SD Department of Environment & Natural Resources
Watershed Protection Program
Total Maximum Daily Load

Hiddenwood Watershed, Walworth County South Dakota
February 1999

These TMDLs were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the US Environmental Protection Agency. The 1998 303(d) Waterbody List identified Hiddenwood Lake as impaired by a measure of Trophic State Index (TSI) which serves as an indicator of the trophic condition of the lake. Individual TMDLs for accumulated sediment and total phosphorus, both contained within the TSI measure, have been developed and are supported below.

TMDL Summary for Accumulated Sediment

Waterbody Name	**Lake Hiddenwood**
Hydrologic Unit Code (HUC)	10130106
TMDL Pollutant	**Accumulated sediment**
Natural Allocation	94 % of loading attributable to natural background
Water Quality Target	Increase/maintain lake storage capacity by 53 acre feet
TMDL Goal	5 % decrease in sediment loads from watershed
303(d) Listing Status	1998 303(d) Waterbody List, Priority 2, Page 23
Targeted Beneficial Uses	Immersion recreation; limited contact recreation; warmwater semipermanent fish life propagation
Reference Documents	Lake Hiddenwood Field Study; Lake Hiddenwood Restoration and Protection Project Proposal

TMDL Summary for Phosphorus

Waterbody Name	**Lake Hiddenwood**
Hydrologic Unit Code (HUC)	10130106
TMDL Pollutant	**Total phosphorus**
Natural Allocation	95 % of loading attributable to natural background
Water Quality Target	Increased visitor days/camp site use; decreased incidence of winter fish kills
TMDL Goal	2% decrease in total phosphorus loads from watershed
303(d) Listing Status	1998 303(d) Waterbody List, Priority 2, Page 23
Targeted Beneficial Uses	Immersion recreation; limited contact recreation; warmwater semipermanent fish life propagation
Reference Documents	Lake Hiddenwood Field Study; Lake Hiddenwood Restoration and Protection Project Preproposal

I. *Executive Summary:*

- ***Waterbody Description and Impairments***

Lake Hiddenwood is a 28 acre (11.3 ha) reservoir located in the northeastern portion of Walworth County, South Dakota. The lake was created by constructing an earthen dam on Hiddenwood Creek during 1926. The watershed above the dam covers 20,340 acres (8,231.5 ha). Because the watershed to lake ratio is high (726 :1), the lake has a relatively constant level. An estimated 256 acre feet (315,806 cu. m) of surface runoff enters the lake annually.

Hiddenwood State Park adjoins the lake. The lake and 325 acre (131.5 ha) park provide easily accessible water-based recreation and camping opportunities to the nearly 5,000 area residents who live in the four small communities located within 25 miles (40.25 km) of the lake. Designated beneficial uses assigned to Lake Hiddenwood include warmwater semipermanent fish life propagation, immersion recreation, limited contact recreation, wildlife propagation and livestock watering.

Since closure of the dam approximately 70 years ago, sediment and nutrient loads originating from sheet and rill erosion in the watershed have contributed to a steady decline in the water quality of Hiddenwood Lake. The lake is hypereutrophic. Algal blooms are an annual occurrence and winter fish kills frequent. The use of the lake for immersion recreation and as a fishery by area residents has decreased significantly.

Sediment has decreased the volume of the lake at a nearly constant rate of 1.3 acre feet per year. At closure of the dam, Hiddenwood Lake had a volume of approximately 208 acre feet (256,593 cu. m) and a maximum depth of 17.5 feet (5.3 m). By 1993, lake volume had decreased to 123 acre feet and maximum depth to 12 feet (3.66 m) with an average depth of less than five feet (1.52 m).

The annual erosion rate over the watershed is less than one-half ton per acre. However, while erosion and delivery rates are low, with a watershed to lake ration of 726:1, the total amount of sediment reaching the lake is high. The high levels of phosphorus entering the lake are associated with the sediment and vegetation within the watershed.

Because of the low erosion and delivery rates and need to increase depth to restore full realization of immersion recreation and fishery beneficial uses, removal of 81,633 cubic yards (62,417 cu. m) of sediment by dredging was selected as the most viable restoration option. The dredge plan developed called for the removal of all accumulated sediment from lake areas six through nine (18.5 acre feet = 29,846 cubic yards) and one-half the sediment from lake areas

two through five (32.1 acre feet = 51,787 cubic feet). See Figure III the for location of lake areas targeted for sediment removal. Selective dredging of 80,173 cubic yards (61,300 cu. m) was completed during 1995 and 1996 to increase lake storage capacity to 173 acre feet (213,416 cu. m). This storage capacity equals 83 percent of the original volume.

To maintain full support of beneficial uses, additional activities are recommended. Increased use of conservation tillage practices on farm land, construction of two low head detention dams and construction of four animal waste management systems is recommended to reduce sediment and nutrient loading from the watershed. The installation of a aerators in the lake is recommended to minimize the incidence of winter fish kills. It is unlikely the frequency of winter kills will be adequately addressed by dredging alone given the small size and narrow shape of the lake and protection from the wind afforded by tree growth around the lake.

- ***Stakeholder Description***

  Realization that the beneficial uses of Lake Hiddenwood were threatened and the efforts to correct the sources of the impairments, has a long history. A sediment survey was completed during 1959 by the Soil Conservation Service (SCS), now Natural Resource Conservation Service (NRCS), and South Dakota Department of Game, Fish and Parks (GFP) at the request of the Selby Commercial Club. Based on the results of the survey, it was determined that lake volume had decreased by 20 percent. During the next 20 years, support of beneficial uses continued to deteriorate. The South Dakota Department of Water and Natural Resources, now Department of Environment and Natural Resources (DENR), estimated an additional 20 percent of the lake's original volume had been lost to sedimentation during the two decade period.

  During 1978, the Walworth Conservation District requested that NRCS, through the Resource Conservation and Development Program (RC & D), develop options for addressing sediment related use impairments. NRCS proposed construction of a new dam below the current dam site. Construction of the dam was not cost effective nor judged an acceptable option by local residents. A year later, GFP attempted to remove accumulated sediment by dredging the lake. The amount of sediment removed was less than planned and achieved less than the desired result. A 1984 proposal developed by NRCS to stop further sediment loading of the lake by constructing a sediment storage structure upstream from the dam met a fate similar to the 1978 new dam proposal.

  Hydrologic unit planning completed by the Walworth Conservation District during 1989 identified continued interest in addressing water quality deterioration and associated use impairment of the lake as local priority. In

response to this interest, a workplan to dredge the lake and reduce loading from the watershed was developed by the district with assistance from the North Central RC & D. Funding for development of the workplan was provided by a 604 (b) grant from DENR. The project was unsuccessfully considered for 319 NPS funding during 1993. Funding for the project was secured through the South Dakota Consolidated Water Facilities Construction Program during 1995. The dredging segment of the project was completed during 1995-1996.

A list of agencies and organizations involved with the development of the 1993 NPS/Consolidated Fund Project workplan and completion of restoration activities completed to date is shown in Figure I.

