WATERSHED PROJECT FINAL REPORT

SECTION 319 NONPOINT SOURCE CONTROL PROGRAM

UPPER SNAKE CREEK WATERSHED PROJECT

Project Sponsor

Dakota Central Resource Conservation and Development Association

This project was conducted in cooperation with the South Dakota Department of Environment and Natural Resources and the United States Environmental Protection Agency, Region VIII

Grants C998185-03, C998185-04 and C998185-05

EXECUTIVE SUMMARY

Project title: Upper Snake Creek Watershed Project

Section 319 Grant Number: C998185-03, C998185-04 and C998185-05

Project Start Date: June 28, 2004 Project Completion Date: August 31, 2010

Funding: Project Budget $1,126,765.00

Section 319 Grants	FFY 2003	$ 36,309.65
	FFY2004	$463,690.35
	FFY 2005	$ 44,364.74
Total Section 319 Grants		$544,364.74

Section 319 Grant Expenditures	$541,572
Section 319 Match Accrued	$389,214
Total 319 Expenditures	$930,786

SUMMARY OF ACCOMPLISHMENTS

The Upper Snake Creek Watershed Project was sponsored by the Dakota Central Resource Conservation and Development Association to:

> "Restore and protect the beneficial uses of Mina Lake, Loyalton Dam, Cresbard Lake and Snake Creek by implementing best management practices (BMPs) in the Snake Creek watershed that reduce sediment and nutrient loading and prevent bacterial contamination, and complete water quality assessments and develop TMDLs for Bierman Gravel Pit and Rosette Lake."

The project was designed to begin implementing a six year strategy developed to implement TMDLs for waterbodies in the Upper Snake Creek Watershed. Near the end of the project period, it was determined that most of the practices selected to implement the TMDLs were installed and that additional BMPs necessary to fully implement the TMDLs could be installed more efficiently during a planned Upper James River Watershed Project.

The activities completed during the project period:

- installed BMPs that reduced phosphorus, nitrogen and sediment loading by 58,800 lbs/yr., 204,084 lbs/yr. and 45,190 tons/yr. respectively,
- contributed to reducing the TSI values for Mina and Cresbard Lakes and Loyalton Dam,
- collected data needed to draft TMDLs for Rosette Lake and Bierman Gravel Pit, and
- resulted in accomplishing most project milestones and attaining the project goal.

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INTRODUCTION

The Upper Snake Creek Project was developed by the Dakota Central Resource Conservation and Development Association (RC&D) working cooperatively with local, state and federal project partners to implement multiple total daily maximum loads (TMDLs) in an eight digit Hydrologic Unit Code (HUC) 10160008 watershed. The Upper Snake Creek Project is Objective A1 Project A1a (Land and water resources developed and managed in a sustainable condition.) in the association's plan of work.

The TMDLs in the project area were developed based on studies completed after data used to prepare the 1998 South Dakota Unified Watershed Assessment identified the Snake Creek HUC as a watershed in need of restoration. Of the 39 HUCs (watersheds) assessed by the South Dakota Department of Environment and Natural Resources (DENR) during 1998, the Snake Creek HUC ranked 15th on the state's priority list for preparation of TMDLs. Factors considered in the rating process included landuse, treatment needs, point source density and the density of TMDL acres in the HUC.

The 780,267 acre Upper Snake Creek TMDL Implementation Project:

- is in the James River Basin
- encompasses land in McPherson, Edmunds, Faulk, Spink, Brown and Hand Counties in north central South Dakota (Figure 1) and
- includes the watersheds of five lakes or dams (Figure 2)

    1. Mina Lake,
    2. Loyalton Dam,
    3. Cresbard Lake,
    4. Rosette Lake, and
    5. Bierman Gravel Pit.

Each of the five waterbodies was listed on the 1998 South Dakota 303d List of Impaired Waterbodies. The parameter used to determine impairment was trophic state index (TSI). During 2003, EPA approved phosphorus TMDLs drafted by DENR to reduce the NPS loads entering Mina Lake, Loyalton Dam and Cresbard Lake. **NOTE:** Cresbard Lake was delisted (2008) for TSI then relisted for pH (2010) based on water quality data collected during the project period as part of DENR's statewide lakes assessment activities.

Activities designed to acquire the data needed to develop TMDLs for Rosette Lake and Bierman Dam were included in this project.

A descriptive summary of each waterbody and the sources of nonpoint source (NPS) loading identified appear later in this section of the report. For more detailed information visit:

http://denr.sd.gov/dfta/wp/wp.aspx

Community efforts to improve Mina Lake, Loyalton Dam, and Cresbard Lake, initiated during the 1980s with a Section 208 Clean Water project, have been ongoing. The actions taken include:

- recreation area improvements,
- dam structural repair, and
- watershed conservation practice implementation projects.

The Upper Snake Creek Watershed assessment projects were initiated during 2001 at the request of local organizations, and citizens who were concerned about the quality of water in Mina Lake, Loyalton Dam, and Cresbard Lake. The main concerns expressed were related to algae blooms and water safety for swimming and boating.

The assessment projects included:

- a review of existing water quality data about the lakes and watershed,
- in-lake, tributary and outlet water sampling,
- watershed modeling using the Agricultural Nonpoint Source Model (AGNPS),
- biological monitoring,
- aquatic macrophyte and sediment surveys, and
- a quality assurance/quality control component (QA/QC).

During the assessment process, conservation district staff contacted selected landowners to discuss the implementation of best management practices (BMPs) that might be available should a project be funded.

Based on data from the assessments; Mina Lake, Loyalton Dam, and Cresbard Lake were classified as eutrophic with TSI values more or less typical (81.35, 68, and 74.8 respectively) of the Northern Glaciated Plains Ecoregion but low enough to support assigned beneficial uses. Using information generated during the assessment it was determined that:

- previous implementation of BMPs in the watershed had reduced nitrogen loading to a greater extent than phosphorus,
- the likely sources of phosphorus loading were associated with livestock production,
- occasional elevated bacterial levels and algae blooms occur in the waterbodies, and
- the installation of BMPs will be necessary to improve the TSI of each waterbody.

The beneficial uses and impairments to the uses of Mina Lake, Loyalton Dam, Cresbard Lake, and Snake Creek are listed in Table 1. Based on available data, it was concluded that without the implementation of practices to reduce nonpoint source pollution (NPS) and stabilize or reverse the trend of increasing TSIs, the continued realization of the beneficial uses not impaired is not sustainable. In that event, the uses of the lakes and watershed for swimming, boating, recreation, wildlife, and residential living will be impaired. In addition, the economic health and sustainability of the communities of Aberdeen, Cresbard, Ipswich and surrounding rural residents and agricultural producers will be adversely impacted.

The Upper Snake Creek TMDL Implementation Strategy was developed by representatives of the Dakota Central Resource Conservation and Development Association (RC&D), USDA Natural Resources Conservation Service (NRCS) and DENR following recommendations outlined in the Mina, Loyalton and Cresbard water quality assessments.

Table 1. Uses and Impairments Of Waterbodies in the Upper Snake Creek Watershed.

Beneficial Use – X/Impaired - Y	Snake Creek	Mina Lake	Loyalton Dam	Cresbard Lake	Rosette Lake	Bierman Gravel Pit
Domestic water supply waters		X				
Warmwater permanent fish life propagation		X				X
Warmwater semipermanent fish life propagation			X	X		
Warmwater marginal fish life propagation	XY				X	
Immersion recreation		X	X	X	X	X
Limited contact recreation	XY	X	X	X	X	X
Fish and wildlife propagation/ recreation/stock watering	X	X	X	X	X	X
Irrigation	X					
TSI Criteria – Implementation of narrative water quality standard (have citations can we put in words)		Y	Y	Y[1]		

1 – Removed from impaired status during the project period based on new data.

Activities included in the six year strategy were selected to reduce phosphorus loads from the watershed to:

- Snake Creek by 38.8 percent,
- Mina Lake by 38.8 percent,
- Loyalton Dam by 10 percent and internal loading by 40 percent, and
- Cresbard Lake by 40 percent.

To facilitate comparison of the planned accomplishments during the project period, the milestones for activities identified in the strategy to attain the reductions are listed in Table 10 located in the Monitoring and Evaluation section of this report

This project segment:

- was the first of two planned segments expected to last a total of six years;
- initiated the implementation of the Mina, Loyalton and Cresbard TMDLs;
- included actions to reduce NPS loads from priority areas identified in the Rosette and Bierman subwatersheds as data was collected to develop TMDLs for the waterbodies;
- helped sustain the support of the beneficial uses assigned to the waterbodies included in the project area; and
- is expected to improve the economic and social well being of the residents of the project area.

The project was completed by a partnership that included several agencies and organizations. See Table 14 located in the Coordination Section of this report for a list of project partners and their contributions to the project.

The partnership's activities were coordinated by a steering committee that consisted of representatives from the:

- Dakota Central RC&D Council;
- McPherson, Edmunds, Faulk, Spink and South Brown County Conservation Districts and United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) field offices;
- North Central Resource Conservation and Development Association (NCRC&D);
- DENR Watershed Protection Program;
- South Dakota Department of Agriculture (SDDA);
- United States Fish and Wildlife Service (USFWS);
- South Dakota State University Cooperative Extension Service; and
- South Dakota Association of Conservation Districts (SDACD)

Coordinator services to direct implementation of the project implementation plan (PIP) were secured using contractual agreements. During the early stages of the project, the sponsor entered a contractual agreement for temporary coordinator services with the South Dakota Association of Conservation Districts (SDACD). The coordinator provided by SDACD was an association employee whose hiring was made possible because of the association's Section 319 funded Watershed Planning and Assistance Program. The agreement with SDACD was terminated when a contract for coordinator services was finalized with the Spink County Conservation District. The district's contractual agreement with Dakota Central included providing office space, administrative support and day-to-day supervision.

Progress in implementing the project workplan was behind schedule during much of the first three years. The status was moved to on schedule after the agreement for coordinator services was completed with the Spink Conservation District and the partners took increased ownership of the project. The coordinator used monthly reports to the Dakota Central and conservation district boards as a tool to ensure the key players in the project were knowledgeable of project accomplishments and provided opportunities for involvement in both their area and project-wide.

The coordinator interacted with partner agencies and organizations to secure the financial and technical assistance required to implement the PIP. The installation of cropland and grassland BMPs was accomplished using financial and technical assistance provided by this grant; the USDA Farm Service Agency's (FSA) Conservation Reserve Program (CRP); USFWS wildlife habitat programs; and the SD Conservation Commission's Natural Resources Conservation Grant Program. Assistance for the design of animal waste management systems (AWMS) was provided by USDA NRCS animal nutrient management specialists, this grant and the joint DENR – SDDA Manure Management System Engineering and Design Assistance Program for Existing Confined Animal Feeding Operations (CAFO) Program. Construction of the systems used funds from the Environmental Quality Incentive Program (EQIP) administered by NRCS and the SD Conservation Commission's Natural Resources Conservation Grant Program.

The challenges encountered during project start-up, and the realization that the workplan developed did not project a timeline or the practices required to attain the project goal, necessitated several amendments to the tasks planned and budget.

