SECTION 319 NONPOINT POLLUTION CONTROL PROGRAM

WATERSHED PROJECT FINAL REPORT

LOWER BIG SIOUX RIVER WATERSHED IMPLEMENTATION PROJECT SEGMENT 1

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This project was completed in cooperation with the South Dakota Department of Environment and Natural Resources and the United States Environmental Protection Agency, Region 8.

Grant #9998185-08, 9998185-09

EXECUTIVE SUMMARY

PROJECT TITLE: Lower Big Sioux River Watershed Project (Segment 1)

PROJECT START DATE: 01 July, 2008

PROJECT COMPLETION DATE: 30 June, 2010

FUNDING:

Funding Sources	Original Budget	Expended
U.S. EPA Section 319 Grant	$167,250.00	$44,308.94
Cons. Comm.	$52,567.00	$0.00
SD GF&P	$13,750.00	$0.00
USDA	$1,875.00	$182.125.19
Local Cash and In-Kind Match	$80,558.00	$162,343.81
Totals:	**$316,000.00**	**$388,777.94**

The project goal was "Improve the water quality of the Lower Big Sioux River by implementing Total Maximum Daily Loads (TMDLs) developed for this section of the river".

To attain the goal the following actions were taken during this project segment:

- working with local citizens and organizations to develop a TMDL implementation strategy based on the watershed assessment and TMDL to guide future project segments
- initiating a public education and outreach campaign to inform landowners, stakeholders and area residents on water quality issues and BMPs important to the Lower Big Sioux River Basin Watershed and
- installation of BMPs targeted towards identified high priority sub-watersheds

This project was the first of several planned implementation segments designed to implement BMPs, and therefore, restore and protect the water quality of the Lower Big Sioux River. Since the TMDLs are currently being developed, Load reductions goals will be established when the TMDLs are finalized and listed in subsequent project proposals.

The project goal was established based on water quality information gathered during the Lower Big Sioux River Watershed Assessment project completed during 2002. Initial water quality data indicated high levels of fecal coliform bacteria and Total Suspended Solids (TSS) in both the Lower Big Sioux River and its tributaries which resulted in the placement of all five reaches of the Lower Big Sioux River on the 303d waterbody list as impaired during 2004. The first Project Implementation Plan (PIP) was developed during October 2007 to initiate a watershed project and gear up for installing BMPs designed to reduce fecal coliform bacteria and TSS loading into the River. The proposal was based on preliminary data from the assessment project

and the draft TMDL report for the Lower Big Sioux River which was later completed during January 2008.

During the 2002 watershed assessment, 572 livestock operations were located and analyzed using the Agricultural Non-Point Source (AGNPS) pollution feedlot model. Of the 572 operation assessed, 180 operations were rated at or above 50. Seventy -three of the 180 operations rated at or above 50 were located in Lincoln County and the remaining 107 were located in Union County. Prioritization of animal feeding operations with AGNPS ratings over 50 in all reaches of the watershed, through the use of mapping tools, was used as a starting point for Implementation.

A majority of work in the watershed during the first year of the project consisted of 387 producer contacts and meetings in order to educate and inform them about the project and opportunities for technical and financial support to install BMPs to improved water quality. Eighty producers with high priority feeding operations were visited multiple times during the project. Many of them were aware of water quality issues associated with the Lower Big Sioux River, but a majority did not know about the technical a financial assistance available to them. First contacts usually consisted of a general overview of the project and project goals followed by BMP discussions and producer planning. Additional meetings were conducted to identify specific issues associated with their operation and how they could be addressed.

A total of 4 feasibility studies, 5 cultural resource reviews, 2 waste storage facility designs and 1 constructed facility were completed during this segment of the project. CRP practices installed consisted of 84.4 acres of native grass seeding, filter strips, riparian buffers and 5,568 linear feet of grassed waterways. Nutrient management plans have been written for 2 hog confinement operations adopting conservation tillage on 1,382 acres of cropland in order to comply with NRCS 590 standards for erosion.

Since the watershed receives a large portion of its drainage from Iowa and Minnesota, load reductions will require the cooperative efforts of the three states in order to meet the TMDLs. Coordination of producer contacts, education, awareness and local organizations will be necessary to facilitate ongoing implementation projects in the Lower Big Sioux River Basin by all three states. This two year project was the first of several locally lead project segments planned to implement BMPs in the watershed. Copies of this final report will be made available to Minnesota and Iowa watershed districts as a tool to share ideas and watershed activities that have been successful.

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INTRODUCTION

Watershed Basin

The Big Sioux River, which originates north of Watertown, South Dakota, flows generally south for 420 miles to its confluence with the Missouri River near Sioux City, Iowa. A summary of the Big Sioux River Basin features is listed in Table 1.

The Lower Big Sioux River forms the boundary between South Dakota and Iowa near Brandon, SD to Sioux City, IA. The TMDL watershed project area is shown in Figure 1. Major tributaries to the Lower Big Sioux in the Iowa reach include the Rock River, drainage area 1,688 square miles, and Indian Creek with a drainage area of 63 square miles. Major tributaries to the Lower Big Sioux in the South Dakota portion of the reach include Brule Creek, Beaver Creek, Ninemile Creek, and Pattee Creek which have drainage areas of 214, 99, 44, and 41 square miles, respectively. The river meanders between Sioux Falls and Sioux City (linear distance 75 miles; river distance 125 miles). The meandering nature of the river creates a diversity of aquatic habitats. Agriculture, specifically row crops and livestock feeding operations with mostly open feedlots is the main land use in the watershed.

Table 1: Big Sioux River and its Basin Features.

Waterbody Name:	**Big Sioux River, seven and five impaired segments in IA and SD, respectively**
Hydrologic Unit Code:	Big Sioux River – 10170203; Rock River – 10170204
SD DENR Waterbody ID:	SD-BS-R-BIG_SIOUX_13-17
Location:	S33, T92N, R49W to S25, T100N, R49W
Water Quality Standards and Designated Uses:	See Table 2 and Table 3
Major Tributaries (Iowa):	Rock River, Indian Creek
Major Tributaries (South Dakota):	Beaver Creek, Brule Creek
Receiving Waterbody:	Missouri River
Stream Segment Length (Iowa):	125 miles
Stream Segment Length (South Dakota):	130 miles
Watershed Area:	
Total	9,570 square miles
Iowa	1,436 square miles
South Dakota	6,603 square miles
Minnesota	1,531 square miles

