Campbell Valley Restoration
2013 Final Report

Implemented by

Wildlands Restoration Volunteers, in partnership with The Nature Conservancy, US Fish and Wildlife Service, and the Robert's Ranch.

September 13, 2012 – September 30, 2013

Note: This report covers one of multiple phases of the Campbell Valley Restoration Project. The continuation of the larger restoration effort affecting many miles of stream and the larger watershed could be continued for 10 years assuming sufficient resources can be obtained.

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Thanks

On behalf of all of our partners and volunteers, Wildlands Restoration Volunteers extends a tremendous thank you to our funders and sponsors for this important project: U.S. Fish and Wildlife Service (Partners for Fish and Wildlife Program), The Nature Conservancy, Colorado Water Conservation Board (Watershed Restoration Program), Eco-Hydro Consulting, The Foundation for Sustainability and Innovation, Colorado Parks and Wildlife, Cargill-Canola Cares, Mugs Coffee Lounge, O'Dell Brewing Company, OtterCares, Colorado Lien CO, Pioneer Sand and Gravel Co, REI, and dozens of other private donors and sponsors. We also thank, from the bottom of our hearts, the 100's of volunteers who lifted and placed rock, planted plants, cut willows, cooked food, managed tools, and made technical preparations to see this work get done. Without all of your support, this project would not happen.

Campbell Valley Project Summary

Campbell Valley was historically a low-flow, spring-fed stream corridor, until water from an incomplete irrigation canal was diverted into the natural drainage about 100 years ago. This event, followed by continual leakage into the stream corridor, has raised the base flow of the creak substantially for nearly a century and has caused continued instability and extensive erosion. It is estimated that more than 4.8 million cubic yards of soil has been eroded from Campbell Valley over the past century. This soil has washed down stream to fill reservoirs and ponds, clog irrigation equipment, and impact natural stream corridors. Due to down-cutting of the primary stream channel by 30-50 feet, the process of stream rejuvenation has caused all tributaries to down-cut to meet the new valley bottom. This process has led to the development of over 3.5 miles of gullies that range from 5 to 30 feet deep. While the main spring fed channel has stabilized, active head-cutting has continued, constantly cutting away at upland pasture lands and wildlife habitat, and contributing sediment to downstream water bodies. The channel leading from the largest leak in the irrigation canal to the confluence with Campbell Creek continues to be very unstable. This active incision and head cutting contribute the vast majority of sediment to the Campbell creek system.

Watercourse: Natural base flow rates in Campbell Creek are estimated to range between 1-2 cfs in most years. However, leakage from the North Poudre Irrigation Canal has increased the base flows to approximately 5-8 cfs during the irrigation season. The channel formed by the leakage descends to the confluence with Campbell Creek at a grade almost double the stable grade for these highly erodible soils. What was once a heavily vegetated foothills pastoral valley is now a system of gullies and denuded riparian areas. Loose colluvial soils have allowed significant down-cutting of gullies (up to 35 feet deep at the mouth). Historically, this valley was grazed above its carrying capacity, though current grazing management practices have reduced the grazing intensity and duration to more sustainable levels.

This project was developed by partners to address severely degraded stream channels and erosion trenches and gullies throughout the 3,584-acre work area.

Project Goals: This project engages multiple partners to address the following goals: (a) Develop a long-term (10 years) project design and implementation strategy to address gully stabilization and valley-wide restoration; (b) restore the diverse riparian plant community; (c) reduce gully erosion in priority one sub-watersheds; and (d) maintain and improve the grazing resources.

