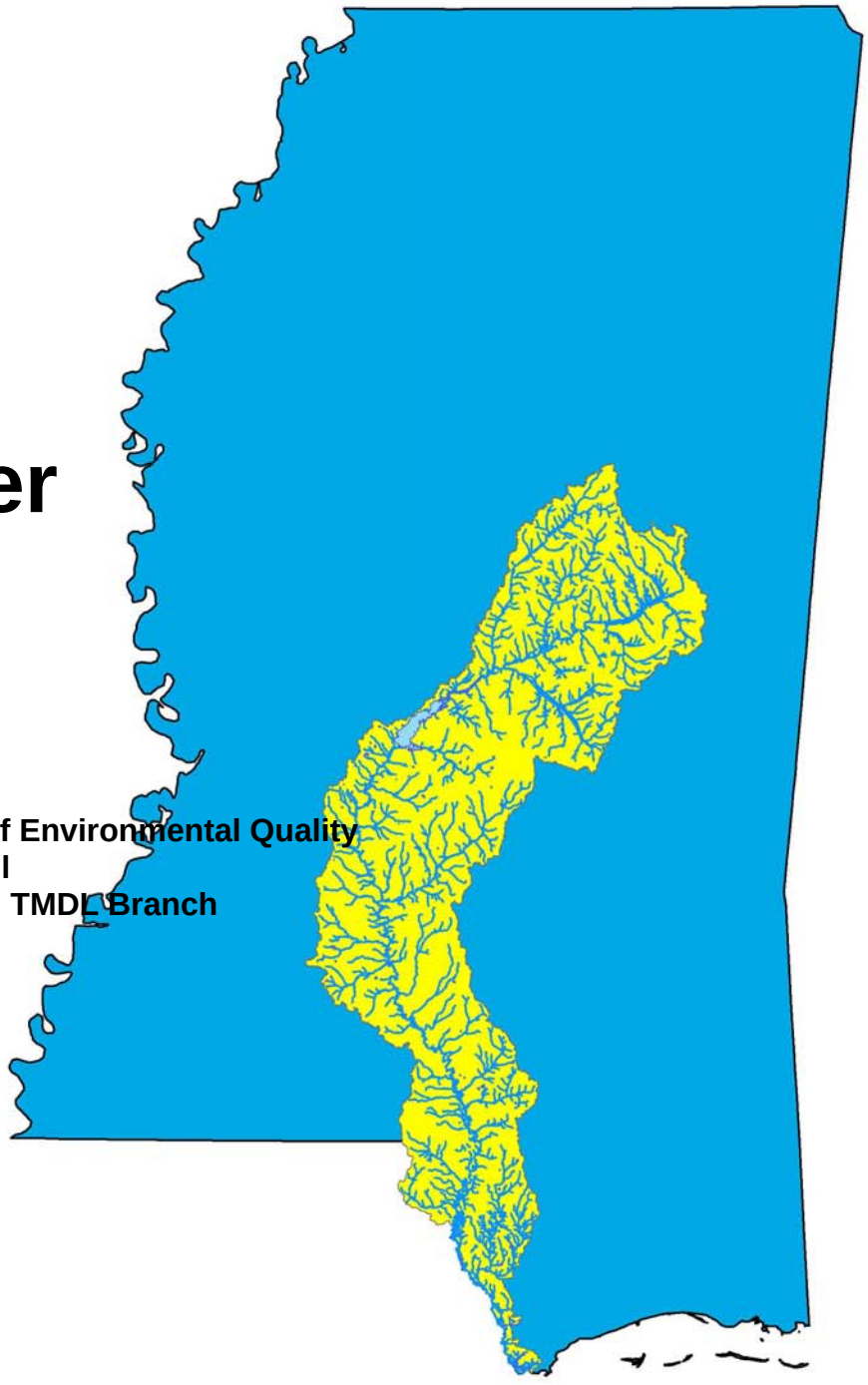
FINAL REPORT
June 29, 2009

Total Maximum Daily Load
Total Nitrogen and Total Phosphorus
For the Pearl River



Pearl River Basin

Prepared By

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FOREWORD

This report has been prepared in accordance with the schedule contained within the federal consent decree dated December 22, 1998. The report contains one or more Total Maximum Daily Loads (TMDLs) for water body segments found on Mississippi's 1996 Section 303(d) List of Impaired Water bodies. Because of the accelerated schedule required by the consent decree, many of these TMDLs have been prepared out of sequence with the State's rotating basin approach. The implementation of the TMDLs contained herein will be prioritized within Mississippi's rotating basin approach.

The amount and quality of the data on which this report is based are limited. As additional information becomes available, the TMDLs may be updated. Such additional information may include water quality and quantity data, changes in pollutant loadings, or changes in landuse within the watershed. In some cases, additional water quality data may indicate that no impairment exists.

Conversion Factors

To convert from	To	Multiply by	To convert from	To	Multiply by
$mile^2$	acre	640	acre	ft^2	43560
km^2	acre	247.1	days	seconds	86400
m^3	ft^3	35.3	meters	feet	3.28
ft^3	gallons	7.48	ft^3	gallons	7.48
ft^3	liters	28.3	hectares	acres	2.47
cfs	gal/min	448.8	miles	meters	1609.3
cfs	MGD	0.646	tonnes	tons	1.1
m^3	gallons	264.2	µg/l * cfs	gm/day	2.45
m^3	liters	1000	µg/l * MGD	gm/day	3.79

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	µ	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

TABLE OF CONTENTS

FIGURES

TABLES

TMDL INFORMATION

Table 1. Listing Information

Name	ID	County	HUC	Evaluated Cause
Pearl River	MSUPRLRE	Neshoba and Leake	03180001	Nutrients
Pearl River	MSUMPRLR1E	Hinds, Rankin, and Copiah	03180002	Nutrients
Pearl River	MSUMPRLR2E	Leake and Madison	03180002	Nutrients
Pearl River	MSLMPRLRE	Simpson, Lawrence, and Copiah	03180003	Nutrients
Pearl River	MSLPRLRE	Marion, Pearl River, and Hancock	03180004	Nutrients

Table 2. Water Quality Standards

Parameter	**Beneficial use**	**Water Quality Criteria**
Nutrients	Aquatic Life Support	Waters shall be free from materials attributable to municipal, industrial, agricultural, or other dischargers producing color, odor, taste, total suspended solids, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated uses.

