

# Station Creek Restoration Report

PLANNING, DESIGN, IMPLEMENTATION AND MANAGEMENT  
STRATEGY



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## Executive Summary

This report includes planning, design, implementation report, and an adaptive management plan for low-tech restoration on Station Creek, Franklin County, Idaho. Station Creek runs for nearly a mile through the property of Mr. Terry Westerberg, who requested low tech restoration for the stream through his land. The creek historically contained several beaver dams and accompanying ponds, but in the absence of beavers, the channel has become much less complex with almost no ponds or habitat complexity. This report describes the planning process driving the restoration, a description of our design, and a summary of the structures implemented in spring 2019. We also recommend an adaptive management plan which addresses management both before and after the introduction of beavers into station creek, including balancing the restoration benefits of beaver activity with protecting infrastructure and property.

## Background

Canyon Aquatic Restoration Specialists has been asked to design and implement a low-tech, process based restoration project on [Station Creek](#) in southeast Idaho. Station Creek is a left-bank tributary to the Bear River (Figure 1) downstream of Oneida Narrows and the Mink Creek confluence. The project is on landowner Terry Westerberg's property. Terry saw the success of neighbor Jay Wilde's beaver reintroduction on Birch Creek, just over the hill, and wanted to see similar improvements to Station Creek through his property. The project was originally envisioned as a BDA-assisted (Beaver Dam Analog), beaver translocation project and may be funded by Pacificcorps. (Joe Wheaton). A downstream neighbor has some concerns about translocating beaver within the area which has slowed actions for the Idaho Fish and Game to transplant beaver within the area. Regardless if beaver are introduced or not, the building of BDA structures will be helpful to Terry Westerberg for creating good fish habitat.

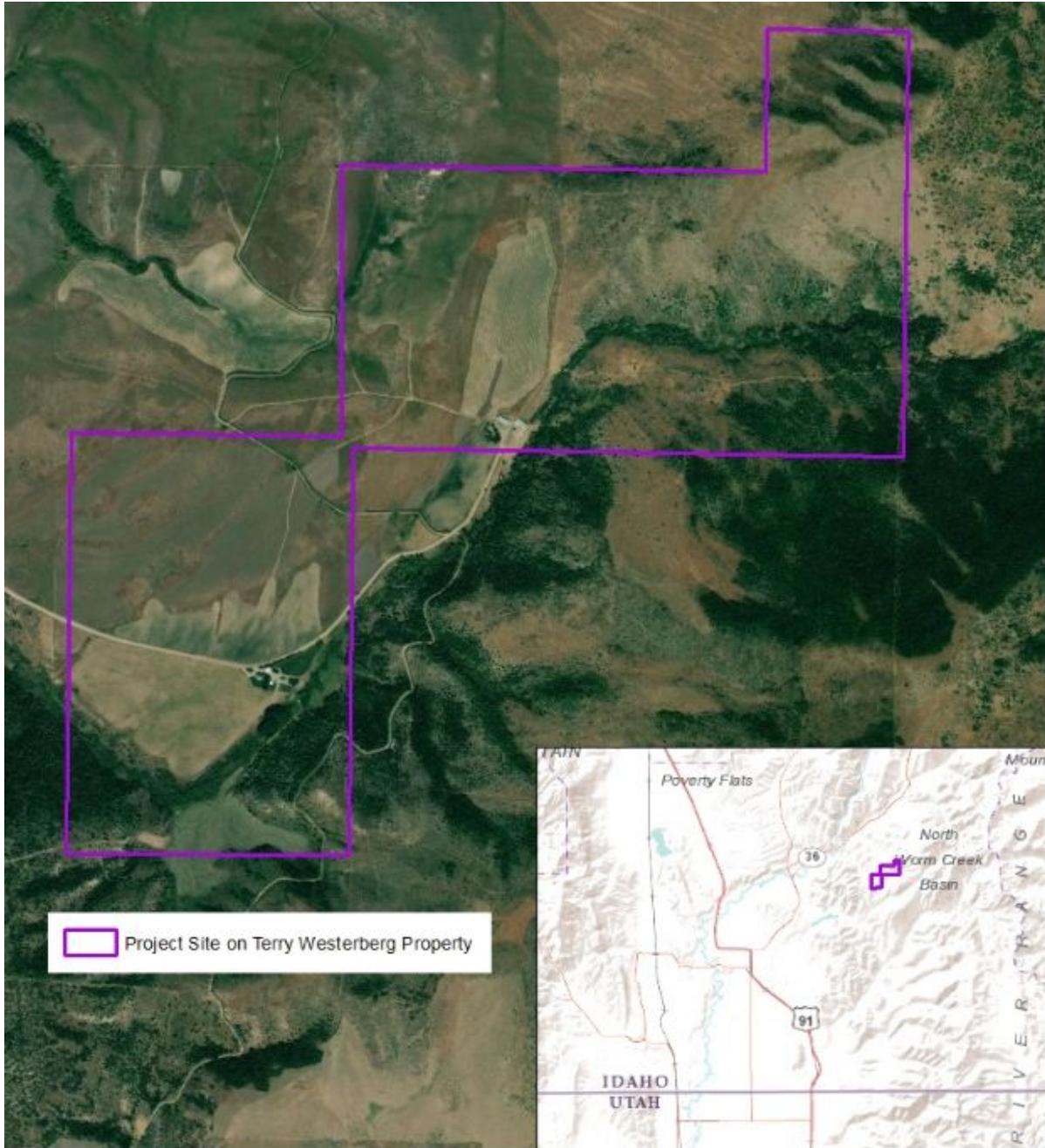


Figure 1. Map of the Station Creek watershed in Southern Idaho.

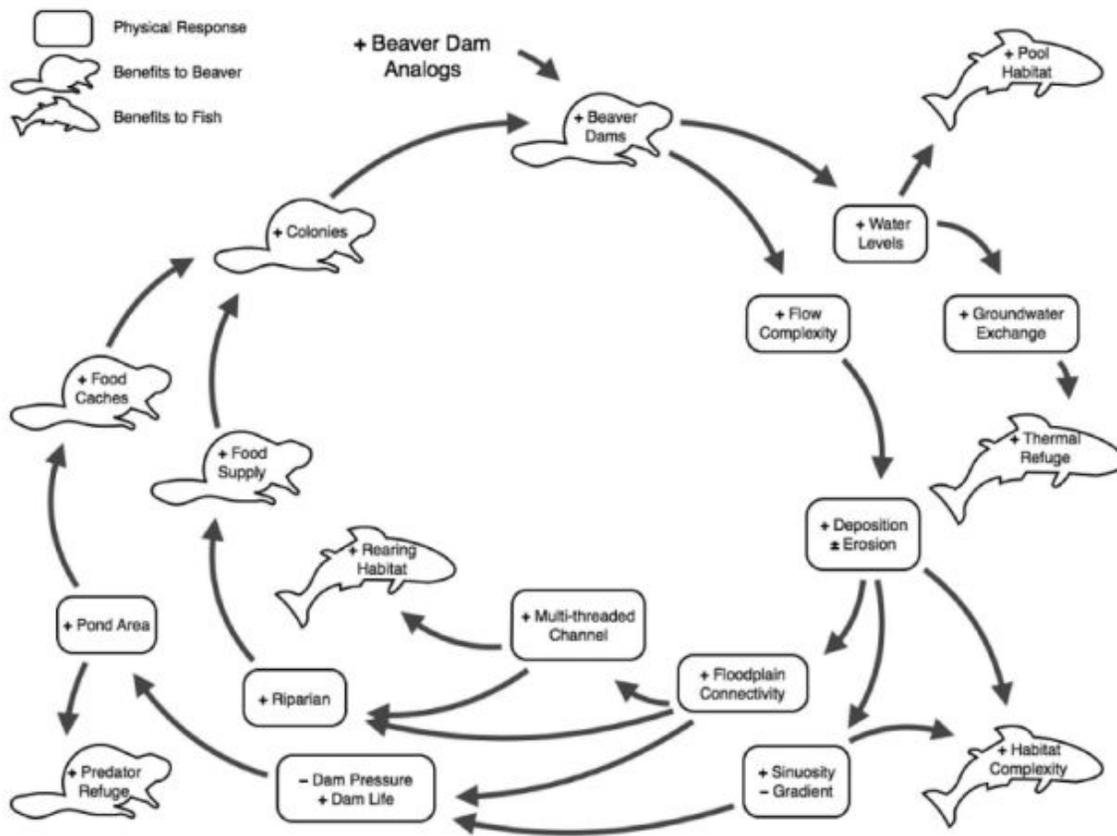
## Management Goals

The building and implementation of BDA's on Terry Westerberg's property is in an attempt to increase fish and wildlife habitat (Shahverdian 2018). The implementation of BDA's and other woody debris structures is meant to slow water flow, create ponding, create a diverse riparian corridor, and reconnect the floodplain. These implementations are an attempt to accentuate geomorphic units within the channel creating habitat that will be beneficial to Bonneville Cutthroat trout, birds, small game, and larger game species. In short:

1. Creation of BDA structures allow the stream to diversify and create heterogeneous geomorphic units for fish habitat (Bouwes et al. 2016).
2. Creation of BDA and woody debris structures cause floodplain connectivity with the creek making the system a self-sustaining, wood-accumulating, complex meadow habitat good for wildlife (Lee 2017).

## Beaver Dam Analogs

Beaver dam analogs and other woody debris structures mimic natural built dams by beavers which accumulate wood, promote the slowing and ponding of water, increase riverine habitat for fish, promote floodplain connectivity, and an increase in riparian habitat which is beneficial for birds and other wildlife (figure 2) (Shahverdian et al. 2019).

