

MARAIS DES CYGNES RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: Osage City Reservoir Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Upper Marais des Cygnes

County: Osage

HUC 8: 10290101

HUC 11 (HUC 14): 020 (060)

Drainage Area: Approximately 4.52 square miles.

Conservation Pool: Area = 47.4 acres, Mean Depth = 1.3 meters

Designated Uses: Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water Supply; Food Procurement; Industrial Water Supply

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

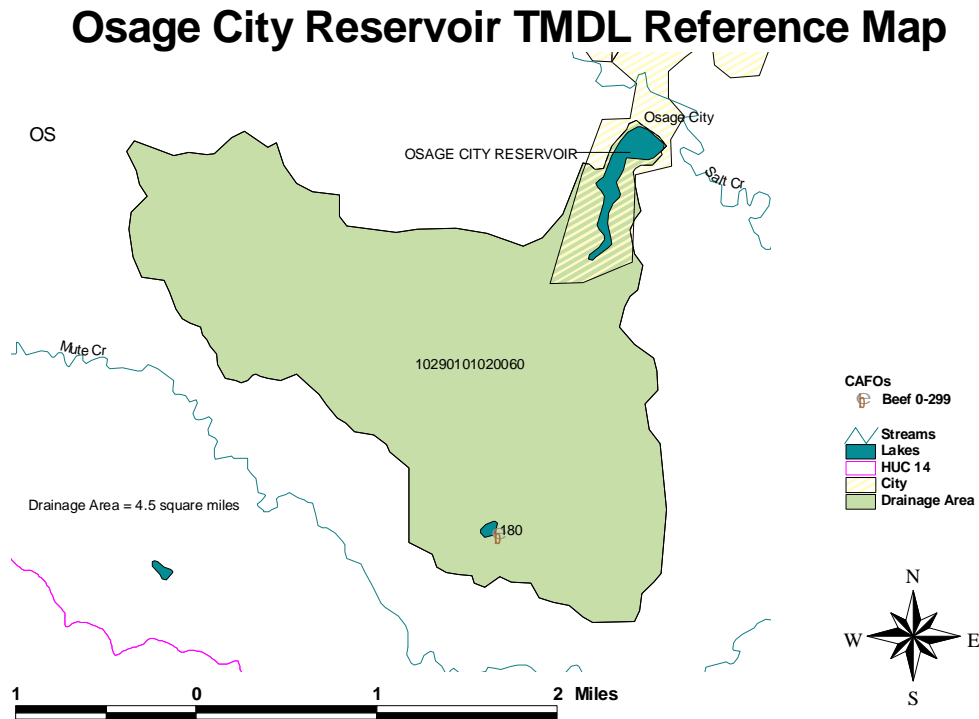
Level of Eutrophication: Hypereutrophic, Trophic State Index = 77.07

Monitoring Sites: Station 066101 in Osage City Reservoir (Figure 1)

Period of Record Used: One survey in 1989.

Current Condition: The average chlorophyll a concentration was 114.4 ppb in 1989. The average, total phosphorus concentration was 140 ppb over the period of record. The chlorophyll a to total phosphorus yield appears high.

Figure 1



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: \$ 64 |

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

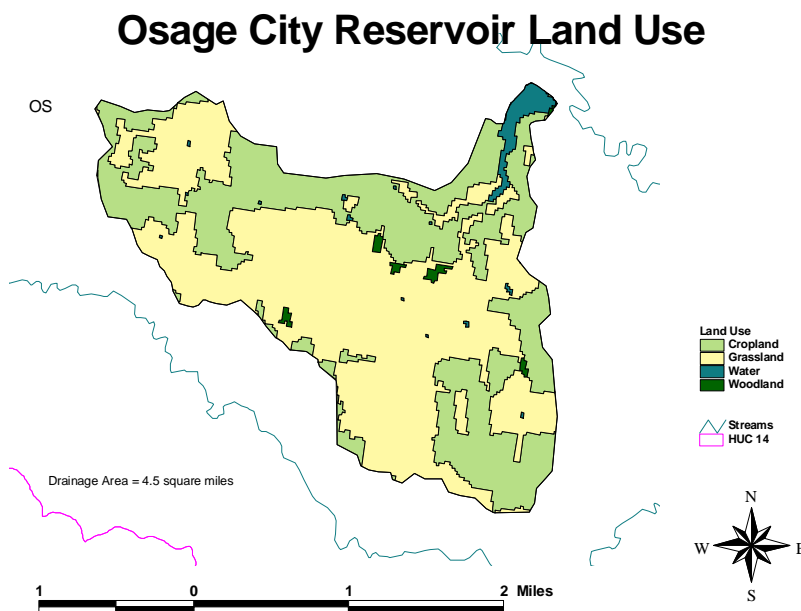
In order to improve the trophic condition of the reservoir from its current hypereutrophic status, the desired endpoint will be summer chlorophyll a concentrations at or below 20 ug/l, corresponding to a trophic state of eutrophic conditions by 2009. Refined endpoints will be developed in 2005 to reflect additional sampling and artificial source assessment and confirmation of impaired status of the reservoir.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The watershed has a moderate potential for nonpoint source pollution. An annual phosphorus load of 6,180.6 pounds per year is necessary to correspond to the concentrations seen in the reservoir.

