KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: **Mission Lake**
Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Delaware **County**: Brown

HUC 8: 10270103 **HUC 11**: 020 (Grasshopper Creek Watershed)

Drainage Area: Approximately 8.1 square miles.

Conservation Pool: 71 acres, maximum depth = 4 meters

Tributary Arm: Mission Creek

Designated Uses: Primary Contact Recreation; Food Procurement; Domestic Water Supply; Industrial Water Supply; Aquatic Life Support

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

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

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)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303d: Not Supporting Aquatic Life

Monitoring Sites: Station 013601 in Mission Lake.

Period of Record Used: 1989, 1994, 1996, 1997, 1998

Lake Record:

Site Name	Date	Phosphorus (mg/L)	Chlorophyll a (ug/L)
LM013601	07/10/89	**0.10000**	**27.60**
LM013601	07/10/89	**0.11000**	**26.00**
LM013601	07/10/89	**0.15000**	
LM013601	07/10/89	**0.14000**	
LM013601	05/31/94	**0.09000**	**13.00**
LM013601	05/31/94	**0.12000**	10.10
LM013601	05/31/94	**0.11000**	
LM013601	05/31/94	**0.10000**	
LM013601	07/09/96	**0.30000**	3.90
LM013601	07/09/96	**0.33000**	4.90
LM013601	07/09/96	**0.32000**	
LM013601	07/09/96	**0.31000**	
LM013601	07/08/97	**0.07000**	**39.20**
LM013601	07/08/97	**0.07000**	**42.60**
LM013601	07/08/97	**0.07000**	
LM013601	07/08/97	**0.07000**	
LM013601	07/21/98	**0.10600**	**23.80**
LM013601	07/21/98	**0.09600**	**19.60**
LM013601	07/21/98	**0.08400**	
LM013601	07/21/98	**0.08100**	

Current Condition: Lake consistently has elevated chlorophyll a concentrations during summer months, average concentration is 21.1 ppb, related to a Trophic State Index of 60.5 which is indicative of very eutrophic conditions. Total phosphorus data are consistently elevated in the lake, averaging 140 ppb. Sixty percent of the samples taken from the lake were at or over 100 ppb. The lake tends to be phosphorus limited and fairly high in turbidity. Resuspension of sediment and phosphorus is a likely characteristic of this lake because of its shallow depth.

Desired Endpoints of Water Quality at Mission Lake over 2004 - 2008:

1. Maintain chlorophyll a concentrations below 12 ppb, allowing a slightly eutrophic condition (TSI < 55)

These TMDL endpoints address the narrative criteria pertaining to nutrients in Mission Lake, the expectation is achieving this endpoint will reduce the threat of algal populations explosions. Seasonal variation is accounted for under this TMDL since phosphorus from winter and spring runoff loadings is retained by the reservoir into the summer productivity season.

This endpoint will be reached as a result of expected reductions in loading from the various sources in the watershed resulting from implementation of corrective actions and Best Management Practices, as directed by this TMDL. Achievement of the endpoints indicate loads are approaching the loading capacity of the lake, water quality standards are attained and full support of the designated uses of the lake has been restored.

3. SOURCE ASSESSMENT

The primary source of phosphorus within Mission Lake is probably runoff from agricultural lands in the Mission Creek drainage where phosphorus has been applied. Land use coverage analysis indicates 77% of the watershed is in cropland. To meet mean observed total phosphorus, total phosphorus load must average 8157 pounds/yr.

Soils in the watershed appear to be low in permeability (average permeability of 0.4"/hr). Under most conditions, 90-94% of the watershed will contribute runoff.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Point Sources: Since there are no point sources located in the lake watershed and this impairment is primarily associated with agricultural non-point source pollution, there will be no Wasteload Allocation assigned to point sources for nutrients under this TMDL.

Non-Point Sources: As described in the Source Assessment, the drainage has a high proportion of cropland and a strong propensity for runoff. Estimated loadings of phosphorus need to be reduced by 90% in order to achieve full support of the lake uses. Therefore, the Load Allocation will involve reducing phosphorus loading to 736 pounds per year in order to reach the endpoints.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the endpoint. Therefore, the margin of safety will be 80 pounds per year of total phosphorus taken from the load capacity to ensure that adequate load reduction occurs to meet the endpoint.

State Water Plan Implementation Priority: Because this lake has a domestic water supply function, some activity in non-point source pollution reduction conducted under the Governor's Water Quality Initiative and is associated with other TMDLs regarding the water quality of Grasshopper Creek subwatershed and because of the need to comprehensive package implementation measures to handle multiple pollutants in the agricultural setting, this TMDL will be a **High Priority** for implementation.

Unified Watershed Assessment Priority Ranking: This lake's watershed is in the Delaware Subbasin (HUC8: 10270103). The Unified Watershed Assessment assigned a priority ranking of 3 (Highest Priority for restoration work.)

