



Bear Creek Habitat Improvement Project
Final Report
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Report prepared by:

Becky Reed
Project Director, RMFI
and
Eric Billmeyer
Executive Director, RMFI

Rocky Mountain Field Institute
3310 West Colorado Avenue, Colorado Springs, CO 80904
Phone: 719-471-7736 Fax: 719-622-6707 E-mail: rmfi@rmfi.org Web: www.rmfi.org

Foreword

The Bear Creek Habitat Improvement Project would not have been possible without out the wide variety of support this project received from the Pikes Peak Ranger District, Colorado Springs Utilities, the Colorado Division of Wildlife, the U.S Fish and Wildlife Service, the Colorado Motorcycle Trail Riders Association, and Trout Unlimited. Financial support for the project was provided through a collaborative agreement between the U.S Fish and Wildlife Service (USFWS) and the U.S Forest Service (USFS) with additional monies provided by Colorado Springs Utilities (CSU). Special thanks to Denny Bohon, USFS, and to Kirsta Scherff-Norris, CSU, for navigating through the myriad of permitting and funding processes that needed to be completed to allow the project to go forward. We would also like to thank the members of RMFI's 2010 *Earth Corps* program who did almost all of the back breaking labor to complete the project objectives. Program participants included: Julia Bedell, Nathan Chellman, Marshall Genn, Tess Hayden, Brad Koegel, Hilary Lempit, Claire Qubain, Greg Walth, Matt Williams, and Willy Zhang.

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I. INTRODUCTION

The Bear Creek watershed lies just west of the City of Colorado Springs along the eastern flank of the Pikes Peak massif (Lat. 38° 48' 15" N, Long. 104° 55' 30" W)(Figure 1). Encompassing both National Forest lands administered by the Pike National Forest and private lands owned by the City of Colorado Springs and managed by Colorado Springs Utilities, the watershed is extremely important for its recreational opportunities, its value as a water resource, and as vital habitat for the Federally threatened greenback cutthroat trout (*Oncorhynchus clarki stomias*).

The goal of the *Bear Creek Habitat Improvement Project* is to enhance and protect greenback cutthroat habitat within the Bear Creek drainage by reducing sedimentation and erosion impacts from 3.9 miles of the Pike National Forest system trail #667, which runs adjacent to upper Bear Creek. Trail #667 provides connections to over a hundred miles of additional trails in both the Pike National Forest and Colorado Springs open space and parklands. The trail is popular for hiking, camping, mountain biking, and off-highway vehicles (motorcycles). Impacts due to the heavy recreational use of the trail are exacerbated by the highly erodible soils made up of decomposing Pikes Peak granite. The result is sections of the trail outslope failing, and severe over-steepening and vegetation loss on many cutslope sections. In addition, the trail crossed the creek eight times, had poor drainage design, and had segments that were within a foot of the stream channel.