The SD Nonpoint Source Task Force recommended the approval of funding for the second project segment at its November 2009 meeting. The SD Board of Water and Natural Resources acted favorably at the board's January 2010 meeting. Prior to awarding the second segment grant, the project partners determined that, given progress made toward implementing the TMDLs, amending the current workplan by adding funds to complete the remaining activities over a 12 month period was a better alternative than initiating a new project. Subsequent to approval, Dakota Central RC&D and DENR concurred that, because of challenges related to the availability of staff to manage the amended project implementation plan (PIP), the project should be terminated and other avenues pursued to install the remaining BMPs. See the Results and Recommendations section of this report for additional information.

A description of the TMDL waterbodies included in this project follows. See Figures 1 and 2 for maps of the project area and subwatersheds in the project area.

Snake Creek

Upper Snake Creek is a natural stream that

- is located in north central South Dakota,
- drains portions of McPherson, Edmunds, and Brown counties, and
- flows into the James River north of Redfield, Spink County, South Dakota.

Most of the Upper Snake Creek Watershed is located in the Northern Glaciated Plans (46) ecoregion (Level III) with the extreme eastern edge of the watershed in the Northwestern Glaciated Plans (42) ecoregion (Level III).

Climatic conditions in the watershed are characterized by seasonal extremes. Average temperatures range from approximately 18 degrees Fahrenheit (F) during the winter months to 70^{o} F during the summer. Average annual precipitation in north central South Dakota is approximately 18.3 inches; average snowfall 27.4 inches. Approximately 73 percent of the precipitation occurs during the months of April through September. Tornadoes and severe thunderstorms occur during the summer. The storms, typically local and of short duration, occasionally produce heavy rainfall events.

The landscape is characterized by an upland plain that is moderately dissected by streams and entrenched drainageways. Land elevation ranges from about 1,968 feet mean sea level (msl) in the west and north parts of the watershed to 1,413 msl in the east. Major soil associations in the watershed include the Niobell-Noonan, Bryant, Williams-Vida, and Williams-Bowbells.

Landuse is primarily agricultural with approximately 47 percent of the land cultivated and non-cultivated cropland; 39 percent range and pasture. Wheat, row crops and hay are the main crops grown on cultivated land. Several animal feeding operations, to include wintering areas, are located in the watershed.

Mina Lake

Mina Lake is located in northeastern Edmunds County, South Dakota at 441667° N Latitude, 98.731667° W Longitude (SW NE SEC. 25-T123N-R66W). The watershed is in portions of two Level IV ecoregions. One, the Drift Plains (46i), is located within the Northern Glaciated Plains (46) ecoregion; the other the Missouri Coteau (42a), is located in the Northwestern Glaciated Plains (42) ecoregion.

The 326.2 hectare (806 acre) lake, managed by the South Dakota Department of Game, Fish and Parks (GF&P), was formed by a dam constructed across Snake Creek by the Work Projects Administration (WPA). Construction was completed during February 1934. The dam is 109.7 meters wide (360 feet), 9.8 meters high (32 feet) and has a 45.7 meter wide spillway (150 feet). The spillway was repaired during 1994. During spring 2000, the outlet reach above the dam was cleared of debris.

Mina Lake:

- has a watershed that encompasses approximately 63,924.4 ha (157,960 acres),
- holds 7,258.5 acre-feet of water,
- reaches a maximum depth of 8.23 meters (27 feet); average depth 3.38 meters (11.1 feet),
- has more than 33.6 kilometers (20.9 miles) of shoreline, and
- outlets back into Snake Creek.

The 1998 South Dakota 303(d) Waterbody List identified Mina Lake for TMDL development for trophic state index (TSI), increasing eutrophication trend. A water quality assessment completed during 2003 determined that dissolved oxygen, fecal coliform bacteria and total suspended solids exceeded the tributary water quality standards established for Snake Creek.

During the study, at least one water quality standard violation occurred at each of the Snake Creek monitoring sites above Mina Lake (SC-1, SC-2, SC-6, SC-7 and SC-8). That four of the fecal coliform standard violations occurred during increased hydrologic flows suggests the high fecal levels may be associated with:

- animal feeding areas,
- manure management practices, include land application, and
- cattle grazing in the riparian areas along Snake Creek.

Based on the data, it was determined that reversing the increasing TSI value trend and restoring the water quality of the lake to full support of beneficial uses would require decreasing sediment, nitrogen and phosphorus inputs from the watershed. The phosphorus reduction needed was estimated as 38.8 percent. The large reduction (15,304 kg/yr = 6,940.6 lbs/yr) in total phosphorus entering Mina Lake exceeds current ecoregion-based beneficial use criteria.

The reduction is expected to reduce in-lake total phosphorus levels and chlorophyll-a TSI values and increase transparency. Increasing transparency (algal and non-algal turbidity) is expected to increase the growth of submerged macrophytes, which will in turn, increase the uptake of nitrogen and phosphorus thereby reducing available nutrients that support algal blooms. It is hypothesized that, over time, these reductions will reverse the present TSI trend. In addition, increasing densities of submerged macrophytes is expected to promote growth of littoral zone cover for macroinvertebrates and forage fish, and ambush points for predator species.

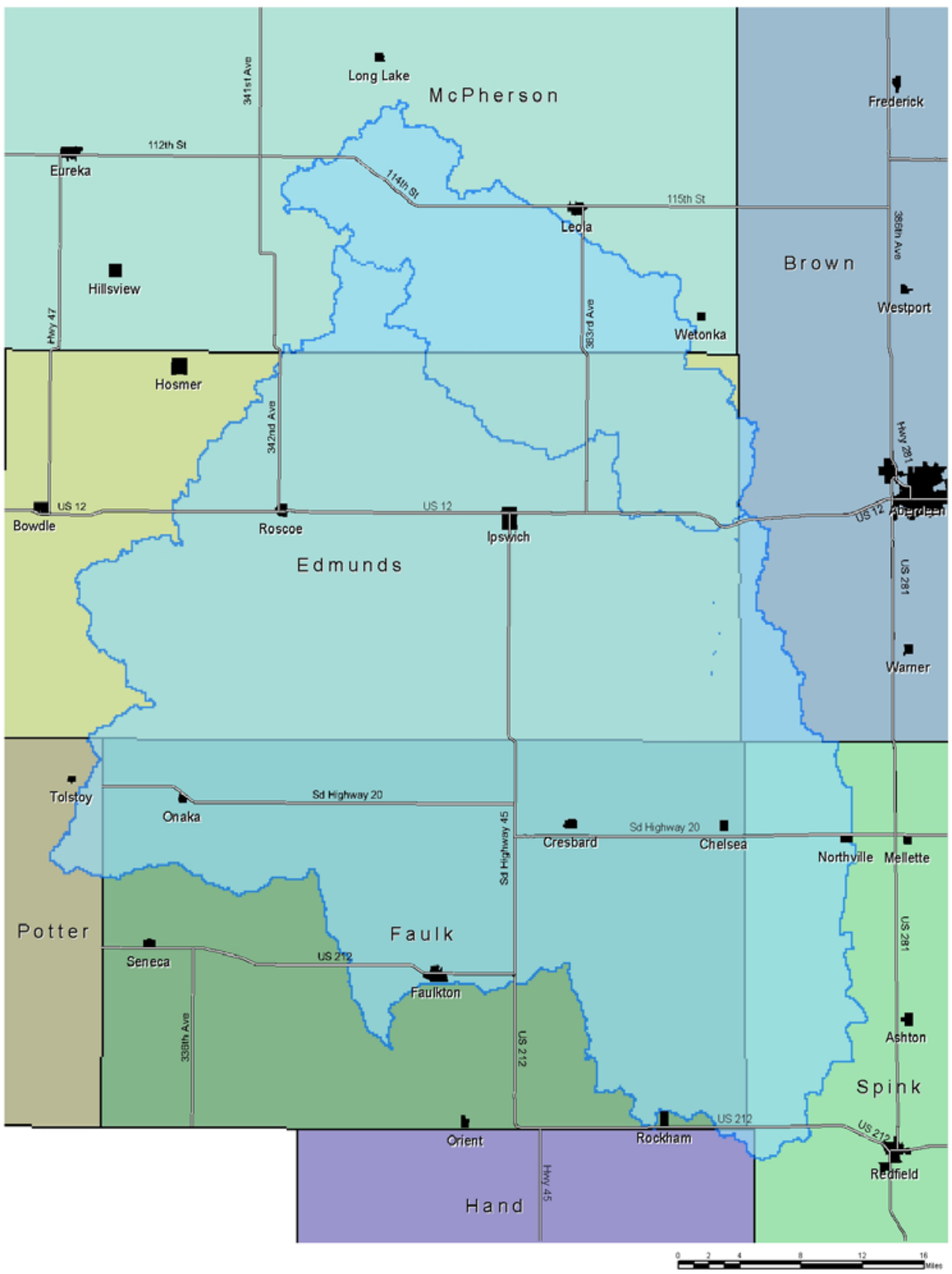


Figure 1. Upper Snake Creek project area.

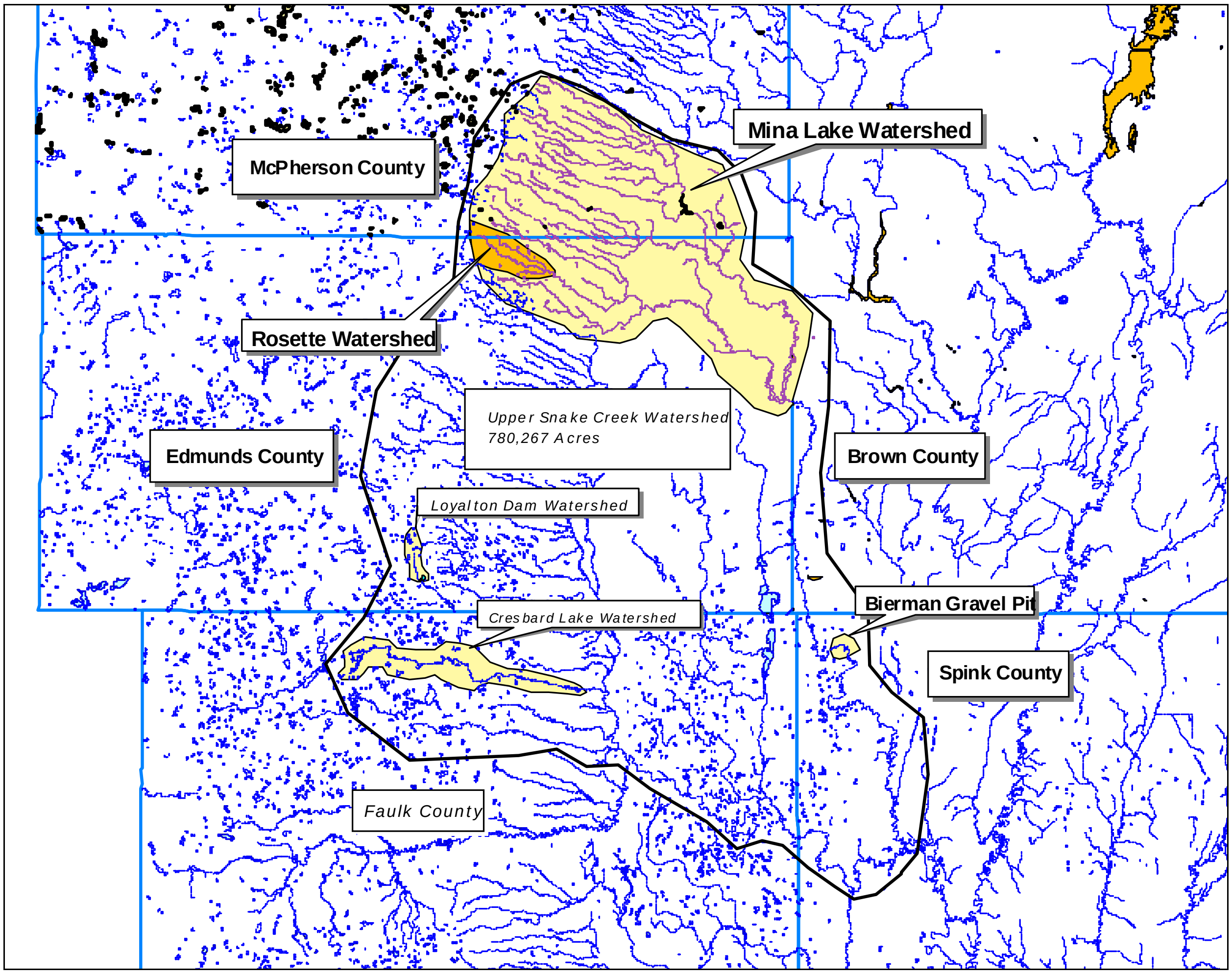


Figure 2. Subwatersheds in the project area.

