South Dakota

Bad River
Section 319
National Monitoring Program Project

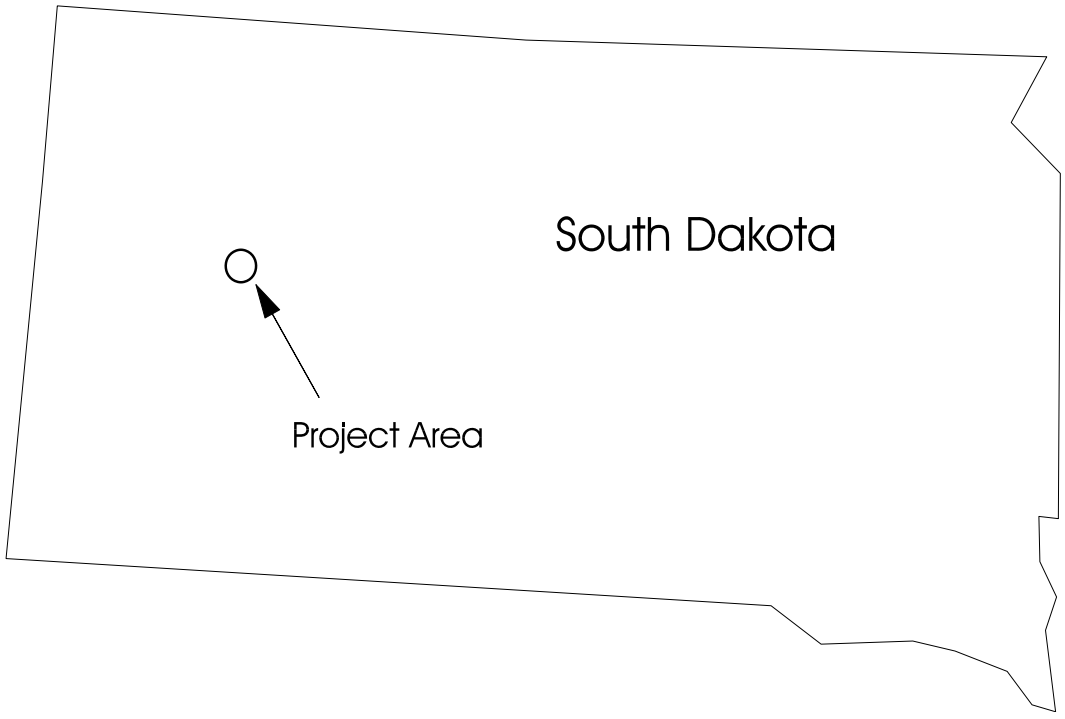
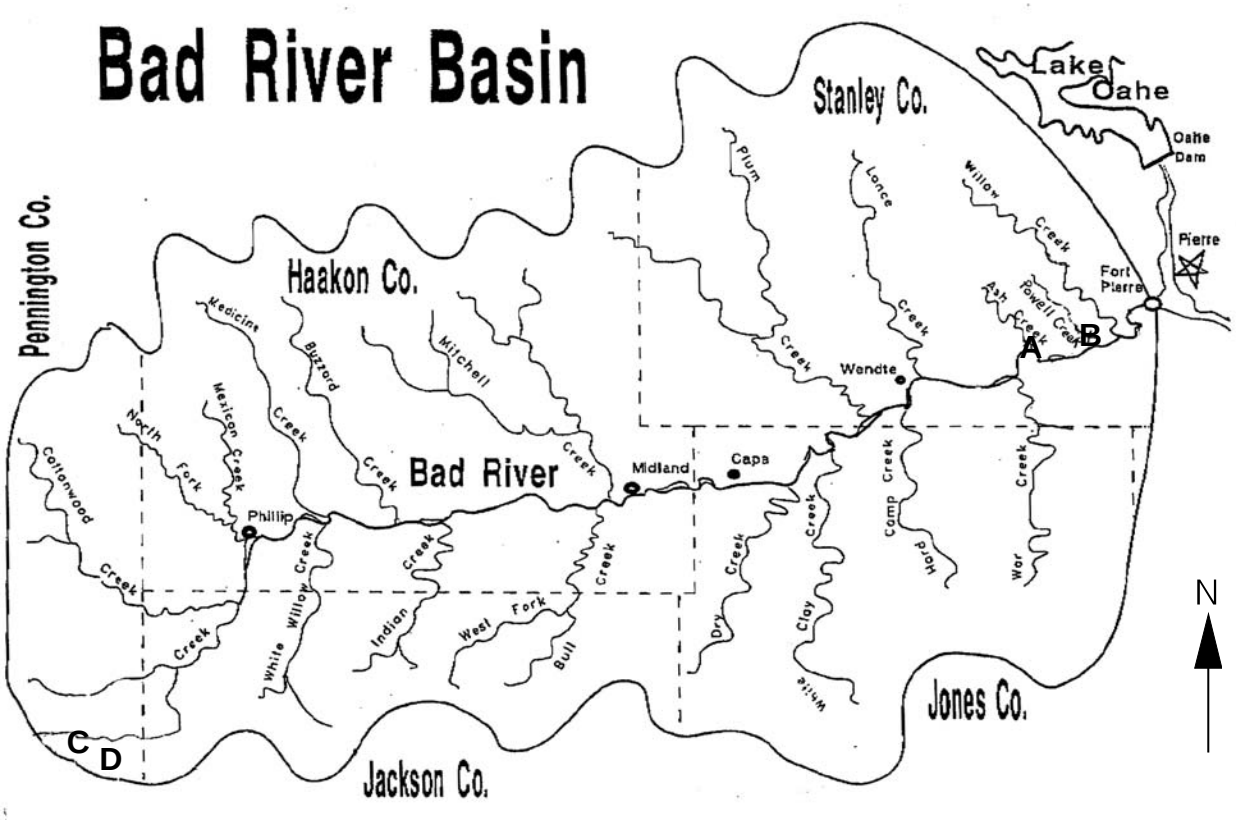


