THE 1998 SOUTH DAKOTA REPORT TO CONGRESS

305(b) WATER QUALITY ASSESSMENT

Protecting South Dakota's Tomorrow ...Today

Prepared By
SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Nettie H. Myers, Secretary

SOUTH DAKOTA WATER QUALITY
WATER YEARS 1996-1997

The 1998 Report to Congress of the United States

by the State of South Dakota pursuant to

Section 305(b) of the Federal Water Pollution Control Act

South Dakota Department of
Environment and Natural Resources
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INTRODUCTION

This document, commonly called the 305(b) report, was prepared by the South Dakota Department of Environment and Natural Resources (DENR) pursuant to Section 305(b) of the Clean Water Act Amendments of 1977 (P.L. 95-217).

The purpose of this report is to provide an assessment of the water quality of South Dakota's water resources and to summarize state programs established to prevent and control water pollution. It is the intent of this report to inform the citizens of South Dakota and the US Environmental Protection Agency (EPA) on the quality of state water resources, and to serve as the basis for management decisions by government staff and officials for the protection of water quality.

EPA uses information from 305(b) documents to report the states' progress in meeting and maintaining Clean Water Act goals for the ecological health of the nation's waters and their domestic, commercial and recreational uses. DENR will use the information in this report along with population data, economic analyses, program capability assessments, and other appropriate information sources to plan and prioritize water pollution control activities. The 305(b) document is also used to prepare the state 303(d) list.

South Dakota DENR uses the 305(b) report as a tool to stimulate formulation of nonpoint source (NPS) projects and to produce a priority water body list for the program. The 305(b) report is routinely sent to all state conservation districts and water development districts. Each looks at watershed information for their geographical area of interest. This helps them focus on the location, nature and severity of water problems in their areas. This generally leads to public discussions which start the long process towards nonpoint source pollution control implementation.

The 305(b) report is also shared with the Nonpoint Source Task Force. This helps them focus their efforts and provides information used in the priority water body ranking system. The NPS program also uses the 305(b) document to supplement news articles released through the state Information and Education (I&E) program. Finally, the report is currently being utilized by the US Forest Service to screen grazing permits that require detailed National Environment Policy Act (NEPA) reviews before reissuance.

The water quality assessment in this report relies heavily on the statistical analysis of data generated by DENR, EPA, US Geological Survey, and the US Army Corps of Engineers along with the personal observations of field samplers, the results of many specialized investigations and best professional judgement. While this assessment is as comprehensive as resources permit, undoubtedly some of the state's water quality problems, particularly localized ones, do not appear in this report.

South Dakota Law (SDCL 34A-2-4 and 6) authorizes the Department's Secretary to provide this assessment of current state water quality to Congress and to the people of the State of South Dakota.

II.
EXECUTIVE
SUMMARY

SOUTH DAKOTA 1998 305(b) REPORT
EXECUTIVE SUMMARY

It is the purpose of this report to assess the water quality of South Dakota's water resources and to summarize ongoing programs to control water pollution. This report meets the requirements of Section 305(b) of the Clean Water Act which mandates a biennial report on water quality to Congress. This report is also intended to inform the citizens of South Dakota on the status of the quality of their water resources and to serve as the basis for management decisions by government staff and local officials for the protection of water quality. DENR will use the information in this report along with population data, economic analyses, program capability assessments, and other appropriate sources to plan and prioritize water pollution control activities.

Surface Water Quality

South Dakota has a total of 9,937 miles of rivers and major streams (Table 1). Of this total, 3,800 miles are presently managed as fisheries by the state Department of Game, Fish and Parks (GF&P). For the 1998 305(b) document, approximately 3,200 miles have been assessed and reported by DENR for water quality for a period covering nearly six years (January 1992 to September 1997). This marks a major change from previous 2-year reporting. Over this longer interval, 36% of assessed stream miles were found to support all their assigned beneficial uses, 17% partially supported their uses, and 47% were non-supporting of their designated uses.

For the six year monitoring period, 2,986 designated river miles were assessed for goal attainment of fishable and aquatic life use support and 650 miles for swimmable goal attainment. Thirty-five percent of assessed stream miles fully met fishable/aquatic life criteria, whereas 21% partly met, and 44% did not meet fishable/aquatic life criteria. Nearly 37% of stream miles designated for immersion recreation supported swimmable uses; 10% partly met swimmable criteria; and 53% did not meet swimmable criteria.

Similar to previous reporting periods, nonsupport was caused primarily by total suspended solids (TSS) from agricultural nonpoint sources (NPS) and natural origin. Water and wind erosion from croplands, gully erosion from rangelands, stream bank erosion and other natural erosion areas (e.g. badlands) were primary contributors of TSS to state streams. In terms of stream miles affected, the second most important cause of impairment this reporting period was elevated fecal coliform bacteria (FC) concentrations. Recently revised figures indicate that non-support due to FC decreased from 64% of swim-rated stream miles for 1991-93 to 53 percent (1993-95) then increased to 67% for the 1995-97 assessment period. This compares to 53% non-support for the present monitoring summation (1992-1997). The primary sources of this high degree of non-support can be traced to elevated bacterial levels found in the lower reaches of the Cheyenne and Big Sioux Rivers.

Less important causes of impairment this reporting period included elevated total dissolved solids concentration (TDS), low dissolved oxygen (DO), elevated stream pH and water temperature in approximate order of importance. Natural pollutant sources for dissolved and suspended solids are exemplified by badland areas and weathered shale outcrops adjacent to streams that occur in western South Dakota and along the Missouri River, and by erosive loess soils in extreme southeastern South Dakota.

In contrast to frequent dry periods that characterized the late 1980s (1988 and 1989), large parts of South Dakota experienced above average annual rainfall during the last seven years. Unusually heavy rainfall during most of the decade of the 1990s created flood conditions over most of eastern South Dakota in the spring and summer of 1993, 1995, and 1997. Annual precipitation and accumulations of soil moisture are the highest reported in the state for any extended period since the 1940s to early 1950s (A. R. Bender, state climatologist report, 1995). An increased number of large runoff events in the state from 1991 to 1997 produced a greater incidence of severe TSS exceedances during the present and previous reporting periods.

TABLE 1. ATLAS

State population (1995 est.)	739,000
State surface area (sq. mi.)	77,047
No. of water basins (according to State Subdivisions)	14
Total no. of river miles	9,937
No. of perennial river miles (subset)	1,932
No. of intermittent stream miles (subset)	8,005
No. of border river miles of shared rivers/streams (subset)	360*
Miles of ditches and canals (man-made waterways)	424*
No. of lakes/reservoirs/ponds	799
Acres of lakes/reservoirs/ponds	750,000
Square miles of estuaries/harbors/bays	0
No. of ocean coastal miles	0
No. of Great Lakes shore miles	0
Acres of freshwater wetlands	1,780,000
Acres of tidal wetlands	0
Name of border rivers: Missouri River, Big Sioux River, Bois de Sioux River.	

* (EPA, 1991)

In addition, runoff waters percolating through the alkaline soils of normally semi-arid parts of the state may initially have produced elevated water pH and dissolved solids concentration in some monitored river basins. Although the dilutional effects of increased stream flows were probably instrumental in producing a drop in major swimming use violations due to fecal coliform in some state rivers and streams, apparently a greater opposite effect occurred in lakes with swimming facilities where there was an increased incidence of excessive fecal coliform (>200/100 ml) in swimming areas during 1993, 1995, and 1997 compared to 1992, 1994, and 1996.

It has become evident that higher than average annual precipitation can produce considerable suspended sediment problems over large areas of the state, particularly in the west and southeast. It is also apparent that the number of fecal coliform violations in state swimming areas increases significantly during years of above normal rainfall.

The Department of Environment and Natural Resources continues to conduct special chemical/physical/biological stream surveys as well as routine ambient monitoring to assess the quality of receiving streams and to document water quality problem sources.

In addition to rivers and streams, South Dakota has 799 publicly owned lakes and reservoirs according to a past GF&P survey, totaling approximately 750,000 acres. Four Missouri River mainstem reservoirs make up 548,000 surface acres or 73% of estimated total lake acreage. Approximately 565 waterbodies are listed in ARSD 74:51:02 and classified for a variety of beneficial uses. GF&P presently manages 450 state lakes for fish.

Approximately 98% of use nonsupport for lakes can be attributed to nonpoint sources. Excluding the four mainstem reservoirs, 16% of the lake acreage assessed is presently considered to support all designated uses. Twenty-six percent of total lakes acreage partially supports uses, and 58% does not support uses. The results obtained during recent assessments show moderate improvement in lake use support over data gathered during the late 1980s. This can be partially attributed to the beneficial effects on lake water levels and water quality produced by increased annual rainfall in many parts of the state from 1991 to 1995 and 1997. However, as previously noted, recent high water conditions may have been largely responsible for an increase in fecal coliform levels at monitored swimming beaches during 1993, 1995, and 1997.

Most lakes in the state are characterized as eutrophic to hypereutrophic. Runoff, carrying sediment and nutrients from agricultural land, is the major nonpoint pollution source. Smaller waterbodies are more severely impacted by nonpoint sources than the larger lakes. For example, many small stockwater dams in west-central South Dakota were reported during the last assessment to be filling rapidly with sediment due primarily to the effect of heavier than normal rainfall the past five years on the erodible soils of this semi-arid region (NRCS communication). However, incoming sediments from several major and many minor tributaries are also shortening the useful lives of the four large mainstem reservoirs. Sedimentation rates for Lake Oahe and Lake Sharpe are now estimated to be higher than previously projected by the COE. Downstream reservoirs Francis Case and Lewis and Clark have lost more than 10% and 15%, respectively, of their original water holding capacity to sediment as of 1995 (COE, 1995).

Conversely, recent heavy rains over large areas of the state appeared to have, at least temporarily, improved the general water quality of many of our monitored lakes that suffered from low water levels during the late 1980s. Some were left in the same or worse condition, however, presumably due to their being resupplied with poor quality water from their respective watersheds. Unfortunately, the high water conditions that prevailed in South Dakota particularly during 1993, 1995, and 1997 increased watershed erosion and sedimentation to state lakes and streams.

Wetlands

According to recent estimates issued by the US Fish and Wildlife Service (USFWS), South Dakota originally had approximately 2,735,100 acres of wetlands. Today, there are roughly 1,780,000 acres remaining. This represents a loss of 35% attributable to both natural and human causes. In the second half of the last decade the rate of wetland destruction within the state appeared to have slowed considerably. All of the causative factors are not known at this time but one major influence was probably the "Swampbuster" provisions of the 1985 Farm Bill which effectively reduced or removed certain incentives for producers to drain and convert wetlands to agricultural use. Another contributing factor may have been that many of the remaining wetlands are very difficult and/or economically unfeasible to drain and utilize for crop production. The destruction rate for all types of wetland basins in South Dakota was estimated by USFWS at 4.5% between 1983 and 1989. Highest losses were recorded for small temporary wetland basins less than two acres in area.

South Dakota made substantial progress in the past several years toward developing appropriate wetland water quality standards and establishing an integrated state wetland protection program.

In 1991, EPA approved a grant in the amount of $91,805 for a state proposal to develop and implement a comprehensive statewide wetlands protection program. This funding has covered 75 percent of wetland coordinator costs for two years. The wetlands program has been supervised by an Interagency Wetlands Working Group (IWWG) composed of representatives from four state agencies including DENR; Department of Game, Fish and Parks; Department of Agriculture; and Department of Transportation. A strategy for wetland management is being developed by the Interagency Working Wetlands Group. Oversight and coordination of the program as well as duties in public relations and information have been handled by the IWWG. An additional EPA approved grant in the amount of $60,000 broadened the time frame of the program by 18 months.

On December 3, 1992, South Dakota adopted, through the South Dakota Surface Water Quality Standards, that wetlands be included as "waters of the state". Wetlands were also designated for beneficial use of wildlife propagation and stock watering which provides protection under existing narrative and numeric water quality standards. All definitions within state regulations were made consistent with the definition as stated previously.

A South Dakota Wetland Policy is being developed by the IWWG. This policy is to provide state agencies with consistency in wetland management and protection and to encourage increased public awareness of the functions and benefits of wetland resources. Project tasks for the IWWG included: 1) formation of a multi-agency wetland group to develop a draft wetlands policy, 2) to reach consensus among state agencies on the importance of wetland functions and benefits, 3) to reach consensus among state agencies on the conservation of wetlands in South Dakota, 4) to gather public input on a State Wetlands Policy via public meetings and presentations statewide; and, 5) to produce a final comprehensive South Dakota Wetland Policy for distribution across the state.

Ground Water Quality

Ground water quality is highly variable but is generally suitable for domestic, industrial, and agricultural (including irrigation) use. Many of the deeper aquifers contain higher concentrations of dissolved salts. Shallow aquifers are generally more easily contaminated. Ground water degradation results from improperly located and/or constructed wells, wastewater treatment lagoons, septic systems, feedlots, landfills, improperly sealed wells, leaking aboveground and underground chemical storage tanks and hazardous materials spills. Petroleum products and nitrate are the major contaminants.

The substance in ground water most frequently occurring in concentrations above the EPA Maximum Contaminant Level (MCL) is nitrate as nitrogen. There are several potential sources of nitrate, including nonpoint sources such as commercial and manure fertilizer use. Three studies conducted in South Dakota during the 1980s and early 1990s confirmed that in selected areas elevated nitrate as nitrogen concentrations were a concern. Approximately 10-20% of the samples collected from these studies had concentrations exceeding 10 mg/l, the South Dakota Ground Water Quality Standard for Nitrates.

Impacts to ground water from application of pesticides were also examined in these studies. Pesticides were detected in 10-15% of the ground water samples collected, but less than 1% of the samples collected were found to be over the Maximum Contaminant Level (MCL) or Life Time Health Advisory (LTHA) limit, indicating limited impact to ground water from labeled use. Most pesticide detections were sporadic or non-reoccurring.

In 1994, South Dakota initiated a Statewide Ground Water Quality Monitoring Network to systematically assess ambient ground water quality and monitor for nonpoint source pollutants in a number of shallow aquifers across the state. Nitrate and pesticides continue to be sampled through this network along with a number of other inorganic ions, trace elements, radionuclides, and volatile organic compounds. The initial well sampling phase is near completion with 76 monitoring sites established, consisting of 138 water quality monitoring wells. Four additional aquifers will be added to the network in 1998.

Petroleum products were involved in 74% of reported spills during this reporting cycle. Leaking underground storage tanks (UST) were responsible for 32% of incidents, involving mainly petroleum products. The percentage of spills caused by leaking USTs increased slightly from the last reporting period. Recent increases in the number of reported UST releases may be occurring because of the approaching facility upgrade deadline of 1998. In addition, petroleum spills from previous years continue to be remediated and monitored. Petroleum components such as benzene, toluene, ethylbenzene, and xylene render water unpalatable at very low concentrations and constitute potential health risks at higher concentrations. There were no violations of drinking water standards due to petroleum products recorded this reporting cycle.

Accidental releases of fertilizers and pesticides contribute to South Dakota's point source ground water contamination. Damaged equipment and improper handling and disposal of containers and rinsate have resulted in agricultural chemicals reaching the ground water. The total number of reported agricultural chemical spill cases has remained steady in recent years.

Public and Private Water Supply Systems:

South Dakota has approximately 760 public water systems (PWS). A public water system is defined as any water system that serves at least 25 people for at least 60 days per year. Community PWS make up 480 of the total PWS and serve residential populations. Most South Dakota water systems (85%) rely totally on ground water.

The bacteriological quality of community water supplies varies from month to month, but generally 80% of the systems are considered safe at any one time. From January 1995 through November 1997, 28,334 routine samples were submitted for testing by state public water systems. Of these, 1,277 or 4.5% were declared unsafe due to the presence of coliform bacteria. This compares with 4.0% of samples found to be unsafe during the last reporting cycle (State Health Laboratory).

In terms of secondary drinking water standards, much of the water quality of public drinking water supplies within South Dakota is poor. Many PWS have very hard water. Numerous PWS exceed the recommended standards for total dissolved solids, iron, manganese, sodium, chlorides, and sulfates. Some systems also violate the primary water standards for nitrate (1 PWS), fluoride (2 PWS), and radium (12 PWS).

Organic chemicals are regularly sampled by all systems and the Maximum Contaminant Levels (MCLs) have not been violated. MCLs are the highest level at which a chemical or a bacteriological parameter can be consumed without ill effects.

Specific problems found in unregulated private wells throughout the state are primarily high nitrate levels and coliform bacteria. During the present reporting period 13% of 2,479 tested domestic wells exceeded the Federal Drinking Water Standard of 10 mg/l nitrate-nitrogen. By contrast, only one PWS out of 756 tested was found to exceed the nitrate standard. Exceedances of the drinking water standard for total coliform bacteria (i.e. the mere presence of coliforms) were found in 27% of 3,282 private wells. This is six times the frequency reported in regulated state public water systems (4.5%) over a comparable period of time.

Information supplied by domestic well owners during sampling of their wells indicates that feedlots, corrals, and septic tanks are the major sources of nitrate contamination that is exacerbated by runoff from flooding and heavy rains. This survey revealed the following practices to be particularly prevalent: 1) placement of a well within a feedlot or downgradient of a feedlot; 2) placement of a well downgradient from a septic tank or drainfield; and most importantly 3) poor well construction allowing for entrance of contaminants into the well.

Water Pollution Control Programs

The water quality goals of the state are to identify water quality problems; set forth effective management programs for water pollution control; alleviate water quality problems; and achieve and preserve water quality for all intended uses.

Surface Water Discharge System:

One program that the state implements to achieve our water quality goals is the National Pollutant Discharge Elimination System (NPDES) program. South Dakota received delegation of the NPDES program from EPA on December 30, 1993. Prior to that time, EPA issued NPDES permits in South Dakota. South Dakota's program is called the Surface Water Discharge System. These permits are issued to regulate point sources of discharge to surface waters of the state. Permittees are required to meet effluent limits based on water quality, technology, and best professional judgement.

As part of our implementation of the Surface Water Discharge program, the state regulates concentrated animal feeding operations. Currently, the state has issued two general permits for animal feeding operations. One permit is for concentrated swine feeding operations. The other general permit is for concentrated animal feeding operations, excluding swine. In 1997, the department issued the swine permit in response to an increased interest in swine production in South Dakota. Based on the success of the swine permit, the department issued the livestock general permit in 1998 to regulate all other concentrated animal feeding operations.

The two general permits detail the design and operational requirements that must be met to receive coverage under the general permit. The department reviews the plans and specifications for the manure management system and issues approval, based on the criteria in the permits. The producer must construct and operate the facility as approved. The general permit also regulates the land application of the manure, and requires ground water monitoring or an additional ground water discharge permit for operations located over or near shallow aquifers.

The Clean Water State Revolving Fund (SRF) was established by the 1987 Clean Water Act Amendments to replace the Construction Grants Program. This is a low-interest loan program for wastewater, storm water, and nonpoint source pollution control projects. The state of South Dakota made the first loan in 1989. As of April 1, 1998, the program has made 98 loans totaling over $84.5 million to 51 entities. Approximately one-third of the total loan amount has been to address secondary treatment needs. In addition, since the quality of finished water or wastewater is highly dependent on the skill of the plant operator, the state assures that training for these operators is continually upgraded.

Interest rates for the SRF program must be at or below market rate and are set annually by the Board of Water and Natural Resources. Rates are currently 4.5% for a 10-year loan, 5.0 % for a 15-year loan, and 5.25% for a 20-year loan. Disadvantaged communities are eligible for subsidized rates of 3.25% or 0% under the Drinking Water SRF Program.

The Drinking Water SRF Loan Program was created by the Safe Drinking Water Act Amendments of 1996. This program provides low-interest loans to communities and non-profit corporations for drinking water projects. The State of South Dakota made its first loan in January of 1998. As of April 1, 1998, five loans have been made totaling $4.85 million.

The federal 1996 Safe Drinking Water Act requires each state develop a Source Water Assessment and Protection Program which is designed to protect public water supply systems from potential contaminant sources. A source water assessment must be completed for each of the 760 public water supply systems in South Dakota. This includes delineating a contributing area to the water supply, inventorying potential pollution sources within the area, and evaluating the susceptibility of the water supply to each pollution source.

South Dakota has set aside 10% of its FY1997 Drinking Water Revolving Fund allotment for source water assessment and protection. This is $1,255,880. Other funding sources will be used to supplement this effort. These potential funds include Public Water System Supervision, Nonpoint Source 319, 106 Ground Water and potentially other environmental funding sources.

Nonpoint Source Pollution Control:

Nonpoint Source Pollution is that which originates from diverse sources. Nonpoint pollution controls must reflect this by using all of the resources available from the various state, federal, and local organizations plus have landowner support and participation. South Dakota uses primarily voluntary measures for the implementation of Best Management Practices to control NPS pollution. Over the past 20 years, the program has initiated 136 development and implementation projects throughout the state. The Clean Water Act section 319 program is the focal point for a majority of the existing NPS control programs. However, the technical and financial assistance currently available is not sufficient to solve all of the NPS pollution problems in the state. Other solutions must be explored. Landowners have the capability to accomplish much if they understand the problems and the ways to solve them. Educating the public about NPS pollution issues has been effective in prompting many landowners to voluntarily implement activities to control NPS pollution. In some cases, however, enforcement may be needed to increase compliance with state and federal requirements.

To help guide NPS activities in the state, a NPS Task Force comprised of state and federal agencies, local groups and citizens, producer groups and any others interested in NPS pollution, was formed and continues to meet regularly. They are responsible for providing advice and recommendations to the agencies on all NPS activities in the state. The continuation of this ad hoc task force, coupled with expansion and the addition of innovative new programs will insure that South Dakota remains a leader in nonpoint source pollution control.

Groundwater Protection Program:

South Dakota has an active ground water protection program. A statewide monitoring network that is being established to monitor the general quality of the state's ground water and to identify problem areas and contaminants, is nearing completion of the well installation phase. Other ongoing DENR ground water activities include: the primary enforcement authority for Underground Injection Control (UIC) Program (Section 1425); the delegation of the Underground Storage Tank (UST) program under RCRA Subtitle I; the delegation of a state Aboveground Storage Tank (AST) program; ground water quality standards; SARA Title III, state Superfund/Federal Facilities program (state CERCLA program); increased involvement in assessment, enforcement, and cleanup activities resulting from accidental releases of potential pollutants; an EPA-approved wellhead protection program; initiation of a major source water protection program; the development of a pesticide and ground water state management plan; and a ground water discharge permit program. The Comprehensive State Ground Water Protection Program is currently underway.

Pesticide and fertilizer contamination of ground water due to point source releases is evident in South Dakota. Numerous cleanup efforts continue in response to ground water contamination resulting from equipment damage or human error. Reduction of these incidents and their severity continues to be addressed. Bulk pesticide containment regulations went into effect July, 1989. To further address potential point sources of pesticides or fertilizers, chemigation equipment regulations are also in effect. South Dakota Department of Agriculture requirements now in effect for chemical loading and rinsing containment pads required facilities to have fertilizer containment pads in place by 1992 and all secondary containment structures constructed by 1996. All pesticide operational area containment systems were in place by 1995. Work is currently underway involving DENR and South Dakota Department of Agriculture to develop fertilizer and pesticide management plans designed to reduce potential impacts to ground water from land application of agricultural chemicals.

III.
SURFACE WATER QUALITY ASSESSMENT

A. SURFACE WATER QUALITY MONITORING PROGRAM

General Discussion

South Dakota DENR monitors the surface water in the state through an established ambient water quality sampling program, special intensive water quality surveys, intensive fish surveys, total maximum daily loads, surface water discharge (SWD) permits, and individual state and federal lakes/nonpoint source projects. Aside from DENR, the United States Geological Survey, the Corps of Engineers and the US Forest Service also conduct routine monitoring throughout the state. All data resulting from these monitoring efforts are available from the responsible agency. Much of the data has been entered into the United States Environmental Protection Agency STORET computer system.

Water samples are analyzed for physical, chemical, biological, and bacteriological parameters to provide baseline data for the determination of potential effects of point and nonpoint sources of pollution. Baseline data are also used as a management tool to determine the effectiveness of control programs on existing point and nonpoint sources and for directing future control activities. Water samples show whether or not a waterbody is meeting its assigned water quality beneficial uses. Water quality standards were first established for all surface waters by the state's Committee on Water Pollution in 1967. The Water Management Board completed its most recent triennial review and revisions in April 1997. These standards consist of beneficial use classifications and water quality criteria necessary to protect these uses.

All surface waters in the state are classified for one or more of the following beneficial uses:

(1) Domestic water supply waters;

(2) Coldwater permanent fish life propagation waters;

(3) Coldwater marginal fish life propagation waters;

(4) Warmwater permanent fish life propagation waters;

(5) Warmwater semipermanent fish life propagation waters;

(6) Warmwater marginal fish life propagation waters;

(7) Immersion recreation waters;

(8) Limited contact recreation waters;

(9) Wildlife propagation and stock watering;

(10) Irrigation waters; and

(11) Commerce and industry waters.

All streams in South Dakota are assigned the beneficial uses (9) and (10) unless otherwise stated in ARSD 74:51:03. Lakes listed in Uses Assigned to Lakes 74:51:02 are assigned the beneficial uses of (7) and (8) unless otherwise specified. All lakes in South Dakota are assigned the beneficial use (9) unless otherwise stated in the same reference. Table 2 contains a summary of the established beneficial uses and a partial listing of assigned criteria to protect them. Current State Toxic Pollutant Standards for human health and aquatic life are presented in Table 3.

Fixed Station Ambient Monitoring

The DENR Water Quality Monitoring program consisted of 94 active instream stations this reporting period (Appendix A). Sampling station locations are determined by assessing areas located within high quality beneficial use classifications, located above and below municipal/industrial discharges, or within problem watersheds. Currently, the central office and three regional offices of the department collect these samples on a monthly, quarterly, or bi-annual basis. This type of water sampling is invaluable for monitoring historical information, natural background conditions, possible runoff events, and acute or chronic water quality problems.

Typically, grab samples are collected mid-stream, either from a bridge or by wading. Some stations may have to be sampled from the bank depending on the conditions. Every station is sampled in the same manner and location each time. When the sample has been collected, the sampler immediately obtains the water and air temperatures, pH reading, and dissolved oxygen content. Water depth and width as well as other visual observations are also recorded. The samples are properly preserved and shipped in ice to the laboratory for analysis. Sample test results are entered into STORET.

The most commonly sampled parameters include fecal coliform, conductivity, hardness, BOD_5, alkalinity, residue (TS, TSS, TDS), pH, ammonia, nitrates, and phosphorous (total and ortho). Several stations are sampled for sodium, calcium, and magnesium during the irrigation season. Stations which are located along streams that receive mine drainages are also analyzed for cyanide, cadmium, lead, copper, zinc, chromium, mercury, nickel, silver, and arsenic.

Ambient station locations, descriptions, and schedules are included in Appendix A. More detailed descriptions of individual stream sites are available from DENR on request.

Intensive Water Quality Monitoring (Point Sources)

Water quality monitoring surveys are performed by the Surface Water Quality Program to document stream improvement areas, stream degradation areas, develop TMDLs, or to provide data for verifying SWD limits.

TABLE 2. NUMERIC CRITERIA ASSIGNED TO BENEFICIAL USES OF SURFACE WATERS OF THE STATE ARSI

Table 2. CONTINUED

[1] 30-day average
[2] daily maximum
[3] There may be no induced temperature change over spawning beds. No discharge or discharges may affect the temperature by more than 4° F in streams classified for the beneficial use of coldwater permanent or marginal fish life propagation or warmwater permanent fish life propagation; by more than 5° F in streams classified for the beneficial uses of warmwater semipermanent or marginal fish life propagation; or by more than 3° F in lakes or impoundments classified for the beneficial use of fish life propagation. Exceptions to this criterion may be granted if the discharge will not impair the designated beneficial use of fish life propagation. In addition, the maximum incremental temperature may not exceed 2° F per hour.

Table 3. SOUTH DAKOTA SURFACE WATER QUALITY STANDARDS [1] FOR TOXIC POLLUTANTS - ARSD 74:51:01

Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute (CMC)/ Chronic (CCC)	Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute(CMC)/ Chronic (CCC)
Acenaphthene	1,200/2,700		Cadmium	-/-	3.7[9]/1.0[9]
Acenaphthylene (PAH)[6]	-/-	-/-	Carbon Tetrachloride[5] (Tetrachloromethane)	0.25/4.4	-/-
Acrolein	320/780	-/-	Chlordane[5]	0.00057/0.00059	2.4/0.0043
Acrylonitrile[5]	0.059/0.66	-/-	Chlorine	-/-	19/11
Aldrin[5]	0.000013/0.000014	3.0/-	Chlorobenzene (monochlorobenzene)	680/21,000	-/-
Anthracene (PAH)[6]	9,600/110,000	-/-	Chlorodibromomethane (HM)[6]	0.41/34	-/-
Antimony	14/4,300	-/-	Chloroform (HM)[5] (Trichloromethane)	5.7/470	-/-
Arsenic[5]	0.018/0.14	360/190	2-Chloronaphthalene	1,700/4,300	
Asbestos[5]	7,000,000 fibers/L	-/-	2-Chlorophenol	120/400	
BHC (alpha)[5] (Hexachlorocyclohexane-alpha)	0.0092/0.031	-/-	Chromium(III)	-/-	550[9]/180[9]
BHC (beta)[5] (Hexachlorocyclohexane-beta)	0.16/0.055	-/-	Chromium(VI)	-/-	15/10
BHC (gamma) (Lindane)[5] (Hexachlorocyclohexane-gamma)	0.019/0.063	2.0/0.08	Chrysene (PAH)[5]	0.0028/0.031	-/-
Benzene[5]	1.2/71	-/-	Copper	1,300/-	17[9]/11[9]
Benzidine[5]	0.00012/0.00054	-/-	Cyanide (weak acid dissociable)	700/220,000	22/5.2
Benzo (a) Anthracene (PAH)[5] (1,2 Benzanthracene)	0.0028/0.031	-/-	4,4'-DDD[5]	0.00083/ 0.00084	-/-
Benzo (a) Pyrene (PAH)[5] (3,4 Benzopyrene)	0.0028/0.031	-/-	4,4'-DDE[5]	0.00059/ 0.00059	-/-
Benzo (b) Fluoroanthene (PAH)[5] (3,4 Benzofluoroanthene)	0.0028/0.031	-/-	4,4'-DDT[5][7]	0.00059/ 0.00059	1.1/0.001
Benzo (k) Fluoroanthene (PAH)[5] (11,12 - Benzofluoroanthene)	0.0028/0.031	-/-	Dibenzo (a,h) Anthracene (PAH)[C] (1,2,5,6-Dibenzanthracene)	0.0028/0.031	-/-
Benzo (g,h,i) Perylene (PAH)[6] (1,12 Benzoperylene)	-/-	-/-	1,2 Dichlorobenzene	2,700/17,000	-/-
Beryllium[5]	-/-	-/-	1,3 & 1,4-Dichlorobenzene	400/2,600	-/-
Bis (2-chloroethyl) Ether[5]	0.031/1.4	-/-	3,3'-Dichlorobenzidine[5]	0.04/0.077	-/-
Bis (2-chloroisopropyl) Ether	1,400/170,000	-/-	Dichlorobromomethane (HM)[6]	0.27/22	-/-
Bis (2-ethylhexyl) Phthalate[5]	1.8/5.9	-/-	1,2-Dichloroethane[5]	0.38/99	-/-

TABLE 3. SOUTH DAKOTA SURFACE WATER QUALITY STANDARDS [1] FOR TOXIC POLLUTANTS - ARSD 74:51:01 (Continued)

Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute (CMC)/ Chronic (CCC)	Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute (CMC)/ Chronic (CCC)
Bromoform (HM)[6] (Tribromomethane)	4.3/360	-/-	1,1-Dichloroethylene[5]	0.057/3.2	-/-
Butyl Benzene Phthalate	3,000/5,200		2,4-Dichlorophenol	93/790	-/-
1,2-Dichloropropane	0.52/39		Mercury	0.14/0.15	2.1/0.012[10]
1,3-Dichloropropylene, Cis & Trans (1,3-Dichloropropene)	10/1,700	-/-	Methyl Bromide (HM) (Bromomethane)	48/4,000	-/-
Dieldrin[5]	0.00014/0.00014	2.5/0.0019	Methyl Chloride (HM)[6] (Chloromethane)	-/-	-/-
Diethyl Phthalate	23,000/120,000	-/-	Methylene Chloride (HM)[5](Dichloromethane)	4.7/1,600	-/-
2,4-Dimethylphenol	540/2,300		N-Nitrosodimethylamine[5]	0.00069/8.1	-/-
Dimethyl Phthalate	313,000/2,900,000	-/-	N-Nitrosodi-n-Propylamide	0.005/1.4	
Di-n-butyl Phthalate	2,700/12,000	-/-	N-Nitrosodiphenylamine[5]	5.0/16.0	-/-
4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol)	13.4/765	-/-	Nickel	610/4,600	1,400[9]/160[9]
2,4-Dinitrophenol	70/14,000	-/-	Nitrobenzene	17/1,900	-/-
Dioxin (2,3,7,8-TCDD)[5]	0.000000013/ 0.000000014	-/-	PCB-1016, 1221, 1232, 1242, 1248, 1254, 1260[6] (Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260)	0.000044/ 0.000045	-/0.014
1,2-Diphenylhydrazine[5]	0.040/0.54	-/-	Pentachlorophenol	0.28/8.2	20 [8]/13[8]
2,4-Dinitrotoluene[5]	0.11/9.1	-/-	Phenanthrene (PAH)[6]	-/-	-/-
Endosulfan (alpha & beta)	0.93/2.0	0.22/0.056	Phenol	21,000/4,600,000	-/-
Endosulfan Sulfate	0.93/2.0	-/-	Pyrene (PAH)[6]	960/11,000	-/-
Endrin	0.76/0.81	0.18/0.0023	Selenium[7]	-/-	20/5
Endrin aldehyde	0.76/0.81	-/-	Silver	-/-	3.4[9]/-
Ethylbenzene	3,100/29,000	-/-	1,1,2,2-Tetrachloroethane[5]	0.17/11	-/-
Fluoranthene	300/370	-/-	Tetrachloroethylene[6]	0.8/8.85	-/-
Fluorene (PAH)[6]	1,300/14,000	-/-	Thallium	1.7/6.3	-/-
Heptachlor[5]	0.00021/0.00021	0.52/0.0038	Toluene	6,800/200,000	-/-
Heptachlor epoxide[5]	0.00010/0.00011	0.52/0.0038	Toxaphene[5]	0.00073/0.00075	0.73/0.0002
Hexachlorobenzene[5]	0.00075/0.00077	-/-	1,2-Trans-Dichloroethylene	700/-	
Hexachlorobutadiene[5]	0.44/50	-/-	1,1,1-Trichloroethane	-/-	-/-
Hexachlorocyclopentadiene	240/17,000	-/-	1,1,2-Trichloroethane[5]	0.60/42	-/-
Hexachloroethane[5]	1.9/8.9	-/-	Trichloroethylene[5]	2.7/81	-/-

TABLE 3. SOUTH DAKOTA SURFACE WATER QUALITY STANDARDS [1] FOR TOXIC POLLUTANTS - ARSD 74:51:01 (Continued)

Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute (CMC)/ Chronic (CCC)	Pollutant	Human Health Value Concentrations in ug/L Use 1[3] / Uses 2-3-4-5-6[4]	Aquatic Life Value Concentrations in ug/L Uses 2-3-4-5-6 Acute (CMC)/ Chronic (CCC)
Indeno (1,2,3-c,d) pyrene (PAH)(c)	0.0028/0.0311	-/-	2,4,6-Trichlorophenol[5]	2.1/6.5	-/-
Isophorone[5]	8.4/600	-/-	Vinyl chloride[5] (Chloroethylene)	2.0/525	-/-
Lead	-/-	65[9]/2.5[9]	Zinc	-/-	110[9]/100[9]

South Dakota Surface Water Quality Standards[1]
for Toxic Pollutants

(1) The aquatic life values for arsenic, cadmium, chromium (III), chromium (VI), copper, lead, mercury (acute), nickel, selenium, silver and zinc given in this document refer to the dissolved amount of each substance unless otherwise noted. All surface water discharge permit effluent limits for metals shall be expressed and measured in accordance with ' 74:52:03:16.

(2) Apply to the beneficial uses as designated but do not supersede those standards for certain toxic pollutants as previously established in §§ 74:51:01:31, 74:51:01:32, 74:51:01:44 to 74:51:01:54, inclusive, and §§ 74:51:01:56 and 74:51:01:57.

(3) Based on two routes of exposure - ingestion of contaminated aquatic organisms and drinking water.

(4) Based on one route of exposure - ingestion of contaminated aquatic organisms only.

(5) Substance classified as a carcinogen with the value based on an incremental risk of one additional instance of cancer in one million persons (10^{-6}).

(6) Chemicals which are not individually classified as carcinogens but which are contained within a class of chemicals with carcinogenicity as the basis for the criteria derivation for that class of chemicals; an individual carcinogenicity assessment for these chemicals is pending.

(7) Also applies to all waters of the state.

(8) pH-dependent criteria. Value given is an example only and is based on a pH of 7.8. Criteria for each case must be calculated using the following equation taken from Quality Criteria for Water 1986 (Gold Book):

Pentachlorophenol (PCP), ug/L

Chronic = $e^{[1.005(pH) - 5.290]}$ Acute = $e^{[1.005(pH) - 4.830]}$

(9) Hardness-dependent criteria in ug/L. Value given is an example only and is based on a $CaCO_3$ hardness of 100 mg/L. Criteria for each case must be calculated using the following equations taken from Quality Criteria for Water 1986 (Gold Book):

TABLE 3. CONTINUED

Cadmium, ug/L

Chronic = (*0.909)$e^{(0.7852[\ln(hardness)]-3.490)}$ Acute = (*0.944)$e^{(1.128[\ln(hardness)]-3.828)}$

*Conversion factors are hardness-dependent. The values shown are with a hardness of 100 mg/L as calcium carbonate ($CaCO_3$). Conversion factors (CF) for any hardness can be calculated using the following equations:

Chronic: CF = 1.101672 - [(ln hardness)(0.041838)]

Acute: CF = 1.136672 - [(ln hardness)(0.041838)]

Chromium (III), ug/L

Chronic = (0.860)$e^{(0.8190[\ln(hardness)]+1.561)}$ Acute = (0.316)$e^{(0.8190[\ln(hardness)]+3.688)}$

Copper, ug/L

Chronic = (0.960)$e^{(0.8545[\ln(hardness)]-1.465)}$ Acute = (0.960)$e^{(0.9422[\ln(hardness)]-1.464)}$

Lead, ug/L

Chronic = (*0.791)$e^{(1.273[\ln(hardness)]-4.705)}$ Acute = (*0.791)$e^{(1.273[\ln(hardness)]-1.460)}$

*Conversion factors are hardness-dependent. The values shown are with a hardness of 100 mg/L as calcium carbonate ($CaCO_3$). Conversion factors (CF) for any hardness can be calculated using the following equations:

Acute and Chronic: CF = 1.46203 - [(ln hardness)(0.145712)]

Nickel, ug/L

Chronic = (0.997)$e^{(0.8460[\ln(hardness)]+1.1645)}$

Acute = (0.998)$e^{(0.8460[\ln(hardness)]+3.3612)}$

Silver, ug/L

Acute = (0.85)$e^{(1.72[\ln(hardness)]-6.52)}$

Zinc, ug/L

Chronic = (0.986)$e^{(0.8473[\ln(hardness)]+0.7614)}$

Acute = (0.978)$e^{(0.8473[\ln(hardness)]+0.8604)}$

(10) These criteria are based on the total-recoverable fraction of the metal.

The major intent of the water quality assessment program is to monitor instream water quality at critical points to ensure protection of the assigned beneficial uses.

The water quality surveys are also utilized to verify existing surface water discharge (SWD) limits and develop total maximum daily loads (TMDL). Any facilities needing treatment greater than secondary treatment are evaluated by conducting an intensive water quality survey both before and during a wastewater discharge. These wasteload allocations are the basis for future treatment needs and SWD limits.

With increased emphasis on water quality improvements to justify federal expenditures, the monitoring program will concentrate on showing water quality improvements from the upgrading of wastewater treatment facilities. After wastewater treatment facilities are upgraded, monitoring is still utilized to verify SWD limits developed through computer modelling (e.g. STREAMDO, Colorado Ammonia Model).

Surveys provide an evaluation of whether or not the wastewater treatment is adequate to protect the beneficial use. All survey data is compiled in reports which basically follow the same format.

Typical parameters analyzed or measured on water quality surveys are as follows:

1. Biochemical oxygen demand
2. Conductivity
3. pH
4. Alkalinity (T)
5. Total solids
6. Suspended solids
7. Ammonia as N
8. NO_3-NO_2 as N
9. TKN as N
10. Total PO_4 as P
11. Ortho PO_4 as P
12. Fecal coliform
13. Stream flow

<u>Intensive Water Quality Monitoring (Special Studies)</u>

Intensive water quality monitoring is sometimes initiated to assess special problem areas, to obtain data for use in site-specific criteria modification studies, or to provide an updated database for a waterbody.

<u>Intensive Fish Survey Monitoring</u>

Fish surveys are conducted by GF&P and the Surface Water Quality Program to assist in the evaluation of the impact of wastewater on the receiving stream and to evaluate the fishery classification of questionable segments. The fish survey results, although they are qualitative in nature, are used in conjunction with the water quality surveys to evaluate the impact of wastewater on stream water quality.

The surveys are normally conducted with an electroshocker or bag seine. Fish captured by either technique are identified, measured, assessed for health status and returned unharmed to the stream. Normally, sample sites are surveyed above a wastewater treatment plant and below the facility. Fish surveys are conducted prior to the upgrading of a facility to give an indication of which species are present in the stream and then again after construction. Also, fish surveys are conducted to evaluate questionable stream segment classifications. Some cases exist where the fishery classification is questionable or a segment that is currently not classified as a fishery may support fishlife.

Biological Sampling Program

Biological samples are often included as part of a diagnostic/feasibility study or a special study. The state Clean Lakes Program includes aquatic plant and algae surveys, either as chlorophyll *a* concentration or identified and counted as parameters to be estimated.

Toxicity Testing Program

Priority toxic pollutants are relatively expensive to analyze and are not routinely monitored except for special situations. Whole effluent toxicity tests have been included as permit limits in many municipal and industrial SWD permits.

Monitoring List

The following table (Table 4) consists of waterbodies requiring additional monitoring before beneficial use support can be determined. These waterbodies had limited data or information available, but the data did not meet the minimum criteria established under the methodology for surface water assessment (see Methodology Chapter).

TABLE 4. POTENTIAL WATERBODIES TARGETED FOR MONITORING

BASIN	WATERBODY	LOCATION	SIZE
BELLE FOURCHE	Bear Butte	LL=	180 ac.
RIVER	Lake	442713/1302712	
BIG SIOUX	Brule Creek	Headwaters to mouth	26.3 mi.
RIVER			
	Pipestone Creek	Headwaters to mouth	32.9 mi.
	Union Creek	Headwaters to mouth	36 mi.
	Antelope Lake	LL=	230 ac.
		444955/974326	
	Bailey Lake	LL=	173 ac.
		445942/974535	
	North Waubay	LL=	4992 ac.
	Lake	452500/972324	

TABLE 4. CONTINUED

BASIN	WATERBODY	LOCATION	SIZE
BIG SIOUX	Wall Lake	LL=	207.6 ac.
RIVER		433200/965730	
	West Oakwood	LL=	300 ac.
	Lake	442636/965930	
	Willow Lake	SEC36 T114N	339 ac.
		R57W	
CHEYENNE RIVER	Cherry Creek	Sulfur Creek to Hwy 73	7.7 mi.
	Fall River	Headwaters to mouth	9 mi.
	Sage Creek	Hdwt. to Cheyenne R.	15 mi.
		confluence	
	Sulfur Creek	Hdwt. to Cherry Creek	102.7 mi.
		confluence	
	Stockade Lake	LL=	120 ac.
		434600/1033100	
JAMES	Crow Creek	Headwaters to mouth	46 mi.
RIVER			
	Cain Creek	Headwaters to mouth	48 mi.
	Firesteel Creek	Headwaters to mouth	53.7 mi.
	Foote Creek	SEC33 T124N R64W	6 mi.
		SEC35 T125N R65W	
JAMES	Redstone Creek	Headwaters to mouth	56.9 mi.
RIVER			
	Turtle Creek	Lake Redfield to	5.75 mi.
		mouth	
	Twelve Mile Creek	Headwaters to mouth	33 mi.
	Wolf Creek	Headwaters to mouth	20 mi.
	Fordham Dam	SEC16 T115N	120 ac.
		R59W	

TABLE 4. CONTINUED

BASIN	WATERBODY	LOCATION	SIZE
JAMES	Willow Creek Dam	LL=	350 ac.
RIVER		454218/ 983536	
MINNESOTA	Lone Tree Lake	N CNTR DEUEL CO	186 ac.
RIVER		SEC3 T116N R58W	
MISSOURI	Cedar Creek	Hdwt. to Lake	5 mi.
RIVER		Francis Case	
	Garden Creek	Hdwt. to Lake	7 mi.
		Francis Case	
	Grouse Creek	Headwaters to	10 mi.
		Byre Lake	
	Hiddenwood	Hdwt. to Lake	22 mi.
	Creek	Hiddenwood	
	Oak Creek	Hdwt. to Missouri	43.1 mi.
		River	
	Pease Creek	Lake Geddes to	2 mi.
		Lake Francis Case	
	Platte Creek	Lake Platte to	8 mi.
		Lake Francis Case	
	Snake Creek	Academy Lake to	5 mi.
		Lake Francis Case	
	Spring Creek	Headwaters to	61.7 mi.
		Lake Pocasse	
MISSOURI	Swan Lake Creek	Headwaters to	20.2 mi.
RIVER		Swan Lake	
	Bowdle-Hosmer	SEC5 T124N	169 ac.
	Lake	R57W	
	Byre Lake	LL=	138 ac.
		435538/995020	
	Crow Lake	8mi.W&8mi.S	500 ac.
		of Wessington	
		Springs SD	

TABLE 4. CONTINUED

BASIN	WATERBODY	LOCATION	SIZE
MISSOURI	Lake Francis Case	Big Bend Dam to	118000 ac.
RIVER		Ft. Randall Dam	
	Lewis and Clark	Ft. Randall Dam to	33000 ac.
	Lake	Gavins Point Dam	
	McCook Lake	LL=	273 ac.
		423218/963024	
	Lake Oahe	North Dakota to	336000 ac.
		Oahe Dam	
	Lake Pocasse	LL=	1378 ac.
		455418/1001600	
	Lake Sharpe	Oahe Dam to	61000 ac.
		Big Bend Dam	
	Lake Yankton	LL=	250 ac.
		425136/972842	
RED RIVER	Mud Lake	NE Roberts Co.	2381 ac.
		adj. Lake Traverse	
	Jim Creek	Headwaters to	25.8 mi.
		Lake Traverse	
VERMILLION	Vermillion	Headwaters to	115 mi.
RIVER	River	Wakonda	

Section 303(d) Waters

Section 303(d) of the federal CWA requires states to identify waters that must have a Total Maximum Daily Load (TMDL) established. Items that must accompany this list include targeted pollutants, timeframes for TMDL development, and priority ranking for completion of TMDLs. For the 1998 list, EPA is requiring states to include a comprehensive list of all waters requiring TMDLs along with a schedule for developing the required TMDLs within 8-13 years. The department has spent considerable time and effort in preparing the 1998 303(d) Waterbody List. The list has been finalized and was submitted to EPA by April 1, 1998.