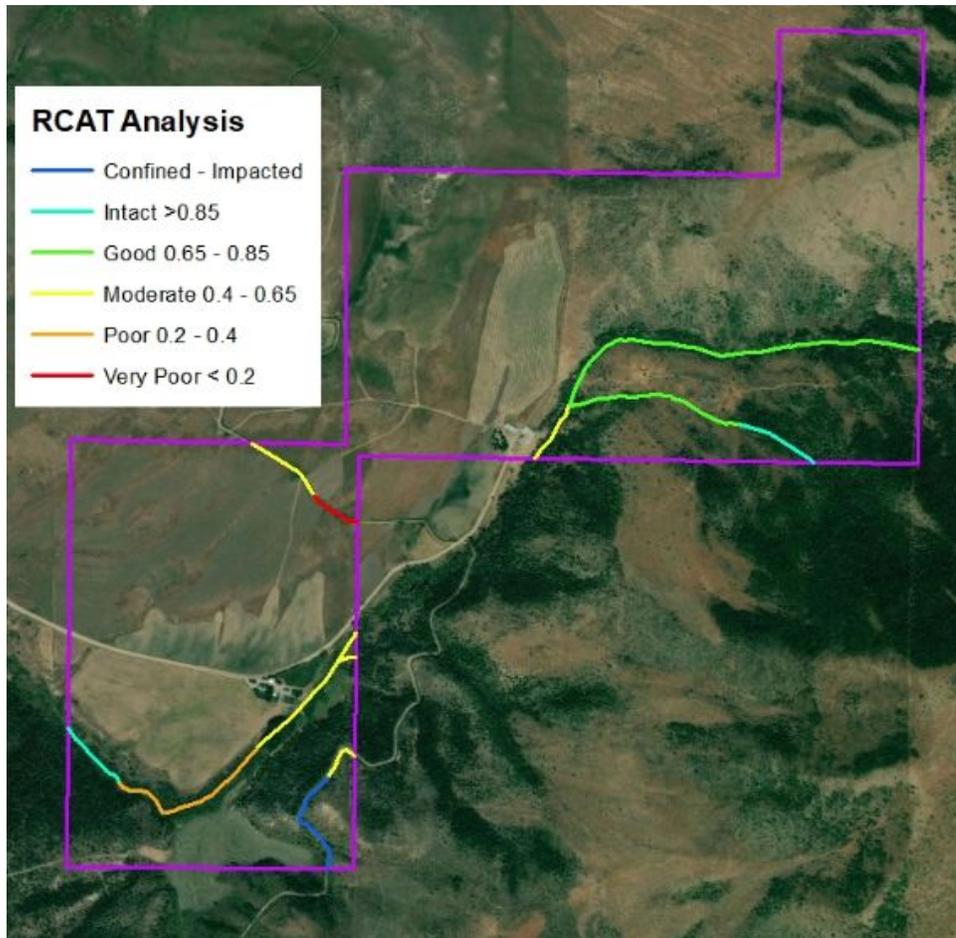


**Figure 2.** Copied from Figure 1 Bouwes et al. (2016b). Diagram demonstrates how beaver dam analogs promote geomorphic processes, fish habitat, riparian habitat, floodplain connectivity, and provide necessary needs for translocated beaver. Increased promotion of these characteristics is under the presumption that the stream is self-sustaining in accumulating woody debris or has continual beaver activity.

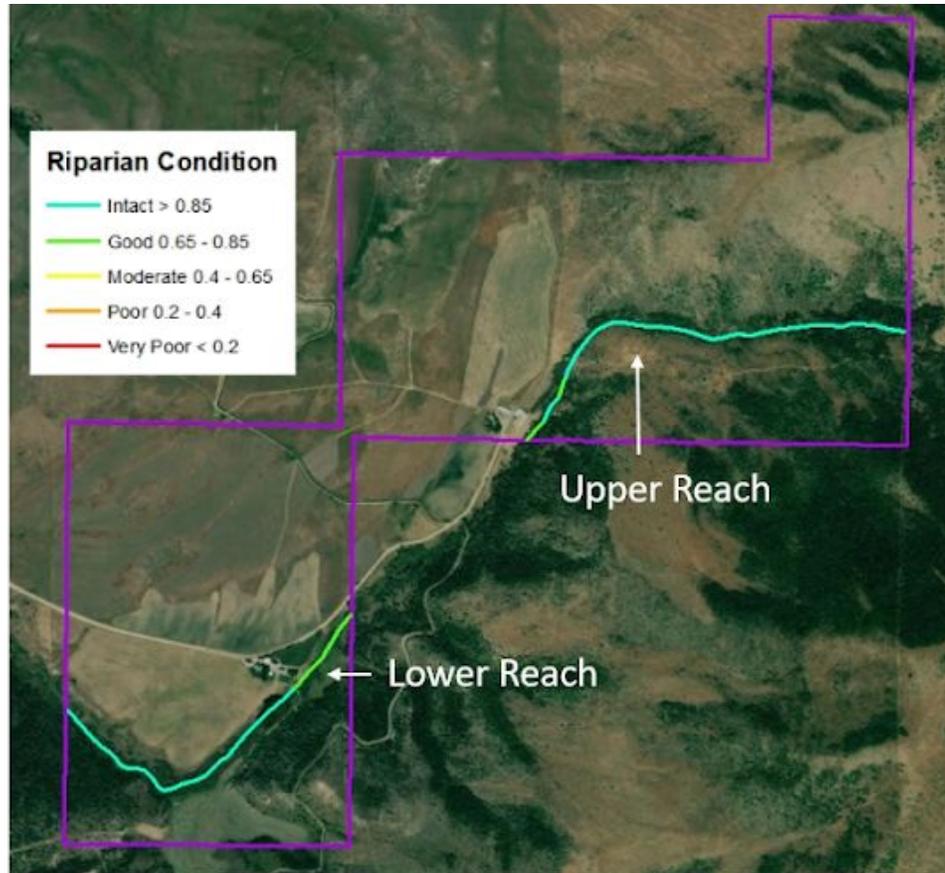
To determine the need for beaver dam analogs and woody debris structures, indicators of the environment need to be clearly assessed. 1) Determine the amount of riparian and nearby vegetation to the creek as an indicator of the creek being structurally starved and as good habitat for potential beaver introduction. 2) Determine the extent to which the creek can move throughout the reach based on the valley-bottom delineation so as not to impact structure, roads, or other property that may see overland flow, flooding, and beaver activity as a nuisance. 3) Based on the riparian condition, valley-bottom delineation, and assessment of nearby risks; determine the extent to which beaver activity is possible and where within the reach beaver dam building could occur.

## Structurally-Starved Creek

Figure 3 shows the boundary for Terry Westburg's property and the output for the RCAT (Riparian Condition Assessment Tool). The RCAT tool is used in ARCMAP to assess the valley bottom delineation and riparian vegetation to determine the current condition of riparian vegetation as it relates to the historic departure of riparian vegetation in that area (Macfarlane et al. 2017).



**Figure 3.** RCAT analysis of riparian vegetation on Station Creek. Categories show the condition of the riparian vegetation along the stream according to their color code (Macfarlane et al. 2018).



**Figure 4.** Changes to riparian condition assessment based on field observations. The project will be split into two reaches, upper and lower. The upper reach is .8 miles long, the lower reach is .67 miles long.

The upper reach of the Station Creek project is abundant in willows, dogwoods, and has a fair number of aspens which increase the farther upstream you go. The riparian corridor here has many standing trees and shrubs as well as fallen debris (figure 5) which is capable of being incorporated into the stream and be used for beaver dam building activity. The RCAT analysis showed moderate to good riparian condition but based on our field observations we have updated the riparian condition to good-intact (figure 4). This analysis of riparian condition is important and gives a clear indication of how much wood is available for the stream to use.

The lower reach is similar to the upper reach with an abundant amount of trees and shrubs throughout the riparian corridor. Willows and dogwoods are prevalent which would be good supporting debris for beaver dam building. Aspens, (beaver's preferred tree species) are sparse but large cottonwoods are prevalent which beaver's would make use of. Fallen debris (figure 5) is present and evidence of historic beaver activity is suggestive of a good to intact riparian condition which we have updated (figure 4).

Observing and understanding the riparian condition of plants along the stream is important for future success of helping the stream become self-sustaining in wood-accumulation