One source of phosphorus within the reservoir is runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 40.3 % of the watershed is cropland (Figure 2). In 1999, the total amount of fertilizer sold in Osage County was 10,190 tons. Assuming that the drainage area of Osage City Reservoir covers 0.63% of the county, then 64.6 tons of fertilizer were bought and potentially used with the watershed.

Figure 2



Phosphorus from animal waste is a contributing factor. Fifty-seven percent of land around the lake is grassland; the grazing density of livestock is low. Animal waste, from a beef confined animal feeding operation, adds to the nitrogen and phosphorus load going into Osage City Reservoir. Potential animal units for the facility are 180. The actual number of animal units on site is variable, but typically

less than potential numbers.

Fertilizer applications to lawns within the drainage and stormwater delivery to the reservoir are possible loading sources. The population of Osage City is projected to increase 14% to the year 2020. The population density in the watershed is moderate (28.5 people/square mile).

Contributing Runoff: The watershed's average soil permeability is 0.5 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 63.4% of this watershed, chiefly along the stream channels.

Background Levels: A small grove of trees is adjacent to Osage City Reservoir; 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.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Phosphorus is the limiting nutrient in Osage City Reservoir and allocated under this TMDL. More detailed assessment of sources and confirmation of the trophic state of the reservoir 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 partially due to nonpoint source pollutants. Background levels may be attributed to leaf litter and geology. The assessment suggests that urban and agricultural runoff in the watershed contributes to the hypereutrophic state of the reservoir. Generally a Load Allocation of 1,036.6 pounds of total phosphorus per year, leading to an 81.4% 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 115.2 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 a more detailed source assessment and additional in-lake monitoring of nutrient and algal content is needed, this TMDL will be a Low

Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Upper Marais des Cygnes subbasin (HUC 8: 10290101) with a priority ranking of 5 (High Priority for restoration).

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

5. IMPLEMENTATION

Desired Implementation Activities

There is some opportunity to reduce nonpoint source nutrient loads to Osage City Reservoir. Attention should be given to both the urban and agricultural Best Management Practices. 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

Until the 2006 assessment of the continuation of monitoring is made, no direction can be made to those implementation programs.

Time Frame for Implementation: Continued monitoring over the years from 2001 to 2005.

Targeted Participants: Primary participants for implementation will be agricultural producers within the drainage of the lake. A detailed assessment of sources will be conducted by KDHE over 2002-2005.

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 Osage City Reservoir will be reexamined to confirm the impaired status of the lake. Should the case of impairment remain, source assessment, allocation and implementation activities will ensue.

Delivery Agents: Depending upon confirmation of impairment and assessment of probable sources, the primary delivery agents for program participation will be Osage City, conservation districts for programs of the State Conservation Commission, and the Natural Resources Conservation Service.

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 Marais des Cygnes 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 Low Priority consideration and should not receive funding until after 2006.

Effectiveness: Effectiveness of corrective actions will depend upon the sources which contribute to the impairment at the lake.

6. MONITORING

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

7. FEEDBACK

Public Meeting: The public meeting to discuss TMDLs in the Marais des Cygnes Basin was held February 28, 2001 in Ottawa. 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 Marais des Cygnes Basin.

Public Hearings: Public Hearings on the TMDLs of the Marais des Cygnes Basin were held in Fort Scott on May 30 and Ottawa on May 31, 2001.

Basin Advisory Committee: The Marais des Cygnes Basin Advisory Committee met to discuss the TMDLs in the basin on October 4, 2000, February 28 and May 30, 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 Osage City Reservoir. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: Osage City Reservoir 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 after Fiscal Year 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