

Final

TMDLs for Chloride, Sulfate, and Total Dissolved Solids for Bayou de L'Outre Watershed, Arkansas

(HUC-reach 08040202-006, -007, and -008)

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EXECUTIVE SUMMARY

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (at Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for impaired waterbodies. A TMDL establishes the amount of a pollutant that a waterbody can assimilate without exceeding its water quality standard for that pollutant. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the lack of knowledge concerning the relationship between pollutant loads and the water quality of the receiving waterbody. The TMDL components are illustrated using the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

The study area for this TMDL is the Bayou de L'Outre Watershed, which is on the Arkansas/Louisiana state border in southern Arkansas and is in Planning Segment 2D. Forest is the dominant land use in the Bayou de L'Outre Watershed.

This document contains three stream segments in the Bayou de L'Outre on the state's 2004 section 303(d) list for impairments caused by chloride, sulfate, and total dissolved solids (Table ES-1). The numeric water quality criteria that apply to the Bayou de L'Outre and were used to calculate the total allowable loads for minerals (Cl, SO₄, and TDS) are presented in Table ES-2, respectively.

Table ES-1. Section 303(d) and Integrated Report information for Bayou de L'Outre

HUC-reach number	Stream reach name	Impaired use ^a	Causes of impairment	Suspected sources of impairment
08040202-006	Bayou de L'Outre	AI(Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction
08040202-007	Bayou de L'Outre	AI(Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction
08040202-008	Bayou de L'Outre	AI(Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction

^aAI = agriculture and industry water supply
Source: ADEQ 2005

Table ES-2. Numeric water quality criteria for chloride, sulfate, and TDS in the Bayou de L'Outre Watershed

	Stream reach name	Chloride ^a	Sulfate ^a	TDS ^a
		(mg/L)	(mg/L)	(mg/L)
	Bayou de L'Outre above Gum Creek	250	90	500
	Bayou de L'Outre below Gum Creek	250	90	750
	Louisiana Subsegment 080501 Criteria	250	45	500

Note: mg/L = milligrams per liter

^a The Arkansas criteria shall apply to all surface waters of the state at all times except during periods when flows are less than the applicable critical flow. Streams with regulated flow will be addressed on a case-by-case basis to maintain designated instream uses. These standards apply outside the applicable mixing zone. Waters may, on occasion, have natural background levels of certain substances outside the limits established by these criteria, in which case these criteria do not apply to the naturally occurring excursions. These criteria are not to be exceeded in more than one in ten samples collected over a period of not less than 30 days or more than 360 days.

Sources: APCEC 2007, LDEQ 2007.

The TMDLs for all pollutants (chloride, sulfate, and TDS) were developed using the load duration curve methodology. This method illustrates allowable loading at a wide range of stream flow conditions. The steps for applying the methodology were as follows: (1) develop a flow duration curve; (2) convert the flow duration curve to load duration curves; (3) plot observed loads with load duration curves; and (4) calculate the TMDL, MOS, WLA, and LA. The TMDLs were not developed for a particular season, and they apply year-round.

In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established, thereby providing the basis for establishing water quality-based controls. WLAs were given to permitted point source discharges. The LAs include background loadings as well as human-induced nonpoint sources. An explicit MOS of 10 percent was included. A summary of the TMDLs for the Bayou de L'Outre Watershed is presented in Table ES-3.

Table ES-3. Summary of TMDLs, MOS, WLAs, and LAs for the Bayou de L'Outre Watershed

HUC-reach number	Water quality station	Pollutant	Total allowable loading	Explicit MOS (10%)	Σ WLA	Σ LA	Percent reduction
			lb/day				
08040202-006	OUA0005	Chloride	146,331	14,633	0	131,698	74.3
08040202-006	OUA0005	Sulfate	26,340	2,634	0	23,706	94.1
08040202-006	OUA0005	TDS	292,662	29,266	2,517	260,879	70.6
08040202-007		Chloride	34,501	3,450	2,825	28,226	74.3
08040202-007		Sulfate	6,210	621	0	5,589	94.1
08040202-007		TDS	69,003	6,900	0	62,102	70.6
08040202-008		Chloride	10,256	1,026	5,750	3,481	74.3
08040202-008		Sulfate	1,846	185	1,642	19	94.1
08040202-008		TDS	20,512	2,051	16,816	1,645	70.6

Note: Load allocations for segment 08040202-008 are included in segment 08040202-007. Load allocations for segment 08040202-007 are included in segment 08040202-006.

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1 INTRODUCTION

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (at Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not supporting their designated uses even after pollutant sources have implemented technology-based controls. A TMDL establishes the maximum allowable load (mass per unit of time) of a pollutant that a waterbody is able to assimilate and still support its designated uses. The maximum allowable load is determined on the basis of the relationship between pollutant sources and in-stream water quality. A TMDL provides the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

Monitoring data collected by the Arkansas Department of Environmental Quality (ADEQ) indicate that observed pollutant levels sometimes exceed water quality criteria for three segments of Bayou de L'Outre. The impaired designated uses for the waterbody are (1) fisheries (streams, Typical Gulf Coastal Ecoregion) and (2) agriculture and industry water supply. The pollutants causing these impairments include chloride, sulfate, and total dissolved solids (TDS). Table 1-1 presents information from Arkansas's 2004 Integrated Report (ADEQ 2005) for Bayou de L'Outre.

Table 1-1. Section 303(d) and Integrated Report information for Bayou de L'Outre

HUC-reach number	Stream reach name	Impaired use ^a	Cause of impairment	Suspected sources of impairment
08040202-006	Bayou de L'Outre	AI (Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction
08040202-007	Bayou de L'Outre	AI (Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction
08040202-008	Bayou de L'Outre	AI (Cl, SO ₄ , TDS)	Chloride, sulfate, TDS	Resource extraction

^aAI = agriculture and industry water supply.
Source: ADEQ 2005.

2 BACKGROUND INFORMATION

2.1 General Description

The three stream segments addressed in this TMDL report are near the Arkansas/Louisiana state line in southern Arkansas (Figure 2-1) in a portion of U.S. Geological Survey (USGS) hydrologic unit code (HUC) 08040202. The impaired segments are entirely within Union County. Table 2-1 lists the county in which each segment is located and the approximate drainage area of each segment. Segment 08040202-008 is a tributary of 08040202-007, which in turn is a tributary of 08040202-006.

Table 2-1. County and drainage area for each listed segment in the Bayou de L'Outre Watershed

HUC-reach number	Stream reach name	County	Total drainage area (acres)	Unique subwatershed area (acres)
08040202-006	Bayou de L'Outre	Union	80,535	61,547
08040202-007	Bayou de L'Outre	Union	18,988	13,345
08040202-008	Bayou de L'Outre	Union	5,643	5,643

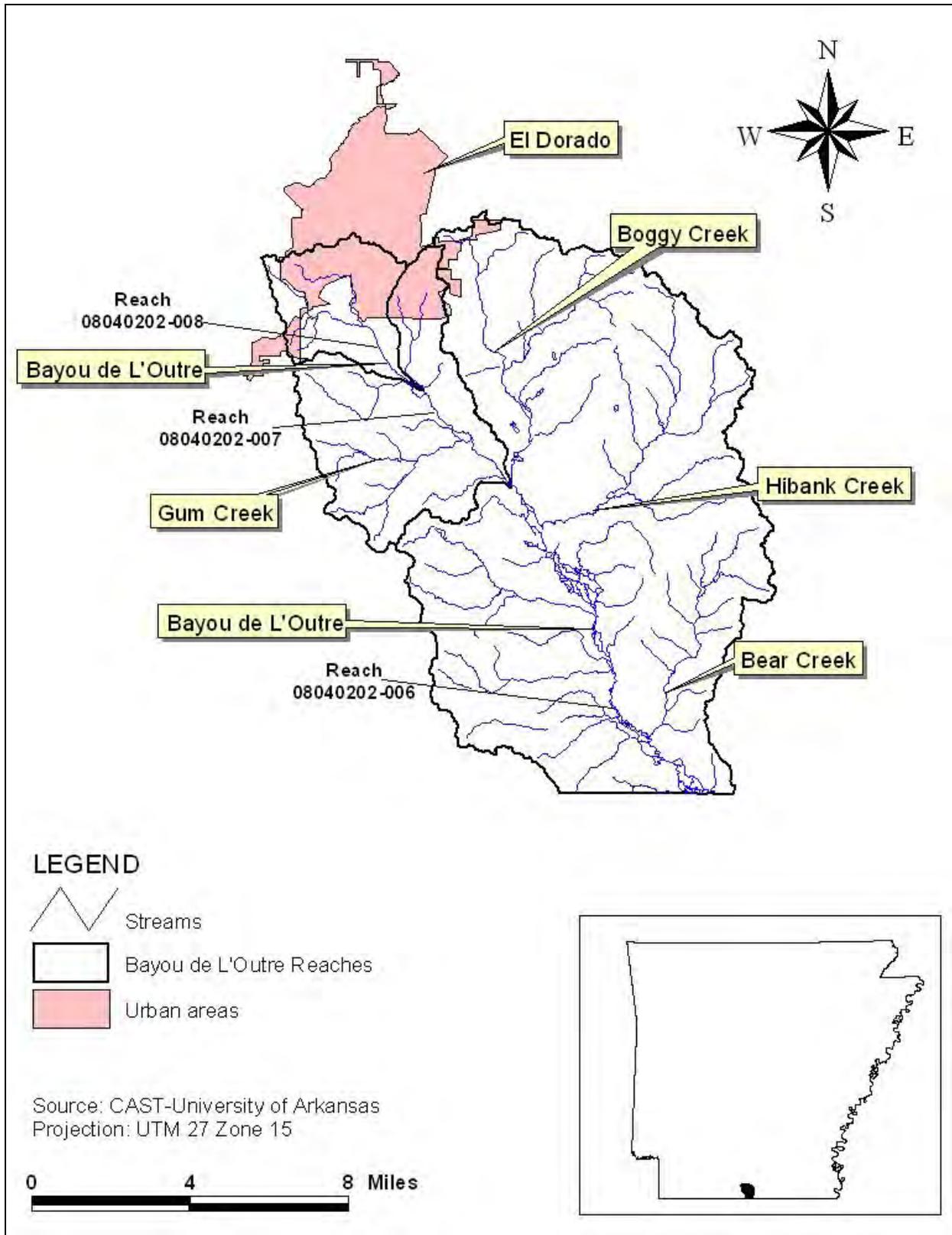


Figure 2-1. Location of the Bayou de L'Outre Watershed.

2.2 Land Use

Land use data were obtained from the Center for Advanced Spatial Technologies (CAST) at the University of Arkansas in Fayetteville (2005). Table 2-2 and Figure 2-2 present the percentage of stream segment area covered by each land use and the land use coverage, respectively. Forest constitutes more than 50 percent of the land area in all the listed segments in the Bayou de L'Outre Watershed. Segment 008 has the largest amount of urban area (27 percent) because a large portion of the City of El Dorado is located in this segment.

Table 2-2. Land use by stream segment

Land use	HUC-reach number					
	08040202-006		08040202-007		08040202-008	
	Area (acres)	Percent coverage	Area (acres)	Percent coverage	Area (acres)	Percent coverage
Barren	162	0.2	101	0.5	63	1.1
Forest	69,538	86.4	13,961	73.5	2,920	51.8
Pasture/forage	6,795	8.5	2,332	12.3	1,021	18.1
Urban	3,455	4.3	2,447	12.9	1,542	27.3
Water	493	0.6	144	0.8	94	1.7
TOTAL	80,444	100	18,985	100	5,640	100

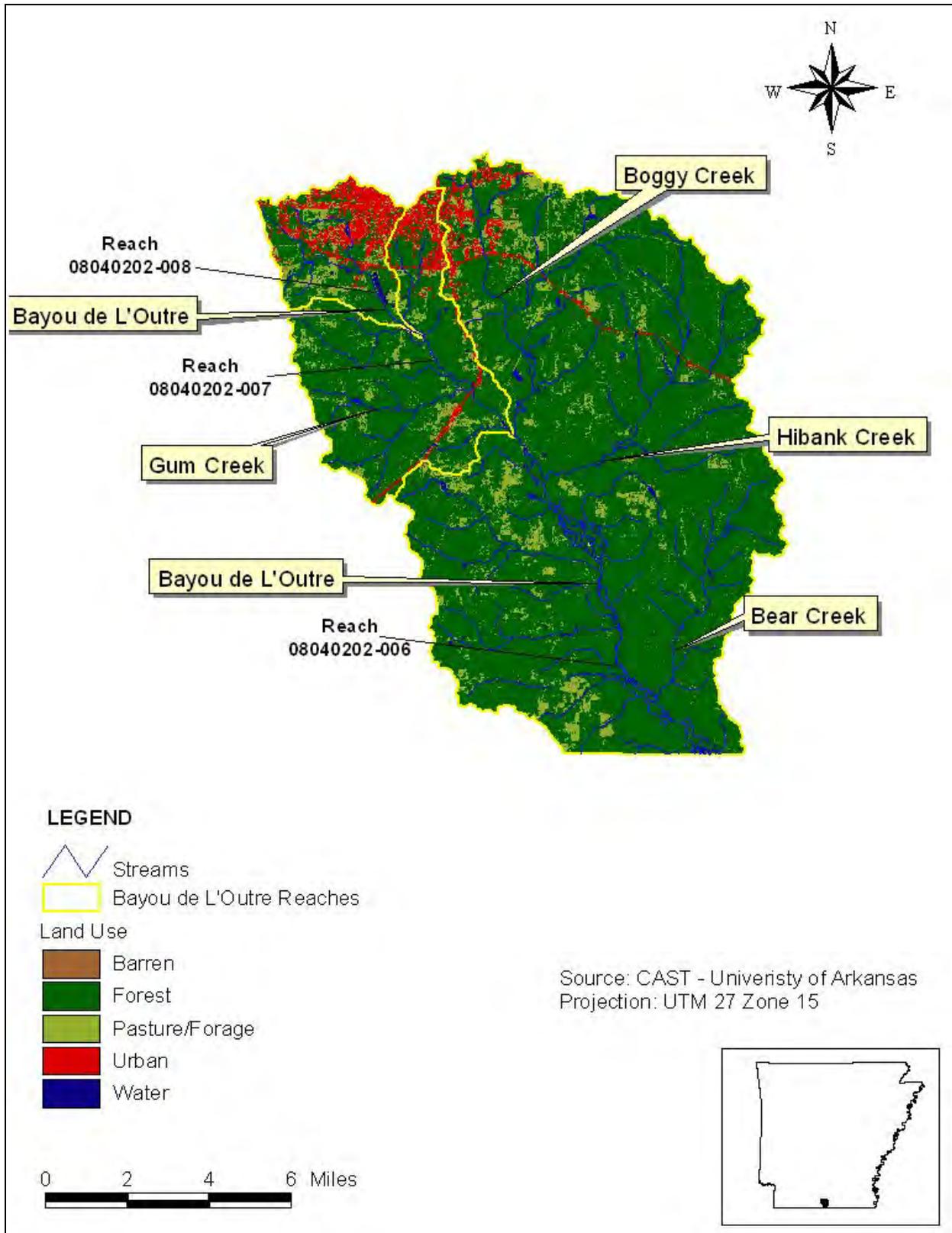


Figure 2-2. Land use in the Bayou de L'Outre Watershed.

2.3 Flow Characteristics

There are no USGS stream flow gauges in the Bayou de L'Outre Watershed to characterize flow in the watershed.

2.4 Designated Uses and Water Quality Criteria

The designated uses for Bayou de L'Outre are primary contact recreation; secondary contact recreation; domestic, industrial, and agricultural water supply; and fisheries (subcategory streams, Typical Gulf Coastal Ecoregion) (APCEC 2007). Arkansas's 2004 Integrated Report (ADEQ 2005) indicates that the three listed segments have impaired uses of agriculture and industry water supply due to minerals (Cl, SO₄, and TDS). While aquatic life is noted as an impaired use in Arkansas's 2004 Integrated Report (ADEQ 2005), the actual impaired designated use is fisheries (subcategory streams, Typical Gulf Coastal Ecoregion).

The designated use of fisheries "provides for the protection and propagation of fish, shellfish, and other forms of aquatic life (APCEC 2007, p. 3-1)". The subcategory of "streams" indicates "water which is suitable for the protection and propagation of fish and other forms of aquatic life adapted to flowing water systems whether or not the flow is perennial (APCEC 2007, p. 3-2)". The subcategory of "Typical Gulf Coastal Ecoregion" designates "Streams supporting diverse communities of indigenous or adapted species of fish and other forms of aquatic life. Fish communities are characterized by a limited proportion of sensitive species; sunfishes are distinctly dominant followed by darters and minnows (APCEC 2007, p. 3-4)". The Typical Gulf Coastal Ecoregion fish community may generally be characterized by the key species of redbfin shiner, spotted sucker, yellow bullhead, warmouth, slough darter, and grass pickerel and the indicator species of pirate perch, flier, spotted sunfish, dusky darter, creek chubsucker, and banded pygmy sunfish. Agricultural water supply designates waters that will be protected for irrigation of crops and/or consumption by livestock (APCEC 2007). Industrial water supply indicates waters that will be protected for use as process or cooling water (APCEC 2007).

This report addresses three stream segments in the Bayou de L'Outre Watershed that are included on Arkansas's 2004 section 303(d) list for chloride, sulfate, and TDS impairments. The impaired designated use of all the segments is agriculture and industry water supply.

Arkansas's water quality standards (APCEC 2007) provide chloride, sulfate, and TDS criteria for Bayou de L'Outre (Table 2-3). The chloride, sulfate, and TDS criteria apply at all times except during periods when flows are less than the applicable critical flow. The criteria are not to be exceeded in more than 1 in 10 samples collected over a period of not less than 30 days or more than 360 days. The monitoring station for this TMDL is in the portion of Bayou de L'Outre from Hibank Creek to the mouth of Mill Creek.

Bayou de L'Outre enters into Louisiana. Louisiana and Arkansas have similar water quality standard for chloride, however Louisiana has a slightly more stringent standards sulfate and TDS (LDEQ 2007). 40 CFR 131.10(b), states that States must ensure that their water quality standards provide for the "attainment and maintenance of the water quality standards of downstream waters." The development of TMDLs for shared waters with differing numeric

water quality criteria, requires that both states and/or EPA consider both the differences and the implications for TMDL development. For Bayou de L'Outre, to be protective of the existing designated uses in the downstream State of Louisiana, Louisiana water quality criteria are used in this TMDL.

Table 2-3. Numeric criteria for chloride, sulfate, and TDS in the segments of concern in the Bayou de L'Outre Watershed

	Stream reach name	Chloride ^a	Sulfate ^a	TDS ^a
		(mg/L)	(mg/L)	(mg/L)
	Bayou de L'Outre above Gum Creek	250	90	500
	Bayou de L'Outre below Gum Creek	250	90	750
	Louisiana Subsegment 080501 Criteria	250	45	500

Note: mg/L = milligrams per liter.

^a The Arkansas criteria shall apply to all surface waters of the state at all times except during periods when flows are less than the applicable critical flow. Streams with regulated flow will be addressed on a case-by-case basis to maintain designated instream uses. These standards apply outside the applicable mixing zone. Waters may, on occasion, have natural background levels of certain substances outside the limits established by these criteria, in which case these criteria do not apply to the naturally occurring excursions. These criteria are not to be exceeded in more than one in ten samples collected over a period of not less than 30 days or more than 360 days.

Source: APCEC 2007, LDEQ 2007.

The Arkansas water quality standards also include an antidegradation policy (APCEC 2007), which states that existing in-stream water uses and the level of water quality necessary to protect the existing uses must be maintained and protected.

State water exhibiting high water quality must be maintained and protected unless the state finds that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the state must ensure water quality adequate to protect the existing uses fully.

Those uses and the water quality for which the outstanding resource waters were designated must be protected by (1) implementing water quality controls, (2) maintaining the natural flow regime, (3) protecting in-stream habitat, and (4) encouraging land management practices protective of the watershed.

In cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method must be consistent with section 316 of the federal Clean Water Act.

2.5 Point Sources

Two point sources in the Bayou de L'Outre Watershed are permitted to discharge chloride or total residual chlorine, two are permitted to discharge sulfate, and three are permitted to discharge TDS (Tables 2-4, 2-5, and 2-6). These tables represent the current permit limits. Table 2-7 presents additional point sources facilities that are in the Bayou de L'Outre Watershed, but not included in the TMDLs due to the reasons provided within the table. Figure 2-3 shows the location of the National Pollutant Discharge Elimination System (NPDES)-permitted facilities included in the TMDL.

Table 2-4. Point source discharge information for chloride in the Bayou de L'Outre Watershed

NPDES permit number	Facility name	Location	Outfall	Dis-charge (mgd)	Receiv-ing waters	Average limit concen-tration	Max. limit concen-tration	Average quantity limit	Max. quantity limit
						mg/L	mg/L	lb/day	lb/day
Reach 007									
AR0000680	Great Lakes South	324 Southfield Cutoff, El Dorado	1	1.354	Gum Creek & Walker Creek	None	Report	None	None
Reach 008									
AR0001171	Great Lakes Chemical Corp-Central Plant	2226 Haynesville Hwy (Hwy 15S), El Dorado	1	0.93	Bayou de L'Outre	Report	Report	None	None
			2	0.321	Bayou de L'Outre	129	193.5	None	None
			4	Storm-water runoff	Bayou de L'Outre	98	147	None	None
AR0033723	City of El Dorado-South WWTP	325 Quail Crossing, El Dorado	1	7.00	Bayou de L'Outre	None			
Reach 006									
AR0037800	Clean Harbors El Dorado, LLC	309 American Cir, El Dorado Twp	9	1.214	Boggy Creek	631	631	4,631	4,631

Note: mg/L = milligrams per liter.

Table 2-5. Point source discharge information for sulfate in the Bayou de L'Outre Watershed

NPDES permit	Facility name	Location	Outfall	Dis-charge (mgd)	Receiv-ing waters	Average limit concen-tration	Max. limit concen-tration	Average quantity limit	Max. quantity limit
						mg/L	mg/L	lb/day	lb/day
Reach 008									
AR0000647	Lion Oil Company-El Dorado Refinery	1000 McHenry Ave, El Dorado	1	2.67	Loutre Creek	68	102	1,514	2,271
AR0001171	Great Lakes Chemical Corp-Central Plant	2226 Haynesville Hwy (Hwy 15S), El Dorado	1	0.93	Bayou de L'Outre	90	135		
			2	0.321	Bayou de L'Outre	250	375		
			4	0.45	Bayou de L'Outre	Report	Report		
AR0033723	City of El Dorado-South WWTP	325 Quail Crossing, El Dorado	1	7.00	Bayou de L'Outre	No monitoring			

Note: mg/L = milligrams per liter.

Table 2-6. Point source discharge information for TDS in the Bayou de L'Outre Watershed

NPDES permit	Facility name	Location	Outfall	Dis-charge (mgd)	Receiv-ing waters	Average limit concen-tration	Max. limit concen-tration	Average quantity limit	Max. quantity limit
						mg/L	mg/L	lb/day	lb/day
Reach 008									
AR0000647	Lion Oil Company-El Dorado Refinery	1000 McHenry Ave, El Dorado	1	2.67	Loutre Creek	207	310	4,596	6,894
AR0001171	Great Lakes Chemical Corp-Central Plant	2226 Haynesville Hwy (Hwy 15S), El Dorado	2	0.321	Bayou de L'Outre	500	750		
			4	0.45	Bayou de L'Outre	500	750		
AR0033723	City of El Dorado-South WWTP	325 Quail Crossing, El Dorado	1	7.00	Bayou de L'Outre	No monitoring			
Reach 006									
AR0037800	Clean Harbors El Dorado, LLC	309 American Cir, El Dorado Twp	9	1.214	Boggy Creek	1,360	1,360	9,981.3	9,981.3

Note: mg/L = milligrams per liter.

Table 2-7. Point source discharges not included in the TMDLs for the Bayou de L'Outre Watershed

NPDES permit	Facility name	Location	Reason for not including
Reach 007			
AR0036072	Georgia Pacific Wood Production, LLC-	5482 Junction City Hwy (167)	This permit contained limits for floating debris, oil and grease, TSS, BOD ₅ , and pH. None of these were of interest to the TMDL and were not included.
Reach 006			
AR0047368	Columbian Chemicals Company	713 Industrial Rd	This permit contained limits for TSS, chemical oxygen demand, and pH. None of these were of interest to the TMDL and were not included.

2.6 Nonpoint Sources

Sources of dissolved minerals like chloride, sulfate, and TDS include urban and agricultural runoff, forestry, and natural geology. Chloride is found in all human and animal waste, and therefore septic systems and areas where animal waste is deposited can be chloride sources. Fertilizers are also a common source of chlorides (University of Florida 2003). TDS can originate from natural sources (e.g., mineral springs, carbonate deposits, salt deposits) and urban and agricultural runoff (Wilkes University 2005).

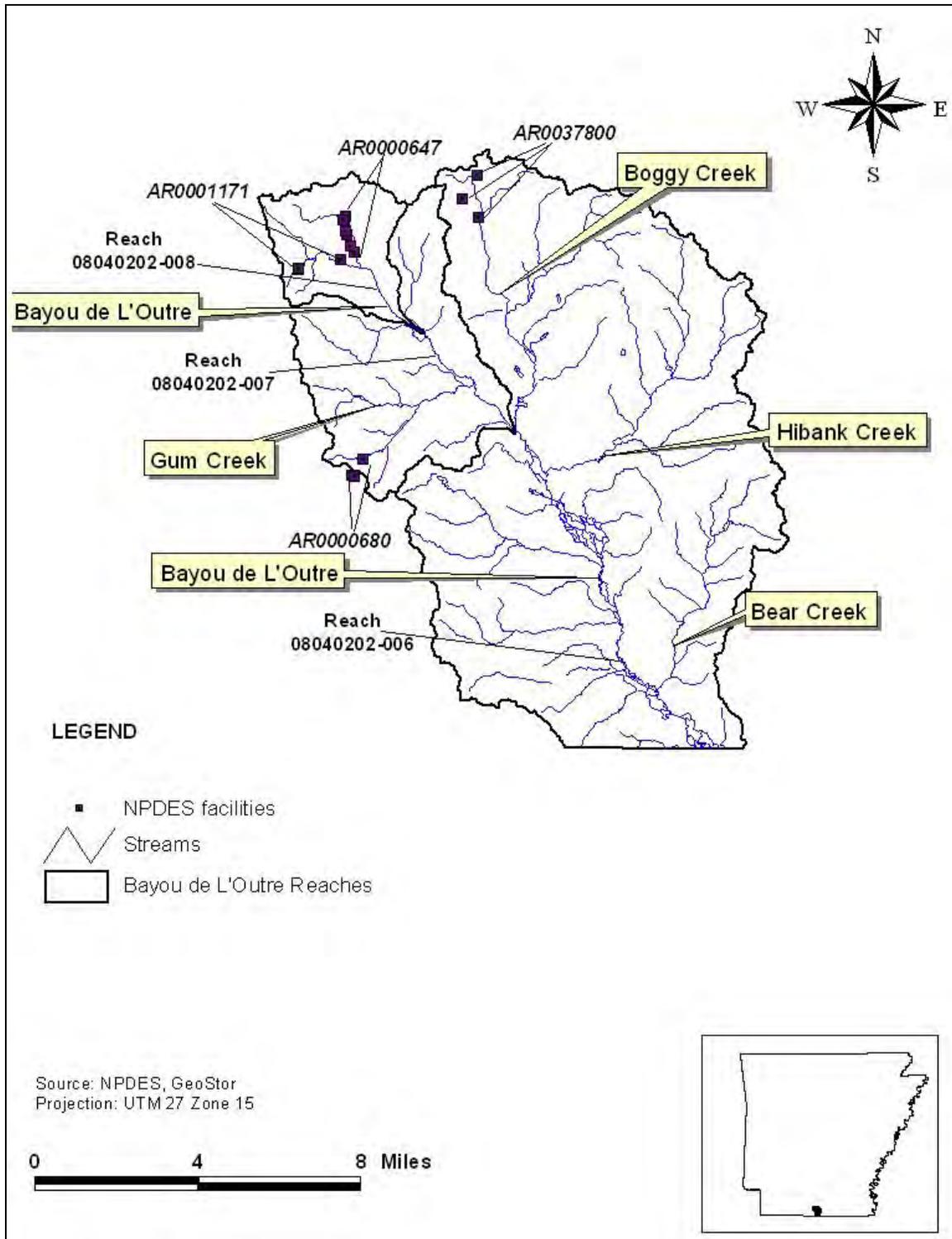


Figure 2-3. Location of NPDES facilities in the Bayou de L'Outre Watershed.

