

Price River Drainage

Section 319 Non-Point Source Pollution Control Program

Watershed Project Final Report

Mud Creek/Scofield Reservoir

By

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BUDGET TABLE FOR MUD CREEK RIPARIAN RESTORATION					
Funding Sources	FY 2005	FY 2006	FY 2008	FY 2010	TOTAL
EPA Section 319 Funds	\$7,328.13	\$14,641.35	\$35,500.00	\$50,000.00	\$107,469.48
State and Local Matching Funds					
Blue Ribbon Fisheries				\$33,600.00	\$33,600.00
Easement of District Property				\$210,000.00	\$210,000.00
Habitat Council				\$88,684.00	\$88,684.00
TOTAL BUDGET	\$7,328.13	\$14,641.35	\$35,500.00	\$382,284.00	\$439,753.48

Summary Accomplishments

During fall of 2010, UDWR personnel installed 203 treatments based on prescribed methods derived from Frontier Corporation's degradation assessment. These treatments repaired 5,296 feet of eroding banks within the restoration area. Although 64 of the installed structures were damaged during spring runoff in 2011, these structures were repaired during fall 2011 and have withstood similar events resulting from the recent Seely Fire runoff.

Fencing of the entire 21.3-acre restoration area (easement boundary) was completed in 2011 protecting vegetation from grazing and, based on recent monitoring of photopoints, increasing bank stability, stream shading and quality of instream habitat.

The Mud Creek watershed improvement project began in October 2010. All goals of this project, other than those monitoring activities outlined in the project quality assurance plan, have been completed as follows:

- All USACE, Water Rights, and State Historical Preservation Society clearances were attained prior to onset of any on-the-ground work.
- All of the streambank and in-channel stabilization measures were successfully installed by the Utah Division of Wildlife Resources (UDWR) "stream team". Frontier Corporation (District-contracted environmental consultant) staked the locations of delineated wetlands, and the UDWR sited their work areas, staging areas, and access routes to avoid disturbances to wetlands to the greatest extent practicable.

- The wooden post and rail perimeter fence around the outer boundary of the restoration area was installed. The UDWR hired a subcontractor to install the fence.
- The UDWR recontoured areas temporarily disturbed during project construction and reseeded the disturbed areas with a native seed mix.
- The actual as-built location of the fence was surveyed by a licensed surveyor (Jones and DeMille Engineering) hired by Carbon County Recreation and Transportation Special Service District (District). The surveyed fence boundary will be the boundary for the project's conservation easement, which, as described below, will be finalized during September 2012.
- Frontier Corporation used a hand-held GPS unit and located and photo-documented the as-built condition of the restoration work as the basis for monitoring the success of the restoration work.
- Frontier and UDWR completed a site inspection in summer 2011 to assess the stability and success of the streambank and channel stabilization and revegetation measures and the condition of the perimeter fence.
- Based on the results of the summer 2011 inspection, UDWR completed minor repairs in fall 2011 to structures damaged during the historic 2011 spring runoff period. Additionally, UDWR recontoured and reseeded areas temporarily disturbed during the repair effort.
- As part of the monitoring and maintenance agreement associated with USACE permitting, UDWR and the District continue to spray for noxious weeds on the land inside the project area (easement) boundaries and on those areas outside the project area that were temporarily disturbed during project construction, including the main staging and materials storage area.
- The District and the UDWR will execute the project's conservation easement and record it at the County Recorder's office during September 2012.

Ongoing monitoring and maintenance activities will continue to include:

