

MISSOURI RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Hiawatha City Lake
Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Tarkio-Wolf

County: Brown

HUC 8: 10240005

HUC 11 (HUC 14s): 060 (010)

Drainage Area: 0.82 square mile

Conservation Pool: Area = 4 acres, Maximum Depth = 5.5 meters

Designated Uses: Secondary Contact Recreation, Expected Aquatic Life Support, Drinking Water, Industrial Water Supply, and 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)).

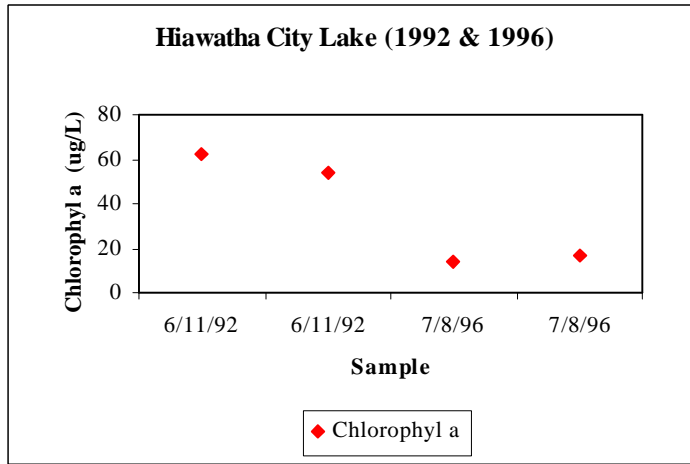
2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic, Trophic State Index = 65.93

Monitoring Sites: Station 011601 in Hiawatha City Lake.

Period of Record Used: Two surveys in 1992 - 1996.

Figure 1



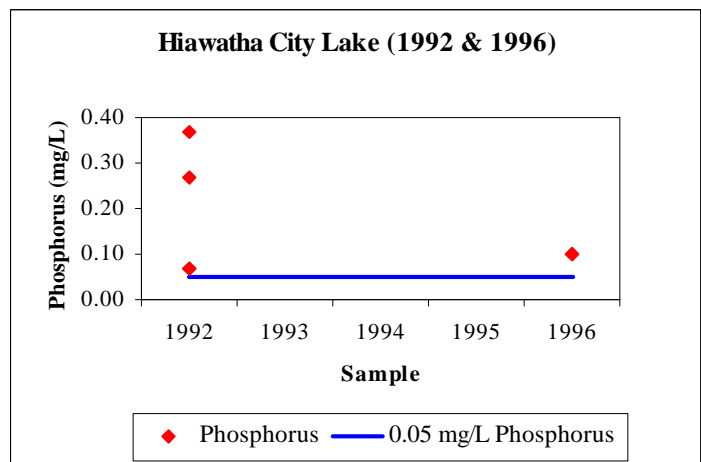
Current Condition: Hiawatha City Lake has elevated chlorophyll a concentrations averaging 36.8 ppb (Figure 1). This relates to a Trophic State Index of 65.93, indicating hypereutrophic conditions. The chlorophyll a concentration was elevated (averaging 58.2 ppb) in the 1992 survey. During the 1996 survey, the average concentration (15.4 ppb) was below the desired endpoint.

The Trophic State Index 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 7 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: \geq 64 |

Figure 2

The total phosphorus concentrations are high, averaging 163.3 ppb. One hundred percent of the samples are over 50 ppb (Figure 2). The total nitrogen to total phosphorus ratio is 13.2, indicating that phosphorus is the limiting factor. The chlorophyll a to total phosphorus yield is moderate. Light is indicated to be a limiting factor as well.



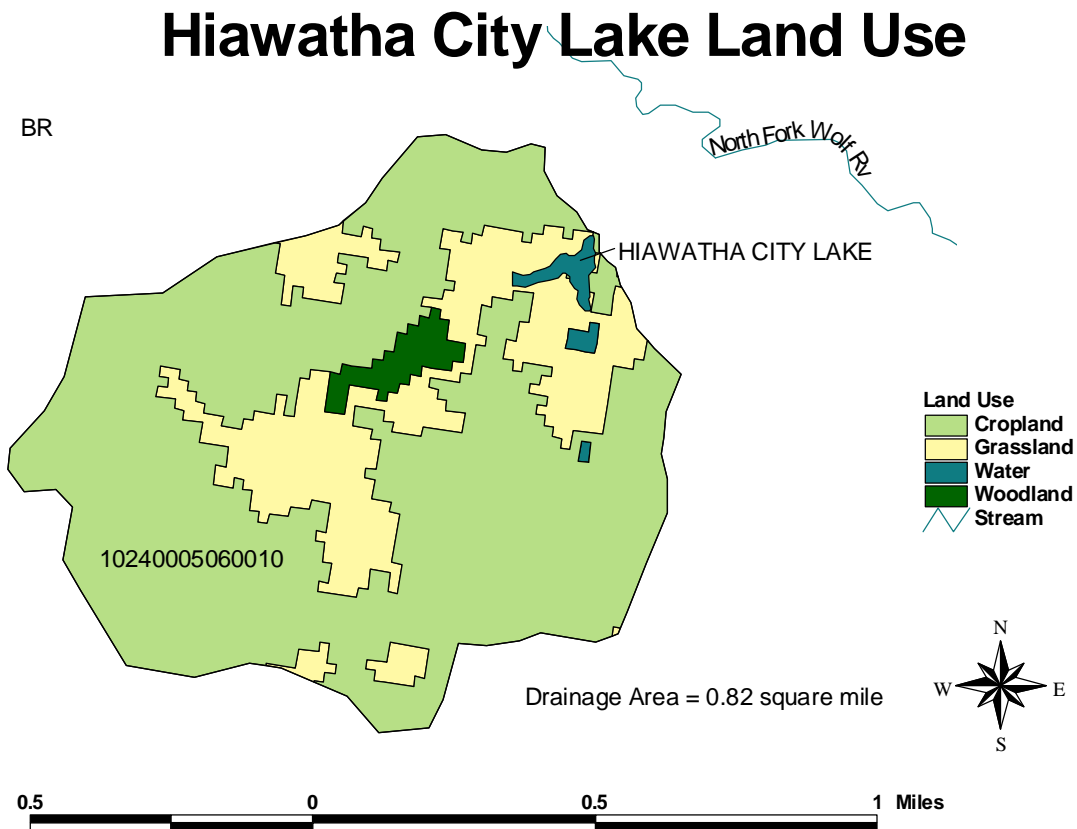
Interim Endpoints of Water Quality (Implied Load Capacity) at Hiawatha City Lake over 2005 - 2009:

