

LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Rattlesnake Creek
Water Quality Impairment: Sulfate

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Rattlesnake

Counties: Rice and Stafford (primarily)

HUC 8: 11030009

HUC 11:

040 (010, 020, 030, 050, 060, and 070)

010 (010, 020, 030, 040, 050, 060, and 070) *unimpaired*

020 (010, 020, 060, and 070) *unimpaired*

030 (010, 020, 030, 040, 050, 060, 070, and 080) *unimpaired*

Drainage Area: 251.7 mi² (+846.2 mi² *unimpaired*)

Main Stem Segment: WQLS: 1; starting at confluence with Arkansas River and traveling upstream to confluence of Wild Horse Creek.

Designated Uses: Special 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

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

Impaired Use: Domestic Water Supply

Water Quality Standard: 250 mg/l for Domestic Water Supply (KAR 28-16-28e(c)(3)(A))

In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the water quality criteria listed in Table 1a of KAR 28-16-28e(d), at ambient flow, the existing water quality shall be maintained, and the newly established numeric criteria shall be the background concentration, as defined in KAR 28-16-28b(e). Background concentrations shall be established using the methods outlined in the "Kansas implementation procedures: surface water," dated June 1, 1999... (KAR 28-16-28e(b)(9)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303(d): Not Supporting Domestic Water Supply

Monitoring Sites: Station 030 near Raymond

Period of Record Used: 1985 to 1999

Flow Record: Rattlesnake Creek near Raymond (USGS Station 07142620)

Long Term Flow Conditions: Median Flow = 24 cfs , 7Q10 = 1 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 examined from the Raymond 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 75-99% range. Load curves were established for the sulfate 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 tons of sulfate 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 all three seasons for the water quality sampling site. Fifty five percent of Spring samples from water quality site 030 were over the criteria. 72% of Summer-Fall samples were over the criterion and 63% of Winter samples were over the criterion. Overall 61% of the samples at site 030 were over the criteria. This would represent a baseline condition of non-support of the impaired designated use at the site below Quivera. Samples taken at Hudson monitoring the upstream reach of Segment 1 averaged 140 mg/l, indicating no impairment by sulfate on the upper reach.

NUMBER OF SAMPLES OVER SULFATE STANDARD OF 250 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.
Raymond (030)	Spring	0	0	0	7	11	8	26/47 = 55%
	Summer	0	1	4	3	3	2	13/18 = 72%
	Winter	0	0	4	14	4	3	25/40 = 63%

Desired Endpoints of Water Quality (Implied Load Capacity) at Site 030 over 2005 - 2010:

The ultimate endpoint for this TMDL will be to Achieve the Kansas Water Quality Standards fully supporting Drinking Water Use. This TMDL will, however, be phased. The current standard of 250 mg/L of sulfate was used to establish a load duration curve representing the TMDL.

Kansas Implementation Procedures for Surface Water allow for a numerical criterion based on natural background to be established using the mean concentration of in stream measurements gathered when stream flow was less than the median flow on the creek. A minimum of five data points is needed to determine the background concentration. The specific stream criteria to supplant the general standard will be developed concurrent with Phase One of this TMDL following the appropriate administrative and technical Water Quality Standards processes. Meanwhile, a Phase Two endpoint has been developed for the creek based on currently available information and is 456 mg/L from data collected over 1985-1999 at flows equal to or less than 24 cfs. The Phase Two TMDL will be based on the future standard.

Seasonal variation has been incorporated in this TMDL through the documentation of the seasonal consistency of elevated sulfate levels. 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

Groundwater from the Permian geologic formations underlying the eastern portion of the Rattlesnake Creek watershed tends to be naturally high level in sulfate. This ground water is typically directed up to the surface in the vicinity of the Quivera refuge, where the water undergoes evaporation. Comparison of the sulfate and flow taken on concurrent samples at Hudson and Raymond indicate an average sulfate concentration at Hudson above the marshes of 140 mg/l and a flow of 19 cfs. Values at Raymond averaged 442 mg/l and 10 cfs, respectively. Evaporation from the creek and in Quivira National Wildlife Refuge further increases the concentration at downstream locations of Segment 1. The average ratio of loading above Quivera to that below is 68%, indicating concentrating effects by the wetland and a longer residual time within the marsh than that seen in the upstream segments.

Another indicator that the source of the sulfate load in Rattlesnake Creek is natural in occurrence is that the sulfate concentration at both water quality monitoring sites 660 and 030 are directly proportional (graphs attached) to the naturally derived chloride concentration. Excursions from the sulfate criterion have been recorded at water quality site 030 exclusively. Excursions at this site only occur at flows less than about 24 cfs, regardless of season.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

Additional assessment will be necessary to ascertain the amount of natural sulfate loading within the watershed. The following can be anticipated:

Point Sources: There is one point source above the monitoring location(s), St. John. The Wasteload Allocation based on a 0.316 cfs design flow shall be 384 pounds per day of sulfate at 1 cfs. Since the upper portion of Segment 1 has low sulfate content, the 250 mg/l endpoint will be applicable regardless of development of elevated background concentrations on Segment 1 below Quivera.

