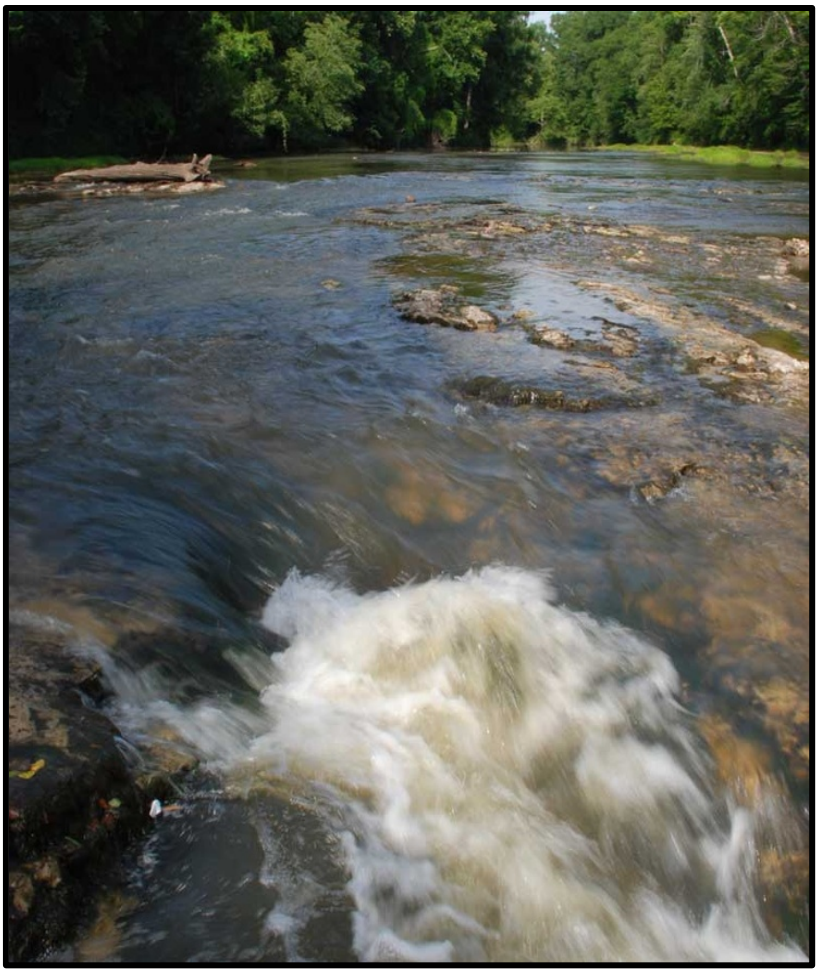
Final REPORT
May 2014

pH TMDL for the Strong River Watershed

Pearl River Basin
Rankin, Scott, Smith, and Simpson Counties, Mississippi

Prepared By

Mississippi Department of Environmental Quality
Office of Pollution Control
Modeling and TMDL Branch



MDEQ
PO Box 2291
Jackson, MS 39225-2291
(601) 961-5171
www.deq.state.ms.us

Mississippi Department of
Environmental Quality

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
Strong River	511911	Rankin, Scott, Smith, and Simpson	pH
Near D'Lo to MWS 5124 boundary at confluence with Robinson Creek			

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

Strong River (511911) near D'Lo to MWS 5124 boundary at confluence with Robinson Creek 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 Pearl River Basin in Rankin and Simpson Counties. 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 discharge and stormwater discharge over acidic soils. The low pH in this water must be attributed either to unknown point or nonpoint sources of low pH or to natural background conditions. Bienville National Forest, which is approximately 179,000 acres of pine and oak trees, is located at the headwaters of this stream. There is information that suggests the waters in this watershed exhibit low pH due to naturally acidic soil conditions. USGS pH data, from the 1960s and 1970s, indicate low pH values for this segment which is shown later in Figure 10.

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.