Figure 48: Bad River (South Dakota) Project Location



Legend

- Watershed Boundary
- County Boundary
- Cities and Towns
- **A** Ash Creek Monitoring Site (Control)
- **B** Powell Creek Monitoring Site (Treatment)
- **C** Whitewater North Monitoring Site (Treatment)
- **D** Whitewater South Monitoring Site (Control)

Figure 49: Water Quality Monitoring Stations for Bad River (South Dakota)

PROJECT OVERVIEW

The Bad River watershed, located in west central South Dakota (Figure 48), consists entirely of rolling prairie rangeland. Livestock grazing and dryland wheat farming are the main land uses of the watershed. The Bad River joins with the Missouri River at its mouth, near Ft. Pierre, South Dakota. Soil erosion, primarily from poor grazing management and poorly maintained riparian areas, is causing excessive sedimentation to the main channel of the Missouri River. This has impaired recreation due to loss of depth in the Missouri Channel. Loss of channel depth below the dam for the Oahe Reservoir on the Missouri River, located 10 miles upstream from the mouth of the Bad River, has impaired the hydropower generation of Oahe Dam during winter months. This, in turn, causes flooding in the cities of Pierre and Ft. Pierre.

The Bad River Section 319 National Monitoring Program project, by using a two-paired watershed design, will determine the effectiveness of best management practices (BMPs). The rangeland, cropland and riparian areas in the treatment watersheds (Powell Creek in the eastern part of the Bad River watershed and Whitewater North Creek in the western part of the watershed) will be treated with appropriate BMPs, such as fencing, rotational grazing, alternative feeding and watering stations, and vegetation plantings. All land uses will be monitored regularly and the information will be tracked by the use of a Geographic Information System (GIS) database.

Sampling for this project is complete, and analysis of the data is ongoing. A final report will be submitted in December of 2007.

