

LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Cow Creek Water Quality Impairment: Dissolved Oxygen

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Cow **Counties:** Reno, Rice, Ellsworth and Barton

HUC 8: 11030011

HUC 11 (HUC 14s): **010** (010, 020, 030, 040, 050, 060, and 070)
020 (010, 020, 030, 040, 050, and 060)
030 (010, 020, 030, 040, 050, 060, 070, and 080)

Drainage Area: 947.2 mi² (*unimpaired - 155 mi²*)

Main Stem Segments: 1, 3, 5, 6; starting at the confluence with the Arkansas River and traveling upstream to north-central Barton County.

Tributary Segments: Calf Creek (16)
Little Cheyenne Creek (7)
Little Cow Creek (2)
Lost Creek (17)
Plum Creek (4)
Spring Creek (20)

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 Segments
Expected Aquatic Life Support on Calf Creek, Little Cow Creek, Lost Creek, Plum Creek, and Spring Creek
Special Aquatic Life Support on Little Cheyenne Creek
Ground Water Recharge on Little Cheyenne Creek, Little Cow Creek, and Plum Creek

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

Impaired Use: 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): Not Supporting Aquatic Life

Monitoring Sites: Station 287 near Hutchinson; Station 522 near Willowbrook; Station 656 Little Cow Cr near Lyons; Station 657 Cow Cr near Lyons

Period of Record Used: 1985 to 1999 (Station 287); 1990 to 1999 (Station 522); 1992 to 1999 (Stations 656 & 657)

Flow Record: Cow Creek near Lyons (USGS Station 07143300); 1975–1998

Long Term Flow Conditions: 10% Duration High Flow Exclusion = 150 cfs, 7Q10 = 1 cfs

Current Conditions: Load duration curves were assembled for the three defined season: Spring (Mar-Jul), Summer-Fall (Aug-Oct) and Winter (Nov-Feb) based on long term average monthly flows.

At Site 287 a single excursion was seen during July 1996. Overall, less than 1% of the samples were under the criteria. This would represent a baseline condition of full support of the impaired designated use.

At Site 522 a single excursion was seen during June 1995. Overall, 2% of the samples were under the criteria. This would represent a baseline condition of full support of the impaired designated use.

At Site 656 excursions were seen during all seasons of the year; 47 percent of Spring samples and 60% of Summer-Fall samples were under the criterion. Seven percent of Winter samples were under the criterion. Overall, 37% of the samples were under the criteria (16 of 43 samples). This would represent a baseline condition of non-support of the impaired designated use.

At Site 657 two excursions were seen; one during July 1996 and one during August of 1997. Overall, less than 5% of the samples were under the criteria (2 of 43 samples). This would represent a baseline condition of full support of the impaired designated use.

NUMBER OF SAMPLES DISSOLVED OXYGEN STANDARD OF 5 mg/L BY FLOW AND SEASON

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Hutchinson (287)	Spring	0	0	0	1	0	0	1/42 = 2%
	Summer	0	0	0	0	0	0	0/27 = 0%
	Winter	0	0	0	0	0	0	0/34 = 0%

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Willowbrook (522)	Spring	0	1	0	0	0	0	1/23 = 4%
	Summer	0	0	0	0	0	0	0/13 = 0%
	Winter	0	0	0	0	0	0	0/18 = 0%

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Little Cow Cr at Lyons (656)	Spring	0	0	1	5	2	1	9/19 = 47%
	Summer	1	1	2	2	0	0	6/10 = 40%
	Winter	0	0	1	0	0	0	1/14 = 7%

Station	Season	0 to 10%	10 to 25%	25 to 50%	50 to 75%	75 to 90%	90 to 100%	Cum Freq.
Cow Cr at Lyons (657)	Spring	0	0	0	1	0	0	1/19 = 5%
	Summer	0	0	0	1	0	0	1/10 = 10%
	Winter	0	0	0	0	0	0	0/14 = 0%

Site 656 was the only sampling location identified as not supporting aquatic life. Because of this, the drainage area associated with site 656 will be the emphasis of this TMDL (HUC 14s 11030011030010 and 11030011030020).

A comparison of Dissolved Oxygen (DO) to Biochemical Oxygen Demand (BOD), ammonia, nitrate, phosphorus and stream flow suggests two separate causes for low DO. In some instances DO excursions appears to coincide with the lowest flow conditions and warmest water temperatures, therefore, flow and temperature are seen as components of low DO levels in the watershed. DO excursions also occurred in instances when BOD, ammonia, nitrate and phosphorus concentrations were much higher than average for the sampling period, suggesting that nutrient or organic enrichment can combine with other factors to cause DO excursions.

Desired Endpoints of Water Quality (Implied Load Capacity) at Sites 287, 522, 656 and 657 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 targeted watershed.

MUNICIPALITY	STREAM REACH	SEGMENT	TYPE	DESIGN FLOW
Lyons	Little Cow Creek	2	Oxd Ditch	0.55 mgd

The population projection for Lyons through the year 2020 indicates modest growth. Projections of future water use and resulting wastewater for Lyons appears to be at or slightly above design flow limits. The excursions from the water quality standard appear to occur under all flow conditions. Of significance to point sources are the excursions under the lowest flow in all seasons indicating that point sources may have an impact under lower flows in the watershed. However, examination of effluent monitoring indicates very low levels of BOD leaving the treatment plant and entering the stream system.

