Section 319 Nonpoint Source Pollution Control Program Watershed Final Report

Matt Warner and Calder Reservoirs & Pot Creek Water Quality Improvement Projects FY-08 & 10

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Executive Summary

	EPA 319 Grant	Match	Total
FY2008	$64,800	$41,039	$105,839
FY2010	$63,600	$76,702	$140,302
Total	**$128,400**	**$117,741**	**$246,141**

To help improve water quality in the Matt Warner/ Pot creek Drainage two grants were awarded to Duchesne Conservation District for work in the Pot Creek watershed. The first grant was awarded in 2008 and was for $64,800. It was intended to be the first of five years of incremental funding for a variety of projects aimed at improving water quality and increasing public awareness of local water quality issues. Thus the second grant was awarded in 2010 for $63,600. Project worked started in 2009 and concluded in 2012.

In 2004 Matt Warner Reservoir and Calder Reservoir were listed on Utah's 303(d) List of Impaired Waterbodies for partially supporting their cold-water fishery beneficial use due to low dissolved oxygen levels and high total phosphorus concentrations. Both Reservoirs are small stabilized lakes located on Pot Creek in Uintah County. Matt Warner is located upstream of Calder Reservoir. The Matt Warner and Calder Reservoirs Total Maximum Daily Load (TMDL) was approved by EPA in 2007. The sources of TP loading were identified as soil erosion from native soils, animal waste, inadequate road design, and drainage. According to the TMDL a TP load reduction for Matt Warner of 22 kg/year and for Calder Reservoir 118 kg/year is needed to properly restore their cold-water beneficial use.

Implementation strategies identified within the TMDL include stream restoration and improved grazing management. The scope of work accomplished in these projects addressed the primary sources of nutrients identified within the TMDL analysis.

1.0 Introduction

A Total Maximum Daily Load (TMDL) analysis was completed for Matt Warner and Calder Reservoirs due to low dissolved oxygen and high nutrient concentrations (phosphorus) and approved by the Environmental Protection Agency (EPA) in July of 2007. This report addresses the primary sources of nutrients identified within the TMDL analysis, as well as the methods used to implement those TMDLs.

1.1 Project water quality priority

As required by §26-11-6 of the Utah Code Annotated 1953, the waters of the State of Utah are grouped into classes to protect against controllable pollution. Pursuant to the §303(d) list Unified Assessment Category; Calder Reservoir has been identified as a High Priority watershed, while Matt Warner Reservoir was listed as Low Priority. Although Matt Warner Reservoir was identified as low priority for the TMDL analysis, its proximity and hydrologic linkage to Calder Reservoir facilitated the TMDL development without affecting the State's other high priority TMDL's. The designated uses for Matt Warner and Calder Reservoirs are 2B (secondary contact recreation), 3A (cold water fishery) and 4 (agriculture).

Both Reservoirs were listed on the State of Utah's §303(d) list as partially supporting their designated beneficial use as cold-water fisheries due to low dissolved oxygen and high total phosphorus concentrations. Nutrient contamination (phosphorous loading) causes excessive algal growth and turbidity. In September 2004, the Utah Division of Wildlife Resources reported the deaths of three adult cows and fifteen calves from liver failure after drinking water from Matt Warner Reservoir that contained blue-green algae blooms. Water with high biological productivity results in lower oxygen concentrations and stress to the aquatic community. Calder Reservoir experienced a near total winter fish kill in the same year. Biologists from the Utah Division of Water Resources believe the combination of six years of drought and decreased water quality caused these events. Nutrients are delivered directly to the reservoirs during spring runoff and storm events. Both in the TMDL Analysis and in the Utah's Lakes and Reservoirs Report, the source of nutrients (phosphorus loading) identified within the watershed included soil erosion from native soils, animal waste, inadequate road design and drainage.

A TMDL was developed for Matt Warner and Calder Reservoirs with specified goals of shifting phytoplankton dominance away from blue-green algae, dissolved oxygen (DO) concentrations of no less than 4 mg/L in 50% of the water column and trophic state index values of 40-50 (mesotrophy). A load reduction of total phosphorus (TP) of 22 kg/yr for Matt Warner Reservoir and 118 kg/yr for Calder Reservoir was established as necessary to achieve these goals.

Implementation strategies identified within the TMDL include stream restoration and improved grazing management. These measures are addressed within this proposal for implementation funding.

1.2 Waterbody information

Matt Warner and Calder Reservoirs are part of a chain of three stabilized lakes on Pot Creek starting with Matt Warner, the largest reservoir, followed by Calder and Crouse reservoirs. Pot Creek is both the inflow and outflow to both Reservoirs. The Reservoirs reside in the Diamond Mountain area in the Lower Green River/Diamond Mountain Watershed (HUC 14060001) in Uintah County, Utah.

The capacity of Matt Warner Reservoir is 2,796 acre-feet with a surface area of 297 acres. Calder Reservoir has a capacity of 1,630 acre-feet with a surface area of 99 acres. The average annual stream flow from Pot Creek to Matt Warner Reservoir and Calder Reservoir was calculated as 3,056 acre-feet and 4,323 acre-feet, respectively. Both Reservoirs are owned and operated by the Utah Division of Wildlife Resources as cold water fisheries and have recreation facilities. Calder Reservoir primarily functions as a cold water fishery, yet in times of drought, water from the reservoir can be drained for agriculture purposes. The shoreline of Matt Warner Reservoir is partially owned by the Division of Wildlife Resources and has public access while the east side is privately owned.

1.3 Maps

Figure 1 shows the project areas for the 2008 grant in relation to the reservoirs, the topography, watershed boundary and location within the state of Utah. Figure 2 shows the 2010 grant project work.

Figure 1. 2008 Project Work in Pot Creek Watershed.