The origins of the nutrient and sediment loads identified during the watershed assessment indicated that reducing the loads requires the installation of best management practices (BMPs) in the watershed, in riparian areas along Snake Creek and its tributaries and the lake. Most the BMPs recommended to reduce the loads were associated with improved livestock management.

Watershed BMPs recommended included:

- exclusion from or allowing only seasonal access to riparian areas,
- installation of stream crossing structures,
- development of alternative watering sources, and
- adoption of managed/rotational grazing practices.

Riparian restoration alternatives recommended included reshaping cut banks, and revegetating or installing riprap to protect segments of streambank and the lakeshore.

Eleven (14.5 percent) of the 76 animal feeding areas identified in the Mina watershed were determined to be areas of concern. The 11 had Agriculture Nonpoint Source (AGNPS) Model feedlot subroutine ratings ranging from 41 to 62. DENR uses an AGNPS rating of 40 as the benchmark for recommending that an operation construct an ag waste management system (AWMS).

Four additional operations, located in “cells” with multiple feeding areas, had ratings greater than 40 but were not considered significant contributors to water quality impairment.

Loyalton Dam

Loyalton Dam, a 36 acre impoundment of Dry Run Creek, is located three miles southeast of Loyalton, South Dakota, in south central Edmunds County. The dam, constructed by the WPA, was closed during 1938.

Dry Run Creek:

- drains 6,419 acres above the dam,
- enters the impoundment from the southeast, and
- receives the water released from the dam.

The dam has a water volume of 214 acre-ft at spillway elevation. Because of shallow depth, maximum 14.0 ft (4.3 meters), the reservoir is not subject to stratification.

The 1998 South Dakota 303(d) Waterbody List identified Loyalton Dam for TMDL development because of elevated trophic state index (TSI) values. Information supporting the listing was derived from statewide lake assessment data and the 1996 305(b) report.

Data collected during the watershed assessment, completed during 2002 (reported 2003) indicated that a 10 percent reduction of phosphorus loading from the watershed and a 50 percent reduction of the inlake phosphorus load are necessary to bring Loyalton Dam to full support of its assigned beneficial uses

Approximately 42 percent of the watershed is tilled58 percent pasture and range. NPS runoff from both crop and grass lands was found to impact the water quality of the reservoir.

The most probable source of fecal coliform bacteria entering the dam was determined to be associated with livestock grazing management. The AGNPS model identified 1,240 acres as the main source of phosphorus loading.

Livestock management practices identified to reduce fecal coliform loading included:

- constructing fences to exclude access to lakeshore and stream bank,
- development of alternative water sources,
- establishing/improving riparian buffer zones, and
- improved grazing management to increase surface cover (c-factor).

Practices to reduce sediment and nutrient loads from cropland included:

- conversion of highly erodible cropland to pastures using CRP,
- improved surface cover (c-factor) on the 1,240 acres identified using AGNPS,
- installation of grassed waterways, and
- enhancement of riparian buffer zones.

Cresbard Lake

Cresbard Lake is a 69-acre impoundment located in northwest Faulk County and southwest Edmunds County, South Dakota. The small towns of Wecota and Norbeck are located in the watershed. An estimated population of 76,839 resides within a 65-mile radius of the Lake.

The lake:

- was formed by a dam across an unnamed tributary that drains approximately 40,858 acres above the dam,
- holds a total water volume of 904 acre-ft,
- reaches a maximum depth of 14.0 feet (4.3m),
- is not subject to stratification, and
- outlets on the east to the North Fork of Snake Creek in northwest Faulk County.

The 1998 South Dakota 303(d) Waterbody List included Cresbard Lake for TMDL development for trophic state index (TSI). Based on data collected during the recent assessment, it was determined that a 40 percent reduction in the total phosphorus load from the watershed would be required to meet a TMDL goal of a mean in-lake TSI of 74.8.

Livestock grazing and feeding areas were identified as the probable sources of the fecal coliform bacteria loads. To reduce loading, it was recommended that:

- five feedlots and/or feeding areas located near the inlet stream should be evaluated for installation of BMPs,
- alternative water sources should be provided where livestock have been restricted from access to the stream or lake, and
- grazing intensity and season of use should be limited to provide improve plant vigor and growth.

An estimated 5,760 acres of crop and range lands were considered critical areas that require BMP installation to attain the TMDL goal. It was further recommended that all critical phosphorus cells should be targeted for increased surface cover management (i.e., c-factor $\geq$ 0.1).

BMPs recommended to reduce sediment and nutrient load levels to that required to attain the goal included:

- conversion of highly erodible cropland to rangeland using CRP,
- improvement of land surface cover (C-factor) on cropland and rangeland,
- reducing fertilizer use to approximately 50 lb/acre of nitrogen and 20 lb/acre of phosphorus, and
- installation of grassed waterways and riparian buffer zones.

Rosette Lake

Rosette Lake is a 14.5-acre (5.9 ha) impoundment located in north central Edmunds County, South Dakota. The inlet to Rosette Lake is an unnamed tributary that drains approximately 5,517 acres before entering the impoundment on the northeast.

The lake:

- holds a total water volume of 169 acre-ft,
- reaches a maximum depth at 18.0 feet (5.5 m), and
- is not subject to stratification.

The estimated population within a 65-mile radius of Rosette Lake is 83,400. The primary landuse in the Rosette Lake watershed is agricultural. Existing and previous management practices appear to contribute to increased sediment and nutrient runoff.

Excessive sediment and nutrient loading have lead to increased trophic levels. Because of the increase, Rosette Lake was placed on the 1998 South Dakota 303(d) Waterbody List for TSI trend. The source(s) of NPS loads were determined using water quality monitoring, stream gauging and land use analysis. The data acquired will be used to formulate recommendations for restoration of the lake and draft a TMDL.

Bierman Gravel Pit

Bierman Gravel Pit is a 14.4-acre (5.8 ha) impoundment located in northwest Spink County, South Dakota. The inlet to Bierman Gravel Pit was constructed by breaching the berm between Bierman Gravel Pit and Snake Creek. The canal formed functions as both inlet and outlet to the waterbody, and allows surface water from Snake Creek flow into the groundwater feed Bierman Gravel Pit.

The “lake”:

- holds a total water volume of 115 acre-ft.
- reaches a maximum depth of 23.0 feet (7.0 m), and
- has a watershed of approximately 95 acres if the connection to Snake Creek is closed.

The estimated population within a 65-mile radius of Bierman Gravel Pit is 95,986. The primary landuse in the watershed is agricultural.

The 1998 South Dakota 303(d) Waterbody List identified Bierman Gravel Pit for TMDL development for TSI.

Without the connection to Snake Creek the "natural" watershed (95 acres) does not contain non-point source threats. The watershed assessment was designed to determine if the canal is needed to maintain water level; if not, closing the canal will be recommended to reduce the size of the watershed. Data collected during the assessment will be used to develop recommendations for action in the watershed and draft a TMDL.

PROJECT GOAL, OBJECTIVES AND ACTIVITIES

Project Goal and Objectives

The project goal was:

> "Restore and protect the beneficial uses of Mina Lake, Loyalton Dam, Cresbard Lake and Snake Creek by implementing best management practices (BMPs) in the Snake Creek watershed that reduce sediment and nutrient loading and prevent bacterial contamination, and complete water quality assessments and develop TMDLs for Bierman Gravel Pit and Rosette Lake."

Attaining the goal will:

- initiate the implementation of the TMDLs developed for the lakes;
- improve the TSI values of 81.35, 68, and 74.8 respectively; and
- result in the development of TMDLs for Bierman Gravel Pit and Rosette Lake.

Eight tasks divided among five objectives were selected to attain the goal. A descriptive summary of the activities completed to accomplish the tasks follows. The summary for each activity includes a comparison of the milestone accomplishment to planned.

An application of alum to Loyalton Dam to reduce internal phosphorus loading was included in the TMDL implementation strategy. The application was scheduled for the second segment of the project. The decision to make the application, or not to do so, was to have been based on load reductions realized from BMPs installed in the watershed. After a review of treatment cost versus benefit, it was concluded that the alum treatment was not a practical activity at this time and was, therefore, not included in the continuation grant proposal.

Accomplishments by Tasks:

Objective 1: Through the application of best management practices in the watershed reduce sediment, nutrient, and fecal coliform bacteria loading to Mina Lake, Loyalton Dam, Cresbard Lake and Snake Creek by 38 percent.

NOTE: See Tables 11 and 12 in the Monitoring and Evaluation section for load reductions required to attain the project goal and fully implement the TMDL developed for each waterbody.

As recommended by the Mina Lake, Loyalton Dam and Cresbard Lake TMDLs; the BMPs installed were directed toward reducing NPS pollutants originating from grasslands, croplands and animal feeding operations. Priority for installation was given to sites identified as critical cells during the watershed assessments using AGNPS and the AGNPS Feedlot Routine. When producers with land or an animal feeding operation in a priority cell were contacted, most indicated little to no interest in installing the BMPs offered. To overcome the challenge, the project coordinator identified other cells where BMP installation would yield the target NPS load reductions.

Financial assistance available for the design and installation of BMPs was provided by local, state and federal organizations and agencies. Criteria used to select which sources of funds to access for a particular BMP included:

- “fit-to-program”,
- availability in a timely manner,
- the operator’s preference, and
- compatibility of the program to his operation.

Financial resources provided by project partners and 319 funds were used to install BMPs outside of the assessed subwatersheds but within the Snake Creek Watershed when a BMP was determined to benefit reaching the TMDLs.

The sources of funds accessed for financial assistance included:

- SDDA - SD Natural Resource Conservation Grant (South Dakota Conservation Commission Grant) and the Manure Management System Engineering and Design Assistance Program for Existing Confined Animal Feeding Operations (CAFO) Program;
- SD DENR – Consolidated Water Facilities Fund (CWF), Manure Management System Engineering and Design Assistance Program for Existing Confined Animal Feeding Operations (CAFO) Program, and Pollution Prevention (P2) Grant funds;
- USDA NRCS – Environmental Quality Incentive Program (EQIP);
- USDA FSA – Conservation Reserve Program (CRP);
- USFWS – North American Wetland Conservation and Partners for Wildlife; and
- US EPA - Clean Water Act Section 319 Implementation Project and Pollution Prevention (P2) Grants.

