

Upper Oregon Creek Restoration Project Final Report



Prepared for:

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)



May 2024

Prepared by:

BIG HOLE WATERSHED COMMITTEE (BHWC)



IN APPRECIATION

This project is the work of many hands over many years. With persuasion and perseverance, this project marched forward from early concepts in 2020 to completion in 2023. The results are attributed to the funding of both merit-based and generous sponsors, the commitment of the individuals representing the partners developing and completing the work, the quality and commitment of our outstanding contractors, and the support of the community, including many conservation organizations and groups.

A sincere thank you to those involved in the partnership effort that brought this project to completion in the name of conservation of water and habitat. The restored ecosystem of Upper Oregon Creek will benefit the land and people of the Big Hole River long into the future.

THANK YOU TO:

Montana Fish, Wildlife and Parks

Jim Olsen, Fisheries Biologist

Vanna Boccadori, Wildlife Biologist

Montana Department of Environmental Quality

Eric Trum, Water Restoration Specialist

Stephen Carpenedo, Senior Wetland Specialist

Natural Resource Damage Program

Ray Vinkey, Environmental Scientist

Trout and Salmon Foundation

David James



Contents

Executive Summary	5
Background	6
Project Location	6
History of Project Area	7
Regulatory Framework and Superfund Jurisdiction	7
Project Significance	8
Project Goals	9
Project Activities	11
Task 1 – Project Planning	11
Task 2 – Landowner Agreements, Operation and Maintenance	12
Task 3- Monitoring and Project Effectiveness	13
Before and After Photos	14
Quantification of Sediment Load Reductions	17
Normalized Difference Vegetation Index (NDVI) Readings	18
Task 4- Project Implementation	20
Task 4- Outreach and Education	36
Task 6- Project Administration	37
Partners	38
Contractors	38
Volunteers	38
Complications	39
Recommendations	39
Deliverables	40
Finances	43
Funding Sources for Project	43
Conclusions	44
Attachments	44

Figures

Figure 1. Big Hole River Watershed and project area (red star)	6
Figure 2. Upland conditions prior to the project.	7
Figure 3. Upper Oregon Creek project photo point locations with correlating pre-implementation photos.	15
Figure 4. Upper Oregon Creek photo point 8 before and after photo series.	15
Figure 5. Upper Oregon Creek photo point 9 before and after photo series.	16
Figure 6. 2022 satellite imagery (top) compared to 2023 satellite imagery (bottom) displays the success of the vegetation treatments implemented with this project.	16
Figure 7. BHWC intern measuring captured sediment behind 3 different gully check structures	17
Figure 8. NDVI Time-Series of Oregon Cr. Upland Polygon	18
Figure 9. 2019 NDVI Image Upper Oregon	19
Figure 10. 2023 NDVI Image Upper Oregon	19
Figure 11. Change in NDVI 2019-2024	19
Figure 12. Heli Works 2022 fertilizer (black) and seed (green) exact flight paths	21
Figure 13. 2022 Upper Oregon Creek Treatments	23
Figure 14. 2023 Upper Oregon Creek Treatments	24

Tables

Table 1. Project Scope	9
Table 2. NDVI Values 2019-2023	18
Table 3. Summary of all project implementation treatments	25
Table 4. Project Implementation Photos	26
Table 5. Task 1- Project Planning: Deliverables	40
Table 6. Task 2- Landowner Agreements, Operation and Maintenance: Deliverables	40
Table 7. Task 3- Project Effectiveness Monitoring: Deliverables	41
Table 8. Task 4- Project Implementation: Deliverables	41
Table 9. Task 5- Education and Outreach: Deliverables	42
Table 10. Task 6. Project Administration: Deliverables	42
Table 11. Project Funding Summary	43
Table 12. DEQ Program Grant #221022 Finances	43

Executive Summary

Since 2014, the Big Hole Watershed Committee (BHWC) has invested significant time and energy into the French Creek drainage, a major tributary to the Big Hole River. Restoration projects in adjacent tributaries (Oregon Creek) and the nearby Superfund site have all worked toward the common goals to reduce sediment, improve habitat, and support native fish refugia. From 2020-2023, BHWC implemented the Upper Oregon Creek Restoration Project to address mining and logging-related damages to the upper reach of Oregon Creek. The project was an extension of BHWC's many years of involvement of remedy and restoration on the Mount Haggin Injured Area (RDU 15) of the Anaconda Superfund site, under the Natural Resource Damage Program (NRDP), amalgamating many years' worth of adaptive management techniques under one project.

This project was designed to improve water quality by reducing sediment loading from upland erosion, improve riparian habitat and vegetation conditions, and remove a fish passage barrier in the headwater reaches of Oregon Creek.

The project objectives were to:

1. Capture sediment on the floodplain and in the stream channel.
2. Detain sediment in 15 active gully networks.
3. Establish vegetation on 25 acres of upland slopes to prevent sheet erosion.
4. Reconnect 11 acres of floodplain to surface water.
5. Remove a failed culvert, impeding fish passage to approximately .5 miles of Oregon Creek headwaters

The project achieved several resource improvements, including improving water quality by reducing upland sediment entering Oregon Creek, creating conditions for self-perpetuating vegetative growth and soil formation processes in the uplands, expanded riparian and wetland buffers to retain sediment on the landscape and fully connected the stream for optimal fish passage and stream connectivity.

Major project accomplishments include:

- Installation and maintenance of 123 in-stream structures (beaver dam analogs (BDAs)/post-assisted log structures (PALS)) to capture sediment in the channel and on the floodplain.
- Installation and maintenance of 74 gully check dams and 18 gully slash filters in the gully networks to capture eroding upland sediment.
- Approximately 600 ft of straightened and incised channel filled in and re-established to reconnect 11 acres of floodplain ("Stage 0" component).
- 25 bare and eroding acres revegetated (seeded) and fertilized by hand and by helicopter.
- Removal of a failed culvert, reconnecting approximately .5 miles of Oregon Creek headwaters.
- 30 acres of aspen enhancement and 8,300 linear feet of gullies filled with slash and wood.

Project monitoring has demonstrated qualitative and quantitative improvements in the resource. Gully check structures captured 43 tons of sediment in the first year after implementation and have an installed capacity of another 27 tons. Upland vegetation cover on bare slopes increased and Oregon Creek's lower reach is no longer channelized.

The project manager for the restoration work was the BHWC. The BHWC is a multi-stakeholder, locally-led watershed group that supports water, wildlife, and people for the Big Hole River. In 2021, the BHWC was awarded 319 project funding by the Montana Department of Environmental Quality (DEQ) for this project. The project was in partnership with Montana Fish, Wildlife and Parks (MFWP), NRDP, and the Trout and Salmon Foundation.

The total project cost was **\$238,819.16**.

Background

Project Location

Oregon Creek is a headwater tributary of California Creek, which flows into French Creek, and then into Deep Creek, which then feeds into the Big Hole River upstream of Dickie Bridge. The Upper Oregon Creek Restoration Project is located in Deer Lodge County, Montana, approximately 12 miles southwest of the city of Anaconda (Figure 1). The project site is located on MFWP property within the Mount Haggin Wildlife Management Area (WMA), an area that experienced heavy mining and logging pressure from the mid-1800s to the mid-1900s. The area is bounded by the Beaverhead-Deer Lodge National Forests. The latitude and longitude of the upper extent of the project is 46.0180, -113.0105. The latitude and longitude of the lower extent of the project is 45.9988, -112.9980.

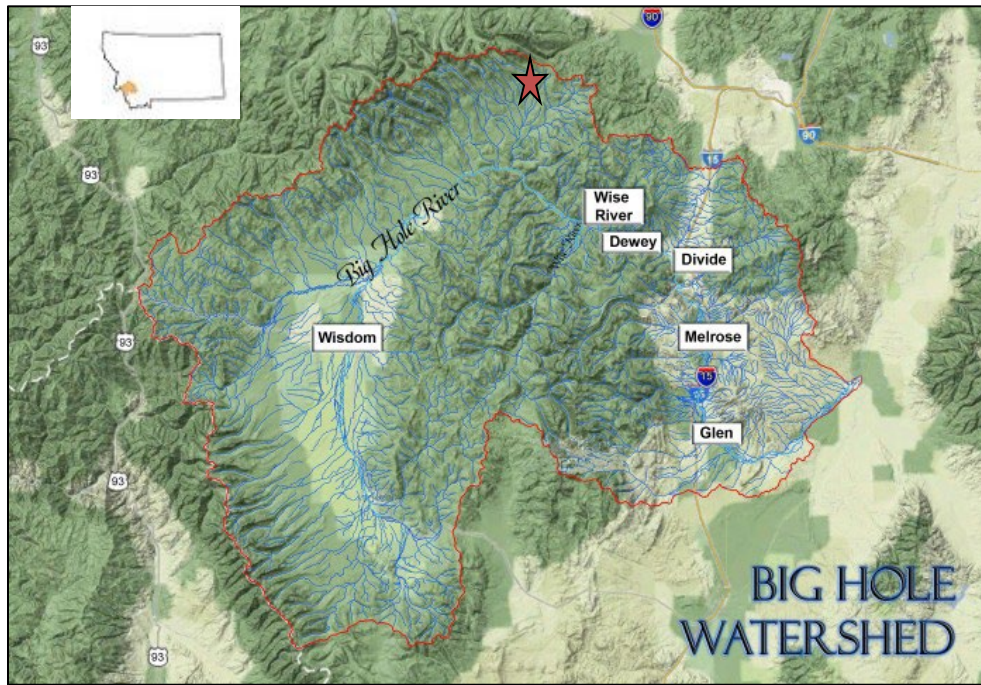


Figure 1. Big Hole River Watershed and project area (red star)

History of Project Area

Oregon Creek is a headwater tributary to the Big Hole River on the Continental Divide (Big Hole River < Deep Creek < French Creek < California Creek < Oregon Creek) and is within the state-owned Mount Haggin Wildlife Management Area (WMA). The area has an extensive history of mining related disturbance. Aerial emissions from smelting activities in Anaconda deposited heavy metals (e.g. Copper, Arsenic, Cadmium, Lead and Zinc) on nearby mountains that killed upland vegetation and, together with intensive logging to fuel the smelters, removed a vast majority of the vegetation community from the upper extents of the WMA. Devoid of vegetation, large areas developed extensive networks of rills and large gullies during heavy rain events, most severely in areas with geologic parent material of highly erodible volcanic tuff (Figure 2). These erosive processes persisted on 25 acres of uplands in the upper reaches of Oregon Creek, contributing annual plumes of fine sediment into the creek and eventually into the Big Hole River. These acres were purchased by MFWP in 2020 and added to the WMA.