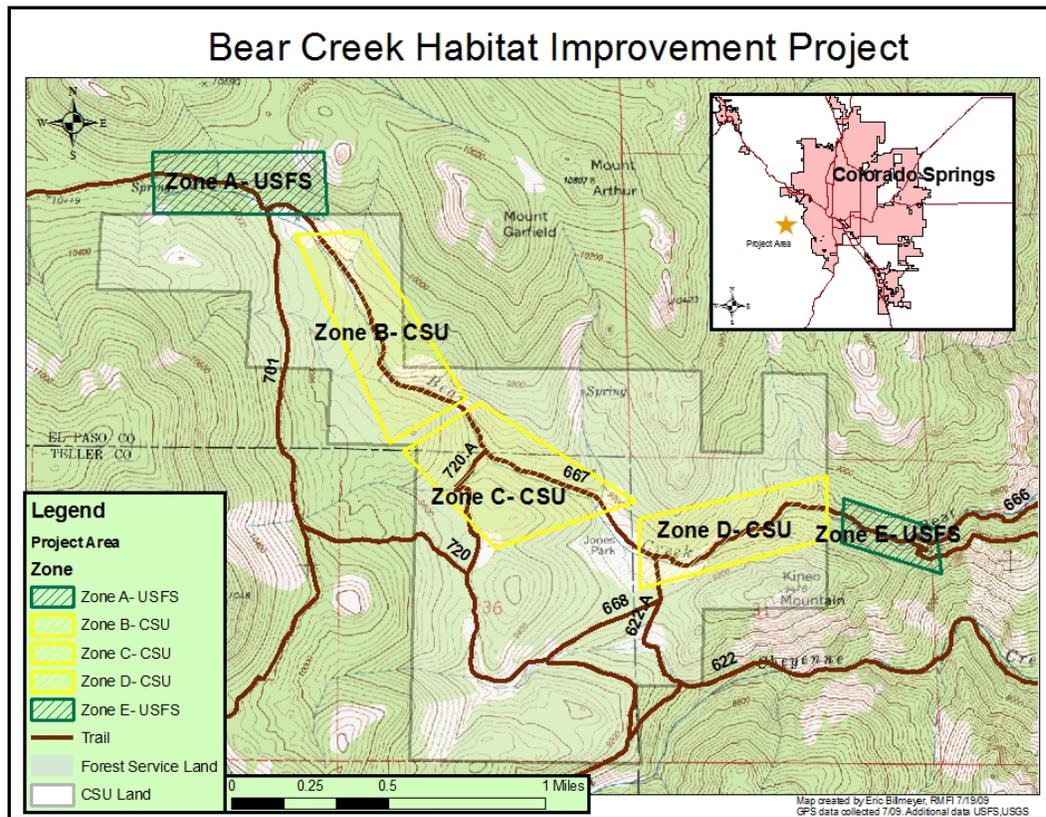


Figure 1. Overview of project area

The *Bear Creek Habitat Improvement Project* focused on eliminating sediment influx from erosion off the trail into Bear Creek through the use of erosion control structures, retaining walls, reconstruction of eroded banks, construction of bridges, rerouting portions of the trail and restoring closed sections, and applying re-vegetation techniques to eroded banks and slopes. Completion of erosion control, stabilization, and restoration work throughout the project corridor provided the following benefits:

- Reconstruction and new construction of drainage ditches to attenuate runoff and trap sediment resulting in substantial reduction in the amount of sediment transported off trail and into Bear Creek during storm events.
- Stabilization and revegetation of outslope banks resulting in a reduction of sediment erosion into stream.
- Stabilization and revegetation of cutslope banks resulting in a reduction of sediment erosion into stream.
- Construction of new trail away from a riparian area and restoration of the old trail, resulting in a buffer of protection between the stream channel and trail corridor.
- Reconstruction of eroded banks where the trail crosses the creek eliminating the flow of water down the trail during high flow events, and providing a sustainable platform for the construction of new bridges.

II. ZONE A- USFS Lands

This zone lies in Pike National Forest and encompasses the furthest distal reach of the *Bear Creek Habitat Improvement Project*. The northwest boundary of the zone lies approximately 1.5 miles east of a South Slope Watershed access road and 2.7 miles northwest of the first bridge crossing on Trail 667. The length of trail included in this zone is just less than .5 mile.

Summary of work completed:

Work in this area primarily focused on closing a portion of the Trail 667 dead end spur to avoid an unnecessary stream crossing, and opening an 887 ft. re-route of the trail on the northeast side of the creek that avoids contact with the stream. Restoration of the old trail included soil de-compaction; seeding; transplanting bunch grass from the surrounding area; and laying erosion control matting. The new trail was cut with McLeod rakes with attention paid to proper water drainage. Timber risers and timber outslope walls were constructed in the new trail.

Special attention was paid to both closed entrances to the restored old trail. Timber deadfall and vegetation provided visual blocks, obstructing the line of sight. The west-end closure required technical construction as the old trail was steep, full of loose sediment, and crossed the stream. A series of timber risers were constructed in the old trail to catch sediment before entering the stream. Terraced rock retaining walls were built beside the trail in a steep, loose, heavily denuded area. Both areas were then seeded, re-vegetated with transplants, and matted (Img. 2 and 3).

Above the re-route, brush and rock check dams were constructed in existing drainage channels to attenuate storm flow. As rock was scarce and deadfall was abundant in the area, brush dams were constructed more often than rock (Img. 1) The construction of the brush dams is very

similar to the corner joint of a log cabin, with logs stacked on top of one another, alternating from each side. The intersection of the logs is built inline with the flow of water, so the water hits the intersection head-on and is diverted to the sides thus attenuating the flow and causing sediment to be trapped by the structure. In larger drainage channels, two brush dams were constructed, one behind the other. This second dam provides a back-up, secondary structure to catch sediment in large storm events.

