features that prevent channel migration.

Moderate. These areas are where the buffer, the limit of allowable channel migration, are less than the modeled valley width or where there are few confining features. Although channel migration would restore geomorphic function to the system, the potential for such migration to induce crop loss is considered a risk here.

High. These areas are either near infrastructure, such as the house at the north of the site, or there is significant likelihood of the channel migrating out of the buffer into fields, such as the middle of the site.

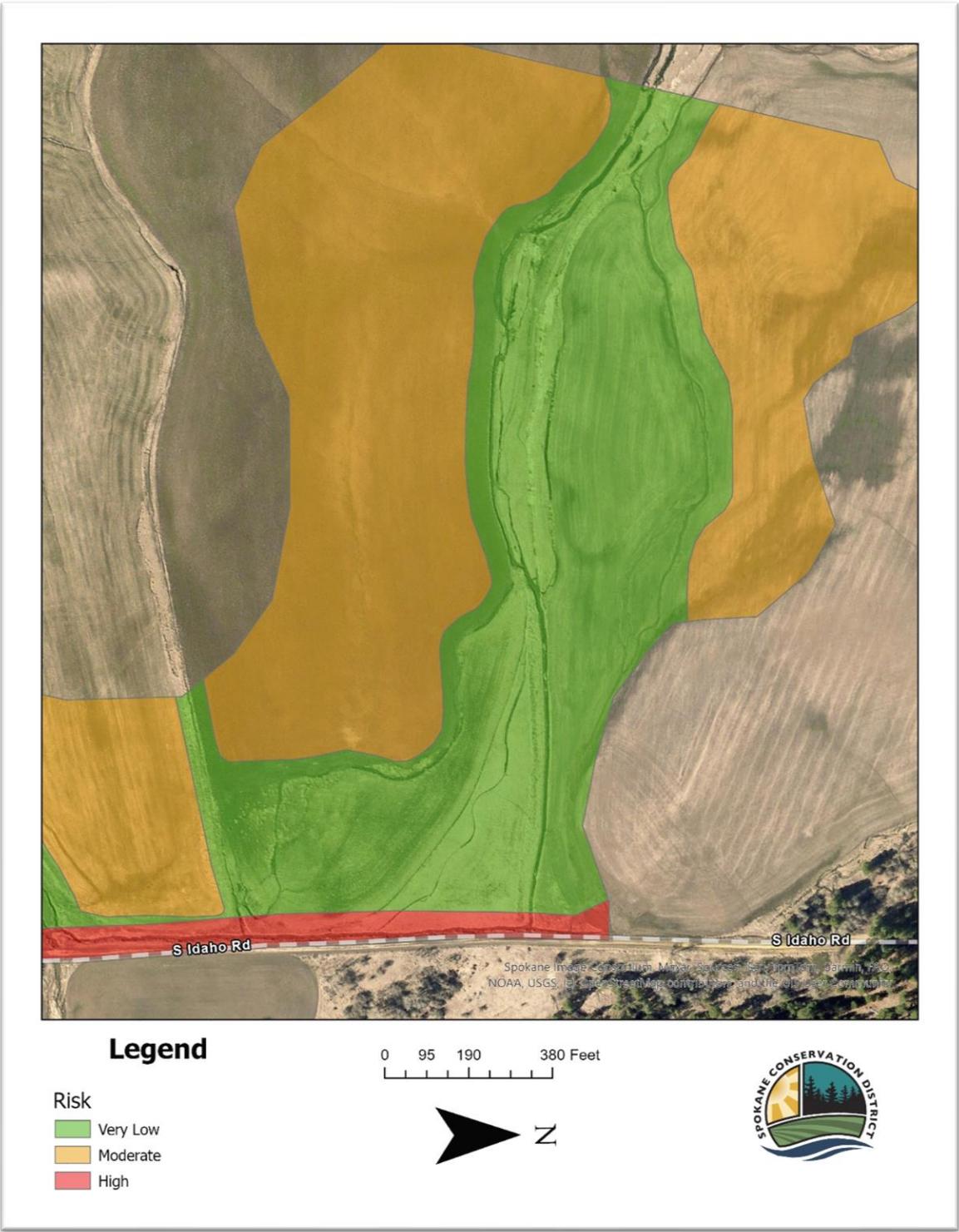


Figure 2. Risk Assessment Map. A Valley Bottom Estimation Tool was used to assess the potential stream valley and likelihood the stream would pose a risk to infrastructure or crops. Isolated to lower risk area to be targeted with treatment.

