FINAL REPORT
JUNE 2015

pH TMDL for Bayou Pierre Watershed

South Independent Basin
Claiborne County, Mississippi

Prepared By

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FOREWORD

The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 2012 Section 303(d) List of Impaired Water Bodies. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, modifications to the water quality standards or criteria, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Table 1. Conversion Factors

From	To	multiply by	From	To	multiply by	From	To	multiply by
mi^2	$feet^2$	27,878,400	$meter^3$	liter	1,000	miles	feet	5,280
km^2	$feet^2$	10,763,911	$Feet^3/sec$	gallons/ min	448.8312	km	feet	3,280.84
hectares	$feet^2$	107,639	$meter^3$	gallons	264.1721	miles	meters	1,609.34
acre	$feet^2$	43,560	$meter^3$	$Feet^3$	35.3147	meters	feet	3.2808
mi^2	acre	640	$Feet^3$	Liter	28.3168	km	miles	0.6214
km^2	acre	247.1044	$Yard^3$	$Feet^3$	27	days	seconds	86,400
km^2	hectar es	100	$Feet^3$	gallons	7.4805	mg/l * MGD	lbs/day	8.3454
hectares	acre	2.4710	$Yard^3$	$meter^3$	0.7646	µg/l * cfs	gm/day	2.4500
km^2	mi^2	0.3861	$Feet^3/sec$	MGD	0.6463	tonnes	ton	1.1

Table 2. Prefix Symbols

Fraction	Prefix	Symbol	Multiple	Prefix	Symbol
10^{-1}	deci	d	10	deka	da
10^{-2}	centi	c	10^2	hecto	h
10^{-3}	milli	m	10^3	kilo	k
10^{-6}	micro	:	10^6	mega	M
10^{-9}	nano	n	10^9	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f	10^{15}	peta	P
10^{-18}	atto	a	10^{18}	exa	E

The fonts used in this document are ink saving fonts based on Inkfarm.com ink-usage calculator. Century Schoolbook was selected for the body text. Eras Medium ITC was used for subheadings, and Goudy Old Style was used for headings.

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TMDL INFORMATION PAGE

Listing Information

Name	ID	County	Cause
Bayou Pierre	602812	Claiborne	pH
Near Carlisle from confluence with Storm Creek to 6029 MWS boundary near the confluence with Whiskey Branch			

Water Quality Standard

Parameter	Beneficial use	Water Quality Criteria
pH	Fish and Wildlife	The applicable water quality criteria, as described in the *WPC-2 State of Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*, requires that the pH shall be within the range of 6.0 to 9.0 standard units (s.u.)

Executive Summary

Bayou Pierre (602812) near Carlisle from the confluence with Storm Creek to the 6029 MWS boundary near the confluence with Whiskey Branch was assessed by the Mississippi Department of Environmental Quality (MDEQ) as not supporting its designated use for the pH standard on the State's 2012 Section 303(d) List of Impaired Water Bodies (MDEQ, 2012). This water quality limited segment is located in the South Independent Basin in Claiborne County. The applicable water quality criteria, as described in the *WPC-2 State of Mississippi's Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*, requires that the pH shall be within the range of 6.0 to 9.0 standard units (s.u.) (MDEQ, 2012).

The specific causes of the low pH for this water body are not known but are believed to be a combination of point source discharges and stormwater discharge over acidic soils. The wasteload allocation for the total maximum daily load (TMDL) requires that the pH in effluent from permitted point sources shall be within the range of 6.0 to 9.0 s.u. The load allocation for the TMDL requires that the pH of waters originating from nonpoint sources shall be within the range of 6.0 to 9.0 s.u. These allocations provide for the year-round protection of water quality. The location of the watershed is shown in Figure 1.

