LOWER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body: **Little Arkansas River Subbasin**
Water Quality Impairment: Nutrients and Oxygen Demand 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: Nutrients--Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life. (KAR 28-16-28e(c)(2)(B)).

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

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

Monitoring Sites: Station 282 in Valley Center

Period of Record Used: 1980 to 1999

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; Average flow 10% = 414 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 %)
Biochemical Oxygen Demand (BOD)	4.70 mg/L (1.44 - 12.3 mg/L)
Phosphorus	800 ug/L (280 - 2000 ug/L)
Ammonia	160 ug/L (20 - 156 ug/L)
Nitrate	957 ug/L (10 - 3930ug/L)
Total Suspended Solids	127 mg/l (5 - 1180 mg/l)

Three main parameters (MBI, %EPT, and BOD) were analyzed to address the nutrient/ oxygen demand impairment. The Macroinvertebrate Biotic Index rates the nutrient and oxygen demanding pollution tolerance of large taxonomic groups (order and family). Higher values indicate greater pollution tolerances. Along with the number of individuals within a rated group, a single index

value is computed which characterizes the overall tolerance of the community. The higher the index value the more tolerant the community is of organic pollution exerting oxygen demands in the stream setting. Index values greater than 5.4 are indicative of non-support of the aquatic life use; values between 4.51 and 5.39 are indicative of partial support and values at or below 4.5 indicate full support of the aquatic life use.

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.

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%.

Overall, the average concentration of nutrients in the Little Arkansas River averages to 820 ug/L phosphorus, 4.7 mg/l BOD, 160 ug/L ammonia, and 950 ug/L nitrate. Suspended Solids tended to be high, averaging 127 mg/l.

Comparison of Biological Index Values and Average Nutrient and Sediment Concentrations

Station	MBI	Tot. Phosp	Nitrate	Ammonia	BOD	TSS
Great Bend	5.45	1.13 mg/l	1.3 mg/l	1.0 mg/l	6.1 mg/l	106 mg/l
Valley Center	**4.67**	**0.80 mg/l**	**0.95 mg/l**	**0.16 mg/l**	**4.7 mg/l**	**127 mg/l**
Derby	5.15	0.80 mg/l	1.86 mg/l	0.70 mg/l	6.5 mg/l	98 mg/l
Ark City	4.81	0.73 mg/l	1.37 mg/l	0.15 mg/l	6.6 mg/l	153 mg/l
Cowskin	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 MBI value of 4.5 or less over 2005-2009.

Achievement of this endpoint would be indicative of full support of the aquatic life use in the stream reach. While the narrative water quality standard pertaining to nutrients is utilized by this TMDL, there is no apparent direct linkage between MBI values and nutrient levels. A number of factors may contribute to the occasional excursion in index values above 4.5. These include ambient concentrations, sediment, flows, adequate habitat, and stream modifications. The link between MBI values and nutrient levels on the Little Arkansas River remains qualitative at this phase of the TMDL.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are sixteen NPDES permitted municipal wastewater dischargers located within the Little Arkansas subbasin above the Valley Center monitoring site. The Sedgwick County cities discharge below the site. Most permits are set to expire in 2002.

MUNICIPALITY	STREAM REACH	SEGMENT	DESIGN FLOW	TYPE	WATERSHED
Geneseo	Upper Little Ark	14	0.075 MGD	Mech	Upper Little Arkansas
Little River	Upper Little Ark	14	0.060 MGD	Lagoon	Upper Little Arkansas
Windom	Upper Little Ark	14	0.0275 MGD	Lagoon	Upper Little Arkansas
Buhler	Upper Little Ark	14	0.168 MGD	Oxid.Dch	Upper Little Arkansas
McPherson	Dry Turkey Creek	13	2.000 MGD	Mech	Turkey-Sun
Galva	Turkey Creek	12	0.058 MGD	Lagoon	Turkey-Sun
Inman	Blaze Fork	N/A	0.132 MGD	Lagoon	Turkey-Sun
Moundridge	Black Kettle Creek	368	0.233 MGD	Lagoon	Mid Little Arkansas
Burrton	Kisiwa Creek	15	0.120 MGD	Lagoon	Mid Little Arkansas
Halstead	Little Arkansas	10	0.420 MGD	Mech	Mid Little Arkansas
Memorial Home	Black Kettle Creek	368	0.010 MGD	Lagoon	Mid Little Arkansas
Goessel	Middle Emma Crk	7	0.060 MGD	Lagoon	Emma & Sand Crks
Hesston	Middle Emma Crk	7	1.300 MGD	Mech	Emma & Sand Crks
Newton	Sand Creek	4	3.000 MGD	Mech	Emma & Sand Crks
Walton	Beaver Creek	26	0.038 MGD	Lagoon	Emma & Sand Crks
Sedgwick	Sand Creek	4	0.292 MGD	Mech	Emma & Sand Crks

Population projections for these municipalities to the year 2020 indicate growth for most of the towns. Projections of future water use and resulting wastewater appear to remain under design flows for each of the wastewater systems. Most cities appear to have additional treatment capacity available. The lagoon systems monitor for BOD and TSS, usually ranging from 20-40

mg/l BOD and 70-90 mg/l TSS. Two systems, Memorial Home and Windom have not discharged over the last year. The mechanical plants monitor BOD, TSS and ammonia. Usually, BOD and TSS range between 1-20 mg/l. For ammonia, average concentrations in effluent are 2 mg/l for Buhler, 3.4 mg/l for Geneseo, 2.5 mg/l for Halstead, 0.1 mg/l for Hesston, 0.4 mg/l for McPherson and 0.3 mg/l for Newton. It is significant that the three largest volume dischargers, McPherson, Newton and Hesston have effluent with less than 0.5 mg/l ammonia. No monitoring data for phosphorus or total nitrogen are available.