Priority HUC 11s and Stream Segments: The drainage of this lake is within a single HUC 11 (020). The priority segment would be Mission Creek (40).

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement necessary soil sampling to recommend appropriate fertilizer applications on cropland
2. Maintain necessary conservation tillage and contour farming to minimize cropland erosion.
3. Install necessary grass buffer strips along streams.
4. Reduce activities within riparian areas
5. Install proper manure storage
6. Implement nutrient management plans to manage manure application to land
7. Monitor wastewater discharges for excessive phosphorus loadings

Implementation Programs Guidance

Industrial Section KDHE

a. Ensure proper permitting and inspection of livestock waste management systems

Non-Point 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.
d. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority subwatersheds and stream segments within those subbasins identified by this TMDL.

Local Environmental Protection Program - KDHE

a. Support inspection of on-site wastewater systems to minimize nutrient loadings

Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.
b. Provide sediment control practices to minimize erosion and sediment and nutrient transport
c. Provide livestock waste management systems for proper manure storage, disposal and land application.
d. Provide livestock watering sites to reduce use of streams
e. Repair failing septic systems in proximity to streams

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

Small Lake Program - SCC

a. Evaluate dredging opportunities to restore depth to lake and improve water quality.

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

Timeframe for Implementation: Pollution reduction practices should be installed within the drainage during the years 2000-2004.

Targeted Participants: Primary participants for implementation will be agricultural producers operating within the drainages of the priority subwatersheds. Implemented activities should be targeted at those areas with greatest potential to impact the lake. Nominally, this would be activities located within one mile of the streams including:

1. Total rowcrop acreage
2. Cultivation alongside stream
3. Drainage alongside or through animal feeding lots
4. Livestock use of riparian areas
5. Fields with manure applications
6. On-site wastewater discharges to stream

Some inventory of local needs should be conducted in 2000 to identify such activities. Such an inventory would be done by local program managers with appropriate assistance by commodity representatives and state program staff in order to direct state assistance programs to the principal activities influencing the quality of the streams in the watershed during the implementation period of this TMDL.

Milestone for 2004: The year 2004 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, milestones should be reached which will have at least eighty percent of the producers responsible for the land use activities cited in the local assessment participating in the implementation programs provided by the state. Additionally, sampled data from Mission Lake should indicate evidence of reduced phosphorus and chlorophyll levels in the conservation pool elevations relative to the conditions seen over 1988-1998.

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 pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. 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.

3. 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.

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

5. 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.

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

7. The *Kansas Water Plan* and the Kansas-Lower Republican 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 pollution 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 is a **High Priority** consideration.

In State Fiscal Year 1999, the state provided to Brown County $100,870 of State Water Plan Funds for non-point source pollution reduction. The Commission will decide State Fiscal Year 2000 allocations in May 1999 and is expected to direct similar amounts of funding to the county for the next fiscal year

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

Should participation significantly lag below expectations over the next five years or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-1998, the state may employ more stringent conditions on agricultural producers in the watershed through establishment of a Critical Water Quality Management Area in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

KDHE will continue to collect seasonal samples from Mission Lake twice in the five-year period 2000-2004 and twice during 2005-2008.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the KLR Basin were held March 10, 1999 in Topeka, April 27 in Lawrence and April 29 in Manhattan. 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 Kansas-Lower Republican Basin.

Public Hearing: A Public Hearing on the TMDLs of the Kansas-Lower Republican Basin was held in Topeka on June 3, 1999.

Basin Advisory Committee: The Kansas-Lower Republican Basin Advisory Committee met to discuss the TMDLs in the basin on December 3, 1998; January 14, 1999; February 18, 1999; March 10, 1999; May 20, 1999 and June 3, 1999.

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

Agriculture: November 10, 1998; December 18, 1998; February 10, 1999; April 10, 1999, May 4, 1999, June 8, 1999 and June 18, 1999.

Municipal: November 12, 1998, January 25, 1999; March 1, 1999; May 10, 1999 and June 16, 1999.

Environmental: November 3, 1998; December 16, 1998; February 13, 1999; March 15, 1999, April 7, 1999 and May 3, 1999.

Conservation Districts: March 16-18, 24-25, 1999

Milestone Evaluation: In 2004, evaluation will be made as to the degree of implementation which has occurred within the drainage and current condition of Mission Lake.
Subsequent decisions will be made regarding implementation approach and follow up of additional implementation.

Consideration for 303d Delisting: Mission Lake will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2004-2008. Therefore, the decision for delisting will come about in the preparation of the 2008 303d list. Should modifications be made to the applicable water quality criteria 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 for Fiscal Years 2000-2004.

Approved January 26, 2000.