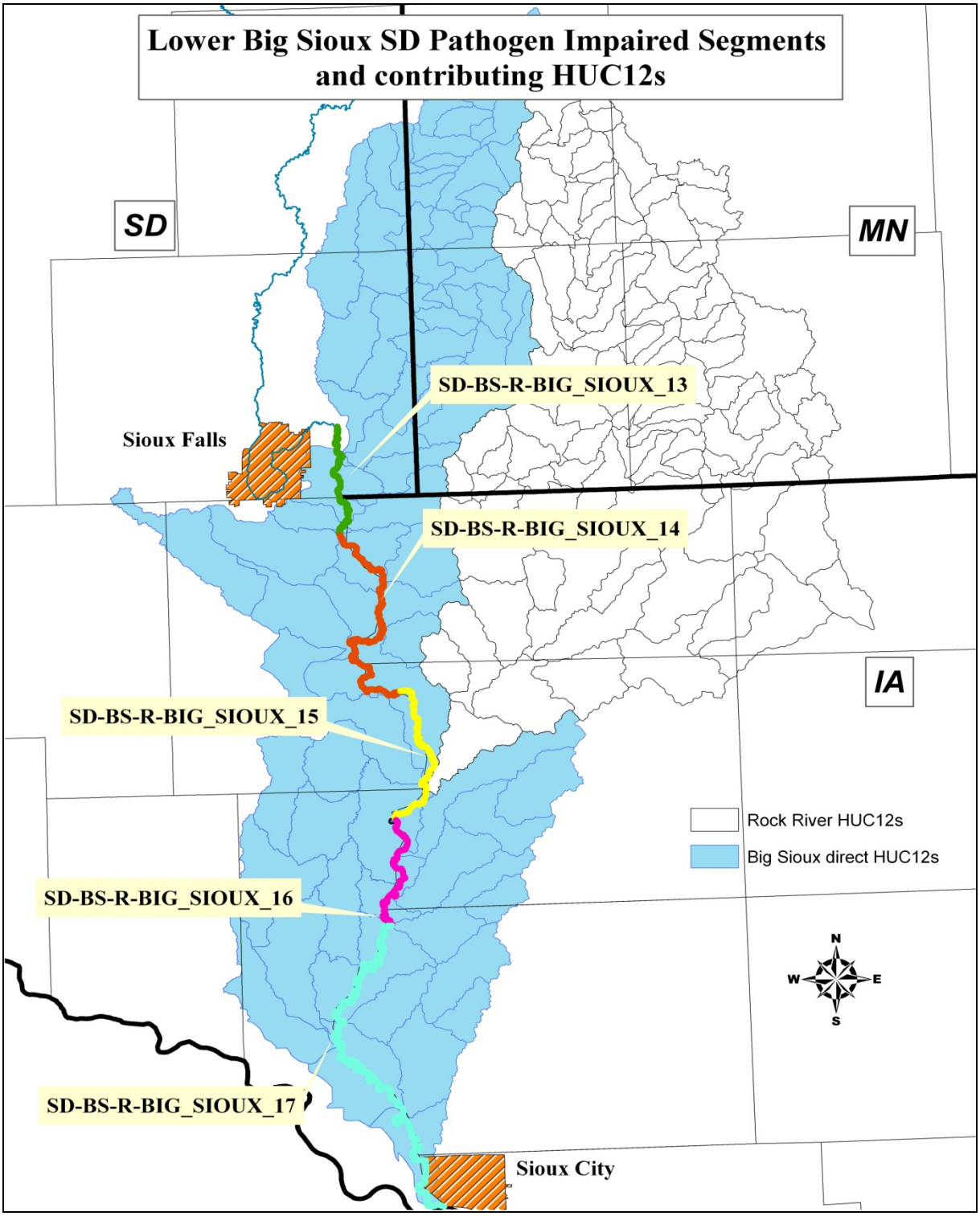

Figure 1: Lower Big Sioux River TMDL Watershed.

Water Body Description

The Lower Big Sioux River drains approximately 661,418 acres (1,033 miles^2) and 919,040 acres (1,436 miles^2) in South Dakota and Iowa, respectively. The watershed is located in the Northern Glaciated Plains and Western Corn Belt Plains ecoregions. The Northern Glaciated Plains ecoregion is characterized by a flat to gently rolling landscape composed of glacial drift. The Western Corn Belt Plains ecoregion is level to gently rolling glacial till plains with areas of moraine hills and loess deposits.

Wildlife that inhabit the area include whitetail deer, red fox, beavers, raccoons, ring-necked pheasants, mourning doves, and numerous other species of songbirds, waterfowl, reptiles and amphibians. The average rainfall is approximately 25 inches per year with 78 percent falling during the growing season. The average annual snowfall is approximately 34 inches but varies widely from year to year.

In South Dakota, the portion of the river that extends from the City of Brandon to the mouth of the river is divided into five impaired TMDL segments as shown in (Table 2). The beneficial uses and impairments for the 5 segments are shown in (Table 3).

Table 2: Beneficial Uses for Targeted Project Water bodies (5 TMDL Segments).

Lower Big Sioux River Segments and Listed Beneficial Use:	**Minnesota/Iowa Boarder to Beaver Creek (BSRTMDL-1)**	**Beaver Creek to the Rock River (BSRTMDL-2)**	**Rock River to Indian Creek (BSRTMDL-3)**	**Indian Creek to Brule Creek (BSRTMDL-4)**	**Brule Creek to Missouri River Confluence (BSRTMDL-5)**
(1) Domestic water supply	**X**	**X**	**X**	**X**	**X**
(5) Warm water semi permanent fish life propagation	**X**	**X**	**X**	**X**	**X**
(6) Warm water marginal fish life propagation waters	**X**	**X**	**X**	**X**	**X**
(7) Immersion recreation	**X**	**X**	**X**	**X**	**X**
(8) Limited contact recreation	**X**	**X**	**X**	**X**	**X**
(9) Fish & wildlife propagation, Recreation and stock watering	**X**	**X**	**X**	**X**	**X**
(10) Irrigation waters	**X**	**X**	**X**	**X**	**X**

Table 3: Water Quality Data and Impaired Beneficial Uses for Targeted Water Bodies.

Waterbody Segment	TMDL	303 (d) Listed	Impaired Beneficial Use and Cause*						
			1	5	6	7	8	9	10
BSRTMDL - 1	Public Comment	Yes	Full	Full	Full	Non (Fecal Coliform)	Full	Full	Full
BSRTMDL - 2	Public Comment	Yes	Full	Full	Full	Non (Fecal Coliform)	Full	Full	Full
BSRTMDL - 3	Public Comment	Yes	Full	Non (TSS)	Full	Non (Fecal Coliform)	Full	Full	Full
BSRTMDL - 4	Public Comment	Yes	Full	Non (TSS)	Full	Non (Fecal Coliform)	Non (Fecal Coliform)	Full	Full
BSRTMDL - 5	Public Comment	Yes	Full	Non (TSS)	Full	Non (Fecal Coliform)	Non (Fecal Coliform)	Full	Full

* Number corresponds to beneficial uses listed in Table 1
Source - Tables 4 & 5 Lower Big Sioux River Total Maximum Daily Load (TMDL) segments (1-5) *(Total Maximum Daily Loads For Pathogen Indicators Big Sioux River, Iowa and South Dakota 2007)*

BSRTMDL-1 is a 29.2 mile river segment which drains approximately 333,914 acres in South Dakota from the Minnesota/Iowa border to Beaver Creek near Canton. Load duration curves included in the draft TMDL report indicate bacteria targets are exceeded at mid to high flow conditions and contribute to the impairment of the Lower Big Sioux River Segment at the monitoring site. This segment retains full support for 6 of the 7 beneficial uses but does not support immersion recreation because of fecal coliform levels.

BSRTMDL-2 is a 25.3 mile river segment which drains approximately 47,203 acres of South Dakota from Beaver Creek to the Rock River. Bacterial targets are exceeded at mid to high flow conditions in the mainstem river and high and low flows in the tributaries. This segment has full support for 6 of the 7 beneficial uses, but does not support immersion recreation because of fecal coliform levels.

BSRTMDL-3 is a 21.4 mile river segment which drains approximately 37,136 acres of South Dakota from the Rock River to Indian Creek. Bacterial targets are exceeded at mid to high flow conditions. This segment is in full support for 5 of the 7 beneficial uses, but does not support immersion recreation and warm water semi permanent fish life propagation because of fecal coliform and total suspended solid levels.

BSRTMDL-4 is a 26.6 mile river segment which drains approximately 46,494 acres of South Dakota Indian Creek to Brule Creek. Bacterial targets are exceeded at mid to high flow conditions. This segment is in full support for 4 of the 7 listed beneficial uses, but does not support immersion recreation, limited contact recreation and warm water semi permanent fish life propagation because of fecal coliform and total suspended solid levels.

BSRTMDL-5 is a 34.7 mile river segment which drains approximately 196,669 acres of Union County from Brule Creek to the mouth at the Missouri River. Bacterial targets are exceeded at high flow conditions. This segment is in full support for 4 of the 7 listed beneficial uses, but does not support immersion recreation, limited contact recreation and warm water semi permanent fish life propagation because of to fecal coliform and total suspended solid levels.