Table 3. Total Maximum Daily Load for the Pearl River Basin

	WLA lbs/day	**WLA sw lbs/day**	**LA lbs/day**	**MOS**	**TMDL lbs/day**
Total Nitrogen	12,747.6	416.9	22571.1	Implicit	35,735.6*
Total Phosphorous	2,549.4	46.4	2509.3	Implicit	5,105.1*

*TMDL applies such that TN and TP targets will be met in each of the impaired segments

Table 4. Point Source Loads

Facility	Permit	Flow (MGD)	TN Load (lb/day)	TP Load (lb/day)
Bogalusa POTW	LA0046515	6	575.86	138.01
Carriere Regional Wastewater Treatment System	MS0061941	4	383.90	92.00
Columbia POTW, South	MS0044164	1.47	141.08	33.81
Georgia Pacific Corp., Monticello Mill	MS0002941	26.04	2064.57	161.25
Jackson POTW, Savanna Street	MS0024295	46	5221.10	1180.12
Jackson POTW, Trahon and Big Creek	MS0044059	4.5	510.76	115.45
Kosciusko POTW*	MS0027774	2.048	196.56	47.11
Morton POTW	MS0036234	2.97	337.10	76.19
Philadelphia POTW*	MS0021156	1.34	128.61	30.82
Picayune POTW (Airport Rd)	MS0042161	3.075	295.13	70.73
Picayune POTW (Neal Rd)	MS0061174	2.4	230.34	55.20
Poplarville POTW	MS0020494	1.1	124.85	28.22
Sanderson Farms Inc., Monticello	MS0055492	1.0	1118.33	132.70
Tuscolameta Watershed WLA**	---	---	1419.42	387.76
Total			12,747.6	2,549.4

*HCR Facility with a concentration based permit limit

**Nutrient load for all facilities included in the Tuscolameta Nutrient TMDL

EXECUTIVE SUMMARY

This TMDL is for the five segments of the Pearl River from the headwaters to the mouth at the Mississippi Sound, which were on the Mississippi 2008 Section 303(d) List of Impaired Water Bodies due to the evaluated cause of nutrients. Other evaluated causes of impairment will be addressed in separate TMDL reports. This TMDL will provide an estimate of the total nitrogen (TN) and total phosphorus (TP) allowable in this river.

Mississippi does not have water quality standards for allowable nutrient concentrations. MDEQ currently has a Nutrient Task Force (NTF) working on the development of criteria for nutrients. An annual concentration of 0.7 mg/l is an applicable target for TN and 0.1 mg/l for TP for water bodies located in the Ecoregion 65, which is the predominant ecoregion of the Pearl River Basin. MDEQ is presenting these preliminary target values for TMDL development which are subject to revision after the development of numeric nutrient criteria.

There are five river segments included in this TMDL, which are listed in Table 1 and shown in Figure 1. This TMDL focuses on the entirety of the Pearl River and major and direct point sources in the Pearl River Basin, which are listed in Table 4. This TMDL does not examine direct sources to the West Pearl River in Louisiana which diverges from the main stem of the Pearl River at Wakaiah Bluff in Pearl River County. This TMDL also does not examine nonpoint source loading from landuses that drain directly to the West Pearl River.

The limited nutrient information and estimated existing concentrations indicate reductions of nutrients can be accomplished with implementation of best management practices (BMPs) and reduction of TP from point sources.

INTRODUCTION

1.1 Background

The identification of water bodies not meeting their designated use and the development of total maximum daily loads (TMDLs) for those water bodies are required by Section 303(d) of the Clean Water Act and the Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (40 CFR part 130). The TMDL process is designed to restore and maintain the quality of those impaired water bodies through the establishment of pollutant specific allowable loads. This TMDL has been developed for the 2008 §303(d) listed segments shown in Figure 1.

