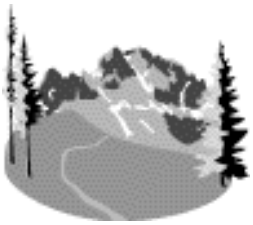

Rocky Mountain
Field Institute

11/23/2009

Upper Ski Creek Watershed Erosion Control and Restoration Project- Phase 2

Task 3
Final Report

El Paso and Teller Counties, Colorado
Pike National Forest

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CONTENTS

Executive Summary

The Rocky Mountain Field Institute (RMFI) and its partners successfully completed the second and final phase of an erosion control and restoration project within the upper Ski Creek Watershed, Pikes Peak, CO. The *Upper Ski Creek Watershed Erosion Control and Restoration Project-Phase 2* is the fourth project to be completed as part of the *Pikes Peak Watershed Restoration Project*, a large-scale, multi-year effort to address severe sedimentation and erosion impacts caused by stormwater runoff from the Pikes Peak Highway. This report details the work undertaken to finalize the multi-year effort to completely stabilize the upper Ski Creek drainage and to complement work initiated by the Pike National Forest within the basin in the early 1990's. Overall the project contributed to both forest health and watershed protection. The *Pikes Peak Watershed Restoration Project* is a cooperative effort between the Rocky Mountain Field Institute (RMFI), a nonprofit 501(c) 3 organization, the Pikes Peak Chapter of the Sierra Club, the City of Colorado Springs, and the USDA Forest Service.

To address the severe sedimentation and erosion impacts in the upper Ski Creek Watershed, RMFI and its partners constructed 31 cross-vane structures, 7 gully plugs/bank restoration structures, and 3 check dams. Over 2500' of bank stabilization was completed throughout this year's project area. In addition, over 6,500 sq/ft of erosion control matting and almost 1 acre of seed and soil amendment was laid down to restore degraded areas adjacent to the channels. Volunteers and interns contributed 303 hours to the project and our Pikes Peak Corps program for youth team contributed another 918 hours. Post-project monitoring of the erosion control and vegetation prescriptions implemented this past summer was completed and will continue for the next three years to show that the prescriptions are performing to expectations and are reducing sediment transport within the upper Ski Creek Watershed.

Success of this project would not have been possible without the financial support of the Colorado Water Conservation Board, the National Forest Foundation, and the Pikes Peak Fund as well as the physical efforts of volunteers from the Pikes Peak Corps, the Sierra Club, the Zebulon Pike Youth Service Center, and the University of Colorado at Colorado Springs (UCCS) and student interns from UCCS and CU-Boulder.

1.0 Project Background

As part of the restoration efforts within the Pikes Peak Watershed, the *Upper Ski Creek Basin Erosion Control and Restoration Project-Phase 2* addressed severe sedimentation and erosion impacts in the creek's headwater area. This project complemented work begun in 2007 to completely stabilize the upper Ski Creek drainage and finalize work initiated by the Pike National Forest within the basin in the early 1990's.

Ski Creek is one of the most degraded waters within the Pikes Peak Watershed. A 1993 Forest Service study concluded that the creek was out of equilibrium and was carrying an extremely high sediment load. Observed suspended sediment in the creek significantly exceeded the sediment threshold 100% of the time with the average exceedance calculated at 27,000%. According to a 2004 water quality report, sediment in the creek has severely stressed the creek's aquatic life. The high sediment loads carried by Ski Creek have also been found to be negatively impacting storage capacity of the South Catamount Reservoir, a primary source of drinking water for the City of Colorado Springs.

The project goals were to mitigate sedimentation impacts and stabilize the upper Ski Creek drainage through the implementation of several different erosion control and revegetation prescriptions and to establish a defined main channel and rehabilitate the multiple braid channels found within the reach. To achieve the project goals the following treatments were specifically implemented to accomplish the following objectives:

- Substantial reduction in the velocity of runoff and sediment transport by constructing cross-vane grade control structures to attenuate flow and stabilize the channel bottom.
- Stabilization and restoration of multiple braided channels within the reach leading to a prevention of further erosion and impact to the local forest through the reconstruction of eroded banks, construction of check dams, and revegetation efforts.
- Stabilization of channel banks and establishment of native vegetation in bare areas on the periphery of the channels through extensive rock armoring of stream banks and revegetation efforts.