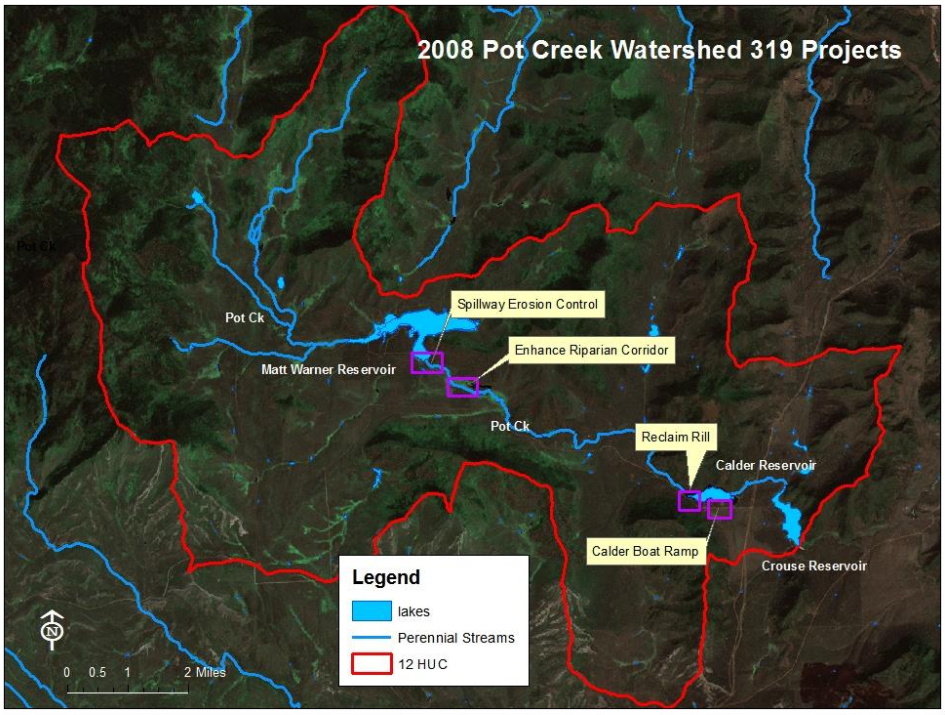
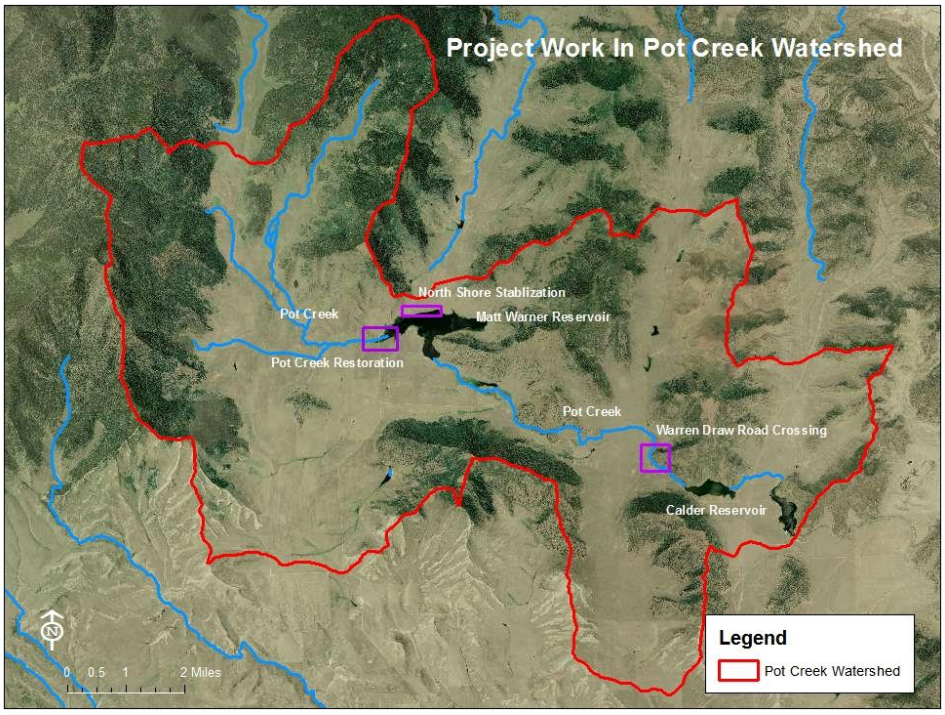


Figure 2. 2010 Project Work in Pot Creek Watershed**.**



1.4 General watershed information

The Matt Warner and Calder Reservoirs' watershed is located primarily in Uintah County, Utah with a small portion falling within Daggett County to the northeast. The watershed encompasses an area of approximately 42,395 acres. The watershed highpoint, the east peak of Mount Lena, is 9,147 feet above sea level, thereby, developing a complex slope of 4.3% to Calder Reservoir and 5.5% to Matt Warner Reservoir. The average stream gradient of Pot creek is 0.8% with a maximum slope of 30% in the mid-elevation mountains of the Pot Creek Drainage. Land within the watershed is used for livestock grazing, wildlife, and recreation.

A 15 year normal annual precipitation at the reservoirs was calculated as 26 inches/year, with the majority falling as snow during the winter. There are no local monitoring stations for temperature near Matt Warner and Calder Reservoirs. The frost-free season is 60 to 80 days.

Principle vegetation types include ponderosa pine, sagebrush, oak and wheatgrass. The dominant soils are loam, very channery silt loam, extremely bouldery loam and extremely stoney sandy loam.

1.5 Water quality problems

The Division of Water Quality has regularly monitored water quality within Matt Warner and Calder Reservoirs as well as Pot Creek. The United States Geological Service (USGS) maintained a gauging station on Pot Creek above Matt Warner Reservoir and the Utah Division of Water Rights has a gauging station on each reservoir.

Water quality concerns within Matt Warner and Calder Reservoirs include nutrient enrichment (eutrophication) and associated low dissolved oxygen concentrations, fish kills and blue-green algal blooms. There are no point sources of pollution within the watershed, all existing pollution results from non-point sources. Current non-point sources of phosphorus loading, sited in the TMDL analysis, include upland and streambank soil erosion, internal loading, animal waste, and recreational use.

The TMDL developed for Matt Warner and Calder Reservoirs specified goals of shifting phytoplankton dominance away from blue-green algae, with a DO of no less than 4 mg/L in 50% of the water column and a trophic state index value of between 40-50 (mesotrophy). A load reduction of total phosphorus (TP) from 223 kg/yr to 201 kg/yr for Matt Warner Reservoir and 263 kg/yr to145 kg/yr for Calder Reservoir was established as necessary to achieve these goals. Implementation strategies identified within the TMDL include watershed erosion controls, revegetation, restoring riparian habitats and grazing controls. All of these measures are addressed within this proposal for implementation funding.

2.0 Project Goals, Objectives, and Tasks

2.1 2008 Project Goals

The overall project goals for the 2008 grant were to reduce non-point source pollution into Matt Warner and Calder Reservoirs by:

- Facilitating the implementation of best management practice on pasturelands and rangelands
- Improving the riparian corridor to reduce nutrient loading and stream bank erosion
- Increasing the vegetation cover in the watershed to minimize soil erosion
- Provide administrative services to document matching contributions, project tracking, coordination, and report generation.

These projects were supported by the Uintah County Conservation District.