FIGURE I. Lake Hiddenwood Project Stakeholders

Walworth Conservation District Selby/Java area residents Selby Commercial Club Hiddenwood Sportsmen Club Selby Public School District	SD GFP SD DENR SD Lakes and Streams Association NRCS North Central Resource Conservation and Development Association

- ***Intent to Submit as a Clean Water Act Section 303(d) TMDL***

  In accordance with Section 303(d) of the Clean Water Act, the South Dakota Department of Environment and Natural Resources submits for EPA, Region VIII review and approval, the sediment and phosphorus total maximum daily loads (TMDLs) for Hiddenwood Lake as provided in this summary and attached documents. The TMDLs were established at a level necessary to meet the applicable water quality standards for nutrients and sediments with consideration of seasonal variation and a margin of safety. The designated use classifications that will be protected through implementation of the TMDL include: warmwater semipermanent fish life propagation, immersion recreation, limited contact recreation.

II. *Problem Characterization:*

- ***Waterbody description***

  Lake Hiddenwood is a 28 acre (11.3 ha) reservoir located in the northeastern portion of Walworth County, South Dakota (Figures II and III). Walworth County is situated in the north central portion of the state. The entire county lies within the Missouri River Basin. The river forms the western border of the county.

  The lake was created by constructing an earthen dam on Hiddenwood Creek during 1926 to provide water based recreational opportunities for area residents. Since closure of the dam, development of the area around the lake has been

ongoing. Area residents purchased 165 (66.77 ha) acres at the time the dam was constructed to create Hiddenwood State Recreation Area. During the late 1930s, WPA constructed terraces on the south side of the lake, a picnic shelter and a bath house. The terraces were planted with trees. The recreation area was transferred from local to state ownership during 1947 and has been operated under the direction of the SD Department of Game, Fish and Parks (SD GFP) since that time. During 1951, the area was designated a state park.

The SD GFP has continued to expand recreational opportunities available at the lake. Improved camp sites, a boat ramp, swimming beach, ball diamonds and hiking and nature trails have been developed. During 1973, an additional 160 acres (64.75 ha) was purchased to bring the park to its present 325 acre (131.52 ha) size. The park is well wooded with naturally occurring and planted hardwoods and conifers around the lake and along the riparian area adjacent to Hiddenwood Creek.

- ***Maps***

Figure II. Hiddenwood Lake and Watershed
Figure III. Hiddenwood Lake Surface Acres By Lake Segment
Figure IV. Hiddenwood Lake Existing Lake Bottom

- ***Waters Covered by TMDL***

Hiddenwood Lake is the waterbody targeted by this TMDL.

- ***Rationale for Geographic Coverage***

The 28 acre (11.3 ha) lake receives flows from Hiddenwood Creek which drains an area approximately nine miles (14.48 km) long by 3.5 miles (5.63 ha) wide (Figure II). The creek has a low channel gradient and exhibits a high degree of meandering as it flows through a 20,340 acre (8,231 ha) watershed. Topography of the watershed is described as undulating to moderately rolling over soils that are moderate to deep in profile, medium textured, well drained and moderately permeable.

Land use patterns in the watershed have remained essentially unchanged since 1926. Currently, forty-four percent of the watershed (8,950 acres = 3,622 ha) is maintained as rangeland; fifty-six percent (11,390 acres = 4,609 ha) as cropland. Rangeland occupies the flood plain and steeper valley sides. Most of the cropland occurs on the flatter slopes at the top of the watershed.

FIGURE II. Hiddenwood Lake and Watershed

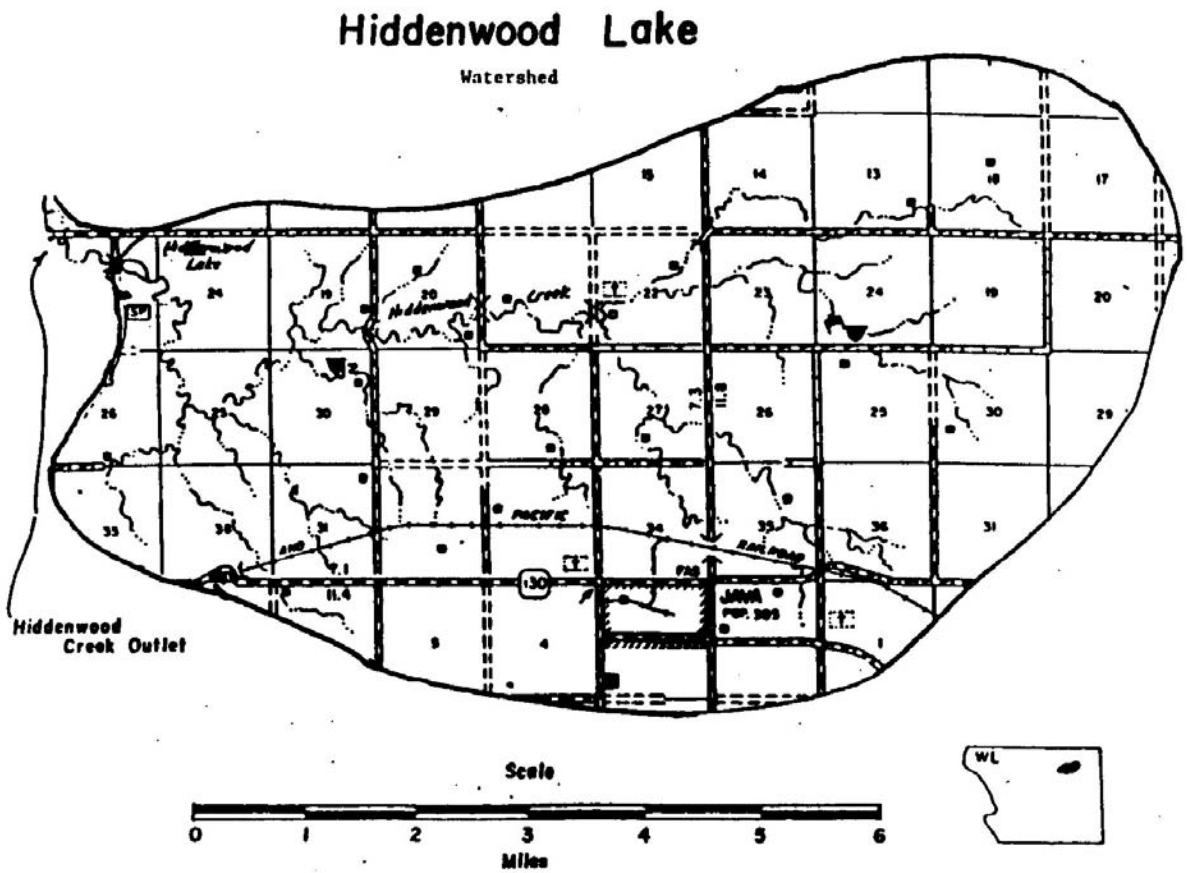

Figure 2. Hiddenwood Lake and Watershed

- ***Pollutant(s) of Concern***

Accumulated Sediment
Total Phosphorus

- ***Use Impairments or Threats***

Hiddenwood Lake and the adjacent park have been an important recreational site both for area residents and persons traveling through the area for more than seventy years. The current estimated population within 65 miles of the lake is approximately 29,500. Of this total, the nearly 5,000 persons who live in the four small towns located within 25 miles of the lake are the primary lake and park users.