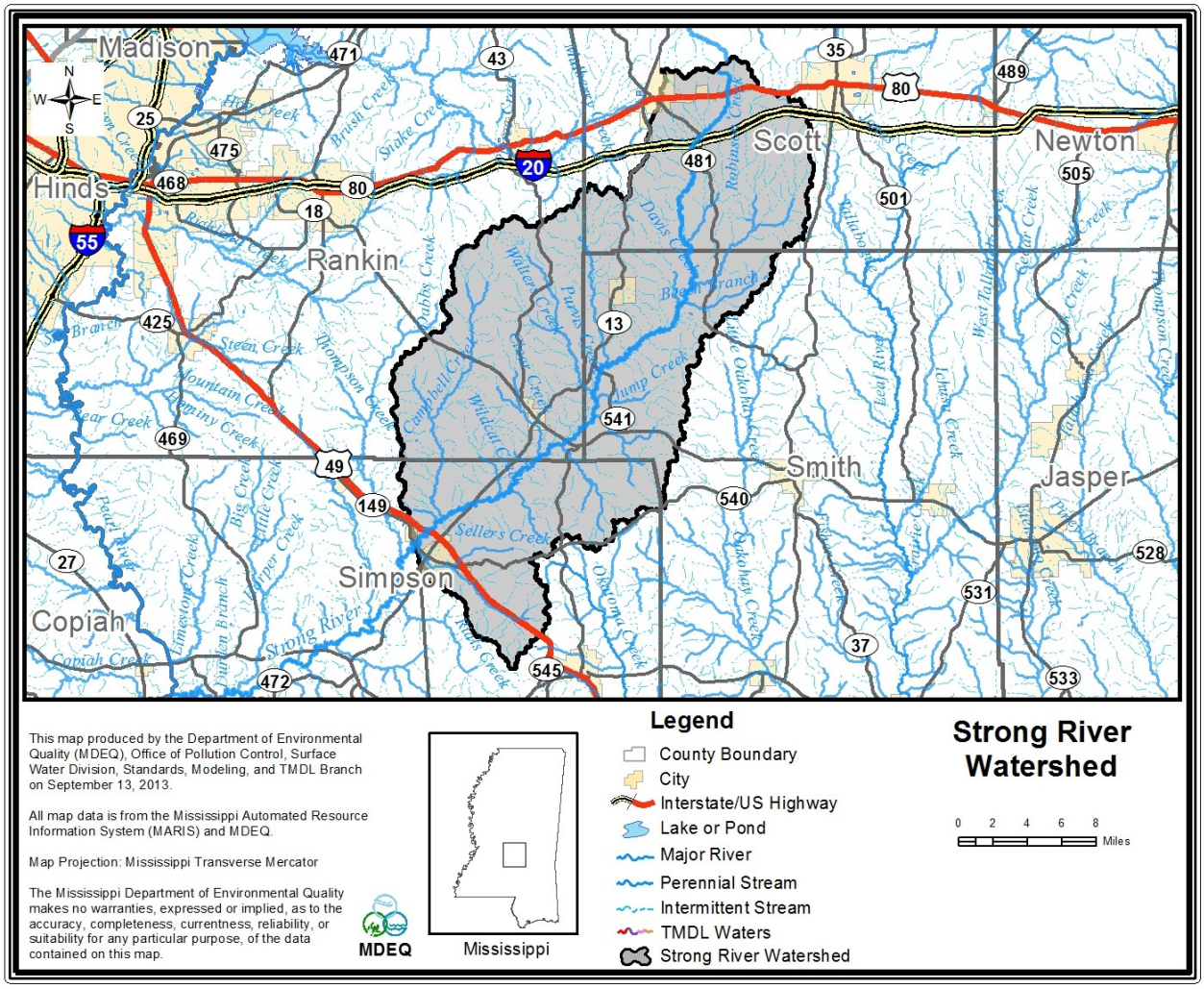

Figure 1. Location of Strong River Watershed

Introduction

The Strong River (511911) 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.

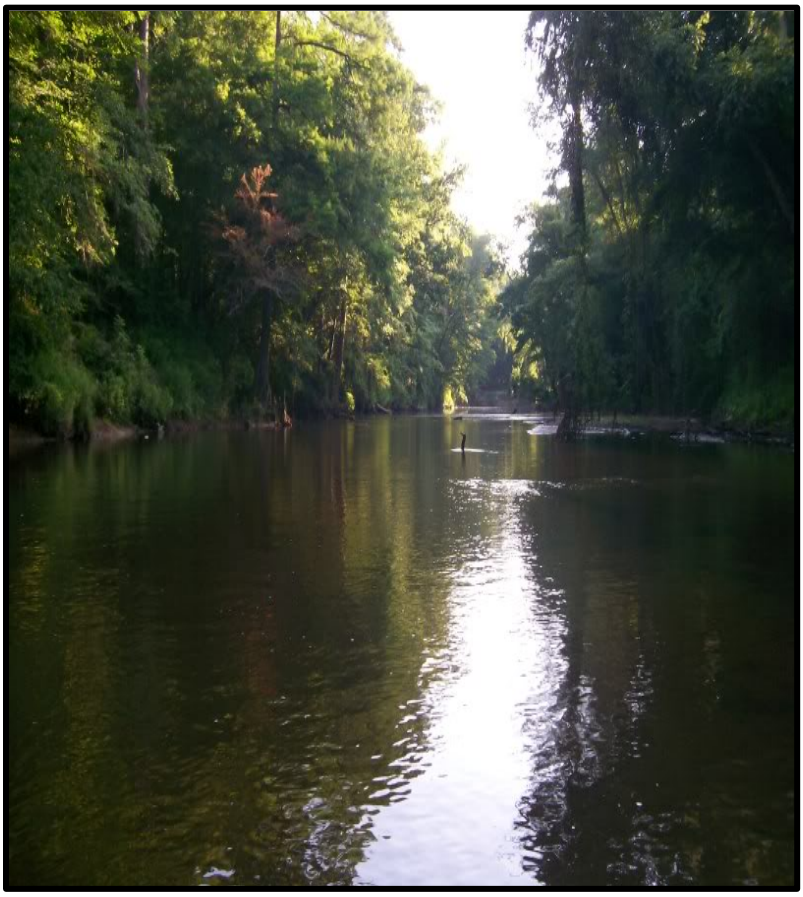

Figure 2.
www.bullnettlenews.com/forum/yaf_postsm58577_Kayaking-the-Strong-River.aspx

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 southeast, 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 the Strong River 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). Although there is information that suggests that waters in the basin exhibit low pH due to natural conditions, there is currently not enough information readily available to determine whether the low pH in this segment is attributed to natural conditions. Therefore, the applicable pH criteria for these segments are the allowable range of 6.0 to 9.0 s.u.

Watershed Characterization

The Strong River is located in Rankin, Scott, Smith, and Simpson Counties near D'Lo. There are several canoe outfitters in business in the area which provide for extensive use of the stream for contact recreation as well as camping sites. One major canoe starting point is at D'Lo Waterpark in D'Lo, MS.

Landuse is predominantly forest (Table 3 and Figure 4). 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 Strong River Watershed

	Water	Urban	Forest	Scrub/Barren	Pasture	Cropland	Wetland	
area	1674	11262	147056	28509	41785	3555	38404	272245
% area	0.6%	4.1%	54.0%	10.5%	15.3%	1.3%	14.1%	100%