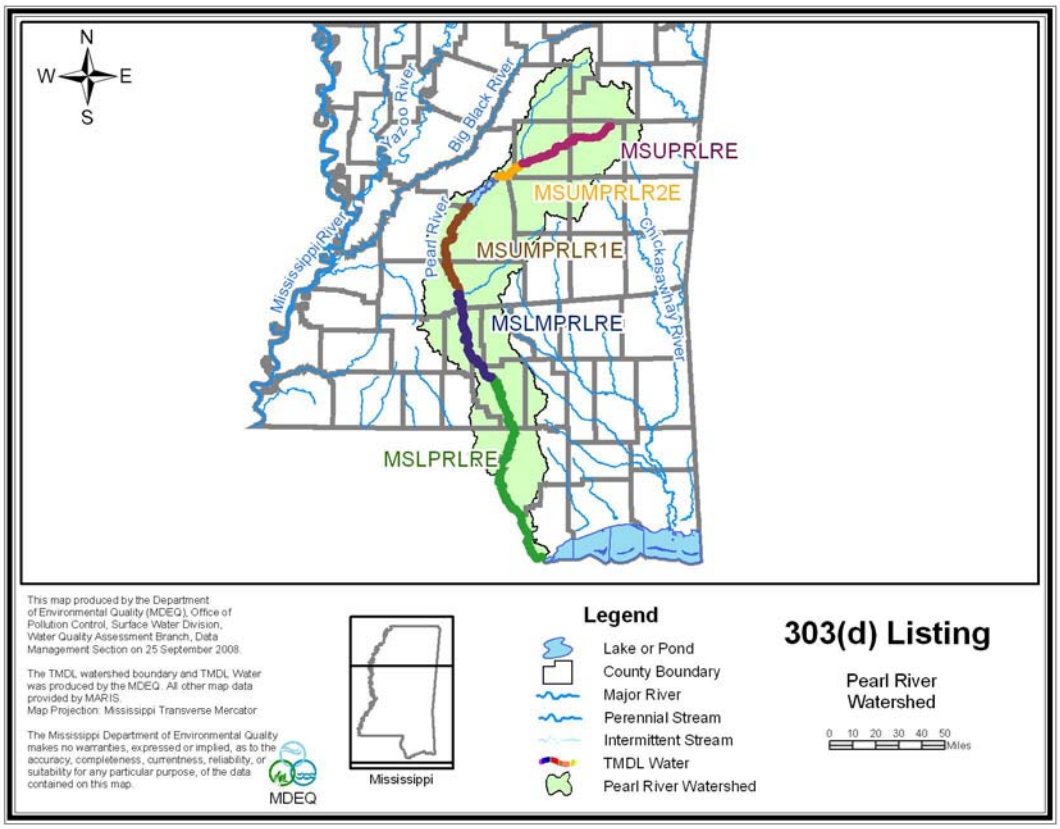


Figure 1. §303(d) Listed Segments of the Pearl River

1.2 Listing History

The segments were originally listed by evaluating the basin for water bodies that were potentially impaired due to activities within the watersheds. There are no state numeric criteria in Mississippi for nutrients. These numeric criteria are currently being developed by the Mississippi Nutrient Task Force in coordination with EPA Region 4. MDEQ proposed a work plan for numeric nutrient criteria development that has been mutually agreed upon with EPA Region 4 and is on schedule according to the approved timeline for development of numeric nutrient criteria (MDEQ, 2007).

1.3 Applicable Water Body Segment Use

The water use classifications are established by the State of Mississippi in the document *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007). The designated beneficial use for the Pearl River above the Ross Barnett Reservoir is Fish and Wildlife. From the Ross Barnett Reservoir to the City of Jackson water intake, the designated beneficial use is Public Water Supply. The majority of the Pearl River, from Byram Bridge to the mouth, has a designated beneficial use of Recreation.

1.4 Applicable Water Body Segment Standard

The water quality standard applicable to the use of the water body and the pollutant of concern is defined in the *State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters* (MDEQ, 2007).

Mississippi's current standards contain a narrative criteria that can be applied to nutrients which states "*Waters shall be free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor, taste, total suspended or dissolved solids, sediment, turbidity, or other conditions in such degree as to create a nuisance, render the waters injurious to public health, recreation, or to aquatic life and wildlife, or adversely affect the palatability of fish, aesthetic quality, or impair the waters for any designated use* (MDEQ, 2007)." In the 1999 Protocol for Developing Nutrient TMDLs, EPA suggests several methods for the development of numeric criteria for nutrients (USEPA, 1999). In accordance with the 1999 Protocol, "*The target value for the chosen indicator can be based on: comparison to similar but unimpaired waters; user surveys; empirical data summarized in classification systems; literature values; or professional judgment.*" MDEQ believes the most economical and scientifically defensible method for use in Mississippi is a comparison between similar but unimpaired waters within the same region. This method is dependent on adequate data which are being collected in accordance with the current nutrient criteria development plan.

1.5 Nutrient Target Development

Nutrient data were collected quarterly at 99 discrete sampling stations state wide where biological data already existed. These stations were identified and used to represent a range of stream reaches according to biological health status, geographic location (selected to account for ecoregion, bioregion, basin and geologic variability) and streams that potentially receive non-point source pollution from urban, agricultural, and silviculture lands as well as point source pollution from NPDES permitted facilities.

Nutrient concentration data were not normally distributed; therefore, data were log transformed for statistical analyses. Data were evaluated for distinct patterns of various data groupings (stratification) according to natural variability. Only stations that were characterized as "least disturbed" through a defined process in the M-BISQ process (M-BISQ 2003) or stations that resulted in a biological impairment rating of "fully attaining" were used to evaluate natural variability of the data set. Each of these two groups was evaluated separately ("least disturbed sites" and "fully attaining sites). Some stations were used in both sets, in other words, they were considered "least disturbed" and "fully attaining". The number of stations considered "least disturbed" was 30 of 99, and the number of stations considered "fully attaining" was 53 of 99.

Several analysis techniques were used to evaluate nutrient data. Graphical analyses were used as the primary evaluation tool. Specific analyses used included; scatter plots, box plots, Pearson's correlation, and general descriptive statistics.

In general, natural nutrient variability was not apparent based on box plot analyses according to the 4 stratification scenarios. Bioregions were selected as the stratification scheme to use for TMDLs in the Pascagoula Basin. However, this was not appropriate for some water bodies in smaller bioregions. Therefore, MDEQ now uses ecoregions as a stratification scheme for the water bodies in the remainder of the state.

In order to use the data set to determine possible nutrient thresholds, nutrient concentrations were evaluated as to their correlation with biological metrics. That thorough evaluation was completed prior to the Pascagoula River Basin TMDLs. The methodology and approach were verified. The same methodology was applied to the subsequent basins and ecoregions.

For the preliminary target concentration for each ecoregion, the 90th percentile was derived from the mean nutrient value at each site found to be fully supporting of aquatic life support according to the M-BISQ scores.

1.6 Selection of a TMDL Endpoint

One of the major components of a TMDL is the establishment of instream numeric endpoints, which are used to evaluate the attainment of acceptable water quality. Instream numeric endpoints, therefore, represent the water quality goals that are to be achieved by meeting the load and wasteload allocations specified in the TMDL. The endpoints allow for a comparison between observed instream conditions and conditions that are expected to restore designated uses.

For this TMDL, MDEQ is presenting preliminary targets for TN and TP. An annual concentration 0.7 mg/l is an applicable target for TN and 0.1 mg/l for TP for water bodies located in ecoregion 65. MDEQ is presenting these preliminary target values for TMDL development. Due to the limited data set an applicable target for Large Rivers could not be developed. These targets are considered to be very conservative for larger water bodies. Therefore, the targets are subject to revision after the development of nutrient criteria, when the work of the NTF is complete.

WATER BODY ASSESSMENT

2.1 Water Quality Data

Nutrient data was collected on the Pearl River in the spring of 2008. Algal Growth Potential Tests (AGPT) were performed to determine the limiting nutrient in the Pearl River. The nitrogen, phosphorous, and AGPT results are presented in Table 5. A water quality study was conducted on the Pearl River in the summer of 2006 by USEPA Region 4 and DEQ. Nutrient and AGPT data were also gathered as a part of this study. The 2006 nutrient data and AGPT results are shown is Table 6. The AGPT results from the 2006 and the 2008 sampling show nitrogen is the limiting nutrient. Historically, there have been numerous water quality monitoring sites on the Pearl River that have collected nutrient data. A summary of this historical data is presented in Table 7.