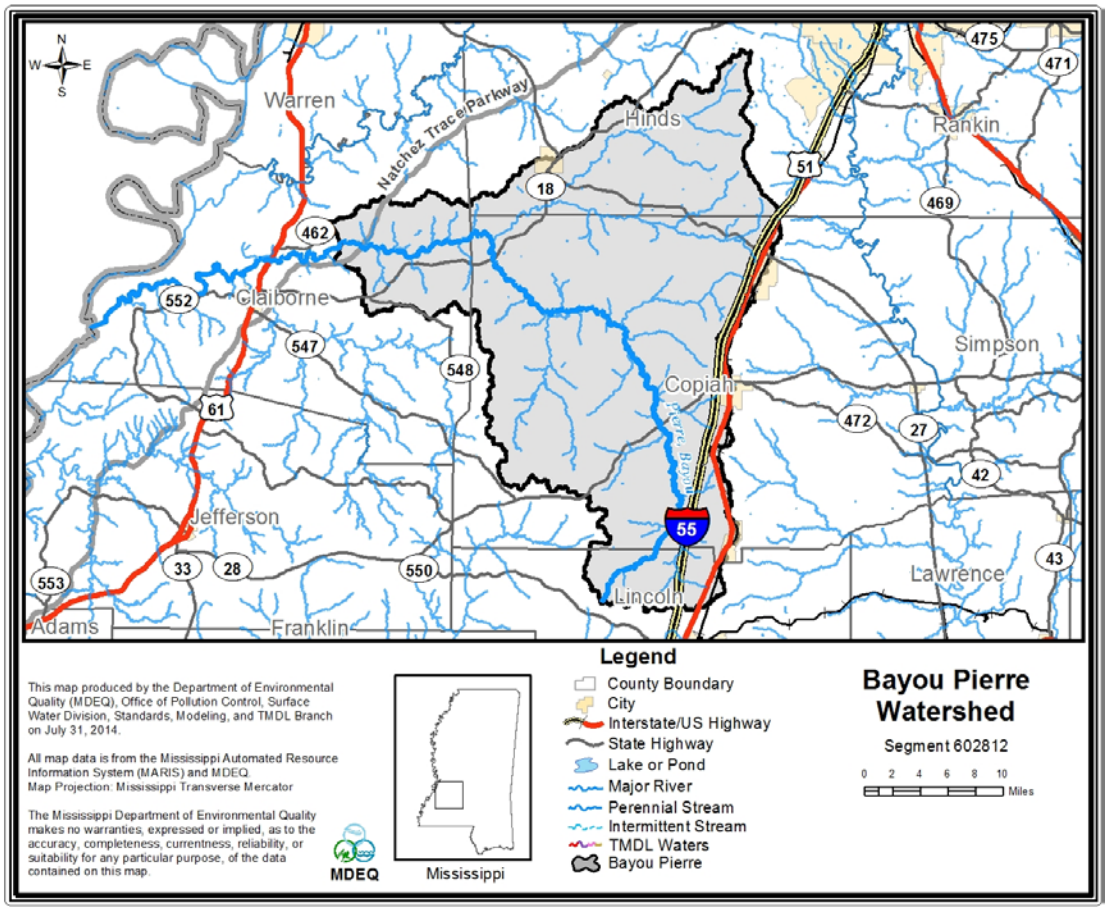

Figure 1. Location of Bayou Pierre Watershed

Introduction

Bayou Pierre (602812) was identified by MDEQ as not supporting the designated use for the pH standard on *Mississippi's 2012 Section 303(d) List of Impaired Water Bodies* (MDEQ, 2012). TMDLs are required for impaired waters on the §303(d) list as required by the Federal Clean Water Act §303(d) and the implementing regulations in accordance with 40 CFR.130. A TMDL establishes the maximum amount of a pollutant a water body can assimilate without exceeding the applicable water quality standard. The TMDL also allocates the total allowable load to individual sources or categories of sources through wasteload allocations (WLAs) for point sources, and through load allocations (LAs) for non-point sources. The WLAs and LAs in the TMDL provide a basis for states to reduce pollution from both point and non-point source activities that will lead to the attainment of water quality standards and protection of the beneficial use.

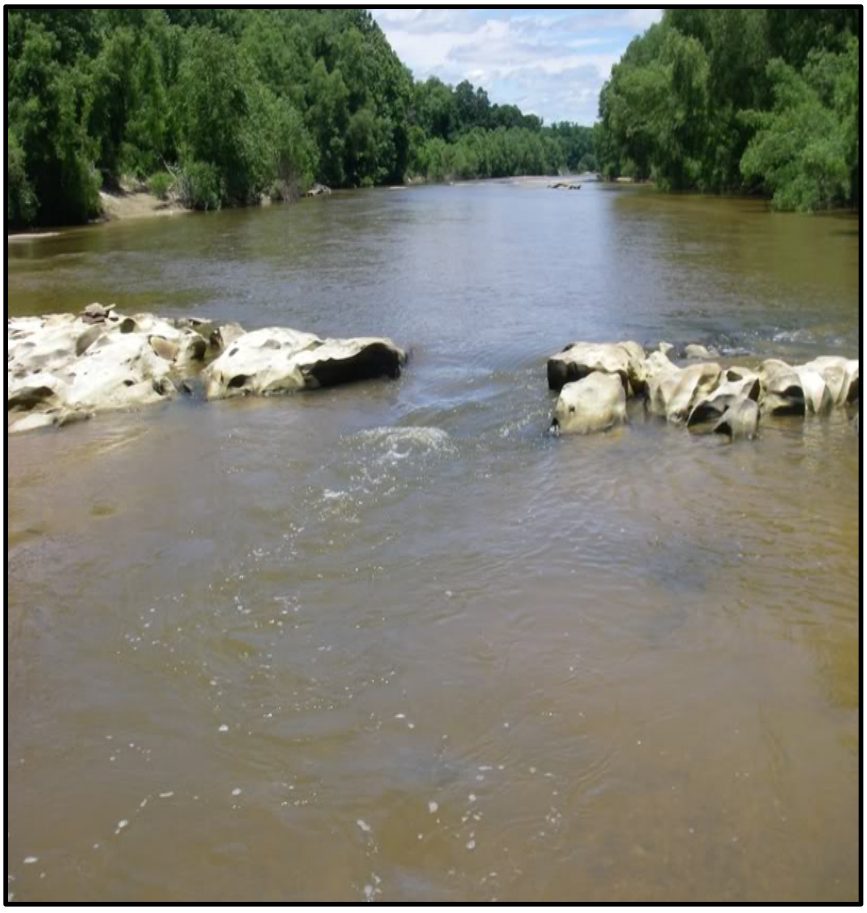

Figure 2. Bayou Pierre

Problem Definition

pH is a measure of the hydrogen ion concentration in water as well as a measure of the acidity or alkalinity. Specifically, pH is defined as the negative logarithm of the hydrogen ion concentration in terms of moles per liter.

$$pH = -\log [H+]$$

pH values can range from 0 s.u. for a very acidic solution to 14 s.u. for a very basic solution. A pH equal to 7.0 s.u. represents neutrality. One of the most significant environmental impacts of pH is the effect that it has on the solubility and thus the bioavailability of potentially toxic substances that may be present in surface waters.

As the pH in a water body becomes lower (i.e., the solution becomes more acidic) many insoluble toxic substances like cyanides, sulfides, and most metals become more soluble and thus more likely to have toxic effects on fish and other aquatic life. Slight increases in pH may greatly increase the toxicity of pollutants such as ammonia. (Lee, 1998)

Due to high humidity in the southwest, large amounts of rainwater, which is naturally slightly acidic, move through the soil. If weak acids are formed from the reaction of hydrogen ions combining with carbon dioxide or other compounds, bases may be gradually leached from the soil as the water percolates through it, lowering the soil pH. Decomposition of coniferous vegetation, which produces more fulvic acids than either deciduous vegetation or grasses, is another process that lowers soil pH.

Applicable Water Quality Standard

The TMDL for Bayou Pierre will be established at a level to ensure consistency with the applicable water quality criteria and protection of its designated use (i.e., Fish and Wildlife). The State of Mississippi *Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* includes numeric water quality criteria for pH of 6.0 to 9.0 s.u. for waters with these designated uses (MDEQ, 2012).

Watershed Characterization

The impaired segment of Bayou Pierre is located in Claiborne County. The area is mostly known for hunting and other recreational activities such as four-wheeling and picnicking on the sandbars.

Landuse for the watersed is predominantly forest (Table 3 and Figure 4). However, the immediate landuse surrounding the impaired segment is cropland and pasture. The landuse distributions presented in Table 3 and Figure 4 were derived from the State of Mississippi's Automated Resource Information System (MARIS), which is based on 2006 Landsat Thematic Mapper digital images.

