

UTAH SUCCESS STORY: MAIN CREEK



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PHASE 1 RESTORATION EFFORTS DECREASE TEMPERATURE AND POLLUTANT LOADING IN WALLSBURG WATERSHED

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Summary

Main Creek is one of several tributaries to Deer Creek Reservoir located in northern Utah. This reservoir is an important drinking water source to Salt Lake City and the Wasatch Front. Deer Creek Reservoir has experienced low dissolved oxygen due to elevated water temperatures and excess algae growth as a result of nutrient loading. Main Creek also has high levels of phosphorus and *E. coli* as well as elevated water temperature. In March 2007, the local community initiated a watershed restoration strategy (Wasatch Conservation District, 2012) that implemented several best management practices (BMPs) targeting nonpoint sources of pollution. The result of these restoration activities not only led to a decrease in both phosphorus and *E. coli*, but now Main Creek supports its cold water fishery designated use due to lowered water temperature.

Problem

The Wallsburg watershed covers approximately 45,000 acres in Wasatch County, Utah. Elevation ranges from 5,500 ft. at the inlet to Deer Creek Reservoir to the Wasatch Mountain peaks at 9,500 ft. There is a wide central valley used primarily for agriculture and residential use. The watershed's only town of Wallsburg covers 320 acres at the center of Round Valley and had a population of 274 in 2000. At approximately 14.6 miles, Main Creek is the largest stream in the watershed and is fed by springs in the Wasatch Mountains. Irrigation ditches convey water from Main Creek across the eastern edge of the valley. It is also a tributary to Deer Creek Reservoir.

Deer Creek Reservoir (UT-L-16020203-001) serves Utah and Salt Lake Counties by providing a significant amount of drinking and irrigation water, as well as being a popular recreational destination. It was identified as impaired on Utah's 2000 303(d) List for failing to protect its cold water fishery designated use due to low dissolved oxygen and elevated water temperatures. Water quality analyses were summarized in two reports: Upper Provo River Management Plan (PSOMAS, 1999) and 2002 Deer Creek Reservoir Total Maximum Daily Load (TMDL). The approved TMDL study (UDWQ, 2002) determined that the low oxygen levels were partially caused by high total phosphorous (TP) concentrations. Phosphorous sources in the Deer Creek Reservoir watershed include both point and nonpoint sources. The only point source that discharges to surface waters is the Midway Fish Hatchery. Heber Valley Special Service District's Wastewater Treatment Facility uses treated effluent to irrigate corn and alfalfa fields in the summer and a rapid infiltration basin during other times of the year. The nonpoint sources were categorized as being related to urban development and agricultural activities. The Deer Creek Reservoir TMDL showed that in-lake phosphorus concentrations needed to be reduced to 0.025 mg/L and tributaries to 0.04 mg/L as well as a target TP load of 18,000 kg/yr to meet Utah's water quality standard of at least 50% of the water column having DO concentrations greater than 4 mg/L. The TMDL identified a reduction of 865 kg/yr TP loading from agricultural sources.

Though Main Creek comprises only 8% of the inflow into Deer Creek Reservoir, it contributes 17% of the TP load. Further assessments of Main Creek (UT16020203-009) placed it on the 2010 303(d) List for failing to protect its infrequent recreational and cold water fishery uses due to elevated levels of *E. coli* and water temperature respectively. Figure 1 shows that *E. coli* concentration in Main Creek often exceeded the water

quality standard of 206 MPN/100 ml protective for infrequent recreation. For the 2010 303(d) listing, temperature in Main Creek exceeded the 20° C water quality standard set to protect for cold water fisheries 18% of the time between 2004-2008 (Figure 2).

It is noteworthy that this watershed contains 3 Utah Sensitive Species: the Leatherside Chub, the Bonneville Cutthroat Trout, and the Columbia Spotted Frog.

FIGURE 1. AVERAGE ANNUAL E. COLI CONCENTRATION IN MAIN CREEK ABOVE DEER CREEK RESERVOIR.