Figure 2. Upland conditions prior to the project.

Regulatory Farmwork and Superfund Jurisdiction

Oregon Creek (MT41D003_080) is listed by the Montana DEQ as impaired for sedimentation/siltation, Arsenic, Copper, Lead, anthropogenic/physical substrate alterations, and alterations in streamside cover. This area is currently the highest priority watershed in the BHWC Middle/Lower Big Hole WRP, and this upper Oregon Creek sediment source was the last known major source of sediment to the system.

With the acquisition of this parcel in 2020, management responsibilities for the area containing the Upper Oregon Creek project transferred to the State of Montana. Exhibiting degraded conditions similar to those being addressed under existing Superfund responsibilities and work plans, this Upper Oregon Creek project area was added to the purview of NRDP remedy and restoration activities in January, 2022. This transfer of responsibility was accomplished after consultation with the Environmental Protection Agency (EPA) and with the submission of an Addendum to the NRDPs 2018 Remedy and Restoration Work Plan, the EPA-sanctioned document outlining the scope of activities under this Superfund unit.

A Consent Decree (CD) was filed in federal court between the State of Montana, the United States, and Atlantic Richfield company in 2008. As part of the CD settlement, the Natural Resource Damage Program agreed to perform remedy and restoration actions on State-owned properties, including the WMA. From 2010 to the present, NRDP has performed remedial and restoration actions throughout the WMA, which is included in EPA's designated Surface Water Evaluation Area. NRDP has completed work plans for the remedy in this area, which have been approved by EPA in consultation with DEQ. EPA has agreed that the work NRDP will perform in Oregon Creek is remedial action. Therefore, the work planned for this Upper Oregon Creek

project will adhere to CERCLA cleanup standards (42 U.S.C. 9621). Specifically, this means that state permits are not required as articulated in CERCLA Section 121(e) (42 U.S.C. 9621(e)):

"(e) PERMITS AND ENFORCEMENT. —(1) No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with this section."

Project Significance

This project is a critical piece of a larger initiative by MFWP to establish a native fish stronghold for Westslope Cutthroat trout and Arctic grayling over 40 miles of headwater tributaries. The substantial sediment reductions and habitat improvements from this project will support the success of these native fish.

In August 2019, MFWP completed construction of a fish passage barrier downstream of the Oregon Creek project (Phase 1) on French Creek. Phase 2 consisted of the removal of nonnative trout and introduction of native Westslope Cutthroat trout and Arctic grayling into the drainage. Introductions of Westslope Cutthroat trout and Arctic grayling began in 2023. Once fully established, the French Creek population (Oregon Creek) will represent one of the largest interconnected populations of Westslope Cutthroat trout in the upper Missouri River drainage and the only population of fluvial Arctic grayling in the absence of non-native species.

The public benefits to this project are vast. Because this project is on public land, there will be a direct impact on the quality of recreational access and aesthetic benefit available to visitors. The Mount Haggin WMA is a popular place to fish, hunt, hike, and camp. Recreationists from near and far will see the impacts of this project, from the aesthetic improvements of a naturally sinuous stream to recovering naturally vegetated hillsides. Ideally, nearby beaver will recolonize the area within a decade. Enhanced fish and wildlife habitat may also result in improved hunting and angling opportunities as well as activities like bird watching and wildlife viewing. Furthermore, the landowners present in the Deep Creek and French Creek drainages downstream of the project area are affected by increased sediment loading and maintenance at irrigation diversions, and these conditions should improve as a result of this project.

Project Goals

All of the goals and objectives of this project have been delivered and accomplished. No real deviations from the project scope were encountered. The project scope (**Table 1**) deliberately followed a five-prong strategy:

Table 1. Project Scope	
Uplands	Riparian
<p>Bare upland slopes:</p> <ul style="list-style-type: none"> ○ Soil scarification, fertilization, and seeding on contour (i.e., coir "band-aids") ○ Aerial fertilization and seeding ○ Rill treatments with slash and coir <p>Gullies:</p> <ul style="list-style-type: none"> ○ Gully BMPs using available log material and slash (gully check dams) ○ Fill gullies with surplus slash and log material from MFWP's Upper Oregon Creek Aspen Enhancement project. 	<p>In-stream structures:</p> <ul style="list-style-type: none"> ○ Post-assisted log structures ○ Beaver Dam Analogues <p>Road crossings:</p> <ul style="list-style-type: none"> ○ Remove 1 failed culvert <p>Stage 0:</p> <ul style="list-style-type: none"> ○ Regrade existing valley surfaces (cut/fill) to allow for natural fluvial process. ○ Install large woody debris on floodplain to add surface roughness and complexity.

1. *Goal:* Capture sediment on the floodplain and in the stream channel.
Objective: Install in-stream check structures (beaver dam analog (BDA)/Post-assisted log structures (PALS)) to aggrade the stream bed and restore stream function and dynamics.
Outcome: Installation and maintenance of 123 in-stream structures

2. *Goal:* Detain sediment in 15 active gully networks.
Objective:
 - a. Install gully check dams and gully slash filters to capture eroding upland sediment.
 - b. Utilize MFWP's Upper Oregon Aspen Enhancement project's surplus slash material to fill gullies (mechanically and by hand).**Outcome:**
 - a. Installation and maintenance of 74 gully check dams and 18 gully slash filters in the gully networks
 - b. 30 acres of aspen enhancement and 8,300 linear feet of gullies filled with slash and wood.

3. *Goal:* Establish vegetation on 25 acres of upland slopes to prevent sheet erosion.
Objective:
 - a. Apply native seed mix and slow-release organic fertilizer (Sustane 8-2-4) by helicopter and hand.
 - b. Apply soil scarification and trenching techniques using coconut coir erosion fabric, fastened with stakes and nearby woody debris (i.e., coir "band-aids").***Outcome:***
 - a. 25 bare and eroding acres revegetated (seeded) and fertilized by hand and by helicopter.
 - b. 60 individual coir "band-aids" produced from 18 (8' x 112.5') erosion control blankets were installed within the upland revegetation polygons.

4. *Goal:* Reconnect 11 acres of floodplain to surface water (white polygon).
Objective: Implement 1,126 feet of "stage 0" cut and fill to restore stream function and dynamics.
Outcome: Approximately 600 ft of straightened and incised channel was filled in, and the stream diverted to relic side channels, reconnecting 11 acres of floodplain to Oregon Creek surface water.

5. *Goal:* Remove a failed culvert, impeding fish passage to approximately .5 miles of Oregon Creek headwaters (yellow dot)
Objective: Pull perched culvert and reconstruct stream channel
Outcome: Removed perched culvert and reconstructed stream channel

No particular number of structures or hard-set project figures were identified as a metric for success during the planning process and writing of the *Upper Oregon Creek Restoration Project-Implementation Plan*. Instead, reaches and project areas were identified for treatments and restoration actions. All of the restoration actions and treatments were fully accomplished to meet project goals. The only metric that was "short" was the amount of channel estimated to be filled during the "stage 0" project. Instead of the estimated 1,126 feet of channel, only 600 ft of channel was filled and regraded. This was because the channel that was planned to get filled was full of mature willows and an intact riparian area. The project objective had already been met with the 600 ft; therefore, we decided to forego the remainder of the channel cut and fill.

Project Activities

Task 1 – Project Planning

Contractor shall coordinate work with project partners including Montana Department of Fish, Wildlife and Parks and Montana DEQ through site visits, participation in meetings and provide other forms of communication during the project. Contractor shall finalize project designs for Upper Oregon Creek Restoration activities. Contractor shall coordinate with DEQ to draft and finalize design plans for the Oregon Creek restoration. Contractor shall prepare bid documents, required permitting, and contracting procedures before commencing earthwork. Additionally, prior to implementation, Contractor shall establish photo points that can be repeated to adequately document each phase of the project (i.e., before, during, and after implementation).

Deliverables

Contractor shall submit to DEQ the following deliverables:

- A complete copy of the preliminary site investigation and site maps.
- A complete, draft copy of project designs for review and comment.
- A complete, final copy of project designs. In the final designs, Contractor shall address all concerns raised by DEQ in the review of previous drafts.
- Copies of all permits, authorizations, or approvals necessary for implementation of the project designs.
- Summaries of scoping and planning meetings with project partners.

Summary of Activities Completed

Throughout the project's early phases (and all phases), BHWC was in close coordination with MFWP and the NRDP. During the project's planning phases, there were two major project developments.

The first significant development was that NRDP verified for BHWC and MFWP that the Upper Oregon Creek Restoration Project area is technically within the Mount Haggin Uplands Injured Area (IA). Because MFWP recently acquired the previously private land parcels, and the natural resources being restored are from the Anaconda smelter emissions, the project site falls within the Remediation and Restoration Area (RRA) that NRDP is responsible for. This means that the Upper Oregon Creek Project area is subject to Superfund (CERCLA) jurisdiction. This meant that none of the traditional restoration permitting requirements needed to be met by both MFWP and BHWC. This news came after BHWC had already hired Morrison-Maierle Inc (MMI) to conduct a jurisdictional wetland delineation within the "stage 0" and beaver mimicry structure reaches. The wetland delineation was conducted on 9/22/2021. Even though the wetland delineation was unnecessary, the BHWC plans to use as much relevant information as possible from the report in future monitoring efforts. Due to the projects Superfund jurisdiction, no further permitting activities were necessary for this project, including MFWP Environmental Assessment requirements (MEPA). Additionally, MMI completed a volume (cut/fill) report for the "stage 0" work. Using publicly available LiDAR data, MMI was able to calculate the cut and fill volumes in cubic yards. This data was at first needed for permitting purposes, but was ultimately used to inform our contractor on estimated quantities.