Project Area

The Lower Big Sioux River Project area starts at the confluence of Beaver Creek in southeastern Minnehaha County and extends to the mouth at the Missouri River. The majority of the watershed is located in Lincoln and Union Counties with only a small portion in Minnehaha County. A large percentage of the project area is dominated by a rolling landscape with loess hills and intensive row crop farming and livestock operations. The southern edge of the project area drops down into the Missouri River Alluvial Floodplain and is dominated by mostly row crop agriculture with few livestock operations. The watershed project area encompasses 496,526 acres which is comprised of approximately 80% cropland, 15% pastureland and 5% residential and built up land (Figure 2).

There is a difference of 164,892 acres between the TMDL watershed and the implementation project watershed because of the shared monitoring site between the Central Big Sioux River Watershed Project and the Lower Big Sioux River Watershed Project. The overlapping watersheds that were included in the TMDL report were Slip-up Creek, Pipestone Creek, Split Rock Creek and Beaver Creek. Since the Central Big Sioux Watershed Project is addressing the overlapping land in its implementation project it was not included in the Lower Big Sioux River Assessment or Implementation Project.

The Lower Big Sioux River Implementation Project area is divided into five river segments from Brandon, SD to the Mouth near Sioux City, IA (Table 4). All five segments (R-13 through R-17) are impaired due to pathogen levels associated with storm events and high flow conditions.

Table 4: Lower Big Sioux River Implementation Project Reach and Segment Designations.

Segment	Length (Miles)	Description	Mainstem Sites	Tributary Sites (SD)
SD-BS-R-BIG_SIOUX_13	15.8	Above Brandon, SD to Nine Mile Creek (SD)	LBSM01	LBST02
SD-BS-R-BIG_SIOUX_14	33.2	Nine Mile Creek (SD) to near Fairview, SD	LBSM03, LBSM05, LBSM08	LBST04, LBST06, LBST07
SD-BS-R-BIG_SIOUX_15	20	Near Fairview, SD to near Alcester, SD	LBSM08, LBSM09, LBSM13	LBST10, LBST11
SD-BS-R-BIG_SIOUX_16	16.6	Near Alcester, SD to Indian Creek (IA)	LBSM13 LBSM17	LBST12
SD-BS-R-BIG_SIOUX_17	59.9	Indian Creek (IA) to mouth	LBSM17, LBSM19, LBSM20, LBSM21	LBST14, LBST15, LBST16, LBST18

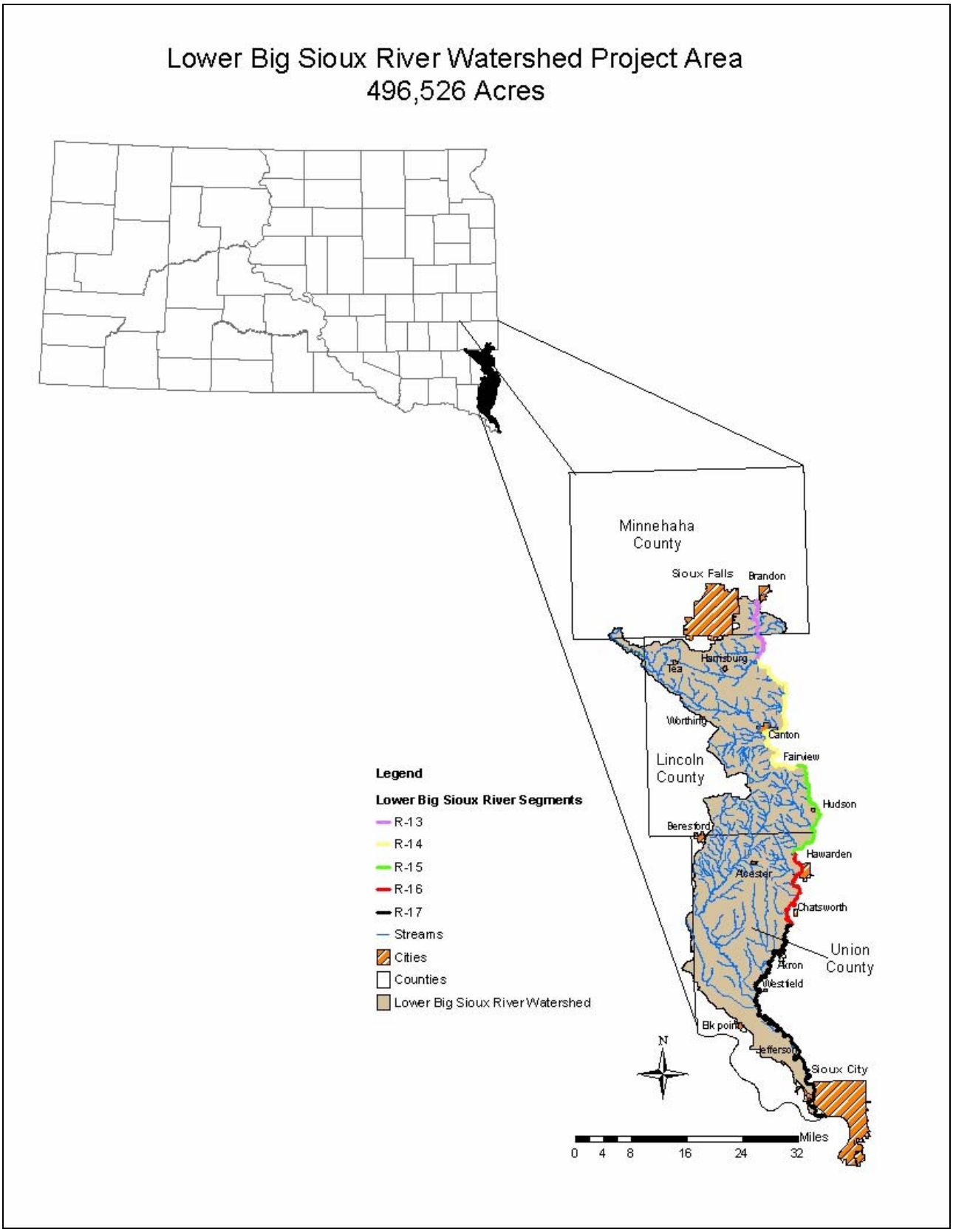

Figure 2: Lower Big Sioux River Project Area

Nonpoint Source Pollutants

Preliminary data from the draft TMDL showed fecal coliform bacteria and total suspended solids in high concentrations for all 5 segments of the Lower Big Sioux River mainstem. The levels increased downstream resulting in nonsupport of immersion recreation, limited contact recreation and warm water semi permanent fish life propagation. The most likely sources of the impairments were identified as runoff from:

- Confined animal feedlots
- Feeding areas in close proximity to drainages
- Grazing livestock standing in, crossing or heavily grazing riparian areas
- Improper application and handling of manure
- Intense row cropping practices

Information from the watershed assessment conducted in 2002 indicated 180 of the 572 feedlots assessed were rated at or above 50 with the Agricultural Non-Point Source Pollution (AGNPS) Feedlot Module. Project goals established were based on those feedlots with rankings > 50 in the watershed. Geographic Information System Arc-Map was used to further refine the list of operations to target those near or on the major tributaries in the watershed.

A project Implementation Proposal (PIP) was developed to plan and install BMPs designed to reduce loading into the Lower Big Sioux River. The list of BMPs included:

- Animal waste management system feasibility studies
- Animal waste management system designs
- Nutrient management plans
- Conservation Tillage
- Cropland BMPs
- Grazing Management
- Riparian Restoration

Cost-share funds for installing the practices were provided by the United States Environmental Protection Agency (U.S. EPA) Section 319 Nonpoint Source Pollution Control Grant, the United States Department of Agriculture (USDA) Continuous Conservation Reserve Program (CCRP) and the Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program (EQIP).

Watershed awareness was also accomplished by information and education (I&E) activities during the project. News articles, newsletters, posters, and public meetings were used to inform producers about the project and how it could help them with future BMP planning.

