

**BELLE FOURCHE RIVER WATERSHED MANAGEMENT
AND PROJECT IMPLEMENTATION PLAN SEGMENT 4
WATERSHED PROJECT FINAL REPORT
SECTION 319 NONPOINT SOURCE
POLLUTION CONTROL PROGRAM**

Topical Report RSI-2296

prepared for

Belle Fourche River Watershed Partnership
1837 5th Avenue South
Belle Fourche, South Dakota 57717

December 2011



**BELLE FOURCHE RIVER WATERSHED MANAGEMENT
AND PROJECT IMPLEMENTATION PLAN SEGMENT 4
WATERSHED PROJECT FINAL REPORT
SECTION 319 NONPOINT SOURCE
POLLUTION CONTROL PROGRAM**

Topical Report RSI-2296

by

Matthew B. Stoltenberg
Jared K. Oswald

RESPEC
P.O. Box 725
Rapid City, South Dakota 57709

prepared for

Belle Fourche River Watershed Partnership
1837 5th Avenue South
Belle Fourche, South Dakota 57717

December 2011

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.

Grant # C-99818505, C-99818506, C-99818509, C-99818510

EXECUTIVE SUMMARY

Project Title: Belle Fourche River Watershed Management and Project Implementation Plan Segment 4

Grant Number(S): 998185-09, 998185-10

Project Start Date: June 1, 2009

Project Completion Date: December 31, 2011

Funding

Total EPA Grant Budget: \$1,296,150

Total Matching Funds Budget: \$2,355,926

Total Nonmatching Funds Budget: \$2,675,300

Total Budget: \$6,327,376

Budget Revisions

June, 2009
319 Award \$655,000

June, 2010
319 Award \$641,150

Total Expenditures of EPA Funds: \$1,296,150

Total 319 Matching Funds Accrued: \$1,655,461

Total Nonmatching Funds Accrued: \$2,778,676

Total Expenditures: \$5,730,287

Belle Fourche River Watershed Management and Project Implementation Plan Segment 4 was sponsored by the Belle Fourche River Watershed Partnership (BFRWP) with support from agricultural organizations, federal and state agencies, and local governments. This project continued implementation of the Best Management Practices (BMPs) identified in the Total Maximum Daily Load

(TMDL) report for the Belle Fourche River. The objectives of this project segment were:

- Continue implementation of BMPs in the watershed to reduce total suspended solids (TSS) 21.5 milligrams per liter (mg/L) reduction below the Belle Fourche Reservoir; 33 mg/L reduction above the Belle Fourche Reservoir.
- Conduct public education and outreach to stakeholders within the Belle Fourche River Watershed.
- Track progress made toward reaching the goals of the TMDL to help ensure that the BMPs are being implemented in an effective manor.

Several of the completed activities resulted in a reduction of sediment-laden irrigation waste water discharged from the Belle Fourche Irrigation District (BFID) delivery system into surrounding water by 2,811 acre-feet per year. This brings the total acre-feet reduction to 8,466, or 49 percent of the 10-year goal. Eleven real-time stage control units installed on the gates of check structures on both the north and south canals reduced nonused irrigation water by more precisely maintaining the level within the canals and laterals. The BFID lined 1,300 feet of the inlet canal and replaced open ditches with pipe on 6,718 feet of the laterals that delivers water from the BFID to the producers.

Several activities were completed to improve irrigation efficiencies after water was delivered to irrigators within the Belle Fourche River Watershed. A total of 54,285 feet of pipeline was installed by 26 producers to convey water to center pivot irrigation systems or to gated pipe that replaced open ditches. Twenty-four center-pivot sprinkler systems were installed to replace existing surface irrigation.

Grazing/riparian areas were improved significantly within the watershed. Approximately 38,000 feet of pipeline, 19 watering facilities, and 30,000 feet of cross fence were installed using 319 dollars to provide off-stream livestock water and improve grazing distribution. These projects involved 5 producers improving approximately 3,000 riparian acres. New conservation plans were written for over 126,000 acres of grazing lands and follow up was conducted on over 48,000 acres.

Approximately 43 public education and outreach events were completed during this project segment. Outreach activities were in the form of public meetings, informational booths, website maintenance, radio sound bites, rainfall simulator

demonstrations, and watershed tours. It is estimated that outreach and education efforts reached at least 16,000 people. A soil quality demonstration trailer was purchased by the BFRWP in 2009 to demonstrate the effects of erosion on soils and how they relate to TSS. The trailer was used at several events sponsored by the BFRWP. The Butte County, Lawrence County, and Elk Creek Conservation Districts each sent out newsletters which included project updates. The BFRWP hosted 10 meetings to provide updates on project work and progress being made. The BFRWP website continues to be updated with happenings and project status and is located at <www.bellefourchewatershed.org>. Outreach activities have helped increase participation and support in the BFRWP and also gave the BFRWP several contacts for BMP installation. Several informative sound bites were broadcasted on local radio to increase public awareness of water quality issues and to promote involvement with the project.

Preliminary estimates based on BMP installation indicate that TSS load was reduced by 55,278 tons per year in this segment, which is 11,144 tons per year greater than what was estimated to be accomplished in this project segment. This brings the cumulative TSS load reduction to 161,211 tons per year towards the goal 289,910 tons per acre identified in the TMDL. Currently, the project is in the seventh year of implementation.

ACKNOWLEDGEMENTS

The Belle Fourche River Watershed Partnership would like to thank all those involved with this segment of the implementation of practices recommended from the Belle Fourche River Watershed Total Maximum Daily Load. The efforts of all those involved from the following organizations are greatly appreciated and have been essential to the success of this project:

Belle Fourche Irrigation District

Butte County Conservation District

Crook County Conservation District

Elk Creek Conservation District

Individual ranchers, farmers, and landowners within the watershed

Lawrence County

Lawrence County Conservation District

Natural Resources Conservation Service

South Dakota Association of Conservation Districts

South Dakota Conservation Commission

South Dakota Department of Agriculture

South Dakota Department of Environment and Natural Resources

South Dakota Game Fish and Parks

South Dakota Grassland Coalition

South Dakota School of Mines and Technology

South Dakota State University

United States Army Corp of Engineers

United States Bureau of Reclamation

United States Environmental Protection Agency

United States Fish and Wildlife Service

United States Geological Survey

Wyoming Department of Environmental Quality.

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 PROJECT GOALS AND OBJECTIVES	7
2.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES	7
2.2 EVALUATION OF GOAL ATTAINMENT	9
3.0 BEST MANAGEMENT PRACTICES	10
3.1 REDUCING NONUSED IRRIGATION WATER AND IMPROVING EFFICIENCY	10
3.2 MANAGED GRAZING	14
4.0 SUMMARY OF PUBLIC PARTICIPATION AND OUTREACH	19
5.0 MONITORING RESULTS	23
5.1 WHITEWOOD CREEK FECAL COLIFORM TMDL SUMMARIES	23
5.2 WATER-QUALITY ANALYSIS	23
5.2.1 Horse Creek Flow Analysis	32
5.3 EVALUATION OF GOAL ATTAINMENT	33
6.0 SUCCESSES OF THE PROJECT AND ASPECTS OF THE PROJECT THAT DID NOT WORK WELL	36
7.0 PROJECT BUDGET/EXPENDITURES	38
7.1 319 BUDGET	38
7.2 MATCHING FUNDS BUDGET	38
7.3 NONMATCHING FEDERAL FUNDS BUDGET	38
8.0 FUTURE ACTIVITY RECOMMENDATIONS	45
9.0 REFERENCES	46
APPENDIX A. <i>E. COLI</i> TOTAL MAXIMUM DAILY LOAD FOR WHITEWOOD CREEK	A-1
APPENDIX B. FECAL COLIFORM TOTAL MAXIMUM DAILY LOAD FOR WHITEWOOD CREEK	B-1

LIST OF TABLES

TABLE	PAGE
1-1 Summary of Belle Fourche River Watershed Exceedance Water-Quality Data	3
2-1 Planned Versus Actual Milestone Completion Dates	8
3-1 Best Management Practices Implemented.....	11
4-1 Summary of Public Outreach and Education During Segment 4.....	20
5-1 Summary E. coli Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River.....	25
5-2 Summary Fecal Coliform Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River	25
5-3 Summary Total Suspended Solids Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River.....	26
7-1a Planned Budget of 319 Funds.....	39
7-1b Actual Budget of 319 Funds.....	40
7-2a Planned U.S. Environmental Protection Agency 319 and Matching Funds Budget.....	41
7-2b Actual U.S. Environmental Protection Agency 319 and Matching Funds Budget.....	42
7-3a Planned Nonmatching Funds Budget.....	43
7-3b Actual Nonmatching Funds Budget	44

LIST OF FIGURES

FIGURE	PAGE
1-1 Belle Fourche River Watershed.....	2
3-1 Location of Automated Sites in the Belle Fourche Irrigation District.....	12
3-2 Gate Automation Unit Installed in the Belle Fourche Irrigation District.....	13
3-3 Center Pivot Installed in the Belle Fourche Irrigation District.....	14
3-4 Location of Producer Irrigation Implementation Project in Segment 4.....	15
3-5 Lining of the Inlet Canal.....	16
3-6 Location of Producer Range Implementation Projects in Segment 4.....	17
3-7 Photograph of a Monitoring Site Before Planned Grazing Best Management Practice Installation in 2008.....	18
3-8 Photograph Monitoring Site After Planned Grazing Best Management Practice Installation in 2010.....	18
4-1 Soil Quality Demonstration During a Watershed Tour.....	22
4-2 Youth Range Camp Near Sturgis.....	22
5-1 Location of the Five Water-Quality Monitoring Sites within the South Dakota Portion of the Belle Fourche River Watershed.....	24
5-2 Median Fecal Coliform Concentrations Observed at Water-Quality Monitoring sites on the Belle Fourche River in South Dakota, Pre- and Post-BMP Implementation.....	28
5-3 Median Total Suspended Solids Concentrations Observed at Water-Quality Monitoring sites on the Belle Fourche River in South Dakota, Pre- and Post-BMP Implementation.....	28
5-4 Percent Exceedances of the Fecal Coliform Water Quality Standard for Pre- (Red) and Post- (Green) BMP Implementation at Five Water-Quality Monitoring Sites on The Belle Fourche River.....	30
5-5 Percent Exceedances of the TSS Water Quality Standard for Pre- (Red) and Post- (Green) BMP Implementation at Five Water-Quality Monitoring Sites on The Belle Fourche River.....	31
5-6 Location of Horse Creek in Relation to the Fields and Main Delivery System Within the Belle Fourche Irrigation District.....	32
5-7 Box Plot of Historic Monthly Flows at the Mouth of Horse Creek.....	34

LIST OF FIGURES (Continued)

FIGURE	PAGE
5-8 Box Plot of Average Daily Flows on Horse Creek during the Belle Fourche Irrigation District Irrigation Season; Before and After Best Management Practice Implementation.....	34

1.0 INTRODUCTION

The Belle Fourche River is a natural stream that drains parts of Butte, Lawrence, and Meade Counties in South Dakota. The headwaters are located in Wyoming. The river flows into the Cheyenne River in southern Meade County and ultimately to the Missouri River. The watershed is shown in Figure 1-1. The Belle Fourche River Watershed encompasses approximately 2,100,000 acres (3,300 square miles) in South Dakota and includes Hydraulic Units 10120201, 10120202, 10120203. The city of Spearfish (population 8,606) is the largest municipality located in the South Dakota portion of the watershed. Other South Dakota communities in the watershed include Deadwood (population 1,380), Lead (3,027), Sturgis (4,442), Belle Fourche (4,565), Fruitdale (62), Nisland (204), and Newell (646).

Land in the watershed is used primarily for grazing with some cropland and a few urban areas. Wheat, alfalfa, native and tame grasses, and hay are the main crops. Some corn is grown in the Belle Fourche Irrigation District (BFID). Gold mining, while reduced in scope from the past and silviculture occur in the Black Hills portion of the watershed. Approximately 15 percent of the watershed is federally owned. Of this, 11 percent is managed by the U.S. Forest Service and 4 percent by the Bureau of Land Management.