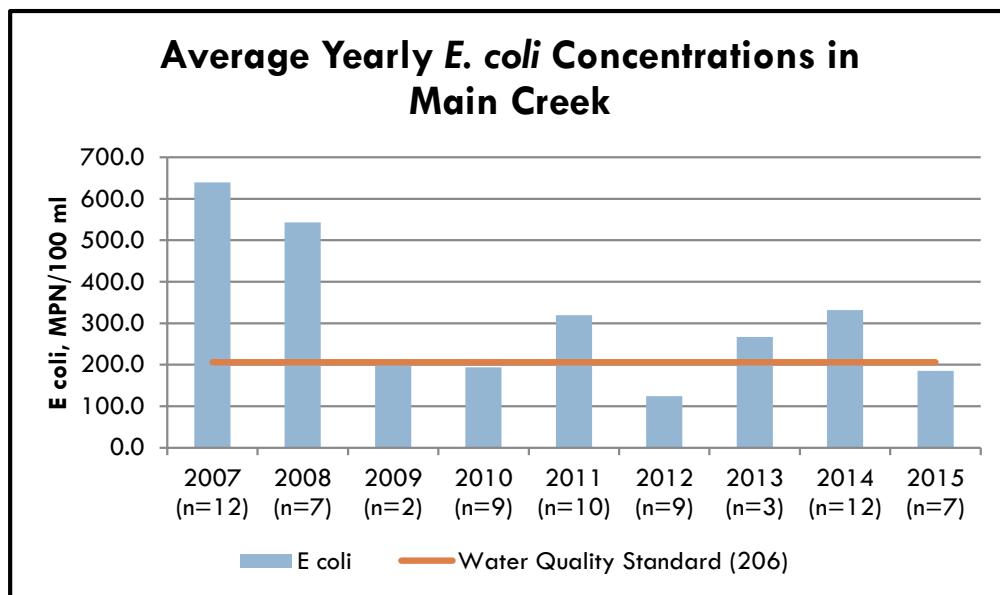


FIGURE 2. WATER TEMPERATURE READINGS IN MAIN CREEK ABOVE DEER CREEK RESERVOIR.