PROJECT GOALS, OBJECTIVES, TASKS AND ACTIVITIES

Objective 1: By June 30, 2009, develop a strategic plan to implement the TMDLs developed for water bodies in the Lower Big Sioux River Basin Watershed

Task 1: Develop a TMDL Implementation Project Plan for the Lower Big Sioux River Basin.

Product 1: Implementation plan for the Lower Big Sioux River Basin.

Provide technical assistance to the Lincoln Conservation District to involve local stakeholders in the development of the implementation plan for the Lower Big Sioux River Basin. A steering committee made up of local, state, and federal partners would manage the Lower Big Sioux River Basin Watershed Project. The steering committee, formed during the first project year, would oversee the development of the following:

- Strategic plan for future segments that includes, identifies, quantifies, and schedules needed BMP implementation to restore the Lower Big Sioux River to full support status of all its beneficial uses,
- Practice manual that will establish priorities for BMP implementation, and
- Work plan for the second project segment.

A memorandum of understanding that defines the responsibilities and obligations of each district in completing the project was entered into between the Conservation Districts and other partners. The project coordinator provided assistance to the Lincoln Conservation District to keep the local, regional, and state stakeholders in the project implementation plan informed and updated through personal contacts, and planning and steering committee meetings. The cost to complete the implementation plan was salary costs of project staff and stakeholders.

Milestones:	**Planned**	**Completed**
Steering committee/planning group meetings.	3	2
Watershed PIP Strategic plan	1	0
Practice Manual	1	0
Memoranda of Understanding	1	1
Project segment 2 work plans	2	2

Accomplishment: A steering committee/planning group was formed and consisted of nine individuals. There were two members selected from the Lincoln Conservation District, two members from Union Conservation District, two South Dakota DENR employees, two NRCS District Conservationists and the watershed coordinator. The first meeting was January 20, 2009 to discuss water quality issues with the Lower Big Sioux River and bring everyone up to speed with the project. The second meeting during July 2009 was set up to discuss how the project was being received by landowners and which areas of the watershed should be targeted as priority for BMPs based on the first fecal coliform TMDL.

A strategic plan was discussed in the second meeting, but additional TMDLs were still being established for the Lower Big Sioux River Mainstem and major tributaries. The strategic plan would have been limited to information from the first fecal coliform TMDL only, so the plan was not completed. Additional TMDLs slated for the Lower Big Sioux River Watershed were to include: TSS TMDLs for the Mainstem River, Brule Creek and Union Creek, and fecal coliform TMDLs for Brule and Union Creek as well. When all of the TMDLs have been finalized; target areas, load reductions and BMPs will be established with more certainty.

A formal agreement between the Lincoln Conservation District and Union Conservation District was signed with Lincoln Conservation District as the lead project sponsor. The agreement was made with the intent to cooperatively assist the project through working relationships they had already created with the producers in the watershed. A Memorandum of Understanding was also signed by the Lincoln Conservation District to define their responsibilities in the support and execution of the Lower Big Sioux River Watershed Project Segment 1.

A practice manual was not drafted during this segment of the project. Since the USDA's suite of conservation practices, installation guidelines, rules and specifications was so extensive and refined it has been adopted to serve as the manual.

During segment 1 of the Lower Big Sioux River Watershed Project a Project Implementation Proposal was completed and approved by the SD DENR for a segment 2 continuation of the watershed project. The Lower Big Sioux River Watershed Project segment 2 was scheduled to start at the completion of segment 1 on July 1, 2010. Additional BMPs scheduled for segment 2 included constructions of 4 waste storage facilities and a terrace restoration project to repair 20,000 linear feet of failing terraces.

Objective 2: Application of BMPs in critical areas to reduce sediment, nutrient and fecal coliform bacteria loading of the Lower Big Sioux River.

It was anticipated that as the watershed assessment report and TMDLs were completed for water bodies in the project area the suite of BMPs offered would change accordingly.

Task 2: Provide for the installation of cropland management BMPs.

Assistance to install BMPs on 2,500 acres of cropland was available to landowners/operators to reduce sediment and nutrient loads originating from identified critical areas. The BMPs installed included but were not limited to filter strips, grassed waterways, conservation tillage, grass seeding, terraces, and wetland restorations.

Product 2: Conservation tillage on 2,100 acres of cropland.

Technical assistance was provided to landowners/operators to encourage the adoption of conservation tillage (no-till, reduced-till, etc.) through educational outreach activities. Technical Assistance was provided by the Project Coordinator in partnership with NRCS, the SDSU Cooperative Extension Service, area conservation tillage farmers, and conservation district staff.

Milestones:	**Planned**	**Completed**
Conservation tillage	2,100 ac.	1,382 ac.

Accomplishment: Conservation tillage has been implemented on 1,382 acres of cropland by two producers in the watershed. Tillage operations were converted from conventional tillage and minimal tillage to minimal tillage and no-till and/or conservation crop rotation.

Product 3: Perennial vegetation on 350 acres of cropland.

Technical and financial assistance was provided to landowners/operators to plant erodible cropland to a grass/alfalfa, native, or a native and introduced grass and forbs seed mix. Funds for BMP installation was provided by state and federal wildlife conservation agency programs, state conservation programs, and USDA conservation programs (CCRP, EQIP, WHIP, etc.)

Milestones:	**Planned**	**Completed**
Grassland established on cropland	350 ac.	51.1 ac.

Accomplishment: Technical assistance was provided to two producers with CRP contracts for native grass establishment on cropland. One contract was for 39.9 acres of CRP general signup rare and declining habitat and the other contract was 11.2 acres of CRP Farmed Wetland Program (FWP).

Product 4: Twenty-five (25) acres of filter strips and 27,226 linear feet of grassed waterways on cropland.

BMPs installed were funded by the landowner/operator, USDA conservation programs (EQIP and CCRP) and by state conservation programs. The BMPs installed are listed below:

Milestones:	**Planned**	**Completed**
Filter Strips	25 ac.	13.9 ac.
Grassed Waterways	27,226 L.F.	5,568 L.F.

Accomplishment: Technical assistance planning and surveying was provided to three producers wanting to construct grass waterways. Two producers constructed new grass waterways totaling 5,568 linear feet. One producer decided that it would be more economical to continue farming the field he had signed up for a grass waterway rather than constructing a new one sized larger to handle the volume of water so the contract was cancelled. Pictures of a waterway project from impaired conditions to constructed and planted to grass can be seen in Figures 3 & 4.

Figure 3: Classic Gully Erosion Pre-Construction

Figure 4: Constructed Grass Waterway

Technical assistance was also provided to a producer who installed a 13.9 acre filter strip, approximately 3,420 linear feet, to buffer a perennial stream that ran through his cropland. Since the producer was unable to tile this particular piece of land, he thought it would be better if it was enrolled into a program where it would generate some income.

Task 3: Provide assistance to landowners to install BMPs on 1,500 acres of grassland

Grassland BMPs would be installed to reduce fecal coliform bacteria, nutrient, and sediment loading by reducing runoff, and improving stream banks and riparian area vegetation. The BMPs included but were not limited to: rotational grazing systems, riparian management, riparian buffers, riparian land use agreements, and stream bank/shoreline stabilization.

Product 5: One Thousand Acres of rotational grazing systems.

The implementation of rotational grazing systems on grasslands would require the installation of practices that support the landowners change in grazing management, and included: livestock water developments (pipelines, tanks, rural water hook-ups, wells, ponds, dugouts, etc.) and fencing. Technical assistance for grassland BMP installation would be requested from the SD Grassland Planning and Implementation Project, Cooperative Extension Service and NRCS Field Offices. Practices installed would be funded by the landowner with assistance from South Dakota and Federal conservation and wildlife programs (Game Fish and Parks, U.S. Fish and Wildlife Service Private Land Programs, etc.) and USDA conservation programs (CCRP, EQIP).