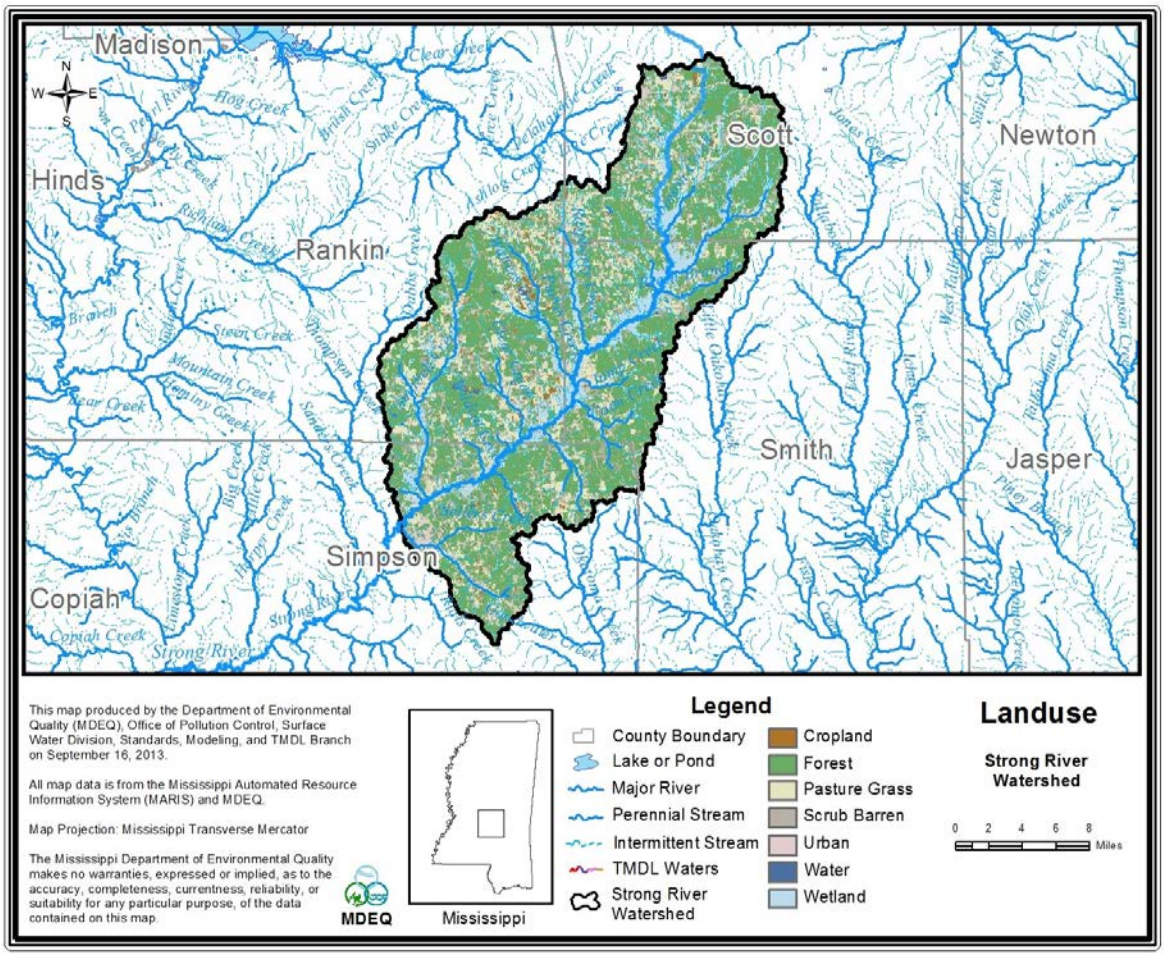

Figure 3. Landuse Distribution Map

Source Identification

There are 14 point sources in the watershed that flow into the impaired segment. Currently, there are 6 that are active, 5 that are inactive, and 3 that have no pH data. 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. All of the point sources are shown in Figure 4 and Table 4 below. The vast majority 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. However, there are a few that have pH violations above the maximum allowable pH value of 9. There are only two dischargers that show violations below the minimum pH standard of 6. These data are shown in Figures 5 and 6.