The State and Groundwater Management District No. 5 are implementing a Rattlesnake Creek Subbasin Management Plan which will work toward water use reduction over a 12 year period and attempt to rebalance available water supply with demand. One aspect of the plan is flow augmentation along Rattlesnake Creek to supply the Quivera Wildlife Refuge with water during autumn migratory season. If such a plan is implemented, the discharges to the creek will be subject to NPDES permitting and fall under the Wasteload Allocation of this TMDL. Monitoring of the augmentation water will be needed to assess the impact to Quivera and downstream reaches of the creek in terms of sulfate levels. As these new discharges enter into the impaired segment, the current wasteload allocation will be revised by adjusting current load allocations to account for the presence and impact of these new point source dischargers.

Non-Point Sources: The vast majority of the sulfate load is background in nature. The Load Allocation based on the existing standard will be 1350 pounds per day at 1 cfs. This allocation increases to 2460 pounds per day at 1 cfs if the elevated background concentration becomes the applicable criterion. The allocation also increases as a function of flows, up to 58,670 pounds per day at 24 cfs and using the tentative background concentration.

Defined Margin of Safety: The Margin of Safety will be ten percent of the applicable sulfate wasteload, or 43 pounds tons per day at 1 cfs. Again, the Margin of Safety will remain in place despite incorporation of background concentrations or increases in available flow.

State Water Plan Implementation Priority: Because it appears this watershed's sulfate load is predominately natural this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Rattlesnake (HUC 8: 11030009) with a priority ranking of 15 (High Priority for restoration work).

Priority HUC 11s and Stream Segments: The lower portion of Segment 1 below Quivera will be the priority segment of this TMDL.

5. IMPLEMENTATION

Desired Implementation Activities

1. Establish appropriate background concentrations
2. Reestablish freshwater baseflows to reduce sulfate concentrations along Rattlesnake Creek.

Implementation Programs Guidance

Water Quality Standards and Assessment - KDHE

- a. Establish background levels of sulfate for Rattlesnake Creek.

Rattlesnake Creek Subbasin Water Resources Management Program - KDA

- a. Implement Rattlesnake Creek Management Plan to improve stream flow in Rattlesnake Creek, especially upstream of Highway 281 and to reduce the possibility of induced saltwater movement to the creek by upwelling of the salt/fresh water interface from groundwater withdrawals near the stream.

Timeframe for Implementation: Continued monitoring over the years 2001-2005. Development of a background level- based water quality standard should be accomplished with the 2002 water quality standards. Implementation of the Rattlesnake Creek Subbasin Management Plan will occur over 2000 - 2012.

Targeted Participants: Primary participants for implementation will be the Groundwater Management District and irrigators in the area participating in the water management of the regional aquifer which will have impacts on the quantity and quality of water in Segment 1.

Milestone for 2005: The year 2005 marks the mid-point of the ten year implementation window for the watershed. At that point in time, additional monitoring data from Stations 660 and 030 will be re-examined to confirm the impaired status of the river and the suggested background concentration. Should the case of impairment remain, source assessment, allocation and further implementation activities will ensue

Delivery Agents: Depending upon confirmation of impairment and assessment of probable sources, the primary delivery agents for program participation will be the Kansas Department of Health and Environment, the Kansas Water Office, the Kansas Department of Agriculture, and Big Bend GMD #5.

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. 82a-706. Empowers the chief engineer of the Division of Water Resources, KDA, to enforce and administer the laws of this state pertaining to the beneficial use of water and shall control, conserve, regulate, allot and aid in the distribution of the water resources of the state for the benefits and beneficial uses of all of its inhabitants in accordance with the rights of priority of appropriation.
4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.
6. The *Kansas Water Plan* and the 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 TMDL is a Low Priority consideration and should not receive funding.

Effectiveness: Minimal control can be exerted on natural contributions to loading.

6. MONITORING

KDHE will continue to collect bimonthly samples at Station 030 and (in 2000 and 2004) at rotational Station 660, including sulfate samples over each of the three defined seasons. Based on that sampling, the status of 303(d) listing will be evaluated in 2006 including application of a numeric criteria based on background concentrations. Should impaired status remain, 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 2005-2009.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Lower Arkansas River Basin were held March 9, 2000 and April 26-27, in Hutchinson, Wichita, 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 River Basin. A draft of this TMDL has been maintained on the website since June 1, 2000 and modifications to the original draft have been available to the public for viewing and review up to the date of submitting this TMDL to EPA.

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

Basin Advisory Committee: The Lower Arkansas River Basin Advisory Committee met to discuss the TMDLs in the basin on September 27, and November 8, 1999; January 13 and March 9, 2000. The Committee recommended approval of the Basin Plan which set high priority TMDLs in the basin, thereby, delegating medium and low priority status to this and subsequent TMDLs for the basin. The Kansas Water Authority approved the Basin Plan on July 11, 2000.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:
Sedgwick County Technical Advisory Group: August 8, October 14, November 15, 1999 and January 20, 2000.
Agriculture: January 12, February 2 and 19, 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 2006, evaluation will be made as to the degree of impairment which has occurred within the watershed and current condition of Rattlesnake Creek. Subsequent decisions will be made regarding implementation approach and follow up on additional implementation in subwatersheds.

Consideration for 303(d) Delisting: Rattlesnake Creek will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2000-2005. Therefore, the decision for delisting will come about in the preparation of the 2006 303(d) list. Should modifications be made to applicable criterion 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 2005.

Approved July 27, 2001.