Milestones:	**Planned**	**Completed**
Rotational Razing Systems	1,000 ac.	0 ac.
Fencing	5,000 L.F.	0 L.F.
Pipelines	5,000 L.F.	0 L.F.
Tanks	3	0
Rural Water Hook-ups	1	0

Accomplishment: No rotational grazing systems were installed during this segment of the implementation project. One producer had started to plan for a rotational grazing system with cross fencing, dam and water tanks with pumps near the end of this segment of the project, and will completed during segment 2. The producer was planning to change his grazing system on approximately 300 acres of pasture along the Big Sioux River.

Product 6: BMPs on 500 acres of riparian grasslands.

Assistance was provided to install BMPs that reduce sediment and nutrient loadings to water bodies on riparian grasslands. The implementation of buffers in riparian areas would require the installation of practices that support the landowners change in grazing management, including: stream bank stabilization, tree and shrub planting, livestock water developments (pipelines, tanks, rural water hook-ups, wells, ponds, dugouts, etc.), stream crossing, livestock exclusion, and fencing.

Technical assistance for grassland BMP installation was requested from the SD Grassland Planning and Implementation Project, Cooperative Extension Service and NRCS Field Offices. Practices installed were funded by the landowner with assistance from state and federal

conservation and wildlife programs (Game Fish and Parks, U.S. Fish and Wildlife Service Private Land Programs and USDA conservation programs CCRP and EQIP).

Milestone: 16 acres of Riparian Buffer

Accomplishment: One Riparian Buffer was installed on 16 acres along Brule Creek. The landowner opted to exclude all livestock from the riparian area and surrounding pasture. It was decided in the planning stage of the project that the landowner wanted to return the pasture to a more natural condition. The land is immediately adjacent to Union Grove State Park and Brule Creek. Figures 5-8 show the progression from a heavily grazed riparian area to a non-grazed pasture with trees, shrubs, weed barrier fabric and native vegetation reestablishment.

Figure 5: Heavily Grazed Riparian Area

Figure 6: Riparian Buffer Site Preparation

Figure 7: Forested Riparian Buffer Installed

Figure 8: Trees and Weed Barrier Fabric

Task 4: Provide assistance to landowners to complete four (4) animal waste management system feasibility studies and designs to provide landowners information for implementing systems that meet their business needs and reduce fecal coliform and nutrient transfer to water bodies.

Product 7: AWMS feasibility studies, system designs, nutrient management plans and archeological/cultural resource searches.

Assistance was provided along with private consultants and/or the Animal Nutrient Management Team to complete feasibility studies, nutrient management plans and designs based on a priority evaluation and ranking by from the watershed assessment project information. Cultural resource investigations were conducted by the watershed coordinator and NRCS personnel for operations planning for animal waste management systems. Funding for cultural resource studies was available to landowners that would have needed additional archeological investigations to follow requirements of federal cost-share regulations. Since this project was set up as a transitional type project, basic BMPs such as feasibility reports and designing of waste storage facilities were implemented in an effort to bolster the number of implementation ready projects for the future segments.

Milestones: (Waste Storage Facilities)	**Planned**	**Completed**
Feasibility Studies	4	4
Designs	4	2
Cultural Resources Reviews	4	5
Constructed	0	2

Accomplishment: Four (4) feasibility studies, four (4) cultural resources inventories, two (2) nutrient management plans, and two (2) constructed facilities have been completed during this segment of the implementation project.

The producer that constructed a hog confinement facility to replace 2 existing open ended barns containing 1,000 finishing pigs was contacted through the project. The producer was given technical assistance starting from the final design process through the construction phase of the project. Since the project did not have 319 funds available for construction during the first segment, the producer was persuaded to apply for EQIP funding to help cost share the manure tank portion of the confinement barn.

The application and contract was completed by the NRCS with assistance from the watershed coordinator. A nutrient management plan and cultural resources survey was completed by the watershed coordinator to comply with the rules and regulations set forth by the EQIP program. The producer was granted $148,117.19 of EQIP funding to construct a 2,400 finishing hog confinement facility to replace the outdated structures that he had. The confinement barn was completed September 24, 2009 and ground monitoring wells were installed as well. The producer had signed an agreement with NRCS to fully abandon the outdated structures and reclaim the area where they were. The cost to construct the manure handling portion of the facility was $300,000.00 with $151,882.81 of local match. The project site and completed structure can be seen in Figures 9 & 10.

Figure 9: Initial Construction of the 2,400 Head Hog Finishing Unit

Figure 10: Completed 2,400 Head Hog Facility with Ground Water Monitoring Wells

The existing feedlot was given an AGNPS rating of 52 with no treatment of the runoff. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to calculate nitrogen and phosphorus leaving the site as well. It calculated a discharge of 1,055 pounds of nitrogen and 211 pounds of phosphorus per year. The feedlot information was re-entered into the AGNPS feedlot model, STEPL and the Feedlot and Grazing Tool (FLGR) for conditions after construction of the new confinement barn which resulted in an AGNPS rating of 0 with load reductions for nitrogen phosphorus and fecal coliform bacteria at 422 pounds, 95 pounds and 1.17E+12 colony forming units (CFU's) respectively per year.

One other producer had completed a design for a hog confinement facility with federal 319 funding through the project with plans to abandon two open ended units that were currently in use. Since his hog suppliers did not have enough hogs to fill his existing barns, the producer deferred his EQIP contract until a more favorable opportunity to continue with his plan.

During January of 2009, one producer had received a formal complaint from the SD DENR indicating an issue with runoff from his facility into a road ditch. The producer was contacted by the watershed coordinator in an effort to address the issue. A meeting was set up with the district conservationist and the producer to discuss possible solutions. Information gathered about the operation during the first meeting included: animal type, numbers, feedlot size, surface water drainage characteristics and manure handling. The information was entered into the Agricultural Non-Point Source (AGNPS) pollution feedlot model to assess the runoff potential of the operation and document reductions from future implementation activities. The feedlot was given a rating of 54 with no treatment of the runoff. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to calculate nitrogen and phosphorus leaving the site as well. It calculated a discharge of 2,110 pounds of nitrogen, 422 pounds of phosphorus.

Since the producer was near retirement age and the operation was small, he agreed to work with the watershed project to come up with a plan to reduce the runoff from the operation by alternative options. Additional meetings were made to provide technical assistance for implementing a Vegetative Treatment Area (VTA) in the feedlot where the runoff was occurring. The producer decided to install the VTA on his own because he did not want to enter into any contracts or become a permitted facility at the time. The producer was made aware of the pros and cons to that type of practice and the consequences of it failing.

A conservation plan was written to install a one strand hot wire to exclude cattle access from the treatment area. The .4 acre area was graded and seeded to a mix of wheat grass and brome. Since it was an unusually high precipitation year, the grading and seeding of the area became a difficult task. The producer finally finished seeding the area in time for summer and fall rains to continue flooding it. Most of the grass grew, but standing water set back growth on the east side of the vegetative area (Figures 11 & 12). The producer agreed to re-seed the area the following year when the weather allowed it in order to fully establish the vegetation again. The total cost of implementing the VTA was around $200.00 of in-kind work and materials.

Figure 11: Feedlot VTA Fenced and Seeded

Figure 12: Feedlot VTA Established with Ponding Water

The feedlot information was re-entered into the AGNPS feedlot model and STEPL for existing conditions after installation of the permanent grass vegetative treatment area which resulted in an AGNPS rating of 43 with a reduction in phosphorus of 359 pounds.

Objective 3: Provide BMP and project information to 800 watershed residents, landowners, and members of stakeholder organizations to inform them on project activities and BMP installation, and to maintain local support and involvement.

Task 5: Information Campaign.