Technical assistance for the design and installation of the BMPs was provided by:

- NRCS District Conservationists (DCs) – Grassland and Cropland BMPs,
- NRCS Office of the State Engineer – Ag waste management systems (AWMS), and
- USFWS – grassland and cropland BMPs.

Prior to construction of a BMP, compliance with cultural resource and threatened and endangered species requirements was completed and 401 and 404 permits obtained.

Landowners and operators and other project cooperators provided assistance for BMP design and installation were required to enter a cooperative agreement outlining the responsibilities of the cooperator and project sponsor. The agreement included an operation and maintenance (O&M) clause which specified the operation and maintenance requirements, procedures for BMP failure or abandonment, time period (life span) for which the BMP will be maintained and the responsibilities of the parties to the agreement.

The milestones for the BMPs installed during completion of the tasks summarized below are as amended. The reader is directed to the Evaluation subsection of the Monitoring and Evaluation section of this report for the original milestones for this project segment and a comparison of how the accomplished levels relate to that required for full TMDL implementation.

The location of each BMP installed was mapped (Figure 1) using data entered into the DENR Project Management System (Tracker).

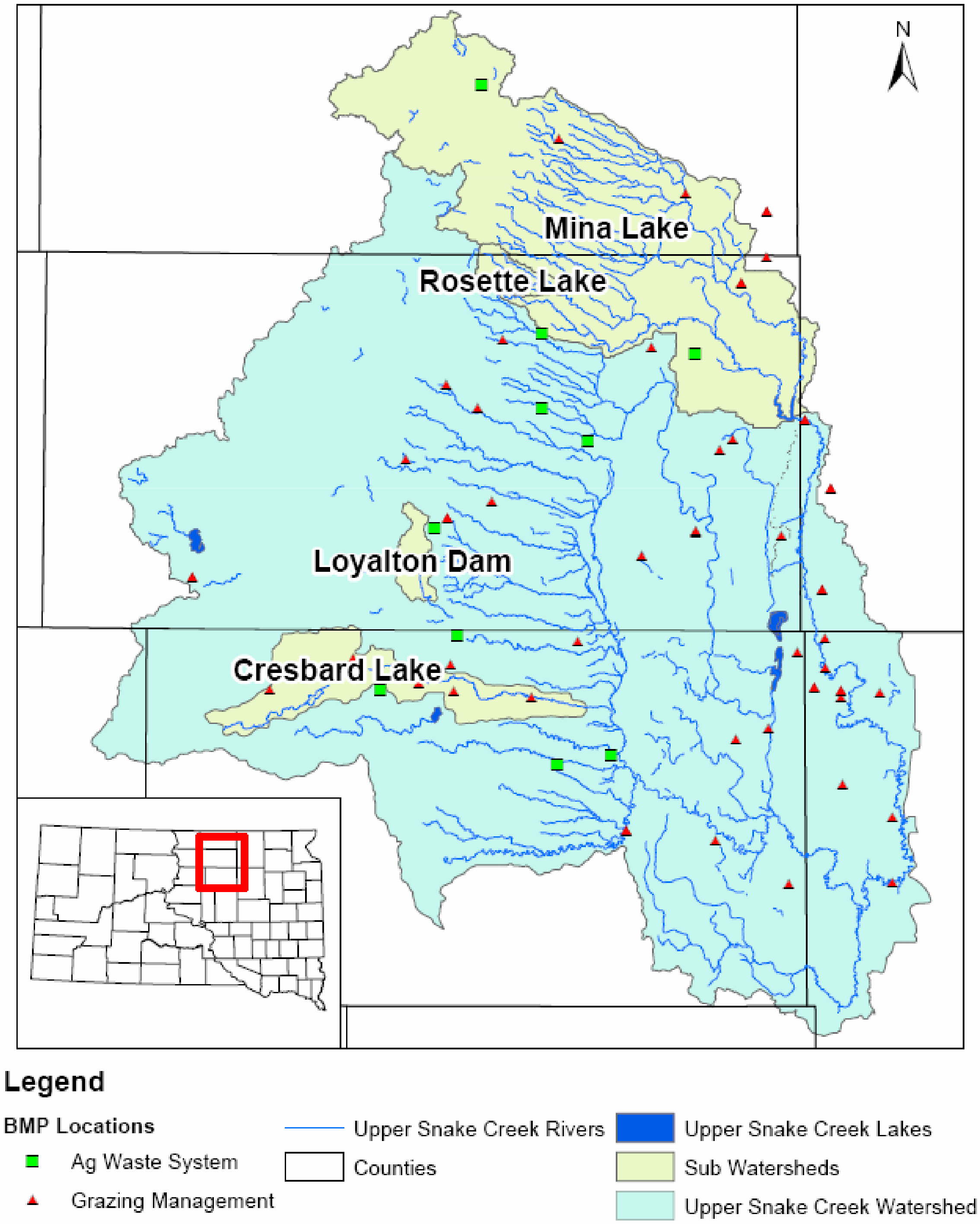


Figure 3. Location of BMPs Installed.

Load reductions realized from the BMPs installed were determined using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) developed by EPA Region 5. The load reductions achieved during each project year were provided to DENR in partial fulfillment of reporting requirements. The data was included in annual reports prepared using the format provided by DENR to facilitate entry into EPA's Grants Reporting and Tracking System (GRTS).

Task 1: Grassland/Cropland Management

Planned grazing systems (Figure 4) and grassland restoration practices were installed on 13,622 acres managed by 50 livestock producers and 360 linear feet of stream banks and shoreline (Figure 5) were stabilized during the project period to reduce sediment and nutrient loading from the watershed.

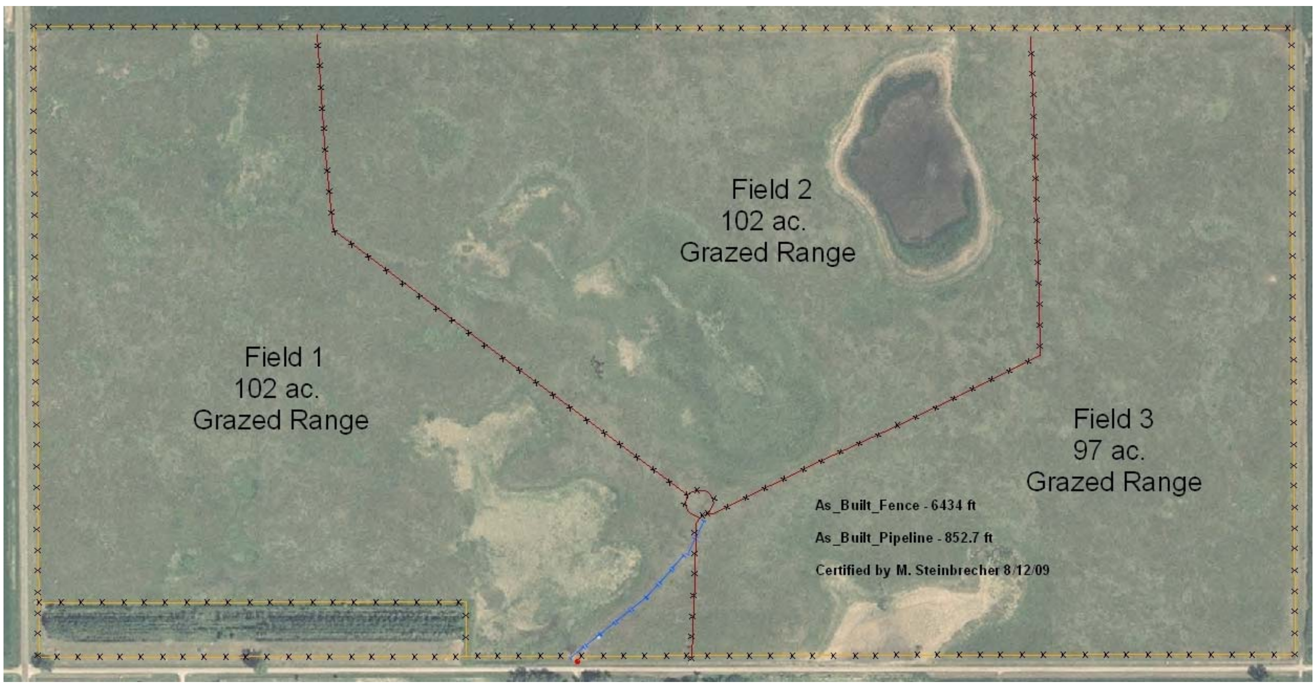


Figure 4. Three paddock managed grazing system developed in the project area.

The grassland BMPs resulted in the improvement or development of grazing systems that reduced total nitrogen, phosphorus and sediment loading by 193,178 lb/yr., 55,355 lb/yr., and 1,037 tons/yr. respectively

While during the early portion of the project period producers expressed interest in installing buffers and grass waterways (Figure 6), none of the 500 acres planned were installed using resources provided by the project. Based on information provided by producers, the level of financial assistance offered by programs such as the Continuous Conservation Reserve Program (CCRP) exceeded that offered by the project. According to NRCS district conservationists for Edmunds, Faulk and McPherson Counties, producers in the project area enrolled approximately 4,400 acres in the CCRP Program during the project period. The average size of the parcels placed under permanent cover by the nearly 290 contracts contributing to the total equaled approximately 15 acres. Using the average as a base to calculate load reductions, the permanent cover established reduced nitrogen loading by 10,906 lbs/yr., phosphorus by 3,444 lbs/yr. and sediment by 11 tons/yr.

Figure 5. Mina Lake shoreline stabilized by reshaping and installing riprap.

Figure 6. Filter strip installed to reduce NPS loading from cropland.

The BMPs were planned with technical assistance from NRCS district conservationists and program specialists and the USFWS. Financial assistance for installation was provided by a SD Conservation Commission Natural Resources Conservation Grant, this grant, and the NRCS EQIP and FSA CCRP Programs.

The BMPs were installed using the conservation practices listed in Table 2. For a description of the practices, refer to USDA FSA standards for Conservation Practices or the USDA NRCS electronic Field Office Technical Guide (efotg). The guides are available by accessing fsa.usda.gov and nrscs.usda.gov respectively.

Table 2. Practices Used to Install BMPs.

Practice	Practice Code	Units Installed
Continuous CRP	327 Conservation Cover 380 Windbreak/Shelterbelt Establishment 390 Riparian Herbaceous Cover 391 Riparian Forest Buffer 393 Filter Strip 472 Access Control 595 Pest Management 610 Salinity and Sodic Soil Management 645 Upland Wildlife Habitat Management	4,430 acres
Grass Seeding	342 Critical Area Planting 550 Range Planting	263.3 acres
Streambank and Shoreline Stabilization	580 Streambank & Shoreline Protection	360 linear ft.
Tree Plantings	380 Windbreak/Shelterbelt Establishment. 645 Upland Wildlife Habitat Management	47.7 acres
Managed Grazing Fence	528 Prescribed Grazing 382 Fence	13,622 acres 101,440 linear ft.
Pipeline	516 Pipeline	106,535 linear ft.
Water Tanks	614 Watering Facility	42
Wells	642 Water Well	8
Pasture Pumps	614 Watering Facility	1
Pond/Dugout Cleanout	378 Pond	17

Milestones: Grazing systems and grassland restoration.
Planned - 14,750 acres
Accomplished – 13,622 acres
Buffers and grass waterways
Planned – 500 acres
Accomplished – 4,430 acres CCRP

Task 2: Livestock Nutrient Management, AWMS and Nutrient Management Plans

Livestock producers were provided information regarding assistance available for the construction of AWMS using

- letters to producers with systems located in critical cells identified using AGNPS,
- personal contact, and
- newspaper articles.