The second development was that BHWC was successfully awarded a Task Order (TO)/contract with NRDP to continue restoration/remedy planning and implementation on the Mount Haggin Wildlife Management Area (WMA). The scope of work within that TO included budget for labor/crews to perform work in the Upper Oregon Creek Restoration Project area. Those dollars went toward the non-federal match requirement needed under the BHWC/DEQ contract.

Because this project did not need any permits and did not have a standard design stamped by an engineer, the BHWC developed the *Upper Oregon Creek Restoration Project-Implementation Plan* to identify each restoration action and describe the specific criteria and design specifications for implementation for each action. This implementation plan was used in place of the designs and permits required under the BHWC/DEQ contract and approved by DEQ in March 2022. The implementation plan was the primary document referenced during implementation.

Other planning activities included coordination with MFWP on the procurement of project materials, including seed, biodegradable coir blankets and Sustane fertilizer. Those materials were purchased directly by MFWP and used as non-federal match under the BHWC/DEQ contract.

Task 2 – Landowner Agreements, Operation and Maintenance

Contractor shall ensure landowner agreements are in place to ensure maintenance and monitoring of all on-the-ground projects. Contractor shall submit a draft of each landowner agreement to DEQ for review and comment prior to signature. After addressing DEQ comments, Contractor shall submit a copy of each signed, final landowner agreement to DEQ. Contractor shall ensure each landowner agreement addresses the following:

- Project Design. Identify who shall design the project, the date by which the design shall be completed, and who shall pay for any costs associated with the design work.
- Project Implementation. Identify who shall implement the project, the date by which the work shall be completed, and who shall pay for costs associated with project implementation.
- Revegetation of Disturbed Areas. The landowner agreement must require disturbed areas to be revegetated using appropriate plant species, stocking density, weed and pest control, and protection from grazing/browsing by domestic and wild animals. In addition, the agreement must identify who is responsible for revegetation efforts.
- Operation and Maintenance. The landowner agreement must identify who is responsible for operating and maintaining all structures, vegetation, management measures, and water quality benefits associated with the project. The agreement must ensure appropriate operation and maintenance for the life of the project (typically 10 years).
- Grazing Management Plan. Include a sustainable management plan for livestock grazing, designed to protect and enhance riparian functions.
- Site Access. The landowner agreement must identify the procedure(s) for obtaining access to the project site for the purposes of project planning, implementation, operation and maintenance, and post-implementation monitoring. The agreement must provide the Contractor and DEQ access, at reasonable times, with prior notification, to evaluate project effectiveness over the life of the project.

Deliverables

Contractor shall submit to DEQ the following deliverables:

- Draft landowner agreements for review and comment, in Microsoft Word or pdf format. Contractor shall submit all draft landowner agreements prior to signature, and allow sufficient time for review, comment, and subsequent modification prior to implementation.
- PDF copies of signed landowner agreements. Contractor shall ensure signed landowner agreements address all comments and concerns raised by DEQ.

Summary of Activities Completed

BHWC drafted a Landowner Agreement (LOA) between the BHWC and MFWP. BHWC sent a draft LOA to DEQ for review on 8/27/2021, 10/13/2021, and 12/14/2021. Most DEQ comments/concerns were related to the grazing management language and the minimum years of project maintenance. There are no current grazing leases on the new MFWP parcels. The language in the LOA needed to make it clear that livestock grazing will be excluded from the project site for a minimum of 10 years. This language was finalized and signed by BHWC. BHWC sent the LOA to MFWP on 12/14/2021 and received final signature on 12/14/2021.

Task 3- Monitoring and Project Effectiveness

Contractor shall, in consultation with the DEQ Project Manager, develop methods for evaluating and reporting on the effectiveness of the project in addressing water quality issues. The evaluation methods shall include a monitoring plan to guide monitoring activities including an estimate of sediment load reduction, photo point monitoring, and UAS imagery.

Deliverables

Contractor shall submit to DEQ the following deliverables:

- A complete draft monitoring plan for review and comment in electronic (Microsoft Word) format, allowing sufficient time for review, comment, and subsequent modification prior to implementation. The monitoring plan must identify the specific monitoring that will occur, who will complete the monitoring, and how the data will be analyzed and reported.
- A final monitoring plan. Contractor shall ensure that the final monitoring plan addresses all comments and concerns raised by DEQ.
- A written summary of all monitoring activities. The written summary must include the following:
 - Electronic copies of photo-point photographs, in JPEG format. A photo log identifying photo ID, site ID, photo date, photographer name, latitude and longitude from which the photo was taken, approximate direction the photographer was facing, and a brief description of what the photo is intended to show.
 - Electronic copies of all data and data analyses.
 - A detailed description of any deviations from the final monitoring plan, and an explanation of the need for each deviation.

Summary of Activities Completed

BHWC drafted the *Upper Oregon Creek Restoration Project Monitoring Plan* and sent a draft to DEQ for review on 8/27/2021. DEQ gave the first round of comments back to BHWC to incorporate into the subsequent draft document. On 10/15/2021, BHWC and DEQ met on zoom to discuss the monitoring plan and how to incorporate the necessary comments, concerns, and monitoring protocols. The main discussion focused on how specifically to quantify sediment load reductions in the uplands and riparian areas. BHWC received final approval from DEQ in March, 2022.

The *Upper Oregon Creek Restoration Project Monitoring Plan* was designed to assess the restoration project's effectiveness for sediment reduction and improvement of fluvial and upland habitat. The monitoring plan identified four strategies to assess ecologic recovery trends, specifically in relation to the sediment loading to the stream, as well as the hydrologic and vegetative response.

1. Before and after photo points, aerial imagery (including Unmanned Aerial System (UAS) drone imagery owned by BHWC) and satellite imagery of the project area will be used to document changes/improvements in the stream and vegetation conditions in the uplands.
2. Quantification of sediment load reductions by measuring representative structures and extrapolating those values to account for all structures, both upland and in-stream.
3. Normalized Difference Vegetation Index (NDVI) readings will be collected for the Stage 0 and upland slope areas using the Google Earth Engine to measure and compare average greenness (i.e., NDVI) before and after the project in the "stage 0" and upland project areas.
4. Channel geometry will be measured in the incised ditch and in the newly wet side channel after the Stage 0 project is completed.

Before and After Photos

On 7/22/2021, BHWC established photo points throughout the project area and developed a photo log identifying photo ID, site ID, photo date, photographer name, etc. Nine photo points were established and were used in 2023 monitoring activities ([Figure 3](#)).

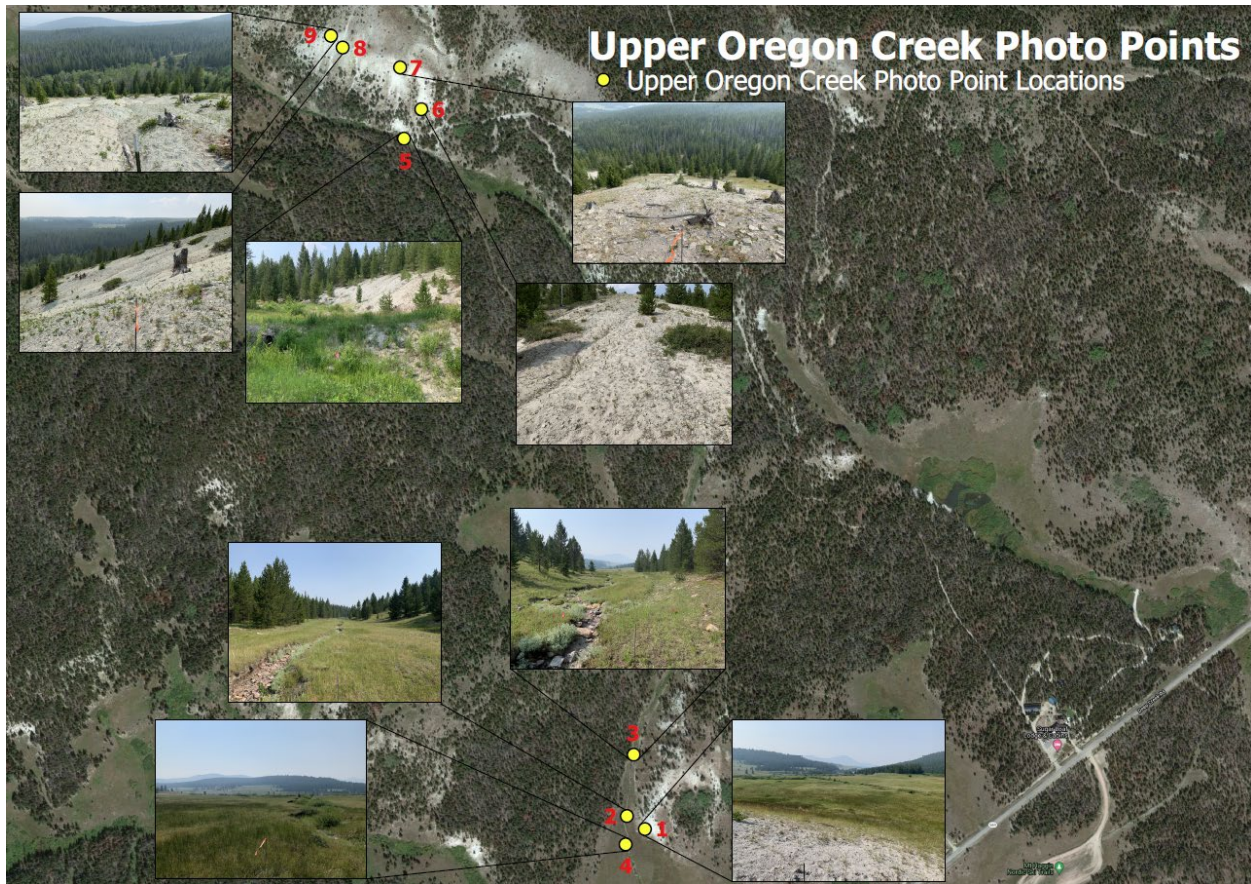


Figure 3. Upper Oregon Creek project photo point locations with correlating pre-implementation photos.