Risk vs. Opportunity Assessment

Risk at this site varies and is generally modulated by the boundary of the riparian buffer and subtle relief of the valley bottom. The higher risk areas at the site are located upstream of the proposed LTPBR work where a recreationally-used, retired rail grade crosses the property and in the center of the site where a resident lives and the related access road (Figure 2). The lower reaches of the site, specifically the proposed area, have great allowable space for geomorphic activity. Consequently, the lower portion of the site presents the greatest opportunity for restoration.

Potential Recovery Space

The recovery space on this site is constrained by the landowner land management goals. Because the valley floor is the most fertile soil for agriculture, maintaining crops in the valley floor is a goal. Therefore, this limits restoration to the area bounded by the riparian buffer. Corroborating the opportunity assessment, the reach at the lowest end of site has the most recovery space.

Resource Analysis

Assessment of Current Conditions and Recovery Potential

Geomorphic Condition

The current channel condition is an incised, channelized stream representative of Cluer and Thornes Stage 2 or Stage 3. The channel is actively maintained as such to maximize agricultural land, and the active channel comprises approximately 6% of the modeled valley bottom (Figure 3). Unless land management practices change, the channel will remain as such.

The potential floodplain of this unnamed tributary at this site is assumed to be the bounds of the riparian buffer. Although utilizing this space would require erosion, current land management practices have prevented the channel from utilizing its mapped floodplain. Below is a comparison of the area of current and geomorphic potential in absolute and percent of valley bottom.

<u>Feature</u>	<u>Area, ft²</u>	<u>% of Valley Bottom</u>
Active Channel	144,371	6%
Geomorphic Potential	1,071,022	45%
Valley Bottom	2,359,909	100%