Table 3. Landuse in Bayou Pierre Watershed

	Water	Urban	Forest	Scrub/Barren	Pasture	Cropland	Wetland
area	2,594	18,409	247,467	55,891	65,949	8,018	20,670
% area	**0.6%**	**4.4%**	**59.1%**	**13.3%**	**15.7%**	**1.9%**	**4.9%**

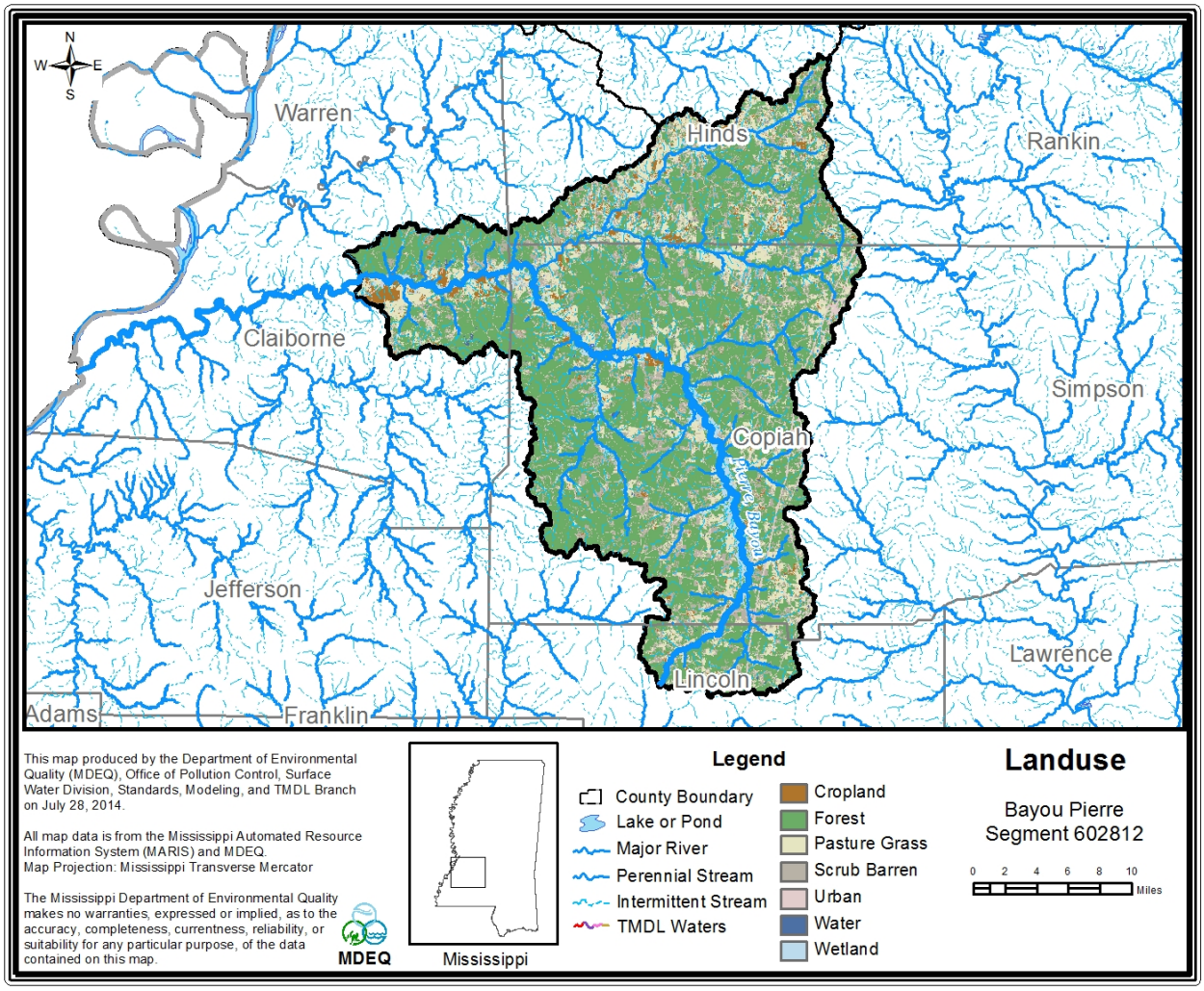

Figure 3. Landuse Distribution Map

Source Identification

There are 29 point sources (42 outfalls) in the watershed that flow into the impaired segment. The point sources are shown in Figure 4 and Table 4. Currently, there are 18 that are active and 11 that are inactive. It is noted that an inactive point source is a NPDES facility that is not in use or is closed. An inactive point source may be reactivated when needed. There are data available for only 11 of the point sources (active and inactive). Mostly all of the discharge monitoring report (DMR) data submitted by these facilities are within the 6.0 S.U. to 9.0 S.U. range which is the water quality standard. These data are shown in Figure 5.

