

# KANSAS-LOWER REPUBLICAN BASIN TOTAL MAXIMUM DAILY LOAD

## Waterbody: Kansas River Below Topeka Watershed Water Quality Impairment: Fecal Coliform Bacteria

### 1. INTRODUCTION AND PROBLEM IDENTIFICATION

<b>Subbasin:</b> Middle Kansas	<b>Counties:</b> Shawnee, Jackson, Jefferson, and Douglas
<b>HUC 8:</b> 10270102	<b>HUC 11s:</b> 180 (Muddy Creek) 160 (Little Muddy Creek)
<b>Drainage Area:</b>	about 140 miles <sup>2</sup> , excluding the Shunganunga Creek drainage
<b>Main Stem Segments:</b>	1, 3 & 4, segment endpoints at confluence of Soldier Creek and confluence of Delaware River
<b>Tributary Segments:</b>	Tecumseh Creek (107) Whetstone Creek (104) Spring Creek (105) Muddy Creek (2) Elm Creek (98) West Fork Muddy Creek (93) Little Muddy Creek (99)
<b>Designated Uses:</b>	Primary and Secondary Contact Recreation on Main Stem Segment 1, 3, & 4, and Muddy Creek. Secondary Contact Recreation on Tecumseh Creek, Whetstone Creek, Spring Creek, Elm Creek, Little Muddy Creek and W. Fork Muddy Creek. Special Aquatic Life Support on Main Stem Segment 1, 3, & 4.
<b>1998 303d Listing:</b>	Table 1–Predominant Point and Non-point Source Impacts
<b>Impaired Use:</b>	Secondary Contact Recreation on all listed segments; Primary Contact Recreation on Main Stem Segment 1, 3, & 4 and Muddy Creek.
<b>Water Quality Standard:</b>	Fecal Coliform Bacteria: 2000 colonies per 100 ml for Secondary (KAR 28-16-28e(c)(7)(C)); 900 colonies per 100 ml for Primary (KAR 28-16-28e(c)(7)(B)) Classified streams may be excluded from applying these criteria when streamflow exceeds flow that is surpassed 10% of the time ((KAR 28-16-28c(c)(2))

## 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Support for Designated Use under 1998 303d:** Not Supporting Secondary Contact Recreation

**Monitoring Sites:** Station 143 east of Topeka

**Period of Record Used:** 1996 to 1997

**Flow Record:** Kansas River flow was calculated seasonally (30 years of average daily flow) from Kansas River at Topeka, KS (USGS Station 06889000); 1968-1997.

**Long Term Flow Conditions:** 10% Duration High Flow Exclusion = 16,800 cfs; 7Q10 = 625 cfs

**Current Conditions:** Since loading capacity varies as a function of the flow present in the stream, this TMDL represents a continuum of desired loads over all flow conditions, rather than fixed at a single value. Flow duration data were determined from the Topeka Gaging Station for each of the three defined seasons: Spring (Apr-Jun), Summer-Fall (Jul-Oct) and Winter (Nov-Mar). High flows and runoff equate to lower flow durations, baseflow and point source influences generally occur in the 85-99% range. Load curves were established for both Primary Contact Recreation and Secondary Contact Recreation criterion by multiplying the flow values along the curve by the applicable water quality criterion and converting the units to derive a load duration curve of colonies of bacteria per day. These load curves represent the TMDL since any point along the curve represents water quality at the standard at that flow. Historic excursions from WQS are seen as plotted points above the load curves. Water quality standards are met for those points plotting below the applicable load duration curves.

Excursions were seen in Summer-Fall (Jul.- Oct.) and Winter (Nov - Mar.). Samples were taken over the Summer-Fall and Winter as part of the Governor's Water Quality Initiative. Since the sampling site location was recently constructed over the river, there are no Spring samples to analyze. All the Summer-Fall samples exceeded the primary criterion and 22% of the Winter samples exceeded the secondary criterion. Overall, 56% of the samples exceeded the criteria. This would represent a baseline condition of non-support of the impaired designated use. Because of the limited sampling, no low flow conditions were sampled.

