SOLOMON RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Water Body/Assessment Unit: Webster Lake and Upper South Fork Solomon River
Water Quality Impairment: Sulfate

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Upper South Fork Solomon

Counties: Graham, Rooks, Sheridan, Sherman, and Thomas

HUC 8: 10260013 **HUC 11** (14)**:** **010** (010, 020, 030, 040, 050, 060) (Figure 1)
020 (010, 020, 030, 040, 050, 060, 070)
030 (010, 020, 030, 040, 050)
040 (010, 020, 030, 040, 050, 060)
050 (010, 020, 030, 040)

Ecoregion: Western High Plains, Flat to Rolling Cropland (25d)
Central Great Plains, Rolling Plains and Breaks (27b)

Drainage Area: Approximately 1,144 square miles.

<u>Webster Lake</u>

Conservation Pool: Area = 3,436 acres
Watershed Area: Lake Surface Area = 213:1
Maximum Depth = 12.0 meters (39.4 feet)
Mean Depth = 4.9 meters (16 feet)
Retention Time = 1.76 years (21.1 months)

Designated Uses: Primary and Secondary Contact Recreation; Expected Aquatic Life Support; Food Procurement; Irrigation

Authority: Federal (U.S. Bureau of Reclamation) and State (Kansas Dept. of Wildlife and Parks)

2002 303(d) Listing: Solomon River Basin Lakes

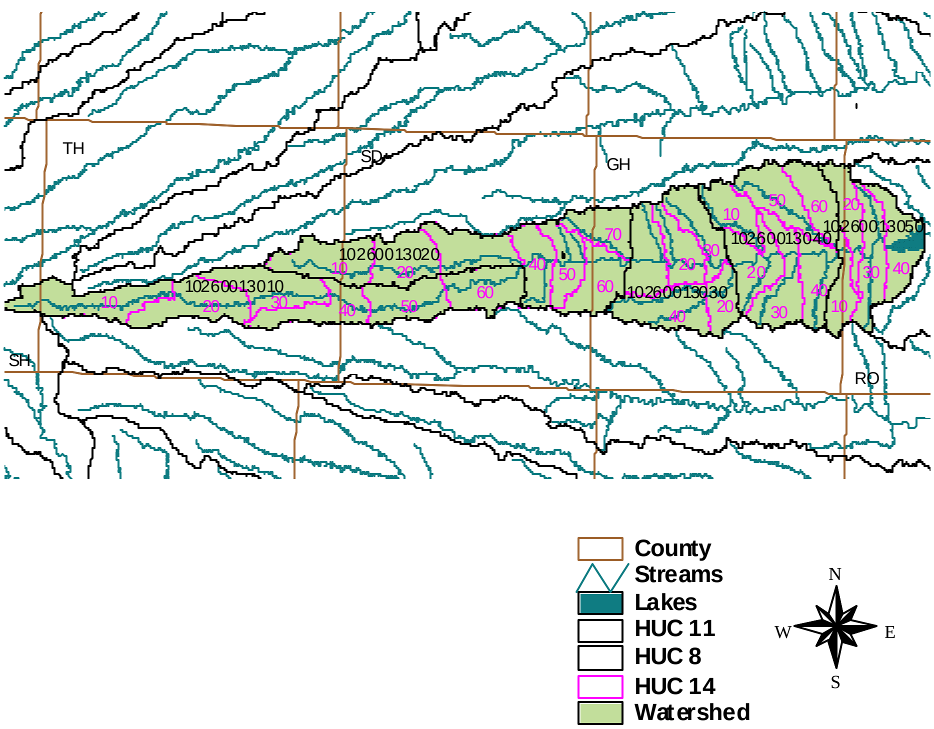
<u>Upper South Fork Solomon River</u>

Main Stem Segment: WQLS: 4-part, 6, 7, 9, 10, 12, 14, & 16 (Upper South Fork Solomon River) starting at Webster Lake and traveling upstream to the headwater of the Upper South Fork Solomon River.

Tributaries: Antelope Cr (13)
Brush Cr (17)
Coon Cr (8)
Foster Cr (19)
Jackson Branch (24)
Rock Cr (22)
Sand Cr (11, 15, & 27)
Skunk Cr (26)
Slate Cr (25)
South Martin Cr (23)
Spring Cr (5 & 817)
Storer Cr (20)
Wildhorse Cr (18)
Youngs Cr (21)

Figure 1

Webster Lake HUC 14



Designated Uses: Primary and Secondary Contact Recreation; Expected Aquatic Life Support; Drinking Water; Food Procurement; Groundwater Recharge, Industrial Water Supply, Irrigation; Livestock Watering on Main Stem Segments

2002 303(d) Listing: Webster Lake Basin Streams

Impaired Use: Attainable Domestic Water Supply

Water Quality Standard: Domestic Water Supply: 250 mg/L at any point of domestic water supply diversion (K.A.R.28-16-28e(c) (3) (A) Livestock Watering: 1,000 mg/L (Table 1a of K.A.R. 28-16-28e(d));

In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the domestic water supply criteria listed in table 1a in subsection (d), at ambient flow, due to intrusion of mineralized groundwater, the existing water quality shall be maintained, and the newly established numeric criteria for domestic water supply shall be the background concentration, as defined in K.A.R. 28-16-28b(e). Background concentrations shall be established using the methods outlined in the ''Kansas implementation procedures: surface water quality standards,'' as defined in K.A.R. 28-16-28b(ee), available upon request from the department. (K.A.R. 28-16-28e(c) (3)(B))

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Support for Designated Use under 2002 303(d): Not Supporting Domestic Water

Lake Monitoring Site: Station 012001 in Webster Lake (Figure 2).

Period of Record Used: Six surveys during 1986 - 2000

Elevation Record: Webster Reservoir near Stockton, KS (USGS Gage 6873100)

Stream Chemistry Monitoring Site: Station 547 near Damar (South Fork Solomon River)

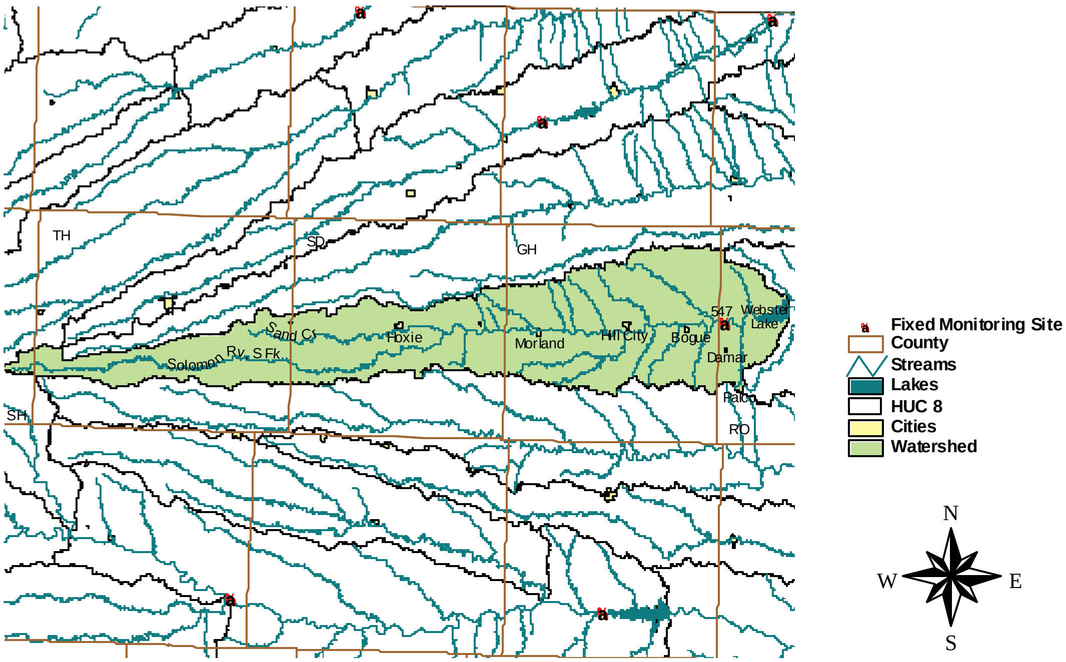
Period of Record Used: 1990 - 2002

Flow Record: South Fork Solomon River above Webster Reservoir, KS (USGS Gage 6873000)

Long Term Flow Conditions: Median Flow = 9.4 cfs

Figure 2

Webster Lake TMDL Reference Map



Current Condition: The sulfate concentrations in Webster Lake have been elevated every year since the 1986 monitoring period (Appendix A and the table below). In 1986, the average sulfate concentration was 200 mg/L. For the period of record that followed, the sulfate concentration was above the drinking water standard, averaging 351 mg/L. The sulfate concentrations have increased significantly over time.

