KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Lower Kansas River
Water Quality Impairment: Nutrients and Oxygen Demand Impact on Aquatic Life

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Lower Kansas **HUC 8:** 10270104

Waterbody: Lower Kansas River Watershed

HUC 11: 180 (Main Stem Segment 1); 140, 160 (Main Stem Segment 3); 050, 130, 140 (Main Stem Segment 4); 020, 030 (Main Stem Segment 18)

Counties: Johnson, Wyandotte, Douglas, and Leavenworth

Drainage Area: 59,756 miles^2 at Desoto

Main Stem Segments: 1, 3, 4, & 18, starting at confluence of the Wakarusa River and ending at the confluence of the Missouri River, headwaters Douglas County near Eudora

Designated Uses: Special Aquatic Life Support on Main Stem Segments.

1998 303d Listing: Table 2–Stream Segments Identified by Biological Monitoring

Impaired Use: Special Aquatic Life Support on Main Stem Segments.

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 303d:

Main Stem Segment 1--Partially Supporting for Aquatic Life
Main Stem Segment 3, 4, & 18–Fully Supporting for Aquatic Life but Threatened

Monitoring Sites: Station 127 at Wyandotte Co. line ; Station 203 at Kansas City, KS ; Station 254 at Desoto, Station 250 at Bonner Springs, Station 255 at Eudora

Period of Record Used:

Stream Chemistry:127 & 250 (1996–1998); 203 & 255 (1985–1998); 254 (1990–1998)
Biological Monitoring: 203 & 254 (1980–1996)

Flow Record: USGS Station at Desoto (06892350), Recorded daily data 1917–1997

Current Condition:

Parameter	Desoto Average & Range	Kansas City, Kansas Average & Range
Macroinvertebrate Biotic Index (MBI)	4.40 (3.91 - 5.18)	4.86 (3.64 - 6.28)
% Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa	43.92 (26.32 - 93.00%)	33.37 (19.05 - 61.54%)
Biochemical Oxygen Demand (BOD)	4.36 mg/L (1.0 - 13.0 mg/L)	4.17 mg/L (1.0 - 15.4 mg/L)
Phosphorus	416 ug/L (160 - 1,610 ug/L)	421 ug/L (120 - 1,620 ug/L)
Nitrate	748 ug/L (10 - 1,670 ug/L)	846 ug/L (10 - 2,000 ug/L)

Three main parameters (MBI, %EPT, and BOD) were analyzed to address the nutrient/ oxygen demand impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index value is computed which characterizes the overall tolerance of the community. The higher the index value the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use.

The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders; Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality.

In this stream segment, the MBI indicates that aquatic life support is partially impaired (MBI between 4.51 and 5.39) at the Kansas City sampling station. Sixty-three percent of the surveys resulted in MBI values over 4.5. Average MBI under partial support conditions was 4.83; average MBI under full support conditions was 4.09. When aquatic life is partially impaired, the percent EPT taxa drop to 19.05 - 43.48% (24.5% average). Under full support conditions, the percentage averages 37.7%. With the historical average of BOD greater than 4 mg/L, some water quality impairment is indicated. Biochemical Oxygen Demand vs. flow was graphed for the time period between 1987 and 1997, and no strong correlations were found.

Phosphorus and nitrate were graphed against the flow. In both graphs, the nutrient concentration increased with increased flow, which suggests that phosphorus and nitrate are being transported into the stream segments during high runoff events. Overall, the average concentration of nutrients in the Upper Kansas River watershed tends to be high (419 ug/L phosphorus and 797 ug/L nitrate).

Desired Endpoint for Upper Kansas River for 2004 - 2008
The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be average MBI values of 4.5 or less over 2004-2008.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach, therefore the narrative water quality standard pertaining to nutrients would be attained.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: Urban fertilizer applications are a contributing factor to the water quality impairment. The population within the watershed is projected to increase significantly through the year 2040, with the exception of Wyandotte County that expects a population decrease of 22 percent. With the rising populations, the acreage devoted to suburban homes and businesses and their fertilizer applications will increase.

Contributing Runoff: The watershed has an average soil permeability of 0.8 inches/hour according to NRCS STATSGO data base. Runoff would be produced under storms ranging in duration from one to six hours, having a recurrence interval of five, ten or twenty five years. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. Generally, 29.8 percent of the watershed would generate runoff under dryer conditions or smaller storms. Moderate or wet conditions or larger storms would see runoff contributed from 65.0 to 93.4 percent of the watershed.

