

Building on Past Implementation Success in the Deer Creek Reservoir

Using the TMDL Process to Maintain and Protect Water Quality

In 1941, the Bureau of Reclamation completed construction of the Deer Creek Reservoir, located on the Provo River in Wasatch County, Utah. Since that time, Deer Creek

Reservoir has become a vital source of drinking water for over one million people, as well as a source of irrigation water and a popular recreation destination. In the 1980s, concerns over excessive nutrients in Deer Creek Reservoir led to the formation of the Jordanelle Reservoir Water Quality Technical Advisory Committee (JTAC), the group responsible for the development of a water quality management plan for Deer Creek and Jordanelle reservoirs. Although Deer Creek Reservoir at one time did not support the coldwater fishery beneficial use due to low dissolved oxygen (DO) levels and high temperatures, analysis of recent data from Deer Creek Reservoir through the TMDL process revealed that stakeholder efforts led to significant improvements in both water quality and the health of the reservoir's fishery. Despite these improvements, the TMDL analysis revealed that DO levels remained a concern under certain conditions. Too much phosphorus beyond the current loads could lead to algal blooms that would affect the quality of the drinking water supply and require costly treatment. As a result, the TMDL for Deer Creek Reservoir established quantifiable targets to maintain current water quality and identified phosphorus reductions to provide a margin of safety and allow for future growth in the watershed.

TMDL at a Glance

Deer Creek Reservoir Total Phosphorus

(approved September 2002)

www.waterquality.utah.gov/TMDL/Deer_Creek_Reservoir_TMDL.pdf

Factors causing impairment

Coldwater aquatic life use impaired by low dissolved oxygen levels at the bottom of the reservoir caused by excessive phosphorus loads and high surface water temperatures that affect the reservoir's fisheries

Sources contributing to impairment

Nonpoint source runoff from urban areas and agricultural activities; a fish hatchery

Restoration options

Implement agricultural best management practices, cleanup potential concentrated animal feeding operations, streambank restoration, load reduction from fish hatchery, and develop comprehensive nutrient management plans for feedlots casing water quality impairments

Stakeholder involvement

Wasatch, Salt Lake, and Utah counties, Midway Fish Hatchery, Jordanelle Reservoir Water Quality Technical Advisory Committee, five regional conservancy districts, Utah Department of Environmental Quality

Status of waterbody

Met annual phosphorus load reductions established by the TMDL to allow for future growth and a margin of safety during 2006 and 2007; mixed success in meeting other endpoints established by the TMDL to maintain good water quality

Benefits to stakeholders

Clean water, recreation, aesthetics, economy, funding, partnerships and education

How are TMDLs at work in the Deer Creek Reservoir?

The TMDL process provided stakeholders with a framework for compiling, analyzing, and understanding data for parameters affecting DO levels in the Deer Creek Reservoir. The data analysis of factors contributing to the coldwater fishery beneficial use impairment identified for Deer Creek Reservoir, including dissolved oxygen levels, temperature, algae levels, water clarity, and fishery health, all showed signs of improvement at the time of TMDL development. These improvements are attributed to years of water quality improvement projects and programs. Although the TMDL development process did reveal improvements in water quality, it also highlighted the sensitivities of Deer Creek Reservoir. The final TMDL report states that although major improvements are not needed, it is important to have a plan in place that stresses protection and management of current conditions—particularly in light of growth and development pressures in Wasatch County. As a result, stakeholders were able to participate in the development of a TMDL that establishes quantifiable goals to maintain current

What is a total maximum daily load (TMDL)?

It is a study or analysis that calculates the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. The TMDL establishes a pollutant budget and then allocates portions of the overall budget to the pollutant's sources. For more information on TMDLs, visit EPA's website at www.epa.gov/owow/tmdl.

phosphorus loads and identifies phosphorus reductions necessary to maintain a margin of safety and allow for future growth.

Who were the participating stakeholders and key partners?

Development of TMDLs in the state of Utah is the responsibility of the Utah Department of Environmental Quality (UDEQ). To develop total phosphorus TMDL for Deer Creek Reservoir, UDEQ worked with key stakeholders and partners at the federal, state, and local levels. The JTAC and the Central Utah Water Conservancy District (CUWCD) provided data and technical tools used in developing the TMDL. Unlike TMDL development, TMDL implementation is largely in the hands of other stakeholders and partners, depending on the actions recommended by the TMDL. In the case of Deer Creek Reservoir, there are nine key projects and programs identified in the TMDL necessary to maintain current phosphorus loads, as well as provide additional load reductions. These projects are the responsibility of local, state, and federal partners, including Wasatch County, JTAC, CUWCD, the Utah Association of Conservation Districts, the Utah Mitigation Reclamation and Conservation Commission, UDEQ, and the Natural Resources Conservation Service.