Average Sulfate Concentration in Webster Lake

Date	Sulfate (mg/L)	Reservoir Forebay Elevation (ft)
7/30/86	200	normal pool elevation = 1892.45
6/28/89	374	1870.77
8/13/91	292	1859.50
6/6/94	302	1894.17
6/24/97	371	1894.14
7/18/00	388	1891.19

The concentrations of sulfate in Webster Lake have often been higher than the in-stream sulfate concentrations in the Upper South Fork Solomon River during the six months prior to the lake sampling date (Figures 3 & 4). The sulfate has concentrated in the lake due to evaporation, the lack of precipitation, and the decrease of discharge of fresh groundwater.

Figure 3

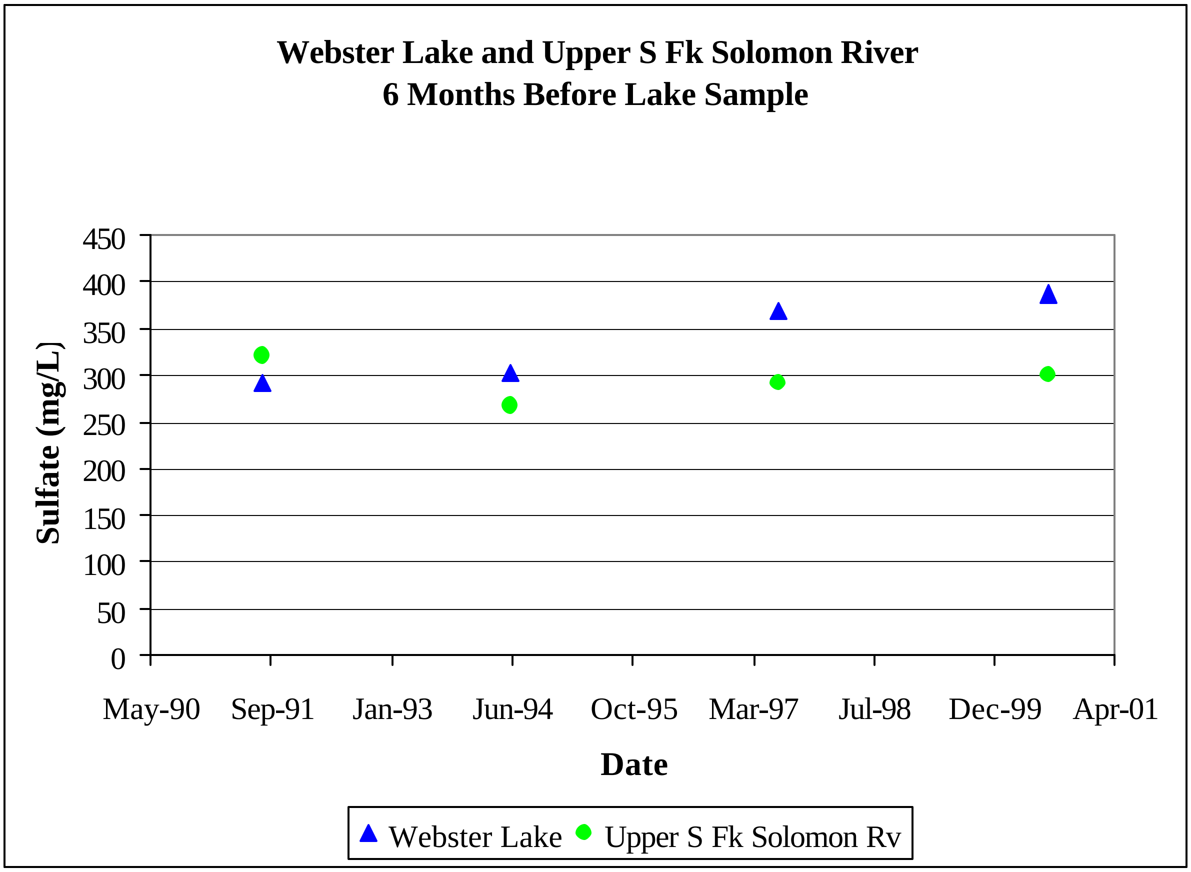
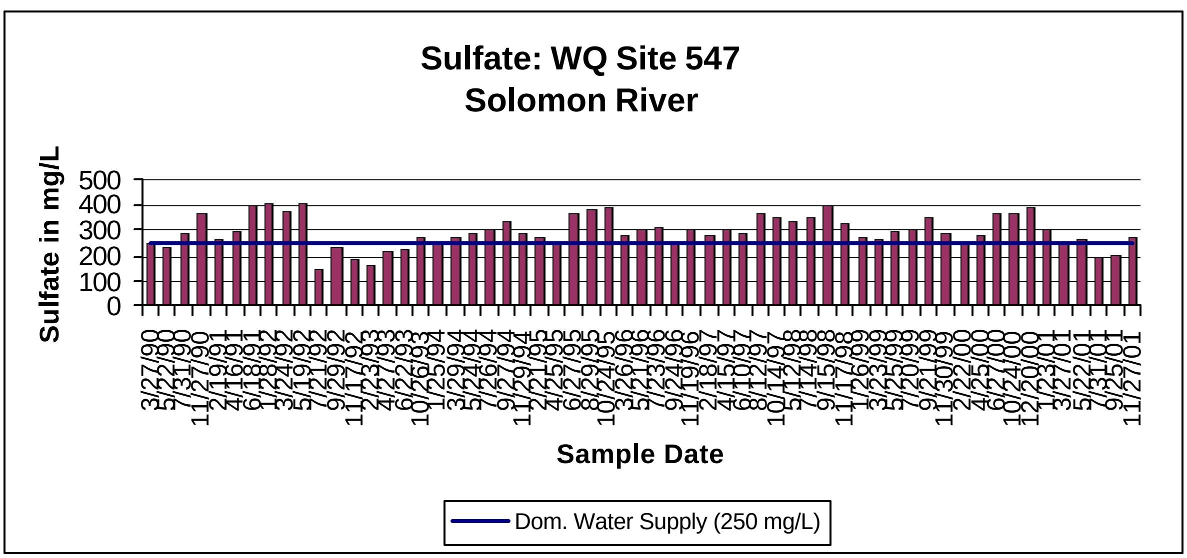
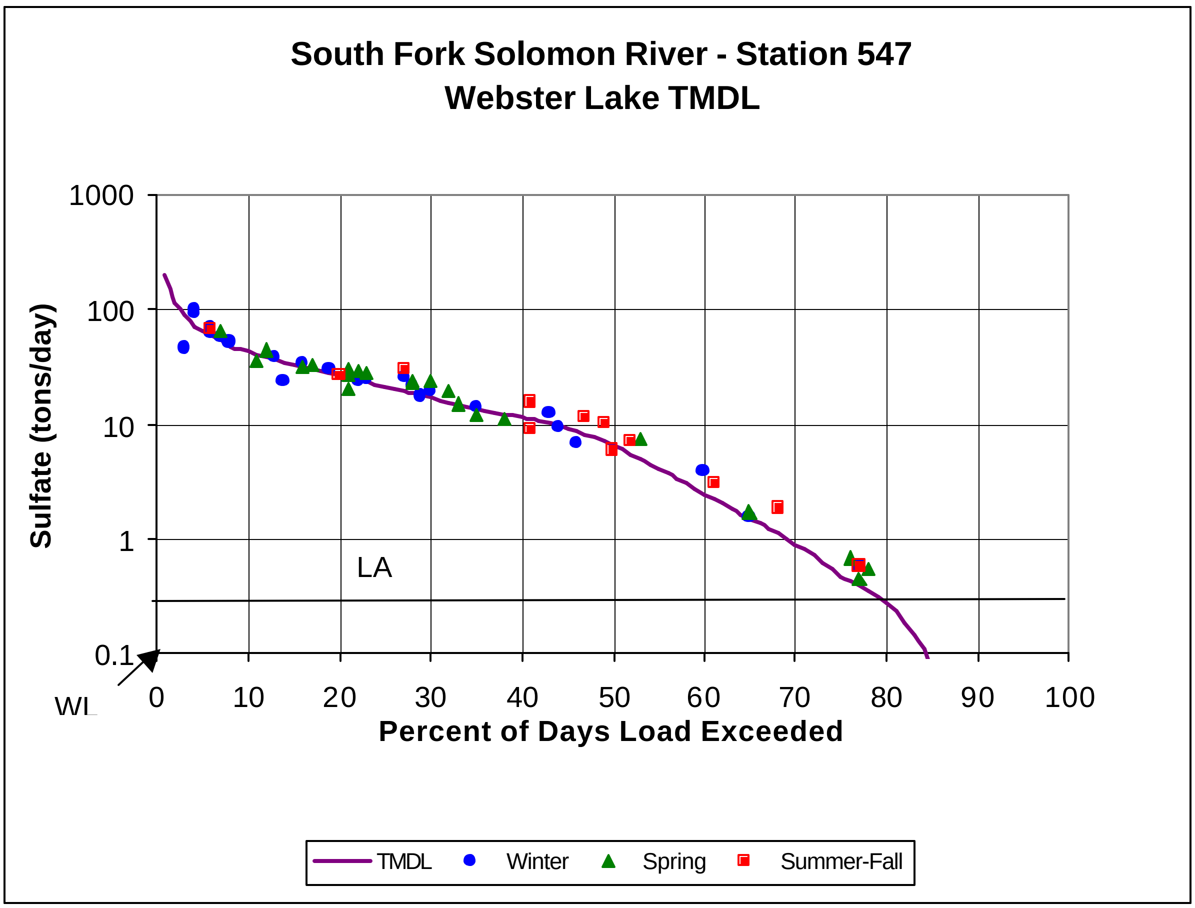