2.0 Budget

The final cost of the *Upper Ski Creek Basin Erosion Control and Restoration Project-Phase 2* was $117,484 including in-kind donations of time of $24,725. Funding included $35,000 from the National Forests Foundations Matching Awards Program, $25,000 from Colorado Water Conservation Board's Colorado Watershed Protection Fund Grant Program, now known as the Healthy Rivers Fund, and a $32,759 grant from the Pikes Peak Fund.

3.0 Project Implementation

Originally the project was scheduled to start with on the ground implementation in early June, however due to heavy spring snows the project site was not clear to work in until almost July. The late start, while causing a few logistic challenges, was in hindsight very beneficial in that we were able to see and adjust project objectives as our stream and restoration work was tested day after day due to an early onset of our normal monsoon season. Future stream work on Pikes Peak will now be scheduled in July to take advantage of the higher flows from these storm events and the immediate feedback they provide on our restoration efforts.

With the snow finally melted in the Basin, final project planning was completed at the end of June. The first phase of the project then commenced in the middle of July with the arrival of the heavy equipment to install the larger cross-vanes. The heavy equipment work was sub-contracted to Chaparral Construction, LLC. of La Veta, Colorado, under the supervision of FIN-UP Habitat Consultants, Inc., of Manitou Springs, CO. Chaparral was the contractor for the initial Upper Ski Creek project in 2007 and was selected for this phase because of the quality of the work performed in the previous project. Chaparral Construction provided a Komatsu PC78 Excavator (15 metric ton) with a hydraulic thumb, and a Deere TC-62H Loader for the project. The lessons learned during the first phase of the upper Ski Creek project taught us that a much smaller excavator than the equipment used in the previous effort would be more effective. The excavator was also equipped with steel lined rubber tracks for better traction when negotiating steep boulder strewn slopes.

The goals for this phase of the project were to construct cross-vanes within the channel to provide grade control, plug gullies that had been feeding into the creek in preparation for their stabilization and restoration by hand crews, and to delineate a single channel where multi-braid channels within the reach existed. Many areas of the project reach were too steep and forested to get to with the equipment and these areas were completed with hand crews.

Figure 1. Installing bank stabilization structure

During the heavy equipment phase of the project, twenty seven cross-vanes and seven gully plug structures were installed using approximately 190 tons of granite rock 18” to 48” in diameter. Construction of all structures was completed in seven days in the middle of July, 2009. Work progressed smoothly, though the steepness of the terrain

and density of the trees in the project area made the work quite challenging. The project completed in 2007 gave us the experience to deal with the decomposed Pikes Peak granite soils that make up the channel floor and how to properly site the boulders so they would sit tightly together. One cross-vane installed in 2007 needed to be repaired after the project was completed. However, this summer's very wet weather was quite helpful in testing the structures while the equipment was in place. This allowed for minor modifications to be completed within the project time frame.

In addition to the structures, the heavy equipment was used to construct or reconstruct approximately 330' of bank. Sixteen large trees (12" - 18" DBH, and approximately 30 feet long) were identified for removal by the District forester and were imbedded into the toe of the channel bank to aid in stabilizing the bank walls. Large rocks were then placed behind the trees and back filled with channel sediment in preparation for revegetation efforts by the hand crews.

