

# LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

## Waterbody: Bluff Creek Water Quality Impairment: Dissolved Oxygen

### 1. INTRODUCTION AND PROBLEM IDENTIFICATION

**Subbasin:** Chikaskia

**Counties:** Sumner and Harper

**HUC 8:** 11060005

**HUC 11 (HUC 14s):** 040 (010, 020, 030, 040, 050, 060, and 070)  
050 (010, 020, and 030)

**Drainage Area:** 413.8 mi<sup>2</sup>

**Main Stem Segment:** 15; starting at the confluence with Fall Creek; headwaters in northwest Harper County.

**Tributary Segments:** Spring Branch (21)  
Baehr Creek (22)

**Designated Uses:** Expected Aquatic Life Support; Primary Contact Recreation; Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segment

Expected Aquatic Life Support on all tributary segments

**1998 303(d) Listing:** Table 1 - Predominant Non-point Source and Point Source Impacts

**Impaired Use:** Expected Aquatic Life Support

**Water Quality Standard:** Dissolved Oxygen: 5 mg/L (KAR 28-16-28e(c)(2)(A))

### 2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

**Level of Support for Designated Use under 1998 303(d):** Partially Supporting Expected Aquatic Life

**Monitoring Sites:** Station 530 near Caldwell; Station 618 near Bluff City.

**Period of Record Used:** 1990 to 1999 (Station 530): 1991, 1995 and 1999 (Station 618 which in 1999 includes Kansas Biological Survey samples from that year)

**Flow Record:** USGS Station 07151670; calculated flow based on measurements at 07151670 and data from Station 07149000 (Medicine Lodge River near Kiowa)

**Long Term Flow Conditions:** 7Q10 = 1 cfs

**Current Conditions:** Excursion from Dissolved Oxygen (DO) water quality standard at Site 530 were seen in the warmer months of the year at flows less than 30 cfs. No excursions were noted at site 618.

A comparison of DO to Biochemical Oxygen Demand (BOD), ammonia and stream flow suggests two separate causes for low DO. In most instances DO excursions appears to coincide with the lowest flow conditions and warmest water temperatures, therefore, flow and temperature are seen as a primary component to low DO levels in the watershed. DO excursions also occurred at somewhat higher low flows. In these instances, BOD was higher than average for the sampling period, suggesting that nutrient or organic enrichment can combine with other factors to cause DO excursions.

**NUMBER OF SAMPLES UNDER DISSOLVED OXYGEN STANDARD OF 5 mg/L BY FLOW**

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Caldwell (530)	Annual	0	0	0	3	2	2	7/58 = 12%

**Desired Endpoints of Water Quality at Site 530 over 2005 - 2009**

The ultimate endpoint for this TMDL will be to achieve the Kansas Water Quality Standard of 5 mg/l to fully support Aquatic Life.

Seasonal variation is accounted for by this TMDL, since the TMDL endpoint is sensitive to the low flow and higher temperature conditions, generally occurring in the summer months.

This endpoint 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 this endpoint will provide full support of the aquatic life function of the creek and attain the dissolved oxygen water quality standard.

### 3. SOURCE INVENTORY AND ASSESSMENT

**NPDES:** There is one NPDES permitted municipal wastewater discharger within the watershed.

MUNICIPALITY	STREAM REACH	SEGMENT	DESIGN FLOW	TYPE
Anthony	Spring Creek	47	1.0 mgd	Oxid. Ditch

Population projections for Anthony to the year 2020 indicate modest declines. Projections of future water use and resulting wastewater appear to be within design flows for the current system's treatment capacity. The City is presently changing its treatment to a 3 cell Wastewater Stabilization Lagoon System with a design flow of 0.3 MGD. Examination of effluent monitoring indicates very low levels of BOD leaving the treatment plant and entering the stream system.

**Livestock Waste Management Systems:** Thirteen operations are registered, certified or permitted within the watershed. All facilities are located in the upper half of the watershed. Potential animal units for all facilities in the watershed total 7,919. The actual number of animal units on site is variable, but typically less than potential numbers.