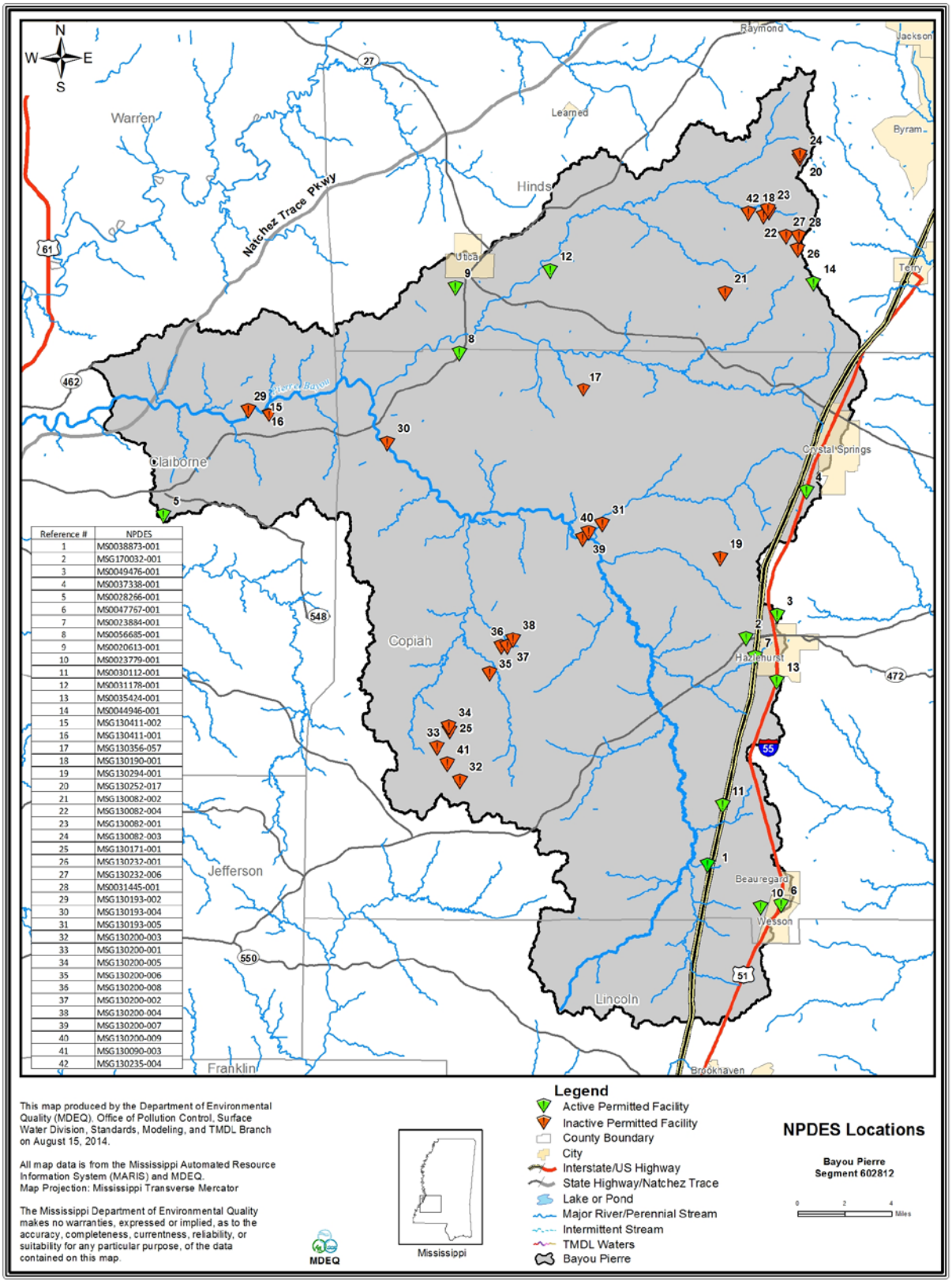

Figure 4. NPDES for Bayou Pierre Watershed

Table 4. NPDES Permitted Sources

Agency ID	Name	County	Permit	Description	Ref # on Figure 4
2875	Hazlehurst Lumber Company	Copiah	MS0049476	Outfall 001 (Boiler blowdown and non-contact cooling water)	3
13742	Union For Reform Judaism, Henry S Jacobs Camp	Hinds	MS0031178	Outfall 001 (Domestic Wastewater)	12
13927	Waltman Hall Inc, Country Junction Truck Stop	Copiah	MS0038873	Outfall 001 (Domestic Wastewater)	1
14070	Midway Food Mart	Hinds	MS0044946	Outfall 001 (Treated Domestic Wastewater)	14
65155	Southeast Supply Header LLC	Claiborne	MSG130411	Outfalls 001 and 002 (Hydrostatic Testing discharge)	15,16
13178	Hazlehurst POTW	Copiah	MS0023884	Outfall 001 (Domestic/ Municipal Wastewater)	7
13448	Wesson POTW	Copiah	MS0023779	Outfall 001 (Domestic Wastewater)	10
13186	Hinds Community College	Copiah	MS0056685	Outfall 001 (Domestic Wastewater)	8

Agency ID	Name	County	Permit	Description	Ref # on Figure 4
13720	MDOT, Interstate 55, Rest Area, Copiah	Copiah	MS0030112	Outfall 001 (Domestic Wastewater)	11
2997	Wilsons Slaughterhouse	Copiah	MS0037338	Outfall 001 (Process and Sanitary Wastewater)	4
4643	BFEL Indemnitor Inc, Potter Production Facility	Copiah	MS0047767	Outfall 001 (Remediated Groundwater)	6
1249	Charles Donald Pulpwood Inc, Hazlehurst Woodyard	Copiah	MSG170032	Outfall 001 (Overflow from Recycle Storage Pond)	2
3833	Southern Lumber Company Inc, Hermanville	Claiborne	MS0028266	Outfall 001 (Inclusive of the discharge from Outfall 002, non-process wastewater, and Storm Water)	5
13429	Utica POTW, South	Hinds	MS0020613	Outfall 001 (Domestic / Municipal Wastewater)	9
13855	Johnson Camper Carwash	Copiah	MS0035424	Outfall 001 (Treated Car Wash Effluent)	13
57300	Denbury Onshore LLC, NEJD Loop	Copiah	MSG130356	Outfall 057 (Hydrostatic Test General Permit)	17

Agency ID	Name	County	Permit	Description	Ref # on Figure 4
18589	Texas Eastern Transmission LP, M1 Expansion Project	Hinds	MSG130082	Outfalls 002 and 004 (Hydrostatic Testing discharge)	21-24
35515	Copiah Storage LLC, Copiah Natural Gas Storage Facility	Copiah	MSG130200	Outfalls 001,002, 003, 004, 005, 006, 007, 008, and 009 (Hydrostatic Testing discharge)	32-40
35521	Southeast Supply Header LLC, Natural Gas Pipeline	Copiah	MSG130193	Outfalls 002, 004, and 005 (Hydrostatic Testing Discharge)	29-31
36190	Gulf South Pipeline Company, East Texas to Mississippi Expansion Project 2	Hinds	MSG130190	Outfall 001 (Hydrostatic Testing Discharge)	18
13755	Mississippi District Assemblies of God, Ranger Trails Camp	Hinds	MS0031445	Outfall 001 (Domestic Wastewater)	28
38115	Gulf Crossing Pipeline Company LLC, Gulf Crossing Project	Hinds	MSG130232	Outfall 001 (Hydrostatic Testing Discharge)	26
38352	Gulf South Pipeline Company LP, Index 387 Segment Reparations	Rankin	MSG130235	Outfall 004 (Hydrostatic Testing Discharge)	42
48780	Midcontinent Express Pipeline LLC, Mississippi Pipeline Project	Hinds	MSG130252	Outfall 017 (Hydrostatic Testing Discharge)	20

Agency ID	Name	County	Permit	Description	Ref # on Figure 4
18969	Texas Eastern Transmission LP, Union Church SCC Hydrostatic Retest Project	Jefferson	MSG130090	Outfall 003 (Hydrostatic Testing Discharge)	41
38115	Gulf Crossing Pipeline Company LLC, Gulf Crossing Project	Simpson	MSG130232	Outfall 006 (Hydrostatic Testing Discharge)	27
53837	Southcross Energy GP LLC, Copiah 8 Inch Pipeline Project	Copiah	MSG130294	Outfall 001 (Hydrostatic Testing Discharge)	19
35399	Spectra Energy and Texas Eastern Transmission LP, Union Church Discharge Line	Copiah	MSG130171	Outfall 001 Regulated Stormwater	25