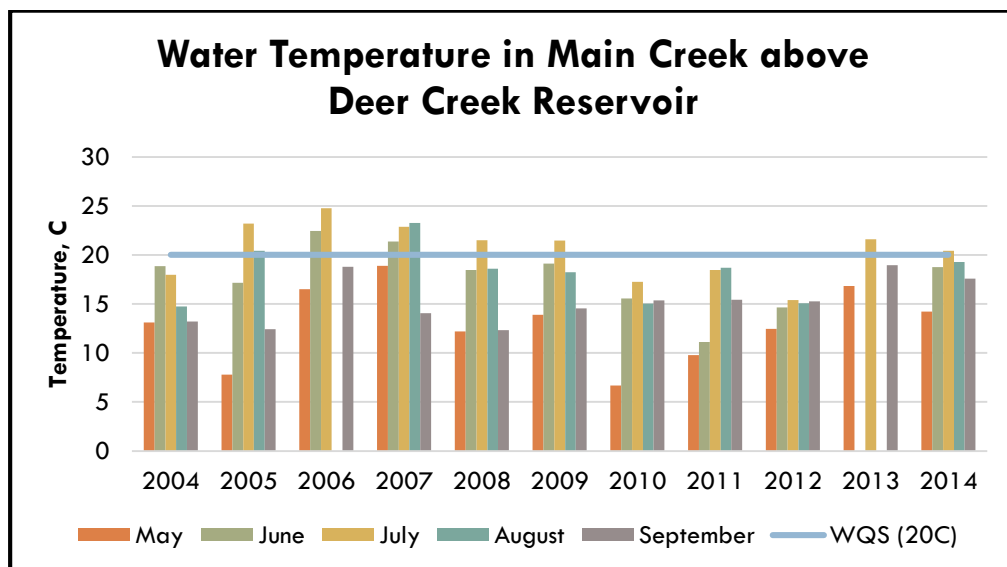
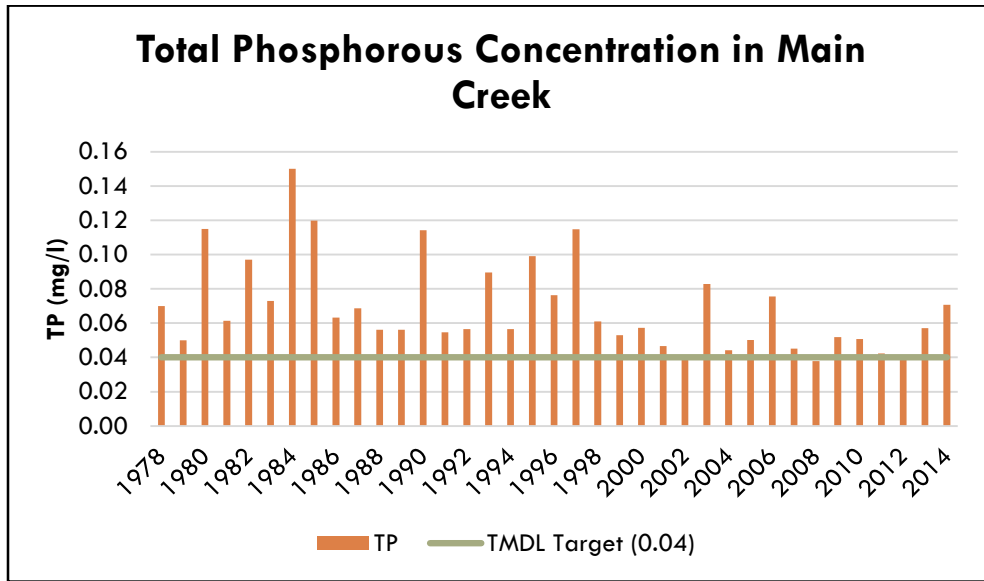


FIGURE 3. AVERAGE ANNUAL TOTAL PHOSPHOROUS CONCENTRATION IN MAIN CREEK ABOVE DEER CREEK RESERVOIR.



The main anthropogenic nonpoint source of TP loading in the Wallsburg watershed is suspected to be from animal waste (manure) and fertilizer. Another potential source is failing septic tanks. Nine percent of the septic systems in the Deer Creek watershed are found in the Main Creek drainage. Agriculture comprises about 6% of the watershed primarily along the valley bottom. Irrigation ditches convey water from Main Creek across the valley intersecting several intermittent drainages leading to seasonal dewatering of Main Creek. Significant natural sources of TP also exist. A recent study applying the Minnesota P Index, which assesses erosion, rainfall and snowmelt runoff pathways, showed snowmelt runoff from forested and shrublands to be the most significant pathway for dissolved phosphorus entering surface waters (Jones, Pearce, Robinson, & Hansen, 2015).

Project Highlights

In March 2007, the Wasatch Conservation District along with local stakeholders met to address resource concerns in the Wallsburg Watershed. Using the Coordinated Resource Management (CRM) process, stakeholders, landowners, and agency personnel evaluated local resources and the potential for actions to protect and restore the watershed. Participants listed water conservation and water quality as the top two resource concerns. Streambank restoration was identified in the Wallsburg CRMP as an effective way to lower water temperature and reduce *E. coli* and TP loading to Main Creek and Deer Creek Reservoir. Streambanks are characterized as highly erodible due to lack of riparian vegetation and access by livestock. The shortage of native woody vegetation along the river also allows for higher instream temperature due to a lack of shading. It is noteworthy that the watershed soils are naturally high in phosphorus so any disruption of soils will lead to higher TP loading to the system causing eutrophication in Deer Creek Reservoir.