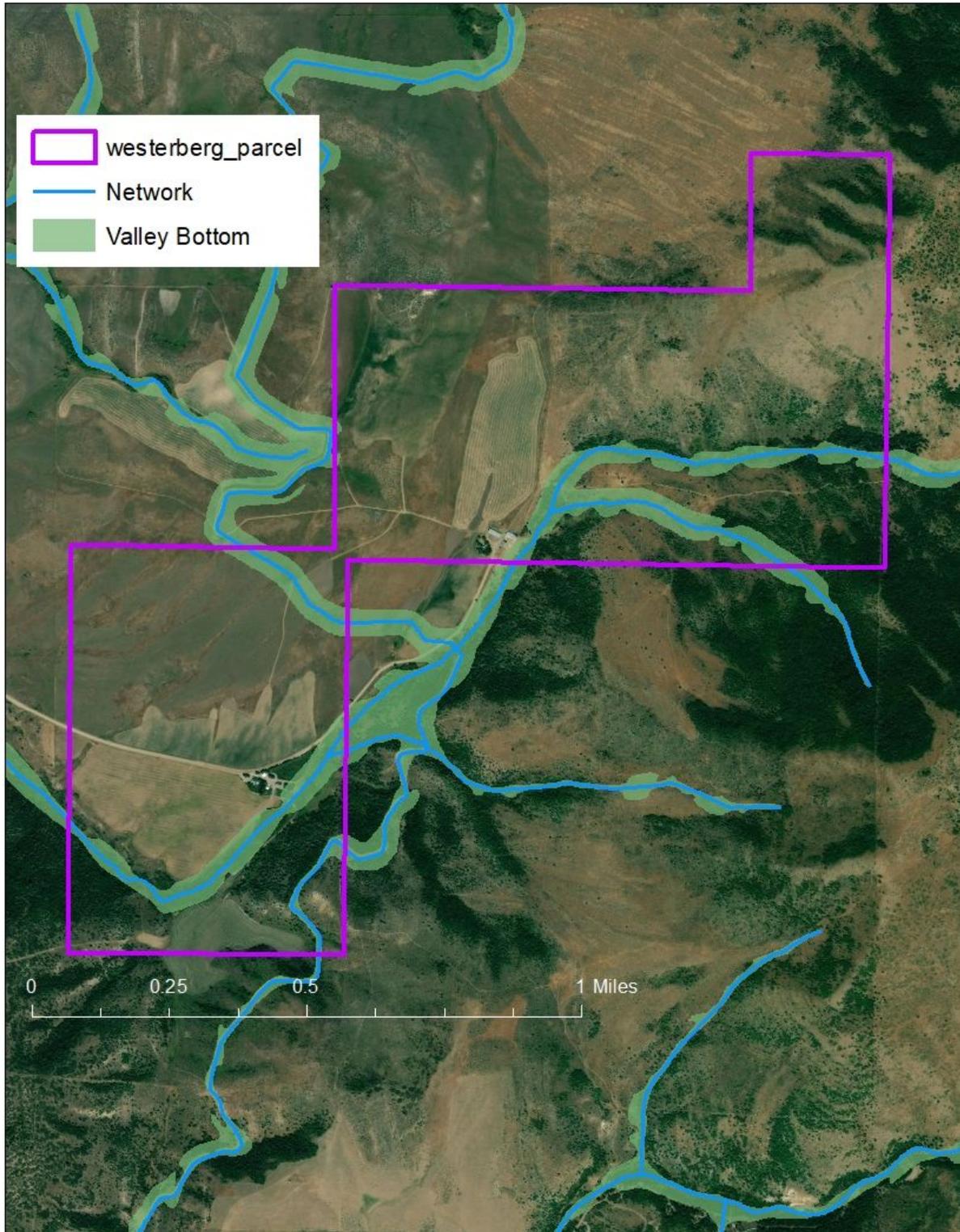
to increase habitat complexity. Woody debris and log jams accentuate the ponding of water, riffles, runs, and allow movement of water onto the floodplain. We would suggest that the project reaches are not structurally-starved and capable of supporting wood accumulation and beaver dam activity based on our field observations.



**Figure 5.** Examples of ground debris. Although woody debris on the ground was plentiful, most wood accumulation was inside the valley bottom but outside of the channel. Therefore, BDA and woody debris structures built within the channel would help jumpstart processes that accentuate flooding and give the stream access to this fallen debris (photo credit Justin Kilmer).

## Valley Bottom

Valley bottom delineation for the upper and lower reaches of Station Creek show the reach as mainly partly confined. The creek flows through an area with occasional steep banks on either side. Most of the available area for the river to meander and spread out will be possible in the lower reach but some wider use of the valley bottom is available in the upper reach. Delineation of the valley bottom gives a clear indication of how much room the creek has to move as wood accumulation or beaver dam building allows ponding and floodplain connectivity to occur.



**Figure 6.** Station Creek valley bottom delineation shows areas within the Westerberg property where the creek has an opportunity to move onto the floodplain and create multiple braided channels caused by BDA's and woody debris structures.

## Assessment of Risks

Based on the information from the assessment, all risks associated with the implementation of BDA's are assumed to be of low risk except for adjacent buildings, pasture, and cropland areas (figure 6). The nearness of grazing land is not expected to be a problem due to the steep hillsides that protect them from overland flows and flooding caused by large woody debris structures and beaver dam activity. The only risks that should cause some concern are the nearness of barns, structures, a culvert, and a 2-track road across the river (figure 20). Limited BDA and PALS building should occur in these areas in order to decrease flooding and the enticement of beavers to these specific areas.

<b>Areas Adjacent to Riverscape Land Use</b>	
Areas adjacent are in an undeveloped range or forest land setting	
Areas adjacent are in a crop, pasture, or hay land setting	X
Areas adjacent are in a developed setting	
<b>Valley Bottom Land Use (e.g., roads, bridges, culverts, buildings, diversions)</b>	
Valley bottom and adjacent area (up and downstream) does not contain infrastructure of concern	X
Valley bottom or adjacent area (up and downstream) contains some infrastructure, but would not be negatively impacted by processes of wood accumulation or beaver dam activity, or consequences of impact would be low	
Valley bottom or adjacent area (up and downstream) contains infrastructure that may be negatively impacted by low-tech structure failure and consequences would be unacceptable	
<b>Stream Order &amp; Wadeability</b>	
1st through 3rd order wadeable stream	X
3rd – 5th order wadeable stream	
5th order non-wadeable stream or greater	
<b>Channel Change and Floodplain Reconnection</b>	
Landowner/manager willing/able to give the stream space to adjust in the valley bottom and understands this may include lateral erosion, deposition, change of stream channel position, and inundation	X
Landowner/manager willing/able to give the stream space to adjust in some portions of the valley bottom but not all of it	
Landowner/manager unwilling/unable to give the stream space to adjust in the valley bottom	
<b>Willingness to allow processes of wood accumulation and/or beaver dam activity</b>	
Landowner/manager willing/able to allow dynamic processes & no concerns with nearby landowner/managers.	
Landowner/manager willing/able to allow some processes (but maybe not all) and/or concerns of or with nearby landowner/managers	X
Landowner/manager unwilling/unable to allow processes of wood accumulation and/or beaver dam activity	
<b>Adaptive Management</b>	
Landowner/manager understands multiple treatments through time may be needed and is committed to follow-up monitoring, maintenance, and adaptive management	X
Landowner/manager understands multiple treatments through time may be needed but resources to do follow-up may limit the ability to adjust or correct problems	
Landowner/manager wants a single intervention; no monitoring, maintenance, or adaptive management will occur	

Figure 6. Copied from Appendix 3D Bennett et al. (2019), ch. 3. Risk analysis sheet for Station Creek.

## Assessment of Conditions

### Geomorphic Condition

The geomorphic condition in this reach is overall good but there is room for improvements as the channel is not actively anastomosing. Current geomorphic condition within this reach contains some pools complemented with riffles but most of the reach

consists of channelized runs. Some BDA's were previously implemented last year within the lower reach and have accentuated bank erosion and lateral connectivity onto the floodplain( figure 7). These same BDA's have also created pools with connected riffles that have established diverse habitat types. These previously built BDA structures have the potential for additional treatments. Additional treatment implementations would be to raise the level of dams and extend dams laterally across the river channel where the stream is moving onto the floodplain.



**Figure 7.** Pictures of previously built BDA structures in the lower reach and accentuated geomorphic units (photo credits Justin Kilmer and Joe Wheaton).

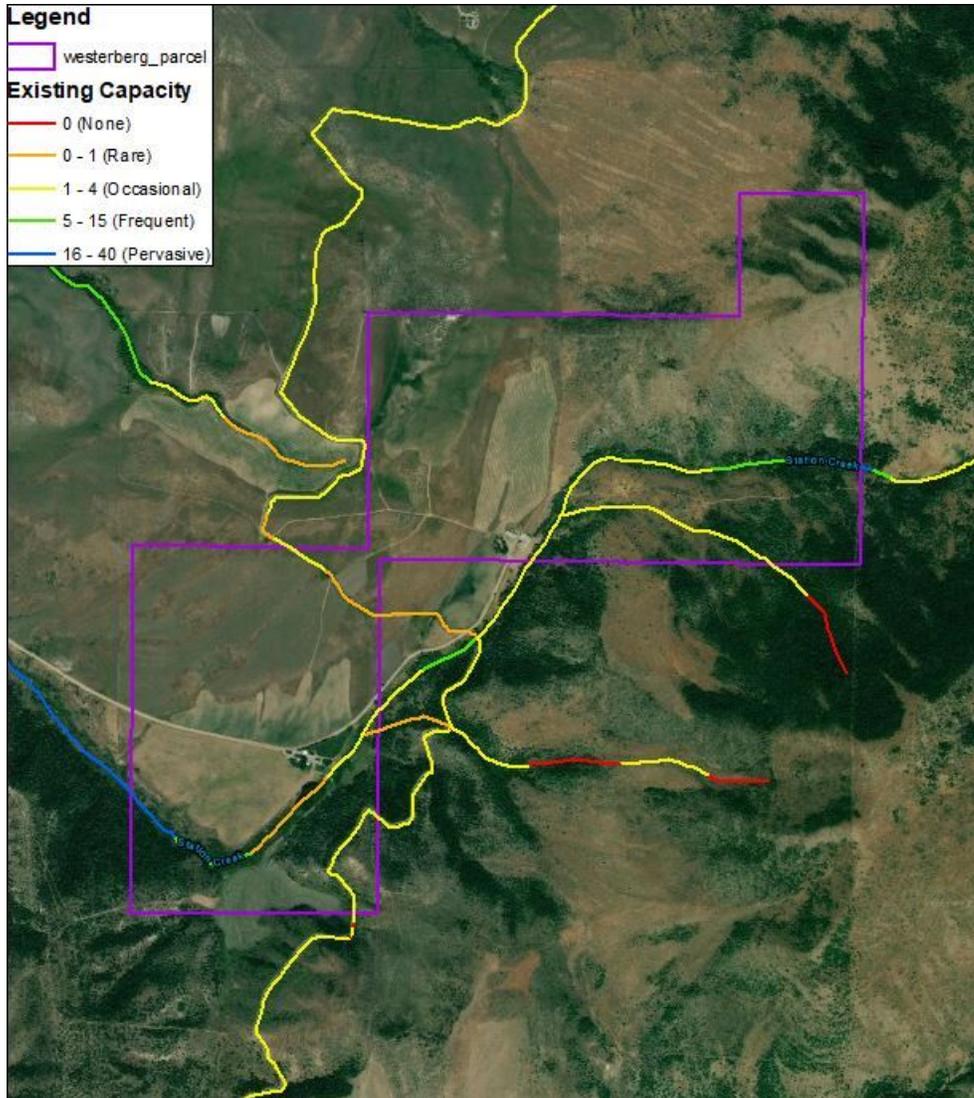
## Riparian Condition to Support Wood Accumulation

Riparian condition of the project reach on Station Creek is the vegetation that is present within the valley bottom where the creek channel runs. Condition was assessed using the RCAT tool and field observations to determine how much riparian vegetation is present, what kinds of vegetation are present, and the relative ability for wood accumulation to occur within the stream.