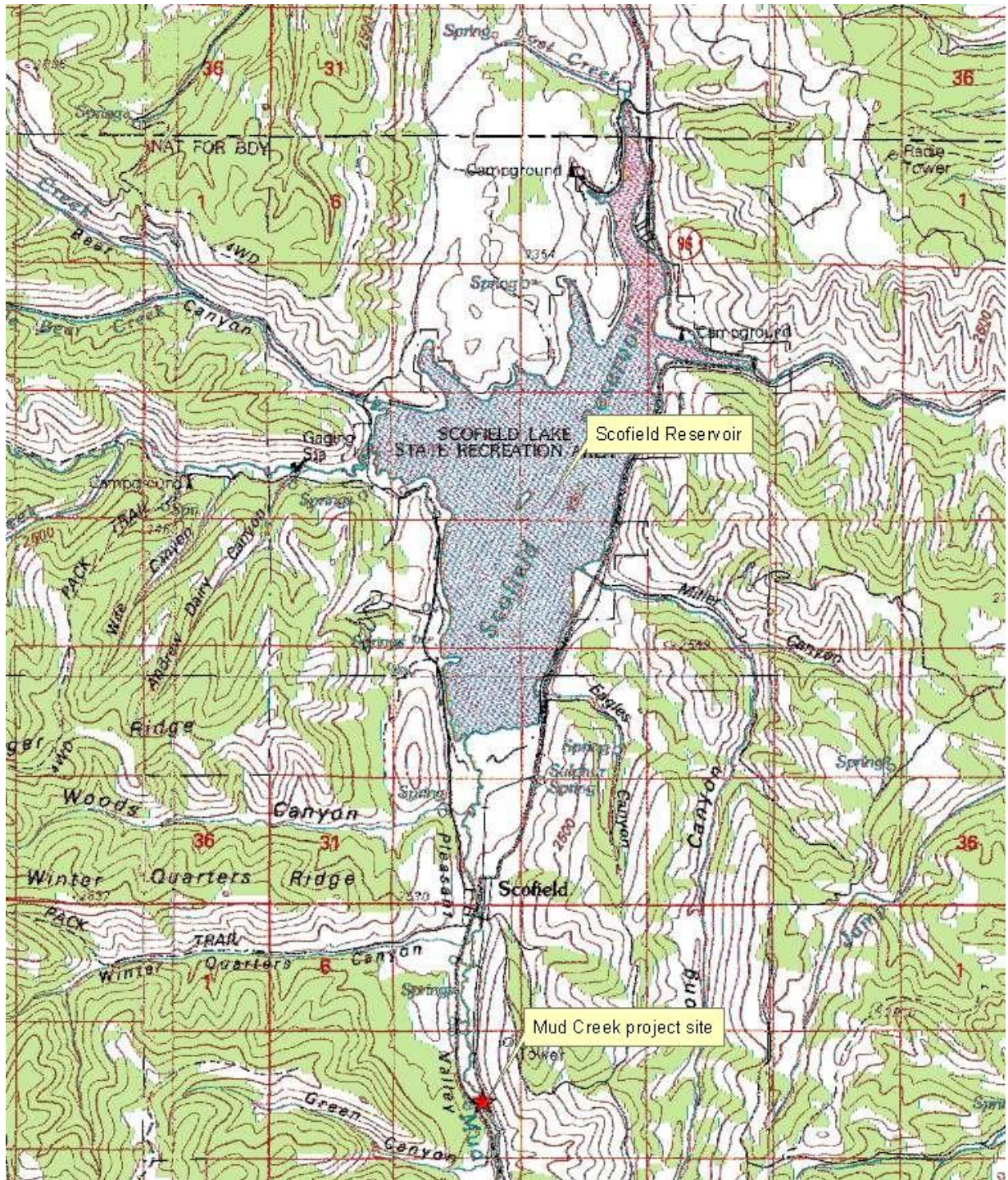
- The District and the UDWR will co-sign the compliance certificate for submittal to the Corps of Engineers and the Utah Division of Water Rights once noxious weed abundance targets are met.

- Beginning in 2012, the UDWR will be responsible for the 5-year post-construction monitoring and reporting for the restoration project as per the special conditions specified in the project's 404 permit.

The Mud Creek project outlined above focused on reducing total phosphorus loads in Scofield Reservoir by applying erosion control strategies of stream restoration and curtailment of grazing. Stream restoration treatments were prescribed based on the level of degradation (erosion) to maximize erosion control. Additionally, exclusion fencing was established around the 21.3-acre easement encompassing the restoration area.