On 7/28/23, BHWC revisited the project site to take after photos. All nine photo points were visited and documented. Figure 4 and Figure 5 display examples of the 2023 before and after photos (photo points 8 and 9).



Figure 4. Upper Oregon Creek photo point 8 before and after photo series.



Figure 5. Upper Oregon Creek photo point 9 before and after photo series.

All photo points show drastic improvements and recovery trends. Photo points 1-4 highlight the instream and “Stage 0” portions of the project, whereas photo points 5-9 highlight the striking vegetation community improvements and robust vegetation establishment. Pre and post-project satellite imagery also demonstrates the widespread vegetation establishment in the uplands (Figure 6).



Figure 6. 2022 satellite imagery (top) compared to 2023 satellite imagery (bottom) displays the success of the vegetation treatments implemented with this project.

Quantification of Sediment Load Reductions

Sediment load reductions were quantified following protocol outlined in our Monitoring Plan. During the summer of 2023 a total of 24 sets of measurements were taken behind individual gully structures to measure the volume of sediment captured, as well as the volume of additional sediment catchment potential were each structure to fill entirely (Figure 7 below). Individual gully check structures retained an average of 1.8 tons of sediment each, with volumes ranging from 6.7 tons to 0.1 tons. Extrapolating the average sediment volumes from those structures to all 74 gully checks, we conservatively estimated a total sediment load reduction of 131 tons directly caught behind our gully structures. This total represents 61% of the total installed capacity of the gully check structures.

Notably, we also calculated the geometry of the gullies where structures were installed. The negative space of the gully prisms represents the volume of soil lost to erosion, a total of 16,640 tons. Since 1900, this amount averages out to 134 tons of sediment per year, roughly the catchment we documented in 2023.

Gully slash filters and in-stream structures certainly provided additional sediment catchment, but this sediment capture was not measured. Based on channel dimensions where beaver mimicry structures were installed, a rough estimate of 4.5 cubic feet of catchment was recorded.



Figure 7. BHWC intern measuring captured sediment behind 3 different gully check structures



Normalized Difference Vegetation Index (NDVI) Readings

NDVI imagery is an excellent way to capture vegetative vigor and response to restoration actions on a landscape scale. With the goal of covering the bare soils with native vegetation to begin to abate downstream sedimentation, the measure of change in vegetation cover on treated uplands was our target for monitoring. We used an [NDVI mapping tool](#) developed at Yale University to assess the change in vegetation cover on a 9-acre upland slope at the upper end of the project.

As shown in Table 2, baseline NDVI cover values for both July 15 and September 15 nearly doubled after our upland slope treatments in 2022. [Figures 8-11](#) also clearly show an uplift in vegetation cover after project treatment in 2022.

Table 2. NDVI Values 2019-2023

	July 15	September 15
2019	0.287	0.232
2020	0.296	0.258
2021	0.254	0.228
2022	0.284	0.295
2023	0.49	0.446