Figure 4



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. Sample data for the sampling sites were categorized for each of the three defined seasons: Spring (Apr-Jul), Summer-Fall (Aug-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. A Load curve was established for the Domestic Water Supply 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. This load curves represent the TMDL since any point along the curve represents water quality for the standard at that flow. Historic excursions from the water quality standard are seen as plotted points above the load curve. Water quality standards are met for those points plotting below the load duration curve (Figure 5).

Figure 5



Station 547: Excursions were seen in each of the three defined seasons and are outlined below. Fifty-five percent of Spring samples and 67% of Summer-Fall samples were over the domestic supply criterion. Sixty-four percent of Winter samples were over the criterion. Overall, 61% of the samples were over the criteria. This would represent a potential baseline condition of non-support of the impaired designated use, if a point of diversion for water supply was present along the river.

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.
South Fork Solomon River (547) Damar	Spring	1	6	4	1	0	0	12/22 = 55%
	Summer	1	0	4	3	0	0	8/12 = 67%
	Winter	6	5	4	1	0	0	16/25 = 64%

Interim Endpoints of Water Quality (Implied Load Capacity) at Webster Lake and Station 547 over 2008 - 2012:

To ensure that the domestic water supply is protected, the desired endpoint will be to maintain average sulfate concentrations below 250 mg/L in Webster Lake.

Current Condition and Reductions for Webster Lake

Parameter	Current Condition	TMDL	Percent Reduction
Sulfate (mg/L)	324	< 250	23 %

The ultimate endpoint for this TMDL will be to achieve the Kansas Water Quality Standards fully supporting Domestic Water Supply. The current standard of 250 mg/L of sulfate was used to establish the TMDL. The reduction of fresh groundwater discharged from the Ogallala Aquifer indirectly contributes to the sulfate impairment. As such, Webster Lake has elevated sulfate levels because of lack of dilution with fresh water. Because some of this elevated sulfate is tied to historic water consumption via surface water irrigation, the 250 mg/l endpoint will apply to all flows at Station 547.

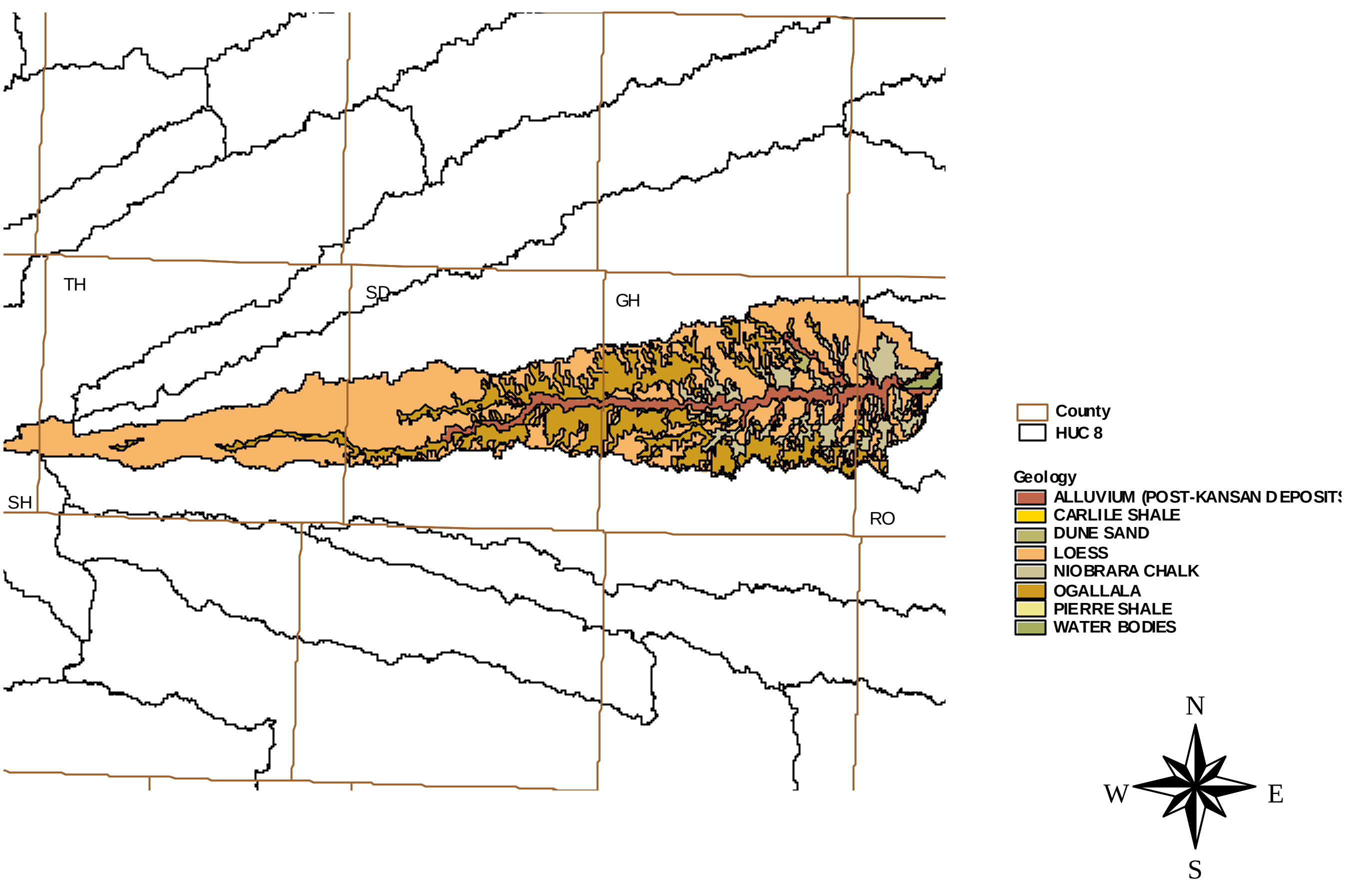
Seasonal variation has been incorporated in this TMDL through the documentation of the seasonal consistency of elevated sulfate levels. Achievement of the endpoints indicates loads are within the loading capacity of the stream, water quality standards are attained and full support of the designated uses of the stream has been restored.