3 CHARACTERIZATION OF EXISTING WATER QUALITY

ADEQ has collected water quality data for chloride, sulfate, TDS, and other parameters in Bayou de L'Outre near Junction City (station OUA0005), which is approximately 7.4 miles upstream of the Arkansas/Louisiana state line (Figure 3-1).

3.1 Comparison of Observed Data to Criteria

3.1.1 Chloride

Water quality monitoring station OUA0005 (Bayou de L'Outre near Junction City, AR) has 190 chloride observations from 1990 to the present. Table A-1 in Appendix A provides a summary of the chloride observations at station OUA0005, including the number of observations; the period of record; the minimum, maximum, mean, and median observations; the number of exceedances of the criterion; and the percentage of observations exceeding the criterion. Appendix A contains the original chloride water quality data. Six percent of the observations at station OUA0005 exceed the 250 mg/L chloride criterion for Bayou de L'Outre.

3.1.2 Sulfate

Water quality monitoring station OUA0005 (Bayou de L'Outre near Junction City, AR) has 192 sulfate observations from 1990 to the present. Table A-1 in Appendix A provides a summary of the sulfate observations at station OUA0005, including the number of observations; the period of record; the minimum, maximum, mean, and median observations; the number of exceedances of the criterion; and the percentage of observations exceeding the criterion. Appendix A contains the original sulfate water quality data. Seventy-four percent of the observations at station OUA0005 exceed the 45 mg/L sulfate criterion for Bayou de L'Outre.

3.1.3 Total Dissolved Solids

Water quality monitoring station OUA0005 (Bayou de L'Outre near Junction City, AR) has 195 TDS observations from 1990 to the present. Table A-1 in Appendix A provides a summary of the TDS observations at station OUA0005, including the number of observations; the period of record; the minimum, maximum, mean, and median observations; the number of exceedances of the criterion; and the percentage of observations exceeding the criterion. Appendix A contains the original TDS water quality data. Forty-eight percent of the observations at station OUA0005 exceed the 500 mg/L TDS criterion for Bayou de L'Outre.

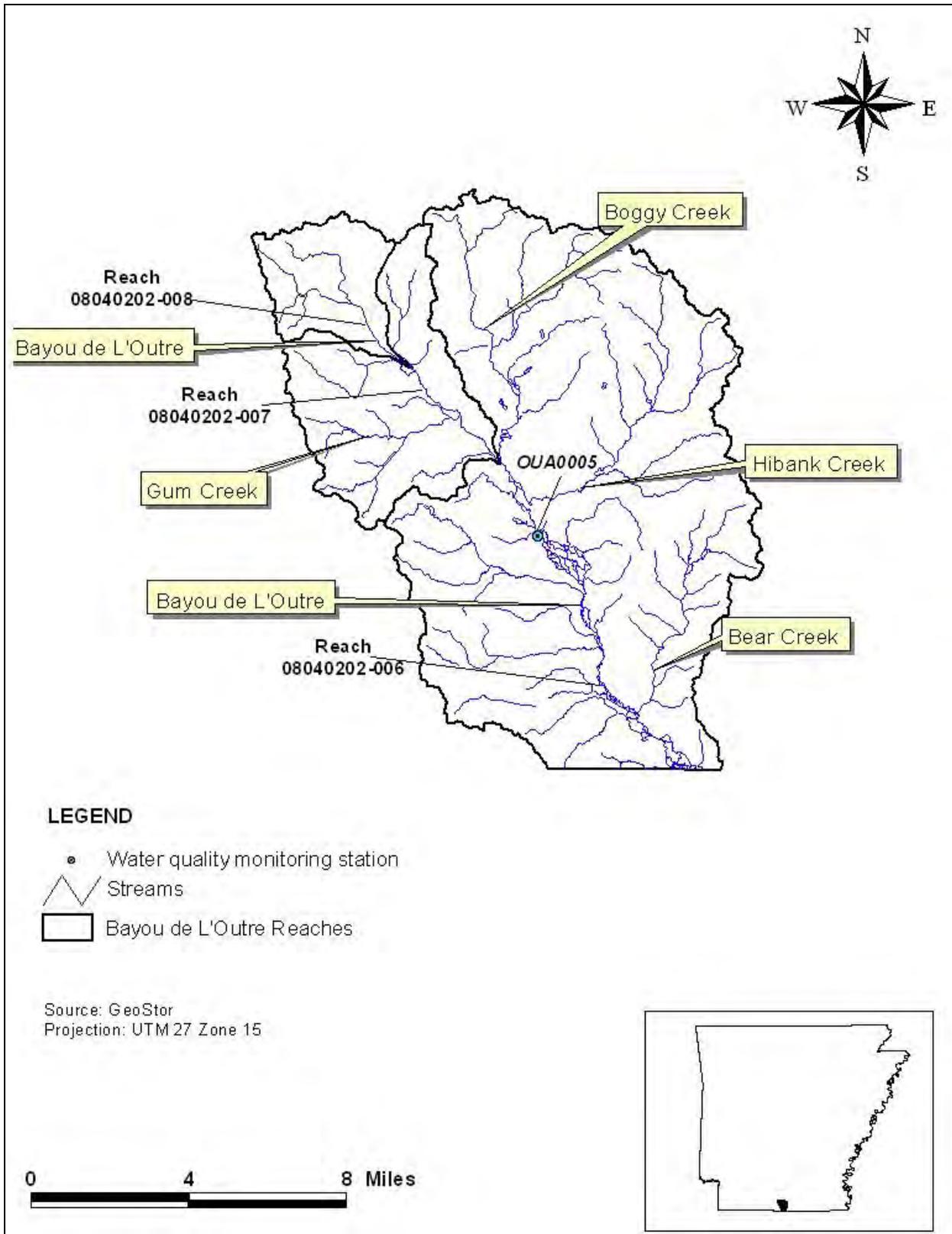


Figure 3-1. Location of the water quality monitoring station in the Bayou de L'Outre Watershed.

3.2 Trends and Patterns in Observed Data

3.2.1 Chloride

The chloride observations at station OUA0005 do not show any strong seasonal trends or patterns, but the highest observations were in the summer months. The highest chloride observations tended to be seen at low flows; however, not enough samples were collected during high flows to allow a valid comparison. Appendix B contains the chloride sampling results plotted over time and versus flow.

3.2.2 Sulfate

The sulfate observations at station OUA0005 do not show a strong seasonal trend or pattern, but the highest observations were in September, October, and November. High sulfate observations seemed to correlate with low flows; however, not enough samples were collected during high flows to allow a valid comparison. The highest sulfate concentrations were observed since 2004 along with higher, in general, concentrations. Appendix B contains the sulfate sampling results plotted over time and versus flow.

3.2.3 Total Dissolved Solids

The TDS observations at station OUA0005 do not show a strong seasonal trend or pattern, but the highest observations were in the summer and fall months. Like, chloride and sulfate, high TDS observations seemed to correlate with low flows; however, not enough samples were collected during high flows to allow a valid comparison. Appendix B contains the TDS sampling results plotted over time and versus flow.

4 TMDL DEVELOPMENT

A TMDL is the total amount of a pollutant that can be assimilated by the receiving waterbody while still achieving water quality standards. In TMDL development, allowable loadings from all pollutant sources that cumulatively amount to no more than the TMDL must be established, thereby providing the basis for establishing water quality-based controls.

A TMDL for a given pollutant and waterbody is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the lack of knowledge in the relationship between pollutant loads and the water quality of the receiving waterbody. The TMDL components are illustrated using the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

TMDLs are generally expressed on a mass loading basis (e.g., pounds per day).

4.1 TMDL Analytical Approach

The methodology used to determine the TMDL for each impaired segment is the load duration curve. Because loading capacity varies as a function of the flow present in the stream, these TMDLs represent a continuum of desired loads over all flow conditions rather than a fixed, single value. The basic elements of this procedure are documented on the Kansas Department of Health and Environment Web site (KDHE 2003). This method was used to illustrate allowable loading for a wide range of flows. The steps for applying this methodology to develop the TMDLs in this report can be summarized as follows:

1. Develop a flow duration curve.
2. Convert the flow duration curve to load duration curves for each impairment.
3. Plot the observed loads with load duration curves.
4. Calculate the TMDL, MOS, WLA, and LA (see Section 4.2).
5. Calculate the loadings required to meet Arkansas's water quality standards.

4.1.1 Flow Duration Curve

A flow duration curve was developed for the USGS gauge used for these TMDLs. Daily stream flow measurements from the USGS gauge were sorted in increasing order, and the percentile ranking of each flow was calculated. The load duration curve methodology requires that the same flow period be used for both developing the flow duration and calculating observed loads from sampling data. The flows are then plotted against the corresponding percent flow that exceeds a specific flow to create the flow duration curves.

Figure 4-1 is an example of a flow duration curve. The plot shows the flow (e.g., cubic feet per second) on the Y axis. The X axis shows the percentage of days on which the plotted flow is exceeded. Points at the lower end of the plot (0 through 10 percent) represent high-flow

conditions where only 0 through 10 percent of the flow exceeds the plotted point. Conversely, points at the high end of the plot (90 to 100 percent) represent low-flow conditions.

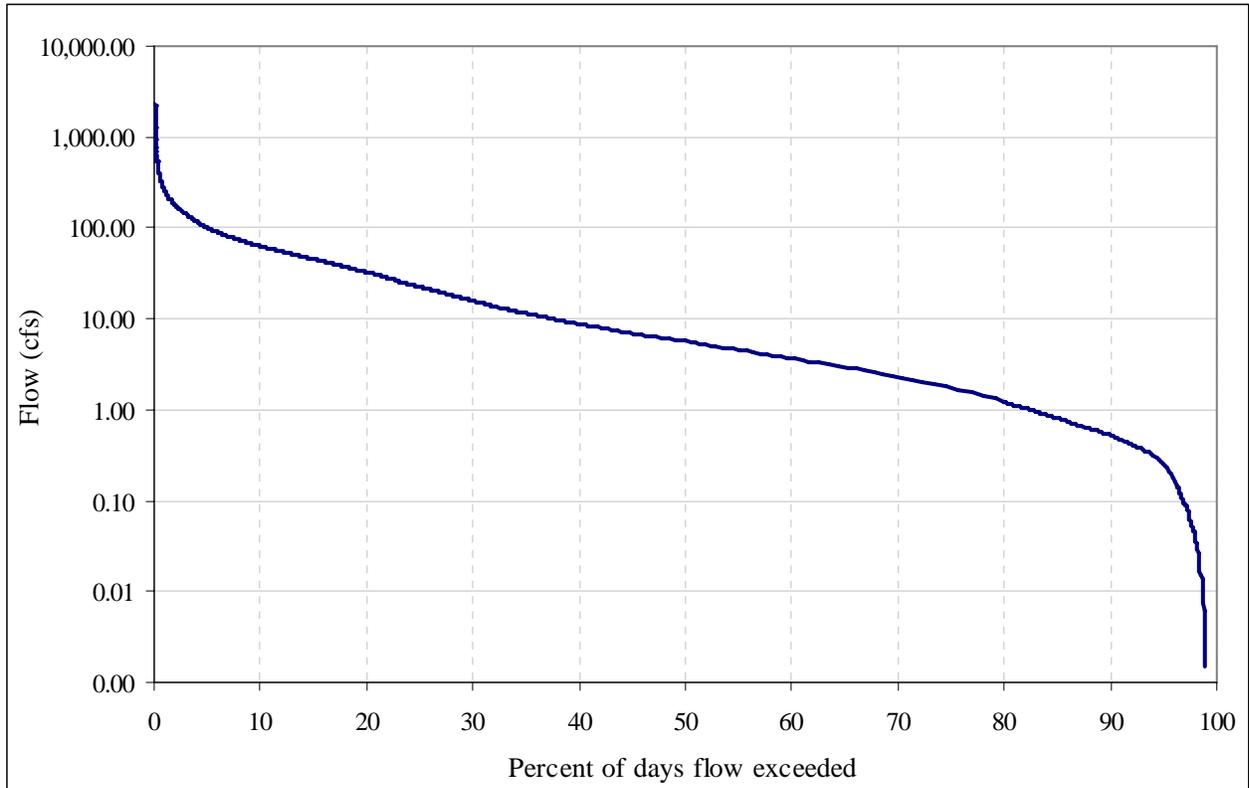


Figure 4-1. Example of a flow duration curve.

There was only one active USGS gauge in the area of concern. Table 4-1 presents the USGS gauge that was used, the period of record used in the TMDL analysis, and the segment(s) represented. For the TMDL calculations, the most recent flow data were used. Data from 1955 through early 2010 were used for USGS station 07366200. Flows were area weighted for each stream segment and those flows were used to create a unique flow duration curve for each segment (Appendix C).

Table 4-1. USGS flow gauge and represented segments for the Bayou de L'Outre Watershed

Station number	Station name	Drainage area (square miles)	Period of record used in TMDL development	Reaches represented
07366200	Little Corney Bayou near Lillie, LA	208	1955–2010	006, 007, 008

4.1.2 Load Duration Curve

For each TMDL parameter (chloride, sulfate, and TDS), the flows from the flow duration curves were multiplied by the appropriate numeric criterion concentration (Table 2-6) to compute an

allowable load duration curve. Each load duration curve is a plot of mass per day versus the percent flow exceedance from the flow duration curves.

The load duration curve is beneficial when analyzing monitoring data with their corresponding flow information plotted as a load. This approach allows the monitoring data to be placed in relation to their position in the flow continuum. Assumptions of the probable source or sources of the impairment can then be made from the plotted data. The load duration curve shows the calculation of the TMDL at any flow rather than at a single critical flow. The official TMDL number is reported as a single number, but the curve is provided to demonstrate the value of the acceptable load at any flow. This approach will allow analysis of load cases in the future for different flow regimes.

4.1.3 Observed Loads

For each sampling station, observed loads were calculated by multiplying the observed concentration of the parameter of concern by the flow on the sampling day. These observed loads were then plotted versus the percent flow exceedance of the flow on the sampling day and placed on the same plot as the load duration curve. Reductions were applied to the observed loads for each parameter until its water quality criteria and allowable percent exceedance were met to obtain an overall percent reduction for each segment. These plots are shown in the appendices to this report as follows:

- Appendix D: Load Duration Calculations for all TMDLs (CD-ROM)
- Appendix E: Load Duration Curve Summaries and Plots for Chloride
- Appendix F: Load Duration Curve Summaries and Plots for Sulfate
- Appendix G: Load Duration Curve Summaries and Plots for Total Dissolved Solids

These plots provide visual comparisons between observed and allowable loads under different flow conditions. Observed loads that are plotted above the load duration curve represent conditions under which observed water quality concentrations exceed the numeric criterion concentrations. Observed loads plotted below the load duration curve represent conditions under which observed water quality concentrations are less than the numeric criterion concentrations (i.e., do not exceed the water quality standards).

4.2 TMDL

Stream segment 08040202-006 was the only segment with a monitoring station. TMDLs for this segment were determined with load duration curves. Table 4-2 presents the TMDLs and allocations for the segments in this report. TMDLs for the other reaches, which did not have water quality stations, were determined from 08040202-006 and using a ratio of the total drainage area of each reaches. In addition, LAs for 08040202-008 are included in 08040202-007 because 08040202-007 is downstream of 08040202-008; similarly, LAs for 08040202-007 are included in 08040202-006.

Both section 303(d) of the Clean Water Act and the regulations at 40 CFR 130.7 require that TMDLs include an MOS to account for lack of knowledge in the available data or in the actual effect that controls will have on the loading reductions and receiving water quality. The MOS

may be expressed explicitly as unallocated assimilative capacity or implicitly by using conservative assumptions in establishing the TMDL. For a more detailed discussion of the MOS, see section 4.4.

Table 4-2. Summary of TMDLs, MOS, WLAs, and LAs for the Bayou de L'Outre Watershed

HUC-reach number	Water quality station	Pollutant	Total allowable loading	Explicit MOS (10%)	Σ WLA	Σ LA	Percent reduction
			lb/day				
08040202-006	OUA0005	Chloride	146,331	14,633	0	131,698	74.3
08040202-006	OUA0006	Sulfate	26,340	2,634	0	23,706	94.1
08040202-006	OUA0005	TDS	292,662	29,266	2,517	260,879	70.6
08040202-007		Chloride	34,501	3,450	2,825	28,226	74.3
08040202-007		Sulfate	6,210	621	0	5,589	94.1
08040202-007		TDS	69,003	6,900	0	62,102	70.6
08040202-008		Chloride	10,256	1,026	5,750	3,481	74.3
08040202-008		Sulfate	1,846	185	1,642	19	94.1
08040202-008		TDS	20,512	2,051	16,816	1,645	70.6

Note: Load allocations for segment 08040202-008 are included in segment 08040202-007. Load allocations for segment 08040202-007 are included in segment 08040202-006.

4.3 Wasteload Allocation

The WLA portion of the TMDL equation is the total loading of a pollutant that is assigned to point sources. The point sources in the Bayou de L'Outre Watershed include mechanical rubber goods, petroleum refining, industrial inorganic chemicals, wastewater facilities, and refuse systems.

WLAs are based on the current permit limits and discharge flow rates. If monitoring was optional or required for a pollutant, a WLA was assigned to the facility based on the water quality criterion and facility flow. An example of this is NPDES permit AR0000680. This facility is required to monitor for chloride so the water quality criterion was used to develop a WLA. During the next permit cycle, ADEQ will determine whether permit limits are necessary for chloride.

No domestic wastewater facilities with permit limits for chloride, sulfate, or TDS were identified in the Bayou de L'Outre Watershed, although it is possible that discharges from such facilities contain these constituents. Permit limits might not be assigned if a waterbody receiving the discharge is not listed and thus the discharge does not adversely affect water quality in the waterbody, or if the effluent from a facility does not contain a particular pollutant. For impaired waterbodies, permit limits are typically assigned. ADEQ designates permit limits during the permitting process on a case-by-case basis.

As noted above, because domestic wastewater facilities typically discharge chloride, sulfate, and TDS, facilities in this basin were assigned WLAs. The WLAs were based on facility flow and the median effluent concentrations of domestic wastewater facilities (during the time that the

TMDL was being developed) as reported in the Permit Compliance System, a database operated by EPA. These medians—chloride (53 mg/L), sulfate (41 mg/L), TDS (343 mg/L)—meet the water quality criteria for Bayou de L’Outre.

Table 4-3 list the WLAs for each point source in the Bayou de L’Outre Watershed. No reductions were necessary for chloride. All facilities required reductions to sulfate loadings for Bayou de L’Outre to meet criteria. In addition, the TDS loadings from AR0033723 were reduced. The loading was originally based on the median TDS concentration in wastewater throughout Arkansas. The loading from this facility was reduced to meet allowable loadings.

Table 4-3. WLAs for the Bayou de L’Outre Watershed

HUC-reach number	NPDES permit	Outfall	Facility	Discharge	Chloride	Sulfate	TDS
				mgd	lb/d	lb/d	lb/d
08040202-007	AR0000680	1	Great Lakes South	1.354	2,825		
08040202-008	AR0000647	1	Lion Oil Company-El Dorado Refinery	2.67		646	1,915
08040202-008	AR0001171	1	Great Lakes Chemical Corp-Central Plant	0.93	1,940	225	
08040202-008	AR0001171	2	Great Lakes Chemical Corp-Central Plant	0.321	346	78	1,339
08040202-008	AR0001171	4	Great Lakes Chemical Corp-Central Plant	0.45	368	109	1,878
08040202-008	AR0033723	1	El Dorado, City of - South WWTP	7	3,096	584	11,684
08040202-006	AR0037800	9	Clean Harbors El Dorado, LLC (formerly Teris, LLC)	1.214			2,517

4.4 Load Allocation

The LA is the portion of the TMDL assigned to natural background loadings, as well as nonpoint sources like urban runoff and agricultural practices. For this TMDL, the LA was calculated by subtracting the WLA and MOS from the total TMDL. LAs were not allocated to separate nonpoint sources because there was a lack of available source characterization data. The LAs are presented in Table 4-2.

4.5 Margin of Safety

The MOS is the portion of the pollutant loading reserved to account for any lack of knowledge in the data. There are two ways to incorporate the MOS (USEPA 1991). One way is to implicitly incorporate it by using conservative model assumptions to develop the allocations. The other way is to explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In this analysis, for all pollutants, the MOS is explicit: 10 percent of each targeted TMDL was reserved as the MOS to account for any lack of knowledge in the TMDL. Using 10 percent of the TMDL load provides an additional level of protection to the designated uses of the segments of concern.

4.6 Seasonality and Critical Conditions

The federal regulations at 40 CFR 130.7 require that TMDLs include seasonal variations and take into account critical conditions for streamflow, loading, and water quality parameters. The sampling results for all pollutants were plotted over time and reviewed for any seasonal patterns (see Section 3.2).

By accounting for critical conditions, the TMDL makes sure that water quality standards are maintained for infrequent occurrences and not only for average conditions.

Because of the way the criteria are written (i.e., including critical and noncritical conditions), the TMDL for a pollutant of concern can be developed by reviewing pollutant loads at all flow conditions within applicable periods of the year and evaluating the percentage of values exceeding the criteria. The load duration curve, which determines the allowable loading at a wide range of flows, was chosen as the approach for these TMDLs (see Section 4.1). Therefore, the TMDLs were calculated at all flows rather than at a single critical flow.

4.7 Future Growth

Compliance with these chloride, sulfate, and TDS TMDLs is based on keeping loadings in the stream below the assimilative capacity of the stream. Allocations between the WLA and LA may be re-evaluated if there is future growth of existing or new point sources discharging to the impaired reaches or their tributaries.

5 FUTURE WATERSHED ACTIVITIES

In accordance with section 106 of the federal Clean Water Act and under its own authority, ADEQ has established a comprehensive program for monitoring the quality of the state's surface waters. ADEQ collects surface water samples at various locations, using appropriate sampling methods and procedures to ensure the quality of the data collected. One of the locations where ADEQ will continue to monitor water quality is Bayou de L'Outre near Junction City, Arkansas (station OUA0005). The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for long-term trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program are used to develop the state's biennial 305(b) report and section 303(d) list of impaired waters, which were most recently published as the *State of Arkansas 2004 Integrated Water Quality Monitoring and Assessment Report* (ADEQ 2005).

6 PUBLIC PARTICIPATION

The federal regulations at 40 CFR 130.7(c)(1)(ii) specify that TMDLs “shall be subject to public review as defined in the State’s CPP.” These TMDLs were developed under contract to EPA, and EPA held a public review period seeking comments, information, and data from the public and any other interested parties. The notice for the public review period was published in the *Federal Register* on December 17, 2007, and the review period closed on January 16, 2008.

Audubon Arkansas submitted general comments for several TMDLs listed in the same public notice. Clean Harbors Environmental Services, Lion Oil, GBM^c & Associates, El Dorado Water Utilities and Great Lakes Chemical Corporation submitted comments specific to this TMDL document. Comments and additional information submitted during the public comment period were used to inform or revise this TMDL document. The comments and responses to these TMDLs, along with comments on similar TMDLs with the same public review period, will be included in the document: *EPA Responses to Comments for Bayou de L'Outre TMDLs in Arkansas*.

After a close review of the comments provided during the comment period, these TMDLs were revised using downstream water quality standards.

EPA will submit the final TMDLs to ADEQ for implementation and incorporation into ADEQ’s current water quality management plan.

7 REFERENCES

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Appendix A

Summary of Water Quality Data

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Table A-2. Chloride, sulfate, and TDS data at station OUA0005	3

Table A-1. Summary of chloride, sulfate, and TDS data for the Bayou de L'Outre Watershed

Pollutant	Station number	Station name	Period of record	Number of observations	Minimum	Maximum	Mean	Median	Number of observations above criterion ^a	% of observations above criterion ^a
					mg/L	mg/L	mg/L	mg/L		
Chloride	OUA0005	Bayou de L'Outre near Junction City, AR	9/4/1990–12/15/2009	224	4.95	874	139.4	126.5	13	5.8%
Sulfate	OUA0005	Bayou de L'Outre near Junction City, AR	9/4/1990–12/15/2009	226	0.02	686	131.3	83.1	167	73.9%
TDS	OUA0005	Bayou de L'Outre near Junction City, AR	9/4/1990–12/15/2009	229	22.8	1,530	527.8	480.0	110	48.0%

^aThe water quality data were compared to the site-specific chloride, sulfate, and TDS water quality criteria of 250, 45, and 500 mg/L, respectively. These are the criteria for Bayou de L'Outre from the mouth of Hibank Creek downstream to the mouth of Mill Creek.