PROJECT BACKGROUND

Project Area

The drainage area of the Bad River is located in west-central South Dakota (Figure 49) and covers 3,209 square miles of mostly rangeland. The rolling topography of fine textured, deep, shale-derived soils allows for significant soil erosion when rangeland and cropland is not properly managed. The project area supports an abundance of wildlife including mule deer, pronghorn antelope, porcupines, bobcats, prairie grouse, and numerous other species.

Relevant Hydrologic, Geologic, and Meteorologic Factors

This area of South Dakota receives, on average, 15-16 inches of rainfall per year. Most of the precipitation is derived from thunderstorm events during the spring and summer, although snowmelt produces significant runoff. On average there are four storms in the year that produce enough rainfall that runoff occurs in the tributaries. Runoff usually lasts for four to five days per storm event.

Land Use

The land use in the watershed is primarily agricultural and consists of 75% rangeland and 25% dryland wheat farming. A large portion of the upper end of the Bad River watershed is owned by the U.S. Forest Service. Rotational grazing practices have been implemented on the federal rangeland and also on many private ranches.

Water Resource Type and Size

The Bad River watershed encompasses 3,209 square miles of western rangeland. The small streams that feed the main channel are ephemeral as are the upper reaches of the Bad River itself. The Bad River enters the Missouri in the town of Ft. Pierre in Stanley County, South Dakota.

Water Uses and Impairments

The official beneficial uses of the Bad River include the following:

- Warmwater marginal fish life propagation waters
- Limited contact recreation waters
- Wildlife propagation and stock watering waters
- Irrigation waters

The main impairment to the Bad River is excess sediment from eroded soils in poorly managed rangeland and riparian areas. The load of sediment from the Bad River creates a problem in the Missouri near the mouth of the Bad River. Loss of channel capacity and water clarity impacts on sport fishing are problems on the Missouri in the Pierre area due to the Bad River sediment.

Pollutant Sources

Soil erosion, primarily from rangeland and riparian areas, is the primary source of the stream sediment.

Pre-Project Water Quality

There is no existing water quality data from the paired watersheds of the Bad River National Monitoring Project.

Water Quality Objectives

The main objective of the project was to document water quality improvements in the treatment subwatersheds due to the implementation of BMPs.

Project Time Frame

1996-2006

PROJECT DESIGN

Nonpoint Source Control Strategy

A two-paired watershed design was implemented for this project, with one pair located in the eastern part of the Bad River watershed (A and B — Figure 47), and the other pair in the western part (C and D — Figure 47), at a higher elevation than the east. The nonpoint source pollution control strategies vary for the different subwatershed that are being treated.

Powell Creek, located in the eastern part of the watershed and comprised of 11,221 acres, was to be the lower treatment subwatershed, while Ash Creek, with 13,702 acres, was to be the lower control. Best management practices that were expected for the Powell Creek subwatershed included riparian management (cross-fencing, dam construction, and alternative feed and watering sites) and rangeland management (rotational grazing). Due to changes in ownership and the farm program, the analysis of Ash and Powell may require some changes. Both watersheds have received a great deal of conservation work on them resulting in two treatments and no controls. Comparisons of the two will be made on a before and after basis for the conservation practices.

In the western part of the watershed, Whitewater North Creek (6,780 acres) served as the higher treatment subwatershed while Whitewater South Creek (6,605 acres) will be the higher control. In 2000, BMPs were implemented in the Whitewater North Creek Implementation Project. This $64,570 project implemented sediment traps, and exclusion area, drop and check structures, timber and rock barbs, and managed grazing.

Project Schedule

Site	Pre-BMP Monitoring	BMP Installation	Post-BMP Monitoring
Whitewater North Creek	1998	1999	2000-2006
Powell/Ash Creek	1998	1999	2000-2006

Water Quality Monitoring

The Bad River Section 319 National Monitoring Project uses a paired watershed monitoring design, with two pairs as part of the protocol. Two subwatersheds have been identified in the eastern part of the watershed (Ash and Powell Creeks) and two in the western portion (Whitewater North and Whitewater South) (Figure 47).