Project 1: Project 1 included improving tributary stream channels and enhancing riparian corridor through planting of wetland grass and sedges. The project area is located downstream of Matt Warner Reservoir on Pot Creek. The water quality benefits of these practices included:

- Wetland plantings will significantly reduce the erosion force potential to the diversion ditch. There is no significant damage done to this channel by the cattle. Where damage was beginning the landowner is taking steps to limit access during the grazing cycles and to stabilize the areas. Additionally, these plants act as nutrient uptake sources through their root systems which will form a deep mat.
- Spreading the watering facilities over the property will encourage the cattle and upland big game to use other water resources besides the valley bottoms, thereby increasing efficient forage and grazing practices over the entirety of the property. As the cattle forage further upslope their waste matter becomes nutrients for additional grasses and forbs which will contribute to increased upland ground cover.

Project 2: Implement soil erosion controls and BMPs in the Pot Creek Watershed. Project work included the west end of Calder Reservoir (Figure 3), boat ramp at Calder Reservoir (Figure 8), and spillway of Matt Warner Reservoir (Figures 11-13). The water quality benefit of these practices included:

- Reduce TP loading into Pot Creek system from soils and sediment

Project 3: Collect soil and sediment samples in the watershed to determine if any types of land use or land cover contain higher amounts of TP concentrations and could possibly be sources of the TP loading into Pot Creek. Figure 20 shows where samples were randomly collected.

2.2 2008 Objectives and Tasks

Goal 1: Improve stability of tributary stream channels and enhance the riparian corridor through the establishment of wetland grasses and sedges to reduce sediment and nutrient loading to the system.

Objective 1: Develop a riparian project that reduces sediment and nutrient loading to the reservoir to improve function of the stream and riparian area. This is part of Project 1.

Task 1 – Cooperate with one streambank landowner and develop a streambank and riparian improvement plan using BMPs and bioengineering principles (e.g. sedge plugs.)

Output: 1 streambank improvement project plan. This was implemented in spring of 2009. Design work met NRCS standards and specifications.

Task 2 – Implement Project- 3,000 sedge and grass plugs were planted in the functional streambank of Pot Creek.

Output: 1 project implemented. Implementation occurred between spring 2009 and fall of 2009. Landowners and project partners implemented projects. NRCS and District staff advised, reviewed and certified this project.

Total Cost: $7,806 ($4,684 319 + $3,122 match)

Goal 2: Improve stability of tributary stream channels and enhance the riparian corridor by implementing soil erosion controls and BMPs to reduce sediment and nutrient loading to the system.

Objective 1: Implement erosion control/reclamation project on west end of Calder Reservoir (Figures 2 - 3). This is part of Project 2.

Output: Approximately 1.5 acres of damaged slope was reclaimed and revegetated native seed mix. Vehicle access was eliminated.

Total Cost: $7,474 ($5,474 319 + $2,000 match)

Task 3: Implement project

- Repaired a 200 yard long rill complex on a 7% grade going into Calder itself.
- Used fill material from sediment basins to resloped gravel parking lot.
- Blocked vehicle access by bouldering ¼ mile of road. Planted rill with native grasses, forbs and wildflowers.
- Capture sediment at the bottom of the rill via straw bales and filter fabric. They will be left in place until vegetation cover has stabilized at 80%.

Figure 3. Overview of Project 2: Repair Rill on West Side of Calder Reservoir.

Figure 4. Rill on West Side of Calder Reservoir before restoration work.

Figure 5. Rill on West Side of Calder Reservoir during restoration work.

Figure 6. Rill on West Side of Calder Reservoir after restoration work.

Objective 2: Implement soil erosion controls and BMPs at the boat ramp of Calder Reservoir (Figures 4-5). This is part of Project 2.

Output: The boat ramp parking area was graveled and leveled. Three cattle guards were installed at the top of the boat ramp. Uintah County DOT is charged with maintaining project.

Total Cost: $40,116 ($22,660 319 + $15,836 match)

Task 4: Implement project grading and graveling parking lot. Install cattle guards at the top of the boat ramp to capture runoff from parking lot. Develop maintenance plan with Uintah County DOT to clean out cattle guard annually.

Output: grading and graveling of parking lot was completed. A cattle guard was installed at the top of the boat ramp to capture runoff from parking lot.

Figure 7. Overview of Project 2: Install BMPs at the boat ramp on Calder Reservoir.

Figure 8. Boat Ramp at Calder Reservoir Before Project.

Figure 9. Boat Ramp at Calder Reservoir After Project.

Figure 10. Parking Lot at Calder Reservoir After Project.

Objective 3: Implement soil erosion controls and BMPs at the spillway of Matt Warner Reservoir (Figures 6-7). This is part of Project 2.

Total Cost: $41,206 ($21,905 319 + $17,861 match)

Task 5: Form an agreement with DWR to complete project work.

Task 6: Implement project by resloping 300 ft of raw cut bank using coconut fiber matting, seeding with native species, removing abandoned irrigation pipe spanning spillway, and stabilizing eroded embankments from concrete abutments.

Output: Work was completed in 2012. Over 300 ft of raw bank at the Matt Warner spillway was reshaped to 3:1 slope. 2 acres were seeded with DWR-approved seed mix.

Figure 11. Overview of Project 2: Reslope Cutbanks at Matt Warner Reservoir Spillway.

Figure 12. Cutbanks at Matt Warner Reservoir Spillway Before Project.

Figure 13. Matt Warner Reservoir Spillway Before Project.

Figure 14. Matt Warner Reservoir Spillway During Project Work.

Figure 15. Matt Warner Spillway After Project Work.

Figure 16. Matt Warner Spillway After Project.

Objective 4: Construction a detention pond and restrict vehicle traffic on south side of Matt Warner Reservoir to catch runoff from an access point and parking area that the public has developed (Figure 19). This is part of Project 2.

Output: Closed off vehicle access point via boulders and constructed small retention pond. Project was completed in August 2012 (Figure 18).

Total Cost: $4,175 ($3,175 319 + $1,000 match)

Task 8: Close off access point using boulders and construct small detention pond to collect sediment from entering into the reservoir.

Figure 17. Overview of Project 2: Construction Detention Pond on South Side of Matt Warner Reservoir.

Figure 18. Before vehicle access blocked and detention pond constructed.

Figure 19. After vehicle access blocked and detention pond constructed.

Figure 20. Example of Detention Pond Created Above Calder Reservoir (2010 Grant Project).

Goal 3: Collect soil and sediment samples randomly to determine if any types of land use or land cover contain higher amounts of TP concentrations and could possibly be sources of the TP loading into Pot Creek.