Based on our assessment, the riparian condition for both the upper and lower reaches is good to intact. Some fallen debris has already accumulated but may not be within the channel or the current floodplain and would therefore be unusable by the creek (figure 5). Therefore in the event that beaver are not introduced to Station Creek, the implementation of BDA's, woody debris structures, and even the addition of wood within the stream will be helpful in jumpstarting geomorphic processes that diversify and create better habitat for fish and other wildlife.

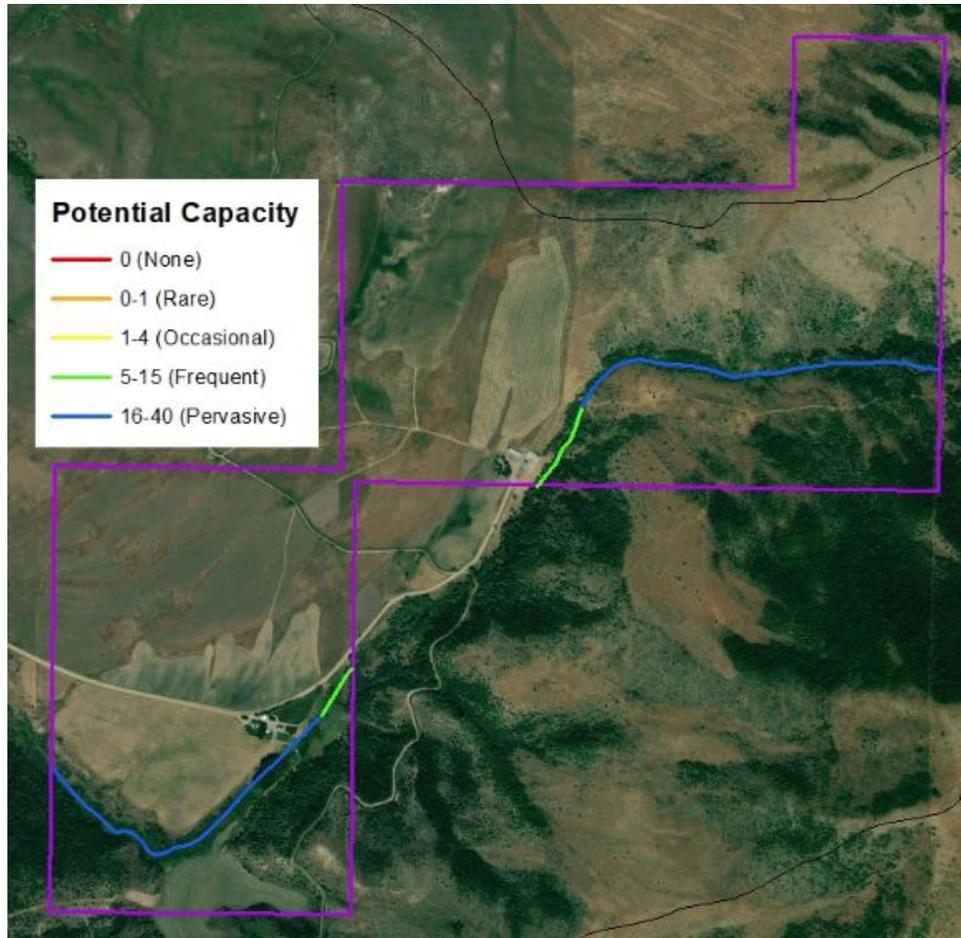
## Capacity to Support Beaver Dam Activity

The Beaver Restoration Assessment Tool (BRAT) allows for the analysis of important stream and landscape characteristics that are deemed important to the livelihood of beavers (Macfarlane et al. 2017). These characteristics range from nearest wood to channel depth, and ultimately result in a single output known as potential capacity. The BRAT outputs show that the existing capacity for the upper and lower reaches ranges from rare to occasional (figure 8).



**Figure 8.** Shows the existing capacity for dam building and beaver activity (Macfarlane et al. 2017).

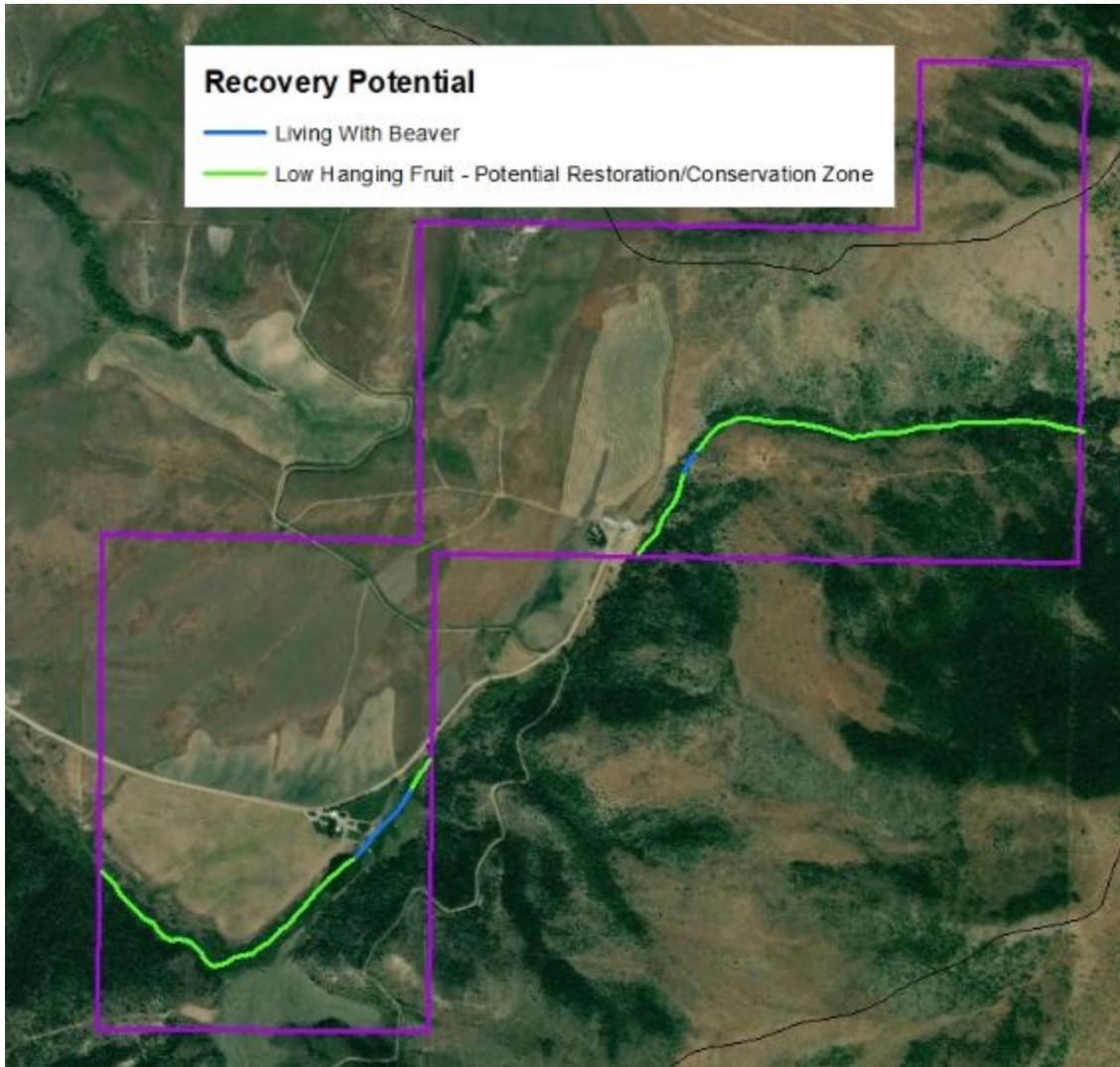
Based on field observations of riparian condition, valley-bottom delineation, and the assessment of risks associated with the Westerberg property; potential capacity was updated from rare-occasional to frequent-pervasive (figure 9).



**Figure 9.** Shows the potential for dam building and beaver activity.

## Recovery Potential

Based on the above analyses, recovery potential for this reach of Station Creek on Terry Westerberg's property is frequent-pervasive (Figure 9). Good riparian habitat, geographic isolation on the stream, wide valley bottoms for flooding and pond building, and the ability to cope with beaver are all characteristics that make this area welcoming for beaver and dam building activities. While some areas within the Westerberg property are caution areas for beaver dam building activity (culvert, canal, nearby structures, etc.), it has been made clear that the ability to cope and deal with nuisance problems is there (figure 10). The implementation of BDA's, PALS, and other woody debris structures to accentuate geomorphic units and overland flow caused by flooding will help reconnect the floodplain and enhance habitat for fish and other wildlife. The time frame associated with recovery of the area will depend largely on the ability to transplant beaver or not. If beaver come into the reach naturally or by anthropogenic means, the recovery time frame will be accentuated.