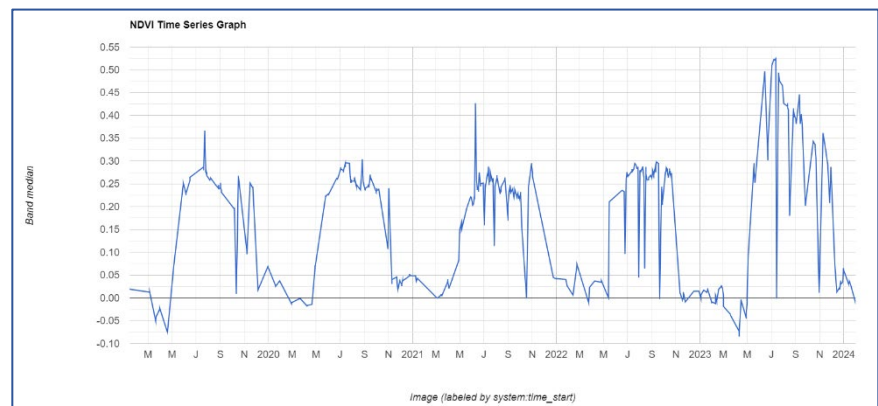


Figure 8. NDVI Time-Series of Oregon Cr. Upland Polygon

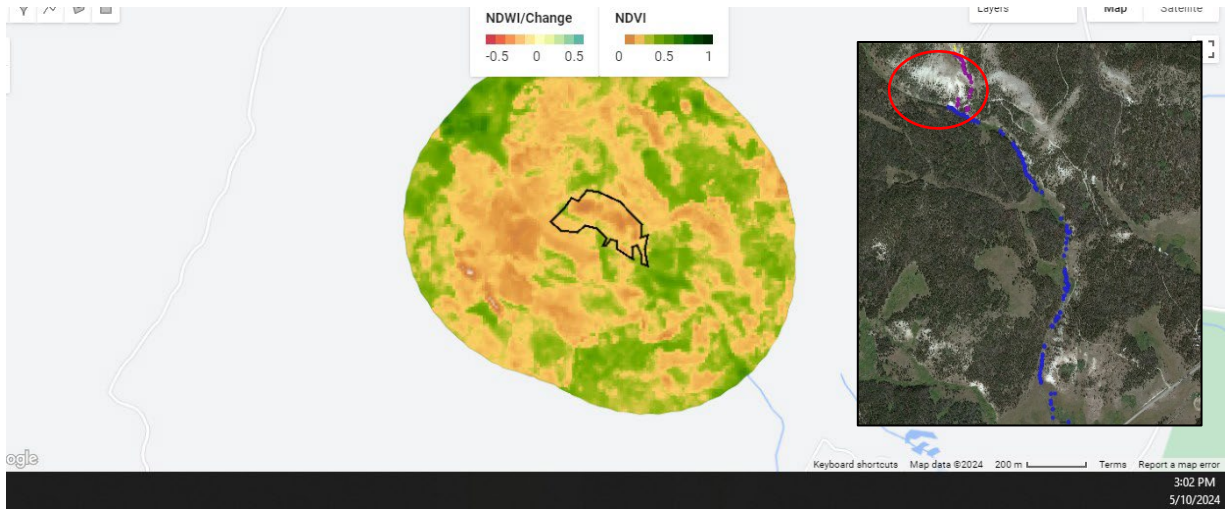


Figure 9. 2019 NDVI Image Upper Oregon

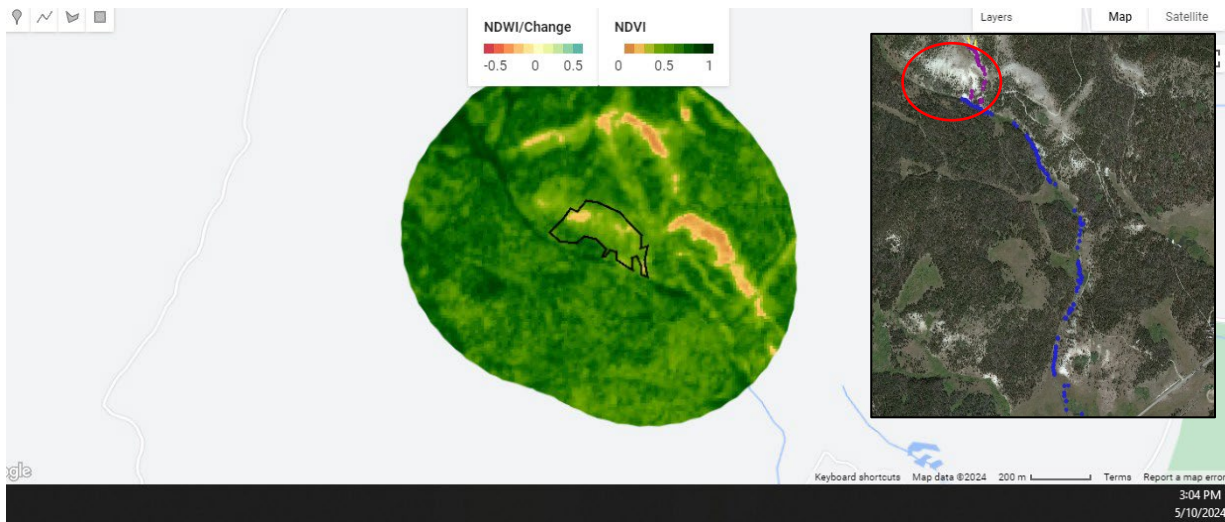


Figure 10. 2023 NDVI Image Upper Oregon

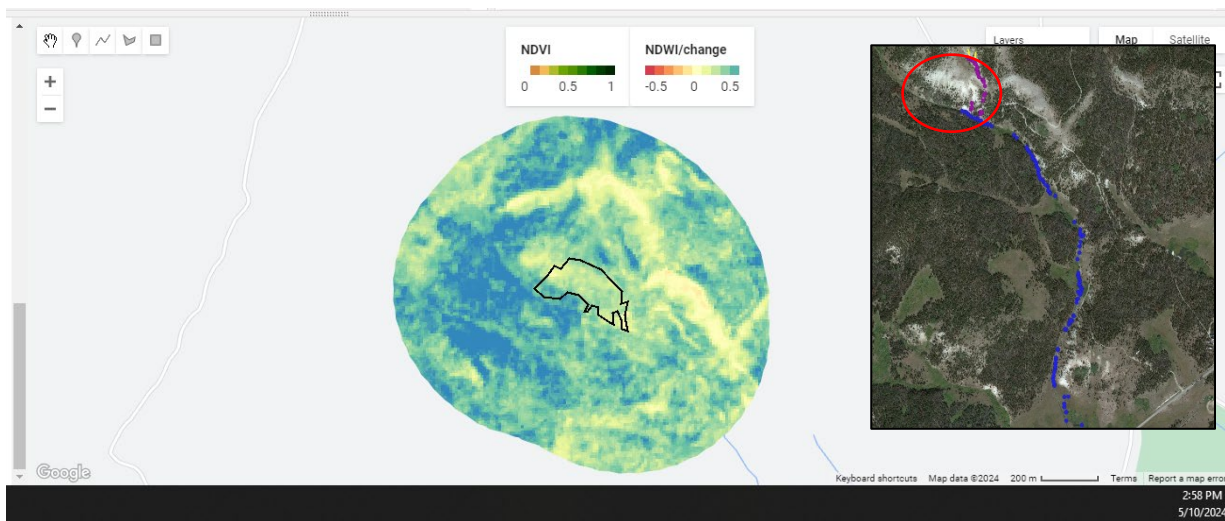


Figure 11. Change in NDVI 2019-2024

Task 4- Project Implementation

Contractor shall implement the Upper Oregon Creek Restoration in accordance with the designs, permits, authorizations, approvals, and other project planning documents completed under Task 1. Contractor shall document implementation activities by providing the deliverables identified below.

Deliverables

Contractor shall submit to DEQ the following deliverables:

- As-built surveys.
- UAS video of completed restoration.
- Final file geodatabase(s) or shapefiles of project area
- Before and after photos
- Plans for post construction site visit for DEQ manager.

Summary of Activities Completed

Most of the project was completed in the 2022 field season. A short summary of each treatment completed in 2022 is summarized below (Figure 13):

In-stream Structures: A total of 99 in-stream structures, comprising of beaver dam analogs (BDAs) and post-assisted log structures (PALS), were strategically installed throughout the project area in June and July. These structures were strategically placed to capture sediment within the channel and on the floodplain, aimed at restoring natural hydrological processes.

Gully Check Dams: 74 gully check dams and 18 gully slash filters were installed throughout the upland gully network from August 8th-18th. This effort targeted erosion control/sediment capture within the upland gully network.

Vegetation Establishment: A total of 60 individual coir "band-aids" produced from 18 (8' x 112.5') erosion control blankets were installed within the upland revegetation polygons. Project work occurred from September 15th-21st. BHWC has historically used a coconut coir product manufactured overseas for the erosion matting/blankets. In an attempt to use a more sustainable and local product, BHWC purchased a hemp matting product from Canada and installed 4 of them alongside the standard coconut product to compare effectiveness.

Aerial Seed and Fertilizer Applications:

The 25 acres of bare upland slopes received the broadcast fertilizer (Sustane 8-2-4) treatment. Treatments were conducted by Heli-Works Flight Services from September 8th-11th. The aerial (helicopter) seed application to the 25 acres of uplands was completed on October 18th, 2022. Heli-Works Flight Services applied the native seed mix at a rate of 16/lbs per acre (Figure 12).

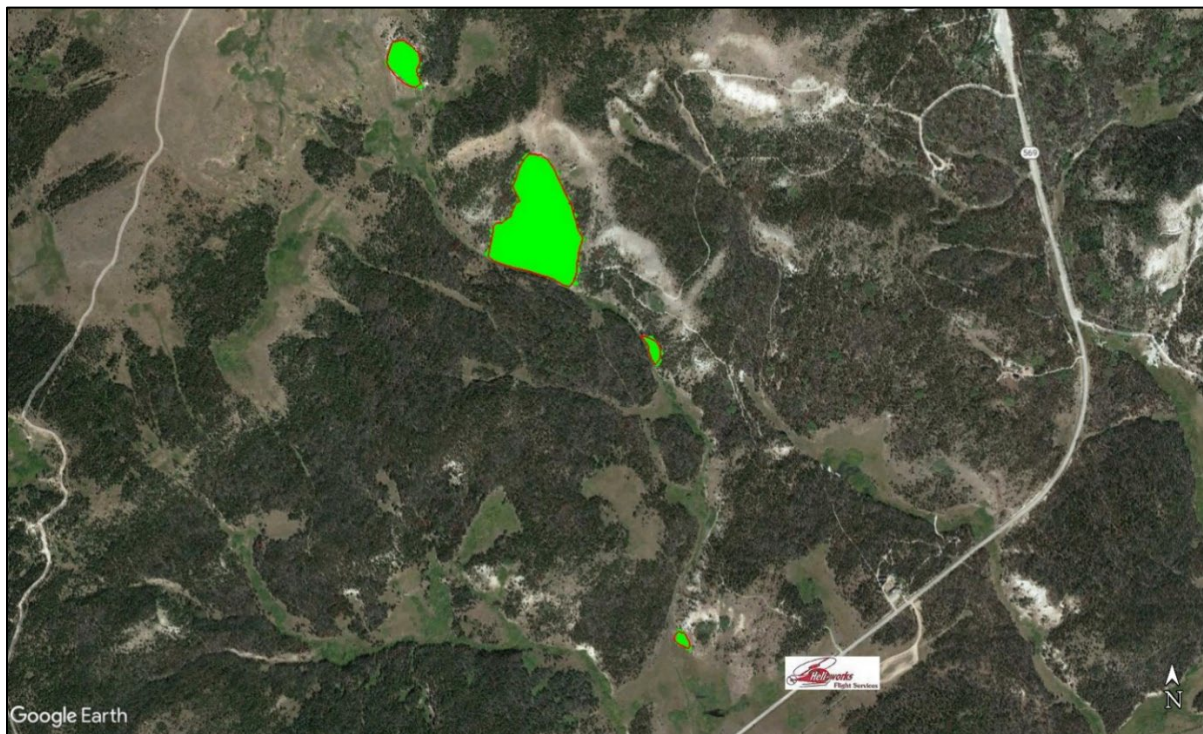
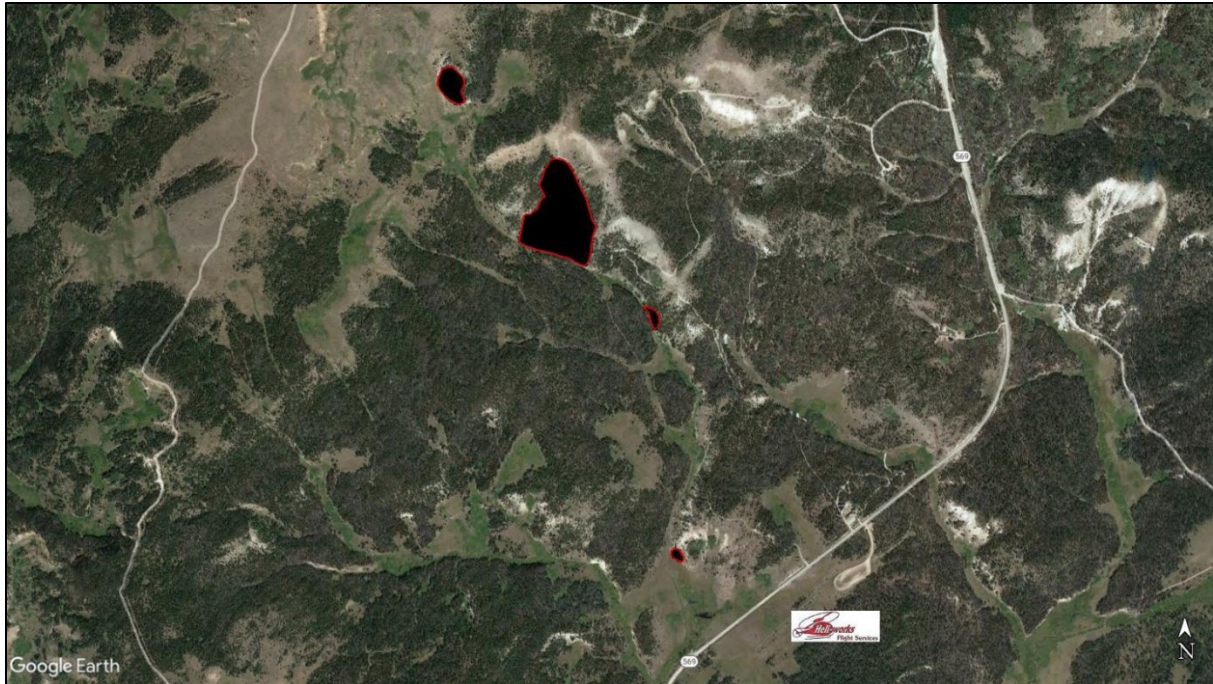


Figure 12. Heli Works 2022 fertilizer (black) and seed (green) exact flight paths

Stage 0 Floodplain Reconnection: Approximately 600 ft of straightened and incised channel was filled in, reconnecting 11 acres of floodplain to Oregon Creek surface water. The construction sequence outlined in the *Implementation Plan* was generally followed. All disturbed areas were seeded with MFWP with approved riparian and upland mixes.

Culvert Removal and Enhancements: The perched culvert in the upper project area was removed in September. The streambed was graded to match the existing upstream and downstream elevations. Two log steps were installed in the streambed and used for grade control. The banks were sloped back to a more natural slope. The excess excavated material was placed on the access road to the east. During construction, BHWC and MFWP decided to completely obliterate the access road from the perched culvert, back to the most eastern gully (approximately 300 ft). The road was acting as a sediment transport system at the base of a few large gullies, moving sediment on the road base and eventually into the creek below. Now, with the culvert pulled and the road obliterated, the stream and surrounding hillslope have a more natural configuration.