The Belle Fourche River is identified in the 1998 and 2002 *South Dakota 303(d) Waterbody Lists* and the 2004 and 2006 *Integrated Report for Surface Water Quality Assessment (IR)* as impaired because of elevated total suspended solids (TSS) concentrations. According to the 2006 IR, the Belle Fourche River, from the Wyoming border to the Cheyenne River, South Dakota, failed to support its assigned uses because of high TSS concentrations. In the report, agricultural activities were listed as a likely source of occasional impairment. This report also states that a natural source of TSS may be the erosion of exposed shale beds that lie along the river and its tributaries. The 2008 IR shows all segments of the Belle Fourche River, with the exception of the reach from the Wyoming border to Fruitdale, South Dakota, were delisted after water-quality standards for TSS were met. The 2010 IR once again showed some of the segments impaired. Table 1-1 contains a summary of 15 impaired TMDL segments within the Belle Fourche River Watershed. The table also lists the impaired beneficial use, impairment parameter, water-quality criteria, and possible source.

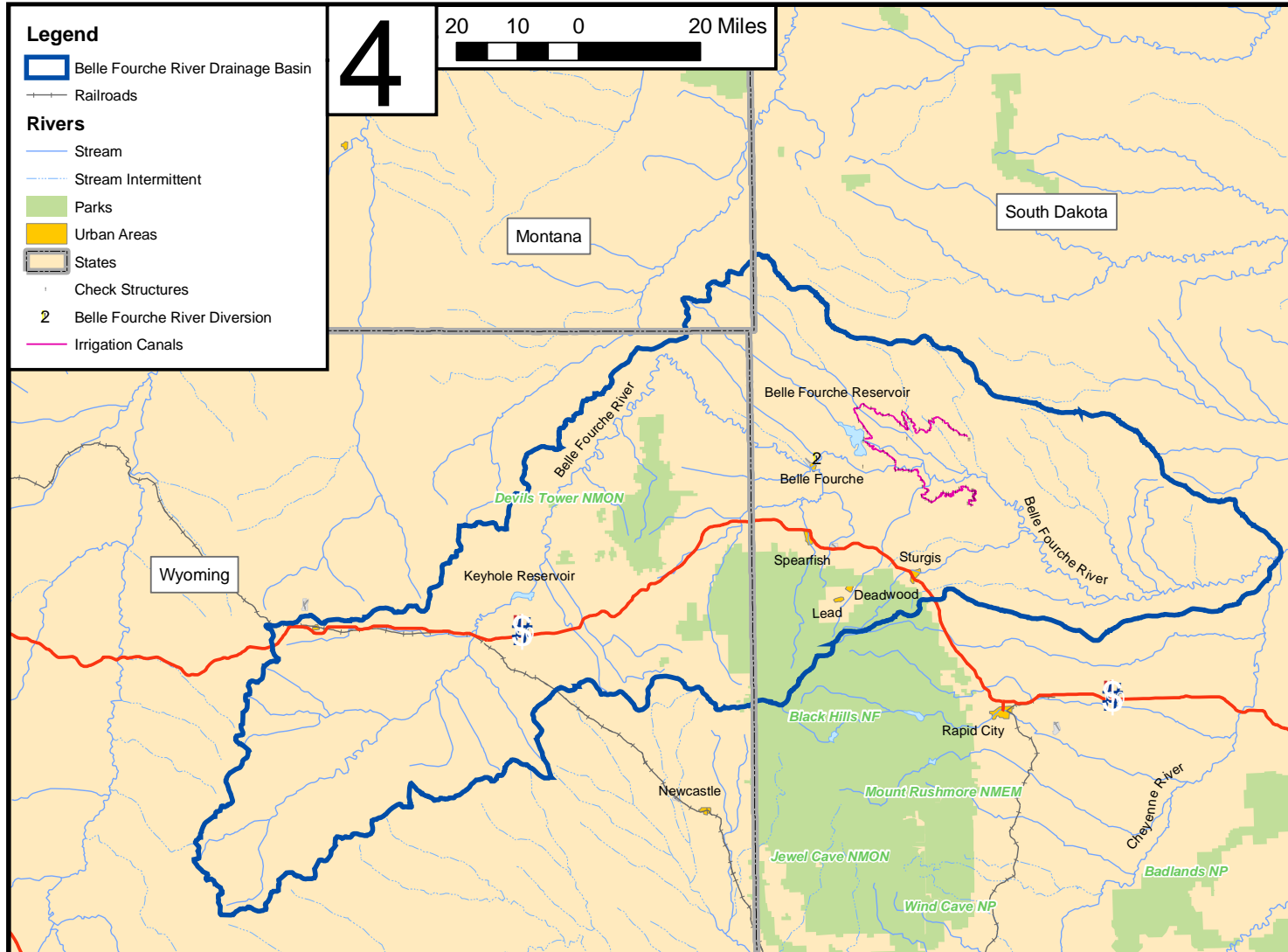


Figure 1-1. Belle Fourche River Watershed.

Table 1-1. Summary of Belle Fourche River Watershed Exceedance Water-Quality Data (Page 1 of 2)

Stream	Stream Reach	Beneficial Use	Impairment Parameter	Water Quality Criteria	Source
Bear Butte Creek	Headwaters to Strawberry Creek	Cold-Water Permanent Fish Life	Water Temperature (°F)	<65°F	Natural Source
Bear Butte Creek	Strawberry Creek to Mouth	Cold-Water Permanent Fish Life	Water Temperature (°F)	<65°F	Natural Source
Belle Fourche River	Wyoming Border to Redwater River, South Dakota	Immersion Recreation	Fecal Coliform (per/100 mL)	200 ^(a) /400 ^(b)	Riparian Grazing/ Wildlife
		Warm-Water Permanent Fish Life	TSS (mg/L)	90 ^(a) /158 ^(b)	Crop Production/ Livestock
Belle Fourche River	Whitewood Creek to Willow Creek	Warm-Water Permanent Fish Life	TSS (mg/L)	90 ^(a) /158 ^(b)	NA
Belle Fourche River	Willow Creek to Alkali Creek	Warm-Water Permanent Fish Life	TSS (mg/L)	90 ^(a) /158 ^(b)	NA
Belle Fourche River	Alkali Creek to Mouth	Immersion Recreation	Fecal Coliform (per/100 mL)	200 ^(a) /400 ^(b)	NA
		Warm-Water Permanent Fish Life	TSS (mg/L)	90 ^(a) /158 ^(b)	NA
Horse Creek	Indian Creek to Mouth	Irrigation Waters	Conductivity (mohms/cm @ 25°C)	2,500 ^(a) /4,375 ^(b)	NA
Redwater River	Wyoming Border to US HWY 85	Cold-Water Permanent Fish Life	Water Temperature (°F)	<65°F	Natural Source
Strawberry Creek	Bear Butte Creek to S5, T4N, R4E	Fish/Wildlife Prop. Rec. Stock Waters	Cadmium (mg/L)	(c)	Mining Impacts
West Strawberry Creek ^(m)	Headwaters to Mouth	Limited Contact Recreation	Fecal Coliform (per/100 mg/L)	1,000 ^(a) /2,000 ^(b)	NA

Table 1-1. Summary of Belle Fourche River Watershed Exceedance Water-Quality Data (Page 2 of 2)

Stream	Stream Reach	Beneficial Use	Impairment Parameter	Water Quality Criteria	Source
Whitewood Creek	Deadwood Creek to Spruce Gulch	Immersion Recreation	Fecal Coliform (per/100 mg/L) Escherichia coli (E. coli)	200 ^(a) /400 ^(b)	Combined Sewers/Grazing/Wildlife
Whitewood Creek	Sandy Creek to I-90	Cold-Water Marginal Fish Life	pH	6.5–8.8	Natural Sources
Whitewood Creek	I-90 to Crow Creek	Warm-Water Permanent Fish Life	pH	6.5–9.0	Natural Sources
Whitewood Creek	Crow Creek to Mouth	Warm-Water Permanent Fish Life	TSS (mg/L)	90 ^(a) /158 ^(b)	NA
Willow Creek	Near Vale, South Dakota	Irrigation Waters	Conductivity (mohms/cm @ 25°C)	2,500 ^(a) /4,375 ^(b)	NA

(a) 30-day average.

(b) Daily maximum.

(c) Cadmium Concentration < $(1.136672 - ((\ln(\text{hardness}) \times 0.041838) \times \exp(1.128 \times (\ln(\text{hardness})) - 3.828))$.

Horse Creek was listed in the 1998 impaired waterbody list for total dissolved solids (TDS) that was later determined to be a listing error. The Horse Creek listing was corrected to conductivity during 2002. During this assessment, approximately 10 percent of the samples collected from Horse Creek exceeded the water-quality standard for TSS. The 2008 IR lists Horse Creek as nonsupporting for conductivity and delisted for TSS. Similar results were shown on the 2010 IR. The TMDL report for Horse Creek includes both TSS and conductivity.

The Belle Fourche River Watershed Partnership (BFRWP) completed a water-quality assessment project which led to development of a TSS Total Maximum Daily Load (TMDL) for the Belle Fourche River and Horse Creek. The project period extended from April 2001 through 2003. Six TMDLs were approved by the U.S. Environmental Protection Agency (EPA) for the Belle Fourche River and Horse Creek in 2005. Based on the results of the watershed study, the main sources of TSS were determined to be rangeland erosion, irrigation return flows, free cattle access to streams, riparian degradation, natural geologic processes, hydraulic alteration by irrigation, and reduced stream miles. The *Ten-Year Belle Fourche River Watershed Strategic Implementation Plan* [Hoyer, 2005] developed to implement the TMDL includes recommendations for reducing TSS concentrations using practices that include irrigation water management, riparian rehabilitation, and grazing management. As part of the Segment 4 implementation project, the fecal coliform TMDL has been developed for Whitewood Creek.

During the winter 2004, the BFRWP applied for and received a Clean Water Act Section 319 Grant to begin implementation of the Best Management Practices (BMPs) recommended in the TMDLs for the Belle Fourche River. Currently, the BFRWP is in its seventh year of implementing BMPs in the watershed and has been funded through Fiscal Year 2013 with the Segment 5 proposal. The project is supported by agricultural organizations, federal and state agencies, local governments, South Dakota State University (SDSU), and the South Dakota School of Mines & Technology (SDSM&T).

Funding for the project included support from local ranchers and farmers, BFRWP, South Dakota Department of Environment and Natural Resources (SD DENR), U.S. Fish and Wildlife Service (USFWS), Lawrence County, BFID, Wyoming Department of Environmental Quality (WYDEQ), Natural Resources Conservation Service (NRCS), Corps of Engineers, Bureau of Reclamation,

U.S. Geological Survey (USGS), and the Clean Water Act Section 319 Grant. Products of the first implementation project segment were the *Ten-Year Belle Fourche River Watershed Strategic Implementation Plan* [Hoyer, 2005] and the *Belle Fourche Irrigation District Water Conservation Plan* [Rolland and Hoyer, 2005]. These plans outline BMP installation activities to be completed in this project for a 10-year time frame, and associated TSS and nonused water savings are presented for each action planned. BMPs recommended by the TMDLs and the 10-year plan installed during this project segment include flow automation units, real-time stage/flow-measuring devices, upgraded water card and water ordering system, updated canal operational model, replacing open irrigation ditches with pipeline, lining open irrigation ditches, installing pipelines to deliver water from the BFID system to the fields, installation of irrigation sprinkler systems within the BFID, and managed grazing. These BMPs were installed in the South Dakota portion of the Belle Fourche River Watershed (Figure 1-1).

2.0 PROJECT GOALS AND OBJECTIVES

The goal of the Belle Fourche River Watershed Management Project is to bring the Belle Fourche River and Horse Creek into compliance with TSS water-quality standards within 10 years. To accomplish the goal, a reduction of 55 percent (289,910 tons/year) in TSS is required. A reduction of 41 percent (2,033 tons/year) in TSS is required for Horse Creek.

In this project segment, the load reduction goal is 44,134 tons per year. To accomplish this goal, this project segment had three objectives:

1. Continue implementation of BMPs in the watershed to reduce TSS 21.5 milligrams per liter (mg/L) reduction below the Belle Fourche Reservoir; 33 mg/L reduction above the Belle Fourche Reservoir.
2. Conduct public education and outreach to stakeholders within the Belle Fourche River Watershed.
3. Track progress toward meeting TMDL goals to help ensure that the BMPs are effective and that the proper BMPs are being implemented.

2.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES

Objective 1. Implement BMPs Recommended to Reduce TSS. This objective was comprised of two tasks: improving irrigation water management and implementing riparian vegetation improvements. The products of this objective included 11 real-time stage control units; replacement of canals, laterals, and/or ditches with 6,718 feet of pipelines; 1,300 feet of inlet canal lining; 54,285 feet of pipeline installed to convey water to center-pivot irrigation systems or to gated pipe that replaced open ditches; installing of 24 sprinkler irrigation systems to replacing existing flood irrigation; rangeland implementation projects benefiting 3,000 riparian acres; and range planning and follow up on 174,146 acres. Implementation of the BMPs is discussed further in Chapter 3.0.