Livestock Waste Management Systems: Five operations are registered, certified or permitted within the watershed. Potential animal units for all facilities in the watershed total 12,624. The actual number of animal units on site is variable, but typically less than potential numbers.

Land Use: Most of the watershed is cropland (90% of the area), grassland (7% of the area) and urban use (2% of the area). Based on 1997 water use reports, approximately 1% of the cropland in the watershed is irrigated. The off-season grazing density is average when compared to densities for the Lower Arkansas River Basin. The growing season grazing density is light when compared to densities for the Lower Arkansas Basin.

On-Site Waste Systems: The upper portion of the subwatershed's population density is low (8 - 9 persons/mi²), while the lower portion of the subwatershed has a high average population densities (area associated with Lyons). The rural population projection for Rice county through 2020 shows moderate declines. While failing on-site waste systems in rural settings can contribute bacteria loadings, their impact on the targeted segment is very limited given the density of the rural population.

Contributing Runoff: The Cow Creek watershed's average soil permeability is 1.8 inches/hour according to NRCS STATSGO data base. About 79% of the watershed produces runoff even under relatively low (1.5"/hr) potential runoff conditions. Under very low (<1"/hr) potential conditions, this area is greatly reduced (14.5%). 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.

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

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 function 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 Little Cow Creek. These reductions have been based on the relationship between DO and BOD for the samples taken at Water Quality Monitoring site 656. 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 25% reduction (from an average of 6.34 to an average of 4.77) in BOD concentration is needed to achieve an average BOD level of 4.77 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 durations, and DO levels in the watershed.

For this phase of the TMDL, the average condition is considered across the seasons, to establish goals of the endpoint and desired reductions. Therefore, target average ambient level was multiplied by the average flow estimated for Little Cow Creek near Lyons. 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, nutrients and DO.

Point Sources: The point sources are responsible for maintaining their systems in proper working condition and appropriate capacity to handle anticipated wasteloads of their respective populations. The city of Lyons appears to be approaching the design flow for its population. The State and NPDES permits will continue to be issued on 5 year intervals, with inspection and

monitoring requirements and conditional limits on the quality of effluent released from this facility. Ongoing inspections and monitoring of the systems 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 Lyons. That flow condition is defined by the permitted design flow of the city at the 7Q10 or 0 - 1.85 cfs. Such flows have been exceeded 23-99% of the time in Winter, 26-99% in Summer and Fall, and 50- 99% of the time in Spring. Streeter-Phelps analysis indicates the BOD WLA of 101.1 pounds per day for the City of Lyons will maintain DO levels above 5 mg/L and is assumed to correspond to an average of BOD 4.77 mg/L at the sampling site. Future NPDES and state permits will be conditioned such that discharges from permitted facility 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 also seen as a primary cause of water quality violations. The previous assessment suggests that lack of flow in the stream, higher water temperatures, and nutrient and organic enrichment are the primary components causing the occasional dissolved oxygen problem. Nutrient/organic enrichments will be the emphasis of this TMDL. The previous assessment suggests that nutrients/organic matter deposited in the stream from cropland adjacent to the stream in the Little Cow Creek subwatershed 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 23% of the time in Winter, 26% of the time in Summer/Fall and 50% of the time in Spring and reducing average instream BOD levels below 4.77 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, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Cow Subbasin (HUC 8: 10270104) with a priority ranking of 27 (Medium Priority for restoration work).

Priority HUC 11s and Stream Segments: Until additional assessment is done on the main stem and tributary reaches between 2000-2005, priority focus of implementation prior to 2005 will concentrate on installing best management practices adjacent to Cow Creek and directly contributing tributaries in HUC11 11030011030.

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 streams.
4. Insure proper on-site waste system operations in proximity to main streams.
5. Insure that labeled application rates of chemical fertilizers are being followed

Implementation Programs Guidance

NPDES and State Permits - KDHE

- a. Municipal permits for facilities in the watershed will be renewed after 2002 with continuation of nutrient monitoring and permit limits preventing excursions in nutrient criteria.
- 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. Provide technical assistance in urban and agricultural setting on practices geared to minimize chemical fertilizer impact to stream resources.
- d. 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. Provide alternative water supplies to small livestock operations
- b. Develop improved grazing management plans
- c. Reduce grazing density on pasturelands

- d. Install livestock waste management systems for manure storage
- e. Implement manure management plans
- f. Install replacement on-site waste systems
- g. 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. Educate chemical fertilizer users on proper application rates and timing.
- c. Provide technical assistance on livestock waste management design.
- d. 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 Little Cow Creek.

Timeframe for Implementation: Pollution reduction practices should be installed within the priority subwatersheds over the years 2001-2005, with follow up implementation thereafter..

Targeted Participants: Primary participants for implementation will be agricultural producers with cropland adjacent to stream, City of Lyons, and 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. Unbuffered cropland adjacent to stream
3. Sites where drainage runs through or adjacent livestock areas
4. Sites where livestock have full access to stream and stream is primary water supply
5. Poor riparian sites
6. Sites which have an urban runoff component
7. Failing on-site waste systems

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 2004: 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 responsible for the facilities and sites cited in the local assessment participating in the implementation programs provided by the state. Additionally, sampled data from site 656 should indicate evidence of improved dissolved oxygen levels at median conditions relative to the conditions seen over 1992-1999.

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 Reno, Rice, Ellsworth 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 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 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 voluntary 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 1987-1999, the state may employ more stringent regulations on non-point sources 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 at Stations 287, 522, 656 and 657 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 Cow 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.

Approved September 11, 2000.