# *SD Department of Environment & Natural Resources*
# *Water Resource Assistance Program*
# *Total Maximum Daily Load*

## *Blue Dog Lake Watershed,*
## *Day County, South Dakota*
## *April, 2000*

TMDLs for total phosphorus and fecal coliform have been developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the US Environmental Protection Agency and are supported below.

### *TMDL Summary Table:*

| **Waterbody Name** | **Blue Dog Lake** |
|---|---|
| **Hydrologic Unit Code (HUC)** | 10160010 |
| **TMDL Pollutant** | **Total phosphorus** |
| **Water Quality Target** | Nitrogen to phosphorus ratio of > 7.5 as averaged over a period of one growing season |
| **TMDL Goal** | Reduce phosphorous inputs by 30% |
| **303(d) Status** | 1998 SD Waterbody List, priority 2, page 20 |
| **Impaired Beneficial Uses** | Warmwater permanent fish life propagation; immersion recreation; limited contact recreation |
| **Reference Document** | Phase I Watershed Assessment Final Report Blue Dog Lake Day County South Dakota (SDDENR, 1999); A Report on the Activities and Expenditures of the Blue Dog/Enemy Swim Lake Watershed Assessment Study (Day Conservation District, 1999) |

### *TMDL Summary Table:*

| **Waterbody Name** | **Blue Dog Lake** |
|---|---|
| **Hydrologic Unit Code (HUC)** | 10160010 |
| **TMDL Pollutant** | **Fecal coliform bacteria** |
| **Water Quality Target** | Grab sample fecal coliform counts <400 colonies/100 mL in any one grab sample |
| **TMDL Goal** | Compliance with state water quality standards |
| **303(d) Status** | 1998 SD Waterbody List, priority 2, page 20 |
| **Impaired Beneficial Uses** | Warmwater permanent fish life propagation; immersion recreation; limited contact recreation |
| **Reference Document** | Phase I Watershed Assessment Final Report Blue Dog Lake Day County South Dakota (SDDENR, 1999); A Report on the Activities and Expenditures of the Blue Dog/Enemy Swim Lake Watershed Assessment Study (Day Conservation District, 1999) |

# I. Executive Summary:

- ***Waterbody Description and Impairments***

Blue Dog Lake is a glacial lake located in Day and Robert counties in northeast South Dakota. The total watershed for Blue Dog Lake is approximately 56,840 acres. Blue Dog Lake is classified as a warmwater permanent fishery. Other beneficial uses include immersion recreation, limited contact recreation, and stock watering and wildlife propagation.

Results from the watershed assessment study indicated that Blue Dog Lake has excessive nutrients and bacteria, and a relatively low sedimentation from the tributaries (approximately 0.5 acre-foot a year). Erosion from the shoreline adds sediment to Blue Dog Lake, reducing Secchi disk measurements. From late August of 1997 to May of 1998 approximately 17 acre-feet of Blue Dog Lake's shoreline eroded away. Although algae and chlorophyll *a* production can be quite high in Blue Dog Lake (73 $mg/m^3$), the particles in the water column appear to limit sunlight penetration which limits algae growth.

There are 25 animal feeding areas in the Blue Dog Lake Watershed. Twelve of these feeding areas had AGNPS ratings greater than 55. These livestock concerns were responsible for 17% of the phosphorus loading and 7.5% of the nitrogen loading according to the AGNPS model. The water quality samples had fecal coliform bacteria in the majority of the samples collected pointing to animal feeding areas as probable sources of nutrient and bacterial contamination.

The Agricultural Non-point Source (AGNPS) model agreed with the water quality monitoring in that it predicted very little overall sediment coming from the watershed. However according to the AGNPS model, a few cultivated areas lose higher than acceptable amounts of soil. These areas had very little residual crop cover and slopes greater than 7%. These critical cells input approximately 18% of the total load of phosphorus to Blue Dog Lake. The model reported that these areas were responsible for 8% of the nitrogen load.

Nutrient loads from the watershed were greatest in the spring with snowmelt and spring rains. The watershed upstream of both Site #6 and Site #5 appear to be inputting the most nutrients in the Owen's Creek drainage. Site #4 is on the other main tributary to Blue Dog Lake with a majority of its water coming from Enemy Swim Lake. However, the watershed upstream of Site #4 did appear to have its own sources of sediment and other nutrient parameters. Although the water exiting Enemy Swim Lake is relatively clean, the amount of water involved made a significant impact to the loadings at Site #4.

The average inlake concentration of phosphorus (0.080 mg/L) is more than enough to support an algal bloom in Blue Dog Lake. The major source of nutrients and bacteria in the watershed is animal feeding areas, summer-long grazing, and poor manure management. The AGNPS model rated 25 feedlots in the watershed, and of these, 12 had rankings over 50. The model showed that removal of nutrients from these 12 animal feeding areas should reduce the phosphorus to Blue Dog Lake by 17%.

The recommended goal for improving the water quality of Blue Dog Lake is to reduce phosphorus inputs by 30% and to reduce bacteria levels to within state water quality standards.

Reducing phosphorus inputs by 30% will move the average phosphorus TSI from hypereutrophic to eutrophic. According to the AGNPS model, eliminating feeding areas with rankings over 50 will result in a 17% reduction in phosphorus. Applying no-till practices to 1,640 acres will reduce phosphorus inputs by another 18%. The extra 6% of predicted phosphorus removal could be considered a safety margin to ensure a 30% reduction. The TMDL goal will be obtained when the nitrogen to phosphorous ratio is greater than 7.5 as averaged over a period of one growing season.

As high fecal coliform bacteria counts usually accompany high nutrient concentrations, controlling animal waste will decrease high fecal concentrations. A reduction at the source for nutrients should result in fecal counts within the limits of the South Dakota Water Quality Standards. The TMDL goal will be obtained when grab samples for fecal coliform bacteria meet the daily water quality standard of <400 colonies/100 mL in any one grab sample. This will greatly improve the condition of the lake for recreational beneficial uses and public beach closures should not occur again.