Objective 2. Conduct Public Outreach and Education, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit. There were approximately 45 outreach activities that involved approx-

imately 16,705 participants; 3 Grant Tracking and Reporting System (GRTS) reports as well as this final report. These activities are further discussed in Chapter 5.0 of this report.

Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development. Water-quality samples were collected by USGS at real-time stream gauging sites and SD DENR at several water-quality monitoring (WQM) sites in the watershed. A detailed statistical analysis is included in Chapter 4.0 of this report. The Whitewood Creek TMDL for fecal coliform and *E. coli* bacteria was also completed.

Table 2-1 lists the project objectives along with their products, planned milestone completion date, and actual milestone completion date. An extension of time from June 2011 to December 2011 was requested from and granted by the SD DENR. The extension of time was needed by agricultural producers to complete installation of BMPs because of alignment of other funding sources, including Environmental Quality Incentives Program (EQIP), and wet conditions throughout the 2011 season.

Table 2-1. Planned Versus Actual Milestone Completion Dates

Belle Fourche River Watershed Partnership Implementation	Planned Completion	Actual Completion
Objective 1. Implement BMPs Recommended to Reduce TSS		
Product 1. Improve Irrigation Delivery and Application	June 2011	December 2011
Product 2. Complete and Install Riparian Area BMPs	June 2011	December 2011
Objective 2. Conduct Public Education and Outreach		
Product 3. Public Outreach, Report Writing, Federal Audit	June 2011	June 2011
Objective 3. Tracking Progress Toward Meeting Goals		
Product 5. GRTS and Final Reports	June 2011	December 2011

2.2 EVALUATION OF GOAL ATTAINMENT

Project success was evaluated by comparing project outputs and outcomes with the planned milestones. All objectives established for this project were reached:

- Implementation of several BMPs recommended within the Phase I Watershed Assessment Final Report and TMDL [Hoyer and Larson, 2004].
- Load reductions, estimated as a result of BMP installation, of 55,278 tons per year which is 11,144 tons per year greater than the goal for this project segment.
- Completion of approximately 45 successful education and outreach activities which led to greater public participation in the project, completion of annual GRTS reports along with this final report, and 2 required federal audits.
- Completion of essential water-quality monitoring and Whitewood Creek fecal coliform and *E. coli* TMDL study.

This project was very successful in that project goals were exceeded for all of the objectives. BMPs were implemented that are estimated to reduce TSS in the Belle Fourche River by 55,278 tons per year.

3.0 BEST MANAGEMENT PRACTICES

Installation of the BMPs recommended in the Belle Fourche River TMDL was continued during this project segment. The BMP installation included funding from local ranchers and farmers, BFID, Bureau of Reclamation, USFWS, and NRCS as well as financial assistance from the 319 project.

The BMPs installed included the following:

- 11 real-time stage control units.
- 6,718 feet of pipeline replaced open irrigation canals and laterals.
- 1,300 feet of canal lining.
- 54,285 feet of pipeline installed by individual irrigators to convey water to center-pivot irrigation systems or to gated pipe that replaced open ditches.
- 24 irrigation sprinkler systems to replace flood irrigation.
- Approximately 38,000 feet of pipeline, 19 watering facilities, and 30,000 feet of cross fence to provide off-stream livestock water and improve grazing distribution involving five producers in 3,000 acres of riparian vegetation improvements.
- Completed conservation plans for over 174,000 acres of grazing lands.

Table 3-1 provides a track of BMP implementation planned and implemented to date.

3.1 REDUCING NONUSED IRRIGATION WATER AND IMPROVING EFFICIENCY

To reduce return flows of nonused irrigation waters, the project installed BMPs that will improve precision in water quantity delivered to irrigators. The installation of 37 units to measure and control flow within the BFID delivery system, enables water levels to be measured, monitored, and adjusted from the BFID office in Newell, South Dakota. Figure 3-1 shows where the automated sites are located within the Belle Fourche Irrigation District. These automated units provide continual oversight of canal water levels and the ability to immediately adjust levels when necessary, thereby reducing waste and improving efficiency. Water-level data at each site are recorded every 10 minutes and stored in a database. This allows for easy summation of the total volume of water delivered

during any given time period and calculation of efficiencies. Figure 3-2 shows an automated site within the Belle Fourche Irrigation District.

Table 3-1. Best Management Practices Implemented

Best Management Practice	10-Year Plan	Planned This Segment	Installed This Segment	Installed to Date
Flow Automation Units	42	3	11	37
Real-time Stage/Flow-Measuring Devices	15	0	0	24
Canal Operational Model	2	0	0	2
Water Card Ordering System	1	0	0	1
Line Open Canals and Laterals (Feet of Lining)	26,560	7,780	1,300	10,360
Replace Open Canals and Laterals With Pipeline (Feet of Pipeline)	25,000	4,000	6,718	14,514
Sprinkler Irrigation Systems	36	18	24	47
Managed Riparian Grazing (Acres)	34,000	500	3,000	22,638

An upgraded water card ordering system was also implemented. The system allows BFID personnel to enter the timing and amount of water ordered for individual farmers on a given ride (or section of the irrigation district). Once this information is entered, the upgraded water card ordering system generates daily water delivery cards for the ditch riders that deliver the water to the fields. It also calculates the amount of lag time that it takes for the water to travel from the dam to all fields within the BFID and provides a daily estimate of the amount of water to release from the dam to meet the water order demands. This system eliminates mathematical and transcription errors from manual data entry and improves the overall efficiency of the system.

Currently, the entire north canal is set up in the Storm Water Management Model (SWMM), an EPA model capable of simulating all the conditions within the north canal. The model was calibrated and validated using data collected at automated checks and portable stage-measuring devices as well as manual field measurements collected during the summers of 2006 through 2008. The hydraulic model is capable of assisting with irrigation delivery system settings and improving irrigation

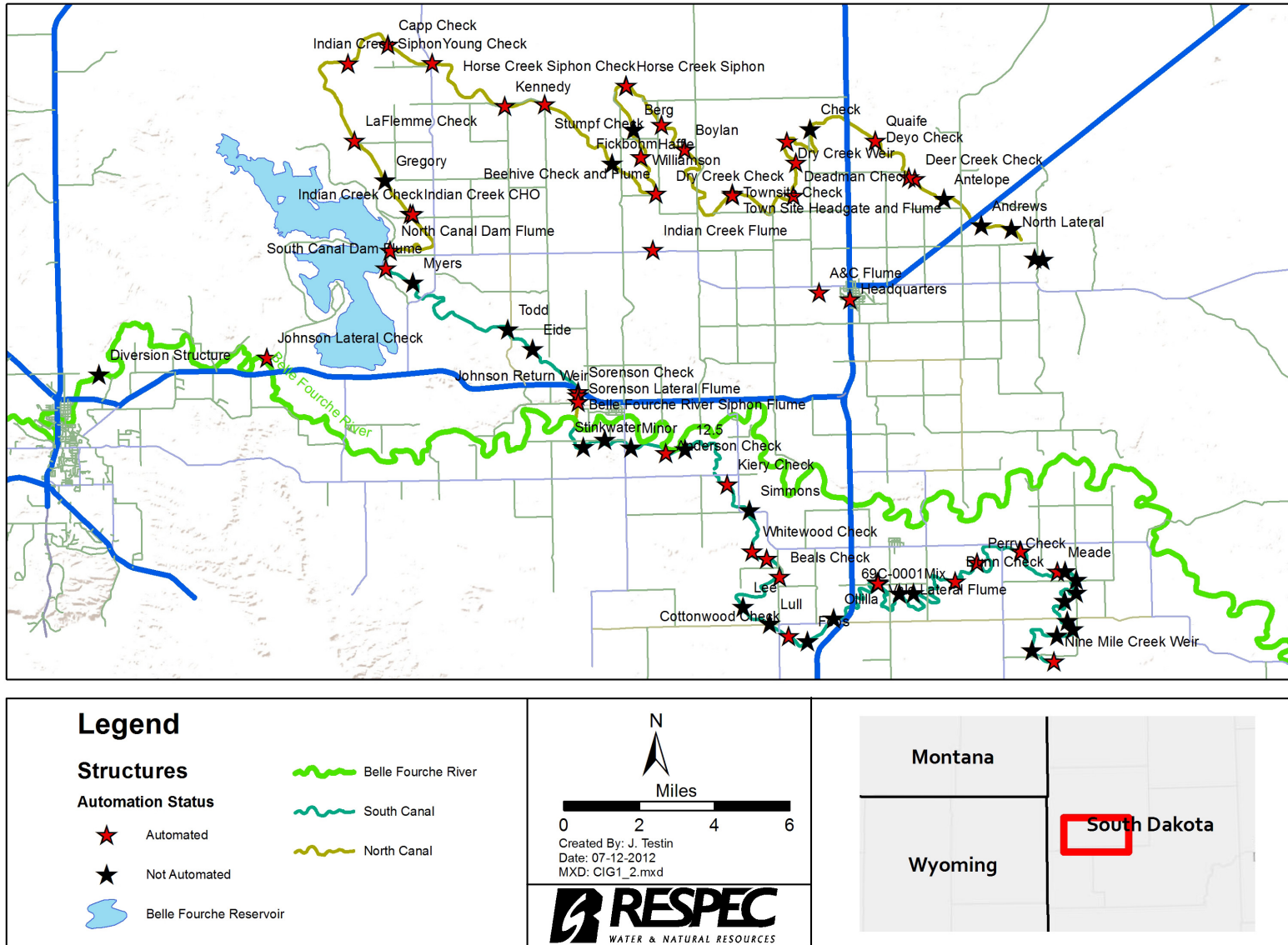


Figure 3-1. Location of Automated Sites in the Belle Fourche Irrigation District.

efficiency during future irrigation season. To help validate the SWMM model, operational curves, charts, and spreadsheets were developed for five automated check structures within the BFID. These tools provide BFID personnel with a better understanding of how to optimally operate automated check structures and offer flow measurements based on the check settings and upstream water levels. Using the operational curves, charts, and spreadsheets along with the developed SWMM model will help BFID personnel understand the dynamic irrigation system. This understanding will reduce irrigation return flows and, in turn, TSS levels in the Belle Fourche River.

RSI-1870-12-003



Figure 3-2. Gate Automation Unit Installed in the Belle Fourche Irrigation District.

A total of 54,285 feet of pipeline was installed by 26 irrigators during this segment to convey water to center-pivot irrigation systems or to gated pipe that replaced open ditches. Twenty Four center-pivot sprinkler systems were installed to replace existing surface irrigation. Figure 3-3 shows a center pivot irrigation system that was partially funded by the project. Locations of producer irrigation BMPs are shown in Figure 3-4.



Figure 3-3. Center Pivot Installed in the Belle Fourche Irrigation District.

Approximately 1,300 feet of inlet canal lining was completed by the BFID during this segment. It was originally estimated that the BFID would line approximately 7,780 feet of the inlet canal. After further study of the project it was determined by the BFID along with BOR to allocate the additional lining to other parts of the BFID in order to receive maximum benefit. The lining has been purchased and plans are being made to utilize it on other sections of the canals or laterals in subsequent years. This will be tracked and reported in future segments. The inlet canal lining is shown in Figure 3-5. A total of 6,718 feet of canal and open laterals within the BFID were replaced with pipeline. This was above the goal of 4,000 feet for this segment. Installation of pipeline eliminated water losses from infiltration and evaporation along these sections.