The outreach activities resulted in the design of 12 AWMS in the project area. Ten of the 12 systems designed were constructed to reduce nutrient loads to and fecal coliform levels in Snake Creek and the lakes in the project area. A nutrient management plan was prepared for each system. The two systems that were not constructed were evaluated for installation of vegetative treatment area (VTA) systems rather than the traditional with holding ponds. The operators of both of the proposed systems cited financial concerns as the reason for not moving to construction.

Each of the ten systems constructed was classified as a confined animal feeding operation (CAFO) and therefore not eligible for financial assistance from the 319 grant. Financial assistance for the designs was provided by the NRCS EQIP Program and the DENR – SDDA Manure Management System Engineering and Design Assistance for Existing CAFOs Project. The DENR – SDDA engineering and design project was funded by a combination of state and EPA Pollution Prevention (P2) Program grant awards.

The systems were designed by NRCS animal nutrient management specialists under the supervision of the NRCS State Engineer, and private firms working through the NRCS Technical Service Provider (TSP) Program. The entity completing the design:

- prepared or provided for the preparation of a nutrient management plan, and
- engineering services during the construction of the system.

When NRCS completed the design, the agency's Ag Nutrient Management Team prepared the nutrient management plan. The nutrient systems designed by TSPs were, in some instances, prepared by private ag consulting firms.

Construction was completed by a contractor selected by the producer. Financial assistance for construction was provided by a SD Natural Resources Conservation Grant and the EQIP program. Post construction assistance with system operation and implementation of the nutrient management plan was provided by the NRCS Ag Nutrient Management Team to those producers requesting assistance.

Milestones: AWMS with nutrient management plans
Amended – Designs – 4; Constructed - 4
Accomplished – Designs – 12; Constructed - 10
Total to Implement the TMDL – 20

Objective 2: Information and Education/Public Participation

Information about the project and opportunities for involvement was provided through personnel contacts, on-site visits, workshops, the news media, and direct mailings. The activities completed are summarized in Table 3.

The importance of an information and education component to project success is demonstrated by the activities completed. Prior to the initiation of an active outreach program, ownership by the partners and participation by producers targeted for BMP installation was behind schedule. After the outreach program was activated both changed and resulted in the project:

- being on schedule and accomplishing,
- nearly all of the milestones established, and

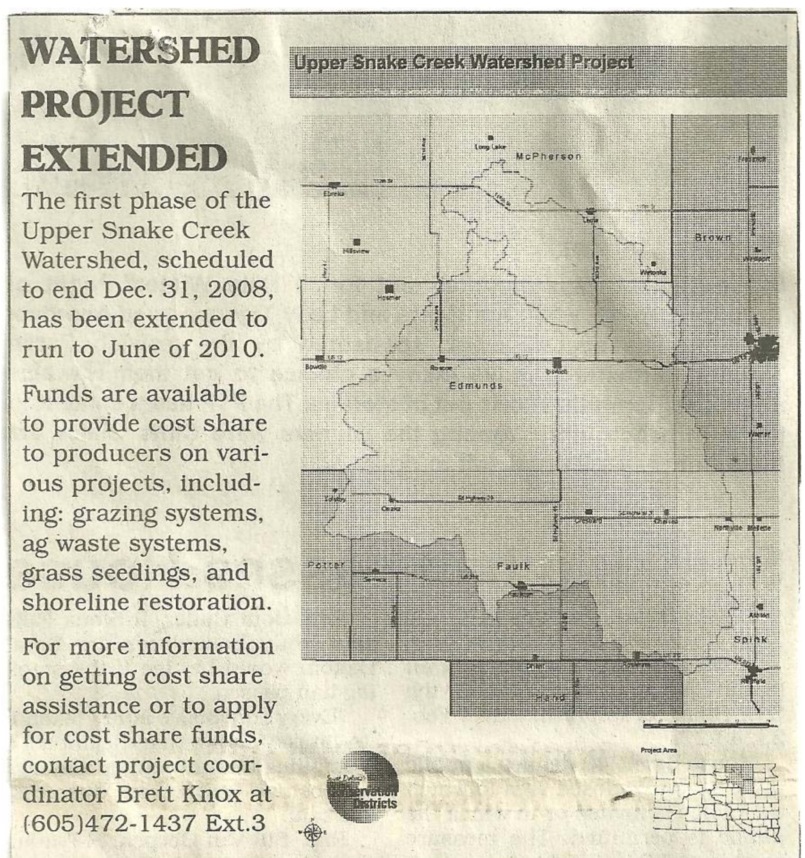
- NPS load reductions that supported attaining the TSI goal for two waterbodies and reducing the TSI in a third.

Figures 7 and 8 illustrate selected outreach activities. See Appendix 1 for project brochure.

Table 3. Summary of Outreach Activities.

Activity	Coverage/Distribution	Purpose	Result
Project Brochure (1)	Project area; conservation district offices	Introduce the project and involvement opportunities	Most project milestones accomplished by project's end.
Newspaper Articles (3)	Project area; printed in 6 newspapers AWMS cost share add printed twice	Project awareness availability of cost share	13,622 acres of managed grazing installed; 12 AWMS constructed, 360 ft. shoreline/streambank stabilized; 4,400 acres filter strips and buffers installed using CCRP.
Newsletters (1)	Project area; article printed in conservation district newsletter	Project awareness availability of cost share for BMP installation.	
Activity Reports (31)	Conservation districts in project area; DCRC&D Board	Improve project ownership, support and participation	Project moved from behind to on schedule and most milestones accomplished by project's end.
Direct Mailings			
Producers (3)	Letters sent to producers in partner conservation districts	Project awareness availability of cost share for BMP installation	13,622 acres of managed grazing installed; 12 AWMS constructed, 360 ft. shoreline/streambank stabilized; 4,400 acres filter strips and buffers installed using CCRP.
Livestock Feeders (1)	Critical cells identified using AGNPS	Opportunities for assistance with constructing an AWMS	12 AWMS designed; 10 constructed
Meetings/Workshops/Tours			
Conservation Districts (5) County Commissioners (2) Civic Organization (1)	Project area	Improved project awareness, ownership, support, and participation project awareness and support	Moved from behind to on schedule and most milestones accomplished by project's end.
Producers (1)	Spink County	Project awareness availability of cost share for BMP installation	Managed grazing systems, filter strips and buffers installed
Nutrient Management Workshops (2)	Project area	Provide information relative to managing manure to reduce NPS pollution originating from livestock production activities	Producers attending aware of practices available to reduce NPS pollution originating from livestock production operations; 12 AWMS designed; 10 constructed
Managed Grazing Tours (8)	Project area	Promote grassland BMP installation	13,622 acres of managed grazing installed
AWMS Tour (1)	Spink County – open to producers in project area	Showcase AWMS constructed	12 AWMS designed; 10 constructed

Figure 7. Livestock producers learn the benefits of managed grazing.



WATERSHED PROJECT EXTENDED

The first phase of the Upper Snake Creek Watershed, scheduled to end Dec. 31, 2008, has been extended to run to June of 2010.

Funds are available to provide cost share to producers on various projects, including: grazing systems, ag waste systems, grass seedings, and shoreline restoration.

For more information on getting cost share assistance or to apply for cost share funds, contact project coordinator Brett Knox at (605)472-1437 Ext.3

Upper Snake Creek Watershed Project

Figure 8. Financial assistance to construct an AWMS.

Milestones: News releases, Articles and Newsletters
Planned – 26 Total
Accomplished – 34 (Includes activity reports to partners)
Informational Meetings and Workshops
Planned – 8
Accomplished – 20 (Includes tours)
Brochures
Planned – 0
Accomplished – 1
Direct Mailings
Planned – 0
Accomplished – 4
BMP Implementation and TMDL Results
Planned – 1
Accomplished - 0

Objective 3: Rosette Lake and Bierman Gravel Pit Assessments.

The Rosette Lake and Bierman Gravel Pit Watershed Assessments were designed to:

- collect data required to develop TMDLs,
- identify feasible restoration alternatives, and
- facilitate a seamless transition to TMDL implementation.

The assessments included:

- collection of in-lake and watershed water quality samples,
- QAQC of the sampling protocols, and
- watershed modeling.

Task 4. In-Lake Sampling

In-lake water quality samples were collected at Rosette Lake and Bierman Gravel Pit to determine the ambient nutrient concentration, trophic state and the nutrient reductions required to improve the trophic state of both waterbodies.

Tables 4 and 6 and Figures 9 and 10 identify the in-lake and tributary sampling sites for Rosette Lake and Bierman Gravel Pit.

Nutrient and solids parameters were sampled at one of the planned two in-lake sites in Rosette Lake; one in Bierman Gravel Pit. Surface and bottom samples were collected at each sampling site semi-monthly during March 2005 – May 2007 except during periods of project staff transition and when ice cover made sampling conditions unsafe. During the months of June, July and August a second set of samples was collected at each sampling site.

A total of 33 samples were collected from Rosette Lake and 30 from Bierman Gravel Pit using protocols outlined in the DENR's EPA approved *Standard Operating Procedures for Field Samplers.* The totals exceed the number planned for Rosette by five; Bierman by two. The additional in-lake sampling was possible because fewer stream samples (25) than the planned (48) were collected because of low/no stream flow. In addition, six of the 11 planned QAQC sample sets (blank and replicate) were collected. All water quality samples were sent to the South Dakota State Health Laboratory in Pierre for analysis of the parameters listed in Table 5.

Figure 9. Collecting Water Quality Samples at the Bierman Gravel Pit Inlet/Outlet.

Table 4. Tributary Monitoring Sites.

Waterbody	**Latitude**	**Longitude**
Rosette		
RST -1 (Inlet)	45..560822	-99.045380
RST -2 (Outlet)	45.56087	-99.034673
Bierman Gravel Pit		
BIO-1 (inlet/outlet to Snake Creek)	45..214493	-98.657379

In addition to the water quality sampling, macrophyte and sediment surveys were completed for each waterbody to determine the percent coverage and sediment depth respectively.

Data resulting from the sampling completed was transmitted electronically by the lab to DENR, entered into STORET by DENR and used to calculate TSI values for the waterbodies.

DENR is re-evaluating the use of TSI as an indicator of waterbody impairment. EPA is reviewing DENR's request in this regard. Therefore, preparation of TMDLs for the waterbodies by DENR is dependent on EPA's ruling and will be deferred until EPA completes its review of the request

Milestones: In-lake water quality samples
Planned: Rosette Lake – 28; Bierman Gravel Pit – 28; QAQC – 11 samples taken for each waterbody
Accomplished: Rosette Lake – 33; Bierman Gravel Pit – 30; QAQC – 6 total.