3. SOURCE INVENTORY AND ASSESSMENT

Sulfate Background: The main natural sources of sulfate in the Upper South Fork Solomon River and Webster Lake are from the weathering of Cretaceous bedrock that underlies the drainage basin of Webster Lake. Oxidation of the sulfide in pyrite (iron sulfide) and the dissolution of small amounts of gypsum (hydrous calcium sulfate), especially in selected units of the Pierre Shale and the Smoky Hill Member of the Niobrara Chalk, during the weathering of the bedrock increase the sulfate concentration of water moving through the subsurface. This water then discharges directly into streams or into overlying Ogallala Formation and alluvial sediments before entering streams. Evapotranspiration consumption of water in the drainage basin and evaporation from the surface of streams and the Lake have increased the sulfate concentration of the surface water.

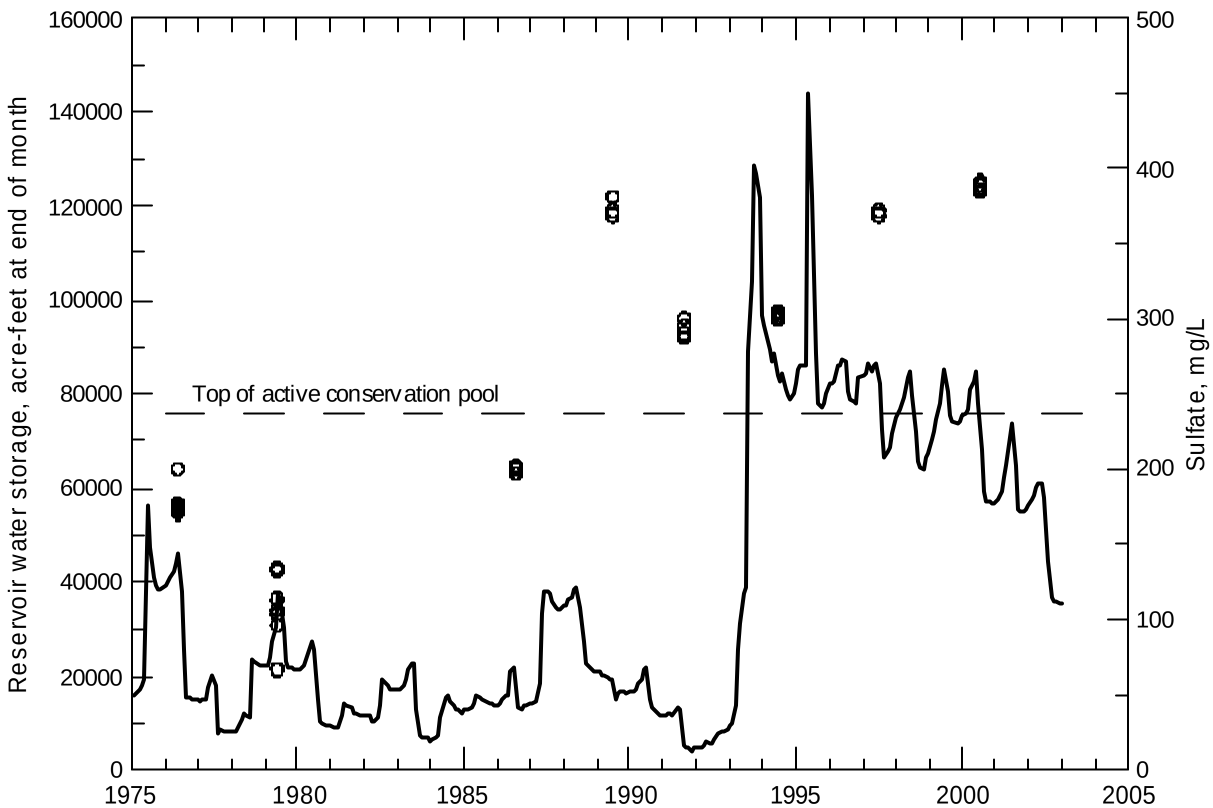
Figure 6

Webster Lake Geology



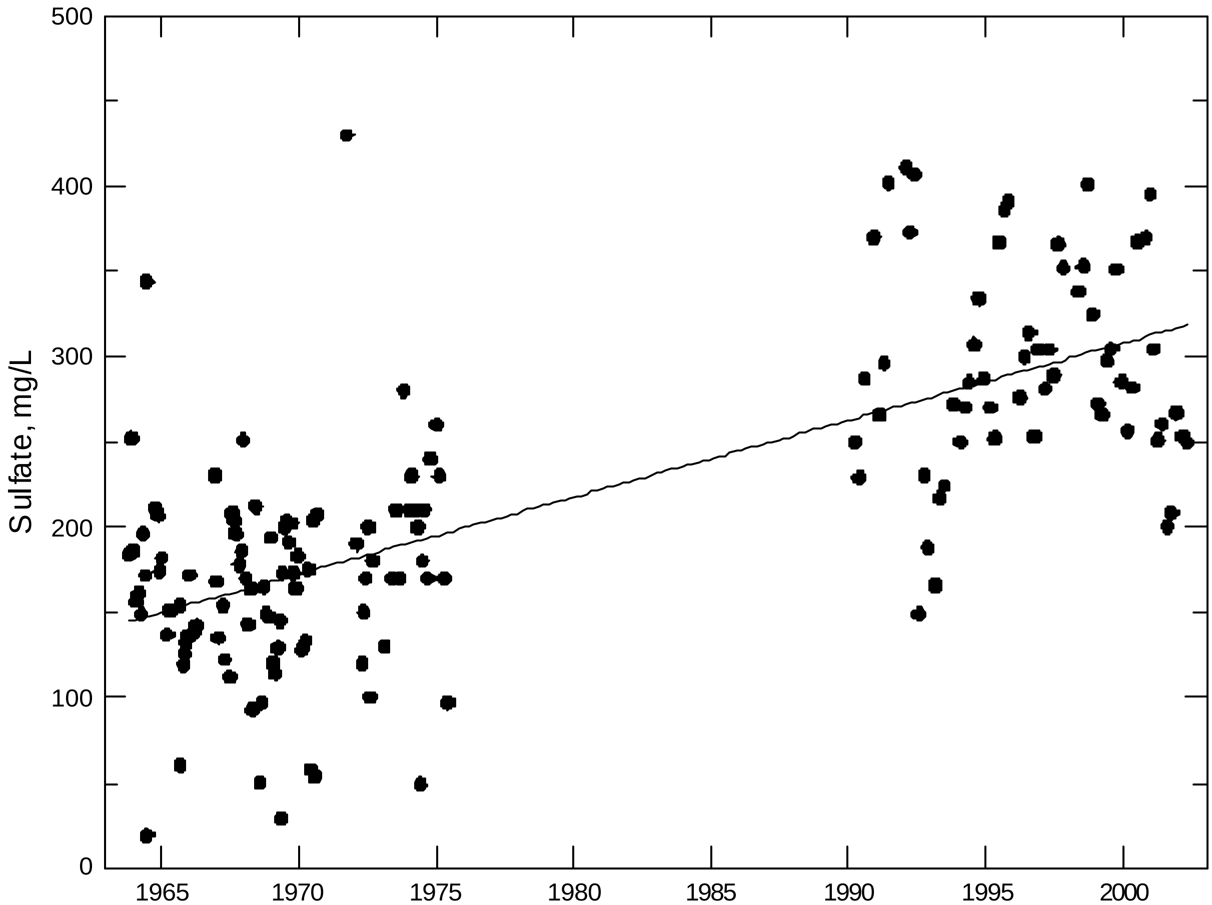
Factors Controlling Variations in Sulfate: The record of water quality for Webster Lake indicates that the sulfate concentration has increased substantially during the period of observation (Appendix A). Large fluctuations in the amount of rainfall that runs off into lakes can cause variations in the dissolved solids content of lake water. The runoff following substantial rainstorms is appreciably fresher than most of the baseflow of streams and can dilute the dissolved solids concentration of lake water as it fills the lake. However, the volume of water stored in Webster Lake is not well correlated with the sulfate content of the lake water (Figure 7). The lower sulfate concentrations for the lake water occurred during the earlier period of record when the lake storage was relatively low. Even though the lake storage was large during 1993-2000, the sulfate concentration has been relatively high.