Table A-2. Chloride, sulfate, and TDS data at station OUA0005

Date collected	Chloride	Sulfate	TDS
	(mg/L)	(mg/L)	(mg/L)
9/4/1990	384	165	1,064
10/2/1990	279		812
10/30/1990	386	73	729
11/27/1990	366	57	746
1/2/1991	75.8	25	225
2/5/1991	191	52	483
3/12/1991	153	45	402
4/2/1991	110	25	316
5/7/1991	29.3	13	139
6/4/1991		80	440
7/2/1991	103	84	435
8/6/1991	253	85	536
9/3/1991			378
10/1/1991			397
10/29/1991			452
11/25/1991	121	36.5	354
1/7/1992	109	41.3	305
2/4/1992	100	46.1	296
3/3/1992	68.2	35.4	224
4/7/1992	116	51	346
5/5/1992	133	46.9	375
6/2/1992	118	32.9	319
7/7/1992	103	67.2	416
8/4/1992	126	61	447
9/1/1992	128	76.6	507
9/29/1992	142	91.1	513
10/27/1992		106	496
12/1/1992	120	53.1	358
1/12/1993		18.1	220
2/9/1993	105	62.3	356
3/9/1993	225	46.9	505
4/13/1993	91.4	22.9	259
5/18/1993	107	58.2	357
6/21/1993	49.9	13.2	141
7/26/1993	327	133	888
8/24/1993	874		690
9/21/1993	149	163	651
10/26/1993	183	82	487
11/23/1993	119	71.8	366
12/21/1993		58.2	
1/18/1994		22.6	210
2/15/1994	39.6	16.9	140
3/14/1994	53.6	27.3	184
4/18/1994	131	23.3	
5/23/1994	224	61.3	588
6/28/1994	253	70	637
7/19/1994	344	63	818

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Date collected	Chloride	Sulfate	TDS
	(mg/L)	(mg/L)	(mg/L)
8/16/1994	193	101	655
9/27/1994	156	213	754
10/24/1994	109	27.1	299
11/28/1994	267	62.1	610
12/19/1994	50.8	13.2	171
1/9/1995	125		
2/14/1995	126	130	532
3/28/1995	213	74.1	582
4/24/1995	62.368	9.8	174
5/23/1995	162	75.7	480
6/20/1995	127	164	610
7/17/1995	119	170	588
8/8/1995	115.182	204	655
9/19/1995	137	193	647
10/17/1995	147	230	726
11/13/1995		215	743
12/18/1995	162	82	441
1/30/1996	157	79.7	451
2/20/1996	142	80.6	447
3/12/1996	179	96.9	532
4/23/1996	110.259	37.1	341
5/21/1996	129.3	152.4	637
6/18/1996	137	86.2	473
7/16/1996	110.888	80	395
8/6/1996	107.929	29	337
9/10/1996	126	96.8	509
10/1/1996	95.6	39.6	274
11/19/1996	120.1	77.3	414
12/17/1996	105.304	64.6	352
1/28/1997	50.994	23.1	175
2/25/1997	54.446	28	197
3/11/1997	53.619	32.7	
4/15/1997	84.756	48.7	284
5/13/1997	84.899	82.3	384
6/10/1997		39.5	277
7/22/1997	95.939	239	663
8/26/1997	102.153	81.641	425
9/30/1997	136.5	190.2	674
10/28/1997	139	67.2	386
11/18/1997		41.724	363
12/15/1997	128.833	54.288	358
1/20/1998	71.96	31.455	227
2/17/1998	65.38	17.768	191
3/17/1998	26.75	10.26	127
4/14/1998	115.371	71.522	401
5/19/1998	114	204	667
6/9/1998	137	112	517
7/21/1998	49.1	124	684

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Date collected	Chloride	Sulfate	TDS
	(mg/L)	(mg/L)	(mg/L)
8/11/1998	119	175.8	694
9/1/1998	121	191	636
9/29/1998	130	158	651
11/16/1998	142	49.4	380
12/22/1998	82.6	25	230
1/26/1999	68.6	28.8	216
2/23/1999	104	97.5	420
3/23/1999	84.2	62.1	324
4/27/1999	110.31		508
4/28/1999	29.4	31.4	
5/25/1999	130	152	584
6/29/1999	55.2	22	236
7/27/1999	112	301	852
8/17/1999	153	268	863.5
9/21/1999	121	190	870
10/19/1999	160	195	697.5
11/22/1999	161.64	216.04	705.5
12/20/1999	187	131.24	593.5
1/25/2000	146.96	112.48	520
2/29/2000	148	62.6	402.5
3/27/2000	72.2	27.5	266
4/24/2000	111	83.6	448.5
5/30/2000	159	28.6	429
6/27/2000	127	85.7	432
7/25/2000	168.45	201.1	690
8/22/2000	210.48	420.12	1,161
9/18/2000	8.06	6.68	79
10/17/2000	177.9	230.5	738
11/7/2000	183.4	239.92	716.5
12/19/2000	53	32.3	233
1/30/2001	33.21	17.65	127
2/27/2001	62.7	25.05	
3/26/2001	66.4	33.72	227
4/17/2001	71.46	15.31	222.5
5/22/2001	68.28	32.8	273.5
6/19/2001	105.1	95.24	477
8/20/2001	215.75	237.8	854.5
9/17/2001	235	155	713.5
10/23/2001	148.95	120.77	486
11/19/2001	201.8	151	654
12/11/2001	90.9	27.37	265
1/14/2002	142.38	62.95	398
2/26/2002	109	46.6	328
3/26/2002	54.27	26.2	205
4/23/2002	139	143	589
5/28/2002	102	75.65	365
6/25/2002	70.83	170.73	
7/23/2002	159	151	607.5

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Date collected	Chloride	Sulfate	TDS
	(mg/L)	(mg/L)	(mg/L)
8/20/2002	91.26	107.02	443
9/17/2002	57.9	3.46	1,220
10/15/2002	36.4	4.37	602
11/5/2002	106	44.1	281
12/3/2002	168	143	548
1/21/2003	122	107	415
2/25/2003	21.8	9.23	112
3/25/2003	197	66.6	386
4/15/2003	160.38	131	525
5/20/2003	175	116	22.8
6/17/2003	124	80.3	377
7/15/2003	35.9	4.48	144
8/12/2003	213	238	920
9/23/2003	165	158	548
10/14/2003	192	254	768
11/11/2003	327	296	836
12/16/2003	208	82.6	463
1/20/2004	175	59.9	83.5
2/17/2004	48.5	18.8	177
3/16/2004	73.2	35.6	234
4/13/2004	94.2	55.5	314
5/11/2004	147	294	805
5/15/2004	93.8	238	660
7/20/2004	117	312	748
8/17/2004	204	411	1,020
9/21/2004	241	686	1,530
10/19/2004	126	156	511
11/30/2004	43.3	26.1	177
12/14/2004	55	56.3	227
2/22/2005	101	99.4	352
3/28/2005	79.6	62.4	287
4/26/2005	118	183	573
5/23/2005	187	210	676
6/21/2005	740		1,070
7/26/2005	154	232	717
8/23/2005			706
9/27/2005	169	110	508
10/25/2005	243	630	1,130
11/29/2005	200	529	1,150
12/27/2005	10.8	8.72	84
1/17/2006	142	0.02	506
2/14/2006	144	68.9	340
4/18/2006	203	238	796
5/16/2006	139	188	602
6/27/2006	198	322	978
7/25/2006	249	506	1,490
8/14/2006	310	378	1,250
8/29/2006	193	265	928

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Date collected	Chloride	Sulfate	TDS
	(mg/L)	(mg/L)	(mg/L)
9/26/2006	4.95	8.33	55
10/24/2006	23.1		787
11/13/2006	196	147	578
11/28/2006	22	250	782
12/5/2006	188	230	691
1/2/2007	62.8	29.7	204
2/6/2007	115	109	375
2/12/2007	133	124	414
3/13/2007	163	175	575
4/3/2007	142	55.8	403
4/23/2007	148	79.7	432
5/1/2007	149	78.6	427
6/12/2007	164	247	778
6/18/2007	178	267	828
7/17/2007	97.4	23.7	277
9/5/2007	166	338	880
9/17/2007	203	371	955
10/9/2007	199	353	950
11/13/2007	229	408	1,100
11/26/2007	160	214	647
12/4/2007	167	206	643
1/22/2008	163	177	566
2/4/2008	129	64.2	343
2/19/2008	75.3	24.1	220
3/17/2008	97	63.2	306
4/15/2008	104	88.5	400
5/20/2008	100	91.1	396
6/10/2008	247	399	1,140
7/15/2008	198	467	1,170
8/11/2008	149	415	1,140
8/19/2008	60.2	229	509
9/2/2008	86.9	194	541
10/14/2008	142	545	1,210
10/20/2008	135	350	859
11/3/2008	170	405	984
12/16/2008	97.9	127	417
1/6/2009	80	86	338
2/3/2009	64.4	90.9	543
3/3/2009	140	170	525
4/28/2009	112	159	525
5/26/2009	80.2	115	431
6/23/2009	198	425	1,120
7/7/2009	160	635	1,350
8/10/2009	86	125	455
12/15/2009	46.5	22	153

Appendix B

Chloride, Sulfate, and TDS Figures for the Bayou de L’Outre Watershed

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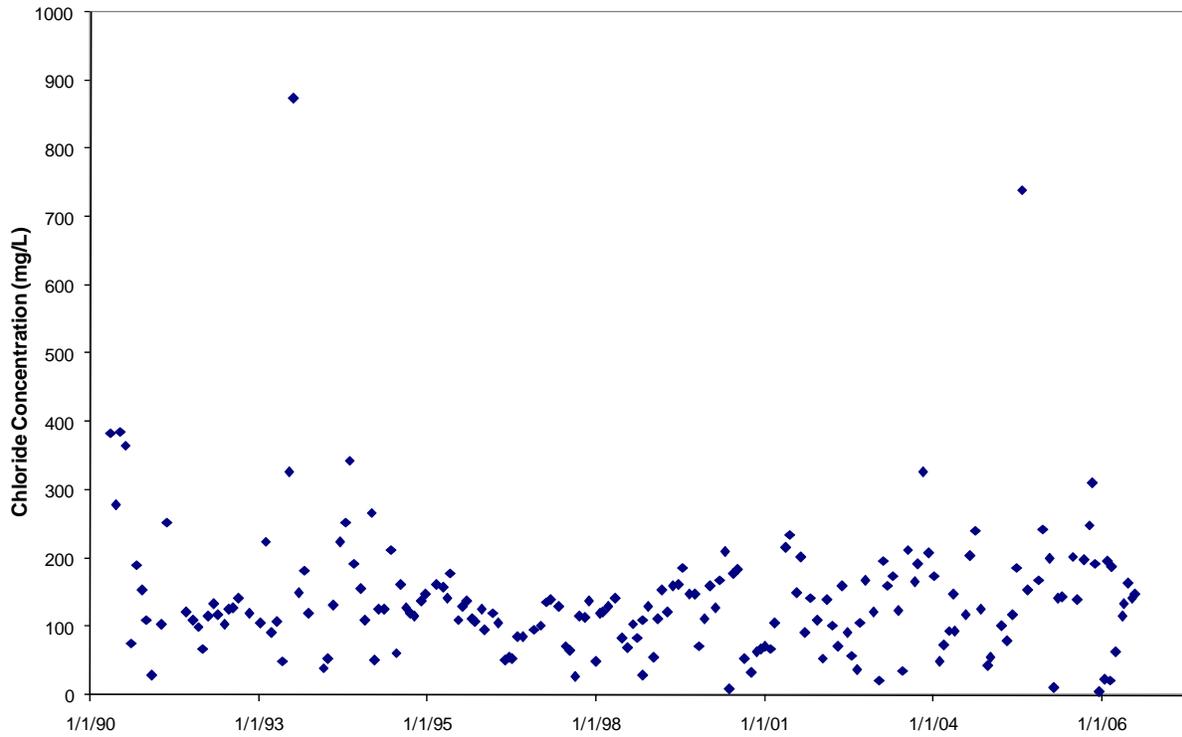


Figure B-1. Time series chloride observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

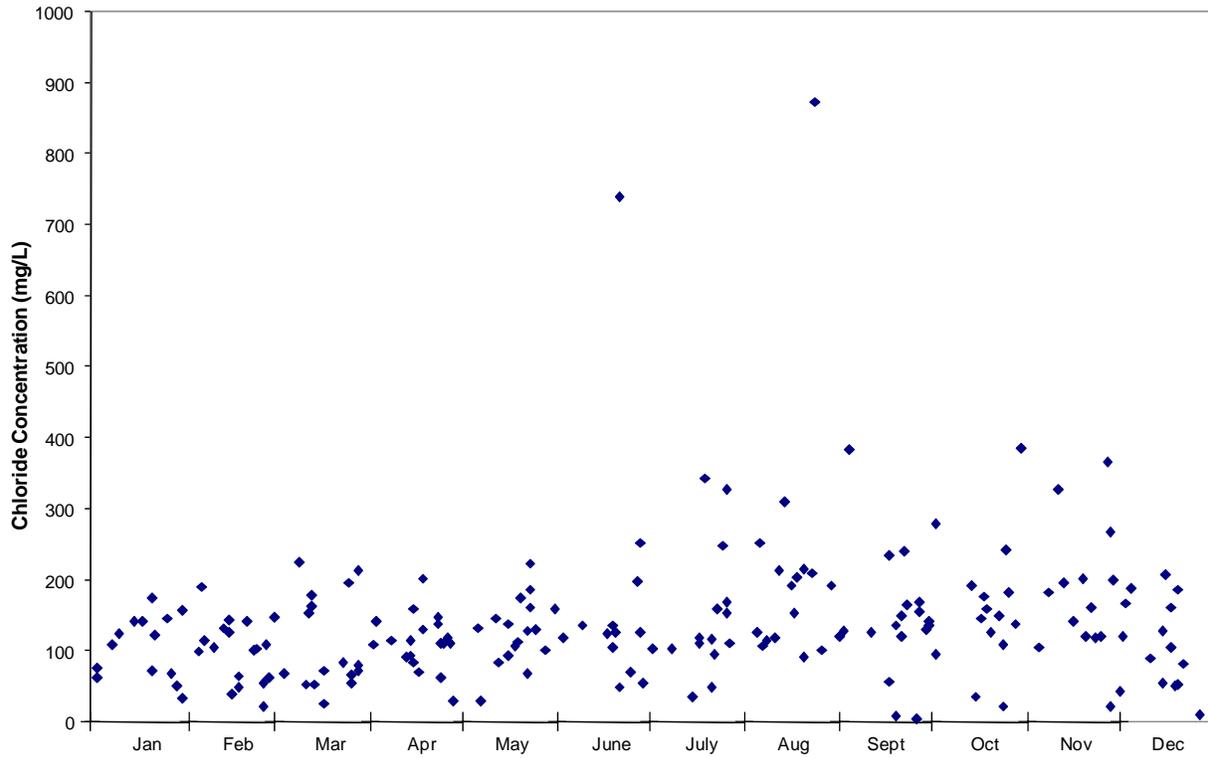


Figure B-2. Seasonal chloride observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

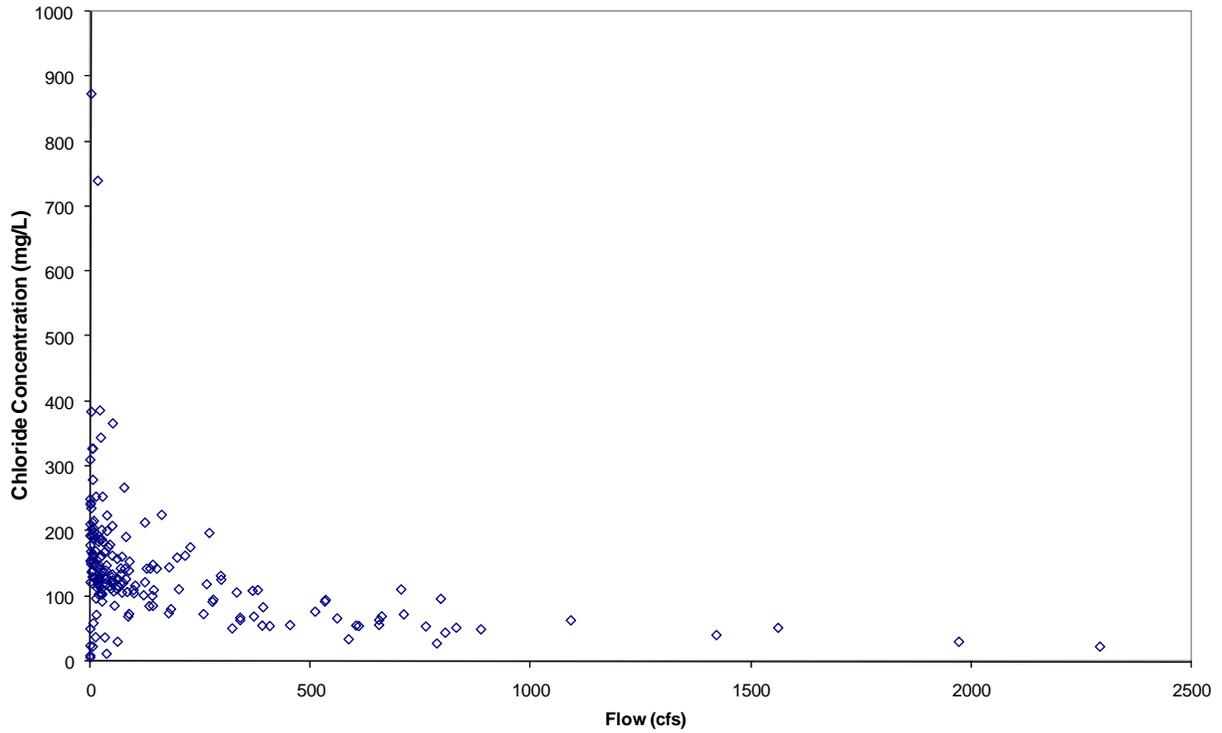


Figure B-3. Chloride observations versus flow at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

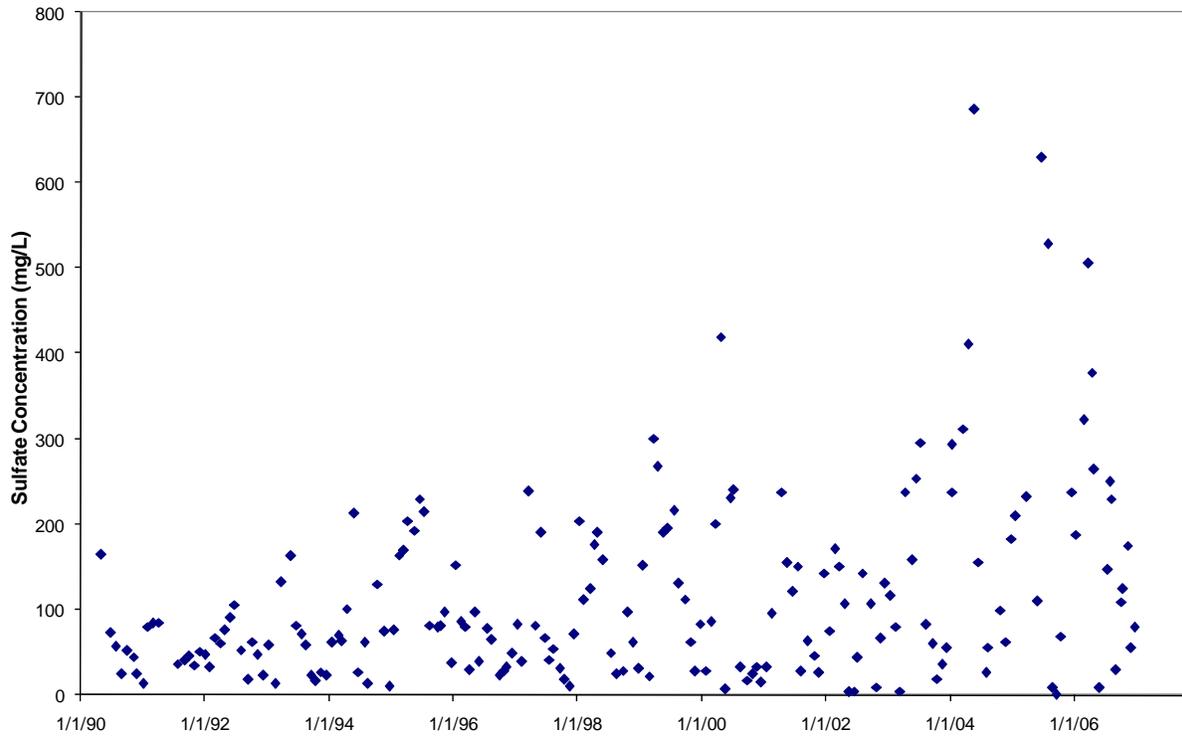


Figure B-4. Time series sulfate observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

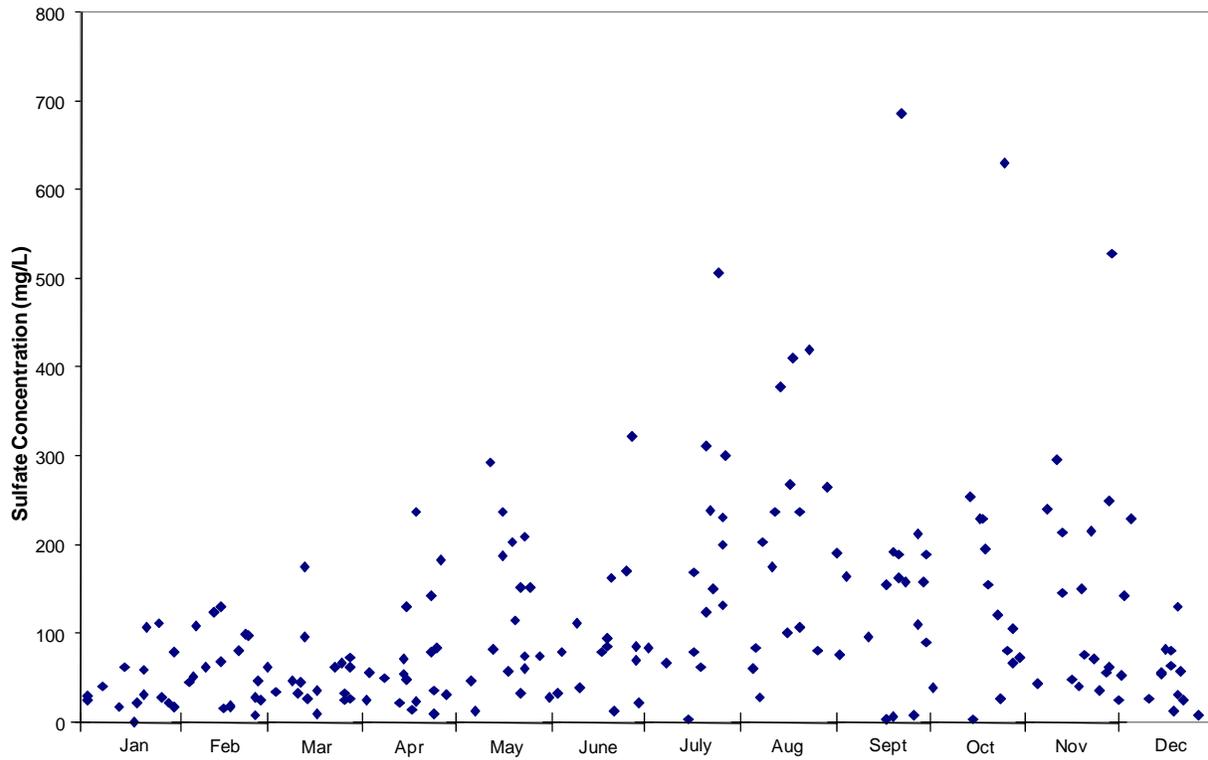


Figure B-5. Seasonal sulfate observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

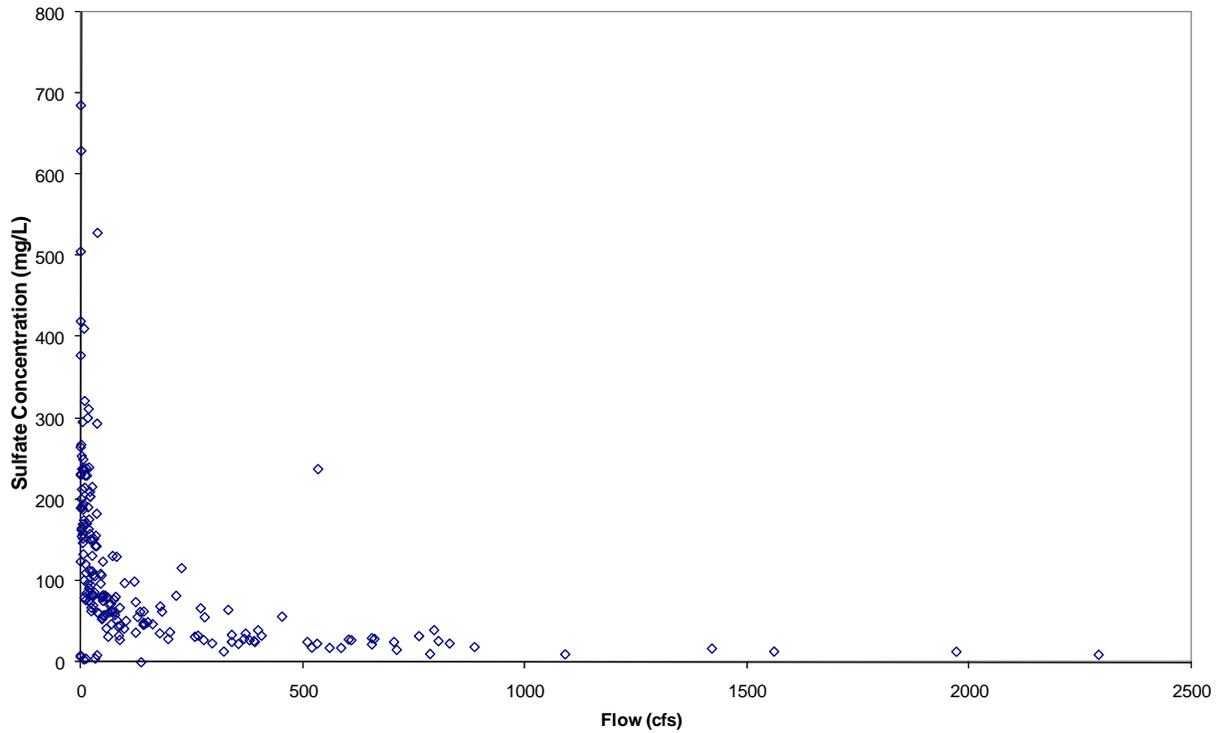


Figure B-6. Sulfate versus flow at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