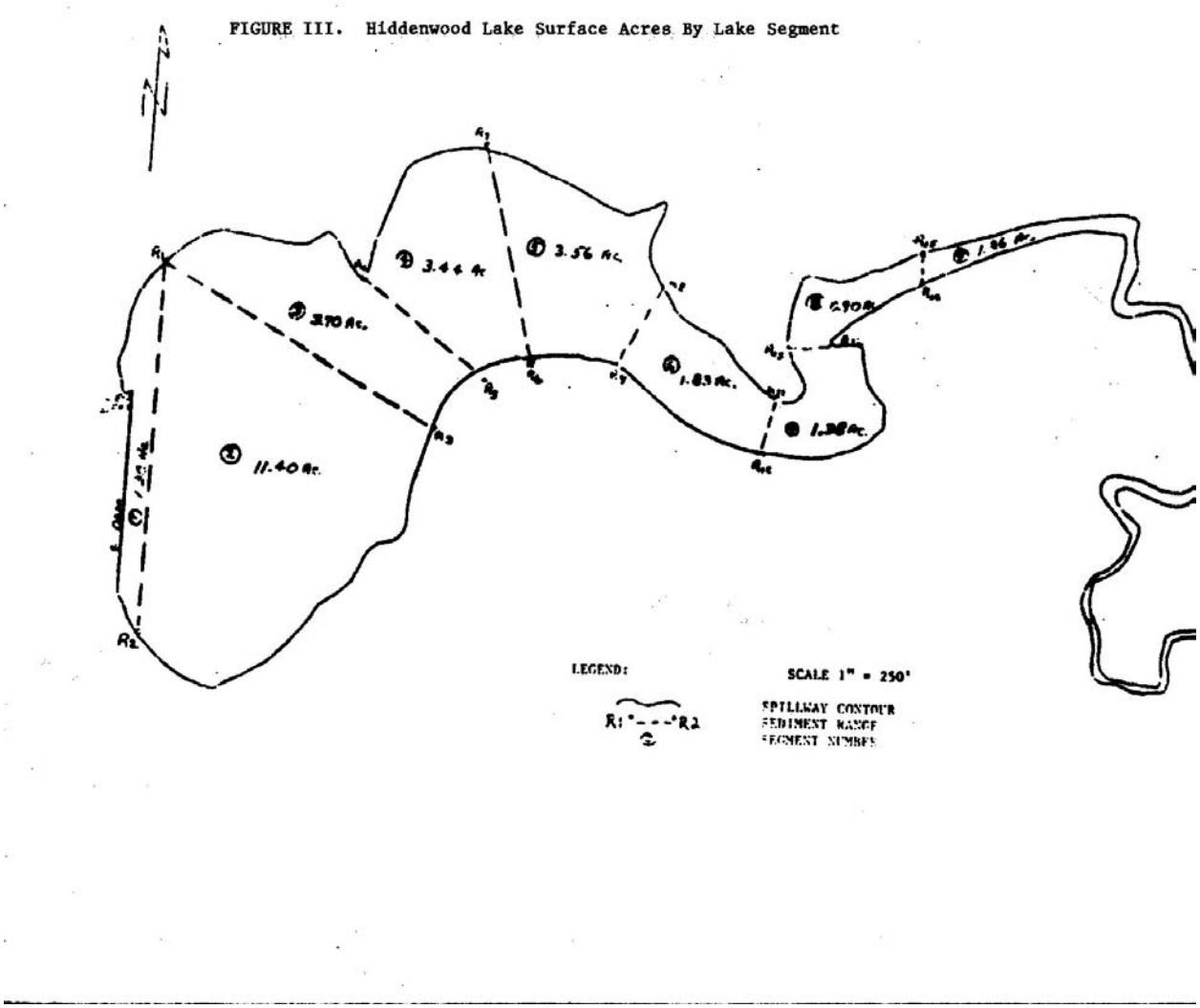

Figure III. Hiddenwood Lake Surface Acres by Lake Segment

From the 1960s through the early 80s park visitations normally ranged between 25 and 30 thousand per year. During the next ten year period, the number declined to approximately one half that level with a corresponding decline in overnight stays from 443 to 169. The reduction in visitor days and campers has been attributed to the decline in the water quality of the lake and associated loss of swimming and fishing opportunities as storage capacity of the reservoir decreased.

The decline in use of the lake and adjacent state park is directly linked to the decline in water quality of the lake. Accumulated sediment decreased lake depth. The high phosphorus level promoted algal blooms. The use of the lake for immersion recreation and as a fishery was impaired.