Figure 7. **Change in sulfate concentration and water storage in Webster Lake during 1975-2002.**



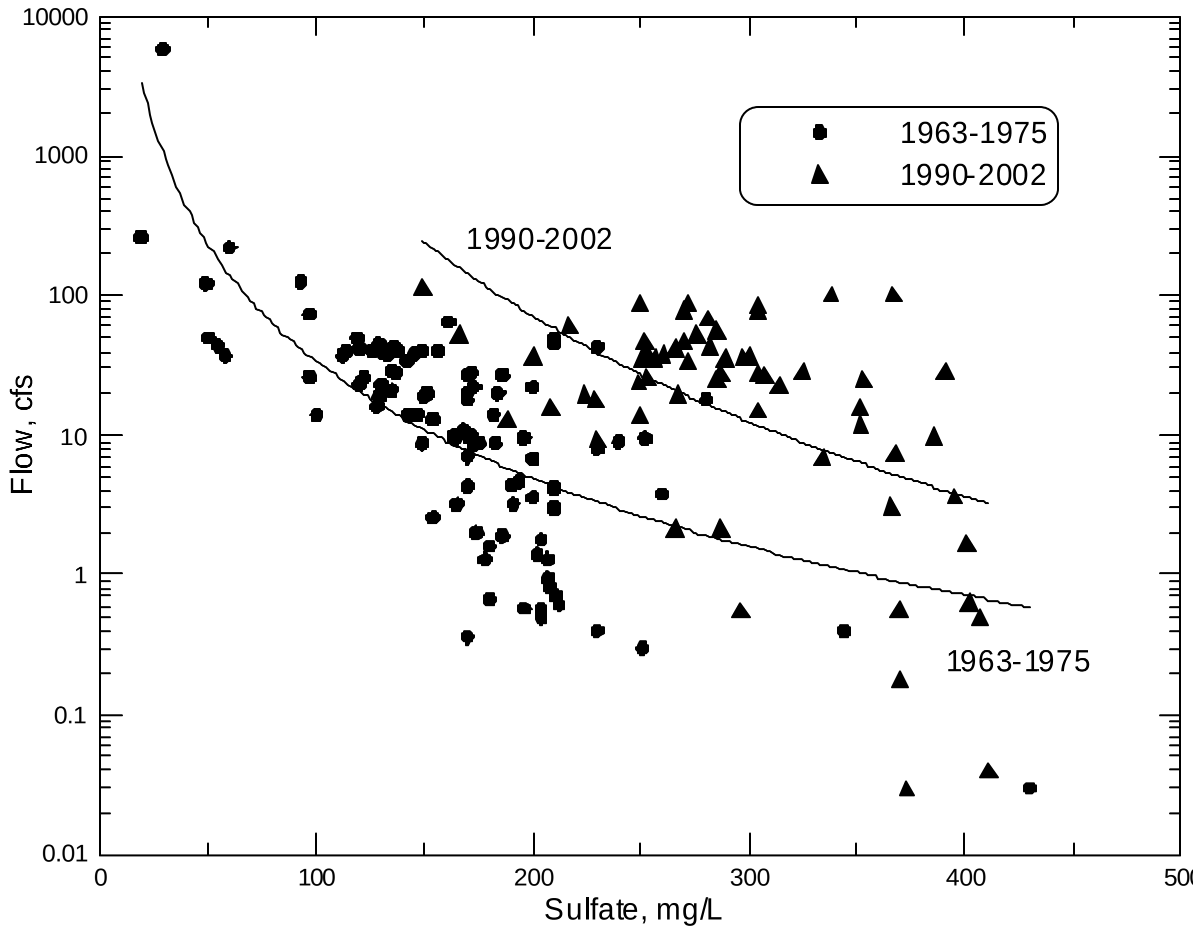
The sulfate concentration in the Upper South Fork Solomon River (Station 547) just upstream of Webster Lake has increased substantially from the period 1963-1975 to 1990-2002 (Figure 8). In general, there is an inverse relationship between the sulfate content of the river and the rate of streamflow at the water-quality monitoring site (Figure 9). However, the best-fit power curve for the period 1990-2002 is shifted to higher sulfate concentrations for the same flow values for the river for the period 1963-1975. The mean annual flows from 1963 to 2001 are shown in Figure 10. The chemical data indicate that the increase in the sulfate content of Webster Lake is related mainly to the sulfate concentration of the water entering the lake in the Upper South Fork Solomon River (Figure 11).

Figure 8. **Change in sulfate concentration with time for the South Fork Solomon River at KDHE monitoring site 547, including a linear regression line for the data. The earlier set of data is from the USGS and the later set from KDHE.**



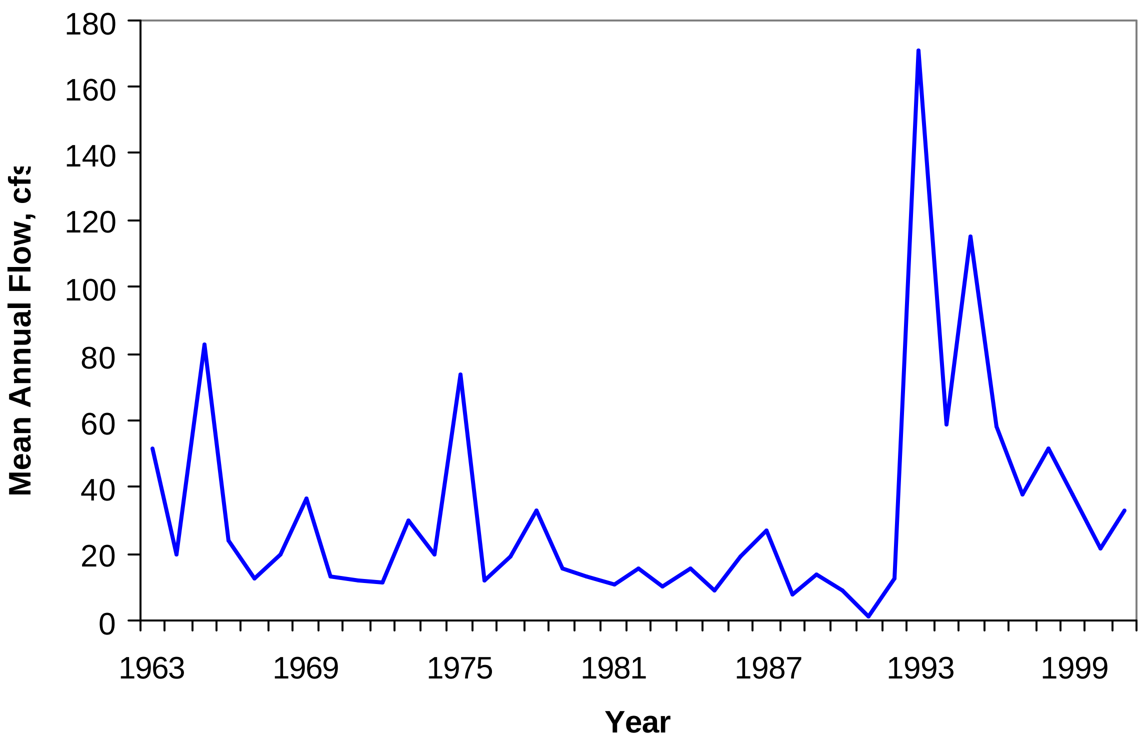
The most probable explanation for the increase in the sulfate content of the Upper South Fork Solomon River, and thus, of Webster Lake from the 1970s to 2000 is related to water use and consumption in the watershed of the river and lake. The specific conductance and chloride concentration of both the river and lake water also increased along with the sulfate content during this period, indicating an overall increase in the dissolved solids of the waters. There are no known, substantial human sources of sulfate or other major dissolved constituents that were added to the system during this time that could account for the increases. Evaporation and plant transpiration consume water and leave dissolved constituents in the residual water, thereby increasing the constituent concentrations.