B. METHODOLOGY

Two major types of assessments were used to determine use support status of waterbodies; one based on monitoring and the other based on qualitative evaluations. Monitoring data were primarily obtained from DENR, USGS, and COE fixed station monitoring networks, but operational/intensive survey data, where appropriate, supplemented fixed station monitoring data. Three major sources of quantitative and qualitative lake assessment data were the 1979 DENR Clean Lakes Classification Report (Koth,1981), the 1989 and the 1991-95 DENR Lake Water Quality Assessments (Stewart and Stueven, 1996; 1994).

The Department of Environment and Natural Resources maintains a Quality Assurance Program to ensure that all environmental water quality measurement data generated or processed meets standard accepted requirements for precision, accuracy, completeness, representativeness, and comparability. This entails the preparation and periodic review and revision of the DENR Quality Assurance Program and individual Project Plans. It also includes the preparation of periodic reports to DENR management and the US EPA; the review of contracts, grants, agreements, etc., for consistency with QA requirements; and the administration of QA systems and performance audits. The latter activity requires the establishment of schedules for the collection of the duplicate and spike samples, periodic testing of field sampling techniques and liaison with contracted labs to ensure compliance with QA objectives. In 1991, the then Office of Resources Management created a QA document and protocol for its Clean Lakes and NPS programs. An updated QA document (SOP manual) is presently being prepared by the Watershed Protection Program.

The ambient monitoring station assessment network provides useful information on overall stream water quality. However, because of station locations, sampling frequencies and limited funds, some significant water quality problems may not be monitored. Most ambient monitoring is done during periods when precipitation events are not occurring. This hinders the full effect of nonpoint sources from being known. Only a brief summary of water quality is included because of the large volume of data and reports. A more detailed description of the stream ambient monitoring program is found in the preceding Surface Water Quality Monitoring Program chapter of this document. Additional information concerning any particular aspect of this assessment is available from the Department of Environment and Natural Resources.

Fixed station monitoring data were assessed by dividing major streams into segments which contain the same or similar designated beneficial uses, water quality standards criteria, and environmental and physical influences. Data obtained during the current reporting period were analyzed by utilizing the US EPA STORET data storage/retrieval system. The data for each monitored segment were compared to state water quality standards applicable to the beneficial uses assigned to the segment in question (Tables 2 and 3).

For this report, monitored stream course mileages were remeasured using GIS with “Arcview” software and shorter more realistic representative stream segments established for most monitoring sites. These adjustments will affect use support status (Degree of use support: Table 5).

Nearly all partially supporting and non supporting stream segments are also listed in the 1998 303(d) list as requiring Total Maximum Daily Loads. The exact stream segment descriptions may vary somewhat between the 303(d) list and the 305(b) report, but the segments generally coincide with each other.

Specific criteria were developed to define how data for streams would be evaluated to determine the status of each stream segment (waterbody). The following criteria were utilizied:

Description	**Criteria Used**
Number of observations (samples) required to consider data representative of actual conditions	20 samples for any one parameter required at any site. If greater than 25% of samples exceed water quality standards, this threshold was reduced to 10 samples, since impairment is more likely.
Required percentage of samples exceeding water quality standards in order to consider segment water quality-limited	>10% (>25% if less than 20 samples available).
Data age	Data must be less than five years old (1992 and newer) unless there is justification that data is representative of current conditions. While a data age of two years matches the 305(b) listing cycle, it does not allow for enough samples to accurately portray variability.
Quality Assurance/Quality Control	There must be a consensus that the data meets QA/QC requirements similar to those outlined in DENR protocols. QA/QC data was encouraged to be submitted.

Deviations from the above criteria were allowed in specific cases, and are generally discussed in the tables listing the 1998 TMDL waterbodies (The 1998 South Dakota 303(d) Waterbody List and Supporting Documentation, 1998).

Use support assessment for all assigned uses was based solely on frequency of violation of water quality standards for any one worst-case of the following parameters: total suspended solids, total dissolved solids, pH, water temperature, dissolved oxygen, unionized ammonia, fecal coliform (May 1 - September 30), metals and others. Violations of more than one parameter were not considered additive in determining overall use-support status for any given waterbody. A stream segment with <u>only slight impairments</u> (≤ 10% violations for one or more parameters) is considered fully supporting. Complete listings of relevant parameters appear in Tables 2 and 3. EPA established the following general criteria in the 1992 305(b) Report Guidelines suitable for determining use support of monitored streams:

Fully supporting	1 - 10% of values violate standards
Partially supporting	11 - 25% of values violate standards
Not supporting	>25% of values violate standards

Use support assessment for fishable (fish and aquatic life propagation) use primarily involved monitoring levels of the following major parameters: dissolved oxygen, unionized ammonia, water temperature and pH, and suspended solids.

State water quality parameters pertinent to assessment of swimmable use (immersion recreation) are the following: fecal coliform (May 1 - September 30) and dissolved oxygen. The pH criterion (pH:6.5 - 8.3) was deleted from state immersion standards in 1993 due to the high natural pH values (≥

8.0) that characterize most state waters and the rarity of low pH readings (<7.0) in those same swimmable waterbodies. Fecal coliform and dissolved oxygen are also used to estimate use-support status of limited contact recreation (or secondary contact) waters (Table 2).

Lakes assessed for water quality and trophic state were normally sampled once in spring and summer (June through September) at one to three established sites, dependent on lake size. Separate surface and bottom water samples were collected at each site for determination of 17 standard water quality parameters. Air and water temperature, D.O., pH, and secchi disk visibility were measured on site. Chlorophyll *a* was extracted from 100-400 ml of lake water and analyzed as described by Strickland and Parsons (1968). The remaining parameters were determined at the State Health Laboratory, Pierre, South Dakota, from water samples properly preserved and shipped in ice coolers within 24 hours of collection.

Trophic assessment of state lakes was based on trophic status as determined by combining Carlson's (1977) Trophic State Indices (TSI) for secchi depth, total phosphorus and chlorophyll *a*. Use support status of assessed lakes was determined by establishing the following ranges of TSI values to correspond to full, partial, and non support:

Use Support	TSI	Trophic Condition
Fully supporting	00-35	oligotrophic
Fully supporting	36-50	mesotrophic
Fully supporting	51-55	moderately eutrophic
Partially supporting	56-65	eutrophic
Not supporting	66-100	hypereutrophic

Trends in lake trophic status (short and long term) were estimated primarily by comparison of TSI values obtained in 1979 (Koth, 1981), and data gathered during the 1989 and 1991-95 DENR lake assessments (Stewart and Stueven, 1996; 1994).

Short term trends for assessed lakes since the last reporting period were tabulated in the River Basins assessment chapter of this section. A difference of three units or more between respective TSI values was arbitrarily selected as signifying a change in lake water quality between monitoring periods. Long term trends covering the period from 1979 through 1995 are summarized in the Lake Water Quality Assessment chapter of this section.

Long term trends for individual lakes appear in the 1995 South Dakota Lake Assessment Final Report.

In order to ensure a sufficient number of samples was available for each stream segment (usually 20) to arrive at an assessment that would be statistically acceptable, the period of record considered for this 305(b) document was from January 1, 1992 to September 30, 1997 (5 3/4 years).

Much of the waterbody information is summarized in Tables 5 through 15. More detailed information on each river basin and the assessed lakes within each drainage is presented in Tables 16 through 30.

For convenience, lake-specific information gathered during the present lake water quality assessment was included in the River Basin Assessments chapter of this section. The lake assessment was based primarily on a state-wide lake survey conducted by DENR from 1993 to 1995. Lakes were chosen on the basis of public ownership, public access, a minimum surface area of 100 acres, and their inclusion in the 1979 South Dakota Clean Lakes Classification Report (Koth, 1981) and annual DENR Lake Water Quality Assessments from 1989 through 1995 (Stewart and Stueven, 1996; 1994).

C. STATEWIDE SURFACE WATER QUALITY SUMMARY

South Dakota has a total of 9,937 miles of rivers and major streams (Table 1). Major or significant streams in this context are waters that have been assigned aquatic life use support in addition to the beneficial uses of wildlife propagation/stockwatering and irrigation (9, 10). This definition includes primary tributaries and, less frequently, subtributaries of most state rivers and larger perennial streams. In a few cases, lower order tributaries may be included, for example in the Black Hills area which has a relatively large number of permanent streams. If all existing and mostly waterless stream channels and gullies are to be included as state waters, the great majority of which serve only to carry snowmelt or stormwater runoff for a week or two during an average year, total stream mileage within South Dakota would greatly exceed the above quoted figure (EPA, 1991).

Approximately 3,200 miles have been assessed, and resulting data evaluated and reported, by DENR, to determine water quality status for an extended period covering the last 6 years (January 1992 to September 1997). Data needed to be evaluated over this longer time span to ensure enough data points were available for each stream segment (usually 20) to properly characterize existing stream conditions. Since for some stream segments only 4 (or fewer) samples were available per year, evaluation of a set of data covering at least 5 years of sampling was required to adequately portray the natural variability in water quality that is typical of stream environments. Moreover, due to recent changes in EPA policy guidelines, the present 305(b) document will be the last such full hard-copy report produced by the state and should therefore serve as a benchmark or reference for future annual electronic reports and abbreviated biennial hard-copy documents recommended in the 1997 guidelines.

Currently, 36% of the assessed stream miles fully support their assigned beneficial uses, 17% are partially supporting, and 47% do not support their uses. The high percentage (64%) of moderate and severe impairment can be attributed largely to persistently high levels of total suspended solids (TSS) present in many of the monitored streams this reporting period as a result of continued high water conditions in many areas of the state.

During this reporting cycle, 2,986 designated miles were assessed for goal attainment of fishable (aquatic life) use which includes 650 miles also assessed for swimmable goal attainment. During this assessment period, nearly 35% of assessed stream miles fully met fishable/aquatic life criteria, whereas 21% partly met, and 44% did not meet fishable/aquatic life criteria. Nearly 37% of 650 stream miles fully supported swimmable uses, 10% partly met and 53% did not meet swimmable criteria.

Nonsupport was again caused primarily by total suspended solids from agricultural nonpoint sources and natural origin. In terms of total stream miles affected, the second most important cause of impairment this reporting period was elevated fecal coliform bacteria concentrations. Recently revised figures indicate that non-support due to FC decreased from 64% of swim-rated stream miles for the years 1991-93 to 53% (1993-95) then increased to 67% for 1995-1997. Less important causes of impairment this reporting cycle included elevated total dissolved solids concentration (TDS), low dissolved oxygen (DO), elevated stream pH and water temperature, in approximate order of importance. Natural pollutant sources of dissolved and suspended solids are exemplified by erosive soils that occur in western South Dakota and along the Missouri River (including considerable exposed marine shale formations) and in extreme southeastern South Dakota (including large areas of highly erodible loess soils).

In contrast to frequent dry periods that characterized the years 1988 and 1989, large parts of South Dakota experienced above average annual rainfall for most of this decade. Unusually heavy rainfall and snowmelt runoff during the present and previous reporting periods produced flood conditions over much of eastern South Dakota in the spring and summer of 1993, 1995, and 1997. An increased number of large runoff events in the state from 1991 to 1997 continued to produce a high incidence of severe TSS exceedances during this reporting period. In addition, runoff waters percolating through leachable calcareous soils of normally semi-arid parts of the state also resulted in elevated water pH and dissolved solids concentrations in some monitored river basins. Although the dilutional effects of increased stream flows were probably instrumental in producing a drop in major swimming use violations due to fecal coliform in a few state rivers and streams, apparently a greater opposite effect occurred in lakes with swimming facilities where there was an increased incidence of excessive fecal coliforms in swimming areas during the wet years 1993, 1995 and 1997.

It has become evident that higher than average annual precipitation can produce considerable suspended sediment problems over large areas of the state particularly in the west and southeast. It is also apparent that fecal coliform concentrations increase significantly in a number of state lakes during times of above normal rainfall. Appropriate best management practices should be applied to treat the sources of these and other impacts whose effects are likely to be masked during periods of low precipitation.

In addition to rivers and streams, South Dakota has 799 publicly owned lakes and reservoirs according to a past GF&P survey, totaling approximately 750,000 acres. Four Missouri River mainstem reservoirs make up 548,000 surface acres or 73% of estimated total lake acreage. Approximately 565 waterbodies are considered significant lakes that are listed in ARSD 74:51:02 and classified for aquatic life and recreation beneficial uses. GF&P presently manages 450 state lakes for fish. Total state water area has been estimated by the South Dakota Conservation Districts as approximately 1.6 million acres.

Approximately 98% of use nonsupport for lakes can be attributed to nonpoint sources. Excluding the four mainstem reservoirs, 16% of the lake acreage assessed is presently considered to support all designated uses. Twenty-six percent of total lakes acreage partially supports uses, and 58% does not support uses. The results obtained during recent assessments show moderate improvement in lake use support over data gathered during the late 1980s. This can be partially attributed to the beneficial effects on lake water levels and water quality produced by increased annual rainfall in many parts of the state from 1991 to 1995 and 1997.

Most lakes in the state are characterized as eutrophic to hypereutrophic. They tend to be shallow and turbid and are well-supplied with dissolved salts, nutrients, and organic matter from often sizeable watersheds of nutrient-rich glacial soils that are extensively developed for agriculture. Runoff, carrying sediment and nutrients from agricultural land, is the major nonpoint pollution source.

The water quality of assessed surface waters in South Dakota during this monitoring period is summarized in Tables 5 through 10.

TABLE 5. DESIGNATED OVERALL USE SUPPORT STATUS FOR RIVERS AND STREAMS IN SOUTH DAKOTA

Type of Waterbody: Rivers and Streams (miles)			
Degree of Use Support	Assessment Basis		Total Assessed
	Evaluated	Monitored	
Size fully supporting	-	1,158	1,158
Size partially supporting	-	538	538
Size not supporting	-	1,504	1,504
TOTAL	-	3,200	3,200

TABLE 5 A. AQUATIC LIFE USE SUPPORT (ALUS) STATUS FOR WADABLE STREAMS AND RIVERS IN SOUTH DAKOTA

Degree of ALUS	Miles Assessed Based on B/H[a] Data Only	Miles Assessed Based on P/C[b] Data Only	Miles Assessed Based on B/H and P/C Data	Total Miles Assessed for ALUS
Fully Supporting	-	1,062	-	1,062
Partially Supporting	-	617	-	617
Not Supporting	-	1,307	-	1,307

Wadable rivers and streams: Missouri River excluded (flowing 121 miles)
[a]B/H = Biological/Habitat Data
[b]P/C = Physical/Chemical Water Quality Data
dash (-) = category applicable no data available

TABLE 6. DESIGNATED OVERALL USE SUPPORT STATUS FOR LAKES AND RESERVOIRS IN SOUTH DAKOTA

Type of Waterbody: Lakes and Reservoirs (acres)			
Degree of Use Support	Assessment Basis		Total Assessed
	Evaluated	Monitored	
Size fully supporting	-	21,211	21,211
Size partially supporting	-	33,719	33,719
Size not supporting	-	77,229	77,229
TOTAL	-	132,159	132,159

TABLE 7. INDIVIDUAL USE SUPPORT SUMMARY FOR RIVERS AND STREAMS

Type of Waterbody: <u>Rivers and Streams</u>

Goals	Use	Size Assessed (Miles)	Size Fully Supporting (Miles)	Size Fully Supporting but Vulnerable (mi)	Size Partially Supporting (Miles)	Size N[illegible] Support[illegible] (Miles[illegible]
Protect & Enhance Ecosystems	Aquatic Life[a]	2986	1062	*	617	1307
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *
Protect & Enhance Public Health	Fish Consumption	170	170	*	-	-
	Shellfishing	*	*	*	*	*
	Swimming	650	238	*	64	348
	Secondary Contact	2522	1886	*	439	197
	Drinking Water[b]	546	546	*	0	0
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *
Social and Economic	Agricultural	3032	2635	*	339	58
	Cultural or Ceremonial	-	-	*	-	-
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *

[a] Waterbodies assessed using chemical/physical data. Frequency of exceedance of individually designated water quality standards (pp. 16 and 28) de[illegible] and aquatic life in general.

[b] Waterbody meets goal of supplying safe drinking water with conventional treatment.

asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.

TABLE 8. INDIVIDUAL USE SUPPORT SUMMARY FOR LAKES AND RESERVOIRS

Type of Waterbody: Lakes and Reservoirs

Goals	Use	Size Assessed (Acres)	Size Fully Supporting (Acres)	Size Fully Supporting but Vulnerable (A)	Size Partially Supporting (Acres)	Size Not Supporting (Acres)
Protect & Enhance Ecosystems	Aquatic Life[a]	132,159	21,211	*	33,719	77,229
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *
Protect & Enhance Public Health	Fish Consumption	469,297[e]	469,297	*	0	0
	Shellfishing	*	*	*	*	*
	Swimming[b]	597,121[e]	591,490	*	5,631	0
	Secondary Contact[c]	597,121[e]	596,959	*	162	0
	Drinking Water[d]	493,098[e]	493,098	*	0	0
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *
Social and Economic	Agricultural	566,785[e]	562,092	*	4,693	0
	Cultural or Ceremonial	-	-	*	-	-
	State Defined 1. 2.	 * *	 * *	 * *	 * *	 * *

[a] Waterbodies assessed using physical /chemical data and chlorophyll a analysis. Degree of eutrophication (TSI values) determines support status fo

[b] Based on frequency of exceedance of 200/100 ml for fecal coliform.

[c] Based on frequency of exceedance of 1000/100 ml for fecal coliform.

[d] Waterbody meets goal of supplying safe drinking water with conventional treatment.

[e] Includes one or more of the Missouri River mainstem reservoirs (548,000 acres). All assessments in Table 8 from October 1, 1995 to September 3

asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.

TABLE 9. TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS CAUSE CATEGORIES IN SOUTH DAKOTA

Type of waterbody: Rivers and Streams (miles)

Cause Category	Size of Waters by Contribution to Impairment (miles)		
	Major	Moderate	Minor
Cause unknown	-	-	-
Unknown toxicity	-	-	-
Pesticides	-	-	-
Priority organics	-	-	-
Nonpriority organics	-	-	-
Metals	25	-	-
Ammonia	0	27	448
Chlorine	-	-	-
Other inorganics	-	-	-
Nutrients	*	*	*
pH	39	24	795
Siltation	-	-	-
Organic enrichment/low DO	0	103	497
Salinity/TDS/chlorides	58	2	482
Conductivity	58	28	100
Elevated stream temperature[a]	11	30	172
Flow alterations	0	72	-
Other habitat alterations	0	43	-
Pathogen indicators (fecal)	545	362	283
Radiation	-	-	-
Oil and grease	-	-	-
Taste and odor	-	-	-
Suspended solids (TSS)	1257	496	619
Noxious aquatic plants	-	-	-
Total toxics	-	-	-
Turbidity	-	-	-
Exotic species	0	0	0
Other	0	0	0

asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.
[a] replaces “thermal modifications”

TABLE 9. CONTINUED

Type of waterbody: Lakes and Reservoirs (acres)

Cause Category	Size of Waters by Contribution to Impairment (ac)	
	Major	Moderate/Minor
Cause unknown	-	-
Unknown toxicity	-	-
Pesticides	-	-
Priority organics	65	-
Nonpriority organics	-	-
Metals	65	-
Ammonia	-	-
Chlorine	-	-
Other inorganics	-	-
Nutrients	98,874	19,554
pH	-	-
Siltation	78,116	46,072
Organic enrichment/low DO	46	-
Salinity/TDS/chlorides	0	0
Thermal modifications	0	0
Flow alterations	0	15,481
Other habitat alterations	0	43
Pathogens indicators [b] (fecal)	-	-
Radiation	0	0
Oil and grease	0	0
Taste and odor	0	0
Suspended solids (TSS)	3,181	14,133
Total toxics	-	-
Turbidity	3,181	14,133
Exotic species	-	-
Algae	98,063	20,365
Aquatic macrophytes	964	610

[b] see Tables 37 and 38 (Public Health/Aquatic Life Concerns)
asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.

TABLE 10. TOTAL SIZES OF WATERS IMPAIRED BY VARIOUS SOURCE CATEGORIES IN SOUTH DAKOTA

Type of waterbody: Rivers and Streams (miles)

Source Category	Contribution to Impairment	
	Major[a]	Moderate/Minor[a]
Industrial Point Sources	11	-
Municipal Point Sources	0	33
Combined Sewer Overflows	-	-
Agriculture	2316	805
Silviculture	-	-
Construction	-	-
Urban Runoff/Storm Sewers	0	150
Resource Extraction	2	62
Land Disposal	0	13
Hydromodification	-	-
Habitat Modification	-	-
Marinas	-	-
Atmospheric Deposition	-	-
Contaminated Sediments[b]	25	-
Unknown Source	-	-
Natural Sources	1212	1080
Other	-	-

[a] asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.

[b] bottom sediments contaminated with toxic or nontoxic pollutants; includes historical contamination from sources that are no longer actively discharging.

TABLE 10. CONTINUED

Type of waterbody: Lakes and Reservoirs (acres)

Source Category	Contribution to Impairment	
	Major[a]	Moderate/Minor[a]
Industrial Point Sources	0	0
Municipal Point Sources	0	0
Combined Sewer Overflows	0	0
Agriculture	81,842	39,311
Silviculture	162	1,698
Construction	-	-
Urban Runoff/Storm Sewers	173	-
Resource Extraction	-	-
Land Disposal	10,873	9,768
Hydromodification	-	-
Habitat Modification	1,339	15,481
Marinas	0	0
Atmospheric Deposition	-	-
Contaminated Sediments[b]	-	-
Unknown Source	-	-
Natural Sources	11,674	5,398
Other	-	-

[a] asterisk (*) = category not applicable
dash (-) = category applicable no data available
zero (0) = category applicable, but size of waters in the category is zero.

[b] bottom sediments contaminated with toxic or nontoxic pollutants; includes historical contamination from sources that are no longer actively discharging.

D. LAKE WATER QUALITY ASSESSMENT

Two major types of assessments were used to determine water quality and use support status of state lakes; one based on current and previous field monitoring (Stewart and Stueven, 1996; 1994) (Koth, 1981); and the other based on qualitative evaluations, for example, when monitoring data is incomplete or fragmentary from DENR or other agencies, as in the case of the Missouri River mainstem reservoirs.

South Dakota DENR is currently developing a strategy to evaluate lake water quality on an ecoregion basis. This ecoregion effort will require the determination of reference lakes for comparative purposes.

One hundred twelve lakes were sampled in spring and summer from 1989 through 1995. In recent years, water quality of the four mainstem Missouri River Reservoirs has been monitored by the US Army Corps of Engineers. Lack of adequate recent data has precluded continuation of their assessment for 305(b) reporting. The monitoring status of the mainstem reservoirs and downstream Missouri River waters remains undetermined at the present time. Consequently, these waterbodies have also been transferred to Table 4 awaiting future assignments of monitoring protocols. The remaining lakes in Table 11 (687) do not meet the criteria for assessment listed below.

The lakes included in lake assessment sampling include all lakes in the state that meet the following criteria:

1. A lake must be publicly owned.
2. A lake must be over 100 surface acres.
3. A lake must have public access.

Privately owned lakes are currently not being assessed by DENR.

The mainstem Missouri River Reservoirs have a total combined surface area of 548,000 acres. Five other lakes in South Dakota with a surface area >5,000 acres have a combined surface area of 61,279 acres. The total surface acreage of assessed lakes less than 5000 acres in area amounted to 81,229 acres in the previous 305(b) report.

Carlson's (1977) Trophic State Indices (TSI) were used to determine trophic status of the lakes which were assessed from 1979 through 1995. The parameters used included Secchi depth, total phosphorus and chlorophyll *a*. Carlson's Indices were selected because of ease of use and to ensure continuity with past 305(b) reports. Carlson's Indices were also used to determine short term (3-year) and 16 year trends in lake water quality.

Of 112 lakes reported as monitored in the last 305(b) document (Table 11), only two were rated as oligotrophic and 10 as mesotrophic. Oligotrophic waterbodies were Deerfield and Pactola Reservoirs in the Black Hills. Lakes rated as mesotrophic included Shadehill Reservoir in northwestern South Dakota. Five of the remaining nine mesotrophic lakes were located within the Black Hills and surrounding area. Lakes Enemy Swim, Pickerel, Roy, and Lake Yankton were eastern state lakes also placed in this category.

The major problems of South Dakota lakes continue to be excessive nutrients, algae, and siltation due to nonpoint source pollution (primarily agricultural). Water quality degradation due to acid precipitation, acid mine drainage, or toxic pollutants does not presently appear to be a significant problem in South Dakota lakes. Lake-specific data is tabulated in the River Basin Assessments section.

Clean Lakes Program

The South Dakota Clean Lakes Program is a two-phased effort designed to first identify sources of pollution and determine alternative restoration methods; and second to control the sources of pollution and restore the quality of impacted lakes. Both phases of the program are state and local efforts, with supplemental technical and financial assistance from EPA and other federal agencies used whenever possible.

TABLE 11. TROPHIC STATUS OF SIGNIFICANT PUBLICLY OWNED LAKES

	Number of Lakes	Acreage of Lakes
Total	799	750,000
Assessed	112	132,159
Oligotrophic	2	1,199
Mesotrophic	10	23,205
Eutrophic	37	30,526
Hypereutrophic	63	77,229
Dystrophic	0	0
Unknown	687	617,841

The Lake/Watershed Assessment phase of the program encompasses a series of procedures to assess the current condition of selected water bodies. Included in this phase are water quality, water quantity and watershed data collection sub-programs. The state provides the local sponsor with technical assistance, training, and equipment to conduct the assessment portion of the project. Generally, the local project sponsor is responsible for collecting the data using existing local resources only or 319 assessment grant funding. Following the collection of sufficient data, the state conducts an evaluation of the data and prepares a report which details baseline information, identifies sources of pollution, describes alternative pollution control methodologies and outlines implementation costs. A TMDL is developed using this information.

Prior to the implementation of specific pollution control and restoration alternatives, the project sponsor is responsible for the preparation of a complete pollution control and lake restoration plan based on recommendations from the assessment. Technical assistance for this process is provided by the state. If the plan is approved, the project sponsors are eligible to apply for appropriate state and federal funding.

The vast majority of the pollution sources affecting the lakes in South Dakota are agricultural non-point sources. The methods used to control these sources are selected on a case-by-case basis. The selection of methods is based on the evaluation of individual watersheds using the Agricultural Non-Point Source Model (USDA-ARS, 1994) or a manual inventory of land use, soil type and nonpoint sources. The AGNPS model delineates critical cells within the watershed and is then used to predict which control methods would be the most effective.

Following this evaluation, coordination with state and federal agricultural agencies is solicited to verify the critical nature of the identified cells and the selected control methods. For those areas targeted as critical, the owner/operators are contacted to request their voluntary participation in the control program. The state does have in effect the Sediment and Erosion Control Act of 1976 which is implemented by individual state conservation districts. However, any action under the Act is based strictly in response to complaints. There are no provisions for forcing compliance on identified problem areas. Specific practices currently recommended for non-point source pollution control include the full range of Best Management Practices (BMP) both mechanical and managerial, large and small sediment control structures, shoreline erosion control and the installation of manure management systems. DENR has a Surface Water Discharge program (SWD) that prohibits discharge to lakes. It also monitors communities and ensures compliance. In those few instances where point source pollution may occur, Best Available Technology is applied to correct the problem.

The South Dakota Clean Lakes Program is dependant upon many other resource management programs to conduct restoration activities. The Nonpoint Source Program, Department of Agriculture, Wetlands Program, Surface Water Quality Program, Petroleum Release Program, Ground Water Quality Program, Natural Resources Conservation Service, and many local agencies and special purpose districts are all crucial to the protection or restoration of lakes in the state. All of the above mentioned programs have linkages to components of many different types of projects. Land use ordinances exist in South Dakota as local and county zoning ordinances. These vary from comprehensive to non-existent in the state and are considered local issues.

In conjunction with the development of recommended pollution control alternatives, the diagnostic/feasibility study data evaluation is also designed to provide recommendations for in-lake restoration alternatives. The primary recommendations provided for lake restoration range from natural flushing, reducing or eliminating sources of pollution, to sediment removal by dredging, depending on what is appropriate. Restoration methods employed in the past include aeration, sediment removal, weed harvesting and chemical weed control and some preliminary attempts at biomanipulation. For a complete list of restoration methods that have been employed to date, refer to Table 12.

TABLE 12. LAKE REHABILITATION TECHNIQUES

Rehabilitation Technique	Number of Lakes Where Technique Has Been Used	Acres of Lakes Where Technique Has Been Used
IN-LAKE TREATMENTS		
Phosphorus Precipitation/Inactivation	0	0
Sediment Removal/Dredging	15	4,275
Artificial Circulation to Increase Oxygen	4	3,351
Aquatic Macrophyte Harvesting	5	16,137
Application of Plant Herbicides (including copper sulfate)	9	17,353
Lake Level Drawdown	4	216
Hypolimnetic Withdrawal of Low DO Water	0	0
Dilution/Flushing	0	0
Shading/Sediment Covers or Barriers	0	0
Destratification	0	0
Sand or Other Filters to Clarify Water	0	0
Food Chain Manipulation	1	9
Biological Controls	2	44
Other In-lake Treatment (Specify) Community Collection Wastewater Systems	9	18,714
Other In-lake Treatment (Specify) Rough Fish Harvesting	13	50,295
WATERSHED TREATMENTS		
Sediment Traps/Detention Basins	2	1,359
Shoreline Erosion Controls/Bank Stabilization	13	31,414
Diversion of Nutrient Rich In-Flow	0	0
Conservation Tillage Used	All Lakes	750,000
Integrated Pest Management Practices Applied	0	0
Animal Waste Management Practices Installed	7	16,853
Porous Pavement Used	0	0
Redesign of Streets/Parking Lots to Reduce Runoff	0	0
Road or Skid Trail Management	4	14,285
Land Surface Roughening for Erosion Control	0	0
Riprapping Installed	4	17,510
Unspecified Type of Best Management Practice Installed	All Lakes	750,000

TABLE 13. LIST OF CLEAN LAKES PROGRAM PROJECTS

Name of Project	Type of Project	Federal Funding ($)	Problems Assessed	Management Measures Proposed or Undertaken
Lake Cochrane	Phase II	$20,500	Sedimentation	Access road management and sediment traps
Oakwood Lakes	Phase II	$35,000	Shoreline Erosion	Rip-Rap on lakeshore
Lake Kampeska	Phase II	$70,000	Shoreline Erosion	Rip-Rap on lakeshore
Lake Herman	Phase II	$475,126	Sedimentation	Dredged Lake
Big Stone Lake	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Feedlot, Municipal sewage
Big Stone Lake	Phase II	$381,500	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste, Municipal sewage
1989 Lake Water Quality Assessment	LWQA	$100,000	Statewide Assessment	Statewide Assessment
Lake Hendricks	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste
Lake Campbell	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste
Swan Lake	Phase I	$100,000	Nonpoint Source Sediment/nutrient	Dredge, channel diversion
McCook Lake	Phase II	$110,422	Sedimentation	Dredge
Burke Lake	Phase II	$35,000	Sedimentation	Dredge
Wall Lake	Phase II	$303,310	Sedimentation	Dredge
1991-92 Lake Water Quality Assessment	LWQA	$60,000	Statewide Assessment	Statewide Assessment
Punished Woman Lake	Phase II	$240,000	Sedimentation	Dredge
Lake Kampeska	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste
Lake Poinsett	Phase I	$94,890	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste
1993 Lake Water Quality Assessment	LWQA	$50,000	Statewide Assessment	Statewide Assessment
1994 Lake Water Quality Assessment	LWQA	$52,000	Statewide Assessment	Statewide Assessment
Lake Madison /Brant	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste
Elm Lake	Phase I	$100,000	Nonpoint Source Sediment/nutrient	BMP's, Animal Waste

Active Phase I projects in South Dakota include the following lakes:

Lake Madison/Brant - federally funded
Elm Lake - federally funded
Clear Lake (Deuel Co.) - federally funded
Blue Dog Lake - federally funded

Clean Lakes implementation is accomplished by many different funding sources, as described above. The following is a description of implementation projects which are active.

Ravine Lake

The Ravine Lake project is an EPA Section 319 nonpoint source pollution control activity to restore the lake and to improve the water quality of its Broadland Creek watershed. The project began in April of 1994, and will terminate in March of 1999. Funding, technical assistance, and support have been supplied by EPA, South Dakota Department of Environment and Natural Resources, the US Fish and Wildlife Service, South Dakota Department of Game, Fish and Parks, Beadle County, South Dakota Conservation Commission, Beadle County Conservation District, City of Huron, and watershed landowners.

Major activities are to improve Broadland Creek through implementation of Best Management Practices, improve Ravine Lake by hydraulic dredging; initiate a program of urban Best Management Practices and conduct a storm sewer inventory; and to inform the general public of the project.

Watershed practices that have been implemented include animal waste management systems designed for two feedlots and two more systems in development; two grassed waterways have been designed and one more identified; 40 acres of grass have been planted, and one grazing system has been developed.

Three sediment ponds were built during the fall of 1997. Dredging operations began in the lake in the spring of 1998. An eight-inch dredge will be used to remove approximately 100,000 cubic yards of sediment. Shoreline stabilization work on public land will commence during the summer of 1998 around the lake using “soft” and “hard” practices.

Swan Lake

The diagnostic/feasibility study for Swan Lake was completed in January 1993. A workplan for the restoration of Swan Lake’s beneficial uses was developed later that same year. Major components of the workplan included sediment removal, implementation of management practices throughout the lake’s original 1000-acre watershed, shoreline stabilization, development and implementation of a management plan for the operation of the inlet structure from the 80,000-acre Turkey Ridge Creek watershed to the lake, and public information and education.

Sediment removal equipment was mobilized to the site in early 1994. Dredging began in July 1995 upon completion of the sediment disposal ponds. With the use of two dredges in a short first season of dredging, slightly more than 70,000 cubic yards of sediment were removed from the lake. The sediment removal completed to date is 345,000 cubic yards. Another 45,000 cubic yards is planned to be removed in 1998.

As anticipated in the planning phase of the project, sediment removal activities have had a considerable effect on the water level of the lake. Therefore, the managed plan of operation for the Turkey Ridge Creek inlet structure will not be implemented until after sediment removal is completed to ensure adequate water depth to float the dredges.

Shoreline stabilization and implementation of agricultural management practices in the lake’s original 1000-acre watershed were completed in 1996 and 1997. Management practices included grassed waterways, filter strips, critical area plantings, residue management, contour farming, and conservation cropping

The majority of the workplan activities were completed by December 1997. It is likely that the sediment disposal ponds will not be reclaimed until the year 2000.

Swan Lake Improvement Association is the project sponsor and has committed more than $100,000 in cash to match grant funds secured for the project. To date, the sponsor has received a one-time grant through the EPA Section 319 program and two annual awards from South Dakota's Consolidated Water Facilities Construction Program. Large commitments of in-kind services in the form of administration, labor, and equipment have been provided by Swan Lake Improvement Association, local county government, other local community organizations, and local interested individuals and businesses.

Lake Redfield

An assessment of Lake Redfield and the Wolf Creek-Turtle Creek watershed in Spink County was completed in May 1993. Planning efforts to address nonpoint sources of pollution identified in the assessment report began in July 1994.

During the 14-month planning period, a multi-objective workplan was developed to improve the water quality of Redfield Lake and the Turtle Creek watershed in Spink County to the James River, to restore the beneficial uses assigned to Lake Redfield, and to enhance recreational opportunities in the Lake Redfield vicinity.

The project objectives consisted of the following: (1) increase awareness of nonpoint source pollution and control through urban and rural information and education programs; (2) reduce the nutrient and sediment loadings to Turtle Creek and Lake Redfield by implementing management practices in the lake and watershed including grassed waterways, tree plantings, manure management systems, grass seedings, alternative livestock watering systems, wetland restoration, bank stabilization in riparian areas, sealing of abandoned wells, managed grazing systems, and lake shoreline stabilization; (3) increase the mean depth of Lake Redfield through the removal of sediment and cattails; (4) eliminate nonpoint source pollution to Turtle Creek associated with a livestock auction barn located in the city limits of Redfield; and (5) improve recreational facilities adjacent to Lake Redfield including handicapped accessible fishing pier, parking area, camping pads, boat ramp, comfort station, trails, and picnic areas.

The project has been awarded its full request for funding through the South Dakota Department of Agriculture's Conservation Commission fund. The project sponsor, Spink County Conservation District, has received funds through the EPA Section 319 Program, South Dakota Department of Environment and Natural Resources' Consolidated Water Facilities Construction Program, as well as federal funds available through the Intermodel Surface Transportation Efficiencies Act. The city of Redfield has committed a significant amount of cash match to the project. The funding package also includes varying amounts of federal and local in-kind services.

Two AG waste management systems have been installed and two more are scheduled to be implemented in the next two years. This is the second of three years of dredging that plans to remove 275,000 cubic yards of sediment. Grassed waterways, tree planting and other shoreline stabilization methods are proposed for the next two years as well. The last two years of work has also removed eight acres of heavy overgrown cattails with another two acres of cattails scheduled to be removed this year.

The watershed improvements should be completed by 1999 and reclaiming the ponds should complete the project by the year 2001.

Impaired Lakes

A description of impaired lakes is included in the section of this report titled River Basin Assessments. The lakes are listed by their location in each major river basin in the state.

The South Dakota Surface Water Quality Standards (SD SWQS) ARSD Article 74:51 do apply to 799 lakes in the state. Each of the lakes is named in the standards and assigned beneficial uses. The beneficial uses assigned to lakes include at least one of the following:

Domestic Water Supply
Coldwater Permanent Fish Life Propagation
Coldwater Marginal Fish Life Propagation
Warmwater Permanent Fish Life Propagation
Warmwater Semipermanent Fish Life Propagation
Warmwater Marginal Fish Life Propagation
Immersion Recreation
Limited Contact Recreation
Wildlife Propagation and Stock Watering
Irrigation
Commerce and Industry

Standards for toxic substances are in accordance with the SD SWQS.

Acid Effects on Lakes

During the Lake Water Quality Assessment, each lake was measured for field pH. As a result of this monitoring, no lakes have been found to have pH levels less than 7.00 SU (standard units). The state is not aware of any lakes in South Dakota that are currently being impacted by acid deposition (Table 14). This is attributed to a lack of industrialization and a natural buffering capacity of the soils.

TABLE 14. ACID EFFECTS ON LAKES

	Number of Lakes	Acreage of Lakes
Assessed for Acidity	112	132,159
Impacted by High Acidity	-0-	-0-
Vulnerable to Acidity	-0-	-0-

Trends in Lake Water Quality

Trends were determined for South Dakota lakes using information collected during the 1989 - 1995 Lake Water Quality Assessments. Chlorophyll *a*, total phosphorus, and Secchi depth were used to calculate trophic state using Carlson's Trophic State Index. A mean annual TSI was calculated for each year the lakes were sampled with information from the 1979 South Dakota Lakes Survey as a base. The trophic state indices were plotted on a graph and a regression calculated for the data points to determine trends. Table 15 is a summary of trends in water quality of South Dakota public lakes. Approximately 565 state lakes are presently listed in ARSD 74:51:02 as having been assigned beneficial uses other than stock watering and wildlife propagation (9).

TABLE 15. TRENDS IN PUBLIC LAKES (1979-1995)

	Number of Lakes	Acreage of Lakes
Assessed for Trends	112	132,159
Improving	54	53,808
Stable	22	28,537
Degrading	30	43,877
Trend Unknown	6	5,937

E. RIVER BASIN ASSESSMENTS

Introduction

South Dakota has fourteen major river basins, most of which drain into the Missouri River (Figure 1). The following sections contain brief narratives that discuss noteworthy waterbodies and pollution problems. A detailed state map showing assessed lakes and streams provides general use support information (Figure 2). More specific information is provided in the accompanying river basin tables for the monitored waterbodies in each river basin that is identified in Figure 1 and shown in outline in Figure 2.

Much of the information necessary for River Basin Assessments is obtained from the state stream ambient monitoring program. This fixed ambient network presently consists of 94 active in-stream stations. The collected data is evaluated to define water quality in the state, identify pollution, and report changes in the state's water quality.

Sampling station locations are determined by assessing areas located within high quality beneficial use classifications, located above and below municipal/industrial discharges, or within problem watersheds. Currently, DENR collects samples at those locations on either a monthly or quarterly basis for nutrient, bacterial, and general physical and chemical parameters. Stations which are located along mine drainages are also analyzed for cyanide and ten metals including arsenic. Several stations are sampled for sodium, calcium, and magnesium during the irrigation season. The samples are shipped in ice containers to the laboratory for analysis. Sample test results are then entered into STORET. This type of water sampling is used to monitor historical information, natural background conditions, possible runoff events, and as an indication of possible acute or chronic water quality problems.

Lake monitoring within each river basin is conducted in conjunction with the Watershed Assessment Program, diagnostic/feasibility studies, and special lake studies. Many of the standard parameters measured in streams are also evaluated for state lakes with the addition of secchi disk visibility, chlorophyll *a* level, oxygen/water temperature profiles, total phosphorus, and total volatile solids. Similarly, in the course of sampling lakes as well as streams, any pollution sources or environmental conditions which may affect water quality are noted by field personnel. Unlike stream evaluations, however, lake trophic state and trends in lake trophic condition are estimated with Carlson's (1977) Trophic State Indices (TSI). Short term (3-year) trends in lake trophic status are summarized in Tables 17 to 30.

Baseline data show whether or not a waterbody is meeting its assigned water quality beneficial uses. A description of the procedure involved is found in the methodology section of this document. Baseline data evaluations are used as a management tool to determine the effectiveness of control programs on existing point and nonpoint sources and for directing future control activities.

TABLE 16. KEYS FOR RIVER BASIN INFORMATION TABLES

Name -	Name of waterbody.
Location -	Best available description, LL = latitude/longitude.
Size -	Best available estimate of entire waterbody size, lakes in acres and rivers in miles. (Impacts were assumed to affect the entire waterbody unit).
Assessment method -	M = monitored
Basis -	Monitoring agency/program and sampling site identification/WQM number.
Cause for impaired uses -	1 = Unknown toxicity 2 = Pesticides 3 = Priority organics 4 = Nonpriority organics 5 = Metals 6 = Ammonia 7 = Chlorine 8 = Other inorganics 9 = Nutrients 10 = pH 11 = Siltation 12 = Organic enrichment/DO 13 = Salinity/TDS/chlorides 14 = Thermal modifications 15 = Flow alteration 16 = Other habitat alterations 17 = Pathogens 18 = Radiation 19 = Oil and grease 20 = Taste and odor 21 = Suspended solids 22 = Noxious aquatic plants 23 = Filling and draining 24 = Conductivity
	H = High relative contribution (non support) M = Moderate relative contribution (partial support) S = Slight relative contribution (full support)

TABLE 16. CONTINUED.

Source categories -

Codes: 0: Point Sources
- 00: Controlled by permit
- 01: Industrial
- 02: Municipal
- 03: Municipal Pretreatment (indirect dischargers)
- 04: Combined sewer (end-of-pipe)
- 05: Storm sewers (end-of-pipe)

09: Nonpoint Sources (unspecified)

10: Agriculture
- 11: Non-irrigated crop production
- 12: Irrigated crop production
- 13: Specialty crop production (e.g., truck farming and orchards)
- 14: Pasture land
- 15: Range land
- 16: Feedlots - all types
- 17: Aquaculture
- 18: Animal holding/management areas

20: Silviculture
- 21: Harvesting, restoration, residue management
- 22: Forest management
- 23: Road construction/maintenance

30: Construction
- 31: Highway/road/bridge
- 32: Land Development

40: Urban Runoff
- 41: Storm sewers
- 42: Combined sewers
- 43: Surface runoff

50: Resource Extration/Exploration/Development
- 51: Surface mining
- 52: Subsurface mining
- 53: Dredge mining
- 54: Petroleum activities
- 55: Mill tailings
- 56: Mine tailings

TABLE 16. CONTINUED.

60: Land Disposal (Runoff/Leachate from Permitted Areas)
- 61: Sludge
- 62: Wastewater
- 63: Landfills
- 64: Industrial land treatment
- 65: On-site wastewater systems (septic tanks, etc.)
- 66: Hazardous waste

70: Hydromodification
- 71: Channelization
- 72: Dredging
- 73: Dam construction
- 74: Flow regulation/modification
- 75: Bridge construction
- 76: Removal of riparian vegetation
- 77: Streambank modification/destablization

80: Other
- 81: Atmospheric deposition
- 82: Waste storage/storage tank leaks
- 83: Highway maintenance and runoff
- 84: Spills
- 85: In-place contaminants
- 86: Natural
- 87: Recreational activities

90: Source Unknown

Magnitude: H: High
M: Moderate
S: Slight

Trend (3-year) - S = stable, D = degrading, I = improving, V = vulnerable, U = unknown

Trophic status (TROP) - O = oligotrophic
(lakes only) M = mesotrophic
E = eutrophic
H = hypereutrophic
U = unknown

Support status (SUP) - F = full support
(lakes and streams) P = part support
N = non-support
U = unknown

The Vermillion River Basin (Figures 1 and 2, Table 17).

The Vermillion River basin covers an area of 2,652 square miles in southeastern South Dakota. The basin is about 150 miles in length and varies in width from 12 miles in the north to 36 miles in the south. Much of the lower 22 miles of the river is channelized. The major economic pursuit is agriculture. It is estimated that 96 percent of the total surface area is devoted to agriculture. That leaves the remaining areas for municipalities, sand and gravel operations, lowland areas, and other uses.

The Vermillion River basin experienced extended periods of above normal rainfall from 1992 through 1995 that resulted in flooding during spring and summer of 1993, 1995, and to some extent, 1997. These high water conditions produced increased siltation and sedimentation to local waterbodies.

The water quality of the basin is usually marginal for designated beneficial uses most often the result of elevated total suspended solids (TSS). During the previous two reporting periods (1991-1995) the warmwater fishery use continued to be impacted by excessive TSS which represented the sole cause of non-support for the entire drainage. Moderate increases in TSS were noted during 1995-1997 which was a similarly wet period in the watershed. Total dissolved solids (TDS) showed a moderate decline although there was little change in water pH between reporting cycles. A moderate impairment for secondary contact was noted in the upper and lower reach of the river due to elevated fecal coliform numbers the last two years. This rating resulted from an increase in bacteria numbers after September 1995.

Overall water quality in the basin has remained relatively stable since 1986 with moderate fluctuations in TSS during most years and a decline in fecal coliform concentrations from the levels reported in 1986. The present evaluation of the lower quarter of the river course (Table 17) covered 5 3/4 years of accumulated data and resulted in a rating of non-support due to excessive TSS and moderate impairment owing to elevated fecal coliform bacteria concentrations.