NPDES: The following nine NPDES permitted wastewater dischargers that release some nutrients into the watershed:

1. Desoto MWTP–oxidation ditch
2. Nelson Complex–Johnson County MSD–trickling filter-single stage
3. Kansas City (Plant #14)–oxidation ditch
4. BPU Kaw Power Station–oxidation ditch
5. Americold, Kansas City
6. Kansas City (Plant #20)–activated sludge-complete mix
7. Johnson County (Cedar Mill SSD #1)–oxidation ditch
8. Bonner Springs–oxidation ditch
9. Johnson County Mill Creek Regional WTF–waste stabilization pond-discharging

Background Levels: Leaf litter falls into the streams and decomposes increasing the biochemical oxygen demand. 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

There is an indirect, yet un-quantified relation between nutrient loading and biological integrity. Decreased loads should result in aquatic communities, indicative of improved water quality. The characteristics of biological data to integrate the impacts of the entire watershed on the aquatic community defies allocation of specific loads between point and non-point sources. The relative presence of point and non-point activities has to be used to assess the relative contributions and responsibilities for nutrient load reduction in the watershed. Therefore, allocations are made for this TMDL in a general sense to direct appropriate action, following in the belief that qualitative reduction in nutrient loads will yield improved MBI values. More detailed allocations will be made in 2004 based on additional source assessment and establishment of appropriate numerical nutrient criteria.

Point Sources: Based on the source assessment, lagoons are less likely to contribute to water quality violations. Ongoing inspections and monitoring of the lagoons will be made to ascertain the contributions have been made by these sources into the stream. At this point, the Wasteload Allocation will be a reduction of BOD loadings from point sources such that monthly average BOD concentrations are maintained below 30 mg/l, leading to instream concentrations of DO remaining above 5 mg/l at flows below 750 cfs. The sporadic occurrence of partial support conditions, indicated by MBI values over 4.5, seems to indicate a lack of consistent loading from the upper drainage.

Non-Point Sources: Given the runoff characteristics of the watershed, overland runoff can easily carry phosphorus and nitrates from the watershed into the streams. The sporadic nature of the MBI values indicates that nutrient impairment waxes and wanes over time, hinting that loadings are variable. As such, non-point sources are implicated as a primary source of these loadings. There are variety of sources contributing nutrient loads to the stream. Additional assessment is necessary to quantify those contributions. At this point, the Load Allocation will be a reduction of nutrient loadings such that average phosphorus concentrations are below 100 ppb in stream and nitrate concentrations average below 200 ppb.

Defined Margin of Safety: Given the variable nature of the MBI values seen on this stream, additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 70% of the sample population when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa.

State Water Plan Implementation Priority: Because this TMDL needs additional source assessment and definition of the relationship between aquatic community response and nutrient loading and because numeric nutrient criteria will be developed over the next five years, this TMDL will be a Medium Priority for implementation.

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 and Stream Segments: Since it is the only segment that is partially supporting to aquatic life, main stem segment 1 should be the priority focus of implementation.

5. IMPLEMENTATION

Desired Implementation Activities

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. Install proper manure storage
6. Implement nutrient management plans to manage manure application to land
7. Monitor wastewater discharges for excessive nutrient loadings

Implementation Programs Guidance

Industrial Program KDHE

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

Municipal Program - KDHE

a. Ensure proper permitting and operations of municipal wastewater systems to limit nutrient and BOD discharges.

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.

Local Environmental Protection Program - KDHE

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

Water Resource Cost Share Program - SCC

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

Non-Point Source Pollution Control Program - SCC

a. Provide sediment control practices to minimize erosion and sediment and nutrient transport
b. Provide livestock waste management systems for proper manure storage, disposal and land application.
c. Provide livestock watering sites to reduce use of streams
d. 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

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: Management practices necessary to implement this TMDL beyond the initial emphasis should be deferred until 2004, pending additional source assessment and evaluation of biological data collected over 2000-2004.

Targeted Participants: Primary participants for implementation will likely be agricultural producers operating within the drainage of the priority subwatershed. Initial work over 2000-2004 should include an inventory of activities in those areas with greatest potential to impact the stream, including, within a mile of the stream:

1. Total rowcrop acreage
2. Cultivation alongside stream
3. Fields with manure applications
4. On-site wastewater discharges to stream
5. Condition of riparian areas
6. Presence of livestock along stream

Some inventory of local needs should be conducted in 2000 - 2004 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 mid-point of the ten year implementation window for the watershed. At that point in time, adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the nutrient impairment.

Additionally, biological data from Lower Kansas River over 2000-2004 should not indicate trends of reduced support of the aquatic community. Numeric nutrient criteria should be established by 2004 and sampled data from Lower Kansas River should indicate evidence of reduced nutrient levels relative to the conditions seen over 1987-1998.

Delivery Agents: The primary delivery agents for program participation will be the point source dischargers, 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. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Johnson, Wyandotte, Douglas, and Leavenworth counties.

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 **Medium Priority** consideration.

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 biological samples from the Lower Kansas River for three years over 2000 - 2004 and an additional three years over 2004-2008 to evaluate achievement of the desired endpoint. As numeric nutrient criteria become established, routine sampling at the Desoto and Kansas City stations for nutrients should be evaluated over 2000-2008. Periodic monitoring of nutrient content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits.

Additional source assessment needs to be conducted and local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2000-2004 in order to support appropriate implementation projects.

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 June16, 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 Lower Kansas River. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the non-priority subwatersheds.

Consideration for 303d Delisting: The streams in this watershed 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 after Fiscal Year 2004.

Approved January 26, 2000.