1.0 INTRODUCTION

Figure 1: Mud Creek location relative to Scofield Reservoir



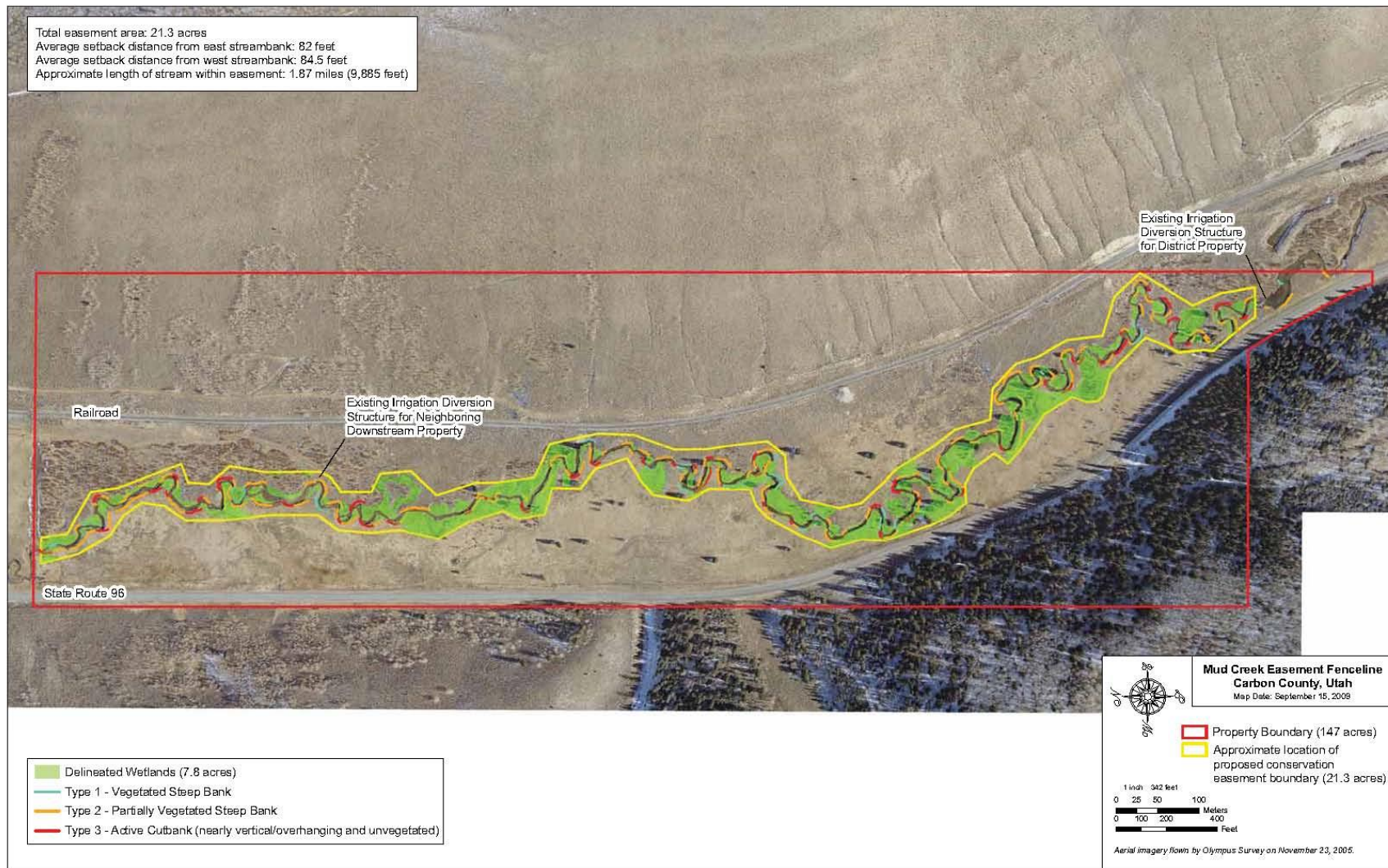
Scofield Reservoir is located in Carbon County, Utah within the Wasatch Montane Zone ecoregion at an elevation of 7,618 feet. The Reservoir was constructed at the confluence of several perennial streams including Fish Creek, Mud Creek (locally referred to as Clear Creek), Pondtown Creek and other springs and small tributaries. The Reservoir's outlet feeds into the Price River, a tributary of the Green River 70 miles to the southeast and ultimately the Colorado River.

The capacity of Scofield Reservoir is 73,600 acre feet and has a surface area of 2,815 acres. The average annual stream flows from major tributaries are: Fish Creek with 35,453 acre feet; Mud Creek with 12,567 acre feet; and Pondtown Creek with 5,382 acre feet. Scofield Reservoir is used by Carbon County residents for several purposes including flood control, recreation, and storage for drinking water and irrigation. Of the beneficial uses provided by Scofield Reservoir, its use as a cold water fishery is impaired (Table 1) due to low dissolved oxygen resulting from elevated nutrient inputs.