As stated before, due to the steepness of the terrain and the density of the forest along portions of the Ski Creek reach, volunteer hand crews and our Pikes Peak Youth Corps program was used to complete in channel work and bank stabilization in many areas. Work was completed in July and August, 2009. The crews stabilized over 1900' of stream bank within the main channel of the upper Ski Creek drainage. The work consisted of using native rock material to rebuild banks that were either completely eroded away or had eroded below the bankfull stage. Rock boulders were also used to fill voids in undercut banks and rock cobble was used to armor unprotected banks. Seed and erosion control matting was applied to denuded and restored areas to aid in the further stabilization of the banks. The crews also completed an additional four smaller cross-vane structures and eliminated three major headcuts within the channel by recountouring the channel bottom and through the use of large boulder. In all, hand crews moved approximately 60 tons of native rock material to rebuild banks, construct cross-vanes, and armor channel banks all along the main Ski Creek corridor.

Hand crews also completed an additional 280' of stream bank and restoration of adjacent areas next to the main channel of the upper Ski Creek drainage. Several multiple braid channels had formed along sections of the main Ski Creek drainage. These channels created numerous gullies which caused extensive erosion to occur outside of the main channel corridor. Crews rebuilt banks to

Figure 2. Pikes Peak Corps members completing bank stabilization work

keep the flow in the main reach and then completed stabilization work within the disconnected gully channels through the construction of check dams and placement of boulders and woody debris along the toe slope. This work required an additional 25 tons of native rock. In addition, 6,528 sq/ft of erosion control matting and almost 1 acre of seed and soil amendment was laid down to restore degraded areas adjacent to the main reach and these disconnected channels.

Construction and implementation of all treatments were very successful. In all, the project produced the following results:

- 275 tons of rock was utilized to construct 31 cross-vanes structures, 7 gully plug/bank restoration structures, 3 check dams, and stabilization of 2,585 feet of stream.
- 6,528 sq/ft of erosion control matting and 1 acre of seed applied to restore degraded areas.
- 25 volunteers contributed 303 hours to the completion of the project while the 10 member volunteer Pikes Peak Corps Youth team contributed 918 hours over 13 days.

4.0 Post-Project Monitoring/ Wrap-up

RMFI and FIN-UP personnel completed post-project monitoring of the project site in October 2009. Base line cross-section measurements were taken at four locations within the project reach in 2007. These four cross-sections were re-surveyed, and were plotted against the pre-project data (Attachment A). These cross-sections will continue to be evaluated for the next three to assess how well the cross-vanes and the bank stabilization techniques are working to stabilize the channel and reduce erosion. In addition, to assess the effectiveness of the transplant and seeding efforts, three vegetation plots measuring 1m x 1m were established for monitoring and evaluation purposes. The plots were located within restored areas and will sample increases in vegetation cover using the point line transect method. Vegetation surveys will be repeated every year for the next three years in the fall after the summer monsoon season.

The entire *Upper Ski Creek Basin Erosion Control and Restoration Project,* both *Phase 1* and *Phase 2* has shown promise that a highly degraded stream channel residing in an extremely erosive environment can be stabilized. The methods found to restore Ski Creek will be distributed in several ways. Initial results of this year's project, and the three years of data collection we now have on *Phase 1* of the Ski Creek project, will be compiled into a report early next year and distributed to the Pike National Forest District Office, the Sierra Club Pikes Peak Chapter, the City of Colorado Springs, the National Forest Foundation, the Colorado Water Conservation Board, and will be available on our

website at ww.rmfi.org. Projects results are also being conveyed through our e-mail newsletter. A final report on the entire project will be produced at the end of the monitoring period for *Phase 2*. The final report will provide the basis for research articles to be submitted to peer reviewed journals and it is anticipated that we will be presenting the information at various conferences.

The *Upper Ski Creek Basin Erosion Control and Restoration Project- Phase 2* was accomplished with the support of a very broad group of partners. Planning of the project was done in close collaboration with the Pike National Forest District Office and the City of Colorado Springs Department of Transportation. Much of the transplanting, seeding, and placement of the erosion control matting was completed through the efforts of the 25 volunteers from the local chapter of the Sierra Club, the Zebulon Pike Youth Service Center, the University of Colorado at Colorado Springs (UCCS) and individuals from the surrounding community. Implementation of the project could not have been possible without the hard work of the 10 member volunteer Pikes Peak Corps Youth program. The Corps was instrumental in moving the 85 tons of rock utilized in stabilizing the main reach of Ski Creek and the tributary gullies. This was the first year of our Pikes Peak Corps program and the Ski Creek project was a highlight for many team members. Pikes Peak Corps team member Krystal Wright summed up her experience saying;