In order to improve the trophic condition of the lake from its current hypereutrophic status, the desired endpoint will be summer chlorophyll a concentrations at or below 20 ug/l, corresponding to a trophic state of eutrophic conditions by 2009. 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 Hiawatha City Lake has a moderate potential for nonpoint source pollutants. An annual phosphorus load of 1,433.0 pounds per year is necessary to correspond to the concentrations seen in the lake.

Figure 3



A source of phosphorus within the Hiawatha City Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 75.2% of the watershed is cropland (Figure 3). In 1999, 24,197 tons of fertilizer were sold in Brown County. Assuming that the drainage area of the Hiawatha City Lake covers 0.14% of the county, then 35 tons of fertilizer were bought and potentially used with the watershed.

Animal waste adds to the phosphorus load going into the Hiawatha City Lake. Twenty-two percent of land around the lake is grassland. The summer grazing density of livestock is low.

Contributing Runoff: The watershed's average soil permeability is 0.9 inches/hour according to NRCS STATSGO database. About 100% of the watershed produces runoff even under relatively low (1.5"/hr) potential runoff conditions. 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 31.4% of this watershed, chiefly along the stream channels.

Background Levels: Two percent of the watershed is woodland; leaf litter may be adding to the nutrient load. The atmospheric phosphorus and geological formations (i.e. soil and bedrock) may contribute to phosphorus loads. Nutrient recycling from the sediments in the lake may contribute available phosphorus to the lake for algal uptake.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Phosphorus is the limiting nutrient in Hiawatha City Lake and allocated under this TMDL. 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: The assessment suggests that cropland and animal waste contribute to the hypereutrophic state of the lake. Water quality violations are partially due to leaf litter and geology. Generally a Load Allocation of 696.4 pounds of total phosphorus per year, leading to a 46% reduction, is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus loads and the chlorophyll a endpoint. Therefore, the margin of safety will be 77.4 pounds of total phosphorus per year taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and

the resulting water quality.

State Water Plan Implementation Priority: Because the Hiawatha City Lake is used for drinking water, this TMDL will be a Medium Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Tarkio-Wolf (HUC 8: 10240005) with a priority ranking of 13 (High Priority for restoration).

Priority HUC 11s: The majority of the watershed is within HUC 11 (060).

5. IMPLEMENTATION

Desired Implementation Activities

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

Fisheries Management - KDWP

- a. Assist evaluation in-lake or near-lake potential sources of nutrients to lake.
- b. Advise county on applicable lake management techniques which may reduce nutrient loading and cycling in lake.

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 and Nonpoint Source Pollution Control Programs--SCC

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed lakes.
- b. 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 lake 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 2006. Evaluation of nutrient sources to lake and identification of potential management techniques should occur prior to 2006.

Targeted Participants: Primary participants for implementation will be the Kansas Department of Wildlife and Parks and agricultural producers within the drainage of the lake.

Milestone for 2006: The year 2006 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Hiawatha City Lake should indicate probable sources of nutrients and plans in place to initiate implementation.

Delivery Agents: The primary delivery agents for program participation will be the Kansas Department of Wildlife and Parks, 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 Missouri 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 once before 2005 and once between 2005 and 2009.

7. FEEDBACK

Public Meeting: A public meeting to discuss TMDLs in the Missouri Basin was held February 28, 2001 in Atchison. 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 Missouri Basin.

Public Hearing: A Public Hearing on the TMDLs of the Missouri Basin was held in Hiawatha on May 29, 2001.

Basin Advisory Committee: The Missouri Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2000, February 28 and May 29, 2001.

Milestone Evaluation: In 2006, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of the Hiawatha City Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: Hiawatha City Lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 303(d) 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 during Fiscal Years 2002-2006.

Bibliography

Carney, C. Edward 1999, *Requested information on the two TMDL "review themes" you received from EPA which relate to lakes* [Memorandum] 5 Aug. 1999

Liscek, Bonnie C. 2001, *Reference for Determining Limitation/Co-Limitation of Nutrients* [Memorandum] 18 Jun. 2001

Stiles, Thomas C. 1999, *Rationale and Reference to Selected TMDL Issues* [Memorandum] 6 Aug. 1999