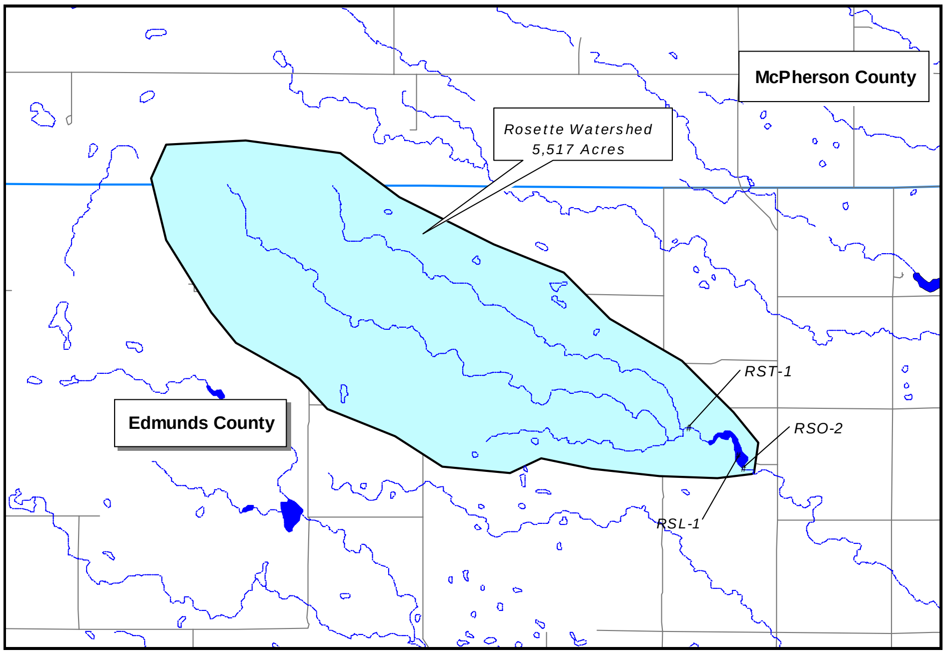


Figure 10. Rosette Lake in-lake and tributary monitoring sites.

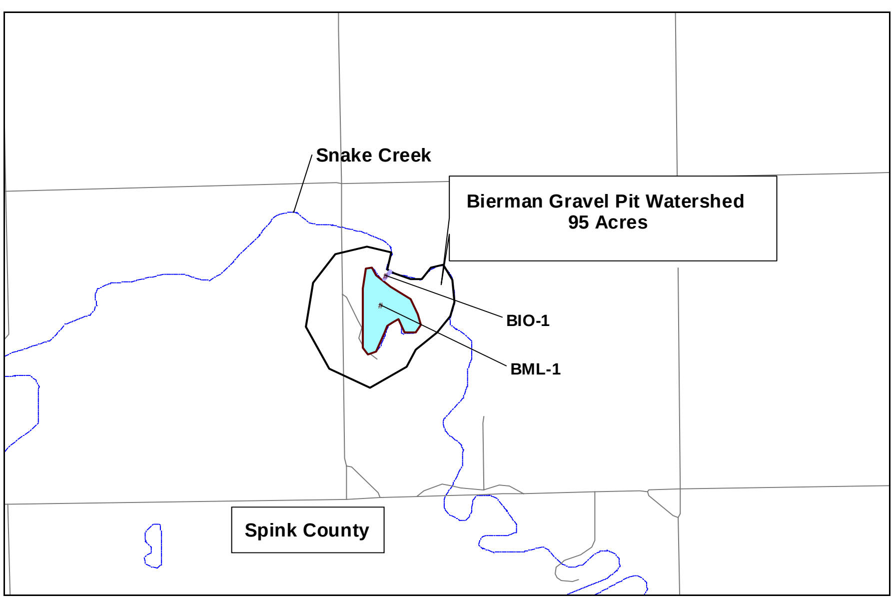


Figure 11. Bierman Gravel Pit in-lake and tributary monitoring sites.

Table 5. In-lake Parameters Measured.

Parameter		
Physical	**Chemical**	**Biological**
Air temperature	Total alkalinity	Fecal coliform
Water temperature	Field pH	E. coli
Secchi transparency	Dissolved oxygen	Chlorophyll *a*
Depth	Total solids	Aquatic macrophytes
Visual observations	Total suspended solids	
	Volatile suspended solids	
	Ammonia	
	Un-ionized ammonia	
	Nitrate-nitrite	
	Total Kjeldahl nitrogen	
	Total phosphorus	
	Total dissolved phosphorus	
	Conductivity	

Task 5. Tributary Sampling

Hydrologic and chemical monitoring of the tributaries to Rosette Lake and Bierman Gravel Pit was completed to determine sediment and nutrient loads entering waterbodies from their respective watersheds.

Stage recorders (Figure 12) were installed at the tributary monitoring sites (Figures 11 and 12 and Table 5) to obtain continuous flow data during the project period with the exception of the winter months from freeze up to ice melt in the spring. The data collected was paired with nutrient data to identify BMP installation target areas in the watersheds

Table 6. In-lake Water Quality Monitoring Sites.

Waterbody	Latitude	Longitude
Rosette		
RSL -1 (Closest to dam)	45.55594	-99.040759
Bierman Gravel Pit		
BML-1	45.208774	-98.655694

Discrete discharge measurements were taken as scheduled and during storm events using a hand held current velocity meter. Discharge measurements and water level data were used to calculate a hydrologic budget for the tributaries. The data collected was used by DENR to calculate loadings from each watershed.

The tributary samples planned included:

- twice weekly during the first week of spring snowmelt runoff and once each week thereafter until runoff ceased,
- after storm events base flows,

- from the outlet once each week during the first two weeks of run-off and twice each week thereafter until the major run-off ceased, and
- at the upstream side of the spillway approximately every three weeks during the time there was flow over the spillway/outlet.

Table 7 lists the parameters measured.

Figure 12. Installing a stage recorder at Rosette Lake.

Table 7. Tributary Parameters Measured.

Parameter		
Physical	**Chemical**	**Biological**
Air temperature	Total solids	Fecal coliform bacteria
Water temperature	Total suspended Solids	E. Coli
Discharge	Dissolved oxygen	Chlorophyll *a*
Depth	Ammonia	
Visual observations	Un-ionized ammonia	
Water level	Nitrate-nitrite	
	TKN	
	Total phosphorus	
	Total dis. Phosphorus	
	Volatile suspended solids	
	Field pH	

Because stream flow was intermittent, tributary monitoring was limited to a total of 25 samples.

Data resulting from the sampling completed was:

- transmitted by the lab to DENR,
- entered into STORET by DENR, and
- will be used to calculate loads to the waterbodies as required See following paragraph.

DENR is re-evaluating the use of TSI as an indicator of waterbody impairment. EPA is reviewing DENR's request in this regard. Therefore, preparation of TMDLs for the waterbodies by DENR is dependent on EPA's ruling and will be deferred until EPA completes its review of the request. In the interim, the data collected will be used to evaluate baseline conditions of the lakes.

Milestones: In-lake water quality samples
Planned: Rosette Lake – 28; Bierman Gravel Pit – 28; Streams – 48; QAQC – 11 sets
Accomplished: Rosette Lake – 33; Bierman Gravel Pit – 30; Streams – 25; QAQC – 6 sets

Task 6: QA/QC

To ensure that the results from the water quality samples and field measurements were accurate and defendable, the collection of all samples and measurements followed DENR's EPA approved QA/QC procedures outlined in the *South Dakota Standard Operating Procedures for Field Samplers.*

The protocol requires the collection of a minimum of 10 percent of all the water quality samples. The QA/QC sample sets consisted of blanks and replicate samples. Of the 11 sample sets planned based in the Rosette Lake - Bierman Gravel Pit sampling plan, six were collected.

Water samples were collected with a suspended sediment sampler when possible. All sample bottles were iced and shipped to the lab and collected using the methods described in the South Dakota *Standard Operating Procedures for Field Samplers*.

Milestone: QA/QC Samples
Planned: Rosette Lake 11 sample sets; Bierman Gravel Pit 11 sample sets
Accomplished: 6 sets (Combined total both lakes)

Task 7: AnnAGNPS Modeling

Priority areas for BMP installation in the Rosette Lake watershed were identified using Agricultural Non-point Source (AGNPS) model 3.65 during the Mina Lake Watershed Assessment Project. Additional modeling that was planned based on results of the current watershed assessment was not completed. The decision was based on DENR's request to EPA to change from TSI to another criterion as an indicator of impairment.

Given its small size (95 acres), the planned modeling of the Bierman Gravel Pit watershed to identify critical areas requiring BMP installation was replaced with a visual inspection.

Milestones: Critical Cell Identification

Planned: Up dated identification - Rosette Lake; Identified Bierman Gravel Pit
Accomplished: Modeling of the watersheds was not completed. See above.

Objective 5: Reports

Task 8: Reports

The status of reports listed in the PIP follows.

- Semiannual and annual reports (with load reductions) submitted electronically to DENR for entry in the EPA Grants Reporting and Tracking System (GRTS).

  Status – Two semi-annual reports and six annual reports submitted to DENR. The annual reports included load reductions.

- A final report prepared following guidelines provided by DENR.

  Status – The report was prepared and submitted according to the guidelines.

- Reports specific to Rosette Lake and Bierman Gravel Pit:
  1. Results of the AGNPS and AnnAGNPS models with critical areas identified.
  2. A summary of historical water quality and land use information with a comparison to data collected during the project to determine/evaluate water quality trends.
  3. An evaluation of the hydrology of the Rosette Lake and Bierman Gravel Pit watersheds and the chemical, biological, and physical condition of their respective tributaries.
  4. A summary of all QA/QC activities completed during the project.
  5. Feasible restoration recommendations and a TMDL for each watershed.

DENR anticipates that Rosette Lake and Bierman Gravel Pit will be removed from the impaired waterbody list as a result of revised assessment methodologies. Therefore, none of the reports planned for Rosette Lake and Bierman Gravel Pit have been completed. When the new methodologies are finalized and approved by EPA, the reports and TMDLs, if required, will be drafted. In the interim, the samples collected will be used as baseline data to evaluate the effectiveness of BMPs installed.

Milestones: Reports

GRTS – Midyear - 2; Annual- 6
Final – End of Project
Rosette/Bierman Reports – After sampling is complete
Accomplished – See status of reports above.

MONITORING AND EVALUATION

Monitoring

Monitoring project progress was based on reaching project milestones.

Monitoring activities included tracking:

- the source and use of funds expended for each project task undertaken and BMP installed,
- progress toward reaching project milestones as planned,
- load reductions credited toward reductions needed to implement the TMDLs for Mina Lake, Loyalton Dam and Cresbard Lake,
- progress toward attaining the TSI goals for Mina Lake, Loyalton Dam and Cresbard Lake, and
- completion of the Rosette Lake and Bierman Gravel Pit TMDLs.

Local support and partner contributions were tracked by keeping records of landowner cash and inkind contributions, and attendance records at tours, informational meetings, and project coordinator presentations and contacts.

Financial, milestone accomplishment and load reductions were monitored using the DENR project management program (TRACKER). STEPL was used to calculate load reductions realized from the BMPs installed.

Progress toward reaching the TSIs established for Mina Lake, Loyalton Dam, and Cresbard Lake was monitored by collecting water quality samples at two sites in each lake each year during the project period. Sample collection and analysis was guided by a project specific sampling and analysis plan (SAP) developed with technical assistance from DENR. The plan included the collection of water quality samples required to estimate TMDL attainability for Rosette Lake and Bierman Gravel Pit. In addition to the samples collected as part of this project, the waterbodies were included in the SD statewide lakes monitoring project.

The protocols followed during the implementation of the SAP were those in DENR's *Standard Operating Procedures Manual for Field Samplers*. Sample analysis was completed by the South Dakota State Health Laboratory located in Pierre, SD.

Data resulting from in-lake and stream water sampling was forwarded to DENR for entry into the EPA STORET database. The data will be used to prepare TMDLs for Bierman Gravel Pit and Rosette Lake that may be required following the EPA's response to DENR's request to change listing criteria.