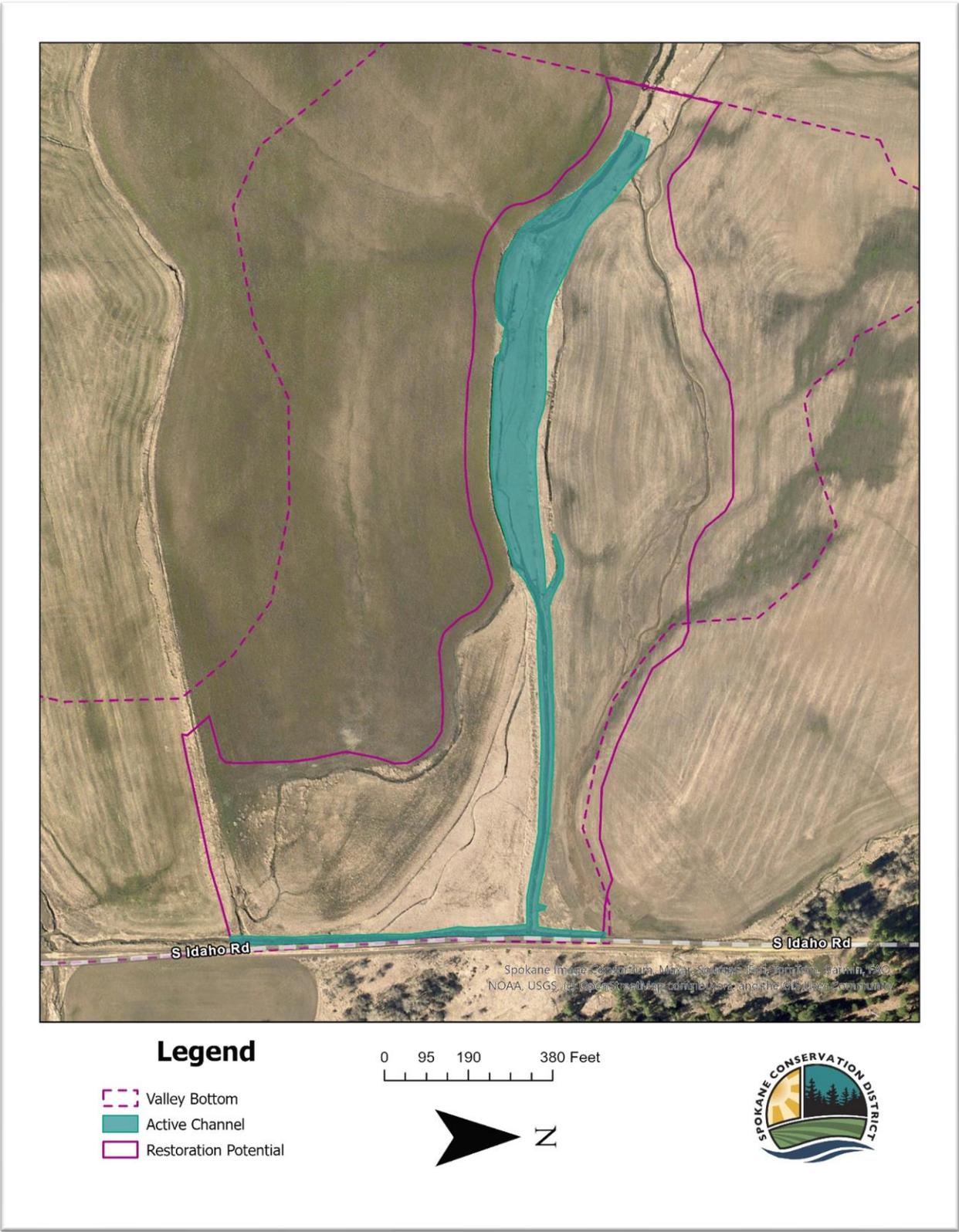


Figure 3. Mapped active channel, modeled valley bottom, and the restoration potential.

Identification of pathways of recovery

Due to landowner goals of farming, there is a limit on recovery potential and stage 8 is not compatible with these goals

Flow Regime's ability to "Do the Work" of Restoration

Field observation of active erosion indicates that the creek is currently eroding the landscape and therefore capable of doing the work. However, the primary goals of increasing water availability for plantings and capturing sediment would benefit from LTPBR practices.

Riparian Condition to support Process of Wood Accumulation

This project site is the location of a riparian planting project. Consequently, the vegetation is immature and not visible in aerial imagery. However, as the vegetation matures, woody vegetation is expected to become available. Additional riparian plantings through the course of the 15-year riparian buffer contract are also expected to create an increase in wood supply in this reach. One of the goals of this project is to pond water to increase subsurface water availability that will further promote vegetation establishment thereby increasing available wood supply.

Riparian Condition Capacity to support Process of Beaver Dam Activity

The lack of riparian vegetation hinders current observation of beaver activity on this site. Verbal accounts from the 1960s indicated that beaver were present in this vicinity and beaver activity was recently (Spring 2025) observed on streams and restoration projects within 2 miles of this site. As such, it is assumed that as riparian vegetation and conditions become favorable, beaver will relocate. The recent and ongoing riparian vegetation plantings here are creating conditions more favorable for such activity.

Project Objectives

To address the degradation of the stream, this project finds the site suitable for the introduction of wood in the form of BDA's and PALs within the channel to promote restoration of natural processes. The objectives of doing so are to 1) capture sediment as a means of reducing turbidity and 2) backing up water to increase water availability for the planted vegetation. These can be measured by monitoring aggradation, measuring depth to water table (piezometers), and plant survival.

Design - Phase 1

Overall Project Plan

Considering the opportunities for restoration in light of risks and landowner goals, one reach for restoration was identified. The lowermost portion of the largest stream body within the site was chosen for LTPBR practices. This reach was inferred to have a low risk and greater opportunity for geomorphic activity. Within this reach, structures will be installed to target expansion of the active channel in directions with the lowest risk of impacting nearby cropland.

