2023 Final Report
Beaver Creek Stream Restoration Project Phase 2
Nelson, Montana

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Agreement number: RRG-22-1807A

Total Project Cost: $541,422.87
RRG: $125,000 (Used $100,451.11)

Completion and quarterly reports can be provided by the Lewis and Clark CD.

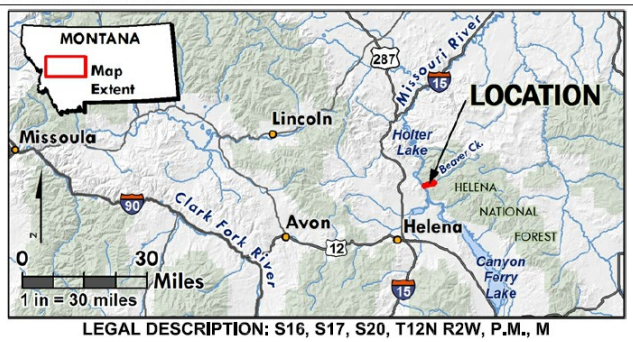
Attachments: Completion Report, Construction Field Reports

Project Partners
NorthWestern Energy, Inc.
U.S. Forest Service, Helena Ranger District
Pat Barnes Chapter Trout Unlimited
Montana Fish, Wildlife and Parks
MT DNRC-Renewable Resource Program
Lewis and Clark Conservation District
Missouri River RAC
River Design Group, Inc., TNT Excavating, Greenwing Restoration

Introduction

The Beaver Creek project area is located just south of Nelson, Montana approximately 14 miles Northeast of Helena, MT in Lewis and Clark County. Lower Beaver Creek was a highly impaired system resulting from past agricultural and grazing practices that resulted in stream channelization and removal of riparian vegetation. These impacts led to channel incision, bank instability and overall stream habitat degradation. It is currently 303d listed for sediment impairments and alteration of riparian habitat. Although an impaired stream, Beaver Creek is a primary spawning stream for the large rainbow and brown trout that migrate from Holter lake and supports a popular fishery for anglers on the Missouri River below Hauser Dam. Restoration efforts aimed to improve floodplain connectivity, riparian habitat and increase both spawning and rearing habitat for focal species.

BEAVER CREEK VICINITY MAP



LEGAL DESCRIPTION: S16, S17, S20, T12N R2W, P.M., M

NorthWestern Energy previously funded LiDAR acquisition, preliminary project analysis and final designs to restore 1.2 miles of lower Beaver Creek and approximately 13.0 acres of riparian and wetland habitat. Fall of 2020, NorthWestern Energy in partnership with the USFS-Helena Ranger District, Pat Barnes Trout Unlimited Chapter and Montana Fish, Wildlife and Parks implemented Phase I. Phase 1 included just over 0.5 miles (2,648 linear feet) of channel construction and approximately 7.0 acres of wetland and riparian habitat. Phase II was implemented last fall (2022) and included 0.7 miles of channel construction (3,704 LF) and 8.62 acres of wetland and riparian habitat, Figure 1.

This project improved aquatic habitat condition on Beaver Creek by establishing proper channel and floodplain dimensions and creating off-channel, disconnected, and connected shallow emergent wetlands. Preserved scrub/shrub wetland communities are also supported by new floodplain surfaces. Goals of the project included: 1) improving aquatic and riparian habitat diversity for fish and wildlife; 2) reconnecting former abandoned floodplain surfaces and reconnect abandoned oxbows to increase stream length and reduce channel slope 3) establishing riffle and pool sequences to form a C4 stream type 4) convert existing channel to emergent wetlands and construct and preserve scub/shrub wetland communities 5) install naturalized streambank structures to allow bank vegetation to become established while improving habitat complexity.