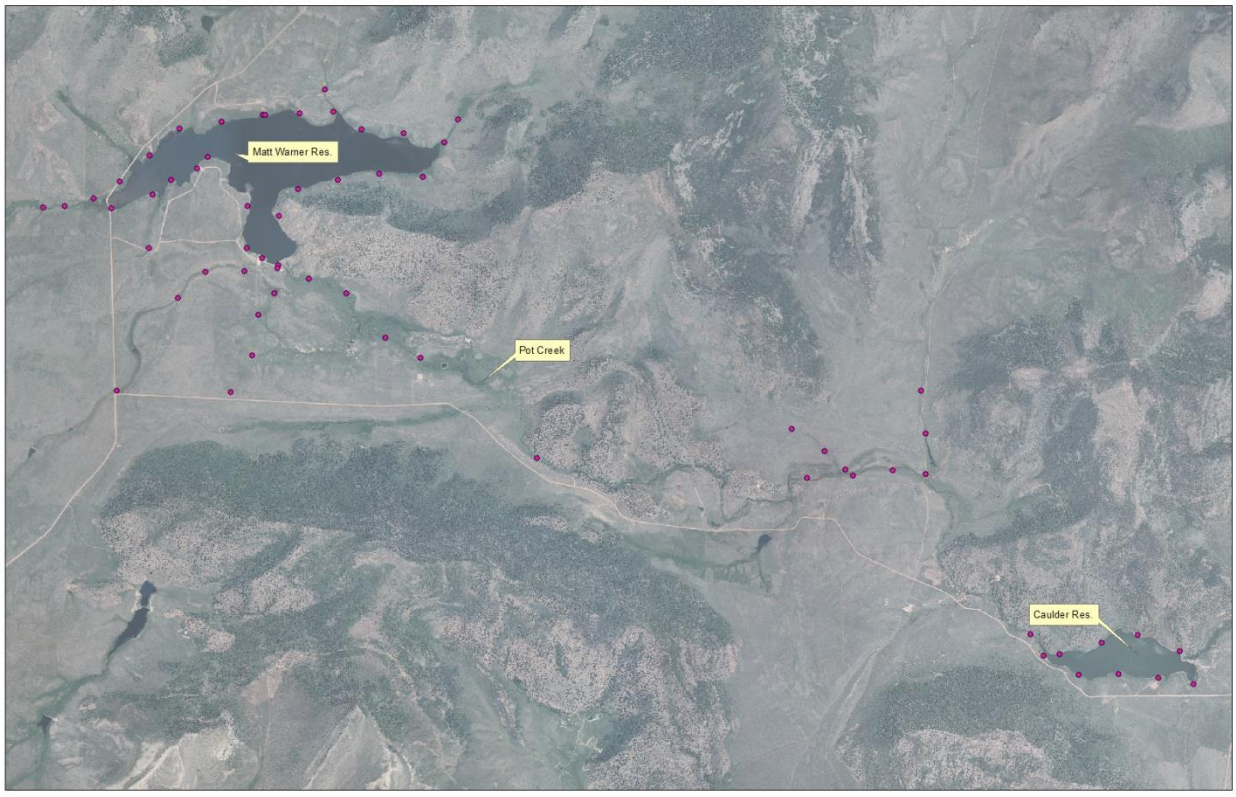
Objective 1: Contract to have soil and sediment samples taken in the Pot Creek watershed. Process samples at USU (Project 3). See Figure 21 for sampling locations and section 3.6 for results.

Task 8: Collect samples according to standards. Process samples at USU lab in Logan.

Output: 3 people collected 65 soil samples around the Pot Creek watershed. Soil sampling took a total of 150 man hours. Soil samples were sent to USU for processing. The results of the soil tests found that much of the soil within the Pot Creek watershed is high in phosphorus, suggesting the high TP in the watershed comes from a nonpoint source throughout the watershed. The average of the samples taken was 27.9 mg/kg, with the highest being 66.8 mg/kg and the lowest being 2.9 mg/kg. The sample with the highest phosphorus level was taken in a dry inlet on the north side of Matt Warner Res. The second highest was found near the Pot Creek inlet on Matt Warner's west side.

Total Cost: $3,662 ($3,662 319 + $0 match)

Figure 21. Soil Sample Sites



Goal 4: Provide administrative services to project sponsors documenting matching contributions, oversight of contracts, tracking individual project progress, coordinating team efforts, and generating reports and data in a timely manner.

Objective 1: Provide administrative services.

Task 10: Track Match and Prepare Reports

Output: UACD documented match for the project. The watershed coordinator and UDWQ produced annual and final reports. Conservation District staff advised on all reports.

Total Cost: $4,640 ($3,240 319 + $1,400 match)

2.3 2010 Project Goals

The FY-2010 funding was requested after identifying several degraded areas in the Pot Creek watershed. The 2010 project focused on the north shoreline of Matt Warner Reservoir and Warren Draw Road crossing of Pot Creek upstream of Calder Reservoir.

Project 1: Project 1 includes improving water quality by reducing sediment loading into Pot Creek from the Warren Draw road crossing. Project area is located upstream of Calder Reservoir (Figures 21-24).

Project 2: Project 2 includes repairing and stabilizing the north shoreline of Matt Warner Reservoir (Figures 25-27).

Project 3: Project 4 includes the development of an outreach plan on erosion mitigation and water quality benefits. This plan would include local landowners as well as the Uintah Basin Watershed Council.

Project 4: Provide administrative services to project sponsors documenting matching contributions, oversight of contracts, tracking individual project progress, coordinating team efforts, and generating reports and data in a timely manner.

The water quality benefits of these practices include:

- Reduced sediment loading during spring runoff and rain events into Pot Creek, Matt Warner Reservoir, and Calder Reservoir
- Reduced overall maintenance costs and reduced damage during vehicle passage which further reduces sediment loading
- Improved water flow in the original stream channel during high flow which will help restore fluvial function in this reach of Pot Creek

Figure 22. Overview of Project 1: Repair Warren Draw Road Crossing.