How did stakeholders participate in the TMDL development process?

The overall TMDL process includes the following elements: Clean Water Act (CWA) section 303(d) listing decisions, TMDL development, and TMDL implementation. Each element of the TMDL process provided stakeholders with an opportunity to express concerns and share information about the water quality problems in Deer Creek Reservoir with UDEQ and other key partners. A description of each element of the TMDL process is provided below.

Section 303(d) Listing Decisions

If a waterbody does not meet water quality standards (i.e., numeric or narrative criteria) for one or more pollutants, it goes on a state's CWA section 303(d) list. Impaired waterbodies on this list require a TMDL for each pollutant contributing to the impairment. Stakeholders have the opportunity to provide input during the 303(d) listing process. UDEQ placed Deer Creek Reservoir on Utah's 303(d) list in 2000 due to low dissolved oxygen levels at the bottom of the reservoir and high surface water temperatures—factors that affect the reservoir's cold water fisheries. UDEQ made the state's 2000 CWA section 303(d) list available to the public for review via the UDEQ Division of Water Quality web site and published two public notices in two newspapers.

TMDL Development

To initiate the development of the Deer Creek TMDL, UDEQ analyzed existing data to verify the dissolved oxygen and temperature impairments. As a result of this analysis, the final TMDL report recommended that UDEQ consider removing Deer Creek Reservoir from the state's 303(d) list as having a temperature impairment. Removal from the CWA section 303(d) list of impaired waterbodies is referred to as delisting.

Although the analysis revealed that Deer Creek Reservoir and its fishery are both healthy, the data also indicated that the water quality is very sensitive. Changes in the current phosphorus loads could affect the quality of the drinking water supply and result in the need for costly treatment to control odor and improve taste. As a result, the TMDL report emphasized the need to maintain phosphorus loads at current levels. The TMDL development process included identifying quantifiable goals, also referred to as endpoints or targets, established to maintain current phosphorus loads. The TMDL report identifies seven endpoints that would serve as a yardstick to measure progress toward maintaining current water quality conditions. The seven endpoints are as follows:

- Percent of the water column with dissolved oxygen concentrations below the target threshold value to support beneficial use

- No fish kills
- In-lake phosphorus concentration
- In-stream phosphorus concentration
- Annual and monthly (August–October) phosphorus loads to lake
- Average Trophic State Index (i.e., a measure of the relationship among nutrients, algal biomass, and lake clarity)
- Algae biomass

To provide a margin of safety and to account for future sources, the TMDL analysis identified point and nonpoint sources of phosphorus to the Deer Creek Reservoir and assigned phosphorus load reductions to those sources. The TMDL analysis assigns the Midway Fish Hatchery a wasteload allocation of 400 kilograms per year (kg/yr), a 160 kg/yr decrease in its current phosphorus load of 560 kg/yr. The TMDL reserved a phosphorus wasteload allocation of 500 kg/yr for future point sources. Urban nonpoint sources received a load allocation of 1,300 kg/yr, requiring a 300 kg/yr load reduction from the current load of 1,600 kg/yr. The TMDL assigned a load allocation of 3,595 kg/yr to agricultural nonpoint sources, a reduction of 2,465 kg/yr from the current phosphorus load of 6,060 kg/yr. The TMDL analysis included a 900 kg/yr load allocation for future nonpoint sources to allow for future growth. The TMDL also included a ten percent margin of safety.

Throughout the TMDL development process, UDEQ worked with members of the JTAC to obtain stakeholder input. In addition, UDEQ made the draft TMDL available for public review and comment using both local newspapers and the Internet. UDEQ did not receive comments from the public, but the final TMDL reflects input from the JTAC.

TMDL Implementation

The final TMDL report identifies nine restoration projects that, at the time of the final TMDL, were either in process or recently completed. The nine projects identified as key to TMDL implementation are as follows:

- Provo River Restoration Project
- Conversion to Sprinkler Irrigation Systems
- Heber Valley Water Quality Basins
- Cleanup of Potential CAFOs
- Integrated Watershed Information System
- Main Creek Stream Bank Restoration
- Agricultural BMP Projects
- Midway Fish Hatchery Settling Pond Installation and Maintenance
- Cautious Responsible Growth in Heber Valley and Jordanelle Basin.

