UPPER ARKANSAS RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: **Arkansas River (Near Great Bend)**
Water Quality Impairment: Nutrients and Oxygen Demand Impact on Aquatic Life

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Arkansas-Pickle
Lower Walnut (portion)

Counties: Barton, Stafford, Pawnee, Rush, Rice and Edwards

HUC 8: 11030004 **HUC 11** (HUC 14s)**:** **050** (080)
060 (010, 020, 030)
070 (010, 020, 030, 040, 050, 060, 070, 080)
11030008 **030** (040, 050)

Drainage Area: 641.2 mi^2

Main Stem Segments: 1; beginning at the confluence with Rattlesnake Creek and continuing upstream to the confluence of Walnut Creek (**Figure 1**).

Designated Uses: Special Aquatic Life, Secondary Contact Recreation, Domestic Water Supply; Food Procurement; Ground Water Recharge; Industrial Water Supply Use; Irrigation Use; Livestock Watering Use for Main Stem Segments.

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

Impaired Use: Special Aquatic Life Support on Main Stem Segment

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 303(d): Partially Supporting Aquatic Life

Monitoring Sites: Station 284 near Great Bend (**Figure 1**)

Period of Record Used: 1980 to 1999 (Station 284)

Flow Record: Arkansas River at Great Bend (USGS Station 07141300) 1975 to 1998

Long Term Flow Conditions: Average Flow = 152 cfs, Median Flow = 20 cfs**,** 7Q10 = 1 cfs

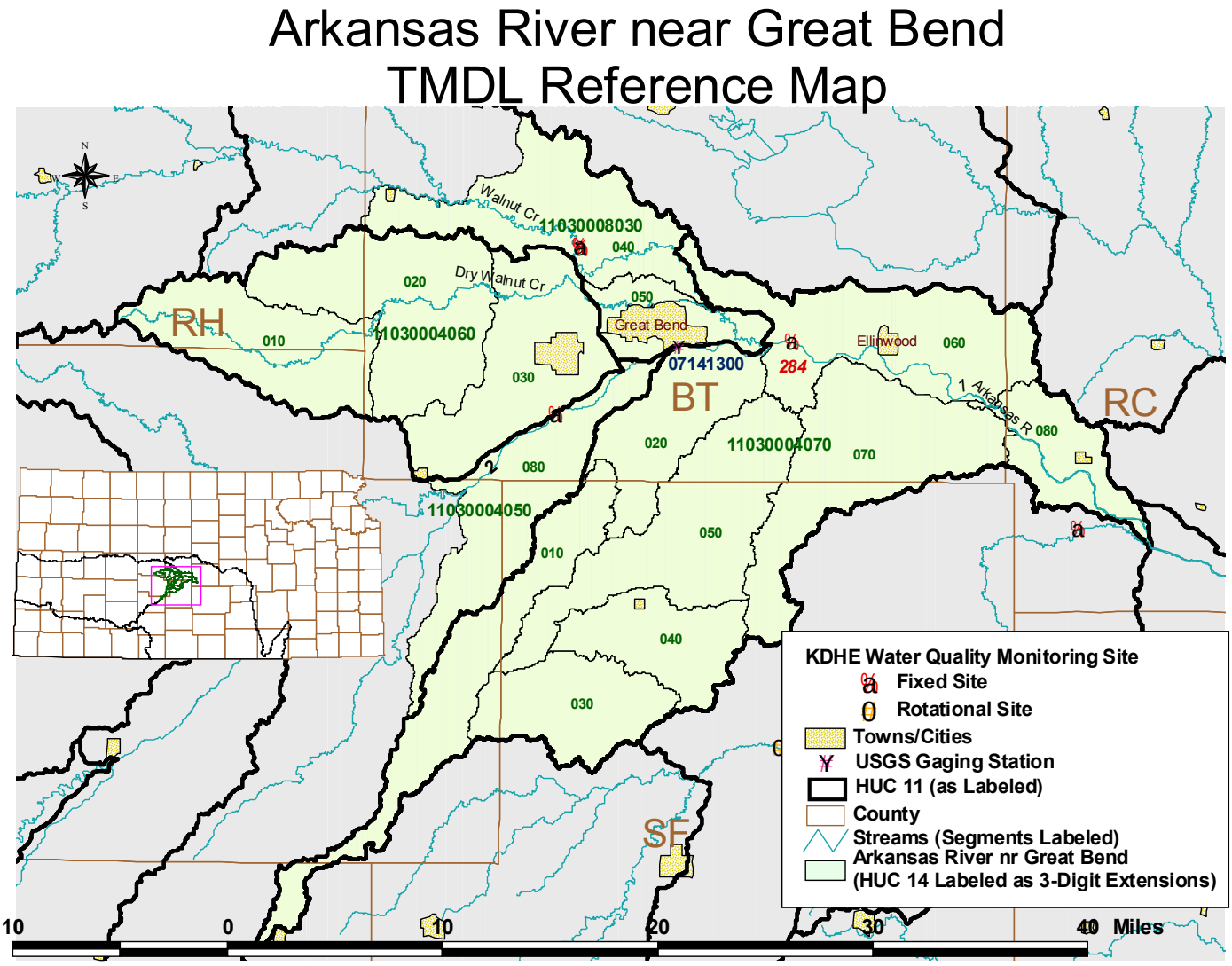

Figure 1

Current Conditions:

Parameter	Historical Average & Range (1980 - 1996 for biological data)
Macroinvertebrate Biotic Index (MBI)	5.45 (4.39 - 7.85)
% Ephemeroptera, Plecoptera, and Trichoptera (EPT) Taxa	18.2 (0.00 - 31)
Biochemical Oxygen Demand (BOD)	6.071 mg/L (0.01 - 50.4 mg/L)
Phosphorus	1,132 ug/L (130 - 10,980 ug/L)
Ammonia	1,002 ug/L (24 - 5,647 ug/L)
Nitrate	1,295 ug/L (70 - 3,270 ug/L)
Total Suspended Solids	106.3 mg/L (1.0 - 1,500 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 not supported (MBI greater than 5.4). Ninety five percent of the surveys resulted in MBI values over 4.5; 45% of the surveys had MBI values over 5.4. A single survey was under the 4.5 level (4.39). When aquatic life is partially impaired (MBI > 4.5), the percentage of EPT taxa ranges from 0.00 - 41.18% (18.2% average). Under the single full support condition, the percentage was 35. The historical average of BOD (6.22 mg/L) is above normal background levels (3 - 4 mg/L).

Phosphorus, ammonia, and nitrate were graphed against the flow. In the phosphorus graph, the nutrient concentration initially decreases with increased flow until about 100 cfs where the phosphorus concentration begins to increase slightly with flow, which suggests that phosphorus is being transported into the stream segments during high runoff events. In the ammonia and nitrate graphs the trend is for the nutrient concentration to decrease slightly in the case of nitrate and significantly in the case of ammonia with increasing flow, which suggests that ammonia, and nitrate are being diluted during high runoff events. Overall, the average concentration of nutrients in the Arkansas River at this location tends to be higher (1,132 ug/L phosphorus, 1,002 ug/L ammonia, and 1,295 ug/L nitrate) than downstream biological monitoring sites.

Station	*MBI*	*Total P*	*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	4.6 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

Desired Endpoint for Arkansas River near Great Bend 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 values 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 specific nutrient levels. A number of factors may contribute to the occasional excursion in index values above 4.5. These include ambient quality, waste loads, flows, adequate habitat and stream modifications. The link between MBI values and nutrient levels at this location on the Arkansas River remains qualitative at this phase of the TMDL, but given the elevated concentrations seen at the downstream monitoring site, any reduction in those levels will result in improved MBI values..

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are two NPDES permitted wastewater dischargers immediately upstream from the sampling site.

DISCHARGER	STREAM REACH	SEGMENT	DESIGN FLOW	EXPIRATION DATE
Great Bend MWTP	Arkansas River	2	3.6 mgd	2002
Great Bend Packing	Arkansas River	2	0.816 mgd	1992

Population projections indicate moderate increase for Great Bend (~9 %) to the year 2020. According to current water use and resulting wastewater, Great Bend MWTP has sufficient treatment capacity available. Great Bend has recently upgraded its treatment system. These system improvements should substantially reduce nutrient loading to the river from the previous system. The following table summarizes the water quality data for effluent from the plant from September 1999 through March 2000, after its system upgrade.

Great Bend MWTP						
	BOD (mg/L)	TSS (mg/L)	Ammonia (mg/L)	Total Phos (mg/L)	Total N (mg/L)	DO (mg/L)
High	20	8	0.9	2.2	3.1	10.4
Low	3	2	<0.05	0.3	1.1	6.0
Average	7.4	4	0.2	1.0	2.3	7.6
Highest Wkly Avg	20	7	0.9	2.2	3.1	10.4
Highest Monthly Avg.	11	6	0.5	2.2	3.1	9.75

The following table summarizes water quality data for effluent from the Great Bend Packing Plant from 1999 - 2000.

Great Bend Packing			
	BOD (mg/L)	Ammonia (mg/L)	Flow (MGD)
Average	33	3.9	0.6

Great Bend Packing has been operating under a permit that has been administratively extended since 1992. This permit should be reviewed and updated within the next year.