Seven lakes in the basin have been assessed; Lake Preston, Whitewood Lake, Swan Lake, Silver Lake, Lake Thompson, Lake Vermillion and Lake Marindahl. A diagnostic/feasibility study has been completed for Swan Lake. The first five lakes are highly eutrophic (TSI: 72-89) with algae, nutrient enrichment and siltation being major causes of nonsupport. Lake Marindahl presently ranks as eutrophic (TSI: 56). Siltation and sedimentation problems are particularly severe at Lake Vermillion (TSI: 67) owing to its large watershed (>260,000 acres) comprised mostly of cropland. Although Lake Vermillion showed comparatively little change in annual TSI values the last several years, fecal coliform bacteria levels at Lake Vermillion swimming areas exceeded 200 colonies/100ml twelve times in 1993 but only three times for 1994-1995 and six times from 1996 to 1997 (Tables 34 and 35).

Resident response within this basin indicates local lakes are not meeting their swimmable uses due to excessive algal/macrophyte growth and deterioration of beaches by siltation. Eutrophication is also accelerated by increasingly large numbers of feedlots and/or animal holding/management areas in the river basin, erosion runoff from fertilized cropland, and stream bank erosion.

An implementation Phase II project which includes hydraulic dredging of the lake sediments and watershed management measures is nearing completion at Swan Lake. The volume of sediment removed by the end of 1997 totaled 345,000 cubic yards with another 45,000 cu. yds. scheduled to be removed in 1998 (Lake Water Quality Assessment chapter).

Table 17

Big Sioux River Basin (Figures 1 and 2, Table 18).

The Big Sioux River basin is located in eastern South Dakota. The lower portion of the river forms the Iowa-South Dakota border. The basin drains an approximate 4,280 square miles in South Dakota and an additional 3,000 square miles in Minnesota and Iowa. The adjacent Big Sioux Coteau contains an additional non-contributing 1,970 square miles. The basin's primary source of income is agriculture, but it also contains a majority of the state's light manufacturing, food processing, and wholesaler industries. Four state education institutions, many vocational schools, and Sioux Falls, the state's largest city, are located within this basin making this the heaviest populated region in the state.

DENR maintains 14 active water quality sampling sites on the Big Sioux River and one site on the lower Skunk Creek tributary in Sioux Falls. Most of the fixed stations are representative of the various segments of the nearly 388-mile length of the River and are located from Watertown in Codington County south to Richland in Union County, the last downstream site. However, two sites located in the upper half of the river course are not adequately representative of their reach of 168 river miles due to their close proximity. This was also true of the downstream site on Skunk Creek whose representative segment was adjusted from 50 miles to the lower 13 miles of the creek. Similar mileage reductions and other adjustments were made in stream segments of the other river basins, based on recent remeasurements of stream courses.

Most of the monitored reach of the Big Sioux River is partially supporting or not supporting its fishable (aquatic life) beneficial use at the present time (Fig. 2). As in the last three reporting periods, use impairment in the upper half of the drainage this assessment was due to excessive total suspended solids (TSS). Increased rainfall in the upper watershed from 1991 to 1997 compared to previous decades is probably a major contributing factor. Last reporting cycle over 100,000 acres in the upper drainage (northwest of Watertown, SD) that was formerly non-contributing, was added to the existing watershed acreage of nearly 213,000 acres. Above normal rainfall and channelization work completed in the vicinity of Still Lake increased the Big Sioux drainage area above Watertown by at least 50%. High water conditions the last several years also necessitated periodic surface discharges of excessive levels of un-ionized ammonia by the Watertown WWTF. This resulted in moderate impairment to several miles of river four or five years ago but no significant violations for ammonia were noted during the last several years.

Downstream, from Dell Rapids to Sioux Falls, excessive fecal coliform was the cause of major impairment (non-support). In addition, elevated total suspended solids were a source of moderate impairment in this reach. During this reporting period, fecal coliform levels were moderately higher for sites in the Sioux Falls area. This increase was due primarily to higher bacteria concentrations at site #64 in Sioux Falls (Figure 10) during 1997 relative to levels present in 1996 and 1995 at this site, and at other sites below the city limits.

The lowermost segment of the Big Sioux River from approximately 15 miles downstream of Canton, South Dakota, to the Missouri River confluence continues to be non-supporting of its assigned uses due to excessive TSS and excessive fecal coliform. Here, too, bacteria levels showed an increase the last several years. In sharp contrast with all river segments downstream of Watertown, South Dakota, the uppermost 50-mile segment of the Big Sioux River fully supported its assigned uses during the present and recent assessments. Minor exceedances were TSS, FC, and ammonia. During previous reporting periods, low DO and elevated TSS were minor impairments.

Sources of fecal coliform in the lower Big Sioux (Lincoln/Union County) may be discharges of wastewater from upstream city sewers, individual rural farmsteads/dwellings and runoff from feed-lots/animal holding sites. During periods of high precipitation discharges from storm sewer and emergency bypasses of municipal wastewater facilities may be contributors of fecal coliforms to the Big Sioux River.

Sediment sources are overland runoff from nearby croplands and feedlots, inflow from tributaries, and considerable streambank erosion. Potential for severe soil erosion appears to be particularly high in a 50-mile reach of the Big Sioux south of Canton, SD, where the river channel borders an extensive hilly area of highly erosive soils. This situation promotes bank erosion and high sediment runoff in the Big Sioux and tributaries in the area.

Pipestone, Union, and Brule Creeks (Table 4) were reported by the local conservation district to be impacted to an unknown extent by excessive TSS, siltation and agricultural wastes. Skunk Creek near Sioux Falls is presently supporting its beneficial uses. Last reporting period, Skunk Creek was non supporting due to excessive TSS.

With one or two possible exceptions, lakes in the Big Sioux River basin are eutrophic to varying degrees due to algae, nutrient enrichment, and siltation. Most can be considered hypereutrophic (highly eutrophic) at the present time. Moreover, trends point to continued and noticeable nutrient enrichment for the long term due to several factors: the moderate size of some of the waterbodies but particularly the shallow average depth of most of the basin lakes makes them more susceptible to rapid changes produced by large nutrient and sediment loads from often sizeable agricultural watersheds comprised of nutrient-rich glacial soils.

Comparison of lake TSI values from past reporting periods suggested little or no change in the general water quality of eight of 13 basin lakes between assessment cycles for which trend data was available; an apparent improvement in four or 31% of the monitored lakes, and a decline in the water quality of one lake or 8% of the total. This generally favorable short-term trend may constitute evidence of the beneficial effects of increased precipitation and cooler summer climate that prevailed in the state the last several years, on the condition of local lakes.

Watershed management programs are attempting to reduce sediment and nutrient loads from both cultural and natural sources within the basin. Completion of the Watertown WWTP upgrade in late 1997 has reduced yet another significant source of ammonia and bacteria to the Big Sioux River.

Projects currently underway, include an assessment study of Lake Madison/Brant Lake; watershed and lakeshore stabilization for Lake Kampeska (Phase II); and expansion of a recently completed central wastewater collection system for the residents of Lake Poinsett. In addition, an assessment has been completed for this large lake and its drainage. Two assessments have also been completed for Lakes Pelican and Madison/Brant and two assessments are underway this water year in Blue Dog Lake and Clear Lake (Deuel Co.). Pelican Lake will be included with Lake Kampeska in the upper Big Sioux River Watershed Project (Phase II) with availability of funding from 319 grants. The Lake Campbell/Battle Creek Watershed Project is now in implementation. A four-year sediment removal (dredging) project in Wall Lake was completed in late October 1993. More than 1.6 million cubic yards of sediment were removed from 90% of the lake basin.

Minnesota River Basin (Figures 1 and 2, Table 19).

The Minnesota River basin is found at the northeastern corner of the state. It is bordered on the north by the Red River tributaries, on the west by the undrained Prairie Coteau Pothole region, on the south by the Big Sioux River, and on the east by the South Dakota/Minnesota border. The basin drains an area of 1,572 square miles within South Dakota. Agriculture remains the number one economic mainstay, while manufacturing and quarrying also contribute significantly.

Water quality within the basin continues to be good to satisfactory. During this assessment two minor exceedances were recorded for excessive TSS and elevated pH in the Lac Qui Parle and South Fork Yellowbank Rivers, respectively. During 1992-1993, slight to moderate impairments were noted in the main branch of the Whetstone River, the Little Minnesota River, and the north fork of the Yellowbank River due to elevated total suspended solids (TSS). During 1994-1995, two instances of elevated TSS, 102 and 100 mg/l, were noted in the Little Minnesota and Whetstone Rivers, respectively. Overall, there appeared to be no consistent pattern in the water quality of most of these streams. Impairments detected were for the most part sporadic and isolated events probably caused alternately by brief periods of heavy localized runoff and periods of dry weather.

The south fork of the Whetstone River continues to support its assigned beneficial uses. In the past, water quality degradation in this reach occurred during low river flow (decreased dilution) in the form of increases in water conductivity, low DO, and fecal coliform exceedances. During dry periods Milbank WWTF discharges make up most or all of the flow volume of the lower South Fork.

Five of seven lakes in the basin that have been monitored are eutrophic to varying degrees due to algae, nutrient enrichment, and siltation (TSI: 61-73). The one exception, Lake Cochrane, has the best water quality of the monitored waterbodies with a current (1995) TSI of 52. Adjacent Lake Oliver has a moderately higher TSI of 57. Punished Woman and Big Stone Lake have been particularly impacted by siltation from their watersheds and shorelines. There was recent improvement in the water quality of all five lakes based on their latest calculated TSIs (Table 19).

A major lake restoration measure at Punished Woman Lake begun several years ago is the removal of large amounts of accumulated bottom sediments by dredging. The initially funded dredging project has been completed. Additional dredging may be conducted at a later date pending availability of funding. In addition, plans have been drawn up for watershed and shoreline stabilization measures which should greatly reduce sediment input to this lake in the future. In Lake Cochrane, a sanitary district sewer project has been completed around the periphery of the lake which is substantially decreasing nutrient levels entering that waterbody.

In the past, Whetstone River had carried large loads of sediment into the south end of Big Stone Lake during high water years. The construction and subsequent modification of a diversion dam and sediment barrier immediately south of the lake outlet, has resulted in a substantial reduction in sedimentation to the lake. This river flow management system, which includes a control structure, was designed to divert approximately 80% of peak river flows with attendant sediment from lower Big Stone Lake to the Minnesota River.

Potential pollutant sources of sediment, nutrients and bacteria to lakes in this basin continue to be nonirrigated crop land, pasture land, feedlots, and animal holding/management areas.

A number of completed implementation projects in this basin are expected to significantly reduce pollutant loads to Big Stone Lake and tributaries in the near future. Lake Farley, near Milbank, South Dakota, has been renovated to restore its sediment trapping capacity which should further reduce the amount of sediment as well as nutrients entering the lower Whetstone River. Sisseton, Veblen, and Peever, South Dakota and Browns Valley, Minnesota, wastewater facilities have been upgraded to reduce the volume and improve the quality of wastewater discharges to the Little Minnesota River. Thirty-four feedlot projects have been completed in the Big Stone Lake watershed and a number of lake shore stabilization and watershed improvement projects are currently underway or nearing completion. Funding to continue the Little Minnesota River subwatershed portion of the Big Stone Lake restoration effort is being shifted from Section 319 of the Clean Water Act to Public Law 566 (PL566) Watershed Project through the USDA.

Table 19

Red River Basin (Figures 1 and 2, Table 20).

The Red River basin covers the extreme northeastern corner of the state. The only tributaries to the river located in South Dakota drain a total of 600 square miles. Once again, agriculture, with all its activities, is the main economic industry.

During 1990-91, discussions were held among local organizations to form a lake restoration district for the Lake Traverse/Mud Lake area. This resulted in the formation of the Lake Traverse Association Corporation in 1991. Organizational activities began in 1992 that resulted in the award of a Minnesota Clean Water Partnership grant for a Phase I Diagnostic/Feasibility study for the Lake Traverse Improvement Project by the Minnesota Pollution Control Agency (MPCA) in early 1993. The Lake Traverse watershed assessment conducted by the Bois De Sioux Watershed District and MPCA has been ongoing for the past two years. The data collection phase has been completed with a final report scheduled to be completed in 1998. DENR conducted water quality monitoring of the Jim Creek tributary for this study. A Red River Basin Board was formed this reporting period for the purpose of flood control and river management.

Water quality monitoring confirmed that Lake Traverse and White Lake Dam are highly eutrophic. Lake Traverse has a history of dense blue-green algal blooms and periodic attempts to treat the blooms in some of the lake embayments with copper sulfate. Observation and comparison with past monitoring data suggested that this large lake has attained relative stability at a high trophic level. The water quality of White Lake Dam may have degraded somewhat over the past decade, although fairly recent annual TSIs for this lake show little change from 1991 through 1993 (TSI: 69-72).

In 1991, Lake Traverse received a respite in the form of sufficient rain to maintain good lake water levels and to exert a diluting and flushing effect on the lake. Local residents reported that algal blooms were less severe and water clarity had improved during 1991. Lake Traverse again benefited from abundant rainfall during the last reporting period (1993-94) and a similar improved lake status was observed by residents. During 1995, local weather conditions apparently returned to a more “normal” pattern with less rainfall and more sunshine during spring and summer. Unfortunately, this more pleasant weather resulted in higher water temperatures and illumination that may have triggered an increase in the size of the summer blue-green algal bloom that was noted by lake residents in 1995.

White Lake Dam, an alternate drinking water supply for the City of Britton, is impacted by agricultural fertilizers, livestock operations, and by siltation.

Table 20

James River Basin (Figures 1 and 2, Table 21).

The James River basin is the second largest river basin in the state. It drains approximately 12,000 square miles stretching from the northern to the southern borders. It is located in east-central South Dakota. Agriculture and related businesses are the predominant sources of income. There are numerous industries in the basin, most of which are related to agriculture.

Water quality in the James River basin has shown steady improvement over the last ten years. Better water quality may have resulted in a large part due to completed and ongoing projects for the construction and rehabilitation of WWTFs for small municipalities and the city of Huron. Completion of a upgrade of the Huron wastewater facility should prevent further emergency discharges which in the past have been responsible for fish kills in the James River. However, river turbidity (cloudy or muddy water) may remain a persistent problem in the James River due to the considerable silt and sediment periodically brought in by its many small tributaries and the large amount of previously accumulated material on the river bottom.

This assessment, most of the upper half of the James River from the North Dakota border to the vicinity of Lake Byron, partially supported beneficial uses due to low dissolved oxygen (DO). Low oxygen levels were recorded as the major impairment in the upper half of the river course from 1991 to 1993 when there were more frequent oxygen depletions recorded than more recently. Decay of excessive organic matter accumulations in slough-like conditions during winter and under ice cover may have temporarily depleted river oxygen supplies. Excessive organic loading may also have occurrred during periods of runoff in this part of the river. Winter and summer oxygen deficits have not been uncommon in the slow-flowing upper reach of the James River.

The 32-mile segment immediately upstream of Huron, South Dakota, supported its fishery uses during the present reporting period. A minor impairment noted was low DO in winter under ice cover. A concern for drinking water use, also mostly in winter, are elevated TDS concentrations which may approach 1500 mg/l in this reach. Another concern is high TSS during spring runoff (100-150 mg/l).

Most of the lower James River basin fully supported its beneficial uses during the current assessment (1992-97). Moderate impairment was caused by elevated total suspended solids (TSS) in the lowest reach. Minor impacts over the entire lower half of the river course were mainly elevated TSS, fecal coliform, TDS, pH, and low DO. Oxygen levels in the lower river appeared to have improved since previous assessments whereas instances of elevated TSS (> 90 mg/l) increased in 1993 and were particulary high from 1993 to 1995. More rainfall and greater river flows in the area may have further increased stream turbidity at that time.

Moccasin Creek is not classified as a fishery resource, its classification being limited to wildlife propagation, stockwatering, and irrigation use (9,10). The creek as a whole is at present supporting these designated beneficial uses

Turtle Creek WQM stations (2) were inactivated October 1990 since that stream no longer receives surface discharges from the Redfield WWTF which had been upgraded to a total retention facility. Water quality monitoring at nearby Lake Redfield and upstream tributaries was completed under the Clean Lakes Program. A diagnostic/feasibility study was published May 1993.

Implementation projects for the rehabilitation of Lake Redfield and its watershed have been underway for two years (Lake Water Quality Assessment chapter).

Lakes in the basin are highly eutrophic because of nutrient enrichment and siltation. Agricultural activities, including livestock operations, are considered major pollution sources.

There appears to have been no perceptible decline in water quality as indicated by TSIs in most of the monitored basin lakes over the last two reporting periods. Of the ten lakes for which recent data (1994-95) was available, four showed no appreciable change in TSI values since 1991-92, while an equal number registered noticeable improvements (lower TSI values) and two lakes showed a decline in water quality since 1993. Lakes Richmond and Wilmarth showed poorer water quality in 1994 and 1995 reporting period. Lake Richmond TSIs in 1995 were similar to those recorded in 1993 when the reservoir was turned brown and muddy by heavy summer runoff. The hypereutrophic rating (H) for Lake Wilmarth has been due primarily to the presence of very high in-lake phosphorus presumably brought in by watershed runoff. The most recent water samples from the lake ranged from 0.8 to 1.2 mg/l total phosphorus.

An assessment has been completed (1998) in Elm Lake. Assessments in Lake Mitchell and Lake Faulkton were completed this reporting cycle. Assessments for Lakes Byron, Redfield, and Ravine were completed prior to 1994 and those waterbodies are currently undergoing lake and watershed restoration measures as part of their Phase II implementation projects. Implementation activities in Ravine Lake, which lies within the city limits of Huron, SD, will involve lake sediment removal by water-borne hydraulic dredge since a previous attempt at draining this small reservoir and removing accumulated sediment with land-based equipment had proved unsuccessful due to unfavorable natural conditions in winter (Lake Water Quality Assessment chapter: 1996 305(b) Report).

Table 21

Table 21

Missouri River Basin (Mainstem) (Figures 1 and 2, Table 22).

The Missouri River is the largest body of water in South Dakota. It makes a definite cut down the middle of the state to form what is commonly referred to as either "east or west" river country. The river enters the state on the north from North Dakota and flows south until it reaches the vicinity of Pierre. It receives significant flows from the Grand, Moreau, and Cheyenne River basins. From Pierre onward the river generally flows east-southeast until it exits the state on the southeast tip. It receives contributing flows from the Bad, White, James, Vermillion, and Big Sioux River basins. During its course through the state, the Missouri River, excluding its major tributaries, drains an approximate 16,610 square miles; 2,580 square miles of this is located within the Missouri Coteau and is considered non-contributing.

The dominant feature of the Missouri River in South Dakota is the presence of four impoundments; Lake Oahe at Pierre (Oahe Dam), Lake Sharpe at Fort Thompson (Big Bend Dam), Lake Francis Case at Pickstown (Ft. Randall Dam), and Lewis and Clark Lake at Yankton (Gavins Point Dam). The largest of these is Lake Oahe with 22,240,000 acre-feet of storage capacity. The impoundments serve for flood control, downstream navigation, hydroelectric generation, irrigation, municipal water use, and water related recreation. The 70-mile reach from the Gavins Point Dam to Sioux City is the last major free-flowing segment of the Missouri River in the state.

Water quality, for the most part, remains good, although exceedances in surface water temperature and elevated pH may occur from time to time. DENR no longer monitors the Missouri River and mainstem reservoirs as part of its WQM network. This sampling is presently conducted by the Corps of Engineers and US Geological Survey at former DENR sites for a reduced number of parameters. More extensive monitoring is required for these large waterbodies to properly characterize present water quality upon which reliable use-support determinations can be based.

Oak Creek is partially supporting its beneficial uses because of siltation, organic enrichment, and habitat alteration. Naturally occurring erosion and livestock grazing along streamsides are the problem sources.

Reservoir problems that deserve serious consideration are the erosion occurring along shorelines due to extreme fluctuations in water levels, and the large amount of sediment deposited in the reservoir basins by five major western tributaries (more than 27 million tons per year by a recent COE estimate) especially the Bad, White and Cheyenne Rivers.

Water turbidity caused by suspended clay and other sediment particles has persisted for most of the open water season in the upper half of Lake Sharpe from 1991 through 1997 (also see Bad River Basin section). However, those have been years of above average rainfall in the region. Moderate improvement in water clarity can be expected once precipitation in the Bad River basin returns to more normal levels. It must be noted that the already accumulated sediment in shallower areas will be subject to resuspension by strong winds during the greater part of each year and erodible high banks will provide sediment/water turbidity released by rainfall runoff, changing reservoir water levels and wind/wave action. A number of small tributaries are an additional source of sediment to Lake Sharpe.

Lake Francis Case in the Lower Missouri basin is similarly impacted by sediment - laden inflows from the White River primarily derived from natural erosion processes in the western Badlands. Additional sediments are provided to Lake Francis Case by a number of smaller tributaries that enter various embayments throughout the length of this mainstem reservoir from the east and west.

During 1992-93, Charles Mix County Conservation District reported that sediments from the Cedar and Platte Creeks were severely impacting the embayments into which they emptied. Platte Creek Bay and Cedar Creek Bay are popular fishing and recreational areas with the latter bay also serving as the site of an intake for the Randall Community Rural Water system. The area affected by siltation was estimated at 120 acres. Less severe sediment impacts were noted in three other bays on the eastern shore of Lake Francis Case with a total area in excess of 300 acres. Similar siltation impacts are probably taking place at the present time particularly since rainfall amounts in southeastern South Dakota were again above normal during 1995 and 1997.

Downstream of this reservoir, the sediment-free water discharged from Lake Francis Case exerts a considerable erosive force on the banks of the Missouri River. Nearly two miles of high banks on the eastern shore of the unchannelized river between Lake Francis Case and Lewis and Clark Lake were reported to be severely affected. Riverside cropland has been continually lost to bank erosion for the past two decades at two separate stretches near Marty and Greenwood, SD (Charles Mix County Conservation District, written communication). Shoreline erosion was severe this reporting period due to significant increases in water released from all of the large mainstem reservoirs upstream during summer, fall, and winter of 1995-97. The unusually large discharges were made necessary to free up sufficient reservoir storage space for the 1996-98 spring runoffs. Major erosion problems similar to those noted above developed during late 1997 in the Missouri shoreline downstream of Lewis and Clark Lake due to high reservoir discharges.

Most lakes in the basin are highly eutrophic because of nutrient enrichment and siltation. Water quality of these lakes has generally declined in the past decade. Agricultural activities are the problem sources. A dredging project has been active in McCook Lake since 1991 to remove large accumulations of sediment. By 1995, more than 1.4 million cubic yards have been removed. The project goal is to dredge the entire lake basin before the end of 1998. Two other dredging projects that were completed shortly before or during this reporting period included East Lake Eureka and Lake Hiddenwood.

Lake Yankton in the southeast Lower Missouri Basin continues to have the best water quality of the assessed basin lakes (TSI: 47.6). Burke Lake near the upper basin's southern border had been experiencing sedimentation, nuisance growths of blue-green algae and macrophytes, odor problems and fish kills. Results of a 1991 assessment indicated that tributaries to the lake experienced contamination with high levels of fecal coliform bacteria and nutrients. Watershed sources of bacteria and nutrients included a dairy farm and animal pastures. During 1993, a dredging project was carried to completion in Burke Lake. Various lake improvement activities were subsequently carried out around the lake shore and the immediate watershed (Lake Water Quality Assessment chapter, 1996 305(b) Report). So far, the lake has shown only moderate improvement in water quality. The annual TSI improved from 84.9 in 1991 to 82.3 in 1994.

Last reporting period there were only eight monitored basin lakes with recent available data (1994-95). Of those, six indicated stable or improved water quality and two somewhat worse water conditions since the previous assessment.

Table 22

Table 22

Grand River Basin (Figures 1 and 2, Table 23).

The Grand River basin covers 5,680 square miles within northwest South Dakota and southwest North Dakota. This is a sparsely populated region with a population density of approximately 1 person per square mile. The major income is derived from agriculture (83%). However, this basin possesses energy resources in commercially exploitable quantities. As of June 1995 there were 121 producing oil wells and 54 gas wells concentrated primarily in north central and southwest Harding County, respectively. The combined daily output of these well fields averaged 3,445 barrels of oil and 23.3 million cubic feet of natural gas.

Water quality within the north fork drainage fluctuates widely and, at times, is adequate to at least partially support designated beneficial uses. This reporting period minor impairment in the North Fork Grand River was due to elevated total suspended solids concentration and conductivity (full support). During 1994 and 1995, cause of moderate impairment was elevated conductivity.

Apparently, high water conductivity and TDS concentration are more or less typical of both north and south fork drainages. The north fork watershed drains the southern periphery of the North Dakota Badlands which may be a major source of high levels of TDS and TSS to this branch of the Grand River. Much of the suspended sediment is normally deposited in Bowman Haley Reservoir upstream of Shadehill Reservoir whereas dissolved salts may be concentrated by evaporation while water is held in storage. The most common dissolved salts in the Shadehill Reservoir drainage are sodium sulfate and sodium bicarbonate.

The south fork drainage contains erosive soils which contribute sediment and suspended solids that often produce high TSS levels in the South Fork Grand River. These problems are aggravated by agricultural and grazing practices. Past observations indicated agricultural practices such as streamside grazing and cropping are continuing in the south fork drainage. The years 1993 to 1995 were generally periods of above average waterflows in the Grand River Basin. Similar to past reporting periods, the south fork drainage again did not support its beneficial uses due to excessive TSS. Moderate impairments noted in previous assessments were from high conductivity, elevated dissolved solids, low dissolved oxygen, and elevated pH.

The Grand River from the Shadehill Reservoir tailwaters to 20 miles downstream was nonsupporting of its coldwater marginal fishery designation due solely to elevated stream temperature (>75^0F) (moderate impairment) and pH (>8.8). One or both of these parameters were typically the cause of non-support for this reach in previous assessments. As noted in the 1994 report, water pH, conductivity, and total dissolved solids had been increasing steadily in this reach and presumably in Shadehill Reservoir during the late 1980's and early 1990's. Values for these parameters during 1990-92 were some of the highest recorded in a decade. However, during the previous and present assessments the above parameters declined to concentrations present at the start of the above-mentioned increases. This was probably the beneficial result of increased rainfall (dilution) within the basin after 1992. Nonetheless it should be noted again that the major tributaries to Shadehill Reservoir are typically high in total dissolved solids (TDS). The remaining length of the Grand River of some 65 miles was also rated as non-supporting this reporting cycle due to excessive total suspended solids concentration (TSS).

Currently, a watershed improvement project funded by the 319 nonpoint source program is underway in the Shadehill Reservoir drainage. The overall goal of the project is to maintain the high water quality of the reservoir and to improve the beneficial use support of the North Fork Grand River to fully supporting and the South Fork to partially supporting. In order to accomplish this goal, the following objectives were established: reduce cropland erosion on 20,000 watershed acres by 1997, and improve 60,000 acres in poor to fair condition to fair or good condition by 1997. Accomplishments as of November, 1997 include:

1) production of a watershed map to direct reservoir activities and to guide watershed best management practices on a voluntary basis,
2) completion of a reservoir sediment survey,
3) Great Plains Conservation program contracts have been written on 116,000 acres,
4) 64,000 acres are managed by a grazing management plan,
5) 4,000 acres are managed under conservation tillage systems,
6) two animal waste management systems have been installed,
7) 48 acres of tree plantings have been installed,
8) 2,350 acres of grass seeding have been planted,
9) one sediment basin and 4 dugouts have been constructed,
10) 92,000 feet of pipeline have been installed,
11) 27.4 miles of fence have been installed.

Two lakes within the basin that were monitored under Clean Lakes Assessment include Shadehill Reservoir (4,693 acres) and Flat Creek Lake (203 acres). Shadehill Reservoir is presently supporting all but one of its assigned beneficial uses and has maintained a mesotrophic status (mean TSI:45) for the periods 1989-92 and 1995-97. The reservoir is partially supporting its irrigation use due to natural limitations imposed by local soil-water incompatibility where high sodium concentration in stored water combined with the clayey characteristics of most soils in this region significantly reduces the acreages suitable for continuous irrigation.

During 1993, the lake trophic index indicated what proved to be a temporary decline in water quality (TSI:61). This was due to an increase in lake phosphorus concentration probably brought about by increased watershed runoff in 1993. Probably as a response to this sudden nutrient influx, a dense bloom of blue-green *Aphanizomenon* developed during July and August in the north arm of the reservoir and reappeared in summer of 1994 (WRI report 1995). A larger summer algal biomass in the reservoir was also indicated by the annual chlorophyll *a* TSI which nearly doubled from 31 in 1992 to 60 in 1993 and 1994. In 1995, water quality returned to conditions similar to those that prevailed in the reservoir prior to 1993 (mesotrophic status). These conditions were maintained in 1996 and 1997. A slight increase in combined TSI took place from 43 in 1995 and 1996 to 44 in 1997. However, a noticeable decline in water clarity was observed in 1996 and 1997, most of which may have been due to sediment turbidity.

Sedimentation, suspended solids and, to a lesser extent, nutrient concentration appear to be gradually increasing in the main body of this large reservoir. Sedimentation at the two major reservoir inlets, particularly at the South Fork inlet, is progressing at a more rapid rate and may affect the recreational potential of the upper reservoir in a few years.

Water quality in nearby Flat Creek Dam improved from a combined TSI of 76 in 1991 (non-support status) to 63 (partially supporting) in 1994. This improvement may have been largely due to increased runoff in 1993 which may have exerted a diluting and flushing effect on this normally hypereutrophic artificial lake, in contrast to the temporary nutrient enrichment produced in the much less productive Shadehill Reservoir. Causes of pollution to this small reservoir include nutrient enrichment and siltation. Unspecified agricultural activities are the problem sources in this drainage. This waterbody has not been sampled since 1994.

Lake Isabel is eutrophic (TSI:62) and partially supported its fishable/swimmable uses from 1991 to 1993. There is no more recent monitoring data available for this waterbody. The lake serves as the drinking water supply for the nearby town of Isabel and has frequently been treated with copper sulfate to temporarily alleviate algae/macrophyte problems during the summer months. The municipality has been engaged in finding an alternate water supply since the drinking water quality of Lake Isabel is poor especially in dry years. Several years ago the town of Isabel participated in a feasibility project to be included in an expansion of the Tri-County Rural Water System.

Moreau River Basin (Figures 1 and 2, Table 24).

This basin is located in the northwest part of South Dakota and drains an area of 5,037 square miles. As with the Grand River basin to the north, agriculture is the mainstay of this sparsely populated basin. Approximately two-thirds of the basin's land is devoted to pasture and ranching operations. There was in past years considerable gas, oil, and coal exploration conducted in this river basin but few energy resources were discovered. At present there is only one producing oil well in the basin located near the western boundary of Dewey County. Average production is 13 barrels a day.

Water quality within this basin is marginal. Much of the sediment in the drainage comes from erosive Cretaceous shales which also mineralize the water. As in the adjoining Grand River basin to the north, this leads to high levels of total dissolved solids (TDS) in the water of local streams, primarily sulfate, iron, manganese, sodium, and other metals and minerals.

During the winter months the Moreau River often freezes to the bottom following frequent periods of low or no flow during late summer and fall. Water quality data from past assessments indicated that three-fourths of the river basin has at least partially supported its designated uses for most of the past decade. Moderate impairment was usually due to suspended or dissolved solids and fecal coliforms. The lower basin was impaired by suspended solids derived from the highly erosive soils that occur in this area.

During the previous three reporting periods and the present assessment the Moreau River basin was nonsupporting of its beneficial uses due to suspended solids (TSS). Higher than average runoff from 1991 through 1995 and 1997 was probably responsible for excessive TSS levels over the entire basin. A secondary problem in the lower drainage during the present assessment was elevated fecal coliform numbers which constituted a moderate impairment.

Two small lakes in the river basin, Coal Springs Dam and Dewberry Lake were assessed several years ago. At that time, both waterbodies were found to be highly eutrophic (hypereutrophic) with TSIs of 71 and 81, respectively. The lakes were impacted by unspecified agricultural activities, probably livestock grazing, causing algae blooms, nutrient enrichment and siltation problems.

Table 24

Bad River Basin (Figures 1 and 2, Table 25).

The Bad River basin lies in west-central South Dakota between the Cheyenne and White River Basins. The basin drains an approximate 3,151 square mile area. Historically, a main feature of the basin has been a general lack of surface water flow. The upper portion of the Bad River receives water from several artesian wells in the Philip area so that water is present most of the year. There are prolonged periods of low flow in the reach from Midland to the Missouri River. This flow pattern has not held up for most of the 1990s due to above average rainfall.

In past reporting periods the Bad River has not supported its beneficial uses due to elevated suspended solids concentration. Monitoring during the 1987-89 cycle failed to detect high suspended solids concentrations but only indicated moderately elevated conductivity. These results were obtained because of very low river flows prior to and during sampling. However, monitoring during the 1990s again indicated high levels of TSS (4000 - 21860 mg/l) were entering Lake Sharpe with increased rainfall in the Bad River basin from 1990 through 1995. This resulted in ratings of non-support thus far this decade, most of which is covered by the present assessment (1992-1997).

During past monitoring periods an apparent pattern of poor water quality was noted in the lower Bad River. Exceedances of suspended solids (TSS) standards occurred during high river flows (present and previous reporting period) while during minimal flows, elevated dissolved solid concentrations (>2500 mg/l) and excessively high conductivity readings (>2500 umhos/cm) were recorded. However, it has become evident that the erodible marine shales that underlie much of the drainage supply large quantities of dissolved salts in addition to suspended solids to the river during major watershed runoff events. Water conductivity in the Bad River has averaged 2325 μmhos/cm for the period from 1968 to 1995. Fecal coliform levels appeared to have declined from levels recorded before 1994, and no exceedances were recorded this assessment.

During years of above normal runoff, sufficient Bad River sediment is deposited on the Missouri River bed below Lake Oahe to restrict the main river channel causing local water levels to fluctuate and present a potential flooding problem for riverside residences in the southeast area of Pierre, South Dakota. This often necessitates a reduction in the volume of water released from Oahe Dam which serves to interrupt power generation producing a negative economic impact. Winter flooding in the developed flood plain has occurred on an irregular basis since 1979 caused by the formation of ice jams during periods of icing. Dredging the accumulated river sediments has been proposed as a remedial measure. However, initial considerations indicate this to be a costly proposition requiring the initial removal of more than 3 million cubic yards of sediment. Periodic maintenance dredging may also be necessary in the long term unless some means are found to drastically reduce the amount of sedimentation from the Bad River. A limited dredging project to deepen boat channels near two river islands below Pierre is scheduled for completion in 1998. A 1996 COE project designed to flush sediments downstream has met with moderate success. This involved lowering waterlevels in the Missouri River below the Bad River confluence and then sharply increasing Oahe Reservoir water releases for a period of time.

Suspended sediment from the Bad River has perceptibly increased water turbidity in Lake Sharpe for more than 30 miles downstream of the confluence. The turbidity has a negative impact on sport fishing, recreation, and tourism in this area. Water quality data for the past 33 years have indicated that erosion in the Bad River basin and subsequent sediment yield to the Missouri River are on-going problems that first became evident shortly after the filling of the mainstem reservoirs in the early 1960s.

Rangeland in this area is on a relatively steep topography overlain by shallow, erosive Pierre Shale soils whose structure may deteriorate even under what is considered normal grazing pressure. Past field observations indicated that large acreages of range in the lower watershed were in poor condition and that increased snowmelt or rainfall such as occurred in recent years would very likely produce even more severe erosion and sedimentation events than were noted in the last decade. In fact, many small stockwater dams in the Bad River basin are reported to be rapidly filling with eroded sediment at the present time.

In 1989, a sediment monitoring program was established in the Bad River drainage to determine the sources of sedimentation; quantify the extent of sediment transport into Lake Sharpe on the Missouri River; and to develop alternate remedial methods of watershed management to reduce sediment loads impacting the Bad River and Lake Sharpe. Previous studies have indicated that until 1980 approximately 3.2 million tons of sediment was deposited in the Missouri from the Bad River each year. Since the application of extensive conservation measures in the Bad River watershed (e.g. CRP) sediment loads are reported to have dropped by as much as 40% in selected watersheds. While this reduction is appreciable, there remains a considerable volume of sediment (approx. 2.8 million tons) still entering upper Lake Sharpe on a yearly basis at the present time. The 1989 monitoring study determined that rangeland in the lower half of the drainage was the major erosion contributor and 85% of the sediment came from streambank and gully erosion.

Based on information gained from this study, Phase II of the Bad River Water Quality Project was initiated on March 12, 1990. This stage of the project was designed to identify and assess cost effective, landowner-acceptable Best Management Practices (BMPs) that will reduce sediment loading and serve as a model for similar projects in the entire Missouri River Basin. Grazing management practices that reduce the dependence of livestock on riparian areas were targeted as the main thrust of the project.

BMPs presently being applied include rotational grazing systems, construction and rehabilitation of sediment dams, and restoration of wildlife and riparian areas among others. At the same time, vegetative responses to different implemented grazing systems and the effect of various grazing strategies on development of gully erosion (gully headcut advance) are being investigated. Other Best Management Practices being promoted to reduce sediment loading of the Bad River include the use of conservation tillage and no-till farming on cropland and the construction of wind protection fences in the uplands that will allow moving animal feeding areas out of riparian zones.

The Phase II Project ended in 1994 and a final report is available. This project has demonstrated that significant erosion and sediment reduction can be accomplished with the implementation of conservation practices. Over 90 percent of the landowners in selected project areas have applied some form of BMP and about 95 percent of the project area has been treated. Preliminary data indicate a 40 percent reduction in sediment delivery from the Plum Creek subwatershed. Although these results are promising, much remains to be done to significantly reduce the sediment loads to Lake Sharpe.

Other similar projects are currently being implemented in the Bad River Basin. A Phase III Project is continuing the efforts of the Phase II Project by promoting BMPs in additional areas of the watershed, especially in the lower third of the watershed where the erosion problems are most severe. A Demonstration Project in the upper portions of the watershed is also being implemented. This project is demonstrating to landowners the various BMPs that were successful during the Phase II Project. Both of these projects are scheduled to end in 1999. It is hoped that these projects convince landowners that it is worth their effort to implement certain BMPs, for environmental reasons and to improve their own farm/ranch operations.

Two of the four small lakes monitored in this basin were rated as hypereutrophic this reporting cycle. Freeman Dam and Hayes Lake appear to have undergone a moderate decline in water quality between 1989 and 1994 and between 1991 and 1993, respectively. Hayes Lake, Waggoner Lake, and Murdo Dam were not monitored this reporting period but the former was rated as hypereutrophic and the latter two waterbodies as eutrophic during 1991-93. Freeman Dam water quality appears to have deteriorated between 1989 and 1994.

Causes for impairment in these lakes include algae, macrophytes, nutrient enrichment, and siltation. Problem sources may be livestock operations, lakeside farmland, and septic systems.

White River Basin (Figures 1 and 2, Table 26).

The White River basin is the most southern of the five major drainages which enter the Missouri River from the west. The total drainage area of the basin, in South Dakota, is 8,250 square miles. Agriculture dominates the basin's economy with the majority of the land used as rangeland or cropland. There are a few sand and gravel operations in the area.

Water quality within this basin is extremely poor. It is the most severely impacted basin in the state. The single most important source of this poor quality is the highly erosive soil within the river drainage. This basin receives the majority of the runoff and drainage from the Badlands. The exposed Badlands are a major natural source of both suspended and dissolved solids to the river. Severe erosion occurs in the Badlands and throughout the entire length of the basin. Suspended sediments in the White River leaving the Badlands area averaged in excess of 5100 mg/l from October 1989 to August 1993. Last reporting cycle, TSS averaged more than 6400 mg/l. In sharp contrast, river water entering the Badlands drainage averaged less than 250 mg/l. Total dissolved solids concentrations followed a similar pattern of increase, 2460 mg/l and 670 mg/l, respectively. More recently, the pattern of increase was similar though less dramatic. Apparently, heavy rainfall in the upper White River basin (vic. Oglala, SD) upstream of the Badlands had increased TSS concentrations there to an average of 645 mg/l from 1996 to 1997.

Suspended sediment is deposited in Lake Francis Case at an average rate of 11,800,000 tons per year. Largely as a result of these appreciable sediment loads from the White River watershed, Lake Francis Case has lost an estimated >10% of reservoir water capacity to siltation since its creation in 1952. In the reservoir, sediment turbidity may be evident as far as 77 miles downstream of the White River/Missouri River confluence.

Present water quality monitoring showed no improvement over conditions observed for the past decade in this basin. Extremely high exceedances of suspended solids were again noted in the lower half of the White River drainage. Minor impairment this reporting period was caused by elevated total dissolved solids. Fecal coliform was the cause of major and moderate impairment in the middle and lower reach of the White River, respectively.

Owing to generally higher than normal runoff and riverflows in this basin during 1991-95 and 1997, TSS concentrations were also excessive in the upper White River and the Little White tributary for the previous three and present reporting cycles. A single fecal coliform exceedance during the current reporting period may be attributable to runoff from pastures and livestock holding areas. There is one previously assessed lake within this basin, Snow Dam, which was rated as hypereutrophic.

Niobrara River Basin (Figures 1 and 2, Table 27).

The tributaries of this basin that lie in South Dakota are located in the very south-central part of the state. These tributaries include the Keya Paha River and the Minnechadusa River. Ponca Creek is located within this basin but drains to the Missouri River. These streams drain approximately 2,000 square miles in South Dakota. Agriculture is the leading source of income to the basin.

Water quality in this basin was rated fair to marginal over much of the past decade due to total suspended solids and occasional fecal coliform exceedances but supported its beneficial uses during the 1987-89 period. Improved water quality at that time may have been mainly the result of low stream flow. Increased stream flows from 1990 to 1995 and after were instrumental in increasing suspended solids concentrations in the Keya Paha River so far this decade. This resulted in downgrade of basin water quality to a partial support status during the present assessment (1992-1997) though TSS levels were not as high as those found in most other eastern South Dakota streams. Past impacts, mainly before 1988, may have been caused by stream bank erosion as well as bacteria from sporadic wastewater discharges from the communities of Mission and Antelope. This reach must be monitored more closely to better determine all the major pollution sources contributing to the overall degradation (e.g. sedimentation) of this high quality stream during periods of normal or heightened stream flow. In recent years the support status of the Keya Paha River seems to have been inversely dependent on the amount of runoff and stream flow. This assessment the river was partially supporting due to excessive TSS. Minor impairments were due to elevated pH and ammonia concentration.

Rahn Lake, the only lake in the basin that was assessed, is highly eutrophic due to nutrient enrichment and siltation. These problems are caused by agricultural activities.

Cheyenne River Basin (Figures 1 and 2, Table 28).

The portion of the Cheyenne River Basin that lies in southwestern South Dakota drains 16,500 square miles within the boundaries of the state. The total drainage for the basin is 32,600 square miles. The area in this basin is very diverse. It includes the Black Hills, part of the Badlands, rangeland, irrigated cropland, and many mining areas. After traversing the western half of the state from southwest to northeast, the Cheyenne River flows into Lake Oahe, a reservoir on the Missouri River.

Cheyenne River water quality continues to be generally poor. The monitored two lower river segments did not support their designated fishable uses due to high total suspended solids (TSS) similar to past reporting periods. Also similar to the last assessment was impairment of the swimmable use owing to excessive fecal coliform levels. No TSS violations were noted for the upper Cheyenne River during 1994-1995 assessment contrasted with 38% of samples exceeding the standard during 1996-1997. Below average rainfall in the upper drainage during the 1994 water year may have been largely responsible for the decrease in TSS. Total dissolved solids (TDS) remained high during both periods (25% and 43% exceedance) for this upper river segment and were responsible for ratings of partial and non-support respectively. It is probable the elevated concentrations of TDS are mainly of natural geologic origin being derived from runoff leaching the extensive shale formations in the upper Cheyenne River drainage. Changes in the other measured parameters were minor between the previous and present reporting cycle.

Large silt loads carried by this normally shallow prairie stream impact Lake Oahe during periods of high flow. Monitoring records indicate that 11.6 million tons of sediment per year flow from the Cheyenne River into lower Lake Oahe. Severe soil erosion in the Badlands and along much of the river's lower course is the source of the suspended and dissolved solids problem in the lower reaches. A major transporter of eroded soil in the former is the Sage Creek tributary of the Cheyenne River which drains a large portion of the northern Badlands.

The lower Cheyenne drainage, in general, contains a high percentage of erodible cropland and rangeland in west-central South Dakota which may contribute additional large amounts of eroded sediment carried by numerous small tributaries during periods of heavy rainfall that occurred with increasing frequency from 1991-95 and 1997. Many small stockwater dams in the lower watershed are rapidly filling with sediments as a result of this increased precipitation even though large acreages of rangeland and cropland are currently enrolled in the Conservation Reserve Program (CRP) in this region of the state.

High fecal coliform counts are commonly recorded at all river sites nearly every reporting period. Likely sources of bacteria are livestock wastes and partially treated wastewater carried by overland runoff during recent periods of high precipitation in this basin. Irrigation return flows, cropland, rangeland and old mine tailings also contribute to water quality problems, the latter two sources particularly in the lower half of the river course. The river frequently carries high concentrations of nitrate (>1.00 mg/l) at the lowermost site near Bridger, South Dakota. Possibly, one source is irrigation return flows entering the tributary Belle Fourche River.

A past problem was the presence of excessive levels of mercury in fish and sediments in the Cheyenne River arm of Lake Oahe. Previous studies in the 1970's and 1984 revealed mercury levels in game fish that exceeded recommended FDA levels for consumption. The mercury appeared to originate from gold mining operations in the northern Black Hills region and entered the Cheyenne via the tributary Belle Fourche River. Mining operations had used mercury in their gold recovery process but mercury use was discontinued in 1970. As a result, mercury concentrations seemed to have declined in fish and habitat of the Belle Fourche River, Cheyenne River, and the Cheyenne River arm (Foster Bay) of Lake Oahe between 1970-71 and 1984-88 (Ruelle et at., 1993) (Sowards et al., 1991).

Very recent (1998) tests carried out on fish flesh samples collected (by EPA) from the lower Cheyenne River and Foster Bay by the U.S. Department of Health and Human Services, Atlanta, Georgia, supported those results. Mercury (methyl mercury) in fish flesh of several species was found to have declined to nominal concentrations, not significantly exceeding local background levels.

Rapid Creek water quality typically ranges from good to satisfactory in its upper reaches with fair to poor quality downstream of Rapid City. During this assessment, the creek upstream of Pactola Reservoir supported its assigned uses. Minor impairments noted were elevated pH, TSS, and fecal coliform. The north fork of Rapid Creek was severely impaired by elevated water temperature, probably the result of low flows. The next site downstream and adjacent to the Rapid City limits also fully supported its designated uses. Elevated water pH, temperature and TSS were minor exceedances recorded. The 13-mile reach above the Rapid City WWTP was partially impaired due to excessive fecal coliform.

The 48-mile stream segment downstream of the Rapid City WWTP to the Cheyenne River confluence was non-supporting of its swimmable use this assessment. A major recurring problem is this reach appears to be excessive fecal coliform bacteria levels. Minor impairments over the assessment period (1992-1997) were elevated TSS, ammonia and low DO in order of importance.