Streambank restoration projects began on Main Creek in September 2013. Several best management practices (BMPs) have been implemented including fencing, soil lifts, off-site watering, native vegetation plantings, j-hooks, water gaps, and riparian seeding. These BMPs are common practices associated with erosion control and decreasing instream temperature.

Phase 1 concluded in December 2014 with 3.22 miles of stream restored. In some sections meanders were reinstalled and banks were pulled back to a 3:1 slope. The disturbed areas were seeded with a wide assortment of

riparian vegetation species. Other sections used soil lifts wrapped with coconut fiber mesh. A seed mixture was spread below the fabric and native vegetation was planted. Over 10,000 willow cuttings were inserted through the coconut fiber. Five miles of exclosure fencing has also been installed reducing unrestricted cattle access. Water gaps and hardened crossings were installed to allow cattle selective water access and movement between pastures.

Wallsburg Watershed Restoration Phase 1 included the first five landowners upstream from Deer Creek Reservoir. Four of the five landowners completed stream restoration projects on their property along Main Creek. Subsequent phases will focus on finishing up mainstem Main Creek, Spring Creek and Little Hobble Creek restoration and bank stabilization projects. Phase 2 began in October 2014 which included the Phase 1 fifth landowner along Main Creek and two additional upstream landowners on Little Hobble Creek. Depending on the availability of project funds, the Wasatch Conservation plans to assist additional landowners along Spring Creek for Phase 3 beginning in the fall of 2015.

FIGURE 4. MAIN CREEK PRIOR TO PHASE 1 RESTORATION.



FIGURE 5. UTAH DIVISION OF WILDLIFE RESOURCES' RIPARIAN TEAM SLOPING MAIN CREEK BANKS BACK TO A 3:1 SLOPE.



FIGURE 6. CROSS VANE INSTALLATION AND ROCK PLACEMENT ALONG MAIN CREEK.



FIGURE 7. VOLUNTEERS PLANTING WILLOW POLE CUTTINGS ALONG MAIN CREEK.



FIGURE 8. MAIN CREEK (SAME REACH FIGURE 4) AFTER PHASE 1 IMPLEMENTATION.



Results

Following the Main Creek Sampling and Analysis Plan, partners collected a host of data to measure NPS project effectiveness. Data collection included biological, chemistry, chemical, and visual aspects of this project. As a result, the stream now meets its cold water fishery designated use due to lowered instream temperature and will be removed from Utah's 303(d) in 2016. Both *E. coli* and TP loading have also been reduced since implementation work commenced. Monitoring efforts will continue until three years post project work.

Assessment of 2004-2008 temperature data triggered an impairment listing in 2010 with an 18% exceedance of the water quality standard (WQS) of 20°C required to protect cold water fisheries (Figure 2). Utah's assessment methodology allows for 10% exceedance of the water quality standard. The most recent data assessment (2010 – 2014) indicates only a 4% exceedance. Main Creek is now considered to be fully supporting its cold water fishery designated use and will be delisted in 2016.

Trend analysis of TP concentration shows a general decrease over time however concentrations are still above the TMDL target of 0.04 mg/L. Stable concentrations point to natural sources of pollution. There is a positive correlation between flow and concentration indicating that erosion and transport of TP during high flows is a dominant process in the watershed. TP loading has decreased by 63% after Phase 1 restoration.

FIGURE 9. GRAPH INDICATES A DOWNWARD TREND IN TP CONCENTRATION OVER TIME THOUGH STILL EXCEEDING THE TMDL TARGET OF 0.04 MG/L.