Watershed Description: Spring Gulch flows into Campbell Creek (24,083 acres), the primary perennial spring-fed creek running through Campbell Valley. Campbell Creek flows into Dry Creek, which flows into the Cache La Poudre River. We've collaborated with The Nature Conservancy to implement a flow and sediment monitoring program for Campbell Creek and the Spring Gulch leakage channel. We now have one season's baseline data. Initial indications are that the leakage is indeed playing a very large role in the increased sediment transport at Campbell Valley. The highest concentration of sediment below the confluence of Campbell creek and the leak flow from spring gulch occurred on May 9-12 when the irrigation canal reached full discharge of 88cfs was 11800mg/L. Average sediment concentration was 626mg/L and average discharge at this point was 3cfs. Estimated total yearly suspended sediment load is 1848 tons/year.
Best grazing management practices were changed in 2009 to include a rotational grazing strategy that reduces grazing pressure in existing pastures and excludes grazing in restored riparian areas in the short term. The existing riparian area consists of a dense cover of herbaceous wetland species. Due to the dramatic down-cutting of the main channel, and the associated loss of woody riparian species followed by continual grazing, there is little hope that a significant riparian woody species seed or root source exists.

Project Team & Partners

- Eco-Hydro Consulting (Jonathan Stauffer), Technical Consultant
- Brian Bledsoe, Kyle Hardie, Peter Kulchawik Technical Consultants
- Gregg Campbell, Nate Boschmann, John Giordanengo, & Larry Lechner Technical Advisors
- Nate Boschmann, Restoration Projects Coordinator, Wildlands Restoration Volunteers
- Heather Knight, TNC Partner Liaison
- Zach Thode, Ranch Manager
- Nate Boschmann, Project Manager, Wildlands Restoration Volunteers

Planning and Implementation Timeline

Timeline

2012	2013	Product
Jan - Feb	Jan - Feb	Project scoping and planning process
April	March	Design work begins
April	quarterly	Water quality monitoring begins, and continues quarterly in 2013
June	June	Gulley and riparian monitoring begins
June-Aug	March-Oct.	Heavy equipment work in spillway, reservoir, and riparian areas as needed.
May - Oct	April - Oct	Crew leader training & work days
Aug - Sep	Aug - Sep	Evaluation monitoring of 2010-2011 work sites
Ongoing		Marketing, capacity building, fundraising, partnership building, adaptive mgt

Summary of Accomplishments

Continuing our collaboration with The Robert's Ranch and The Nature Conservancy, the primary easement holder on the ranch, WRV began implementation of further treatments based on experience gained during the pilot phase of the project, as well as the final conversion of the precarious leakage fed agricultural reservoir into a stable wetland.

Brian Bledsoe CSU engineering department was hired to perform the primary design for the regrading of the reservoir. Earthwork and wetland vegetation design was completed by Steve Johnson of Natural Resource Services Inc. Wildlands Restoration Volunteers was employed as the Project Management agency to plan and oversee short-, mid- and long-term restoration and monitoring efforts. However, this project would not be possible without the broad and enthusiastic support of a variety of partners: The Robert's Ranch, The Nature Conservancy, The U.S. Fish and Wildlife Service, The Colorado Water Conservation Board, Natural Resources Conservation Service, Colorado State University, and many others.

By October 31, 2013, after one season of work, the following accomplishments were attained:

1. Engineering design for the regrading of Evans reservoir to a stable wetland.
2. Design and implementation of erosion control treatments on 300 feet of gullies and deeper valley trenches with 15 tire structures and a hand regraded headcut..
3. Design and implementation of restoration treatments on 1100 linear feet of banks along around the wetland and incoming and outgoing channels.
4. Installation of 7698 native shrubs and trees.
5. Regraded and seeded approximately 3,000 square feet of headcuts
6. Seeded 55,960ft2 with customized native seed mixes.
7. Installed 24,452ft^2 of erosion matting and mulched 30,000ft^2 with wood straw.
8. Completed repairs after fall flooding events.
9. Held two trainings in Crew Leadership for Ecological Restoration, and held 4 tours for CSU students, international programs, and land management agencies.
10. Engaged volunteers and youth corps to accomplish 1935 hours of labor
11. Engaged 2 corporate groups, Cargill Canola Cares, and City of Fort Collins Utilities Dept. providing for a growing corporate presence in the restoration efforts.
12. Completed baseline monitoring and longitudinal profiles in Valley Trenches 4, 5, 11, 12, 18,19 and follow-up monitoring in Valley Trenches 1, 2, and 3.
13. Completed follow-up photo monitoring in all erosion and riparian restoration work areas.
14. Completed initial flow and sediment monitoring for Campbell Creek and Leaky Creek.

