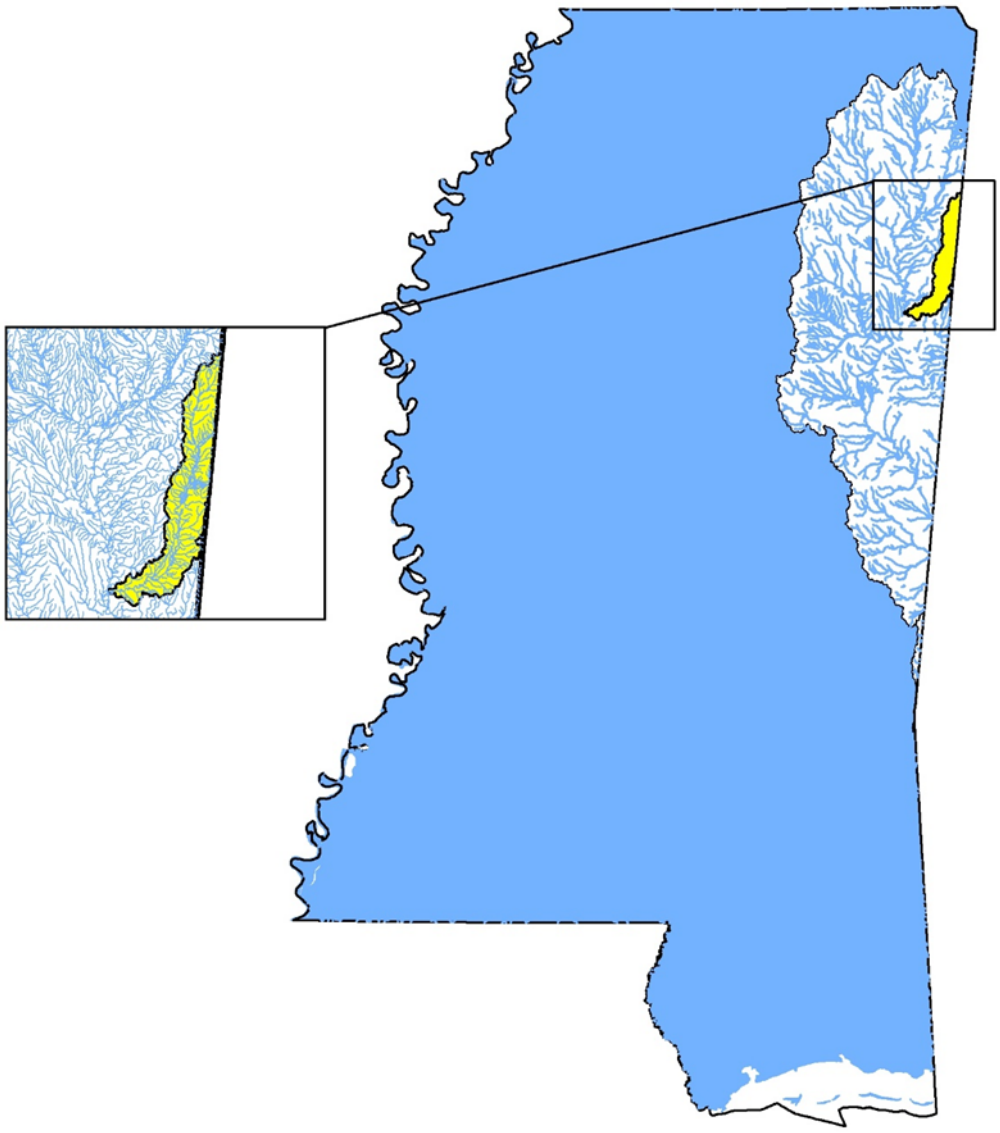
FINAL REPORT
January 2021

pH TMDL for Buttahatchee River Watershed

Tombigbee Basin
Monroe County,
Mississippi

Prepared By

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



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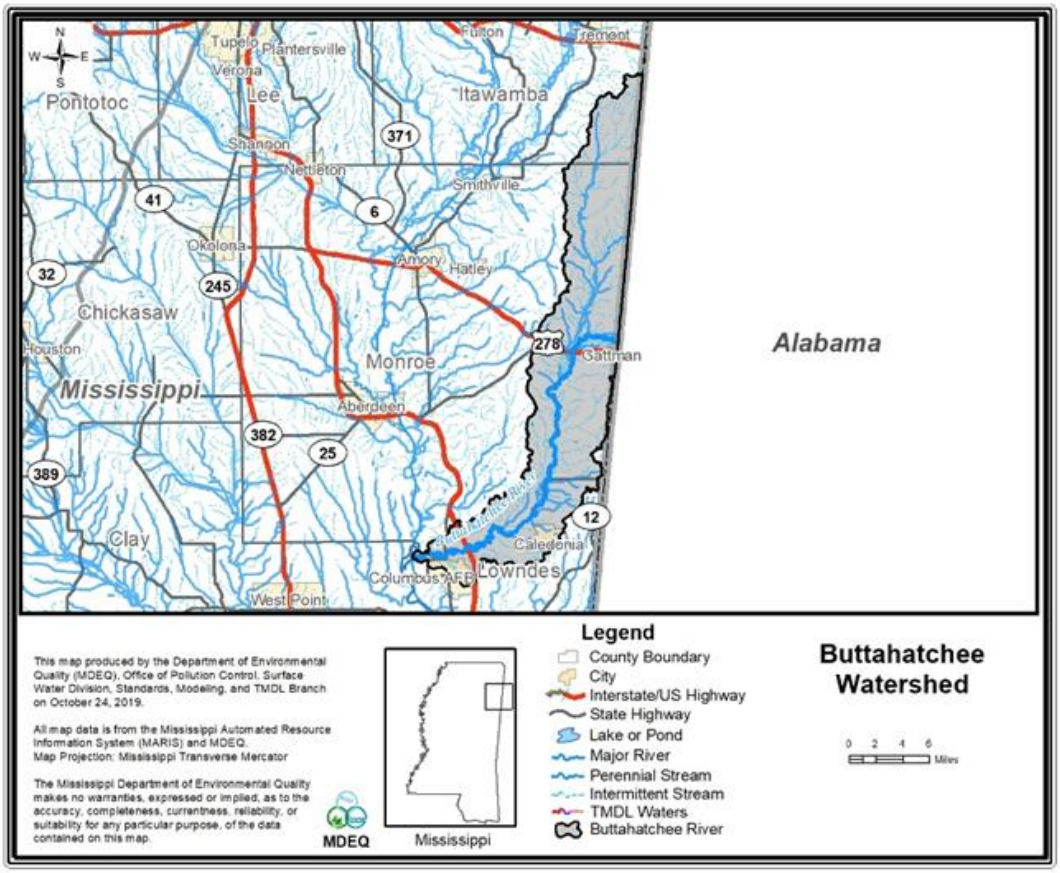
Mississippi Department of
Environmental Quality

TMDL Fact Sheet

pH TMDL for Buttahatchee River Watershed

The Buttahatchee River (806711) near Greenwood Springs was identified as impaired due to pH by the Mississippi Department of Environmental Quality (MDEQ) and is listed on the 2018 Mississippi Section 303(d) List of Impaired Water Bodies (MDEQ, 2018). The specific causes of the low pH for this water body are not known but are believed to be a combination of point source effluent and storm water discharge over acidic soils. There are no active point sources in in the watershed in Mississippi, but others may exist upstream in Alabama. The waste load allocation requires that the pH in effluent from future permitted point sources shall be within the range of 6.0 to 9.0 s.u.