Table 5. 2008 Nutrient Data and AGPT Results

Station Number	Station Location	Date	TN (mg/l)	TP (mg/l)	AGPT (mg/l)	Limiting Nutrient
A0450019	Pearl River at Pearlington	4/30/2008	0.95	0.10	6.3	Nitrogen
		5/28/2008	0.96	0.12		
A0490019	Pearl River at Rosemary Rd near Terry	4/22/2008	1.44	0.17	9.5	Nitrogen
		5/12/2008	1.45	0.25		
A0770166	Pearl River near Monticello	4/30/2008	1.58	0.16	9.2	Nitrogen
		5/27/2008	1.76	0.18		
A0910168	Pearl River near Columbia	4/30/2008	1.53	0.19	13	Nitrogen
		5/28/2008	1.18	0.15		
A1090004	Pearl River near Bogalusa	4/30/2008	1.11	0.12	3.2	Nitrogen
		5/28/2008	1.31	0.20		
A1210162	Pearl River at Florence Byrum Rd near Byram	4/25/2008	1.25	0.14	10	Nitrogen
		5/21/2008	1.14	0.15		
Site 2	Pearl River at Hwy 28 near Georgetown	4/30/2008	1.43	0.16	9.9	Nitrogen
		5/27/2008	1.55	0.15		

Table 6. 2006 Nutrient Data and AGPT Results

Station Number	Station Location	Date	TN (mg/l)	TP (mg/l)	AGPT (mg/l)	Limiting Nutrient
A0490016	Pearl River at Jackson at Impound Lot	8/23/2006	1.06	0.06		
		8/22/2006			3.5	Nitrogen
A0490017	Pearl River at Jackson WWTP above discharge	8/23/2006	058	0.05		
		8/25/2006			3.0	Nitrogen
A0490018	Pearl River at Jackson WWTP below discharge	8/23/2006	1.57	0.39		
		8/25/2006			20	Nitrogen
A0490019	Pearl River near Terry at Rosemary Rd	8/23/2006	2.43	0.14	NA	NA
A1210162	Pearl River at Florence Byrum Rd near Byram	8/23/2006	2.42	0.36		
		8/24/2006			38	Nitrogen
C0490033	Pearl River at Jackson at Water Works	8/23/2006	1.10	0.06	NA	NA

Table 7. Historical Data

Waterbody ID	Station Number	Station Location	Date Range	# of Samples	TN (mg/l)			TP (mg/l)		
					avg	max	min	avg	max	min
MSLMPRLRE	2488250	Near Wanilla @ Mill Rd. Bridge	12/16/1996 – 1/13/1997	2	0.97	1.09	0.85	0.12	0.14	0.10
MSLMPRLRE	2488500	At Monticello @ Hwy 84	4/22/1997 – 10/16/2001	19	1.41	2.17	0.35	0.16	.024	0.12
MSLPRLRE	2488940	Near Foxworth @ Hwy 35	1/7/1991 - 9/12/1996	28	1.17	2.65	0.34	0.15	0.85	0.01
MSLPRLRE	2489000	At Columbia @ Hwy 98	9/26/1978 – 3/21/1992	13	1.10	1.80	0.6	NA	NA	NA
MSLPRLRE	2489500	Near Bogalusa, LA @ Hwy 26	12/11/1996 – 9/3/2004	54	0.91	1.66	0.32	0.12	0.71	0.01
MSLPRLRE	2492668	At Pearlington @ Hwy 90	1/8/1991 – 12/3/2001	117	0.71	3.60	0.12	0.15	4.86	0.00
MSLPRLRE	PL095	Near Picayune Above Walkiah Bluff	8/23/1999	1	0.98	0.98	0.98	0.12	0.12	0.12
MSLPRLRE	PL096	Near Picayune Above Walkiah Bluff	8/23/1999	1	0.86	0.86	0.86	0.30	0.30	0.30
MSLPRLRE	PL490	At Pearlington Above Hwy 90 Bridge	6/20/2003 – 11/3/2005	42	0.60	1.16	0.29	0.07	0.13	0.02
MSUMPRLR1E	2486500	At Byram @ Old Swinging Bridge	1/4/1988 – 12/5/2001	105	1.85	4.30	0.29	0.27	8.28	0.01
MSUMPRLR1E	PL309	Near Richland Below I20 Bridge	12/3/2001	1	0.79	0.79	0.79	0.10	0.10	0.10
MSUMPRLR1E	PL310	Near Richland Near Old Jackson Landfill	12/3/2001	1	1.11	1.11	1.11	0.11	0.11	0.11
MSUMPRLR1E	PL312	Near Richland Below I20 Bridge	12/3/2001	1	0.21	0.21	0.21	0.08	0.08	0.08

2.2 Assessment of Point Sources

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of nutrients in the watershed and the amount of pollutant loading contributed by each of these sources. Under the CWA, sources are broadly classified as either point or nonpoint sources. Under 40 CFR §122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Point sources can be described by two broad categories: 1) NPDES regulated municipal and industrial wastewater treatment plants (WWTPs) and 2) NPDES regulated activities, which include construction activities and municipal storm water discharges (Municipal Separate Storm Sewer Systems [MS4s]). For the purposes of this TMDL, all sources of nutrient loading not regulated by NPDES permits are considered nonpoint sources.

This TMDL will focus on nutrient loads from major industrial and municipal WWTPs in the Pearl River Basin. The lower order streams in the basin that are potentially impaired by nutrient enrichment are the subject of separate TMDLs and are addressed in separate reports. The minor facilities are in other TMDLs or will not have an impact on water quality in the segments addressed by the TMDL based on professional judgment. Point source dominated freshwater systems are generally nitrogen limited. However, they may be made to be controlled by phosphorous by a TP reduction to point sources (Thomann and Mueller, 1987).