<u>Long-Term Restoration Needs:</u> From its watershed assessment and analysis, Eco-Hydro Consulting quantified existing conditions and provided an estimation of restoration needs to address erosion issues in the project area:

- 95,250 feet (18 miles) of gullies, valley trenches, swales, and erosional features were documented. Of these, approximately 70% are moderate to high priority: 66,000 feet (12.5 miles).
- 578 assessment points were taken. About 400 are specific erosional features are in need of restoration, while others are simply watershed overview locations.
- An estimate of between 600 and 950 structures are required to treat existing gullies. However, a complete restoration design should be completed to verify this estimate more accurately.

In addition to the erosion control work in the uplands, approximately 3 miles of additional riparian and stream restoration work is possible. Additional analysis is necessary to determine the most appropriate treatments. On-going partnership meetings are under way to address the concerns in the main stem of the project area. Planning is underway to address the instability in the leakage fed Spring Gulch Creek, and contracting is underway to commission an analysis of the stability of the main stem of Campbell Creek to identify treatment priorities and sites potentially vulnerable to incision as we reduce sediment contributions up stream.

Methodology

Erosion Control

For the purposes of this project, erosion features were divided into five general categories:
1) Alluvial gullies/valley trenches (large, linear upland erosional scars formed in the alluvial portion of the valley flat (relic floodplain);
2) Upland gullies (generally smaller, linear upland erosion scars formed on the hillslopes and transition zones adjacent to the alluvial valley flat;
3) Hillslope scarps (abbreviated upland shelf-like erosional features on the hillslope contour, rarely associated with a channel feature and ranging between one and two feet deep);
4) Headcuts/knickpoints (larger scarps, usually associated with a channel feature, and ranging between two and eight feet deep);
5) Off-channel, linear erosional features (discontinuous, linear gullies, usually on the contour and often caused by cattle trailing);

A variety of structures were utilized in each of these erosion features, drawing from contemporary and conventional erosion control and in-stream restoration philosophies. The following is a list of structures employed, including temporary "working" names for structures developed for this project:

- Check Dam
- One-Rock Dam
- Rock Vane
- Vertical Tire Check Dam*
- Vertical Tire Toe Wall*
- Rock Toe Wall
- Zuni Bowl (in shallow headcuts)
- Rock Step-Pools (in deep headcuts)
- Check Riffle*
-Rock Ramp
-Media Luna
- Scarp Walls
-Rock Ramp
* = working name.

Left: Media Luna. Reduces channel formation in upland swails.
Bottom Left: Tire check under construction
Bottom Right: Tire checks with one season's sediment accumulation

Several of the above structures were drawn from works by Bill Zeedyk and Van Clothier, represented well in "Let the Water Do the Work: Induced Meandering, an Evolving Method for Restoring Incised Channels", promoted by the Quivira Coalition of New Mexico.

Photos of more of these structures are available in **Appendix A**.

General Implementation Approach: Once the geometry (i.e., grade, longitudinal profile, cross section, depth, length, and presence of unique erosion features within each valley trench) of each erosion feature was measured, a unique system of treatments was designed for three major valley trenches, several gullies, and a system of scarps and headcuts. Construction lay-out included survey staking and outlining feature dimensions on the ground with paint. All structures were built by hand by volunteers, supervised by staff, contractor, and volunteer leaders.

Materials: Type L and VL rock was used in most cases to construct structures. Due to the abundance of waste tires on site, and the desire to make good use of the tires if possible, additional designs were developed to experiment with this waste source.

Fencing and Water Gaps

A broad system of drift fencing and seven hardened-fenced water gaps have been installed to protect work sites, especially restored riparian areas.

Riparian Restoration

From a valley-wide rapid assessment of existing riparian conditions, restoration sites were chosen where little to no native shrub or tree cover existed. Knowledge of the native woody plant community in similar drainages across the northern Front Range of Colorado was used to determine the suitable plant material for this site. A combination of container stock (#1 and #5 pots) and cuttings (from local healthy stream corridors on the ranch) was acquired for this project. The following table lists the species and quantities of container stock used to restore riparian area around the newly created wetland in 2013..