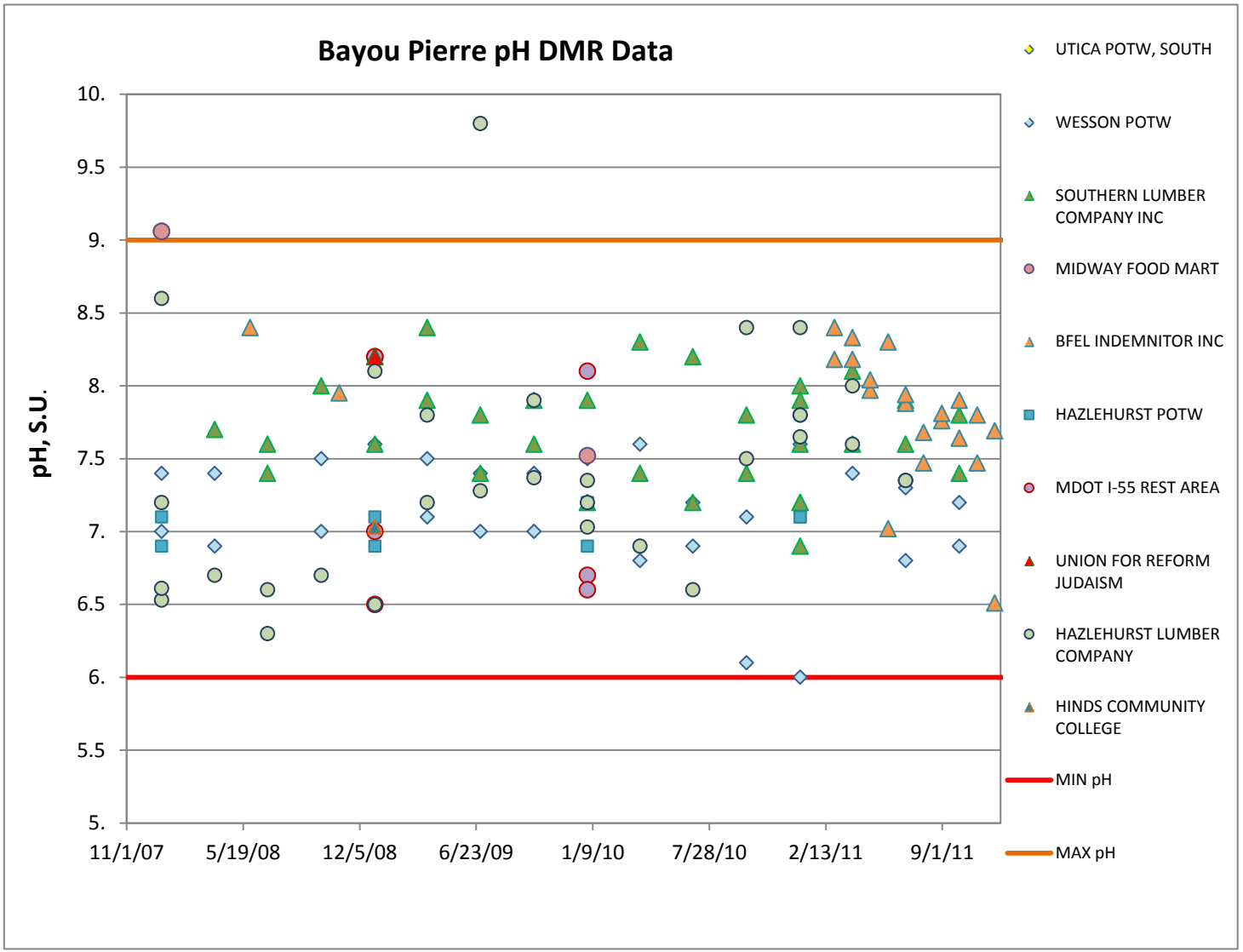

Figure 5. Available DMR pH Data 2007 - 2011

Water Quality Data

MDEQ collected ambient monthly water quality samples from Bayou Pierre. The monitoring station is shown in Figure 6. The ambient pH data are shown in Figure 7 along with the discharge measured in the stream. Table 5 shows a further breakdown of the pH violations as compared to the discharge measured on those days for station 07290650. After reviewing all available data, including the historical data, it is believed the low pH values do not correlate with any particular season or discharge of flow. It is also believed the low values are not associated with naturally occurring conditions. Though, the data range for the historical data is only from 1961-1973, no violations of the pH standard were observed during that timeframe. Figures 8 and 9 show the historical USGS pH data. There is insufficient information available to determine the cause for the lower pH values; however, probable causes may be attributed to stormwater runoff from fertilized soils for cropland and inactive natural gas pipelines.