> *"The Pikes Peak Corps program taught me a whole lot. I learned the true meaning of hard work, restoration and much more. I benefited also from this, I made new friends and I can use everything I learned in the future, because I plan to go into college to study environmental sciences. I am so glad I participated in the program. I got stronger mentally and physically, gained self confidence and I truly value the word teamwork now."*

The value of labor provided by our volunteers and Pikes Peak Corps was over $24,725 using the 2008 Independent Sector rate (://www.independentsector.org/programs/research/volunteer_time.html). In addition to the generous $25,000 from the Colorado Water Conservation Board, funding for the project was provided by a $35,000 MAP grant from the National Forest Foundation, and a $32,759 grant from the Pikes Peak Fund. Thank you to all of our supporters and volunteers!

Attachment A: Budget

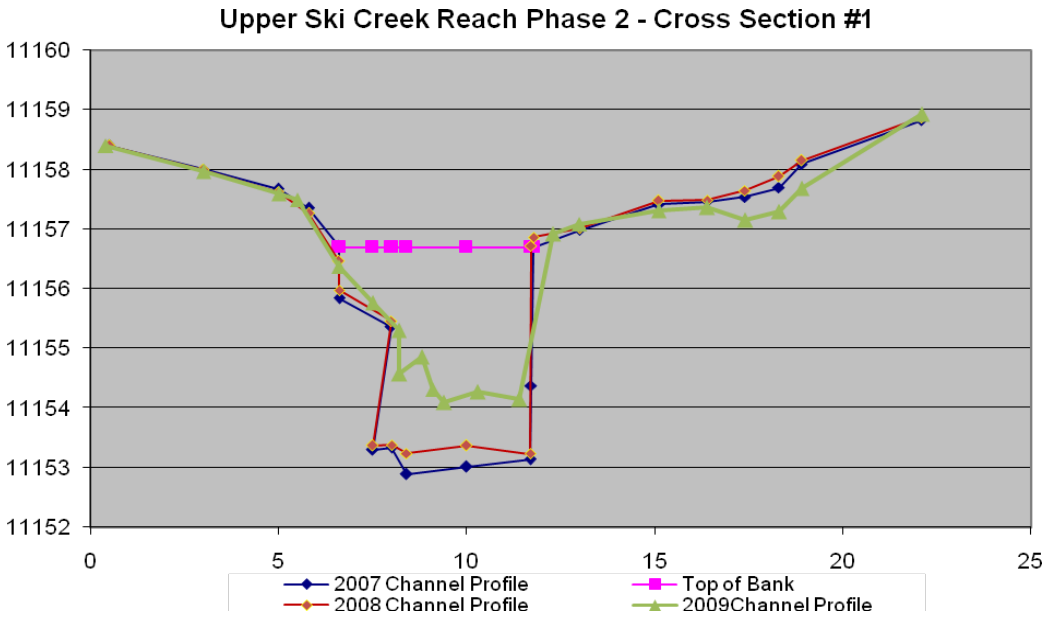
Organization: Rocky Mountain Field Institute			Project: Upper Ski Creek Basin Erosion Control and Restoration Project-Phase 2	
Part I:Final Project Budget				
	(a)	**(b)**	**(c)**	**(d)**
Category	**Funds Requested from CWCB**	**Matching Funds**	**Partner In-kind Contributions**	**Total Category Value**
Salaries & Benefits	$11,000.00	$30,718.00	$24,725.00	$66,443.00
Consultants	$10,600.00	$18,837.00	$0.00	$29,437.00
Stipends	$0.00	$0.00	$0.00	$0.00
Office Expenses	$0.00	$53.00	$0.00	$53.00
Publications/Outreach Materials	$0.00	$58.00	$0.00	$58.00
Supplies	$2,000.00	$214.00	$0.00	$2,214.00
Equipment/Rental	$1,400.00	$2.00	$0.00	$1,402.00
Travel	$0.00	$1,150.00	$0.00	$1,150.00
Indirect Expenses	$0.00	$16,727.00	$0.00	$16,727.00
Total	**$25,000.00**	**$67,759.00**	**$24,725.00**	**$117,484.00**