Wetland Creation

In the fall of 2012, after multiple dam breaches, WRV collaborated with the CSU engineering department to develop a plan for regrading the imperiled Evans Reservoir into a stable wetland. Earthwork and installation of grade control structures were completed over the winter by NRSI. While there was no new contribution of water from the irrigation canal from November through March, draining the reservoir was slow and muddy conditions persisted through the winter necessitating some diversion from the submitted plan. During the 2013 Project season volunteers seeded, installed erosion matting and planted wetland and riparian plants trees and shrubs. Early season weather cancellations delayed our spring project past the point where upland seeding was likely to be successful. Seeding mulching and additional erosion mat installation was delayed till the fall and will take place in mid October. Two significant weather events took place during the season that had adverse affects on the unfinished project. In June, less than two weeks after the wetland restoration project, a 1.8”/hour storm took place directly upstream of the project site. The fill slope, northern ephemeral inlet and two of the grade control structures in the main leakage inlet were damaged. Repairs were completed by NRSI and one volunteer project was redirected to reinstall some of the washed out and silted over vegetation. The sustained rains in September again damaged the fill slope and northern ephemeral inlet. These repairs were accomplished in October in collaboration with NRSI and a corporate sponsor The Riparian Restoration scheduled for the end of October was rescheduled to November 3rd due to early season snows.

Quantity	Plant Description	Common Name	Size
500	*Carex aquatilis*	Water Sedge	10 ci
500	*Carex nebrascensis*	Nebraska Sedge	10 ci
500	*Juncus blaticus*	Baltic Rush	10 ci
750	*Eleocharis palustris*	Creeping Spikerush	10 ci
500	*Schoenoplectus acutus*	Hardstem Bulrush	10 ci
500	*Scirpus americanus*	Three-square Bulrush	10 ci
500	*Deschampsia cespitosa*	Tufted Hairgrass	10 ci
300	*Beckmannia syzigachne*	Sloughgrass	10 ci
500	*Glyceria maxima*	American Mannagrass	10 ci
500	*Glyceria striata*	Fowl Mannagrass	10 ci
500	*Spartina pectinata*	Prairie Cordgrass	10 ci
20	*Swida sericea*	Red-osier Dogwood	#1
30	*Ribes auream*	Golden current	#1
30	*Prunus virginiana*	Chokecherry	#1
30	*Rosa woodsii*	Wood's Rose	#1

To the left is a list of wetland and riparian plants installed at Evans wetland this season.
In addition 30 cottonwood and 2000 willow cuttings were installed.

