FINAL
Total Maximum Daily Load (TMDL)

For
Organic Enrichment & Dissolved Oxygen

Tombigbee River (Aliceville Reservoir) AL/03160106-0402-102

Pickens County, Alabama

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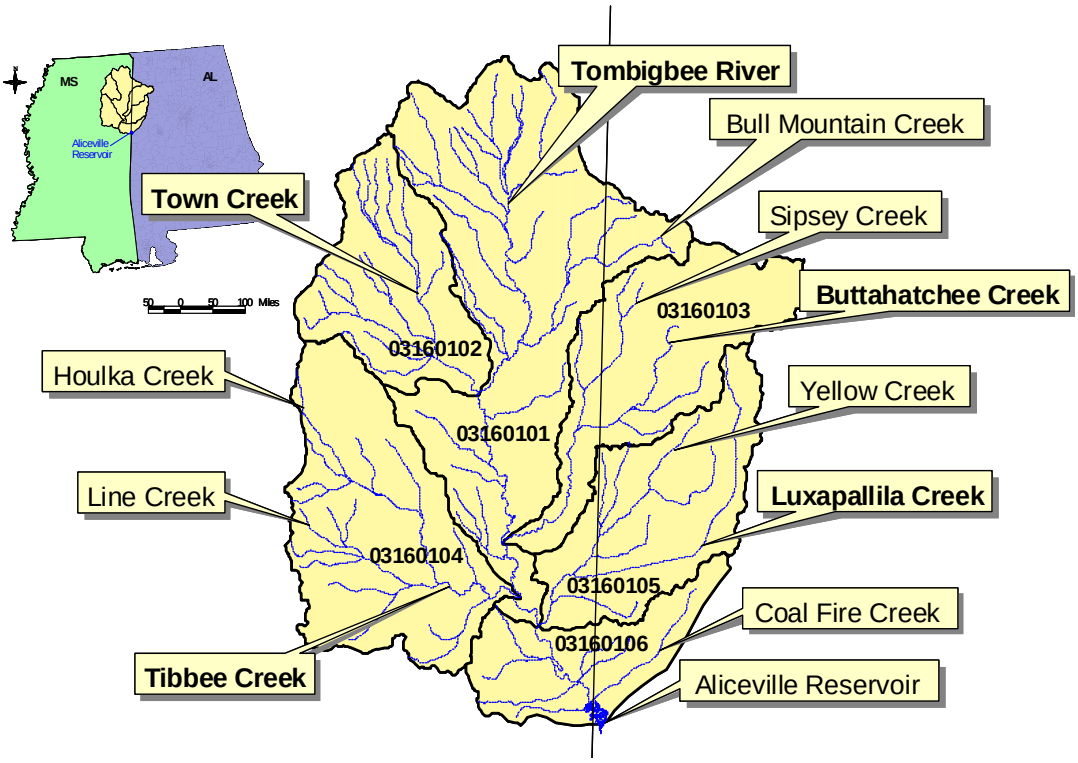
ADEM	Alabama Department of Environmental Management
BOD	Biochemical Oxygen Demand
BOD-5	5-Day Biochemical Oxygen Demand
CAFO	Concentrated Animal Feeding Operation
CBOD	Carbonaceous Biochemical Oxygen Demand
$CBOD_U$	Ultimate Carbonaceous Biochemical Oxygen Demand
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
HUC	Hydrologic Unit Code
LA	Load Allocation
MDEQ	Mississippi Department of Environmental Quality
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
NBOD	Nitrogenous Biochemical Oxygen Demand
NH_3-N	Ammonia Expressed as Concentration of Nitrogen
$NOBD_U$	Ultimate Nitrogenous Biochemical Oxygen Demand
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
SOD	Sediment Oxygen Demand
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USGS	United States Geological Survey
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WWTP	Wastewater Treatment Plant
7Q10	7-day Average Low Flow with a Recurrence Interval of Once in Ten Years