**PERCENT OF SAMPLES OVER WATER QUALITY STANDARDS BY FLOW AND SEASON**

STREAM NAME	I M P A I R M E N T	S E A S O N	MAGNITUDE	0 TO 10 %	10 TO 30 %	30 TO 60 %	60 TO 90 %	90 TO 100 %	F R E Q U E N C Y	Current Condition of Water Quality at Site 143 Over 1996-1997
KANSAS RIVER BELOW TOPEKA	F C B	S F	900-2000	0	14	14	0	0	7/7=100%	9/16=56%
			> 2000	0	0	57	0	0		
			> 2 X 2000	0	14	0	0	0		
	W	> 2000	0	0	0	0	0	2/9=22%		
		> 2 X 2000	11	11	0	0	0			

**Interim Endpoints of Water Quality (Implied Load Capacity) at Site 143 over 2004 - 2008:**

Overall, the endpoint of this TMDL will be to reduce the percent of samples over the applicable criteria from 56% to less than 10% for samples taken at flows below the high flow exclusion over the monitoring period of 2004-2008. This TMDL endpoint meets water quality standards as measured and determined by Kansas Water Quality Assessment protocols. These assessment protocols are similar to those used to cite the stream segments in this watershed as impaired on the Kansas 1998 Section 303d list.

Seasonal variation in endpoints is accounted for by TMDL curves established for each season and will be evaluated based on monitoring data from 2004-2008. Monitoring data plotting below the applicable seasonal TMDL curves will indicate attainment of the water quality standards. As with the overall endpoint, the manner of evaluation of the seasonal endpoints is consistent with the assessment protocols used to establish the case for impairment in these streams. Seasonal endpoints will be refined in 2004 to reflect additional sampling over 1999-2003.

1. Less than 10 % of samples taken in Spring exceed primary criterion at flows under 16,800 cfs with no samples exceeding the criterion at flows under 4,400 cfs.
2. Less than 10% of samples taken in Summer or Fall exceed the primary criterion at flows under 16,800 cfs with no samples exceeding the criterion at flows under 2,500 cfs.
3. Less than 10% of samples taken in Winter exceed secondary criterion at flows under 16,800 cfs.

These endpoints will be reached as a result of expected, though unspecified, 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 within the loading capacity of the stream, water quality standards are attained and full support of the designated uses of the stream has been restored.

### 3. SOURCE INVENTORY AND ASSESSMENT

**NPDES:** There is a single NPDES permit discharging wastewater directly into the stream reach. However, the UCB Cello plant does not discharge bacteria in its industrial wastewater. There are a number of small facilities located on the Tecumseh and Muddy Creek tributaries. It is also noted that the Topeka - Oakland treatment plant discharges into the reach upstream of the reaches covered in this TMDL.

**Livestock Waste Management Systems:** There are a small number of registered or permitted operations located in the watershed, most are located in the upper reaches of the subwatersheds some distance away from the main stem. One swine operation is located close to the river, but below the monitoring station used for this TMDL.

**Land Use:** Most of the watershed is grassland (48% of the area), cropland (25% of the area), urban (15% of the area) or woodland (10% of the area). Grazing density of livestock is about average for the Kansas/Lower Republican basin (28 animal units/sq. mi.) The Muddy Creek subwatershed has the largest number of operations and registered animal units, reflected in a higher grazing density of 44 animal units/sq.mi..

**On-Site Waste Systems:** The population density in the watershed south of the mainstem is high owing to the vicinity of development around Topeka. Rural population projections for Shawnee County through 2020 show significant increases in population. While failing on-site waste systems can contribute bacteria loadings, their impact on the Kansas River, given the magnitude of river flows will be minimal. Excursions from the water quality standards caused by on-site waste systems is probably more significant on the major tributaries than on the main stem.