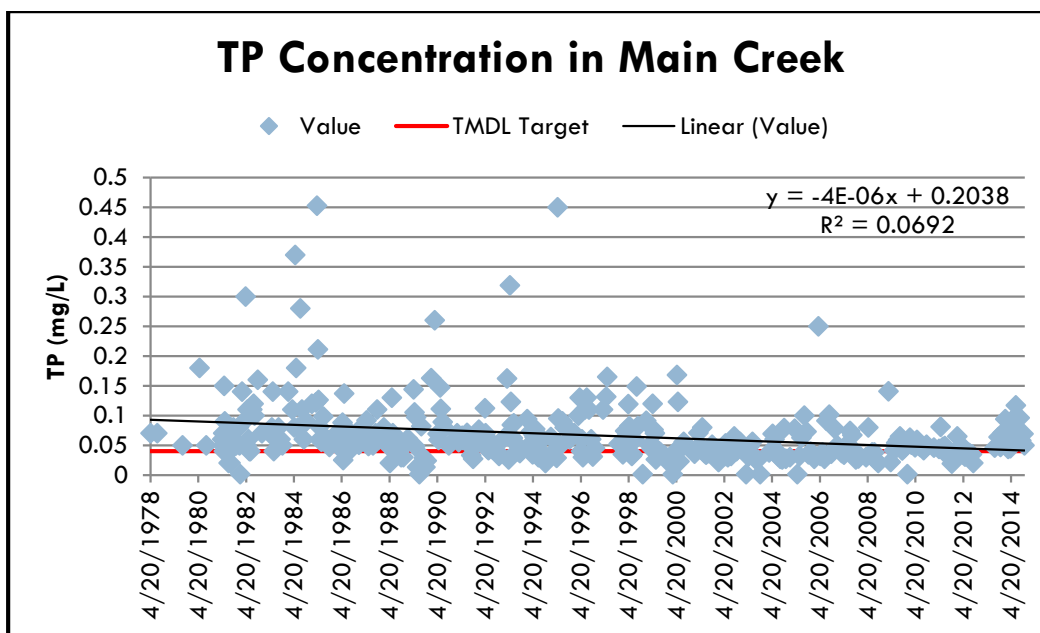


FIGURE 10. BAR GRAPH INDICATES A 63% REDUCTION IN TP LOADING AFTER MAIN CREEK PHASE 1 RESTORATION WAS COMPLETED.