Location of Buttahatchee River Watershed

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TMDL Information

Table 1: Listing Information

Name	ID	County	Cause
Buttahatchee River	806711	Monroe	pH
Near Greenwood Springs from confluence with Sipsey Creek to the 8068 MWS boundary near the confluence with Alsup Creek			

Table 2: 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.)

Introduction

The Buttahatchee River (806711) 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, 2018). 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. The impaired segment of the Buttahatchee River is shown in Figure 1.

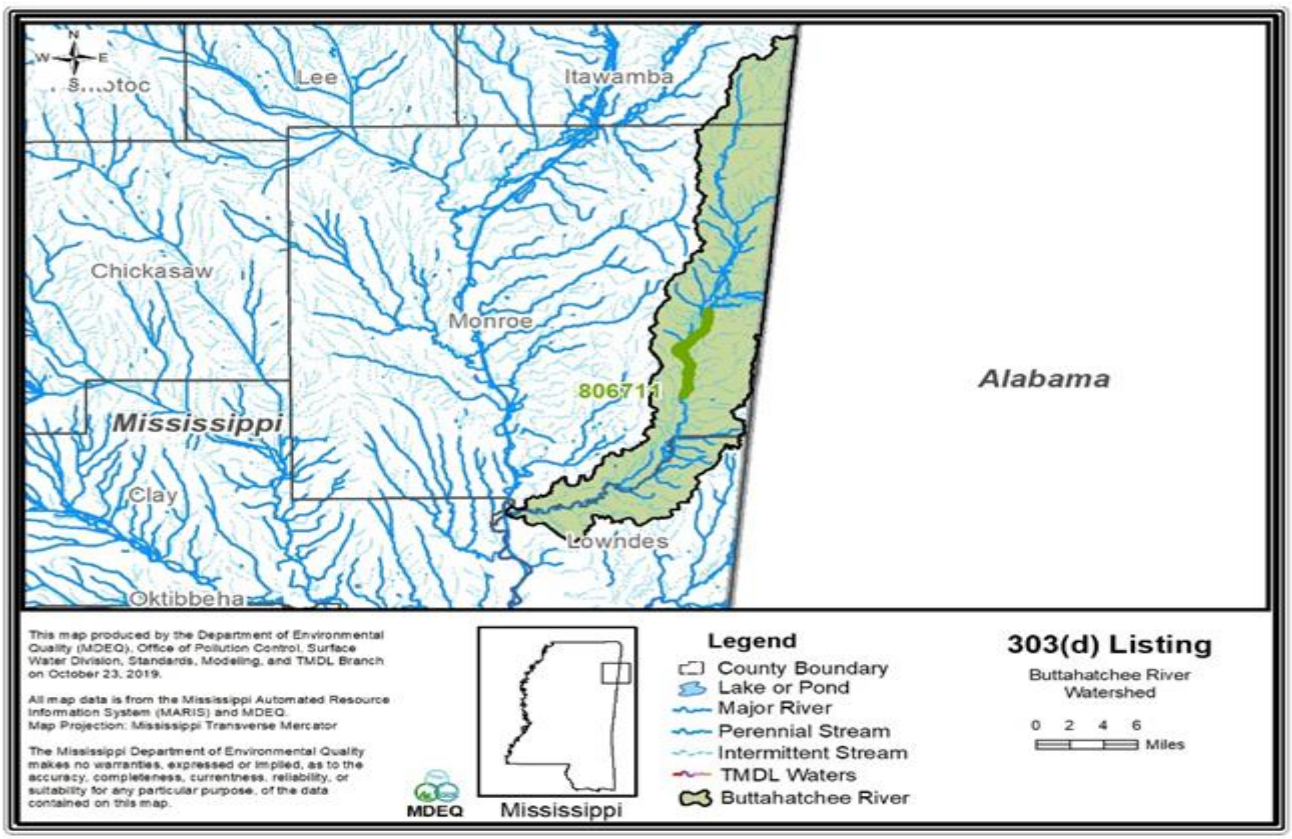

Figure 1: The Buttahatchee River 303(d) Impaired Segment

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 Buttahatchee 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, 2016). 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 can be attributed to natural conditions. Therefore, the applicable pH criteria for this segment is the allowable range of 6.0 to 9.0 s.u.