**Figure 10.** Beaver management based on BRAT analysis. Map shows potential areas where beaver translocation could occur easily and areas where living with beaver are noted. Living with beaver areas are places where beaver nuisance may occur and the willingness to deal with them will be necessary.

# Project Design

## Reach Locations and Complex Objectives

Objectives for the upper and lower reaches of Station Creek are similar. Most of the reasoning for the implementation of BDA's, woody debris structures, and the possible translocation of beaver into the area is to support lateral connectivity with the floodplain and ponding for fish habitat (figure 11). Larger ponds can be recreated in the upper reach where historic beaver dams currently exist (figure 12). In the lower reach, ponds are already accentuating with BDA and woody debris structures which were implemented in 2018 (figure 13).

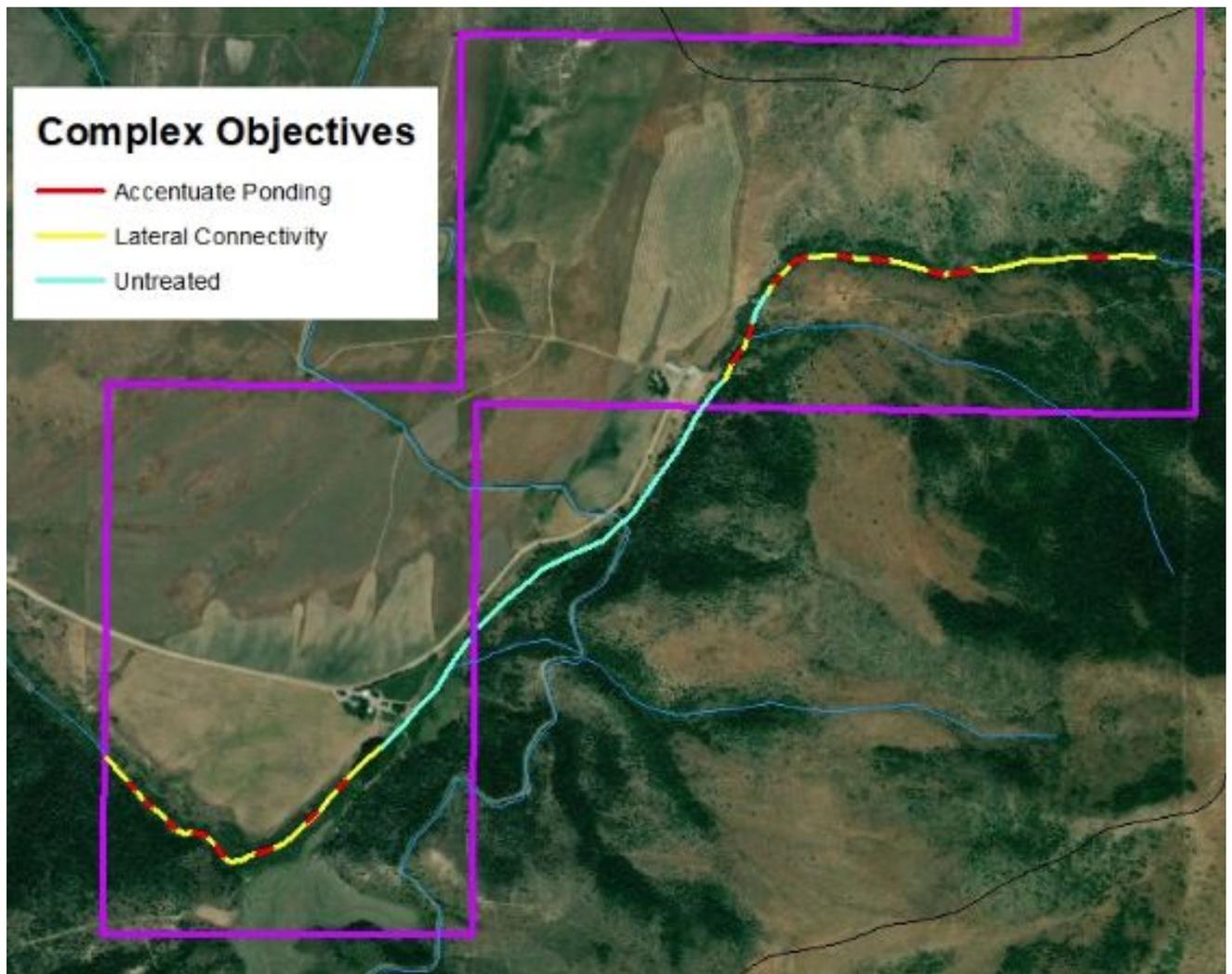
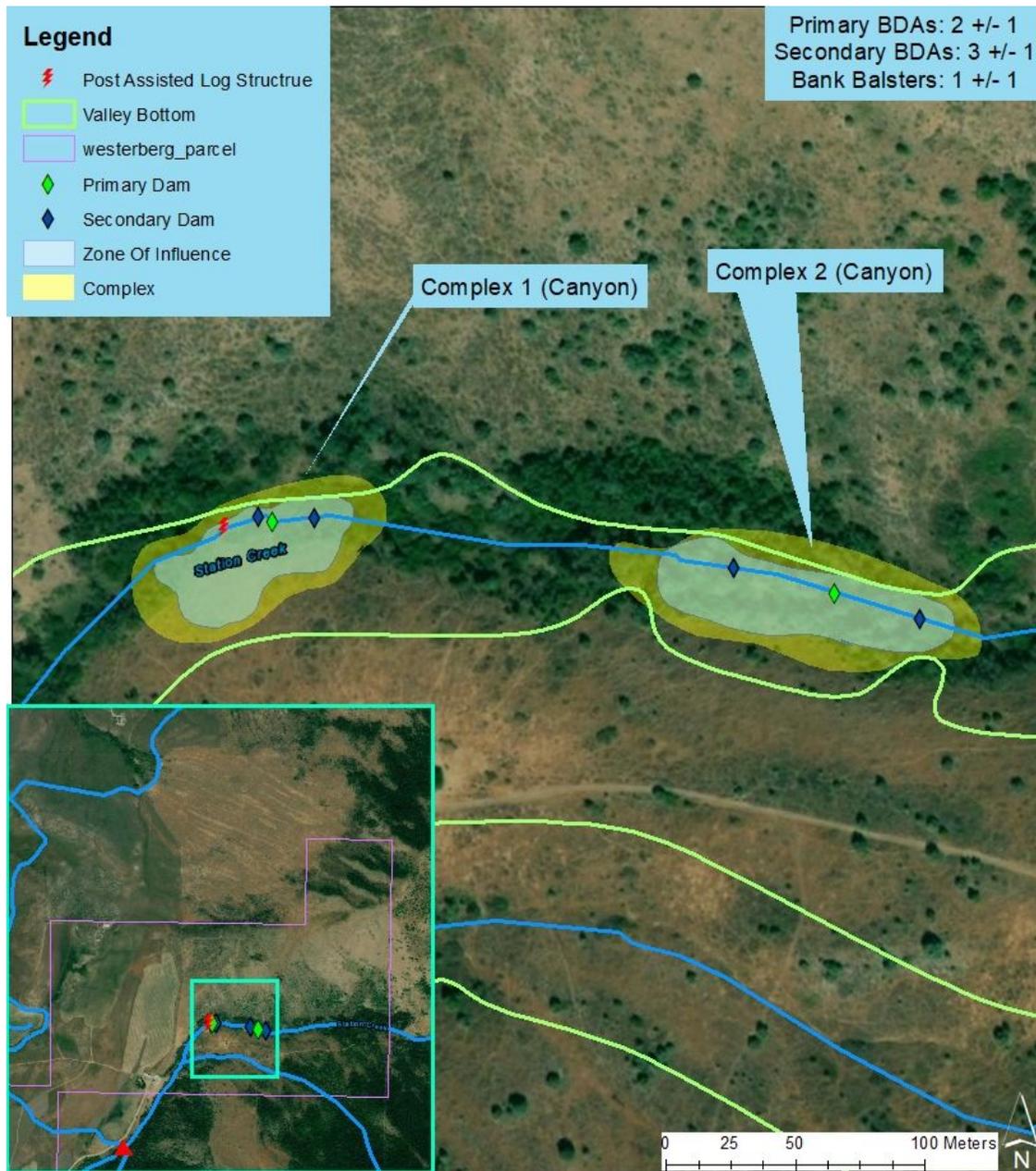