The wastewater from the facilities was characterized based upon the best available information. Kosciusko POTW and Philadelphia POTW are HCR facilities. Bogalusa POTW is located in Louisiana which is in USEPA Region 6. Literature values were used to estimate the mass loadings of TP and TN from municipal discharges (USEPA 1997). Estimated concentrations of TN and TP for different treatment types are given in Table 8 below (USEPA 1997). For the facilities that are not municipal discharges (Georgia Pacific Corp., Monticello Mill and Sanderson Farms Inc., Monticello) estimated existing nutrient concentrations were taken from the NPDES permit applications with the exception of the TN limit for Sanderson Farms which is a categorical limit. For Georgia Pacific estimated concentrations of 1.4 mg/l and 9.5 mg/l were used for TP and TN respectively. For Sanderson Farms estimated concentrations of 30 mg/l and 134 mg/l were used for TP and TN respectively.

Table 8. TN and TP Median Concentration in Wastewater Effluents

	Treatment Type			
	Primary	Trickling Filter	Activated Sludge	Stabilization Pond
No. of Plants Sampled	55	244	244	149
TP (mg/l)	6.6 ±0.66	5.9 ± 0.28	5.8 ± 0.29	5.2 ± 0.45
TN (mg/l)	22.4 ± 1.30	16.4 ± 0.54	13.6 ± 0.62	11.5 ± 0.84

There are 16 major or direct facilities that are shown in Table 9 below.

Table 9. NPDES Sources

Facility Name	City	County	Permit	Discharge (MGD)
Bogalusa POTW	Bogalusa	Washington Parish	LA0046515	6
Carriere Regional Wastewater Treatment System	Picayune	Pearl River	MS0061941	4
Columbia POTW, South	Columbia	Marion	MS0044164	1.47
Georgia Pacific Corp., Monticello Mill	Monticello	Lawrence	MS0002941	26.04
Jackson POTW, Savanna Street	Jackson	Hinds	MS0024295	46
Jackson POTW, Trahon and Big Creek	Jackson	Hinds	MS0044059	4.5
Kosciusko POTW	Kosciusko	Attala	MS0027774	2.048
Morton POTW	Morton	Scott	MS0036234	2.97
Philadelphia POTW	Philadelphia	Neshoba	MS0021156	1.34
Picayune POTW (Airport Rd)	Picayune	Pearl River	MS0042161	3.075
Picayune POTW (Neal Rd)	Picayune	Pearl River	MS0061174	2.4
Poplarville POTW	Poplarville	Pearl River	MS0020494	1.1
Sanderson Farms Inc. Monticello*	Monticello	Lawrence	MS0055492	1
Tuscolameta Watershed WLA **				

*Permit only, no facility constructed

** Includes 3 major facilities (Central Industries, Forest POTW, Peco Farms) (MDEQ, 2009)

Nutrient loadings from NPDES regulated construction activities and MS4s are considered point sources to surface waters. These discharges occur in response to storm events and are included in the WLAsw portion of this TMDL. As of March 2003, discharge of storm water from construction activities disturbing more than one acre must obtain an NPDES permit. The purpose of the NPDES permit is to eliminate or minimize the discharge of pollutants from construction activities. Since construction activities at a site are of a temporary, relatively short term nature, the number of construction sites covered by the general permit varies. The target for these areas is the same range as the TMDL target for the watershed. The WLAs provided to the NPDES regulated construction activities and MS4s will be implemented as best management practices (BMPs) as specified in Mississippi's General Storm Water Permits for Small Construction, Construction, and Phase I & II MS4 permits. Properly designed and well-maintained BMPs are expected to provide attainment of water quality standards.

There are 11 MS4 permits within the Pearl River Basin. These MS4 permits are listed in Table 10.

Table 10. MS4 Permits

Permit ID #	MS4 Name
MSRMS4026	City of Brandon, MS4 Storm Water Management Program
MSRMS4028	City of Flowood, MS4 Storm Water Management Program
MSRMS4019	Hinds County, MS4 Storm Water Management Program
MSRMS4024	MDOT, MS4 Storm Water Management Program
MSRMS4031	Madison County, MS4 Storm Water Management Program
MSRMS4007	City of Madison, MS4 Storm Water Management Program
MSRMS4025	City of Pearl, MS4 Storm Water Management Program
MSRMS4035	Rankin County, MS4 Storm Water Management Program
MSRMS4029	City of Richland, MS4 Storm Water Management Program
MSRMS4009	City of Ridgeland, MS4 Storm Water Management Program
MSS049786	City of Jackson, MS4 Storm Water Management Program

2.3 Assessment of Non-Point Sources

Non-point loading of nutrients and organic material in a water body results from the transport of the pollutants into receiving waters by overland surface runoff, groundwater infiltration, and atmospheric deposition. The two primary nutrients of concern are nitrogen and phosphorus. Total nitrogen is a combination of many forms of nitrogen found in the environment. Inorganic nitrogen can be transported in particulate and dissolved phases in surface runoff. Dissolved inorganic nitrogen can be transported in groundwater and may enter a water body from groundwater infiltration. Finally, atmospheric gaseous nitrogen may enter a water body from atmospheric deposition.

Unlike nitrogen, phosphorus is primarily transported in surface runoff when it has been sorbed by eroding sediment. Phosphorus may also be associated with fine-grained particulate matter in the atmosphere and can enter streams as a result of dry fallout and rainfall (USEPA, 1999). However, phosphorus is typically not readily available from the atmosphere or the natural water supply (Davis and Cornwell, 1988). As a result, phosphorus is typically the limiting nutrient in most non-point source dominated rivers and streams, with the exception of watersheds which are dominated by agriculture and have high concentrations of phosphorus contained in the surface runoff due to fertilizers and animal excrement or watersheds with naturally occurring soils which are rich in phosphorus (Thomann and Mueller, 1987).

Watersheds with a large number of failing septic tanks may also deliver significant loadings of phosphorus to a water body. All domestic wastewater contains phosphorus which comes from humans and the use of phosphate containing detergents. Table 9 presents the estimated loads from various land use types in the Pearl River Basin based on information from USDA ARS Sedimentation Laboratory (Shields, et. al., 2008).

The Pearl River Basin contains mainly scrub/barren but also has different landuse types, including urban, water, forest, pasture, cropland, and wetlands. The landuse information is based on the National Land Cover Dataset (NLCD). The landuse distribution for the Pearl River Basin without the West Pearl River landuse is shown in Table 11 and Figure 2. By multiplying the

landuse category size by the estimated nutrient load, the watershed specific estimate can be calculated. The TMDL target concentration and load is also presented in Table 11, along with the recommended percent reduction.