3.2 MANAGED GRAZING

Information from resource inventories of several ranches located in the watershed were used to plan and install BMPs that significantly improved grazing/riparian areas within the watershed. Approximately 38,000 feet of

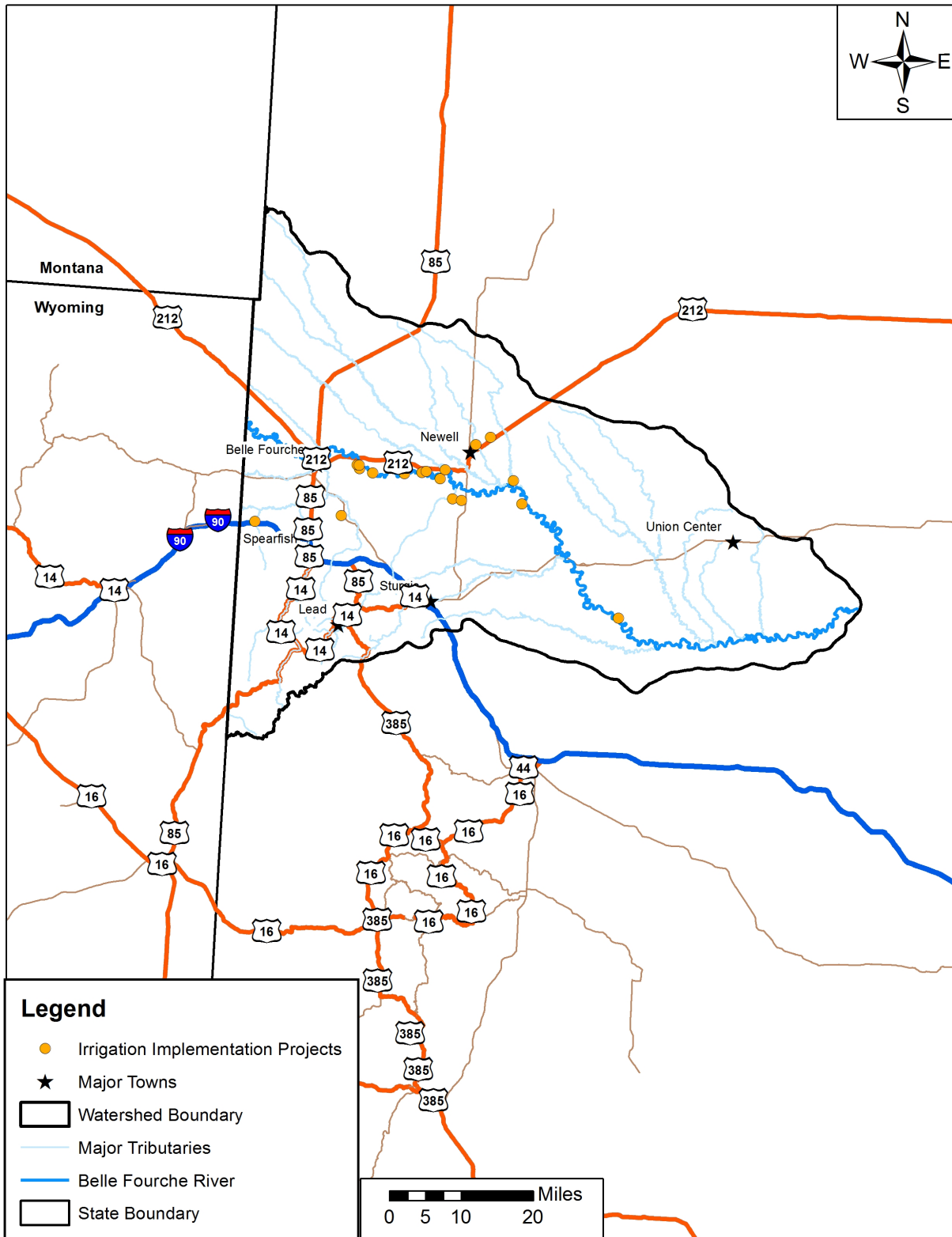


Figure 3-4. Location of Producer Irrigation Implementation Project in Segment 4.

pipeline, 19 watering facilities, and 30,000 feet of cross fence were installed using 319 dollars to provide off-stream livestock water and improve grazing distribution. Improved grazing distribution maintains or improves the integrity of the riparian corridor of the watershed. Healthy riparian areas are integral to trapping sediment from rangeland runoff, reducing TSS entering the Belle Fourche River. These projects involved five producers resulting in an estimated 3,000 acres of riparian vegetation improvements. Figure 3-6 shows the location of the riparian vegetation improvement projects funded with Segment 4 funds. In addition to practices installed, conservation plans and follow ups to those plans were written for over 174,000 acres of grazing lands in the watershed. This was done in cooperation with the South Dakota Grassland Coalition (SDGLC) and their 319 project titled Grassland Management and Planning Project Implementation Plan. The continued success of this partnership between the SDGLC and BFRWP has provided a solution to reduce TSS coming from range riparian sites as well as adjacent uplands. Figure 3-7 and 3-8 show a photo monitoring effort as part of range riparian BMP implementation project on a ranch in the watershed. Figure 3-7 was taken in 2008 before BMP implementation and Figure 3-8 was taken in 2010 after implementation. You can visually note an increase of over all stream bank stabilization. This was accomplished by developing off stream water, fencing, and improving livestock grazing practices that limit the time cattle spend on the creek.

RSI-1870-12-006



Figure 3-5. Lining of the Inlet Canal.

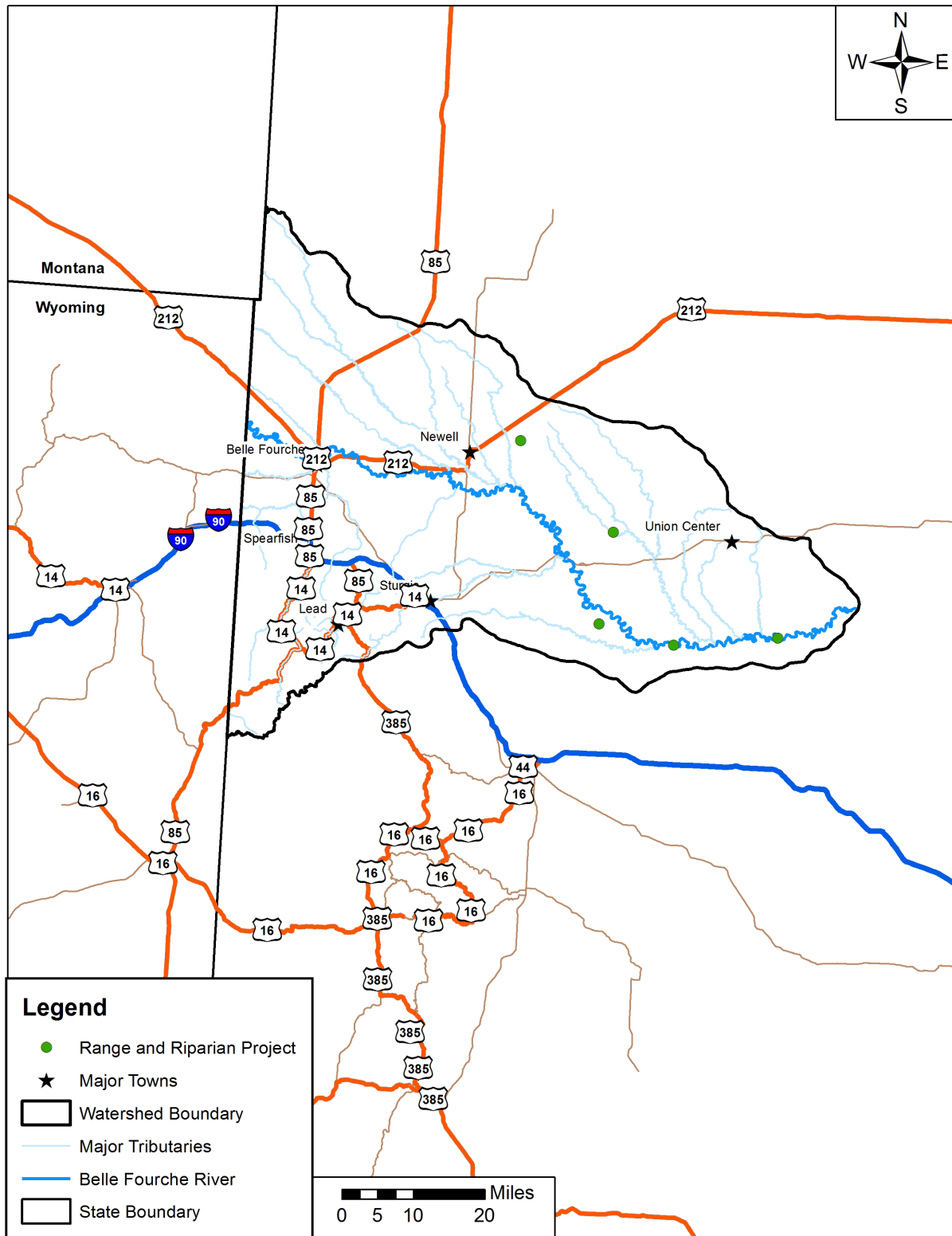


Figure 3-6. Location of Producer Range Implementation Projects in Segment 4.

RSI-1870-12-008



Figure 3-7. Photograph of a Monitoring Site Before Planned Grazing Best Management Practice Installation in 2008.

RSI-1870-12-009



Figure 3-8. Photograph Monitoring Site After Planned Grazing Best Management Practice Installation in 2010.

4.0 SUMMARY OF PUBLIC PARTICIPATION AND OUTREACH

Approximately 45 public education and outreach events were completed during this project segment. The outreach activities are shown in Table 4-1. Outreach activities were in the form of public meetings, informational booths, Web site, radio sound bites, watershed tours, range riparian workshops, and youth range camps. It is estimated that outreach and education efforts reached over 16,000 people. The Butte County, Lawrence County, and Elk Creek Conservation Districts each sent out newsletters which included project updates. The BFRWP hosted 10 meetings to provide updates on project work and progress being made. The BFRWP Web site, located at www.bellefourchewatershed.org, continues to be updated with events and project status. Sound bites were used on local radio stations provide overviews of BFRWP happenings and lead listeners to the website for additional information. The BFRWP used their soil quality demonstration trailer to educate audiences of all ages about the importance of good stewardship on soil health. Figure 4-1 shows a soil quality demonstration at one of the BFRWP's tours.

The BFRWP sponsored/cosponsored seven tours in the watershed during Segment 4. These tours included local producers; state and federal agency staff; local, state, and federal government officials; and the interested public. Partners in these tours included Butte, Lawrence, and Elk Creek Conservation Districts, South Dakota Association of Conservation Districts, South Dakota State University Cooperative Extension, South Dakota Society for Range Management, NRCS, and Bureau of Reclamation. These tours showcased projects sponsored by the BFRWP, including irrigation demonstrations in the BFID and rangeland demonstrations on ranches in the watershed. These outreach activities helped increase participation and support for the BFRWP and also gave the BFRWP several contacts for BMP installation.

The BFRWP conducted range riparian monitoring workshops educating producers about proper management and monitoring techniques. The BFRWP also sponsored range youth camps in the watershed educating high school age students about proper range management techniques. Figure 4-2 shows a range camp taking place near Sturgis in June 2010.

**Table 4-1. Summary of Public Outreach and Education During Segment 4
(Page 1 of 2)**

Type of Education and Outreach	Date	Number of Participants
Belle Fourche River Watershed Partnership Meetings (10 Meetings)	June 2009– May 2011	200
Riparian Management Training Workshop	2009	25
Butte/Lawrence County Fair Booth	2009, 2010	400
Legislative Watershed Tour	2009	35
SDACD Annual Meeting, Booth and Watershed Tour	2009	250
SRM Range Tour	2009	25
House and Senate Ag and Natural Resource Tour	2009	60
Grazing Lands Conservation Initiative Conference Poster Presentation	2009	150
Vale Ag Show	2010, 2011	300
Black Hills Stock Show Rainfall Simulator Demo	2010, 2011	60
Sturgis Key City Pen of 3	2010, 2011	600
Sturgis High Career Fair	2010, 2011	1,000
Two SDSU Small Acreage workshops Rainfall Simulator Demonstrations	2010	100
Cammack Ranch Supply Open House Booth and Rainfall Simulator	2010	300
Hydrology Conference Presentation	2010	200
Belle Fourche Tri State Expo Booth	2010, 2011	600
South Dakota High School Range Camp	2009, 2010	80
Rapid City Ag Appreciation Day Rainfall Simulator Demonstration	2010	500
Ag Lenders Range Camp Tour and Rainfall Simulator	2010	25

**Table 4-1. Summary of Public Outreach and Education During Segment 4
(Page 2 of 2)**

Type of Education and Outreach	Date	Number of Participants
American Indian and Native Alaskan NRCS Tour and Rainfall Simulator Demonstration	2010	85
NRCS Organic Producer Tour Rainfall Simulator Demo	2010	60
Elk Creek Conservation District Tour Rainfall Simulator Demonstration	2010	60
Range Monitoring Workshop	2010	40
Rainfall Simulator Demonstration, Mud Butte	2010	40
DENR Watershed Tour	2011	10
Informational Radio Sound Bites	2010, 2011	10,000
Website	2009–2011	1,500

RSI-1870-12-010



Figure 4-1. Soil Quality Demonstration During a Watershed Tour.

RSI-1870-12-011



Figure 4-2. Youth Range Camp Near Sturgis. The Belle Fourche River Watershed Partnership help sponsor this activity by providing cash and in-kind contributions.