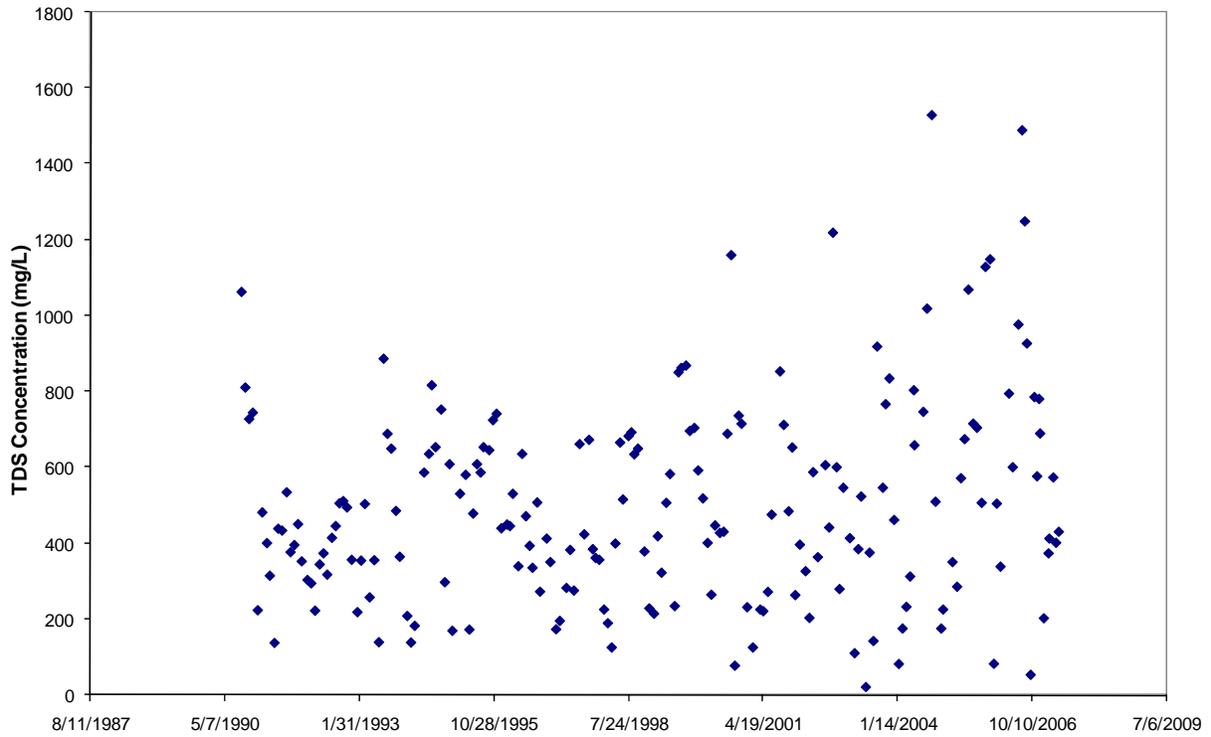


Figure B-7. Time series TDS observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

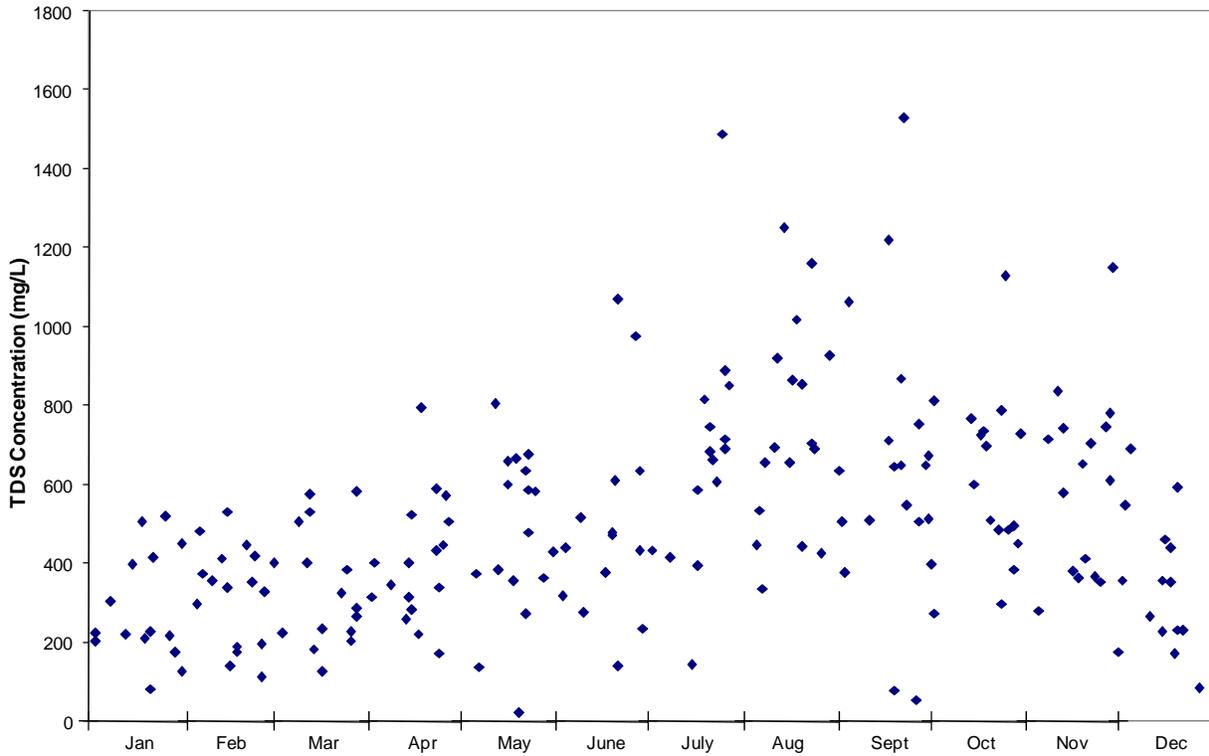


Figure B-8. Seasonal TDS observations at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

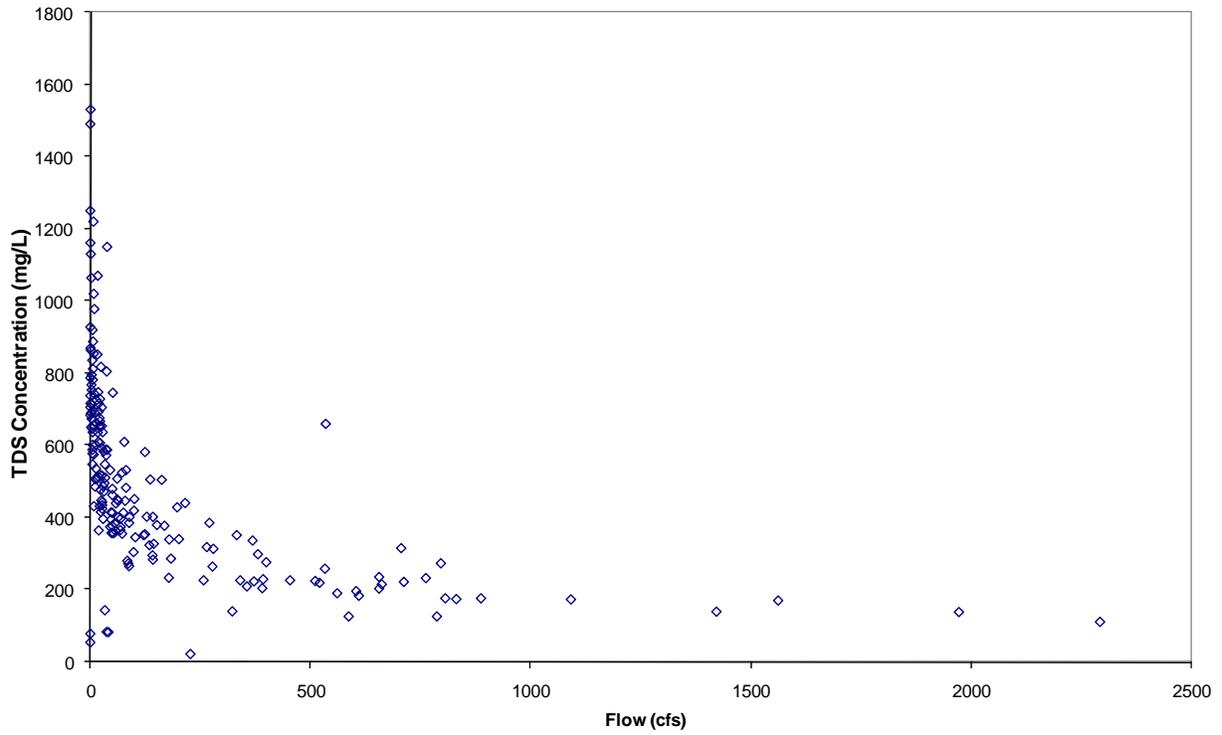


Figure B-9. TDS versus flow at Bayou de L'Outre (stream reach 006) near Junction City, Arkansas (station OUA0005).

Appendix C

Flow Duration Curves for the Bayou de L'Outre Watershed

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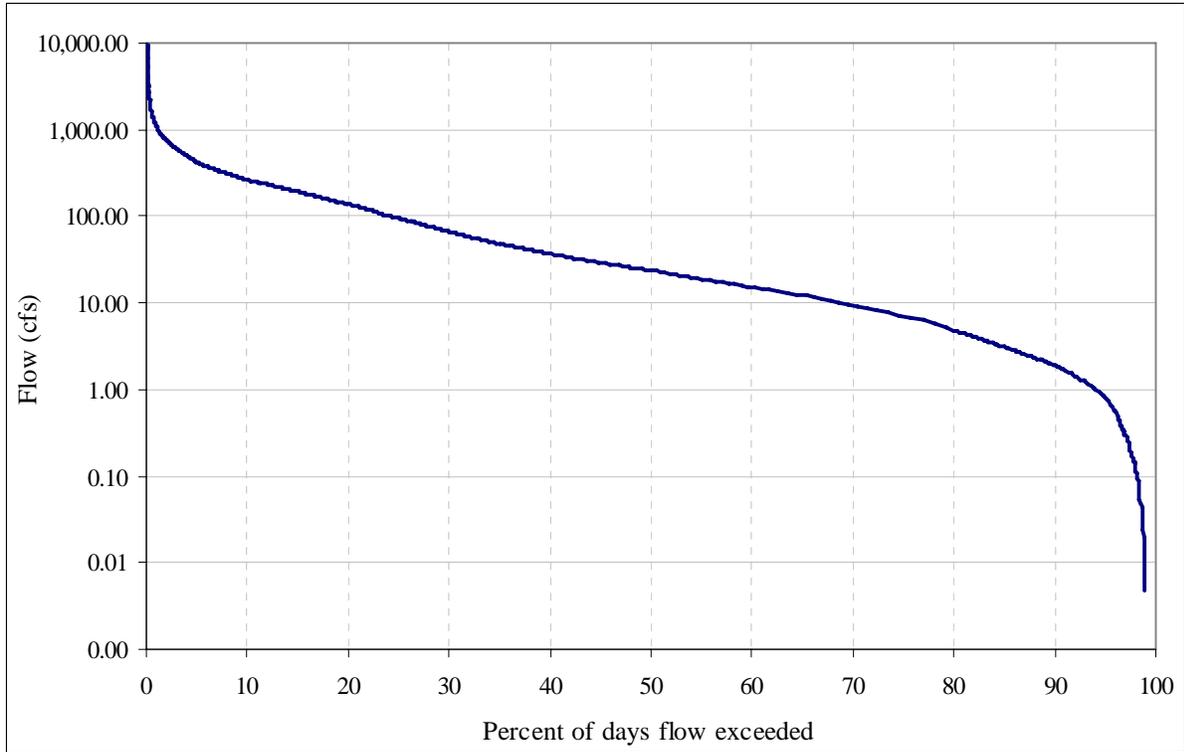


Figure C-1. Flow duration curve for HUC-reach 08040202-006 in the Bayou de L'Outre Watershed.

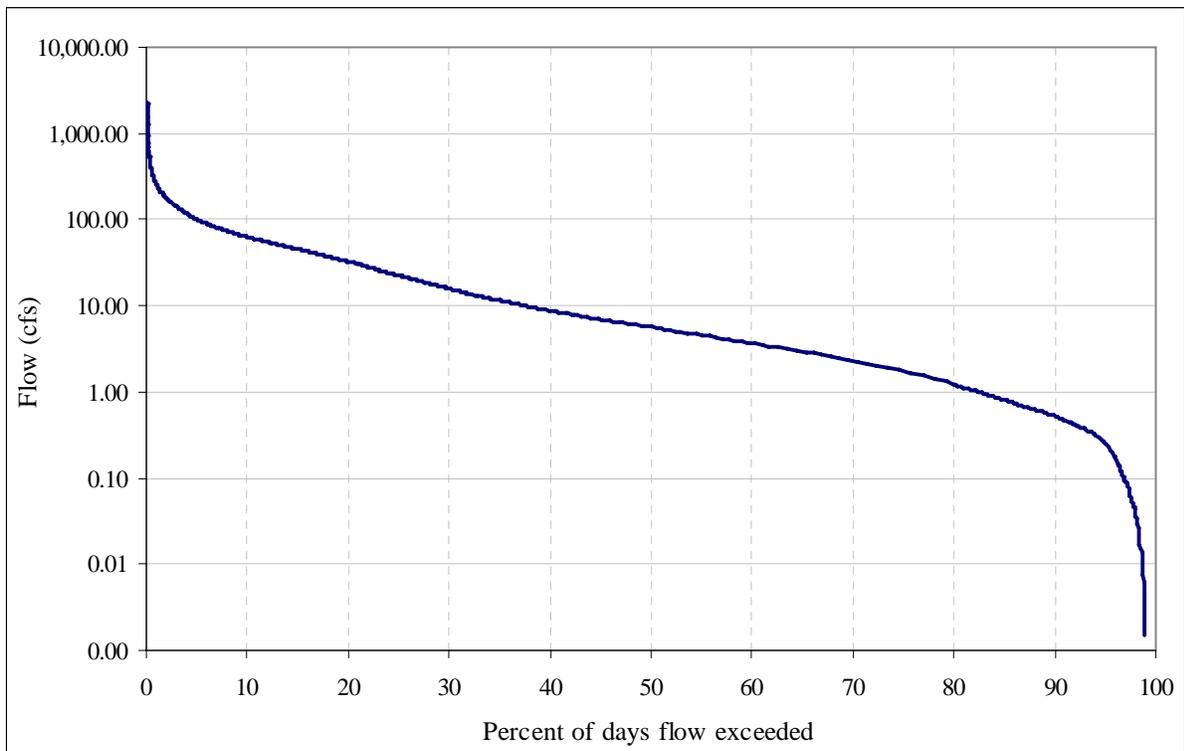


Figure C-2. Flow duration curve for HUC-reach 08040202-007 in the Bayou de L'Outre Watershed.

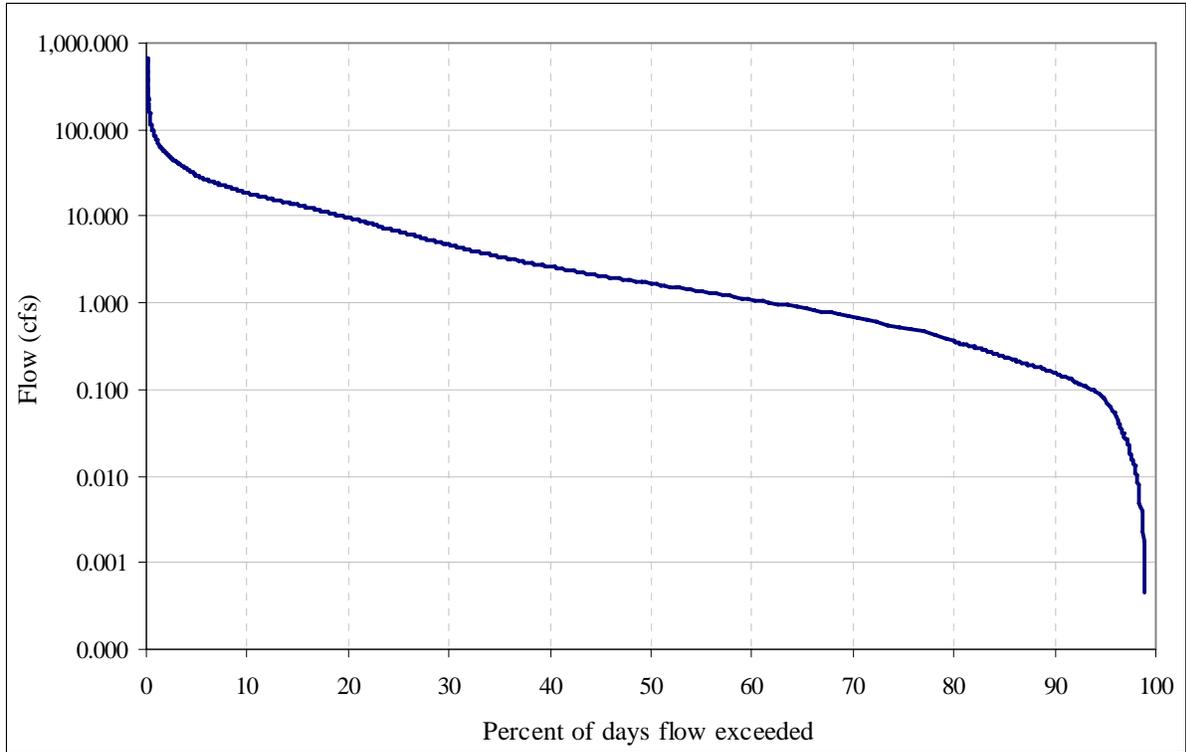


Figure C-3. Flow duration curve for HUC-reach 08040202-008 in the Bayou de L'Outre Watershed.

Appendix D

Load Duration Curve Calculations for All TMDLs (CD-ROM)

This appendix contains extremely large files, which are included only on a CD-ROM. To obtain a copy of this appendix, please contact EPA.

Appendix E

Load Duration Curve Summaries and Plots for Chloride

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Table E-4. Allowable Chloride load for Bayou De L’Outre (HUC-reach 08040202-008)	7

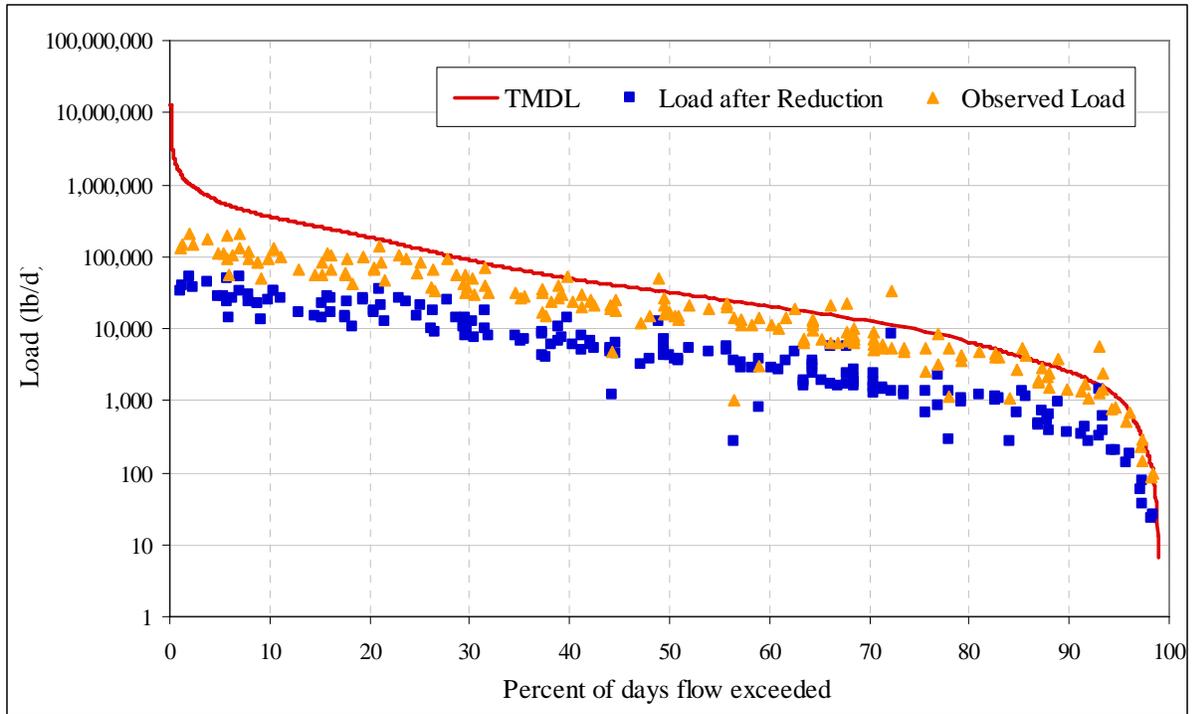


Figure E-1. Chloride load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Table E-1. Allowable Chloride load for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						145,161.6
8/18/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/19/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/20/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/21/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/22/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/23/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/24/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/25/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/26/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
For brevity, most cells in this spreadsheet have been hidden						
5/1/1991	7180	0.100	3461.805	0.00	4668050.7468	0.00E+00
4/26/1958	8060	0.100	3886.093	0.00	5240179.5292	0.00E+00
4/6/1997	8210	0.100	3958.415	0.00	5337701.4807	0.00E+00
4/15/1991	8840	0.100	4262.167	0.00	5747293.6772	0.00E+00
4/29/1958	11000	0.100	5303.602	0.00	7151609.7793	0.00E+00
4/28/1991	11400	0.100	5496.460	0.00	7411668.3167	0.00E+00
4/30/1991	13800	0.100	6653.609	0.00	8972019.5413	0.00E+00
4/27/1958	18200	0.100	8775.050	0.00	11832663.4530	0.00E+00
6/9/1974	19100	0.100	9208.981	0.00	12417795.1622	0.00E+00
4/29/1991	19300	0.100	9305.410	0.10	12547824.4309	1.25E+04
4/28/1958	20000	0.000	9642.912	0.00	13002926.8714	0.00E+00

Table E-2. Existing load for Chloride for for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
8/24/1993	874	1.205	93.1	5.682E+03	1.463E+03	1.463E+03	Yes
6/21/2005	740	8.196	72.3	3.272E+04	8.422E+03	9.947E+03	Yes
10/30/1990	386	10.607	67.7	2.208E+04	5.685E+03	1.287E+04	Yes
9/4/1990	384	1.157	93.3	2.397E+03	6.170E+02	1.404E+03	Yes
11/27/1990	366	24.589	49	4.854E+04	1.250E+04	2.984E+04	Yes
7/19/1994	344	11.571	66.1	2.147E+04	5.527E+03	1.404E+04	Yes
7/26/1993	327	2.989	85.3	5.272E+03	1.357E+03	3.628E+03	Yes
11/11/2003	327	2.121	88.9	3.742E+03	9.633E+02	2.575E+03	Yes
8/14/2006	310	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
10/2/1990	279	2.893	85.7	4.353E+03	1.121E+03	3.511E+03	Yes
11/28/1994	267	37.125	39.8	5.347E+04	1.376E+04	4.506E+04	Yes
8/6/1991	253	6.268	76.9	8.553E+03	2.202E+03	7.607E+03	Yes
6/28/1994	253	13.500	62.6	1.842E+04	4.743E+03	1.638E+04	Yes
7/25/2006	249	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
10/25/2005	243	0.530	96.1	6.951E+02	1.790E+02	6.436E+02	Yes
9/21/2004	241	0.227	97.4	2.946E+02	7.583E+01	2.750E+02	Yes
9/17/2001	235	1.157	93.3	1.467E+03	3.776E+02	1.404E+03	Yes
3/9/1993	225	78.108	27.7	9.479E+04	2.440E+04	9.479E+04	Yes
5/23/1994	224	18.322	55.8	2.214E+04	5.699E+03	2.224E+04	Yes
8/20/2001	215.75	3.857	82.7	4.489E+03	1.156E+03	4.681E+03	Yes
3/28/1995	213	59.786	31.5	6.869E+04	1.768E+04	7.256E+04	Yes
8/12/2003	213	2.459	87.3	2.825E+03	7.273E+02	2.984E+03	Yes
8/22/2000	210.48	0.087	98.3	9.853E+01	2.536E+01	1.053E+02	Yes
12/16/2003	208	24.107	49.5	2.705E+04	6.963E+03	2.926E+04	Yes
8/17/2004	204	3.713	83	4.085E+03	1.052E+03	4.506E+03	Yes
4/18/2006	203	1.543	91.5	1.689E+03	4.349E+02	1.872E+03	Yes
11/19/2001	201.8	12.536	64.4	1.364E+04	3.513E+03	1.521E+04	Yes
11/29/2005	200	18.322	55.8	1.976E+04	5.088E+03	2.224E+04	Yes
6/27/2006	198	4.388	81	4.686E+03	1.206E+03	5.325E+03	Yes
3/25/2003	197	130.179	20.9	1.383E+05	3.561E+04	1.580E+05	Yes
11/13/2006	196	2.314	88	2.447E+03	6.299E+02	2.809E+03	Yes
8/16/1994	193	3.857	82.7	4.015E+03	1.034E+03	4.681E+03	Yes
8/29/2006	193	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
10/14/2003	192	1.205	93.1	1.248E+03	3.214E+02	1.463E+03	Yes
2/5/1991	191	39.054	38.8	4.023E+04	1.036E+04	4.740E+04	Yes
12/20/1999	187	12.536	64.4	1.264E+04	3.255E+03	1.521E+04	Yes
5/23/2005	187	10.125	68.5	1.021E+04	2.629E+03	1.229E+04	Yes
11/7/2000	183.4	9.161	70.4	9.062E+03	2.333E+03	1.112E+04	Yes
10/26/1993	183	13.982	61.7	1.380E+04	3.553E+03	1.697E+04	Yes
3/12/1996	179	21.697	51.9	2.095E+04	5.393E+03	2.633E+04	Yes
10/17/2000	177.9	0.092	98.2	8.790E+01	2.263E+01	1.112E+02	Yes
5/20/2003	175	109.447	23	1.033E+05	2.660E+04	1.328E+05	Yes
1/20/2004	175	19.768	54	1.866E+04	4.804E+03	2.399E+04	Yes
9/27/2005	169	5.786	78	5.274E+03	1.358E+03	7.022E+03	Yes
7/25/2000	168.45	0.868	94.7	7.885E+02	2.030E+02	1.053E+03	Yes
12/3/2002	168	15.911	58.9	1.442E+04	3.712E+03	1.931E+04	Yes
9/23/2003	165	2.363	87.8	2.103E+03	5.413E+02	2.867E+03	Yes
5/23/1995	162	24.107	49.5	2.106E+04	5.423E+03	2.926E+04	Yes
12/18/1995	162	103.661	23.6	9.058E+04	2.332E+04	1.258E+05	Yes
11/22/1999	161.64	12.536	64.4	1.093E+04	2.814E+03	1.521E+04	Yes
4/15/2003	160.38	34.714	41.2	3.003E+04	7.731E+03	4.213E+04	Yes
10/19/1999	160	3.134	84.8	2.705E+03	6.963E+02	3.803E+03	Yes
5/30/2000	159	94.983	25	8.146E+04	2.097E+04	1.153E+05	Yes
7/23/2002	159	10.607	67.7	9.097E+03	2.342E+03	1.287E+04	Yes
1/30/1996	157	29.411	44.7	2.491E+04	6.412E+03	3.569E+04	Yes
9/27/1994	156	1.591	91.3	1.339E+03	3.447E+02	1.931E+03	Yes
7/26/2005	154	0.270	97.1	2.243E+02	5.774E+01	3.277E+02	Yes
3/12/1991	153	42.911	37.2	3.541E+04	9.116E+03	5.208E+04	Yes
8/17/1999	153	0.627	95.7	5.173E+02	1.332E+02	7.607E+02	Yes
9/21/1993	149	0.964	94.3	7.750E+02	1.995E+02	1.170E+03	Yes
10/23/2001	148.95	5.304	79.2	4.261E+03	1.097E+03	6.436E+03	Yes
2/29/2000	148	68.465	29.6	5.465E+04	1.407E+04	8.309E+04	Yes
10/17/1995	147	6.750	75.7	5.352E+03	1.378E+03	8.192E+03	Yes
5/11/2004	147	17.839	56.4	1.414E+04	3.641E+03	2.165E+04	Yes