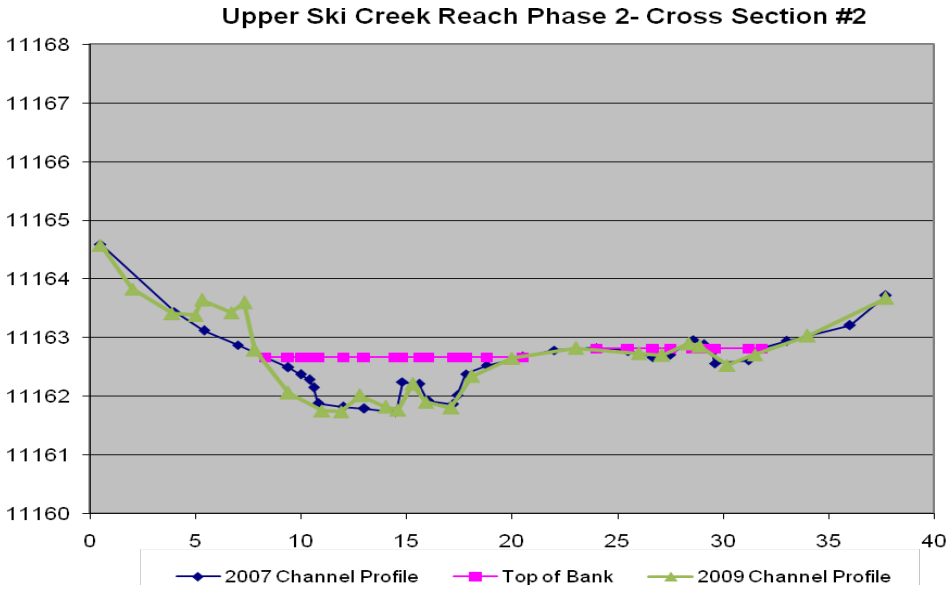
Part II. List of Donors

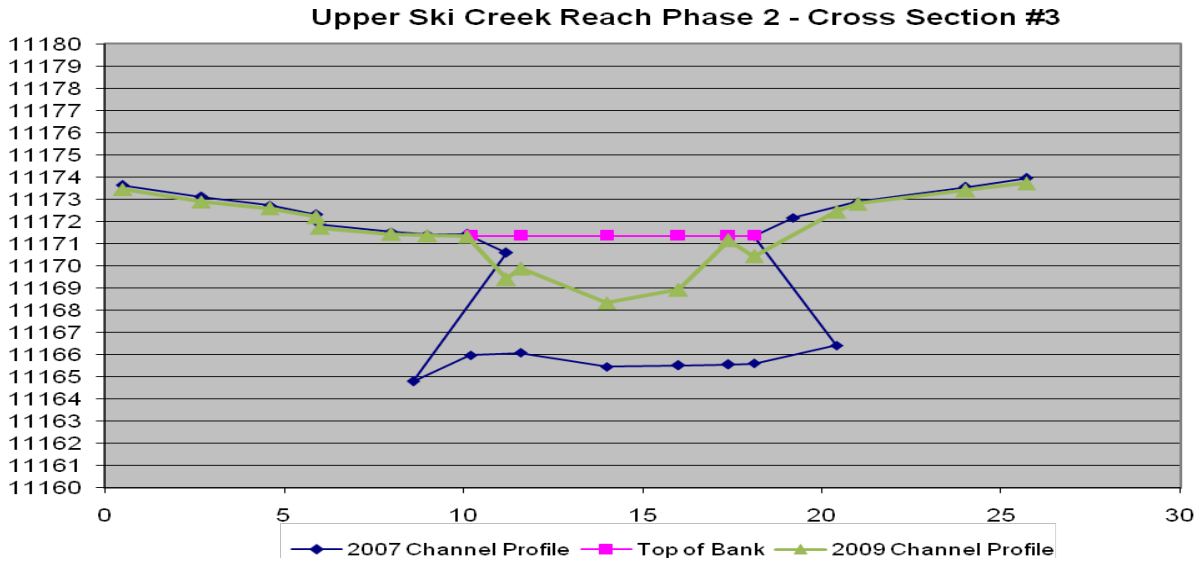
DONOR	AMOUNT	
Pikes Peak Fund	$32,759.00	Received
National Forest Foundation	$35,000.00	Received
Colorado Water Conservation Board	$25,000.00	Received
Volunteer Groups	$24,725.00	Received (In-Kind)
Total	**$117,484.00**	