Livestock Waste Management Systems: Thirty eight operations are registered, certified or permitted within the watershed. With the exception of two truck washes, one dairy and nine swine facilities, all these other operations are beef. Potential animal units for all facilities in the watershed total 130,308. Six facilities are located within a mile of the main stem or primary tributary upstream of monitoring site 284. Potential animal units for these facilities total 63,153.

All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating 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 potential numbers.

Land Use: Most of the watershed is cropland (79.5%), grassland (18%), urban use(1.5%) or woodland (1% of the total area). The off-season grazing density of livestock is average to high for the Upper/Lower Arkansas and Cimarron basins, with the highest densities in Barton county. When compared to densities across the Upper/Lower Arkansas and Cimarron basins, about half of the watershed's growing season grazing density is average to high for those HUC14s within the

watershed with high percentages of grassland, while the other half is comparably low for HUC14s with high percentages of cropland. Based on 1997 water use reports, approximately 23% of the cropland in the watershed is irrigated. Most irrigation occurs within the main stem valley and south of the main stem.

On-Site Waste Systems: Most of the watershed's population density is very low, 3 - 12 persons/sq. mi., except for areas adjoining Great Bend, 17 - 48 persons/mi^2. Rural population projections for Barton Counties through 2020 show slight increases. All other counties involved indicate moderate decreases. A number of residents within the higher density areas of Barton County are in rural settings without sewer service, relying instead on on-site waste systems. Failing septic systems contribute nutrient loadings. The consistent condition of partial support seems to indicate a persistent loading from some source, although, given the size of the rural population and the magnitude of other potential sources, the on-site waste system impact on the Arkansas River can only be considered very limited.

Background Levels: One percent of the Arkansas River watershed is woodland. 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.

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

There is a direct, yet unquantified relation between nutrient loading and impaired biological integrity. Decreased loads should result in aquatic communities which are 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. There is a general relationship seen between the elevated MBI value seen at Great Bend and ambient concentrations of certain parameters, particularly ammonia. 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 Arkansas River at this location. 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 Arkansas River at Great Bend. 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 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 these sources and the expected MBI score.

Point Sources: There are two facilities releasing effluent into the watershed upstream of the survey point. The primary discharger, Great Bend, has upgraded its treatment facility in 1999 and initial effluent quality data indicate improved quality, especially pertaining to ammonia. Since the 7Q10 flow condition is generally exceeded 95% of the time, the Wasteload Allocation is defined as the flow regime between 70 and 100% exceedence. This accounts for the design flows of the two point sources (6.8 cfs). Therefore, the allocation for point sources is demarcated by the area under each respective load duration curve bounded from 70% to 100%. 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 facilities can be expected to discharge. Initial emphasis will be on reduced ammonia levels discharged to the stream. Similar treatment below Wichita and Salina resulted in dramatic improvement in MBI values downstream from those plants. Since Great Bend has upgraded its treatment plant under its newly issued permit, ammonia levels should be below historic loads and current permit limits (1.5 mg/l as N). Total Phosphorus and Total Nitrogen in the effluent are also monitored by the city under the current permit. The packing plant has an initial ammonia permit limit of 6 mg/l as N.

Nonpoint Sources: Although the consistent nature of MBI values greater than 4.5 indicates that nutrient impairment was fairly constant over time, the variability above the 4.5 indicates the nutrient load also varied. As such, nonpoint sources are also implicated as a primary source of these loadings. These sources tend to become dominant under higher flow conditions. Therefore, the area under the load duration curves bounded from 1-70% constitutes the Load Allocation for this TMDL. The Load Allocation intends to reduce loadings such that ambient stream levels for phosphorus are below 800 ppb in stream, nitrate below 1 ppm, ammonia below 0.2 ppm, BOD below 6 ppm and sediment concentrations average below 100 ppm in the stream.

First Stage TMDL Goals and Gross Allocations for Arkansas River below Great Bend

	MBI	T.PHOSP	NITRATE	AMMONIA	BOD	TSS
CURRENT	5.45	927.5 #/D	1,067 #/D	821 #/D	5007 #/D	87,005 #/D
REDUCTION	0.95	270.9 #/D	246 #/D	657 #/D	82 #/D	4,925 #/D
TMDL	4.50	656.6 #/D	821 #/D	164 #/D	4925 #/D	82,080 #/D
WLA		36.9 #/D	37 #/D	55 #/D	738 #/D	3,688 #/D
L.A.		619.7 #/D	784 #/D	109 #/D	4187 #/D	78,392 #/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 55% 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 additional source assessment and definition of the relationship between aquatic community response and nutrient loading are needed, and numeric nutrient criteria will be developed over the next five years, this TMDL will be a Medium Priority for implementation. During this phase, the emphasis of this TMDL will be on ammonia reduction in the stream and non-point source reductions from upstream implementation activities.

Unified Watershed Assessment Priority Ranking: This watershed lies within Arkansas - Pickle (11030004) subbasin with a priority of 40 (Medium Priority for restoration work).