Products 8: Information campaign

The Lincoln Conservation District and its project partners would produce three newsletters and two press releases, establish and maintain a project web site, and make two presentations that informed project area residents of the Lower Big Sioux River watershed. Activities were to be lead by the project coordinator and are listed below:

Milestones:	**Planned**	**Completed**
Web Site developed and maintained for two years	1	1
Newsletters	2	2
Project information presentations	2	2
News releases to local/area media	3	2

Accomplishment: The SDACD website had previously been developed to allow watershed residents with internet access to get online to see if they were in watershed project areas and personnel to contact for assistance with watershed programs. During segment 1 of the project, two newsletter articles were written and placed on the Conservation District newsletter that is circulated biannually. Two project information presentations were planned and advertised during the first segment. One presentation was given to the Brule Creek Watershed Board during January 2009. The second presentation was given to watershed residents in the Alcester auditorium. The Alcester Manure Management Meeting was advertised to the public through posters, radio spots on WNAX and an ad in the local newspaper.

Objective 4: Monitor, Evaluate and Report Project Progress:

Task 6: Complete activities required to monitor, evaluate and report project progress and success.

Reports describing project activities as required by the South Dakota DENR; and participating agencies and associations would be prepared and submitted.

Product 9: Semiannual, annual, monthly and final project reports:

Semiannual (2 each):

Since the project remained on schedule, semiannual reports were not required.

Annual (2 each in October 08 and 09):

The annual reports were submitted to DENR in a format that met the GRTS reporting requirements. The reports included information on:

- Estimated load reductions for BMPs installed using STEPL; and
- Pollutant reductions in respect to each TMDL river segment.

Monthly progress reports were submitted to the project sponsor and co-sponsors. These were submitted electronically or in written form by the Project Coordinator at sponsor meetings.

Final Report:

The final project report was drafted using a format provided by DENR and included a comparison of planned versus accomplished milestones and planned versus actual project budget, pictures of project activities, and maps showing the locations of completed BMPs, load reductions, and other information as may be required to fulfill reporting requirements.

Milestones: (Waste Storage Facilities)	**Planned**	**Completed**
Semiannual reports	2	0
Annual reports	2	2
Monthly reports	24	24
Final Report	1	1

Accomplishment: All reports have been completed and submitted for Segment 1 of the Lower Big Sioux River Watershed Implementation Project. Table 5 is a summary of all project milestones for segment 1.

Summary of Project Goals and Objectives

Table 5: Planned Versus Completed Project Milestones.

OBJECTIVES / TASKS/ PRODUCTS	PLANNED MILESTONES	COMPLETED MILESTONES
Objective 1 - Task 1		
Project Implementation Development (PIP)		
Watershed PIP and Segment 2 PIP	2	2
Steering committee meetings	3	2
Strategic Plan	1	0
Practice Manual	1	1
MOU	1	1
Objective 2 - Task 2		
Cropland BMPs		
Conservation Tillage	2,100 ac.	1,382 ac.
Grass Seeding	350 ac.	51 ac.
Filter-strips	25 ac.	13.9 ac.
Grass Waterways	27,226 L.F.	5,568 L.F.
Objective 2 - Task 3		
Riparian and Grassland BMPs		
Riparian Buffers	500 ac.	19.4 ac.
Rotational Grazing Systems	1,500 ac.	0
Fencing	10,000 L.F.	0
Pipelines	9,000 L.F.	0
Tanks	5	0
Rural Water Hookups	2	0
Objective 2 - Task 4		
Waste Storage Facilities	0	2
Feasibility Studies	4	4
Engineering Designs	4	2
Cultural Resources Reviews	4	5
Nutrient Management Plans	4	2
Objective 3 - Task 5		
Informational Outreach		
Website Maintenance	1	1
Newsletters	2	2
Presentations	2	2
News Releases	3	2
Objective 4 - Task 6		
Project Reports		
Monthly	24	24
Semi-annual	2	2
Annual	2	2
Final	1	1

MONITORING RESULTS

Stream water quality monitoring for the Lower Big Sioux River mainstem will continue through SD DENR's ambient water quality monitoring stations throughout the river basin especially for: Segment R15 - Site LBSM09 (WQM66) at Hudson, SD, Segment R16 - Site LBSM13 (WQM67) at Hawarden, IA, and Segment R17 – Site LBSM19 (WQM32) at Richland, SD. These stations are sampled on a monthly basis.

Evaluation tools were utilized to measure reductions of non-point sources of pollution for the various BMPs implemented. Pollutant loadings before and after implementation activities were documented for all project activities. Models such as AGNPS, RUSLE2, STEPL, BIT and Tracker were used to measure the effectiveness of the BMPs and capture load reductions in relation to location in the watershed. The product of these tools created a geo-database that could be used for this segment and future segments to gather a vast amount of information in order to quantify water quality improvement on a large watershed scale. When future TMDLs are completed for the rest of the major tributaries in the watershed, the geo-database could be used to target priority areas where BMP implementation has the greatest impact on water quality.

The Lower Big Sioux River Project segment 1 BMPs recorded in the Tracker system for cropland and grassland included: conservation tillage, CRP grass seeding, filter strips, grass waterways and riparian buffers. Load reductions for all BMPs installed are summarized in Table 6. Since the Tracker program allows the user to map the BMPs relative to their watershed location, load reductions have been summarized for each TMDL water body segment separately in Table 7.

One quarter of the watershed coordinator's salary was paid for by the statewide 303d water quality project. This not only allowed the project more flexibility for the suite of BMP's and funding available to producers, but expanded the project area to other watersheds needing assistance. The reductions and BMPs installed during segment 1 for the state 303d project were entered into a separate Tracker database. The 319 BMP locations were mapped along with the 303d BMP locations to show how the two projects complemented each other (Figure 13). Some of the 303d implementation projects were within the Lower Big Sioux River 319 project area, but most of them were located outside the watershed and throughout the state.

Table 6: Annual Load Reductions by BMP.

Best Management Practices	N (Pounds)	P (Pounds)	Sediment (Tons)	Fecal Coliform
Waste Storage Facility Construction	422	741	8	* 1.17E+12
Riparian Management	1,530	1,440	9	* 5.9E+13
Cropland Management	13,558	4,347	3,114	
Total Reductions	**15,510**	**6,528**	**3,131**	*** 6.02E+13**

*Fecal Coliform Bacteria amounts are expressed in colony forming units (CFU's)

Table 7: Annual Load Reductions by River Segment.

Lower Big Sioux River Segments	N (Pounds)	P (Pounds)	Sediment (Tons)	Fecal Coliform
(R-13) Brandon to Nine Mile Creek				
(R-14) Nine Mile Creek to Near Fairview				
(R-15) Fairview to Near Alcester	422	95	8	1.17E+12
(R-16) Alcester to Indian Creek				
(R-17) Indian Creek to Missouri River	15,088	6433	3,123	5.9E+13