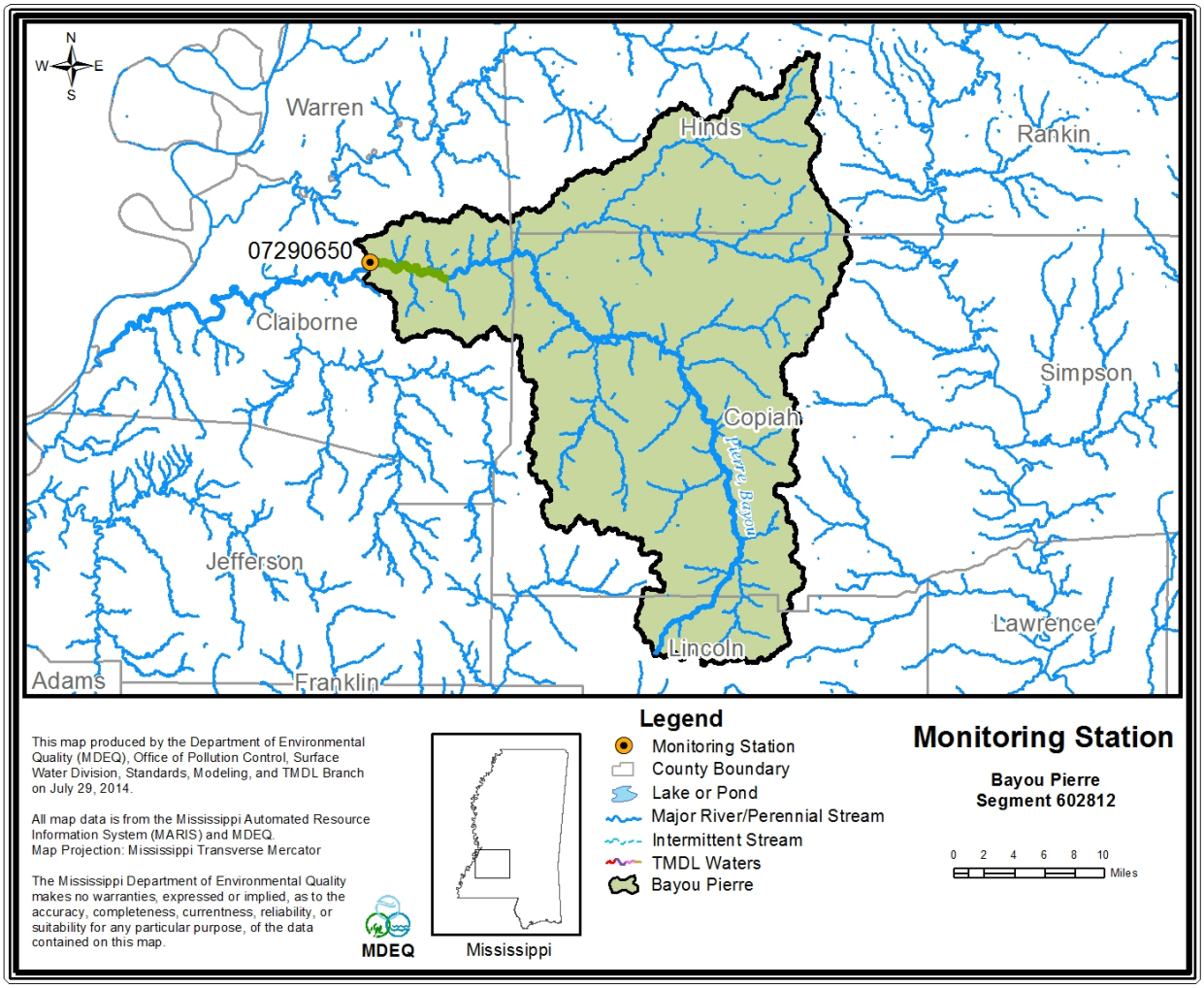

Figure 6. Monitoring Station for Ambient Site (07290650)

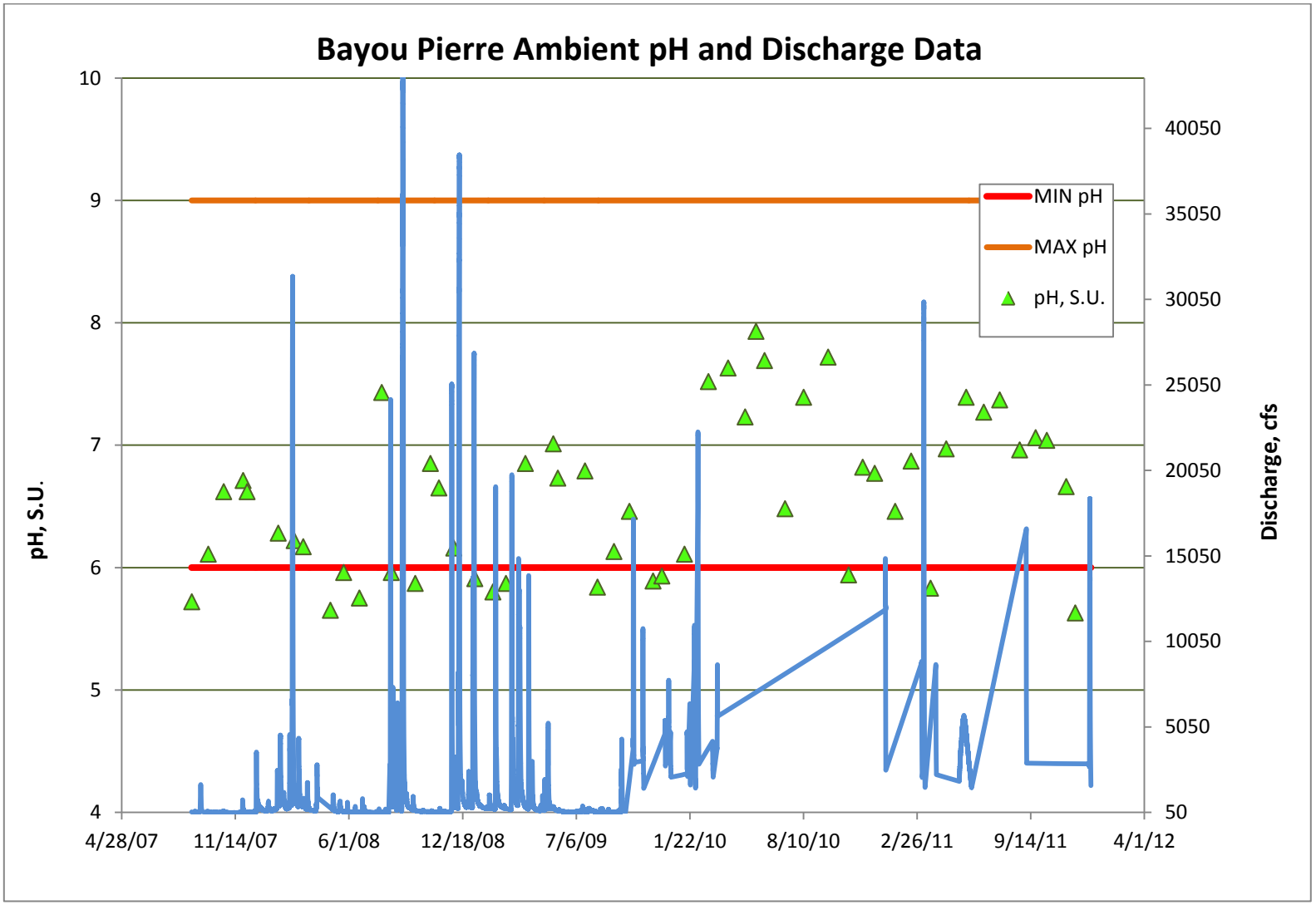

Figure 7. Bayou Pierre Ambient pH Data and Discharge Data

Table 5. pH Violations versus USGS Discharge Data (07290650)

Date	pH Value	Average discharge measured (cfs)
08/29/2007	5.72	81
04/24/2008	5.65	357
05/22/2008	5.96	91
06/19/2008	5.75	48
08/14/2008	5.96	2030
09/25/2008	5.87	182
01/08/2009	5.91	4670
02/09/2009	5.8	270
03/04/2009	5.87	274
08/12/2009	5.84	77
11/18/2009	5.89	Not available
12/03/2009	5.93	Not available
10/28/2010	5.94	Not available
03/21/2011	5.83	Not available
12/01/2011	5.63	Not available