The TMDL report estimates that these projects, implemented by local, state, and federal partners, will generate approximately 2,965 kg/yr in phosphorus reductions at a cost of approximately \$38,100,000. Two of the nine projects—the Provo River Restoration Project and the Conversion to Sprinkler Irrigation Systems—are associated with the Central Utah Project Completion Act; as a result, phosphorus reductions associated with these projects are secondary goals.

What is the current status of Deer Creek Reservoir as a result of the TMDL process?

The 2008 Water Quality Implementation Report for the Provo River, Jordanelle Reservoir, and the Deer Creek Reservoir, prepared for the Provo Watershed Council, provide a summary of the data collected during the 2006 and 2007 water years. Table 1 provides a summary of an assessment of progress in Deer Creek Reservoir during 2006 and 2007 using the endpoints established through the TMDL development process as a yardstick.

According to the 2006 and 2007 data, annual phosphorus loads to Deer Creek Reservoir were below the 15,300 kg/yr total load allocation (i.e., current and future allocations to point sources and nonpoint sources) established in the TMDL. However, monthly phosphorus loads during the critical period of August–October exceeded the target loads set by the TMDL during 2006 and 2007. The data show that Deer Creek Reservoir met the endpoints for no fish kills and in-lake phosphorus concentration, but did not meet the endpoints for DO concentrations in the water column, trophic state index, and algae biomass.

Table 1. Summary of Deer Creek Reservoir Endpoint Assessment for 2006 and 2007

Parameter (Proposed Target)	Meet Endpoint in 2006?	Meet Endpoint in 2007?
Percent of the water column with dissolved oxygen concentrations below the target threshold value to support beneficial use (<50% of column with DO <4.0 mg/l)	No	No
Fish habitat (No fish kills)	Yes	Yes
In-lake phosphorus concentration (0.025 mg/l TP (Avg all depths))	Yes	Yes
In-stream phosphorus concentration (0.030 mg/l TP and 0.020 mg/l DTP)	[Information on this endpoint not provided in the 2008 report]	
Total Phosphorus loads to lake: Annual (15,300 kg/yr TP and 9,700 kg/yr DTP)	Yes	Yes
Total Phosphorus loads to lake: August–October (560 kg/mo TP and 350 kg/mo DTP)	No	No
Average Trophic State Index (40–45)	No	No
Algae biomass (5.1 ug/l Chlorophyll a; 6.5 x 10 ⁷ um ³ /ml Biomass; 3.3 x 10 ⁷ um ³ /ml Cyanophyta)	No	No

How did local stakeholders benefit from the TMDL process?

Through the TMDL process, stakeholders had the opportunity to claim credit for water quality improvements in Deer Creek Reservoir and play a role in establishing the future direction of water quality management for the reservoir. Striving to achieve the water quality management goals established in the TMDL will benefit stakeholders in a number of ways.

- **Allowing future growth without sacrificing water quality.** By incorporating pollutant load reductions and a margin of safety, the TMDL takes into consideration the growth of Wasatch County without compromising the quality of the drinking water and irrigation supply.
- **Ensuring a high quality drinking water supply while keeping down treatment costs.** Deer Creek Reservoir is a major source of drinking water for over one million people, distributed by five separate utilities located in Salt Lake, Utah, Wasatch, and Summit counties. Although Deer Creek Reservoir supported its drinking water designated use at the time of TMDL development, the TMDL process revealed the sensitive nature of the reservoir and helped stakeholders set goals to prevent future drinking water designated use impairment.

- **Improved recreational opportunities and aesthetics.** Maintaining and reducing phosphorus loads will help to keep Deer Creek Reservoir free from nuisance algae blooms that can affect recreational enthusiasts desire to enjoy activities such as swimming, boating, and fishing on the reservoir.
- **Established sustainable, effective partnerships.** The cooperation among partners at all levels, including UDEQ, JTAC, local communities, conservation districts, water suppliers, and watershed groups, have established a strong foundation for maintaining the water quality of Deer Creek Reservoir and addressing future issues.



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For more information on the Utah TMDL Program, visit www.waterquality.utah.gov/TMDL/