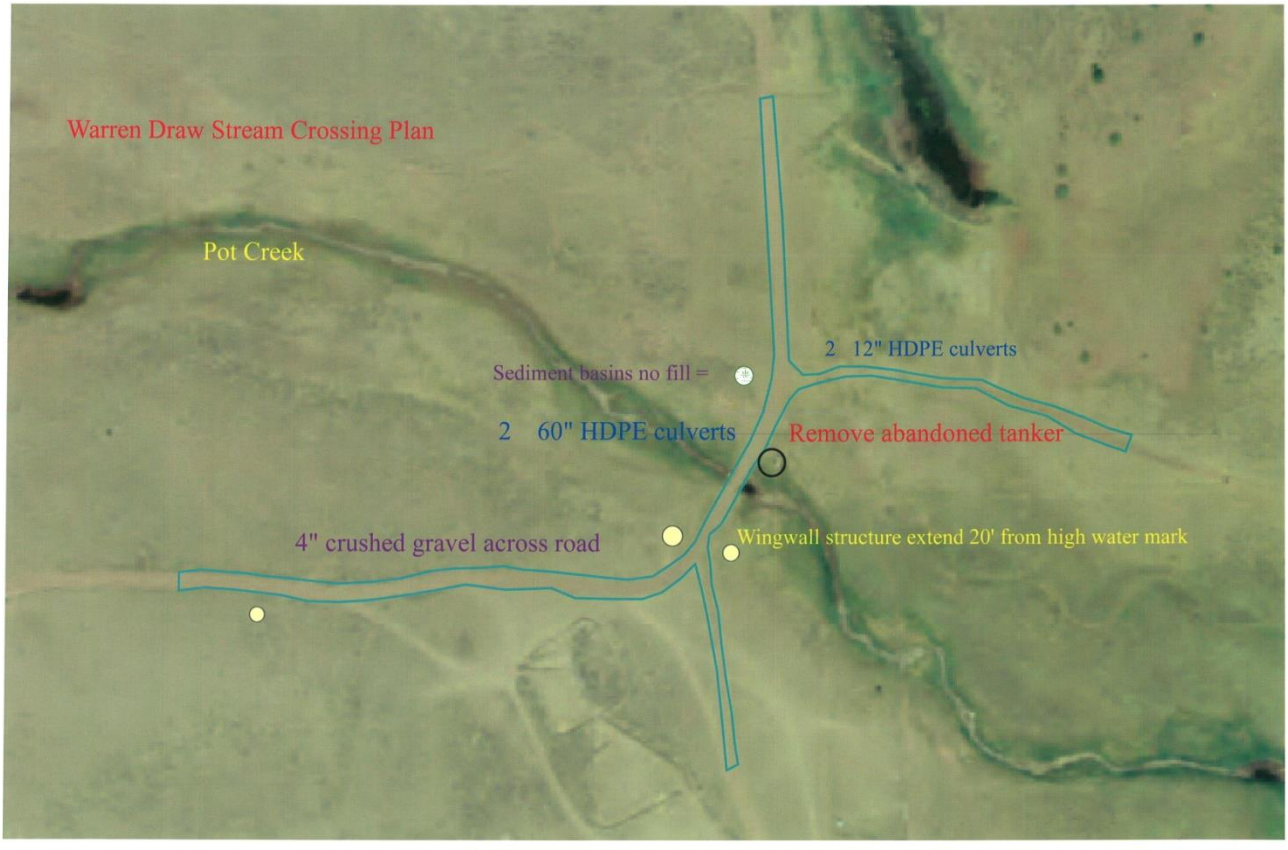


Figure 23. Warren Draw Road Crossing of Pot Creek Before Project.

2.4 2010 Objectives and Tasks

Goal 1: Assist the Uintah County Roads Department, Utah DWR, and landowners in Butch Cassidy Ranchettes in designing and installing erosion controlling/mitigating best management practices at and near the Warren Draw Road crossing of Pot Creek (Figures 21-24).

Objective: The reduction of sediment from entering the water that ultimately flows into Calder Reservoir.

Task 1 – Identify technically and financially feasible BMPs with Uintah County DOT. Design work will meet NRCS, USFS and EPA standards and specifications.

Task 2 – Implement project plan.

Outputs include:

- Coordinated with Uintah County DOT to insure the county has secured permission from the Corp of Engineers to install the new culvert
- Replaced exiting culverts with one 60" aluminum culvert
- Armored the banks of both sides of the crossing with rip rap
- Raised the roadbed over the culvert approximately 8" with the high point directly over the culvert.
- Installed several sediment detention ponds on each side of the road crossing
- Graveled road for 150 feet of crossing in both directions

- Removed abandoned tanker near stream

Total Cost: $21,807 ($10,779 319 + $11,028 match)

Figure 24. Warren Draw Crossing After Project Work.

Figure 25. Detention Pond Created Along Warren Draw Crossing.

Goal 2: Repair 600 feet of bank damage along the north shoreline of Matt Warner Reservoir (Figures 25-27) caused by wave action from the prevailing southwest wind.

Objective: Reduce sediment and TP loading from entering the water from the banks of Matt Warner Reservoir.

Task 3 – Implement plan by:

- Reshaped eroded bank to 2:1 slope
- Stabilized soil with riprap
- Seeded with native species

Output: 600 feet of the bank were reshaped and additional BMPs were installed and 1 acre reseeded.

Total Cost: $115,314 ($49,640 319 + $65,674 match)

Figure 26. Overview of Project 2: Repair North Shoreline of Matt Warner Reservoir.

Figure 27. Eroded bank along Matt Warner Reservoir.

Figure 28. Bank along Matt Warner Reservoir after project.

Goal 4: Provide administrative services to project sponsors documenting matching contributions, oversight of contracts, tracking individual project progress, coordinating team efforts, and generating reports and data in a timely manner.

Objective 1: Provide administrative services.

Task 10: Track Match and Prepare Reports

Output: UACD documented match for the project. The watershed coordinator and UDWQ produced annual and final reports. Conservation District staff advised on all reports.

Total Cost: $4,580 ($3180 319 + $1,400 match)

3.0 Monitoring Results

Utah's Division of Water Quality is continuing to monitor several sites within the Matt Warner and Calder Watershed, including the reservoirs, as part of its long-term water quality monitoring efforts.

Water quality samples and photos are being taken every 6 weeks for 3 years. DWQ will monitor reservoir water quality annually for next 10 years.

3.1 Total Maximum Daily Load (TMDL) Implementation Effectiveness

The TMDL for this watershed was a key tool in planning and implementing these projects.

3.2 Best Management Practices (BMP) Implementation Effectiveness

All of the project implementation work followed the BMP protocol. The earth work was completed while the Pot Creek stream flow was at a minimum; the North shore line work on Matt Warner reservoir was completed while the lake elevation was 48" below the spillway elevation. In summary, the work was all completed after a low precipitation year and during late summer before any significant seasonal runoff. The timing of the construction work allowed for sediment entering the water course to be kept to an absolute minimum.

The sample analysis indicates high levels of TP and dissolved sediments. All of the construction projects have been designed to help reduce these contaminants.

3.3 Water Surface Improvements

3.3.1 Chemical

The goal of the TMDL was to reduce TP loading by 48 lbs/year. To achieve this reduction, TP loads were reduced by installing best management practices (BMPs) from critical areas. Critical areas were identified in the TMDL and in-field assessments. There are three main objectives to attain this project goal: reduce phosphorus loading, erosion control, and an education program.

