

KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Potter's Lake Water Quality Impairment: Eutrophication

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower Kansas River

County: Douglas

HUC 8: 10270104

HUC 11: 020

Drainage Area: Approximately 0.056 square miles.

Conservation Pool: Area 1 acre, Maximum Depth 1.0 meter

Designated Uses: Secondary Contact Recreation; Aquatic Life Support

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

Impaired Use: Both uses potentially impaired from 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)).

pH less than 6.5 and greater than 8.5 (KAR 28-16-28e(c)(2)(C))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic - Trophic State Index = greater than 70

Monitoring Sites: Station 073401 in Potter's Lake.

Period of Record Used: One previous survey on September 13, 1994. Precipitation was slightly below normal for both the year and prior month at this location. The survey should be representative of mean summer condition. The appearance of the lake typically remains, as it was observed on this survey, very “green” throughout the summer (based on frequent observations while on campus).

Current Condition: The lake has an average concentration of 100 ppb indicating a hypereutrophic condition. The average total phosphorus concentration is 30 ppb. Phosphorus appears to be the primary limiting factor, but the total phosphorus data is suspect. There are moderate levels of inorganic turbidity, but high light availability within the water column. Chlorophyll-to-phosphorus yield was extremely high.

The data for this lake presented a dilemma unique for the lakes listed for the Kansas River Basin. Model predictions for chlorophyll a, given observed nutrient levels, should average about 11 ppb. This means the observed algal biomass during the survey was either an extreme “bloom” that over-represented mean summer condition, or the total phosphorus data was in error. This second alternative is actually more believable. Frequent observation of this lake suggests that the high chlorophyll a is more typical of lake condition. Actual in-lake total phosphorus levels should be on the order of 100-to-150 ppb.

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 are seen with chlorophyll a concentrations over 12 ug/l and hypereutrophy occurs at levels over 20 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 |

During the summer of 1994, the pH was high 100 percent of the time. The average pH was 8.92 ranging from 8.82 to 9.01. The high summer pH occurrences are related to periods of large phytoplankton productivity.

Interim Endpoints of Water Quality (Implied Load Capacity) at Potter’s Lake over 2004 - 2008:

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 2008. Achievement of this endpoint should also result in pH values between 6.5 and 8.5. Refined endpoints will be developed in 2004 to reflect additional sampling and artificial source assessment and confirmation of impaired status of lake.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The primary source of phosphorus within Potter's Lake watershed is probably runoff from the campus where phosphorus has been applied. Land use coverage analysis indicates that 100% of the watershed is urban (campus). An annual phosphorus load of 24 pounds per year is necessary to correspond to the concentrations seen in the lake.

Background Levels: Nutrient recycling from the sediments in the lake is likely contributing available phosphorus to the lake for algal uptake. Some organic pollution may be contributed by wildlife on the campus. Geological formations contain small amounts of phosphorus (up to 0.5% of total weight), and may contribute to phosphorus loads.

4. ALLOCATION OF POLLUTION 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: Since this impairment is primarily associated with urban non-point source pollution, there will be no Wasteload Allocation assigned to point sources for nutrients under this TMDL.

Non-Point Sources: Water quality violations are predominantly due to non-point source pollution. Background levels may be attributed to geological sources and wildlife waste. The assessment suggests that fertilizer applications to the campus contribute to the hypereutrophic state of the lake. Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus into the streams. Generally a Load Allocation of 2.6 pounds per year, leading to a 88% reduction in available phosphorus 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 0.3 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: This TMDL will be a Low Priority for implementation because Potter's Lake is a small lake under state jurisdiction and of limited scope within the basin.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Lower Kansas Subbasin (HUC 8: 10270104) with a priority ranking of 1 (Highest Priority for restoration work).

Priority HUC 11s: The entire watershed is with HUC 11 (020).

5. IMPLEMENTATION

Desired Implementation Activities

There is very little opportunity for non-point source reductions in this very small watershed. It is likely that this lake will never be at a productivity level that fully supports uses. However, it may be possible to manipulate the type of productivity towards more aquatic plants and clearer water, and away from turbid and green water. Dredging is not projected to have much additional water quality benefit.

Implementation Programs Guidance

Until additional assessment of probable non-point sources and in-lake nutrient content is made, no direction can be made to those implementation programs.

Timeframe for Implementation: Additional non-point source pollution reduction practices should be installed within the lake after the year 2004 re-evaluation.

Targeted Participants: Primary participants for implementation will be the University of Kansas personnel. A detailed assessment of sources will be conducted by KDHE over 2002-2004.

Milestone for 2004: The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, additional monitoring data from Station 073401 will be re-examined 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 the University of Kansas personnel.

Reasonable Assurances:

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

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 established water quality standards.
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 non-point 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 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 Low Priority consideration and should not receive funding until after 2004.

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

6. MONITORING

KDHE will collect nutrient and chlorophyll a samples from Potter's Lake in 2001 and 2003. Additional data, to establish nutrient ratios, source loading and further determine mean summer lake trophic condition, would be of value prior to 2004. If lake impairment is confirmed in 2004, further sampling and evaluation should occur in 2005 and 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

Consideration for 303d Delisting: The lake in this watershed will be evaluated for delisting under Section 303d, based on the monitoring data over the period 1999-2003. Therefore, the decision for delisting will come about in the preparation of the 2004 303d list. Should the lake continue to be listed as impaired in 2004, the next evaluation for delisting will occur with the preparation of the 2008 Section 303d list. Should modifications be made to the applicable water quality criteria during the ten year implementation period, consideration for delisting, development of desired endpoints of this TMDL and implementation activities will 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 January 26, 2000.