Class	Beneficial Use Designation
1C	protected for domestic purposes with prior treatment as required by Utah Department of Environmental Quality
2B	protected for secondary water contact
3A	protected for cold water species of game fish, including the necessary aquatic organisms in their food chain
4	protected for agricultural uses such as irrigation and stock watering

Elevated total phosphorous concentrations lead to algal blooms and subsequent die-offs which are likely related to seasonal fish kills. Denton et al. (1983), determined that Mud Creek accounted for 29% of the nutrient input to Scofield Reservoir. Improved conditions (e.g., reduced erosion and curtailment of grazing) along the restored area of the Mud Creek corridor will, therefore, serve to reduce the impairment of this water.

1.1 Map of project area



2.0 PROJECT GOALS, OBJECTIVES, AND TASKS

Goal #1: Reduce pollution loading to Scofield Reservoir and restore habitat alterations by improving riparian habitat the stability of the stream channel and banks and creating fish habitat.

Objective: Plan, design and implement riparian restoration projects in priority areas. UDWQ anticipates that the total phosphorus contribution will be reduced by 34% or 179 kg annually.

Task 1: Restore the natural geomorphic conditions of the river including correct and functional stream channel width/depth ratios, meander pattern and floodplains; stable vegetated banks with undercut banks; woody riparian vegetation; in-stream rock and woody structure and cover for fish habitat. Stream restoration practices to be implemented will utilize heavy machinery to slope back and stabilize vertical eroding banks, construct new meanders, install rock vanes and barbs, root wads, large logs, juniper and willow revetments, coconut erosion control fabric, dormant willow cuttings and bare root stock planting, reseeding, and fencing for livestock management.

Actual Output: During fall of 2010, UDWR personnel installed 203 treatments based on prescribed methods derived from Frontier Corporation's degradation assessment. These treatments repaired 5,296 feet of eroding banks within the restoration area. Although 64 of the installed structures were damaged during spring runoff in 2011, these structures were repaired during fall 2011 and have withstood similar events resulting from the recent Seely Fire runoff.

Task 2: Improve livestock management. BMP's for livestock management will include fencing, watering sites, rest/rotational grazing, timing and season of use, off-stream watering, etc. These specific projects will reduce sediment and nutrient loading, increase stream shading, reduce stream temperatures, and improve the cold water fishery habitat.

Actual Output: Fencing of the entire 21.3-acre restoration area (easement boundary) was completed in 2011; protecting vegetation from grazing and, based on recent monitoring of photopoints, increasing bank stability, stream shading, and quality of instream habitat.

Although both control and treatment (restored) sections saw reductions in fish abundance, the 70% reduction in fish abundance between 2010 and 2011 within the restored reach (i.e., estimated fish abundance declined from 319 fish/mile in 2010 to 96 fish/mile in 2011) was much greater than the 13% reduction in fish abundance observed for the same time period (i.e., estimated fish abundance declined from 1,048 fish/mile in 2010 to 907 fish/mile in 2011) in the control area of Mud Creek. The mean size of fish

sampled within the restored area during the 2010 sampling event (148 mm) increased by 16% to an estimated mean length of 176 mm in 2011. The mean length of fish sampled in the control section declined by 7% during the same period; from 169 mm in 2010 to 158 mm in 2011.

Although only one year of fish population monitoring has been performed, these data suggest that restoration may be providing quality habitat for larger fish. Continued monitoring of habitat quality and biological response will serve to clarify this point in the future.