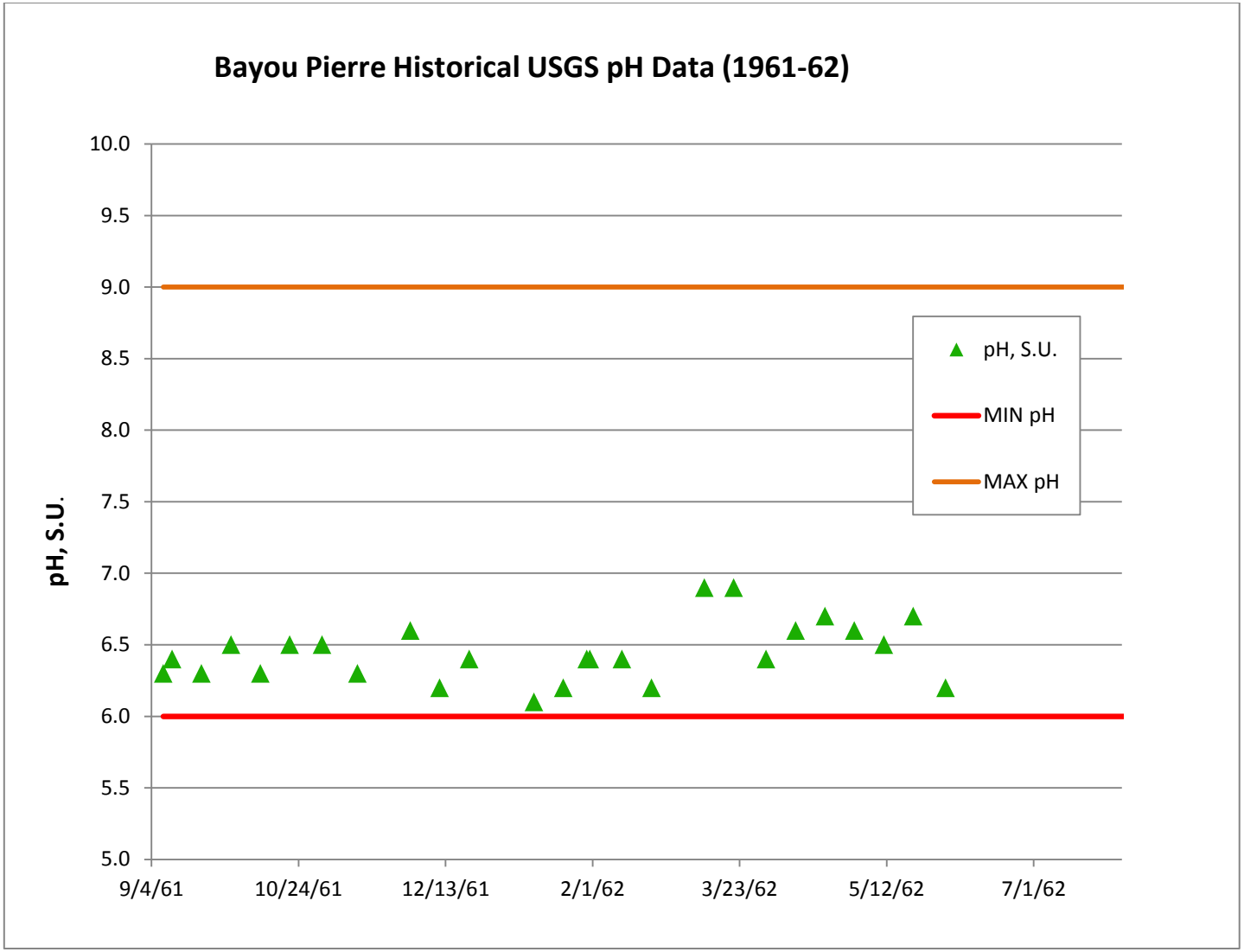

Figure 8. Bayou Pierre Historical USGS pH Data (1961-62)