TMDLs for Cl, SO4, and TDS in Bayou de L'Outre Watershed, Arkansas

Table E-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
1/25/2000	146.96	10.125	68.5	8.026E+03	2.066E+03	1.229E+04	Yes
2/14/2006	144	86.304	26.3	6.703E+04	1.726E+04	1.047E+05	Yes
1/14/2002	142.38	33.268	42.1	2.555E+04	6.577E+03	4.037E+04	Yes
9/29/1992	142	9.161	70.4	7.016E+03	1.806E+03	1.112E+04	Yes
2/20/1996	142	38.090	39.3	2.917E+04	7.510E+03	4.623E+04	Yes
11/16/1998	142	72.804	28.7	5.576E+04	1.436E+04	8.835E+04	Yes
1/17/2006	142	65.572	30.2	5.022E+04	1.293E+04	7.958E+04	Yes
10/28/1997	139	42.429	37.3	3.181E+04	8.189E+03	5.149E+04	Yes
4/23/2002	139	17.357	57.1	1.301E+04	3.350E+03	2.106E+04	Yes
5/16/2006	139	2.555	86.9	1.916E+03	4.932E+02	3.101E+03	Yes
9/19/1995	137	1.929	89.8	1.425E+03	3.669E+02	2.341E+03	Yes
6/18/1996	137	14.947	60.3	1.104E+04	2.843E+03	1.814E+04	Yes
6/9/1998	137	12.536	64.4	9.263E+03	2.385E+03	1.521E+04	Yes
9/30/1997	136.5	1.446	91.9	1.065E+03	2.742E+02	1.755E+03	Yes
5/5/1992	133	33.268	42.1	2.387E+04	6.144E+03	4.037E+04	Yes
4/18/1994	131	142.715	19.4	1.008E+05	2.596E+04	1.732E+05	Yes
9/29/1998	130	10.125	68.5	7.100E+03	1.828E+03	1.229E+04	Yes
5/25/1999	130	14.464	61	1.014E+04	2.611E+03	1.755E+04	Yes
5/21/1996	129.3	2.555	86.9	1.782E+03	4.588E+02	3.101E+03	Yes
12/15/1997	128.833	23.625	50	1.642E+04	4.226E+03	2.867E+04	Yes
9/1/1992	128	5.304	79.2	3.662E+03	9.426E+02	6.436E+03	Yes
6/20/1995	127	8.679	71.4	5.945E+03	1.530E+03	1.053E+04	Yes
6/27/2000	127	10.125	68.5	6.936E+03	1.786E+03	1.229E+04	Yes
8/4/1992	126	30.375	44	2.064E+04	5.314E+03	3.686E+04	Yes
2/14/1995	126	39.054	38.8	2.654E+04	6.833E+03	4.740E+04	Yes
9/10/1996	126	7.714	73.5	5.243E+03	1.350E+03	9.362E+03	Yes
10/19/2004	126	16.393	58.3	1.114E+04	2.868E+03	1.989E+04	Yes
1/9/1995	125	143.197	19.4	9.655E+04	2.485E+04	1.738E+05	Yes
6/17/2003	124	24.107	49.5	1.612E+04	4.151E+03	2.926E+04	Yes
1/21/2003	122	22.661	50.9	1.491E+04	3.839E+03	2.750E+04	Yes
11/25/1991	121	59.786	31.5	3.902E+04	1.004E+04	7.256E+04	Yes
9/1/1998	121	8.196	72.3	5.349E+03	1.377E+03	9.947E+03	Yes
9/21/1999	121	0.222	97.4	1.447E+02	3.726E+01	2.692E+02	Yes
11/19/1996	120.1	36.161	40.4	2.342E+04	6.030E+03	4.388E+04	Yes
12/1/1992	120	23.143	50.5	1.498E+04	3.856E+03	2.809E+04	Yes
11/23/1993	119	32.786	42.4	2.104E+04	5.417E+03	3.979E+04	Yes
7/17/1995	119	2.314	88	1.485E+03	3.824E+02	2.809E+03	Yes
8/11/1998	119	9.161	70.4	5.880E+03	1.514E+03	1.112E+04	Yes
6/2/1992	118	127.286	21.2	8.101E+04	2.086E+04	1.545E+05	Yes
4/26/2005	118	17.357	57.1	1.105E+04	2.844E+03	2.106E+04	Yes
7/20/2004	117	8.679	71.4	5.477E+03	1.410E+03	1.053E+04	Yes
4/7/1992	116	49.179	34.6	3.077E+04	7.921E+03	5.968E+04	Yes
4/14/1998	115.371	30.375	44	1.890E+04	4.866E+03	3.686E+04	Yes
8/8/1995	115.182	10.125	68.5	6.290E+03	1.619E+03	1.229E+04	Yes
5/19/1998	114	10.607	67.7	6.522E+03	1.679E+03	1.287E+04	Yes
7/27/1999	112	7.714	73.5	4.660E+03	1.200E+03	9.362E+03	Yes
4/24/2000	111	12.054	65.3	7.217E+03	1.858E+03	1.463E+04	Yes
7/16/1996	110.888	22.661	50.9	1.355E+04	3.489E+03	2.750E+04	Yes
4/27/1999	110.31	29.411	44.7	1.750E+04	4.505E+03	3.569E+04	Yes
4/23/1996	110.259	96.911	24.7	5.763E+04	1.484E+04	1.176E+05	Yes
4/2/1991	110	339.913	7	2.017E+05	5.192E+04	4.125E+05	Yes
1/7/1992	109	47.250	35.4	2.778E+04	7.151E+03	5.734E+04	Yes
10/24/1994	109	183.215	15.8	1.077E+05	2.773E+04	2.224E+05	Yes
2/26/2002	109	69.429	29.4	4.082E+04	1.051E+04	8.426E+04	Yes
8/6/1996	107.929	177.430	16.2	1.033E+05	2.659E+04	2.153E+05	Yes
5/18/1993	107	25.554	48	1.475E+04	3.797E+03	3.101E+04	Yes
11/5/2002	106	40.500	38.2	2.316E+04	5.961E+03	4.915E+04	Yes
12/17/1996	105.304	160.072	17.7	9.092E+04	2.341E+04	1.943E+05	Yes
6/19/2001	105.1	11.089	66.9	6.286E+03	1.618E+03	1.346E+04	Yes
2/9/1993	105	34.714	41.2	1.966E+04	5.061E+03	4.213E+04	Yes
2/23/1999	104	47.732	35.2	2.678E+04	6.893E+03	5.793E+04	Yes
7/2/1991	103	13.018	63.5	7.232E+03	1.862E+03	1.580E+04	Yes
7/7/1992	103	11.571	66.1	6.429E+03	1.655E+03	1.404E+04	Yes
8/26/1997	102.153	13.018	63.5	7.173E+03	1.847E+03	1.580E+04	Yes

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Table E-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
5/28/2002	102	9.161	70.4	5.040E+03	1.297E+03	1.112E+04	Yes
2/22/2005	101	58.340	31.9	3.178E+04	8.182E+03	7.080E+04	Yes
2/4/1992	100	67.983	29.7	3.667E+04	9.440E+03	8.250E+04	Yes
7/22/1997	95.939	6.268	76.9	3.243E+03	8.350E+02	7.607E+03	Yes
10/1/1996	95.6	383.306	5.8	1.976E+05	5.088E+04	4.652E+05	Yes
4/13/2004	94.2	134.519	20.4	6.835E+04	1.760E+04	1.633E+05	Yes
5/15/2004	93.8	257.466	10.4	1.303E+05	3.353E+04	3.125E+05	Yes
4/13/1993	91.4	256.501	10.4	1.265E+05	3.255E+04	3.113E+05	Yes
8/20/2002	91.26	13.018	63.5	6.408E+03	1.650E+03	1.580E+04	Yes
12/11/2001	90.9	133.554	20.5	6.548E+04	1.686E+04	1.621E+05	Yes
5/13/1997	84.899	26.518	47.2	1.214E+04	3.126E+03	3.218E+04	Yes
4/15/1997	84.756	68.465	29.6	3.130E+04	8.058E+03	8.309E+04	Yes
3/23/1999	84.2	64.608	30.5	2.934E+04	7.554E+03	7.841E+04	Yes
12/22/1998	82.6	189.001	15.2	8.420E+04	2.168E+04	2.294E+05	Yes
3/28/2005	79.6	88.233	26.1	3.788E+04	9.752E+03	1.071E+05	Yes
1/2/1991	75.8	245.894	11.2	1.005E+05	2.588E+04	2.984E+05	Yes
3/16/2004	73.2	85.822	26.5	3.388E+04	8.723E+03	1.042E+05	Yes
3/27/2000	72.2	42.429	37.3	1.652E+04	4.254E+03	5.149E+04	Yes
1/20/1998	71.96	123.911	21.5	4.809E+04	1.238E+04	1.504E+05	Yes
4/17/2001	71.46	342.806	6.9	1.321E+05	3.402E+04	4.160E+05	Yes
6/25/2002	70.83	6.750	75.7	2.579E+03	6.639E+02	8.192E+03	Yes
1/26/1999	68.6	318.698	7.8	1.179E+05	3.036E+04	3.868E+05	Yes
5/22/2001	68.28	41.465	37.7	1.527E+04	3.931E+03	5.032E+04	Yes
3/3/1992	68.2	178.876	16.1	6.580E+04	1.694E+04	2.171E+05	Yes
3/26/2001	66.4	163.930	17.5	5.871E+04	1.511E+04	1.989E+05	Yes
2/17/1998	65.38	270.002	9.8	9.521E+04	2.451E+04	3.277E+05	Yes
2/27/2001	62.7	163.930	17.5	5.544E+04	1.427E+04	1.989E+05	Yes
4/24/1995	62.368	525.539	3.7	1.768E+05	4.551E+04	6.378E+05	Yes
9/17/2002	57.9	3.375	84.1	1.054E+03	2.713E+02	4.096E+03	Yes
6/29/1999	55.2	315.805	7.9	9.403E+04	2.421E+04	3.833E+05	Yes
12/14/2004	55	218.412	12.9	6.479E+04	1.668E+04	2.651E+05	Yes
2/25/1997	54.446	290.734	8.8	8.538E+04	2.198E+04	3.528E+05	Yes
3/26/2002	54.27	188.037	15.3	5.504E+04	1.417E+04	2.282E+05	Yes
3/11/1997	53.619	196.233	14.6	5.675E+04	1.461E+04	2.381E+05	Yes
3/14/1994	53.6	293.627	8.7	8.489E+04	2.185E+04	3.563E+05	Yes
12/19/2000	53	366.913	6.3	1.049E+05	2.700E+04	4.453E+05	Yes
1/28/1997	50.994	400.181	5.4	1.101E+05	2.834E+04	4.857E+05	Yes
12/19/1994	50.8	752.147	2	2.061E+05	5.306E+04	9.128E+05	Yes
6/21/1993	49.9	155.251	18.2	4.179E+04	1.076E+04	1.884E+05	Yes
7/21/1998	49.1	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
2/17/2004	48.5	427.181	4.9	1.117E+05	2.877E+04	5.184E+05	Yes
11/30/2004	43.3	388.127	5.7	9.065E+04	2.334E+04	4.710E+05	Yes
2/15/1994	39.6	684.647	2.4	1.462E+05	3.765E+04	8.309E+05	Yes
10/15/2002	36.4	5.786	78	1.136E+03	2.924E+02	7.022E+03	Yes
7/15/2003	35.9	15.911	58.9	3.081E+03	7.931E+02	1.931E+04	Yes
1/30/2001	33.21	282.537	9.1	5.061E+04	1.303E+04	3.429E+05	Yes
4/28/1999	29.4	29.893	44.3	4.740E+03	1.220E+03	3.628E+04	Yes
5/7/1991	29.3	949.827	1.3	1.501E+05	3.864E+04	1.153E+06	Yes
3/17/1998	26.75	378.966	6	5.468E+04	1.408E+04	4.599E+05	Yes
10/24/2006	23.1	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
2/25/2003	21.8	1104.113	1	1.298E+05	3.342E+04	1.340E+06	Yes
12/27/2005	10.8	17.839	56.4	1.039E+03	2.675E+02	2.165E+04	Yes
9/18/2000	8.06	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
9/26/2006	4.95	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes

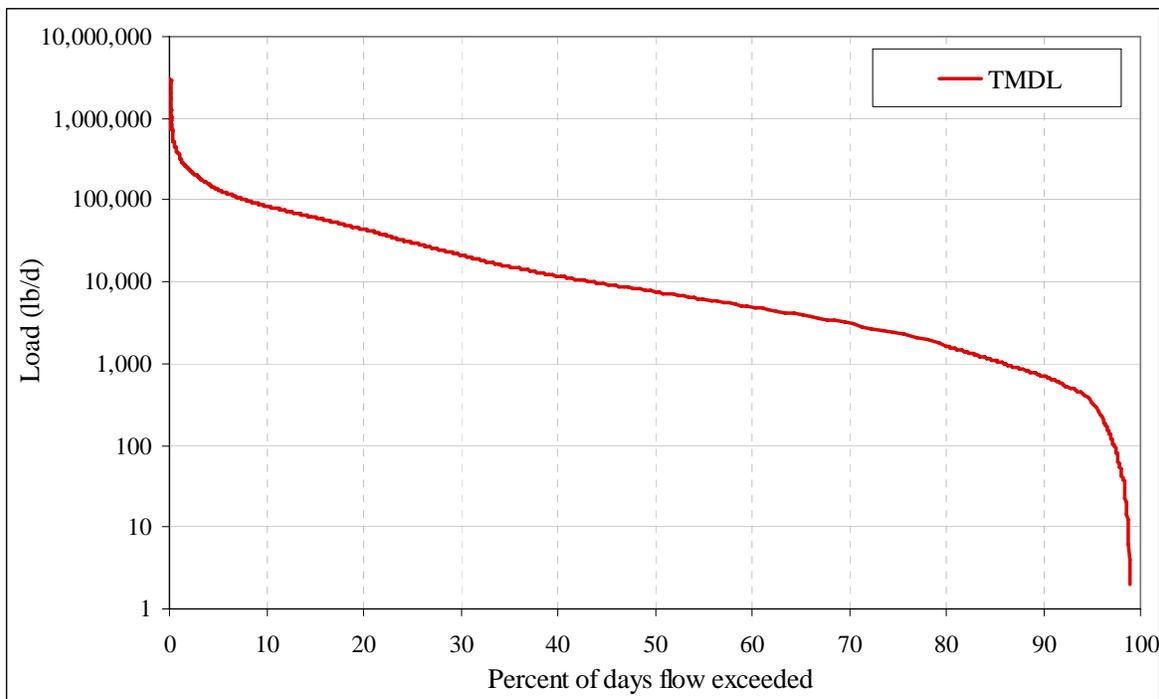


Figure E-2. Chloride load duration curve for Bayou De L'Outre (HUC-reach 08040202-007)

Table E-3. Allowable Chloride load for Bayou De L'Outre (HUC-reach 08040202-007)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						34,225.55
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/29/58	11000	0.1	1,250.46	0.00	1,686,175.00	0.00
04/28/91	11400	0.1	1,295.93	0.00	1,747,490.46	0.00
04/30/91	13800	0.1	1,568.76	0.00	2,115,383.18	0.00
04/27/58	18200	0.1	2,068.94	0.00	2,789,853.18	0.00
06/09/74	19100	0.1	2,171.25	0.00	2,927,812.96	0.00
04/29/91	19300	0.1	2,193.99	0.10	2,958,470.68	2,958.47
04/28/58	20000	0	2,273.56	0.00	3,065,772.73	0.00

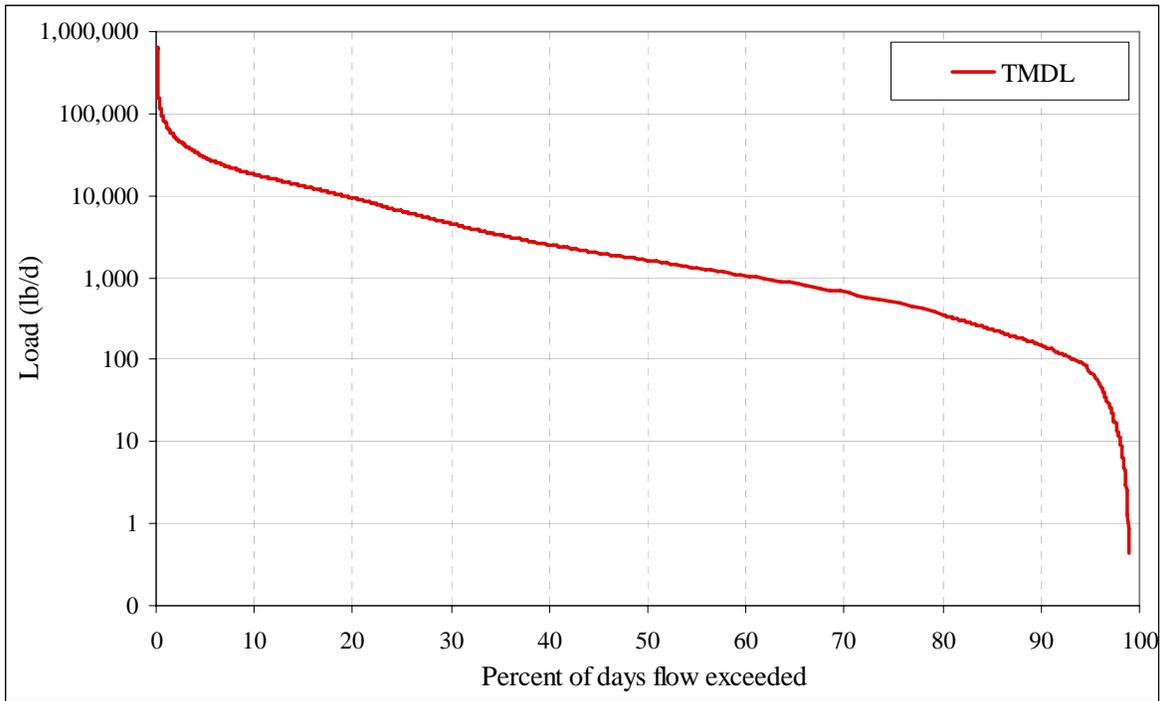


Figure E-3. Chloride load duration curve for Bayou De L'Outre (HUC-reach 08040202-008)

Table E-4. Allowable Chloride load for Bayou De L'Outre (HUC-reach 08040202-008)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						7,325.45
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/15/91	8840	0.1	298.73	0.00	290,031.90	0.00
04/29/58	11000	0.1	371.72	0.00	360,899.42	0.00
04/28/91	11400	0.1	385.24	0.00	374,023.03	0.00
04/30/91	13800	0.1	466.34	0.00	452,764.72	0.00
04/27/58	18200	0.1	615.03	0.00	597,124.49	0.00
06/09/74	19100	0.1	645.45	0.00	626,652.63	0.00
04/29/91	19300	0.1	652.21	0.10	633,214.43	633.21
04/28/58	20000	0	675.86	0.00	656,180.76	0.00

Appendix F

Load Duration Curve Summaries and Plots for Sulfate

Figure F-1. Sulfate load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	2
Figure F-2. Sulfate load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-007).....	6
Figure F-3. Sulfate load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-008).....	6
Table F-1. Allowable Sulfate load for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	2
Table F-2. Existing load for Sulfate for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	3
Table F-3. Allowable Sulfate load for Bayou De L'Outre (HUC-reach 08040202-007).....	6
Table F-4. Allowable Sulfate load for Bayou De L'Outre (HUC-reach 08040202-008).....	7

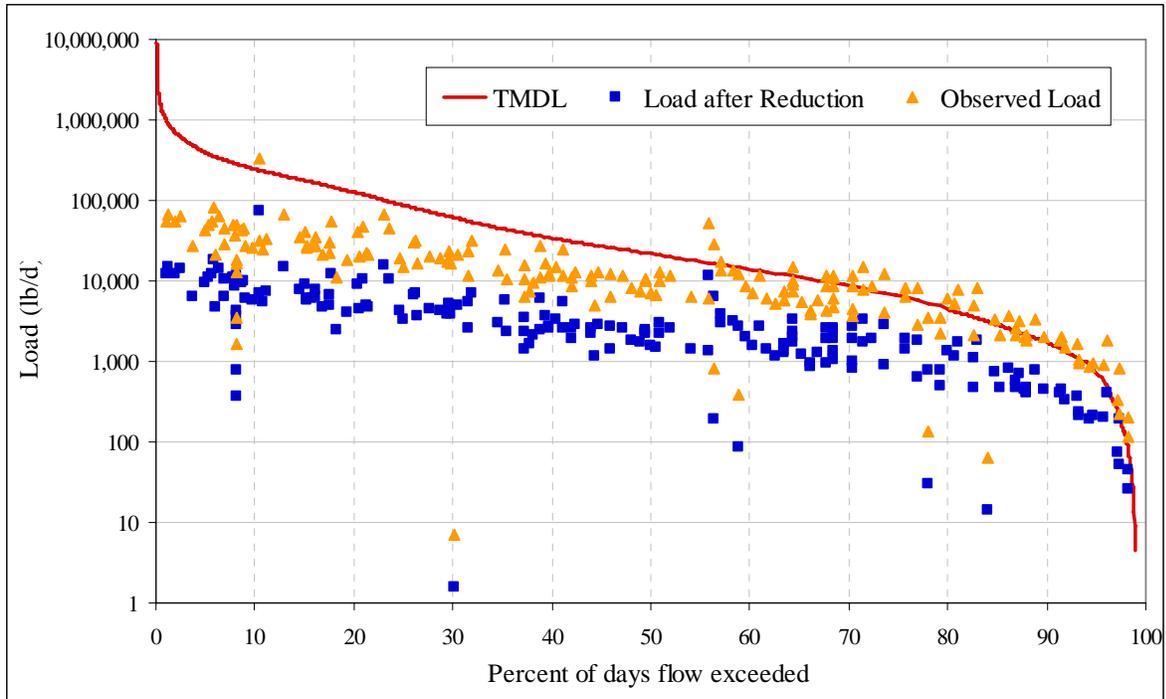


Figure F-1. Sulfate load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Table F-1. Allowable Sulfate load for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						99,290.5
8/18/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/19/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/20/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/21/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/22/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/23/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/24/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/25/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
For brevity, most of the cells in this spreadsheet have been hidden						
5/1/1991	7180	0.100	3461.805	0.00	3192946.7108	0.00E+00
4/26/1958	8060	0.100	3886.093	0.00	3584282.7980	0.00E+00
4/6/1997	8210	0.100	3958.415	0.00	3650987.8128	0.00E+00
4/15/1991	8840	0.100	4262.167	0.00	3931148.8752	0.00E+00
4/29/1958	11000	0.100	5303.602	0.00	4891701.0890	0.00E+00
4/28/1991	11400	0.100	5496.460	0.00	5069581.1286	0.00E+00
4/30/1991	13800	0.100	6653.609	0.00	6136861.3662	0.00E+00
4/27/1958	18200	0.100	8775.050	0.00	8093541.8018	0.00E+00
6/9/1974	19100	0.100	9208.981	0.00	8493771.8909	0.00E+00
4/29/1991	19300	0.100	9305.410	0.10	8582711.9107	8.58E+03
4/28/1958	20000	0.000	9642.912	0.00	8894001.9800	0.00E+00