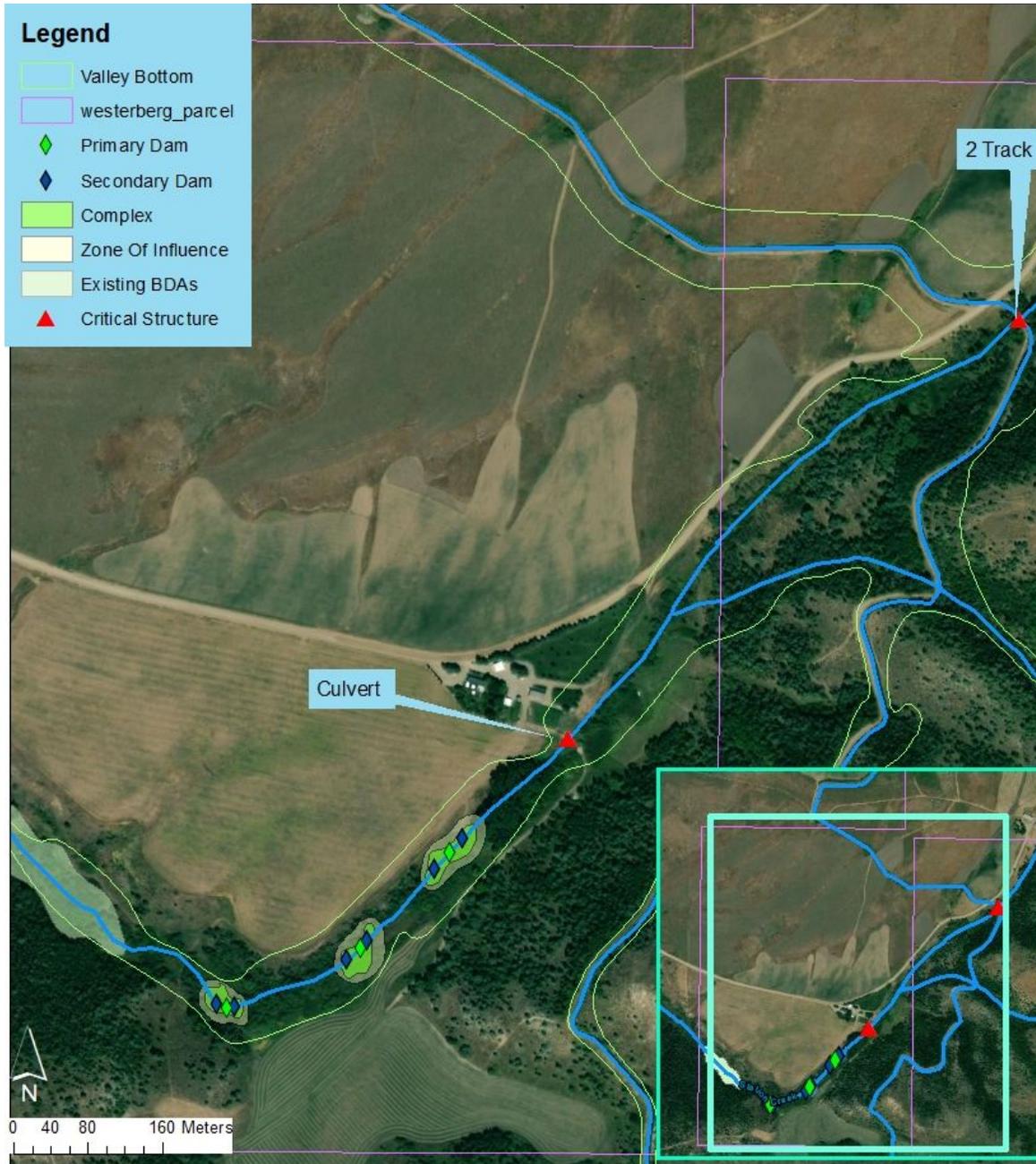
Figure 11. Complex objectives for Station Creek.



**Upper Reach**

The 2 upper complexes are under project by Canyon Aquatics. The complexes will consist of a series of primary and secondary dams.

Figure 12. Design for complex builds on the upper reach of Station Creek. The hydraulic zone of influence is an area which we expect ponding and flooding onto the floodplain to occur.



**Lower Reach**

The lower reach consists of 4 complexes as well as a zone of existing BDAs. There are 2 critical structures. One culvert that must be maintained as well as a 2 track river crossing.

**Figure 13.** Design for complex builds on the lower reach of Station Creek.

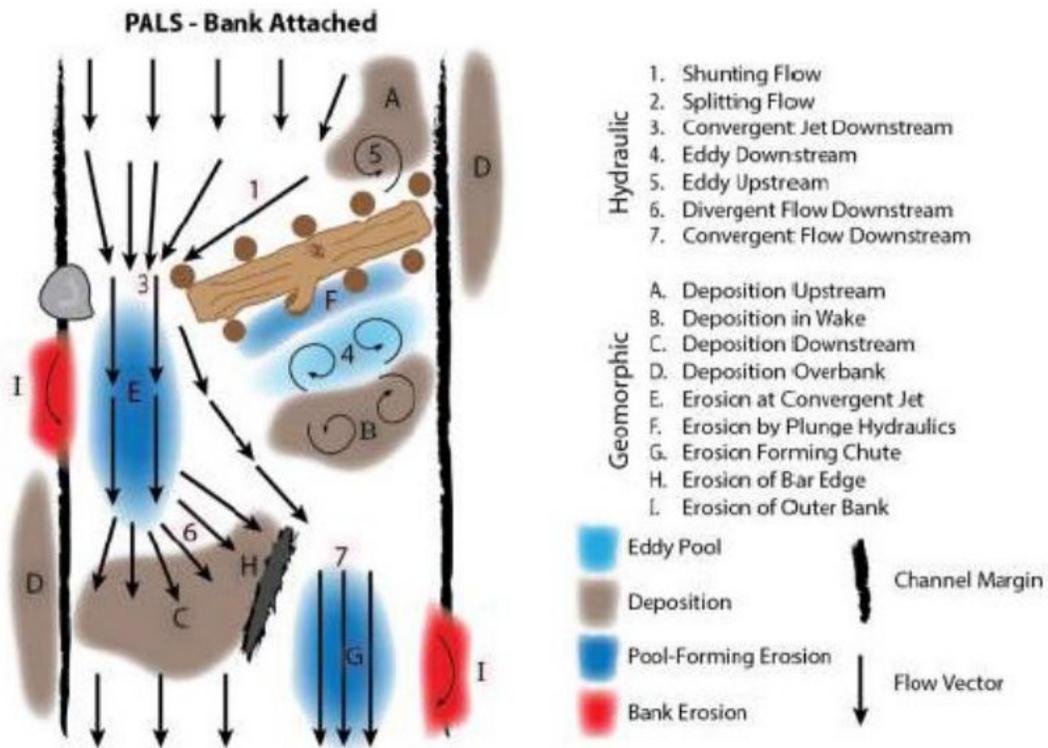
## Table of Intended Structures

**Table 1.** BDA and woody debris structures being built within Canyon's identified work zone.

<b>ID</b>	<b>Structure 1 (Canyon)</b>	<b>Structure 2 (Canyon)</b>
<b>Location</b>	42°10'19" N 111°43'52" W	Potential site upstream of structure 1
<b>Geomorphic Setting</b>	Wide valley, possibly historic dam, flow separates mid-channel by trees	Wide valley, flow separated by island occupied by trees.
<b>Geomorphic Condition</b>	Good	Good
<b>Complex Objective</b>	Create/expand pond	Locate and restore historic pond sites
<b>Complex Length (m)</b>	15	10
<b>Structure Count (#)</b>	3	3-4
<b>Structure Types</b>	BDAs	BDAs
<b>Description</b>	One primary BDA to plug channel at narrow point, two secondaries upstream to slow flow	If there is extra time, work upstream and locate historic sites

## Schematics of Design

Our plan includes mainly postless BDA's, but also prescribes bank structures aimed at directing flow at the banks to widen the channel (here termed "bank blasters") (Figure 13). Each of these types of structures will be built without posts due to distance of the sites from vehicle access and with deep snow (figure 15, 16). We selected locations to install bank blasters based on sections of the channel which were narrow, fast, and locked into place by vegetative roots. These are reaches where pools do not exist and beaver might be less likely to build in the current condition, but would be necessary to obtain objectives of lateral erosion to widen the channel and reconnect the floodplain (table 1).



**Figure 14.** Copied from Figure 3.5 Camp. R. (2015A). Bank blaster with associated legend shows a post assisted log structure (PALS) redirecting flow causing bank erosion and creating habitat features.

The locations of proposed complexes were selected with historic beaver ponds in mind (figure 12). Evidence including wide, flat valley bottoms, and channel incision through fine bed material indicated likely locations of previous beaver ponds. Reaches where Station Creek passes through flatter, wider valley bottoms present opportunities for more rapid recovery because the channel does not need to widen. Here, flows can more easily be slowed, and there is room for

pools to form. Where pools form and flow is disrupted by a BDA, there is also a chance for wood to get caught behind the structure.

The design elements described here will by themselves provide woody debris structure which the stream lacks in its current condition and provide a mechanism for the system to accumulate more woody debris naturally. They are also aimed at creating habitat more suitable to the survival of beaver in the event of future translocations or migrations.

Postless BDA Details

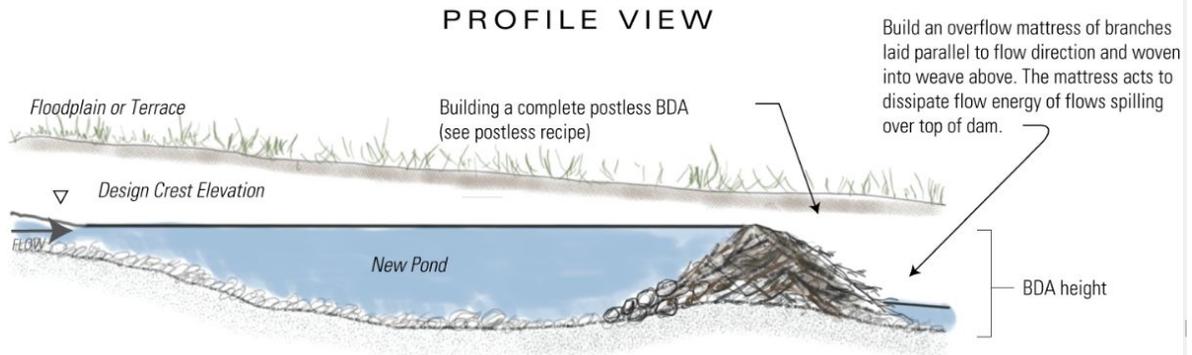


Figure 15. Postless BDA built with smaller sticks (Copied from Figure 30 Shahverdian et al. 2019, ch. 4).