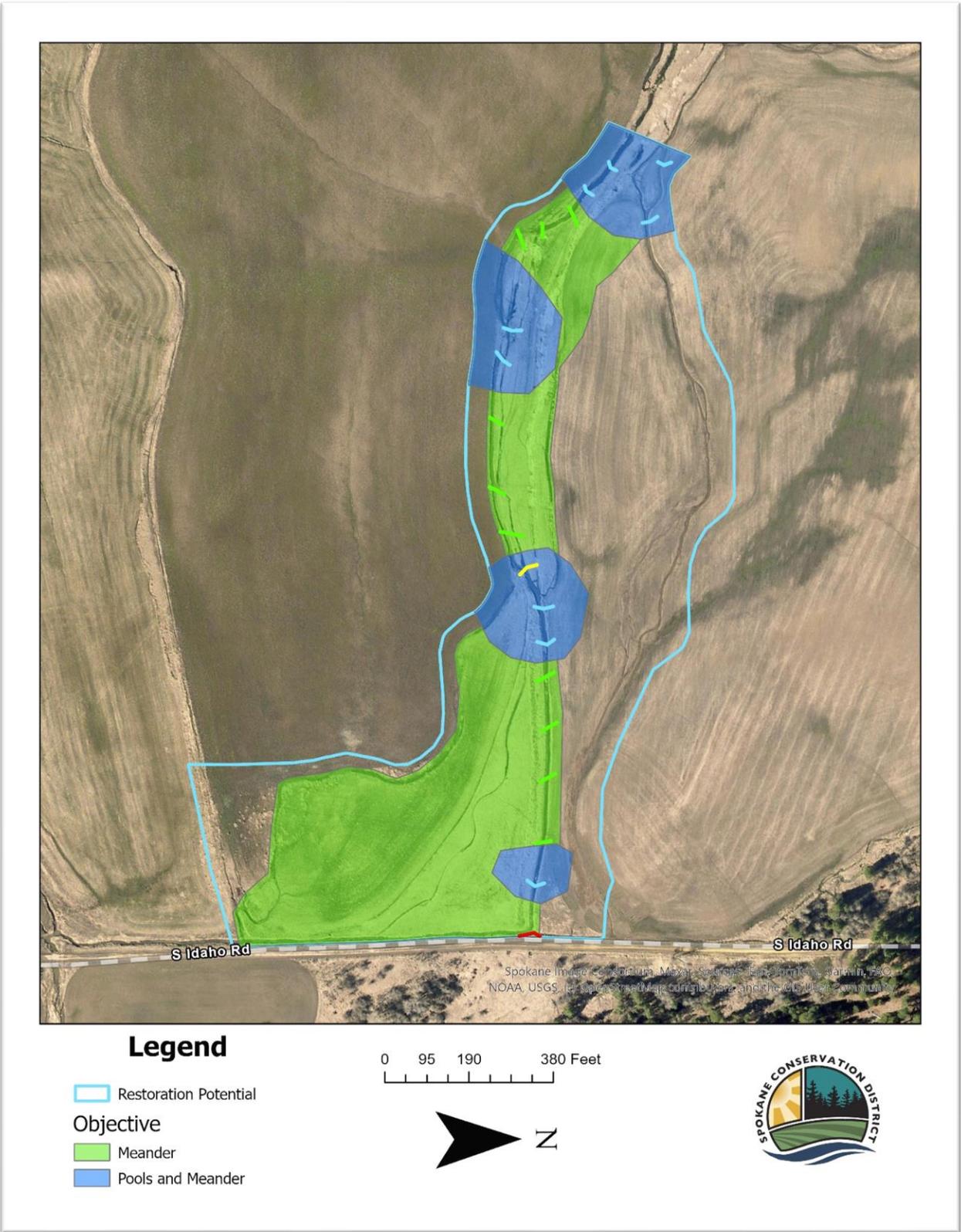


Figure 4. Site map colored by the goals.

Design Objectives

This design aims to aggrade channels from Stage 3 and 4 into Stage 5. This will occur through multiple check dam structures to encourage aggradation at key points within the site as well as multiple meander-creating structures between the aggrading features. The aggrading structures will encourage floodplain access by speeding up the process of a Stage 4 channel evolving into Stage 5 or beyond. Meanwhile, the meander-creating structures will encourage Stage 3 channels to progress toward Stage 4, also producing some of the eroded sediment that will become aggraded material downstream. The improvements to water table access created by these processes will also allow riparian plantings to be more successful, eventually recruiting large woody debris to the system that will allow for further evolution of the channels over time.

Typical Structure Types

Within this designed plan there are three structure types presented. Each structure type is intended to affect the flow regime in specific ways to cater to the site's potential for restoration. Below, the intended erosion and deposition impacts and pooling and overbank flow dynamics of each structure type are explained.