Once the water in Blue Dog Lake stops rising, shoreline protection and restoration practices should be implemented. The sediment inputs from the Blue Dog Lake shoreline were adding to the suspended solids concentration in the lake. Establishment of vegetation around the shoreline should reduce suspended sediment concentrations and add valuable fish habitat to Blue Dog Lake. Long-term monitoring should continue on Blue Dog Lake to track watershed improvements in the inlake trophic state levels and decreases in bacterial contamination.

- ***Stakeholder Description***

The Day Conservation District was the local sponsor of the Blue Dog Lake/ Enemy Swim Watershed Assessment project. As local sponsor, the District hired the local coordinator and administered project funds. Funds for the project were from Section 319 Nonpoint Source funds administered by the Environmental

Protection Agency (EPA). EPA granted the money to the state of South Dakota for the water quality assessment. The 40% local match needed for the project was provided by the Blue Dog Lake Association and the Enemy Swim Lake Sanitary district.

**Table 1. Stakeholders**

| | |
|---|---|
| Blue Dog Lake Association<br>Enemy Swim Sanitary District<br>Day Conservation District<br>Roberts Conservation District<br>Sisseton-Wapheton Sioux Tribe<br>Day County<br>City of Webster | US EPA Non-Point Source Program<br>Natural Resource Conservation Service<br>SD Dept. of Game, Fish & Parks<br>SD Dept. of Environment & Natural Resources – Water Rights<br>SD Dept. of Environment & Natural Resources – Environmental Services<br>SD Dept. of Environment & Natural Resources – Watershed Protection |

- ***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 phosphorus and fecal coliform bacteria total maximum daily loads (TMDLs) for Blue Dog Lake as provided in this summary and attached documents. These TMDLs have been established at levels necessary to meet the applicable water quality standards with consideration of seasonal variation and a margin of safety. The following designated use classifications will be protected through implementation of this TMDL: warmwater fish life propagation, immersion recreation, and limited contact recreation.

# *II. Problem Characterization:*

- ***Waterbody description/Maps***

  Blue Dog Lake is a 608 hectare (1,502 acre) natural lake located on the eastern central border of Day County in northeast South Dakota (Figure 1). Blue Dog Lake was most likely formed by an ice block from a receding glacier during the Pleistocene Epoch. Blue Dog Lake has a maximum depth of 2.4 meters (8 feet) when the lake elevation reaches the crest of the outlet structure. The mean depth is 1.9 meters (6.2 feet) at that elevation. Blue Dog Lake has approximately 9.5 kilometers (8.7 miles) of shoreline.

  The outlet of Enemy Swim Lake / Campbell Slough is the other main tributary for Blue Dog Lake. Enemy Swim Lake is located approximately 5 miles north of Blue Dog Lake and has some of the best water quality of any natural lake in the state.

- ***Waters Covered by TMDL***
  Blue Dog Lake is the benefactor of this TMDL.

- ***Pollutant(s) of Concern***
  Total Phosphorus
  Fecal coliform bacteria

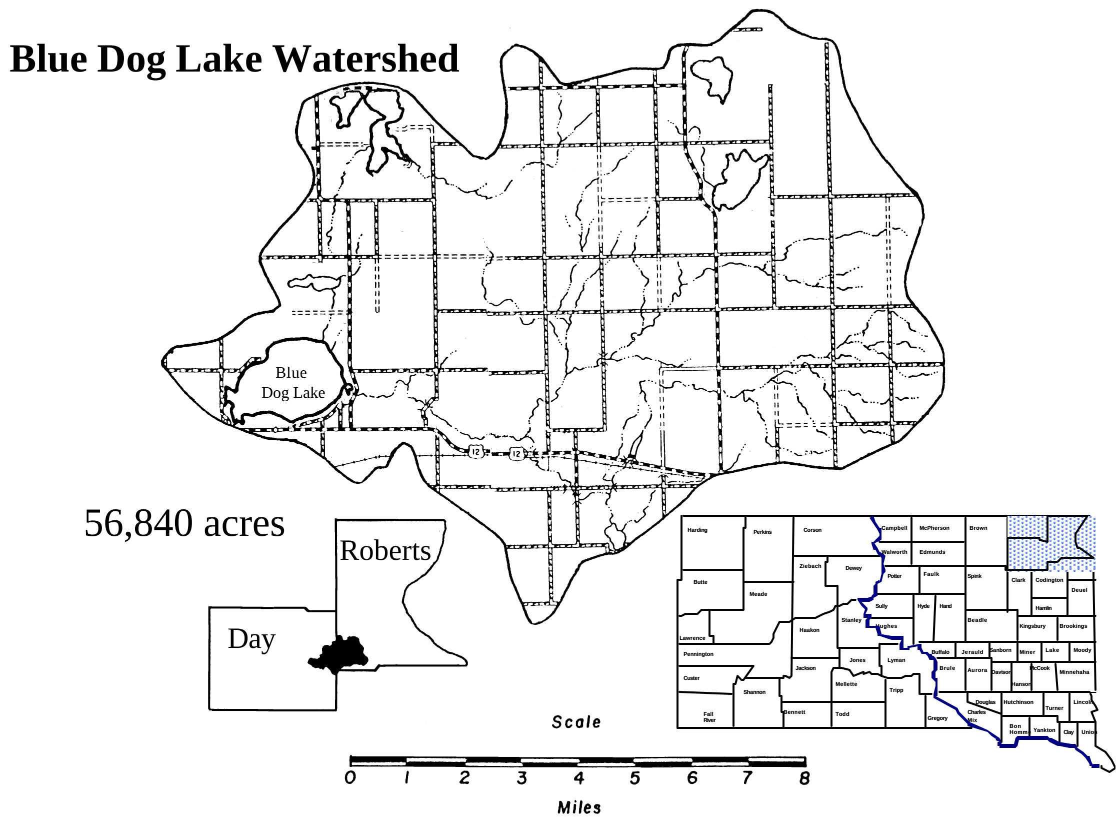



Figure 1.