5.0 MONITORING RESULTS

5.1 WHITEWOOD CREEK FECAL COLIFORM TMDL SUMMARIES

The Whitewood Creek fecal coliform and *E. coli* TMDL studies were completed as part of Segment 4. The summaries are attached in Appendix A.

5.2 WATER-QUALITY ANALYSIS

To gain insight as to the effectiveness of the current implementation plan, a rigorous statistical analysis was performed on multiple aspects of data that were collected at five WQM sites located within the South Dakota portion of the Belle Fourche River Watershed). Figure 5-1 shows the location of the five water-quality monitoring sites within the South Dakota portion of the Belle Fourche River Watershed. The data collected at the five WQM sites on the main stem of the Belle Fourche River consist of *E. coli* concentrations, fecal coliform concentrations, and TSS concentrations. The sites are listed in order from upstream to downstream. The data were grouped into two categories: Pre-BMP and post-BMP implementation. Pre-BMP implementation refers to data collected before the Year 2005, while post-BMP implementation refers to data collected after, and including the Year 2005.

Tables 5-1 through 5-3 display the basic summary statistics for *E. coli*, fecal coliform, and TSS data collected and analyzed for the five WQM sites. Let it be noted that for the *E. coli* data analyzed in Table 5-1, no record of data exists before the Year 2009. As no previous or pre- BMP data is available, no comparison for *E. coli* reduction can be made within this segment of the implementation plan and the summary provided will be used as a comparison for future BMP implementation progress. It should also be noted that BMP implementation to-date has focused on TSS reductions rather than bacteria, although many of the practices will have a positive impact on the loadings for both constituents.

The mean concentrations of fecal coliforms at all but one site dropped after significant BMP implementation began in 2005 (post-BMP). The largest percent reduction was observed at WQM 21 with a reduction of 87.5 percent. The smallest percent reduction was observed at WQM 76, showing that the site increased with a rather significant gain of over 300 percent. This very well may have been an error

in sampling or a heavy storm event, as it appears an outlier within the dataset exists. This value, occurring in July of 2009, ranges over three times larger than that of the next highest observed value.

RSI-1870-12-012

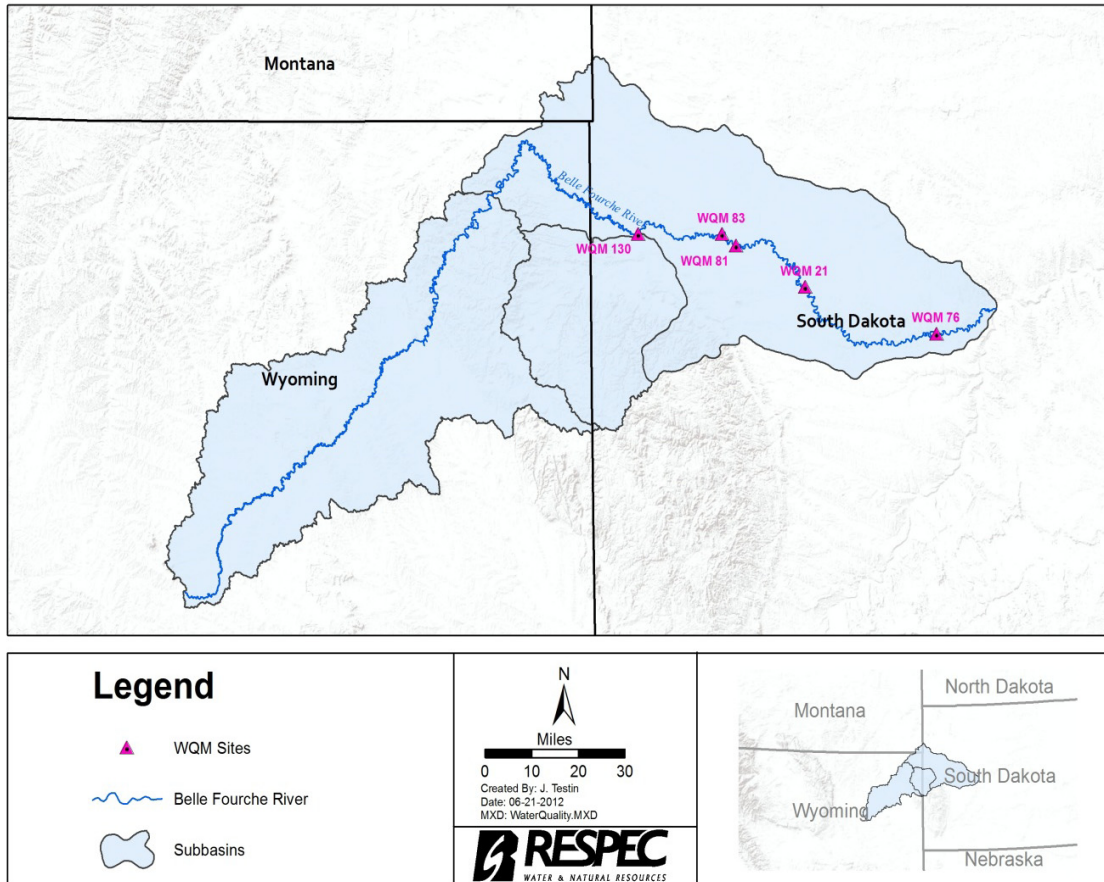


Figure 5-1. Location of the Five Water-Quality Monitoring Sites within the South Dakota Portion of the Belle Fourche River Watershed.

The mean concentrations of TSS at all but one site dropped after significant BMP implementation began in 2005 (post-BMP). As with the fecal coliform concentrations, WQM 76 was the only site to show an increase in mean values of TSS. This increase was observed to be 65.3 percent. The largest percent reduction was observed at WQM 21 with a reduction of 84.5 percent.

When analyzing the mean of a dataset, it should be noted that an unusually high value may skew the set of samples. This would result from an unusually high concentration observed within the data, such as was seen within the fecal coliform data for WQM 76 in July of 2009. This outlier within the data could easily have

Table 5-1. Summary *E. coli* Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River

Site	BMP Status	Mean (cfu/100 mL)	Standard Deviation	Q1	Median	Q3	Min	Max	n
WQM130	Post-BMP	301.9	757	45	96	164	17	3,020	15
WQM 81	Post-BMP	53.2	24.4	36.5	42.5	75	32	96	6
WQM 83	Post-BMP	42.3	23.5	24.3	35.5	62	19	83	6
WQM 21	Post-BMP	77.5	121.4	14.8	26.5	125.8	14	323	6
WQM 76	Post-BMP	1,514.2	2,861.4	16	42	2,910	4	9,678	15

Table 5-2. Summary Fecal Coliform Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River

Site	BMP Status	Mean (cfu/100 mL)	Standard Deviation	Q1	Median	Q3	Min	Max	n
WQM130	Pre-BMP	599.3	972.8	150	305	517.5	60	3,800	14
WQM130	Post-BMP	363.4	891.7	78	150	320	2	5,300	35
WQM 81	Pre-BMP	453.3	665.8	130	225	675	60	1,800	6
WQM 81	Post-BMP	128.2	78.2	67.5	110	160	60	310	11
WQM 83	Pre-BMP	297.9	680.6	24	70	160	2	3,315	31
WQM 83	Post-BMP	60.2	31.4	33	62	92.5	12	100	10
WQM 21	Pre-BMP	768	2473.4	10	40	307.5	0	24,000	170
WQM 21	Post-BMP	96	110.4	35.5	47	130	24	390	10
WQM 76	Pre-BMP	964	5,584.3	7.8	43.5	147.5	0	52,400	92
WQM 76	Post-BMP	4,265.9	22,246.6	45.5	79	220	2	130,000	34

Table 5-3. Summary Total Suspended Solids Statistics for Mainstream Water-Quality Monitoring Sites on the Belle Fourche River

Site	BMP Status	Mean (mg/L)	Standard Deviation	Q1	Median	Q3	Min	Max	n
WQM130	Pre-BMP	245.2	781.7	5	8	87	1	4,520	37
WQM130	Post-BMP	203.4	457.6	5	22	170	1	2,800	79
WQM 81	Pre-BMP	192.1	890.8	7	18	44	1	6,885	105
WQM 81	Post-BMP	80.3	143.5	5	22	63.5	1	640	30
WQM 83	Pre-BMP	77.6	154.6	9.8	34.5	68.8	1	885	104
WQM 83	Post-BMP	62	129.2	5.5	19	54	1	680	30
WQM 21	Pre-BMP	527.1	1,517.7	11	41.5	255.8	0	1,4977	198
WQM 21	Post-BMP	81.8	143.8	12	25.5	76.5	1	700	28
WQM 76	Pre-BMP	349.7	1,280.9	8.5	35	110	1	1,1000	135
WQM 76	Post-BMP	578.1	1,855.1	8	38	145	1	1,3000	85

thrown off the mean calculated and misconstrue the dataset; therefore, it is useful to analyze the population medians to see if a similar trend exists. This analysis was performed using a hypothesis test known as The Mann-Whitney test, which tests the equality of two population medians. The Mann-Whitney test provides a safeguard against drawing wrong conclusions from analysis from data that cannot be determined to be normally distributed.

Figures 5-2 and 5-3 display the median concentration values at each WQM site, pre- and post-BMP implementation for fecal coliform concentrations and TSS concentrations on The Belle Fourche River. Again, let it be noted that no record of *E. coli* concentrations exist before the Year 2009. Therefore any comparison for *E. coli* reduction cannot be made within this segment of the implementation plan.

To gain understanding of the statistical significance of any of the changes in median values, whether they are positive or negative, a Mann-Whitney Test was performed. Datasets were separated into two categories: pre-BMP (η_1) and post-BMP (η_2) at each of the sites. The Null hypothesis (H_0) is that the median concentrations at each of the sites pre-BMP implementation was equal to the median concentrations at each of the sites post-BMP implementation. The alternate hypothesis (H_1) is that the median concentrations at each of the sites pre-BMP implementation were not equal to the median concentrations at each of the sites post-BMP implementation. The Null and alternate hypothesis's are represented mathematically as follows:

$$\begin{aligned} H_0 : \eta_1 &= \eta_2 \\ H_1 : \eta_1 &\neq \eta_2. \end{aligned} \tag{5-1}$$

The results of the Mann-Whitney tests performed for the five WQM sites indicate that at the 95th percentile confidence interval a difference between the population medians do exist. Therefore, the WQM data obtained are sufficiently adequate for the analysis that was performed. Although there appears to be a difference between the population medians throughout the WQM sites, the lack of sampling either Pre- or post-BMP implementation, does not allow us to declare that this difference is statistically significant.

The overall goal for the Belle Fourche River Watershed is to have all waterbodies within the watershed come into compliance with water-quality standards as set forth by the Clean Water Act. The Belle Fourche River has been assigned the

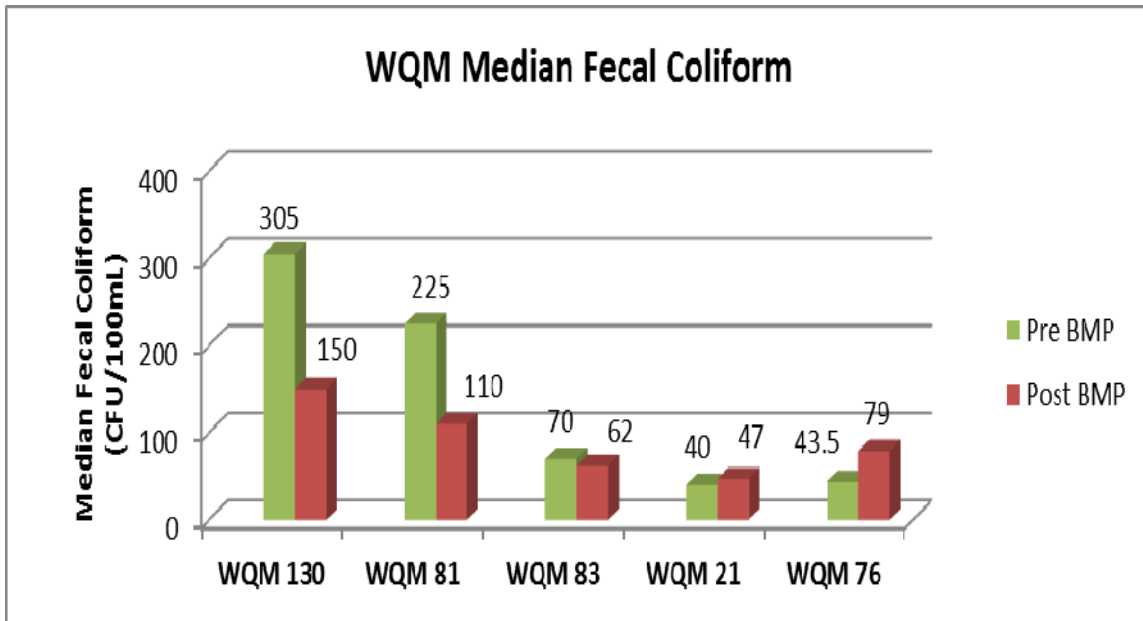


Figure 5-2. Median Fecal Coliform Concentrations Observed at Water-Quality Monitoring sites on the Belle Fourche River in South Dakota, Pre- and Post-BMP Implementation.