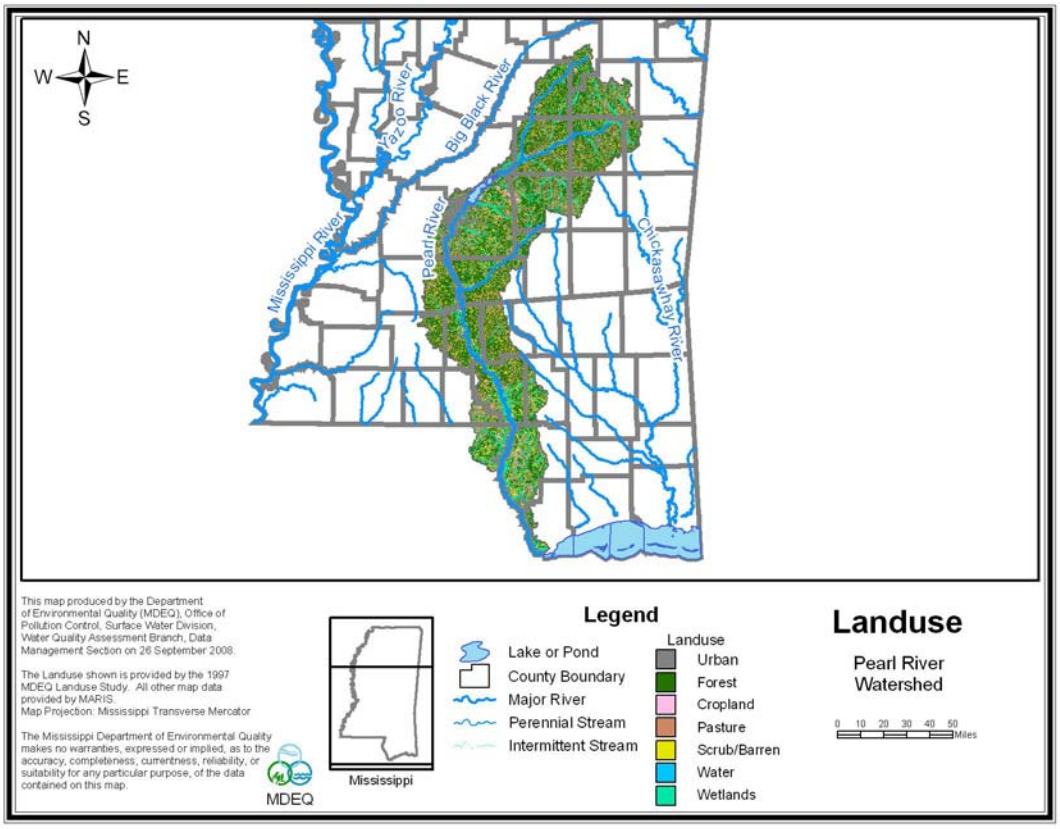
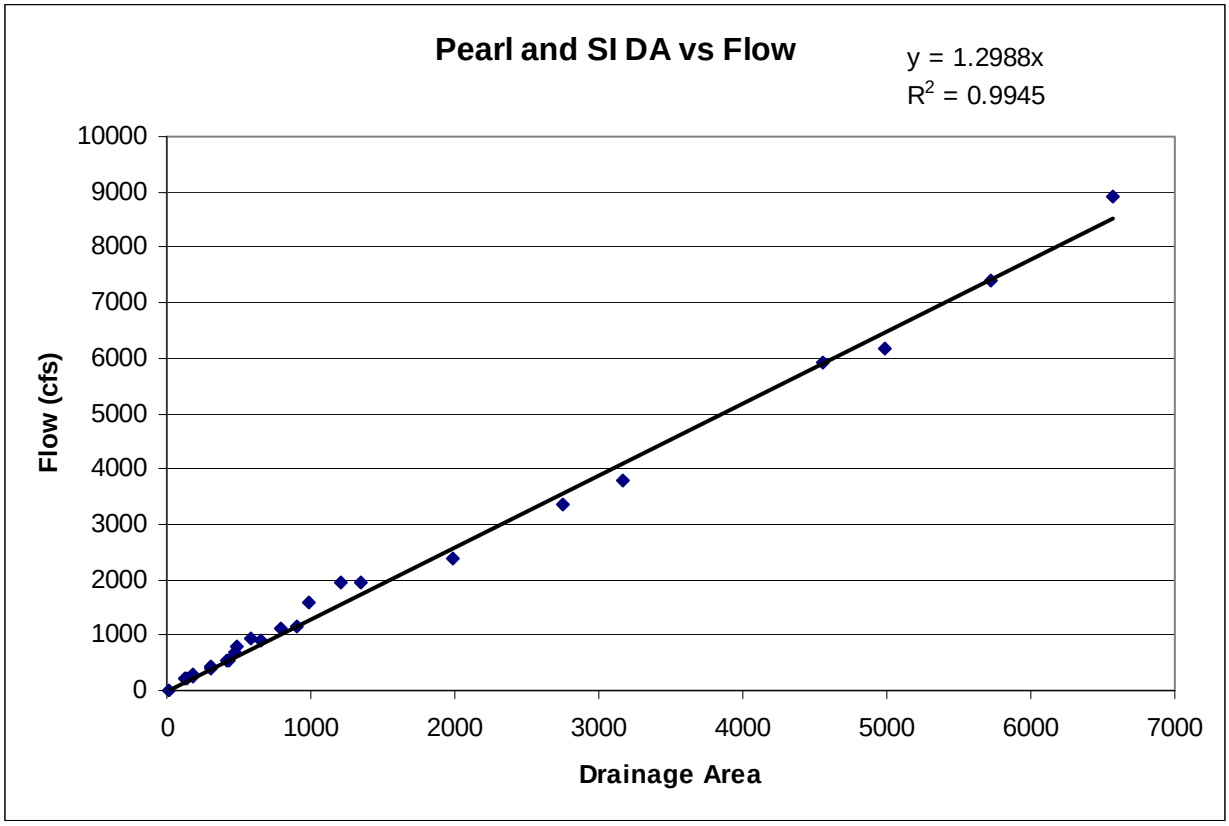


Figure 2. Landuse in the Pearl River Watershed

2.4 Estimated Existing Load for Total Nitrogen and Total Phosphorus

The average annual flow in the basin was calculated by utilizing the flow vs. area graph shown in Figure 3 below. All available gages in the Pearl River and South Independent Streams Basins were compared to the watershed size. A very strong correlation between flow and watershed size was developed for the two basins. The equation for the line that best fits the data was then used to estimate the annual average flow for the basin. The TMDL target TN and TP loads were then calculated, using Equation 1 and the results are shown in Table 11.