Priority HUC 11s and Stream Segments: Until additional assessment is done on the main stem and primary tributary reaches between 2000-2005, priority focus of implementation prior to 2005 will concentrate on installing best management practices adjacent to the main steam and directly contributing tributaries and reducing ammonia loads from point sources.

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. Ensure proper monitoring, permitting, and operations of municipal wastewater systems to limit nutrient and BOD discharges.

b. Issue permits with appropriate ammonia limits to all point sources

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 after final EPA nutrient criteria guidance is issued.

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: Ammonia reduction from point sources should be complete prior to 2005. Pollutant reduction practices should be installed within the priority subwatersheds after the year 2005. To some degree, reduction practices associated with reducing bacteria impairment will have an impact on reducing nutrient loads to the stream. Monitoring of wastewater and receiving stream quality should commence with the renewal of permits.

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 point sources around Great Bend and agricultural producers operating within the drainage of the priority subwatershed. Initial work in 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 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 and industrial point sources will continue monitoring and subsequently treat effuent to reduce nutrient loading once EPA guidance and numeric criteria are 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 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 Arkansas River should indicate evidence of reduced nutrient levels relative to the conditions seen over 1980-1999.

Delivery Agents: The primary delivery agents for program participation will be KDHE Muncipal and Industrial programs, 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 Barton County.

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 Upper 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 Medium Priority consideration. Priority should be given to activities which reduce loadings of bacteria and nutrients to the stream prior to 2005 in upstream drainages.

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 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 nutrient content of wastewater discharged from treatment systems will be expected under reissued NPDES and state permits, along with ambient upstream and downstream monitoring.

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 Upper Arkansas Basin were held March 8 and April 24 in Garden City and April 25, 2000 in Great Bend. 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 Upper Arkansas Basin.

Public Hearing: A Public Hearing on the TMDLs of the Upper Arkansas Basin was held in Garden City on May 31, 2000.

Basin Advisory Committee: The Upper Arkansas Basin Advisory Committee met to discuss the TMDLs in the basin on October 6, 1999; January 11 and 24, 2000; March 8, 2000.

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

Associated Ditches of Kansas: October 6, 1999; January 28, 2000; March 8, 2000; and April 24, 2000.
Agriculture: February 28, 2000
Environmental: March 9, 2000

Milestone Evaluation: In 2005, evaluation will be made as to the degree of impairment which has occurred within the drainage and current condition of Arkansas River. Subsequent decisions will be made regarding implementation approach, follow up of additional implementation and implementation in the nonpriority subwatersheds. The second stage of this TMDL is anticipated to begin after 2005 with the adoption of numeric criteria in water quality standards.

Consideration for 303(d) Delisting: Arkansas 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 nutrient 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.

APPENDIX

CALCULATIONS OF CURRENT AND DESIRED LOADS

Estimated Existing Loads calculated by average flow and average concentration:

Total Phosphorus: 152 cfs * 1.13 mg/l * 5.4 = 927.5 #/D
Nitrate: 152 cfs*1.3 mg/l*5.4 = 1067 #/D
Ammonia: 152 cfs*1.0 mg/l*5.4 = 821 #/D
BOD: 152 cfs*6.1 mg/l*5.4 = 5007 #/D
TSS: 152 cfs*106 mg/l*5.4 = 87,005 #/D

Desired Loads recalculated using lower ambient concentrations:

Total Phosphorus: 152 cfs * 0.80 mg/l * 5.4 = 656.6 #/D
Nitrate: 152 cfs*1.0 mg/l*5.4 = 821 #/D
Ammonia: 152 cfs*0.2 mg/l*5.4 = 164 #/D
BOD: 152 cfs*6.0 mg/l*5.4 = 4925 #/D
TSS: 152 cfs*100 mg/l*5.4 = 82,080 #/D

Wasteload Allocations calculated by design flow and desired or permitted concentrations

Great Bend discharges 3.6 MGD (5.57 cfs); Great Bend Packing discharges 0.816 MGD (1.26 cfs)

Total Phosphorus: 6.8 cfs * 1.00 mg/l * 5.4 = 36.9 #/D
Nitrate: 6.8 cfs*1.0 mg/l*5.4 = 37 #/D
Ammonia: 6.8 cfs*1.5 mg/l*5.4 = 55 #/D
BOD: 6.8 cfs*20 mg/l*5.4 = 738 #/D
TSS: 6.8 cfs*100 mg/l*5.4 = 3688 #/D

Load Allocations found by subtracting Wasteload Allocation from Desired Load:

Total Phosphorus: 619.7 #/D
Nitrate: 784 #/D
Ammonia: 109 #/D
BOD: 4187 #/D
TSS: 78,392 #/D

Approved September 11, 2000