Table F-2. Existing load for Sulfate for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
9/21/2004	686	0.227	97.4	8.385E+02	1.881E+02	1.881E+02	Yes
10/25/2005	630	0.530	96.1	1.802E+03	4.043E+02	4.403E+02	Yes
11/29/2005	529	18.322	55.8	5.228E+04	1.173E+04	1.521E+04	Yes
7/25/2006	506	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
8/22/2000	420.12	0.087	98.3	1.967E+02	4.412E+01	7.204E+01	Yes
8/17/2004	411	3.713	83	8.230E+03	1.846E+03	3.082E+03	Yes
8/14/2006	378	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
6/27/2006	322	4.388	81	7.620E+03	1.710E+03	3.642E+03	Yes
7/20/2004	312	8.679	71.4	1.460E+04	3.277E+03	7.204E+03	Yes
7/27/1999	301	7.714	73.5	1.252E+04	2.810E+03	6.404E+03	Yes
11/11/2003	296	2.121	88.9	3.387E+03	7.599E+02	1.761E+03	Yes
5/11/2004	294	17.839	56.4	2.829E+04	6.347E+03	1.481E+04	Yes
8/17/1999	268	0.627	95.7	9.060E+02	2.033E+02	5.203E+02	Yes
8/29/2006	265	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
10/14/2003	254	1.205	93.1	1.651E+03	3.705E+02	1.001E+03	Yes
11/28/2006	250	2.748	86.2	3.706E+03	8.314E+02	2.281E+03	Yes
11/7/2000	239.92	9.161	70.4	1.185E+04	2.660E+03	7.604E+03	Yes
7/22/1997	239	6.268	76.9	8.080E+03	1.813E+03	5.203E+03	Yes
8/12/2003	238	2.459	87.3	3.157E+03	7.082E+02	2.041E+03	Yes
5/15/2004	238	257.466	10.4	3.305E+05	7.415E+04	2.137E+05	Yes
4/18/2006	238	1.543	91.5	1.981E+03	4.443E+02	1.281E+03	Yes
8/20/2001	237.8	3.857	82.7	4.947E+03	1.110E+03	3.202E+03	Yes
7/26/2005	232	0.270	97.1	3.379E+02	7.580E+01	2.241E+02	Yes
10/17/2000	230.5	0.092	98.2	1.139E+02	2.555E+01	7.604E+01	Yes
10/17/1995	230	6.750	75.7	8.374E+03	1.879E+03	5.603E+03	Yes
12/5/2006	230	4.821	80	5.981E+03	1.342E+03	4.002E+03	Yes
11/22/1999	216.04	12.536	64.4	1.461E+04	3.277E+03	1.041E+04	Yes
11/13/1995	215	4.484	80.7	5.200E+03	1.167E+03	3.722E+03	Yes
9/27/1994	213	1.591	91.3	1.828E+03	4.101E+02	1.321E+03	Yes
5/23/2005	210	10.125	68.5	1.147E+04	2.573E+03	8.405E+03	Yes
8/8/1995	204	10.125	68.5	1.114E+04	2.499E+03	8.405E+03	Yes
5/19/1998	204	10.607	67.7	1.167E+04	2.618E+03	8.805E+03	Yes
7/25/2000	201.1	0.868	94.7	9.414E+02	2.112E+02	7.204E+02	Yes
10/19/1999	195	3.134	84.8	3.296E+03	7.395E+02	2.601E+03	Yes
9/19/1995	193	1.929	89.8	2.008E+03	4.504E+02	1.601E+03	Yes
9/1/1998	191	8.196	72.3	8.444E+03	1.894E+03	6.804E+03	Yes
9/30/1997	190.2	1.446	91.9	1.484E+03	3.329E+02	1.201E+03	Yes
9/21/1999	190	0.222	97.4	2.273E+02	5.099E+01	1.841E+02	Yes
5/16/2006	188	2.555	86.9	2.591E+03	5.813E+02	2.121E+03	Yes
4/26/2005	183	17.357	57.1	1.713E+04	3.844E+03	1.441E+04	Yes
8/11/1998	175.8	9.161	70.4	8.686E+03	1.949E+03	7.604E+03	Yes
3/13/2007	175	3.664	8.1	3.459E+03	7.760E+02	3.042E+03	Yes
6/25/2002	170.73	6.750	75.7	6.216E+03	1.395E+03	5.603E+03	Yes
7/17/1995	170	2.314	88	2.122E+03	4.761E+02	1.921E+03	Yes
9/4/1990	165	1.157	93.3	1.030E+03	2.310E+02	9.606E+02	Yes
6/20/1995	164	8.679	71.4	7.677E+03	1.722E+03	7.204E+03	Yes
9/21/1993	163	0.964	94.3	8.478E+02	1.902E+02	8.005E+02	Yes
9/29/1998	158	10.125	68.5	8.629E+03	1.936E+03	8.405E+03	Yes
9/23/2003	158	2.363	87.8	2.013E+03	4.517E+02	1.961E+03	Yes
10/19/2004	156	16.393	58.3	1.379E+04	3.094E+03	1.361E+04	Yes
9/17/2001	155	1.157	93.3	9.674E+02	2.170E+02	9.606E+02	Yes
5/21/1996	152.4	2.555	86.9	2.101E+03	4.712E+02	2.121E+03	Yes
5/25/1999	152	14.464	61	1.186E+04	2.660E+03	1.201E+04	Yes
11/19/2001	151	12.536	64.4	1.021E+04	2.291E+03	1.041E+04	Yes
7/23/2002	151	10.607	67.7	8.639E+03	1.938E+03	8.805E+03	Yes
11/13/2006	147	2.314	88	1.835E+03	4.117E+02	1.921E+03	Yes
4/23/2002	143	17.357	57.1	1.339E+04	3.003E+03	1.441E+04	Yes
12/3/2002	143	15.911	58.9	1.227E+04	2.753E+03	1.321E+04	Yes
7/26/1993	133	2.989	85.3	2.144E+03	4.811E+02	2.481E+03	Yes
12/20/1999	131.24	12.536	64.4	8.874E+03	1.991E+03	1.041E+04	Yes
4/15/2003	131	34.714	41.2	2.453E+04	5.503E+03	2.882E+04	Yes
2/14/1995	130	39.054	38.8	2.738E+04	6.143E+03	3.242E+04	Yes
7/21/1998	124	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
2/12/2007	124	24.107	8.1	1.612E+04	3.617E+03	2.001E+04	Yes

Table F-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
10/23/2001	120.77	5.304	79.2	3.455E+03	7.751E+02	4.403E+03	Yes
5/20/2003	116	109.447	23	6.848E+04	1.536E+04	9.085E+04	Yes
1/25/2000	112.48	10.125	68.5	6.143E+03	1.378E+03	8.405E+03	Yes
6/9/1998	112	12.536	64.4	7.573E+03	1.699E+03	1.041E+04	Yes
9/27/2005	110	5.786	78	3.433E+03	7.701E+02	4.803E+03	Yes
2/6/2007	109	21.697	8.1	1.276E+04	2.862E+03	1.801E+04	Yes
8/20/2002	107.02	13.018	63.5	7.514E+03	1.686E+03	1.081E+04	Yes
1/21/2003	107	22.661	50.9	1.308E+04	2.934E+03	1.881E+04	Yes
10/27/1992	106	15.429	59.5	8.821E+03	1.979E+03	1.281E+04	Yes
8/16/1994	101	3.857	82.7	2.101E+03	4.714E+02	3.202E+03	Yes
2/22/2005	99.4	58.340	31.9	3.128E+04	7.017E+03	4.843E+04	Yes
2/23/1999	97.5	47.732	35.2	2.510E+04	5.632E+03	3.962E+04	Yes
3/12/1996	96.9	21.697	51.9	1.134E+04	2.544E+03	1.801E+04	Yes
9/10/1996	96.8	7.714	73.5	4.028E+03	9.036E+02	6.404E+03	Yes
6/19/2001	95.24	11.089	66.9	5.697E+03	1.278E+03	9.205E+03	Yes
9/29/1992	91.1	9.161	70.4	4.501E+03	1.010E+03	7.604E+03	Yes
6/18/1996	86.2	14.947	60.3	6.949E+03	1.559E+03	1.241E+04	Yes
6/27/2000	85.7	10.125	68.5	4.680E+03	1.050E+03	8.405E+03	Yes
8/6/1991	85	6.268	76.9	2.874E+03	6.447E+02	5.203E+03	Yes
7/2/1991	84	13.018	63.5	5.898E+03	1.323E+03	1.081E+04	Yes
4/24/2000	83.6	12.054	65.3	5.435E+03	1.219E+03	1.001E+04	Yes
12/16/2003	82.6	24.107	49.5	1.074E+04	2.410E+03	2.001E+04	Yes
5/13/1997	82.3	26.518	47.2	1.177E+04	2.641E+03	2.201E+04	Yes
10/26/1993	82	13.982	61.7	6.184E+03	1.387E+03	1.161E+04	Yes
12/18/1995	82	103.661	23.6	4.585E+04	1.029E+04	8.605E+04	Yes
8/26/1997	81.641	13.018	63.5	5.732E+03	1.286E+03	1.081E+04	Yes
2/20/1996	80.6	38.090	39.3	1.656E+04	3.715E+03	3.162E+04	Yes
6/17/2003	80.3	24.107	49.5	1.044E+04	2.342E+03	2.001E+04	Yes
6/4/1991	80	27.964	45.9	1.207E+04	2.707E+03	2.321E+04	Yes
7/16/1996	80	22.661	50.9	9.778E+03	2.194E+03	1.881E+04	Yes
1/30/1996	79.7	29.411	44.7	1.264E+04	2.836E+03	2.441E+04	Yes
4/23/2007	79.7	3.905	8.1	1.679E+03	3.766E+02	3.242E+03	Yes
11/19/1996	77.3	36.161	40.4	1.508E+04	3.382E+03	3.002E+04	Yes
9/1/1992	76.6	5.304	79.2	2.191E+03	4.916E+02	4.403E+03	Yes
5/23/1995	75.7	24.107	49.5	9.843E+03	2.208E+03	2.001E+04	Yes
5/28/2002	75.65	9.161	70.4	3.738E+03	8.386E+02	7.604E+03	Yes
3/28/1995	74.1	59.786	31.5	2.390E+04	5.361E+03	4.963E+04	Yes
10/30/1990	73	10.607	67.7	4.177E+03	9.370E+02	8.805E+03	Yes
11/23/1993	71.8	32.786	42.4	1.270E+04	2.849E+03	2.722E+04	Yes
4/14/1998	71.522	30.375	44	1.172E+04	2.629E+03	2.521E+04	Yes
6/28/1994	70	13.500	62.6	5.097E+03	1.144E+03	1.121E+04	Yes
2/14/2006	68.9	86.304	26.3	3.207E+04	7.195E+03	7.164E+04	Yes
7/7/1992	67.2	11.571	66.1	4.194E+03	9.409E+02	9.606E+03	Yes
10/28/1997	67.2	42.429	37.3	1.538E+04	3.450E+03	3.522E+04	Yes
3/25/2003	66.6	130.179	20.9	4.676E+04	1.049E+04	1.081E+05	Yes
12/17/1996	64.6	160.072	17.7	5.578E+04	1.251E+04	1.329E+05	Yes
7/19/1994	63	11.571	66.1	3.932E+03	8.821E+02	9.606E+03	Yes
1/14/2002	62.95	33.268	42.1	1.130E+04	2.534E+03	2.762E+04	Yes
2/29/2000	62.6	68.465	29.6	2.312E+04	5.186E+03	5.683E+04	Yes
3/28/2005	62.4	88.233	26.1	2.970E+04	6.662E+03	7.324E+04	Yes
2/9/1993	62.3	34.714	41.2	1.167E+04	2.617E+03	2.882E+04	Yes
11/28/1994	62.1	37.125	39.8	1.244E+04	2.790E+03	3.082E+04	Yes
3/23/1999	62.1	64.608	30.5	2.164E+04	4.855E+03	5.363E+04	Yes
5/23/1994	61.3	18.322	55.8	6.058E+03	1.359E+03	1.521E+04	Yes
8/4/1992	61	30.375	44	9.994E+03	2.242E+03	2.521E+04	Yes
1/20/2004	59.9	19.768	54	6.387E+03	1.433E+03	1.641E+04	Yes
5/18/1993	58.2	25.554	48	8.022E+03	1.800E+03	2.121E+04	Yes
12/21/1993	58.2	37.125	39.8	1.165E+04	2.615E+03	3.082E+04	Yes
11/27/1990	57	24.589	49	7.560E+03	1.696E+03	2.041E+04	Yes
12/14/2004	56.3	218.412	12.9	6.633E+04	1.488E+04	1.813E+05	Yes
4/3/2007	55.8	61.715	8.1	1.857E+04	4.167E+03	5.123E+04	Yes
4/13/2004	55.5	134.519	20.4	4.027E+04	9.034E+03	1.117E+05	Yes
12/15/1997	54.288	23.625	50	6.918E+03	1.552E+03	1.961E+04	Yes
12/1/1992	53.1	23.143	50.5	6.628E+03	1.487E+03	1.921E+04	Yes

TMDLs for Cl, SO₄, and TDS in Bayou de L'Outre Watershed, Arkansas

Table F-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
2/5/1991	52	39.054	38.8	1.095E+04	2.457E+03	3.242E+04	Yes
4/7/1992	51	49.179	34.6	1.353E+04	3.035E+03	4.082E+04	Yes
11/16/1998	49.4	72.804	28.7	1.940E+04	4.352E+03	6.043E+04	Yes
4/15/1997	48.7	68.465	29.6	1.798E+04	4.035E+03	5.683E+04	Yes
5/5/1992	46.9	33.268	42.1	8.416E+03	1.888E+03	2.762E+04	Yes
3/9/1993	46.9	78.108	27.7	1.976E+04	4.433E+03	6.484E+04	Yes
2/26/2002	46.6	69.429	29.4	1.745E+04	3.915E+03	5.763E+04	Yes
2/4/1992	46.1	67.983	29.7	1.690E+04	3.792E+03	5.643E+04	Yes
3/12/1991	45	42.911	37.2	1.042E+04	2.337E+03	3.562E+04	Yes
11/5/2002	44.1	40.500	38.2	9.634E+03	2.161E+03	3.362E+04	Yes
11/18/1997	41.724	27.964	45.9	6.293E+03	1.412E+03	2.321E+04	Yes
1/7/1992	41.3	47.250	35.4	1.053E+04	2.361E+03	3.922E+04	Yes
10/1/1996	39.6	383.306	5.8	8.187E+04	1.837E+04	3.182E+05	Yes
6/10/1997	39.5	192.376	15	4.099E+04	9.195E+03	1.597E+05	Yes
4/23/1996	37.1	96.911	24.7	1.939E+04	4.351E+03	8.045E+04	Yes
11/25/1991	36.5	59.786	31.5	1.177E+04	2.641E+03	4.963E+04	Yes
3/16/2004	35.6	85.822	26.5	1.648E+04	3.697E+03	7.124E+04	Yes
3/3/1992	35.4	178.876	16.1	3.415E+04	7.662E+03	1.485E+05	Yes
3/26/2001	33.72	163.930	17.5	2.982E+04	6.689E+03	1.361E+05	Yes
6/2/1992	32.9	127.286	21.2	2.259E+04	5.067E+03	1.057E+05	Yes
5/22/2001	32.8	41.465	37.7	7.336E+03	1.646E+03	3.442E+04	Yes
3/11/1997	32.7	196.233	14.6	3.461E+04	7.765E+03	1.629E+05	Yes
12/19/2000	32.3	366.913	6.3	6.392E+04	1.434E+04	3.046E+05	Yes
1/20/1998	31.455	123.911	21.5	2.102E+04	4.716E+03	1.029E+05	Yes
4/28/1999	31.4	29.893	44.3	5.063E+03	1.136E+03	2.481E+04	Yes
1/2/2007	29.7	315.805	8.1	5.059E+04	1.135E+04	2.622E+05	Yes
8/6/1996	29	177.430	16.2	2.775E+04	6.226E+03	1.473E+05	Yes
1/26/1999	28.8	318.698	7.8	4.951E+04	1.111E+04	2.646E+05	Yes
5/30/2000	28.6	94.983	25	1.465E+04	3.287E+03	7.885E+04	Yes
2/25/1997	28	290.734	8.8	4.391E+04	9.851E+03	2.413E+05	Yes
3/27/2000	27.5	42.429	37.3	6.293E+03	1.412E+03	3.522E+04	Yes
12/11/2001	27.37	133.554	20.5	1.972E+04	4.423E+03	1.109E+05	Yes
3/14/1994	27.3	293.627	8.7	4.324E+04	9.700E+03	2.437E+05	Yes
10/24/1994	27.1	183.215	15.8	2.678E+04	6.008E+03	1.521E+05	Yes
3/26/2002	26.2	188.037	15.3	2.657E+04	5.961E+03	1.561E+05	Yes
11/30/2004	26.1	388.127	5.7	5.464E+04	1.226E+04	3.222E+05	Yes
2/27/2001	25.05	163.930	17.5	2.215E+04	4.969E+03	1.361E+05	Yes
1/2/1991	25	245.894	11.2	3.316E+04	7.439E+03	2.041E+05	Yes
4/2/1991	25	339.913	7	4.584E+04	1.028E+04	2.822E+05	Yes
12/22/1998	25	189.001	15.2	2.549E+04	5.718E+03	1.569E+05	Yes
4/18/1994	23.3	142.715	19.4	1.794E+04	4.024E+03	1.185E+05	Yes
1/28/1997	23.1	400.181	5.4	4.986E+04	1.119E+04	3.322E+05	Yes
4/13/1993	22.9	256.501	10.4	3.168E+04	7.108E+03	2.129E+05	Yes
1/18/1994	22.6	171.162	16.8	2.086E+04	4.681E+03	1.421E+05	Yes
6/29/1999	22	315.805	7.9	3.747E+04	8.407E+03	2.622E+05	Yes
2/17/2004	18.8	427.181	4.9	4.332E+04	9.718E+03	3.546E+05	Yes
1/12/1993	18.1	250.716	10.8	2.448E+04	5.491E+03	2.081E+05	Yes
2/17/1998	17.768	270.002	9.8	2.588E+04	5.805E+03	2.241E+05	Yes
1/30/2001	17.65	282.537	9.1	2.690E+04	6.034E+03	2.345E+05	Yes
2/15/1994	16.9	684.647	2.4	6.241E+04	1.400E+04	5.683E+05	Yes
4/17/2001	15.31	342.806	6.9	2.831E+04	6.351E+03	2.846E+05	Yes
6/21/1993	13.2	155.251	18.2	1.105E+04	2.480E+03	1.289E+05	Yes
12/19/1994	13.2	752.147	2	5.355E+04	1.201E+04	6.244E+05	Yes
5/7/1991	13	949.827	1.3	6.660E+04	1.494E+04	7.885E+05	Yes
3/17/1998	10.26	378.966	6	2.097E+04	4.705E+03	3.146E+05	Yes
4/24/1995	9.8	525.539	3.7	2.778E+04	6.232E+03	4.363E+05	Yes
2/25/2003	9.23	1104.113	1	5.497E+04	1.233E+04	9.165E+05	Yes
12/27/2005	8.72	17.839	56.4	8.391E+02	1.882E+02	1.481E+04	Yes
9/26/2006	8.33	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
9/18/2000	6.68	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
7/15/2003	4.48	15.911	58.9	3.845E+02	8.625E+01	1.321E+04	Yes
10/15/2002	4.37	5.786	78	1.364E+02	3.059E+01	4.803E+03	Yes
9/17/2002	3.46	3.375	84.1	6.299E+01	1.413E+01	2.802E+03	Yes
1/17/2006	0.02	65.572	30.2	7.074E+00	1.587E+00	5.443E+04	Yes

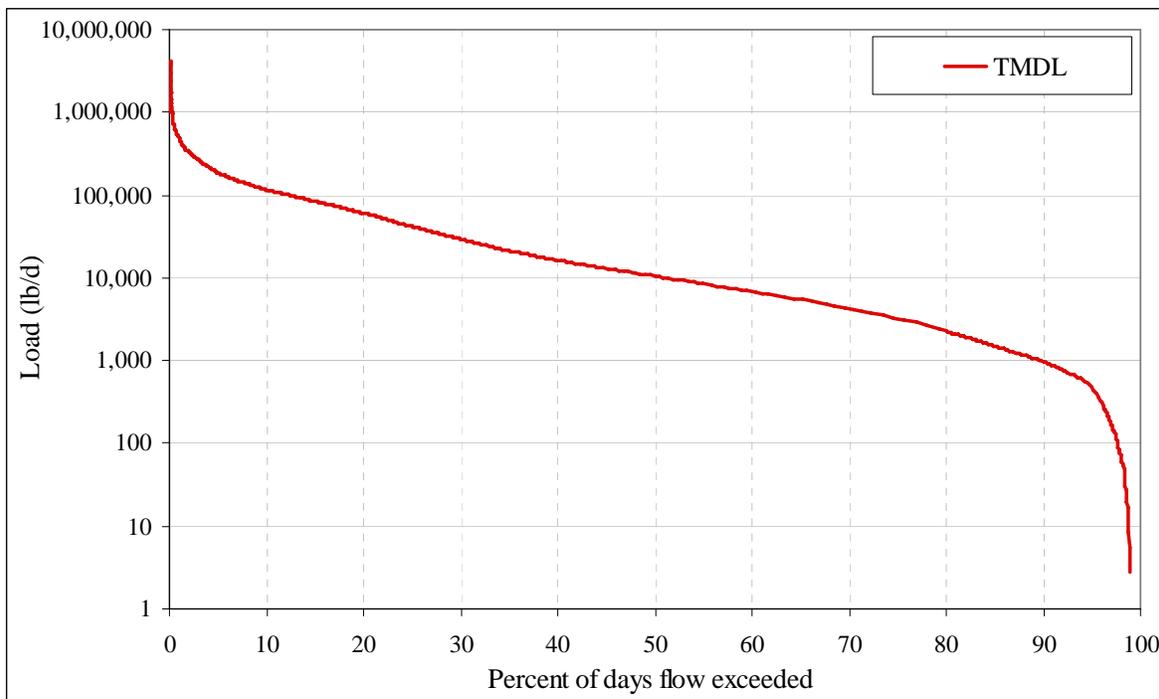


Figure F-2. Sulfate load duration curve for Bayou De L'Outre (HUC-reach 08040202-007)

Table F-3. Allowable Sulfate load for Bayou De L'Outre (HUC-reach 08040202-007)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						47,231.26
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/28/91	11400	0.1	1,295.93	0.00	2,411,536.83	0.00
04/30/91	13800	0.1	1,568.76	0.00	2,919,228.79	0.00
04/27/58	18200	0.1	2,068.94	0.00	3,849,997.39	0.00
06/09/74	19100	0.1	2,171.25	0.00	4,040,381.88	0.00
04/29/91	19300	0.1	2,193.99	0.10	4,082,689.54	4,082.69
04/28/58	20000	0	2,273.56	0.00	4,230,766.37	0.00

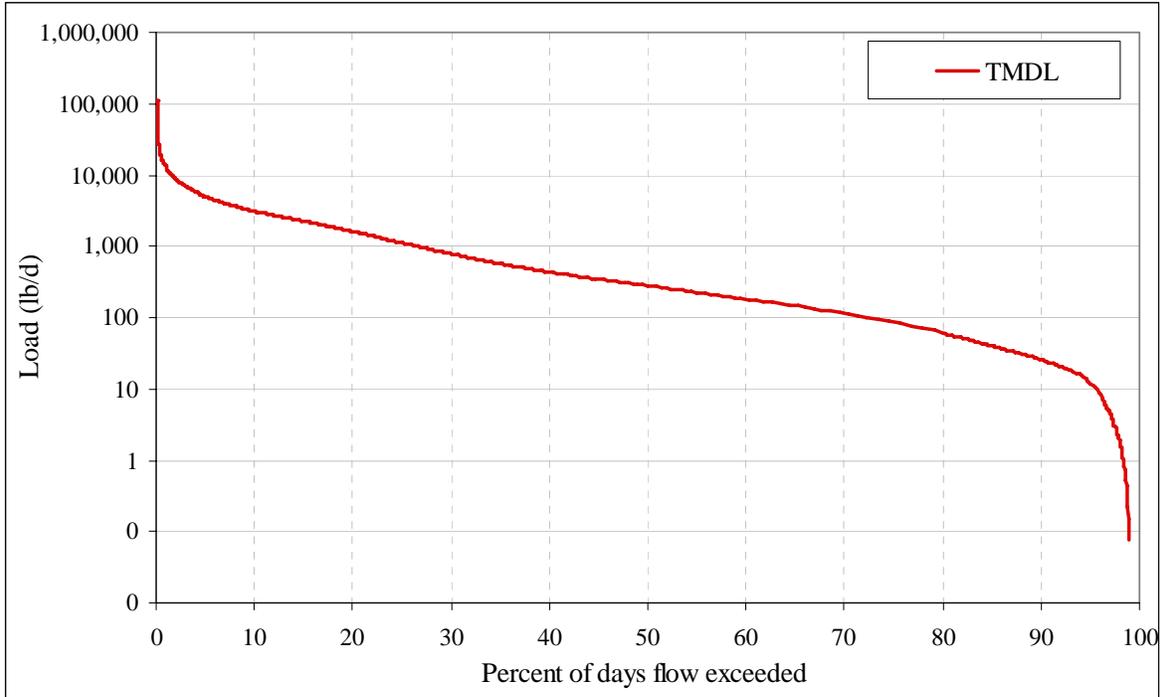


Figure F-3. Sulfate load duration curve for Bayou De L'Outre (HUC-reach 08040202-008)

Table F-4. Allowable Sulfate load for Bayou De L'Outre (HUC-reach 08040202-008)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						1,261.60
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/06/97	8210	0.1	277.44	0.00	46,390.16	0.00
04/15/91	8840	0.1	298.73	0.00	49,949.94	0.00
04/29/58	11000	0.1	371.72	0.00	62,154.90	0.00
04/28/91	11400	0.1	385.24	0.00	64,415.08	0.00
04/30/91	13800	0.1	466.34	0.00	77,976.15	0.00
04/27/58	18200	0.1	615.03	0.00	102,838.11	0.00
06/09/74	19100	0.1	645.45	0.00	107,923.51	0.00
04/29/91	19300	0.1	652.21	0.10	109,053.60	109.05
04/28/58	20000	0	675.86	0.00	113,008.91	0.00

Appendix G

Load Duration Curve Summaries and Plots for TDS

Figure G-1. TDS load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	2
Figure G-2. TDS load duration curve for Bayou De L'Outre (HUC-reach 08040202-007)	6
Figure G-3. TDS load duration curve for Bayou De L'Outre (HUC-reach 08040202-008)	7
Table G-1. Allowable TDS load for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	2
Table G-2. Existing load for TDS for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006).....	3
Table G-3. Allowable TDS load for Bayou De L'Outre (HUC-reach 08040202-007)	6
Table G-4. Allowable TDS load for Bayou De L'Outre (HUC-reach 08040202-008)	7

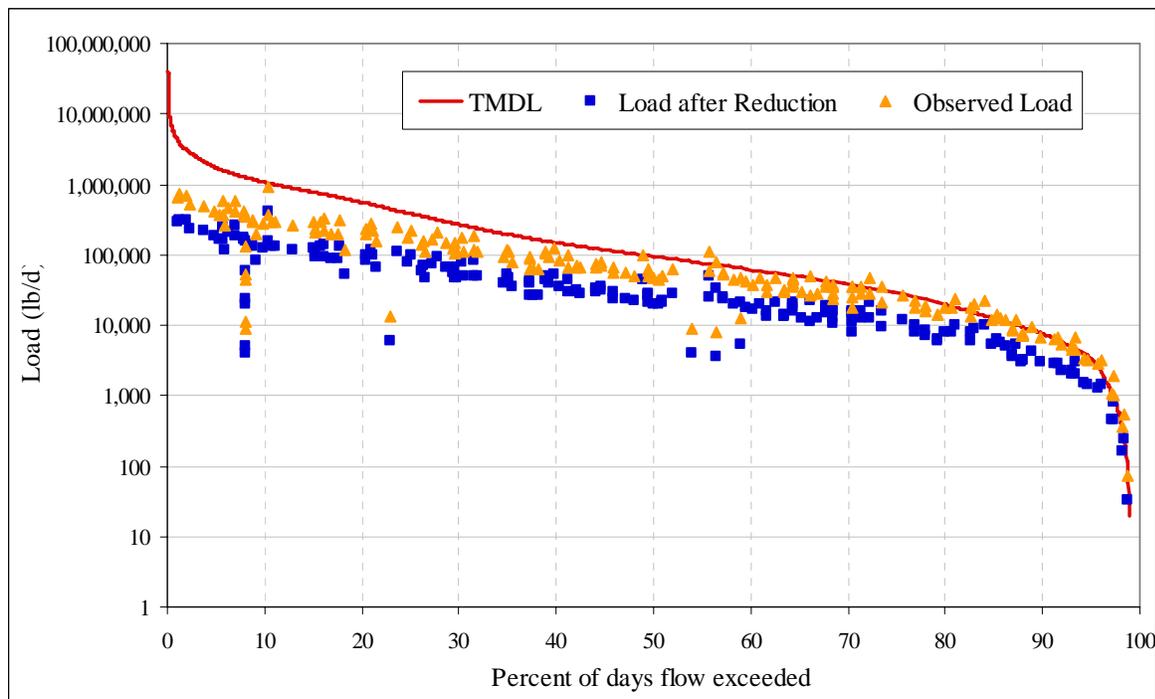


Figure G-1. TDS load duration curve for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Table G-1. Allowable TDS load for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						435,484.7
8/18/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/19/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
8/20/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/21/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/22/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/23/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/24/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
9/25/1956	0	100.000	0.000	0.00	0.0000	0.00E+00
For brevity, most cells in this spreadsheet have been hidden						
5/1/1991	7180	0.100	3461.805	0.00	14004152.2405	0.00E+00
4/26/1958	8060	0.100	3886.093	0.00	15720538.5875	0.00E+00
4/6/1997	8210	0.100	3958.415	0.00	16013104.4421	0.00E+00
4/15/1991	8840	0.100	4262.167	0.00	17241881.0315	0.00E+00
4/29/1958	11000	0.100	5303.602	0.00	21454829.3378	0.00E+00
4/28/1991	11400	0.100	5496.460	0.00	22235004.9501	0.00E+00
4/30/1991	13800	0.100	6653.609	0.00	26916058.6238	0.00E+00
4/27/1958	18200	0.100	8775.050	0.00	35497990.3589	0.00E+00
6/9/1974	19100	0.100	9208.981	0.00	37253385.4865	0.00E+00
4/29/1991	19300	0.100	9305.410	0.10	37643473.2927	3.76E+04
4/28/1958	20000	0.000	9642.912	0.00	39008780.6142	0.00E+00