Figure 3. Drainage Area and Flow in the Pearl River and South Independent Streams Basins



Nutrient Load (lb/day) = Flow (cfs) * 5.394 (conversion factor)* Nutrient Concentration (mg/L)
(Equation 1)

Table 11. Estimated Loads for the Pearl River

			Water	Urban	Scrub/Barren	Forest	Pasture/Grass	Cropland	Wetland	Total	
		Acres	66,080.8	310,865.7	2,035,682.7	638,436.7	726,579.7	106,230.9	779,811.5	4,663,688.1	
Land Use	**TN kg/mile^2**	Percent	1.42%	6.67%	43.65%	13.69%	15.58%	2.28%	16.72%	100.00%	
Forest	111.3	Miles^2 in watershed	103.3	485.7	3180.8	997.6	1135.3	166.0	1218.5	7287.0	
Pasture	777.2	Flow in cfs based on area	9464.4	cfs							
Cropland	5,179.9										
Urban	296.4	TN Load kg/mi^2 annual avg	257.4	296.4	111.3	111.3	777.2	5,179.9	265.2		
Water	257.4	TP Load kg/mi^2 annual avg	257.4	3.1	62.1	62.1	777.2	2,589.9	265.2		
Wetland	265.2										
Scrub/Barren	111.3	TN Load kg/day	72.8	394.4	969.9	304.3	2417.4	2,355.6	885.3	7,399.7	kg/day
		TP Load kg/day	72.8	4.2	541.2	169.7	2417.4	1,177.8	885.3	5,268.3	kg/day
Land Use	**TP kg/mile^2**										
Forest	62.1	TN estimated load per day	16,313.49	lbs/day							
Pasture	777.2	TP estimated load per day	11,614.60	lbs/day							
Cropland	2,589.9										
Urban	3.1	TN target concentration	0.7	mg/l							
Water	257.4	TP target concentration	0.1	mg/l							
Wetland	265.2										
Scrub/Barren	62.1	TN target load per day	35,735.58	lbs/day							
		TP target load per day	5,105.08	lbs/day							
		TN reduction needed	0.0%								
		TP reduction needed	56.0%								

The land use calculations are based on 2004 data. The nutrient estimates are based on USDA ARS. The TMDL targets are based on EPA guidence for calculation of targets when considering all available data.

ALLOCATION

3.1 Wasteload Allocation

There are 16 major or direct discharge NPDES point sources. Two of the facilities, Kosciusko POTW and Philadelphia POTW, are HCR facilities. The TN and TP limits for these two facilities will be based on concentration. The City of Jackson POTW, Savannah Street facility, currently has seasonal flow limits of 46 MGD in the summer (May – October) and 120 MGD in the winter (November – April). The average flow of this facility, taken from their NPDES permit application based on 777 samples, is 48.14 MGD. The TP and TN loads for this facility were calculated based on the summer flow of 46 MGD and are to be applied as a 30-day average load in the permit. Bogalusa POTW is located in Louisiana which is in USEPA Region 6. The WLA for 13 of the point sources is shown in Table 12. Three of the facilities are included in a nutrient TMDL for Tuscolameta Creek. The WLA for Tuscolameta Creek is included in Table 12 as a part of the Pearl River WLA (MDEQ, 2009). Future permits will be considered in accordance with Mississippi's *Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification*(1994).

The AGPT results indicate that the river is nitrogen limited and needs to be driven back to being phosphorous limited. While this TMDL does not recommend a reduction to point source loading of TN, it does recommend quarterly monitoring of TN and applying the TN WLA load at these facilities. These limits are shown in Table 12. The estimated existing point source contribution of TN is 12,747.6 lbs and 36% of the TMDL target load.

This TMDL recommends an overall 56% reduction of TP from the 16 major facilities in the Pearl River Watershed based on the analysis given in Table 10. The estimated existing point source contribution is greater than the TP TMDL target load. Given the recommended TMDL percent reductions of 56% for TP, the WLA portion of the TMDL is 2,549.4 lbs. These limits are shown in Table 12.

Table 12. Waste Load Allocation for Point Source Contributions

Facility	City	County	Permit #	Discharge (MGD)	TP (mg/l)	TN (mg/l)	TP (lbs/day)	TN (lbs/day)
Bogalusa POTW	Bogalusa	Washinton Parish	LA0046515	6	2.76	11.5	138.01	575.86
Carriere Regional Wastewater Treatment System	Picayune	Pearl River	MS0061941	4	2.76	11.5	92.00	383.90
Columbia POTW, South	Columbia	Marion	MS0044164	1.47	2.76	11.5	33.81	141.08
Georgia Pacific Corp., Monticello Mill	Monticello	Lawrence	MS0002941	26.04	0.83	9.5	161.25	2,064.57
Jackson POTW, Savanna Street	Jackson	Hinds	MS0024295	46	3.07	13.6	1,180.12	5,221.10
Jackson POTW, Trahon and Big Creek	Jackson	Hinds	MS0044059	4.5	3.07	13.6	115.45	510.76
Kosciusko POTW*	Kosciusko	Attala	MS0027774	2.048	2.76	11.5	47.11	196.56
Morton POTW	Morton	Scott	MS0036234	2.97	3.07	13.6	76.19	337.10
Philadelphia POTW*	Philadelphia	Neshoba	MS0021156	1.34	2.76	11.5	30.82	128.61
Picayune POTW (Airport Rd)	Picayune	Pearl River	MS0042161	3.075	2.76	11.5	70.73	295.13
Picayune POTW (Neal Rd)	Picayune	Pearl River	MS0061174	2.4	2.76	11.5	55.20	230.34
Poplarville POTW	Poplarville	Pearl River	MS0020494	1.1	3.07	11.5	28.22	124.85
Sanderson Farms Inc. Monticello	Monticello	Lawrence	MS0055492	1	15.9	134	132.70	1,118.33
Tuscolameta Watershed WLA **	---	---	---	---	---	---	387.76	1419.42
Total							**2,549.4**	**12,747.6**