**Land Use:** Most of the watershed is cropland (68% of the area) and grassland (31% of the area). Based on 1997 water use reports, less than 1% of the cropland in the watershed is irrigated. Most of the grassland is located in the upper third of the watershed and on the steeper slopes of alluvial valleys. The off-season grazing density is comparatively high for the upper half and average for the lower half of the watershed. The growing season grazing density is average for the watershed when compared to densities for the Lower Arkansas Basin.

**On-Site Waste Systems:** Most of the watershed's population density is very low, 2 - 12 persons/mi<sup>2</sup> except for areas associated with towns or cities (38-52 persons/mi<sup>2</sup>). The rural population projection for Harper County through 2020 shows moderate declines. While failing on-site waste systems can contribute nutrient loadings, their impact on the impaired segments is very limited, given on the size of the rural population.

**Background Levels:** Some organic enrichment 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..

**Contributing Runoff:** The watershed's average soil permeability is 1.5 inches/hour according to NRCS STATSGO data base. About 76% of the watershed produces runoff even under relative low (1.5"/hr) potential runoff conditions. Under very low (<1"/hr) potential conditions, this potential contributing area is almost halved (40%). 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 5% of this watershed, chiefly along the stream channels.

#### 4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

It is presumed that reductions in BOD loads will reduce DO excursions under certain critical flow conditions. Therefore, the allocation of wasteloads and loads will be made in terms of BOD reductions. Yet, because DO is a presently undefined manifestation of multiple factors, the initial pollution load reduction responsibility will be to decrease the average condition of BOD over the range of flows encountered on Bluff Creek. These reductions have been based on the relationship between DO and BOD for the samples taken at Water Quality Monitoring site 530. Allocations relate to the BOD levels seen in the creek for two groups of samples. The first group is when DO was less than the standard and the second is when DO was greater than the standard. From this, a 34% reduction (from an average of 3.8 to an average of 2.52) in BOD concentration is needed to achieve an average BOD level of 2.52 mg/L or less. Additional monitoring over time will be needed to further ascertain the relationship between BOD reductions of point and non-point sources, flow conditions, water temperatures and DO levels along the stream.

For this phase of the TMDL, the average condition is considered across the seasons, to establish goals of the endpoint and desired reductions. Therefore, the target average BOD level was multiplied by the average flow estimated for Bluff Creek near Caldwell. This is represented graphically by the integrated area under each BOD load duration curve established by this TMDL. The area is segregated into allocated areas assigned to point sources (WLA) and nonpoint sources (LA). Future growth in wasteloads should be offset by reductions in the loads contributed by nonpoint sources. This offset along with appropriate limitations should eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between physical factors, organic matter and DO.

**Point Sources:** Point sources are responsible for maintaining their systems in proper working condition and appropriate detention volume to handle anticipated wasteloads of their respective populations. Anthony presently relies on an oxidation ditch for their wastewater treatment but will change treatment in 2001 to a 3 cell lagoon system which will reduce their discharge of bacteria and BOD and reduce their design flow to 0.30 mgd. Ongoing inspections and monitoring of this system will be made to ensure that minimal contributions have been made by this source.

The Wasteload Allocation, as defined on the BOD graph, is that flow condition which would most likely be influenced by the City of Anthony. That flow condition is defined by the permitted design flow of the city at the 7Q10 or 0 - 1.46 cfs. Such conditions have been exceeded 80- 99% of the time. Streeter-Phelps analysis indicates the BOD WLA of 70.2 pounds per day for the City of Anthony will maintain DO levels above 5 mg/L and is assumed to correspond to an average of BOD 2.52 mg/L at the sampling site. Future NPDES and state permits will be conditioned such that discharges from permitted facilities will not cause violations of the applicable criteria at or below this 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 and seasons, non-point sources are seen as the primary cause of water quality violations. The previous

assessment suggests that lack of flow in the stream, higher water temperatures, and organic enrichment are the primary components causing the occasional dissolved oxygen problem. Since the flow component is natural in its source, especially at low flow when the majority of the excursions occurred, organic enrichments will be the emphasis of this TMDL. The previous assessment suggests that organic matter deposited in the stream from adjacent cropland is a primary suspect in the excessive nutrient/organic matter problem.

