LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Mingenback Lake
Water Quality Impairment: Eutrophication Bundled with Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Little Arkansas **County:** McPherson

HUC 8: 11030012 **HUC 11** (HUC 14)**: 020** (050)

Drainage Area: Approximately 18.3 square miles. **(Figure 1)**

Conservation Pool: Area = 4.1 acres, Maximum Depth = 1 meter

Designated Uses: Secondary Contact Recreation; Expected Aquatic Life Support; Food Procurement

1998 303d Listing: Table 4 - Water Quality Limited Lakes

Impaired Use: All uses are impaired to a degree by eutrophication

Water Quality Standard: Nutrients - Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

Dissolved Oxygen: 5 mg/L (KAR 28-16-28e(c)(2)(A))

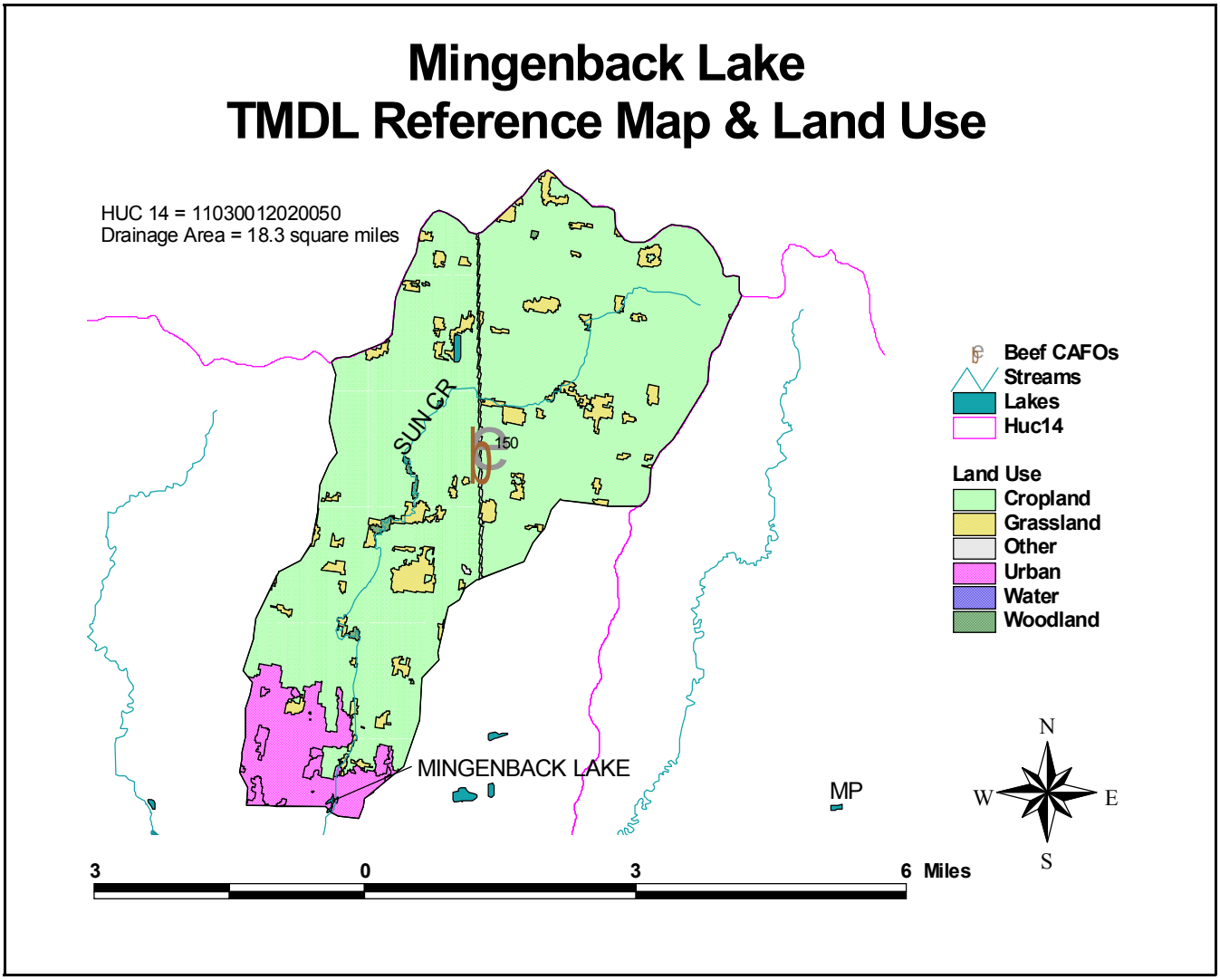

Figure 1

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Fully Eutrophic, Trophic State Index = 55.58

Monitoring Sites: Station 064701 in Mingenback Lake.

Period of Record Used: One survey during 1994, plus complaint investigations over the years.

Current Condition: The total phosphorus concentrations is elevated averaging 290 ppb. The average chlorophyll a concentration (12.8 ppb) is below the water quality standard for secondary contact recreation (20 ppb), yet there is a history of frequent, large blue-green algae blooms

(*Microcystis aeruginosa*). The chlorophyll a to total phosphorus yield is very low. Nitrogen appears to be the primary limiting factor, although hydrologic flushing may be more important. Light is not limiting, despite high inorganic turbidity.

The Trophic State Index of 61 is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 30 ug/l. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

1. Oligotrophic	TSI < 40
2. Mesotrophic	TSI: 40 - 49.99
3. Slightly Eutrophic	TSI: 50 - 54.99
4. Fully Eutrophic	TSI: 55 - 59.99
5. Very Eutrophic	TSI: 60 - 63.99
6. Hypereutrophic	TSI: ≥ 64

The low dissolved oxygen observed is probably due to either organic or nutrient loads and subsequent eutrophication. The average dissolved oxygen concentration was 3.7 mg/L.

Interim Endpoints of Water Quality (Implied Load Capacity) at Mingenback Lake over 2005 - 2009:
In order to prevent any further degradation of the lake, the desired endpoint will be summer chlorophyll a concentrations at or below 12.8 ug/l. Achievement of this endpoint should also result in dissolved oxygen values above 5 mg/L. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The watershed has a very high potential for nonpoint source pollution. An annual phosphorus load of 7,165 pounds per year is necessary to correspond to the concentrations seen in the lake. The annual nitrogen load is 12,015 lb/yr.

The primary source of phosphorus within Mingenback Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 83.8 % of the watershed is cropland. In 1998, 43,740 tons of fertilizer were purchased in McPherson County. Since the watershed accounts for 2.05 percent of the county, then 898 tons of fertilizer were bought and possibly used in the watershed.

Fertilizer applications to lawns within the drainage and stormwater delivery to the lake are probable loading sources. Nine percent of the watershed is urban. The population of McPherson is expected to grow through 2020.

Phosphorus from animal waste is a contributing factor. Seven percent of land around the lake is grassland. The summer grazing density of livestock is low; the winter grazing density is average. One beef facility, Larson Acres, is located within the drainage area and contains up to 150 animal units.

Contributing Runoff: The watershed's average soil permeability is 0.8 inches/hour according to NRCS STATSGO data base. About 100% of the watershed produces runoff even under relative low (1.5''/hr) potential runoff conditions. Under very low (<1"/hr) potential conditions, this potential contributing area is almost halved (100%). Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds' soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5"/hr of rain will generate runoff from only 5% of this watershed, chiefly along the stream channels.

Background Levels: Nutrient recycling from the sediments in the lake is likely contributing available phosphorus to the lake for algal uptake. There is a large bottom feeding fish community in the lake. Resuspension of sediment occurs with the high flushing rate. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

Point Sources: A current Wasteload Allocation of zero is established by this TMDL because of the lack of point sources in the watershed. Should future point sources be proposed in the watershed and discharge into the impaired segments, the current wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers.