Livestock: There are 51,151 animal units registered, certified or permitted within the watershed, distributed among 191 operations. Most of these operations are either swine (59) or beef (61) followed by dairy (46). These livestock facilities have waste management systems designed to minimize runoff entering their operations or retaining runoff from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable, but typically less than permitted numbers. Grazing densities during the summer appear heaviest in the Upper Little Arkansas watershed and in the drainages to the west of the river. Relatively high density is seen in the Chisholm Creek drainage above Park City. Winter grazing patterns indicate heaviest concentrations along upper Sand Creek with fairly uniform distribution throughout the remainder of the subbasin.

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

County inventories of livestock indicate that among the six counties of the subbasin, Reno and Rice counties had the most cattle, Harvey and McPherson counties had the most hogs and Rice and McPherson counties had the most chickens.

On-Site Waste Systems: The heaviest population densities appear centered around the major cities of the sub-basin. The lightest concentration of people is in the northwest portion of the subbasin and along the river above Halstead. All counties within the drainage are expected to grow over the next 20 years, but patterns in rural areas outside incorporated municipal systems indicate declines, except in Sedgwick County. Therefore, pressure by increased numbers of on-site waste systems is not likely to contribute to the problem, except between Sedgwick and

Wichita. The infrequent excursions from the water quality standards seem to indicate a lack of persistent loadings from such systems on any grand scale. It is likely that the contribution of high nutrient loads from on-site waste systems is restricted to local areas.

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: Most of the woodland in the watershed is adjacent to the Little Arkansas River. Leaf litter falls into the streams and decomposes increasing the oxygen demand. Small amounts of phosphorus are contributed from the watershed soils. Nitrogen loads may be contributed from the atmosphere. The soils tend to have a high phosphorus content associated with their clay structure.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

There is an direct, yet unquantified relation between nutrient 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 nutrient loads between point and nonpoint sources. Additionally, no specific relationship between the observed ambient nutrient levels and the biological impairment indicated by the MBI 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 nutrients and 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 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 these sources and the expected MBI score.

Point Sources: There are sixteen municipal facilities releasing effluent into the watershed. 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 (12-15 cfs) would constitute a flow which was exceeded 96-97% 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 nutrients and BOD, there is some assimilation and degradation of the constituents in transit while flowing downstream. At this stage of the TMDL, the desired condition is reduction of average effluent quality in order to reduce point source loading at higher flows. Desired average quality of effluent would be 1 ppm TP, 1 ppm NO3, 1.5 ppm ammonia, 20 ppm BOD and 100 ppm TSS. Maintenance of these levels will ensure that downstream ambient levels under normal flow conditions will be lower than current conditions, provided there is an impact of treatment upgrades by the point sources and there is concurrent reductions in load allocations. Further refinement of this allocation will come with information on effluent concentrations and developed nutrient criteria for streams, resulting in specific permit limits in the second stage of this TMDL.

The Wasteload Allocations represent the average load which the treatment plants can be expected to discharge. Because of the detention time of effluent leaving the plants before entering the creek, actual concentrations are likely to be lower than the general condition described by the Wasteload Allocation. Furthermore, the instream assimilation or degradation of the organic or nutrient parameters in transit will result in lower actual ambient concentrations at low flow at the monitoring site than that suggested by this allocation. Furthermore, biological processes transform available nitrogen into nitrate and ammonia forms in a dynamic fashion, therefore, both species should be considered in total when assessing potential reduction in nitrogen loading to the stream.

Nonpoint Sources: Given the runoff characteristics of the watershed, overland runoff can easily carry sediment, phosphorus, and nitrogen from the watershed into the stream reaches . The composition of the watershed indicates a mixture of rural and urban nonpoint 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, this Load Allocation intends to reduce loadings such that ambient levels for phosphorus are below 750 ppb in stream, nitrate below 0.9 ppm, ammonia below 0.15 ppm, BOD below 4.5 ppm and sediment concentrations average below 100 ppm in the stream.