Stream Restoration

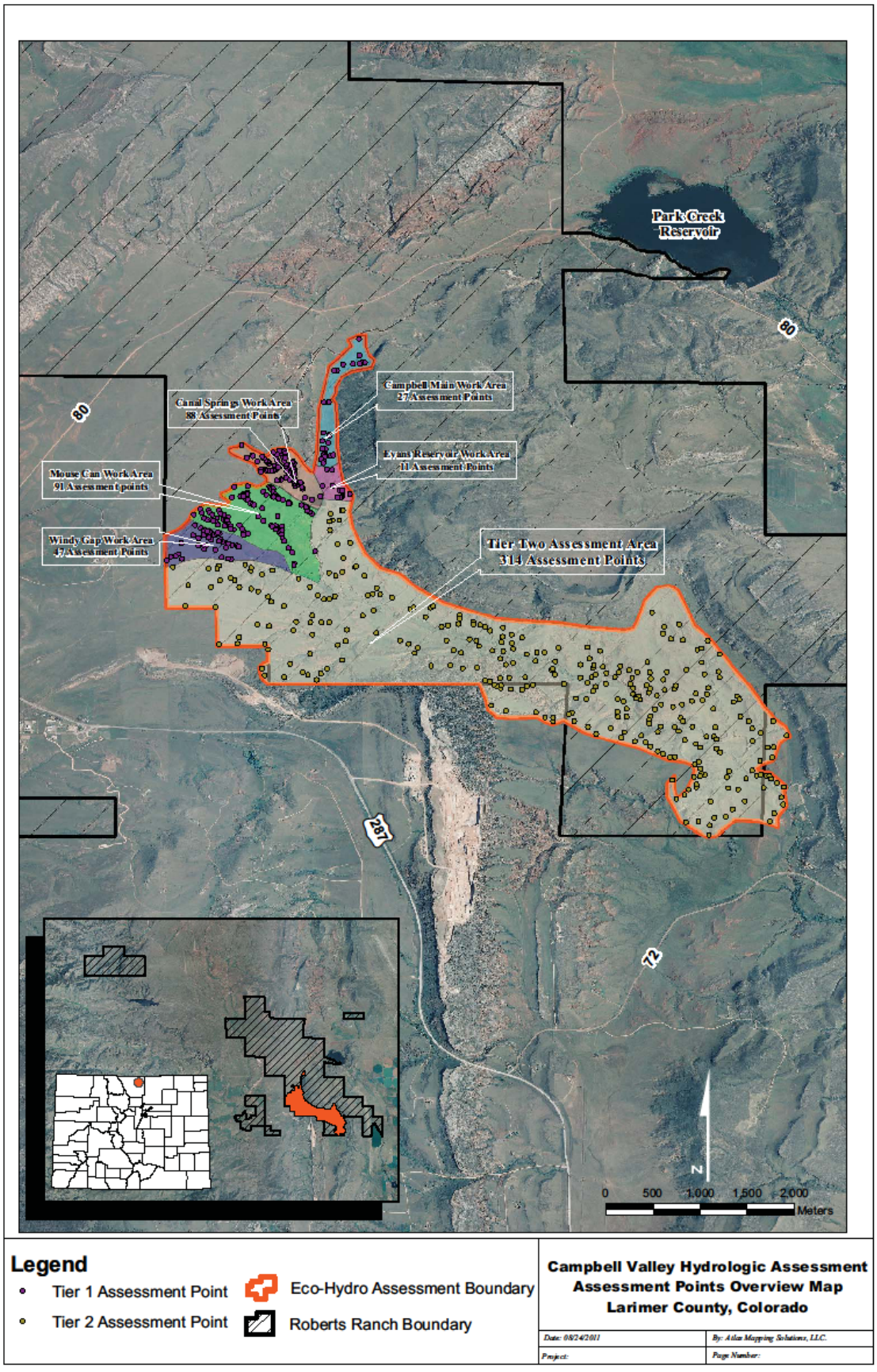
Stream channel stabilization on the leakage fed reach of Spring Gulch creek that has been shown in last year's flow and sediment study to be the largest continuous sediment contributor to Campbell Creek. This will include a 600ft^2 sheet pile grade check to address the 4' head-cut most immediately endangering the upstream wetlands , multiple smaller volunteer installed rock grade checks to reduce the effective grade to 1.7% and regarding of incised banks to allow for establishment of vegetation. Assessment and design was completed this season by CSU engineering department under the supervision of Brian Bledsoe. Construction will begin this winter pending adequate funding.

Monitoring

An upland monitoring plan was developed during the pilot project phase, and baseline data has been collected (physical and visual). Primary variables to monitor include: indicators of gully erosion in control and treatment areas, survival and growth of planted riparian woody species, effectiveness of fencing and water gap structures, vegetative cover, and effectiveness of gully stabilization structures. Observational data is tracked by established photo points on all work areas. Evaluation monitoring is conducted periodically (1 to 3 years on four paired gully study sites) to compared baseline survey data to determine treatment effects compared to similar untreated gullies. . A comprehensive baseline water quality and quantity monitoring program has been completed and will continue on a scaled

Proper functioning condition (PFC) and riparian rapid assessment surveys developed specifically for this project accompanied photo point monitoring in the primary stem of the valley. Refer to Appendix B for data forms and photo points.

The map indicates the sampling points at which erosion assessments were conducted in the primary project area



Campbell Valley Budget

The budget below lists project costs from December 1, 2012 to October 31, 2013.