*HCR Facility with a concentration based permit limit
**WLA from Tuscolameta Creek Nutrient TMDL

3.1.1 Wasteload Allocation Storm Water

MDEQ has established a method to estimate the storm water waste load allocation (WLAsw). The WLAsw is calculated according to equation 2 below. The intent of the storm water NPDES permit is not to treat the water after collection, but to reduce the exposure of storm water runoff to pollutants by implementing various controls. Storm water NPDES permits require the establishment of controls or BMPs to reduce the pollutants entering the environment.

Waste Load Allocation Storm Water (WLAsw) = LA * % Urban Area in MS4 within watershed * 70% (Equation 2)

3.2 Load Allocation

Based on the measured instream concentrations of TN from monitoring performed in 2006 and 2008, this TMDL recommends a nonpoint source reduction of TN. There is insufficient data to calculate a percent reduction for TN. This TMDL also recommends a 56% reduction to nonpoint source loads of TP based on the analysis given in Table 10. Best management practices should be encouraged in the watersheds to reduce potential TN and TP loads from non-point sources. For land disturbing activities related to silvaculture, construction, and agriculture, it is recommended that practices, as outlined in "Mississippi's BMPs: Best Management Practices for Forestry in Mississippi" (MFC, 2000), "Planning and Design Manual for the Control of Erosion, Sediment, and Stormwater" (MDEQ, et. al, 1994), and "Field Office Technical Guide" (NRCS, 2000), be followed, respectively.

3.3 Incorporation of a Margin of Safety

The margin of safety is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving water body. The two types of MOS development are to implicitly incorporate the MOS using conservative model assumptions or to explicitly specify a portion of the total TMDL as the MOS. The MOS selected for this model is implicit.

3.4 Calculation of the TMDL

A predictive model was not used to calculate the TMDL. Equation 1 was used to calculate the TMDL for TP and TN. The target concentration was used with the average flow for the watershed to determine the TMDL.

The nutrient TMDL loads were then compared to the estimated existing loads previously calculated. Best management practices are encouraged in this watershed to reduce the nonpoint nutrient loads.

Table 13. Calculation of the TMDL

	Flow (cfs)	Concentration (mg/l)	TMDL (lbs/day)	% Reduction
TP	9,464.4	0.1	5,105.1*	56%
TN	9,464.4	0.7	35,735.6*	0%

*TMDL applies such that TN and TP targets will be met in each of the impaired segments

3.5 Seasonality and Critical Condition

This TMDL accounts for seasonal variability by requiring allocations that ensure year-round protection of water quality standards, including during critical conditions.

CONCLUSION

Nutrients were addressed through an estimate of a preliminary total phosphorous concentration target and a preliminary total nitrogen concentration target. Based on the estimated existing and estimated target total phosphorous concentrations, this TMDL recommends a 56% reduction of the phosphorous loads from both point and nonpoint sources entering these water bodies to meet the preliminary target of 0.1 mg/l. NPDES permit limits for TP are recommended in Table 11. This TMDL recommends a reduction to nonpoint sources of TN but does not recommend a reduction to point sources of TN although it does set a TN WLA. The implementation of BMP activities should reduce the nutrient load entering the Pearl River. This will provide improved water quality for the support of aquatic life in the water bodies, and will result in the attainment of the applicable water quality standards.

4.1 Next Steps

MDEQ's Basin Management Approach and Nonpoint Source Program emphasize restoration of impaired waters with developed TMDLs. During the watershed prioritization process to be conducted by the Pearl River Basin Team, this TMDL will be considered as a basis for implementing possible restoration projects. The basin team is made up of state and federal resource agencies and stakeholder organizations and provides the opportunity for these entities to work with local stakeholders to achieve quantifiable improvements in water quality. Together, basin team members work to understand water quality conditions, determine causes and sources of problems, prioritize watersheds for potential water quality restoration and protection activities, and identify collaboration and leveraging opportunities. The Basin Management Approach and the Nonpoint Source Program work together to facilitate and support these activities.

The Nonpoint Source Program provides financial incentives to eligible parties to implement appropriate restoration and protection projects through the Clean Water Act's Section 319 Nonpoint Source (NPS) Grant Program. This program makes available around $1.6M each grant year for restoration and protections efforts by providing a 60% cost share for eligible projects.

Mississippi Soil and Water Conservation Commission (MSWCC) is the lead agency responsible for abatement of agricultural NPS pollution through training, promotion, and installation of BMPs on agricultural lands. USDA Natural Resource Conservation Service (NRCS) provides technical assistance to MSWCC through its conservation districts located in each county. NRCS assists animal producers in developing nutrient management plans and grazing management plans. MDEQ, MSWCC, NRCS, and other governmental and nongovernmental organizations work closely together to reduce agricultural runoff through the Section 319 NPS Program.

Mississippi Forestry Commission (MFC), in cooperation with the Mississippi Forestry Association (MFA) and Mississippi State University (MSU), have taken a leadership role in the development and promotion of the forestry industry Best Management Practices (BMPs) in Mississippi. MDEQ is designated as the lead agency for implementing an urban polluted runoff control program through its Storm Water Program. Through this program, MDEQ regulates most construction activities. Mississippi Department of Transportation (MDOT) is responsible for implementation of erosion and sediment control practices on highway construction.

Due to this TMDL, projects within this watershed will receive a higher score and ranking for funding through the basin team process and Nonpoint Source Program described above.

4.2 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 statewide newspaper. The public will be given an opportunity to review the TMDLs 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 Kay Whittington at Kay_Whittington@deq.state.ms.us.

All comments should be directed to Kay_Whittington@deq.state.ms.us or Kay Whittington, 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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