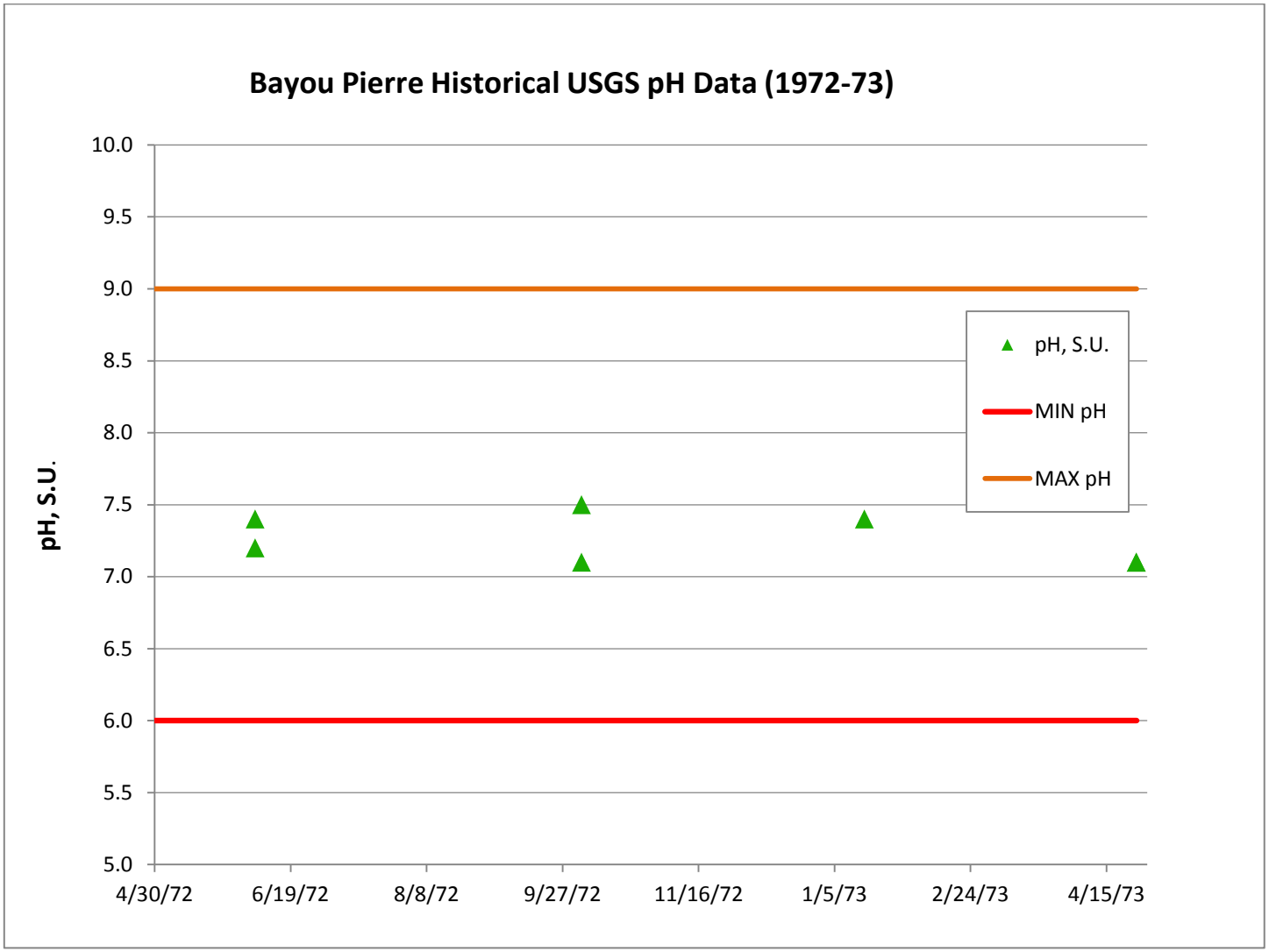

Figure 9. Bayou Pierre Historical USGS pH Data (1972-73)

Ambient pH measurements were taken between 2007 and 2011 (Figure 7). As shown in this figure, all of the water quality standard excursions were attributed to low pH. As summarized in Table 6 below, 28.3% of the pH measurements did not meet water quality standards. These violations occurred throughout the year with no specific pattern, and are a shown in Table 7 according to the season that was violated.

Table 6. Assessment Table for Ambient pH

Data Window	Number of Samples	Number of samples not meeting water quality standards (low pH)	Percentage of data not meeting water quality standards
2007 - 2011	53	15	28.3%

Table 7. Bayou Pierre Ambient pH Violations by Season

Date	pH Value	Season Violated*
08/29/2007 11:45	5.72	summer
04/24/2008 11:25	5.65	spring
05/22/2008 11:40	5.96	spring
06/19/2008 11:30	5.75	summer
08/14/2008 11:40	5.96	summer
09/25/2008 11:45	5.87	fall
01/08/2009 11:00	5.91	winter
02/09/2009 11:15	5.8	winter
03/04/2009 11:25	5.87	spring
08/12/2009 11:45	5.84	summer
11/18/2009 11:50	5.89	fall
12/03/2009 11:50	5.93	winter
10/28/2010 11:55	5.94	fall
03/21/2011 12:04	5.83	spring
12/01/2011 11:00	5.63	winter

***Dec-Feb (winter), Mar-May (spring), Jun-Aug (summer), Sep-Nov (fall)**

Total Maximum Daily Load (TMDL)

A TMDL establishes the total pollutant load a water body can receive and still achieve water quality standards. The components of a TMDL include a WLA for point sources, a LA for non-point sources, and a margin of safety (MOS) to account for uncertainty. 40 CFR.130.2(i) provides flexibility concerning how TMDLs are expressed and suggests that they may be expressed in terms of mass per time, toxicity, or other appropriate measure. For this TMDL as well as other pH TMDLs that have been established by MDEQ, it has been determined that the appropriate measure for the allocation should be in terms of pH standard units.

Wasteload Allocation

There are 28 point sources that are identified for this watershed. For future dischargers to discharge to this watershed or to tributaries in the watershed, effluent pH levels should be no less than 6.0 s.u. and no greater than 9.0 s.u. and shall not cause the pH to rapidly change more than 1 unit s.u. This is a standard NPDES permit requirement.

Load Allocation

The nonpoint sources causing or contributing to pH violations are unknown. The potential nonpoint sources include, but are not limited to, low pH in stormwater runoff, groundwater infiltration, and acid rain deposition. The load allocation for this TMDL suggests that the pH of waters originating from any nonpoint sources in the watershed shall be no less than 6.0 s.u. and no greater than 9.0 s.u. if possible based on the natural conditions found in the watershed.

Margin of Safety

The margin of safety in TMDLs is used to account for the lack of knowledge concerning the relationship between the pollutant loads and the resulting quality of the receiving water body. The allocations used in this TMDL ensure that loads from any point source(s) and loads originating from any non-point source activities must individually meet the pH target of 6.0 to 9.0 s.u. before entering the stream. As long as pH from both point and non-point source activities are consistent with the allocations in this TMDL, water quality standards will be met.

Seasonal Variation

The allocation proposed for this TMDL provides for year-round protection (i.e., protection during all seasons and environmental conditions) of the pH criteria. Based on the available data and information, critical conditions for this TMDL could not be determined. However, considering that this TMDL is protective during all seasons and environmental conditions, it will inherently be protective during critical conditions whenever they occur.

Recommendations

The wasteload allocation for this TMDL is considered and used by MDEQ through its NPDES permitting process. This TMDL recommends further monitoring from the point sources in their DMRs. The TMDL also recommends further ambient monitoring within the stream.

Achieving the load allocation will require a better understanding of the causes and sources of the low pH. Future monitoring and data collection should provide insight regarding the potential causes of the low pH in this watershed.

Next Steps

MDEQ has adopted the Basin Approach to Water Quality Management, a plan that divides Mississippi's major drainage basins into five groups. During each yearlong cycle, MDEQ resources for water quality monitoring will be focused on one of the basin groups. During the next monitoring phase in the Tombigbee River Basin, these watersheds may receive additional monitoring to identify any changes or improvements in water quality.

Public Participation

This TMDL will be published for a 30-day public notice. During this time, the public will be notified by publication in the newspaper. The public will be given an opportunity to review the TMDL and submit comments. MDEQ also distributes all TMDLs at the beginning of the public notice to those members of the public who have requested to be included on a TMDL mailing list. Anyone wishing to become a member of the TMDL mailing list should contact Greg Jackson at gjackson@deq.state.ms.us.

All comments should be directed to Greg Jackson at gjackson@deq.state.ms.us or Greg Jackson, MDEQ, PO Box 2261, Jackson, MS 39225. All comments received during the public notice period and at any public hearings become a part of the record of this TMDL and will be considered in the submission of this TMDL to EPA Region 4 for final approval.

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