Figure 9. Relationship between flow and sulfate concentration for the South Fork Solomon River at KDHE monitoring site 547, including power curves for the two data periods. The earlier set of data is from the USGS and the later set from KDHE.



The upper watershed of the Upper South Fork Solomon River in Thomas and Sheridan counties is underlain by the Ogallala-High Plains aquifer. Pumping of groundwater from the aquifer for irrigation has caused water-level declines in Thomas and Sheridan counties in the uppermost watershed. There are many irrigation wells in the alluvial aquifer in the river valley upstream of Webster Lake. The water-level declines in the High Plains aquifer and pumping from the alluvial aquifer have led to decreased discharge of groundwater to the river. Soil conservation practices could also be responsible for a portion of the long-term decrease in river flow. Following the droughts of the 1930s and 1950s, agricultural land was treated to decrease soil erosion, including terracing of sloping ground. Retention of water on terraced farmland during and following rainfall events decreased the amount of runoff to streams in comparison with cropland without soil retention treatment. Water retained on terraced land would be partially consumed by evaporation and some would seep into the soil. Some of this water could recharge the subsurface but much of the water would also be consumed by evapotranspiration. Water in the High Plains aquifer is generally fresher than groundwater in the bedrock underlying the aquifer and most of the watershed of Webster Lake in Graham and Rooks counties. Water in the alluvial aquifer of the river also has a higher dissolved solids content than that of the High Plains aquifer. Rainfall runoff would be expected to be fresher than groundwater in the bedrock and alluvial aquifer. The decline in streamflow from water consumption from the uppermost part of the watershed meant that there was less discharge of fresher groundwater from the High Plains aquifer and somewhat less rainwater runoff from terraced land following rainstorms to dilute more mineralized water in the river and the lake downstream. However, the decrease in flow of the river cannot account for all of the increase in the dissolved solids contents of the river and the lake.

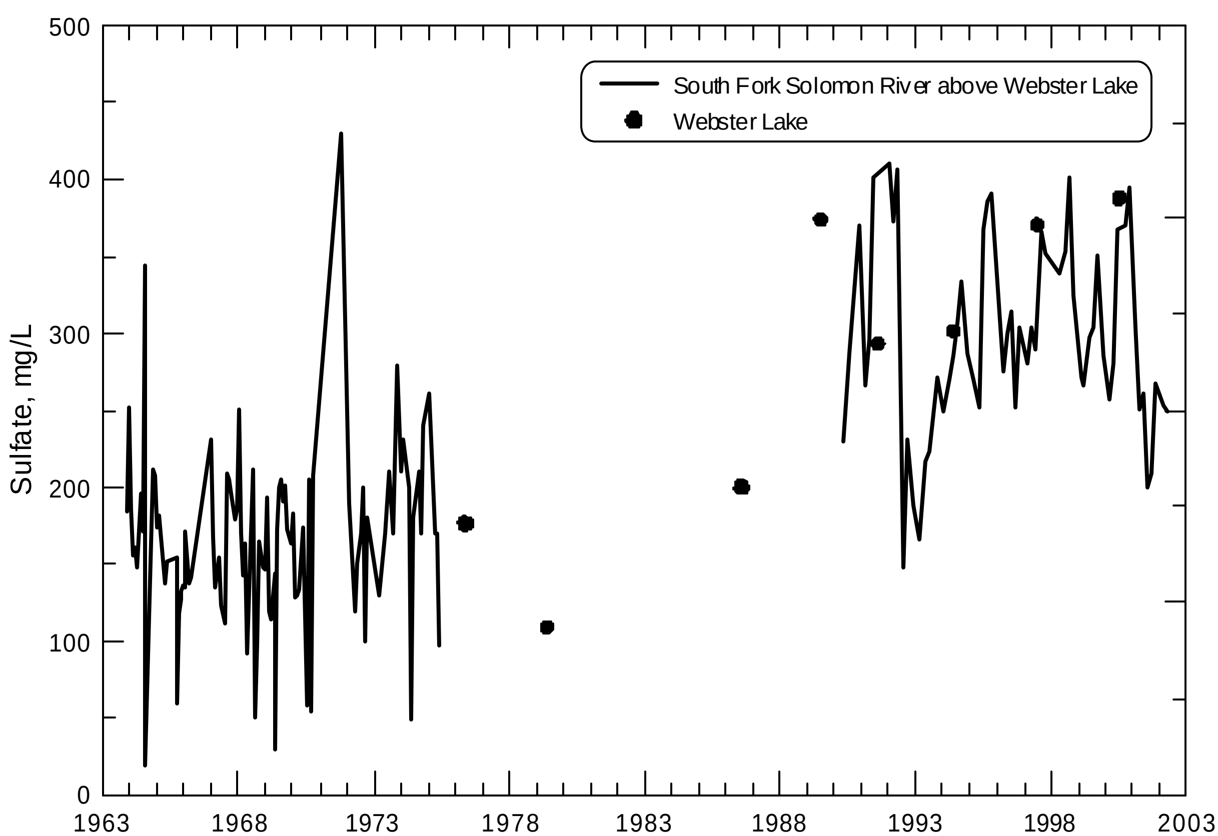
Figure 10. Annual variation in flow of the South Fork Solomon River at the USGS gaging station at KDHE monitoring site 547.



Dissolved loads of major constituents usually increase with increasing flow, even though the concentrations are generally lower in the higher flow. The increase in sulfate concentration for similar river flows during the later period in comparison to the earlier period (Figure 9) indicates why the loads are greater. The most probable explanation for the greater sulfate loads is related to the increase in the rate of supply of dissolved solids to the soils of irrigated land both overlying the High Plains aquifer and the alluvial aquifer of the river. Most of the irrigation water applied to crops is consumed by evapotranspiration, leaving the dissolved salts in the soil. Although some of the salts are leached below the root zone, much of the salt remains within the root zone of the soil. Heavy rainfall first must saturate shallow soil before substantial runoff occurs. The rainwater infiltrating the shallow soil dissolves readily soluble salts. Water in the saturated soil moves laterally down slope in the soil if the rainfall rate is great enough. The saturated soil water then leaves the fields in small surface drainages to form runoff to the river tributaries. The buildup of substantial amounts of salts in irrigated soils generally requires several years. Thus, there is a lag time between the transport of dissolved salts in groundwater used for irrigation to the soil and the appearance of substantial amounts of the salts in the river and lake water. Irrigation in western Kansas increased appreciably from the 1950s to the 1980s. The increase of sulfate in the river water and the lake water fits the timing of the increase in irrigation and the lag time for buildup and transport of the additional dissolved salts to the river and Webster Lake.

Consumption of water by phreatophytes (high water-use trees) in the valley of the Upper South Fork Solomon River increases the dissolved solids concentration of groundwater in the alluvial aquifer. A Kansas Geological Survey study was conducted for the Division of Water Resources (DWR), Kansas Department of Agriculture, to assist the DWR Subbasin Program in understanding stream-aquifer relationships in the river basin (Butler et al., 2002). The KGS installed observation wells across the alluvial aquifer near Station 547. The highest dissolved solids observed in the aquifer were associated with the riparian portion of the valley. Water levels in the observation well in the riparian zone exhibit a diurnal variation that is similar to that observed in an ongoing study by the KGS in the middle Arkansas River basin in Kansas to quantify groundwater consumption by phreatophytes. If the area of phreatophyte covered valley has increased from the middle to the later part of the 20th century in the Upper South Fork Solomon River valley upstream of Webster Lake, phreatophyte impacts on water loss and dissolved solids concentration could be partially responsible for the long-term decrease in streamflow and increase in sulfate concentration in the river.