- ***Rationale for Geographic Coverage***
  The total watershed for Blue Dog Lake is roughly 23,003 ha (56,840 acres). One half of the watershed boundary of Blue Dog Lake extends east into Roberts County. The main tributary to Blue Dog Lake is Owen's Creek. Owen's Creek begins in Roberts County on the western slope of the Waubay Moraine. The Waubay Moraine was left after the advancement of the second and third glaciers of the Pleistocene Epoch. The placation formed the Coteau de Prairies, the major physiographic formation of far eastern South Dakota. The meltwater of the glaciers cut channels and deposited glacial outwash in those channels that connects most of the major lakes in the area through ground water (Leap, 1988).

The outlet of Enemy Swim Lake/Campbell Slough is the other main tributary for Blue Dog Lake. Enemy Swim Lake is located approximately 5 miles north of Blue Dog Lake and has some of the best water quality of any natural lake in the state. The joint Blue Dog/Enemy Swim Watershed Assessment was initiated in 1996. EPA Section 319 Nonpoint Source Funds totaling $70,000 were secured for the project. The 319 funds paid for 60% of the total project, requiring the local sponsor to secure the remaining 40% as non-federal match dollars. Day Conservation District agreed to sponsor the project with cash support for $20,000 from both the Blue Dog Lake Association and the Enemy Swim Sanitary District. In-kind services were also used as non-federal dollars. In-kind services came from the Blue Dog Lake Association, SD Dept. of Game Fish and Parks, Day Conservation District, Bud's Resort, Coast Auto, and the project coordinator. The conservation district secured an additional $5,000 of federal 604(b) special project money to complete a septic leachate survey on Enemy Swim Lake.

Land use in the watershed is primarily agricultural. The conservation district estimated 35.2% of the land is rangeland, 25.4% is crop, 31.2% is hay or CRP ground, 0.2% woodland, and 8% of the land is in other uses (water, municipalities, and low lake developments). Two small communities are included in the Blue Dog watershed. The city of Waubay is located on the south shore of Blue Dog Lake, although only a small corner of the town is actually in the watershed. The town of Ortley is located 4 miles west and 1 mile south of the Owen's Creek inlet to Blue Dog Lake. According to the 1998-1999 Municipal Directory, Ortley has a population of 63 people (SDML, 1998). The south and east shores of Blue Dog Lake are lined with cabins. The lake cabins were connected to a central wastewater collection system in 1992. The lake is also home to the Blue Dog State Fish Hatchery.

Land ownership in the watershed is diverse. The conservation district estimated 83% private, 7.5% tribal, 3% state, and 6.5% federal. The state and federal lands are mostly small game and waterfowl production areas. Tribal lands are intermixed with privately owned lands.

- ***Use Impairments or Threats***

  <u>Total Phosphorous</u>

  The phosphorus concentrations in Blue Dog Lake were 4 times greater than the amount needed for an algal bloom. Typically, targets for nutrient reduction are linked to chlorophyll *a* TSI levels. Although sediments are most likely playing a role in limiting algal growth and chlorophyll *a* production, there is still a good phosphorus to chlorophyll *a* relationship. However, Blue Dog Lake's TSI level during the project was already almost mesotrophic, and improving chlorophyll *a* to an oligotrophic level is unrealistic. The TSI level for phosphorus in Blue Dog Lake is slightly above the hypereutrophic and eutrophic boundary. The phosphorus TSI can be lowered to the eutrophic level.

Fecal Coliform Bacteria

Many outside factors can influence the concentration of fecal coliform in a lake environment. Sunlight and time seem to lessen fecal concentrations even though nutrient concentrations remain high. As a rule, if fecal bacteria concentrations are low or non-detectable it does not mean animal waste is absent from a waterbody. Blue Dog Lake was listed in the 1998 South Dakota Waterbody List as impaired by fecal coliform bacteria due to public beach closures over the previous 5 years.

- ***Probable Sources***

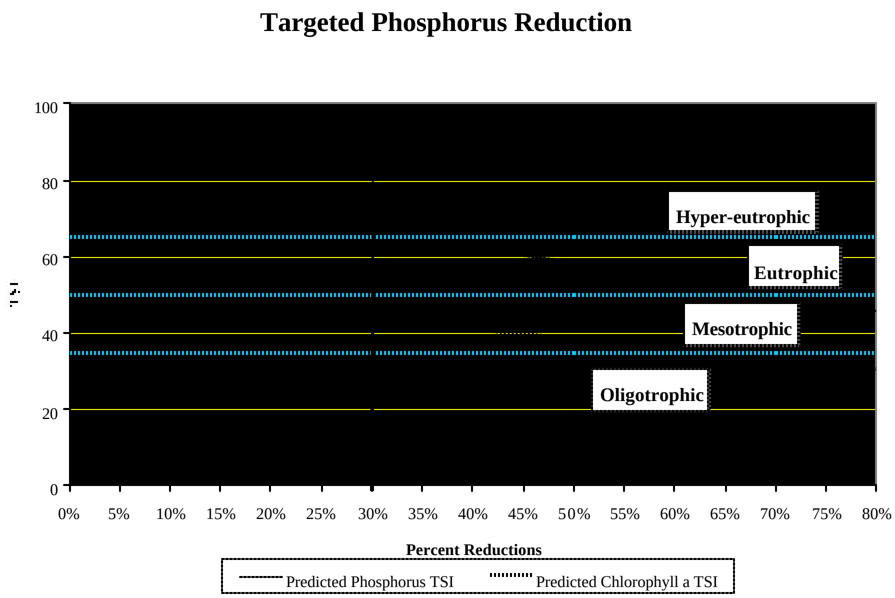
Runoff from animal feeding areas, cattle pastured in riparian areas, poor manure management, or waste from beavers and other wildlife may be responsible for the high fecal concentrations. Cattle are the most likely source because the fecal concentrations were highest during storm events. If beaver or other wildlife were the source, fecal concentrations would be diluted because the runoff would not cause an increase in fecal coliform concentrations.