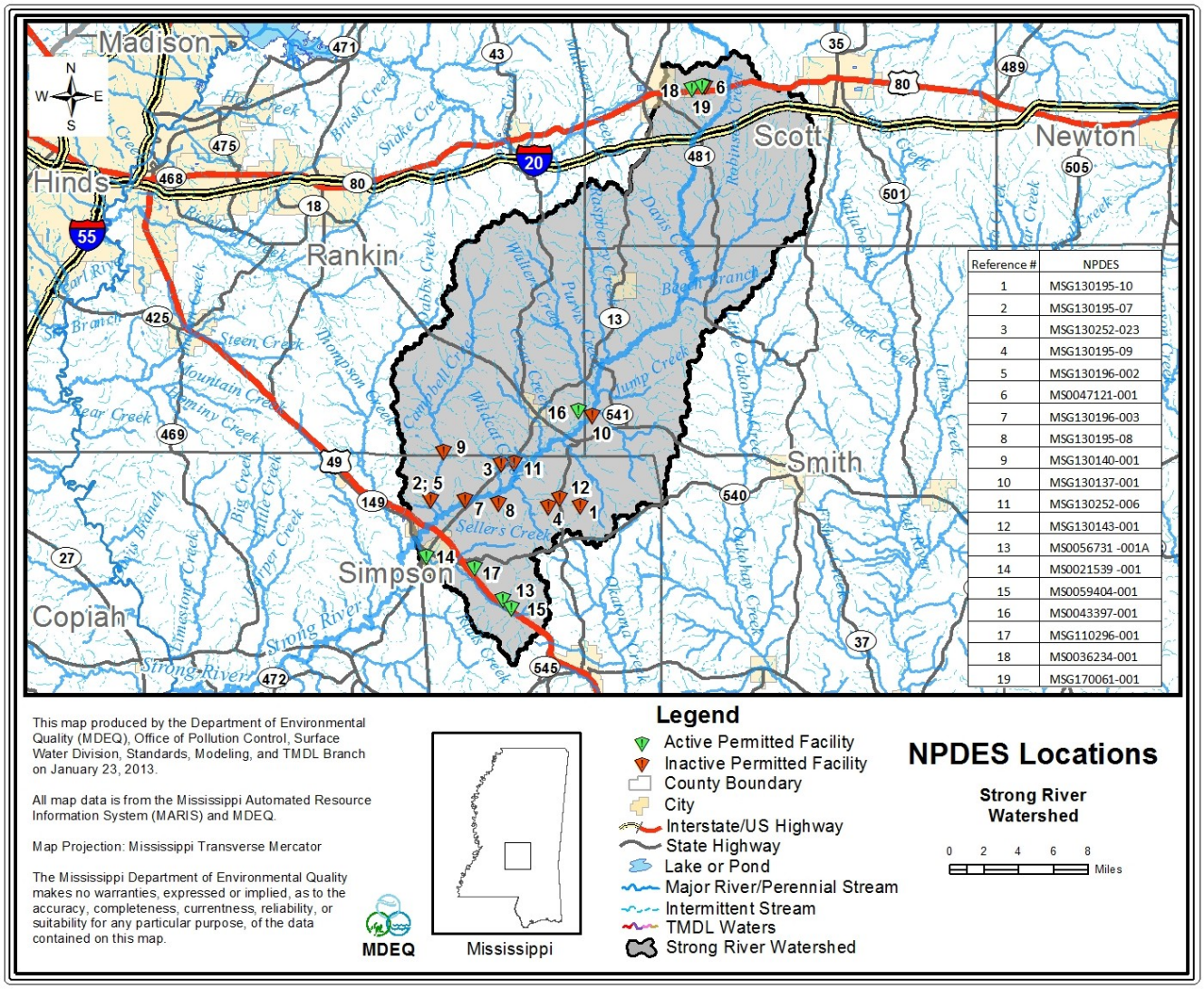

Figure 4. NPDES for the Strong River Watershed

Table 4. NPDES Permitted Sources

Agency Interest	Name	County	Permit	Description
36323	Boardwalk Pipeline Partners LP, Southeast Expansion Project One	Simpson	MSG130195	Outfalls 007, 008, 009, and 010 (Hydrostatic Test Discharge)
48780	Midcontinent Express Pipeline LLC, Mississippi Pipeline Project	Simpson	MSG130252	Outfalls 006 and 023 (Hydrostatic Testing Discharge)
36325	Boardwalk Pipeline Partners LP, Southeast Expansion Project Two	Simpson	MSG130196	Outfalls 002 and 003 (Hydrostatic Test Discharge)
9345	International Paper, Morton Lumber Mill	Scott	MS0047121	Outfall 001(boiler condensate, boiler blowdown, and water from handwash and water fountains)
23353	Gulf South Pipeline Company LP, Index 301 Pipeline Replacement	Rankin	MSG130140	Outfall 001 (Hydrostatic Test Discharge)
23200	M G Dyess Inc, East Mississippi CO2 Pipelines	Rankin	MSG130137	Outfall 001 (Hydrostatic Test Discharge)
23482	G B Boots Smith Corporation, Martinville 8 Inch Pipeline	Simpson	MSG130143	Outfall 001 (Hydrostatic Test Dsicharge)
14684	Howard Industries Inc.	Simpson	MS0056731	Outfall 001A (Sanitary Wastewater)
13260	Mendenhall POTW	Simpson	MS0021539	Outfall 001 (Domestic Wastewater Discharge)
18878	Copiah Lincoln Community College, Simpson County Center	Simpson	MS0059404	Outfall 001 (Treated Domestic Wastewater Discharge)
13351	Puckett POTW	Rankin	MS0043397	Outfall 001 (Municipal Wastewater)
56444	Tri County Ready Mix Inc, Mendenhall Plant	Simpson	MSG110296	Outfall 001 (Process Wastewater from Ready Mix Plant)
13289	Morton POTW	Scott	MS0036234	Outfall 001 (Municipal/Domestic Wastewater)
23306	Richton Tie and Timber LLC, Morton Woodyard	Scott	MSG170061	Outfall 001 (Overflow from Log Spray Recirculation Pond)