Figure 11. Sulfate concentration in the South Fork Solomon River at KDHE monitoring site 547 and in Webster Lake. The earlier set of river water data is from the USGS and the later set from KDHE.



Irrigation Return Flows: Aggravation or impairment associated with irrigation return flows in this watershed is possible. Irrigation reports from groundwater sources in 1998 indicate that 53,987 acres were irrigated in the watershed. One hundred and fifty acres were irrigated with surface water. A total of 62 acre-feet of surface water and 56,162 acre-feet of groundwater were used in the watershed during 1998. See the point of diversion map in Appendix C.

NPDES: Seven permitted waste treatment facilities are located within the watershed (Figure 12). Four are non-overflowing lagoons that are prohibited from discharging and three are discharging municipal waste treatment plants. The non-overflowing lagoons may contribute to the load under extreme precipitation events (flow durations exceeded under 5 percent of the time). Such events would not occur at a frequency or for a duration sufficient to cause an impairment in the watershed. Any anthropogenic sulfate sources or hydrologic modifications increasing the sulfate concentration would be minor in comparison with the natural sulfate source in the watershed.

Since none of the municipal NPDES sites in the watershed are currently required to monitor for sulfate in their effluent, average sulfate concentrations for municipal sources were estimated based on the sulfate in their influent. For mechanical plants, a one to one ratio was used to estimate the sulfate in effluent from the cities in the watershed's finished water.

The Hill City and Hoxie MWTPs discharged 0.15 MGD and 0.13 MGD respectively based on monitoring data from last year. Palco MWTP did not discharge during the last year.

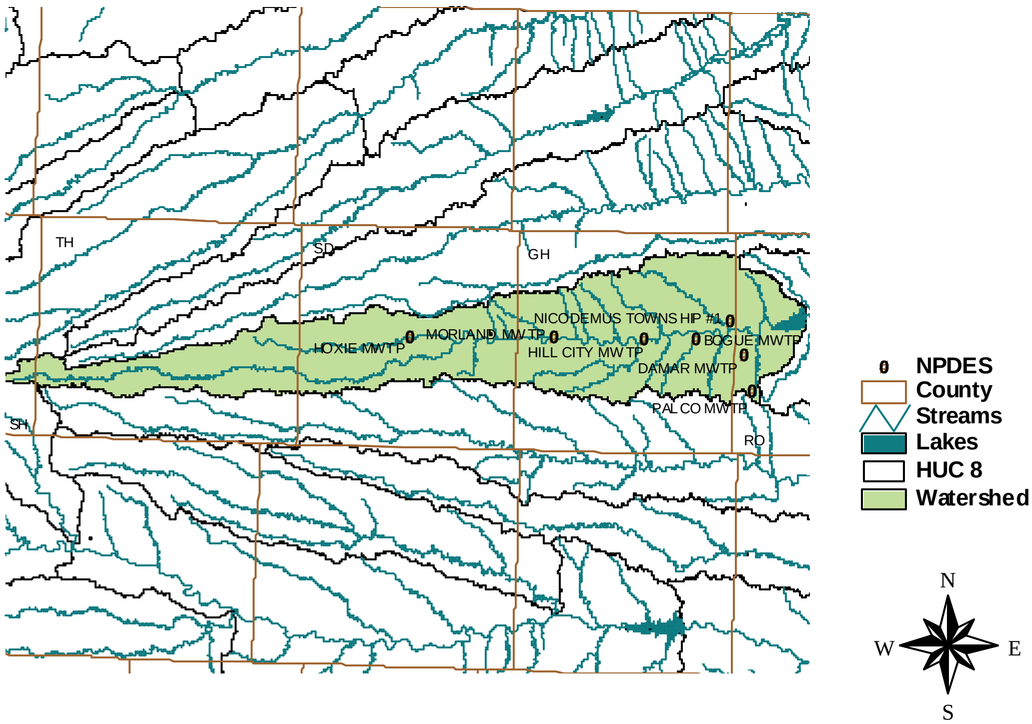
Waste Treatment Plants in the Webster Lake Watershed

Kansas Permit Number	Name	Type	Design Capacity (MGD)	Sulfate Wasteload Allocation (tons/day)
M-SO10-NO01	Damar MWTP	Three-cell Lagoon	Non-overflowing	0
M-SO19-OO01	Hill City MWTP	UV Disinfection	0.35	0.350
M-SO20-OO01	Hoxie MWTP	Trickling Filter	0.2	0.027
M-SO28-NO01	Morland MWTP	Three-cell Lagoon	Non-overflowing	0
M-SO30-OO01	Palco MWTP	Trickling Filter	0.03	0.005
M-SO45-NO01	Nicodemus Township # 1	Two-cell Lagoon	Non-overflowing	0
M-SO07-NO01	Bogue MWTP	Three-cell Lagoon	Non-overflowing	0
		Total	**0.58**	**0.382**

Oil Field Brine: Oil-field brine in Kansas that was disposed at or near the surface in the past generally has a sulfate concentration that is relatively low in comparison with the high chloride content. Thus, oil-brine contamination in the drainage basin is not expected to be a significant source of sulfate in the lake water.

Figure 12

Webster Lake NPDES Sites



Contributing Runoff: The watershed's average soil permeability is 1.5 inches/hour according to NRCS STATSGO database. About 76.1% of the watershed produces runoff even under relatively 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. Generally, storms producing less than 0.5"/hr of rain will generate runoff from 4.3% of this watershed, chiefly along the stream channels.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

The source assessment has ascertained that natural sulfate loading within the watershed is overwhelmingly responsible for the excursions seen at the monitoring stations located within the Webster Lake/Upper South Fork Solomon River watershed.

Point Sources: Based on an estimated discharge volume from all point sources contributing to station 547 (0.9 cfs) and the current effluent concentrations below 250 mg/l, a Wasteload Allocation of up to 0.4 tons per day will be established by this TMDL. (Figure 5). Appendix B details the calculations used to estimate the Wasteload allocations.

Nonpoint Sources: The Load Allocation based on the existing standard of 250 mg/L across all flow conditions is shown in Figure 5 and is 6.3 tons per day at median flow (9.4 cfs).

Defined Margin of Safety: The Margin of Safety provides some hedge against the uncertainty of loading and the sulfate endpoints for the Webster Lake Watershed. Since there are no sulfate adding processes present in the municipalities discharging to the Upper South Fork Solomon River, the sulfate loads added by those facilities reflect the sulfate content of their source water which is below the 250 mg/l criterion. The resulting wasteloads are fixed at existing concentrations below the 250 mg/l endpoint and this explicit Margin of Safety will assure there will be no exceedance of the sulfate criterion as a result of these loadings above Webster Lake.

There are varying degrees of impact on sulfate levels from historic irrigation within the drainage of Webster Lake. In the long term, the Load Allocations established by this TMDL reflect either the existing water quality standard or the background concentrations. The Margin of Safety implicitly assures these Load Allocations will achieve the endpoints of the TMDL through policies and objectives established under the Kansas Water Plan. Two objectives under the State Water Plan call for, by 2010; 1) reduction of water level decline rates within the Ogallala aquifer and implementation of enhanced water management in targeted areas; and, 2) reduction in the number of irrigation points of diversion for which the amount of water applied in acre-feet per acre exceeds an amount considered reasonable for the area and those [irrigation points of diversion] that overpump the amount authorized by their water rights. Pursuit of these two water conservation objectives will have water quality benefits, including assuring excessive irrigation will not directly or indirectly load surface waters with residual salts, thereby causing endpoints to be non-attained.

State Water Plan Implementation Priority: Because the sulfate impairment in Webster Lake is primarily due to natural geologic sources, this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: Webster Lake lies within the Upper South Fork Solomon (HUC 8: 10260013) with a priority ranking of 69 (Low Priority for restoration).

Priority HUC 11s: Because of the natural geologic contribution of this impairment, no priority subwatersheds or stream segments will be identified.

5. IMPLEMENTATION

Desired Implementation Activities

1. Monitor any anthropogenic contributions of sulfate loading to the lake and river.
2. Establish an alternative background criterion.
3. Assess likelihood of the lake being used for domestic uses.