# *III. TMDL Endpoint:*

- ***Description***

It recommended that total phosphorus be reduced to a TSI level of 63.75. A 30% reduction of the incoming phosphorus load will be needed to reach this target (Figure 2). After implementing the BMPs needed to reduce phosphorus loads, long-term monitoring should be conducted to see if the target has been reached.

**Figure 2.**




This target was established because the AGNPS model estimated a 35% reduction of phosphorus in the watershed by eliminating discharge from selected feeding areas and improving manure and crop management in other areas. It is also recommended that an attempt be made to establish shoreline vegetation around the perimeter of Blue Dog Lake. Established littoral vegetation would reduce shoreline erosion, reduce re-suspension of bottom sediments, and provide fishery habitat. It must be remembered, however, if sedimentation is reduced, algal growth may increase. Because the success of the vegetative plantings is not predictable, a targeted amount of sediment reduction will not be included in the report.

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

The TMDL goal of a 30% reduction in phosphorus input will be defined by a water quality endpoint of a nitrogen to dissolved phosphorus ratio of greater than 7.5 (N:P > 7.5), as averaged over a period of one growing season.

The goal will greatly diminish productivity in the lake which in turn will lead to greater support of assigned beneficial uses. This improvement in water quality will ensure that visible pollutants are controlled, more pollutants will not form in the lake and the growth of nuisance aquatic life will eventually diminish.

It will also greatly improve recreation on the lake by increasing aesthetics for swimming and fishing, as well as reduce possible bacterial contamination originating from animal feeding areas. The TMDL goal to reduce inlake fecal coliform to within state water quality standards with counts to less than 400 per 100 mL in any daily grab sample will eliminate beach closures.

## *IV. TMDL Analysis and Development:*

- ***Data Sources***

Data was collected by DENR and the Roberts - Day Conservation Districts during late summer 1996 to late summer of 1998.

- ***Analysis Techniques or Models***

In order to complement existing water quality data in the Blue Dog Lake watershed, a computer model was selected in order to asses the nonpoint source (NPS) loadings throughout the drainage. The model selected was the Agricultural Nonpoint Source Pollution Model (AGNPS) version 3.65. This model was developed by the USDA - Agricultural Research Service to analyze the water quality of runoff events in the watershed. The model predicts runoff volume and peak rate, eroded and delivered sediment, nitrogen, phosphorus, and chemical oxygen demand (COD) concentrations in the runoff and sediment. The model was designed to run utilizing a single storm event of equal magnitude for all acreage in the watershed. The model then analyzes the runoff data from the headwaters of the watershed to the outlet. The pollutants are routed in a step-wise fashion so the flow at any point may be examined. The AGNPS model was to be used to objectively compare different subwatersheds and individual cells within a watershed to other watersheds within a drainage basin.

In order to further evaluate the water quality status of the Blue Dog Lake watershed, land use and geotechnical information was compiled. This information was then incorporated into a computer model. The primary objective of utilizing a computer model on the Blue Dog Lake watershed was to:

1) Evaluate and quantify Nonpoint Source (NPS) yields from each subwatershed and determine the net loading to Blue Dog Lake.
2) Define critical NPS cells within each subwatershed (elevated sediment, nitrogen and phosphorus).
3) Prioritize and rank each animal feeding area and quantify the nutrient loadings from each area.

Hydrologic and water quality data was obtained from 10 tributary monitoring station locations within the watershed as well as inlake sampling sites. Samples collected at each site were taken according to South Dakota's EPA approved Standard Operating Procedures for Field Samplers. Water samples were sent to the State Health Laboratory in Pierre for analysis. Quality Assurance/Quality Control samples were collected on 10% of the samples according to South Dakota's EPA approved Clean Lakes Quality Assurance/Quality Control Plan. This data was used in the nutrient reduction response calculation.

- ***Seasonality***

  Different seasons of the year can yield differences in water quality due to changes in precipitation and agricultural practices. To discuss seasonal differences, Blue Dog Lake samples were separated into spring (snowmelt – May 31), summer (June 1 – August 31), and fall (September 1 – October 31). The Blue Dog Lake watershed experienced heavy snows during the 1996 – 1997 winter. A wet pattern continued into 1998. During the project, 65 samples were collected in the spring samples, 53 samples in the summer months and 55 samples in the fall months. The summer and fall samples were collected after heavy rainfall that occurred in scattered areas of the watershed. Not all sites were sampled during every runoff event in the summer and fall due to the scattered rains and intermittent flow.

- ***Margin of Safety***

  The AGNPS data indicated that the Blue Dog Lake watershed had a low sediment deliverability rate at both the inlets and the outlet of Blue Dog Lake. The AGNPS model estimated the sediment deliverability to the lake was .026 ton/acre/year. This corresponds to 1,465 tons of sediment entering Blue Dog Lake resulting from one year's average rainfall events. The estimated load was quite low when compared to other watersheds in northeast South Dakota.

An analysis of the Blue Dog Lake watershed indicated that there were approximately 55 cells with erosion rates greater than 5 ton/acre. This was only 4% of the total number of cells found in the Blue Dog watershed. The model indicated that the majority of these cells were located in areas that have a landslope of 7% or greater and have a c-factor of 0.19 or more. The high c-factors can be a product of limited or non-existent conservation tillage practices. The AGNPS model was run with 41 cells having the c-factors changed to represent a no-till practice. These 41 cells are equal to 1,640 acres of cropland. The model showed a 35% reduction in sediment delivered to Blue Dog Lake.

To reduce sediment loads to Blue Dog Lake, it is recommended those areas having landslopes greater than 7% and limited or non-existent conservation tillage practices be modified to represent no-till or limited-till practices. Cells should be field verified before any BMPs are utilized.