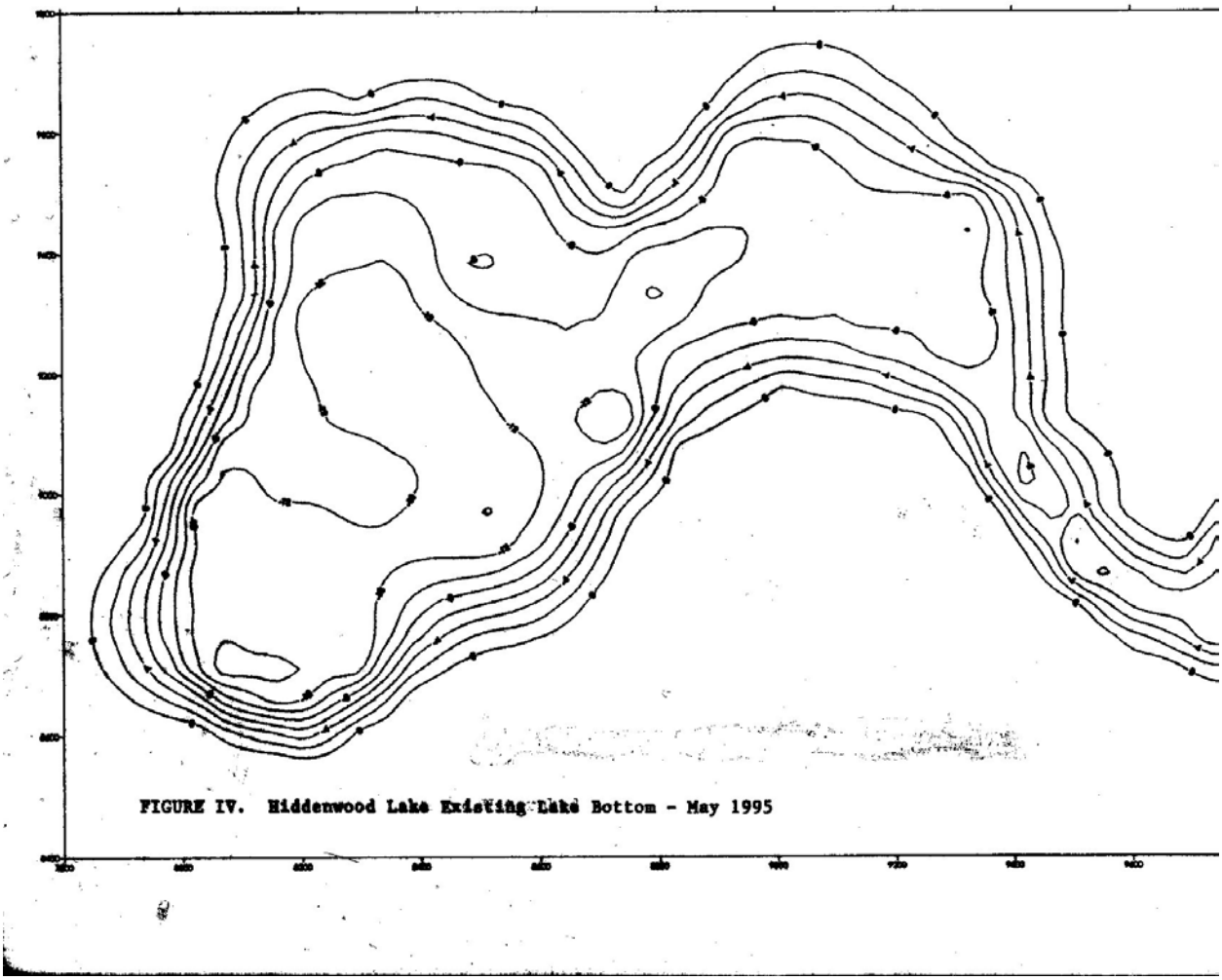

Figure IV. Hiddenwood Lake Existing Land Bottom

Sediment and nutrient loads originating from sheet and rill erosion in the watershed have been identified as the major pollutants contributing to the decline in the water quality of Hiddenwood Lake. The lake is hypereutrophic. Algal blooms are an annual occurrence and winter fish kills frequent. The use of the lake for immersion recreation and as a warm water fishery is severely impaired.

Based on the amount of sediment in the lake and a 15 percent delivery ratio, the annual erosion rate over the watershed is less than one-half ton per acre. However, while erosion and delivery rates are low, with a watershed to lake ratio of 726:1 the total amount of sediment reaching the lake is high.

Monitoring data and trophic state index (TSI) calculations (Table 1) indicate nutrient loading has followed a pattern similar to that of sediment. The mean TSI

values suggest a trend toward increased hypereutrophic state. While there is relatively high variability within the individual TSI values used to calculate the means, there is a greater degree of consistency within the TSI values for phosphorus, the main contributor to the overall TSI, for each sampling period.

TABLE 1. Hiddenwood Lake TSI Values

Year	Secchi Disc	Total Phosphorus	Chlorophyll a	Mean
1979				70.1
1989	70.82	93.65		82.23
1991	61.29	92.73	73.61	75.88
1993	67.73	88.18	66.97	74.29

Secchi Disc TSI values range from higher eutrophic to lower hypereutrophic. The corresponding measures of Secchi depth were 0.47, 0.91 and 0.59 meters respectively. When Secchi readings are considered with turbidity data and observed discoloration of the water attributed to tannins leached from watershed vegetation, it appears algal production is limited by light penetration. Algal production can be expected to increase with greater water clarity.

- ***Probable Sources***

The primary source of the sediment and nutrient loads entering the lake is naturally occurring sheet and rill erosion. This conclusion is based on the lake and watershed studies and analysis of the watershed using AGNPS and professional judgement as summarized below.

1. Land use in the watershed has remained essentially unchanged since closure of the dam during 1926. Rangeland occupies the flood plain and steeper valley slopes. Most of the cropland is located on the flatter ground at the top of the watershed.

2. Studies of the lake and watershed have documented a nearly constant 1.3 acre-foot/year (1,604 cu. m) rate of decrease in lake volume and less than 0.5 ton/acre (200 kg/ha) annual erosion rate respectively. At closure of the dam, Hiddenwood Lake had a volume of approximately 208 acre feet (256,593 cu. m) and a maximum depth of 17.5 feet (5.3 m). During the 70 plus years since construction, maximum depth has decreased to 12 feet (3.66 m) and an average depth to less than five feet (1.52 m). During the same period, lake volume decreased to 166 acre feet by 1959 (204,781 cu. m), 140 acre feet (172,706 cu. m) by 1979 and approximately 123 acre feet (151,735 cu. m) by 1993 (Table 2 and Figure III).

TABLE Lake Hiddenwood Restoration and Protection Project Storage by Segments

Segment No.	Area (ac.)	Original Capacity (ac. ft.)	Sediment 1959 (ac. ft.)	Capacity Loss (1959) (%)	Capacity Loss (1993) (%)	Sediment (1993) (ac. ft.)	Remaining Depth (1993) (ft.)
1	1.30	9.20	1.37	15.0	25.0	2.3	NA
2	11.40	104.73	16.17	15.0	25.0	26.2	11.0
3	3.70	27.78	4.72	17.0	35.0	11.1	10.0
4	3.44	26.85	6.44	24.0	50.0	13.5	9.0
5	3.56	17.75	5.64	32.0	75.0	13.4	8.5
6	1.83	10.44	3.31	32.0	80.0	8.3	8.0
7	1.38	6.34	2.61	41.0	90.0	5.7	7.0
8	0.90	2.83	1.47	52.0	95.0	2.7	4.0
9	1.86	1.86	0.93	50.0	95.0	1.8	<3.0
Total or Average	29.37	207.78	42.66	20.5%	40.9%	85.0	4.4

Table 2. Lake Hiddenwood Restoration and Protection Project Storage by Segments

3. The watershed was analyzed using the Agricultural Nonpoint Source Model (AGNPS) to identify critical areas and animal feeding operations (AFOs) that might yield high sediment and nutrient loads. For sediment, 31 forty acre (16.19 ha) cells (1,240 acres = 501.83 ha) with a calculated erosion rate of greater than 1.2 tons/acre were identified. Feeding area ratings calculated for the 12 AFOs in the watershed ranged from 10 to 59. The operations vary in size from 24 to 450 animals units. Five of the operations have 100 or more animal units. Four of these operations received ratings greater than 40.

According to the SD GFP, the frequent winter fish kills are more directly related to size, shape and protected nature of the lake than water quality. The lake is small, narrow and well protected from the wind. Consequently, when snow covers the ice it is not blown away. As a result sunlight is blocked, vegetation in the lake dies and decays and the oxygen content of the water is depleted below levels needed to support a fishery.

III. TMDL Endpoint:

- ***Description***

The accumulated sediment TMDL and support of Hiddenwood Lake's intended uses was accomplished by dredging to restore the lake volume to its pre-1959 storage capacity of 173 acre feet (213,416 cu. m). A total of 80,173 cubic yards (61,300 cu. m) of sediment was removed from the lake during the summers of 1995 and 1996. The 1993 lake storage capacity was 123 cubic feet (151,735 cu. m).

Based on the amount of sediment removed, the post-dredge lake storage capacity is 172.7 acre feet (213,035 cu. m).