The Load Allocation, as directed by the BOD graph, assigns responsibility for maintaining water quality above the TMDL curve over flow conditions exceeded less than 80% of the time and reducing average instream BOD levels below 2.52 mg/L.

**Defined Margin of Safety:** The Margin of Safety will be implied based on conservative assumptions used in the permitting of the point source discharges including coincidence of low flow with maximum discharge from the treatment plant, associated CBOD content and temperature of the effluent, and the better than permitted performance of the treatment plant in producing effluent with BOD well below permit limits under critical summer conditions.

**State Water Plan Implementation Priority:** Because this watershed has indicated some problem with dissolved oxygen which has short term and immediate consequences for aquatic life along with the opportunity to address bacteria impairments on the stream, this TMDL will be a High Priority for implementation.

**Unified Watershed Assessment Priority Ranking:** This watershed lies within the Chikaskia River Subbasin (HUC 8: 11060005) with a priority ranking of 30 (Medium Priority for restoration work).

**Priority HUC 11s and Stream Segments:** Because of the lack of DO violations at Site 618 and because of its greater proportion of cropland and the benefits to introduce filter strips to insulate the stream from surrounding land use, HUC 11 11060005040 and Stream Segments 15, 21, 22, and 24 within this HUC should be the focus of priority.

## **5. IMPLEMENTATION**

### **Desired Implementation Activities**

1. Renew state and federal permits and inspect permitted facilities for permit compliance
2. Install proper manure and livestock waste storage
3. Install grass buffer strips along tributaries.
4. Install pasture management practices, including proper stock density on grasslands
5. Remove winter feeding sites in proximity to streams
6. Reduce livestock use of riparian areas
7. Insure proper on-site waste system operations in proximity to main streams.

## **Implementation Programs Guidance**

### **NPDES and State Permits - KDHE**

- a. Municipal permits for facilities in the watershed will be renewed after 2002 with continuation of BOD monitoring and BOD permit limits.
- b. Livestock permitted facilities will be inspected for integrity of applied pollution prevention technologies.
- c. Registered livestock facilities with less than 300 animal units will apply pollution prevention technologies.
- d. Manure management plans will be implemented.

### **Non-Point Source Pollution Technical Assistance - KDHE**

- a. Support Section 319 demonstration projects for pollution reduction from livestock operations in watershed.
- b. Provide technical assistance on practices geared to small livestock operations which minimize impact to stream resources.
- c. Guide federal programs such as the Environmental Quality Improvement Program, which are dedicated to priority subbasins through the Unified Watershed Assessment, to priority watersheds and stream segments within those subbasins identified by this TMDL.

### **Water Resource Cost Share & Non-Point Source Pollution Control Programs - SCC**

- a. Develop improved grazing management plans
- b. Install livestock waste management systems for manure storage
- c. Implement manure management plans
- d. Install replacement on-site waste systems
- e. Coordinate with USDA/NRCS Environmental Quality Improvement Program in providing educational, technical and financial assistance to agricultural producers.

### **Riparian Protection Program - SCC**

- a. Design winter feeding areas away from streams
- b. Develop riparian restoration projects

### **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 livestock producers on riparian and waste management techniques.
- b. Provide technical assistance on livestock waste management design.
- c. Continue Section 319 demonstration projects on livestock management.

### **Agricultural Outreach - KDA**

- a. Provide information on livestock management to commodity advocacy groups.
- b. Support Kansas State outreach efforts.

## **Local Environmental Protection Program - KDHE**

- a. Inspect on-site waste systems within one mile of main tributary streams.

**Timeframe for Implementation:** Pollution reduction practices should be installed along the priority stream segments (15, 21, 22, and 24) over the years 2000-2005, with follow up implementation thereafter.