It is also recommended that the croplands targeted by the AGNPS model with slopes greater than 7% be placed under minimum tillage or be seeded to grass.

Once the lake water level stops increasing in elevation, an attempt should be made to establish shoreline and littoral (emergent) vegetation around Blue Dog Lake. Stabilization can be from “hard or soft practices. Hard practices include rip rap, gabion baskets and other inert materials. Soft practices include trees and vegetation. The vegetation would reduce shoreline erosion, reduce re-suspension of bottom sediments, and provide better fish habitat. Lake managers should be reminded that the improved light penetration in Blue Dog Lake might cause an increase in algal production until inlake nutrient concentrations are reduced.

## V. *Allocation of TMDL Loads or Responsibilities:*

- ***Wasteload Allocation***

There are no point sources of pollutants that are of concern in this watershed, therefore the "wasteload allocation" component of the TMDL is considered a zero value. The TMDL is considered wholly included in the "load allocation" component of the TMDL.

- ***Load Allocation***

*Nutrients*

Using the AGNPS model, the resulting data showed 2.42 lbs/acre of nitrogen and 0.58 lbs/acre of phosphorus enter Blue Dog Lake annually. The nitrogen deliverability rate was comparable to other watersheds in the area while the phosphorus was relatively low. Both nitrogen and phosphorus loads were calculated using the sum of sediment bound and soluble forms of the respective nutrients. As with the sediment load, the annual nutrient loads were made up of a series of average annual rainfall events that may have incurred in the region.

The nutrient load leaving Blue Dog Lake at the outlet, as calculated by AGNPS, was 2.28 lbs / acre of nitrogen and 0.36 lbs / acre of phosphorus. This correlates to a nutrient trapping efficiency for nitrogen of 6% and a trapping efficiency for phosphorus of 38%. The analysis of subwatershed loadings using the model produced the following results:

**CRITICAL PHOSPHORUS SUBWATERSHEDS**

| Sub-watershed # | Outlet Cell # | Annual Total Phosphorus (lbs/acre) |
|---|---|---|
| | | |
| 7 | 930 | 1.05 |
| 9 | 1060 | 1.29 |
| 10 | 1085 | 1.05 |
| 12 | 1342 | 1.07 |

**CRITICAL NITROGEN SUBWATERSHEDS**

| Sub-watershed # | Outlet Cell # | Annual Total Nitrogen (lbs/acre) |
|---|---|---|
| 5 | 723 | 3.92 |
| 7 | 930 | 4.02 |
| 9 | 1060 | 5.19 |
| 10 | 1085 | 4.20 |
| 12 | 1342 | 3.86 |

In comparison of the total twelve delineated subwatersheds in the Blue Dog Lake drainage, four subwatersheds had significantly higher phosphorus yields. These four watersheds listed above deliver 7,867.6 lbs. of phosphorus to the watershed. This cumulative load represents 37% of the total phosphorus load delivered to the watershed while occupying only 20 % of the total subwatershed acreage.

The nitrogen analysis for the subwatersheds shows five critical subwatersheds in the drainage. These five subwatersheds produce 43,277.2 lbs. of nitrogen, which is 51% of the total nitrogen delivered to the watershed. These five subwatersheds occupy approximately 29% of the total subwatershed acreage. The AGNPS model indicated that a possible source of elevated nutrient runoff is from cropland where applied fertilizer is left unincorporated in the soil or only slightly incorporated. The model also suggested that the presence of an animal feeding area with an AGNPS feedlot rating of 50 or greater in the subwatershed would greatly increase the nutrient load delivered from the subwatershed.

*Fecal coliform bacteria*

Typically, inlake bacteria concentrations are low due to exposure to sunlight, time and dilution in a large body of water. Of the 30 individual in-lake samples collected, 60% of the fecal coliform concentrations were below detection limits. The maximum concentration (360 colonies / 100 mL) was collected in a sample on September 22, 1997 at Site #2. Site #1's fecal coliform counts were below the detection limit on the same date. Site #2 was closer to the Owen's Creek inlet and was most likely effected by the high fecal coliform samples from a runoff event just prior to the lake sample. The average fecal coliform bacteria count was

27 counts/100 mL. The peaks in bacterial presence coincide with runoff events in the watershed. However, there were times when fecal coliform counts were detected at Site #1 and were not detected at Site #2. This again shows the spatial variability that can be found in a lake.

Tributaries to the lake tell another story (Table 3) with extremely high concentrations of bacteria found. Since high nutrient concentrations usually accompany the fecal bacteria counts, controlling animal waste would greatly address both concerns and restore beneficial uses.

**Table 3. Fecal Coliform Exceedences**

| Site | Date | Event | Concentration Colonies/100 mL |
|---|---|---|---|
| BDL-5 | 10/30/96 | Storm | 10,000 |
| BDL-5 | 8/14/97 | Storm | 2,800 |
| BDL-5 | 5/12/98 | Storm | 2,900 |
| BDL-5 | 10/5/98 | Storm | 7,200 |
| BDL-6 | 9/4/96 | Base Flow | 5,600 |
| BDL-6 | 10/30/96 | Storm | 42,000 |
| BDL-6 | 7/16/97 | Base Flow | 20,000 |
| BDL-6 | 8/14/97 | Storm | 11,000 |
| BDL-6 | 8/27/97 | Base Flow | 24,600 |
| BDL-6 | 9/15/97 | Storm | 4,200 |
| BDL-6 | 5/12/98 | Storm | 38,000 |
| BDL-6 | 8/3/98 | Storm | 59,000 |
| BDL-6 | 8/22/98 | Storm | 37,000 |
| BDL-6 | 10/5/98 | Storm | 46,000 |

## ***Conclusions***

It is recommended that the implementation of the appropriate best management practices be targeted to the critical cells and priority animal feeding areas. Animal feeding areas with an AGNPS rating of 55 or greater should be evaluated for potential operational or structural modifications in order to minimize or eliminate nutrient yields. The model suggested that a reduction of 7.5% in nitrogen load and 17% in phosphorus load could be realized if these feedlots were modified to include runoff containment systems and buffer zones (cell # 35, 459, 505, 623, 627, 797, 876, 1099, 1255, 1264, 1357, 1360).