Work statistics:

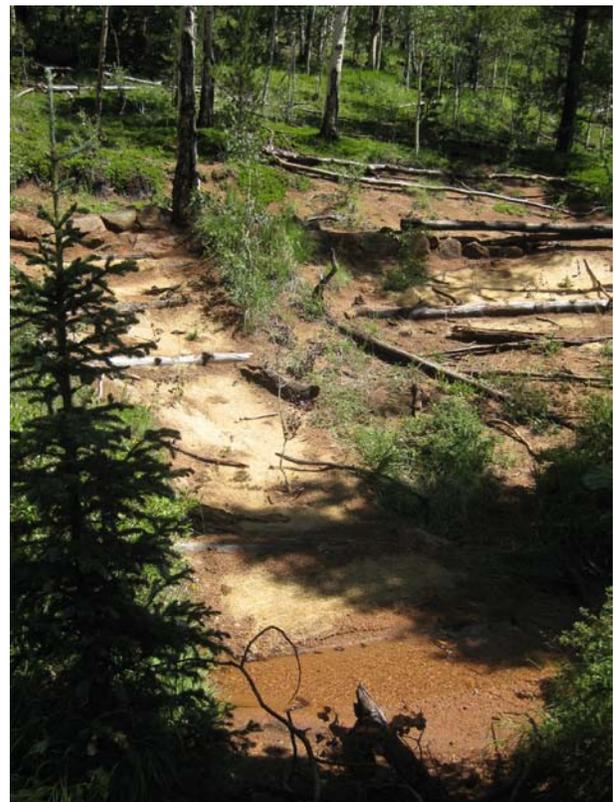
- 887 ft. new trail
- 2,056 ft.² old trail restored
- 1 bridge
- 8 brush check dams
- 2 rock check dams, 171 ft.³
- 1 in-trail drain, 40 ft.²
- 178 transplants
- 86 ft. timber outslope reinforcement
- 6 timber risers
- 57 ft.² rock retaining walls
- 152 ft. of timber obstacles placed



Img. 1: Brush check dams



Img. 2: BEFORE closure of west end of old trail.



Img. 3: AFTER closure

III. ZONE B- CSU Lands

Zone B lies exclusively on Colorado Springs Utilities land. This zone includes approximately .75 miles of trail. It includes two stream crossings as well as one major tributary crossing.

Summary of work completed:

The focus of this area was mitigating the flow of sediment into the creek. Zone B already had a number of drainage channels, however, these channels fed directly into the creek, thus providing a direct corridor for sediment from the trail to Bear Creek. Rock and brush check dams were constructed in these drainage channels to catch sediment (Img. 4). Additionally, key drainage channels were redirected away from the creek to areas suitable to catch large quantities of sediment.

At the site of the tributary crossing, the down-trail bank was reconstructed to keep water off the trail and in the stream corridor (Img. 5 and 6). This site had historically been a problem area with the tributary running down the trail during major and minor storm events. The original project plan for this crossing was to install a rock culvert. However, after seeing the site several times this summer it became apparent that a bridge was necessary to ensure water quality protection of the creek in this area. This was mostly due to very high flows witnessed in this tributary over the course of this summer's monsoon. Rough calculations showed comparable flow rates between the tributary and Bear Creek. Due to the similar flow rates it was felt that this volume of water *could not* be adequately contained within an appropriately sized rock culvert. Prior to construction of the bridge, RMFI rebuilt the stream bank, raising the bank 3 feet to where it historically stood. This reconstructed bank not only redefines the stream channel, but also serves to keep sediment from the trail from entering the stream.

Work statistics:

- 11 rock check dams, 655 ft.³
- 7 brush check dams
- 27 ft.³ bank reconstruction
- 1 rock water bar, 16 ft.²
- 10 log erosion barriers



Img. 4: Rock check dam, catching sediment.



Img. 5: BEFORE water bar. Water is running down the trail.



Img. 6: AFTER water bar and before new bridge.

IV. ZONE C- CSU Lands

This zone lies in the middle of the greater project area. Trail 720-A comes in from the southwest, increasing recreational impacts within this zone. The length of trail included in this zone is just over .5 mile on Trail 667 and 836 feet on Trail 720-A.

Summary of work completed:

The work on Trail 667 focused on stabilizing the outslope of the trail by constructing rock and timber retaining walls. 108 feet of timber outslope stabilization and 50 square feet of multilevel rock retaining wall were constructed (Img. 7). The majority of work in this zone focused on Trail 720-A. 720-A steeply intersects Trail 667 from the southwest. Just before this intersection, there is a bridge-covered stream crossing. To minimize sediment deposition into the stream, two water bars were constructed above the bridge crossing. Further up Trail 720-A, a major tributary crosses the trail. A large, cobbled drain was constructed to re-direct water back to the original channel (Img. 8 and 9). This drain keeps the water clear and sediment-free. In the same area, 39 feet of timber logs were placed on the outslope of the trail to provide slope stabilization and prevent sediment from running off the trail into the stream.