Maintaining the volume gained will be accomplished by building two low head dams in the watershed above the lake and increased use of reduced tillage methods in the watershed. The dams will be constructed with a capacity sufficient to store the 25 year sediment load, 31 acre feet (39,476 cu. m). The use of no-till farming systems on 1240 acres (501.83 ha) will reduce sediment loading by an estimated five percent and extend the life of the sediment traps. Based on the model, if the 31 forty acre cells (1,240 acres = 501.83 ha) with a loading of greater than 1.2 tons/acre were converted to no-till farming, the reduction in sediment loading that can be expected from a twenty-five year storm event is 5.7 percent (92.4 tons to 87.1 tons = 93,878 kg to 88,494 kg).

Based on predictions provided by the AGNPS Model, a two percent decrease in phosphate loading will be achieved by construction of ag waste systems for the four AFOs with feedlot ratings of 40 or greater. Because as much as 95 percent of the phosphate load appears to be from natural causes, best professional judgment indicates that removal of the phosphate load originating form the AFOs will probably not significantly alter the overall load to the lake and TSI. Therefore construction of the four systems are included under margin of safety.

- ***Endpoint Link to Surface Water Quality Standards***

A measurable change in TSI may not be achievable for Lake Hiddenwood. As much as 95 percent of the phosphorus load entering the lake appears to be from natural sources. Only a two percent reduction in phosphate loading is predicated from construction of ag waste systems for the four AFOs with feedlot ratings of 40 or greater. Given the high phosphorus TSI, best professional judgment indicates that removal of the phosphate originating from the AFOs will probably not significantly reduce the overall TSI.

It is also unlikely that an increase in water clarity will be realized either from dredging or installation of sediment traps. The water is discolored. The discoloration is attributed to tannins leached from vegetation in the watershed. In addition, any clarity improvements realized will, in all probability, be offset by a corresponding increase in chlorophyll production.

Given the natural origin of the nutrient load and the effect of vegetation on water clarity, it is suggested that TSI may not be a reliable indicator of water quality impairment for Hiddenwood Lake. Replacement with surrogate measures related to visitor days, camper use and reduction in the fish kills is recommended. An increase in the number of visitor days, camp site use and a reduction in the incidence of winter fish kills will indicate support. If a reduction

in winter kills can not be sustained or if recreational uses do not increase, a downgrade in the fish life propagation and recreational designated uses should be considered.

IV. TMDL Analysis and Development:

- ***Data Sources***

Data and observations used in the development of the TMDL for Hiddenwood Lake was accessed from the sources listed below:

1. Lake sedimentation data collected by SCS (NRCS) during 1959.
2. Preliminary Report of Lake Hiddenwood Recreation Damsite and Reservoir completed by NC RC & D during 1978.
3. Lake sediment data collected by DENR during 1979
4. 1995 Lakes Assessment Report - data collected by DENR during 1979, 1989, 1991 and 1993.
5. Watershed inventory information collected by NC RC & D during 1991.
6. AGNPS cell parameter data collected by NRCS during 1996 .

- ***Analyses Techniques or Models***

Data used to characterize the water quality and determine the trophic state of Hiddenwood Lake was collected by DENR using the department's EPA approved standard operating procedures and quality assurance/quality control plan in effect at the time of collection.

The effect of land use and AFOs in the watershed was completed using the AGNPS Model developed by the United States Department of Agriculture, Agricultural Research Service to analyze and predict the effect single storm events can be expected to have on water quality in a watershed.

- ***Seasonality***

Water quality for a waterbody may vary seasonally in response to precipitation, temperature and practices in the watershed. The TMDLs developed for Hiddenwood Lake are based on water quality data collected primarily during the summer months, visitor days and frequency of winter kills. Collection of additional seasonal water quality data is recommended as both a margin of safety and post implementation activity.

- ***Margin of Safety***

To maintain the water quality improvements already gained due to the TMDL and support of designated uses, implementation of additional practices is recommended as part of the margin of safety for this TMDL. Practices recommended include:

1. Construction of two low head dams above the dam to trap and store 32 acre feet (39,476 cu. m) of sediment, which equals the 25-year sediment load.

2. Construction of four ag waste systems to remove nearly four percent of the total nitrogen load and two percent of the total phosphorus load entering the lake.

3. Development of nutrient management plans for all AFOs in the watershed to minimize the possible contribution to the nutrient load entering the lake.

4. Use of reduced till or no-till cultivation systems on the 1240 acres (501.83 ha) identified through the AGNPS model, if ground truthing verifies the results of the model. This practice will extend the life of the low head dams constructed as sediment traps.

5. Installation of aerators in the lake to increase oxygen content of the water and thereby decrease the incidence or severity of winter fish kills.

V. Allocation of TMDL Loads or Responsibilities:

- ***Waste Load Allocation***

The are no identified point sources of pollution in the watershed. Therefore, the "wasteload allocation" component of this TMDL equals zero.

- ***Load Allocation/Background Allocation***

It is unlikely the trophic status of the Hiddenwood Lake can be changed significantly by dredging alone or in combination with the installation of additional practices in the watershed. Even though a low per acre loading rate from the watershed exists the high watershed to lake ratio (726:1) is high. It should be possible to maintain the overall improvements to the lake and continued support of the designated lake uses realized by increasing lake volume to its pre-1959 levels.

The source of approximately 94 percent of the sediment loading of Hiddenwood Lake appears to be naturally occurring sheet and rill erosion in the watershed. The remaining six percent appears to be linked primarily to cropland located in the upper portion of the watershed.

Nutrient loading of the lake also appears to be primarily linked to naturally occurring sheet and rill erosion. Nutrients carried with the sediment and leached from vegetation, primarily grasses and deciduous and coniferous trees, are the probable source of as much as 90 percent of the total nitrogen and 95 percent of the total phosphate entering the lake. An estimated nearly four percent and two percent respectively of nitrogen and phosphorus loads appear to originate from

the four AFOs in the watershed that have feeding area ratings of 40. While sources of the remainder of the nitrogen and phosphorus loads is unaccounted for, it is possibly linked to the eight AFOs with AGNPS feeding area ratings of less than 40.

- ***Allocation of Responsibility***

Based on studies of erosion in the watershed, lake sedimentation rate and the AGNPS Model, the source of approximately 94 percent of the sediment loading of Hiddenwood Lake appears to be naturally occurring sheet and rill erosion in the watershed. The remaining six percent appears to linked primarily to cropland located in the upper portion of the watershed.

Based on information gained through use of the AGNPS Model and best professional judgement, 95 percent nutrient loading of the lake also appears to be linked to naturally occurring sheet and rill erosion. Nutrients carried with the sediment and leached from vegetation, primarily grasses and deciduous and coniferous trees, are the probable source of as much as 90 percent of the total nitrogen and 95 percent of the total phosphorus entering the lake. Nearly four percent and two percent respectively of nitrogen and phosphate loads appear to originate from the four AFOs in the watershed that have AGNPS feeding area ratings of 40. While sources of the remainder of the nitrogen and phosphorus loads is unaccounted for, it possibly is linked to, at least in part, the eight AFOs with AGNPS feeding area ratings of less than 40.