The tillage practices on critical cells having a high c-factor and a slope of 7% or greater should also be modified to conservation tillage practices. These practices might include strip cropping, limited-till and no-till. The modification of the c-factor (representing no-till) on 41 cells in the watershed produced reductions in the model output of 35% for sediment, 18% for phosphorus and 8% reduction in nitrogen. The reduction in nutrients and sediment could be less or more depending on crop producer participation and modification costs. It is highly recommended that all critical cells and animal feeding areas be field verified in advance of implementing best management practices.

- ***Allocation of Responsibility***

Nutrient Analysis

The suspected sources of elevated nutrient loads to the Blue Dog Lake watershed were animal feeding areas and the application of unincorporated fertilizers on croplands and areas of highly erodible soils or lands with slopes greater than 7%. It is recommended that the implementation of the appropriate best management practices be targeted to the critical cells and priority animal feeding areas.

Animal feeding areas with an AGNPS rating of 55 or greater should be evaluated for potential operational or structural modifications in order to minimize nutrient yields. The model suggested that a reduction of 7.5% in nitrogen load and 17% in phosphorus load could be realized if animal waste management systems were implemented on these feedlots.

The tillage practices on critical cells having a high c-factor and a slope 7% or greater should also be modified to include conservation tillage practices to better incorporate applied fertilizers. These practices might include strip cropping, limited-till and no-till. The modification of the c-factor (representing no-till) on 41 cells in the watershed produced reductions in the model output of 18% for phosphorus and 8% reduction in nitrogen. All cells should be field verified for accuracy before implementation of Best Management Practices (BMPs).

Feedlot Analysis

Twenty-five animal feeding areas were identified by AGNPS as being potential sources of nonpoint pollution. The AGNPS model ranked the animal feeding areas utilizing data collected and then inputted into the model. Of the twenty-five animal feeding areas defined, twelve feedlots had an AGNPS rating of 55 or greater when using a 25-year frequency storm event. Seven feeding areas have a rating of 64 or greater.

To analyze the impacts of these animal feeding areas on the watershed, the model was run after removing the feedlots that ranked 55 or greater. The model was then run by removing the feeding areas that ranked greater than 64. The resulting data was then compared to the output data from the model run with the original data. Reductions in nutrients delivered to the watershed could were then calculated. The results of this action on the model indicated that when those cells that rated 55 or greater were removed, a 17% reduction in phosphorus could be realized as well as a 7.5% reduction in nitrogen delivered to the watershed. Removing all feedlots from the model that had a rating of 64 or greater (seven cells) produced a 2% net reduction in total phosphorus and a 4% reduction in total nitrogen.

It is recommended that the twelve feedlots with an AGNPS rating of 55 or greater have animal waste management systems constructed to lower nutrient yields to Blue Dog Lake.

Trophic State Index

The average TSI in Blue Dog Lake was 61.36 ranking Blue Dog Lake as eutrophic. However, there was quite a large range of values for the three parameters used to calculate TSI. The average chlorophyll *a* TSI was 46.83 (mesotrophic), the average phosphorus TSI was 65.86 (slightly hyper-eutrophic), and the average Secchi disk TSI was 73.82 (hyper-eutrophic). It appears that the suspended sediments were restricting chlorophyll *a* production even through there was plenty of available phosphorus for prolonged nuisance algal blooms.

Long-Term Trends

The long-term trends in Blue Dog Lake from 1979 to 1998 appeared to show slight to moderate improvement. The late 1980's were drought years and nutrients may have been concentrated in lakes. The wet years of 1993 – 1998 may have flushed many of the nutrients out of the lake producing apparent improvement. The Secchi disk trend remained flat over the years. The most likely reason was the shallow depth of Blue Dog Lake has not changed over the years and was still subject to wind and waves suspending bottom sediments.

Recommended Reduction Goal

It is recommended that a reduction goal of 30% in phosphorus inputs to Blue Dog Lake should be attained. The 30% reduction will most likely move the average phosphorus TSI level downward from hypereutrophic to eutrophic. This goal is best monitored by the attainment of a nitrogen to phosphorous ratio greater than 7.5 as a average over a period of one growing season. After implementing best management practices in the watershed, long-term monitoring should be conducted to see if the goal and target have been reached.

**Recommendations**

According to the water quality monitoring data and the AGNPS model, animal feeding areas and manure management were the most likely source of nutrients and bacteria to Blue Dog Lake. It is recommended that the twelve feeding areas with AGNPS ratings greater than 55 have animal waste systems constructed to eliminate nutrient and bacteria runoff. These livestock operations should also implement NRCS approved manure management plans.

## *VI. Schedule of Implementation:*

The DENR is working with a local sponsors on an implementation project on Elm Lake that began the spring of 2000. The sponsors requested and were granted project assistance during the 1999 fall Section 319 and SD Conservation Commission funding rounds.

## VII. *Post-Implementation Monitoring:*

Once the implementation project is completed, post-implementation monitoring will be required to assure that the TMDL has been reached and improvements to the beneficial uses occur.

