LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: **Little Arkansas River Subbasin**
Water Quality Impairment: Sediment Impact on Aquatic Life

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Little Arkansas **Counties**: Sedgwick, Harvey, McPherson, Marion, Reno and Rice

HUC 8: 11030012

HUC 11: 010 (Upper Little Arkansas), 020 (Turkey Creek), 030 (Middle Little Arkansas), 040 (Emma and Sand Creeks), 050 (Lower Little Arkansas-Chisholm Creek)

Drainage Area: 1327 miles^2 at Valley Center

Main Stem Segments: 1, 3, 5, 9, 10, and 14, starting at confluence of Arkansas River, headwaters in Rice County near Geneseo.

Tributary Segments:

Jester Creek (2)
- West Fork (18)
- Gooseberry Creek (17)

Sand Creek (4)
- Mud Creek (16)
- Unnamed Trib (26)

Emma Creek (6 & 7)
- West Emma (8)

Kisiwa Creek (15)
Black Kettle Creek (368)
Turkey (Sun) Creek (11 & 12)
- Dry Turkey Creek (13)
  - Unnamed Trib (24)
- Running Turkey Creek (25)

Sand Creek (23)
Lone Tree Creek (20)
Dry Creek (22)
Salt Creek (21)
Horse Creek (19)

Designated Uses: Primary and Secondary Contact Recreation on Main Stem Segments and Sand Creeks
Secondary Contact Recreation on remaining tributaries

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

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

Water Quality Standard: Suspended solids - Narrative: Suspended solids added to surface waters by artificial sources shall not interfere with the behavior, reproduction, physical habitat or other factor related to the survival and propagation of aquatic or semi-aquatic or terrestrial wildlife. (KAR 28- 16-28e(c)(2)(D)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 1998 303d: Partially Supporting

Monitoring Sites: Station 218 in Valley Center

Period of Record Used: 1980 to 1996

Flow Record: Little Arkansas River at Valley Center (USGS Gaging Station # 07144200); 1974-1999
Long Term Flow Conditions: Estimated 7Q10 = 5.3 cfs at Valley Center; 10% Exceedence Flows = 650 cfs at Valley Center

Current Conditions:

Parameter	Historical Average & Range (1980 - 1996 for biological data)
Macroinvertebrate Biotic Index (MBI)	4.67 (4.22-5.48)
% Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa (Count)	30 % (21 - 45 %)
Total Suspended Solids	127 mg/L (5 - 1180 mg/L)

Percent EPT taxa and total suspended solid concentrations need to be analyzed to address the sediment/biological impact impairment. The MBI index may also be examined; however it is not as good of an indicator as percent EPT taxa. The EPT index is the proportion of aquatic taxa present within a stream belonging to pollution intolerant orders; Ephemeroptera, Plecoptera and Trichoptera (mayflies, stoneflies and caddisflies). Higher percentages of total taxa comprising these three groups indicate less pollutant stress and better water quality. Typically, these macroinvertebrates utilize a coarse substrate in the stream for habitat. Elevated amounts of suspended solids deposit on the substrate and limits its utility by these clean water indicators.

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On this stream segment, the average MBI value indicates that aquatic life support is partially impaired (MBI between 4.51 and 5.39). Four of the surveys resulted in MBI values under 4.5, 13 were under 5.4. MBI under full support conditions averaged 4.32, MBI under partial support conditions was 4.81. When aquatic life is fully or partially impaired, the percentage of EPT taxa averages 30-31%.

Total suspended solids ranges fairly high levels, averaging 127 mg/l. When suspended solids are graphed against flow for the time period between 1985 and 1997, the concentration of total suspended solids increases with high flows.