Table G-2. Existing load for TDS for station OUA0005 for Bayou De L'Outre (HUC-reach 08040202-006)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
9/21/2004	1530	0.227	97.4	1.870E+03	8.250E+02	8.250E+02	Yes
7/25/2006	1490	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
8/14/2006	1250	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
9/17/2002	1220	3.375	84.1	2.221E+04	9.798E+03	1.229E+04	Yes
8/22/2000	1161	0.087	98.3	5.435E+02	2.398E+02	3.160E+02	Yes
11/29/2005	1150	18.322	55.8	1.136E+05	5.014E+04	6.671E+04	Yes
10/25/2005	1130	0.530	96.1	3.233E+03	1.426E+03	1.931E+03	Yes
6/21/2005	1070	8.196	72.3	4.730E+04	2.087E+04	2.984E+04	Yes
9/4/1990	1064	1.157	93.3	6.641E+03	2.930E+03	4.213E+03	Yes
8/17/2004	1020	3.713	83	2.042E+04	9.011E+03	1.352E+04	Yes
6/27/2006	978	4.388	81	2.314E+04	1.021E+04	1.597E+04	Yes
8/29/2006	928	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
8/12/2003	920	2.459	87.3	1.220E+04	5.383E+03	8.953E+03	Yes
7/26/1993	888	2.989	85.3	1.432E+04	6.317E+03	1.088E+04	Yes
9/21/1999	870	0.222	97.4	1.041E+03	4.592E+02	8.075E+02	Yes
8/17/1999	863.5	0.627	95.7	2.919E+03	1.288E+03	2.282E+03	Yes
8/20/2001	854.5	3.857	82.7	1.778E+04	7.843E+03	1.404E+04	Yes
7/27/1999	852	7.714	73.5	3.545E+04	1.564E+04	2.809E+04	Yes
11/11/2003	836	2.121	88.9	9.566E+03	4.220E+03	7.724E+03	Yes
7/19/1994	818	11.571	66.1	5.105E+04	2.252E+04	4.213E+04	Yes
10/2/1990	812	2.893	85.7	1.267E+04	5.590E+03	1.053E+04	Yes
5/11/2004	805	17.839	56.4	7.746E+04	3.417E+04	6.495E+04	Yes
4/18/2006	796	1.543	91.5	6.624E+03	2.922E+03	5.617E+03	Yes
10/24/2006	787	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
11/28/2006	782	2.748	86.2	1.159E+04	5.114E+03	1.001E+04	Yes
10/14/2003	768	1.205	93.1	4.993E+03	2.203E+03	4.388E+03	Yes
9/27/1994	754	1.591	91.3	6.471E+03	2.855E+03	5.793E+03	Yes
7/20/2004	748	8.679	71.4	3.501E+04	1.545E+04	3.160E+04	Yes
11/27/1990	746	24.589	49	9.894E+04	4.365E+04	8.953E+04	Yes
11/13/1995	743	4.484	80.7	1.797E+04	7.928E+03	1.633E+04	Yes
10/17/2000	738	0.092	98.2	3.647E+02	1.609E+02	3.335E+02	Yes
10/30/1990	729	10.607	67.7	4.171E+04	1.840E+04	3.862E+04	Yes
10/17/1995	726	6.750	75.7	2.643E+04	1.166E+04	2.458E+04	Yes
7/26/2005	717	0.270	97.1	1.044E+03	4.607E+02	9.830E+02	Yes
11/7/2000	716.5	9.161	70.4	3.540E+04	1.562E+04	3.335E+04	Yes
9/17/2001	713.5	1.157	93.3	4.453E+03	1.965E+03	4.213E+03	Yes
8/23/2005	706	0.019	98.8	7.344E+01	3.240E+01	7.022E+01	Yes
11/22/1999	705.5	12.536	64.4	4.770E+04	2.105E+04	4.564E+04	Yes
10/19/1999	697.5	3.134	84.8	1.179E+04	5.202E+03	1.141E+04	Yes
8/11/1998	694	9.161	70.4	3.429E+04	1.513E+04	3.335E+04	Yes
12/5/2006	691	4.821	80	1.797E+04	7.928E+03	1.755E+04	Yes
8/24/1993	690	1.205	93.1	4.486E+03	1.979E+03	4.388E+03	Yes
7/25/2000	690	0.868	94.7	3.230E+03	1.425E+03	3.160E+03	Yes
7/21/1998	684	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
5/23/2005	676	10.125	68.5	3.692E+04	1.629E+04	3.686E+04	Yes
9/30/1997	674	1.446	91.9	5.258E+03	2.320E+03	5.266E+03	Yes
5/19/1998	667	10.607	67.7	3.816E+04	1.684E+04	3.862E+04	Yes
7/22/1997	663	6.268	76.9	2.241E+04	9.889E+03	2.282E+04	Yes
5/15/2004	660	257.466	10.4	9.166E+05	4.044E+05	9.374E+05	Yes
8/16/1994	655	3.857	82.7	1.363E+04	6.012E+03	1.404E+04	Yes
8/8/1995	655	10.125	68.5	3.577E+04	1.578E+04	3.686E+04	Yes
11/19/2001	654	12.536	64.4	4.422E+04	1.951E+04	4.564E+04	Yes
9/21/1993	651	0.964	94.3	3.386E+03	1.494E+03	3.511E+03	Yes
9/29/1998	651	10.125	68.5	3.555E+04	1.568E+04	3.686E+04	Yes
9/19/1995	647	1.929	89.8	6.730E+03	2.969E+03	7.022E+03	Yes
6/28/1994	637	13.500	62.6	4.638E+04	2.046E+04	4.915E+04	Yes
5/21/1996	637	2.555	86.9	8.780E+03	3.873E+03	9.304E+03	Yes
9/1/1998	636	8.196	72.3	2.812E+04	1.240E+04	2.984E+04	Yes
11/28/1994	610	37.125	39.8	1.221E+05	5.389E+04	1.352E+05	Yes
6/20/1995	610	8.679	71.4	2.855E+04	1.260E+04	3.160E+04	Yes
7/23/2002	607.5	10.607	67.7	3.476E+04	1.533E+04	3.862E+04	Yes
10/15/2002	602	5.786	78	1.879E+04	8.288E+03	2.106E+04	Yes
5/16/2006	602	2.555	86.9	8.297E+03	3.661E+03	9.304E+03	Yes
12/20/1999	593.5	12.536	64.4	4.013E+04	1.770E+04	4.564E+04	Yes
4/23/2002	589	17.357	57.1	5.514E+04	2.433E+04	6.319E+04	Yes
5/23/1994	588	18.322	55.8	5.811E+04	2.564E+04	6.671E+04	Yes
7/17/1995	588	2.314	88	7.340E+03	3.238E+03	8.426E+03	Yes

TMDLs for Cl, SO4, and TDS in Bayou de L'Outre Watershed, Arkansas

Table G-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
5/25/1999	584	14.464	61	4.556E+04	2.010E+04	5.266E+04	Yes
3/28/1995	582	59.786	31.5	1.877E+05	8.280E+04	2.177E+05	Yes
11/13/2006	578	2.314	88	7.215E+03	3.183E+03	8.426E+03	Yes
3/13/2007	575	3.664	8.1	1.136E+04	5.014E+03	1.334E+04	Yes
4/26/2005	573	17.357	57.1	5.364E+04	2.367E+04	6.319E+04	Yes
12/3/2002	548	15.911	58.9	4.703E+04	2.075E+04	5.793E+04	Yes
9/23/2003	548	2.363	87.8	6.983E+03	3.081E+03	8.601E+03	Yes
8/6/1991	536	6.268	76.9	1.812E+04	7.995E+03	2.282E+04	Yes
2/14/1995	532	39.054	38.8	1.121E+05	4.944E+04	1.422E+05	Yes
3/12/1996	532	21.697	51.9	6.226E+04	2.747E+04	7.899E+04	Yes
4/15/2003	525	34.714	41.2	9.830E+04	4.337E+04	1.264E+05	Yes
1/25/2000	520	10.125	68.5	2.840E+04	1.253E+04	3.686E+04	Yes
6/9/1998	517	12.536	64.4	3.496E+04	1.542E+04	4.564E+04	Yes
9/29/1992	513	9.161	70.4	2.535E+04	1.118E+04	3.335E+04	Yes
10/19/2004	511	16.393	58.3	4.518E+04	1.993E+04	5.968E+04	Yes
9/10/1996	509	7.714	73.5	2.118E+04	9.344E+03	2.809E+04	Yes
4/27/1999	508	29.411	44.7	8.059E+04	3.555E+04	1.071E+05	Yes
9/27/2005	508	5.786	78	1.585E+04	6.994E+03	2.106E+04	Yes
9/1/1992	507	5.304	79.2	1.450E+04	6.399E+03	1.931E+04	Yes
1/17/2006	506	65.572	30.2	1.790E+05	7.895E+04	2.387E+05	Yes
3/9/1993	505	78.108	27.7	2.128E+05	9.386E+04	2.844E+05	Yes
10/27/1992	496	15.429	59.5	4.128E+04	1.821E+04	5.617E+04	Yes
10/26/1993	487	13.982	61.7	3.673E+04	1.620E+04	5.091E+04	Yes
10/23/2001	486	5.304	79.2	1.390E+04	6.134E+03	1.931E+04	Yes
2/5/1991	483	39.054	38.8	1.017E+05	4.489E+04	1.422E+05	Yes
5/23/1995	480	24.107	49.5	6.241E+04	2.754E+04	8.777E+04	Yes
6/19/2001	477	11.089	66.9	2.853E+04	1.259E+04	4.037E+04	Yes
6/18/1996	473	14.947	60.3	3.813E+04	1.682E+04	5.442E+04	Yes
12/16/2003	463	24.107	49.5	6.020E+04	2.656E+04	8.777E+04	Yes
10/29/1991	452	48.215	35	1.175E+05	5.186E+04	1.755E+05	Yes
1/30/1996	451	29.411	44.7	7.154E+04	3.156E+04	1.071E+05	Yes
4/24/2000	448.5	12.054	65.3	2.916E+04	1.286E+04	4.388E+04	Yes
8/4/1992	447	30.375	44	7.324E+04	3.231E+04	1.106E+05	Yes
2/20/1996	447	38.090	39.3	9.183E+04	4.052E+04	1.387E+05	Yes
8/20/2002	443	13.018	63.5	3.111E+04	1.372E+04	4.740E+04	Yes
12/18/1995	441	103.661	23.6	2.466E+05	1.088E+05	3.774E+05	Yes
6/4/1991	440	27.964	45.9	6.637E+04	2.928E+04	1.018E+05	Yes
7/2/1991	435	13.018	63.5	3.054E+04	1.348E+04	4.740E+04	Yes
6/27/2000	432	10.125	68.5	2.359E+04	1.041E+04	3.686E+04	Yes
4/23/2007	432	3.905	8.1	9.100E+03	4.015E+03	1.422E+04	Yes
5/30/2000	429	94.983	25	2.198E+05	9.696E+04	3.458E+05	Yes
8/26/1997	425	13.018	63.5	2.984E+04	1.317E+04	4.740E+04	Yes
2/23/1999	420	47.732	35.2	1.081E+05	4.771E+04	1.738E+05	Yes
7/7/1992	416	11.571	66.1	2.596E+04	1.145E+04	4.213E+04	Yes
1/21/2003	415	22.661	50.9	5.072E+04	2.238E+04	8.250E+04	Yes
11/19/1996	414	36.161	40.4	8.075E+04	3.562E+04	1.317E+05	Yes
2/12/2007	414	24.107	8.1	5.383E+04	2.375E+04	8.777E+04	Yes
4/3/2007	403	61.715	8.1	1.341E+05	5.918E+04	2.247E+05	Yes
2/29/2000	402.5	68.465	29.6	1.486E+05	6.557E+04	2.493E+05	Yes
3/12/1991	402	42.911	37.2	9.304E+04	4.105E+04	1.562E+05	Yes
4/14/1998	401	30.375	44	6.570E+04	2.898E+04	1.106E+05	Yes
1/14/2002	398	33.268	42.1	7.142E+04	3.151E+04	1.211E+05	Yes
10/1/1991	397	13.982	61.7	2.994E+04	1.321E+04	5.091E+04	Yes
7/16/1996	395	22.661	50.9	4.828E+04	2.130E+04	8.250E+04	Yes
10/28/1997	386	42.429	37.3	8.834E+04	3.897E+04	1.545E+05	Yes
3/25/2003	386	130.179	20.9	2.710E+05	1.196E+05	4.740E+05	Yes
5/13/1997	384	26.518	47.2	5.492E+04	2.423E+04	9.655E+04	Yes
11/16/1998	380	72.804	28.7	1.492E+05	6.583E+04	2.651E+05	Yes
9/3/1991	378	81.000	27.2	1.651E+05	7.286E+04	2.949E+05	Yes
6/17/2003	377	24.107	49.5	4.902E+04	2.163E+04	8.777E+04	Yes
5/5/1992	375	33.268	42.1	6.729E+04	2.969E+04	1.211E+05	Yes
2/6/2007	375	21.697	8.1	4.388E+04	1.936E+04	7.899E+04	Yes
11/23/1993	366	32.786	42.4	6.472E+04	2.855E+04	1.194E+05	Yes
5/28/2002	365	9.161	70.4	1.804E+04	7.957E+03	3.335E+04	Yes

TMDLs for Cl, SO4, and TDS in Bayou de L'Outre Watershed, Arkansas

Table G-2. (continued)

Date	Observed Concentration (mg/L)	Flow/unit area on sampling day (cfs)	Percent exceedance for flow on sampling day	Current load (lbs/day)	Reduced load (lbs/day)	Allowable load with MOS incorporated (lbs/day)	Reduced load less than or equal to allow load?
11/18/1997	363	27.964	45.9	5.475E+04	2.416E+04	1.018E+05	Yes
12/1/1992	358	23.143	50.5	4.469E+04	1.972E+04	8.426E+04	Yes
12/15/1997	358	23.625	50	4.562E+04	2.013E+04	8.601E+04	Yes
5/18/1993	357	25.554	48	4.921E+04	2.171E+04	9.304E+04	Yes
2/9/1993	356	34.714	41.2	6.666E+04	2.941E+04	1.264E+05	Yes
11/25/1991	354	59.786	31.5	1.142E+05	5.036E+04	2.177E+05	Yes
12/17/1996	352	160.072	17.7	3.039E+05	1.341E+05	5.828E+05	Yes
2/22/2005	352	58.340	31.9	1.108E+05	4.887E+04	2.124E+05	Yes
4/7/1992	346	49.179	34.6	9.178E+04	4.049E+04	1.791E+05	Yes
4/23/1996	341	96.911	24.7	1.782E+05	7.864E+04	3.528E+05	Yes
2/14/2006	340	86.304	26.3	1.583E+05	6.983E+04	3.142E+05	Yes
8/6/1996	337	177.430	16.2	3.225E+05	1.423E+05	6.460E+05	Yes
2/26/2002	328	69.429	29.4	1.228E+05	5.419E+04	2.528E+05	Yes
3/23/1999	324	64.608	30.5	1.129E+05	4.981E+04	2.352E+05	Yes
6/2/1992	319	127.286	21.2	2.190E+05	9.662E+04	4.634E+05	Yes
4/2/1991	316	339.913	7	5.794E+05	2.556E+05	1.238E+06	Yes
4/13/2004	314	134.519	20.4	2.278E+05	1.005E+05	4.898E+05	Yes
1/7/1992	305	47.250	35.4	7.773E+04	3.429E+04	1.720E+05	Yes
10/24/1994	299	183.215	15.8	2.955E+05	1.304E+05	6.671E+05	Yes
2/4/1992	296	67.983	29.7	1.085E+05	4.788E+04	2.475E+05	Yes
3/28/2005	287	88.233	26.1	1.366E+05	6.026E+04	3.212E+05	Yes
4/15/1997	284	68.465	29.6	1.049E+05	4.627E+04	2.493E+05	Yes
11/5/2002	281	40.500	38.2	6.138E+04	2.708E+04	1.475E+05	Yes
6/10/1997	277	192.376	15	2.874E+05	1.268E+05	7.004E+05	Yes
10/1/1996	274	383.306	5.8	5.665E+05	2.499E+05	1.396E+06	Yes
5/22/2001	273.5	41.465	37.7	6.117E+04	2.699E+04	1.510E+05	Yes
3/27/2000	266	42.429	37.3	6.087E+04	2.686E+04	1.545E+05	Yes
12/11/2001	265	133.554	20.5	1.909E+05	8.422E+04	4.862E+05	Yes
4/13/1993	259	256.501	10.4	3.583E+05	1.581E+05	9.339E+05	Yes
6/29/1999	236	315.805	7.9	4.020E+05	1.774E+05	1.150E+06	Yes
3/16/2004	234	85.822	26.5	1.083E+05	4.779E+04	3.125E+05	Yes
12/19/2000	233	366.913	6.3	4.611E+05	2.034E+05	1.336E+06	Yes
12/22/1998	230	189.001	15.2	2.345E+05	1.034E+05	6.881E+05	Yes
1/20/1998	227	123.911	21.5	1.517E+05	6.693E+04	4.511E+05	Yes
3/26/2001	227	163.930	17.5	2.007E+05	8.855E+04	5.968E+05	Yes
12/14/2004	227	218.412	12.9	2.674E+05	1.180E+05	7.952E+05	Yes
1/2/1991	225	245.894	11.2	2.984E+05	1.317E+05	8.953E+05	Yes
3/3/1992	224	178.876	16.1	2.161E+05	9.535E+04	6.513E+05	Yes
4/17/2001	222.5	342.806	6.9	4.114E+05	1.815E+05	1.248E+06	Yes
1/12/1993	220	250.716	10.8	2.975E+05	1.313E+05	9.128E+05	Yes
1/26/1999	216	318.698	7.8	3.713E+05	1.638E+05	1.160E+06	Yes
1/18/1994	210	171.162	16.8	1.939E+05	8.553E+04	6.232E+05	Yes
3/26/2002	205	188.037	15.3	2.079E+05	9.173E+04	6.846E+05	Yes
1/2/2007	204	315.805	8.1	3.475E+05	1.533E+05	1.150E+06	Yes
2/25/1997	197	290.734	8.8	3.089E+05	1.363E+05	1.059E+06	Yes
2/17/1998	191	270.002	9.8	2.782E+05	1.227E+05	9.830E+05	Yes
3/14/1994	184	293.627	8.7	2.914E+05	1.286E+05	1.069E+06	Yes
2/17/2004	177	427.181	4.9	4.078E+05	1.799E+05	1.555E+06	Yes
11/30/2004	177	388.127	5.7	3.705E+05	1.635E+05	1.413E+06	Yes
1/28/1997	175	400.181	5.4	3.777E+05	1.666E+05	1.457E+06	Yes
4/24/1995	174	525.539	3.7	4.932E+05	2.176E+05	1.913E+06	Yes
12/19/1994	171	752.147	2	6.937E+05	3.061E+05	2.738E+06	Yes
7/15/2003	144	15.911	58.9	1.236E+04	5.452E+03	5.793E+04	Yes
6/21/1993	141	155.251	18.2	1.181E+05	5.209E+04	5.652E+05	Yes
2/15/1994	140	684.647	2.4	5.170E+05	2.281E+05	2.493E+06	Yes
5/7/1991	139	949.827	1.3	7.121E+05	3.142E+05	3.458E+06	Yes
3/17/1998	127	378.966	6	2.596E+05	1.145E+05	1.380E+06	Yes
1/30/2001	127	282.537	9.1	1.935E+05	8.539E+04	1.029E+06	Yes
2/25/2003	112	1104.113	1	6.670E+05	2.943E+05	4.020E+06	Yes
12/27/2005	84	17.839	56.4	8.083E+03	3.566E+03	6.495E+04	Yes
1/20/2004	83.5	19.768	54	8.903E+03	3.928E+03	7.197E+04	Yes
9/18/2000	79	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
9/26/2006	55	0.000	100	0.000E+00	0.000E+00	0.000E+00	Yes
5/20/2003	22.8	109.447	23	1.346E+04	5.938E+03	3.985E+05	Yes

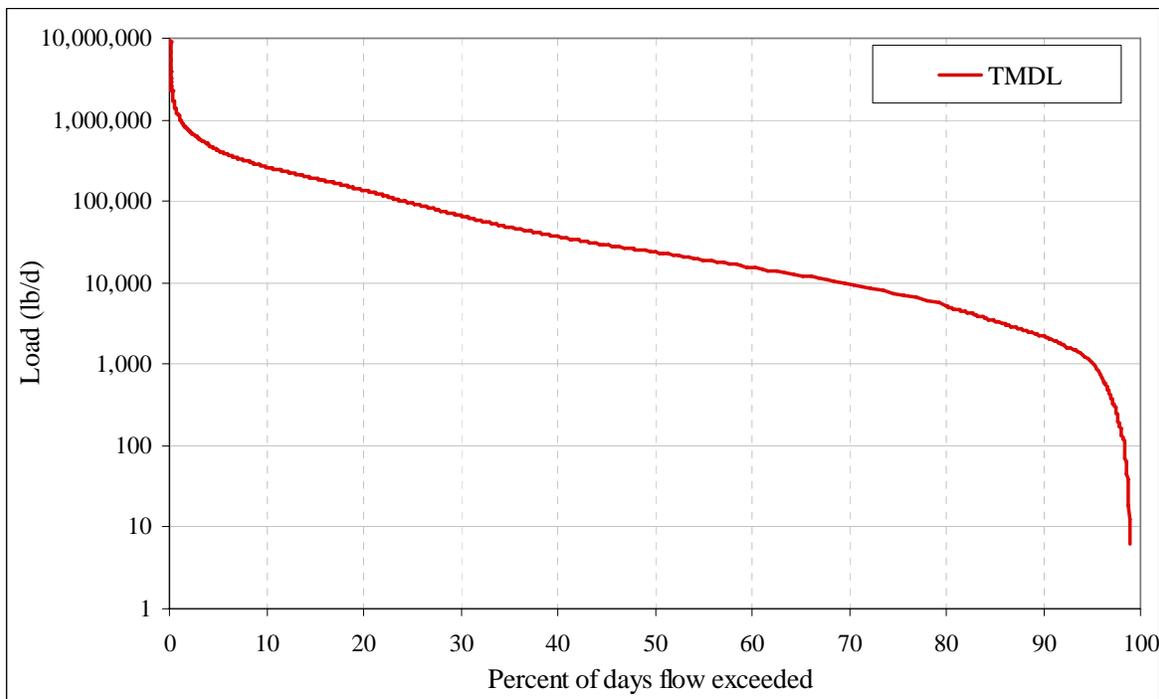


Figure G-2. TDS load duration curve for Bayou De L'Outre (HUC-reach 08040202-007)

Table G-3. Allowable TDS load for Bayou De L'Outre (HUC-reach 08040202-007)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						106,783.73
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/26/58	8060	0.1	916.25	0.00	3,854,780.00	0.00
04/06/97	8210	0.1	933.30	0.00	3,926,519.08	0.00
04/15/91	8840	0.1	1,004.91	0.00	4,227,823.22	0.00
04/29/58	11000	0.1	1,250.46	0.00	5,260,866.00	0.00
04/28/91	11400	0.1	1,295.93	0.00	5,452,170.22	0.00
04/30/91	13800	0.1	1,568.76	0.00	6,599,995.53	0.00
04/27/58	18200	0.1	2,068.94	0.00	8,704,341.93	0.00
06/09/74	19100	0.1	2,171.25	0.00	9,134,776.42	0.00
04/29/91	19300	0.1	2,193.99	0.10	9,230,428.53	9,230.43
04/28/58	20000	0	2,273.56	0.00	9,565,210.92	0.00

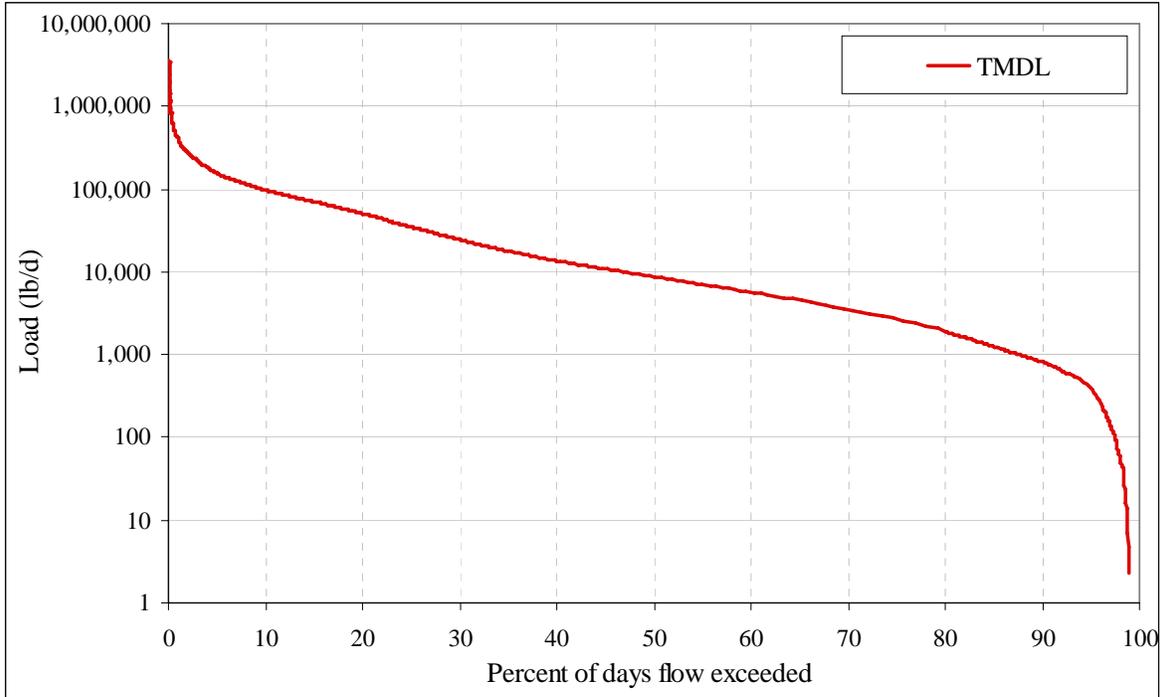


Figure G-3. TDS load duration curve for Bayou De L'Outre (HUC-reach 08040202-008)

Table G-4. Allowable TDS load for Bayou De L'Outre (HUC-reach 08040202-008)

Date	Observed flow (cfs)	Percent exceedance for observed flow	Adjusted flow for entire basin (cfs)	Width for area under curves (%)	Allowable load to meet standard (lb/day)	Area under TMDL curve (lb/day)
						39,476.01
08/18/56	0	100	0.00	0.00	0.00	0.00
08/19/56	0	100	0.00	0.00	0.00	0.00
08/20/56	0	100	0.00	0.00	0.00	0.00
09/21/56	0	100	0.00	0.00	0.00	0.00
09/22/56	0	100	0.00	0.00	0.00	0.00
09/23/56	0	100	0.00	0.00	0.00	0.00
09/24/56	0	100	0.00	0.00	0.00	0.00
09/25/56	0	100	0.00	0.00	0.00	0.00
09/26/56	0	100	0.00	0.00	0.00	0.00
09/27/56	0	100	0.00	0.00	0.00	0.00
09/28/56	0	100	0.00	0.00	0.00	0.00
09/29/56	0	100	0.00	0.00	0.00	0.00
Fro brevity, most cells have been hidden.						
04/26/58	8060	0.1	272.37	0.00	1,425,042.34	0.00
04/06/97	8210	0.1	277.44	0.00	1,451,562.98	0.00
04/15/91	8840	0.1	298.73	0.00	1,562,949.66	0.00
04/29/58	11000	0.1	371.72	0.00	1,944,846.86	0.00
04/28/91	11400	0.1	385.24	0.00	2,015,568.57	0.00
04/30/91	13800	0.1	466.34	0.00	2,439,898.79	0.00
04/27/58	18200	0.1	615.03	0.00	3,217,837.54	0.00
06/09/74	19100	0.1	645.45	0.00	3,376,961.37	0.00
04/29/91	19300	0.1	652.21	0.10	3,412,322.22	3,412.32
04/28/58	20000	0	675.86	0.00	3,536,085.21	0.00

EPA Responses to Comments for the Bayou de L'Outre TMDLs in Arkansas

Prepared for:

United States Environmental Protection Agency, Region 6
Water Quality Protection Division
Permits, Oversight, and TMDL Team
Dallas, TX

Prepared by:



Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030

March 26, 2008

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PLEASE NOTE: Throughout this document there are references to other comments and responses. For brevity and the reader’s convenience, hyperlinks to these other comments and responses are provided. The hyperlinks are *underlined and italicized*. By pressing “Control” and clicking a hyperlink, the reader can go directly to the cross-referenced comments. Comment numbers and request numbers start over in each letter. References to comment numbers are within the current letter unless otherwise noted. Please note that in 2010 the TMDL was revisited in order to assure that Louisiana, the downstream State, Standards (wqs) were considered within the TMDL in accordance with 40 CFR 131.10(b) Regs.