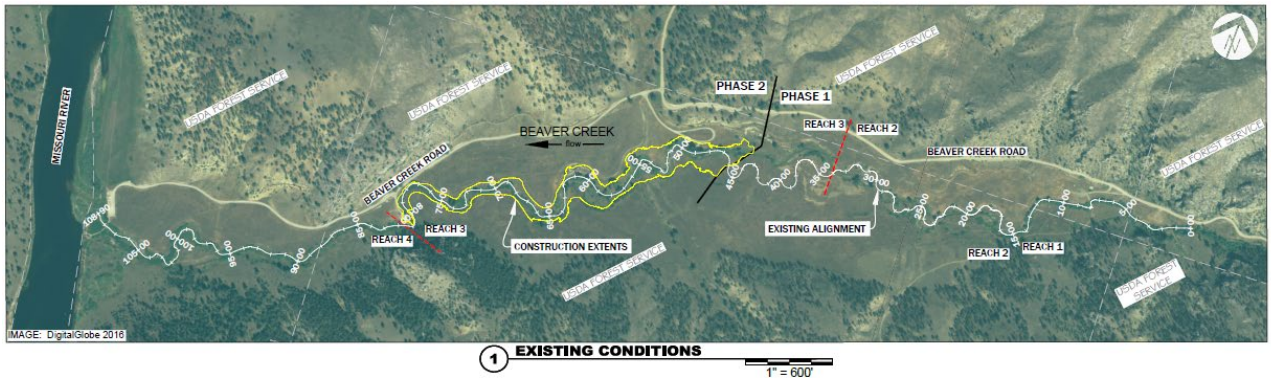


Figure 1. Phase 2 stream and wetland restoration project restoration overview.

Phase 2 project work was completed December 1st 2022 and spanned a ten week construction period. As mentioned before, restoration strategies included reconnecting former floodplain surfaces, converting the existing channel to emergent wetlands and preserving and construction other scrub-shrub wetland communities. Constructed riffle and pool sequences along with naturalized banks and large wood complexes create diverse aquatic habitat for target fish species (rainbow and brown trout) and other aquatic wildlife. Constructed floodplain surfaces have varied elevations to encourage natural establishment of diverse plant communities and improve riparian habitat for wildlife species such as the Bullock's oriole, willow flycatcher and sandhill cranes.

Discussion and Results

The Beaver Creek Restoration project (Phase 1 and 2) planning took several years. Environmental analysis of two alternatives was dependent on a thorough site assessment including LiDAR, hydraulic analysis and initial design provided by the River Design Group (RDG) and funded by NorthWestern Energy. Environmental analysis including SHPO and ESA clearance, supported a Decision Memo (6/10/2019) determining proposed activities were categorically excluded under 36 CFR 220.6(e)(18). Permits issued for the project included a 124 permit (MT FWP) and 318 authorization (MT DEQ) and a Nationwide Permit 27 (NOW-2020-00149, UACOE). In addition to the USFS the Beaver Creek Restoration project was supported by many agencies including NorthWestern Energy, MT FWP Future Fisheries Improvement Program, MT DNRC, Pat Barnes Trout Unlimited Chapter, Lewis and Clark Conservation District and many volunteers (Capital HS students, Helena Young Professionals). Local contractors included TNT excavating, Doug Mote logging, Greenwing Restoration and Summer Star Construction.

To address Beaver Creek sediment impairments, improve both aquatic and riparian habitat and the rainbow and brown trout fishery for recreational benefit, the scope of work for Phase 2 included:

- Reconnect former floodplain surfaces
- Reconnect abandoned oxbow channels
- Construct new riffle/pool habitat
- Convert existing channel to off channel wetlands or side channels
- Implement streambank treatments, restore floodplain and riparian upland vegetation to increase woody riparian shrubs and trees.

To address the channel incision and reconnect the floodplain surfaces to historic levels, 0.7 miles of new channel reconstruction was necessary. This involved the removal of 13,313 CY of earthwork material that was subsequently placed in the existing channel (9,765 CY) or placed in the onsite repository (3,548 CY). LiDAR imagery identified the historic channel and this determined surface elevations and placement for the design channel and incorporation of abandoned oxbow channels. Reference reach conditions guided design criteria and constructed riffle and pool habitat, Figure 2 below. Compound pool and log step pool structures were created using onsite large wood material 10-12” in diameter. Streambed substrate was sourced onsite floodplain with some larger material sourced commercially off-site.