## VIII. *Public Participation:*

- ***Summary of Public Review***

This project included extensive public review and information and education program which is documented in the report. "A Report on the Activities and Expenditures of the Blue Dog / Enemy Swim Lake Watershed Assessment Study". The following table summarizes efforts taken to gain public education, review and comment during development of the TMDL:

- ***Project Information and Education Efforts***

**Table 2.**

| ***Public Meetings/ Personal Contact*** | ***Articles/ Fact Sheets*** | ***Document Distribution*** |
|---|---|---|
| • 34 public meetings, board meetings, fairs workshops, etc. documented in Reference 2. | • 12 fact sheets<br>• 2 news releases<br>• 3 newsletters (to 516 lake & watershed property owners) | US EPA<br>Blue Dog Lake Association<br>Enemy Swim Sanitary District<br>Roberts Conservation District<br>Day Conservation District<br>Sisseton-Wapheton Sioux Tribe<br>NRCS<br>City of Webster<br>Day County |
| ***Electronic media*** | ***Mailings*** | ***Public Comments Received*** |
| **December, 1998**<br>Assessment Summary added to department website<br>**May 2000**<br>TMDL Summary advertised on department website | **Interested parties**<br>May 5, 2000<br>**Stakeholders**<br>May 5, 2000<br>**Daily Newspapers**<br>May 5, 2000 | Comments received during project meetings and review of the draft report and findings were considered. |

## *IX. Supporting Development Document(s) (attached):*

Stueven, G. H. and Bren, Ron, M. September 1999. PHASE I WATERSHED ASSESSMENT FINAL REPORT BLUE DOG LAKE DAY COUNTY SOUTH DAKOTA. South Dakota Watershed Protection Program, Division of Financial and Technical Assistance, South Dakota Department of Environment and Natural Resources, Pierre, South Dakota.

Skadsen, Dennis. January 1999. A REPORT ON THE ACTIVITIES AND EXPENDITURES OF THE BLUE DOG/ENEMY SWIM LAKE WATERSHED ASSESSMENT STUDY. Day Conservation District, Webster, South Dakota.

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**REGION 8**
**999 18TH STREET - SUITE 300**
**DENVER, CO 80202-2466**
**http://www.epa.gov/region08**

February 7, 2001

Ref: 8EPR-EP

Steven M. Pirner, Secretary
Department of Environment & Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Re: TMDL Approvals
*Blue Dog Lake*
*Clear Lake*
*Freeman Lake*
*Punished Woman Lake*
*Upper Lake Sharpe*

Dear Mr. Pirner:

We have completed our review of the total maximum daily loads (TMDLs) as submitted by your office for the waterbodies listed in the enclosure to this letter. In accordance with the Clean Water Act (33 U.S.C. 1251 *et. seq.*), we approve all aspects of the TMDLs as developed for the water quality limited waterbodies as described in Section 303(d)(1).

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

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 cleanup. 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. 33040 for July 24, 1992). Further, EPA states that "*...in some situations water quality standards – particulary 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 Vernon Berry of my staff at 303/312-6234.

Sincerely,

Jerry Anderson for

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

Enclosure

Enclosure

## APPROVED TMDLS

| Waterbody Name* | TMDL Parameter/ Pollutant | Water Quality Goal/Endpoint | TMDL | Section 303(d)1 or 303(d)3 TMDL | Supporting Documentation (not an exhaustive list of supporting documents) |
|---|---|---|---|---|---|
| Blue Dog Lake* | phosphorus | TSI ≤ 65 | 30% reduction in phosphorus loads | Section 303(d)(1) | ■ Phase I Watershed Assessment Final Report, Blue Dog Lake, Day County, South Dakota (SD DENR, Sept. 1999)<br>■ Report on the Activities and Expenditures of the Blue Dog / Enemy Swim Lake Watershed Assessment Study (Day Conservation District, January 1999) |
| Clear Lake* | phosphorus | TSI ≤ 61 | 20% reduction in average annual tributary phosphorus loads | Section 303(d)(1) | ■ Phase I Watershed Assessment Final Report, Clear Lake, Deuel County, South Dakota (SD DENR, June 1999) |
| | sediment | Increase average lake depth by 4 feet over 116 surface area acres | Remove 750,000 cubic yards of lake sediment | Section 303(d)(1) | |
| Freeman Lake* | nitrate | nitrate - 50 mg/L as a 30 day average<br>nitrate - 88 mg/L as a daily maximum | reduce nitrate delivery to the lake by 33,000 Kg/year | Section 303(d)(1) | ■ Water Quality Sample Results (SD DENR, 1979-1999)<br>■ Freeman Lake Watershed AGNPS Study Results<br>■ Saline-Seep Diagnosis, Control and Reclamation (USDA, Conservation Research Report No. 30, May, 1983) |
| | selenium | selenium - 5 $\mu$g/L as a 30 day average<br>selenium - 20 $\mu$g/L as a daily maximum | reduce selenium delivery to the lake by 152.6 Kg/year | Section 303(d)(1) | |

| Waterbody Name* | TMDL Parameter/ Pollutant | Water Quality Goal/Endpoint | TMDL | Section 303(d)1 or 303(d)3 TMDL | Supporting Documentation (not an exhaustive list of supporting documents) |
|---|---|---|---|---|---|
| Punished Woman Lake* | sediment | Increase average lake depth in mid-lake area to 12 - 15 feet | ■ 50% reduction of in-lake sediment<br>■ Remove 421,000 cubic yards of lake sediment | Section 303(d)(1) | ■ 1993 South Dakota Lakes Assessment Final Report (SD DENR, March 1994)<br>■ Punished Woman's Lake Diagnostic / Reasibility Study Report (SD DWNR, April 1991)<br>■ South Dakota Lakes Classification and Inventory Final Report (SD DWNR, 1981)<br>■ Classification, Preservation, Resoration of lakes in Northeastern South Dakota (State Lakes Preservation Committee, 1977) |
| | nutrients | 50% reduction of pondweed, cattail, and bulrush<br><br>15% reduction of in-lake sediment | Remove 421,000 cubic yards of lake sediment | Section 303(d)(1) | |
| Upper Lake Sharpe* | sediment | re-vegetate 45% of stream channel types F and G (Rosgen's Stream Channel Classification) | 30% reduction of annual sediment delivery to Lake Sharpe by the year 2010 | Section 303(d)(1) | ■ Lower Bad River Basin Study Final Report (USDA, NRCS, revised June 1994)<br>■ Upper Bad River Basin Study (USDA, NRCS, October 1998)<br>■ Bad River Phase II Water Quality Project Final Report (Stanley County Conservation District, 1996)<br>■ Report on Factors Affecting Sediment Yield in the Pacific Southwest Area and Selection and Evaluation of Measures for Reduction of Erosion and Sediment Yield (Pacific Southwest Inter-Agency Committee, October 1968) |