2.1 Planned and Actual Milestones, Products, and Completion Dates

GOAL/OBJECTIVE/TASK	PLANNED OUTPUT/PRODUCT	PLANNED AMOUNT	ACTUAL OUTPUT	COMPLETION DATE
Goal 1: Objective 1: Plan, design and implement riparian restoration projects in priority areas. UDWQ anticipates that the total phosphorus contribution will be reduced by 34% or 179 kg annually.				
Task 1: Restore the natural geomorphic conditions of the river	Log vane installation	20	27	10/31/11
	Rock vane install	70	64	10/31/2011
	Rock barb install	10	14	10/31/2011
	Recountouring	5,000 ft.	5,167 ft.	10/31/2011
	Willow planting	100	155	10/31/2011
	Sod mat install	15	22	10/31/2011
	Root wad install	25	16	10/31/2011
Task 2 Improve livestock management.	Fencing	21.3 acres	22.243 acres	01/25/2011

2.2 Evaluation of Goal Achievement and Relationship to the State Non-Point Source (NPS) Management Plan

Reducing pollution loading to Scofield Reservoir and restoration of habitat alterations by improving riparian habitat the stability of the stream channel and banks and creating fish habitat has been related to the State NPS Management Plan in the following ways:

- 1) Cooperation between Carbon County, UDWR advisory councils, DEQ, the Price River Conservation District, EPA, and private consultants has served to improve working relationships and set the bar for future efforts among cooperators at the sub-watershed scale.
- 2) Division of data collection and monitoring duties among private consultants, UDWR biologists, and DEQ personnel has made assembly and assessment of project success more effective and has, again, served as an example for improved quality assurance during future stream restoration efforts.
- 3) Planning procedures (e.g., development of a tiered assessment of degradation) have allowed for more effective planning at a watershed scale. Prescriptions for stream restoration actions (e.g., log vanes, rock vanes, and willow plantings) based on tiered assessments of degradation have become a common practice among UDWR stream restoration biologists and allowed for broad scale assessments in the Duchesne River and San Pitch River drainages. These planning procedures have allowed us to assess threats, restoration costs and opportunities within geographic priority areas.

2.3 Supplemental Information



Figure 2: Newly installed rock vane on Mud Creek



Figure 3: Rock vane installed as part of Mud Creek project



Figure 4: Recontouring within the restoration area

3.0 BEST MANAGEMENT PRACTICES DEVELOPED AND/OR REVISED

The Mud Creek project specifically target nutrient and sediment loading. The prescribed installation of log vanes, rock vanes, willow plantings, rock barbs, root wads, shoreline recontouring, and exclusion fence installation were chosen to reduce erosion and achieve these reductions through grazing curtailment and stream bank stabilization. Oversight for installation of all treatments was provided by biologists trained in Rosgen methodologies (i.e., having attended Rosgen courses I - IV) and Utah State University

geomorphology coursework. The majority of these structures withstood a 100-year flood event during spring 2011 after a minimal post-installation (healing) period.

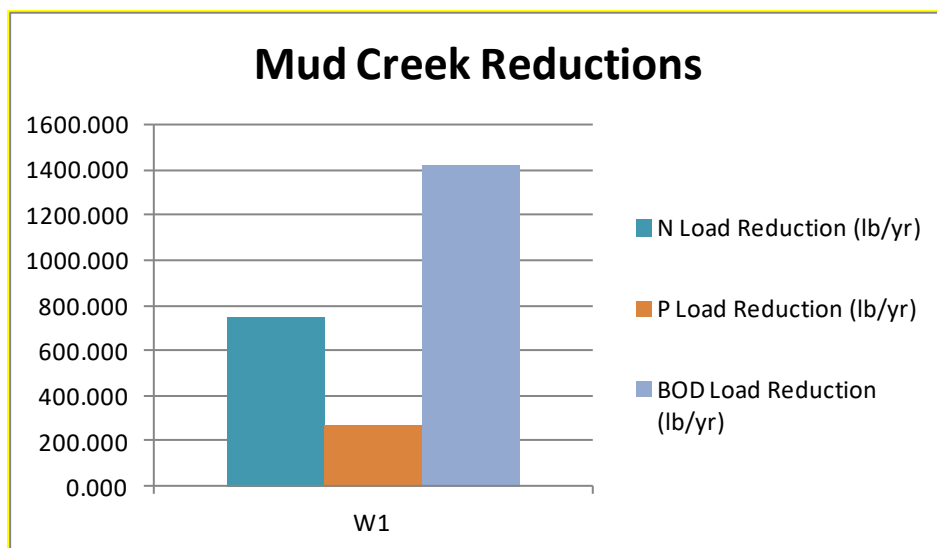
4.0 MONITORING RESULTS

The monitoring goals of this project are to document progress in achieving improved water quality conditions as non-point source control programs are implemented. Monitoring goals are also set to document and review effectiveness of BMPs. Monitoring on this project supplements the State's ongoing overall water quality monitoring program. Utah Division of Water Quality will continue to monitor Mud Creek and Scofield Reservoir as part of its long-term water quality monitoring efforts.