Table 8 describes the procedures carried out to complete all water quality monitoring and evaluation activities. The task numbers in the left hand column correspond to the number for each task in the Accomplishments by Tasks section of this report.

The water quality parameters measured to determine load reduction goals are listed in Table 9.

Table 8. Sampling and Analysis Procedures.

Task Number	Task Description	Activity	Reference: in SDWRA-2003 Vol. I or II SOP
Task 5	In-lake sampling at 3 sites for Nutrient and Solids Parameters (Table 5). An estimated 56 samples are to be collected. Macrophyte Survey to be conducted.	In-lake Sampling D.O. and Temp. Profiles. Fecal, E.coli and Chl-*a* sampling, macrophyte survey	Volume I Section 14.0 pages 1-21 Volume II Section 2.0 pages 1-6
Task 6	Install water level recorders and monitor stage records. Discrete discharge measurements will be taken on a regular schedule and during storm surges. Collect water quality samples from tributary monitoring sites. Table 9 shows the parameters to be measured. An estimated 48 tributary samples are to be collected	Water Levels Flow (Marsh-McBirney) or (AquaCalc) Tributary Sampling Procedures	Volume I Section 12.0 pages 1-21
Task 7	The collection of all field water quality data will be accomplished in accordance with the Standard Operating Procedures for Field Samplers, South Dakota Non-point Source Program. 18 replicate and 18 blank samples	Quality Assurance	Section 8.0 pages 1-8
Task 8	Use of the AGNPS computer model	Watershed Modeling	Volume I Section 13.0 pages 1-2
Section 5.0	Evaluation of Loyalton Dam- pre and post alum treatment monitoring	In-lake Sampling	Volume I Section 14.0 pages 1-21

Table 9. In-lake Parameters Measured.

Physical	Chemical	Biological
Air temperature	Total alkalinity	Fecal coliform
Water temperature	Field pH	E. coli
Secchi transparency	Dissolved oxygen	Chlorophyll *a*
Depth	Total solids	Aquatic macrophytes
Visual observations	Total suspended solids	
	Volatile suspended solids	
	Ammonia	
	Un-ionized ammonia	
	Nitrate-nitrite	
	Total Kjeldahl nitrogen	
	Total phosphorus	
	Total dissolved phosphorus	

Evaluation

Project progress was evaluated by comparing planned to accomplished milestones.

The effectiveness of BMPs installed relative to improvement in water quality was evaluated by:

- assessment of feedlots before and after construction using AnnAGNPS,
- sheet, rill, and gully erosion formulas for soil loss and transport, and
- STEPL to estimate load reductions realized from BMP installation.

As shown in Tables 10 and 11, the activities planned and BMPs installed, for the most part equaled or exceeded the milestones established for the Segment 1 and the amended PIP. The main deviation from the milestones is related to the Rosette Lake and Bierman Gravel Pit assessment report and TMDLs. As discussed previously, the data collected to write the reports will be used to guide BMP installation in the respective watersheds while DENR's request for a change in the use of TSI as an indicator of impairment is being considered. The reports and TMDLs will be drafted should EPA not favorably consider DENR's request.

When the BMPs installed are compared to the level estimated to fully implement the TMDL for each waterbody, with the exception of the buffers and grass waterways installed using CCRP, the numbers installed were below the milestones identified for the project area when the implementation strategy was developed. This difference is expected to be addressed by adding the Upper Snake Creek Project area to a proposed Upper James River Project.

Table 10. BMPs Planned to Attain Load Reduction Goal - Installed Comparison.

BMP	Planned	Installed
Grazing Management (Acres)	21,400	13,622
Stream Bank - Shoreline Plantings (Acres)	15	0
Stream Bank – Shoreline Stabilization (lineal ft.)	600	360
Cropland to Range Conversion (Acres)	3,500	263.8
Buffer Strips/Grass Waterways - CCRP (Acres)	500	4,430
AWMS	20	12
Alum Treatment	1	0

Table 11. Planned Versus Accomplished Milestone Comparison.

Milestone by Task	Planned		Accomplished
	Segment 1	Amended	
Objective 1			
Task 1			
Planned grazing/grassland Restoration (acres)	12,500.	14,750	13,622
Fence (linear feet)	120,000	120,000	101,440
Grass Seeding (acres)	141.67	2,250	263.8
Riparian Buffers/Fenced Exclusion (linear feet)	11,400	11,400	0
Streambank & Shoreline Plantings (acres)	10	10	0
Streambank & Shoreline Stabilization (linear feet)	300	300	360
Tree Plantings (acres)	10	100	47.7
Pipeline (linear feet)	40,000	40,000	106,535
Tanks (number)	20	20	42
Pond/Dugout Cleanout (number)	20	20	17
Wells (number)	4	4	8
Pasture Pumps (number)	4	4	1
Buffers and Grass Waterways (acres)	500	500	4,430 acres CCRP
Task 2			
AWMS Designs AWMS constructed	4 4	4 4	12 10
Objective 2			
Task 3			
News releases	10		
Newsletter Articles	10	26	40
Newsletters/Activity Reports/Direct Mailings	6		
Informational meetings and workshops	8	8	20
Project Brochure	0	0	1
BMP Implementation and TMDL Results	1	0	0
Objective 3			
Task 4			
In-lake Sampling Rosette Lake Bierman Gravel Pit	 28 28	 28 28	 24 28
Task 5			
Tributary Sampling Mina Rosette Bierman	12	26	 6 22 4
Task 6			
QA/QC	22 sample sets	22 sample sets	5
Task 7			
AnnAGNPS Modeling (Replaced with visual inspection)	1 report	1 report	0
Objective 5			
Reports Mid-year Annual		 8	 2 6
Assessment Reports and TMDL Recommendations	2	2	0
Final Report	1	1	1

Load Reductions

The load reductions realized from the BMPs installed were calculated using STEPL. Tables 12 and 13 show a comparison of the target reduction to the achieved and achieved to the level needed to fully implement the TMDL for each waterbody. When reviewing the data, the reader should take into consideration that the target levels are delivered to the waterbody; the achieved total load reductions at the sites of installation.

Table 12. Load Reductions Calculated Using STEPL

TMDL Watershed	Load Reduction/Year					
	Nitrogen (Pounds)		Phosphorus (Pounds)		Suspended Solids (Tons)	
	Target[2]	Achieved	Target[2]	Achieved	Target[2]	Achieved
Mina Lake		23,634	9,366	5,223		99
Loyalton Dam (External Load))		NA	330	238		NA
Cresbard Lake		30,232	1,856	3,460		156
Upper Snake Creek[1]		173,852	13,063	49,879		4,034
Total		204,084	24,615	58,800		4,190

1 Includes reduction from CCRP in project area

2 Target =delivered; achieved = total onsite reductions

The project and TMDL goals (Table 13) for waterbodies included in the project are predicated on reducing phosphorus to achieve a reduction in the TSI value. The phosphorus reduction levels in both pounds/year and percent achieved for Mina Lake and Loyalton Dam are below the target level set during the water quality assessments of the waterbodies; above for Cresbard Lake.

Table 13. Load Reductions Achieved – TMDL Implementation Comparison

TMDL Watershed	Load Reduction/Year					
	Phosphorus (Pounds)		Percent Reduction		TSI	
	Target	Achieved	Target	Achieved	Target[t][2]	Achieved
Mina Lake – External Load	9,366	5,223	38.8	25..2	79.18	72.3
Loyalton Dam –External Load	330	238	10.0	7.2	65	68.4
Loyalton Dam –Internal Load	-	0	50.0	0		
Cresbard Lake – External Load	1,856	3,460	40.0	74.6	74.8	71.2
Upper Snake Creek - Load[1]	13,064	49,879	38.8			
Total	14,920	58,800				

1 – Percent reduction not calculated. See Table 12, footnote 2 above.

2 – Target reduced from 68 by DENR based on re-evaluation of WQ information.

However, when the TSIs achieved are compared to the target at the time this report was prepared:

- the load reductions in the Mina Lake and Cresbard Lake watersheds appear to have been sufficient to attain the TSI goal for the lakes. (**NOTE:** See previous discussion regarding delisting of Cresbard Lake.)
- the external reductions to Loyalton Dam were not sufficient to attain the target TSI.

BEST MANAGEMENT PRACTICES DEVELOPED AND REVISED

This project was designed to implement and develop TMDLs using established practices and procedures. Best management practice development and/or revision was not a planned project activity nor were any developed or revised.

RELATIONSHIP TO MANAGEMENT PLAN

Activities completed during the project period supported attaining the goal of the SD NPS Program as outlined in the SD NPS Management Plan. Examples of support provided by the Upper Snake Creek Watershed Restoration Project include but are not limited to the following SD NPS Management Tasks:

- Tasks 1 and 7 - Use monitoring data gathered to complete a TMDL for a 303(d) listed waterbody.

  Water quality data was provided to DENR for the development of TMDLs for Rosette Lake and Bierman Dam.

- Task 4 – Implement TMDLs within two years of completion.

  The Upper Snake Creek Watershed Restoration Project was initiated within two years of the development of the TMDLs for Mina Lake, Loyalton Dam, and Cresbard Lake. The installation of BMPs in the watersheds of two waterbodies, Rosette Lake and Bierman Gravel Pit, included on the SD 303d list of impaired waterbodies was initiated while the data to draft TMDLs for the waterbodies was being completed as part of this project.

- Tasks 5 and 14. –Annual GRTS reports with load reduction data.

  GRTS reports with load reduction data were provided to DENR for use in meeting 319 Program reporting requirements. The reductions were calculated using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL)

- Task 8 – Implement clusters of TMDLs on a 12 or 8 digit Hydrologic Unit Codes (HUCs).

  The project area included a cluster of TMDLs in eight digit Hydrologic Unit (HUC) 10160008.

- Task 10 – Implement multiple TMDLs for several waterbodies across county and conservation district boundaries using financial and technical assistance from federal, state and local project partners to expand the TMDL implementation capabilities of the SD NPS Program.

  The Upper Snake Creek Project:

  - implemented approved TMDLs for three waterbodies and the upper portion of Snake Creek,
  - initiated the installation of NPS control BMPs in two additional impaired waterbodies,
  - encompassed an area that included land in seven counties, and

- was sponsored by the USDA authorized Dakota Central Resource Conservation and Development Association in partnership with four conservation districts and several local, state and federal project partners (See Table 14).

COORDINATION AND PUBLIC PARTICPATION

Coordination

As project sponsor, Dakota Central RC&D was responsible for providing the leadership, administration, and coordination necessary to complete project tasks so that the objectives were reached and the goal attained.

To ensure planned financial and technical resources were available, coordination was accomplished through a steering committee. Table 14 identifies the local, state, and federal project partners represented on the committee

Table 14. Project Partner Contributions.