Campbell Valley
as of 10/31/2013

Direct Expenses	YTD	CWCB	CPW	Cargill	Barb	TNC	FSI
Proj Supp - Food	460	0	460				
Pro Supp - Kitchen Gear	32	32	0				
Pro Supp - Tools	30	30	0				
Proj Mat - Porta- Potties	600	0	600				
Proj Mat - Seeds	2,065	0	2065				
Proj mat - Erosion Control	8,882	8882	0				
Proj mat - Soil Amendments	540	540	0				
Proj mat - Plants	5,130	0	5130				
Proj mat - Rock	335	335	0				
Proj Mat - Prof Serv	4,808	4808	0				
Proj Serv - Heavy Equip Oper & Rental	33,200	33200	0				
Proj Serv - Mileage	830	724	106				
Proj Serv - Transport Vehicle Rental	216	49	167				
Proj Staff - All	14,562	10339	4223				
Total Direct Expenses	**$71,690**	**$58,939**	**$12,751**	-	-	-	-
Total Volunteer Days	124						
Indirect Expenses	4,417	3242	1175				
Total Expenses	**$76,107**	**$62,181**	**$13,926**	-	-	-	-
Overhead 14%	10,654.95	811.72	1691.92	5,000.00	151.00	3,000.00	-
Grand Total Expenses	**$86,762**	**$62,993**	**$15,618**	**$5,000**	**$151**	**$3,000**	-

In-Kind

Volunteer Labor and travel time	**$21,962.88**
Professional Design/Supv	**$21,000.00**
Other Planning and Leadership	**$1,793.34**
Volunteers Driving to Worksite	**$5,440.50**
TOTAL	**$50,196.72**
Total Expenses and In-Kind	**136,958**

Appendix A - Erosion Control Structures -

Rock Vane

Tire toe wall

Regrading soil pillars by hand to reduce snow-based saturation points near headcuts and the base of valley walls. Additional grading was completed by excavator.

Construction of 4-step step pool with 6-foot headcut.

Small Zuni Bowl.

Medium-sized Zuni Bowl

Media Luna

Scarp Walls

Check Riffle

One-rock Dam

Regraded and rock ramped headcut. This experimental treatment was done with all hand labor. Future treatments be regraded using an excavator.

This is the same structure after a season of vegetation establishment. This picture was taken immediately after the flooding in September 2013.

Campbell Valley Tires

The tire problem at Campbell Valley (just a fraction of it).

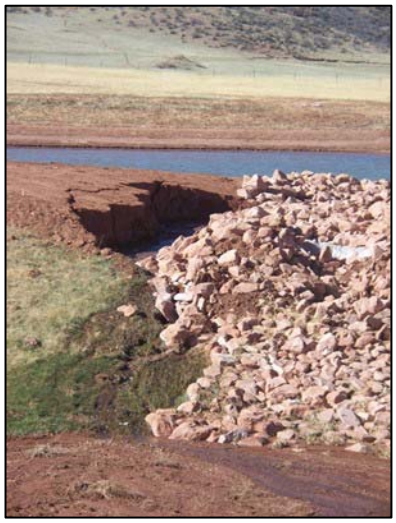
NOTE: tires do not work well for stabilizing gullies, at least using this dump-n-run method.

Left Tires dumped into a side gully. There are ten others like it with tires remaining, and many more that were washed out into the main channel during flood events.

Bottom Left: Tire check under construction by volunteers.

Bottom Right: Tire checks with one season's sediment accumulation. 100% of these treatments have held up through this seasons flood events including a 1.8"/hour storm in June.

Appendix B - Wetland Creation –



Breach in Evans Reservoir

Winter regrading and Dam Removal

Regraded wetland with structures.

Installation of grade control structures

Volunteers installing wetland plugs.

Volunteer with willows by step pools

Installed sedges on project day.

Wetland mid summer with repairs.

Volunteers installing erosion mat on fill slope from dam material

After 1.8”/hour storm

Fill slope after storms in September

Storm damaged inlet