Fall River in its upper half is often impaired during the warmer seasons of each year due to a natural source. Warmwater springs continually feed creeks and tributaries to the river and cause violations of the coldwater fishery standards for water temperature during late spring and summer. For this reason, the stream is managed as a warmwater fishery during the summer months and as a stocked coldwater (trout) fishery during the colder months. There was visible improvement in the general water quality of this waterbody following upgrade of the Hot Springs WWTF to a total retention facility a number of years ago. Both DENR sampling sites on the Fall River were subsequently inactivated in October 1990. Limited USGS monitoring data indicated that the upper half of the river is supporting both its coldwater marginal fishery and warmwater permanent fishery designations with regard to stream temperature standards. The lower half of Fall River below Hot Springs, SD has not been monitored for water quality since 1990.

Black Hills streams other than those mentioned above usually have good to satisfactory water quality and fulfill their fishable/swimmable designated uses. They are, however, relatively small streams vulnerable to losses of flow exacerbated by periodic droughts in the Black Hills and the increase in the size and density of the ponderosa pine forest canopy; the latter being the natural result of forest fire suppression in the long term. Recent studies suggest a management regime that would maintain an intermediate level (e.g. 50% canopy cover) rather than a dense or open ponderosa pine canopy would benefit soil moisture, ground water, and therefore stream flow during drier years. Establishing this level of forest cover would represent a good compromise between maintaining a forest ecosystem and increasing the water production potential of the Black Hills (South Dakota Farm and Home Research, winter 1995, SDSU) (South Dakota Horizons, August 1995, SDSU).

Grazing of streamside vegetation, which increases stream bank erosion, water temperature and nutrient loading, also continues to be a problem in a number of Black Hills streams.

The entire monitored length of French Creek fully supported its designated beneficial uses the last two assessments. There were very few violations noted in the measured stream parameters the last several years. During the 1992-97 monitoring period minor impairments noted were elevated TSS and FC. This stream was also fully supporting of uses during the 1987-89 monitoring period. Overall water quality has remained in the good to satisfactory range for the last ten years.

Flynn Creek, a small tributary of the south fork of Lame Johnny Creek, supported its fishable (aquatic life) beneficial use during this assessment with minor impairments due to elevated TSS and water pH (>8.8). This small stream had fully supported all its designated uses during earlier reporting cycles indicating Flynn Creek has fairly consistent good water quality.

Lower Battle Creek was moderately impaired this assessment due to elevated water temperature and pH. Grace Coolidge Creek supported its coldwater fishery use with elevated water temperature the only minor impairment. Upper Battle Creek supported its designated uses with elevated TSS a minor exceedance. Generally, in past reporting periods, these streams were moderately impaired by either or both high pH (>8.6) and water temperature. Those moderate exceedances may be attributed to natural conditions.

Upper Spring Creek was moderately impaired this period due to excessive fecal coliform. However, Spring Creek had supported its assigned uses during previous reporting periods. There was no significant violation of standards detected in the waters of the lower creek flowing out of Sheridan Lake for the last six years. This is a reasonably good indication that water quality is consistently acceptable over the entire length of Spring Creek. Minor impairments infrequently noted were elevated pH and TSS.

Castle Creek below Deerfield Reservoir supported designated uses this assessment. Elevated TSS was a minor impairment. In the past, slightly elevated pH also frequently occured in the lower reach.

Box Elder Creek supported its uses in the upper reach for the present and previous two reporting periods. Lower Box Elder Creek also supported beneficial uses. The monitored segment of the lower creek is classified for (9, 10) only.

Few consistent long-term trends in water quality were evident for the monitored smaller creeks in the Black Hills. Probably for most of these small streams, moderate water quality fluctuations can be expected to occur between monitoring periods largely as a result of natural climatic and hydrological factors.

The Black Hills region traditionally has some of the best surface water quality in the state. This is due in a large part to a cooler climate during the growing season, and higher rainfall than the surrounding plains as a result of greater elevation and forest cover. Also contributing importantly to better water quality in this region is the nature of local bedrock formations which are much less erodible than the highly erosive and leachable marine shales and badlands on the surrounding plains.

Two artificial lakes in this basin, Deerfield, and Pactola Reservoir, were rated as oligotrophic/mesotrophic during previous reporting periods with the former the more productive waterbody. Data collected in 1997 suggested moderate nutrient enrichment of Deerfield had taken place to a higher mesotrophic status from a TSI of 40 in 1996 to 47 in 1997. The combined TSI for Pactola increased from 34 to 39 between the last two reporting periods. The significantly higher TSI for Deerfield, relative to 1996, was due in large part to a larger chlorophyll *a* concentration in 1997. More data is needed to establish a trend for the two connected reservoirs. About a third of the monitored lakes appeared to have undergone a moderate decline in water quality during the last three years, including Angostura Reservoir. The less favorable conditions were due primarily to higher measured in-lake phosphorus levels during 1995 compared to 1992. In Angostura Reservoir, higher combined TSIs during 1996 and 1997 were due to sediment turbidity. The increases in algae in these relatively large lakes as a result of more available phosphorus were small except in Stockade Lake (120 surface acres). In two small Black Hills reservoirs (<20 acres), Biltmore and Horsethief, higher TSIs calculated in 1994 were primarily the result of larger algal biomass (higher chlorophyll *a* concentration) while at the same time their in-lake phosphorus showed only small increases or declined against phosphorus values measured in 1991.

Recent (1995-97) monitoring data on which to base short term trends was not available for the remainder of the basin lakes. Scheduled sampling of half of those lakes was not possible due to funding cuts in the lake monitoring program.

Angostura, Deerfield and Pactola Reservoirs are high quality waterbodies vulnerable to nutrient enrichment and sedimentation from natural soil erosion, recreational activities, and various silvicultural activities. Eutrophication and sedimentation of Angustora Reservoir may be hastened by the inflow of often poor quality water from the upper Cheyenne River.

Table 28

Table 28

Belle Fourche River Basin (Figures 1 and 2, Table 29).

The upper Belle Fourche River from the Wyoming border to the Whitewood Creek confluence was supporting its fishery use this reporting period. Minor impairment was caused by elevated pH and total suspended solids (TSS). A major natural source of occasional elevated TDS and TSS to this reach of the river may be the extensive exposed shale beds that lie along the river's course upstream of the city of Belle Fourche. Agricultural/rangeland activities are likely additional sources of occasional impairment. The lower Belle Fourche River was moderately impaired by excessive TSS and slightly impaired by occasional elevated ammonia.

Horse Creek was moderately impaired during the 1985-1987 reporting period by high water conductivity probably from irrigation return flows. Recent USGS monitoring data (1993-95) indicated Horse Creek is partially supporting its irrigation use due to conductivity in excess of 3000 mg/l. Irrigation return flows may be contributing to the high conductivity in this stream at this time. Limited past data also suggest that total suspended solids (TSS) may be frequently excessive in this stream.

Redwater River fully supported its assigned uses during this assessment and most previous reporting periods. Minor impairment this reporting cycle came from elevated total suspended solids, conductivity, and water temperature.

The middle reach of Spearfish Creek was partially impaired by elevated stream pH this assessment period (1992-1997). The 12-mile segment between Elmore and Maurice, SD recorded non-support due also to high pH. It is suggested that higher pH may be due largely to the limestone formations located along the course of the stream. Minor exceedances were elevated water temperature, ammonia, and TSS, in order of importance.

Commerical streamside placer mining activities are no longer a significant source of water quality problems in Black Hills streams within the Belle Fourche and Cheyenne River Basins. During 1996 and 1997, Homestake Mining and Brightwater Inc., an affiliate of the Dunbar Resort, reclaimed the Red Placer that was previously mined by Dakota Placers under South Dakota Mining Permit No. 208. Homestake and Brightwater jointly own the Red Placer claim and developed an extensive reclamation and stream rehabilitation plan for the minesite. Approximately 16 acres of mine-affected lands along Whitewood Creek were reclaimed, and the stream channel was reconstructed and stabilized throughout the site. At the present time only recreational gold panners are exerting a limited impact on a few segments on other creeks (e.g. upper Rapid Creek) in both Black Hills river basins.

A 23-mile reach of Bear Butte Creek from the headwaters to the Lawrence County line was severely impaired by heavy metals and moderately impacted by elevated TSS. The sources of excessive heavy metals are old streamside mine tailings along Strawberry Creek and in-place contaminants in the Bear Butte streambed.

Strawberry Creek, approximately 5 miles southeast of Deadwood, South Dakota, is a western tributary of upper Bear Butte Creek. In past years, upper Strawberry Creek was severely impacted by local mine tailings; seepage and runoff from which produced conditions of low water pH (avg. 4.1) and excessive TSS in this stream during the period (1993-95). In addition, there was moderate impairment due to elevated TDS and water conductivity. However, there was dramatic improvement in stream pH (avg. 7.2) and conductivity starting with the November 1994 samples and some improvement in TDS although not in total suspended solids (TSS). During 1996-1997, water quality in Strawberry Creek declined. Non-support was caused by TDS, conductivity, elevated TSS, and low pH. Average water pH fell to 6.85 for this recent period.

This reporting period, Whitewood Creek partially supported its swimmable beneficial use from the headwaters to its confluence with Gold Run Creek at Lead, South Dakota, due to high fecal coliform. Another moderate impairment consisted of excessive TSS. Minor exceedances were elevated water temperature and TSS. This reach needs to be monitored monthly to determine any consistent trends in water quality.

Downstream of Gold Run Creek water quality of Whitewood Creek routinely declines for the next nine or ten miles. During the present reporting period, non-support of this reach was attributable solely to high fecal coliform levels. Causes of minor impairment were elevated pH and TSS. The lower half of Whitewood Creek fully supported its assigned uses this reporting period as during past assessments. Minor impairments noted in the lower creek were due to elevated fecal coliform, TSS, pH, and ammonia. Summarized water quality data from 1992 and 1997 indicated that from one half to three quarters of Whitewood Creek stream miles supported their assigned uses (Figure 3).

A principal source of high fecal coliform numbers to the stream's middle reach may be faulty segments of the Deadwood, SD, wastewater collection system in the vicinity of the creek. Sewage pipes in this area have deteriorated with age and are gradually being repaired or replaced. Another source of coliform to the creek may be the Lead, South Dakota combined sewer overflow (CSO). A Surface Water Discharge permit has been issued to the city of Lead and the Lead-Deadwood Sanitary District for their CSOs, requiring compliance with EPA's nine minimum controls for CSOs.

In past assessments (1989-1993), West Strawberry Creek, a southeastern tributary of upper Whitewood Creek, was moderately impaired by elevated water temperatures (>65^{0}F), TSS and high pH. Lack of adequate flows may have been a major contributing factor for these conditions. Increased flows during the last assessment resulted in one exceedance of the TSS standard for this stream. All other parameters measured were within designated limits. This assessment, West Strawberry Creek fully supported assigned beneficial uses. Minor impairments were elevated pH, temperature, and TSS.

Annie Creek, Squaw Creek, False Bottom Creek, Stewart Gulch Creek, Fantail Creek, and Whitetail Creek were six small tributaries investigated this assessment. These are tributaries of Spearfish Creek, Redwater River, and Whitewood Creek, respectively. All of those tributaries supported their assigned uses. Squaw Creek, a tributary of Spearfish Creek, was slightly impaired (10%) by elevated pH. Other common minor impairments noted in three of the six streams were elevated TSS and water temperature.

Belle Fourche Reservoir (Orman Dam) continued to support its assigned uses for the last two reporting periods with TSI values in the mesotrophic range (combined TSIs: 42 and 43). However, inorganic turbidity has been a moderate water quality problem in Belle Fourche Reservoir (Secchi visibility TSIs: 49 and 54). Much of this turbidity may be attributed to the previously mentioned surface shale formations within this drainage. Crow Creek, Owl Creek and water diversions from the Belle Fourche River transport large quantities of TSS into the reservoir during highwater periods. Agricultural activities may at times be a major source of nutrients and siltation to this large reservoir.

Newell Lake fully supported its beneficial uses during the last two reporting periods. Partial support in a previous assessment was largely due to heavy summer rains and runoff in the watershed during 1993 which brought high levels of TSS and phosphorus into the lake. A similar situation may have occurred during 1996 but the lake remained fully supporting by a slight margin (combined annual TSI = 55) for that year. The 1997 TSI calculated was 43 which placed Newell Lake in the mesotrophic range. Mesotrophic status has been maintained in the lake from 1989 to 1997, with the exception of 1993 and 1996. There is insufficient recent monitoring data available for the remainder of the lakes in this basin.

Little Missouri River Basin (Figures 1 and 2, Table 30).

The Little Missouri River Basin is a small basin located in the northwestern corner of the state. The river enters the state from southeast Montana and drains some 605 square miles before exiting into North Dakota. The basin's economy is dominated by agriculture with approximately 90 percent of the land being used for agricultural production. The majority of this land is used for rangeland, as limited water supplies reduce the amount of land available for crops. The basin mineral industry is limited to the extraction of sand and gravel. However, thin beds of lignite coal do exist and test holes for oil have been drilled. At the present time, neither the coal nor the oil are commercially produced.

The Department of Environment and Natural Resources discontinued monitoring water quality of the Little Missouri River in 1979. Data from previous samples showed that the water quality was generally suitable for the designated beneficial uses although minor violations of the Water Quality Standards criteria for TDS, TSS, and conductivity were occasionally noted. Conductivity exceedances occurred primarily during winter when formation of ice cover tends to concentrate salts in the remaining flow. The violations were generally attributed to agricultural non-point sources in Montana/South Dakota and naturally occurring erosion and soluble minerals. There are no significant point source discharges in the South Dakota portion of the basin.

Limited monitoring by USGS suggested that the Little Missouri River continued to support its designated beneficial uses last reporting period. Stream flow during 1991-92 was relatively low compared to previous years. Flows ranged from 0 to 29 cfs averaging 6 cfs. Flows increased significantly during the previous and present assessments (1993-96) due to greater rainfall in the drainage. During the winter months of this period several high conductivity readings (>2500 mg/l) were recorded. However, no impairments were noted this assessment and the stream was rated as fully supporting. There are no monitored lakes within this river basin.

F. WETLANDS

In South Dakota, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (ARSD 74:51:01) For purposes of federal 404 identification and delineation, wetlands must have each of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly hydric soil, and (3) the substrate is saturated with water or covered by shallow water at some time during the growing season of each year.

There are many types of wetlands, but the most prevalent type in South Dakota is the Palustrine Emergent Wetland, commonly referred to as the prairie pothole. One of the functions of these prairie potholes is the production of waterfowl. Researchers have found an average of 140 ducks produced per square mile per year in eastern South Dakota (US Department of the Interior, 1984). Other major functions of wetlands in the state are the improvement and maintenance of water quality, ground water recharge, and recreation.

Still another important function of the prairie pothole is flood control. A common agricultural practice has been to drain these pothole areas by open ditching and thus eliminate water storage areas. This drainage leads to the concentration of waterfowl breeding populations at the remaining wetlands as well as increased flooding in certain river basins. This has been documented in the James River Basin of North Dakota according to J.G. Sidle in the North Dakota Outdoors publication of August, 1983 (US Department of the Interior, 1984). In the upper James River Basin of South Dakota a 1989 US FWS survey found that at least 5.5% of total wetland acres had been impacted by drainage as well as 6% of the acreage in the Vermillion River drainage and as much as 40% of the acreage in the Upper Big Sioux River watershed (US Department of the Interior, 1991).

In eastern South Dakota, in 1976, 77% of 55,855 dugouts (excavated ponds) were in wetland basins or streams (US Department of the Interior, 1984). In 1989, 19% of total wetland acreage in the upper James River basin had been impacted by dugouts, whereas 36% and 33% of total wetland acres had been affected in the Vermillion and Big Sioux drainages, respectively (US Department of the Interior, 1991). By 1994, through the efforts of the US FWS, the Natural Resources Conservation Service (NRCS), Ducks Unlimited, and 54 Conservation Districts, eastern and western South Dakota had increased the total area of their wetlands by 4,500 acres. These wetlands were all newly created and served to add to the habitat of South Dakota's wildlife.

Due to being located in the Prairie Pothole Region, South Dakota once had approximately 2,735,100 acres of hydric soils. Small wetland areas were densely distributed over most of eastern (east-river) South Dakota (Figure 4). Today, there are roughly 1,780,000 acres of wetlands remaining (Dahl, 1990). This represents a loss of 35 percent, a loss due to both natural and human causes. These figures are available in the 1990 US Fish and Wildlife Service Report to Congress entitled Wetlands Losses in the US 1780's to 1980's. Natural losses result from natural succession,

TABLE 31. EXTENT OF WETLANDS, BY TYPE

Wetland Type Cowardin et al. (1979)	Historical Extent (acres) 1982 NRI	Most Recent Acreage 1992 NRI	% Change
Marine	0.0	0.0	0.0
Estuarine	0.0	0.0	0.0
Riverine	105,100	104,300	-0.8
Lacustrine	756,100	792,500	+4.8
Palustrine	2,108,700	2,107,600	-0.05
Total	2,969,900	3,004,400	+1.2

sedimentation, erosion, the hydrologic cycle, and fire. Human induced impacts may include agricultural drainage, flood control, channelization, filling, dredging, reservoir construction, oil and gas extraction, groundwater extraction, and various waste disposal sources. The impact rate on individual wetland basins (all types) in eastern South Dakota was estimated at 4.5% between 1983/84 and 1989. Highest loss rates were recorded for small temporary wetland basins less than 2 acres in area (US Department of the Interior, 1991).

By contrast, the National Resources Inventory (NRI) conducted by the then Soil Conservation Service (now NRCS) in 1982 located 2,969,900 acres of wetlands in South Dakota . Since heavy emphasis was placed on the hydric soils criterion the number of wetlands found more closely reflects the previously mentioned number of acres of hydric soils in South Dakota. The National Resources Inventory was again conducted in 1992 and 3,004,400 acres of wetlands were found in South Dakota, reflecting an increase in wetland acreage of 34,500 acres (Table 33).

Wetlands are protected by several agencies in South Dakota. Counties are responsible for control of wetland drainage. The US Army Corps of Engineers is responsible for the control of activities which place fill in wetlands. The Corps' authority stems from Section 404 of the Clean Water Act. Before exercising its authority on a particular action, the COE issues a public notice, taking into consideration the comments of the US Environmental Protection Agency, US Fish and Wildlife Service, S.D. Department of Game, Fish and Parks, S.D. Department of Environment and Natural Resources, and other resource agencies. Projects must receive certification from DENR under Section 401 of the Clean Water Act that the project will not violate South Dakota Surface Water Quality Standards. DENR regulates the discharge of pollutants to wetlands under the Surface Water Discharge permitting program.

Approximately 49,000 acres of wetlands are currently owned by the South Dakota Department of Game, Fish and Parks and managed as State Game Production Areas and Public Shooting Areas. The present total area includes a recent acquisition by GF&P of 3,000 acres of lakeshore wetlands in Lake Thompson, Kingsbury County. The US Fish and Wildlife Service (FWS) recently (1994) had 423,800 acres under perpetual easement, 17,348 acres under easement with FmHA, and another 65,000 acres under fee titles. This represented an increase of 42,305 acres or 9.1% over the FWS acreage reported prior to 1993.

“Swampbuster” Provisions

On December 23, 1985, President Reagan signed the Food Security Act of 1985. The Wetland Conservation or “Swampbuster” Provision of the Act was included because of an increased awareness of wetland values and public concern over diminishing wetland resources. Swampbuster's purpose was to remove the incentives for persons to produce agricultural commodities on converted wetlands and to thereby:

*Reduce soil loss due to wind and water erosion;

*Protect the Nation's long-term capability to produce food and fiber;

*Reduce sedimentation and improve water quality;

*Assist in preserving the Nation's wetlands;

*Curb production of surplus commodities.

Swampbuster provisions provide that anyone who, after December 23, 1985, produces an agricultural commodity on a converted wetland shall be determined to be ineligible for certain benefits provided by the US Department of Agriculture (USDA) and agencies of the Department. The 1990 Farm Bill tightened this provision to include the conversion of any land which had the potential to produce an agriculture commodity.

The benefits under this provision include:

* Any type of price support or payment made available under the Agricultural Act;

* Farm storage facility loans under the CCC Chapter Act;

* Disaster payments under the Agricultural Act of 1949;

* Crop insurance under the Federal Crop Insurance Act;

* Farm loans made, insured, or guaranteed by FmHA; and

* Payment for storage of an agricultural commodity under the CCC Charter Act.

Swampbuster determinations and decisions are made by the Natural Resources Conservation Service (NRCS). The agency plays an integral role in determining ineligibility for benefits under swampbuster provisions.

In South Dakota, the NRCS established in the late 1980’s, four wetland inventory teams to accelerate wetland identification on existing croplands as required by swampbuster. These teams had completed about 80% of the statewide inventory at the end of 1991. At that time, resumption of the survey was delayed until new federal guidelines could be incorporated into survey procedure. Maps of designated wetlands found on agricultural lands in eastern South Dakota are available through the

Farm Service Agency or NRCS. Similar maps covering the western half of the state are in the draft stage and nearing completion.

Since the advent of the swampbuster program, annual losses of wetland acreages in the state due to drainage, excavation, or fill, have been estimated to have been reduced by more than 50 percent and in some instances has led to an increase in wetland acreage.

Development of a State Wetland Protection Program.

The state has made progress during 1992-95 toward inventoring indigenous wetlands (Table 31), developing appropriate wetland water quality standards and establishing an integrated state wetland protection program (Table 32).

On December 3, 1992, South Dakota adopted, through the South Dakota Surface Water Quality Standards, that wetlands be included as "waters of the state". Wetlands were also designated for beneficial use of wildlife propagation and stock watering which provides protection under existing narrative and numeric water quality standards. All definitions within state regulations were made consistent with the definition as stated previously.

TABLE 32. DEVELOPMENT OF STATE WETLAND WATER QUALITY STANDARDS

	In Place	Under Development	Proposed
Use Classification	X		
Narrative Biocriteria	X		
Numeric Biocriteria			
Antidegradation	X		

It was found that many of the best management practices that reduce stream, lake, and groundwater pollution, have a similar positive impact on wetlands. Nutrients, pathogens, pesticides, and sediments are all primarily delivered by runoff from agricultural lands. When runoff is controlled, wetlands and water quality are often maintained or enhanced. Some of the prescribed BMPs that would accomplish this purpose included strip cropping, chisel plowing, no-till or minimum-till, ridge-plant, fertilizer/pesticide management and others. Those BMPs help maintain the quality of croplands to which they are applied and at the same time also benefit water quality of nearby wetlands in the path of agricultural runoff.

The EPA issued Section 401 certification for projects in South Dakota until July, 1993. South Dakota began issuing Section 401 Water Quality Certification in July, 1993. The federal permits to which the state applies Section 401 are Section 404/Section 10 permits, NPDES permits, and FERC licenses. The state informally reviews Surface Water Discharge permits. All Solid Waste Subtitle D facilities undergo an informal review for compliance with water quality standards prior to permitting. The state presently has regulations that implement Section 401 activities.

Within South Dakota, a number of federal and state agencies, as well as local governmental units and other organizations have shared various wetlands concerns and responsibilities, as previously mentioned. The Department of Transportation has entered into a mitigation banking agreement with the Department of Game, Fish and Parks, and the US Fish & Wildlife Service for road construction projects.

An Interagency Wetlands Working Group (IWWG), composed of representatives from four state agencies including DENR; Department of Game, Fish and Parks; Department of Agriculture; and Department of Transportation, was formed in 1991.

The first meeting of the wetlands advisory group on February 11, 1991, outlined ten initial goals for a state wetlands program. These included, but were not limited to the following:

1. A complete and accurate wetland (and adjacent habitatat) inventory for South Dakota (types, sizes, uses, location, ownership, condition, protection and restoration potential);

2. Computerization of wetland information;

3. Specific water quality standards for wetlands;

4. Criteria and standards for wetland development/enhancement/restoration;

5. A unified state program for "no net loss";

6. Appropriate wetland mitigation for highway construction;

7. An effective program of incentives for protection of privately-owned wetlands;

8. An effective program to minimize or prevent serious agricultural impacts to wetlands (drainage, pesticide, sediment);

9. A program to provide technical and educational information to inform private and public entities about wetlands; and

10. Identifying or establishing a funding source and buyer for those landowners wishing to sell wetlands.

A South Dakota Wetland Policy is being developed by the IWWG. This policy is to provide state agencies with consistency in wetland management and protection and to encourage increased public awareness of the functions and benefits of wetland resources. Project tasks for the IWWG included: 1) formation of a multi-agency wetland group to develop a draft wetlands policy, 2) to reach consensus among state agencies on the importance of wetland functions and benefits, 3) to reach consensus among state agencies on the conservation of wetlands in South Dakota, 4) to gather public input on a State Wetlands Policy via public meetings and presentations statewide; and, 5) to produce a final comprehensive South Dakota Wetland Policy for distribution across the state.

Oversight and coordination of the program as well as duties in public relations and information have been handled by the IWWG. It is anticipated that with continued EPA funding, this program, currently housed with the S.D. Department of Agriculture, will become permanent within state government.

Though fulfillment of many of the above stated objectives has resulted in significant enhancement of present wetland protection efforts within South Dakota and served to ensure that further losses of valuable wetland habitat will be held to a tolerable minimum, some of the objectives still remain to be addressed. In the end, the effectiveness and viability of a state's wetlands protection efforts largely depend on federal activities, legislation and financial support.

G. PUBLIC HEALTH/AQUATIC LIFE CONCERNS

Although toxic pollutants are of concern in South Dakota, the cost of routinely monitoring most toxic pollutants is prohibitive. At present, priority toxins (heavy metals) are routinely monitored at several WQM stream sites located near historic or current mining activities in the northern Black Hills. Ammonia, which is a 307(a) toxic pollutant, is frequently monitored throughout the DENR fixed station monitoring network (Table 33).

TABLE 33. TOTAL SIZE AFFECTED BY TOXICS

WATERBODY	SIZE MONITORED FOR TOXICS*	SIZE WITH ELEVATED LEVELS OF TOXICS**
Rivers (miles)	3,080	163
Lakes (acres	548,000	0
Estuaries (miles)	N/A	N/A
Coastal waters (miles)	N/A	N/A
Great Lakes (miles)	N/A	N/A
Freshwater wetlands (acres)	0	Unknown
Tidal wetlands (acres)	N/A	N/A

* Ammonia, cyanide, chlorine, and metals including arsenic.

** Elevated levels are defined as exceedances of state water quality standards, 304(a) criteria, and/or FDA action levels, or levels of concern (where numeric criteria do not exist).

<u>Aquatic Life (Fish Kills)</u>

There were twelve separate aquatic life concern incidents investigated from October 1995 to October 1997 and each involved a fish kill. Last reporting period, eleven incidents of fish kill were investigated (1996 305(b) report).

The US Fish and Wildlife Service Field Manual for the Investigation of Fish Kills, offers the following guide for reporting fish kills:

Minor Kill: less than 100 fish
Moderate Kill: 100 to 1,000 fish in 1.6 km of stream or equivalent lentic area.
Major Kill: more than 1,000 fish in 1.6 km of stream or equivalent lentic area.

By these standards, there was one moderate kill and two minor kills in South Dakota streams or lakes. The numbers of fish killed in the remaining incidents were undetermined.

It is extremely important to conduct the initial phases of fish kill investigations at the earliest indication of a die-off. The need for such urgency is due to the fact that fish degrade quite rapidly and the cause of death may disappear or become unidentifiable within minutes. Unfortunately, DENR is often notified days after an incident has occurred, which hampers the ability to positively identify pollution sources or events that may have caused the event.

Five of the incidents were attributed to natural causes. Natural causes include oxygen depletion, gas supersaturation, toxic algal blooms, lake turnovers, toxic changes, bacterial infections, fungi, viruses, parasites and others. Three fish kills were of an undetermined cause, two were related to the operations of hydroelectric dams, one was suspected vandalism, and one was attributed to an agriculture-related ammonia runoff, but was not established.

A minor fish kill occurred in the tailwaters of Oahe Reservoir (upper Lake Sharpe) on February 20, 1996. Sixty to eighty salmon were found from the face of the Oahe Dam discharge to about 1.5 miles down stream. Necropsy showed severe internal injuries such as damage to internal organs and internal hemorrhaging. This damage is consistent with injuries fish would receive passing through the turbines in the dam.

A fish kill of undetermined size occurred at Sheridan Lake on July 16, 1996. A necropsy of perch showed that bacterial and parasitical infections were responsible for the kill. These infections are usually related to environmental stressors. It is suspected that due to weather conditions a large algal die off depleted oxygen levels in the lake. This oxygen depletion stressed the fish, making them susceptible to the bacterial and parasitical infections.

A fish kill of undetermined size occurred in Cottonwood Springs Reservoir on September 26, 1996. Necropsy showed bacterial infections had caused the die-off. The infections were induced by stress related to stocking and/or catch and release practices.

On April 25, 1997, a fish kill of undetermined size occurred at Still Lake, near Florence, South Dakota. It was suspected that an agricultural-related ammonia runoff, coupled with the low temperatures and high pH, was responsible for the kill.

A moderate fish kill was reported at a private fish hatchery near Spearfish, South Dakota, on May 6, 1997. Approximately 30,000 trout were killed in tanks the hatchery owner uses to raise these fish. About 100 dead fish of undetermined species were found dead in the first 100 feet of stream that flows from his tanks to Spearfish Creek. No cause was determined, however damage to a fence and a plastic bag found in one of the tanks suggest vandalism.

A fish kill of undetermined size occurred at the Fort Randall Dam (Lake Francis Case) on September 14, 1997. It appears that the kill is related to the release through the small spillway, which has a deep-water intake. The following are theories on the kill; 1) either the switch to the deep water release or turbulence caused by the baffling system below this spillway is causing gas supersaturation problems, or 2) the fish moving through the spillway are damaged by striking the baffling system below this spillway. No necropsies were performed.

Unsafe Beaches

Recent monitoring data compiled for swimming beaches by the DENR Drinking Water Program appear in Tables 34 and 35. Monitoring of the approximately 57 designated beach areas in the state is conducted weekly during the swimming season from May to September. Water quality samples are collected by the municipality or governmental agency charged with managing the given waterbody. The South Dakota Department of Game, Fish and Parks is most often the monitoring agency responsible for managing lake swimming beaches in the state. Following analysis of such samples by an approved lab, the Drinking Water Program will close a beach area if bacteria concentrations exceed Beach Closure Standards. Beach closings are controlled by the entity regulating the swimming areas.

The number of instances of excessive fecal coliform concentration (>200/100 ml) reported at state beaches nearly doubled from 45 in 1992 to 85 in 1993. This result was attributed mainly to increased nonpoint source runoff and severe flooding during spring and summer of 1993. Decreases in rainfall during 1994 in the monitored swimming areas resulted in a more than 50% drop in reported excessive fecal coliform counts. The following year saw another increase in annual precipitation over eastern South Dakota and a consequent rise in the number of fecal coliform exceedances from 36 in 1994 to 55 in 1995. It was noted that flooding in 1995 was not as severe as that experienced two years earlier during spring and summer. This may largely explain why the number of incidents of high fecal coliform levels was appreciably smaller than reported in 1993 although similar numbers of waterbodies and public beaches were affected in both years (1994 and 1996 305(b) Reports). Similarly, greater rainfall in 1997 compared to 1996 may have resulted in the increase of excessive fecal counts from 36 in 1996 to 57 in 1997.

Surface Drinking Water and Fish Consumption Restrictions

The Surface Water Quality Program, in partnership with the South Dakota Department of Game, Fish and Parks, conducted a series of fish flesh analyses throughout the state in 1996 and 1997.

In 1997, one lake, one Missouri River mainstem reservoir (Lake Oahe at 3 sites) and six streams were sampled for fish flesh analysis. Netted fish were analyzed for total cadmium, total mercury, organochlorine pesticides, PCBs, arsenic, lead, selenium, and zinc. Total mercury was present at concentrations ranging from 0.03 mg/kg to 0.63 mg/kg.

In 1996, six lakes, one Missouri River mainstem reservoir (Lake Francis Case at 3 sites) and one stream were sampled for fish flesh analysis. Fourteen fish species were tested for cadmium, mercury, organochlorine pesticides, and PCBs. There were no detectable levels of PCBs, total cadmium, total DDT or other organochlorine pesticides. Mercury was the only contaminant detected. Total mercury was present at concentrations ranging from 0.05 mg/kg to 0.43 mg/kg, well below the FDA action level of 1.00 mg/kg. No fish consumption advisories were issued this reporting cycle.

TABLE 34. WATERBODIES AFFECTED BY BATHING AREA CLOSURES (1996)

Name of Waterbody	Waterbody Type	Size Affected	Cause of Pollutant	Conc. of Pollutant[a]	S F
Lake Sharpe (Farm Island, Pierre)	Missouri River mainstem reservoir	beach area	fecal coliform	400; 350	N
Lake Sharpe (Pierre City Beach)	Missouri River mainstem reservoir	beach area	fecal coliform	200; 250	N
Lewis & Clark Lake (Midway West)	" "	" "	" "	1000[b]	
Lewis & Clark Lake (Gavins West)	" "	" "	" "	970	
Lewis & Clark Lake (Gavins East)	" "	" "	" "	1100[b]	
Lake Alvin	lake	" "	" "	360-1700[b]	
Big Stone Lake (Hartford Beach)	lake	" "	" "	210; 470	
Lake Eureka (Eureka City Beach)	lake	" "	" "	2700[b]; 1100[b]	
Game Lodge Pond (Custer St. Pk., Black Hills)	lake	" "	" "	309; 355	
Lake Herman	lake	" "	" "	340	
Lake Hiddenwood	lake	" "	" "	920	
Lake Kampeska (Sandy Shore)	lake	" "	" "	310; 580	

TABLE 34. Cont.

Name of Waterbody	Waterbody Type	Size Affected	Cause of Pollutant	Conc. of Pollutant[a]
LaCreek Headquarters (Nat. Wildlife Refuge)	lake	beach area	fecal coliform	290
Lake Lakota	lake	beach area	fecal coliform	300; 50000 [b]
Lake Louise	" "	" "	" "	2700 [b]; 2700 [b]
Lake Mitchell (Day Camp Beach)	" "	" "	" "	460
Pickerel Lake (West)	" "	" "	" "	250
Lake Prior (Woonsocket, SD)	" "	" "	" "	260
Roubaix Lake	" "	" "	" "	1100 [b]
Trent Beach (Trent, SD)	" "	" "	" "	730
Lake Vermillion	" "	" "	" "	240; 1450[b]
Wylie Lake (NW Aberdeen, SD)	" "	" "	" "	500

[a] Beach considered potentially unsafe at $\geq$ 200/100 ml (Drinking Water Program Standards)

[b] Beach closure recommended: Beach to remain closed until safe fecal coliform levels (<200) are attained

[c] Number of reported incidents of $\geq$ 200/100 ml fecal coliform concentration.

TABLE 35. WATERBODIES AFFECTED BY BATHING AREA CLOSURES (1997)

Name of Waterbody	Waterbody Type	Size Affected	Cause of Pollutant	Conc. of Pollutant[a]	S P
Lake Oahe (Mobridge Reveheim)	Missouri River mainstem reservoir	beach area	fecal coliform	1000 [b]; 3800 [b]	NI
Lake Oahe (West Whitlock)	Missouri River mainstem reservoir	beach area	fecal coliform	280; 430	NI
Lake Alvin	lake	" "	" "	1000-3900 [bb]	
Blue Dog Lake (Blue Dog Beach)	lake	" "	" "	330-3500 [bb]	
Lake Cochrane	" "	" "	" "	530	
Lake Eureka (Eureka City Beach)	" "	" "	" "	230-120000 [b]	
Lake Farley (Grant County)	" "	" "	" "	290	
Lake Herman	" "	" "	" "	660	
Lake Hiddenwood	" "	" "	" "	270	

TABLE 35. Cont.

Name of Waterbody	Waterbody Type	Size Affected	Cause of Pollutant	Conc. of Pollutant[a]	
Lake Kampeska (Memorial Beach)	lake	beach area	fecal coliform	400-1200 [b]	
Lake Kampeska (Sandy Shore)	lake	beach area	fecal coliform	510-90000[b]	
Lake Kampeska (Watertown City Beach)	" "	" "	" "	200	
LaCreek Headquarters (Nat. Wildlife Refuge)	" "	" "	" "	210	
Lake Mitchell (Day Camp Beach)	" "	" "	" "	280	
Oakwood Lake	" "	" "	" "	400	
Lake Pelican (Pelican Beach)	" "	" "	" "	250; 450	
Pickerel Lake (West)	" "	" "	" "	380	

TABLE 35. Cont.

Name of Waterbody	Waterbody Type	Size Affected	Cause of Pollutant	Conc. of Pollutant[a]
Lake Poinsett	lake	beach area	fecal coliform	1200-21000 [bb]
Lake Prior (Woonsocket, SD)	lake	beach area	fecal coliform	200
Ravine Lake (Ravine Beach)	" "	" "	" "	200-170000 [bb]
Roubaix Lake	" "	" "	" "	385
Richmond Lake	" "	" "	" "	320; 830
Sheridan Lake	" "	" "	" "	3400[b]
Sylvan Lake (Custer St. Pk., Black Hills)	" "	" "	" "	260
Lake Vermillion	" "	" "	" "	300-2000 [bb]
Wall Lake (Wall Lake Beach)	" "	" "	" "	500
Wylie Lake (NW of Aberdeen, SD)	" "	" "	" "	910-4700 [bb]

[a] Beach considered potentially unsafe at $\geq$ 200/100 ml (Drinking Water Program Standards)
[b] Beach declared closed until safe fecal coliform levels (<200) are attained
[bb] Multiple beach closures
[c] Number of reported incidents of $\geq$ 200/100 ml fecal coliform concentration

TABLE 36. WATERBODIES AFFECTED BY FISH AND SHELLFISH[a] CONSUMPTION RESTRICTIONS

Name of Waterbody	Waterbody Type	Size Affected	Type of Fishing Restriction				Cause(s) (Pollutant(s)) of Concern
			Non Consumption		Limited Consumption		
			General Population	Sub-Population	General Population	Sub-Population	
NONE	-	-	-	-	-	-	-

[a] Does not include shellfish harvesting restrictions due to pathogens.

TABLE 37. WATERBODIES AFFECTED BY SURFACE DRINKING WATER RESTRICTIONS

Name of Waterbody	Waterbody Type	Type of Restriction			Cause(s) (Pollutant(s)) of Concern	Source(s) of Pollutant(s)
		Closure[a] (Y/N)	Advisory[b] (Y/N)	Other (explain)		
NONE	-	-	-	-	-	-

[a] Closures restrict all consumption from a drinking water supply.

[b] Advisories require that consumers disinfect water (through boiling or chemical treatment before ingestion).

TABLE 38. SUMMARY OF WATERBODIES FULLY SUPPORTING DRINKING WATER USE

Rivers and Streams	Contaminants Included in the Assessment	Lakes and Reservoirs	Contaminants Included in the Assessment
Missouri River[a]	All MCLs[b]	Lake Oahe[c]	All MCLs
Big Sioux River	" "	Lake Francis Case[c]	" "
Elm River	" "	Lewis & Clark Lake[c]	" "
James River	" "	Byre Lake	" "
Rapid Creek	" "	Freeman Dam	" "
Spearfish Creek	" "	Lake Isabel	" "
		Lake Kampeska	" "
		Lake Mitchell	" "
		Lake Murdo	" "
		Lake Waggoner	" "
		White Lake Dam	" "

[a]Rural Water System (RWS) Intakes:
Yankton, SD.
Pickstown, SD.
[b]MCL - maximum contaminant level for drinking water standards.
[c]Missour River mainstem reservoirs
Rural Water System (RWS) Intakes:

Lake Oahe:	Lake Francis Case:	Lewis & Clark Lake:
Mobridge, SD	Oacoma, SD	Springfield, SD
WEB RWS	Chamberlain, SD	Bon Homme/Yankton RWS
Gettysburg, SD	Aurora/Burke RWS	
Oahe Plains RWS	Randall II & III RWS	
Tri-County RWS	Lake Andes, SD	
Mid-Dakota RWS		

TABLE 39. SUMMARY OF WATERBODIES NOT FULLY SUPPORTING DRINKING WATER USE

Waterbodies (List)	Source(s) of Data (√)			Characterization[1]	Major Causes
	Ambient	Finished	Use Restrictions		
River and Streams					
None	√	√			
Lakes and Reservoirs					
None	√	√			

[1]Characterization: Fully Supporting but Vulnerable, Partially Supporting, Not Supporting.

TABLE 40. SUMMARY OF CONTAMINANTS USED IN DRINKING WATER ASSESSMENT

River and Streams	Contaminants Included in the Assessment[1]	Lakes and Reservoirs	Contaminants Included in the Assessment[1]
Missouri River	a,b,c,d,e,f,g,h	Lake Oahe	a,b,c,d,e,f,g,h
Big Sioux River	a,b,c,d,e,f,g,h	Lake Francis Case	a,b,c,d,e,f,g,h
Elm River	a,b,c,d,e,f,g,h	Lewis & Clark Lake	a,b,c,d,e,f,g,h
James River	a,b,c,d,e,f,g,h	Byre Lake	a,b,c,d,e,f,g,h
Rapid Creek	a,b,c,d,e,f,g,h	Freeman Dam	a,b,c,d,e,f,g,h
Spearfish Creek	a,b,c,d,e,f,g,h	Lake Isabel	a,b,c,d,e,f,g,h
		Lake Kampeska	a,b,c,d,e,f,g,h
		Lake Mitchell	a,b,c,d,e,f,g,h
		Lake Murdo	a,b,c,d,e,f,g,h
		Lake Waggoner	a,b,c,d,e,f,g,h
		White Lake Dam	a,b,c,d,e,f,g,h

1. Contamination groups. Individually tested contaminants are listed in Appendix E for:

a = VOCs or Volatile Organic Compounds
b = SOCs or Synthetic Organic Compounds
c = Inorganic Compounds
d = Microbiological Contaminants
e = Radiological Contaminants
f = Lead and Copper
g = Turbidity
h = Trihalomethanes

TABLE 41. STATE-LEVEL SUMMARY OF DRINKING WATER USE ASSESSMENTS FOR RIVERS AND STREAMS

Total Miles Designated for Drinking Water Use 546

Total Miles Assessed for Drinking Water Use 546

Miles Fully Supporting Drinking Water Use	546	% Fully Supporting Drinking Water Use	100%	Major Causes
Miles Fully Supporting but Vulnerable For Drinking Water Use	-	% Fully Supporting but Vulnerable for Drinking Water Use	-	-
Miles Partially Supporting Drinking Water Use	-	% Partially Supporting Drinking Water Use	-	-
Miles Not Supporting Drinking Water Use	-	% Not Supporting Drinking Water Use	-	-
Total Miles Assessed for Drinking Water Use	546		100%	

TABLE 42. STATE-LEVEL SUMMARY OF DRINKING WATER USE ASSESSMENT FOR LAKES AND RESERVOIRS

Total Waterbody Area designated for Drinking Water Use 493098[a] acres

Total Waterbody Area Assessed for Drinking Water Use 493098 acres

Acres Fully Supporting Drinking Water Use	493098	% Fully Supporting Drinking Water Use	100%	Major Causes
Acres Fully Supporting but Vulnerable For Drinking Water Use	-	% Fully Supporting but Vulnerable for Drinking Water Use	-	-
Acres Partially Supporting Drinking Water Use	-	% Partially Supporting Drinking Water Use	-	-
Acres Not Supporting Drinking Water Use	-	% Not Supporting Drinking Water Use	-	-
Total Acres Assessed for Drinking Water Use	493098		100%	

[a]Includes 487000 acres of Missouri River Mainstem Reservoirs (See Table 41).

IV.
GROUND WATER QUALITY ASSESSMENT

A. STATE GROUND WATER QUALITY PROGRAM (GWQP): OVERVIEW AND NEEDS

More than three-quarters of the state's population utilizes ground water for domestic needs. General ground water quality in the state is good with only a few aquifers having naturally occurring contaminant problems. Deeper aquifers generally have poorer water quality than shallow aquifers but are also generally less susceptible to contamination.

In South Dakota the most significant ground water quality problems are man-induced ground water degradation from petroleum, nitrate, and other chemicals through accidental releases and product mishandling, poor management practices, improper locating of pollutant producing facilities, and the contamination of shallow wells because of poor well construction or location adjacent to pollution sources. The state Ground Water Quality Program (GWQP) is making strides to reduce these problems by requiring cleanup of contaminated sites and implementing various programs to prevent contamination from occurring. These programs include source water and wellhead protection of public water supplies, underground injection control, ground water discharge permitting regulations, development of management plans for fertilizer and pesticide use, concentrated animal feeding operations permits, underground and aboveground storage tank regulations, and other programs.

The future needs or goals of the GWQP in regard to ground water protection primarily involve better protection of the state's ground water resources by preventing future contamination and more effectively cleaning up the sites already contaminated. Some areas of concern are a better understanding of fate and transport of contaminants through the soils and ground water, a need to monitor agricultural chemicals in ground water, an assessment of aquifer vulnerability, better protection of public water supplies, and the development of an integrated data base with a Geographical Information System (GIS). The future goals of the GWQP are discussed in the Comprehensive State Ground Water Protection Strategy.

The ability of the GWQP to better evaluate and protect the state's ground water quality would be enhanced if the above needs were met. Projects such as statewide monitoring of ground water quality and limited mapping of all aquifers for contamination vulnerability are on-going or were completed. Additional work in these areas and the development of a GIS data base to incorporate all the information are steps that are currently being taken to improve the GWQP and to aid it in making the decisions necessary to protect the ground water resources of the state. A concerted effort to to standardize locational and site identifier information for facilities in all DENR data bases is currently under way for future use in a GIS format. Such projects require funds and personnel to carry out stated objectives, but a long range commitment to protect our ground water supplies is essential for future growth and development. The Comprehensive State Ground Water Protection Plan update (Appendix B) will assist in bringing together local, state, federal, tribal, and public agencies to jointly make this committment.

B. GROUND WATER QUALITY

General Discussion

The state is heavily dependent on ground water. Almost 50% of the approximately 450 million gallons of water used per day in South Dakota is ground water. The uses of ground water include: domestic, agricultural (livestock watering, irrigation) and industrial. Over 80% of the state's public water supplies rely on ground water. Virtually everyone not supplied by public water systems is dependent on ground water for domestic use. Ground Water Quality Standards established to protect all designated uses of state subsurface water are presented in Appendix C.

Aquifers within South Dakota can be grouped into two categories, unconsolidated sand and gravel aquifers (glacial outwash and alluvial), and bedrock aquifers. Glacial aquifers consist of sand and gravel outwash deposited by glacial meltwaters. These occur over much of the area east of the Missouri River. Alluvial aquifers include sand and gravel deposits underlying the major streams and rivers within the state. The glacial and alluvial aquifers are the most abundant and easily accessible sources of ground water for much of the state's population. East of the Missouri River, ground water accounts for about seventy (70) percent of all water used. The water quality within these shallow aquifers is highly variable but generally suitable for domestic, industrial, and agricultural use. Being shallow and consisting of permeable material, these aquifers are susceptible to contamination. The water quality generally deteriorates with depth.