Watershed Characterization

The impaired segment of the Buttahatchee River is in Monroe County. The landuse in the watershed is predominantly forest (Figure 2 and Table 3). The landuse information for the watershed is based on the National Landcover Database 2006 (NLCD 2006).

Table 3: Landuse in the Buttahatchee River Watershed

	Water	Urban	Forest	Scrub/Barren	Pasture	Cropland	Wetland
area	115.50	2369.68	41595.42	7502.11	7539.85	1229.52	16700.41
% area	**0.15%**	**3.08%**	**53.98%**	**9.74%**	**9.78%**	**1.60%**	**21.67%**

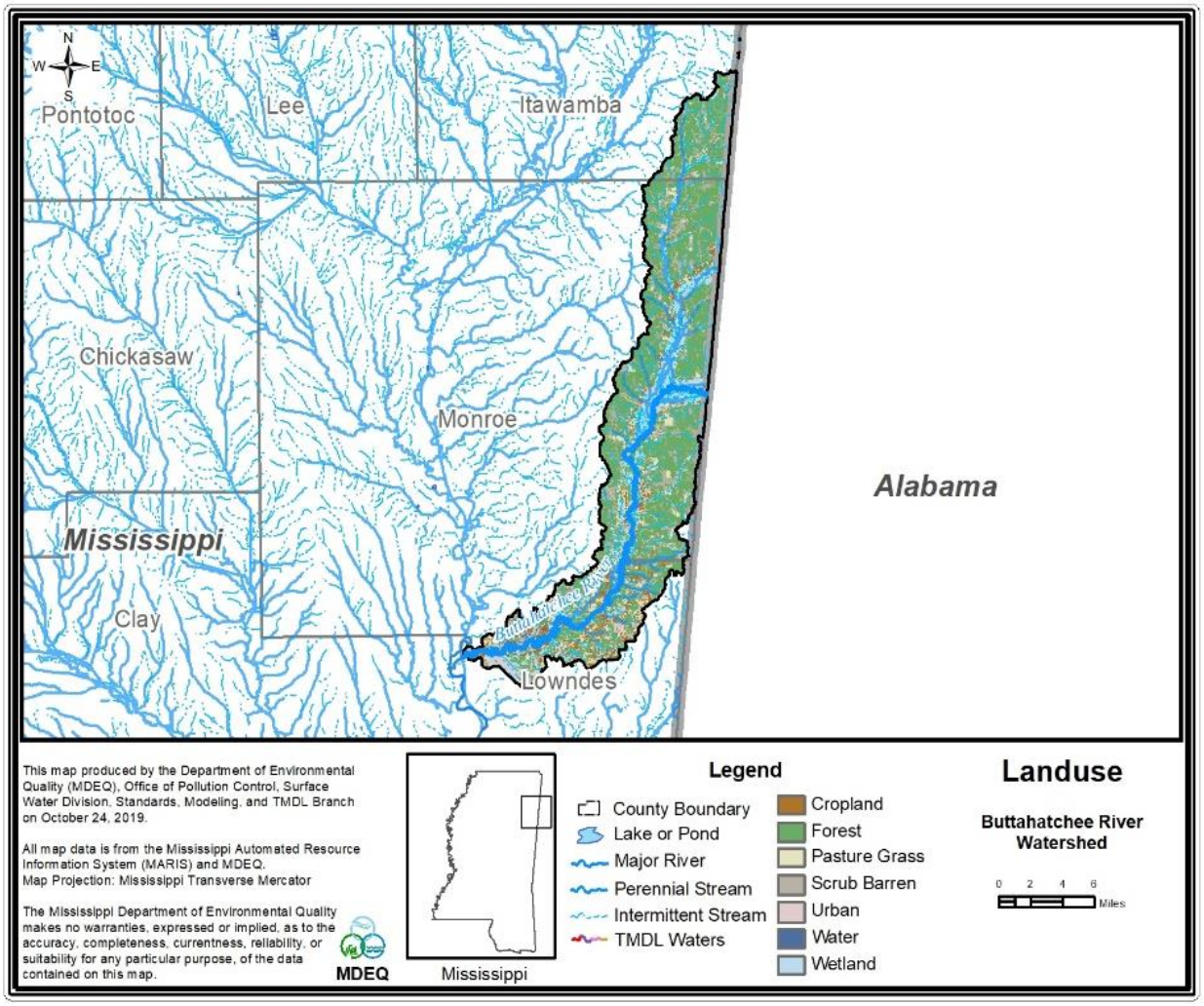

Figure 2: Land use Distribution Map

Source Identification

There are no active point sources in the watershed that discharge into the impaired segment (806711). There may be some NPDES facilities present in the watershed in Alabama; however, MDEQ does not have regulatory authority outside of the state.

Water Quality Data

MDEQ collected ambient monthly water quality samples for the Buttatchee River from 2001 to 2014 at USGS station 02439400. The monitoring station location is shown in Figure 3. The ambient pH data is shown in Figures 4 and shows the stage measured in the stream. 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 attributed to the multitude of pine and oak trees located in the forested areas of the watershed or naturally acidic soils. The lower pH values during this time suggest naturally occurring conditions for low pH in figures 4. Ambient pH data is available in Appendix A.