4.1 Best Management Practice (BMP) Implementation Effectiveness

The implementation of BMPs such as log vanes, rock vanes, rock barbs, root wads, willow plantings, recontouring, and fencing have curtailed grazing and stabilized banks along this section of Mud Creek. Vegetation is reestablishing along this portion of the corridor; resulting in less sediment input during high flow events and providing shade cover over the stream.

To help estimate the effectiveness of stream bank work and fencing, the EPA approved Spreadsheet Tool for Estimating Pollutant Load (STEPL) calculator was used. Soil along Mud Creek and in the area of interest surrounding the project site is mainly Silas-Brycan Loams, with a K factor of .20. Silas-Brycan Loams have a slow infiltration rate when thoroughly wet and has a slow rate of downward water transmission, thereby being mainly a group C soil. The total acres, slope, K factor and Soil Group type C and BMP's used, were entered into the STEPL calculator, enabling more accurate pollution reduction numbers with project implementation. The graph below depicts the reduction numbers estimated by the spreadsheet tool.



The total approximate reduction in phosphorus is 272 lbs/yr. While nitrogen and BOD reductions are 746 lbs/yr and 1,414 lbs/yr. Sediment reduction is also given at approximately 212 tons/yr. As the life span of the BMP's performed in the project are expected to last 10 years, a total phosphorus reduction of 2,720 lbs can be realized.

4.3 Surface Water Improvements

4.3.1 Chemical

As animals are removed from the corridor and stream banks are stabilized the amount of nutrients in the system will continue to decrease. With this decrease in nutrients other water quality parameters such as dissolved oxygen are also expected to improve. As part of the Utah targeted basin sampling, Mud Creek, as well as the other tributaries to Scofield Reservoir, will be sampled monthly from October 2012 through September 2013 for water chemistry including nutrients. This will help in assessing the nutrient load from Mud Creek to the reservoir seasonally and temporally. Scofield Reservoir will be sampled intensively throughout the summer of 2013 to determine if beneficial uses are being supported.

4.3.2 Biological

The amount of sediment and nutrients entering Mud Creek is expected to decrease as a result of this project, leading to a decrease in algal blooms and improvement in dissolved oxygen conditions in Scofield Reservoir. DWQ began assessing stream biological health several years with the Utah Comprehensive Assessment of Stream Ecosystems (UCASE). This assessment involves sampling a variety of streams each fall and recording measurements of physical habitat, substrate, fish and macroinvertebrate communities, and other biological indicators. The results from the UCASE program are being used by the DWQ for beneficial use assessment and to determine BMP effectiveness. One analysis of these results compare the stream macroinvertebrate populations expected in reference conditions with the populations observed in the sampling site. The ratio of observed to expected organisms can be used as an indicator of benthic community health. If only 60 percent of the expected population is observed ($O/E = 0.6$) at a particular site, the site is considered to be impaired and does not support the aquatic beneficial use. The results of the UCASE for Mud Creek are presented in the following table. Each of the sample locations was assessed pre project in July 2010 and will be assessed again in 2015, 5 years post project implementation, as per the recommendation of the DWQ biological assessment program coordinator. The sites are listed in upstream to downstream order.

UCASE Results for Mud Creek

STORET	Location	Year	Observed/ Expected	Assessment
5931575	Mud Creek above Restoration	2010	0.78	FAIR
5931575	Mud Creek below Restoration	2010	0.56	POOR

4.3.3 *Physical/Habitat*

By stabilizing the banks of the creek and allowing for vegetation to increase along the banks, the habitat for fish and other riparian dwelling organisms will improve. Water temperatures may decrease due to better shading along the river. The UCASE results speak to this in that physical conditions are scored along the reach.

4.4 Other Monitoring

Natural Resources Conservation Service (NRCS) is responsible for conducting a project implementation check for all projects implemented with EQIP funds. Utah Association of Conservation Districts (UACD) continues to follow-up with cooperator to make sure proper management practices are implemented and to resolve any problems for all projects. Recently UACD and USU Extension employees have visited each implementation site and verified that each project is built to satisfaction and being used as required.