* 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: Blue Dog Lake, Day County
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: December 12, 2000 Date Review completed: January 10, 2001 VEB

| 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 warmwater marginal fish life propagation, immersion recreation, and limited contact recreation. |
| ■ **Water Quality Standards Target** | X | Water quality targets were established based on trophic status. This is a reasonable approach because the trophic status of the waterbody 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 this lake because it provides an effective surrogate that reflects both 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. |
| ■ **Technical Analysis** | X | Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources, and in identifying acceptable levels of pollutant control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and the waterbody 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 for croplands within the watershed. 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 | 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. |
| ■ **EPA approved Water Quality Standards** | X | Standards upon which this TMDL was based have been formally approved by the EPA. No tribal waters were involved in this TMDL. |

# ■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Clear Lake, Deuel County
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: December 12, 2000 Date Review completed: January 10, 2001 VEB

| 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 warmwater marginal fish life propagation, immersion recreation, and limited contact recreation. |
| ■ **Water Quality Standards Target** | X | Water quality 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, relate 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 because it provides an effective surrogate that reflects both 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 sediments, if needed). |
| ■ **Technical Analysis** | X | Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources, and in identifying acceptable levels of pollutant control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and the waterbody 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, and urban BMPs for lawn fertilization. The in-lake dredging will further reduce the amount of available nutrients into the lake because of increased depth and provide further aquatic life habitat. 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 | 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. |
| ■ **EPA approved Water Quality Standards** | X | Standards upon which this TMDL was based have been formally approved by the EPA. No tribal waters were involved in this TMDL. |

# ■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Freeman Lake, Jackson County
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: January 16, 2001 Date Review completed: January 30, 2001 VEB

| 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 warmwater permanent fish life propagation, immersion recreation, limited contact recreation, and criteria for fish and wildlife propagation, recreation and stock watering. |
| ■ **Water Quality Standards Target** | X | The 30-day average and daily maximum numeric standards for nitrate and selenium were used as quantified endpoints. |
| ■ **TMDL** | X | The TMDLs are expressed in terms of annual nitrate load reduction, and annual selenium load reduction. These are reasonable ways to express the TMDLs for this lake because they provide effective surrogates that reflect both aquatic life and recreational needs, and reflect 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. |
| ■ **Technical Analysis** | X | Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources, and in identifying acceptable levels of pollutant control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and the waterbody 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 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 | The allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to saline seeps which are compounded by factors such as fallow croplands and poor surface drainage. |
| ■ **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. |
| ■ **EPA approved Water Quality Standards** | X | Standards upon which this TMDL was based have been formally approved by the EPA. No tribal waters were involved in this TMDL. |

# ■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Punished Woman Lake, Codington County
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: December 12, 2000 Date Review completed: January 10, 2001 VEB

| 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 warmwater semi-permanent fish life propagation, immersion recreation, and limited contact recreation. |
| ■ **Water Quality Standards Target** | X | Water quality targets were established based on lake depth and reduction of in-lake aquatic vegetation and sediment. These are reasonable targets because they relate to the impaired uses of concern. |
| ■ **TMDL** | X | The TMDL is expressed in terms sediment load reduction and removal of lake sediment. Lake depth is a particularly important factor related to both the recreational use and fisheries use of the lake. |
| ■ **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. |
| ■ **Technical Analysis** | X | Monitoring, empirical relationships, AGNPS modeling, and best professional judgement were used in identifying pollutant sources, and in identifying acceptable levels of pollutant control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and the waterbody 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 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 | The allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as shoreline erosion and bank sloughing. |
| ■ **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. |
| ■ **EPA approved Water Quality Standards** | X | Standards upon which this TMDL was based have been formally approved by the EPA. No tribal waters were involved in this TMDL. |

# ■ TMDL Checklist ■

EPA Region VIII

State/Tribe: South Dakota
Waterbody Name: Upper Lake Sharpe, Jones & Stanley Counties
Point Source-control TMDL: Nonpoint Source-control TMDL: X (check one or both)
Date Received: December 12, 2000 Date Review completed: January 10, 2001 VEB

| 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 coldwater permanent fish life propagation, immersion recreation, and limited contact recreation. |
| ■ **Water Quality Standards Target** | X | Water quality targets were established based on re-vegetation of Bad River channels (i.e., F & G types according to Rosgen's Stream Channel Classification) flowing into the lake. This is a reasonable approach because the majority of sediment delivered to the lake originates in the Bad River watershed. This target relates to the uses of concern in the lake. |
| ■ **TMDL** | X | The TMDL is expressed in terms of annual sediment load reduction. This is a reasonable way to express the TMDL for this lake because the measure reflects both 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. |
| ■ **Technical Analysis** | X | Monitoring, empirical relationships, modeling (e.g., PSIAC, USLE, EGEM), and best professional judgement were used in identifying pollutant sources, and in identifying acceptable levels of pollutant control. This level of technical analysis is reasonable and appropriate because of the character of the pollutants, the type of land use practices, and the waterbody 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 (e.g., improved grazing management) within the Bad River and Antelope Creek watersheds. 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 | The allocation for the TMDL was a "load allocation" attributed to nonpoint sources. Allocation was attributed to such sources as gully and channel erosion from poor landuse management practices (e.g., grazing). |
| ■ **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. |
| ■ **EPA approved Water Quality Standards** | X | Standards upon which this TMDL was based have been formally approved by the EPA. No tribal waters were involved in this TMDL. |