While BHWC had the operator and excavator on site, we utilized the opportunity to take advantage of the machine and incorporate a few "machine assisted enhancements". Those included the installation of 2 machine assisted gully check dams, the 300 ft of road obliteration, and the removal of 2 sediment plumes at the base of two gullies. Material from the sediment plume excavation was placed behind nearby hand-built gully check dams.

Aspen Enhancement: The aspen enhancement portion of the project is complete. Work was performed from October 19th-21st, 2022. The contractor, Worman Forest Management LLC, thinned conifers (primarily lodgepole pine) within 100 feet of eroded gullies, placing the cut material in the gullies for erosion control. Approximately 8,300 linear feet of gullies were treated and 30 acres were thinned, reducing conifer competition within scattered aspen stands. The thinning only removed trees less than 6 inches DBH.

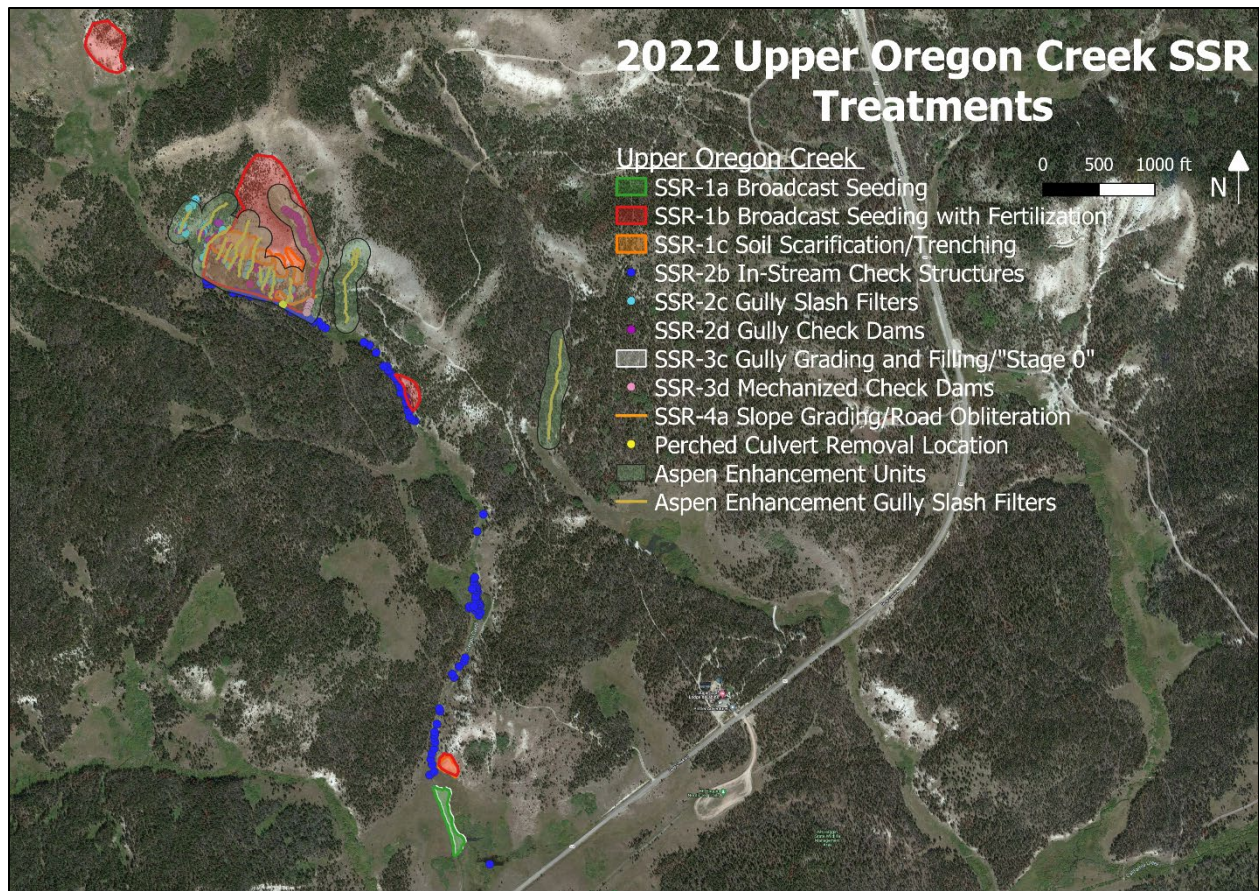


Figure 13. 2022 Upper Oregon Creek Treatments

In 2023, the project area continued to showcase promising recovery and received maintenance/enhancements. A short summary of each treatment completed in 2023 is summarized below (Figure 14):

In-stream Structures Maintenance: In June (6/19/23-6/23/23), Watershed Consulting, Montana Conservation Corps (MCC), and a Wild Rockies Field Institute (WRFI) class spent a week maintaining all old structures and installing new in-stream structures were deemed necessary. We worked from the bottom up, maintaining, adding to, and strengthening ALL of the 2022 structures. We also installed new/additional structures in optimal locations.

Gully Check Dams: Upland sediments were already being captured behind gully check dam structures, some of which are already at capacity. Watershed Consulting and MCC crews spent a portion of a week (6/26/23-6/30/23) maintaining and fixing 2022 installed gully check dams. Some dams had blowouts and log failures. We incorporated leftover coconut coir fabric to patch blowouts. ALL upland gully check structures have been fixed and strengthened.

Vegetation Establishment: Substantial improvements were observed in upland areas, with vegetation from previous seed and fertilizer applications flourishing. No additional vegetation was deemed necessary.

Stage 0 Floodplain Reconnection: Mechanized maintenance on the "stage 0" portion of the project (last year's work) was necessary in 2023. A moderately sized head cut formed in the spring of 2023 when water from Oregon Creek failed to rejoin its historic channel and instead followed a reach of low ground into raw earth from 2022 excavation work. The earth was still "raw" and unvegetated, enabling the head cut to work approximately 30 ft upstream. Watershed Consulting repaired the head cut on 6/29/23. Using an excavator, the headcount was filled in to create a swale and armored with willow transplants and harvested sod mats. We also used the excavator to encourage water to flow into the remnant channel using sod mats and minor channel formation.

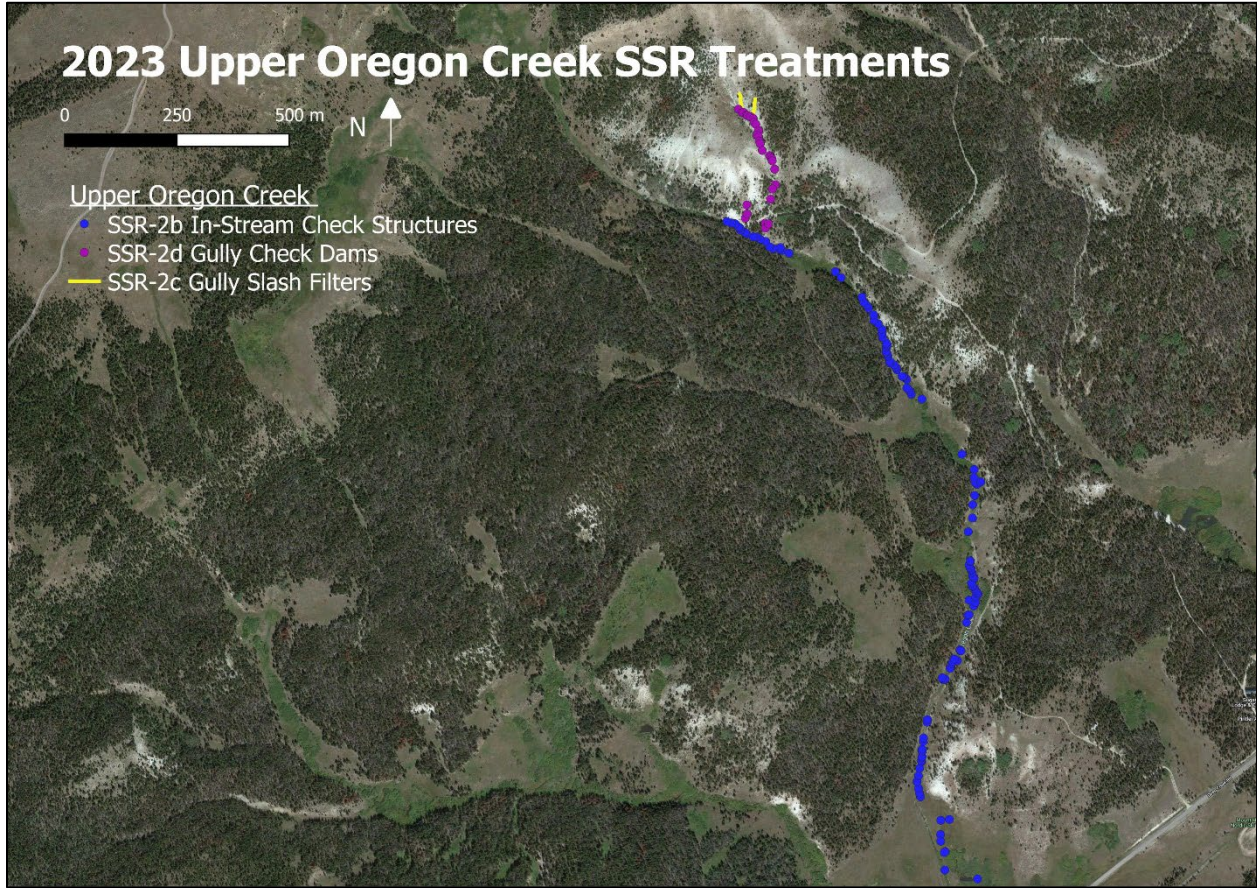


Figure 14. 2023 Upper Oregon Creek Treatments

Table 3 summarizes all of the project metrics and accomplishments made in each aspect of the restoration project across the two years.