Primary, Channel-spanning BDA

These structures are used to create deep, slow water, increase frequency and magnitude of overbank flow, increase hyporheic flows, produce channel aggradation upstream, bar formation, bank erosion (if breached on ends), and sort sediment. The key goals for these structures at this site are to form deep pools that collect sediment and aggrade and increase hyporheic flows.

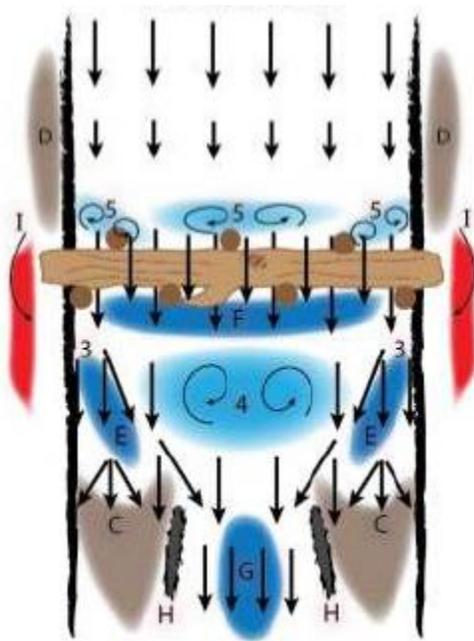


Figure 5. Hypothesized hydraulic and geomorphic responses associated with channel-spanning structures from Figure 3.5 from Camp (2015a).

Angled, Channel-Spanning BDA

These structures are used to force convergent and overbank flow, create eddies behind the structure, induce bank erosion, form scour pools and bars, sort sediment, and create channel avulsion. The key goals for these structures at this site is forcing convergent and overbank flows to reconnect floodplains.

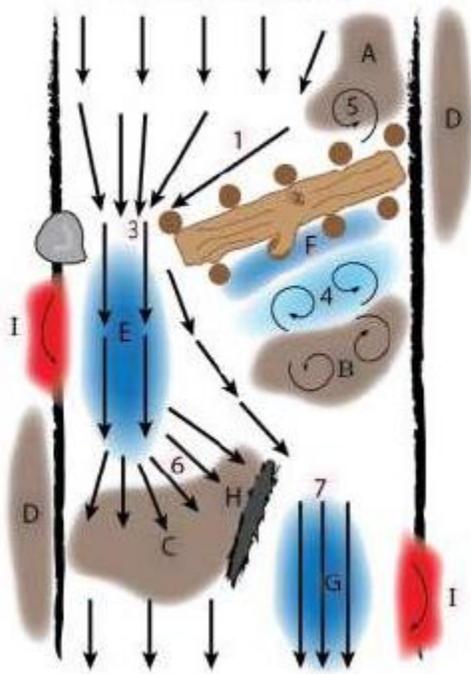


Figure 6. Hypothesized hydraulic and geomorphic responses associated with angled, channel-spanning or bank-attached structures from Figure 3.5 from Camp (2015a).

Splitting, Channel-spanning BDA

These structures are used to force overbank flow and flow separation, create eddy in lee of the structure, induce bank erosion, form scour pools and bars, sort sediment, and create channel avulsion. The key goals for these structures at this site is to force overbank flow separation to reconnect floodplains.

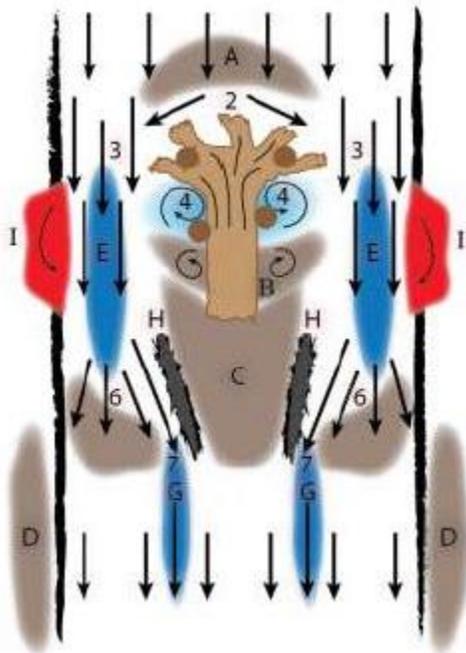


Figure 7. Hypothesized hydraulic and geomorphic responses associated with splitting, channel-spanning or mid-channel structures from Figure 3.5 from Camp (2015a).