The bedrock aquifers, although less susceptible to contamination when they are overlain by thick clay and shale deposits, are also susceptible to contamination where the bedrock occurs at the land surface such as the Ogallala aquifer and outcrop areas in the Black Hills. Bedrock aquifers are the only source of ground water west of the Missouri River, except for a few small alluvial areas along major streams. Greater mineralization commonly occurs at greater depths as distance from the Black Hills increases. These aquifers are still used extensively as rural-domestic and stock water supplies, as well as for municipal and industrial use. The majority of the bedrock aquifers are unsuitable for irrigation. Ground water accounts for up to thirty (30) percent of water used in the western part of the state.

Ground Water Quality Problems

Other than naturally occurring problems in a small number of aquifers, South Dakota does not suffer widespread ground water contamination. However, numerous incidents of man-induced ground water degradation have occurred. The following list identifies facilities or materials documented or suspected of being sources of ground water contamination in South Dakota: fertilizers and pesticides; wastewater treatment lagoons; landfills; mining operations; septic systems; inadequate well design and construction; feedlots; and petroleum and other chemical spills or leaks. The types of pollution problems have remained consistent through the years, although reported spills or leaks of petroleum and other chemicals have varied considerably year to year. Increases in spill reporting are often driven by requirements for facility site assessments and upgrades, as pre-existing contamination is often found during these activities.

Generally, over the past ten years, reported incidents of potential ground water contamination have increased. Petroleum products, fertilizers, and pesticides were the major contaminants, respectively. The annual totals of reported spills of oil and other hazardous substances have fluctuated during the past 10 years. There were increases of forty-one percent (41%) from 1986 to 1987, 120% from 1987 to 1988, 22% from 1988 to 1989, 92% from 1989 to 1990, and 7% from 1990 to 1991. A decrease of 40% occurred between 1991 and 1992 which was followed by an annual 21% increase and another yearly decrease of 19% between 1993 and 1994. A decrease of 14% occurred between 1994 and 1995. In the recent reporting period (1995-1997), there was again an increasing trend in the number of spills reported, as increases of 5% and 11% were recorded.

The large increases in recorded spills during the 1980's may have been due to a greater awareness of the responsibility to report spills; and to underground storage tank (UST) regulations. The reversal of this trend after 1991 may have been partly due to cost factors (such as changes in the out-of-pocket deductible charged to the party responsible for the release) which caused a slowdown in petroleum facility upgrades during which many of the contamination problems are discovered. Recent increases in the number of reported contamination incidents may be occuring because of the approaching facility upgrade deadline of 1998.

Petroleum products were involved in 74% of reported spills during the present reporting cycle. Leaking USTs (nearly all containing petroleum products) were responsible for 46% of the incidents reported from October 1, 1991, to September 30, 1993, but made up only 28% of the reported releases during the 1993-1995 reporting period. From 1995-1997 this portion was 32%. In addition, petroleum spills from past years continue to be remediated and monitored. Petroleum components such as benzene, toluene, ethylbenzene, and xylene constitute potential health risks as well as rendering water unpalatable at very low concentrations.

Fertilizers and pesticides also represent a portion of South Dakota's point source contamination. Damaged equipment and improper handling and disposal of containers and rinsate have resulted in agricultural chemicals reaching the ground water. The number of spill reports concerning agricultural chemicals has remained relatively steady over the past ten years with roughly 40 to 60 incidents reported each year.

Bulk pesticide containment regulations went into effect January 1, 1988, and bulk fertilizer container regulations went into effect July 1989. To further address potential point sources of pesticides or fertilizers, chemigation equipment regulations are also in effect. South Dakota Department of Agriculture (SDDA) requirements now in effect for chemical loading and rinsing containment pads required facilities to have fertilizer containment pads in place by 1992 and all pesticide operational area containment systems were required to be in place by 1995. Additionally, all secondary containment structures were to be constructed by 1996. It does appear that the number and/or severity of releases at fixed agricultural chemical facilities is being reduced.

The effects of agriculture on South Dakota ground water have not been fully identified. Pesticide and fertilizer use is widespread and includes areas overlying shallow ground water. Work is currently underway involving DENR and SDDA to develop fertilizer and pesticide management plans designed to reduce potential impacts to ground water from land application of agricultural chemicals. To date, little evidence has been found to indicate a significant problem exists. However, nitrate levels (NO_3 as

N) greater than 10 mg/l have been found in wells in shallow aquifers in eastern South Dakota. Pesticides have not been found in significant levels in ground water as a result of normal labeled use. Three studies, described later in this section, were initiated to determine what impacts agricultural chemicals may have on the state's ground water. These projects have been supplanted by the permanent statewide monitoring network which has incorporated some of the wells used in those studies.

Potential sources and substances presently responsible for ground water contamination in South Dakota are listed in Table 43. The table shows ten priority pollution sources most affecting state ground water, but a number of other sources such as land application, material transfer operations, pesticide application, shallow injection wells, road salting and others also have the potential to cause contamination. The substance in ground water most frequently occurring in concentrations above the EPA Maximum Contaminant Level (MCL) is nitrate as nitrogen. There are several potential sources of nitrate including nonpoint sources such as commercial and manure fertilizer use on croplands.

Some of the contaminant sources were selected as a priority problem based on being a high concern in localized areas of the state but not over the majority of the state (factor G in Table 43). This was due to the limited number of these sources and/or their being located in a small area of the state. An example is gold mining (mining and mine drainage and waste tailings) which only occurs in the Black Hills area. Many of the previously mentioned contamination problems are the result of improper well location and the construction of various facilities relative to aquifers. Pollution sources such as leaking wastewater treatment lagoons, and improperly located septic systems, feedlots, landfills and pesticide or fertilizer handling and storage facilities, may cause localized ground water contamination. Improper location and/or construction of wells may also lead to and compound ground water contamination. For these reasons, private wells are prone to bacterial, nitrate, and other water quality problems from surface sources.

Table 43. MAJOR SOURCES OF GROUND WATER CONTAMINATION

Contaminant Source	Ten Highest-Priority Sources (√)	Factors Considered in Selecting a Contaminant Source [1]	Contaminants [2]
Agricultural Activities			
Agricultural chemical facilities	√	F, A, C, G	A, B, E
Animal feedlots	√	D, C, B	E, J
Drainage wells			
Fertilizer applications	√	D, C, F, B, G	E, J
Irrigation practices			
Pesticide applications			
Storage and Treatment Activities			
Land application			
Material stockpiles			
Storage tanks (aboveground)	√	D, F, B	D, E, B, H, C
Storage tanks (underground)	√	D, F, B	D, E, B, H, C
Surface impoundments	√	F	E, G
Waste piles			
Waste tailings			
Disposal Activities			
Deep injection wells			
Landfills	√	G	M_2
Septic systems	√	D, C	E, J
Shallow injection wells			
Other			
Hazardous waste generators			
Hazardous waste sites			
Industrial facilities			
Material transfer operations			
Mining and mine drainage and waste tailings	√	G, E	E, H, M
Pipelines and sewer lines	√	B, C	D, E, J
Salt storage and road salting			
Salt water intrusion			
Spills	Covered in other priorities that include spills		
Urban runoff			
Transportation of Materials			

TABLE 43. CONTINUED

[(1)] Factors considered in selection of contaminant source:

A. Human health and/or environmental risk (toxicity)
B. Size of the population at risk
C. Location of the sources relative to drinking water sources
D. Number and/or size of contaminant sources
E. Hydrogeologic sensitivity
F. State findings, other findings
G. Other criteria: high to very high priority in localized areas.

[(2)] Contaminants and classes of contaminants associated with each identified source:

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
F. Fluoride
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses
M. Cyanide
M_2. Other (a variety of contaminants)

Table 44 summarizes point source contamination incidents by source, type of contaminant(s) present and status of the cleanup activities. This information is provided for the entire state as a general statewide contamination incident summary. The state summary covers contamination found in ground water that may or may not be considered an aquifer. The spill site data base covers all reported spill cases in South Dakota but at the present time does not describe the specific aquifer or waterbody impacted. The listed number of reported spills and number of sites that are closed or inactive are specific numbers, but the other data in the table are estimates based on the stage of clean up actions, and the information available about the sites. On the table, the source type labeled "state sites" refers to all reported contamination spills other than leaking petroleum underground storage tanks (LUST) cases and the other described source types. This category includes agricultural chemical spills, above ground storage tank leaks, transportation spills (primarily petroleum and agricultural chemicals) industrial chemicals, and others, because they cannot be addressed as identifable items in this table.

Table 44. STATEWIDE GROUND WATER CONTAMINATION SUMMARY

Aquifer Description Includes aquifers and non-aquifers County(ies) Statewide
Aquifer Settings Glacial, alluvial and bedrock Longitude/Latitude -
Data Reporting Period Inception of spill reporting through September 1997

Source Type	Present in reporting area (circle)	Number of sites in area	Number of sites that are listed and/or have confirmed releases (Total)	Number with confirmed ground water contaminants	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed	Num sites corre actio
NPL	**Yes**/No	3	3	3	solvents, metals, petroleum	3		
CERCLIS (non-NPL)	**Yes**/No	24	24	12	petroleum, metals, solvents, pesticides, fertilizer	24		
DOD/DOE	**Yes**/No		42	11	petroleum, ordinance, metals, solvents	42	13	
LUST	**Yes**/No		2070	1120	Petroleum	2070	240	
RCRA Corrective Action	**Yes**/No		1		Mineral Spirits, Metals	1	1	
Underground Injection	**Yes**/No		Regulated by EPA					
State Sites	**Yes**/No		2998	720	Petroleum products, Agricultural and industrial chemicals	2998	60	
Nonpoint Sources	**Yes**/No	See the information in Appendix D: Table 8-4A concerning the ambient ground water monitoring network and the text concerni						
Other	Yes/**No**							
Totals								

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

The number of sites described as having confirmed ground water contamination is an estimate based on available information and experience. It must be noted that this is an estimated value, as this information is not readily available in the data base. The numbers have been revised compared to the last report, based on a better estimate of the numbers. The general conclusion that can be drawn is that a larger percentage of the LUST sites have ground water contamination compared to State Sites. The State Sites include many transportation accidents and other surface spills which often do not impact ground water. These differences are also reflected in the number of sites that have been cleaned up completely, which shows that the surface spills and those that are one-time releases are more quickly identified and cleaned up, and do not generally cause as long-term a problem as do LUST sites.

The percentage of closed LUST sites (in relation to total LUST spill cases reported) was approximately 59%, while about 79% of the other spill incidents reported were closed at the end of the 1995 reporting period. By 1997 the percentage of closed sites went up slightly to 62% for LUST sites and 80% for the other sites. To date, 73% of the total number of spills reported to DENR have been adequately cleaned up and closed. Although new spills will continue to occur, and existing difficult cases can remain open for a number of years, progress is being made in reducing the environmental threats to South Dakota's ground water from contaminant releases as evidenced by the large number of spill cases that are closed every year.

For this table, sites that are stabilized or have had the contaminant source removed are ones that have been placed in a monitoring program until DENR determines no further action is necessary. Some of these sites have had the initial source, such as an underground storage tank, removed or most of the contaminated soils excavated or remediated, but if the release has caused ground water impacts that are still a concern, monitoring of the ground water continues. When the monitoring shows the remedial actions taken have adequately cleaned up the contamination, the site is either closed or placed in inactive status.

If a site is in the initial stages of assessment, remediation is planned, or a remediation system is in place, the site is considered "open" and to be in active remediation. In some cases the contaminant concentrations may be low and no active remediation is needed, or if limited ground water contamination is found only monitoring will be required. Active remediation may range from excavating very limited amounts of soil contamination from around the source, to large scale soil and ground water remediations. For the LUST and State Sites, any contaminated site that has not reached the stabilized monitoring stage is considered to be in active remediation (with a corrective action plan that will be implemented after it is submitted and approved). Some of the more limited source types (as DOD sites) depict more specific stages of clean-up action. All sites that have confirmed contamination were considered to have had a site investigation.

CERCLIS sites listed include only those sites that are presently active or have potential action pending. Some of these sites may go to a further action category after additional review.

Included with the US Department of Defense (DOD) sites are a number of nuclear missile silo deactivation sites that have encountered soil contamination but did not encounter any ground water contamination.

Tabular information for 4 shallow vulnerable aquifers in eastern South Dakota is shown in Appendix D. These listed aquifers: the Vermillion East Fork, Vermillion West Fork, Parker-Centerville, and Missouri (Elk Point management unit), are also shown on Figure 4. These aquifers are composed mainly of sand and gravel from glacial outwash deposits. The Missouri aquifer is primarily an outwash aquifer with some recent alluvial deposits at land surface. The major water bearing portion of the aquifer consists of the outwash. These four aquifers are also part of the state wide ground water quality monitoring network which, when complete, will sample wells in 25 shallow vulnerable aquifers across the state. Ground water quality information from the monitoring network in those aquifers is shown in Appendix Table 8.4A.

There are 15 small towns located over these shallow aquifers and 5 of these towns have shallow public water supply wells in these aquifers. Since contaminant releases began to be recorded in a DENR database (approximately 15 years ago) there have been 121 spill cases documented over these aquifers. The majority of these spills involved petroleum. To date none of the contamination events have impacted any of the vulnerable public water supply wells for these communities.

The Ground Water Contamination Summary for the Vermillion East Fork, Vermillion West Fork, Parker-Centerville, and Missouri (Elk Point management unit) aquifers is found in Table 8.2A of Appendix D. A summary of this data is shown in the table below. In a majority of instances, "other" spills include releases of petroleum and agricultural chemicals from transportation incidents. Although there are fewer LUST spills than other spills, a greater percentage of "other" spills have been closed. Sixty-three percent of all spills in these aquifers have been closed. In general, LUST cases have a greater percentage of ground water contamination.

Summary of Table 8.2A in Appendix D

Aquifer	Number of Sites	Number of LUST spills	Number of LUST spills *closed*	Number of Other spills	Number of Other spills *closed*
Vermillion East Fork	32	15	11	17	12
Vermillion West Fork	16	4	2	12	9
Parker-Centerville	23	11	9	12	7
Missouri (Elk management unit)	50	22	8	27	18
Total:	121	52	30	68	46

Table 8.4A in Appendix D describes the results of the ambient ground water quality monitoring for the above mentioned four shallow aquifers. These results are based on sampling the ground water in areas not associated with any known point sources of contamination. This monitoring

network has been established in the last few years, therefore these wells have not been sampled extensively at this time. All of the monitoring wells for the four aquifers mentioned above are located in vulnerable areas.

A majority of wells sampled did not detect parameters above the MDL or background levels. The VOC parameter is not sampled every sampling event; therefore, this parameter is considered not applicable. Table 8.4A indicates 6 of the 24 wells sampled had parameters detected at concentrations exceeding the MDL's for at least one sampling event. The Vermillion East Fork, Vermillion West Fork, Parker-Centerville, and Missouri (Elk management unit) aquifers each had one monitoring well exceed the MCL for NO_3. The Missouri (Elk Point management unit) aquifer also had one monitoring well exceed the MCL for arsenic.

Ground Water Indicators

Indicators presently used by the state to track progress and trends in ground water protection efforts are listed for the three categories below:

a. Public ground water supplies.

A number of local communities have developed wellhead protection ordinances to protect their public water supplies (PWS) from contaminant sources. Other communities are also moving forward with various aspects of wellhead protection. Under new source water assessment requirements, all public water supply systems will have protection areas defined around their drinking water source, along with an inventory of all the significant contaminant sources within that area. These public water supply systems will be encouraged to develop source water protection measures based on these contaminant assessments. To date, the contaminants which have been exceeded at PWS wells include fluoride, thallium, antimony, nitrate, and radium 226 and 228. Four PWS exceeded fluoride, one PWS exceeded nitrate, ten PWS exceeded radium 226 and 228, three PWS exceeded antimony, and two exceeded for thallium.

b. Point sources of contamination.

There is one Resource Conservation and Recovery Act (RCRA) facility in the state as defined under Subtitle C. This facility is in Sioux Falls which has a population of approximately 110,000. No assessment of the population at risk was undertaken.

Two CERCLA sites remain in the National Priority List, with approximately 40,000 people within one to three miles of the facilities (Williams Pipeline – Sioux Falls, Ellsworth Air Force Base). More than 35,000 of these people are located near Williams Pipeline.

c. Nonpoint sources of contamination.

Three studies have evaluated the presence of nonpoint sources of nitrate and pesticides in shallow ground water aquifers. Data indicate that both types of chemicals are present, but only nitrate has consistently been found above the MCL. Several studies have shown that up to 25% of shallow domestic wells tested have nitrate levels above 10 mg/l.

Table 8.4A in Appendix D presents results of the ambient monitoring conducted through 1997 for the statewide monitoring network in the aquifers discussed in this report. Sampling for this network began in 1994, but not all the aquifers included in this report have been sampled that long.

There is very limited PWS data available at the present time mostly as a statewide summary (Appendix Table 8.4A). The state does not at present routinely monitor VOCs and SOCs for unregulated private wells. Nitrates (NO_3) are monitored but currently are not listed for private wells on an aquifer basis.

The ground water indicators tabulated above are a limited set of selected data that, taken together, can give a relative indication of the condition of the state's ground water resource. When collected over time these data can be used to help determine trends and chart progress made in the improvement and protection of this vital resource.

C. PESTICIDES AND FERTILIZERS IN GROUND WATER

Ambient Ground Water Quality Monitoring

Over the years, several projects have produced ambient ground water quality data of various types but there was no coordinated effort to systematically assess the ground water quality on a statewide basis. The Department of Environment and Natural Resources began planning a statewide approach for the monitoring of many of the state's shallow aquifers about 6 years ago. The planning resulted in the implementation of the Statewide Ground Water Quality Monitoring Network in 1994. Three studies which preceeded the statewide monitoring effort are the *Oakwood Lakes-Poinsett Rural Clean Water Program (RCWP), Pesticide and Fertilizer Sampling Program* and the *Water Quality Monitoring and Evaluation of Nonpoint Source Contamination in the Big Sioux Aquifer.* These three projects will be briefly discussed below to provide some background on the type of information that has been gathered in South Dakota. Then, a brief explanation of the Statewide Ground Water Quality Monitoring Network will be provided.

RCWP Project

The presence of agricultural chemicals in the ground water has been assessed in several areas of the state through three studies. The 10-year Oakwood Lakes-Poinsett Rural Clean Water Program (RCWP) was one of the first long term ground water monitoring projects in the nation looking at agricultural chemical practices and the impacts to ground water.

In a 106,000-acre area in portions of Brookings, Kingsbury, and Hamlin Counties, seven sites of 10-80 acres in size were instrumented with 114 monitoring wells. Nitrate concentration ranged from less than 0.1 mg/l to over 70 mg/l with 15% of the 3,092 samples exceeding the MCL of 10 mg/l. Nitrate concentrations above the MCL were found in at least one well at all of the seven sites. The highest nitrate concentrations (> 5 mg/l) were found in the top 20 feet of saturated materials. Nitrate concentrations were significantly higher at the farmed sites than the unfarmed sites.

Pesticides were detected in 11% of the 1,628 ground water samples collected. Most detections were very low concentrations with less than 1% of the detections in excess of the MCL or health advisory. Most pesticide detections were not re-occurring, i.e. a pesticide was detected one month but not in subsequent sampling events. Lasso (alachlor), 2,4-D, and Banvel (dicamba) were most frequently detected, and where these chemicals were used, they were detected in the ground water.

Pesticide and Nitrogen Sampling Program

In 1988, the South Dakota Legislature directed DENR to address the potential effect of pesticide and fertilizer use on ground water. A Pesticide and Nitrogen Sampling Program was developed to provide data on the presence and extent of pesticides and nitrate from fertilizers in ground water. The initial year of study was intended to assess future needs for the investigation of ground water quality. The pilot program was designed to detect the presence of pesticides and fertilizer under conditions considered most conducive to movement of chemicals into ground water. DENR chose a portion of a shallow, susceptible aquifer, where irrigation and chemical use were occurring. Monitoring sites were selected to eliminate sources other than field applications of fertilizer or pesticides.

The study was initiated in Turner County in the Parker-Centerville aquifer during 1988 (Figure 4). A total of 24 nested observation wells at 10 sites enabled the sampling of various intervals of the aquifer. Wells were sampled monthly, generally from May through September or October for nitrate, and for common pesticides known to be used in the area.

The following year, monitoring was expanded to include a second shallow sand and gravel aquifer, the Bowdle aquifer. The new sites were chosen to monitor non-irrigated conditions. A year later, two monitoring sites were added to each aquifer.

In 1991, the project was continued in the above two aquifers. During the fall of 1991 an additional 10 wells were drilled at seven sites in the Delmont aquifer located primarily in Douglas County, but no samples were collected from the aquifer in 1991. This aquifer is also a shallow sand and gravel aquifer which is overlain by both irrigated and non-irrigated land.

Most monitoring wells were nested, with the shallowest well screened across the water table and the deeper wells screened through various intervals of the saturated material. The monitoring wells were constructed specifically for securing samples for pesticide analysis, i.e., carefully constructed to prevent the introduction of any contaminants to the well or surrounding aquifer materials.

All three aquifers were sampled from 1992 through 1994 and consisted of approximately 45 wells at 25 sites. During the seven-year monitoring program more than 1600 nitrate (as N) samples and nearly 1200 pesticide samples were collected. Approximately 19 percent of the nitrate samples had concentrations over 10 mg/l, the South Dakota Ground Water Quality Standard. About half of the sites had at least one well frequently above the Maximum Contaminant Level (MCL) for nitrate. Pesticides were detected in about 16 percent of the samples but none were found over the MCL or Life Time Health Advisory (LTHA), indicating limited impact to ground water from labelled use.

At sites with multiple wells, samples from deeper portions of the aquifer had lower nitrate concentrations than those from shallower portions of the aquifer at the same site. There has not been a discernable trend in nitrate concentrations over this seven-year period. Nitrate levels have been somewhat higher in recent years, but the short time of the study and other variables make it difficult to define a specific trend.

Pesticide sampling indicated approximately 16% of the samples collected showed detections of various pesticides, but none of the detections were above the MCL or life time health advisory limit for that pesticide. In different years different pesticides were detected most frequently. Pesticides were seldom detected in the same well in successive sampling periods indicating possible natural degradation or dilution of the pesticides in the aquifer system. The most commonly detected pesticides were alachlor (Lasso), atrazine (Atrazine), terbufos (Counter), metolachlor (Dual), 2,4-D, phorate (Thimet), and dicamba (Banvel).

Water Quality Monitoring and Evaluation of Nonpoint Source Contamination in the Big Sioux Aquifer

The Big Sioux aquifer provides approximately one-third of South Dakota's population with water for municipal, rural water, irrigation, and other uses. Because of the surficial and unconfined nature of the Big Sioux aquifer, it is potentially vulnerable to both point-source and nonpoint source contamination. Recent ground water investigations in the Big Sioux aquifer have found that several areas in the Big Sioux drainage basin contain elevated concentrations of nitrate. Due to the aquifer's vulnerability and growing public concerns about the quality and long-term suitability of water for drinking-water supplies, a permanent monitoring network was established in 1989 to periodically monitor the water quality in the Big Sioux aquifer. General water quality is being studied with an emphasis on nitrate and pesticides. Under the auspices of this study, wells in the network were monitored from 1989 through 1993. Results presented below reflect work conducted in this time period.

The permanent monitoring network, consisting of 28 monitoring wells as of 1993, was installed at 11 locations within the Big Sioux drainage basin (Figure 4). The network wells were not located downgradient from any identifiable point source pollution areas and provided for monitoring over much of the aquifer's extent. Network monitoring wells were nested at each site to monitor the water quality vertically within the aquifer.

The entire permanent monitoring network was sampled 17 times for inorganic analysis. Seven monitoring wells were sampled 32 times for nitrate plus nitrite nitrogen analysis. Since the beginning of 1989, a total of 582 water samples have been collected and analyzed for inorganic parameters.

The entire permanent monitoring network was sampled nine times for pesticide analysis except for two wells at one location which were inaccessible on three occasions and two wells at another location which were inaccessible on one occasion. A total of 232 samples were analyzed for 21 pesticides using the gas chromatography/mass spectrometry method and 233 samples were analyzed for 3 pesticides using the immunoassay method

Nitrate concentrations greater than 5 milligrams per liter (mg/l) were detected in nine of the 28 Big Sioux aquifer permanent monitoring network wells. Of these nine monitoring wells, the highest concentrations of nitrate were found in shallow monitoring wells screened at or through the water table indicating a vertical stratification of nitrate in the ground water. Two of the nine monitoring wells consistently had nitrate concentrations above the primary drinking water standard, for public water systems, of 10 mg/l.

Pesticide analyses using the gas chromatography/mass spectrometry method detected atrazine, 2,4-D, trifluralin, cyanazine, bentazon, EPTC, picloram, dicamba, metolachlor, and alachlor in some of the monitoring wells at one time or another. However, no specific trends could be determined from these data. In addition, two metabolites of atrazine were detected: desethyl atrazine and desisopropyl atrazine. The immunoassay method of analysis was also used in this investigation and detected atrazine, alachlor, and 2,4-D. These three pesticides were the only pesticides analyzed with the immunoassay method.

Using the gas chromatography/mass spectrometry method of analysis, one ground water sample out of 232 analyzed was found to have an atrazine concentration above the Maximum Contaminant

Level (MCL) established by the US EPA. Four ground water samples had a cyanazine concentration above the Lifetime Health Advisory (LTHA) established by US EPA. All other pesticides had concentrations below their respective MCL or LTHA.

Using the immunoassay method of analysis, four ground water samples out of 233 analyzed had atrazine above the MCL. Two ground water samples had alachlor at or above the MCL.

Beginning in 1994, monitoring of the Big Sioux aquifer was expanded and incorporated into a larger effort which examines the water quality in sensitive aquifers across the state. Additional wells have been installed in the Big Sioux aquifer and regular monitoring now occurs in 36 wells at 19 locations. These wells are part of the Statewide Ground Water Quality Monitoring Network.

Statewide Ground Water Quality Monitoring Network

A permanent ground water quality monitoring network is currently being established in a number of shallow aquifers in South Dakota. The aquifers in which permanent monitoring have already been established are shown in Figure 21. The purpose of this network is to examine the water quality in sensitive surficial aquifers across South Dakota. The goals of the monitoring effort are to maintain, and modify as necessary, ground water quality monitoring activities that regularly and systematically assess (a) the present ground water quality, (b) the impact of agricultural chemicals on ground water, and (c) long-term trends in water quality in sensitive aquifers. The initial well installation phase of this project was completed in 1998. Thus far, 80 monitoring sites have been established consisting of a total of 145 water quality monitoring wells. These monitoring sites are distributed across 24 aquifers. Water quality parameters being examined incude major ions, trace elements, radionuclides, volatile organic compounds, and pesticides. In 1997, 124 wells at 68 sites were sampled.

This network of wells is designed and installed specifically to monitor the background quality of shallow ground water for nonpoint source pollutants. To accurately assess the background quality of shallow ground water in these aquifers, municipal, industrial, irrigation, and private wells were avoided. Municipal, industrial, and irrigation wells are usually not suited for examining shallow ground water because they are often completed deep into an aquifer to allow for the maximum yield. Private wells are often unsuitable for background ground water quality monitoring for the same reason as municipal and industrial wells, and also because of their location near local sources of pollution such as animal-holding areas and septic systems. However, shallow ground water is most often the first to be impacted by pollutants and is, therefore, where monitoring efforts of this type should be concentrated. Information from this type of monitoring is very much in demand as agricultural development and drinking water demands continue to put pressure on shallow ground water resources. A comprehensive report of data gathered from 1994-1997 is scheduled for completion in 1998.

D. QUALITY OF PUBLIC DRINKING WATER SYSTEMS

Public Drinking Water Systems

South Dakota has approximately 756 public water systems (PWS). A PWS is defined as any water system that serves at least 25 people for at least 60 days per year. Community PWS make up 480 of the total PWS and serve residential populations. A breakdown of the PWS by type is shown by Figure 5. Most South Dakota water systems (85%) rely totally on ground water.

South Dakota now regulates PWS through South Dakota State Drinking Water Regulations (Appendix E). Previous to 1983, the program was administered by the Environmental Protection Agency. The SD State Drinking Water Regulations dictate the quality of water provided by systems. They address the type and frequency of testing and set Maximum Contaminant Levels (MCLs). MCLs are the highest level at which a chemical or a bacteriological parameter can be consumed without ill effects. Systems exceeding MCL's must notify their customers and investigate realistic alternatives for their water supply such as treatment of the present source, connection to a regional water system, or development of a new source.

Community PWS regularly monitor chemical quality of their water. The 13 inorganic chemicals that are regulated by the SD State Drinking Water Regulations are analyzed every three years by groundwater systems while surface water systems are analyzed annually. After base requirements are met, sampling frequency may be reduced to once every nine years if a waiver is obtained. Radiological chemicals are analyzed at least every four years by all community systems. Volatile Organic Compounds (VOCs) are analyzed every three months for the initial monitoring. After base requirements are met, sampling frequency may be reduced to once every year. Sampling may be further reduced if a waiver is obtained. Sampling for Synthetic Organic Compounds (SOCs) began in 1993. SOCs must be analyzed every three months for the initial monitoring. After base requirements are met, sampling frequency can be reduced to once or twice during each succeeding compliance period, depending on population served. Sampling can be further reduced if a waiver is obtained. Appendix E contains a listing of all tested contaminants as well as the regulations, definition and some procedures pertaining to their assessment.

There are approximately 507 public water systems required to test for compliance with the Lead and Copper Rule. A total of 505 systems have reported through January 1996.

Additional monitoring or treatment technique requirements are triggered when the samples exceed a lead action level of 15.0 ppb or a copper action level of 1.3 ppm, measured in the 90th percentile at the customer's tap. In other words, each system is allowed to exceed the action level with 10 percent of their samples with the 90th percentile concentration determining whether or not the system actually exceeds an action level. Of the 505 systems that have monitored to date, 9 percent have exceeded the lead action level and 6 percent have exceeded the copper action level.

A nitrate sample is to be analyzed by all systems at least once a year. If the sample exceeds the MCL or half the MCL, sampling frequency increases. A nitrite sample must be analyzed by all systems once every three years.

In terms of the secondary drinking water standards, much of the water quality of public drinking water supplies within South Dakota is poor. Many PWS have very hard water. Numerous PWS exceed the recommended standards for total dissolved solids, iron, manganese, chlorides, and sulfates. Some systems also violate the primary water standards of nitrate (1 PWS), fluoride (2 PWS), and radium (12 PWS). Figure 6 shows the number of PWS exceeding secondary standards. Organic chemicals are regularly sampled by all systems with no MCL's being violated.

PWS regularly analyze for an indicator of bacteriological water quality, the total coliform bacteria. Sampling frequency is dependent on the population served by the system. Coliform bacteria, while usually not pathogenic, are indicators of possible fecal contamination. The bacteriological quality of community water supplies varies from month to month, but generally about 80% of the systems are considered safe at any one time. From January 1995 through November 1997, 28,334 routine samples were submitted for testing by state public water systems. Of these, 1277 or 4.5% were declared unsafe due to the presence of coliform bacteria. This compares with 4.0% of samples found to be unsafe during the last reporting cycle (State Health Laboratory).

E. QUALITY OF PRIVATE DRINKING WATER SYSTEMS

Specific problems found in unregulated private wells throughout the state are primarily high nitrate levels and coliform bacteria. During the present reporting period 13% of 2,479 tested domestic wells exceeded the Federal Drinking Water Standard of 10 mg/l nitrate-nitrogen. By contrast, only one PWS out of 756 tested was found to exceed the nitrate standard. Exceedances of the drinking water standard for total coliform bacteria (i.e. the mere presence of coliforms) were found in 27% of 3,282 private wells. This is approximately six times the frequency reported in regulated state public water systems (4.5%) over a comparable period of time.

The frequency of exceedance (private systems) for nitrate and total coliform bacteria declined between the last two reporting periods from 16% to 13% and from 33% to 27%, respectively. By comparison, frequency of bacteria exceedance for PWS was considerably lower. There were 108 coliform MCL violations in 77 systems in 1997. These 108 violations were out of a possible 7761 compliance periods - 1.4% exceedance rate. The exceedances for nitrate over the same time span ranged well below 1%, represented by one violation for 754 PWS tested during 1997.

The yearly variability in reported exceedances, particularly in private wells, can be traced partly to the considerable variation in annual weather patterns since 1991. For example, rainfall amounts have been appreciably greater over much of the state in the odd-numbered years of this decade.

Information supplied by domestic well owners during sampling of their wells indicates that feedlots, corrals, and septic tanks are the major sources of nitrate contamination that is exacerbated by runoff from flooding and heavy rains. This survey revealed the following practices to be particularly prevalent: 1) placement of a well within a feedlot or downgradient of a feedlot; 2) placement of a well downgradient from a septic tank or drainfield; and most importantly 3) poor well construction allowing for entrance of contaminants into the well.

The majority of wells within the state are shallow, ranging in depth between 10 and 90 feet. Many wells are bored and cased with porous concrete. Gravel pack is sometimes used to pack the well screens. The most serious well construction problem with the shallow wells is poor well placement. Of the older well records (dated prior to 1985) reviewed, 90% were not placed properly to prevent surface contamination from entering the well bore. South Dakota Well Construction Standards were revised in 1985 and this defect was likely more prevalent in older wells.

Best Management Practices for well construction have been recommended for each basin. Proper well construction would include the following practices: 1) proper location and placement of the well; 2) following the South Dakota Well Construction Standards and using a Licensed Water Well Driller; 3) the use of PVC or steel casing and screen; 4) construction of the well into the base of the aquifer; 5) the use of grout to prevent surface runoff from entering the well; 6) the addition of gravel pack, if necessary, and 7) the proper development and disinfection of the well. Proper well maintenance should include periodic analysis of the water and additional rehabilitation treatment, as necessary.

V.
POLLUTION CONTROL PROGRAMS

A. POINT SOURCE POLLUTION CONTROL PROGRAM

The state received delegation of the federal National Pollutant Discharge Elimination System (NPDES) program from the United States Environmental Protection Agency (EPA) on December 30, 1993. The NPDES permits issued by the state are referred to as Surface Water Discharge (SWD) permits. EPA continues to issue NPDES permits in South Dakota for facilities over which they retained jurisdiction.

A total of 388 SWD and NPDES permits have been issued in South Dakota. Municipal wastewater treatment facilities account for 271 of these permits.

Approximately 160 communities in the state do not have SWD or NPDES permits. Some of these communities have experienced problems with individual wastewater treatment systems. Localized ground and surface water pollution problems may exist, due to inadequate waste disposal systems in these communities. These communities are often less than 100 people; consequently, the construction of centralized collection and treatment facilities is too costly. The state will continue its efforts to investigate individual waste disposal problems in these communities and provide technical assistance. When investigations of individual waste disposal problems indicate a community-wide problem, the state will work with various technical and financial agencies to evaluate options for central collection and treatment facilities.

A portion of the estimated 160 communities in the state that do not have a permit are located on federal Indian reservations. These communities have central wastewater collection and treatment facilities, but have not applied for NPDES permits. The discharge from these facilities and the absence of a NPDES permit has been brought to the attention of EPA by the state on several occasions. For example, Pine Ridge, a community of more than 4,000 people, does not have a NPDES permit, but frequently discharges raw sewage to a classified fishery. These discharges occur due to malfunctions of a lift station. Many of the centralized wastewater treatment facilities on the Indian reservations are poorly maintained, resulting in discharges due to overflows or damaged dikes. EPA must address these and other problems on the federal Indian reservations.

Since 1979, 166 wastewater treatment facilities were completed with assistance from the Construction Grants program (Table 45). The EPA Construction Grants program provided over $208 million to the state for wastewater improvements. In the 1996 EPA Needs Survey, the state documented $106 million of State Revolving Loan Fund (SRF) needs for eligible wastewater treatment facilities through the year 2016. The largest areas of need are for secondary treatment ($36 million) and major sewer rehabilitation ($26 million).

Technology-based controls are placed in most SWD and NPDES permits. However, technology-based controls alone do not necessarily protect waters of the state from toxic pollutants. Therefore, water quality-based limits and toxicity testing requirements are placed in many of the permits.

Water quality-based limits are developed when technology-based limits are not adequate to protect the beneficial uses of the receiving stream. These limits are often the result of the development and implementation of a total maximum daily load (TMDL). TMDLs are generally developed for water bodies that are not fully supporting their beneficial uses or that would not support their uses with technology-based controls alone.

Whole effluent toxicity testing is required for all major SWD and NPDES permittees, along with the conventional requirements to assess whether or not certain effluents contain toxic pollutants in toxic amounts. If toxicity is found, the discharger is required to conduct a toxicity reduction evaluation. The results of the TRE are expected to identify the source of the toxicity problem and help the discharger eliminate the problem. In the case of a complex situation, a compliance schedule will be developed to give the permittee time to eliminate the problem.

The goal of the whole effluent toxicity approach is to ensure that point source discharges do not contain toxics in toxic amounts.

TABLE 45
SOUTH DAKOTA
COMMUNITIES THAT HAVE COMPLETED
EPA FUNDED WASTEWATER FACILITIES

1. - Aberdeen
2. - Alcester
3. - Alexandria
4. - Alpena
5. - Arlington
6. - Armour
7. - Artesian
8. - Ashton
9. - Avon
10. - Baltic
11. - Belle Fourche
12. - Blunt
13. - Box Elder
14. - Brandon
15. - Brandt
16. - Bridgewater
17. - Bristol
18. - Brookings
19. - Bruce
20. - Camp Crook
21. - Canistota
22. - Canton
23. - Carthage
24. - Cavour
25. - Centerville
26. - Chamberlain
27. - Chancellor
28. - Clark
29. - Clear Lake
30. - Colton
31. - Crooks
32. - Custer
33. - Dell Rapids
34. - DeSmet
35. - Doland
36. - Dupree
37. - Eden
38. - Elk Point
39. - Erwin
40. - Estelline
41. - Ethan
42. - Eureka
43. - Faith
44. - Faulkton
45. - Flandreau
46. - Frederick
47. - Freeman
48. - Ft. Pierre
49. - Garretson
50. - Gary
51. - Geddes
52. - Goodwin
53. - Gregory
54. - Groton
55. - Harrisburg
56. - Hartford
57. - Hazel
58. - Hayti
59. - Henry
60. - Herreid
61. - Highmore
62. - Hot Springs
63. - Hoven
64. - Hughes County
65. - Humboldt
66. - Hurley
67. - Huron
68. - Ipswich
69. - Irene
70. - Iroquois
71. - Isabel
72. - Java
73. - Kadoka
74. - Keystone-Mt Rushmore SD*
75. - Kimball
76. - Kranzburg
77. - LaBolt
78. - Lake Andes
79. - Lake Cochrane SD*
80. - Lake Madison SD*
81. - Lake Norden
82. - Lake Poinsett SD*
83. - Lake Preston
84. - Langford
85. - Lead-Deadwood SD*
86. - Lemmon
87. - Lennox
88. - Letcher
89. - Madison
90. - Marion
91. - Martin
92. - McCook Lake SD*
93. - McIntosh
94. - Mellette
95. - Marion
96. - Menno
97. - Milbank
98. - Miller
99. - Mina Lake SD*
100. - Mission
101. - Mitchell
102. - Mobridge
103. - Monroe
104. - Murdo
105. - Oacoma
106. - Onida
107. - Parker
108. - Parkston
109. - Philip
110. - Peever
111. - Pierre
112. - Plankinton
113. - Platte
114. - Pollock
115. - Prairiewood SD*
116. - Presho
117. - Ramona
118. - Rapid City
119. - Ravinia
120. - Redfield
121. - Reliance
122. - Renner
123. - Revillo
124. - Rosholt
125. - Roslyn
126. - Salem
127. - Scotland
128. - Sinai
129. - Sioux Falls
130. - Sisseton
131. - Spearfish
132. - Spencer
133. - Stickney
134. - Stockholm
135. - Sturgis
136. - Tabor
137. - Tea
138. - Timber Lake
139. - Tripp
140. - Turton
141. - U/B SD*
142. - Veblen
143. - Vermillion
144. - Viborg
145. - Vivian
146. - Volga
147. - Wagner
148. - Wall
149. - Wall Lake SD*
150. - Wakonda
151. - Warner
152. - Wasta
153. - Watertown
154. - Waubay
155. - Wagner
156. - Wessington
157. - Wessington Springs
158. - Westport
159. - Whitewood
160. - White River
161. - Wilmot
162. - Willow Lake
163. - Winner
164. - Wolsey
165. - Woonsocket
166. - Yankton

*SD = Sanitary District

B. COST/BENEFIT ASSESSMENT

The Department's EPA project priority list gives higher priority to those wastewater treatment facilities which discharge to fishable and/or swimmable waters. In addition, DENR has placed a high priority on getting all state WWTFs into compliance as soon as possible. As previously noted, the state also has several "minor" facilities which are not on the National Municipal Policy list which need upgrading.

The small communities served by these "minor" WWTFs are for the most part agriculturally oriented and financially strapped. Financial assistance in the form of grants is usually necessary to make the required upgrading economically feasible. These communities may not have the financial capability to secure an SRF loan. The Department makes every effort to reduce local costs where possible to a manageable level. DENR works with communities to leverage additional grant funds; such as, Community Development Block Grant funds or the state's Consolidated Water Facility Construction Program (CWFCP) funds. The State has secured a dedicated source for CWFCP funds and expects to receive approximately $2.5 million per year for this fund. Small communities will often package Consolidated Grant Funds with SRF loans to make rates affordable for their residents.

EPA regulations require that a community establish acceptable sewer use and user charge ordinances prior to receiving an EPA grant. The user charge ordinance is intended to establish equitable charges for the annual operation and maintenance costs associated with operation of the WWTF. However, most communities also include the debt retirement costs in the user charge ordinance so they can collect all necessary charges once per month. In South Dakota, the monthly user charge (including debt retirement) is approximately $17.00 for communities which have recently constructed or upgraded their treatment facilities.

C. NONPOINT SOURCE POLLUTION CONTROL PROGRAM

Prior to 1988 efforts to protect South Dakota's ground and surface waters from pollution were directed primarily toward municipal and industrial wastewater treatment. With the elimination or reduction of pollution from these point sources, the state has actively begun to focus on nonpoint sources. Efforts to control nonpoint source (NPS) pollution in South Dakota are implemented through the nonregulatory Nonpoint Source Control Program which is located within DENR's Watershed Protection Program.

The primary focus of the NPS Program is the control of NPS pollution through the voluntary implementation of best management practices (BMPs) and holistic land management plans. The major sources of NPS pollution in South Dakota are associated with seven land use practices. These practices along with specific activities associated with each practice are summarized in Table 46.

The South Dakota NPS Program coordinates its efforts with several state and federal agencies. These agencies supply practices and funds to control NPS pollution. The remainder of this section of the 305(b) Report summarizes how the program is organized and managed. NPS control projects that have been implemented are also listed. Additional information concerning the program and the projects may be found by consulting the South Dakota Nonpoint Source Program Plan and NPS Annual Reports respectively.

Nonpoint Source Program Organization

The enactment of Section 319 of the Water Quality Act of 1987 focused attention on the importance of controlling nonpoint source (NPS) pollution. The Act provided direction and significant federal financial assistance for the implementation of state nonpoint source programs.

The South Dakota Nonpoint Source Program has utilized Section 319 of the federal Clean Wtaer Act in addition to other state and federal programs to control nonpoint source pollution. The South Dakota Department of Environment and Natural Resources (DENR) is the designated lead agency. It created a Nonpoint Source Control Program in response to the water quality impairments present in the state. The program is guided by a multi-organization task force. The task force has an open membership and consists of state, federal and local agencies, tribes and organizations having an interest in NPS pollution. Task force membership by agency is shown in Table 47. The task force normally meets six times each year. Agencies, organizations and concerned citizens have the opportunity to provide input and guidance to the program at the meetings and through special issue specific committees. This approach has enabled South Dakota to be recognized as having one of the best NPS programs in the nation. Financial assistance for NPS projects is approved by the South Dakota Board of Water and Natural Resources.

Table 46. South Dakota NPS Program Priority Land Use Catgories and Use Activities

Land Use Practices	Activities
1. Agriculture	a. Cropland
	b. Rangeland
	c. Pastureland
	d. Feedlots
	e. Animal holding/management areas
	f. Agricultural chemical distribution
	g. Ditch weed spraying
2. Silviculture	a. Forest management
	b. Wildfire
	c. Road construction/maintenance
3. Construction	a. Highway/road/bridge
	b. Highway maintenance
4. Urban Runoff	a. Storm sewers
	b. Surface runoff
5. Resource Extraction	a. Surface mining
	b. Mill tailings
	c. Mine tailings
6. Land Disposal	a. On-site wastewater systems
	b. Wastewater
	c. Solid waste/landfills
7. Hydrologic/Habitat Modification	a. Dam construction
	b. Flow regulation/modification
	c. Removal of riparian vegetation
	d. Streambank modification/destabilization
	e. Wetland drainage

Table 47. South Dakota NPS Task Force Membership by Agency

US Environmental Protection Agency
US Forest Service
US Geological Survey
USDA Natural Resources Conservation Service
US Bureau of Reclamation
USDA Consolidated Farm Services Agency
S.D. Department of Environment and Natural Resources
S.D. Department of Agriculture
S.D. Department of Game, Fish and Parks
S.D. Board of Water and Natural Resources
S.D. Conservation Commission
S.D. Association of Conservation Districts
S.D. Cooperative Extension Service
S.D. State University
S.D. School of Mines and Technology
Water Development Districts
Cheyenne River Sioux Tribe
Oglala Sioux Tribe
Standing Rock Sioux Tribe
Flandreau Santee Sioux Tribe
Sisseton-Wahpeton Sioux Tribe
Lower Brule Sioux Tribe
Crow Creek Sioux Tribe
Yankton Sioux Tribe
Rosebud Sioux Tribe
South Dakota Resources Coalition
Resource Conservation and Development Districts
Planning Districts
S.D. Farm Bureau
S.D. Pork Producers
S.D. Cattlemans Association
S.D. Farm Bureau
S.D. Corn Growers
S.D. Wheat, Inc.
S.D. Water Congress
Izaak Walton League
Black Hills Forest Resources Coalition
S.D. Lakes and Streams Association

Nonpoint Source Program Assessment

The provisions of Section 319 require that states complete a nonpoint source assessment prior to requesting financial assistance. DENR completed the assessment for South Dakota during 1988. Copies can be obtained from DENR. An update is contained in this report. Information about specific waterbodies can be found in the Surface Water Assessment Section. Nearly all of the waterbodies in the state that have impaired beneficial uses are impacted by NPS pollution. Sediment, pathogens, and nutrients are the major causes of impairment. Agricultural activities are the major source of the pollutants. Other sources include silviculture, construction, urban runoff, resource extraction, land disposal, hydrological modification, and natural processes.

The USDA Natural Resources Conservation Service (NRCS) "Hydrologic Unit (HU) Planning Process" is used as a tool to aid in the assessment of water quality problems and the development of NPS pollution control projects. The process uses public meetings to obtain input on the perceived problems and needs in an HU. By using this input in conjunction with information obtained from water quality assessment studies the South Dakota NPS Program has been able to plan restoration projects that have strong local support and hence a high probability of success.

Nonpoint Source Management Program Plan

The South Dakota Nonpoint Source Management Program Plan reflects a multi-agency effort to control NPS pollution in the state. The plan contains six basic elements required by USEPA:

1. Identification of Best Management Practices (BMPs) - measures which will be used to reduce pollutant loadings from each category or subcategory of nonpoint pollution.