First Stage TMDL Goals and Gross Allocations for Little Arkansas River

	MBI	T.PHOSP	NITRATE	AMMONIA	BOD	TSS
CURRENT	4.67	1788 #/D	2124 #/D	358 #/D	10,284 #/D	283,921 #/D
REDUCTION	0.17	111 #/D	112 #/D	23 #/D	252 #/D	60,361 #/D
TMDL	4.50	1677 #/D	2012 #/D	335 #/D	10,060 #/D	223,560 #/D
WLA		81 #/D	81 #/D	122 #/D	1620 #/D	8,100 #/D
L.A.		1596 #/D	1931 #/D	213 #/D	8440 #/D	215,460 #/D

Defined Margin of Safety: Given the variable nature of the MBI values seen on this stream, additional biological measures are necessary to assure indications of good aquatic community health. Therefore, the defined Margin of Safety for this TMDL will be a proportion of EPT individuals making up at least 40% of the sample population when MBI values are 4.5 or lower. This will ensure that the majority of aquatic macroinvertebrate population is composed of pollution intolerant taxa. This measure may also correlate with the availability of adequate habitat in the stream to support such a 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 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 necessary soil sampling to recommend appropriate fertilizer applications on cropland
2. Maintain necessary conservation tillage and contour farming to minimize cropland erosion.
3. Install necessary grass buffer strips along streams.
4. Reduce activities within riparian areas
5. Install proper manure storage

6. Implement necessary nutrient management plans to manage manure application to land
7. Monitor wastewater discharges for excessive nutrient loadings

Implementation Programs Guidance

NPDES - KDHE

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

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

Nonpoint Source Pollution Technical Assistance - KDHE

a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management.

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

c. Provide technical assistance on nutrient management in vicinity of streams.

Technical Services - KDHE

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

Environmental Field Services - KDHE

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

Local Environmental Protection Program - KDHE

a. Support inspection of on-site wastewater systems to minimize nutrient loadings

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

a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.

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

Riparian Protection Program - SCC

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

b. Develop riparian restoration projects

c. Promote wetland construction to assimilate nutrient loadings

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, nutrient and pasture management

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

c. Encourage annual soil testing to determine capacity of field to hold phosphorus

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 impairment will have an impact on reducing nutrient 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. Cultivation alongside stream
3. Fields with manure applications
4. On-site wastewater discharges to stream
5. Condition of riparian areas
6. Presence of livestock along stream

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.

Municipal point sources will initiate monitoring and subsequently treat effluent to reduce nutrient loading once EPA guidance and numeric criteria is in place.

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 nutrient impairment. Additionally, biological data from the Little Arkansas River over 2001-2005 should not indicate trends of reduced support of the aquatic community. Numeric nutrient criteria should be established by 2005 and sampled data from Little Arkansas River should indicate evidence of reduced nutrient levels relative to the conditions seen over 1985-1999.

Delivery Agents: The primary delivery agents for program participation will be KDHE working with the point source dischargers, 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. On-site waste system inspections will be performed by Local Environmental Protection Program personnel for Rice, Harvey and Sedgwick 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.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 bacteria and nutrients to the stream during 2001-2005.

Effectiveness: Nutrient 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 and waste management within the watersheds cited in this TMDL.

Technology exists for nitrogen and phosphorus removal and can be placed in wastewater systems with proper planning and design.

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 numeric nutrient criteria 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. Monitoring of nutrient content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits, including ambient monitoring above and below the facilities.

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. The second stage of this TMDL is anticipated to begin after 2005 with the adoption of numeric criteria in water quality standards.

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.

APPENDIX

CALCULATIONS OF CURRENT AND DESIRED LOADS

Estimated Existing Loads calculated by average flow and average concentration:

Total Phosphorus: 414 cfs * 0.80 mg/l * 5.4 = 1788 #/D
Nitrate: 414 cfs*0.95 mg/l*5.4 = 2124 #/D
Ammonia: 414 cfs*.16 mg/l*5.4 = 358 #/D
BOD: 414 cfs*4.7 mg/l*5.4 = 10,284 #/D
TSS: 414 cfs*127 mg/l*5.4 = 283,921 #/D

Desired Loads recalculated using lower ambient concentrations:

Total Phosphorus: 414 cfs * 0.75 mg/l * 5.4 = 1677 #/D
Nitrate: 414 cfs*0.90 mg/l*5.4 = 2012 #/D
Ammonia: 414 cfs*.15 mg/l*5.4 = 335 #/D
BOD: 414 cfs*4.5 mg/l*5.4 = 10,060 #/D
TSS: 414 cfs*100 mg/l*5.4 = 223,560 #/D

Wasteload Allocations calculated by design flow and desired or permitted concentrations

Sum of upstream dischargers = 8 MGD (12.4 cfs), expansion at McPherson could raise to 15 cfs

Total Phosphorus: 15 cfs * 1.00 mg/l * 5.4 = 81 #/D
Nitrate: 15 cfs*1.0 mg/l*5.4 = 81 #/D
Ammonia: 15 cfs*1.5 mg/l*5.4 = 122 #/D
BOD: 15 cfs*20 mg/l*5.4 = 1620 #/D
TSS: 15 cfs*100 mg/l*5.4 = 8100 #/D

Load Allocations found by subtracting Wasteload Allocation from Desired Load:

Total Phosphorus: 1596 #/D
Nitrate: 1931 #/D
Ammonia: 213 #/D
BOD: 8440 #/D
TSS: 215,460 #/D

Approved September 11, 2000.