Implementation Programs Guidance

NPDES and State Permits - KDHE

a. Municipal permits for facilities in the watershed will be renewed after 2004 with annual sulfate monitoring and any excessive sulfate discharge will have appropriate permit limits which does not increase the ambient background levels of sulfate.

Non-Point Source Pollution Technical Assistance - KDHE

a. Evaluate any potential anthropogenic activities which might contribute sulfate to the lake as part of an overall Watershed Restoration and Protection Strategy.

Water Quality Standards and Assessment - KDHE

a. Establish background levels of sulfate for the river and tributaries.

Use Attainability Analysis - KDHE

a. Consult with Division of Water Resources on locating existing or future domestic points of diversion from Webster Lake for drinking water purposes.

Subbasin Management Program - DWR, KDA

a. Establish strategy to reduce consumptive use along the river and riparian area.

Time Frame for Implementation: Development of a background level-based water quality standard should be accomplished with the next water quality standards revision.

Targeted Participants: Primary participants for implementation will be KDHE and DWR.

Milestone for 2008: The year 2008 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, additional monitoring data from Webster Lake will be reexamined to confirm the impaired status of the lake and the suggested background concentration. Should the case of impairment remain, source assessment, allocation and implementation activities will ensue.

Delivery Agents: The primary delivery agents for program participation will be the Kansas Department of Health and Environment and Division of Water Resources.

Reasonable Assurances:

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

1. 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.

2. 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.

3. 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.

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 Solomon 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 pollutant 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 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 samples from Webster Lake and at permanent Station 547. Based on that sampling, the priority status will be evaluated in 2007 including application of a numeric criterion 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 2008-2012.

Monitoring of sulfate levels in effluent will be a condition of NPDES and state permits for facilities. This monitoring will continually assess the functionality of the systems in reducing sulfate levels in the effluent released to the streams upstream of Webster Lake.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Solomon Basin were held January 7 and March 3, 2003 in Stockton. 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 Solomon Basin.

Public Hearing: A Public Hearing on the TMDLs of the Solomon Basin was held in Stockton on June 2, 2003.

Basin Advisory Committee: The Solomon Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2002, January 7, March 3, and June 2, 2003.

Milestone Evaluation: In 2008, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Webster Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2008-2012. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2004 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2004-2008.

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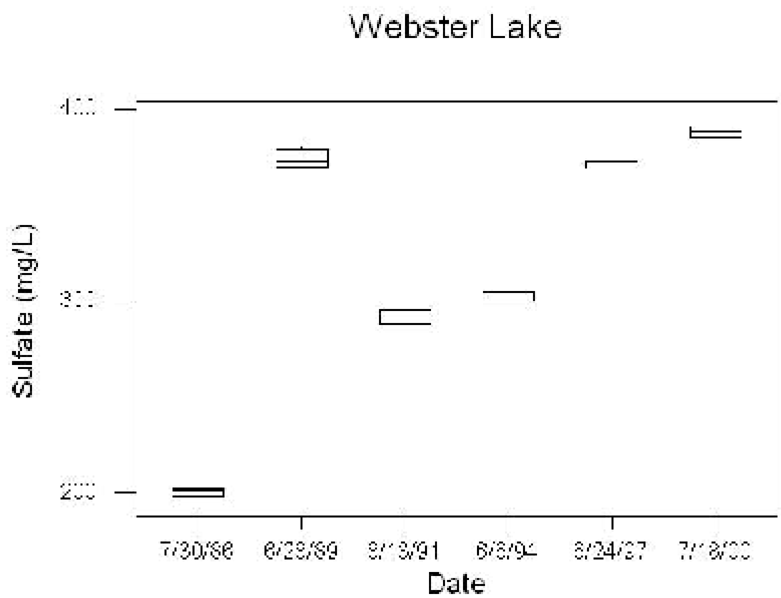
Appendix A - Boxplot

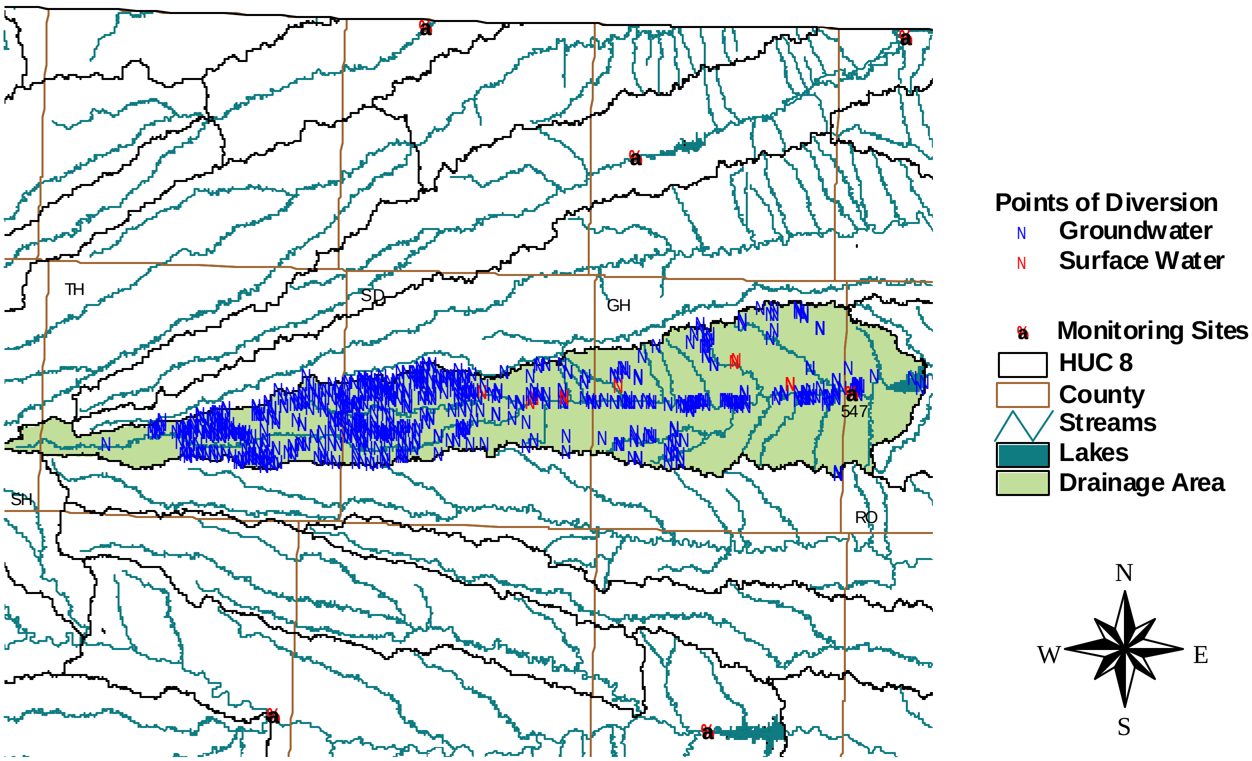


Appendix B - Wasteload Allocation

Permit Number	Facility	Public Water Supply Used to Calculate Influent	Type	Design Flow	Sulfate in Influent	Su E
M-SO10-NO01	DAMAR MWTP		3-cell Lagoon	Non-overflowing	0.0	
M-SO19-OO01	HILL CITY MWTP	City of Hill City	UV Disinfection	0.35	239.5	
M-SO20-OO01	HOXIE MWTP	City of Hoxie	Trickling Filter	0.2	31.8	
M-SO28-NO01	MORLAND MWTP		3-cell Lagoon	Non-overflowing	0.0	
M-SO30-OO01	PALCO MWTP	City of Palco	Trickling Filter	0.03	39.6	
M-SO45-NO01	NICODEMUS TOWNSHIP #1		2-cell Lagoon	Non-overflowing	0.0	
M-SO07-NO01	BOGUE MWTP		3-cell Lagoon	Non-overflowing	0.0	

Appendix C - Point of Diversions

Webster Lake Points of Diversion



Approved January 21, 2004