2. Identification of programs to achieve implementation of BMPs.

3. Four year schedule to achieve major milestones of the NPS Program.

4. Certification by the Attorney General of the authority to carry out the NPS Program.

5. Identification of federal and other assistance sources to be used in implementing the NPS Program.

6. Listing of federal assistance and development projects which the state will review for compliance with NPS consistency.

The Plan was completed during 1989 and has been approved by EPA. It is amended periodically.

Program review is provided by the SD NPS Task Force. The Task Force utilizes program neutral planning to direct its efforts. Program neutral planning is a process of planning based on need rather than a particular source of funds. Once a project is planned, funding is sought from several potential sources. The approach encourages effective use of other programs in addition to the 319 Program.

The Task Force recognizes the importance of using a statewide - but watershed specific approach. The program includes preventative strategies. Prevention is encouraged primarily through a strong information and education (I&E) program. The major elements of the I&E Program include newsletters and news releases, radio programs, video production, related informational documents, education projects, field days for students, water quality conferences, and displays.

Watershed specific projects are selected through a competitive process based on impairment of beneficial uses, presence of public recreational facilities, public health risk, offsite effects, and special considerations. The Task Force selects the highest priority waterbodies for consideration to receive financial assistance. Following a technical review by DENR, the recommendations of the Task Force are submitted to the South Dakota Board of Water and Natural Resources for final review and approval.

Process for Best Management Practices Selection

Many of the NPS control programs utilize existing BMP manuals pertaining to agriculture, silviculture, and mining. To further refine these manuals and to identify additional BMPs for each NPS category the Task Force actively supports BMP selection. BMPs chosen for specific projects are initially identified by the appropriate agency (e.g. NRCS for Ag BMPs) and reviewed by the NPS Task Force.

Agricultural BMPs consist of most of the conservation practices listed in the NRCS Field Office Technical Guide. The usual planning process with an individual landowner involves chosing a combination of practices that will achieve a desired water quality goal. This planning process is called a Resource Management System (RMS). An RMS is a combination of conservation practices and management techniques identified by the primary use of the land or water. Under an RMS, the resource base is protected by meeting acceptable soil losses, maintaining accept-able water quality, and maintaining acceptable ecological and management levels for the selected area. The landowner has a choice of mixing various structural, vegetative, tillage, cropping rotations, land use and management practices that best suit his operation. Often there are several combinations of practices that will achieve a desired level of erosion or water quality pollution control. Therefore, for NPS control it is more practical to specify the desired goal rather than to try to dictate which practices are mandatory.

Nonpoint Source Development Projects

The NPS Program has assisted several organizations with planning and diagnostic activities. Using NPS Development funds [604(b)] the following activities listed in Table 48 have been undertaken:

Table 48. Section 604(b) Nonpoint Source Development Projects

604(b) Projects Initiated

Upper Big Sioux Watershed AGNPS
Lake Poinsett Project Planning and Design
Big Sioux River Bank Stabilization Demonstration Project
Big Sioux River (Moody/Minnehaha Counties) Riparian Assessment
Rapid Creek NPS Assessment Project
Rapid Creek Stormwater Impact Prioritization
Whitewood Creek Streambank Assessment Project
Lake Hendricks Restoration Assessment
Pelican Lake Control Structure Feasibility
Turtle Creek/Lake Redfield Landowner Survey
White River Preservation Project
Lake Faulkton Assessment Project
Firesteel Creek/Lake Mitchell Water Quality Needs Assessment - Landowner Survey
Rapid City Stormwater Impact Prioritization
Vermillion River Basin Watershed Planning
West Yankton Sanitary Sewer Survey
Riparian Area Forestry Project
East River Riparian Demonstration Project
Lake Traverse and Little Minnesota River Land Inventory Project
Demonstrating the Use of Slash Piles to Control Erosion on Fragile Soils
Detention Cell Demonstration Project
Livestock Waste Management Handbook
Project to Develop NPS BMPs for the Western Pennington County Drainage District
Lake Louise Water Quality Monitoring
Lake Andes Watershed Treatment Project
Forestry BMP Pamphlet
Groundwater Protection Project
Local Water Quality Planning Through the Hydrologic Unit Planning Concept
Wetland assessment for the Nonpoint Source Program
Pesticide and Nitrogen Program
Randall RC&D Implementation Planning
North Central RC&D HU Implementation
Mina Lake Water Quality Project
Stockgrowers Speaker
Streambank Erosion Assessment Project - Upper Whitewood Creek
Broadland Creek Watershed Study
Chemical Containment
Platte Lake Planning
Nonpoint Source Impacts of Riparian Areas
Ravine Lake Diagnostic/Feasibility Study
Fish Lake Water Level and Quality Study
Water Quality Study of South Dakota Glacial Lakes and Wetlands

Big Sioux Aquifer Protection Project
Burke Lake Diagnostic/Feasibilty Study
Bad River Phase IA
Minnehaha County NPS Planning Project
Galena Fire Project
Rapid Creek and Aquifer Assessment Project
Bad River Phase IB
Big Sioux Aquifer Study
Pesticide and Fertilizer Groundwater Study

Many of the projects have led to the development of 319 NPS Implementation Projects. Also based on the information gathered, additional projects have been funded through other programs such as the state Soil and Water Fund administered by the SD Conservation Commission.

Nonpoint Source Implementation Projects

Twenty-nine projects are in various stages of implementation. These projects have received Section 319 funding in addition to financial and technical assistance from other federal agencies, the State of South Dakota, and local units of government. A list of the 319 Implementation Projects completed or in progress is shown below in Table 49. Specific information about each project may be obtained by consulting South Dakota Nonpoint Source Annual Reports available through the Department of Environment and Natural Resources.

Table 49. Section 319 Nonpoint Source Implementation Projects

Statewide Lake Assessment
Lake Mitchell Watershed
Lake Hendricks Watershed
Lake Poinsett Watershed
Bachelor Creek Assessment
Upper Big Sioux River Watershed
Lake Redfield Restoration
Bootstraps
Upper Bad River Demonstration
Bad River Phase III
East River Riparian Demonstration II
Ground Water Monitoring Network
Lake Campbell Watershed Restoration
Bad River National Watershed Monitoring
Animal Waste Management II
Animal Waste Management III
South Dakota Lake Protection
Bigstone Lake Restoration II
Bigstone Lake/Little Minnesota
Foster Creek Riparian Demonstration - Beadle County
Foster Creek Riparian Demonstration - Stanley County
East River Area Riparian Demonstration
Clear Lake - Marshall County
Coordinated Resource Management II
Lake Byron Watershed
Shadehill Lake Protection
Mina Lake Water Quality
Lake Kampeska Watershed
Ravine Lake Watershed
Swan Lake Restoration
Nonpoint Source Information Education
Wall Lake
Bigstone Lake
South Dakota Association of Conservation Districts
Coordinated Resource Management I
Big Sioux Well Head Protection
Burke Lake
Richmond Lake
Animal Waste Management I
Bad River Phase II
Riparian Grazing Workshop
Lake Cochrane Protection
Abandoned Well Sealing
East River Riparian Grazing I

Nitrogen & Pesticides in Ground Water
Nonpoint Source Information & Education
Rainfall Simulator
Pickerel Lake Protection
Lake Herman Restoration Project
Wall Lake Restoration Project
Big Stone Lake Restoration Project (Phase II)
South Dakota Nonpoint Source Information and Education Program
Richmond Lake Restoration Project
Bad River Phase II Project
Big Sioux Wellhead Protection/Groundwater Project
Animal Waste Management Project
South Dakota Riparian Management Conference
Pickerel Lake Protection Project
South Dakota Lake Protection Program
Burke Lake Restoration Project
Pesticide and Nutrient Program
Lake Cochrane Protection Project
Big Stone Lake - Little Minnesota River Watershed Project
Beadle County - Foster Creek Riparian Demonstration Project
Stanley County - Foster Creek Riparian Area Demonstration Project
Abandoned Well Demonstration Project
East River Riparian Area Demonstration Project
Pesticide and Nitrogen Sampling Program
Coordinated Resource Management as the South Dakota Process of Choice
Lake Byron Watershed Project
Shadehill Lake Protection Project
Mina Lake Water Quality Project
Lake Kampeska Restoration Project
Animal Waste Management Assistance Continuation Project
South Dakota Nonpoint Source Information and Education Continuation Project
Swan Lake Restoration Project
Ravine Lake Restoration Project
Clear Lake Restoration Project
Rainfall Simulator
Bad River Phase III Project
Upper Bad River Demonstration Project
Lake Campbell Restoration Project
East River Riparian Project II
Statewide Groundwater Monitoring Network
Bad River National Monitoring Project

Future Nonpoint Source Program Directions

NPS pollution originates from diverse sources. Nonpoint pollution controls must reflect this by using all of the resources available from the various state, federal, and local organizations and in addition have landowner support and participation. The technical and financial assistance currently available is not sufficient to solve all of the NPS pollution problems in the state. Additional solutions must be tried. Landowners have the capability to accomplish much if they understand the problems and the ways to solve them. Educating the public about NPS pollution issues may prompt landowners to voluntarily implement activities to control NPS pollution. New federal programs must also be developed to supplement existing programs. Enforcement may be needed to increase compliance with state and federal requirements. The continuation of existing activities coupled with the addition of innovative new programs will ensure that South Dakota remains a leader in nonpoint source pollution control.

D. GROUND WATER PROTECTION PROGRAM

The South Dakota Department of Environment and Natural Resources (DENR) is responsible for all functions pertaining to research, development, planning, allocation, protection and remediation of ground water resources. In 1986, the Department developed a Ground Water Protection Strategy which has been updated on a regular basis. The strategy outlines existing and future efforts for ground water quality management. The major sources of ground water pollution were identified in the strategy and are now addressed by preventative measures including ground water classification for beneficial uses, ground water quality standards, ground water discharge permits, wellhead and source water protection efforts, concentrated animal feedling operations permits, aboveground storage tank and underground storage tank regulations.

DENR ground water quality projects and activities include: a completed pesticide and fertilizer sampling program; primary enforcement authority for Underground Injection Control (UIC); the enforcement of the Underground Storage Tank (UST) program under RCRA Subtitle I; the enforcement of a state Aboveground Storage Tank (AST) program; enforcement of concentrated animal feeding operations permits; ground water quality standards; SARA Title III, state Superfund/Federal Facilities program (state CERCLA program); increased involvement in assessment, enforcement, and cleanup activities resulting from accidental releases of potential pollutants; wellhead protection program activities; an evolving source water protection program, a ground water discharge permit program; an agricultural chemicals (pesticides and fertilizers) in ground water management program and a statewide ground water quality monitoring network.

The 1989 State Legislature enacted the Centennial Environmental Protection Act (CEPA) which included statutory authority for additional ground water protection activities. These included: a voluntary wellhead protection program; water quality analysis for new domestic wells; certification of small on-site wastewater disposal system installers; pesticide and agricultural chemical management plans to protect water quality.

DENR also reviews the construction and operation plans and specifications of municipal wastewater facilities, septic systems and feedlot facilities. Approval of other plans and specifications are given only to those facilities with required protection of ground water resources.

Many reports on ground water resources of the state have been completed in the past several years including those dealing with: average water use in eastern South Dakota; recharge in eastern South Dakota; water quality suitability for both the eastern and western parts of the state; and special studies. Geologic and water resources studies of individual counties are ongoing, as is the state ambient ground water quality monitoring network. In addition, a geologic and water resource bibliography of references was completed. Current state ground water protection programs and their implementation status are summarized in Table 50.

Table 50. SUMMARY OF STATE GROUND WATER PROTECTION PROGRAMS

Programs or Activities	Check (√)	Implementation Status	Responsible State Agency
Active SARA Title III Program	√	Fully Established	DENR
Ambient ground water monitoring system	√	Established, but Expanding	DENR
Aquifer vulnerability assessment	√	Continuing Effort	DENR
Aquifer mapping	√	Continuing Effort	DENR
Aquifer characterization	√	Continuing Effort	DENR
Comprehensive data management system	√	Under Development	DENR
EPA-endorsed Core Comprehensive State Ground Water Protection Program (CSGWPP)	√	Under Development	DENR
Ground water discharge permits	√	Fully Established	DENR
Ground water Best Management Practices	√	Continuing Effort	NRCS*
Ground water legislation	√	Fully Established	DENR
Ground water classification	√	Fully Established	DENR
Ground water quality standards	√	Fully Established	DENR
Interagency coordination for ground water protection initiatives	√	Continuing Effort	DENR*
Nonpoint source controls	NA - not a regulatory program		
Pesticide State Management Plan	√	Under Revision	SDDA*
Pollution Prevention Program	√	Continuing Effort	DENR*
Resource Conservation and Recovery Act (RCRA) Primacy	√	Fully Established	DENR
State Superfund	√	Fully Established	DENR
State RCRA Program incorporating more stringent requirements than RCRA Primacy	NA - Regulations adopted by reference		DENR
State septic system regulations	√	Fully Established	DENR
Underground storage tank installation requirements	√	Fully Established	DENR
Underground Storage Tank Remediation Fund	√	Fully Established	PRCF
Underground Storage Tank Permit Program	√	Fully Established	DENR**
Underground Injection Control Program: Section 1425	√	Fully Established	DENR
Underground Injection Control Program: Section 1422	√	Developed, Waiting EPA Approval	DENR
Vulnerability assessment for drinking water/wellhead protection	√	Continuing Effort	DENR
Well abandonment regulations	√	Fully Established	DENR
Wellhead Protection Program (EPA-approved)	√	Fully Established	DENR
Concentrated Animal Feeding Operations Permits	√	Fully Established	DENR
Source Water Assessment and Protection Program	√	Under Development	DENR
Well installation regulations	√	Fully Established	DENR

*Lead agency with other agencies involved.
**Not a permit program

Underground Injection Control (UIC)

The intent of the UIC program is to maintain ground water quality in useable aquifers. The State UIC program regulates underground injection of oil and gas wastes and the material used for enhanced oil and gas recovery. South Dakota was granted primacy of the Class II (1425) program in 1984. The state has applied for primacy regulating underground injection for in situ mining, shallow injection wells (Classes III & V-1422) such as drainage wells and septic systems, and uses such as geothermal heating systems. Injection of hazardous wastes is prohibited.

Underground Storage Tanks (UST)

The state UST program regulates underground storage tanks. The UST program is designed to prevent ground water pollution from underground storage tank sources and clean up activities from such incidents. South Dakota's UST regulations require tank notification, performance standards, upgrading existing systems, spill and overfill control, installation, corrosion protection, release detection, record keeping, tank maintenance, reporting of releases or spills of petroleum and hazardous substances, initial abatement, investigation and cleanup of spills, requirements for new UST systems, financial responsibility, and closure. South Dakota was granted primacy of the federal UST program within the state in March 1995.

Aboveground Storage Tanks (AST)

The AST program is also designed to prevent ground water pollution and provide for assessment, enforcement, and clean-up from these point sources. The AST regulations require tank notification, performance standards, the upgrading of existing systems, installation, secondary containment, spill and overflow control, corrosion protection, record keeping, tank maintenance, release detection, reporting of releases and spills, initial abatement and corrective action, free product removal and cleanup, and closure.

LUST Trust Fund

DENR administers the Federal Leaking Underground Storage Tank (LUST) Trust Fund through a cooperative agreement with EPA. LUST Trust Funds are used to identify parties responsible for petroleum contamination incidents from underground storage tanks. Based on federal requirements, DENR will be able to use the funds to clean up contamination where a responsible party cannot be identified or is unable to clean up the contamination.

Superfund/Federal Facilities Program

The Superfund/Federal Facilities Program provides regulatory oversight at all Superfund or National Priorities List (NPL) sites and Formerly Used Defense Sites (FUDS) in South Dakota. DENR personnel assist federal cleanup programs by ensuring compliance with South Dakota’s environmental regulations.

Regulated Substance Response Fund

A Regulated Substance Response Fund was established by the 1988 Legislature. This fund was generated from the petroleum and agricultural chemical industries. The fund can be used in emergency remedial efforts, in pollution incident investigations to determine the responsible party, and for corrective actions when a responsible party cannot be identified or refuses to undertake corrective actions. In all cases, DENR attempts to recover all costs from responsible parties.

Petroleum Release Compensation Fund

The 1988 Legislature established a $5 million Petroleum Release Compensation Fund. This fund is used for reimbursement to petroleum tank owners for cleanup costs greater than $10,000 and less than $1,000,000.

Ground Water Discharge Permits

The ground water discharge permit program is designed to further control point sources that may adversely affect ground water. Ground water has been classified for beneficial uses, and ground water quality standards have been set by the Board of Water Management. Ground water with total dissolved solids (TDS) concentrations of 10,000 mg/l or less is classified for drinking water purposes and protected for this beneficial use through numerical ground water quality standards and ground water discharge permits. Ground water with TDS concentrations greater than 10,000 mg/l is not classified for beneficial uses but further degradation is not allowed without the necessary permits.

The ground water discharge permit program involves three permits for a complete plan. These are: a construction permit, a water quality variance, and a discharge permit. The water quality variance limits discharges that degrade ground water. This involves limiting the area and quality of discharge and degradation. Ground water monitoring plans are also a part of the permit. Ground water discharge permits are necessary for discharges above ground water quality standards. These standards must be met at specific compliance points on the site (Appendix C).

Wellhead Protection Program

Wellhead Protection (WHP) activities have been proceeding in South Dakota since 1985 when preliminary work was done to identify areas of influence and potential pollution sources for vulnerable public water supply wells. In 1987, state legislation gave DENR authority to administer a WHP Program. In 1989, the Centennial Environmental Protection Act (CEPA) required the development of a voluntary WHP program. The state WHP plan was approved by EPA in October 1992. State guidelines for local use in WHP were completed in April 1995.

These state WHP guidelines include facility siting and construction criteria, governmental subdivision duties, wellhead protection area delineation, determination of pollution sources, new well siting, and contingency planning. CEPA also provided for political subdivision agreements to enforce WHP programs.

Voluntary local WHP programs have been initiated on a city and county level. Efforts to date involve primarily the Big Sioux aquifer. Brookings County in east-central South Dakota has enacted an ordinance to protect all PWS wells in the County with WHP area delineation based on a 10-year time of travel. Minnehaha County and the city of Sioux Falls have adopted ordinances and completed delineation of WHP areas. Building on these projects, the East Dakota Water Development District and the First District Association of Local Governments have developed uniform ordinances for a eleven (11) county area. Ten counties have adopted the ordinances. Presentations about WHP and the ordinances will improve public awareness, aid in ground water quality management and protect the water quality of the Big Sioux aquifer. Some areas outside the Big Sioux Aquifer that have recently moved forward with wellhead protection activities include the Black Hills area (primarily Lawrence County), Tripp Rural Water System and Clay Rural Water System.

Table 51 shows the number of communities that have wellhead protection ordinances in place and/or have a specific designated wellhead protection zone. A number of other communities have undertaken initial wellhead protection activities through the DENR PWS Waiver Program. DENR anticipates there will be more activity in this area in the near future, primarily because of the new Source Water Assessment requirements noted below.

Table 51. STATE PWS WELLHEAD PROTECTION PROGRAM (1997)

Number of Ground Water-based or Partial Ground Water-supplied Community PWSs	Population Served	Number of Ground Water-based or Partial Ground Water-supplied Community PWSs with Local WHPP in Place	Population Served
369	441,017	59	208,688

A DENR program was enacted in October 1994 that allows waivers of certain public water supply (PWS) sampling requirements provided the systems (PWS) could demonstrate they were not vulnerable to the contaminants in question. This program increased public awareness and involvement in wellhead protection

Source Water Assessment and Protection Program

Federal Safe Drinking Water Act amendments passed in 1996 require states to conduct source water assessments for all public water supplies in the state. In South Dakota this is approximately 760 systems. The Act requires the state to delineate a water supply protection zone (both surface and ground water), identify potential contaminant sources in that zone, and determine the susceptibility of the water supply to the potential contaminant sources. Additionally, public involvement is required in the assessment planning process, and the results of the assessments must be made available to the individual public water supply systems. South Dakota is currently developing the assessment document detailing the procedures the state will employ to conduct the assessments and provide the information to the public.

Pesticides in Ground Water

The South Dakota Department of Agriculture and DENR are developing a draft generic State Management Plan (SMP) for pesticides in ground water. The management plan is a CEPA requirement as well as an EPA requirement. The SMP will be reviewed by the state's Nonpoint Source Task Force which consists of numerous agencies and organizations. The SMP will also be presented at several public meetings.

Ellsworth Air Force Base Superfund Site

As a result of past waste and resource management practices at Ellsworth Air Force Base, some areas were contaminated by various toxic and/or hazardous compounds. In response, a number of environmental restoration programs have been initiated at the Base. In addition, ongoing efforts to comply with applicable laws and regulations ensure that present waste and resource management practices are carried out in a manner that protects human health and the environment.

Ellsworth AFB was activated in 1942. It is in western South Dakota, about 5 miles east of Rapid City and 1 mile north of Interstate 90. The mission of Ellsworth AFB has been to maintain a combat-ready force capable of long-range bombardment operations. To support this mission, quantities of petroleum, oils, and lubricants, solvents, and protective coatings have been used, with resultant wastes generated.

On August 30, 1990, Ellsworth AFB was placed on the National Priorities List (NPL), which brought it under the federal facility provisions of Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This action required the USAF to enter into a Federal Facilities Agreement (FFA) with the US Environmental Protection Agency (EPA) and the State of South Dakota to conduct base environmental restoration efforts. The FFA became effective April 1, 1992. The FFA requires compliance with the National Oil and Hazardous Substances Pollution Contingency Plan, CERCLA guidance and policy, RCRA guidance and policy, and applicable state law. The DENR Ground Water Quality Program has dedicated staff to oversee the Ellsworth AFB cleanup.

Contaminated areas have been subdivided based on the average concentration of hazardous substance, pollutants, or contaminants present. Several areas contain confirmed concentrations of released substances, primarily chlorinated solvents and jet fuel, above risk-based or standard-based action levels. To date, remedial investigations, risk assessments, feasibility studies, and remedial actions are complete at 12 Superfund Operable Units (OUs). Additional work is required east of the Base where chlorinated solvent releases have impacted private drinking water wells. The Air Force has provided an alternative source of drinking water to affected residents.

Long term monitoring is being conducted at nine Superfund OUs and three state lead sites to determine the effectiveness of the remedial actions. The remedial action at five sites consists of a pump and treat system. The remaining OUs are either inactive landfills or burn areas in which the remedial action was design and construction of a cover. In addition, small quantities of low-level radioactive waste were located and removed at two OUs. Chemical warfare agent test kits were also discovered in a radioactive waste burial pit and removed from the Base.

E. OPEN PIT MINING AND HEAP LEACH PROCESSING

The first production scale precious metal open pit mine/heap leach operation began in 1983. This mine is operated by Wharf Resources and is located approximately four miles west of Lead, South Dakota, in the northern Black Hills. This operation was followed in 1988 by Brohm Mining Corporation's Gilt Edge Mine (permitted in 1986) which is located approximately four miles southeast of Lead. In the same year, the Richmond Hill Mine (permitted in 1988) opened. The mine now owned by LAC Minerals, Inc., is located approximately six miles northwest of Lead. In late 1989, the Golden Reward Mining Company, L.P. started heap leach operations at its Golden Reward Mine (permitted in June 1988). This mine is located approximately two miles southwest of Lead.

These operations typically consist of open pit mines from which ore and waste rock are excavated; many haul and access roads; low grade ore, waste rock, spent ore, and topsoil stockpiles; office/shop buildings; crushers to reduce ore to leachable size; and ore processing areas which consist of a processing plant, leach pads, and process ponds.

All leach pads and the bulk of process ponds used in heap leach operations have been designed or retrofitted to double liner systems (sometimes tertiary liners). A double lined system typically consists of a primary liner of high density polyethylene (HDPE) or asphalt (leach pad only), a leak detection, collection, and recovery system (drainage layer), a composite secondary liner of HDPE, polyvinyl chloride (PVC), or asphalt (leach pad only), and clay or low permeability soil. In 1996, operators began using geosynthetic clay liners to replace traditional soil liners. Since 1988, the State of South Dakota has mandated through permit conditions that the primary liners of pads and ponds meet site specific performance standards or action leakage rate (ALR) schedules. The ALR schedule is a system of actions that are required to be performed in response to different leakage rates through a primary liner. Typically, leakage rates and corresponding actions range from 0 to 20 gallons per acre per day (gpad) and no response, to over 500 gpad and shutdown of a pad or pond. The operators are also required to submit a detailed leakage response action plan. This plan describes corrective measures and monitoring in response to leakage through a primary liner. Monitoring of the leak detection, collection, and recovery system occurs at a minimum of once per week or more depending on leakage rates.

At Wharf Resources, the processing area consists of four leach pads with double geomembrane liners placed over a clay liner for ore processing; a clay, hypalon, and double HDPE lined pregnant pond; clay, hypalon, and HDPE lined barren and overflow ponds; a clay, PVC, hypalon, and HDPE-lined neutralization pond, and a clay-lined contingency pond. Wharf has retrofitted two of the older leach pads to include the double liner technology. They have switched from permanent, one time use leach pads to on-off load leach pads. On-off loading entails leaching the ore, neutralizing the ore until required standards are met, and then off loading the neutralized spent ore into a managed depository. The pregnant, neutralization, barren, and overflow ponds were also retrofitted with additional HDPE liners to improve the integrity of these ponds. In 1997, Wharf installed a new 80-mil HDPE primary liner on its Overflow Pond. In 1995, Wharf lined its contingency pond with a single HDPE liner, and in 1997 added a second (new primary) liner to this pond making it a double lined pond. In 1998, Wharf plans to put new primary liners on its Neutralization Pond and Barren Pond. Wharf's present operation encompasses approximately 686 acres.

The processing area for Brohm Mining consists of a single on-off load leach pad with a very low density polyethylene (VLDPE) primary liner, an asphalt secondary liner and a HDPE/soil composite tertiary liner for ore processing; and surge, neutralization, and diatomaceous earth ponds lined with HDPE primary and HDPE/soil composite secondary liners. In 1996, Brohm was granted a new permit to expand its operation. The leach pad was expanded by 8 acres and a stormwater pond was constructed. The pad expansion and pond has a HDPE primary and HDPE/geosynthetic clay composite secondary liner. In 1997, Brohm again expanded this leach pad by an additional 6 acres, using a liner design similar to the 1996 expansion. Brohm is permitted to affect approximately 551 acres at the operation.

The processing area for LAC Minerals, Inc.'s Richmond Hill Mine consists of three permanent single-use leach pads with an HDPE primary and an asphalt emulsion/clay secondary liner for ore processing; barren, pregnant and chlorine ponds with HDPE primary and HDPE/clay secondary liners; and a stormwater pond with an HDPE primary and clay secondary liners. In 1996, LAC Minerals began closure of its pads, completing the project in 1997. The pads were capped with a soil liner to minimize infiltration. LAC Minerals is permitted to affect approximately 439 acres.

The processing area for Golden Reward consists of a single on-off load leach pad with an asphalt primary and PVC/clay composite secondary liner for ore processing; and surge, detoxification, and PMP ponds with HDPE primary and HDPE/clay composite secondary liners. Golden Reward uses a stacker conveyor system for loading the leach pad instead of haul trucks that are used at other operations. However, haul trucks have replaced a mechanical reclaimer in unloading spent ore from the leach pad. Beginning in late 1996, Golden Reward suspended operations for two years. The process area will be maintained on a standby basis. Golden Reward is permitted to affect approximately 493 acres at this operation.

One primary concern related to heap leach operations is the potential that exists for surface and groundwater contamination. This contamination would be from cyanide, metals, and other chemical constituents related to the processing cycle. Increased sediment loads from land disturbing activities can also affect surface water. Water quality at the various operations is monitored by several different systems. Surface water quality is monitored quarterly at a series of monitoring stations located on streams and springs surrounding the mine operations. Groundwater monitoring wells measuring shallow and deep aquifers are positioned around the processing facility. These wells are sampled monthly or quarterly for cyanide, heavy metals, and other conventional water quality parameters.

There was one instance in 1991 when cyanide leaked from a mining facility. In June of 1991, a leach pad at Brohm Mining's heap leach facility leaked when solution rose above a point where process pipes penetrated a lined berm surrounding the pad. This pad was designed to hold excess stormwater and process solution. Upon detection, excess solution was removed from the pad and a monitoring program was initiated. Also, contaminated soils and water were detoxified to ambient conditions and the pipe penetration was eliminated. Additional methods of treating and safely disposing of excess solution were also put in place at the mine. Two Notices of Violation and a penalty of $99,800 were issued to Brohm Mining for the leak incident.

In 1995, Wharf Resources discharged inadequately treated cyanide solution into a tributary of Annie Creek. This discharge resulted in a fish kill in Annie Creek. The discharge ended upon discovery of the problem and Wharf subsequently changed its treatment process to avoid out-of-compliance discharge. Two Notices of Violation were issued, and Wharf agreed to a settlement of $150,000.

Acid mine drainage has become a major concern at LAC Minerals and Brohm. Acid drainage has been detected in waste dump and pit areas at both mines. Sulfide rock which was mined in the pits at both mines is the cause of the acid drainage. Both companies submitted permit amendment applications to the state regarding mitigative measures to be used in dealing with the acid drainage. LAC Minerals' amendment was approved in February 1994, and Brohm's was approved in March 1995. Brohm proposed to cap the waste rock dump and pit areas. To date, Brohm's capping design has not received state approval and no capping has been completed. LAC Minerals hauled reactive waste rock from the waste rock dump to backfill the pit and capped the backfilled pit. This backfilling and capping project was completed in 1995 and has performed exceptionally well, resulting in the project becoming an internationally known case history of successful reclamation of an acid mine drainage problem. As a result of the acid drainage problem, LAC's reclamation bond was increased from $1.1 million to $10.7 million. Brohm's bond was increased from $1.2 million to $10.8 million.

Several other concerns related to open pit heap leach operations include the potential impacts to wildlife, the impacts to nearby residential and recreational areas, the suitability of reclamation plans, and the impacts to the local economy and government. Additionally, the cumulative impact of several such operations may be greater than the impact from a single operation. In response to these concerns, new mining regulations were adopted by the State of South Dakota in 1988. These regulations concern the filing and review of mine permit applications and amendments, permit transfers, reclamation of mill sites, procedures for determining reclamation types, minimum reclamation standards, concurrent reclamation, and temporary cessation.

In 1989, legislation was enacted regarding cumulative impacts of mining and unique and scenic lands designation. The state has recently developed regulations regarding the designation of unique and scenic lands. Cumulative impacts from open pit heap leach gold mines in the Black Hills were studied in a Cumulative Environmental Evaluation (CEE). This study was funded by large-scale gold producers and was completed in December, 1990. The South Dakota Board of Minerals and Environment will use the information in the CEE to evaluate new mine permit applications.

Information derived from the CEE was also used to develop additional mining statutes and regulations. Heap leach gold mines in the Black Hills are now limited to 6,000 acres of total land disturbance. Also, 500 acres of surface mining disturbed land at these sites were to be reclaimed by September 1, 1997. No new permits or amendments to existing permits for large-scale gold mines would have been issued after this date until 500 acres have been reclaimed. Other new statutes and regulations require more detailed post closure plans and critical resource assessments as part of permit applications. More detailed annual reports for large-scale gold permits and exploration permits are also required under the new legislation. Regarding the 500-acre reclamation requirement, in June 1997, the department determined that the 500-acre goal had been met. In July 1997, the Board of Minerals and Environment conducted a review of the state reclamation standards for large scale gold surface mines and inspected reclamation efforts at the five major surface gold mines. The board found that the existing South Dakota reclamation standards are effective.

An initiative approved by voters in November 1992 placed additional acreage limitations on large-scale heap leach gold mines. Expansions of existing large-scale gold and silver operations are now limited to 200 acres of surface mined disturbed land per each individual mine permit. Also, new operations can affect up to 320 acres of surface-mined disturbed land. Operators can expand beyond these limits if they reclaim an acre of land for every acre of expansion; agree not to disturb an equal amount of permitted affected land; or agree to reclaim previously disturbed land inside or outside a permit boundary area. Reclamation acreage credit can be reassigned from one large-scale gold or silver operator to another.

Several existing operators and a few potential new operators have either submitted or will submit state mine permit applications for large-scale gold mines. Wharf Resources submitted a permit application in late 1996 for the Clinton expansion area located immediately to the east of its current operations. It is estimated approximately 245 acres will be affected by this new operation. A hearing on the application before the Board of Minerals and Environment is tentatively scheduled for May 1998.

Whitewood Development Corporation, a fully owned subsidiary of Homestake Mining Co., is drafting a large-scale permit application to mine and reprocess approximately 10 million tons of old mill tailings deposited along Whitewood Creek. The deposits are located north of Whitewood, South Dakota, and downstream along Whitewood Creek to the Belle Fourche River confluence. The tailings will be placed on a heap leach pad and processed in a manner similar to a conventional heap leach operation.

Goldstake Mining, a partner in the Whitewood Creek project, sued Whitewood Development (Homestake) regarding Whitewood Development's failure to develop the project as specified in its contractual agreement. Goldstake was successful in its suit. The arbitrator in the case ruled in early 1995 that Whitewood Development must proceed with acquiring a mining permit for the project. However, in September 1997, Homestake announced it was suspending permitting activities for the project. Homestake, through its subsidiary, Whitewood Development, planned to take Goldstake to arbitration over the project, claiming that Goldstake is not fulfilling its obligations to the partnership.

Brohm Mining Co. submitted an application in May 1995, to mine an oxide ore deposit, the Anchor Hill Project, near their present mine. Since part of this proposed mine area is on US Forest Service administered lands, an environmental impact statement is required. In January 1996, the state granted a permit to mine on private lands. Due to delays in obtaining US Forest Service approval to allow expansion onto public lands, Brohm temporarily suspended mining operations beginning August 27, 1997. This mining hiatus will continue until the environmental impact statement is complete and the US Forest Service grants approval. The US Forest Service Record of Decision for approval was signed in early November 1997. Several parties, including citizens, environmental groups, and Indian tribe, appealed the Record of Decision. On February 18, 1998 the US Forest Service rescinded its approval to correct parts of the environment impact statement. US Forest Service approval is not expected until late 1998 at the earliest. If the US Forest Service allows mining on federal lands, the project will last an additional 3 years and would provide Brohm financial resources to clean up their existing acid mine drainage problems.

The Naneco Minerals, Inc. (formerly Minerva Explorations) proposed Ragged Top Project may involve up to 120 acres of affected land. An existing large-scale mining permit for this area was transferred from Homestake Mining Company to the then Minerva Explorations, Inc. in September, 1991. No mining has been conducted at the site to date. The permit does not allow on-site processing, obligating Naneco to ship ore to another facility for processing. In September, 1993, the Lawrence County Commission revoked Naneco's Conditional Use Permit (CUP) that was originally issued in 1984. The Commission decided the CUP was invalid as Naneco did not initiate mining at the site in a timely fashion. Before Naneco can begin operations at the site, it will need to obtain a new county CUP.

Golden Reward suspended operations in late 1996 for two years and may apply for a permit to mine ore reserves to the west of its current operation. Golden Reward may also seek approval to mine additional areas within the current permit boundary. The reserves could add an additional three years to the life of the project. During 1996 and 1997 Golden Reward continued reclamation activities at the minesite.

F. ON-SITE WASTEWATER DISPOSAL SYSTEMS

Individual and Small On-site Waste-water Treatment Systems

South Dakota has 292,436 housing units throughout the state, according to the 1990 Bureau of the Census report. At least 25% of these households utilize on-site wastewater treatment systems for their sewage disposal needs. For the majority of these households, there is no alternative to an on-site system for treating their wastewater. This can be credited to the rural setting that exists throughout the state.

An on-site wastewater treatment system typically consists of a septic tank for removing solids, and a series of absorption trenches for treatment of septic tank effluent. If these systems are properly constructed and if they are constructed in a proper location, they are a reliable and sanitary method of treating wastewater.

In February 1975, regulations entitled, ARSD 34:04:01 “Private Sewage Disposal Systems” were put into effect to ensure that the on-site systems were installed properly. These regulations remained unchanged until July 18, 1985, when the majority of the requirements were revised. The revisions include design improvements for every component of an on-site wastewater treatment system. The new regulations are entitled, ARSD 74:53:01 “Individual and Small On-site Wastewater Systems”.

New on-site wastewater treatment systems constructed anywhere in South Dakota must comply with all of the requirements listed in the regulations. These are minimum standards, although counties may develop more stringent requirements. The Department of Environment and Natural Resources (DENR) is the agency responsible for reviewing on-site systems for compliance with the regulations. DENR must receive detailed plans and specifications of unconventional systems (as defined in the regulations) to review and approve prior to construction. Mound systems or evapotranspiration systems must also have plans reviewed and approved by DENR prior to construction. Conventional systems may be constructed without having plans approved by DENR, however, some counties require their approval for conventional systems. From October 1995 to October 1997 there were 81 on-site treatment systems approved by DENR. There were also numerous systems that were reviewed, but not approved by DENR.

If an existing system or a new system is improperly constructed and it causes sewage to surface or pollute waters of the state, the regulations contain criteria that are easily interpreted for enforcement purposes. The enforcement of the regulatory requirements is currently managed on a complaint basis. Once a complaint is received, an inspection is conducted. If it is determined that the system is a problem, DENR personnel try first to work with the homeowner. If the problem cannot be resolved, enforcement actions can be undertaken in cooperation with the Attorney General's Office. Approximately fifty complaints were received and investigated by DENR during the present reporting period.

One other activity associated with on-site wastewater systems, is the performance of technical assistance for any interested party. The majority of the technical assistance activities are simply carried out as phone conversations, but occasionally involve discussions with large groups. Technical assistance normally involves interpreting the regulatory requirements for a variety of people, including engineers, contractors, private citizens, government employees, and others.

Improperly constructed on-site wastewater systems can present a very serious health and pollution hazard. The comprehensive regulations that the state has adopted allows DENR to eliminate and prevent the unhealthy conditions resulting from the inadequate systems that occasionally are constructed.

DENR has found that installers were not always aware of the construction requirements. A certification program for installers was established in 1990 to improve the quality of system construction.

To become certified the installer must successfully pass an examination which tests his/her knowledge of the construction requirements. The exam consists of an open book test which encourages the use of the construction regulations to answer test questions, in much the same way the installer should use the regulations when designing and constructing an on-site system. As of October 1997, 519 installers are certified and 333 of those became certified during this reporting period.

G. FEEDLOT PROGRAM

In accordance with the Federal Clean Water Act, the United States Environmental Protection Agency adopted regulations that created the National Pollutant Discharge Elimination System (NPDES) Program to control pollution from point sources. Feedlot operations are defined as point sources of pollution by these regulations. The specific requirements for feedlots are located in the *Code of Federal Regulations* at 40 CFR 122.23 and Appendix B to Part 122. The state has adopted identical regulations which are found in the Administrative Rules of South Dakota, Chapter 74:52:02 - Application requirements. The authority to administer the NPDES Program was delegated to the state on December 30, 1993.

Both the state and federal regulations specify the number of each type of animal that a feedlot must contain before it can be regulated. These numbers, contained in three separate categories, are listed below.

- The first category regulates operations with at least 1,000 slaughter or feeder cattle, 700 mature dairy cattle, 2,500 hogs, or an equivalent 1,000 animal units of other types of livestock.

- The second category regulates operations with at least 300 slaughter or feeder cattle, 200 mature dairy cattle, 750 hogs, or 300 other animal units where runoff is entering waters of the state by means of a ditch or flushing system, or runoff goes directly into waters of the state.

- The third category regulates operations that have been classified as a significant contributor of pollution to waters of the state. This designation is based on the size of the operation; amount of waste reaching waters of the state; location relative to the receiving stream; means of conveyance of the runoff; and slope, vegetation, and rainfall affecting the frequency of the discharge.

Concentrated animal feeding operations and the potential for contamination from the manure produced at these facilities have recently become a major environmental issue in South Dakota. Based on these concerns, two general livestock permits were developed to protect surface and ground water from the potential contamination caused by the manure.

On February 1, 1997, the Secretary issued a general permit for concentrated swine feeding operations. This permit is for new swine units with more than 1,000 animal units, operations where local government requires coverage, or operations where the Secretary determines coverage is necessary or required. Existing operations are addressed on a complaint basis.

Based on the success of the swine permit, the department issued the second general permit in February of 1998. This permit regulates all other concentrated animal feeding operations, except swine. These permits establish requirements for the design and construction of containment structures, producer training, manure disposal, soil and manure testing, producer inspections, and reporting.

These permits were supplemented by additional legislative actions. The first action requires all new large concentrated animal feeding operations located over a shallow aquifer to obtain a ground water discharge permit, unless that county had comprehensive planning and zoning ordinances and wellhead protection ordinances. Another action required DENR to inspect all large concentrated animal feeding operations on a regular basis. DENR recently developed rules concerning the inspection of these operations. The department will conduct construction inspections, periodic compliance inspections, complaint inspections, and final inspections when a facility discontinues their operation. The legislature also required the department to collect a fee for permitting and inspecting concentrated animal feeding operations.

VI.
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REFERENCES CITED

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VII.

KEY TO ABBREVIATIONS

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ACP - Agricultural Conservation Program
AGNPS - agricultural nonpoint source computer model
ALR - action leakage rate
ARSD - Administrative Rules of South Dakota
ASCS - Agricultural Stabilization and Conservation Service
AST - aboveground storage tank
AWMS - animal waste management systems
BMP - best management practice
CDBG - Community Development Block Grant
CEE - cumulative environmental evaluation
CEPA - Centennial Environmental Protection Act
CERCLA - Comprehensive Environmental Response Compensation and Liability Act
CERCLIS - Comprehensive Environmental Response Compensation and Liability Info. System
CES - Cooperative Extension Service
CFR - Code of Federal Regulations
CM&E (CME) - comprehensive monitoring and evaluation
COE - United States Army Corps of Engineers
CRG - Conservation Review Group
CRP - Conservation Reserve Program
CUP - conditional use permit
CWA - Clean Water Act
CWFCP - Consolidated Water Facility Construction Program Funds
DENR - Department of Environment and Natural Resources
DO - dissolved oxygen
EIS - environmental impact statement
EPA - Environmental Protection Agency
FERC - Federal Energy Regulatory Commission
FIFRA - Federal Insecticide, Fungicide, Rodenticide Act
FmHA - Farm Home Loan Administration
FOTG - field office technical guide
gpad - gallons per acre per day
GIS - Geolographical Information System
GPCP - Great Plains Conservation Program
GWQP - Ground Water Quality Program
HDPE - high density polyethylene
HU - hydrologic unit
IWG - Interagency Wetlands Group
LTHA - Life Time Health Advisory
LUST - leaking underground storage tank
MCL - maximum contaminant level
MOU - memorandum of understanding
NMP - National Municipal Policy
NPDES - National Pollutant Discharge Elimination System
NPS - nonpoint source
NRCS - Natural Resources Conservation Service (formerly SCS)
PL - public law

PMP - probable maximum precipitation pond
PVC - polyvinyl chloride
PWS - public drinking water system(s)
QA - quality assurance
QC - quality control
RC&D - Resource Conservation and Development Program
RCRA - Resource Conservation and Recovery Act
RCWP - Rural Clean Water Program
RMS - Resource Management System
SARA - Superfund Amendments and Reauthorization Act of 1986
SCEPA - Second Century Environmental Protection Act
SCS - Soil Conservation Service
SDACD - South Dakota Association of Conservation Districts
SDCL - South Dakota Codified Law
SDCLG - South Dakota Council of Local Governments
SDDA - South Dakota Department of Agriculture
SDEPA - South Dakota Environmental Protection Act
SDGF&P - South Dakota Department of Game, Fish and Parks
SDGS - South Dakota Geological Survey
SDWAG - South Dakota Wetlands Advisory Group
SDWPCA - South Dakota Water Pollution Control Act
SEA - State/EPA Agreement
SMP - State Management Plan
SOC - semivolatile organic compound
SRF - State Revolving Fund
STORET - EPA computer data storage and retrieval system
SWD - Surface Water Discharge program
TDS - total dissolved solids
TMDL - Total Maximum Daily Load
TRE - toxicity reduction evaluation
TSI - Carlson's (1977) Trophic State Indices
TSS - total suspended solids
UIC - underground injection control
USDA - United States Department of Agriculture
USEPA - United States Environmental Protection Agency
USFS - United States Forest Service
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey
UST - underground storage tank
VLDPE - very low density polyethylene
VOC - volatile organic compound
WHP - wellhead protection
WQIP - water quality initiative projects
WQM - ambient water quality monitoring
WQS - water quality standards
WQSP - water quality special project
WWTF - wastewater treatment facility

APPENDICES

APPENDIX A

Surface Water Quality Monitoring Schedule and Sampling Site Description

APPENDIX A
WATER QUALITY MONITORING SCHEDULE

FIELD ANALYSES:

1. Water Temperature
2. Air Temperature
3. Dissolved Oxygen
4. pH
5. Visual Observations
6. Water width and depth (when possible)
7. Flow

FREQUENCY SYMBOLS FOR WQMS:

Q = Quarterly samples once every three months

M = Monthly samples

S = Seasonal samples (May-August)

B = Bi-annual samples in April and October

I = Inactive station

ANALYSES GROUP PARAMETERS:

1. FC, NH3, O-PO4, T-PO4, COND, TSS, TS, ALK, NO3-NO2, HARDNESS, Na, SO4, Cl, (Ca, Mg, May-August).
2. FC, NH3, O-PO4, T-PO4, COND, TSS, TS, ALK, NO3-NO2, HARDNESS, (Na, Ca, Mg May-August).
3. FC, NH3, 0-PO4, T-PO4, COND, TSS, TS, ALK, NO3-NO2, HARDNESS.
4. FC, NH3, O-PO4, T-PO4, COND, TSS, TS, ALK, NO3-NO2, HARDNESS, BOD5, (Na, Ca, Mg, May-August).
5. FC, NH3, O-PO4, T-PO4, COND, TSS, TS, ALK, NO3-NO2, HARDNESS, Cd, Cu, Zn, Cr, Pb, Hg, Ni, Ag, As, Cn.