Work statistics:

- 1 in-trail drain, 48 ft.²
- 2 water bars, 40 ft.²
- 147 ft. timber outslope reinforcement
- 50 ft.² rock retaining wall



Img. 7: Outslope stabilization with timber logs and rock retaining wall.



Img. 8: BEFORE drain. Water channel is unnecessarily wide.



Img. 9: AFTER drain. Stream channel is constricted, water is kept free of sediment with cobbles.

V. ZONE D- CSU Lands

This zone encompasses the last section of the Bear Creek trail on CSU lands. The trail in this section was heavily eroded and required substantial work to ensure the trail did not continue to negatively impact Bear Creek's water quality. The length of trail included in this zone is approximately .5 mile.

Summary of work completed:

This section of trail represented the highest priority, as this is where the majority of sediment flow from the trail to the stream occurred. Work focused on constructing drains in the bed of the trail to provide a path for water seeps to cross the trail and not collect a large sediment load. Drain construction consisted of first creating a trough and lining the up-trail and down-trail sides with large rocks. These rocks varied in size from 75 lbs to over 300 lbs. The majority of rocks used in these drains required 4-person carries to transport the rock to the work site. After the barrier rocks were set, cobble was placed in the trough. The water runs over and through the cobble, with sediment getting caught in the gaps. In one instance, the width and depth of the drain required that a rock be placed on top to bridge the gap and provide easier crossing for bikers and hikers. This structure is the rock culvert listed below. A total of 9 drains and 1 culvert were constructed.

The trail was re-routed in this zone to move it farther from the stream (Img. 10, 11 and 12). The old trail came within a few feet of the stream bank. The crew cut in 335 feet of new trail approximately 30 feet from the stream. The old trail was restored with 193 bunch grass transplants taken during construction of the new trail. A total of 1,745 square feet of old trail was restored with transplants, seed, and erosion control matting. The new trail required only a few drainage structures and outslope reinforcement.

On a steep, eroded slope above the trail, 1,809 square feet of area was restored with seed and erosion control matting (Img. 13 and 14). Old, sediment-covered erosion control matting illustrates that this spot was historically a problem area for restoration. To ensure successful results, the crew placed the matting above the denuded area, staking the edge in vegetation.

Lastly, this zone required the construction of one major outslope rock retaining wall in a heavily damaged, steep area that was depositing a large amount of sediment into the stream. The crew moved dozens of 300+ pound rocks into the hillside, creating a stable outslope to the trail and protecting the stream from further sediment deposition. Additionally, six timber logs placed for outslope reinforcement were constructed in this zone (Img. 15-18).

Work statistics:

- 1 rock culvert, 150 ft.²
- 2 drains, 239 ft.²
- 3,554 ft.² of area seeded, revegetated, and matted
- 335 ft. new trail
- 193 transplants planted
- 2 rock water bars, 8 ft.²
- 105 ft. timber outslope reinforcement
- 367 ft.² rock retaining wall
- 9 rock risers



Img. 10: Above left: BEFORE. New trail cuts to right.

Img. 11: Above right: AFTER. Old trail closed to left, new trail cut to right.

Img. 12: Left: Old trail restored with soil decompaction, transplants, and visual deterrents.



Img. 13: BEFORE



Img. 14: AFTER



Img. 15: BEFORE. Trail is unnecessarily wide and outslope is unstable.

Img. 16: AFTER. Trail is narrowed. Outslope is stabilized with timber and erosion control matting.



Img. 17 and 18: BEFORE and AFTER on large drain installation looking down-trail.

VI. ZONE E- USFS Lands

This is the furthest east zone in the project area and is where the Bear Creek trail (#666) joins with Trail 667 right at a Bear Creek stream crossing. The Bear Creek trail is non-motorized. The length of trail included in this zone is just over 1,300 feet on Trail #667 heading up the Bear Creek drainage and 328 feet of #667 heading toward High Drive.

Summary of Work Completed:

The focal point of work for this zone is where Trail 667 crosses Bear Creek. Just east of this crossing, the trail is very steep and prior to construction provided a direct corridor for sediment to enter the stream channel. To mitigate this, six rock and timber water bars were constructed to direct water and sediment off the trail before the stream crossing. 128 feet of timber outslope stabilization was also constructed on this side of the crossing.