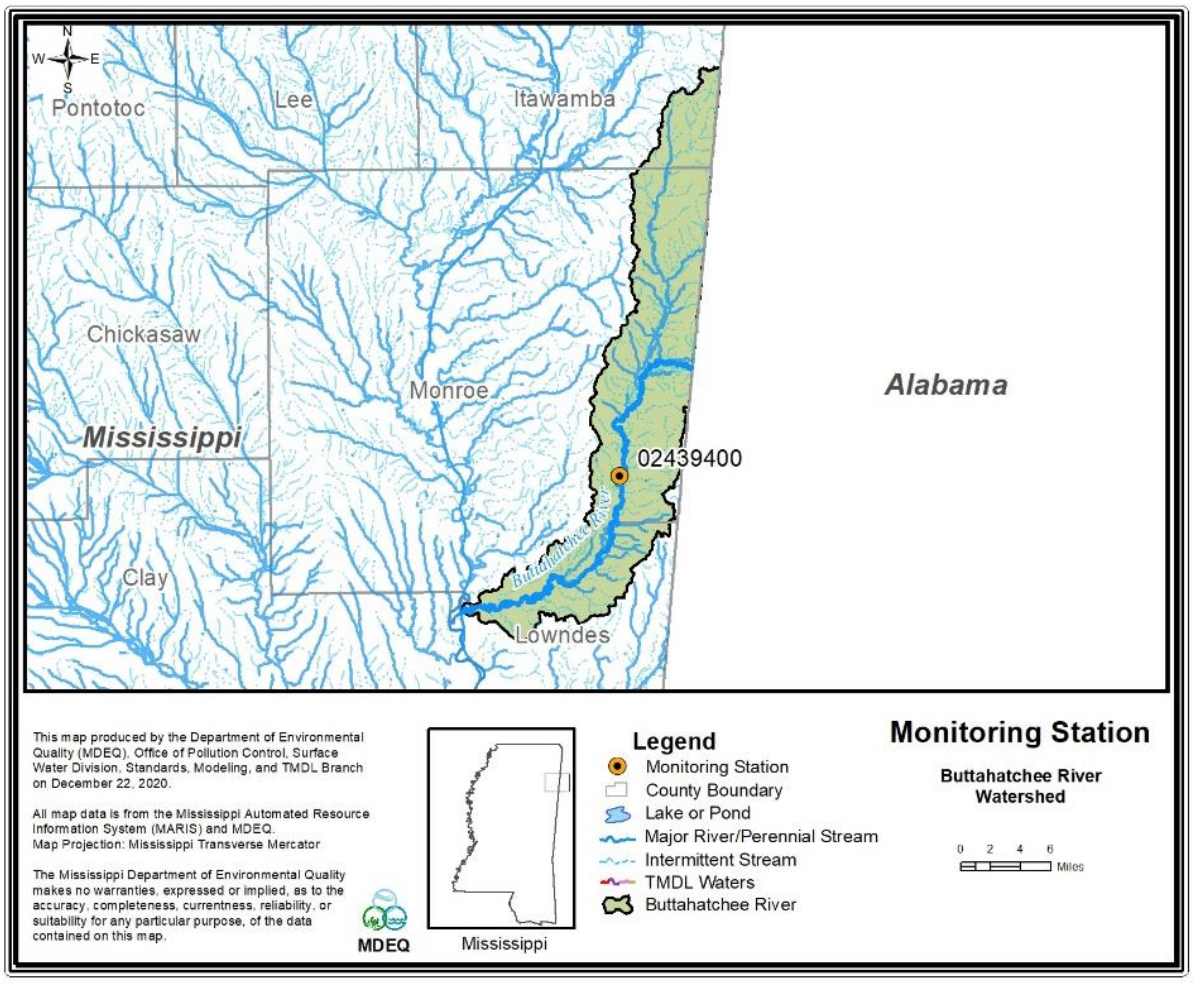

Figure 3: Monitoring Station 02439400

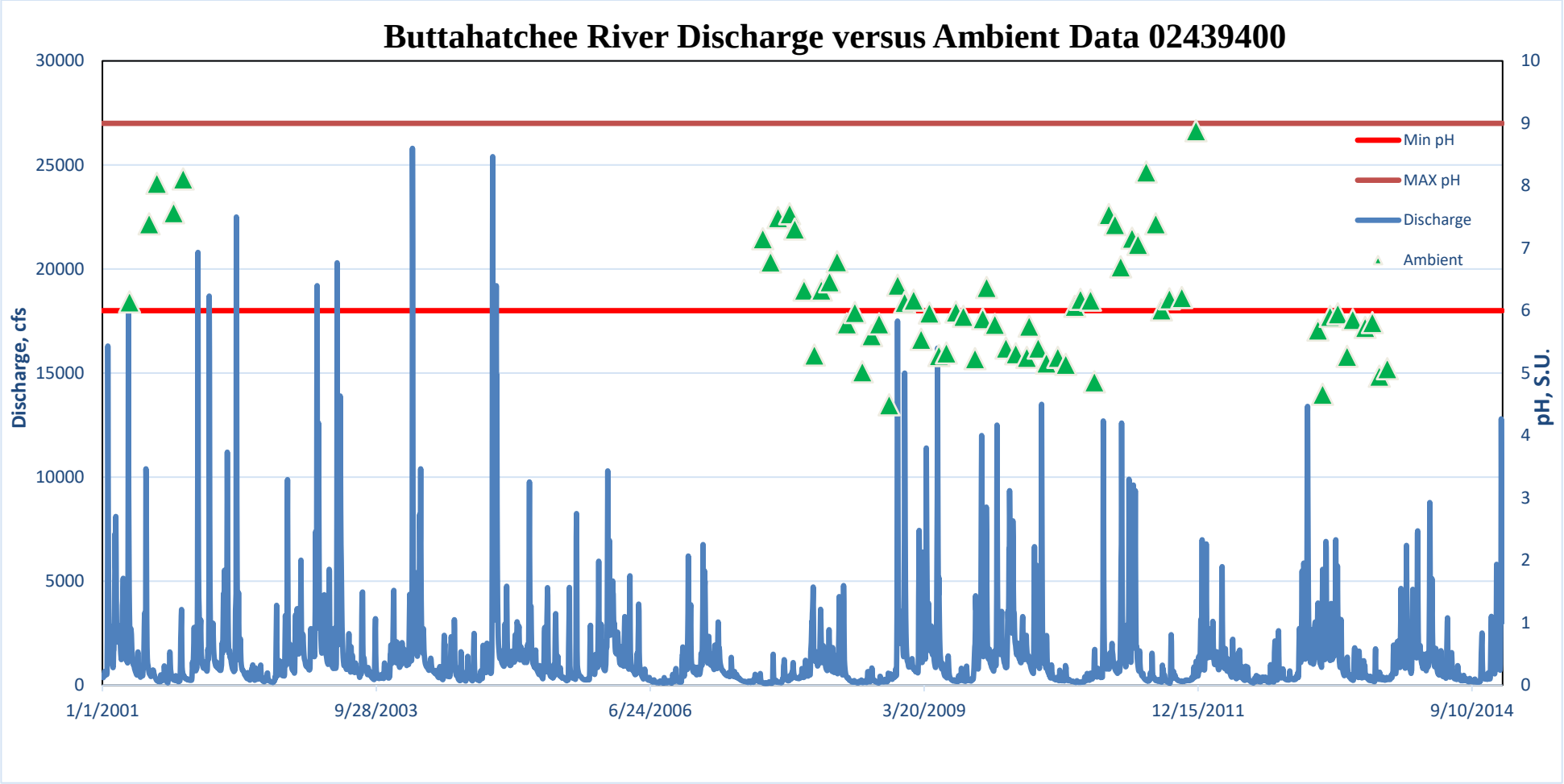

Figure 4: Buttahatchee River Ambient pH Data and Discharge Data

ALLOCATION

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.

Waste load Allocation

There are no point sources identified in this watershed that discharge to the listed segment. 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, but probable causes may be attributed to low pH from stormwater runoff, noncompliant point sources, 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.

Seasonality

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 waste load allocation for this TMDL is considered and used by MDEQ through its NPDES permitting process. This TMDL recommends further