Attachment B:

Cross Section Measurements Pre and Post-Project:






Upper Ski Creek Reach Phase 2 - Cross Section #3
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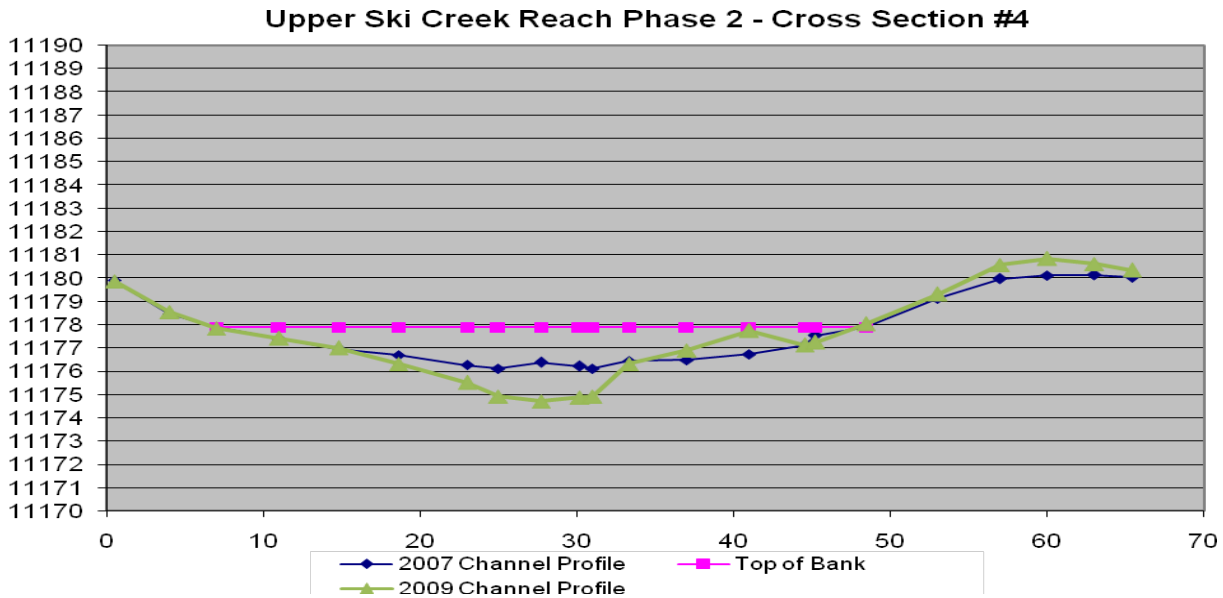
2007 Channel Profile
Top of Bank
2009 Channel Profile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11171
11170
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2007 Channel Profile
Top of Bank
2009 Channel Profile

Attachment C:

Project Photos (more photos included on CD)**:**

Heavy Equipment

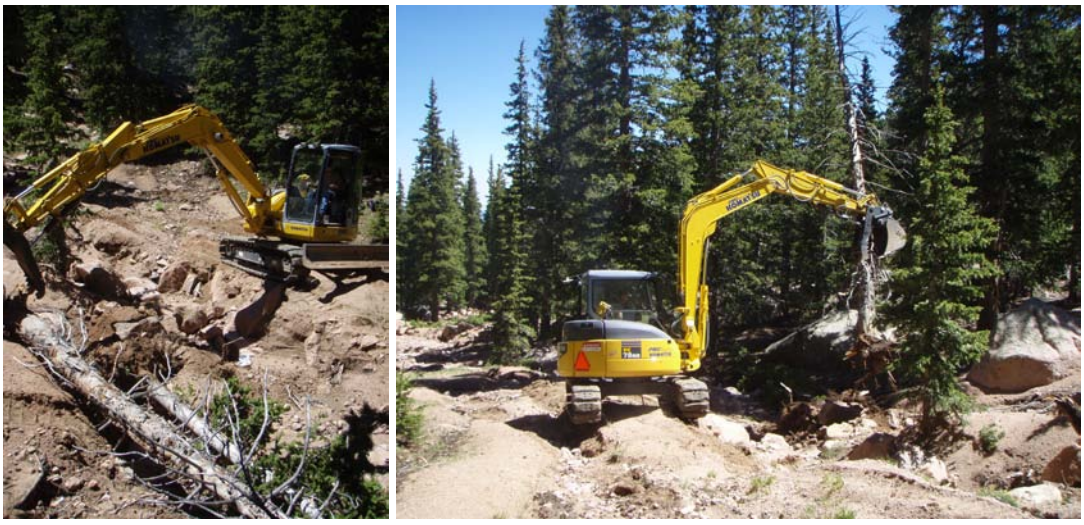

Figure 1 and 2. Installing Cross-vanes and bank stabilization in the upper reach of Ski Creek.

Figure 3 and 4. Completed Cross-vanes in Lower Sub-Reach of Ski Creek.

Volunteers

Figure 5-8. Pikes Peak Corps crew completing bank stabilization.

Figure 9 and 10. Sierra Club volunteers completing revegetation of channel banks.

Attachment D: Scope of Work

Scope of Work
Colorado Watershed Protection Fund Project Grant 2008/9

Upper Ski Creek Watershed Erosion Control and Restoration Project-Phase 2
Rocky Mountain Field Institute

The *Upper Ski Creek Basin Erosion Control and Restoration Project-Phase 2* will stabilize and mitigate erosion and sedimentation impacts in the Ski Creek headwater area on Pikes Peak that has been severely affected by unprotected runoff discharged from the Pikes Peak Highway. This project represents the second and final phase of a multi-year project to completely stabilize the upper Ski Creek Basin. Over 1900' of the main Ski Creek channel will be delineated and stabilized with an additional 700' of braided channels closed and restored. The project will utilize engineered and bio-engineered structures in conjunction with vegetation prescriptions to stabilize and reduce bank erosion, improve habitat for aquatic life, and decrease sediment transport into the South Catamount Reservoir. Techniques to be applied in this project have proven effective in reducing sediment transport within the North Crystal Creek Basin and the upper reach of Ski Creek on Pikes Peak. A detailed monitoring and evaluation plan has been developed and will aid in designing future restoration plans. Completion of this project will advance the CWCB goal of conserving and protecting Colorado's water resources.

Summary of Tasks and Associated Costs

Budget Item, Described by Task	**Total Cost**	**Funding Provided by CWPF**	**Funding Provided by Others**
Task 1:Pre-project preparation including project proposal and monitoring plan, permitting, project engineering and surveying, preparation of project site, and purchase, collection, and storage of construction materials.	*$34,330*	*$5,000*	*$29,330*
Task 2: Project implementation including construction of 31 engineered and/or bioengineered structures, restoration and stabilization of 2,687' of stream reach, and revegetation and stabilization of channel banks and impacted areas with seeding and 12,700 yd^2.	$96,480	$17,500	$78,980
Task 3: Post-project activities including the establishment of monitoring plots, project re-survey, data collection, native seed collection, and completion of final report.	$15,865	$2,500	$13,365
Totals	**$146,675**	**$25,000**	**$121,675**