Table 3. Summary of all project implementation treatments

Project Metric	2022	2023
In-stream Structures Installed	99 (BDAs/PALS)	123 (maintenance and new structures)
Gully Check Dams Installed	74	30 (all maintenance)
Gully Slash Filters Installed	18	-
Upland Revegetation Treatments Installed	60 (coir erosion control blankets)	-
Bare Upland Slopes Revegetated	25 acres	-
Stage 0 Floodplain Reconnection	Approximately 600 ft of channel filled in	Head cut repair conducted
Aspen Enhancement	Approximately 30 acres thinned, 8,300 linear ft of gullies treated	-

Table 4. Project Implementation Photos



Installation of lower reach BDA (2022).



Completion of BDA in the lower reach (2022).



MCC and volunteers building in-stream structures in the middle reach (2022).



Volunteers proud of their work on a large head-cut stabilization structure in the middle reach (2022).



Inspecting a recently completed BDA in the upper reach (2022).



Newly constructed BDA series in the upper reach (2022).



Activated BDA in the lower reach (spring, 2023).



Large head cut activated and properly functioning (spring, 2023)



Good floodplain activation in BDA series (spring, 2023).



Good floodplain activation and sediment capture in upper reach BDA (spring 2023).



Newly constructed gully check dam (2022).



Newly constructed gully check dam (2022).



Newly constructed gully check dam (2022).



Gully check dam series holding back freshly deposited sediments (2023)



Gully check dam maintenance (2023).



Upper most gully check dam at capacity (2023).



Scarification trenches and fertilizer in "coir band-aid", mid-construction (2022)



Coir being installed over trenches and fertilizer, mid construction (2022).



Freshly constructed "coir band-aids" in the uplands (2022).



Freshly constructed "coir band-aids" in the uplands (2022).



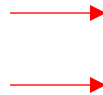
"Coir band-aid" fully vegetated (2023)!



"Coir band-aid" fully vegetated (2023)!



Before photo point (2022).



After photo point (2023). Note the clear success of the vegetation treatments!



“Stage 0” mid construction (2022). Note: red line signifies where the old channel alignment was.



“Stage 0” mid construction (2022). Note: red line signifies where the old channel alignment was..



“Stage 0” head cut formation after first runoff (spring, 2023).



“Stage 0” head cut fix/stabilization (summer,2023)



Before photo of road obliteration (2022).



After photo of road obliteration (2022).



Before photo of perched culvert (2022).



After photo of perched culvert removal (2023).



Aspen enhancement and gully fill (2022).



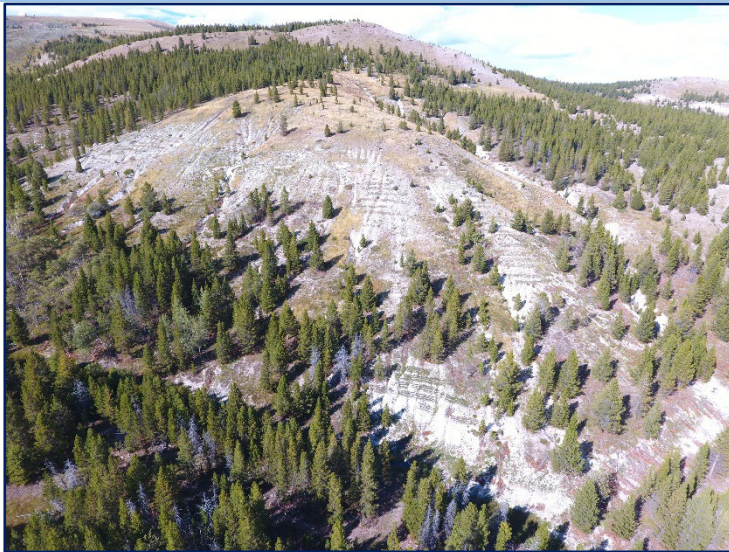
Aspen enhancement and gully fill (2022).



Aspen enhancement and gully fill (2022)..



Aspen enhancement and gully fill (2022)..



9/6/23 drone flight photo of the upper project area.



Touring the stream project site with NRDP (2023). Ray Vinkey is inspecting a head cut structure installed in the middle reach in 2022.



WRFI students enjoying the fruits of their BDA installation labor. (2022).



Watershed Consulting and MCC crews having fun on the project site (2022).

Task 4- Outreach and Education

Contractor shall conduct the following outreach and education activities with the goal of reaching a target audience of residents and recreationists of the Big Hole Valley, Big Hole Watershed Committee (BHWC) partners, mining reclamation professionals, and other interested parties:

- Status Reports/Media: Contractor shall publish content related to the project goals and scope, progress, and results on the BHWC website, social media, and public media outlets.
- Newsletter: Contractor shall create, publish, and distribute one BHWC newsletter and include a report on project status and results.
- Public Meeting: Project status and results must be presented at in at least three BHWC monthly meetings.
- Project Outreach Materials: must include a video showing the benefits to water quality and riparian health from the project

Deliverables

Contractor shall submit to DEQ the following deliverables:

- Electronic copies of status reports/media.
- Electronic copies of newsletters.
- Meeting notes from public meeting.
- Project outreach video.

Summary of Activities Completed

Throughout the life of the project, BHWC has updated the project's website page and social media platforms to reflect the current status/updates on the project. BHWC has recently updated the Upper Oregon Creek project page on our website to encapsulate the success of the project and display the project status and results. BHWC has also highlighted the project in 3 of our bi-annual newsletters. The hardcopy newsletters were mailed to BHWC's mailing list and distributed to local businesses. They were also posted electronically on our website and distributed via email and social media. Lastly, BHWC has given public presentations/updates during our monthly meetings in which Program Manager Ben LaPorte presented project designs and construction plans as well as provided project updates throughout the project.

Our shining and most proud Education and Outreach deliverable for this project is our project outreach film. We hired Tom Attwater Media (TAM) to film and produce our short project film. Tom visited the project site 3 years in a row and has gotten exceptional footage/content. The film is currently complete and will be uploaded onto our YouTube page shortly after the submittal of this Final Report.

Task 6- Project Administration

Contractor shall oversee and be accountable for the completion of all tasks. Contractor shall maintain regular contact with DEQ as defined by the DEQ project manager. Contractor shall prepare and submit Mid-Year, Interim, Annual and Final Reports and Attachment B-billing statements, according to the format and schedule described below.

Report Format

- Contractor shall submit each Attachment B-billing statement, status report, annual report, and final report using the most current report guidance and template provided by the DEQ project manager.
- Contractor shall ensure each Mid-Year, Interim, Annual and Final Report contains adequate documentation to justify accompanying payment requests and match reporting, to the satisfaction of the DEQ project manager.
- Contractor shall ensure that the Final Report is a standalone document describing all contract activities and containing copies of all contract deliverables (even if the deliverables were previously submitted).

Reporting Schedule

- Status Reports: Due June 15th of each year.
- Annual Reports: Due December 15th of each year.
- Interim Reports: Due whenever reimbursement is requested outside of the normal Mid-Year, Annual and Final reporting periods.
- Draft Final Report: Contractor shall submit a complete draft final report for DEQ review and comment at least 15 days prior to the contract expiration date.
- Final Report: Contractor shall submit a final draft, addressing DEQ comments, on or before the contract expiration date.
- Attachment B Billing Statements: Contractor shall submit an Attachment B Billing Statement with each Mid-Year, Interim, Annual and Final Report. To maintain cash flow, Contractor may submit interim Attachment B Billing Statements as frequently as monthly. However, each interim Attachment B Billing Statement must be accompanied by an Interim Report.
- Exception to the Reporting Schedule: The Final Report and associated Attachment B-billing statement will replace the last required status report or annual report.

Deliverables

Contractor shall submit to DEQ the following deliverables as described in the Task 6: Description: Mid-Year Reports, Interim Reports, Annual Reports, Attachment B Billing Statements, and a Final Report. Contractor shall ensure that all reports are written clearly, with appropriate grammar, punctuation, and level of detail.

Contractor shall do the following with respect to all deliverables associated with all tasks in this contract (not just Task 6):

- Adhere to report guidance and templates provided by the DEQ project manager.
- Submit all draft and final documents electronically, in Adobe PDF, Microsoft Word, or Microsoft Excel format.

- Submit all draft and final documents to the DEQ project manager using email, or if files are greater than 5.0 megabytes in size, using the State of Montana File Transfer Service (<https://transfer.mt.gov>) or as directed by the DEQ Project manager.

Summary of Activities Completed

The BHWC has adhered to all of the reporting guidance and templates provided by DEQ and has submitted status reports, annual reports and attachment B-billing statements on time to the DEQ project manager. All drafts and final documents were sent electronically using the State of Montana File Transfer Service. BHWC oversaw and was accountable for the completion of all tasks.

Partners

The Oregon Creek project was developed by the Big Hole Watershed Committee in partnership with Montana Fish, Wildlife and Parks, the Natural Resource Damage Program, the Trout and Salmon Foundation, and the Montana Department of Environmental Quality.