Comparison of Biological Index Values and Average Nutrient and Sediment Concentrations

Station	EPT	MBI	Tot. Phosp	Nitrate	Ammonia	BOD	TSS
Great Bend	18%	5.45	1.13 mg/l	1.3 mg/l	1.0 mg/l	6.1 mg/l	106 mg/l
Valley Center	**30%**	**4.67**	**0.80 mg/l**	**0.95 mg/l**	**0.16 mg/l**	**4.6 mg/l**	**127 mg/l**
Derby	29%	5.15	0.80 mg/l	1.86 mg/l	0.70 mg/l	6.5 mg/l	98 mg/l
Ark City	47%	4.81	0.73 mg/l	1.37 mg/l	0.15 mg/l	6.6 mg/l	153 mg/l
Cowskin	43%	4.56	0.33 mg/l	0.65 mg/l	0.085 mg/l	4.7 mg/l	103 mg/l

Desired Endpoint for Little Arkansas River for 2005 - 2009

The use of biological indices allows assessment of the cumulative impacts of dynamic water quality on aquatic communities present within the stream. As such, these index values serve as a baseline of biological health of the stream. Sampling occurs during open water season (April to November) within the aquatic stage of the life cycle of the macroinvertebrates. As such there is no described seasonal variation of the desired endpoint of this TMDL. The endpoint would be average percent composition of EPT taxa of 40% or more over 2004-2008.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach, therefore the narrative water quality standard pertaining to suspended solids would be attained. While the narrative water quality standard pertaining to suspended solids is utilized by this TMDL, there is no direct linkage between EPT taxa values and suspended solids levels. A number of factors may contribute to the occasional declines in EPT index values. These include flows, adequate habitat, and stream modifications. While the link between EPT index values and suspended solid levels on the Little Arkansas River remains qualitative at this phase of the TMDL, there is little doubt that reduction in sediment loads on the river will create more appropriate habitat for these taxa.

3. SOURCE INVENTORY AND ASSESSMENT

Land Use: The subbasin is 78% cropland and 19% grassland with 1% in woodland. The following table characterizes the five watersheds in terms of drainage and land use.

HUC 11	Watershed Name	Drainage Area	% Grassland	% Cropland	% Woodland	% Urban
010	Upper Little Ark	335	41	56	1.6	0.6
020	Turkey-Sun	355	9	88	0.5	1.6
030	Mid Little Ark	254	20	76	0.3	3.5
040	Emma & Sand Crk	379	8	87	1.1	2.5
050	Lower Little Ark	81	18	66	0.8	15

Contributing Runoff: The watershed ranges in average soil permeability of 2.8 inches/hour in the Upper Little Arkansas watershed to 0.8 and 0.9 inches per hour in Turkey and Emma and Sand Creek watersheds according to NRCS STATSGO data base. A majority of the watershed produces runoff even under relative low (1.5''/hr) potential runoff conditions. 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. Even under very low (<1"/hr) potential conditions, the entire Turkey Creek watershed will runoff, as will 98% of the Emma and Sand Creek Watersheds and 74% of the Upper Little Arkansas. Generally, storms producing less than 0.5"/hr of rain will generate runoff from only 5% of these watershed, chiefly along the stream channels.

Background Levels: Background levels of total suspended solids come from overland runoff and sheet and rill erosion. Sediment becomes suspended during high flow events as soil along the banks and stream bed is eroded.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

There is an indirect, yet un-quantified relation between sediment loading and biological integrity. Decreased loads should result in aquatic communities, indicative of improved water quality. The ability of biological data to integrate the various physical and chemical impacts of the entire watershed on the aquatic community defies allocation of specific suspended solid loads between point and nonpoint sources. Additionally, no specific relationship between the observed ambient suspended solid levels and the biological impairment indicated by the EPT taxa value could be established. Because biological integrity is a function of multiple factors, the initial pollution load reduction responsibility will be to decrease the average condition of sediment over the range of

flows encountered on the Little Arkansas River. Future monitoring will be designed to uncover the actual reasons for the impairment and this TMDL will be adjusted to reflect the new information.