**Background Levels:** Some fecal bacteria counts may be associated with environmental background levels, including contributions from wildlife, but it is likely that the density of animals such as deer is fairly dispersed across the watershed resulting in minimal loading to the streams below the levels necessary to violate the water quality standards.

### 4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

The nature of bacteria loading is too dynamic to assign fixed allocations for wasteloads and non-point loads. Instead, allocation decisions will be made which reflect the expected reduction of bacteria loading under defined flow conditions. These flow conditions will be defined by the presumed ability of point or non-point sources to be the dominant influence on stream water quality. Therefore, the allocation of wasteloads and loads will be made by demarcating the seasonal TMDL curves at a particular flow duration level. Flows lower than that designated flow will represent conditions which are the responsibility of point sources to maintain water quality standards, those flows greater than the designated flow are the responsibility of non-point sources

up to the high flow exclusion value. More detailed Wasteload and Load Allocations will be made in 2004 after additional sampling and more detailed assessment of the sources contributing to the bacteria impairment. At this point of time, the following can be anticipated.

**Point Sources:** The tributary point sources are responsible to maintain their systems in proper working condition and appropriate detention volume to handle anticipated wasteloads of their respective populations. Furthermore, disinfection requirements will be made of the upstream Oakland plant to reduce loadings of bacteria from that facility's wastewater.

The Wasteload Allocation is defined at the flow condition where the sum of the design flows represent more than 10% of the flow or the 7Q10, whichever is greater, thereby exerting influence on the water quality of the stream. For the Kansas River at this location, that flow condition would be flows of 0-625 cfs. Such flows have been exceeded 99% of the time during the three seasons. Future NPDES and state permits will be conditioned such that discharges from permitted facilities will not cause violations of the applicable bacteria criteria at this low flow.

**Non-Point Sources:** Based on the assessment of sources, the distribution of excursions from water quality standards and the relationship of those excursions to runoff conditions, non-point sources are seen as a significant cause of water quality violations. Background levels are not significant as a cause of the problem. Upstream contributions from watersheds and tributaries feeding into the Kansas River is the probable geographic contribution to violations of the water quality standards within this reach. Implementation of non-point source pollution practices in upstream watersheds should be undertaken prior to efforts along the main stem of the river itself.

The Load Allocation assigns responsibility for maintaining water quality below the TMDL curve over flow conditions bracketed by the low flow of 625 cfs demarcating point source influence and the high flow exclusion of 16,800 cfs. These flows are exceeded 19-99% of the time during the Spring, 10-99% of the time over the Summer and Fall and 5-99% of the time during the Winter. Best Management Practices will be directed toward those activities in the upstream watersheds such that there should be accrued benefits of reduced violations of the applicable bacteria criteria at higher flows on the main stem of the river.

**Defined Margin of Safety:** Because there will not be a traditional load allocation made for fecal bacteria, the margin of safety will be framed around the desired endpoints of the applicable water quality standards. Therefore, evaluation of achieving the endpoints should use values set 100 counts less than the criteria (800 colonies for primary contact recreation; 1,900 colonies for secondary contact recreation) to mark full support of the recreation designated use of the streams in this watershed. By this definition, the margin of safety is 100 colonies per 100 ml.

**State Water Plan Implementation Priority:** Because upstream watersheds are likely sources contributing to the bacteria problems seen at the monitoring station and because additional source assessment is necessary to examine contributing activities along the main stem, this TMDL will be a Medium Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Middle Kansas River (HUC 8: 10270102) with a priority ranking of 4 (Highest Priority for restoration work).

**Priority HUC 11s and Stream Segments:** Until additional assessment is done on the main stem reach between 2000-2004, priority focus of implementation prior to 2004 will concentrate on disinfection at Oakland and installing best management practices on upstream watersheds.