Nonpoint Sources: Water quality violations are predominantly due to nonpoint source pollutants. Background levels may be attributed to nutrient recycling. The assessment suggests that urban runoff, cropland, and animal waste throughout the watershed contribute to the eutrophic state of the lake. Generally a Load Allocation of 5,159 pounds per year, leading to a 20% reduction in phosphorus is necessary to reach the endpoint. The Load Allocation for nitrogen is 3,721 pounds per year, resulting in a 65.6% reduction.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 573 pounds per year of phosphorus and 413 pounds per year of nitrogen taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because a more detailed source assessment and additional in-lake monitoring of nutrient and algal content are needed, this TMDL will be a Medium Priority for implementation

Unified Watershed Assessment Priority Ranking: This watershed lies within the Little Arkansas subbasin (HUC 8: 11030012) with a priority ranking of 14 (High Priority for restoration).

Priority HUC 11s: The lake is within HUC 11 (020).

5. IMPLEMENTATION

Desired Implementation Activities

There is ample opportunity for significant control of nutrients and silt from nonpoint sources within this watershed. Best management practices could significantly improve the overall pollutant loads entering Mingenback Lake. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Implementation Programs Guidance

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.
b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
c. Provide technical assistance on nutrient management in vicinity of streams.

Water Resource Cost Share Program - SCC

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

Nonpoint Source Pollution Control Program - SCC

a. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects.
c. Promote wetland construction to assimilate nutrient loadings.

Buffer Initiative Program - SCC

a. Install grass buffer strips near streams.

b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

a. Educate agricultural producers on sediment, nutrient and pasture management.

b. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.

c. Provide technical assistance on livestock waste management systems and nutrient management plans.

d. Provide technical assistance on buffer strip design and minimizing cropland runoff.

e. Encourage annual soil testing to determine capacity of field to hold phosphorus.

Time Frame for Implementation: Pollution reduction practices should be installed within the lake drainage after the year 2005.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainage of the lake. Initial work in 2005 should include local assessments by conservation district personnel and county extension agents to locate within the lake drainage:

1. Total rowcrop acreage
2. Cultivation alongside lake
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications

Milestone for 2005: The year 2005 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Mingenback Lake should indicate evidence of reduced phosphorus levels in the conservation pool elevations relative to the conditions seen in 1994.

Delivery Agents: The primary delivery agents for program participation will be the conservation districts for programs of the State Conservation Commission and the Natural Resources Conservation Service. Producer outreach and awareness will be delivered by Kansas State Extension.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the Kansas Water Plan.

6. The Kansas Water Plan and the Lower Arkansas Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates $16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the Kansas Water Plan. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a Medium Priority consideration.

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming, and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

6. MONITORING

Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2005. Further sampling and evaluation should occur twice before 2005 and once between 2005 and 2010.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9 in Wichita, April 26 in Wichita and Hutchinson, and April 27 in Arkansas City and Medicine Lodge. An active Internet Web site was established at http://www.kdhe.state.ks.us/tmdl/ to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Lower Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Lower Arkansas Basin was held in Wichita on June 1, 2000.

Basin Advisory Committee: The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, November 8, 1999; January 13, 2000; March 9, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:

Agriculture: January 12, February 2 and 29, 2000
Environmental: March 9, 2000
Conservation Districts: November 22, 1999
Industry: December 15, 1999, January 13, February 9 and 22, 2000
Local Environmental Protection Groups: September 30, November 2, December 16, 1999

Milestone Evaluation: In 2005, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Mingenback Lake. Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

Consideration for 303d Delisting: Mingenback Lake will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303d list. Should modifications be made to the applicable nutrient criterion during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2002 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in Kansas Water Plan implementation decisions under the State Water Planning Process after Fiscal Year 2004.

Approved November 13, 2000.