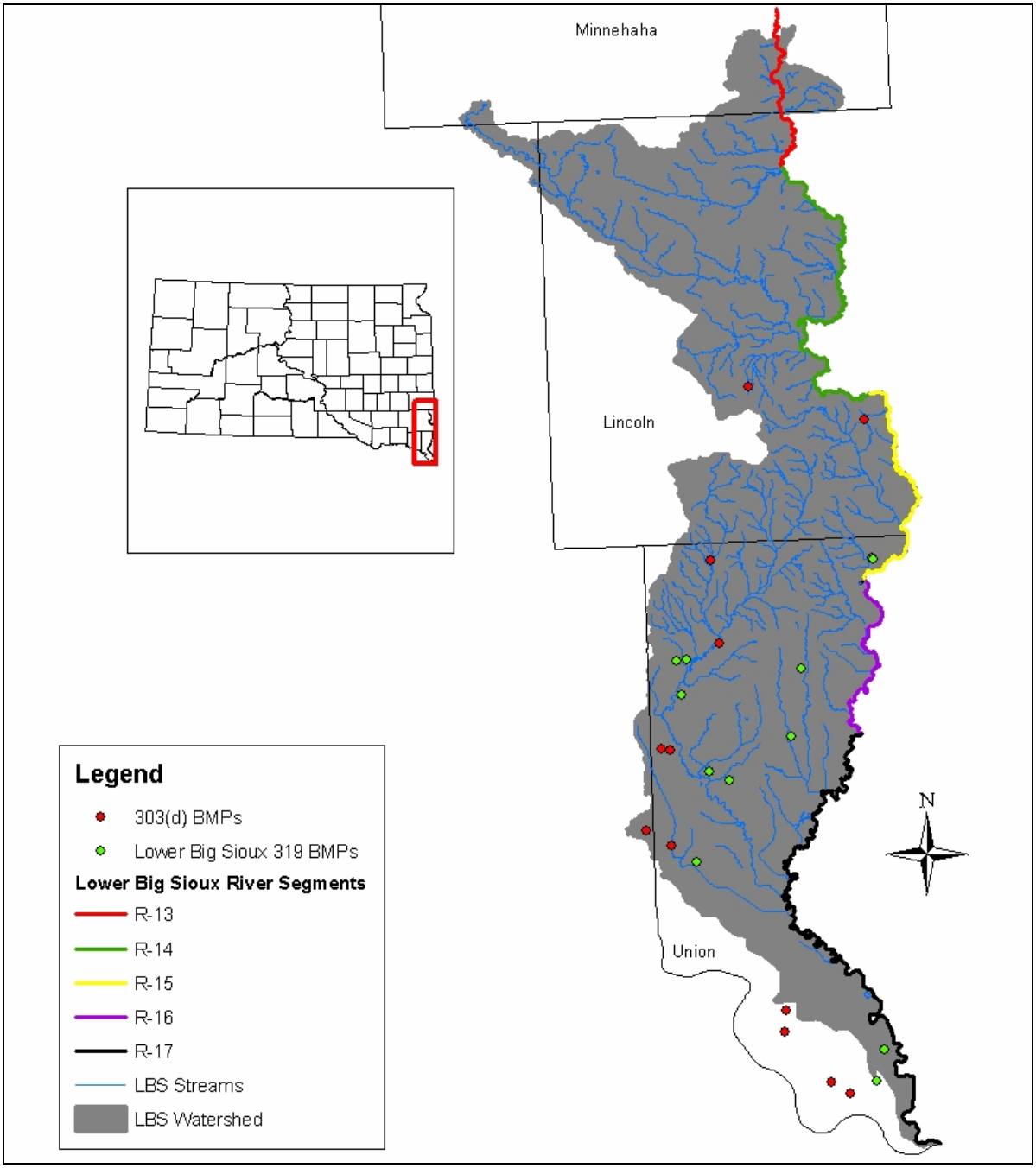

Figure 13: Location of 303d and 319 Project BMPs

COORDINATION EFFORTS

The Lincoln Conservation District was the lead sponsor of the Lower Big Sioux River Watershed Project. The district manager and board of directors provided input and direction for the project through monthly meetings and serving on the steering committee. Federal, state, local agencies and organizations contributed funds, technical services, cash and in kind match to accomplish goals of the project (Table 9). The agencies and their roles are summarized below.

Lincoln and Union Conservation Districts

The Lincoln Conservation District agreed to be the lead project sponsor and entered into a joint agreement with the Union Conservation District to co-sponsor the project. Both counties supported the project by appointing members to serve on the steering committee and allowing the project coordinator access to landowner information through their offices. The Lincoln Conservation District set aside time during each board meeting to approve project implementation activities and funds being spent. The office manager assisted the project coordinator with cost-share reimbursement, file maintenance and other financial transactions.

South Dakota Department of Environment and Natural Resources

The South Dakota Department of Environment and Natural Resources (SDDENR) administered the U.S. EPA Section 319 grant and provided oversight of all project activities. Project administration included on-site office visits, watershed tours, review of reports, approval of payment requests, and attendance of steering committee meetings. Training workshops and meetings were sponsored by the SDDENR to keep the watershed coordinator current with implementation activities and funding procedures. A project officer was appointed to the project to assist in managing funds, setting up and maintaining the Tracker system and reviewing all implementation activities and reporting.

United States Department of Agriculture – Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) provided technical assistance for the planning, design and installation of conservation practices. Personnel included: District Conservationists from Lincoln and Union County field offices; a Soil Conservation Technician from the Union County office; a Civil Engineering Technician from the Minnehaha County office; a Resource Conservation Development Coordinator from the Mitchell South Dakota Service Center. A workspace was rented from the NRCS and software licenses were paid for through the project. Access to the NRCS system enabled the watershed coordinator to generate conservation plans, contracts and maps for BMP implementation activities. Programs utilized, but not limited to, included the USDA's Environmental Quality Incentives Program (EQIP), and Conservation Reserve Program (CRP) administered through the Farm Service Agency (FSA).

South Dakota Association of Conservation Districts

The SDACD provided budgetary administration of salary funding for the watershed coordinator. One half of the coordinator salary administered for the project was generated from the statewide 303d watershed project and Farm Bill Implementation Technical Assistance fund. These funds were specifically used for projects either outside of the watershed or projects not listed in the Project Implementation Proposal in order to expand the suite of BMPs offered.

United Stated Environmental Protection Agency

The United States Environmental Protection Agency provided the Clean Water Act Section 319 Grant which was the primary funding source of the project. EPA officials from the Region 8 office in Denver, Colorado participated in one on-site tour and review of the project.

PUBLIC PARTICIPATION

The public was notified of opportunities to participate in the project through press releases, newsletters, meetings and other public events to inform and educate them about the project. Audiences were given a presentation of the project, its goals, and funding opportunities for Implementation activities in the watershed. A majority of the attendants were agricultural producers with a few in town property owners and sportsmen.

ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

The milestones for implementing 1,500 acres of Rotational Grazing Systems and 500 acres of Riparian Buffers were not met as planned. This may have been caused by the makeup of the Riparian Areas and acreage altogether. Since a large percentage of the land use is intensive row crop, the small riparian areas that exist are highly sought after for stock cow/calf operations. Due to the geographic nature of the watershed, those areas tend to be slender tracts of undeveloped pasture and are heavily utilized for that reason. Producer acceptance of buffering the riparian area was not well received. In many cases, buffering out the stream would essentially remove a majority of the grazing land available to the livestock. Implementing rotational grazing systems on the remaining portion of the pasture was perceived as extra time and work that would not be worth it for the small areas. There are still a fair percentage of larger tracts along riparian area that are used for grazing. Since Segment 1 of the watershed project was a transitional phase project, not all producers with pasture along riparian areas were contacted. Activity may pick up in future segments due to a natural lag time of adopting change.

One aspect of stock cow/calf management that has noticeably changed is the prevalence of grazing field residue rapidly increasing over last 5 years. This may prove that perseverance and continued efforts with implementing riparian buffers may eventually catch on.

PROJECT BUDGET

Table 8: Lower Big Sioux River Implementation Project Original Budget.