VI. Schedule of Implementation:

Sediment removal from the lake is complete. A total of 80,173 cubic yards (61,300 cu. m) was removed by dredge during the summers of 1995 and 1996. Therefore the TMDL target has been met.

Installation of the inlake aerators scheduled for after completion of dredging has been placed on hold. The Walworth Conservation District has been advised that questions of liability associated with maintaining an open water area around the aerators must be answered before installation can proceed.

DENR is working with the Walworth Conservation District to continue the partnership that accomplished the sediment removal portion of the Lake Hiddenwood Restoration and Protection Project. The district has investigated sites for construction of the two low head dams recommended and will evaluate recommendations for further reductions in sediment and nutrient loading from the watershed during the spring and summer of 1999.

A schedule for construction of the low head dams and ag waste management systems and implementation of cropland tillage system best management

practices has not been finalized. DENR will continue to work with the Walworth Conservation District as well as other watershed stakeholders to develop and complete a workplan to install these water quality protection practices by the end of 2002.

VII. Post-Implementation Monitoring:

- ***Description***

Seasonally-based annual water quality monitoring through the year 2000 is recommended to determine if improvements in water quality were achieved as part of sediment removal activities and, if achieved, are being maintained. Collection of data through the recommended time will allow a four year averaging period upon which to base TSI determination. During this period use of the lake and park should also be monitored with increased visitation and overnight camping stays being used as a surrogate indicator of use support.

After the year 2000, participation in the South Dakota Citizen's Monitoring Program is recommended to provided continuous water quality information. It is proposed that the department continue to monitoring Lake Hiddenwood every two to four years as part of the Statewide Lakes Assessment Program.

VII. Public Participation:

- ***Summary of Public Involvement/Information and Education***

The planning of the Hiddenwood Lake Restoration and Protection Project which resulted in dredging of the lake and proposals for further activity in the watershed was locally driven.

The sediment survey completed by NRCS and South Dakota GFP during 1959 was completed at the request of the Selby Commercial Club.

The 1978 study completed by NRCS that proposed construction of a new dam and lead to the completion of a sediment survey by DENR was done at the request of the Walworth Conservation District, South Dakota GFP and North Central RC & D.

NRCS completed the 1984 study that recommended the construction of the upstream sediment storage structures at the request of North Central RC & D on behalf of the district and area residents.

Development of the proposal that resulted in the 1995-96 dredge project can be linked directly to the 1984 Hydrologic Unit (HU) Planning meetings conducted by the conservation district, Selby/Java HU residents and the individuals who attended two meetings in the HU identified water quality of the lake as a priority issue.

Hiddenwood Lake has been identified as an educational resource for area middle and high school students. During 1993 the Selby, South Dakota School District received a National Science Foundation Grant to develop a field study curriculum centered on the lake and watershed. The district plans to use the curriculum as part of an outdoor classroom that will be developed and made available for use by other schools in north central South Dakota.

The 1992-93 development of the Hiddenwood Restoration and Protection Project Proposal for 319 funding was completed by North Central RC & D at the request the Walworth Conservation District using funds provided by a CWA Section 604(b) Grant from DENR.

The 1993 proposal submitted to DENR for CWA Section 319 funding for the project was submitted by the Walworth conservation District. Letters of support for the project were submitted by the Hiddenwood Sportsman's Club, Selby Commercial Club and North Central RC & D, South Dakota GFP, Walworth County Commission, City of Java, City of Selby and Selby Area School District.

Special public information meetings about the project were conducted September 29, 1994 and March 27, 1995 by the Walworth Conservation District to inform area residents about the project and solicit input.

During 1995 a South Dakota Consolidated Facilities Construction Grant was awarded by the South Dakota Board of Water and Natural Resources for completion of the sediment removal phase of the project.

Project status was discussed at Walworth Conservation District's monthly meetings during the1995-96 dredging project and articles were published periodically in the Selby Record. During the preparation of this TMDL input was solicited from the Walworth Conservation District by telephone and FAX.

The project proposal developed for 319 funding was reviewed by the South Dakota Nonpoint Source Task Force and South Dakota Board of Water and Natural Resources during September/October 1993. Although both the task force and board recommended funding, the project was low on the priority list and consequently not selected for funding by EPA.

- ***Summary of Public Review***

  A record of the public involvement in the review of this TMDL as submitted is summarized in Table 2.

TABLE 2. Hiddenwood Lake Project Public Involvement

Electronic media	*Mailings*	*Public Comments Received*
December 1998 Assessment summary added to department website **February 1999** TMDL Summary posted on department website	**Interested Parties** March 3, 1999 **Stakeholders** March 3, 1999 **Daily Newspaper** March 1, 1999	Comments received during project meetings and review of the draft report and findings were considered

VIII. Supporting Development Document(s) (attached):

USDA, Soil Conservation Service and Walworth Conservation District. August 1978. Preliminary Report – Hiddenwood Recreation Damsite and Reservoir, North Central RC & D (RC-050-WA). North Central Resource Conservation and Development Association, Pierre, South Dakota.

North Central RC & D. August 1993. Lake Hiddenwood Restoration and Protection Project Preproposal. North Central Resource Conservation and Development Association, Pierre, South Dakota.

Walworth County Conservation District. September 1993. Lake Hiddenwood Restoration and Protection Project. Walworth conservation district, Selby, South Dakota.

Stueven, G. H. and W. C. Stewart. 1996. 1995 South Dakota Lakes Assessment Final Report. South Dakota Department of Environment and Natural Resources.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 500
DENVER, CO 80202-2466

APR 13 1999

Ref: Ref: 8EPR-EP

Nettie Myers, Secretary
Department of Environment and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

Re: TMDL Approvals
Lake Bryon
Elm Lake
Lake Faulkton
Lake Hendricks
Lake Hiddenwood
Lake Madison/Brant
McCook Lake
Ravine Lake
Redfield Lake
Swan Lake

Dear Ms. Myers:

We have completed our review of the total maximum daily loads (TMDLs) as submitted by your office for the subject waterbodies. In accordance with the Clean Water Act (33 U.S.C. 1251 et. seq.), we approve all aspects of the TMDLs as developed for these water quality limited waterbodies as described in Section 303(d)(1). We acknowledge that these particular TMDLs for the various lakes are based primarily on a voluntary and incentive-based approach to implementation.

Based on our review, we feel the separate TMDL elements listed in the enclosed checklists adequately address the pollutants of concern, taking into consideration seasonal variation and a margin of safety.

For years, the State has sponsored an extensive clean lakes program. Through the lakes assessment and monitoring efforts associated with this program, priority waterbodies have been identified for clean up. It is reasonable that these same priority waters have been a focus of the Section 319 nonpoint source projects as well as one of the priorities under the State's Section 303(d) TMDL efforts.

In the course of developing TMDLs for impaired waters, EPA has recognized that not all impairments are linked to water chemistry alone. Rather, EPA recognizes that "*Section 303(d) requires the States to identify all impaired waters regardless of whether the impairment is due to toxic pollutants, other chemical, heat, habitat, or other problems.*" (see 57 Fed. Reg.