For this phase of the TMDL, an average condition is considered across the seasons, to establish goals of the endpoint and desired reductions. Therefore average ambient levels are multiplied by the average flow estimated for the Little Arkansas River. This is represented graphically by the integrated area under each load duration curve established by this TMDL. The area is segregated into allocated areas assigned to point sources (WLA) and non-point sources (LA). Future growth in wasteloads should be offset by reductions in the loads contributed by non-point sources. This offset along with appropriate limitations should eliminate the impairment. This TMDL represents the "Best Professional Judgment" as to the expected relationship between these sources and the expected MBI score.

Point Sources: There are sixteen NPDES dischargers in the watershed, all with permit limits for TSS. The existing loads contributed by these facilities is unknown and will need to be determined in the future through monitoring of effluent and ambient receiving streamflow. Assuming the total effluent volume arrives at the monitoring site, that flow (15 cfs) would constitute a flow which was exceeded 96% of the time on the Little Arkansas River. However, point source influence on water quality would extend to higher flows as well. Therefore, the allocation for point sources is demarcated by the area under each respective load duration curve bounded from 75% to 100%. At this stage of the TMDL, the assumed condition is maintenance of current conditions at those low flows, presuming a offset of lower loading at higher flows. The Wasteload Allocation represents the load in the stream which the point sources contribute. In most cases, this is a function of permit limits; in the case of TSS, permit limits range from 30 mg/l to 80 mg/l on average.

Non-Point Sources: Given the runoff characteristics of the watershed, overland runoff can easily carry sediment from the watershed into the stream reaches . The composition of the watershed indicates a mixture of rural and urban non-point sources which may contribute to the downstream impairment. These sources tend to become dominant under higher flow conditions. Therefore, the area under the load duration curves bounded from 1- 75% constitutes the Load Allocation for this TMDL. Because of the predominant loads under runoff conditions, the Load Allocation will be a reduction of sediment loadings such that average total suspended solids concentrations are below 100 ppm in stream a majority of the time.

First Stage TMDL Goals and Gross Allocations for Little Arkansas River

	EPT	TSS
CURRENT	30%	283,921 #/D
IMPROVEMENT	10%	- 60,361 #/D
TMDL	40%	223,560 #/D
WLA		8,100 #/D
LA		215,460 #/D

Defined Margin of Safety: In order to ensure that biological data collected in 2004-2008 are not skewed by a single sample with a high proportion of EPT taxa, the defined margin of safety will be a median value of EPT taxa percentages among samples taken over 2004 - 2008 which must exceed 40%. As an additional assurance of full support of the aquatic life use, the median percentage of individuals in a sample which are EPT taxa must exceed 55%. This measure may correlate with the availability of adequate habitat in the stream to support the EPT taxa community.

State Water Plan Implementation Priority: Because the Little Arkansas River is a major tributary to the Arkansas River entering the Wichita area, interacts with the major aquifer of the area, the Equus Beds and since there will be a concurrent effort to reduce bacteria and nutrients across the watershed, this TMDL will be a High Priority for implementation.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Little Arkansas Subbasin (HUC 8: 11030012) with a priority ranking of 14(Highest Priority for restoration work).

Priority HUC 11s and Stream Segments: Because of the propensity for this drainage to produce runoff, leading to excursions from the water quality standards, priority will be given to the upper watersheds within the sub-basin. Specifically, the Upper Arkansas watershed above Halstead, Turkey Creek, Emma Creek and Sand Creek will be the highest priorities. Furthermore, priority should be given to activities along Kisiwa Creek leading to the main stem.