		Original Budget by Funding Source				
ITEM	**319 - EPA**	**Cons. Comm.**	**USDA**	**SD GF&P**	**Local**	**Total**
Personnel Support						
Project Coordinator: Project Coordinator and Benefits - (.5 FTE)	$64,182					$64,182
Travel: Vehicle Lease, Fuel, Oil, Service Repairs, Insurance	$9,704					$9,704
Office Supplies, Postage, Phone	$1,422					$1,422
Office Space	$2,226					$2,226
Contract Management: (Lincoln CD)	$1,484					$1,484
Project Management: (Sponsor and Advisory Board)					$2,164	$2,164
Contract Management (SDACD)	$9,270					$9,270
Computer Support: Lease, Maintainance, Software	$7,356					$7,356
Objective 1: PIP Development						
Task 1: -PIP Development: (Cost Covered in Personnel Support)						
Objective 2: BMP Implementation						
Task 2: Cropland BMPs (2500 acres)						
Product 2: Conservation Tillage - 2100 acres @ $0.00/ac.						
Prodcut 3: Seeding: Perennial Vegetation: 350ac.@ $100/ac.		$17,500		$8,750	$8,750	$35,000
Product 4: Filter Strips (25 ac.) and Grassed Waterways (27,226 LF.)						
Filter Strips - 25 ac. @ $100/ac.			$1,875		$625	$2,500
Grassed Waterways - (25ac.) 27,226 LF. @ $1.70/LF.		$23,142			$23,142	$46,284
Task 3: Grassland BMPs (1,500 acres)						
Product 5: Grassland Management (1000 acres)						
Rotational Grazing Systems: 1000 ac. @ $0.00						
Fencing: 5000 LF @ $1/LF						
Water Developments:						
Pipelines: 5000LF @ $2.50/LF				$2,500	$2,500	$5,000
Tanks: 3 each @ $1000 each		$3,750			$8,750	$12,500
Rural Water Hook-up: 1 each @ $1,550		$900			$2,100	$3,000
Product 6: Riparian Area Grassland Management (500 ac.)		$500			$1,050	$1,550
Rotational Grazing Systems: 500 ac. @ $0.00						
Fencing: 5000 LF @ $1/LF				$2,500	$2,500	$5,000
Water Developments:						
Pipelines: 4000LF @ $2.50/LF		$5,000			$5,000	$10,000
Tanks: 2 each @ $1000 each		$1,000			$1,000	$2,000
Rural Water Hook-up: 1 each @ $1,550		$775			$775	$1,550
Task 4: Animal Waste Management Systems (AWMS)						
Product 7: Feasibility Studies, Designs, Nutrient Plans, Resource Checks (4)						
Initial Feasibility and System Design 4 @ $19,702 each	$59,106				$19,702	$78,808
Nutrient Management Plans 4 @ $2,500 each	$7,500				$2,500	$10,000
Archeological/Cultural Resouces Search 4 @ $500 each	$2,000					$2,000
Animal Waste Management System Construction						
Objective 3: Informational Outreach						
Task 5: Information Campaign (800 watershed residents)						
Product 8: Newsletters, Press Releases, Web Site And Presentations	$2,000					$2,000
Web Site: With SDACD: Maintenance Costs	$1,000					$1,000
Newsletters: 2 mailings (1000 each @ $.50/piece)						
Presentations: 2 @ $200 each (Included in Personnel Costs)						
Press Release/Media Event: 3 @ $50 each (Included in Personnel Costs)						
Totals	$167,250	$52,567	$1,875	$13,750	$80,558	$316,000

PROJECT BUDGET

Table 9: Lower Big Sioux River Implementation Project Actual Budget.

	Actual Budget by Funding Source					
ITEM	**319 - EPA**	**Cons. Comm.**	**USDA**	**SD GF&P**	**Local**	**Total**
Personnel Support						
Project Coordinator: Project Coordinator and Benefits - (.5 FTE)	$24,832.85					$24,832.85
Travel: Vehicle Lease, Fuel, Oil, Service Repairs, Insurance	$6,672.61					$6,672.61
Office Supplies, Postage, Phone	$203.73					$203.73
Office Space	$562.50					$562.50
Contract Management: (Lincoln CD)						
Project Management: (Sponsor and Advisory Board)						
Contract Management (SDACD)	$3,456.25					$3,456.25
Computer Support: Lease, Maintainance, Software	$750.00					$750.00
Objective 1: PIP Development						
Task 1: -PIP Development: (Cost Covered in Personnel Support)						
Objective 2: BMP Implementation						
Task 2: Cropland BMPs (2500 acres)						
Product 2: Conservation Tillage - 2100 acres @ $0.00/ac.						
Prodcut 3: Seeding: Perennial Vegetation: 350ac.@ $100/ac.			$3,194.00		$3,113.00	$6,307.00
Product 4: Filter Strips (25 ac.) and Grassed Waterways (27,226 LF.)						
Filter Strips - 25 ac. @ $100/ac.			$105.00		$104.00	$209.00
Grassed Waterways - (25ac.) 27,226 LF. @ $1.70/LF.			$9,937.00		$925.00	$10,862.00
Task 3: Grassland BMPs (1,500 acres)						
Product 5: Grassland Management (1000 acres)						
Rotational Grazing Systems: 1000 ac. @ $0.00						
Fencing: 5000 LF @ $1/LF						
Water Developments:						
Pipelines: 5000LF @ $2.50/LF						
Tanks: 3 each @ $1000 each						
Rural Water Hook-up: 1 each @ $1,550						
Product 6: Riparian Area Grassland Management (500 ac.)						
Rotational Grazing Systems: 500 ac. @ $0.00			$20,772.00		$3,969.00	$24,741.00
Fencing: 5000 LF @ $1/LF						
Water Developments:						
Pipelines: 4000LF @ $2.50/LF						
Tanks: 2 each @ $1000 each						
Rural Water Hook-up: 1 each @ $1,550						
Task 4: Animal Waste Management Systems (AWMS)						
Product 7: Feasibility Studies, Designs, Nutrient Plans, Resource Checks (4)						
Initial Feasibility and System Design 4 @ $19,702 each	$7,831.00				$2,150.00	$9,981.00
Nutrient Management Plans 4 @ $2,500 each						
Archeological/Cultural Resouces Search 4 @ $500 each						
Animal Waste Management System Construction			$148,117.19		$152,082.81	$300,200.00
Objective 3: Informational Outreach						
Task 5: Information Campaign (800 watershed residents)						
Product 8: Newsletters, Press Releases, Web Site And Presentations						
Web Site: With SDACD: Maintenance Costs						
Newsletters: 2 mailings (1000 each @ $.50/piece)						
Presentations: 2 @ $200 each (Included in Personnel Costs)						
Press Release/Media Event: 3 @ $50 each (Included in Personnel Costs)						
Totals	**$44,308.94**	**$0.00**	**$182,125.19**	**$0.00**	**$162,343.81**	**$388,777.94**

FUTURE ACTIVITY RECOMMENDATIONS

Future segments of the Lower Big Sioux River Implementation Project should continue to work closely with the project sponsor and partners to address the resource concerns in high priority areas of the watershed. Personal contacts and public meetings should continue in order to inform and educate landowners of opportunities available as the project evolves. Project personnel should invest as much time as possible working with landowners to develop a shared interest in restoring the beneficial uses of the watershed. Project reports and progress should be shared with Iowa and Minnesota personnel that are also working on implementation activities in their portions of the Lower Big Sioux Watershed. Existing programs such as CRP and EQIP should continue to be used along with 319 dollars to accomplish the overall goals of the project.

Additional efforts to create awareness and interest for riparian grassland buffers and rotational grazing should be made. Creation of a database with producers that own land adjacent to streams in the watershed would be a valuable tool for contacting and mailing information about project opportunities. Mailings could serve as a way to measure producer interest on a large scale towards changing management of the riparian areas from traditional methods to newer systems with less impact. Levels of riparian program activity should be continually monitored throughout the project in order to aid in the development of new and fresh ideas to enhance riparian health.

During segment 1 a second TMDL was completed for Total Suspended Solids (TSS) for the Lower Big Sioux River. Findings of the study indicated that TSS increased with distance traveled downstream exceeding levels listed to support the beneficial uses of the last 3 river segments. BMPs that reduce sediment transport should be considered for this portion of the watershed. Additional monitoring of stream bank and gully erosion should be investigated in order to refine future segment implementation projects to target critical areas on and along the river. Pilot projects to inventory effects of tiling and riparian degradation due to pasturing should be taken into consideration as well.

Animal feeding operations should remain a high priority in regard to waste storage, handling and utilization. Nonpoint sources of runoff should be targeted for implementation activities along and near tributaries and the Lower Big Sioux River itself. Installation of BMPs in these sensitive areas will provide the largest benefit to enhancing and protecting water quality in the watershed.