Phosphorus load reductions achieved using chemical grab samples indicate a 5.2 lbs/year loading reduction (23%) for Pot Creek watershed. The compliance sampling point is located below Calder Reservoir (5937840).

Chemical and discharge data were collected at four monitoring stations within the watershed from 2000 to September 2012. Table 1 summarizes the phosphorus concentration at these sites. Average TP concentration decreases downstream. Concentration spikes below Matt Warner Reservoir indicating that this reservoir is a source for phosphorus. There is a slight increase in TP below Calder Reservoir as well. Reservoirs can often serve as both a sink and a source for phosphorus. Phosphorus containing particles settle to the substrate and are covered by sediment. Continuous accumulation of sediment will bury some phosphorous too deep to be released into

the water column and thus are removed from biocirculation however, some are released under with anoxic conditions (seasonal overturns) or by stirring of the sediment.

Table 1. Summary Statistics for Total Phosphorous in the Pot Creek Watershed.

Monitoring Id	Site Description	Date Range	Sample Size	Minimum	Maximum	Average
5937880	Pot Ck Above Matt Warner (AB MW)	6/29/00 – 9/12/12	25	Below detection	0.06	0.23
5937840	Pot Ck Below Matt Warner (BL MW)	10/26/10 – 9/12/12	10	Below detection	1.18	0.47
5937810	Pot Ck Above Calder (AB Calder)	6/29/00 – 8/3/11	20	Below detection	0.36	0.10
5937790	Pot Ck Below Calder (BL Calder)	8/29/07 – 9/12/12	4	0.09	0.19	0.14

When comparing TP concentration before and after project completion, there was a 0.07 mg/L decrease at the compliance point (Pot Ck below Calder). Note that the after project data was based on one sample taken recently after a precipitation event. More samples are being taken at all four locations to appropriately determine the reduction in TP after project implementation. Figure 1 and Table 2 shows the TP concentration before and after the project. Pot Creek above Calder Reservoir was dry during the post project sampling event thus no data was collected.

Figure 29. Total Phosphorus Concentration (mg/L) in the Pot Creek Watershed Before and After Project Work.

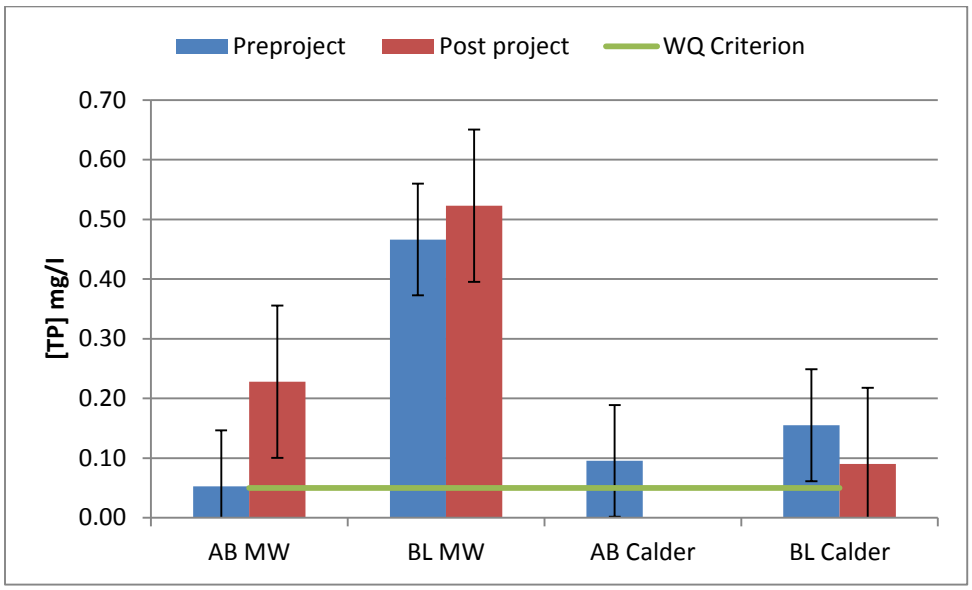


Table 2. Total Phosphorous Concentration (mg/L) in the Pot Creek Watershed Before and After Project Work.

	Pot Ck Above Matt Warner	Pot Ck Below Matt Warner	Pot Ck Above Calder	Pot Ck Below Calder
Preproject	0.05	0.47	0.10	0.16
Postproject	0.23	0.52	N/A	0.09
Difference	-0.18	-0.05	N/A	0.07

TP loading was calculated at all four monitoring stations before and after the project implementation. Chemical data shows Pot Ck below Calder Reservoir has a 5.2 lbs/year load reduction in TP. There is an increase in loading at the upper two monitoring sites mainly due to increase in flow from a recent rain event. Flow from Calder Reservoir is regulated and thus TP loading is less influenced by precipitation events. Figure 2 and Table 3 shows the TP loading before and after the project.

Figure 30. Total Phosphorus Loading (pounds/year) in the Pot Creek Watershed Before and After Project Work.

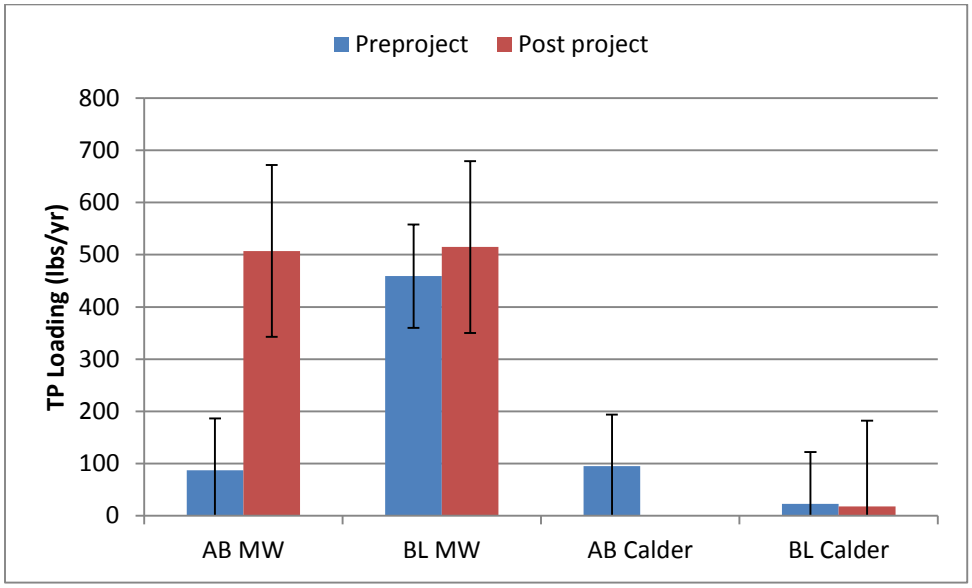


Table 3. Total Phosphorus Loading (pounds/year) in the Pot Creek Watershed Before and After Project Work.