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33040 for July 24, 1992). Further, EPA states that "*...in some situations water quality standards -- particularly designated uses and biocriteria -- can only be attained if nonchemical factors such as hydrology, channel morphology, and habitat are also addressed. EPA recognizes that it is appropriate to use the TMDL process to establish control measures for quantifiable non-chemical parameters that are preventing the attainment of water quality standards.*" (see Guidance for Water Quality-based Decisions: The TMDL Process; USEPA; EPA 440/4-91-001, April 1991; pg.4). We feel the State has developed TMDLs that are consistent with this guidance, taking a comprehensive view of the sources and causes of water quality impairment within each of the watersheds. For example, in several of the TMDLs, the State considered nonchemical factors such as lake depth and its relationship to the impaired uses. Further, we feel it is reasonable to use factors such as lake depth as surrogates to express the final endpoint of the TMDL.

Thank you for your submittal. If you have any questions concerning this approval, feel free to contact Bruce Zander of my staff at 303/312-6846.

Sincerely,

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection and
Remediation

Enclosures

Enclosure

APPROVED TMDLS

Waterbody Name*	TMDL Parameter / Pollutant	Water Quality Goal/Endpoint	TMDL	Section 303(d)1 or (d)3 TMDL	Supporting Documentation
Lake Bryon*	phosphorus	TSI < 70	50% reduction in phosphorus loads	§303(d)(1)	Lake Assessment Project Report, (Lake Byron excerpt) (SD DENR, August 1996) Lake Assessment Project Report, Lake Byron, Beadle County, SD (SD DENR, December 1992) Section 319 Nonpoint Source Control Program Watershed Project Final Report, Lake Byron Watershed Project (Beadle CD, December 31, 1997) Lake Byron Watershed Project Section 319 Project Implementation Plan (SD DENR, July 1993)
	sediment	Decrease annual inlake sediment accumulation by 1200 tons/year	50% reduction in sediment loads	§303(d)(1)	
Elm Lake*	phosphorus	N:TDP ratio > 7.5 averaged over growing season	60% reduction in phosphorus loads	§303(d)(1)	Phase I Watershed Assessment Final Report, Elm Lake, Brown Country, South Dakota (SDDENR, September1998)
Lake Faulkton*	phosphorus	TSI < 90	35% reduction in phosphorus loads	§303(d)(1)	Lake Assessment Project, Lake Faulkton, Faulk County, South Dakota (SD DENR, 1996)
	sediment	Increased average lake depth by 6 feet over 15.5 acres	Remove 150,000 cubic yards of lake sediment	§303(d)(1)	
Lake Hendricks*	phosphorus	TSI < 65	50% reduction in phosphorus loads	§303(d)(1)	Diagnostic/Feasibility Study Report, Lake Hendricks/Deer Creek Watershed, Brookings County, South Dakota; Lincoln County, Minnesota (SD DENR, February 1993)
	sediment	Increased average lake depth by 6 feet over 100 acres	Remove 1 million cubic yards of lake sediment	§303(d)(1)	

Waterbody Name*	TMDL Parameter / Pollutant	Water Quality Goal/Endpoint	TMDL	Section 303(d)1 or (d)3 TMDL	Supporting Documentation
Lake Hiddenwood*	phosphorus	Decreased winter fish kills and increased visitor days	Maintenance of increased depth regime plus 2% decrease in phosphorus loads	§303(d)(1)	Lake Hiddenwood Restoration and Protection Project Preproposal (North Central RC&D; August 1993) Lake Hiddenwood Restoration and Protection Project Implementation Plan for FY 94 (1994) Preliminary Report; Hiddenwood Recreation Damsite and Reservoir, North Central RC&D (RC-050-WA), Walworth County, SD (USDA, SCS; August 1978)
	sediment	Increased depth corresponding to increasing volume by 53 acre-feet	Maintenance of increased depth regime plus 5% decrease in sediment loads	§303(d)(1)	
Lake Madison*	phosphorus	TSI < 50	50% reduction in phosphorus loads	§303(d)(1)	Phase I Watershed Assessment Final Report - Madison Lake/Brant Lake, Lake County South Dakota (SD DENR, October 1998)
Lake Brant*	phosphorus	TSI < 50	50% reduction in phosphorus loads	§303(d)(1)	
McCook Lake*	sediment	Increased average lake depth by 4.5 feet over 183 acres	Remove 1.7 million cubic yards of lake sediment	§303(d)(1)	Diagnostic/Feasibility Study Report McCook Lake, Union County, South Dakota (SD DENR, March 1990)
Ravine Lake*	phosphorus	TSI of <84	70% reduction in phosphorus loads	§303(d)(1)	Diagnostic\Feasibility Study Report, Ravine Lake, Beadle County, SD (SD DENR, July 1990) AGNPS Modeling of the Ravine Lake Watershed, Huron, SD (SD DENR, July 1988)
	fecal coliform	< 400/100 mL fecal coliform counts	< 400/100 mL fecal coliform counts	§303(d)(1)	
Redfield Lake*	phosphorus	TSI < 90	45% reduction in total phosphorus load	§303(d)(1)	Lake Assessment Project Report, Lake Redfield, Spink County, SD (SD DENR, May 1993)
	sediment	Increased average lake depth by 5 feet over 31 acres	Remove 250,000 cubic yards of lake sediment	§303(d)(1)	

Waterbody Name*	TMDL Parameter / Pollutant	Water Quality Goal/Endpoint	TMDL	Section 303(d)1 or (d)3 TMDL	Supporting Documentation
Swan Lake*	phosphorus	TSI < 65	60% reduction in phosphorus loads	§303(d)(1)	Diagnostic/Feasibility Study Swan Lake; Turner County, South Dakota (SD DENR, January 1993)
	sediment	TSI (secchi depth) < 65	50% increase in secchi depth	§303(d)(1)	