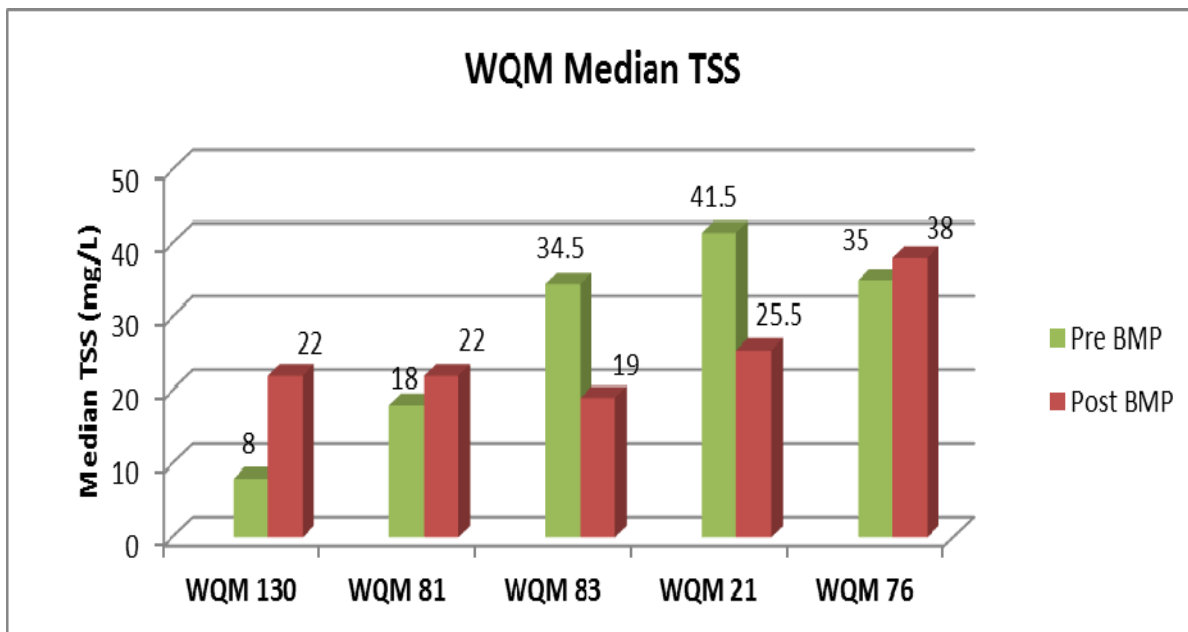


Figure 5-3. Median Total Suspended Solids Concentrations Observed at Water-Quality Monitoring sites on the Belle Fourche River in South Dakota, Pre- and Post-BMP Implementation.

following beneficial uses: Limited Contact Recreation Waters, Immersion Recreation Waters, and Warm-Water Fish Life Propagation. Under this segment of the implementation plan, the goal was to reduce the impairment parameters *E. coli*, fecal coliform, and TSS that are respectively, hindering the beneficial uses listed above.

The impairment parameter *E. coli* has an immersion recreation water-quality standard of 235 mpn/100 mL. Again, noting that no data exist before 2009, the percent exceedances for each site give a baseline comparison for data that were collected within this segment of the implementation plan. WQM 81 and WQM 83 show that no samples collected exceeded the water-quality standard within the monitoring period, and WQM 76 showed the highest percent exceedance at 26.7 percent.

The impairment parameter fecal coliform has an immersion recreation water-quality standard of 400 cfu/100 mL. Figure 5-4 displays the percent exceedances of the water-quality-standard for fecal coliform at each of the five WQM sites on the Belle Fourche River before and after BMP implementation. All but one of the sites show a decrease in percent exceedances for fecal coliform. WQM Sites 81, 83, and 21 show that no samples collected within the monitoring period exceed the water-quality standard. The highest percent exceedance was observed at WQM 76, which actually increased in percent exceedances from pre- to post-BMP, with 14.7 percent of the samples exceeding the water-quality standard.

The impairment parameter TSS has a warm-water fish life propagation water-quality standard of 158 mg/L. Figure 5-5 displays the percent exceedances of the water-quality standard for TSS at each of the five WQM sites on The Belle Fourche River before and after BMP implementation. All sites but one, WQM 21, show an increase in percent exceedances from pre- to post-BMP implementation. Of the post-BMP data, WQM 130 shows the highest percent exceedance at 25.3 percent with WQM 76 a close second, at 24.7 percent. This increase from pre-BMP to post-BMP could be caused by a number of factors. Heavy rainfall that occurred several times during this segment during times of sampling will undoubtedly elevate TSS concentrations.

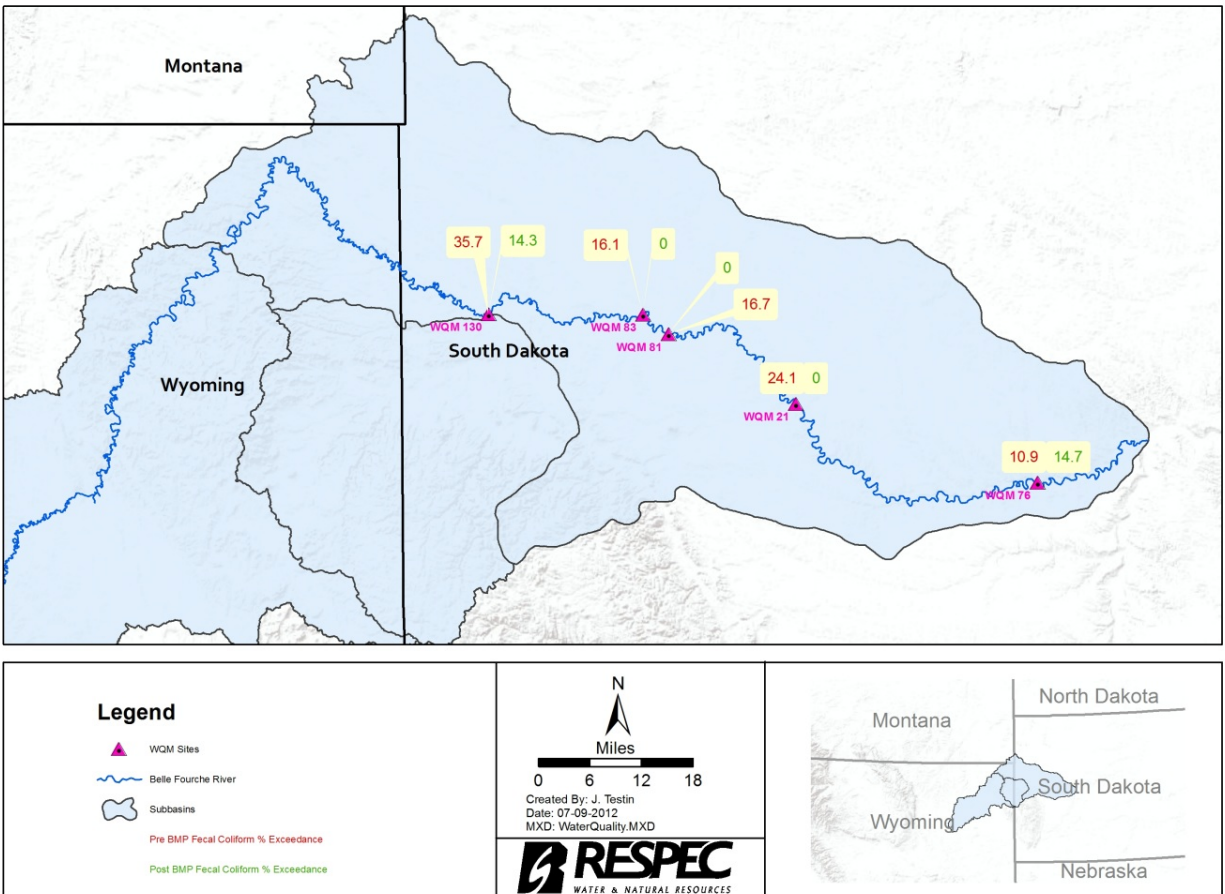


Figure 5-4. Percent Exceedances of the Fecal Coliform Water Quality Standard for Pre- (Red) and Post- (Green) BMP Implementation at Five Water-Quality Monitoring Sites on The Belle Fourche River.

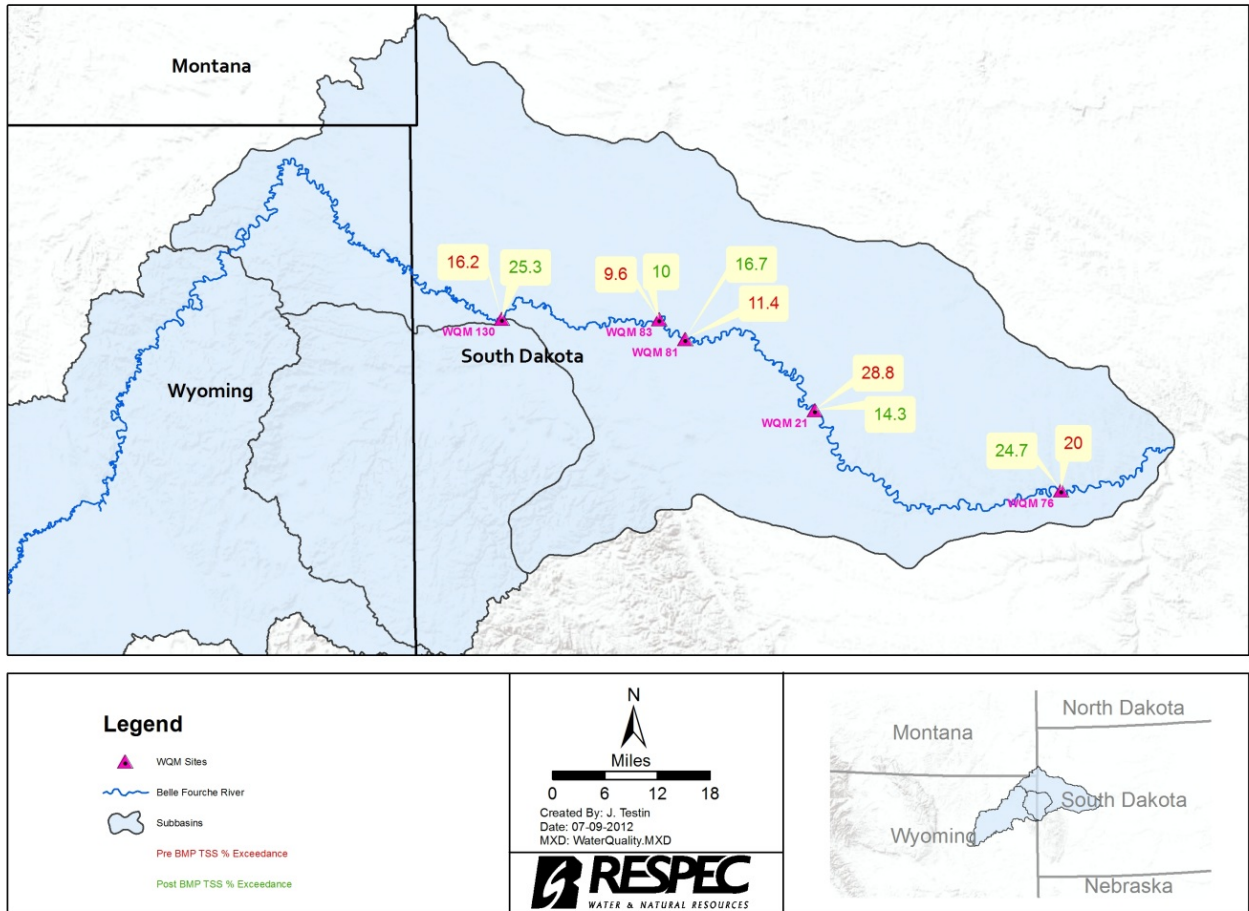


Figure 5-5. Percent Exceedances of the TSS Water Quality Standard for Pre- (Red) and Post- (Green) BMP Implementation at Five Water-Quality Monitoring Sites on The Belle Fourche River.