Big Hole Watershed Committee (BHWC): Project coordination lead, including requesting funding, hosting funding contracts and contractors, maintaining financial and project records, reporting results, outreach, monitoring, and final reporting. *Contact: Pedro Marques, Executive Director, Ben LaPorte, Program Manager, and Tana Nulph, Associate Director.*

Montana FWP/Mount Haggin Wildlife Management Area: Primary landowner for the project area. MFWP funded the aspen enhancement portion of the project and paid for all seeding, fertilizing, and erosion control materials. *Contact: Vanna Boccadori, Wildlife Biologist, Jim Olsen, Fisheries Biologist,*

Montana Department of Environmental Quality (DEQ): Primary funder of the project. MT DEQ provided funds for project design, implementation, monitoring/project effectiveness and outreach and education. Funds came from the 319 Project Program. *Contact: Stephen Carpenedo, Senior Wetland Specialist.*

Natural Resource Damage Program: Supporting funder of the project. NRDP provided funds for implementation and monitoring/project effectiveness. Funds came from existing BHWC contracts with NRDP for management of steep slope restoration in the area. *Contact: Ray Vinkey, Environmental Scientist.*

Trout and Salmon Foundation: Funded \$5,000.00 toward the installation of the 2022 in-stream structures. *Contact: David James*

Contractors

- Watershed Consulting LLC- project implementation
- Montana Conservation Corps-project implementation
- Heli Works LLC-areial seed and fertilizer application

Volunteers

- Wild Rockies Field Institute- project implementation

- Wisconsin Church Youth Group-project implementation

Partnership outcomes: This restoration project brought together several state agencies, nongovernmental organizations, and contractors to collectively address major sediment impairments in the headwaters of the Big Hole River watershed. Serving as the “glue,” the BHWC led the collaboration among all involved entities. The outcomes have resulted in substantial sediment reductions and habitat improvements and provides an excellent example of how diverse groups can work together for the good of the resource.

Complications

There were no major complications in the execution of the Upper Oregon Creek restoration project as it was designed. Construction implementation dates and estimated scheduling were all implemented on time. Leveraging BHWC's extensive decade-long experience working to restore smelter-impacted lands within the Mount Haggin WMA, this project integrated the valuable lessons gleaned from past endeavors.

A Letter of Agreement was signed between the BHWC and DEQ to give our filmmaker the time necessary to complete the outreach film. This contract extension also provided BHWC with more time to complete the Final Report and satisfy all reporting requirements.

Recommendations

Lessons Learned: One of the biggest lessons learned was to incorporate more woody/hardened material during the construction of the “Stage 0” portion of the project. During the “cut and fill” process, we utilized adjacent trees and wood to bury and incorporate into the old channel alignment, but not nearly enough. During the spring of 2023, water found its way onto the freshly disturbed fill area and created a substantial head cut in the lower portion of the project. This could potentially have been avoided if the water hit a hardened surface underneath the soil and wasn't allowed to cut down. Furthermore, the head cutting could have been potentially mitigated with a more in-depth survey of the surrounding “finished” ground surface to ensure water was, in fact, going to flow exactly where we wanted. Because the project was a “Stage 0” project in nature, we always had the approach of “let the water find its own path.” In hindsight, we could have taken a few extra steps to ensure the water flowed into the remnant channel as desired. Luckily, we had the budget to fix and follow through with these lessons learned in 2023.

We also attempted to work with a more locally-sourced erosion control product to potentially replace coir matting that has to be shipped overseas. We deployed two hemp-based erosion control mats adjacent to the coconut fabric. This product disintegrated within a year and is not recommended as a replacement for traditional coir products.

Next Steps: This is the last project on Oregon Creek. Building upon the momentum gained from our successful 2019 restoration efforts on Lower Oregon Creek, this project marks yet another significant milestone. The project was a major success and now needs a few more seasons to continue to establish and mature

Opportunities for Expansion: See above.

Recommendations to Improve 319 Program: No recommendations; the 319 program was very easy to work with throughout this contract.

Deliverables

Table 5. Task 1- Project Planning: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
A complete copy of the preliminary site investigation and site maps.	Complete/March 2022	Approved as part of project implementation plan (Attachment 1)
A complete, draft copy of project designs for review and comment.	Complete/March 2022	Approved as part of project implementation plan (Attachment 1)
A complete, final copy of project designs. In the final designs, Contractor shall address all concerns raised by DEQ in the review of previous drafts.	Complete/March 2022	Approved as part of project implementation plan (Attachment 1)
Copies of all permits, authorizations, or approvals necessary for implementation of the project designs.	Complete/March 2022	Documented in Report 1
Summaries of scoping and planning meetings with project partners.	Complete/March 2022	E-mail record of all planning correspondence included DEQ personnel

Table 6. Task 2- Landowner Agreements, Operation and Maintenance: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
Draft landowner agreements for review and comment, in Microsoft Word or pdf format. Contractor shall submit all draft landowner agreements prior to signature, and allow sufficient time for review, comment, and subsequent modification prior to implementation.	Delivered for review on 8/27/2021, 10/13/2021, and 12/15/2021.	DEQ has reviewed, commented, and accepted the final version for final signature (Attachment 2)
PDF copies of signed landowner agreements. Contractor shall ensure signed landowner agreements address all comments and concerns raised by DEQ.	Complete. Delivered on 12/15/2021.	(Attachment 2)

Table 7. Task 3- Project Effectiveness Monitoring: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
A complete draft monitoring plan for review and comment in electronic (Microsoft Word) format, allowing sufficient time for review, comment, and subsequent modification prior to implementation. The monitoring plan must identify the specific monitoring that will occur, who will complete the monitoring, and how the data will be analyzed and reported.	Completed/Dec.15, 2021	
A final monitoring plan. Contractor shall ensure that the final monitoring plan addresses all comments and concerns raised by DEQ.	Completed/March 2022	Attachment 3
A written summary of all monitoring activities. The written summary must include the following: <ul style="list-style-type: none"> o Electronic copies of photo-point photographs, in JPEG format. A photo log identifying photo ID, site ID, photo date, photographer name, latitude and longitude from which the photo was taken, approximate direction the photographer was facing, and a brief description of what the photo is intended to show. o Electronic copies of all data and data analyses. 	Complete	Photo points and photo log are established. "After" have been taken and will be incorporated into the photo log book. A written summary of all monitoring activities are included in the Final Report (Attachment 4)
A detailed description of any deviations from the final monitoring plan, and an explanation of the need for each deviation.	Complete	Included in the Final Report.

Table 8. Task 4- Project Implementation: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
As-built surveys.	Complete/March 2022	In Implementation Plan
UAS video of completed restoration.	Complete	This deliverable is incorporated and accounted for in the project outreach video (Attachment 5)
Final file geodatabase(s) or shapefile(s) of project area.	Complete	Sent to Steve Carpenedo on 12/14/23 and with Report 6.
Before and after photos.	Complete	After photos were taken on 7/28/23, and will be incorporated into the photo log book (Attachment 4).

Plans for post-construction site visit for DEQ project manager.	Complete	Coordinating with Steve Carpenedo for next season's site visit.
---	----------	---

Table 9. Task 5- Education and Outreach: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
Electronic copies of status reports/media.	Complete	Delivered to Eric Trum and Steve Carpenedo throughout the life of the grant.
Electronic copies of newsletters.	Complete	Included Fall 2021, Summer 2022 and Fall 2022 newsletters in Report 6 (12/14/23).
Meeting notes from public meetings.	Complete	Delivered with Report 6 12/14/23
Project outreach video.	Complete	Attachment 5

Table 10. Task 6. Project Administration: Deliverables

Deliverable	Status/Date Completed	Notes/Comments
Interim status reports <ul style="list-style-type: none"> - June 2022 - June 2023 	Complete/ June 21, 2022 Complete/ July 6, 2023	
Annual Report <ul style="list-style-type: none"> - 2021 Annual Report - 2022 Annual Report - 2023 Annual (Final) Report 	Complete/ Dec.15, 2021 Complete/ Dec. 5, 2022 Complete/12/14/2023	Final Report delivered in May 2024

Finances

BHWC served as the primary hub for project funding to be funneled and managed during this project. Total project cost was \$238,819.16. Funds were provided from 4 funders across 3 funding agreements. Table 11 shows all funding sources involved in the project. Table 12 includes expenditures under this contract.

Funding Sources for Project

Table 11. Project Funding Summary

Funding Source	Purpose	Amount
Montana DEQ (cash)	Design/Implementation/Monitoring/E&O	\$89,000.00
Montana FWP (cash)	Aspen enhancement and paid for all seeding, fertilizing, and erosion control materials	\$61,484.00
Trout and Salmon Foundation (cash)	Installation of the 2022 in-stream structures.	\$5,000.00
Montana NRDP (cash)	Implementation and monitoring/project effectiveness	\$74,399.80
Morrison-Maierle (in-kind)	MMIs time to prepare the "Stage 0" cut/fill volume estimates and meet with BHWC	\$918.00
Volunteers (in-kind)	Project implementation	\$8,017.36
Project Total		\$238,819.16

Table 12. DEQ Program Grant #221022 Finances

Task #: Brief Description	319 Funds	Match	Total
Task 1: Project Planning	\$1,000.00	\$4,957.80	\$5,957.80
Task 2: Landowner Agreement, Operation and Maintenance	\$100.00	\$0.00	\$100.00
Task 3: Project Effectiveness Monitoring	\$2,000.00	\$0	\$2,000.00
Task 4: Project Implementation	\$72,000.00	\$144,861.36	\$216,861.36
Task 5: Education and Outreach	\$5,000.00	\$0.00	\$5,000.00
Task 6: Project Administration	\$8,900.00	\$0.00	\$8,900.00
Total	\$89,000.00	\$149,819.16	\$238,819.16

Conclusions

This project demonstrated a complete watershed approach to reversing natural resource degradation and stopping non-point source sedimentation of a headwater stream. Based on excellent working partnerships with funders and agency personnel, the project was designed and executed in 2 seasons resulting in substantive sediment reductions and vastly improved conditions of both upland and riparian vegetation. Ecological trends in Upper Oregon Creek are improving, native fish have been reintroduced into the system, and the site is now under a maintenance contract with MFWP to ensure structures continue to perform as expected.

Attachments

Attachment 1: Upper Oregon Creek Restoration Project Implementation Plan

Attachment 2: Upper Oregon Creek 2021 Stream Restoration Agreement

Attachment 3: Upper Oregon Creek Restoration Project Monitoring Plan

Attachment 4: Photo Log and Before and After Photos

Attachment 5: Upper Oregon Creek Outreach Video