ambient monitoring within the stream. Subsequent NPDES permit applicants should further study the data to determine the natural condition of this segment and evaluate the possibility of a site-specific criterion for pH for this segment of the Buttahatchee 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.

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 Shawn Clark at sclark@mdeq.ms.gov.

All comments should be directed to Shawn Clark at sclark@mdeq.ms.gov or MDEQ, PO Box 2261, Jackson, MS 39225. All comments received during the public notice period will 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.

ABBREVIATIONS

EPA ..... Environmental Protection Agency
LA ..... Load Allocation
MDEQ ..... Mississippi Department of Environmental Quality
MOS ..... Margin of Safety
NPDES ..... National Pollution Discharge Elimination System
TMDL ..... Total Maximum Daily Load
TSS ..... Total Suspended Solids
USGS ..... United States Geological Survey
WLA ..... Wasteload Allocation
NLCD ..... National Landuse/ Land Cover Dataset

REFERENCES

Canter, L. W. (1985). *River Water Quality Monitoring*. Chelsea, Michigan: Lewis Publishers, Inc.

Chapra, S. C. (1997). *Surface Water Quality Modeling*. New York: McFraw-Hill.

EPA. (1991). *Guidance for Water Quality-based Decisions: The TMDL Process*. Washington, D.C.: EPA Office of Water.

Lee, C. P. (Ed.). (1998). *Environmental Engineering Dictionary*. Rockville, Maryland: Government Institutes, Inc.

MDEQ. (2013). *WPC-1 NDPES Permitting Regulations*. Jackson: MDEQ Office of Pollution Control.