5.2.1 Horse Creek Flow Analysis

Real-time discharge data collected by the USGS at Horse Creek was analyzed over a period of record that spans from October of 1981 to October of 2011. Horse Creek is an irrigation dominated tributary, as it delivers overland return flows from fields within the BFID delivery system, back to the Belle Fourche River. BMPs implemented within the Belle Fourche Irrigation District delivery system, along with on-farm improvements, are designed to reduce the volume of sediment-laden return flows impacting Horse Creek and ultimately the Belle Fourche River. Figure 5-6 shows the relation of Horse Creek to the delivery system and fields located within the BFID.

RSI-1870-12-017

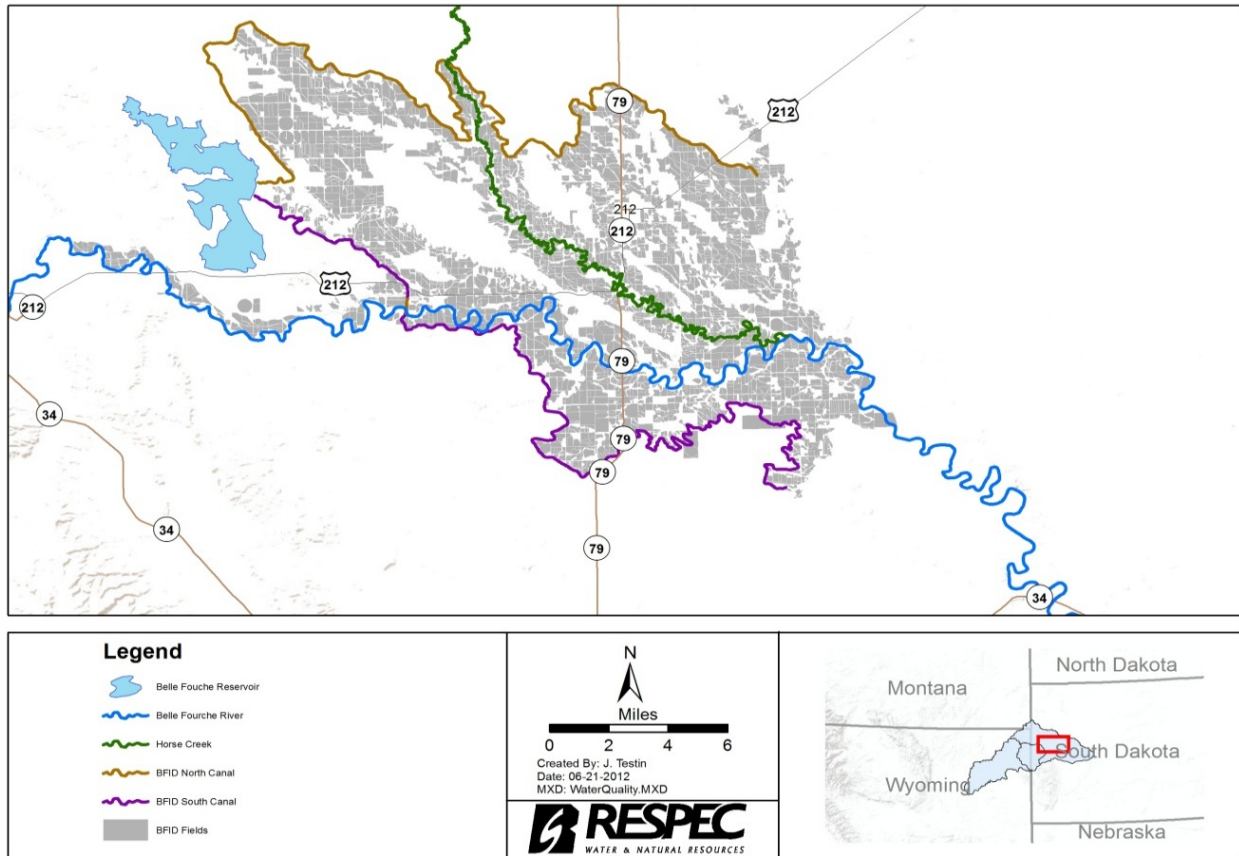


Figure 5-6. Location of Horse Creek in Relation to the Fields and Main Delivery System Within the Belle Fourche Irrigation District.

The influence that waste from the BFID delivery system and fields has on flows in Horse Creek is evident when observing a boxplot of historic monthly flows at the sight shown in Figure 5-7.. The boxplot shows 95 percent of the data (the highest and lowest 2.5 percent of values are considered outliers and therefore are eliminated). Median values of the average daily flow are labeled in blue, the boxes delineate the inner quartile range (the range bounded by the 1st and 3rd quartiles), and the whiskers mark the extents of 95 percent of the data. The typical irrigation season in the BFID begins in June and lasts until the end of September. This is demonstrated in the boxplot as the median flow jumps from 15 cfs in May to 32 cfs in June. The median flow increases to a maximum flow of 52 cfs in September and drastically drops over one order of magnitude lower in October reporting a median value of 4.2 cfs. Since the region receives very little precipitation during the irrigation season, nearly all of the increase in flow can be attributed to losses or waste within the irrigation system.

The BMPs are continuing to show that they are achieving their implementation goals. The BMPs used within the BFID to date include automated gate controls and flow monitoring, the replacement of open ditches with pipeline, the lining of open canals and laterals, the replacement of flood irrigation techniques with sprinkler irrigation, and a more efficient irrigation scheduling system. Along with the implementation of physical BMPs, BMPs in the form of public meetings and project tours have helped extend public outreach and awareness as well. Figure 5–8 displays a boxplot of the median flows during the irrigation season in Horse Creek pre- and post-BMP implementation. The plot shows that the flows are being reduced significantly, especially within July and August, which are typically months with the greatest demand and subsequent amount of irrigation deliveries.

5.3 EVALUATION OF GOAL ATTAINMENT

Project success was evaluated by comparing planned versus actual project outputs and outcomes. The goal was attained by reaching the objectives as follows:

- Implementation of several BMPs from the 10-year BFRWP Strategic Implementation Plan.
- Load reductions, estimated as a result of BMP installation, of 55,178 tons per year which is 11,144 tons/year greater than the goal for the project.

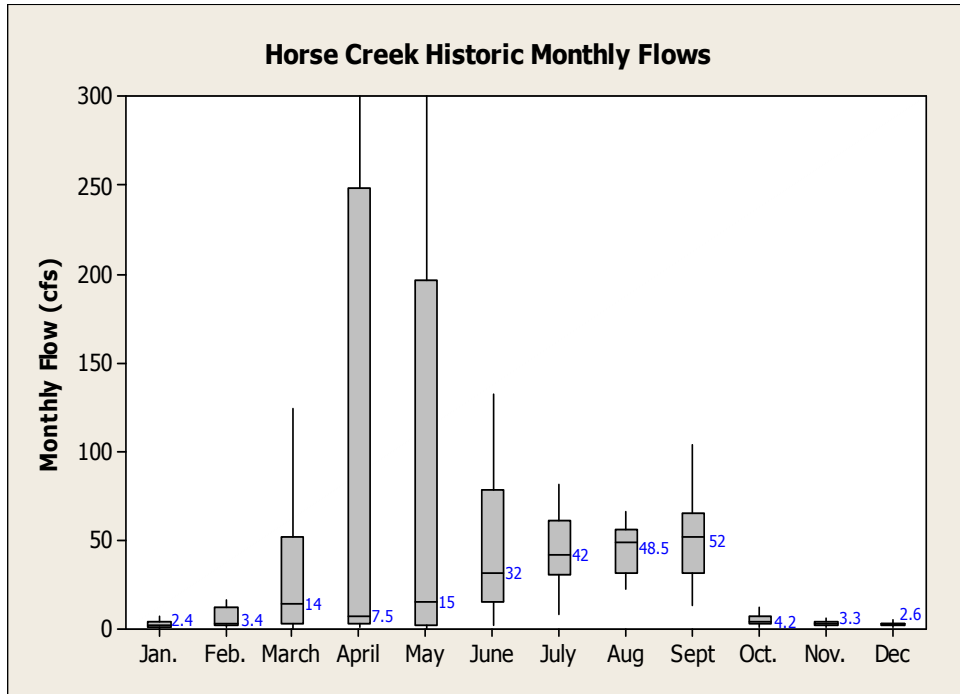


Figure 5-7. Box Plot of Historic Monthly Flows at the Mouth of Horse Creek.

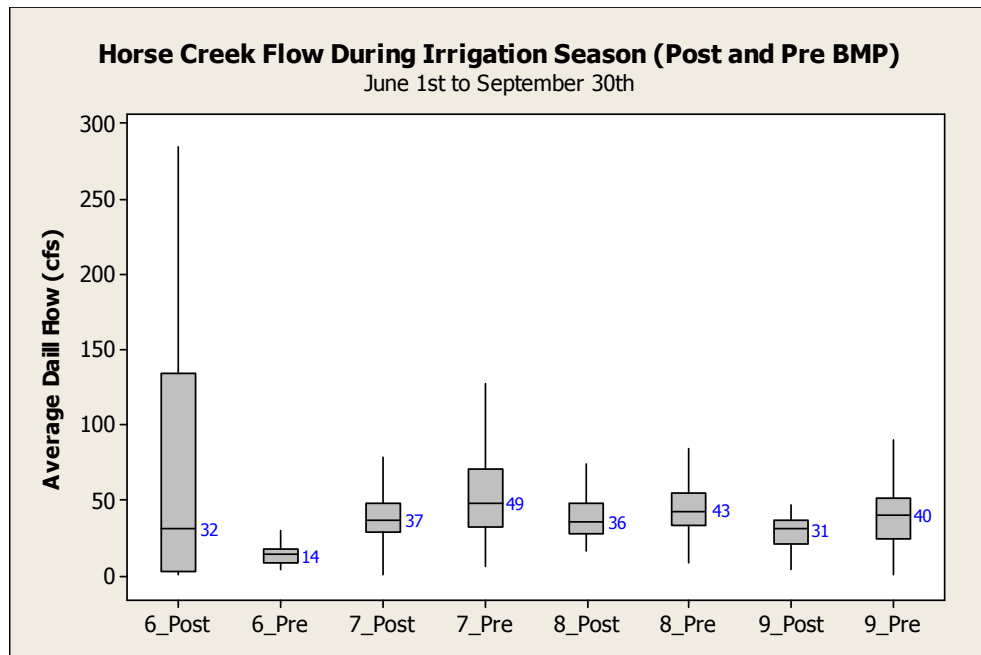


Figure 5-8. Box Plot of Average Daily Flows on Horse Creek during the Belle Fourche Irrigation District Irrigation Season; Before and After Best Management Practice Implementation.

- Completion of nearly 45 successful education and outreach activities which led to greater public participation in the project.
- Completion of midyear and annual Grant Reporting and Tracking System (GRTS) reports along with this final report.

This project was successful in that project goals were attained and BMPs were implemented that are estimated to reduce total suspended solids in the Belle Fourche River and Horse Creek.

6.0 SUCCESSES OF THE PROJECT AND ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

Continued public awareness of this ongoing project greatly enhances the effort being put into improved water quality in the watershed. Combined efforts of radio advertisements, brochures, outreach booths, tours, the BFRWP Website, and the soil quality demonstration trailer were measured as a success. Many comments and questions were received from the public mentioning they heard about the BFRWP from radio advertisements and sound bites. These activities increased interest and awareness from the general public in addition to the producers directly involved in an implementation project. Buy in from the general public is a huge asset when making watershed wide improvements in water quality.

The BFRWP had two ongoing U.S. Department of Agriculture (USDA) NRCS grants during the Segment 4 funding round that augment efforts being made to achieve project goals set out in the 10-year plan. The Conservation Innovation Grant (CIG) provided irrigators in the watershed with an on-line irrigation scheduling software program to assist with irrigation scheduling. The purpose of the project was to provide producers with a reliable, easy-to-use means to monitor and schedule irrigations that will conserve water and reduce the amount of sediment-laden irrigation return flows discharged into the adjacent Belle Fourche River. This was a 3-year project that created a tool that farmers in the watershed have used beyond the end of the project. 319 project funds have been used to provide continued technical support for farmers that have chosen to use the tool to reduce return flows from their fields.

The other USDA grant that was continued was the Cooperative Conservation Partnership Initiative Grant (CCPI). CCPI is part of NRCS' existing EQIP program that provides targeted funds for rangeland improvement practices in the watershed. These range improvement practices include off stream water development and cross fencing for better livestock distribution that in turn lead to sediment reduction in the Belle Fourche River. CCPI provided nearly \$1.4 million for these types of improvement projects during this segment. Currently, CCPI grant is in its fifth and final year of funding.