BANKFULL CROSS SECTION DESIGN CRITERIA				
	Riffle Value (ft)	Run Value (ft)	Pool Value (ft)	Glide Value (ft)
Area	19	20	24	23
Range (Low)	17	19	21	21
Range (High)	21	23	27	25
Width/Depth Ratio	14	10	-	16
Range (Low)	12	8	-	14
Range (High)	16	13	-	20
Width				
Average	16	14	21	19
Range (Low)	15	13	19	18
Range (High)	17	16	22	21
Avg. Depth				
Average	1.2	1.4	1.1	1.2
Range (Low)	1.1	1.2	1.1	1.1
Range (High)	1.3	1.5	1.2	1.3
Max.Depth				
Average	1.8	2.4	4.2	1.7
Range (Low)	1.5	2.0	3.6	1.4
Range (High)	2.0	2.7	4.8	1.9
Scour Depth	2.4	3.0	5.0	2.4

Figure 2. Design criteria for aquatic habitat features.

The old channel was subsequently filled to achieve floodplain connectivity with the design channel but some segments were retained to create connected/disconnected emergent wetlands and side channel/alcove habitat. To stabilize streambanks a combination of vegetated matrix prescriptions were used. Vegetative Matrix 1 and 2 includes the use of category 2 wood (3-6" diameter), category 1 wood (<3"), alluvium fill and willow cuttings. Vegetative Matrix 3 includes the use of category 1 wood and willow cuttings. Approximately 30,000 willow clippings were incorporated into the streambank treatments. To restore riparian and upland vegetation preservation areas were identified to reserve existing vegetation. Material that was removed or salvaged was transplanted into the newly constructed floodplain. Native upland and riparian seed was used in disturbed areas and included mountain brome, basin and blue wildrye, tufted hair grass, bluejoint weed grass, beaked sedge, Nebraska sedge, Canada golden rod, rough bent grass, Sandberg's bluegrass, bluebunch wheatgrass, Idaho fescue, and sterile wheatgrass. Container plants included alder, mockorange, ninebark and chokecherry.

Overall, project results reflect the project goals and objectives initially identified. All tasks were completed that were identified in the scope of work. Some issues contributing to the delay of the project included equipment failure. This delay made it difficult to effectively decommission the staging areas and temporary access routes used by the equipment given frozen ground conditions. The contractor had to remobilize to the site to effectively complete this work. In addition, high flow events experienced post construction and lack of established vegetation contributed to the loss of two grade control structures impacting the stream channel and adjacent floodplain. TNT excavating was able to replace the lost grade control structures and repair the impacted stream reach and floodplain areas. Additional weed treatment beyond the pre/post treatment is necessary to address the noxious weeds resulting from the high level of ground disturbance. Missouri River RAC funds were used for revegetation and agreements with the Lewis and Clark County Weeds Department.

Renewable Resources and Public Benefits

The Beaver Creek project has met restoration goals in restoring Beaver Creek to more natural conditions and restoring hydrologic process providing improved spawning and rearing habitat. Channel stability and instream habitat complexity are reflected in the completion report and field construction reports provided by RDG and attachments to this final report. Beaver Creek maintained surface flow and connectivity to the Missouri River during the 2023 season providing access for both migratory rainbow and brown trout. Due to high flow and turbid conditions, rainbow trout redd counts were not conducted; however, spawning fish were observed in the project area and redd counts will continue in out-years to document spawning success. Brown trout redd counts will proceed fall 2023. Electrofishing efforts with the HLC NF Youth Forest Monitoring program documented rainbow and brown trout recruitment observing several age classes and young of the year. Macroinvertebrate surveys also reflect an increase in abundance and species of aquatic insects. To determine whether the project has fully achieved desired conditions re-vegetation efforts and groundwater wells will be monitored for the next several years including photo point documentation at designated locations.

The University of Montana Bird Ecology Lab will continue to monitor bird abundance and diversity post-construction. These efforts are funded and supported by NorthWestern Energy. MT FWP will continue with creel surveys on Section 10B of the Missouri River to reflect local and regional angler use. Gill netting and electrofishing surveys estimating density of target fish (per mile), rainbow trout natural production of trout and age class structure are conducted annually by FWP. Reports are published and presented annually at the Missouri Technical Advisory Committee Meetings.