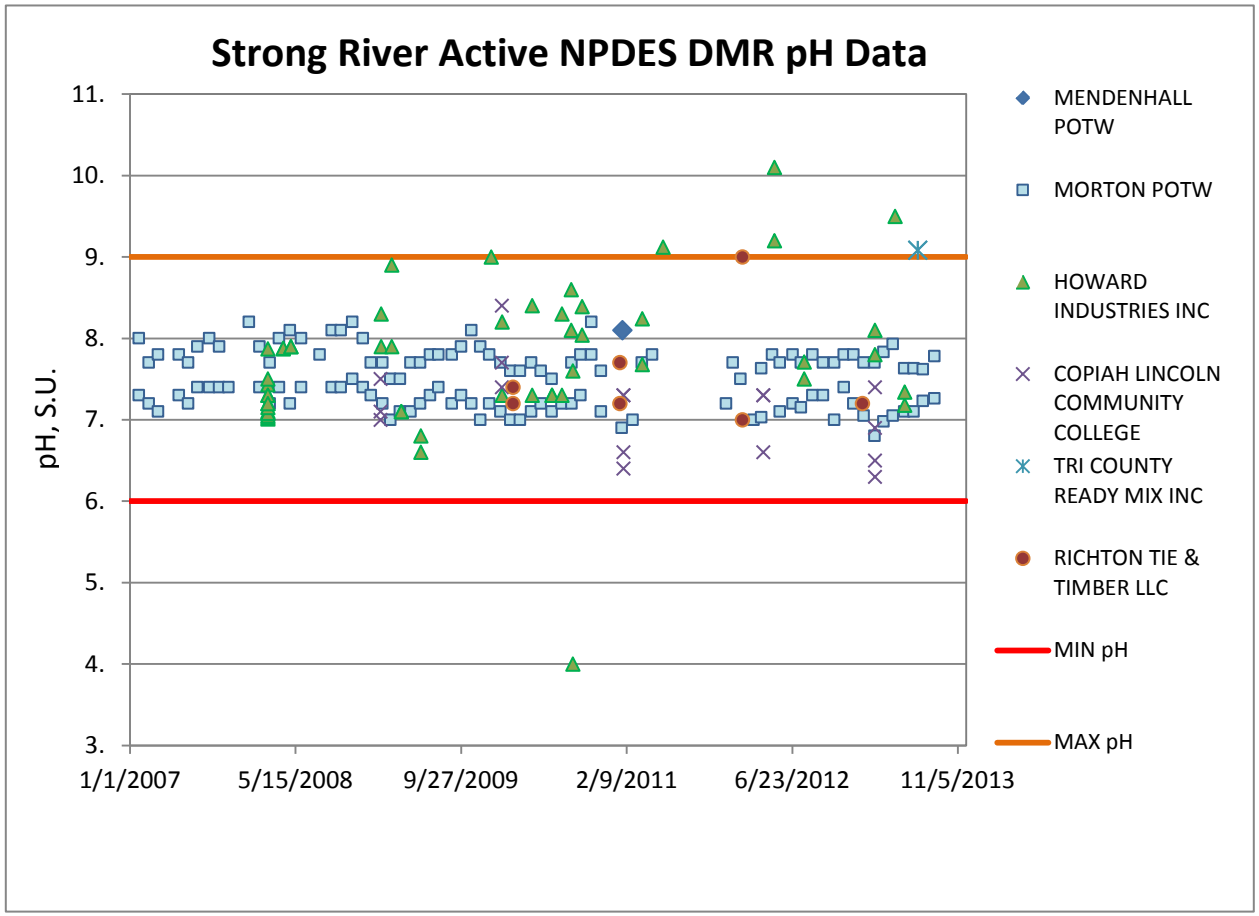

Figure 5. Active DMR pH Data 2007 - 2013

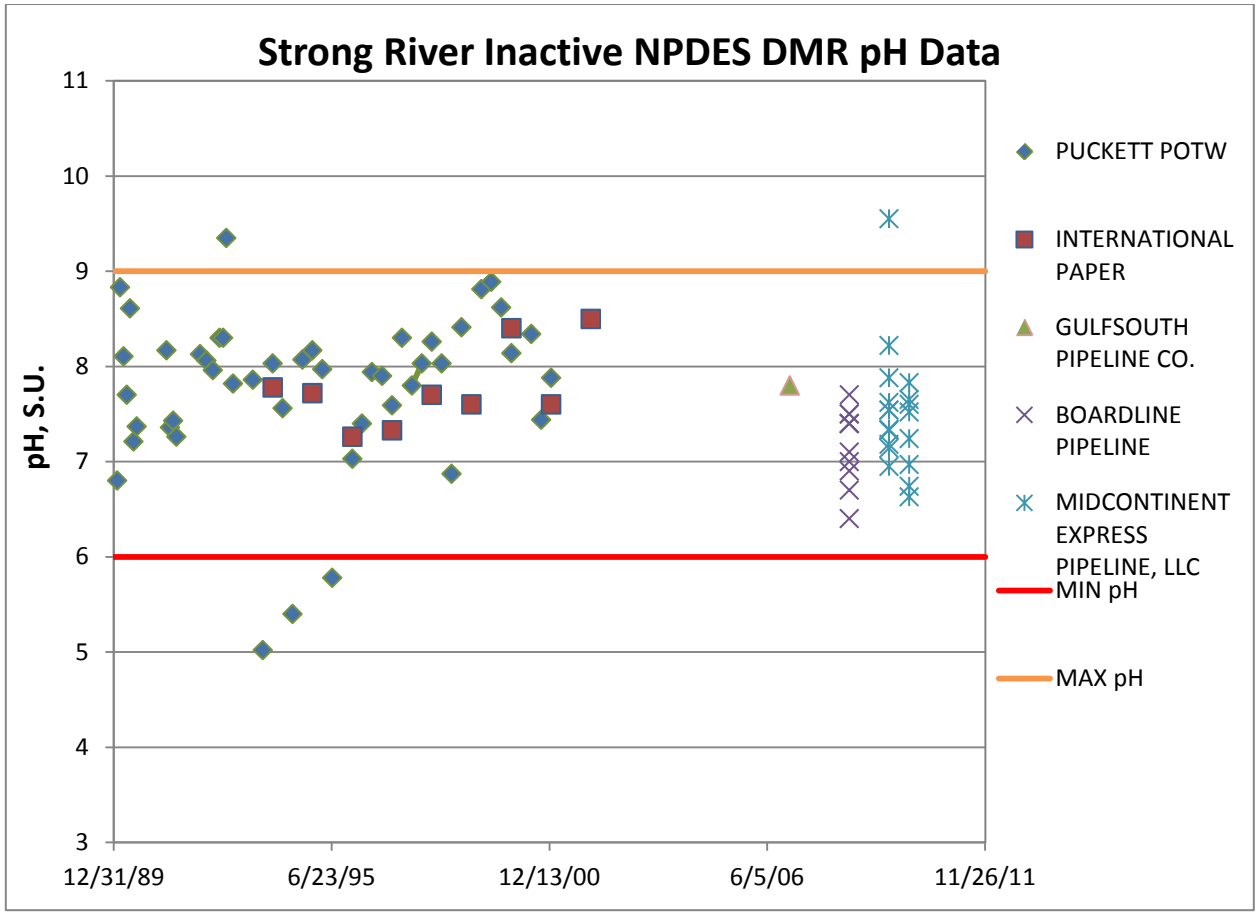

Figure 6. Inactive DMR pH Data 1989 – 2011

Water Quality Data

MDEQ collected ambient monthly water quality samples from the Strong River. The monitoring station is shown in Figure 7. The ambient pH data are shown in Figures 8 and 9. Figure 8 shows the stage measured in the stream. Figure 9 shows the ambient data along with the stage and active pH DMR data. The low pH values don't appear to be associated with any particular season or stage of flow. There is not sufficient information available to determine the cause for the lower pH values, however, it is believed that the low values may be contributed primarily from the multitude of pine and oak trees located in the Bienville National Forest in the upper part of the Strong River Watershed. This forest spans nearly 179,000 acres of pine and oak trees. Figure 10 shows the Strong River in relation to Bienville National Forest. Figure 11 shows the USGS pH data from 1965 through 1971. The lower pH values during this time suggest naturally occurring conditions for low pH.