Reinforcing PAL

These structures are used to shore up a bank that is experiencing unwanted erosion due to excessive energy. The structure is assembled as a revetment within the channel parallel to the streambank to dissipate hydraulic energy away from protected features. The key goal for this structure at this site is to help ensure that high flows do not damage infrastructure, namely the road running along the state border at the eastern end of the property.

Structure Types Legend



Figure 8. Legend for Figures 5-7. Hypothesized hydraulic and geomorphic responses associated with instream wood structures from Figure 3.5 from Camp (2015a).

Structure Locations

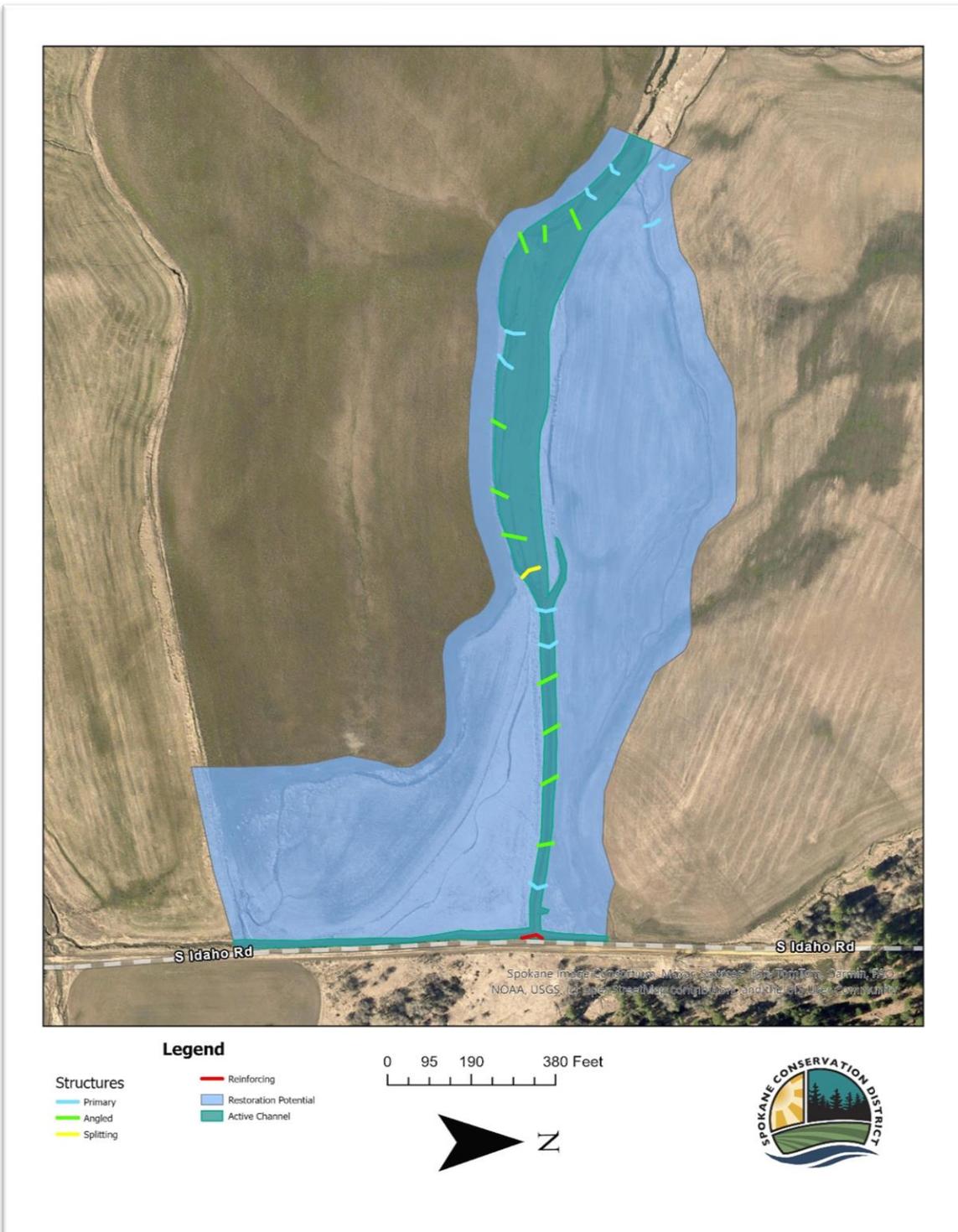


Figure 9. Locations of BDA and PAL structures, color-identified by structure type.