Variables Measured

Biological

N/A

Chemical and Other

Total suspended sediment

Covariates

Stream discharge
Rainfall: amount, duration, intensity
range condition

Sampling Scheme

Because the streams in this area are ephemeral, monitoring is storm-event driven. Storm event occurrence, rainfall amounts, and rainfall intensity are compared with the hydrologic discharge and sediment loads. Complete hydrologic and sediment loads will be calculated on each storm event. Storm samples will be flow integrated. Twenty-four-hour composite samples are collected and analyzed for the duration of flow of each storm event.

During snowmelt in the spring, two 24-hour composite samples are collected during the first week of snowmelt with one sample collected per week thereafter. This is done until runoff ceases.

Land Treatment Monitoring

Rangeland was monitored by measuring range condition and vegetative cover during the project period. Natural Resources Conservation Service (NRCS) personnel rated the range condition using the *NRCS South Dakota Technical Guide* range site descriptions. The Robel Pole method was used to

determine vegetative cover at permanent transects located within each subwatershed (Ash Creek — 21 transects, Powell Creek — 13 transects, Whitewater North — 10 transects, and Whitewater South — 9 transects). The Robel Pole measurements were taken 3 times per transect per year. This information was entered into the GIS.

Monitoring Scheme for the Bad River Section 319 National Monitoring Program Project

Design	Sites or Activities	Primary Parameters	Covariates	Frequency of WQ Sampling	Duration
Paired Watershed	Whitewater North Creek[T] Whitewater South Creek[C] Powell Creek[T] Ash Creek[C]	TSS	Stream discharge Rainfall	During spring snowmelt Storm event	2 yr pre-BMP 1 yr BMP 6-7 yr post-BMP

[T]Treatment
[C]Control

DATA MANAGEMENT AND ANALYSIS

Data Management and Storage

All data collected during the Bad River 319 National Monitoring program will be entered into a relational database, Microsoft Access. Files will be backed up daily and the water quality data will also be stored in the U.S. Environmental Protection Agency's STORET database. The U.S. Environmental Protection Agency (EPA) NonPoint Source Management System (NPSMS) software will be used to track and report data to EPA.

A GIS map will be constructed for the Bad River watershed. The GIS will allow cropland and rangeland BMP tracking throughout the life of the project. Other information, such as rangeland and riparian conditions will be entered into the system.

Statistical comparisons of sediment load to rainfall intensity will be determined by regression analysis at all four subwatersheds. The effectiveness of implementing watershed BMPs will be tested through regression and/or correlation analyses.

INFORMATION, EDUCATION AND PUBLICITY

As part of the Bad River Phase III implementation project, meetings were held with the ranch communities to explain the project. The Upper Bad River Task Force, a group comprised of ranchers and agency personnel committed to improving water quality in the Bad River watershed, met to discuss nonpoint source pollution control strategies. As the project progressed, newspaper articles and brochures were used to highlight project activities.

PROJECT BUDGET

Project Element	Funding Source ($)			
	Federal	State	Local	Sum
LT	154,428	2,000	NA	156,428
WQ Monit	148,978	18,300	NA	167,278
TOTALS	303,406	20,300	NA	323,706

Source: Bad River National Monitoring Project Workplan, 1996

IMPACT OF OTHER FEDERAL AND STATE PROGRAMS

Section 319 watershed funds were used in the Bad River watershed to implement BMPs under the Whitewater Creek North and Bad River Phase III projects. This watershed was also given priority status for funding under the U.S. Department of Agriculture EQUIP (Environmental Quality Incentive Program). Matching funds were provided by the State of South Dakota and participating private ranchers.

OTHER PERTINENT INFORMATION

Project contributors are listed below:

- Private Landowners
- Natural Resources Conservation Service
- South Dakota Department of Environment and Natural Resources
- Upper Bad River Task Force
- Stanley County Conservation District
- East Pennington Conservation District
- U.S. Forest Service

PROJECT CONTACTS

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