5. IMPLEMENTATION

Desired Implementation Activities

1. Implement and maintain conservation farming, including conservation tillage, contour strips and no till farming.
2. Install grass buffer strips along streams.
3. Reduce activities within riparian areas
4. Minimize road and bridge construction impacts on streams
5. Monitor wastewater discharges for excessive Total Suspended Solid loadings

Implementation Programs Guidance

NPDES - KDHE

a. Monitor effluent from wastewater systems to determine their suspended solid contributions and ambient concentrations of receiving streams.

b. Ensure proper monitoring, permitting, and operations of municipal wastewater systems to limit suspended solid discharges after numeric criteria are established.

Non-Point Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of siltation runoff from agricultural or road construction activities

b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.

c. Provide technical assistance on road construction activities in vicinity of streams.

Technical Services - KDHE

a. Incorporate numeric sediment criteria into water quality standards after final EPA guidance is issued.

Environmental Field Services - KDHE

a. Assess stream habitat and other factors impacting the aquatic community throughout the Little Arkansas River.

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

a. Apply conservation farming practices, including terraces and waterways

b. Provide sediment control practices to minimize erosion and sediment transport

Riparian Protection Program - SCC

a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.

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 agricultural producers on sediment and pasture management

b. Provide technical assistance on buffer strip design and minimizing cropland runoff

Time Frame for Implementation: Pollutant reduction practices should be installed within the priority subwatersheds during the years 2001-2005, with minor follow up implementation, including other subwatersheds over 2005-2009. To some degree, reduction practices associated with reducing bacteria or nutrient impairment will have an impact on reducing sediment loads to the stream.

The second stage involves incorporating refined allocations and load reductions including permit limits which should be in place after final EPA guidance has established numeric criteria and those criteria have been incorporated into Kansas water quality standards.

Targeted Participants: Primary participants for implementation will likely be agricultural producers operating within the drainage of the priority subwatershed. Initial work over 2001-2005 should include an inventory of activities in those areas with greatest potential to impact the stream, including, within a mile of the stream:

1. Total rowcrop acreage
2. Degree of residue compliance on Highly Erodible Lands
3. Acreage of poor rangeland or overstocked pasture
4. Livestock use of riparian areas
5. Unvegetated or graded roadside ditches
6. Construction projects without erosion control techniques

Some inventory of local needs should be conducted in 2001 - 2005 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 midpoint of the ten-year implementation window for the watershed. At that point in time, adequate source assessment should be complete which allows an allocation of resources to responsible activities contributing to the sediment impairment. Additionally, biological data from the Little Arkansas River over 2001-2005 should not indicate trends of reduced support of the aquatic community. Quantitative relationships between suspended sediment and biological measures should be established by 2005 and sampled data from Little Arkansas River should indicate evidence of reduced sediment levels relative to the conditions seen over 1985-1999.

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 and Kansas Livestock Association and grain crop associations.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.

4. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

5. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

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

7. The *Kansas Water Plan* and the 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 watershed and its TMDL are a High **Priority** consideration. Priority should be given to activities which reduce loadings of sediments to the stream during 2001-2005.

Effectiveness: Sediment control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming within the watersheds cited in this TMDL.

Should voluntary participation significantly lag below expectations over the implementation period or monitoring indicates lack of progress in improving water quality conditions from those seen over 1990-1999, the state may employ more stringent regulations on nonpoint sources in the watershed through establishment of a Critical Water Quality Management Area in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

As quantified sediment-biology relations become established, KDHE will continue to collect seasonal biological samples from Little Arkansas River for three years over 2001 - 2005 and an additional three years over 2005-2009 to evaluate achievement of the desired endpoint. Periodic monitoring of sediment or solid content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits.

Further MBI and HDI sampling sites may be established to address conditions throughout the reach segments.

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

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the 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, 1999, 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:

Sedgwick County Technical Advisory Group: August 8, October 14, November 15, 1999, January 20, 2000, April 27, 2000 and May 25, 2000.
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 the Little Arkansas River. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303d Delisting: The river will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2005-2009. Therefore, the decision for delisting will come about in the preparation of the 2010 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 during Fiscal Years 2001-2005.

Approved September 11, 2000.