	Pot Ck Above Matt Warner	Pot Ck Below Matt Warner	Pot Ck Above Calder	Pot Ck Below Calder
Preproject	87.1	459.0	94.9	22.9
Postproject	507.2	514.8	N/A	17.7
Difference	-420.1	-55.8	N/A	5.2

The limited sampling data indicate a 23% reduction (5.2 lbs/year) in TP loading. While this reduction cannot be completely attributed to the BMPs installed due to the influence of the two reservoirs and lack of postproject data, stabilizing eroding banks and educating the local public will decrease TP loading in time. Chemical and discharge data will continue to be collected every six weeks to determine project effectiveness.

3.3.2 Biological

As discussed in a previous section, the area immediately surrounding Matt Warner Reservoir has been fenced to prevent livestock from accessing the reservoir. In view of this, the area where Pot Creek enters the reservoir is developing into lush riparian habitat and is used extensively by shore birds and waterfowl.

3.3.3 Physical Habitat

By stabilizing the banks along the shoreline of the reservoirs and creek, the increase in vegetative cover will improve the water quality and subsequent habitat.

3.4 Other Monitoring

Sampling will include targeted samples taken at runoff and base flow before and after implementation of projects. In addition, Utah's Division of Water Quality will continue to monitor several sites within the Matt Warner and Calder Watershed, including the reservoirs, as part of its long-term water quality monitoring efforts.

The Division of Wildlife Resources owns Matt Warner and Calder Reservoirs and have invested substantial money in these fisheries. Maintaining these reservoirs for the public benefit is paramount with the DWR and they have their personnel on site regularly.

Long-term ambient monitoring stations have been established by UDWQ listed as follows:

Site ID	Site Description
5937880	Pot Creek above Matt Warner Reservoir
5937860	
5937850	Matt Warner Reservoir at the Dam
5937840	Pot Creek below Matt Warner Reservoir
5937810	Pot Creek above Calder Reservoir
5937800	Calder Reservoir at Dam
5937790	Pot Creek below Calder Reservoir

3.5 Results of BMP Operation and Maintenance Reviews

See section 4.2

3.6 Results of Soil Sampling

3 people collected 65 soil samples around the Pot Creek watershed. Soil sampling took a total of 150 man hours. Soil samples were sent to USU for processing.

Figure 28 and 29 show the sample sites with the corresponding data.

Based the data, there does not seem to be a correlation between the areas that are high in phosphorus and the areas that are grazed heavily, in fact the data shows the opposite. Furthermore, there does not seem to be a correlation between soil type and phosphorus content.

The average phosphorus content of the samples taken was 27.9 mg/kg, with the highest being 66.8 mg/kg and the lowest being 2.9 mg/kg. The sample with the highest phosphorus level was taken in a dry inlet on the north side of Matt Warner Res. The second highest was found near the Pot Creek inlet on Matt Warner's west side.

The results of the soil tests found that much of the soil within the Pot Creek watershed is high in phosphorus, suggesting the high TP in the watershed comes from a nonpoint source throughout the watershed. Contributing to this belief is the nearby phosphate mine. This being so, keeping erosion to a minimum is key to the health of this watershed.