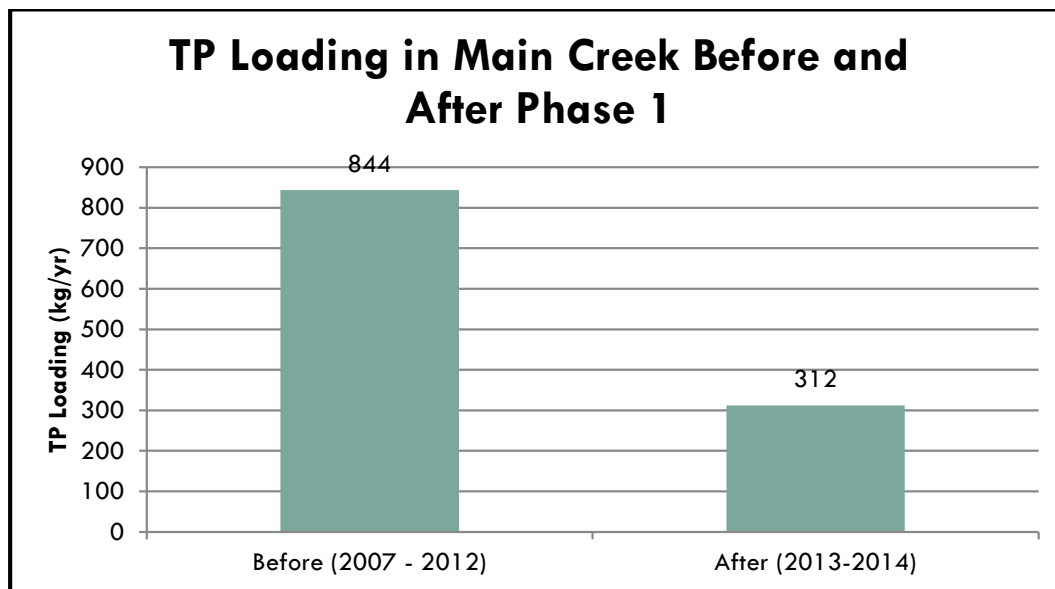


Figure 1 shows a downward trend in *E. coli* concentration in Main Creek as well. When comparing data before and after Phase 1 work, there is a 24% reduction in concentration (Figure 11) though levels still exceed the WQS of 206 MPN/100ml for infrequent contact recreational use. Figure 12 displays a 79% reduction in *E. coli* loading before and after Phase 1 project work. Note that 2014 was a dry water year which could overestimate the percent reduction.

FIGURE 11. BAR GRAPH INDICATES A 24% REDUCTION IN *E. COLI* CONCENTRATION AFTER MAIN CREEK PHASE 1 RESTORATION WAS COMPLETED THOUGH LEVELS STILL EXCEED THE 206 MPN/100ML WQS.

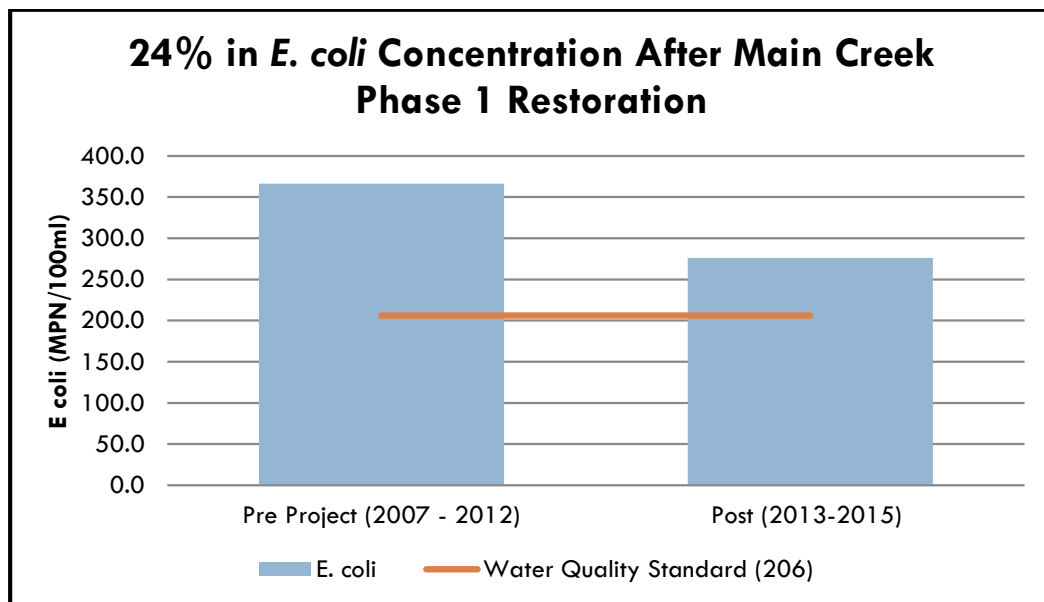
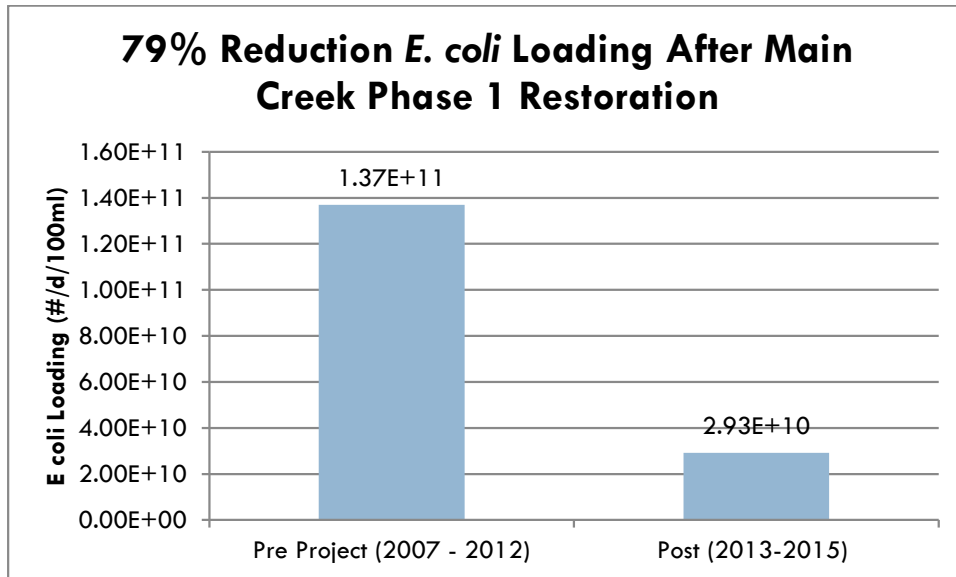