**Targeted Participants:** Primary participants for implementation will be small livestock producers operating without need of permits within the priority watershed. Implemented activities should be targeted at those areas with greatest potential to impact the stream. Nominally, this would be activities located within one mile of the streams including:

1. Facilities without water quality controls
2. Unpermitted permanent feeding/holding areas
3. Sites where drainage runs through or adjacent livestock areas
4. Sites where livestock have full access to contributing tributaries and stream is primary water supply
5. Grazed acreage, overstocked acreage and acreage with poor range condition
6. Poor riparian sites
7. Near stream feeding sites
8. Failing on-site waste systems

Additionally, the City of Anthony will continue to operate its new lagoon system to minimize the introduction of organic material exerting a BOD on Bluff Creek.

Some inventory of local needs should be conducted in 2001 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 2005:** The year 2005 marks the mid-point of the ten year implementation window for the watershed. At that point in time, milestones should be reached which will have at least two-thirds of the landowners identified in the local assessment participating in the implementation programs provided by the state. Additionally, sampled data from Station 530 should indicate evidence of no oxygen deficit problems

**Delivery Agents:** 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 or Kansas Livestock Association, the Kansas Pork Producers Council and the Kansas Dairy Association. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Sumner and Harper 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.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 Lower Arkansas River 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 High Priority consideration.

**Effectiveness:** Current point source controls appear effective in maintaining low BOD levels in wastewater discharged to streams. Non-point source controls for livestock waste have been shown to be effective in reducing pollution in locales such as the Herrington Lake watershed. Buffer



strips are being touted as a significant means for protection of streams. Public education campaigns can change behavior regarding urban fertilizer application rates. The key to effectiveness is participation within a finite subwatershed to direct resources to the activities influencing water quality. The milestones established under this TMDL are intended to gauge the level of participation in those programs implementing 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 1992-1999, the state may employ more stringent conditions on agricultural producers and urban runoff in the watershed in order to meet the desired endpoints expressed in this TMDL. The state has the authority to impose conditions on activities with a significant potential to pollute the waters of the state under K.S.A. 65-171. If overall water quality conditions in the watershed deteriorate, a Critical Water Quality Management Area may be proposed for the watershed, in response.

## **6. MONITORING**

KDHE will continue to collect bimonthly samples on a four year rotation at Station 530 including dissolved oxygen samples. Based on that sampling, the status of 303(d) listing will be evaluated in 2005. Should impaired status remain, the desired endpoints under this TMDL will be refined and more intensive sampling will need to be conducted under specified seasonal flow conditions over the period 2005-2009.

Monitoring of BOD levels in effluent will be a condition of NPDES and state permits for facilities. This monitoring will continually assess the functionality of the systems in reducing nutrient levels in the effluent released to the streams.

Local program management needs to identify its targeted participants of state assistance programs for implementing this TMDL. This information should be collected in 2000 in order to support appropriate implementation projects.

## **7. FEEDBACK**

**Public Meetings:** Public meetings to discuss TMDLs in the Lower Arkansas Basin were held March 9, 2000 and April 26-27, 2000 in Wichita, Hutchinson, Arkansas City and Medicine Lodge. 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 Lower Arkansas Basin.

**Public Hearing:** A Public Hearing on the TMDLs of the Lower Arkansas Basin was held in Wichita on June 1, 2000.

**Basin Advisory Committee:** The Lower Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, November 8, 1999; January 13, 2000; March 9, 2000 and June 1, 2000

**Discussion with Interest Groups:** Meetings to discuss TMDLs with interest groups include:

Agriculture: January 12, February 2 and 29, 2000

Environmental: March 9, 2000

Conservation Districts: November 22, 1999

Industry: December 15, 1999, January 13, February 9 and 22, 2000

Local Environmental Protection Groups: September 30, November 2, December 16, 1999

**Milestone Evaluation:** In 2005, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Bluff Creek. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

**Consideration for 303(d) Delisting:** The river 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 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 for Fiscal Years 2001-2005.

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