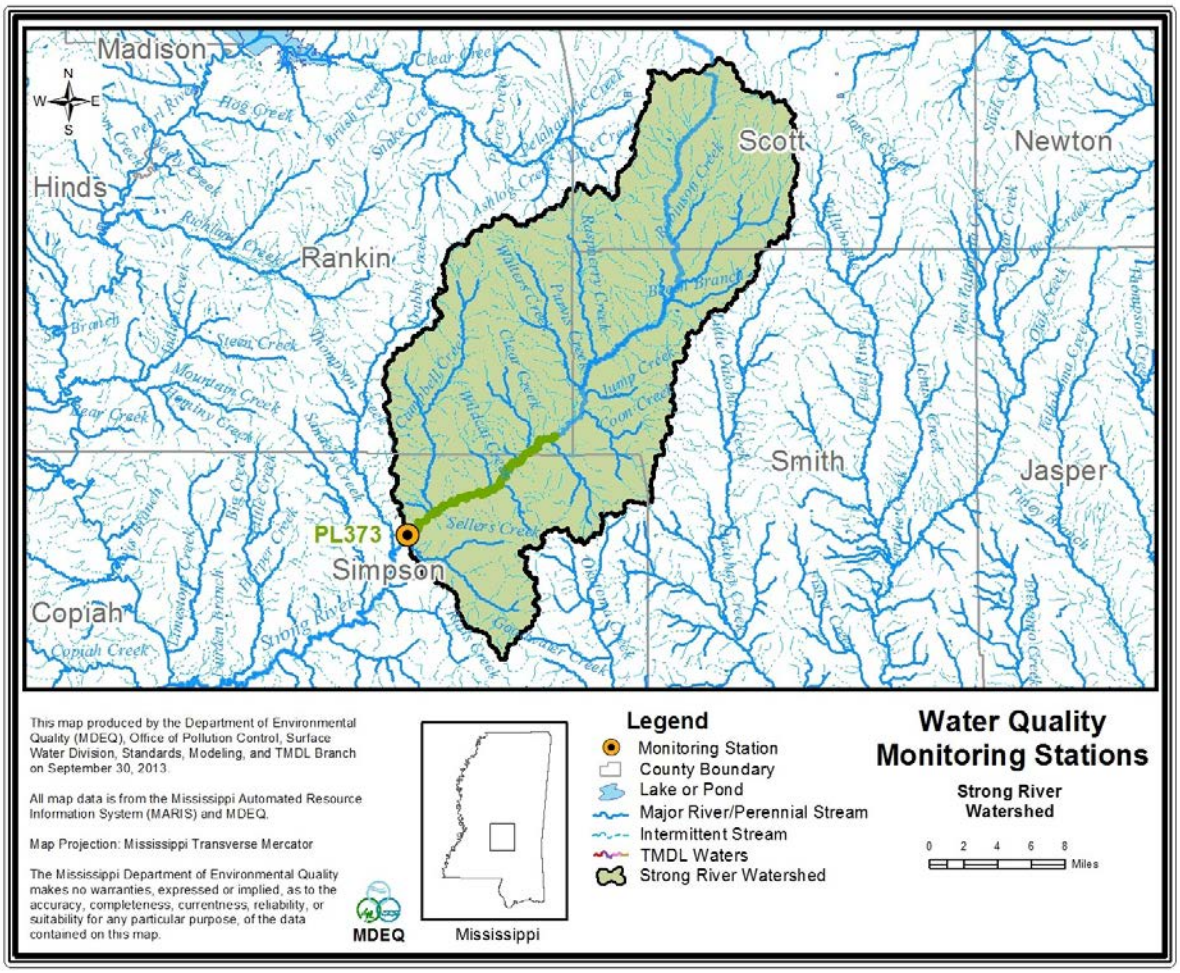

Figure 7. Monitoring Station for Ambient Site

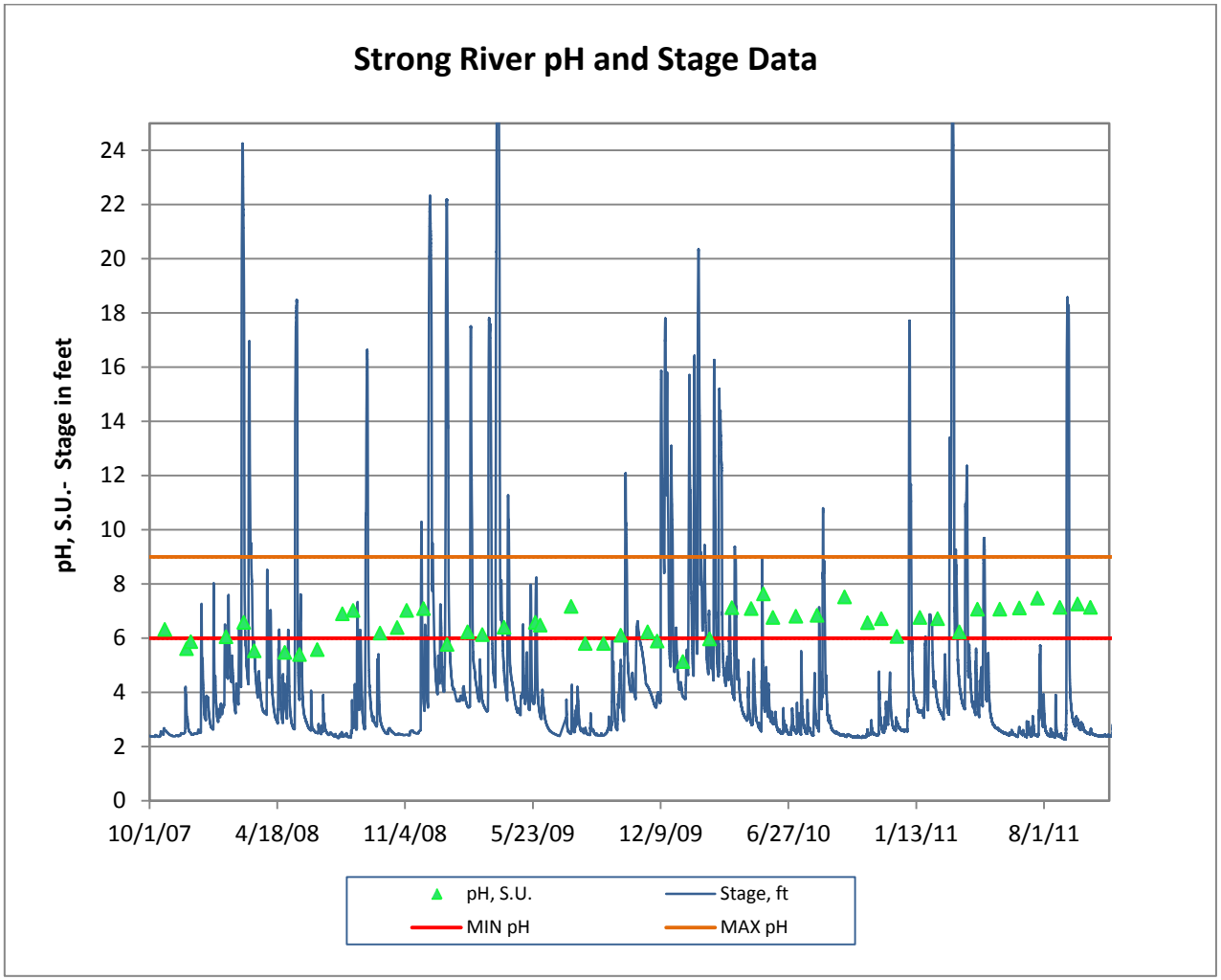

Figure 8. pH Ambient Data and Strong River Stage Data

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 5 below, 20.6% of the pH measurements did not meet water quality standards. These occur throughout the year with no specific pattern, and are a shown in Table 6 according to the season that was violated.