Implementation Recommendations

Implementation

Most of the material for this project can be gathered on site during or shortly before construction. The site has a healthy existing stand of quaking aspen that would benefit from thinning and many Ponderosa pines that need fire ladder reduction. Roughly four to ten logs with a diameter between four and ten inches and a length of five to fifteen feet will be needed per structure. Approximately 26 posts will be needed per structure varying with the stream width.

Anticipated Additional Phases

The site would benefit from two additional phases to encourage activation of the entire available floodplain. As the flow regime changes, more structures added to the site can further push the overbank flows during moderate and high flow events into the unutilized portions of the floodplain. Due to the location of this site being so high in the watershed and the lower flows, it will likely take 5 or more years to see the full effects of a treatment such as this, meaning planning additional phases may not be beneficial until 5 years after implementation.

Adaptive Management Plan

Complete stream restoration of this site is unlikely to be achieved as the result of the work outlined in this report. Furthermore, working in a large valley bottom with such high potential includes many uncertainties. Continued monitoring and the development of a multi-year approach to restoration of this site is necessary to understand and maximize the benefits that can be gained from restoration.

Due to the low flows of this portion of the system, it is not likely any of the structures will see damage from high flow events. However, planning on replacing or improving 10% of the structures created would be beneficial as high flows could potentially produce enough erosion to bypass some of the structures. Structures bypassed in this manner should be reinforced and reattached to the new streambank edge to ensure the structure functions as intended further into the future.

Adaptive management can be used to address uncertainties associated with restoration in the Baugh Creek watershed and provide an outline for how future restoration and management can base decisions on the results of monitoring efforts. Adaptive management can be described as an “iterative, structured way of ‘learning by doing’” (Bouwes et al., 2016). The four stages of adaptive management are: 1) Plan, 2) Do, 3) Evaluate, and 4) Learn. At this site, we are currently in the ‘Plan’ and ‘Do’ phases of restoration monitoring. This report documents the conditions and structure objectives necessary to complete restoration monitoring and evaluation, which can be used to guide future restoration efforts.

Many stream restoration projects lack the resources to document stream restoration outcomes. As such, in many cases the effectiveness of stream restoration actions cannot be assessed. Restoration monitoring should be linked to restoration goals. At Lazy A Farms, restoration goals can be grouped into geomorphic, hydrologic, and ecologic categories and are likely to be achieved over different temporal and spatial scales. Restoration monitoring

therefore needs to account for differences in response times when assessing effectiveness. Geomorphic responses, such as channel aggradation, may occur over relatively short time frames (e.g. one year) or over longer time frames (e.g. ~ 5 years) depending on snowmelt and runoff characteristics. By contrast, increased channel-floodplain connectivity may be dependent on geomorphic responses and require longer time frames. Ecologic responses such as increased riparian extent or expansion of beaver activity are likely to require the longest time frames. An appropriate monitoring strategy is critical to developing realistic expectations for restoration, documenting restoration effectiveness and guiding future restoration efforts.

Developing an appropriate monitoring strategy depends on the restoration goals as well as available resources. Where the goals of monitoring are to inform future management decisions, monitoring strategies can be less intensive than if the goal is scientific publication. Appropriate strategies are highly project dependent and can be designed to be implemented by private consultants, university personnel, agency employees or private landowners.

For this project, riparian plantings will be monitored on a basis of survival, ground water depth and temperature will be monitored using piezometers placed in transect at the upstream and downstream end of the site, surface water temperature will be monitored entering the site and exiting, and the time interval in which the creek runs dry will be measured.

Summary

Low-tech, process-based stream restoration at Lazy A Farms has the ability to mitigate increased water and sediment delivery as well as help restore natural stream form and function that can promote the long-term stream health and survivability of riparian plantings. A variety of structure types will be implemented to achieve a range of restoration goals. The continued success of restoration in the Hangman Creek Watershed, and the long term health of streams in the project area, will require ongoing monitoring efforts to inform future restoration actions.

References

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