WQM SAMPLING SCHEDULE

Revised thru 11/91

STATION	STORET NUMBER	FREQUENCY	ANALYSIS GROUP	REGIONAL OFFICE	NEAREST LOCATION	PERIOD OF WATERBODY	RECORD
1	460740	M	1	NELRO	Watertown (below)	Big Sioux River	4/68-
2	460702	M	1	NELRO	Brookings-Moody Line	Big Sioux River	4/68-
3	460703	M	1	SFRO	Baltic	Big Sioux River	4/68-
4	460755	M	2	SFRO	Hub City	Vermillion River	6/68-
5	460745	M	2	SFRO	Vermillion (below)	Vermillion River	12/68-
6	460805	M	2	NELRO	Hecla	James River	4/68-
7	460707	Q	2	SFRO	Mitchell (below)	James River	7/74-
8	460761	M	2	SFRO	Yankton	James River	7/74-
9	460810	I	2	NELRO	Frederick	Maple River	4/68-6/75
10	460815	Q	1	CEN	Wewela	Keya Paha River	5/68-
11	460835	M	2	CEN	Kadoka	White River	5/68-
12	460825	M	2	CEN	Oacoma	White River	4/68-
13	460840	M	2	CEN	White River	Little White River	5/68-
14	460875	Q	2	BHRO	Edgemont	Cheyenne River	6/67-
15	460865	M	2	BHRO	Wasta	Cheyenne River	6/67-
16	468860	M	2	CEN	Bridger	Cheyenne River	6/68-
17	460905	M	3	BHRO	Hayward	Battle Creek	5/68-
18	460920	I	2	BHRO	Silver City	Rapid Creek	5/68-7/75
19	460910	M	2	BHRO	Farmingdale	Rapid Creek	6/67-
20	460890	I	2	BHRO	Belle Fourche	Belle Fourche River	4/68-10/90
21	460880	Q	2	BHRO	Volunteer	Belle Fourche River	6/67-
22	460900	M	3	BHRO	Spearfish	Spearfish Creek	6/67-
23	460895	M	2	BHRO	Belle Fourche	Redwater River	6/67-
24	460935	M	2	CEN	Whitehorse	Moreau River	4/68-
25	460945	M	2	CEN	Little Eagle	Grand River	4/68-
26	460955	I	2	BHRO	Camp Crook	Little Missouri River	5/68-7/79
27	460710	Q	3	NELRO	Browns Valley	Little Minn. River	4/68-
28	460700	Q	3	NELRO	Big Stone City	Whetstone River	4/68-
29	460850	Q	4	CEN	Ft. Pierre	Bad River	4/68-
30	460925	M	3	BHRO	Nemo	Boxelder Creek	10/68-
31	460831	M	2	SFRO	Brandon	Big Sioux River	7/74-
32	460832	M	3	SFRO	Richland	Big Sioux River	7/74-
33	460733	M	2	NELRO	Columbia	James River	7/74-
34	460734	Q	2	NELRO	Stratford	James River	7/74-
35	460735	Q	2	NELRO	Huron (above)	James River	7/74-
36	460736	Q	2	NELRO	Huron (below)	James River	7/74-
37	460737	Q	2	SFRO	Mitchell (above)	James River	7/74-
38	460738	I	2	SFRO	Menno	James River	-
39	460039	Q	2	CEN	Usta	Moreau River	7/74-
40	460640	Q	2	CEN	Shadehill	Grand River	7/74-
41	460841	I	4	CEN	Powell	Bad River	7/74-8/77
42	460842	Q	2	BHRO	Oglala	White River	7/74-
43	460843	I	2	CEN	Tuthill	Little White River	7/74-8/77
44	460844	I	2	CEN	Tuthill	Little White River	7/74-6/86
45	460645	B	3	NELRO	Gary	LacQui Parle River	7/74-
46	460646	M	3	BHRO	Mystic	Castle Creek	9/70-

WQM SAMPLING SCHEDULE

STATION	STORET NUMBER	FREQUENCY	ANALYSIS GROUP	REGIONAL OFFICE	NEAREST LOCATION	WATERBODY	PERIOD OF RECORD
47	460647	M	1	BHRO	Rochford	Rapid Creek	9/70-
48	460648	I	3	BHRO	Hill City	Spring Creek	7/74-6/75
49	460649	Q	3	BHRO	Rapid City	Spring Creek	7/74-
50	460650	Q	3	BHRO	CusterState Park	Grace Coolidge Creek	7/74-
51	460651	Q	3	BHRO	CusterState Park	French Creek	7/74-
52	460652	M	3	BHRO	Whitewood	Whitewood Creek	7/74-
53	460653	Q	3	BHRO	Custer (below)	French Creek	7/74-
54	460654	M	3	BHRO	Hill City	Spring Creek	10/74-
55	460655	M	2	NELRO	Watertown (above)	Big Sioux River	12/72-
56	460656	I	2	BHRO	Scenic	Cheyenne River	8/76-9/77
57	460657	I	1	BHRO	Hot Springs	Fall River	8/76-10/90
58	460658	I	5	BHRO	Lead	Whitewood Creek	10/74-4/91
59	460659	M	5	BHRO	Pluma	Goldrun Creek	10/74-
60	460660	I	3	BHRO	Deadwood (above)	Whitewood Creek	10/74-10/90
61	460661	I	2	SFRO	Chancellor	Vermillion River	7/75-8/82
62	460662	M	1	NELRO	Brookings	Big Sioux River	7/75-
63	460663	I	2	SFRO	Egan	Big Sioux River	7/75-5/83
64	460664	M	4	SFRO	Sioux Falls	Big Sioux River	7/75-
65	460665	M	2	SFRO	Canton	Big Sioux River	7/75-
66	460666	M	2	SFRO	Hudson	Big Sioux River	7/75-
67	460667	M	2	SFRO	Alcester	Big Sioux River	7/75-
68	460668	I	1	NELRO	Brookings (above)	Six Mile Creek	7/75-12/77
69	460669	M	1	BHRO	Rapid City	Rapid Creek	8/75-
70	460670	I	3	CEN	St. Charles	Ponca Creek	9/75-8/77
71	460671	I	3	CEN	Pierre	Missouri River	9/75-6/83
72	460672	I	3	CEN	Ft. Thompson	Missouri River	9/75-11/81
73	460673	I	3	CEN	Pickstown	Missouri River	9/75-11/81
74	460674	I	3	SFRO	Yankton	Missouri River	9/75-9/77
75	460675	Q	3	BHRO	Pluma	Strawberry Creek	11/75-
76	460676	I	2	BHRO	Elm Springs	Belle Fourche River	9/76-7/88
77	460677	Q	2	CEN	Lemmon	N.Fork Grand River	9/76-
78	460678	Q	2	CEN	Bison	S.Fork Grand River	9/76-
79	460679	Q	2	BHRO	New Underwood	Box Elder Creek	9/76-
80	460680	I	2	NELRO	Watertown	Willow Creek	2/75-11/76
81	460681	Q	5	BHRO	Vale	Belle Fourche River	6/77-
82	460682	Q	5	BHRO	Vale	Whitewood Creek	6/77-
83	460683	Q	5	BHRO	Nisland	Belle Fourche River	6/77-
84	460684	Q	5	BHRO	Crook City	Whitewood Creek	6/77-
85	460685	Q	5	BHRO	Deadwood (below)	Whitewood Creek	6/77-
86	460686	Q	5	BHRO	Pluma	Whitewood Creek	6/77-
87	460687	B	3	NELRO	Albee	S.Fork Yellow Bank	10/78-
88	460688	B	3	NELRO	Big Stone City	N.Fork Yellow Bank	10/78-
89	460689	M	3	BHRO	Belle Fourche	Spearfish Creek	10/78-
90	460690	Q	3	NELRO	Milbank	S.Fork Whetstone Creek	9/78-
91	460691	Q	3	NELRO	Milbank	S.Fork Whetstone Creek	9/78-
92	460692	M	2	BHRO	Rapid City (below)	Rapid Creek	5/79-
93	460693	I	2	BHRO	Sturgis	Bear Butte Creek	10/79-9/82
94	460694	M	3	NELRO	Aberdeen (above)	Moccassin Creek	9/79-
95	460695	M	3	NELRO	Aberdeen (below)	Moccassin Creek	9/79-

WQM SAMPLING SCHEDULE

STATION	STORET NUMBER	FREQUENCY	ANALYSIS GROUP	REGIONAL OFFICE	NEAREST LOCATION	WATERBODY	PERIOD OF RECORD
96	460696	I	3	NELRO	Redfield (above)	Turtle Creek	9/79-10/90
97	460697	I	3	NELRO	Redfield (below)	Turtle Creek	10/79-10/90
98	460698	I	3	NELRO	Sisseton (above)	Little Minnesota River	9/79-5/80
99	460699	I	3	NELRO	Sisseton (below)	Little Minnesota River	9/79-5/80
100	460100	I	3	BHRO	Hot Springs (below)	Fall River	10/79-9/82
101	460101	I	3	BHRO	Hot Springs (above)	Fall River	10/79-10/90
102	460102	M	2	BHRO	Custer (above)	French Creek	10/79-
103	460103	S	3	BHRO	Keystone	Battle Creek	10/79-8/89
110	460110	M	3	BHRO	Rapid City (above)	Rapid Creek	11/82-
111	460111	Q	3	BHRO	Custer	Flynn Creek	11/84-
112	460112	M	2	NELRO	Sand Lake	James River	2/85-
113	460113	M	2	NELRO	Sand Lake	James River	2/85-
114	460114	I	2	SFRO	Hudson	Rock River	5/84-9/86
115	460115	I	4	CEN	Midland	Bad River	8/87-8/90
116	460116	M	5	BHRO	Lead	Strawberry Creek	6/89-
117	460117	M	4	SFRO	Sioux Falls	Big Sioux River	10/90-
118	460118	M	5	BHRO	Lead	Whitetail Creek	10/90-
119	460119	Q	5	BHRO	Lead	Fantail Creek	10/90-
120	460120	Q	5	BHRO	Lead	Stewart Gulch Creek	10/90-
121	460121	Q	4	SFRO	Sioux Falls	Skunk Creek	10/90-
122	460122	M	5	BHRO	Deadwood	Whitewood Creek	2/91-
123	460123	M	5	BHRO	Deadwood (above)	Whitewood Creek	4/91-
BS18	46BS18	I	2	SFRO	Flandreau	Big Sioux River	9/75-5/83
BS23	46BS23	M	4	SFRO	Sioux Falls	Big Sioux River	6/91-
BS24	46BS24	I	4	SFRO	Sioux Falls	Big Sioux River	9/75-6/91
BS29	46BS29	M	4	SFRO	Sioux Falls	Big Sioux River	9/75-
MN31	46MN31	Q	5	BHRO	Elmore	Annie Creek	1/87-
MN32	46MN32	Q	5	BHRO	Elmore	Spearfish Creek	1/87-
MN33	46MN33	Q	5	BHRO	Elmore	Spearfish Creek	1/87-
MN34	46MN34	Q	5	BHRO	Elmore	Spearfish Creek	1/87-
MN35	46MN35	Q	5	BHRO	Maurice	Spearfish Creek	10/90-
MN36	46MN36	I	5	BHRO	Rochford	Rapid Creek	4/87-4/90
MN37	46MN37	I	5	BHRO	Rochford	Rapid Creek	4/87-4/90
MN38	46MN38	Q	5	BHRO	Maitland	False Bottom Creek	4/87-
MN39	46MN39	Q	5	BHRO	Maurice	Squaw Creek	10/90-

Descriptions of Individual River/Stream
WQM Sites available from
DENR, Watershed Protection Program
on request.
Phone: (605) 773-4254
or
Internet Address:
http://www.state.sd.us/denr

APPENDIX B

State Ground Water Program Summary Update

STATE: SOUTH DAKOTA

3 STATE GROUND WATER MANAGEMENT STRUCTURE

3.1 State Statutes Pertaining to Ground Water Quality and Pollution Control

Subject Monitored by Statute	Statute Name/No.	Description of Authority Pertaining to Ground Water Protection
General water pollution control	SDCL 34A-2 General Water Pollution	Statutes give state authority to regulate pollution monitoring and cleanup of state waters. This includes ground water quality standards, ground water discharge permits and chemigation.
Ground water quality (including public health standards)	SDCL 34A-2 General Water Pollution Control Statutes	Covered under general water pollution control.
Solid waste	SDCL 34-16B	Regulates disposal of solid wastes, outlines monitoring requirements.
Hazardous waste	SDCL 34A-2	Prohibits toxic and dangerous discharges. Outlines hazardous waste disposal, monitoring and handling.
Mining	SDCL 45-6D SDCL 45-6C SDCL 45-6B SDCL 45-6	Regulates mining activities, including water pollution.
Oil and gas	SDCL 45-9	State authority to permit oil and gas development according to environmentally sound practices.
Other (specify) Underground Storage Tanks Above Ground Storage Tanks	SDCL 34A-2, 34A-2	Statutes give state authority to develop regulations for monitoring, corrective action and financial responsibility for underground storage tanks. Above ground storage tank regulations are also in effect for registration, monitoring and corrective action.
Pesticides	SDCL 38-21	Prohibits pesticide handling practices which cause pollution.
Fertilizers	SDCL 38-19	Authority for facility construction and siting. Regulations include preventative measures, leak detection and spill reporting and clean up.

Notes: SDCL refers to South Dakota Codified Law.

3.2. State Ground-Water Policy

3.2.1 Status

	Check
Ground water covered under general state statutes	X
Specific state statutes for ground water	X
Policy in existence for protecting ground water quality	X

STATE: SOUTH DAKOTA

3.2.2. Development of Ground Water Policy
3.2.1.1. Is there a ground water policy or strategy development process? Yes X No _
3.2.2.2. Lead agency/: Department of Environment and Natural Resources
3.2.2.3. Describe development process (inter-agency agreements, progress to date, target completion date, etc.):

A state ground water protection strategy was completed in 1987 and is updated as needed. The state has adopted ground water quality classification and standards and ground water discharge permit regulations.

Policies involving specific contamination categories have also been and continue to be implemented. Underground and above ground storage tank regulations include construction, monitoring, and corrective action requirements. The mining and oil and gas regulations also encompass ground water protection.

A comprehensive environmental protection act was enacted in 1989 which included statutory authority for additional ground water protection activities. Activities authorized in CEPA include a wellhead protection program; new domestic well water quality analyses; certification of small on-site wastewater disposal system installers; and agricultural chemical management plan development for ground water quality protection.

The state is developing the Comprehensive State Ground Water Protection Program document describing comprehensive protection efforts in the state. Also under development is the state Source Water Assessment and Protection program which combines elements of the previously approved wellhead protection program with new federal requirements for protecting surface water public drinking water supplies, and additional requirements for potential contaminant source identification and susceptibility analysis.

3.2.3. Characteristics of Policy Developed

Type of Protection	Check
General language	
Non-degradation	X
Limited degradation	X
Differential protection	

Notes:

3.2.4. Policy Classification

3.2.4.1. Does state have a ground water classification system or other system for distinguishing among types of ground water (e.g. use, quality, or other contamination potential)? Yes _X_ No

3.2.4.2. If yes, give brief description of classes: The ground water classification system consists of two classes: water that is less than or equal to 10,000 mg/L TDS and water that is greater than 10,000 mg/L TDS. All ground water that has an ambient concentration of 10,000 mg/L or less TDS is to be maintained for the beneficial use of drinking water supplies at the numerical standards or existing water quality whichever is better.

3.2.5. Quality Standards

3.2.5.1. Has the state adopted ground water quality standards? Yes_X_ No _

3.2.5.2. How are the standards used? The standards are used to control ground water degradation through ground water discharge permits for limited areas and to enforce cleanup standards for spills.

3.2.5.3. Describe briefly the range of contaminants covered. Ground water quality standards apply to all ground water with TDS equal to or less than 10,000 mg/L. Standards include numerical Maximum Contaminant Levels (MCL). Narrative standards apply to potentially toxic pollutants which include many organic chemicals.

STATE: SOUTH DAKOTA

3.4. Inter-Agency Agreements

Topics	Check if Applicable	Description of Agreements and Agencies
Protection of specific aquifers		
Policy and strategy development		
Ground water discharges		
Underground injection control		
Ground water contamination incidents	X	Cooperation with the Division of Emergency and Disaster Services, the State Fire Marshal, and a Memorandum of Understanding with the Department of Agriculture.
Geological survey		South Dakota Geological Survey is a Program of the Department of Environment and Natural Resources.
Other (specify)		

3.5. Status of Ground-Water Resource Assessment Activities

Activity	Check if Applicable	Description of Activities
Ground-water resources assessment (aquifer)	X	Field work for county-wide studies for the eastern half of the state has been completed for 38 counties. A geohydrologic study of an additional county is currently underway, as is a study for two counties in western South Dakota. Additionally, the state has conducted a detailed water quality study of the Big Sioux aquifer, and is currently involved in a comprehensive hydrology study of the Black Hills.
Ambient ground-water quality	X	Pesticide and Fertilizer Sampling Programs have been completed. A statewide ground water quality monitoring network is currently operating with additional aquifers and monitoring wells being added to the program.
Other (specify)		

STATE: SOUTH DAKOTA

3.6. State Ground-Water Monitoring Program

Types of Monitoring	Check	Brief Description of Monitoring Program	Monitoring Data Computerized (Check)	Name of Database (Specify)
Non-hazardous waste sites	X	Site monitoring.		
Hazardous waste sites	X	RCRA and Superfund related.		
Salt water				
Pesticides	X	Pesticide and Fertilizer Sampling Programs completed. Site specific sampling and statewide monitoring network.	X	DENR-GWQ DENR-SDGS
Ambient monitoring	X	Statewide network monitoring of ground water quality and site-specific sampling near pollution sources. Monitoring public water systems for Safe Drinking Water Act compliance.	X	DENR-ODW DENR-SDGS
Regional, County & Local private and site specific observation		Ground water quality monitoring using public wells, by SDGS and USGS to define background water quality. Often sampling is on a one time basis.		DENR-SDGS Studies
Quantity monitoring	X	Quantity monitoring is networked and is used to monitor water levels in major use aquifers. Monitoring is periodic throughout the year.	X	DENR-Water Rights

3.7. State Programs for Public Participation

Context Approaches	General Ground Water Issues	Permit Issuance	Regulation Adoption, Changes	Specific Ground Water Strategy	Source Water and Wellhead Protection	UST & Above Ground Tanks
Public hearings, meetings, workshops	X	X	X	X	X	X
Meetings with local officials	X	X	X		X	X
Citizens' advisory groups (Board of Water Management) (Board of Water and Natural Resources)	X	X	X	X	X	X
Public notices	X	X	X	X	X	
Handbook, other written materials	X	X			X	X
Other (specify):						

STATE: SOUTH DAKOTA

5. STATE-ORIGINATED GROUND WATER PROTECTION PROGRAMS

5.1. Ground Water Strategy
(including ground water quality standards and classification)

Description: See FY 1993-94 SEA.

Funding Source: 106

5.2. Ground Water Monitoring

Description: There is an operating network for ambient ground water quality monitoring, which includes current water quality monitoring of 138 wells at 76 sites in 21 sensitive aquifers. This network is being expanded to include 4 other sensitive aquifers, with 2 additional sites to be also installed in aquifers presently being monitored. Monitoring is also conducted at specific sites near pollution sources. Monitoring in four shallow aquifers for pesticide and fertilizer has been completed. Quantity monitoring is networked and is used to monitor water levels in major use aquifers. Monitoring is periodic throughout the year. Monitoring for nonpoint source contamination began in 1988 through specific projects now completed, and is continuing via the state ambient ground water quality monitoring network.

Funding Source: state funds, 319

5.3. Ground Water Resource Assessment/Aquifer Study/Mapping

Description: The field-work portions of county-wide studies have been completed for all but six counties in eastern South Dakota. A study for Roberts County is now in progress with one more season of field work remaining. The studies include mapping of ground water resources and geology. A two-county study (Todd-Mellette Counties) is underway in western South Dakota. The drilling portion of this study has been completed. Aquifers in the majority of the state have been mapped at least at a reconnaissance level. Approximately 32,700 well logs are kept in the DENR data base. A detailed water quality study of the Big Sioux aquifer has also been conducted. A water quality study of the Fox Hills aquifer in southern Harding County has been completed. A hydrology study in the Black Hills is currently underway.

Funding Source: local, USGS, state funds

5.4. Agricultural Contamination Control

Description: Agricultural Chemicals in Ground Water State Management Plans

Funding Source: 106, FIFRA

5.5. Permits/Control of Discharges to Ground Water

Description: Ground water discharge permit regulations were developed and adopted in 1987. The program is operational.

Funding Source: 106

5.6. Septic Management Program

Description: On-site wastewater disposal is regulated by the State. On-site system installers must be certified by the State.

Funding Source: 106

5.7. Underground Storage Tank (UST) Programs

Description: South Dakota regulates underground storage tanks and in March 1995, received delegation of the program pursuant to Section 9002(b)(2) of RCRA reauthorization of 1984.

Funding Source: RCRA Section 9002(b)(2)

5.8. Contamination Response Program
(other than RCRA/Superfund)

Description: DENR tracks spills of regulated substances from “cradle to grave” and ensures clean-up is completed to protect public health and restore the environment for its intended beneficial use.

Funding Source: 106

5.9. Other: Above-ground Storage Tank Program

Description: South Dakota regulates above-ground storage tanks; the program is similar to the UST program.

Funding Source: 106

APPENDIX C

State Ground Water Quality Standards

APPENDIX D

Aquifer Monitoring and Ground Water Contamination Management Data

Table 8-2A. GROUND WATER CONTAMINATION SUMMARY

Aquifer Name: Vermillion East Fork **County(ies):** Clark, Kingsbury, Miner, Lake, McCook, Turner
Hydrogeologic Setting: The Vermillion East Fork Aquifer was formed from glacial outwash. The outwash consists of s
or near the ground surface.
Spatial Description (optional):
Map Available (optional): see Figure 21
Data Reporting Period: from the initiation of data collection to present

Source Type	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contaminants	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed (In post -clean up monitoring only)	Number of sites with corrective action plans	Numbe with act remedia
NPL								
CERCLIS (non-NPL)								
DOD/DOE	1	1	0	PAH Coal Tar	1		1	
LUST	15	15	6	Petroleum	15	1	3	
RCRA Corrective Action								
Underground Injection								
State Sites								
Nonpoint Sources								
Other	17	5	4	Petroleum, Agricultural Chemicals, Mercury	15	0	3	

VOCs - Volatile Organic Compounds
NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
RCRA - Resource Conservation and Recovery Act
LUST - Leaking Underground Storage Tanks
DOD - Department of Defense
PAH - Polynuclear Aromatic Hydrocarbons

Table 8-2A. GROUND WATER CONTAMINATION SUMMARY

Aquifer Name: Vermillion West Fork **County(ies):** McCook, Turner

Hydrogeologic Setting: The Vermillion West Fork Aquifer consists of valley train outwash deposits. These deposits gravel up to 48 feet thick.

Spatial Description (optional):

Map Available (optional): see Figure 21

Data Reporting Period: from the initiation of data collection to present

Source Type	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contaminants	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed (In post - clean up monitoring only)	Number of sites with corrective action plans	Number with acti remediat
NPL								
CERCLIS (non-NPL)								
DOD/DOE								
LUST	4	4	1	Petroleum	4	2	0	
RCRA Corrective Action								
Underground Injection								
State Sites								
Nonpoint Sources								
Other	12	12	2	Agricultural Chemicals, Petroleum	12	2	1	

VOCs - Volatile Organic Compounds
NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 8-2A. GROUND WATER CONTAMINATION SUMMARY

Aquifer Name: Parker-Centerville **County(ies):** Turner, Clay, Lincoln

Hydrogeologic Setting: The Parker-Centerville Aquifer is formed from glacial outwash and alluvium. It consists of occurring at or near the land surface.

Spatial Description (optional):

Map Available (optional): see Figure 21

Data Reporting Period: from the initiation of data collection to present

Source Type	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contaminants	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed (In post - clean up monitoring only)	Number of sites with corrective action plans	
NPL								
CERCLIS (non-NPL)								
DOD/DOE								
LUST	11	11	8	Petroleum	11	2	0	
RCRA Corrective Action								
Underground Injection								
State Sites								
Nonpoint Sources								
Other	12	12	4	Petroleum, Agricultural Chemicals	12	4	0	

VOCs - Volatile Organic Compounds
NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 8-2A. GROUND WATER CONTAMINATION SUMMARY

Aquifer Name: Missouri (Elk Point Management Unit) **County(ies):** Yankton, Clay, Union
Hydrogeologic Setting: The Missouri Aquifer consists of outwash and alluvium. The average depth to the top of the feet.
Spatial Description (optional):
Map Available (optional): see Figure 21
Data Reporting Period: from the initiation of data collection to present

Source Type	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contaminants	Contaminants	Number of site investigations	Number of sites that have been stabilized or have had the source removed (In post -clean up monitoring only)	Number of sites with corrective action plans	Number active re
NPL								
CERCLIS (non-NPL)	1	1	0	Coal Gas Waste	1	0	1	
DOD/DOE	1	1	0	Petroleum Fuel Oil	1	1	0	
LUST	22	22	13	Petroleum Fuel Oil	22	6	8	
RCRA Corrective Action								
Underground Injection								
State Sites								
Nonpoint Sources								
Other	27	27	7	Petroleum	27	6	3	

VOCs - Volatile Organic Compounds
NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 8-4 A. Statewide Aquifer Monitoring Data

Aquifer Description Statewide
Aquifer Setting ____________

Data Reporting Period Oct. 1, 1995-Sept. 30,

Monitoring Data Type	Total No. of Wells Used in the Assesment	Parameter Groups	Number of Wells							
			No detections of parameters above MDLs* or background levels		No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5mg/l.		Parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/L	Parameters are detected at concentrations exceeding the MCLs	Removed from service	
			ND*	Number of wells in sensitive or vulnerable areas	ND/ Nitrate $\leq$ 5mg/l	Number of wells in sensitive or vulnerable areas				
Raw Water Quality Data from Public Water Supply Wells		VOC	Drinking water tested at the tap.							
		SOC	Not differentiated between raw							
		NO_3	and finished water.							
Finished Water Quality Data from Public Water Supply Entry Points	778	VOC_{21}	357	-	357	-	6	0	-	-
		SOC	359		359	-	4	0	-	-
		NO_3	774	-	Not applicable	-	Not applicable	4	-	-
		Other	-	-	-	-	-	29**	-	-
Raw Water Quality Data from Private or Unregulated Wells		VOC	Not routinely monitored							
		SOC	Not routinely monitored							
		NO_3	Monitored but not listed by aquifer							

*Not Detected at concentrations above the Method Detection Limits.
**Includes radium, antimony, thallium, and/or fluoride.

APPENDIX E

State Drinking Water Standards and Regulations

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WATER QUALITY MONITORING (WQM)
STATION DESCRIPTIONS

WQM: 1

STORET#:	460740	REGIONAL OFFICE:	NELRO
STREAM:	BIG SIOUX RIVER	USGS#:	06479438
FREQUENCY:	MONTHLY	COUNTY:	CODINGTON
NEAREST TOWN:	WATERTOWN	TOWNSHIP:	T116N R52W SEC 16; NE
EPA UIC:	0110111	LONGITUDE:	970256
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	445052

DESCRIPTION:
Approximately 1.5 miles SE (below) Watertown WWTF (I/P basins). On north -south gravel road 2 miles south of US Hwy 212 and I-29 junction, and one mile west of I -29.

WQM: 2

STORET#:	460702	REGIONAL OFFICE:	NELRO
STREAM:	BIG SIOUX RIVER	USGS#:	06480000
FREQUENCY:	MONTHLY	COUNTY:	BROOKINGS
NEAREST TOWN:	BROOKINGS	TOWNSHIP:	T109N R50W SEC 35; SE,SE,NE
EPA UIC:	0110111	LONGTITUDE:	964720
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	441151

DESCRIPTION:
Approximately 3.5 miles south (below) Brookings WWTF, at north -south bridge on old US Hwy 77, 8 miles south of 6th street and Main Avenue. Approximately 0.1 mile north of Brookings -Moody County line and 1.3 miles NW of Medary Creek confluence.

WQM: 3

STORET#:	460703	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	06481000
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA,
NEAREST TOWN:	DELL RAPIDS	TOWNSHIP:	T104N R49W SEC 29; NW,NW,NE
EPA UIC:	0110111	LONGITUDE:	964442
BENEFICIAL USES:	1,5,7,8,9,10	LATITUDE:	434725

DESCRIPTION:
Approximately 2 miles SW (below) Dell Rapids WWTF, at east -west bridge, 2.5 miles south of Dell Rapids, on old US Hwy 77 and 1.8 miles west or 2 miles north of Baltic. Approximately 0.2 mile downstream from confluence of divided channels.

WQM: 4

STORET#:	460755	REGIONAL OFFICE:	SFRO
STREAM:	VERMILLION RIVER	USGS#:	06479000
FREQUENCY:	MONTHLY	COUNTY:	CLAY
NEAREST TOWN:	WAKONDA	TOWNSHIP:	T94N R52W SEC 2; NW,SW,SW
EPA UIC:	0100111	LONGITUDE:	965750
BENEFICIAL USES:	5,8,9,10	LATITUDE:	425926

DESCRIPTION:
7 miles east of Wakonda and 1.4 miles south on SD Hwy 19 at north -south bridge, 29.6 miles upstream from mouth.

WQM: 5

STORET#:	460745	REGIONAL OFFICE:	SFRO
STREAM:	VERMILLION RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	CLAY
NEAREST TOWN:	VERMILLION	TOWNSHIP:	T92N R51W SEC 14; SW,NE,NE
EPA UIC	0100111	LONGITUDE:	965746
BENEFICIAL USES:	5,8,9,10	LATITUDE:	424707

DESCRIPTION:
At East-West bridge on SD Hwy 50, 0.5 mile west of Vermillion.

WQM: 6

STORET#:	460805	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	HECLA	TOWNSHIP:	T128N R61W SEC 21; NE,NW
EPA UIC:	0100111	LONGITUDE:	981015
BENEFICIAL USES:	5,8,9,10	LATITUDE:	455335

DESCRIPTION:
East-West gravel road bridge, 0.5 mile north and 1.3 miles west of Hecla, off SD Hwy 37. 3 miles south of ND -SD border (approximately 7 stream miles), just above Mud Lake-Sand Lake Reservoir.

WQM: 7

STORET#:	460707	REGIONAL OFFICE:	SFRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	HANSON
NEAREST TOWN:	MITCHELL	TOWNSHIP:	T102N R59W SEC 9; NW,NE
EPA UIC:	0100111	LONGITUDE:	975506
BENEFICIAL USES:	5,8,9,10	LATITUDE:	433931

DESCRIPTION:
Approximately 2 miles southeast of Mitchell WWTF d ischarge at east-west gravel road bridge, 2.3 miles south and 4.4 miles east from I -90 and SD Hwy 37 junction.

WQM: 8

STORET#:	460761	REGIONAL OFFICE:	SFRO
STREAM:	JAMES RIVER	USGS#:	06478513
FREQUENCY:	MONTHLY	COUNTY:	YANKTON
NEAREST TOWN:	YANKTON	TOWNSHIP:	T94N R55W SEC 5; NW, NE
EPA UIC:	0100111	LONGITUDE:	972211
BENEFICIAL USES:	5,8,9,10	LATITUDE:	425945

DESCRIPTION:
At east-west bridge, 8.6 miles north of US Hwy 81 and SD Hwy 50 (in Yankton) and 1.4 miles east.

WQM: 9

STORET#:	460810	REGIONAL OFFICE:	NELRO
STREAM:	MAPLE RIVER	USGS#:	06471200
FREQUENCY:	INACTIVE	COUNTY:	BROWN
NEAREST TOWN:	FREDERICK	TOWNSHIP:	T128N R63W SEC 5; NW,NW
EPA UIC:	0110111	LONGITUDE:	982711
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	455613

DESCRIPTION:
At east-west gravel road bridge, on ND-SD border, 7 miles north of Frederick on US Hwy 281 and 3.5 miles east.

WQM: 10

STORET#:	460815	REGIONAL OFFICE:	CENTRAL
STREAM:	KEYA PAHA RIVER	USGS#:	06464500
FREQUENCY:	QUARTERLY	COUNTY:	TRIPP
NEAREST TOWN:	WEWELA	TOWNSHIP:	T95N R76W SEC 24; SE
EPA UIC:	0110111	LONGITUDE:	994645
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	430140

DESCRIPTION:
At north-south bridge on SD Hwy 183, 0.75 mile north of Wewela.

WQM: 11

STORET#:	460835	REGIONAL OFFICE:	CENTRAL
STREAM:	WHITE RIVER	USGS#:	06447000
FREQUENCY:	MONTHLY	COUNTY:	JACKSON
NEAREST TOWN:	KADOKA	TOWNSHIP:	T3S R22E SEC 30; SE,SE
EPA UIC:	0100111	LONGITUDE:	1013130
BENEFICIAL USES:	5,8,9,10	LATITUDE:	434510

DESCRIPTION:
At north-south bridge on SD Hwy 73, 6.2 miles south of I-90 (5.75 miles south of Kadoka).

WQM: 12

STORET#:	460825	REGIONAL OFFICE:	CENTRAL
STREAM:	WHITE RIVER	USGS#:	06452000
FREQUENCY:	MONTHLY	COUNTY:	LYMAN
NEAREST TOWN:	OACOMA	TOWNSHIP:	T103N R73W SEC 3; SW
EPA UIC:	0100111	LONGITUDE:	993322
BENEFICIAL USES:	5,8,9,10	LATITUDE:	434459

DESCRIPTION:
At SD Hwy 47 bridge, 7 miles south of I-90, or 8 miles southwest of Oacoma.

WQM: 13

STORET#:	460840	REGIONAL OFFICE:	CENTRAL
STREAM:	LITTLE WHITE RIVER	USGS#:	06450500
FREQUENCY:	MONTHLY	COUNTY:	MELLETTE
NEAREST TOWN:	WHITE RIVER	TOWNSHIP:	T24N R29W SEC 23
EPA UIC:	0100111	LONGITUDE:	1004452
BENEFICIAL USES:	5,8,9,10	LATITUDE:	433601

DESCRIPTION:
At north-south US Hwy 83 bridge, 1.5 miles north of White River.

WQM: 14

STORET#:	460875	REGIONAL OFFICE:	BHRO
STREAM:	CHEYENNE RIVER	USGS#:	06395000
FREQUENCY:	QUARTERLY	COUNTY:	FALL RIVER
NEAREST TOWN:	EDGEMONT	TOWNSHIP:	T8S R2E SEC 36; SE,SW
EPA UIC:	0100111	LONGITUDE:	1034915
BENEFICIAL USES:	5,8,9,10	LATITUDE:	431820

DESCRIPTION:
At US Hwy 18 bridge on northeast edge of Edgemont, 700 feet upstream of Cottonwood Creek confluence.

WQM: 15

STORET#:	460865	REGIONAL OFFICE:	BHRO
STREAM:	CHEYENNE RIVER	USGS#:	06423500
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	WASTA	TOWNSHIP:	T1N R14E SEC 2; SE,SW
EPA UIC:	0101111	LONGITUDE:	1022403
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	440452

DESCRIPTION:
At east-west old US Hwy 16 bridge, 3 miles east of Wasta, below Box Elder creek confluence (0.6 mile north and 0.7 mile northwest of I-90 101 exit).

WQM: 16

STORET#:	468860	REGIONAL OFFICE:	CENTRAL
STREAM:	CHEYENNE RIVER	USGS#:	06438500
FREQUENCY:	MONTHLY	COUNTY:	ZIEBACH
NEAREST TOWN:	BRIDGER	TOWNSHIP:	T7N R18E SEC 34; NW,NE,NE
EPA UIC:	0101111	LONGITUDE:	1015552
BENEFICIAL USES:	4,7,8,9,10	LATITUDE:	443153

DESCRIPTION:
At north-south bridge on SD Hwy 34, 1 mile southwest and 0.5 mile south of Bridger or 17 miles northwest of SD Hwys 73 and 34 junction.

WQM: 17

STORET#:	460905	REGIONAL OFFICE:	BHRO
STREAM:	BATTLE CREEK	USGS#:	06404000
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	HAYWARD	TOWNSHIP:	T2S R7E SEC 18
EPA UIC:	1000111	LONGITUDE:	1032010
BENEFICIAL USES:	2,8,9,10	LATITUDE:	435218

DESCRIPTION:
At east-west SD Hwy 40 bridge just west of Hayward, approximately 3 miles southeast of Keystone.

WQM: 18

STORET#:	460920	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	06411500
FREQUENCY:	INACTIVE	COUNTY:	PENNINGTON
NEAREST TOWN:	PACTOLA RESERVOIR	TOWNSHIP:	T1N R5E SEC 2; NE,SW
EPA UIC:	1000111	LONGITUDE:	1032854
BENEFICIAL USES:	2,8,9,10	LATITUDE:	440436

DESCRIPTION:
Immediately below Pactola Dam where US Hwy 385 crosses (2,000 feet downstream from base of dam).

WQM: 19

STORET#:	460910	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	06421500
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	FARMINGDALE	TOWNSHIP:	T1S R11E SEC 19; SW,SW
EPA UIC:	0101111	LONGITUDE:	1025115
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	435630

DESCRIPTION:
At north-south oil F.A.S. #6121 bridge, 2 miles southeast of Farmingdale, or 1 mile south of SD Hwy 44.

WQM: 20

STORET#:	460890	REGIONAL OFFICE:	BHRO
STREAM:	BELLE FOURCHE RIVER	USGS#:	06428500
FREQUENCY:	INACTIVE	COUNTY:	BUTTE
NEAREST TOWN:	BELLE FOURCHE	TOWNSHIP:	T9N R1E SEC 18; NW,NE
EPA UIC:	0101111	LONGITUDE:	1040250
BENEFICIAL USES:	4,7,8,9,10	LATITUDE:	444459

DESCRIPTION:
0.3 miles downstream of Wyoming -SD border. The Belle Fourche River is 4 miles straight south of US Hwy 212.

WQM: 21

STORET#:	460880	REGIONAL OFFICE:	BHRO
STREAM:	BELLE FOURCHE RIVER	USGS#:	06437000
FREQUENCY:	QUARTERLY	COUNTY:	MEADE
NEAREST TOWN:	VOLUNTEER	TOWNSHIP:	T6N R8E SEC 3; NW,SE,NE
EPA UIC:	0101111	LONGITUDE:	1030810
BENEFICIAL USES:	4,7,8,9,10	LATITUDE:	443050

DESCRIPTION:
At east-west SD Hwy 34 bridge, 17 miles northeast of Sturgis and SD Hwy 79.

WQM: 22

STORET#:	460900	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	06431500
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	SPEARFISH	TOWNSHIP:	T6N R2E SEC 15; NW,SE,SE
EPA UIC:	1011111	LONGITUDE:	1035141
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	442857

DESCRIPTION:
At Spearfish City Park, approximately 500 feet downstream from fish hatchery.

WQM: 23

STORET#:	460895	REGIONAL OFFICE:	BHRO
STREAM:	REDWATER RIVER	USGS#:	06433000
FREQUENCY:	MONTHLY	COUNTY:	BUTTE
NEAREST TOWN:	BELLE FOURCHE	TOWNSHIP:	T8N R2E SEC 11; SE,NW,SW
EPA UIC:	1000111	LONGITUDE:	1034955
BENEFICIAL USES:	3,8,9,10	LATITUDE:	4440005

DESCRIPTION:
At US Hwy 212 bridge on east edge of Belle Fourche, 0.9 mile upstream of Belle Fourche River confluence.

WQM: 24

STORET#:	460935	REGIONAL OFFICE:	CENTRAL
STREAM:	MOREAU RIVER	USGS#:	06360500
FREQUENCY:	MONTHLY	COUNTY:	DEWEY
NEAREST TOWN:	WHITEHORSE	TOWNSHIP:	T15N R27E SEC 17; SE,SW,SW
EPA UIC:	0100111	LONGITUDE:	1005033
BENEFICIAL USES:	5,8,9,10	LATITUDE:	451521

DESCRIPTION:
At north-south bridge 13.5 miles north of US Hwy 212, 2.5 miles southeast of Whitehorse.

WQM: 25

STORET#:	460945	REGIONAL OFFICE:	CENTRAL
STREAM:	GRAND RIVER	USGS#:	06357800
FREQUENCY:	MONTHLY	COUNTY:	CORSON
NEAREST TOWN:	LITTLE EAGLE	TOWNSHIP:	T20N R27E SEC 32; NE,NE,SW
EPA UIC:	0100111	LONGITUDE:	1004903
BENEFICIAL USES:	4,8,9,10	LATITUDE:	453929

DESCRIPTION:
At north-south SD Hwy 63 bridge, 1.3 miles south of Little Eagle. 13.4 miles north of SD Hwy 20.

WQM: 26

STORET#:	460955	REGIONAL OFFICE:	BHRO
STREAM:	LITTLE MISSOURI RIVER	USGS#:	06334500
FREQUENCY:	INACTIVE	COUNTY:	HARDING
NEAREST TOWN:	CAMP CROOK	TOWNSHIP:	T18N R1E SEC 2; SW,SE,NW
EPA UIC:	0100111	LONGITUDE:	1035815
BENEFICIAL USES:	5,8,9,10	LATITUDE:	453253

DESCRIPTION:
At east-west SD Hwy 20 bridge, on east edge of Camp Crook.

WQM: 27

STORET#:	460710	REGIONAL OFFICE:	NELRO
STREAM:	LITTLE MINNESOTA RIVER	USGS#:	06290000
FREQUENCY:	QUARTERLY	COUNTY:	ROBERTS
NEAREST TOWN:	BROWNS VALLEY	TOWNSHIP:	T125N R50W SEC 11; SE,SE,SE
EPA UIC:	0100111	LONGITUDE:	985234
BENEFICIAL USES:	5,8,9,10	LATITUDE:	453658

DESCRIPTION:
At east-west Roberts County road 33 bridge, 3 miles south and 8.5 miles east from SD Hwys 10 and 81 junction east of Sisseton, or 5.3 miles northeast of Peever.

WQM: 28

STORET#:	460700	REGIONAL OFFICE:	NELRO
STREAM:	WHETSTONE RIVER	USGS#:	05291000
FREQUENCY:	QUARTERLY	COUNTY:	GRANT
NEAREST TOWN:	BIG STONE CITY	TOWNSHIP:	T121N R46N SEC 18, NW,SE,SW
EPA UIC:	0100111	LONGITUDE:	962914
BENEFICIAL USES:	5,8,9,10	LATITUDE:	451732

DESCRIPTION:
1.5 miles west of Big Stone City, on east-west gravel road which runs through town.

WQM: 29

STORET#:	460850	REGIONAL OFFICE:	CENTRAL
STREAM:	BAD RIVER	USGS#:	06441500
FREQUENCY:	QUARTERLY	COUNTY:	STANLEY
NEAREST TOWN:	FT. PIERRE	TOWNSHIP:	T4N R31E SEC 10; NW,NW
EPA UIC:	0100111	LONGITUDE:	1002302
BENEFICIAL USES:	6,8,9,10	LATITUDE:	441935

DESCRIPTION:
At second bridge on Bad River road, 1.6 miles southwest of US Hwy 83 junction, south of Ft. Pierre.

WQM: 30

STORET#:	460925	REGIONAL OFFICE:	BHRO
STREAM:	BOX ELDER CREEK	USGS#:	06422500
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	NEMO	TOWNSHIP:	T2N R5E SEC 12; SE,NE,SE
EPA UIC:	1000111	LONGITUDE:	1032716
BENEFICIAL USES:	5,8,9,10	LATITUDE:	440838

DESCRIPTION:
4.5 miles southeast of Nemo, at north bank across from ranch, 0.2 mile west of Lawrence -Meade County line.

WQM: 31

STORET#:	460831	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	06482100
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	BRANDON	TOWNSHIP:	T102N R48W SEC 33; NW,NW
EPA UIC:	0100111	LONGITUDE:	963559
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	433541

DESCRIPTION:
At east-west black-top road bridge, approximately 1 mile downstream of Brandon WWTF, 0.9 mile south and 1.3 miles west of I -90 Brandon exit.

WQM: 32

STORET#:	460832	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	06485696
FREQUENCY:	MONTHLY	COUNTY:	UNION
NEAREST TOWN:	RICHLAND	TOWNSHIP:	T92N R49W SEC 28; NW
EPA UIC:	0101011	LONGITUDE:	963756
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	424543

DESCRIPTION:
At east-west SD Hwy 50 bridge, one mile east of Richland.

WQM: 33

STORET#:	460733	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER	USGS#:	06471000
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	COLUMBIA	TOWNSHIP:	T122N R62W SEC 29; NW,NE,NW
EPA UIC:	0100111	LONGITUDE:	981930
BENEFICIAL USES:	5,8,9,10	LATITUDE:	453705

DESCRIPTION:
At east-west gravel road bridge, 0.5 mile west of northwest edge of Columbia, 3.6 stream miles upstream of Elm River, 9.4 stream miles downstream of Columbia Road Dam. Reactivated 1985.

WQM: 34

STORET#:	460734	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	BROWN
NEAREST TOWN:	STRATFORD	TOWNSHIP:	T122N R62W SEC 31; SE,SE,NE
EPA UIC:	0100111	LONGITUDE:	981946
BENEFICIAL USES:	5,8,9,10	LATITUDE:	452023

DESCRIPTION:
North-South Brown County road 16, 0.8 mile north of County 16 and County 23 junction.

WQM: 35

STORET#:	460735	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER	USGS#:	06476000
FREQUENCY:	QUARTERLY	COUNTY:	BEADLE
NEAREST TOWN:	HURON	TOWNSHIP:	T111N R61W SEC 16; SW,SE,SE
EPA UIC:	0110111	LONGITUDE:	980913
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	442457

DESCRIPTION:
At north-south gravel road bridge, 3 miles east and 3 miles north of SD Hwy 37 and US Hwy 14 intersection. Approximately 6 miles northeast of Huron WWTF.

WQM: 36

STORET#:	460736	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	BEADLE
NEAREST TOWN:	HURON	TOWNSHIP:	T110N R61W SEC 33; SW,SE,SE
EPA UIC:	0100111	LONGITUDE:	980956
BENEFICIAL USES:	5,8,9,10	LATITUDE:	441700

DESCRIPTION:
At east-west gravel road bridge, 6 miles south and 2.4 miles east of SD Hwy 37 and US Hwy 14 junction or 9.2 miles south and 0.75 mile west of WQM 35. Approximately 5 miles southeastof Huron WWTF.

WQM: 37

STORET#:	460737	REGIONAL OFFICE:	SFRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	DAVISON
NEAREST TOWN:	MITCHELL	TOWNSHIP:	T103N R60W SEC 25; NE,NE,NE
EPA UIC:	0100111	LONGITUDE:	985809
BENEFICIAL USES:	5,8,9,10	LATITUDE:	434209

DESCRIPTION:
At east-west SD Hwy 38 bridge, 3 miles east of SD Hwys 38 and 37 western junction. Approximately 1.8 miles above Mitchell WWTF.

WQM: 38

STORET#:	460738	REGIONAL OFFICE:	SFRO
STREAM:	JAMES RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	HUTCHINSON
NEAREST TOWN:	MENNO/OLIVET	TOWNSHIP:	T98N R57W SEC 31; NW,NE
EPA UIC:	0100111	LONGITUDE:	973755
BENEFICIAL USES:	5,8,9,10	LATITUDE:	431612

DESCRIPTION:
At east-west gravel road bridge, 4 miles north and 2.6 miles west of Menno. Approximately 13 -15 miles above Menno WWTF.

WQM: 39

STORET#:	460039	REGIONAL OFFICE:	CENTRAL
STREAM:	MOREAU RIVER	USGS#:	06359500
FREQUENCY:	QUARTERLY	COUNTY:	PERKINS
NEAREST TOWN:	USTA	TOWNSHIP:	T14N R16E SEC 10; NW,NW,NE
EPA UIC:	0100111	LONGITUDE:	1020920
BENEFICIAL USES:	5,8,9,10	LATITUDE:	451152

DESCRIPTION:
At north-south SD Hwy 73 bridge, 1.7 miles south of Usta.