Agency/Organization	**Contribution**
Nongovernmental	
SD Association of Conservation Districts	Provided interim coordinator through contractual services; technical assistance for administration and BMP planning through the 319 funded Watershed Planning and Assistance Project.
Mina Lake Association	Project awareness in the Mina Lake area
Governmental	
Local	
Faulk, McPherson, South Brown and Spink County Conservation Districts	BMP planning and installation
Spink County Conservation District	Provide coordinator through contractual services and administrative support.
State	
SD Department of Agriculture	Financial assistance for BMP installation and technical assistance to conservation districts; financial assistance for engineering and design of CAFOs through the SD Manure Management System Engineering and Design Assistance for Existing CAFOs Project.
SD DENR	Technical assistance and training with water quality sampling and data interpretation, project management and BMP installation through the 319 Program. Financial assistance for water quality sampling through the use of fee funds; Consolidated Water Facilities Construction Fund grant for AWMs; and design of CAFOs through the SD Manure Management System Engineering and Design Assistance for Existing CAFOs Project.
SDSU Cooperative Extension	Nutrient Management Workshop
Federal	
North Central RC&D	Technical assistance for project management.
US EPA	Financial through Clean Water Act Section 319 and Pollution Prevention Grant to DENR
USDA FSA	Financial assistance for BMP installation through the CRP Program.
USDA NRCS	Financial and technical assistance for BMP installation through the EQIP Program.
USDI FWS	Technical assistance for implementation of grassland seeding, grazing systems, multiple purpose ponds and riparian fencing Partners for Fish and Wildlife Program.

Public Participation

Objective 2, Task 3 outlines the activities completed to provide opportunities for residents in the project area to learn about the project and producers to learn about assistance available for the implementation of BMPs.

The activities completed to provide the opportunities were effective as indicated by the level of BMP installation achieved and the local support for a second project segment. See previous sections of this report for information that supports this observation.

RECOMMENDATIONS

Aspects of the Project That Did Not Work Well

The project did not transition seamlessly from planning to implementation. The "rough" start was attributed to the:

- sponsor and partners not being fully aware of their responsibilities and the financial assistance available for practices, and
- difficulty in employing a project coordinator to direct implementation of the workplan.

Both the practices planned and the budget required several amendments to match the needs of both the water quality aspects of the project with landowner "willingness" to participate.

Continuing the project through the planned extension of the project period was determined not possible when the coordinator left for employment with another resource agency. The loss of the employee resulted in DENR and the sponsor agreeing that the best course of action was to close the project rather than attempt to hire and train a new employee.

Three recommendations to minimize the occurrence of the challenges encountered during this project are listed below.

Recommendations

Ensure the partners are better aware of the project requirements and opportunities before the project is submitted for funding and immediately after funding.

Better up front planning and involvement of project partners and producers in the process.

Incorporate the project into a "larger" project such as one encompassing the northern portion of the James River drainage area in South Dakota to ensure staff is available through the entire TMDL development and implementation process.

PROJECT BUDGET/EXPENDITURES

The project budget included $750,000 in Section 319 funds when the PIP was approved during spring 2003. During the project period, the budget was amended to authorize the expenditure of grant funds for project expenses that would:

- more effectively channel resources toward meeting project milestones,
- lead to attaining the project goal, and
- facilitate progress toward implementing the TMDLs established for waterbodies in the Upper Snake Creek Watershed.

Included in the budget amendments were two reductions in the amount of the Section 319 Grant allocation and the award of state funds from an additional source to pay costs associated with the development of TMDLs for Rosette Lake and Bierman Dam.

A comparison of the original budget to the amended and actual expenditures appears in Tables 15 and 16. The differences between the totals are related to accounting and reporting differences among the agencies providing data used to complete the tables.

Table 15. Funds Allocated - Expended by Grant Source.

Grant/Source		**Match**	**Budget[1]**		**Expended[1]**	**Percent 319 Expenditures**
			Original	**Amended**		
Section 319	Federal	N	750,000	544,365	541,572	58.2
SD Soil and Water Conservation Fund.	State	Y	162,100	85,100	85,083	41.8
SD Consolidated Water Facilities Fund	State	Y	69,000	50,000	0	
SD Natural Resources Fee Fund	State	Y	6,800	6,800	6,800	
Local	Local	Y	495,300	2,500	1,225	
Local cash	Local	Y		298,000	280,326	
Local In-kind	Local	Y		80,000	15,780	
Other Local	Local	N	0	0	1,138,263	
US EPA Pollution Prevention	Federal	N	0	0	45,500	
USDA NRCS EQIP	Federal	N	15,000	80,000	1,035,208	
USDA FSA CRP	Federal	N	15,000		30,000	
USFWS	Federal	N	50,000			
Total			1,563,200	1,126,765	3,179,757	

1 – To nearest dollar.

Table 16. Budget Comparison by Expenditure Category.

Budget Category	Budgeted[1]								Expended[1]			
	Original PIP				Amended PIP							
	319	State/ Local	Other Federal	Total	319	State/ local	Other Federal	Total	319	State/ Local	Other Federal	Total
Salaries & Benefits	141,000			141,000	158,701			158,701	158,702			158,702
Administrative Support	20,000	4,000		24,000	24,657	20,657		4,000	12,501	1,670		14,171
USFWS Assistance			50,000	50,000			50,000	50,000			30,000	30,000
Equipment and Supplies	8,500	4,500		13,000	7,687	4,500		12,187	7,687	372		8,059
Travel	16,000	2,000		18,000	21,959	2,000		23,959	21,959	2,300		24,259
Computer Support					479			479	479			479
Objective 1												
Task 1 Grassland Management												
Grazing Systems									11,499	13,170		24,619
Fence	42,000	42,000		84,000	45,246	82,000		127,246	45,246	36,146		81,381
Grass Seeding	21,500	21,500		42,500	6,687	20,500		27,187	6,688	4,778		11,466
Riparian Buffers/Fence Exclusion	4,000	4,000		8,000	11,449	18,000		29,449				0
Streambank/Shoreline Plantings	5,000	5,000		10,000	2,189	5,000		7,189	4,379	4,380		8,759
Streambank/shoreline Stabilization	15,000	15,000		30,000	2,190	5,000		7,190				
Tree Plantings	50,000	50,000		100,000	40,354	40,000		80,354	40,354	40,770	4,702	85,826
Water Development												
Pipelines	90,000	70,000		160,000	120,970	108,000		228,970	120,970	127,791		248,761
Tanks	22,500	17,500		40,000	39,880	32,000		71,880	40,406	30,782		71,188
Ponds/Dugouts/Cleanouts	57,000	57,000		114,000	21,298	30,000		51,298	21,298	21,238		42,536
Wells	16,000	16,000		32,000	17,609	18,000		35,609	8,514	12,212		20,726
Pasture Pumps	1,000	1,000		2,000	8,514	1,000		9,514	17,609	15,440	63,850	96,899
Cropland Management												
Buffer Strips/Grassed Waterways	10,000	10,000	30,000	50,000		10,000	30,000	40,000				0[2]
Task 2 Livestock Management												
AWMS Design[3]	40,000		30,000	70,000	1,500	5,500		7,000	1,500	166,931	132,271	300,702
AWMS Construction[3]	162,450		277,550	440,000		85,000		85,000		953,346	965,795	1,919,141
Objective 2												
Task 2 Information & Education												
News releases & letters	2,000		2,000	4,000		2,000		2,000	40			40
Meetings, Workshops & Tours	600	800		1,400		800		800	106	1,225		1,331
Mailings	1,300	300		1,600	146	300		446				
Develop Products	1,500	1,000		2,500		1,000		1,000				
Reports/Audit	3,500	1,500		5,000		1,500		1,500	5,282			5,282

Table 16. Budget Comparison by Expenditure Category. (Cont'd.)

Objective 3 Rosette/Bierman Assessments												
- Supplies & shipping		1,100		1,100		1,100		1,100				
Task 4 - Inlake Sampling	8,400			8,400	14,100	6,400		21,500	16,849	6,800		23,649
Task 5 - Tributary Sampling	3,600	3,600		7,200								
Task 6 - QAQC		3,300		3,300		3,300		3,300				
Task 7 - AnnAGNPS	4,400	2,800		7,200								0
Objective 4												
Task 8 GRTS & Final Reports												0
Monitoring & Evaluation												
Inlake Water Quality & QAQC	3,000			3,000	2,749			2,749	Included in Objective 3 expenses			
Total	750,000	643,200	80,000	1,473,200	544,364	486,900	80,000	1,111,264	542,068	1,439,351	1,196,618	3,178,037
Percent Project	50.9	43.7	5.4	100	49	43.8	7.2	100	17.1	45.3	37.7	100

1 – To nearest dollar

2 – Installed using CRP. Financial information not available

3 – Includes expenditures for CAFOs. Local/State not used as match

CONCLUSIONS

Conclusions that can be made based on the information presented in previous sections of this report include:

1. Successful completion of a watershed project requires that the project partners must be involved with the project development and knowledgeable of the PIP.

2. An information and education component is essential to ensuring a project meets established milestones and attains goal.

3. Load reductions realized from the BMPs installed contributed to reducing the TSI values for Mina and Cresbard Lakes and Loyalton Dam.

4. Data required to draft TMDLs for Rosette Lake and Bierman Gravel Pit was acquired.

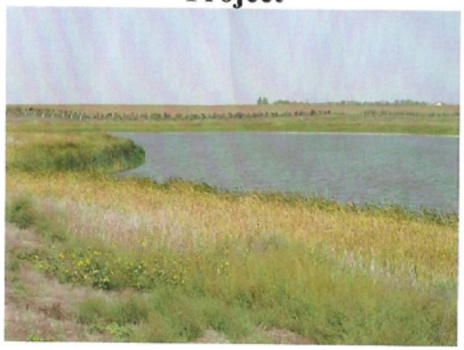
5. The activities completed to implement the PIP, as amended, resulted in accomplishment of most of the milestones established to monitor and evaluate project success.

6. With the exception of not achieving the target TSI value for Loyalton Dam, the project goal was attained.

Appendix

Project Brochure

Upper Snake Creek Watershed Project



Description:

This watershed project is a 6-year plan to be completed in two stages. The project is meant to restore and/or maintain water quality in the watershed by implementing best management practices (BMP's). This includes: Mina Lake, Loyalton Dam, Cresbard Lake, and Snake Creek.

Counties Involved:

Brown, Edmonds, Faulk, McPherson, Spink

Contact Information:

Brett Knox

Examples of BMP's:

-Minimum tillage
-Riparian Management/Grazing Practices
-Stream bank/shoreline plantings and stabilization
-Conversion of cropland to rangeland
-Fertilizer Applications
-Buffer strips/Grassed waterways
-Animal Waste Systems and Design cost share

In-Lake BMP's:

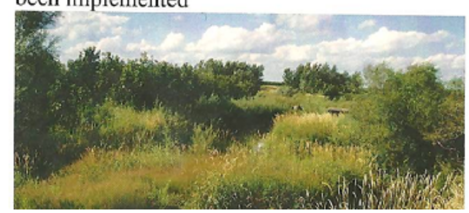
-Aluminum Sulfate Treatment

Benefits of Riparian Buffers:

The riparian zone around a body of water stores water like a sponge during a flood or rainstorm. They also aid in slowing water down in terms of run off and stream velocity. By installing a riparian buffer along streams and rivers run off will decrease and sediments deposited into the water will be filtered out before they reach the water. This will also reduce erosion by protecting the streamside walls with plants with strong root systems. The slower run off is, the more time the water has to soak into the ground to be stored and used later. Stream or river velocity is also important. By simply doubling a streams velocity, the amount of erosion increases four times and it is capable of carrying 64 times the amount of material. As the percentage of vegetation along stream banks increases, erosion decreases.

Farm site picture before a buffer system was implemented

Farm site picture 4 years after buffer system has been implemented



Benefits of Grassed Waterways:

Grassed waterways protect against erosion by protecting the topsoil from moving water. The vegetation acts as a protective cover or shield to prevent erosion from occurring.

Photos courtesy of USDA NRCS