Table 5. Assessment Table for 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	63	13	20.6%

Table 6. Strong River Ambient pH Violations by Season

Date	Value	Season Violated*
08/29/2007 14:50	5.38	summer
11/27/2007 14:05	5.61	fall
12/04/2007 13:30	5.87	winter
03/12/2008 13:10	5.53	spring
04/29/2008 13:20	5.48	spring
05/22/2008 13:35	5.4	spring
06/19/2008 13:55	5.58	summer
01/08/2009 13:30	5.77	winter
08/12/2009 14:05	5.8	summer
09/10/2009 14:20	5.81	fall
12/03/2009 14:05	5.9	winter
01/12/2010 14:15	5.14	winter
02/23/2010 13:50	5.98	winter

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

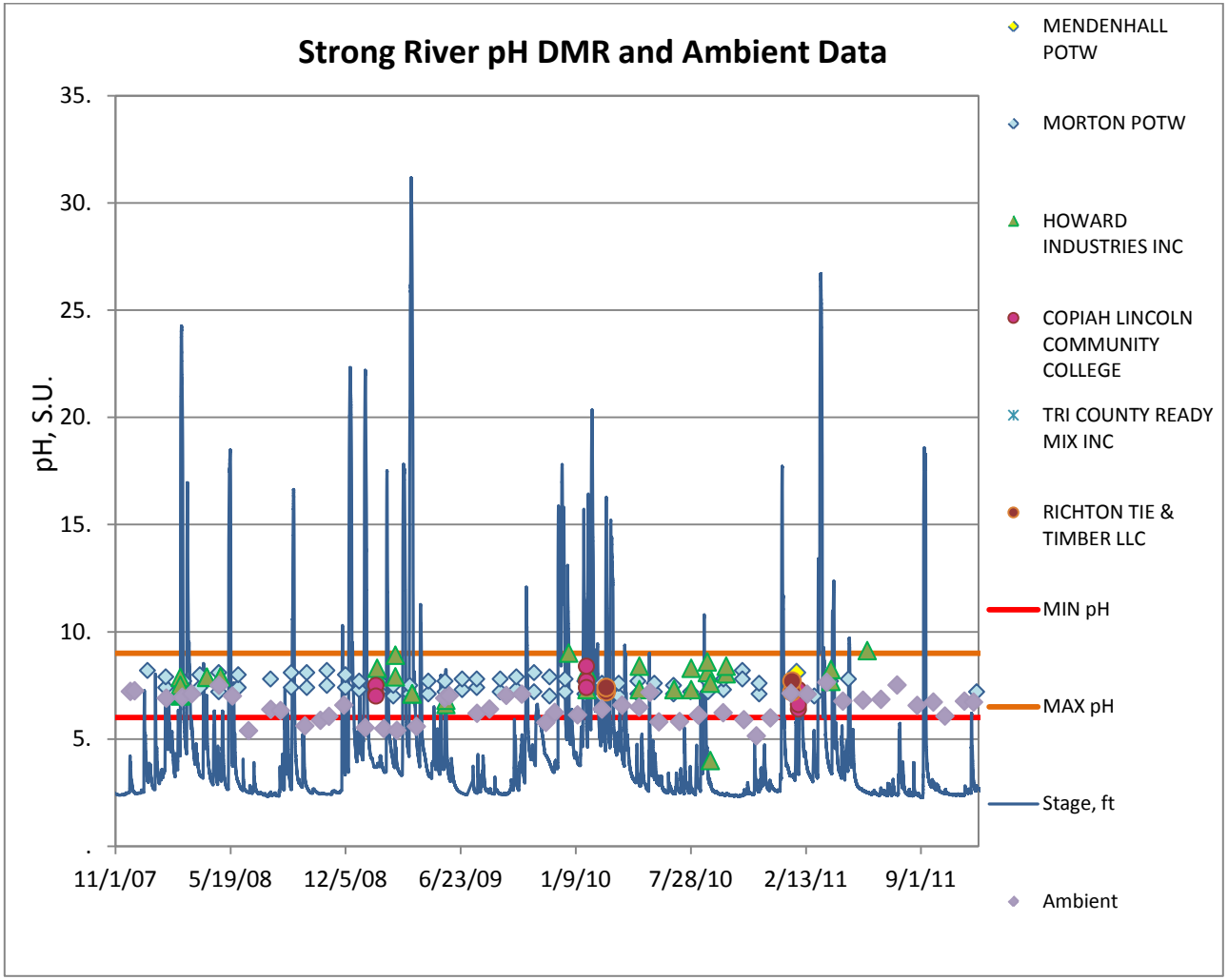

Figure 9. Strong River DMR, Ambient, and Stage Data 2007- 2011

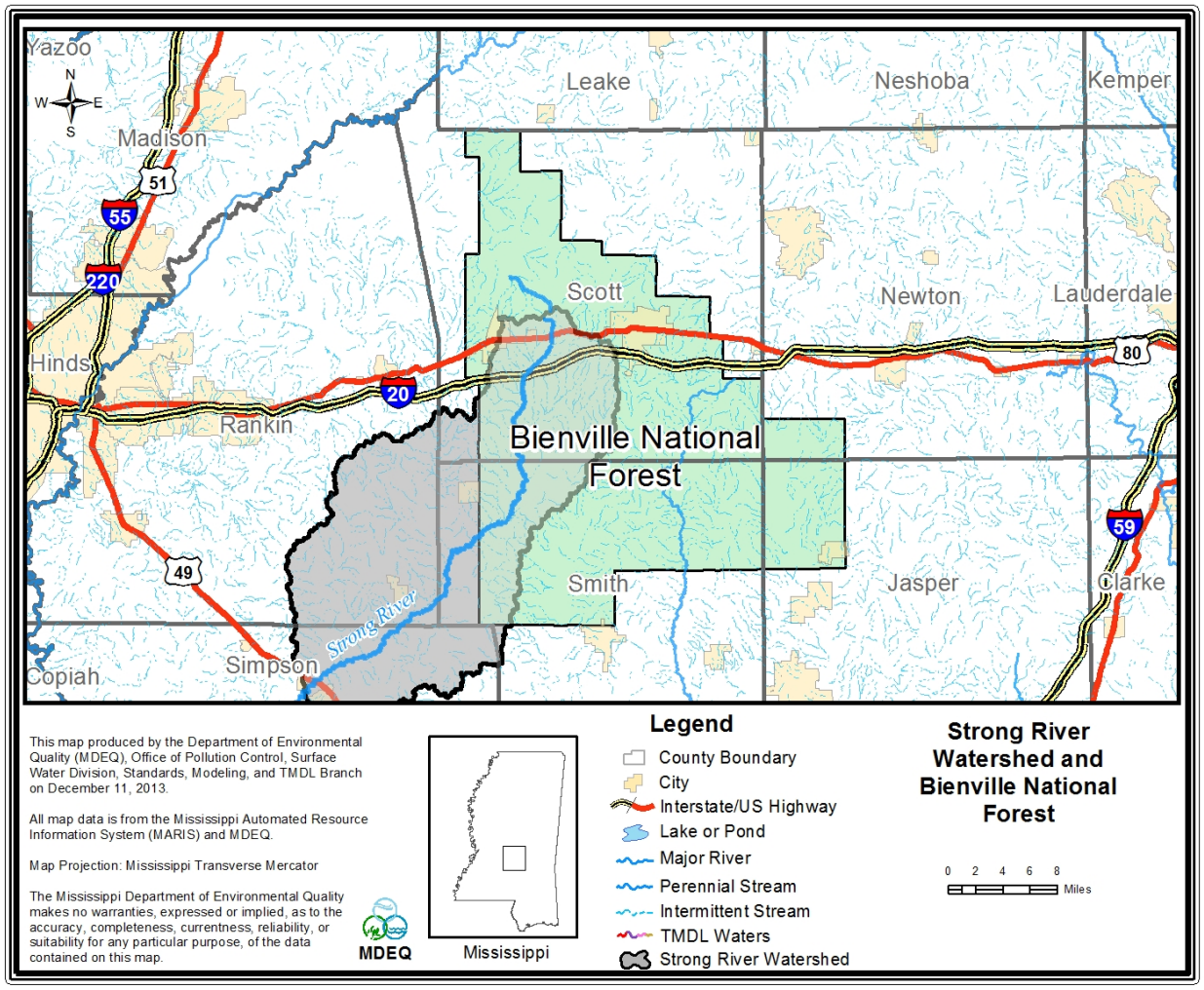

Figure 10. Strong River Watershed and Bienville National Forest

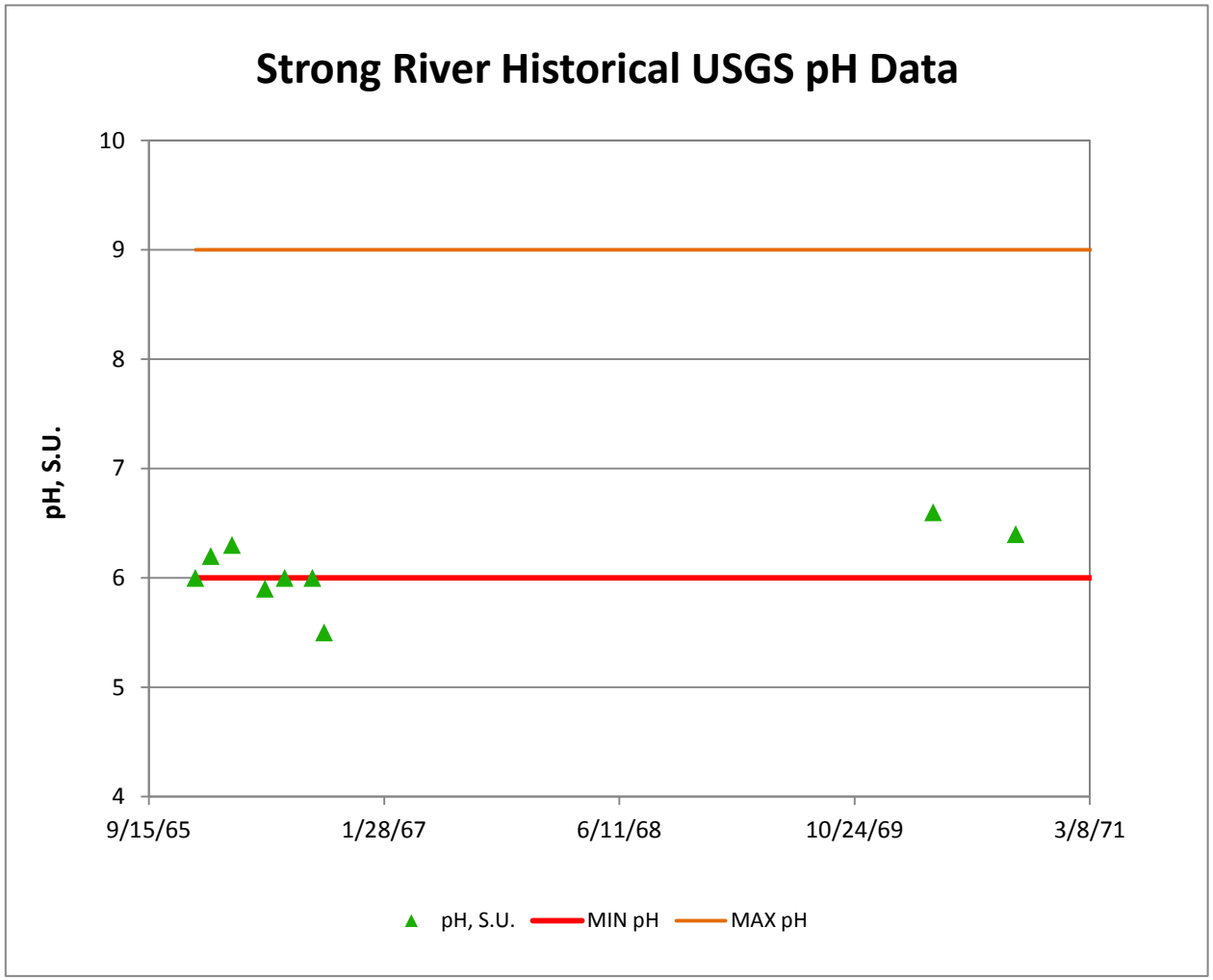

Figure 11. USGS pH Data from 1965 - 1975

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 14 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 as well as further ambient monitoring within the stream. Subsequent NPDES permit applicants should further study the data to determine the natural condition of this segment and possibly promote a site specific criterion for pH for this segment of Strong River.

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. If low pH is determined in the future to be attributed to natural conditions, the load allocation presented in this TMDL could not be reasonably expected to be achieved. If such a determination were to be made, revision of the TMDL and/or the development of a site specific water quality standard for these segments may be appropriate.

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.

References

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