On the western side of the stream, the bank was reconstructed to its original height (Img. 19 and 20). The reconstruction involved constructing a rock retaining wall as the framework, and then building on both sides of the structure with logs and smaller rock. Willow was planted along the stream.

On a steep, eroded slope just above the stream, a large, 2-tiered rock outslope retaining wall was constructed (Img. 21, 22, and 23). This structure serves to stabilize both the trail and slope, and mitigate sediment deposition into the stream channel. Further upstream, 5 drains were placed in the trail to provide an avenue for water seeps to cross the trail (Img. 24 and 25).

Work Completed:

- 82 ft.² bank reconstruction
- 98 ft.² rock retaining wall
- 137 ft.² area restored
- 5 drains, 211 ft.²
- 128.5 ft. timber outslope
- 137 ft.² area restored
- 2 rock water bars, 72 ft.²
- 4 timber water bars, 20 ft.²
- 30 willow transplants
- 60 ft.² brush and rock dam



Img. 19: BEFORE bank reconstruction.



Img. 20: AFTER bank reconstruction.



Img. 21: Left: BEFORE rock retaining wall construction. Slope is very unstable.

Img. 22: Right: AFTER. Rock retaining wall and restoration.

Img. 23: Below: AFTER. Rock retaining wall and restoration.





Img. 24: BEFORE. Water seep



Img. 25: AFTER. Drain

VII. CONCLUSION

The Bear Creek Habitat Improvement Project was a logistically and technically challenging project. The remote nature of the project work and the commitment of time required to meet the project's objectives necessitated the use of a long term backcountry crew. Getting the equipment and supplies needed for such an endeavor initially taxed the resources of both the Colorado Division of Wildlife (CDOW) and RMFI, but once in place the project progressed smoothly even with a very active monsoon season causing weather challenges on an almost daily basis. In all, RMFI conducted 29 days of project work with its *Earth Corps* backcountry crew of 10 and 3 staff and 1 day of work with a crew of 7 hardy volunteers and two staff. The *Earth Corps* program was conducted from July 9th to August 7th and the volunteer day was held on October 3rd. Total cost for the project came in at the \$32,500 project budget. Total value of the volunteer time contributed by *Earth Corps* and the volunteer day is \$60, 809, greatly increasing the overall value of the project. A full breakdown of project costs is included in Appendix A.

A post-project site visit with agency personnel from the USFS, CDOW, USFWS, and CSU was held on October 4th, 2010 to review the project work detailed in this report. Overall, the work completed met the primary objective of the project plan to substantially improve areas of Trail #667 where deficiencies were causing severe erosion and subsequent sediment transport into Bear Creek. The massive rock retaining walls, reestablished banks, and rock hardened water crossings will no doubt be performing their duty well into the next century. In other areas where pre-established drainage ditches were located, primarily in Zones A and B, the additional erosion control structures put into place are temporary fixes until a longer term solution can be implemented. From what was observed this past summer, the amount of sediment production from the motorized trail will overwhelm any standard erosion control structures such as rock or brush check dams within a few years depending on summer monsoonal intensity. With most of the pre-existing drainage ditches leading into the creek, sediment transport can be expected to continue after the storage capacity of the dams has been exceeded. Regular maintenance of the dams will be needed to continue their short-term effectiveness. To fully eliminate the sediment transport from these ditches into the creek, the trail will either need to be moved to a new sustainable location up slope or the ditches reconfigured to drain water and sediment away from the creek. In reality a combination of both will probably be required to meet this objective. It is RMFI's opinion that future work implemented in the Bear Creek drainage should focus on addressing the sediment issues related to these ditches with the above proposed solution.

The work completed this summer already has and will continue to have a substantial positive impact on reducing sediment loading into Bear Creek associated with use of the Bear Creek Trail (#667). With the additional work described above, sediment loading will be reduced even more resulting in even greater improvements to the aquatic habitat of Bear Creek. Please feel free to contact Eric Billmeyer or Becky Reed with any questions regarding the content of this report at 719-471-7736 or rmfi@rmfi.org.

VII. Appendix A- Budget Detail

Bear Creek Habitat Improvement Project Budget

Salaries and Benefits-	\$18,246
Contract Labor-	\$1,205
Office Expenses-	\$114
Travel-	\$181
Supplies/Equipment-	\$7,103
Indirect Expenses-	<u>\$5,651</u>
Total	\$32,500