4.5 Results of BMP Operation and Maintenance Reviews

Best Management Practices (BMPs) for the Mud Creek/Scofield Reservoir project have focused on excluding animal access and stabilizing banks to one of the major tributaries (Mud Creek)..

When projects are completed a certified planner (UDWR biologist or representative from Frontier Corporation) reviews the work accomplished to verify completion of each practice.

The completed project has excluded livestock from entering the Mud Creek riparian corridor within the project area. With grazing exclusion and bank stabilization treatments, areas of degradation now have a vegetative cover, reducing the potential for soil erosion and runoff. Operation and maintenance are required for the life of the installed practices or structures.

5.0 COORDINATION EFFORTS

The Utah Division of Wildlife Resources (UDWR), Price River Conservation District (PRCD), DEQ, and Carbon County Recreation and Transportation Special Service District (District) have been the primary sponsors for this project. These cooperators provided oversight of contractor and consultant selection, volunteer work, and information sharing generated by this project. All partners agreed to oversee project development, planning, implementation, approval, administration, and reporting. The following specific duties were transferred, as per cooperative agreements, to the following agencies:

- District and UDWR: approval

- District and UDWR: technical assistance, follow-up
- UDWR, DEQ, and the District: oversight, project management, monitoring
- UDWR: I&E
- PRCD, DEQ: administer contract, reporting, technical assistance

5.1 Coordination with State and Local Agencies

The state and local agencies listed below helped carry out the project by providing support in the following areas:

- UDWR, DEQ, PRCD: Administration, contracting, staff and technical support
- District: Advisory assistance
- District, UDWR: Additional funding and coordination of volunteers

5.2 Coordination with State Environmental Programs

The following State Environmental Programs supported the project in the following areas:

- Utah Division of Water Quality: Standard program monitoring, technical assistance, 319 Grant Management
- Utah Division of Water Rights: Permits, advisory and monitoring assistance
- UDWR: Advisory assistance
- UDWR: I&E

5.3 Coordination with Federal Agencies

The following federal agencies made key contributions to the project:

- EPA: Financial assistance, Clean Water Act Section 319

5.4 Accomplishments of Agency Coordination Meetings

Agencies have been united for the cause of water quality in the Price River Watershed. These meetings are in the form of project planning and accomplishment overviews. In these meetings planned monitoring methods were discussed, as well as modification of implementation strategies designed to achieve the greatest success.

5.5 Other Coordinated Resources

The project also benefited from contributions by the following organizations:

- Frontier Corporation: project oversight, planning, and coordination

6.0 SUMMARY OF PUBLIC PARTICIPATION

Involvement among UDWR advisory council members, Carbon County representatives, and anglers has showcased the support for merging NPS pollution control efforts as part of a broader effort to encourage outdoor recreation in Utah watersheds. The beneficial use classification system serves to rally support among these partners and highlights the underlying importance of clean water as a catalyst to habitat restoration efforts.

7.0 ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

Although the treatments installed along Mud Creek funded by this grant have only been implemented for a short amount of time, the spring runoff of 2011 and runoff that resulted during the aftermath of the 2012 Seely Fire have put these restoration efforts to an early test. Overall the project treatments implemented seem to be successful and, other than minor repairs required after the spring 2011 runoff season, no problems have been encountered.

8.0 FUTURE ACTIVITY RECOMMENDATIONS

Using the success of this project, Carbon County and UDWR hope to partner with adjacent landowners to restore downstream areas of Mud Creek. Additionally, using the degradation assessment and prescribed treatment model developed during this project, it is UDWR's sincerest hope that similar projects can be applied more broadly on a watershed scale in other drainages in the near future.

9.0 APPENDICES

1. Summary of DEQ and PRCD contracts

Project	UDWR contract #	From	To	EPA	Required Match	Total Match	Projects	EPA Remaining
Mud Creek FY 2008 and FY 2010 (DEQ)	102725	7/01/10	9/30/15	\$85,500	\$57,000	\$298,684	1	\$0
Mud Creek/Scofield (PRCD)	701424	9/09/10	9/30/10	\$21,964.48	\$14,716	\$33,600	1	\$0
Totals:				\$107,464.48	\$71,716	\$332,284		\$0