MDEQ. (2016). *WPC-2 Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters*. (K. D. Caviness, Ed.) Jackson: MDEQ Office of Pollution Control.

MDEQ. (2018). *Mississippi 2018 Section 303(d) List of Impaired Water Bodies*. (G. A. Jackson, Ed.) Jackson, Mississippi: MDEQ Office of Pollution Control.

Water Quality Standards for Surface Waters. (2012). Retrieved from EPA Water: Water Quality Standards: http://water.epa.gov/scitech/swguidance/standards/

APPENDIX A

(Ambient pH Data for Station 02439400 04/10/2001-11/05/2013)

STATION_ID	ACTIVITY_DATE	pH
2439400	04/10/2001 14:50	6.14
2439400	06/20/2001 13:45	7.39
2439400	07/18/2001 13:30	8.04
2439400	09/18/2001 13:45	7.57
2439400	10/22/2001 13:25	8.11
2439400	08/09/2007 11:00	7.15
2439400	09/06/2007 11:38	6.78
2439400	10/04/2007 11:10	7.49
2439400	11/15/2007 11:56	7.55
2439400	12/04/2007 10:45	7.31
2439400	01/07/2008 11:56	6.33
2439400	02/13/2008 11:14	5.29
2439400	03/10/2008 12:40	6.33
2439400	04/09/2008 10:48	6.46
2439400	05/07/2008 11:45	6.78
2439400	06/11/2008 11:43	5.79
2439400	07/10/2008 11:40	5.97
2439400	08/06/2008 10:02	5.02
2439400	09/09/2008 10:58	5.6
2439400	10/07/2008 11:10	5.79
2439400	11/12/2008 09:25	4.49
2439400	12/13/2008 10:45	6.41
2439400	01/08/2009 11:58	6.13
2439400	02/10/2009 10:15	6.17
2439400	03/09/2009 12:51	5.54
2439400	04/08/2009 11:20	5.96
2439400	05/13/2009 11:33	5.28
2439400	06/09/2009 11:15	5.32
2439400	07/14/2009 11:58	5.98
2439400	08/11/2009 11:45	5.91
2439400	09/22/2009 11:31	5.23
2439400	10/20/2009 11:45	5.87
2439400	11/03/2009 11:30	6.37
2439400	12/03/2009 11:30	5.78
2439400	01/13/2010 11:48	5.4
2439400	02/18/2010 11:41	5.31
2439400	03/30/2010 10:55	5.25
2439400	04/08/2010 10:51	5.75
2439400	05/11/2010 11:18	5.4

STATION _ID	ACTIVITY_DATE	pH
2439400	06/10/2010 11:12	5.16
2439400	07/21/2010 11:12	5.25
2439400	08/19/2010 12:01	5.14
2439400	09/21/2010 11:28	6.07
2439400	10/12/2010 11:21	6.18
2439400	11/18/2010 11:16	6.17
2439400	12/02/2010 10:39	4.86
2439400	01/24/2011 10:58	7.54
2439400	02/15/2011 11:45	7.38
2439400	03/08/2011 11:56	6.7
2439400	04/18/2011 12:20	7.16
2439400	05/10/2011 11:21	7.06
2439400	06/09/2011 12:47	8.22
2439400	07/14/2011 11:30	7.39
2439400	08/04/2011 11:08	6.01
2439400	09/02/2011 11:27	6.19
2439400	10/17/2011 11:27	6.21
2439400	12/08/2011 12:15	8.88
2439400	02/25/2013 13:10	5.69
2439400	03/14/2013 12:16	4.66
2439400	04/10/2013 11:55	5.91
2439400	05/09/2013 11:45	5.95
2439400	06/12/2013 12:50	5.27
2439400	07/02/2013 11:30	5.86
2439400	08/16/2013 11:50	5.73
2439400	09/12/2013 12:18	5.81
2439400	10/07/2013 11:30	4.95
2439400	11/05/2013 11:30	5.07