FIGURE 12. BAR GRAPH INDICATES A 79% REDUCTION IN E. COLI LOADING AFTER MAIN CREEK PHASE 1 RESTORATION WAS COMPLETED.



Utah Division of Wildlife Resources (UDWR) has monitored fish populations in the Wallsburg Watershed for many years. The estimated population density, biomass, and age structure of Southern Leatherside Chub captured in 2013 were compared to data from past years and were combined with the 2012 monitoring data to evaluate recent population trends. The 2012 and 2013 data suggest that Southern Leatherside Chub have experienced an increase in population density in Main Creek. On average, 2013 population densities of Southern Leatherside Chub were roughly seven times higher than 2007-2010. Due to lack of habitat and high water temperatures, trout population estimates are not significant enough to report. UDWR anticipates the restoration practices implemented will create deeper pools and eventually cooler water due to willow shading. In-stream conditions will improve for cutthroat trout, but the smaller fish (like Chub) will most likely be the first to respond and take advantage of improved habitat conditions.

Partners and Funding*

*Following information relates only to Phase 1 of Wallsburg Watershed Restoration

One of the biggest successes of this project was the support that was provided by various agencies. The overall cost of the Main Creek Restoration Project was \$1,076,199 (see Table 1 for funding breakdown). Funding sources include landowners, Environmental Protection Agency (EPA), Natural Resource Conservation Service, Utah Department of Agriculture and Food, Utah Division of Water Quality, Provo River Watershed Council (PRWC), and Watershed Restoration Initiative (WRI), Wasatch County, and Wasatch Conservation District. Other project partners include volunteers, Utah State University, Brigham Young University, Utah Association of Conservation Districts, and the Utah Reclamation, Mitigation and Conservation Commission.

Table 1. Funding Sources of Wallsburg Watershed Restoration: Phase 1.

| Entity | Funding Amount |
|----------------------|--------------------|
| EPA (Section 319) | \$150,000 |
| NRCS (EQIP) | \$366,422 |
| UDWQ (State NPS) | \$238,000 |
| UDAF (GIP) | \$125,874 |
| UDWR (WRI) | \$85,000 |
| Landowners (In-kind) | \$57,527 |
| PRWC | \$50,000 |
| Wasatch County | \$3,000 |
| Wasatch CD | \$376 |
| Total | \$1,076,199 |

REFERENCES

- Jones, J., Pearce, A., Robinson, D., & Hansen, N. (2015). *Applying a Phosphorous Risk Index in a Mixed Mountain Watershed*. Provo: BYU.
- PSOMAS. (1999). *Upper Provo River Water Quality Management Plan*. Salt Lake City.
- UDWQ. (2002). *Deer Creek Reservoir Drainage TMDL Study*. Salt Lake City.
- Wasatch Conservation District. (2012). *Wallsburg Coordinated Resource Management Plan*. Provo.