Figure 31. Pot Creek Soil Sample Sites

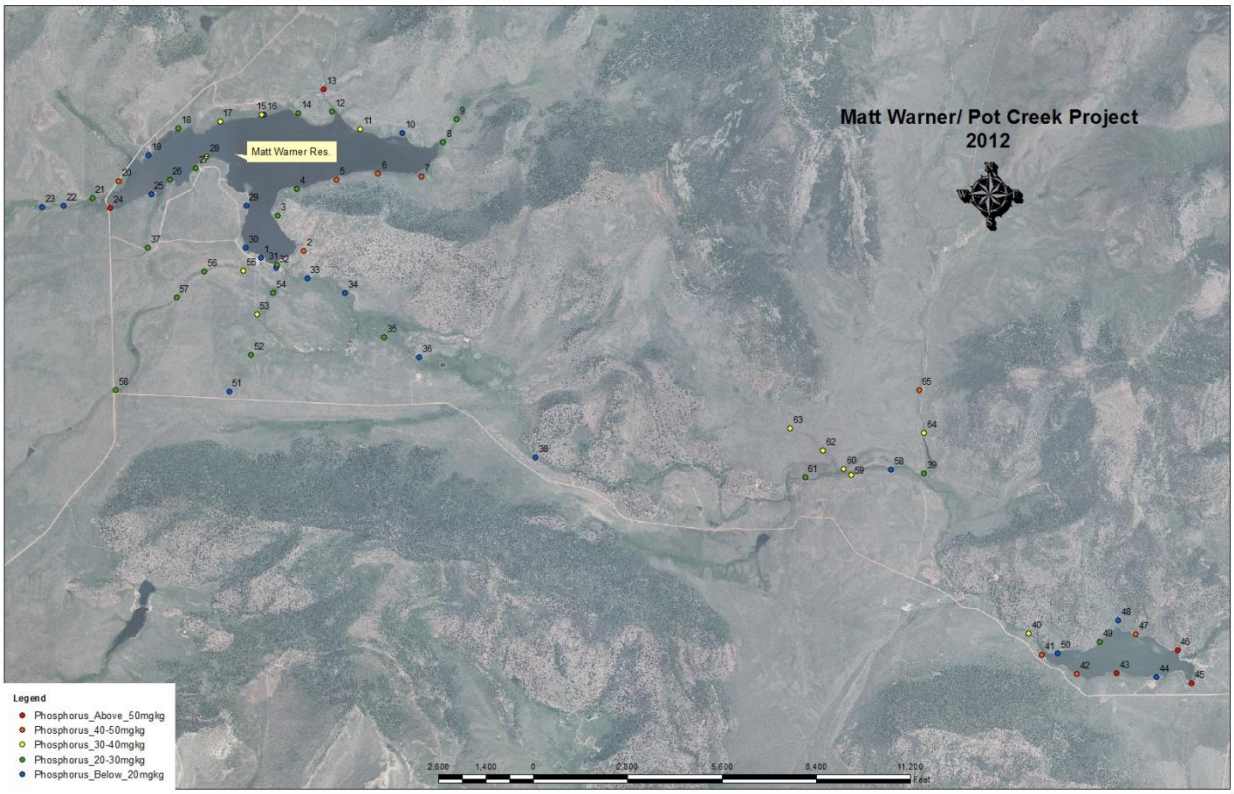


Figure 32. Soil Sample Data

Sample #	Texture	pH	Salinity (dS/m)	Phosphorus (mg/kg)	Potassium (mg/kg)
1	Sandy Clay	7.5	0.60	9.44	101
2	Loam	5.8	0.30	42.9	358
3	Sandy Clay Loam	6.5	0.43	22.1	117
4	Sandy Clay Loam	6.1	0.37	21.4	190
5	Sandy Clay Loam	6.3	0.35	43.3	288
6	Sandy Clay Loam	6.5	0.36	44.7	204
7	Sandy Clay Loam	6.7	0.54	49.0	219
8	Sandy Clay Loam	7.8	0.80	21.9	216
9	Silty Clay Loam	7.5	0.60	29.2	164
10	Silty Clay Loam	7.4	0.50	18.5	170
11	Sandy Clay	6.2	0.40	38.9	265
12	Clay Loam	6.3	0.40	23.3	288
13	Loam	7.8	0.60	66.8	370
14	Clay	7.6	0.70	23.5	123
15	Clay Loam	6.3	0.40	35.8	424
16	Sandy Clay	6.4	0.40	7.25	78.2
17	Sandy Clay Loam	6.3	0.60	30.9	291
18	Clay Loam	7.2	0.40	28.2	479
19	Clay	7.1	0.40	14.7	129
20	Silty Clay Loam	7.2	0.70	41.9	359
21	Clay	7.7	0.60	21.2	191
22	Clay	7.7	0.40	11.9	3.6
23	Clay Loam	6.6	0.50	10.6	22.4
24	Clay	5.5	0.40	65.5	226
25	Sandy Loam	7.1	0.40	10.7	110
26	Sandy Clay Loam	6.8	1.24	21.2	266
27	Sandy Clay Loam	6.9	0.40	29.0	346
28	Loam	6.0	0.40	34.5	663
29	Sandy Clay Loam	6.4	0.40	16.1	190
30	Loam	5.6	0.40	15.8	170
31	Sandy Clay	7.4	0.87	22.8	191
32	Silty Clay Loam	7.8	0.34	2.88	4.3
33	Clay Loam	7.1	0.93	16.8	114
34	Sandy Clay Loam	6.8	1.30	18.6	460
35	Sandy Clay Loam	7.9	0.40	21.3	261
36	Silty Clay Loam	7.9	1.27	9.21	345
37	Sandy Clay	7.5	1.00	22.4	166
38	Clay Loam	7.8	0.50	18.4	71.0
39	Clay Loam	7.0	0.80	25.7	119
40	Loam	5.8	0.50	34.9	118
41	Sandy Loam	6.9	0.40	40.4	255
42	Loam	6.5	0.70	44.5	417
43	Loam	6.9	1.00	50.3	466
44	Sandy Clay	7.4	1.00	19.1	75.7
45	Clay Loam	7.0	0.70	50.9	242
46	Clay Loam	6.3	0.60	54.2	256
47	Sandy Loam	7.2	0.40	42.1	180
48	Sandy Loam	6.6	0.50	9.5	185
49	Loam	7.1	0.60	26.5	440
50	Sandy Clay	7.1	0.29	7.0	93
51	Clay Loam	7.5	0.40	16.5	206
52	Clay Loam	7.2	0.45	28.4	283
53	Sandy Clay Loam	6.3	0.35	32.3	187
54	Clay Loam	6.9	0.31	20.9	224
55	Loam	7	0.40	31.6	130
56	Clay Loam	6.9	0.32	21.2	241
57	Sandy Clay	7.2	0.71	28.0	267
58	Sandy Clay	7	2.03	23.6	172
58	Sandy Loam	6.6	0.50	9.48	185
59	Clay Loam	7	0.93	34.0	175
60	Sandy Clay	6.9	1.43	35.3	353
61	Clay Loam	6.8	0.35	25.4	190
62	Clay Loam	7.4	0.61	38.0	325
63	Clay Loam	6.7	0.30	30.8	398
64	Clay Loam	7.2	0.30	37.4	380
65	Clay Loam	7	0.32	44.1	450

4.0 Coordination Efforts

Utah Department of Natural Resources

Division of Wildlife Resources: Provided match funds and technical assistance

Division of Water Rights: Provided technical assistance and engineering requirements for various parts of the project.

U S Department of Agriculture

National Resource Conservation Service: Provided technical assistance and designs for various parts of the project.

Utah Association of Conservation District: Provided technical assistance, reporting, oversight, project administration, match documentation, contracting, and staffing assistance for the entire project.

Uintah County Conservation District: Quality Assurance

Uintah County Road Department: Assisted with Warren Draw Culvert and Caulder Res. Parking lot

Utah Department of Environmental Quality: Provided 319 grants, oversaw quality assurance and project management

5.0 Summary of Public Participation

There has been public involvement from the inception of the project, through proposal development, review, and submission. Uintah County Conservation District, along with their partners will select project participants and give oversight to project planning and implementation (particularly through the Uintah Basin Watershed Coordinator). This group actively seeks public input into the prioritization of natural resource problems and concerns.

The public participation on this project involved two primary areas. Public opinion and concern was registered due to the fish die off several years ago in Calder Reservoir. This prompted State and Federal management agencies to investigate and monitor this issue with apriority for

developing a management solution to the problem. The EPA, UTDEQ, UTDWR all share a common concern for the environmental issues that are believed to cause the die off. In view of this, the focus of all the project work implemented has been completed with the goal of reducing TP entering the water course.

Other public participation has involved public outreach and review committees to help provide guidance for developing a water shed plan for this watershed.

6.0 Aspects of the Project That Did Not Work Well

All of the projects are working as designed; minor adjustments were made as the projects were constructed.

7.0 Future Activity Recommendations

In review of the project work completed in the Matt Warner/Calder Reservoir watershed drainage; it appears that TP levels are elevated in the soils on the drainage areas. In consideration of the high levels or TP and TDS, the suggested focus of future BMP's should be to increase watershed cover. Projects that accomplish this type of improvement may need to be delayed until decisions are finalized regarding the listing of Sage Grouse as threatened and endangered species. This is especially true for projects involving the reduction of Sage Brush. Spraying with herbicides, spike treatments, or any mechanical treatment designed to reduce Sage Brush cover will need to carefully reviewed and discussed by all interests in this area.

Other BMP treatments for consideration include: bank stabilization on the private sector of the North Shore line of Matt Warner Reservoir and any other projects that intercept surface runoff within the watershed.