Some challenges that caused the project timeline to be extended were extremely wet weather and timing of EQIP funding. To get the most benefit out of the irrigation funds, the BFRWP typically “piggy backs” 319 funds on top of EQIP funds. EQIP funding announcements are made in March so when the 319 implementation grant is scheduled to be done by June 1, the deadline is often unrealistic. With the allowed extension from June 1, 2011, to December 31, 2011, all projects were able to be completed as planned.

7.0 PROJECT BUDGET/EXPENDITURES

The BFRWP received a \$1,296,150 EPA section 319 Grant through DENR to continue installation of the BMPs recommended in the *Phase I Watershed Assessment Final Report and TMDL* [Hoyer and Larson, 2004]. Tables 7-1a, 7-2a, and 7-3a show the budgets of 319, 319/matching funds and nonmatching funds respectively. The budgets were the final budgets after the approval of the Segment 4 amendment and the additional documented changes to the budget after the Segment 4 amendment. Tables 7-1b, 7-2b and 7-3b are the final expenditure budgets for 319, 319/matching funds and nonmatching funds, respectively.

7.1 319 BUDGET

The total 319 budget remained the same with some changes between tasks. From Task 1 Product 1b Install 18 Sprinkler Systems \$65,440 was transferred to other tasks, including Task 2 Product 2 Riparian BMPs \$37,440 to cover increased demand for riparian BMP implementation; Task 3 Product 3 \$19,000 to cover expensed incurred from federally mandated audit; and \$9,000 to Task 4 Product 4 to cover additional analysis requested by EPA for the Whitewood Creek Fecal Coliform TMDL Summary. No other changes were made to the 319 budget.

7.2 MATCHING FUNDS BUDGET

All federal match requirements were met in this project. Final match dollars were not as high as originally estimated. Match from Product 1a was under estimated largely because it was not known at the time of the proposal. Producer cash match for Product 1b was not as high as originally estimated; it was not known at the time of the proposal what the actual cost share to producer match would be. Match on Product 2 was under estimated largely because additional BMP funds were allocated to that product. Minor differences also occurred in Product 5.

7.3 NONMATCHING FEDERAL FUNDS BUDGET

Overall nonmatching funds were under estimated for project by approximately \$100,000. Federal dollars, including NRCS EQIP, can be variable from year to year depending on the demand making it a challenge to estimate actual numbers. Changes occurred in all areas of the nonmatching budget to reflect what was actually spent.

Table 7-1a. Planned Budget of 319 Funds

Project Description	Consultants (\$)	USGS (\$)	Producer (\$)	BFID (\$)	Butte Conservation District (\$)	BFRWP (\$)	Totals (\$)
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL							
Task 1. Reduce Nonused Water							
Product 1. Improved Irrigation Water Delivery and Application							
1a. Line and Pipe Open Canals and Laterals	-	-	-	-			-
1b. Install 18 Sprinkler Systems	-	-	605,000				605,000
1c. Install 3 Stage Control Automation Units				50,000			50,000
Task 2. Riparian Area BMP Implementation							
Product 2. Implement Riparian BMPs			50,000				50,000
Objective 2. Conduct Public Outreach and Education, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit							
Task 3. Project Management							
Product 3. Public Outreach, and Education Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit	487,650	-	-		20,000	20,000	527,650
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development							
Task 4. Whitewood Creek Fecal Coliform TMDL Summaries							
Product 4. Whitewood Creek Fecal Coliform TMDL Summary	13,500						13,500
Task 5. Water-Quality Monitoring to Assess BMPs							
Product 5. Compile Water-Quality Monitoring Data	15,375	34,625	-				50,000
Other Watershed Improvement Projects	-	-	-				-
Total	516,525	34,625	655,000	50,000	20,000	20,000	1,296,150

Table 7-1b. Actual Budget of 319 Funds

Project Description	Consultants (\$)	USGS (\$)	Producer (\$)	BFID (\$)	Butte Conservation District (\$)	BFRWP (\$)	Totals (\$)
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL							
Task 1. Reduce Nonused Water							
Product 1. Improved Irrigation Water Delivery and Application							
1a. Line and Pipe Open Canals and Laterals	-	-	-	-			-
1b. Install 18 Sprinkler Systems	-	-	539,560				539,560
1c. Install 3 Stage Control Automation Units				50,000			50,000
Task 2. Riparian Area BMP Implementation							
Product 2. Implement Riparian BMPs			87,440				87,440
Objective 2. Conduct Public Outreach and Education, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit							
Task 3. Project Management							
Product 3. Public Outreach, and Education Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit	487,727	-	-		26,000	32,923	546,650
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development							
Task 4. Whitewood Creek Fecal Coliform TMDL Summaries							
Product 4. Whitewood Creek Fecal Coliform TMDL Summary	22,500						22,500
Task 5. Water-Quality Monitoring to Assess BMPs							
Product 5. Compile Water-Quality Monitoring Data	15,375	34,625	-				50,000
Other Watershed Improvement Projects	-	-	-				-
Total	525,602	34,625	627,000	50,000	26,000	32,923	1,296,150

Table 7-2a. Planned U.S. Environmental Protection Agency 319 and Matching Funds Budget

EPA 319 and Matching Funds Budget	EPA 319 (\$)	Matching Funds (\$)				Sum of Matching Funds (\$)
		Producer (Cash and In-kind) (\$)	Lawrence County (Cash) (\$)	BFID (Cash and In-kind) (\$)	WY DEQ (Cash)	
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL						
Task 1. Reduce Nonused Water						
Product 1. Improved Irrigation Water Delivery and Application						
1a. Line and Pipe Open Canals and Laterals						
1b. Install 18 Sprinkler Systems	605,000	2,285,000				2,285,000
1c. Install 3 Stage Control Automation Units	50,000					
Task 2. Riparian Area BMP Implementation						
Product 2. Implement Riparian BMPs	50,000	17,000				17,000
Objective 2. Conduct Public Education and Outreach, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit						
Task 3. Project Management						
Product 3. Public Outreach and Education, Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit	527,650					
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development						
Task 4. Whitewood Creek Fecal Coliform TMDL Summary						
Product 4. Whitewood Creek Fecal Coliform TMDL Summary	13,500					
Task 5. Water-Quality Monitoring to Assess BMPs						
Product 5. Compile Water-Quality Monitoring Data	50,000		28,900	10,726	14,300	53,926
Other Water-Quality Improvements						
Total	1,296,150	2,302,000	28,900	10,726	14,300	2,355,926

Table 7-2b. Actual U.S. Environmental Protection Agency 319 and Matching Funds Budget

EPA 319 and Matching Funds Budget	EPA 319 (\$)	Matching Funds (\$)				Sum of Matching Funds (\$)
		Producer (Cash and In-kind) (\$)	Lawrence County (Cash) (\$)	BFID (Cash and In-kind) (\$)	WY DEQ (Cash)	
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL						
Task 1. Reduce Nonused Water						
Product 1. Improved Irrigation Water Delivery and Application						
1a. Line and Pipe Open Canals and Laterals						
1b. Install 18 Sprinkler Systems	539,560	1,384,944		172,042		1,556,986
1c. Install 3 Stage Control Automation Units	50,000					
Task 2. Riparian Area BMP Implementation						
Product 2. Implement Riparian BMPs	87,440	59,075				59,075
Objective 2. Conduct Public Education and Outreach, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit						
Task 3. Project Management						
Product 3. Public Outreach and Education, Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit	546,650					
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development						
Task 4. Whitewood Creek Fecal Coliform TMDL Summary						
Product 4. Whitewood Creek Fecal Coliform TMDL Summary	22,500					
Task 5. Water-Quality Monitoring to Assess BMPs						
Product 5. Compile Water-Quality Monitoring Data	50,000		14,900	10,500	14,000	39,400
Other Water-Quality Improvements						
Total	1,296,150	1,444,019	14,900	182,542	14,000	1,655,461

Table 7-3a. Planned Nonmatching Funds Budget

EPA 319 and Nonmatching Funds Budget	Nonmatching Funds						Sum of Nonmatching Funds (\$)
	SD DENR (Federal) (\$)	NRCS CIG Grant (Federal) (\$)	NRCS EQIP (Federal) (\$)	COE (Federal) (\$)	BOR (Federal) (\$)	USGS (Federal) (\$)	
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL							
Task 1. Reduce Nonused Water							
Product 1. Improved Irrigation Water Delivery and Application							
1a. Line and Pipe Open Canals and Laterals					300,000		300,000
1b. Install 18 Sprinkler Systems			412,500				412,500
1c. Install 3 Stage Control Automation Units							
Task 2. Riparian Area BMP Implementation							
Product 2. Implement Riparian BMPs							
Objective 2. Conduct Public Education and Outreach, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit							
Task 3. Project Management							
Product 3. Public Outreach and Education, Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit			1,400,000				1,400,000
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development							
Task 4. Whitewood Creek Fecal Coliform TMDL Summary							
Product 4. Whitewood Creek Fecal Coliform TMDL Summary							
Task 5. Water-Quality Monitoring to Assess BMPs							
Product 5. Compile Water-Quality Monitoring Data	71,500			14,300	7,148	169,852	262,800
Other Water-Quality Improvements		300,000					300,000
Total	71,500	300,000	1,812,500	14,300	307,148	169,852	2,675,300

Table 7-3b. Actual Nonmatching Funds Budget

EPA 319 and Nonmatching Funds Budget	Nonmatching Funds						Sum of Nonmatching Funds (\$)
	SD DENR (Federal) (\$)	NRCS CIG Grant (Federal) (\$)	NRCS EQIP (Federal) (\$)	COE (Federal) (\$)	BOR (Federal) (\$)	USGS (Federal) (\$)	
Objective 1. Implement BMPs Recommended in the Belle Fourche River Watershed TMDL							
Task 1. Reduce Nonused Water							
Product 1. Improved Irrigation Water Delivery and Application							
1a. Line and Pipe Open Canals and Laterals					205,295		205,295
1b. Install 18 Sprinkler Systems			805,945				805,945
1c. Install 3 Stage Control Automation Units							
Task 2. Riparian Area BMP Implementation							
Product 2. Implement Riparian BMPs							
Objective 2. Conduct Public Education and Outreach, Implementation Record Keeping, Report Writing, Writing Future Grants, and Federal Audit							
Task 3. Project Management							
Product 3. Public Outreach and Education, Implementation Record Keeping, Report and Future Grant Writing, and Federal Audit			1,319,036				1,319,036
Objective 3. Complete Essential Water-Quality Monitoring and TMDL Development							
Task 4. Whitewood Creek Fecal Coliform TMDL Summary							
Product 4. Whitewood Creek Fecal Coliform TMDL Summary							
Task 5. Water-Quality Monitoring to Assess BMPs							
Product 5. Compile Water-Quality Monitoring Data	70,000			14,000	7,000	173,400	264,400
Other Water-Quality Improvements		184,000					184,000
Total	71,500	184,000	2,124,981	14,000	212,295	173,400	2,778,676

8.0 FUTURE ACTIVITY RECOMMENDATIONS

During the next 3 years, additional project segments are planned to finish installing the BMPs outlined in the *Phase I Watershed Assessment Final Report and TMDL* [Hoyer and Larson, 2004] and the *Ten-Year Belle Fourche River Watershed Strategic Implementation Plan* [Hoyer, 2005]. This will ensure that the overall goal for the watershed is met, which is to bring the Belle Fourche River and Horse Creek into compliance with state TSS standards. As additional TMDLs are completed for other lakes and tributaries in the watershed, implementation of TMDLs developed should be added to the Belle Fourche River Watershed project.

9.0 REFERENCES

Hoyer, D. P. and A. Larson, 2004. *Phase I Watershed Assessment Final Report and TMDL*, prepared for the state of South Dakota, Pierre, SD.

Hoyer, D. P., 2005. *Ten-Year Belle Fourche River Watershed Strategic Implementation Plan*, RSI-1821, prepared by RESPEC, Rapid City, SD, for Belle Fourche Irrigation District, Newell, SD.

Rolland, C. and D. P. Hoyer, 2005. *Belle Fourche Irrigation District Water Conservation Plan*, RSI-1824, prepared by RESPEC, Rapid City, SD, for Belle Fourche Irrigation District, Newell, SD.

APPENDIX A

***E. COLI*/TOTAL MAXIMUM DAILY LOAD
FOR WHITEWOOD CREEK**

APPENDIX B

**FECAL COLIFORM TOTAL MAXIMUM DAILY LOAD
FOR WHITEWOOD CREEK**