## 5. IMPLEMENTATION

### Desired Implementation Activities

1. Minimize non-point oriented contributions of bacteria loading to river.
2. Install disinfection treatment at upstream point sources.

### Implementation Programs Guidance

#### NPDES - Municipal Program - KDHE

- a. Issue renewed NPDES permit for Oakland with disinfection requirements and a schedule of compliance for any treatment plant upgrades which are necessary to reduce bacteria counts below criteria downstream.
- b. Evaluate need for financial loan assistance to Topeka to fund Oakland treatment plant expansion and upgrade.

Until additional assessment of probable non-point sources is made, no direction can be made to those non-point source implementation programs. Implementation of bacteria Best Management Practices in upstream tributary watersheds should be completed and their impact on Kansas River mainstem conditions evaluated prior to initiating implementation along the mainstem.

**Timeframe for Implementation:** Installation of disinfection treatment at Oakland should occur prior to 2004. Additional non-point source pollution reduction practices should be installed along the main stem after the year 2004.

**Targeted Participants:** Primary participants for implementation will be Topeka and any targeted activities identified by follow up assessment of sources, conducted by KDHE, conservation district personnel and county LEPP staff.

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. Based on the local assessment, implementation activities should focus participation within those areas with greatest potential for impact on stream resources.

**Milestone for 2004:** The year 2004 marks the mid-point of the ten year implementation window for the watershed. At that point in time, disinfection at upstream point sources should be initiated and adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the bacteria problem. Should sampled data from Station 143 indicate growing problems with bacteria impairment, the assessment and follow-on implementation will be accelerated.

**Delivery Agents:** Regarding point source treatment, KDHE staff in the Municipal Programs Section will develop the appropriate permits, schedules of compliance and review of plans. Review of technical information and studies will be made by KDHE staff of the Technical Services Section and the Bureau of Environmental Field Services.

Depending upon the probable sources, 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 and agricultural interest groups such as Kansas Farm Bureau, Kansas Livestock Association, the Kansas Pork Producers Council and the Kansas Dairy Association. County staff managing Local Environmental Protection Programs for Shawnee County will perform on-site waste system inspections.

**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.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.
4. 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.
5. 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.

6. 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.

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

8. 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 TMDL is a Medium Priority consideration and should not receive funding until after 2004.

The State Revolving Loan Fund is operated through the Municipal Program at KDHE and provides low interest loans for wastewater treatment improvement. Since its inception, \$128 million in loans have been made to municipal dischargers in the state.

In State Fiscal Year 1999, the state provided to Shawnee County, \$94,423 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:** Improvements in reducing bacteria loading to streams can be accomplished through appropriate management and control systems for municipal wastewater, livestock waste and on-site waste systems. Disinfection techniques within mechanical treatment plans have been very effective in reducing bacteria levels within wastewater effluent. Use of ultraviolet lights reduces bacteria counts to under 100 per 100 ml.

## **6. MONITORING**

KDHE should sample for fecal coliform bacteria over each of the three defined seasons in 2002-2004 at Station 143. Based on that sampling, the desired endpoints under this TMDL will be refined and direct more intensive sampling will need to be conducted under specified seasonal flow conditions over the period 2004-2008 to address non point contributions impacting water quality in the stream reach..



In Spring, samples should be taken at flow conditions below 16,800 cfs, particularly below 4,400 cfs. In Summer and Fall, samples need to be taken below flows of 16,800 cfs, a majority of which will be collected at flows less than 2,500 cfs. In Winter, samples need to be taken at flows below 16,800 cfs. Use of the real time flow data available at the Topeka stream gaging station can direct sampling efforts.

Monitoring of bacteria levels in effluent will be a condition of NPDES and state permits for the facilities discharging wastewater. This monitoring will continually assess the contributions of the wastewater systems, as well as the effectiveness in reducing bacteria levels in the effluent released to the river.

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 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 necessary within the watershed of the Kansas River and its current condition of water quality.

**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.