In cooperation with the Lewis and Clark Conservation District, a project tour will be held in the spring of 2024, with the option for the public to attend.

Grant Agreement Administration and Project Costs

The actual project construction timeline was postponed one calendar year from what was originally submitted in the application, Table 1. Factors responsible for this include dissemination of secured funds and resource considerations. Given drought conditions in 2021 and an unconsolidated streambed in the newly constructed channel in Phase 1, Beaver Creek went subsurface in parts. The USFS paused the project to allow the stream channel to adjust and "seal". Phase 2 resumed in September 2022. Equipment failure led to a two-week delay with construction ending December 1st 2022. Corrective action was necessary to meet our best management practices and conservation measures and the contractor had to return to effectively decompact the material and equipment staging areas and temporary access routes July 2023.

Table 1. Project Schedule for the Beaver Creek Phase II Restoration Project 2021

Task	Jan-March	April	May	June	July - November
General Project Management					
Task 1. Pre-construction Services/contract administration					
Task 2. Construction Implementation					
Task 3. Construction oversight/contract administration/Direct Costs					

Total project cost was $541,422.87. A cost break-down highlighting partner funding sources and monies spent by project activity can be found in Table 2. Unbudgeted expenses included the inflated cost of fuel during the 2022 construction season, remobilization of equipment to decompact the staging areas and temporary access routes and to repair the lost grade control structures due to high flow events spring of 2023. Additional Missouri RAC funds were secured to address weed management within the project area. Currently there is $7,500 matching FS funds with the CDA nursery if future revegetation/seeding is needed.

Table 2. Cost Summary Beaver Creek-Phase 2

	Total Budget	Budget Allocation				
		NWE	USFS	PBTU	MT FWP	DNRC
Task 1-GPS equipment, Project Management, Direct Costs	$29,993.23	$13,395	$8,342			$8256.23 (LCCD project management)
Task 2- Per diem, misc. direct costs	$1,692.76	$1,692.76				
Task 3-Construction and Materials	$479,736.88	$327,792	$4,500	$5,250 (in-kind)	$50,000	$92,194.88
Task-4 Seed/Revegetation/Weed	$30,000		$30,000 (Missouri			

Table 2. Cost Summary Beaver Creek-Phase 2						
treatments			RAC)			
Total	$541,422.87	$342,879.76	$42,842	$5,250 In-kind	$50,000	$100,451.11
Percent Total Budget		63.3%	8%	1%	9.2%	18.5%

Figure 3. Pat Barnes Trout Unlimited members and Capital High School students willow collecting.

Supporting Project Documentation

Figure 4. Top of the project area, station 47+00, open streambanks before willow placement.

Figure 5. Channel construction at the top of the project area Station 53+00. Newly constructed channel was raised relative to the old channel (right) to increase floodplain connection and restore floodplain elevations to historic levels.

Figure 6. View from Station 72+50 before construction. Coordinates:-111.890872 46.788562

Figure 7 and 8 . View of Station 72+50 during construction looking upstream. Approximately 4,700 CY of net earthen material were moved to the repository, 9,400 CY were used to plug the old channel, creating a newly expanded and connected floodplain. Bottom picture Station 72+50 July 2023, 7 months post construction.

Figure 9. Completed channel and floodplain construction. The work incorporated juniper limbs buried category 2 wood to amend the soil and willow trenches were placed perpendicular to the channel. Wildlife snag pods were placed to create vertical structure inviting cavity nesters.

Figure 10. Compound pool complex with preserved shrub/scrub habitat, station 55+00.

Figure 11. End of the project area, photo point 83+50. Coordinates -111.893506, 46.787645

Figure 12 and 13. Photo point station 83+50 post-construction winter 2022 and July 2023.

Figure 14. Photo point 81+00 pre-construction, coordinates -111.893506, 46.787645

Figure 15 and 16. Photo point station 81+00 post-construction December 2022 and July 2023, -111.893506, 46.787645