Postless BDA with Key Pieces Details

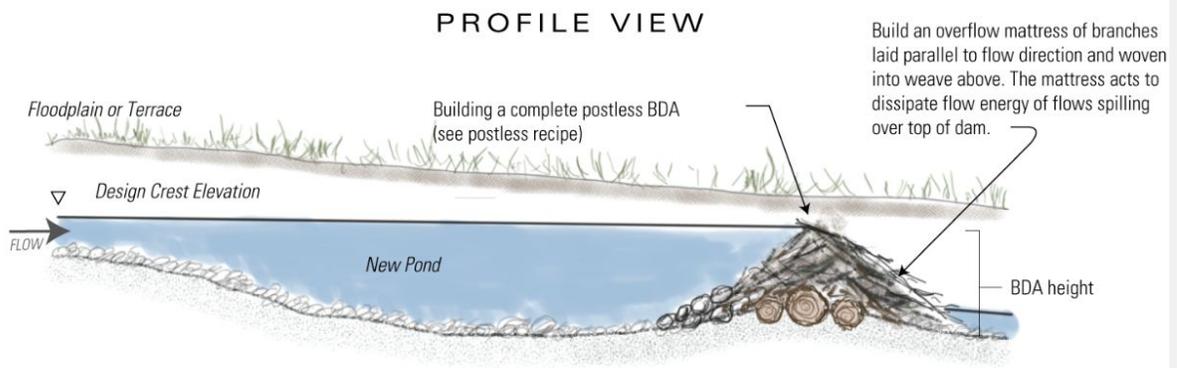
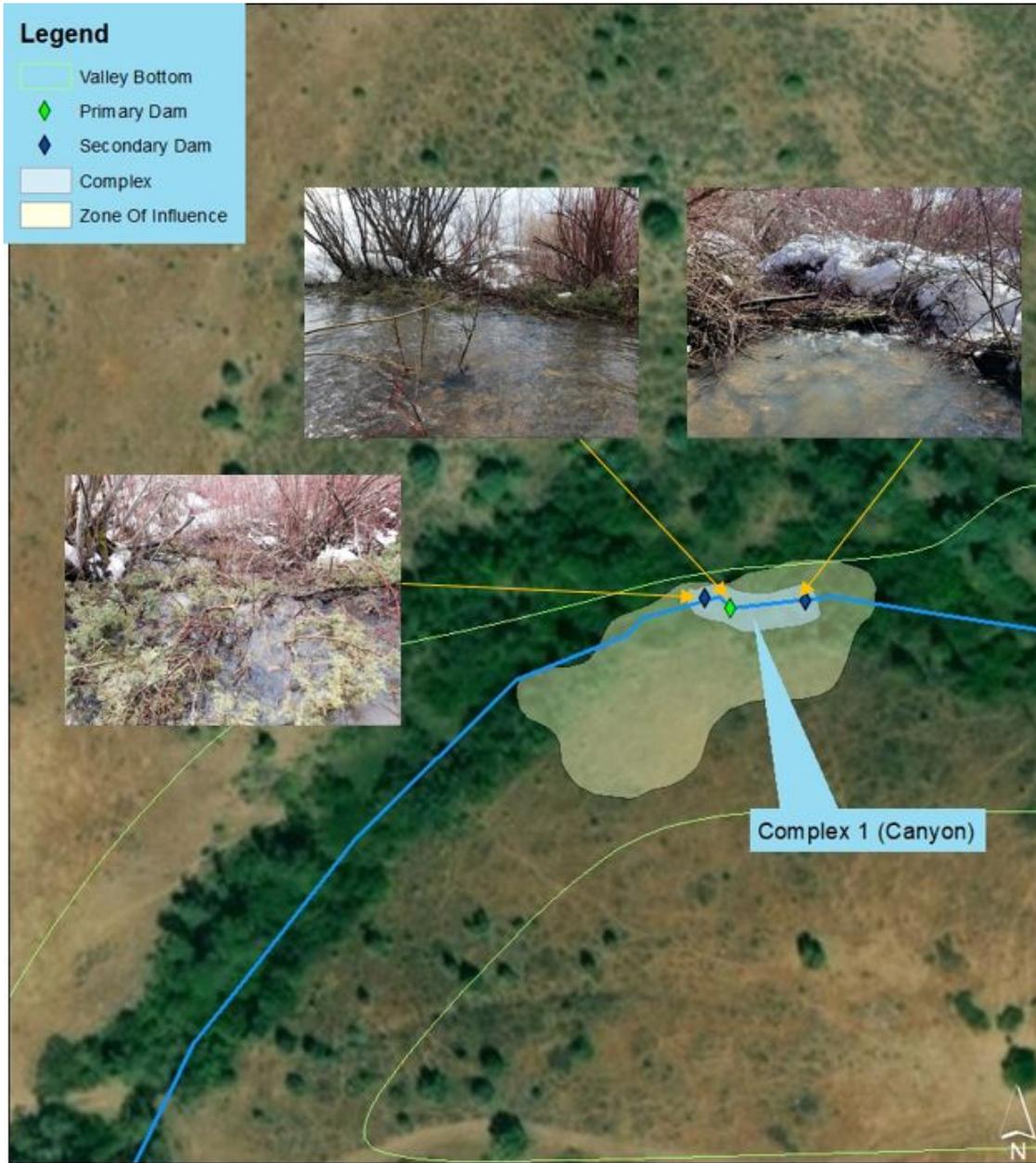


Figure 16. Postless BDA built with an extended mattress made out of larger materials (Copied from Figure 32 Shahverdian et al. 2019, ch. 4).

## Implementation

Due to time constraints, only one complex was able to be completed within Canyon’s implementation section of the upper reach on Station Creek. Postless BDA’s were built to increase ponding and erosion by spreading water laterally across the floodplain (figure 17).

Materials used included surrounding riparian vegetation consisting of willows, dogwoods, juniper boughs and a consistency of mud and rocks (figure 18).



**Upper Reach As Built**

The upper reach consists of 1 complex containing 1 primary BDA as well as 2 secondary BDAs.

**Figure 17.** As built map showing complex built by Canyon Aquatic Restoration Specialists.



**Figure 18:** Before (top) and after (bottom) photos of one constructed secondary BDA. Before woody debris structure, water flowed quickly and without restraint. After woody debris structure was implemented, water immediately began to pond behind structure. Expectation is that with beaver translocation to this area, management of this secondary dam will be improved and the depth of the pond will increase.

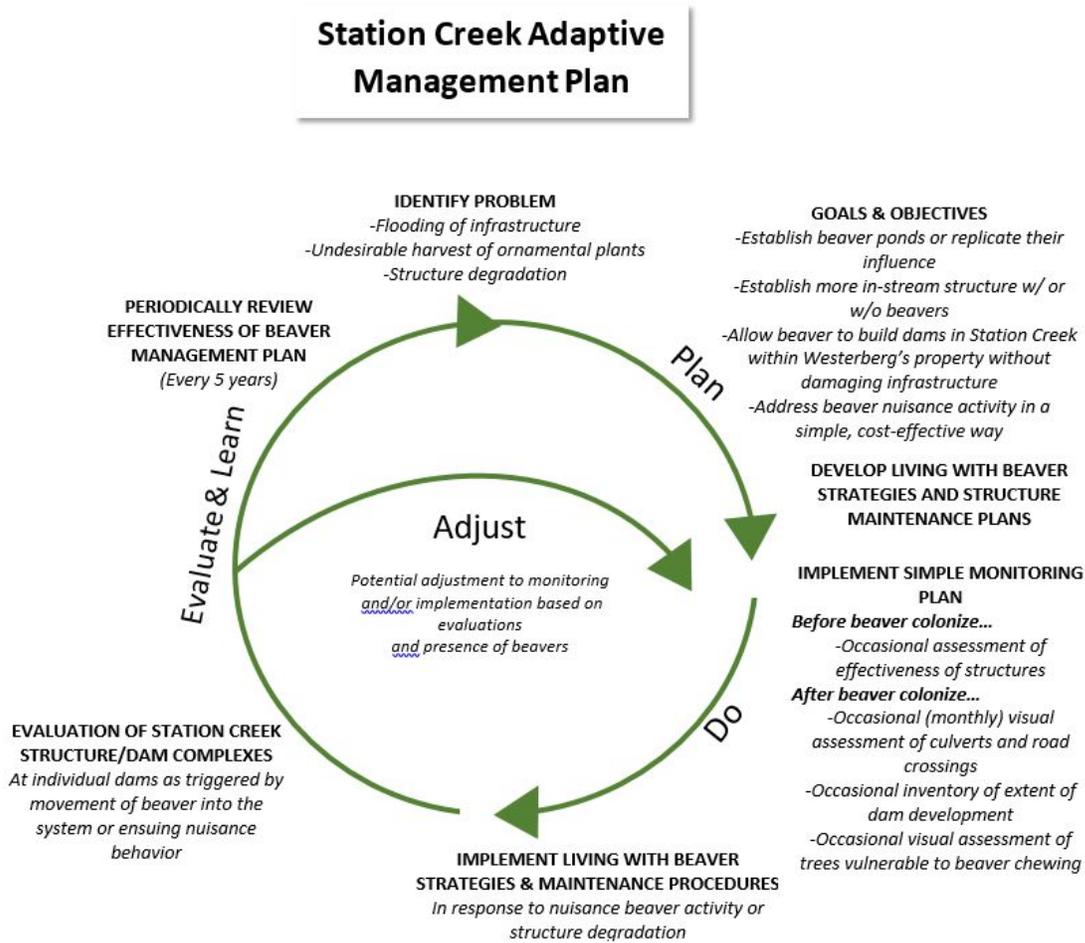
As a result of building these postless BDA structures, ponding depth of water and lateral flow of water onto the floodplain quickly occurred. Within a short amount of time, flowing water was barred from quickly advancing downstream and the depth of water increased from 3 inches to 10-12 inches with relation to the height of the BDA built. An important aspect to consider here is that one of the original objectives for this project was to create BDA structures which would enhance fish habitat including the formation of ponds. While ponding of water was an immediate focus and success for CARS (Canyon Aquatic Restoration Specialists) in the implementation area, we would like to be explicitly clear that the creation of these structures may help to jump-start geomorphic processes but are truly maintained and accelerated with the presence of beavers and dam building activity by them.