BAYOU DE L'OUTRE WATERSHED COMMENTS AND RESPONSES

Clean Harbors Environmental Services Comments



Clean Harbors Environmental Services, Inc.
309 American Circle
El Dorado, AR. 71730
www.cleanharbors.com

Electronic Transfer

January 16, 2008

Ms. Diane Smith
Water Quality Protection Division
U.S. EPA Region 6
1445 Ross Avenue
Dallas, TX 75202-2733

RE: Comments on draft TMDLs for dissolved minerals and metals for Bayou de L'Outre,
Arkansas

Dear Ms. Smith:

Following are comments from Clean Harbors El Dorado, L.L.C. (Clean Harbors) on the draft total maximum daily loads (TMDLs) referenced above.

The wasteload allocation (WLA) for Clean Harbors for total dissolved solids (TDS) is based on the final limits in our current permit. These limits were developed by ADEQ several years ago using dissolved minerals criteria for Boggy Creek that were in effect at that time. The dissolved minerals criteria for Boggy Creek were increased in 2007 after a Use Attainability Analysis (UAA) was completed and approved. In the near future we plan to request a permit modification from ADEQ to revise the final limits for dissolved minerals in our current permit. In order for us to obtain less stringent permit limits for dissolved minerals, the loads in the TMDL would need to be reallocated slightly. Section 4.7 of the TMDL report appears to allow flexibility for reallocating loads without revising the TMDL, but we would like to request assurance from EPA that we are interpreting this correctly. We request that EPA consider adding text to the report to clarify this issue further.

Clean Harbors appreciates the opportunity to review these draft TMDLs and submit comments. If you have any questions or need any additional information concerning these comments, please feel free to contact me at 870-863-7173.

Sincerely,

Michael A. Karp
Environmental Compliance Manager

cc: Phil Hutchison, U.S. EPA Region 6
Scott Kuhn, Clean Harbors
Ron Hines, Clean Harbors

“People and Technology Creating a Better Environment”

EPA Response to Clean Harbors:

The future growth component (documented in section 4.7) allows for the reevaluation of WLAs if discharge scenarios are modified. If the actual nonpoint source loads are less than the allowable nonpoint source loads (i.e., if the actual nonpoint water quality is better than what was allowed in the TMDL), future discharge scenarios that would allow water quality standards to be maintained with higher effluent flow rates and/or higher effluent concentrations could be developed. Such a discharge scenario could be allowable by reallocating unused nonpoint source loads to point source loads, which may be done without revising the TMDL report. Point source loads may also increase in the future if effluent concentrations are less than or equal to the instream criteria from the water quality standards. No changes to the TMDL report are necessary at this time.

Lion Oil Comments

January 16, 2008

Ms. Diane Smith,
Environmental Protection Specialist
Water Quality Protection Division,
U.S. Environmental Protection Agency Region 6
1445 Ross Ave
Dallas, TX 75202-2733

Re: Comments - TMDLs for Chloride, Sulfate, Total Dissolved Solids, Copper, Lead and Zinc for the Bayou de Loutre Basin, Arkansas. Document Dated October 5, 2007.

Dear Ms. Smith:

In accordance with the Federal Register Notice of December 17, 2007 (Volume 72, Number 241) we offer the following comments on the TMDLs for the Stream Reaches listed in the referenced document.

Our comments are as follows:

Lion Oil Comment 1

1. The TMDL procedure is based on documentation developed by the Kansas Department of Health and Environment but is not presented in detail in the report. There is no justification provided in the report as supporting the procedure as appropriate for the development of TMDLs in Arkansas. It is an overly simplistic approach which does not take into account the fact that in accordance with Regulation 2. 501 of the Arkansas Pollution Control and Ecology Commission there are flow conditions during which water quality criteria are not applicable. For example, eco-region based dissolved minerals standards are not applicable when stream flows are less than 4cfs.

EPA Response to Lion Oil 1:

The load-duration method has been used to prepare TMDLs for several years in Arkansas and in many other states around the country. Load-duration is a widely accepted empirical model that does not require a case-by-case justification for use. The reference to the Kansas documentation is for information beyond the overview provided in this document. Additional documentation for using the load-duration approach throughout the United States is available on the EPA Web site at http://www.epa.gov/OWOW/TMDL/duration_curve_guide_aug2007.pdf. The simplicity of the load-duration method is not a disqualification for use. Actually, the load-duration method is well suited for conservative constituents, and it is comprehensive because it incorporates the entire range of flows, not just critical flow. The load-duration is a

¹ EPA noticed the comments provided in reference to copper, lead and zinc, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to those comments at that time.

powerful tool for assessment, TMDL development, and TMDL implementation. Information can be extracted from load-duration figures and tables after the TMDL is established.

EPA believes that the final sentence of this comment is not consistent with the intent of Regulation No. 2. The critical flow value of 4 cfs for dissolved minerals in small streams is intended for permitting calculations for small streams where data are insufficient to estimate a harmonic mean flow. Many small, unnamed tributary streams have less than 4 cfs of flow during a large percentage of the time. Allowing numeric criteria for dissolved minerals to be exceeded a large percentage of the time would not be consistent with the intent of Regulation No. 2 to protect aquatic life.

As stated in the TMDL report, the allowable loads were calculated as the area under the load duration curve. Most of the allowable loading occurs at high flows, not at flows less than 4 cfs. None of the allowable point source loads were reduced on the basis of assimilative capacity that occurs when stream flows are less than 4 cfs. These TMDLs are not contrary to the Regulation 2.501 language that states that there is a criteria exception for low flow.

Lion Oil Comment 2

2. The procedure utilized in the development of the TMDLs does not consider or incorporate critical flows for point source dischargers as defined in Regulation No. 2. 106 of the Arkansas Pollution Control and Ecology Commission.

EPA Response to Lion Oil 2:

This TMDL is established as the assimilative capacity of the stream at the numeric criterion specified in the Arkansas Water Quality Standards, and it will be protective of standards and designated uses during critical conditions. Dischargers are irrelevant at this stage of TMDL development.

Lion Oil Comment 3

3. The regulatory framework for the dissolved minerals TMDLs is flawed. Site specific criteria for many of the stream reaches covered by these TMDLs were approved by the Arkansas Pollution Control and Ecology Commission on June 22, 2007. These new criteria (and projected dissolved minerals limitations for point source dischargers) should have been considered in the development of the dissolved minerals TMDLs. The new criteria for chloride, sulfate and TDS should have been considered in the development of the TMDLs and had they been incorporated, the chloride, sulfate and TDS TMDLs would not have been required since the evaluation criteria requiring 10% exceedance would not have been attained.

EPA Response to Lion Oil 3:

Tables ES-2 and 2-3 of the TMDL report list the site-specific criteria for Bayou de L'Outre. The criteria in these tables were taken from the June 22, 2007, criteria. The most stringent criteria were used in developing this TMDL. This TMDL was completed on the basis of listings on the 2004 303(d) list, which was created using the criteria in effect at

that time. EPA did not reevaluate the assessment results for dissolved minerals for this stream because that is not the purpose of a TMDL. Best Professional Judgment was used on numeric criteria in the June 22, 2007 Regulation 2 would be approved by EPA. The previous versions of Regulation 2 had been approved after additional submittals and clarifications on wordings. The use of old values would have required recalculations by ADEQ on every TMDL. At the time of the permit preparation after the issuance of this TMDL, ADEQ would need to verify that the current approved criterion was still what was specified in the TMDL. This is the procedure on every permit regardless if it has a TMDL on the segment. The listed segments had TMDLs prepared as required by 40 CFR 130.7(c)(1), which states, "Each State shall establish TMDLs for the water quality limited segments identified in paragraph (b)(1) of this section, and in accordance with the priority ranking."

Lion Oil Comment 4

4. The regulatory requirement for the completion of the Copper, Lead and Zinc TMDLs is flawed. The 2004 303(d) list these segments under category 5c which states the data utilized for listing is questionable and should be verified or new data used in the development of any TMDL. The TMDL did not provide any verification of historical data or present new analytical data to support the listing. Therefore the basis of the TMDL is not in accordance with the 2004 303(d) listing.

In addition, in-stream data developed and used in development of 3rd party rule-making was not utilized in the consideration of the data verification required for those segments listed in the 2004 303(d) list as Category 5c.

EPA Response to Lion Oil 4:

EPA public noticed a draft TMDL containing copper, lead and zinc for Bayou de L'Outre, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to the comments in reference to Sulfates at that time. ¹

Lion Oil Comment 5

5. In addition to the basic regulatory flaw described above, the data used in the preparation of the TMDLs is inadequate. For example, the flow station utilized for the TMDL is located on Little Cornie Bayou in Louisiana. As discussed below the hydrologic characteristics for the watershed related to that flow monitoring station are not similar to the characteristics of Bayou De Loutre which is much more urbanized.

The Little Cornie Bayou USGS gauge utilized for flow characterizations does not accurately reflect flow characteristics of Bayou de Loutre. Differences in land use and number of point source discharges impact (increase) flows per unit area in Bayou de Loutre when compared to Little Cornie Bayou. In Bayou de Loutre, the urban use ranges from 4-27% of the individual reaches, compared to less than 1% of Little Cornie Bayou at the gauge station. Likewise, there are numerous NPDES discharges in Bayou de Loutre compared to the Little Cornie Bayou. These conditions present issues related to the use of the flow characteristics to Bayou de Loutre and results in a very conservative flow value on a per-unit basis in the load projections and the application of the MOS.

¹ EPA noticed the comments provided in reference to copper, lead and zinc, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to those comments at that time.

EPA Response to Lion Oil:

Before different stream gauges were used in TMDL analysis, average mean flows from 31 USGS stations in Arkansas were plotted against drainage area. In this analysis, drainage areas ranged from less than 5 square miles to over 1,000 square miles. It was found that drainage area and flow had a good correlation with an R^2 value of 0.93. An effort was then made to select the gauge closest to the watershed in question, and thus Little Cornie Bayou was selected for Bayou de L'Outre. EPA believes that this is an appropriate approach because no recent flow information is available for Bayou de L'Outre. The only long-term flow data that the USGS has published for Bayou de L'Outre are the data for the gauge at Laran, Louisiana (07364700). The period of record for that gauge was water years 1956 through 1977. These data were not used for TMDL development because (1) recent flow data are needed to correlate observed concentrations with stream flow for the load duration approach, and (2) data that are more than 30 years old would probably not provide an accurate estimate of the impacts of urbanization and point source discharges on the flow regime.

In addition, it does not appear that there was any attempt to correlate the flows at which ambient water quality data was collected to applicable critical flows as defined in Regulation No. 2.

EPA Response to Lion Oil:

The TMDLs in this report were calculated using historical flows, including extreme low and high flows, in the reference streams. Per the load-duration methodology, sample data were linked to the flow on the day of the sample. This was shown on figures in the appendices.

In addition, the characterization of point sources contributions is not correct and contains a major error in Table 2-7. In that table, the current permitted loadings for TDS for Lion Oil Outfall 001 is undervalued by a factor of over 70%. This is a major error which results in an unsupported reduction in Lion Oil's wasteload allocation for that parameter in Table 4-3.

EPA Response to Lion Oil:

EPA apologizes that the TMDL report does not clearly state the fact that these TMDLs were based on currently effective permits, not the newer permits that have been stayed during the appeal process. Section 2.5 (Point Sources) has been revised to clearly state this fact. EPA made no assumptions regarding the expected outcome of these permit appeals. Depending on the outcome, the TMDL report might need to be revised in the future. The timing of these TMDLs was unrelated to the permit appeals.

Also, loading reductions in Section 4.4 of the TMDL for Outfall 004 (NPDES No. AR0001171) is not reflective of the actual contribution. Outfall 004 is a storm water discharge and the discharge applied (0.45 mgd) is the maximum flow reported during a storm discharge event. This application artificially elevated the load contribution through this point source.

EPA Response to Lion Oil:

¹ EPA noticed the comments provided in reference to copper, lead and zinc, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to those comments at that time.

This permit requires a WLA for the stormwater outfall.

Lion Oil Comment 6

6. The TMDLs do not contain clearly defined control strategies or recommended regulatory actions to achieve the required loading reductions to come into compliance with the water quality standards. No connection is made between calculated load reductions necessary to meet the water quality criteria and associated wasteload allocations for individual dischargers and for non-point sources. It is too nebulous for the public to understand what actions are being required to achieve the loading reductions. Any actions incumbent upon landowners or NPDES dischargers should be clearly explained and should be linked to the TMDL.

EPA Response to Lion Oil 6:

The TMDL regulations at 40 CFR 130.7 do not specifically mention control strategies as required elements for TMDL reports. Subsequent EPA Guidance has prescribed that implementation is not a required part of EPA approval action on a TMDL. EPA does not discourage implementation plans in TMDL documents, implementation plans can be produced later as part of a follow-up process. The WQMP update provides one such vehicle. Load reductions are not required elements, but they are provided to assist in the TMDL implementation process. These TMDLs are focused on only the required elements. The implementation actions and load reductions are part of the TMDL implementation process undertaken with the stakeholders.

Lion Oil Comment 7

7. The TMDL documentation (Section 2.4.3, page 8) contains language from Regulation No. 2 regarding Arkansas' Antidegradation Policy, but does not provide any context to its applicability to the TMDL process or an explanation of why it is provided.

EPA Response to Lion Oil 7:

The antidegradation policy is included as a required element to specify all parts of the water quality standards. The comment is correct: The policy will not apply to every stream segment in the state. It was not a controlling factor for these TMDLs.

Lion Oil Comment 8

8. The TMDLs approach is overly conservative in that it provides for a 10% Margin of Safety (MOS), yet also incorporates conservative assumptions such as minimum hardness values, even when receiving stream hardness exceeds the Ecoregion default or using discharge hardness values when below the ecoregion default. The application of minimum hardness values artificially reduces the calculated assimilative capacity for metals. It is not appropriate to utilize both multiple conservative default assumptions and a MOS in the preparation of a TMDL. Due to the conservative nature of the assumptions contained in the TMDL, we request that the MOS be eliminated in the revised draft and the final document.

EPA Response to Lion Oil 8:

The margin of safety (MOS) can be implicit or explicit or both. Conservative assumptions are a way to provide an implicit MOS. Conservative assumptions have other purposes other than to provide an implicit MOS. Conservative assumptions are not

prohibited when using an explicit MOS. The preparer of the TMDL is defining a load that will meet the water quality standard with an MOS as required by 40 CFR 130.7. An explicit MOS is one of the ways.

The portion of the comment about lower hardness values reducing the assimilative capacity is a true understanding of the equation, but a stream must first meet the applicable standards to prevent local toxicity. If the monitoring data indicate that the hardness of the reach is lower than the ecoregion average, the assimilative capacity is correctly set with the reach hardness. Another consideration is possibly more stringent downstream standards when the water enters a downstream reach. Because downstream reaches are not impaired for metals, it is assumed that additional dilution capacity and/or higher downstream hardness concentrations are preventing the downstream reaches from being toxic from metals.

The Arkansas Continuing Planning Process (which is guidance, not a regulation) specifies the ecoregion hardness in permitting dischargers as a general rule of thumb. The selection of hardness was based on meeting the toxicity criterion in the local reaches. This resulted in lower allowable effluent discharges, but the allowable effluent was based on science and was not arbitrarily determined.

Lion Oil Comment 9

9. The simplistic TMDL approach is biased in the favor of allocations to Non-point Sources. The proposed allocation process is designed to lock point source discharges into discharging at current mass loadings while giving the vast majority of the loadings to uncontrolled non-point sources. We are unaware of any legal or regulatory requirement for such an approach.

EPA Response to Lion Oil 9:

The regulations at 40 CFR 130.7 require the assignment of the TMDL to WLAs and LAs, which are for point sources and nonpoint sources, respectively. To be included in the WLA, a point source must be in the stream segment that represents the TMDL. Point sources of conservative material pollutants on upstream segments will have their load shown as LAs on downstream segments. This may inflate the LA on downstream segments and make it appear that the LA is too large.

Most NPDES permits, including those for dischargers addressed in these TMDLs, have year-round limits set for the 7Q10 flow. The permits do not increase the allowed discharge of pollutants as flow in the stream increases. The load-duration method of TMDL development and display has brought this fact into focus; it is not a new method of allocation. The discharger is used to looking at the 7Q10 flow and seeing its discharge as a majority of the load in the stream. The single point shown in the table is not at 7Q10 but at the 50 percent value. At that point, there is runoff from nonpoint sources, making the point source load seem smaller. For a typical NPDES permit with a single limit, the nonpoint sources have been given the remaining capacity above the permit at flows larger than 7Q10.

Based on these issues we request:

¹ EPA noticed the comments provided in reference to copper, lead and zinc, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to those comments at that time.

Lion Oil Request 1

1. That USEPA revise the TMDLs in accordance with the requirements of Regulation No. 2 of the Arkansas Pollution Control and Ecology Commission.

EPA Response to Lion Oil 1:

As described in the responses to various comments above, EPA believes that these TMDLs are already consistent with Regulation No. 2. No revision is necessary.

Lion Oil Request 2

2. That in the revision process, the TMDLs for both dissolved minerals and metals be amended to state that point source dischargers are not limited by the mass loadings used in the assessment process as long as their concentration based limits maintain the water quality criteria under applicable ADEQ CPP processes regarding the development of water quality based effluent limits.

EPA Response to Lion Oil 2:

The future growth component (documented in section 4.7 of this TMDL report) allows for the reevaluation of WLAs if discharge scenarios are modified. If the actual nonpoint source loads are less than the allowable nonpoint source loads (i.e., if the actual nonpoint water quality is better than what was allowed in the TMDL), future discharge scenarios that would allow water quality standards to be maintained with higher effluent flow rates and/or higher effluent concentrations could be developed. Such a discharge scenario could be allowable by reallocating unused nonpoint source loads to point source loads, which may be done without revising the TMDL report. Point source loads may also increase in the future if effluent concentrations are less than or equal to the instream criteria from the water quality standards. No changes to the TMDL report are necessary at this time.

Lion Oil Request 3

3. That the TMDL be revised to clearly state the control strategies to achieve the proposed reductions in non-point sources and the process for public involvement in those actions.

EPA Response to Lion Oil 3:

The control strategies to achieve any reductions are not part of this TMDL report. These strategies are typically included in the TMDL implementation plan, which is separate from this document. Reasonable assurances are needed when point sources are given a more-than-equitable share of the load. This was not the case in this document. Please contact ADEQ for information on past TMDL implementation with watershed groups, stakeholders, and public involvement. No revision to the TMDL report is necessary.

Lion Oil Request 4

4. That the USEPA document that the TMDLs for Copper, Lead and Zinc are premature and that the verification data as required by the 303d process has not been made available for public review as required.

EPA Response to Lion Oil 4:

EPA public noticed a draft TMDL containing copper, lead and zinc for Bayou de L'Outre, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to the comments in reference to Sulfates at that time.¹

Lion Oil Request 5

5. We request that in its response to these comments that the USEPA provide an explanation of its understanding of the process by which TMDL allocations are to be translated into NPDES permit limits and incorporated into the Arkansas Water Quality Management Plan. In particular we are interested in opportunities for additional public comment and the process by which the TMDL can be appealed (if necessary).

EPA Response to Lion Oil 5:

There are three to five steps in taking a WLA from a TMDL to a permit limit:

1. EPA approves the TMDL.
2. ADEQ, with public participation, adopts the TMDL as a WQMP update for the general conditions of the document and the load distribution scenario. Reallocations of the TMDL may be made at this time.
3. The TMDL implementation plan is developed with stakeholder involvement. Reallocations of the TMDL may be made at this time. At this point a Watershed Restoration Plan may be submitted, if necessary, and funds may be requested under section 319.
4. The WQMP is updated with detailed plans and permit loads
5. When permits are up for renewal, the WQMP limits will be reviewed and updated, if necessary, prior to permit issuance.

All of these steps have public involvement, most specified in ADEQ procedures. The process for appealing a TMDL is undefined. The State is initially responsible for establishing TMDLs; the state could revise an established TMDL if it so chooses. If conditions change or standards change to the extent that controls in the WQMP are no longer needed, the WQMP may be updated. The WQMP is a living document that evolves over time.

Lion Oil Request 6

6. We request that the revised TMDLs be sent out to public notice again with a 90 day comment period so that adequate time can be given to assess and prepare comments on the changes.

EPA Response to Lion Oil 6:

Most of the issues brought up do require changes to the final TMDL, or they are within the implementation of the TMDL and therefore are outside the scope of this document. Additional public notice periods will be available during the WQMP and permit issuance processes.

We greatly appreciate the opportunity to present these comments and look forward to the response.

¹ EPA noticed the comments provided in reference to copper, lead and zinc, however the metal TMDLs for Bayou de L'Outre will be released at a later date and we will respond to those comments at that time.

Sincerely,

William R. Hammock
Environmental Manager

GBM^c & Associates Comments

219 Brown Lane Bryant, AR 72022 (501) 847-7077 (501) 847-7943 fax



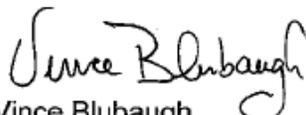
January 16, 2008

Ms. Diane Smith,
Environmental Protection Specialist
Water Quality Protection Division,
U.S. Environmental Protection Agency Region 6
1445 Ross Ave
Dallas, TX 75202-2733

Re: Comments - TMDLs for Chloride, Sulfate, Total Dissolved Solids, Copper, Lead and Zinc for the Bayou de Loutre Basin, Arkansas. Document Dated October 5, 2007.

Comments from GBM^c & Associates for the Bayou de L'Outre report are exactly the same as comments from Lion Oil. Please see [Lion Oil](#) [CTRL + click hyperlink] comments and responses.

Sincerely,
GBM^c & ASSOCIATES


Vince Blubaugh
Principal

El Dorado Water Utilities Comments

El Dorado Water Utilities

600 NORTH WASHINGTON • P. O. BOX 1567 • EL DORADO, AR 71731 (570) 862-0451

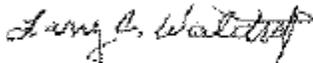
January 16, 2008

Ms. Diane Smith,
Environmental Protection Specialist
Water Quality Protection Division,
U.S. Environmental Protection Agency Region 6
1445 Ross Ave
Dallas, TX 75202-2733

Re: Comments - TMDLs for Chloride, Sulfate, Total Dissolved Solids, Copper, Lead and Zinc for the Bayou de L'Outre Basin, Arkansas. Document Dated October 5, 2007.

Comments from El Dorado Water Utilities for the Bayou de L'Outre report are exactly the same as comments from Lion Oil. Please see [Lion Oil](#) [CTRL + click hyperlink] comments and responses.

Sincerely,



Larry C. Waldrop
General Manager

Great Lakes Chemical Corporation Comments

Comments from Great Lakes Chemical Corporation for the Bayou de L'Outre report are exactly the same as comments from Lion Oil. Please see [Lion Oil](#) [CTRL + click hyperlink] comments and responses.