* An asterisk indicates the waterbody has been included on the State's Section 303(d) list of waterbodies in need of TMDLs.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Lake Bryon
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and sediment loading rate. These are reasonable indicators to use in expressing the TMDL targets since they are quantifiable and relate to the use impairments.
■ TMDL	X	The TMDLs are expressed in terms of annual phosphorus and sediment load reductions. This is a reasonable way to express the TMDL for lakes since it takes lakes a period of time to respond to pollutant reductions.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved, by a high level of detailed monitoring and assessment, by further educational efforts throughout the watershed, by conservative assumptions regarding no-till or minimum till acreage, application of additional nutrient BMPs, and stabilization of more shoreline than recommended through the assessment Study. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas, shoreline areas, and croplands.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Elm Lake
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ **TMDLs result in maintaining and attaining water quality standards**	X	The waterbody classification uses which are addressed by this TMDL are drinking water and recreation.
■ **Water Quality Standards Target**	X	Targets were established based on nitrogen:phosphorus ratios. This is a reasonable approach since it relates to the trophic status of the waterbody which, in turn, relates to the uses of concern.
■ **TMDL**	X	The TMDL is expressed in terms of annual phosphorus load reduction. This is a reasonable way to express the TMDL for lakes since it takes lakes a period of time to respond to pollutant reductions.
■ **Significant sources identified**	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ **Technical analysis**	X	Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ **Margin of safety and Seasonality**	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by application of additional nonpoint source BMPs. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ **Allocation**	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas, shoreline areas, and croplands.
■ **Public review**	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Since part of the Elm Lake watershed is in North Dakota, the state of North Dakota as well as local entities in that State have participated in the development of the TMDL and will be participating in the future through implementation of BMPks within the watershed. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Lake Faulkton
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and lake depth. This is a reasonable approach since it relates to the trophic status of the waterbody as well as the physical nature of the lake which, in turn, relates to the uses of concern.
■ TMDL	X	The TMDL is expressed in terms of annual phosphorus load reduction and removal of lake sediment. This is a reasonable way to express the TMDL for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by application of additional nonpoint source BMPs. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and croplands.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Lake Hendricks
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and lake depth. This is a reasonable approach since it relates to the trophic status of the waterbody as well as the physical nature of the lake which, in turn, relates to the uses of concern.
■ TMDL	X	The TMDL is expressed in terms of annual phosphorus load reduction and removal of lake sediment. This is a reasonable way to express the TMDL for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by augmenting the watershed land use controls with in-lake dredging. The in-lake dredging will further reduce the amount of available nutrients into the lake because of increased depth as well as provide further aquatic life habitat. Additional margin of safety could be provided through addressing the failing wastewater on-site systems near the lake. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and croplands.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance. This TMDL involved cooperation between South Dakota and Minnesota since the watershed is in both states. Lincoln County, Minnesota participated in the process as a stakeholder.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Lake Hiddenwood
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on lake depth, fish kill frequency, and visitor-days. These are reasonable targets for the TMDL since they relate to the impaired uses of concern.
■ TMDL	X	The TMDL are expressed in terms of annual phosphorus load reduction and removal of lake sediment. Also, the TMDL relates to the depth and volume of the Lake. Lake depth has a particularly important factor related to both the recreational use and fisheries use of the Lake. The emphasis at this point in time is to protect the improvements already made in the Lake as well as adding more controls on pollutant sources as a margin of safety.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by application of additional nonpoint source BMPs. Additional BMPs include entrapment dams, construction of four agricultural waste systems, and cropland BMPs. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and croplands as well as to the bottom lake sediment.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Lake Madison/Lake Brant
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ **TMDLs result in maintaining and attaining water quality standards**	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ **Water Quality Standards Target**	X	Targets were established based on trophic status. This is a reasonable approach since trophic status of the waterbody relates to the uses of concern.
■ **TMDL**	X	The TMDLs for each lake are expressed in terms of annual phosphorus load reduction. This is a reasonable way to express the TMDL for this lake since it takes a long period of time for a lake to respond to water quality controls, rather than on a daily basis.
■ **Significant sources identified**	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ **Technical analysis**	X	Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ **Margin of safety and Seasonality**	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved, by increasing the target phosphorus reduction from 40% to 50%, and possibly by application of additional nonpoint source BMPs. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ **Allocation**	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and croplands.
■ **Public review**	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: McCook Lake
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ **TMDLs result in maintaining and attaining water quality standards**	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ **Water Quality Standards Target**	X	Targets were established based on lake depth. This is a reasonable approach since it relates to the trophic status of the waterbody as well as the physical nature of the lake which, in turn, relates to the uses of concern.
■ **TMDL**	X	The TMDL is expressed in terms of removal of lake sediment. This is a reasonable way to express the TMDL for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs.
■ **Significant sources identified**	X	There are no contemporary sources of sediment (the pollutant of concern). Rather, the current lake sediment that has been deposited over the years is the primary cause of impairment within the lake.
■ **Technical analysis**	X	Monitoring, empirical relationships, and best professional judgement were used in identifying acceptable levels of sediment removal from the Lake. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ **Margin of safety and Seasonality**	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by removal of more sediment than calculated to support inlake uses. Seasonality was adequately considered by evaluating the changes in lake conditions over the year, but seasonality has proven to be of very little concern related to the development of the TMDL and application of appropriate water quality controls.
■ **Allocation**	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to lake bottom sediments.
■ **Public review**	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Ravine Lake
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and fecal coliform concentration. This is a reasonable approach since these factors relate to the uses of concern.
■ TMDL	X	The TMDL is expressed in terms of annual phosphorus load reduction and fecal coliform concentration. This is a reasonable way to express the TMDLs for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs and reflects the long response time of lakes of this type to pollutant controls within the watershed.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by application of additional nonpoint source BMPs including the stabilization of more shoreline than calculated and removal of more lake sediments than calculated. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and croplands.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Redfield Lake
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and lake depth. This is a reasonable approach since it relates to the trophic status of the waterbody as well as the physical nature of the lake which, in turn, relates to the uses of concern.
■ TMDL	X	The TMDL is expressed in terms of annual phosphorus load reduction and removal of lake sediment. This is a reasonable way to express the TMDL for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved, by application of additional nonpoint source BMPs, and by dredging more lake sediments than calculated. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as animal feeding areas and bottom sediments.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.

■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Swan Lake
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: March 30, 1999 Date Review completed: April 9, 1999 BAZ

Review Criteria (All criteria must be met for approval.)	Approved (check if yes)	Comments
■ TMDLs result in maintaining and attaining water quality standards	X	The waterbody classification uses which are addressed by this TMDL are aquatic life and recreation.
■ Water Quality Standards Target	X	Targets were established based on trophic status and secchi depth. This is a reasonable approach since it relates to the trophic status of the waterbody as well as the physical nature of the lake which is, in turn, related to the uses of concern.
■ TMDL	X	The TMDL is expressed in terms of annual phosphorus load reduction and increase in clarity (e.g., secchi depth). This is a reasonable way to express the TMDL for this lake since it provides an effective surrogate reflective of both the aquatic life and recreational needs.
■ Significant sources identified	X	Significant sources were adequately identified in a categorical and/or individual source-by-source basis. All sources that need to be addressed through controls were identified (including the removal of lake bottom sediment, if needed.)
■ Technical analysis	X	Monitoring, empirical relationships, and best professional judgement were used in identifying pollutant sources and causes and in identifying acceptable levels of pollutant control, and in identifying appropriate levels of control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and watershed type.
■ Margin of safety and Seasonality	X	An appropriate margin of safety is included by performing ongoing monitoring to assure water quality goals are achieved and by application of additional nonpoint source BMPs including selective dredging, bank stabilization, and elimination of inflow from Turkey Ridge Creek. Seasonality was adequately considered by evaluating the cumulative impacts of the various seasons on water quality and by tailoring the BMPs to seasonal needs.
■ Allocation	X	All the allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as land uses in the Turkey Ridge Creek sub-watershed and in-lake sediments.
■ Public review	X	Public review and participation was conducted through meetings, electronic media, and mailings. The extent of public review is acceptable. Further, the review process sponsored by the State was adequate for purposes of developing a TMDL that will be implemented because of public acceptance.