## Adaptive Management

Adaptive management of this project reach will be an important aspect of determining the success of the BDA implemented project. Much of the management will focus on hypothesized responses of implemented BDA's and possible responses to risks associated with beaver activity (figure 19).

## Hypothesized BDA Responses

Through the implementation of the BDAs we expect beaver activity to occur either naturally, by beaver migration, or by the translocation of beaver into the area. We hypothesize that beaver will continue to expand BDA's making them larger as well as build lodges on the primary BDA's. We expect that the BDA's will create ponding and more lateral flow connecting the floodplain and creating diverse habitat for fish and other wildlife.



**Figure 19.** Adapted from figure 11, Portugal et al. (2015). Adaptive management plan for Station Creek. This plan focuses on adapting to the absence or presence of beavers, dictated both by permission from Idaho Fish and Game as well as how quickly or slowly beavers establish. For example, if beavers don’t start building dams for three years, the way Station Creek restoration is managed will be different before and after beavers begin building dams independently. Some structure maintenance or addition may be required.

Monitoring of the site will occur by observation on a monthly time scale. Each complex should be reviewed for any beaver activity, breaches, and geomorphic processes that are occurring. Based on monitoring, BDA structures may need to be removed, improved, or increased throughout the reach depending on cost, hypothesized responses of new BDA structures, and possible threats that may be occurring to buildings or property.

Scenarios of adaptive management strategies include:

Absence of beaver being translocated: If beaver are not translocated into the reach then management may be focused on increasing the amount of woody debris within the stream channel itself. Implemented BDA’s have been designed and built to accentuate ponding and overland flow increasing the complexity of the habitat which would be beneficial for fish and

other wildlife. This would also slow the flow of water thereby allowing water to flow across the Westerberg property longer throughout the year. Additional structures may need to be built or woody debris increased in the channel in order to allow the creek to naturally form log jams creating different complex habitat types depending on cost and current productivity of implemented BDA's. If the situation does not warrant additional treatments or if multi-channeled, long term stream complexity does not seem possible based on observations, the decision to abandon any future work may also be necessary.

In the event beaver are translocated: If beaver are introduced to the project reach, visual monitoring on a monthly scale will be important. Observations should be made around the beaver release site, other BDA's, and risk areas to beaver dam building activity including the culvert, near structures, the two-track road, and the canal. In the case that beaver activity is a nuisance in the risk areas, the use of a beaver deterrent or beaver deceiver may need to be assessed (Figures 21, 22). In an extreme case, the removal of beaver by trapping may be necessary to alleviate any flooding concerns or damage to property.

## Potential Threats to Infrastructure & Property

- Ornamental trees on property

Beavers have the capacity to migrate and use available vegetation for dam building. There is a possibility that beaver could cut down ornamental trees that are within 100 meters of the stream. It is not likely that they will venture onto the homeowners property given that there is plenty of riparian vegetation by the river. However, it is advised to keep an eye on the trees you would like preserved and be ready to respond if signs of beaver activity appear.

- Clogging culverts

Culverts are narrow tube channels that allow water to flow under a roadway. Culverts are enticing to beavers to block given their small size and fast flow. Obviously this is a concern because we do not want to culvert to be blocked and flood the road.

- Flooding the road

In addition to blocking culverts, beavers building dams close to the road poses a flooding threat to the road.

- Beaver activity within the canal

A canal runs across the state trust lands between Terry Westerberg's property that sources water for irrigation downstream. Some concern is necessary for the possible translocation of beaver that they may build dams within the canal blocking water flow and causing flooding from the canal.

- Property and structure damage from flooding

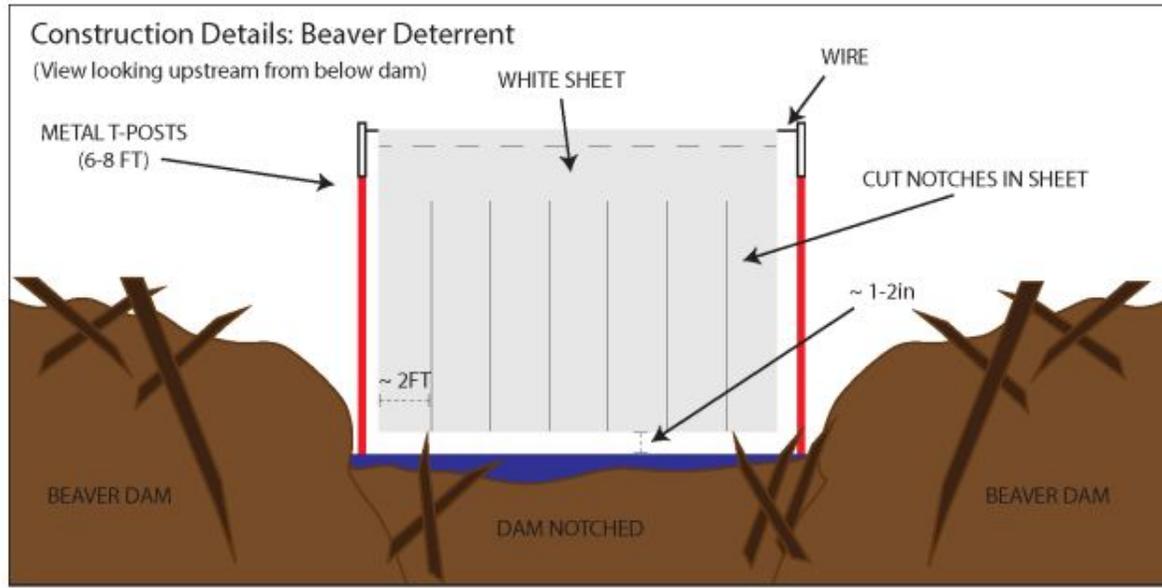
In the case that beaver are translocated to the area, dam building may threaten property and structures that are near the river. In any case possible, the building of BDA's or any other woody debris structures should not occur within the areas near buildings in order to keep beaver from inhabiting these areas.



**Figure 20.** Example areas where beaver activity will cause disturbance. Pictures from left to right, property and structures, culverts, and road crossings that may be threatened by beaver activity( photo credits: left-Audree Provard, middle-Joe Wheaton, and right-Peter Wilcock).

## Management Responses

Below are some management options in response to negative beaver activity. A beaver deterrent is a way of deterring beaver from any further building in that area. An example (figure 21) shows the use of a sheet to deter beaver from continuing the construction of their dam using a low expense method. One of the biggest difficulties with the current translocation of beaver to Station Creek is the worry of a far-away downstream of beaver activity causing problems on their property. In the case that beaver do get moved to Station Creek and cause a nuisance much farther downstream to this neighbor, a beaver deterrent may be the first line of defense to keep beaver off of this neighbor's property. If this does not work, possible trapping of beaver near this neighbor's property should be considered to alleviate any nuisance problems.

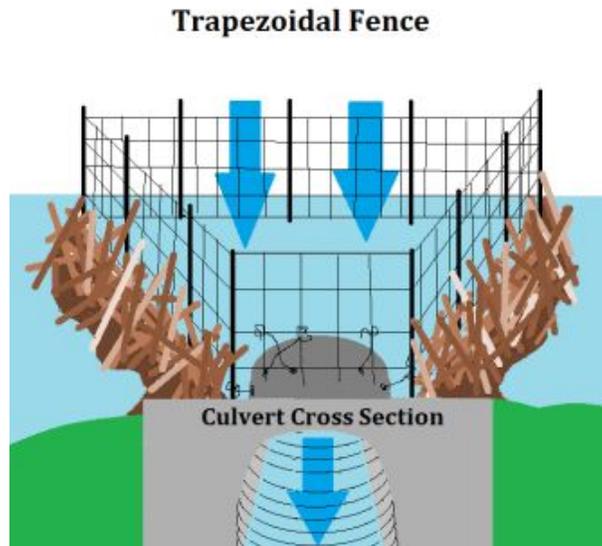


#### Construction Notes

1. Notch dam to desired pond level height.
2. Pound 6-8 ft. metal fenceposts just upstream of dam notch. Fencepost length depends on depth of pond/height of dam)
3. Attach 11-gauge or baling wire between the tops of fenceposts.
4. Affix white sheet or Tyvek house wrap to wire between fenceposts ~1-2 inches above pond water level. Clamps, clothespins, or sewing a sleeve can all be used to attach the sheet to wire.
5. Cut slits into the sheet spaced ~ 2ft.

**Figure 21.** Construction Details of a Beaver Deterrent (Figure copied from Figure 13 Portugal et al. 2015).

A beaver deceiver is built to keep beaver from entering near culverts or other openings in order to prevent them from building dams and causing blockages. In the case that a beaver deceiver is built, occasional management will be necessary as beaver are known to build dams along the outside cage (figure 22). A culvert currently exists on Terry Westerberg's property and may be the victim of beaver dam building. In order to prevent this from occurring, a beaver deceiver should be considered as an option for living with beaver.



**Figure 22:** Basic model of a beaver deceiver (Parks, n.d.). Fencing keeps beaver from entering and building dams in or just outside of the culvert, thereby blocking flow of the water. Management of a beaver deceiver is necessary as beaver will likely pile up woody debris outside the fencing as shown above.

## Conclusion

Beaver dam analogs built by Canyon Aquatic Restoration Specialists are expected to enhance riparian habitat, connect with the floodplain, and increase geomorphic units that increase fish habitat within the creek. BDAs and other woody debris structures have been built to mainly support an increase in large ponds with the expectation that beaver may migrate or be translocated within the reach in the near future. In the case that beaver are not translocated into Station Creek, additional treatments of increased BDAs and woody debris structures may be necessary to promote ponding and initiate geomorphic changes.

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