WQM: 40

STORET#:	460640	REGIONAL OFFICE:	CENTRAL
STREAM:	GRAND RIVER	USGS#:	06357500
FREQUENCY:	QUARTERLY	COUNTY:	PERKINS
NEAREST TOWN:	SHADEHILL	TOWNSHIP:	T21N R16E SEC 29; NW,NW,NE
EPA UIC:	1000111	LONGITUDE:	1021028
BENEFICIAL USES:	3,8,9,10	LATITUDE:	454538

DESCRIPTION:
At north-south SD Hwy bridge 73 bridge, 0.4 mile south of Shadehill and 12 miles south of Lemmon. Approximately 1.5 miles below Shadehill Reservoir.

WQM: 41

STORET#:	460841	REGIONAL OFFICE:	CENTRAL
STREAM:	BAD RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	HAAKON
NEAREST TOWN:	POWELL	TOWNSHIP:	T1N R22E SEC 17; SE,SE,SE
EPA UIC:	0100111	LONGITUDE:	1012912
BENEFICIAL USES:	6,8,9,10	LATITUDE:	440218

DESCRIPTION:
At north-south gravel road bridge, approximately 1.5 miles south of US Hwy 14, south of Powell, or 9 miles east of Philip, at confluence with White Willow Creek.

WQM: 42

STORET#:	460842	REGIONAL OFFICE:	BHRO
STREAM:	WHITE RIVER	USGS#:	06446000
FREQUENCY:	QUARTERLY	COUNTY:	SHANNON
NEAREST TOWN:	OGLALA	TOWNSHIP:	T37N R46N SEC 18;
EPA UIC:	0100111	LONGITUDE:	1024819
BENEFICIAL USES:	5,8,9,10	LATITUDE:	431118

DESCRIPTION:
At east-west US Hwy 18 bridge, 3 miles west of Oglala.

WQM: 43

STORET#:	460843	REGIONAL OFFICE:	BHRO
STREAM:	LITTLE WHITE RIVER	USGS#:	06449000
FREQUENCY:	INACTIVE	COUNTY:	BENNETT
NEAREST TOWN:	TUTHILL	TOWNSHIP:	T37N R35W SEC 17; SW,SW
EPA UIC:	0100111	LONGITUDE:	1012940
BENEFICIAL USES:	5,8,9,10	LATITUDE:	431033

DESCRIPTION:
At northwest-southeast blacktop road bridge, 1.3 miles north of Tuthill.

WQM: 44

STORET#:	460844	REGIONAL OFFICE:	BHRO
STREAM:	LAKE CREEK	USGS#:	06449000
FREQUENCY:	INACTIVE	COUNTY:	BENNETT
NEAREST TOWN:	TUTHILL	TOWNSHIP:	T37N R35W SEC 29
EPA UIC:	1000111	LONGITUDE:	1012940
BENEFICIAL USES:	4,8,9,10	LATITUDE:	430900

DESCRIPTION:
At north-south blacktop road bridge, 0.5 mile south of Tuthill (1.8 miles south of WQM 43), 1 mile below LaCreek National Wildlife Refuge.

WQM: 45

STORET#:	460645	REGIONAL OFFICE:	NELRO
STREAM:	LACQUI PARLE RIVER	USGS#:	
FREQUENCY:	BIYEARLY	COUNTY:	DEUEL
NEAREST TOWN:	GARY	TOWNSHIP:	T115N R47W SEC 3; NE,NW
EPA UIC:	1000111	LONGITUDE:	962707
BENEFICIAL USES:	3,8,9,10	LATITUDE:	444813

DESCRIPTION:
(Gary Creek) - At north-south gravel road, 0.7 mile north of Gary on SD -MN state line.

WQM: 46

STORET#:	460646	REGIONAL OFFICE:	BHRO
STREAM:	CASTLE CREEK	USGS#:	06409000
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	MYSTIC	TOWNSHIP:	T1N R47W SEC 3; NE,SE,SW
EPA UIC:	1000111	LONGITUDE:	1033825
BENEFICIAL USES:	2,8,9,10	LATITUDE:	440437

DESCRIPTION:
0.25 mile east of Mystic on Pennington Co. Hwy 331. Sample site 40 feet upstream of small wooden bridge - west bank.

WQM: 47

STORET#:	460647	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	ROCHFORD	TOWNSHIP:	T2N R3E SEC 24; SE,NE,SE
EPA UIC:	1011111	LONGITUDE:	1034138
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	440653

DESCRIPTION:
At concrete bridge along dirt road, just off main Rochford road, 2 miles southeast of Rochford.

WQM: 48

STORET#:	460648	REGIONAL OFFICE:	BHRO
STREAM:	SPRING CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	PENNINGTON
NEAREST TOWN:	HILL CITY	TOWNSHIP:	T1S R1S SEC 30; NE,NE,SE
EPA UIC:	1001111	LONGITUDE:	1033335
BENEFICIAL USES:	3,7,8,9,10	LATITUDE:	435616

DESCRIPTION:
At US Hwy 385 bridge, approximately 1.2 miles northeast of Hill City, directly across from Harney Ranger Station.

WQM: 49

STORET#:	460649	REGIONAL OFFICE:	BHRO
STREAM:	SPRING CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	PENNINGTON
NEAREST TOWN:	RAPID CITY	TOWNSHIP:	T1S R6E SEC 4
EPA UIC:	1001111	LONGITUDE:	1032432
BENEFICIAL USES:	3,7,8,9,10	LATITUDE:	435920

DESCRIPTION:
At Sheridan Lake Road bridge near Bitter Creek Campground, approximately 4 miles east of Sheridan Lake Road and US Hwy 385 junction.

WQM: 50

STORET#:	460650	REGIONAL OFFICE:	BHRO
STREAM:	GRACE COOLIDGE CREEK	USGS#:	06406998
FREQUENCY:	QUARTERLY	COUNTY:	CUSTER
NEAREST TOWN:	GAME LODGE	TOWNSHIP:	T3S R6E SEC 26; NW,SE,SE
EPA UIC:	1000111	LONGITUDE:	1032212
BENEFICIAL USES:	2,8,9,10	LATITUDE:	434527

DESCRIPTION:
0.7 mile east of Coolidge Inn Game Lodge Resort in Custer State Park, SD Hwy 36, just west of airport road. Sampling site is on west bank, 45 feet upstream of two large culverts.

WQM: 51

STORET#:	460651	REGIONAL OFFICE:	BHRO
STREAM:	FRENCH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	CUSTER
NEAREST TOWN:	BLUEBELL LODGE	TOWNSHIP:	T4S R5E SEC 12; SW,NW,NE
EPA UIC:	1000111	LONGITUDE:	1032828
BENEFICIAL USES:	3,8,9,10	LATITUDE:	434258

DESCRIPTION:
At bridge, 0.4 mile off SD Hwy 87, east of Bluebell Lodge in Custer State Park. Sampling site is on east bank around 20 feet upstream of bridge.

WQM: 52

STORET#:	460652	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	06436190
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	WHITEWOOD	TOWNSHIP:	T6N R4E SEC 22; NW,NE,SW
EPA UIC:	0100111	LONGITUDE:	1033733
BENEFICIAL USES:	5,8,9,10	LATITUDE:	442824

DESCRIPTION:
At Whitewood Valley Road bridge, 0.6 mile north of I-90. Sample site is on east bank at south edge of the bridge.

WQM: 53

STORET#:	460653	REGIONAL OFFICE:	BHRO
STREAM:	FRENCH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	CUSTER
NEAREST TOWN:	CUSTER	TOWNSHIP:	T3S R5E SEC 20; SE,NE,SE
EPA UIC:	0000111	LONGITUDE:	1033220
BENEFICIAL USES:	3,8,9,10	LATITUDE:	434622

DESCRIPTION:
2.1 miles east of US Hwy 16 and SD Hwy 89 (north) junction, on Outlaw Ranch Road bridge, 0.4 mile off US Hwy 16.

WQM: 54

STORET#:	460654	REGIONAL OFFICE:	BHRO
STREAM:	SPRING CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	SHERIDAN LAKE	TOWNSHIP:	T1S R5E SEC 14; NE,SW,SW
EPA UIC:	1001111	LONGITUDE:	1032909
BENEFICIAL USES:	3,7,8,9,10	LATITUDE:	435748

DESCRIPTION:
Influent to Sheridan Lake, west bank upstream of access road bridge to south side picnic area and beach.

WQM: 55

STORET#:	460655	REGIONAL OFFICE:	NELRO
STREAM:	BIG SIOUX RIVER	USGS#:	06479438
FREQUENCY:	MONTHLY	COUNTY:	CODINGTON
NEAREST TOWN:	WATERTOWN	TOWNSHIP:	T117N R53W SEC 13; NW,SW,SW
EPA UIC:	0110111	LONGITUDE:	970845
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	445633

DESCRIPTION:
At north-south blacktop road bridge, 1.3 miles north of SD Hwy 23, 1.7 miles east of inlet-outlet to Lake Kampeska.

WQM: 56

STORET#:	460656	REGIONAL OFFICE:	BHRO
STREAM:	CHEYENNE RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	PENNINGTON
NEAREST TOWN:	SCENIC	TOWNSHIP:	T2S R12E SEC 2; SE,NE,SE
EPA UIC:	0101111	LONGITUDE:	1023835
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	435352

DESCRIPTION:
At northwest-southeast SD Hwy 44 bridge, approximately 8 miles northwest of Scenic.

WQM: 57

STORET#:	460657	REGIONAL OFFICE:	BHRO
STREAM:	FALL RIVER	USGS#:	06402000
FREQUENCY:	INACTIVE	COUNTY:	FALL RIVER
NEAREST TOWN:	HOT SPRINGS	TOWNSHIP:	T8S R6E SEC 4; NE,SW,NW
EPA UIC:	1010111	LONGITUDE:	1032419
BENEFICIAL USES:	1,3,8,9,10	LATITUDE:	432310

DESCRIPTION:
North-south gravel road bridge just north os US Hwy 18, just above confluence with the Cheyenne River. Approximately 5 miles southeast of Hot Springs, below WWTF.

WQM: 58

STORET#:	460658	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	06436170
FREQUENCY:	INACTIVE	COUNTY:	LAWRENCE
NEAREST TOWN:	LEAD	TOWNSHIP:	T5N R3E SEC 33;
EPA UIC:	1001111	LONGITUDE:	1034507
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442057

DESCRIPTION:
Approximately 3 stream miles above Homestake Mining Company discharge point, on gravel road west of Hwy 385. SE 1/4, NE 1/4, S 1/2.

WQM: 59

STORET#:	460659	REGIONAL OFFICE:	BHRO
STREAM:	GOLD RUN CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	PLUMA	TOWNSHIP:	T5N R3E SEC 27; SE,SW,SW
EPA UIC:	0000011	LONGITUDE:	1034422
BENEFICIAL USES:	9,10	LATITUDE:	442134

DESCRIPTION:
Above confluence with Whitewood Creek, just before flow goes underground at intersection of U.S Hwys 385 and 85.

WQM: 60

STORET#:	460660	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	06436170
FREQUENCY:	INACTIVE	COUNTY:	LAWRENCE
NEAREST TOWN:	DEADWOOD	TOWNSHIP:	T5N R3E SEC 13; SW,SE
EPA UIC:	100111	LONGITUDE:	1034303
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442310

DESCRIPTION:
At northeast city limits of Deadwood, 0.3 mile southwest of intersection of Hwys 85 and 14A, near bridge and just off of Hwy 85.

WQM: 61

STORET#:	460661	REGIONAL OFFICE:	SFRO
STREAM:	VERMILLION RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	TURNER
NEAREST TOWN:	CHANCELLOR	TOWNSHIP:	T99N R53W SEC24; SW,SE,SE
EPA UIC:	0100111	LONGITUDE:	970315
BENEFICIAL USES:	5,8,9,10	LATITUDE:	432223

DESCRIPTION:
At east-west SD Hwy 44 bridge, 3.5 miles west of Chancellor.

WQM: 62

STORET#:	460662	REGIONAL OFFICE:	NELRO
STREAM:	BIG SIOUX RIVER	USGS#:	06480000
FREQUENCY:	MONTHLY	COUNTY:	BROOKINGS
NEAREST TOWN:	BROOKINGS	TOWNSHIP:	T110N R50W SEC 32; NW,NW
EPA UIC:	0110111	LONGITUDE:	965204
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	441750

DESCRIPTION:
At east-west blacktop road (Cemetary Road) bridge, 2 miles south of US Hwys 14 and 77 junction (Main street) and 3.3 miles west.

WQM: 63

STORET#:	460663	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	MOODY
NEAREST TOWN:	EGAN	TOWNSHIP:	T106N R48W SEC 7; NE,NE,NE
EPA UIC:	0110111	LONGITUDE:	963745
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	440028

DESCRIPTION:
At east-west SD Hwy 34 bridge, just northeast of Egan.

WQM: 64

STORET#:	460664	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T101N R50W SEC 9; SE,SW,SW
EPA UIC:	0110111	LONGITUDE:	964314
BENEFICIAL USES:	1,5,7,8,9,10	LATITUDE:	433334

DESCRIPTION:
At north-south McClellan street bridge in Sioux Falls immediately below the Falls Park (the river runs north at this site). Approximately 0.5 stream miles above Morrell's WWTF.

WQM: 65

STORET#:	460665	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LINCOLN
NEAREST TOWN:	CANTON	TOWNSHIP:	T98N R48N SEC 16; SW,SW
EPA UIC:	0101111	LONGITUDE:	963137
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	431824

DESCRIPTION:
At east-west US Hwy 18 bridge, 3 miles east of Canton. Approximately 3 stream miles upstream of Canton WWTF on SD -IA border.

WQM: 66

STORET#:	460666	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LINCOLN
NEAREST TOWN:	HUDSON	TOWNSHIP:	T96N R47W SEC 18; SW,NE,NE
EPA UIC:	0101111	LONGITUDE:	962635
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	430807

DESCRIPTION:
At northeast-southwest county road bridge, 0.5 mile east of Hudson, on SD-IA border.

WQM: 67

STORET#:	460667	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	UNION
NEAREST TOWN:	ALCESTER	TOWNSHIP:	T95N R48W SEC 34; SE,SW
EPA UIC:	0101111	LONGITUDE:	962953
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	430000

DESCRIPTION:
At northwest-southeastcounty road bridge, 0.5 mile south of Alcester and 6.5 miles east -southeast.

WQM: 68

STORET#:	460668	REGIONAL OFFICE:	NELRO
STREAM:	SIX MILE CREEK	USGS#:	06479910
FREQUENCY:	INACTIVE	COUNTY:	BROOKINGS
NEAREST TOWN:	BROOKINGS	TOWNSHIP:	T110N R50W SEC 22; SE,SE
EPA UIC:	0100111	LONGITUDE:	965842
BENEFICIAL USES:	6,8,9,10	LATITUDE:	441842

DESCRIPTION:
At east-west gravel road bridge, just west of US Hwy 14 curve on west end of 6th street. Just above old WWTF

WQM: 69

STORET#:	460669	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	06414000
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	RAPID CITY	TOWNSHIP:	T1N R7E SEC 18; SW,NE,NW
EPA UIC:	1011111	LONGITUDE:	1031904
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	440242

DESCRIPTION:
At east-west bridge on Dark Canyon road, just west of SD Hwy 44 and Cleghorn Fish Hatchery.

WQM: 70

STORET#:	460670	REGIONAL OFFICE:	CENTRAL
STREAM:	PONCA CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	GREGORY
NEAREST TOWN:	ST. CHARLES	TOWNSHIP:	T95N R70W SEC 22; SE,SE,NE
EPA UIC:	0100111	LONGITUDE:	990558
BENEFICIAL USES:	5,8,9,10	LATITUDE:	430146

DESCRIPTION:
At north-south gravel road bridge, 1 mile east of St. Charles on US Hwy 18 and 4 miles south.

WQM: 71

STORET#:	460671	REGIONAL OFFICE:	CENTRAL
STREAM:	MISSOURI RIVER	USGS#:	06440000
FREQUENCY:	INACTIVE	COUNTY:	HUGHES
NEAREST TOWN:	PIERRE	TOWNSHIP:	T111N R80W SEC 1; NE,NE,SE
EPA UIC:	1011111	LONGITUDE:	1002329
BENEFICIAL USES:	1,2,7,8,9,10,11	LATITUDE:	442730

DESCRIPTION:
Oahe Dam generator intake water, inside of power house. Sampled by Corps of Engineers.

WQM: 72

STORET#:	460672	REGIONAL OFFICE:	CENTRAL
STREAM:	MISSOURI RIVER	USGS#:	06442700
FREQUENCY:	INACTIVE	COUNTY:	LYMAN
NEAREST TOWN:	FT. THOMPSON	TOWNSHIP:	T107N R72W SEC 27; SE
EPA UIC:	0111111	LONGITUDE:	992645
BENEFICIAL USES:	1,4,7,8,9,10,11	LATITUDE:	440218

DESCRIPTION:
Big Bend Dam generator intake water, inside power plant. Sampled by Corps of Engineers.

WQM: 73

STORET#:	460673	REGIONAL OFFICE:	CENTRAL
STREAM:	MISSOURI RIVER	USGS#:	06453000
FREQUENCY:	INACTIVE	COUNTY:	CHARLES MIX
NEAREST TOWN:	PICKSTOWN	TOWNSHIP:	T95N R65W SEC 8; NW,NE
EPA UIC:		LONGITUDE:	983311
BENEFICIAL USES:	1,4,7,8,9,10,11	LATITUDE:	430355

DESCRIPTION:
Ft. Randall Dam generator intake water, inside power plant. Sampled by Corps of Engineers.

WQM: 74

STORET#:	460674	REGIONAL OFFICE:	SFRO
STREAM:	MISSOURI RIVER	USGS#:	06467500
FREQUENCY:	INACTIVE	COUNTY:	CEDAR, NE
NEAREST TOWN:	YANKTON	TOWNSHIP:	T93N R1W SEC 7; SW,NE,SE
EPA UIC:	1011111	LONGITUDE:	972854
BENEFICIAL USES:	1,4,7,8,9,10,11	LATITUDE:	425056

DESCRIPTION:
Gavins Point Dam generator intake water, inside power plant. Sampled by Corps of Engineers.

WQM: 75

STORET#:	460675	REGIONAL OFFICE:	BHRO
STREAM:	STRAWBERRY CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	PLUMA	TOWNSHIP:	T5N R3E SEC 34; NE,SW,NW
EPA UIC:	1000111	LONGITUDE:	1034416
BENEFICIAL USES:	2,8,9,10	LATITUDE:	442108

DESCRIPTION:
Near Pluma, north side of US Hwy 385, 0.5 miles south of US Hwys 85 and 385 junction.

WQM: 76

STORET#:	460676	REGIONAL OFFICE:	BHRO
STREAM:	BELLE FOURCHE RIVER	USGS#:	06438000
FREQUENCY:	INACTIVE	COUNTY:	MEADE
NEAREST TOWN:	ELM SPRINGS	TOWNSHIP:	T5N R13E SEC 29; NE,NE,NE
EPA UIC:	0101111	LONGITUDE:	1023357
BENEFICIAL USES:	4,7,8,9,10	LATITUDE:	442213

DESCRIPTION:
North-south road bridge between Enning and Elm Springs, 14.25 miles straight south of Enning or 5 miles north of Elm Springs.

WQM: 77

STORET#:	460677	REGIONAL OFFICE:	CENTRAL
STREAM:	NORTH FORK GRAND RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	PERKINS
NEAREST TOWN:	LEMMON	TOWNSHIP:	T21N R14E SEC 11; NW,NW
EPA UIC:	0100111	LONGITUDE:	1022140
BENEFICIAL USES:	6,8,9,10	LATITUDE:	454954

DESCRIPTION:
At north-south county road bridge, 9.5 miles south of White Butte or 9 miles east of Lemmon and SD Hwy 73, then 9.5 miles south.

WQM: 78

STORET#:	460678	REGIONAL OFFICE:	CENTRAL
STREAM:	SOUTH FORK GRAND RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	PERKINS
NEAREST TOWN:	BISON	TOWNSHIP:	T19N R14E SEC 18; SW,NW
EPA UIC:	0100111	LONGITUDE:	1022717
BENEFICIAL USES:	5,8,9,10	LATITUDE:	453637

DESCRIPTION:
North-south county road bridge, 5.5 miles north of Bison.

WQM: 79

STORET#:	460679	REGIONAL OFFICE:	BHRO
STREAM:	BOX ELDER CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	PENNINGTON
NEAREST TOWN:	NEW UNDERWOOD	TOWNSHIP:	T2N R11E SEC 31; SE,NE
EPA UIC:	0100111	LONGITUDE:	1025001
BENEFICIAL USES:	4,8,9,10	LATITUDE:	440519

DESCRIPTION:
At north-south FAS 6121 road bridge, 0.5 mile south of old SD Hwy 16, on south edge of New Underwood.

WQM: 80

STORET#:	460680	REGIONAL OFFICE:	NELRO
STREAM:	WILLOW CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	CODINGTON
NEAREST TOWN:	WATERTOWN	TOWNSHIP:	T116N R52W SEC 9; NW,NW
EPA UIC:	0100111	LONGITUDE:	970501
BENEFICIAL USES:	6,8,9,10	LATITUDE:	445236

DESCRIPTION:
At east-west gravel road bridge, 1.25 miles east of US Hwy 81 and 1.0 mile south of US Hwy 212, near south end of ponds and I/P basins.

WQM: 81

STORET#:	460681	REGIONAL OFFICE:	BHRO
STREAM:	BELLE FOURCHE RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	BUTTE
NEAREST TOWN:	VALE	TOWNSHIP:	T8N R6E SEC 19; SE,SE
EPA UIC:	0101111	LONGITUDE:	1032536
BENEFICIAL USES:	4,7,8,9,10	LATITUDE:	443840

DESCRIPTION:
At north-south SD Hwy 79 bridge, 1 mile west and 1 mile north of Vale. Approximately 2 stream miles downstream from Whitewood Creek confluence, 2.8 miles south of junction of Hwys 212 and 79.

WQM: 82

STORET#:	460682	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	BUTTE
NEAREST TOWN:	VALE	TOWNSHIP:	T8N R5E SEC 26; SE,SE
EPA UIC:	0101111	LONGITUDE:	1032818
BENEFICIAL USES:	5,8,9,10	LATITUDE:	443711

DESCRIPTION:
At northwest-southeast gravel road bridge, 3.3 miles east of Vale. Approximately 1.5 stream miles before Belle Fourche River confluence.

WQM: 83

STORET#:	460683	REGIONAL OFFICE:	BHRO
STREAM:	BELLE FOURCHE RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	BUTTE
NEAREST TOWN:	NISLAND	TOWNSHIP:	T8N R5E SEC 10; NE,SE
EPA UIC:	1001111	LONGITUDE:	1032929
BENEFICIAL USES:	3,7,8,9,10	LATITUDE:	444014

DESCRIPTION:
At northwest-southwest gravel road bridge, 3 miles west then 0.5 mile south (of Hwy 212) of junction of Hwys 212 and 79. Approximately 5 stream miles from Whitewood Creek confluence.

WQM: 84

STORET#:	460684	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	CROOK CITY	TOWNSHIP:	T6N R4E SEC 33; NE,NE
EPA UIC:	1001111	LONGITUDE:	1033742
BENEFICIAL USES:	3,7,8,9,10	LATITUDE:	442632

DESCRIPTION:
At east-west spur bridge, 0.2 mile east of Crook City or 1.0 mile south of Whitewood.

WQM: 85

STORET#:	460685	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	06436170
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	DEADWOOD	TOWNSHIP:	T5N R3E SEC 13; SW,SW
EPA UIC:	1001111	LONGITUDE:	1034218
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442322

DESCRIPTION:
Site is 0.4 mile downstream of Hwy 85 and 14A junction. Station established as a downstream bracket for the Lead-Deadwood Sanitary District WWTF discharge. Station located at bridge, just inside entrance to Dakota Placers Mining Company.

WQM: 86

STORET#:	460686	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	PLUMA	TOWNSHIP:	T5N R3E SEC 13; SW,SE
EPA UIC:	1001111	LONGITUDE:	1034420
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442132

DESCRIPTION:
Immediately above confluence with Gold Run Creek (and Homestake Discharge). Upstream side of US Hwy 85 bridge, 100 feet east of US Hwy 85 and 385.

WQM: 87

STORET#:	460687	REGIONAL OFFICE:	NELRO
STREAM:	SOUTH FORK YELLOW BANK RIVER	USGS#:	
FREQUENCY:	BIYEARLY	COUNTY:	GRANT
NEAREST TOWN:	ALBEE	TOWNSHIP:	T118N R47W SEC 9; NW,NE
EPA UIC:	1000111	LONGITUDE:	952803
BENEFICIAL USES:	3,8,9,10	LATITUDE:	450302

DESCRIPTION:
At east-west county road bridge, 4 miles east of Albee (8 miles east of US Hwy 77).

WQM: 88

STORET#:	460688	REGIONAL OFFICE:	NELRO
STREAM:	NORTH FORK YELLOW BANK RIVER	USGS#:	
FREQUENCY:	BIYEARLY	COUNTY:	GRANT
NEAREST TOWN:	BIG STONE CITY	TOWNSHIP:	T120N R47W SEC 17; NE,NE
EPA UIC:	0100111	LONGITUDE:	962834
BENEFICIAL USES:	4,8,9,10	LATITUDE:	451227

DESCRIPTION:
At north-south county road bridge, 5 miles south of Big Stone City and 8 miles east of US Hwy 77.

WQM: 89

STORET#:	460689	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	BELLE FOURCHE	TOWNSHIP:	T7N R2E SEC 9; NW,NW
EPA UIC:	1011111	LONGITUDE:	1035310
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	443521

DESCRIPTION:
Last culvert on creek before Redwater River confluence, 1 mile west of US Hwy 85 and 5 miles north of US Hwy 14 and I-90.

WQM: 90

STORET#:	460690	REGIONAL OFFICE:	NELRO
STREAM:	SOUTH FORK WHETSTONE RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	GRANT
NEAREST TOWN:	MILBANK	TOWNSHIP:	T120N R48W SEC 6; SW,SW
EPA UIC:	0100111	LONGITUDE:	963802
BENEFICIAL USES:	6,8,9,10	LATITUDE:	451328

DESCRIPTION:
At bridge, 5 blocks east of SD Hwy 15, 1 block off Main Street. Site is above the WWTF and below Lake Farley.

WQM: 91

STORET#:	460691	REGIONAL OFFICE:	NELRO
STREAM:	SOUTH FORK WHETSTONE RIVER	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	GRANT
NEAREST TOWN:	MILBANK	TOWNSHIP:	T120N R48N SEC 6; NE,SE
EPA UIC:	0100111	LONGITUDE:	963708
BENEFICIAL USES:	6,8,9,10	LATITUDE:	451338

DESCRIPTION:
At north-south gravel road bridge, 0.2 mile north of St. Lawrence cemetary, 0.5 mile northeast of Milbank, be low WWTF.

WQM: 92

STORET#:	460692	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	06418900
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	RAPID CITY	TOWNSHIP:	T1N R9E SEC 30; SE,NE
EPA UIC:	0101111	LONGITUDE:	1030440
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	440120

DESCRIPTION:
Approximately 1.5 stream miles (0.4 mile) below Rapid City WWTF, 1.0 mile west of Rapid City municipal airport turnoff, or 4 miles southeast of Rapid City and 0.5 mile south on SD Hwy 44.

WQM: 93

STORET#:	460693	REGIONAL OFFICE:	BHRO
STREAM:	BEAR BUTTE CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	MEADE
NEAREST TOWN:	STURGIS	TOWNSHIP:	T5N R5E SEC 10; NW,NE
EPA UIC:	1000111	LONGITUDE:	1033043
BENEFICIAL USES:	3,8,9,10	LATITUDE:	442500

DESCRIPTION:
At east-west bridge on north edge of Sturgis where Junction Creek crosses creek.

WQM: 94

STORET#:	460694	REGIONAL OFFICE:	NELRO
STREAM:	MOCCASIN CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	ABERDEEN	TOWNSHIP:	T123N R64W SEC 25; NE,NE
EPA UIC:	0100111	LONGITUDE:	982830
BENEFICIAL USES:	9,10	LATITUDE:	452641

DESCRIPTION:
At east-west Melgaard Road bridge (south edge of Aberdeen), 0.8 mile west of Melgaard Park. Approximately 1.5 stream miles above Aberdeen WWTF.

WQM: 95

STORET#:	460695	REGIONAL OFFICE:	NELRO
STREAM:	MOCCASIN CREEK	USGS#:	06471898
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	ABERDEEN	TOWNSHIP:	T122N R64W SEC 13; NW,SW,SW
EPA UIC:	0100111	LONGITUDE:	982940
BENEFICIAL USES:	9,10	LATITUDE:	452349

DESCRIPTION:
At north-south Brown County oil road 10 bridge (1.0 mile east of US Hwy 281), 4.5 miles south of Aberdeen (Melgaard Road). Approximately 7.5 stream miles below Aberdeen WWTF.

WQM: 96

STORET#:	460696	REGIONAL OFFICE:	NELRO
STREAM:	TURTLE CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	SPINK
NEAREST TOWN:	REDFIELD	TOWNSHIP:	T116N R64W SEC 3; SE,SE,SE,
EPA UIC:	0100111	LONGITUDE:	983048
BENEFICIAL USES:	6,8,9,10	LATITUDE:	445301

DESCRIPTION:
At north-south US Hwy 281 bridge on north edge of Redfield. Approximately 1.75 stream miles above WWTF.

WQM: 97

STORET#:	460697	REGIONAL OFFICE:	NELRO
STREAM:	TURTLE CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	SPINK
NEAREST TOWN:	REDFIELD	TOWNSHIP:	T116N R64W SEC 2; NW,NE,NE
EPA UIC:	0100111	LONGITUDE:	983047
BENEFICIAL USES:	6,8,9,10	LATITUDE:	445301

DESCRIPTION:
At east-west gravel road bridge, 0.8 mile north and 0.7 mile east of WQM 96. Approximately 2.5 stream miles below Redfield WWTF.

WQM: 98

STORET#:	460698	REGIONAL OFFICE:	NELRO
STREAM:	LITTLE MINNESOTA RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	ROBERTS
NEAREST TOWN:	SISSETON	TOWNSHIP:	T126N R51W SEC 23; NW,NW,NW
EPA UIC:	1000111	LONGITUDE:	970110
BENEFICIAL USES:	3,8,9,10	LATITUDE:	454121

DESCRIPTION:
At north-south US Hwy bridge 81, 3 miles northeast of Sisseton. Approximately 1.0 stream mile above Sisseton WWTF.

WQM: 99

STORET#:	460699	REGIONAL OFFICE:	NELRO
STREAM:	LITTLE MINNESOTA RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	ROBERTS
NEAREST TOWN:	SISSETON	TOWNSHIP:	T126N R50W SEC 29; SW,SW,SW
EPA UIC:	1000111	LONGITUDE:	965708
BENEFICIAL USES:	3,8,9,10	LATITUDE:	453935

DESCRIPTION:
At east-west SD Hwy 10 bridge, 4 miles east of Sisseton. Approximately 5 miles below Sisseton WWTF.

WQM: 100

STORET#:	460100	REGIONAL OFFICE:	BHRO
STREAM:	FALL RIVER	USGS#:	06402000
FREQUENCY:	INACTIVE	COUNTY:	FALL RIVER
NEAREST TOWN:	HOT SPRINGS	TOWNSHIP:	T7S R6E SEC 33; NW,NE,NW
EPA UIC:	1010111	LONGITUDE:	1032454
BENEFICIAL USES:	1,3,8,9,10	LATITUDE:	432411

DESCRIPTION:
At northwest-southeast US Hwy 18 bridge, 3.8 miles southeast of US Hwy 18 and 385 junction. Approximately 3.5 stream miles below Hot Springs WWTF.

WQM: 101

STORET#:	460101	REGIONAL OFFICE:	BHRO
STREAM:	FALL RIVER	USGS#:	06402000
FREQUENCY:	INACTIVE	COUNTY:	FALL RIVER
NEAREST TOWN:	HOT SPRINGS	TOWNSHIP:	T7S R5E SEC 24; NW,NE,SE
EPA UIC:	1010111	LONGITUDE:	1032834
BENEFICIAL USES:	1,3,8,9,10	LATITUDE:	432550

DESCRIPTION:
At east-west bridge, 0.1 mile west of US Hwys 18 and 385 junction. Approximately 0.5 mile a bove Hot Springs WWTF.

WQM: 102

STORET#:	460102	REGIONAL OFFICE:	BHRO
STREAM:	FRENCH CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	CUSTER
NEAREST TOWN:	CUSTER	TOWNSHIP:	T3S R4E SEC 27; NE,SE,SE
EPA UIC:	1000111	LONGITUDE:	1033711
BENEFICIAL USES:	3,8,9,10	LATITUDE:	434610

DESCRIPTION:
0.5 mile west on US Hwy 16A from SD Hwy 89, then 0.1 mile south on gravel road.

WQM: 103

STORET#:	460103	REGIONAL OFFICE:	BHRO
STREAM:	BATTLE CREEK	USGS#:	06404000
FREQUENCY:	SEASONAL	COUNTY:	PENNINGTON
NEAREST TOWN:	KEYSTONE	TOWNSHIP:	T2S R6E SEC 8; NE,NW,SE
EPA UIC:	1000111	LONGITUDE:	1032533
BENEFICIAL USES:	2,8,9,10	LATITUDE:	435337

DESCRIPTION:
At east-west bridge, 100 yards west of US Hwy 16 and SD Hwy 40 junction.

WQM: 110

STORET#:	460110	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	PENNINGTON
NEAREST TOWN:	RAPID CITY	TOWNSHIP:	T1N R8E SEC 23; SE,NE,SE
EPA UIC:	0101111	LONGITUDE:	1030823
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	440124

DESCRIPTION:
At north-south bridge, 0.6 mile south of US Hwy 44 and county road C210. Approximately 2.5 stream miles (0.8 mile) above Rapid City WWTF. Established in January, 1983.

WQM: 111

STORET#:	460111	REGIONAL OFFICE:	BHRO
STREAM:	FLYNN CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	CUSTER
NEAREST TOWN:	BLUEBELL LODGE	TOWNSHIP:	T4N R5E SEC 25; S
EPA UIC:	1000111	LONGITUDE:	1032803
BENEFICIAL USES:	3,8,9,10	LATITUDE:	434059

DESCRIPTION:
Approximately 3 miles south of Bluebell Lodge on SD Hwy 87, northern most crossing of Flynn Creek. Established in November 1984.

WQM: 112

STORET#:	460112	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER/SAND LAKE	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	COLUMBIA	TOWNSHIP:	T127N R62W SEC 36; NW,NW,NW
EPA UIC:	0100111	LONGITUDE:	981715
BENEFICIAL USES:	5,8,9,10	LATITUDE:	454636

DESCRIPTION:
At west side of Houghton Dam dirt road, 1 mile north of SD Hwy 10 crossing. Or 1 mile north and 2 miles west of Houghton. Established in February, 1985.

WQM: 113

STORET#:	460113	REGIONAL OFFICE:	NELRO
STREAM:	JAMES RIVER/SAND LAKE	USGS#:	06471000
FREQUENCY:	MONTHLY	COUNTY:	BROWN
NEAREST TOWN:	COLUMBIA	TOWNSHIP:	T125N R62W SEC 4; SW,NW
EPA UIC:	0100111	LONGITUDE:	981831
BENEFICIAL USES:	5,8,9,10	LATITUDE:	454009

DESCRIPTION:
At north-south bridge on county road, 3.5 miles north of Columbia. Columbia Road Dam outlet to Sand Lake. Established in February, 1985.

WQM: 114

STORET#:	460114	REGIONAL OFFICE:	SFRO
STREAM:	ROCK RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	SIOUX, IA
NEAREST TOWN:	HAWARDEN, IOWA	TOWNSHIP:	T95N R47W SEC 6; NW,NE,NW
EPA UIC:	<T>LONGITUDE:	962643	
BENEFICIAL USES:	<T>LATITUDE:	430502	

DESCRIPTION:
At east-west gravel road bridge, just west of black-top road curve, 6 miles north of Hawarden, Iowa. Black-top road is approximately 0.1 mile east of IA Hwy 10 as it goes thru Hawarden, or 16 miles east of Beresford. Established in August, 1984.

WQM: 115

STORET#:	460115	REGIONAL OFFICE:	CENTRAL
STREAM:	BAD RIVER	USGS#:	06441000
FREQUENCY:	INACTIVE	COUNTY:	HAAKON
NEAREST TOWN:	MIDLAND	TOWNSHIP:	T1N R25E SEC 7; NW,NE
EPA UIC:	0100111	LONGITUDE:	1010908
BENEFICIAL USES:	6,8,9,10	LATITUDE:	440402

DESCRIPTION:
At north-south Hwy 63 bridge, approximately 0.2 mile south of Hwy 14. This station inactive as of 8/90.

WQM: 116

STORET#:	460116	REGIONAL OFFICE:	BHRO
STREAM:	STRAWBERRY CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	LEAD	TOWNSHIP:	T4N R4E SEC 8; NW,NW,NW
EPA UIC:	1000111	LONGITUDE:	1034027
BENEFICIAL USES:	2,8,9,10	LATITUDE:	441943

DESCRIPTION:
Station is located approximately 4 miles southeast of Lead. 0.1 mile southeast of the Brohm Mining Company administration building, on west side of stream.

WQM: 117

STORET#:	460117	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T102N R48W SEC 30;
EPA UIC:	<T>LONGITUDE:	963751	
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	433632

DESCRIPTION:
Approximately 1.75 stream miles downstream o f Sioux Falls WWTF discharge and 2.75 miles east of I -229 and I-90 interchange. Station located on north side of river along service road that runs parallel with I -90.

WQM: 118

STORET#:	460118	REGIONAL OFFICE:	BHRO
STREAM:	WHITETAIL CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	LEAD	TOWNSHIP:	T4N R3E SEC 4; NE,NE
EPA UIC:	1001111	LONGITUDE:	1034529
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442034

DESCRIPTION:
Station located just above confluence with Whitewood Creek, at small br idge leading into Kirk Power Plant. Approximately 250 feet downstream of Kirk Power Plant Discharge.

WQM: 119

STORET#:	460119	REGIONAL OFFICE:	BHRO
STREAM:	FANTAIL CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	LEAD	TOWNSHIP:	T4N R3E SEC 5; SW,NW,NE
EPA UIC:	1001111	LONGITUDE:	1034728
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442012

DESCRIPTION:
0.75 mile southwest of the Lead city limits on SD Hwy Alt 14/85. Station is located immediately above Fantail/Nevada Gulch con fluence. Approximately 1300 feet up Nevada Gulch road at intersection.

WQM: 120

STORET#:	460120	REGIONAL OFFICE:	BHRO
STREAM:	STEWART GULCH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	LEAD	TOWNSHIP:	T4N R3E SEC 7; NE,NW
EPA UIC:	<T>LONGITUDE:	10348	
BENEFICIAL USES:	2,8,9,10	LATITUDE:	441933

DESCRIPTION:
1.75 miles southwest of the Lead city limits on SD Hwy Alt 14/85. Station is located approximately 100 feet above confluence with Whitetail Creek, on the west side of SD Hwy 14/85, at Golden Reward Mining Company flume.

WQM: 121

STORET#:	460121	REGIONAL OFFICE:	SFRO
STREAM:	SKUNK CREEK	USGS#:	06481500
FREQUENCY:	QUARTERLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T101N R50W SEC 24; NW,SW
EPA UIC:	<T>LONGITUDE:	964726	
BENEFICIAL USES:	6,8,9,10	LATITUDE:	433201

DESCRIPTION:
Station located on right bank approximately 5 feet downstream from bridge on Marion Road. Approximately 1.3 miles upstream from mouth, 1.8 miles downstream from small right bank tributary and 4 miles southwest of Sioux Falls.

WQM: 122

STORET#:	460122	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	DEADWOOD	TOWNSHIP:	T5N R3E
EPA UIC:	1001111	LONGITUDE:	103 44 20
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	44 21 15

DESCRIPTION:
Station located at bridge on Hwy 85, on Southwest edge of Deadwood city limits. NW 1/4, NE 1/4, SE 1/4, Sec 27. Station established to bracket HMC discharge (along with WQM 86).

WQM: 123

STORET#:	460123	REGIONAL OFFICE:	BHRO
STREAM:	WHITEWOOD CREEK	USGS#:	06436170
FREQUENCY:	MONTHLY	COUNTY:	LAWRENCE
NEAREST TOWN:	DEADWOOD	TOWNSHIP:	T5N R3E
EPA UIC:	1010111	LONGITUDE:	103 43 18
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	44 22 59

DESCRIPTION:
At Dunlap Avenue bridge, approximately .5 stream mile above the Rodeo grounds. Approximately .75 mile above Lead -Deadwood Sanitary District WWTF discharge. Station established as an upstream bracket for the LDSD discharge. SE 1/4, NW 1/4, SEC 23.

WQM: BS18

STORET#:	46BS18	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	MOODY
NEAREST TOWN:	FLANDREAU	TOWNSHIP:	T107N R48W SEC 16; NE,NE
EPA UIC:	0110111	LONGITUDE:	96 35 12
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	44 04 40

DESCRIPTION:
At north-south SD Hwy 13 bridge, approximately 2 miles north of Flandreau.

WQM: BS23

STORET#:	46BS23	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T102N R50W SEC 29; SE,NW
EPA UIC:	0110111	LONGITUDE:	964439
BENEFICIAL USES:	1,5,7,8,9,10	LATITUDE:	433635

DESCRIPTION:
Station established to replace BS24 due to increased traffic volume on Hwy 38A. Station located on South side of overpass, samples taken on East bank. Access is gained by the Service road. Established 6/91.

WQM: BS24

STORET#:	46BS24	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T102N R49W SEC 29; SE,SW
EPA UIC:	0110111	LONGITUDE:	964423
BENEFICIAL USES:	1,5,8,9,10	LATITUDE:	433607

DESCRIPTION:
At east-west SD Hwy 38A bridge, immediately above Diversion Dam. Station deactivated 6/91.

WQM: BS29

STORET#:	46BS29	REGIONAL OFFICE:	SFRO
STREAM:	BIG SIOUX RIVER	USGS#:	06482020
FREQUENCY:	MONTHLY	COUNTY:	MINNEHAHA
NEAREST TOWN:	SIOUX FALLS	TOWNSHIP:	T101N R49W SEC 11; NW,NW
EPA UIC:	0100111	LONGITUDE:	964113
BENEFICIAL USES:	5,7,8,9,10	LATITUDE:	433413

DESCRIPTION:

0.25 mile east of I-229 and 0.25 mile north of Brandon Road (Rice St). Approximately 1.5 stream miles above Sioux Falls WWTF. (1.5 stream miles below old WWTF).

WQM: MN31

STORET#:	46MN31	REGIONAL OFFICE:	BHRO
STREAM:	ANNIE CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	ELMORE	TOWNSHIP:	T4N R2E SEC 4; NW,SE,SE
EPA UIC:	1000111	LONGITUDE:	1035236
BENEFICIAL USES:	3,8,9,10	LATITUDE:	441949

DESCRIPTION:

From SD Hwy Alternate 14A at Elmore, north on gravel road #215 approximately 1.5 miles to old rail grade which crosses Annie Creek. Station is located at east side of cement culvert.

WQM: MN32

STORET#:	46MN32	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	ELMORE	TOWNSHIP:	T4N R2E SEC 9; SE,NW,SW,NW
EPA UIC:	1011111	LONGITUDE:	1035334
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	441927

DESCRIPTION:

From Elmore turnoff 1.0 mile north on SD Hwy Alternate 14. Station is just south of "Welcome to Spea rfish Lodge" sign. Sample immediately above large (24") log which has fallen across the stream at this point.

WQM: MN33

STORET#:	46MN33	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	ELMORE	TOWNSHIP:	T4N R2E SEC 5; SW,NW,SE,SE
EPA UIC:	1011111	LONGITUDE:	1035357
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	441955

DESCRIPTION:

From Elmore turnoff, approximately 1.5 miles north on SD Hwy Alternate 14. Spearfish Creek flows north at this point , then turns nearly due west at the road (14A). Sampling site is marked with blue flagging. Park on west side of Highway.

WQM: MN34

STORET#:	46MN34	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	ELMORE	TOWNSHIP:	T4N R2E SEC 5; NW,NW,SW,SE
EPA UIC:	1011111	LONGITUDE:	1035410
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	441956

DESCRIPTION:

From Elmore turnoff, approximately 1.75 miles north on SD Hwy Alternate 14. Station is located approx imately 70 feet east of a red cabin that has a wide pullout/turnaround from SD Hwy Alternate 14. Station is marked with blue flagging.

WQM: MN35

STORET#:	46MN35	REGIONAL OFFICE:	BHRO
STREAM:	SPEARFISH CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	MAURICE	TOWNSHIP:	T6N R2E SEC 33; SE
EPA UIC:	1011111	LONGITUDE:	1035230
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	442644

DESCRIPTION:
Station located approximately 3.8 miles north of Maurice on SD Hwy Alternate 14. Sampling site is situated on the west side of the stream as it makes a sharp turn to the east. Approximately 4.25 miles south of Spearfish on SD Hwy Alternate 14.

WQM: MN36

STORET#:	46MN36	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	PENNINGTON
NEAREST TOWN:	ROCHFORD	TOWNSHIP:	T2N R4E SEC 19; SW,SW
EPA UIC:	1000111	LONGITUDE:	1034137
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	440651

DESCRIPTION:
Station located immediately below confluence of Bloody Gulch and Rapid Creek (on ea st side of bridge).

WQM: MN37

STORET#:	46MN37	REGIONAL OFFICE:	BHRO
STREAM:	RAPID CREEK	USGS#:	
FREQUENCY:	INACTIVE	COUNTY:	PENNINGTON
NEAREST TOWN:	MYSTIC	TOWNSHIP:	T2N R4E SEC 28; SW,NE
EPA UIC:	1000111	LONGITUDE:	1033826
BENEFICIAL USES:	1,2,7,8,9,10	LATITUDE:	440615

DESCRIPTION:
Station located immediately below CB&Q railroad crossing, approximately 2.50 miles north of Mystic.

WQM: MN38

STORET#:	46MN38	REGIONAL OFFICE:	BHRO
STREAM:	FALSE BOTTOM CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	MAITLAND	TOWNSHIP:	T5N R3E SEC 18; NW,NW
EPA UIC:	1000111	LONGITUDE:	1034827
BENEFICIAL USES:	3,8,9,10	LATITUDE:	442356

DESCRIPTION:
Station located approximately .50 mile northwest of Maitland on south side of road.

WQM: MN39

STORET#:	46MN39	REGIONAL OFFICE:	BHRO
STREAM:	SQUAW CREEK	USGS#:	
FREQUENCY:	QUARTERLY	COUNTY:	LAWRENCE
NEAREST TOWN:	MAURICE	TOWNSHIP:	T5N R2E SEC 17; NE,NE
EPA UIC:	1000111	LONGITUDE:	1035338
BENEFICIAL USES:	2,7,8,9,10	LATITUDE:	442404

DESCRIPTION:
Station located at mouth of Squaw Creek, immediately above confluence with Spearfish Creek.

208	208	209	209	210
210	211	211	212	212
213	213	214	214	215
215	216	216	217	217
218	218	219	219	220
220	221	222	222	223
223	224	224	225	225
226	226	227	227	228
228	229	230	230	231
231	232	232	233	233
234	234	235	235	236
236	236	237	237	238