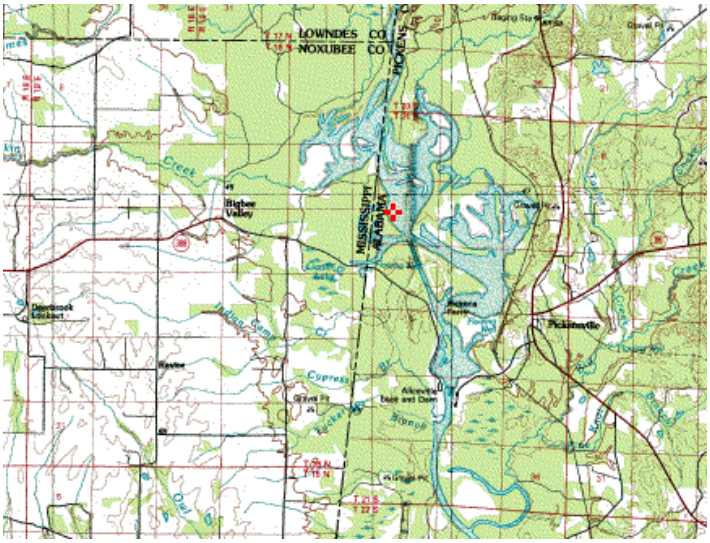


Figure 1. Aliceville Reservoir in the Tombigbee River Basin

1.0 Executive Summary

This report presents the Total Maximum Daily Load (TMDL) for the Tombigbee River from Bevill Dam to the Alabama/Mississippi state line (Aliceville Reservoir), which is listed as impaired by organic enrichment/low dissolved oxygen on Alabama's 2008 Section 303(d) list. TMDLs are required under the Clean Water Act when technologically based controls on permitted point sources alone are insufficient to achieve water quality standards.

Aliceville Reservoir is an impoundment of the Tombigbee River located in Pickens County, Alabama, near the Alabama/Mississippi state line. The reservoir is operated primarily to support navigation on the Tennessee-Tombigbee Waterway and is characterized by low velocities and high temperatures during summer drought periods. The contributing upstream watershed for Aliceville Reservoir occupies an area of 5,750 square miles, most of which is within the State of Mississippi.

Aliceville Reservoir has two designated use classifications: Fish and Wildlife and Swimming. In accordance with Alabama Department of Environmental Management (ADEM) water quality standards, the minimum dissolved oxygen (DO) concentration in a waterbody with these use classifications is 5 mg/L, except in extreme conditions due to natural causes where DO levels are not permitted to drop below 4 mg/L.

Aliceville Reservoir was originally placed on Alabama's 1996 § 303(d) list as not supporting designated uses based on water quality monitoring data collected in 1991 that showed DO concentrations less than 5 mg/L, and occasionally less than 4 mg/L. More recent data, collected by ADEM in 1999, 2001, 2003, 2004 and 2006 and by EPA in 2005, shows that DO values in Aliceville Reservoir continue to drop below 5 mg/L. Analysis of available monitoring data indicates that excursions of the water quality criterion for DO in Aliceville Reservoir are associated with conditions of low flow and high water temperatures. Under these conditions, the ability of water to hold dissolved oxygen is reduced, the rate of reaeration of the water is slowed, and the effects of oxygen-consuming wastes on the DO balance in the water column are enhanced.

Three models were coupled and used to predict the reductions required to meet water quality standards. These modeling tools include: 1) an application of the watershed model, BASINS PLOAD; 2) an application of the hydrodynamic, three-dimensional model, Environmental Fluid Dynamics Code (EFDC); and 3) an application of the Water Quality Analysis Program (WASP) 7.2 eutrophication model. These models were calibrated to observed data in the reservoir.

In order to achieve the applicable water quality standards, the TMDL estimated by these models requires a reduction of 30 percent from the total existing loads of CBODu, Total Phosphorus (TP), and Total Nitrogen (TN) that enter Aliceville Reservoir. Although Aliceville Reservoir is not specifically identified as impaired for nutrients on Alabama's § 303(d) list, reductions to TP and TN are necessary to meet a minimum DO concentration of 5 mg/L. Based upon information currently available, the reductions and

associated allocations for TP and TN are not expected to cause or contribute to excursions of water quality standards to any downstream waterbodies. The sources of CBODu, TN, and TP originate in both Alabama and Mississippi. The TMDL is composed of three categories of allocations: 1) a wasteload allocation for the point sources in Alabama; 2) a load allocation for the nonpoint sources in Alabama; and 3) an aggregate allowable pollutant load, which includes both the point and nonpoint contributions, to Mississippi sources in the Tombigbee River watershed to be allocated at the state line. Table 1 shows the maximum daily loads that will meet and maintain water quality standards during the critical conditions experienced each summer (June – September). Loads for non-summer months can be higher than those in Table 1, as long as the annual average does not exceed the allocations in Table 2.

The percent reduction required for CBODu, TN and TP represented in the tables below is the same as the reduction prescribed in the draft TMDL EPA proposed in October 2007; however, the calculated loads allocated in the final TMDL are greater than the calculated loads proposed in the draft TMDL. In both the proposed and final TMDLs, loads at the MS/AL state line are calculated using results from the same water quality model. In the proposed draft TMDL, the loads at the MS/AL state line were based on output from one model layer when it should have accounted for the loads from all of the layers in the three dimensional model. This error was caught during the public comment period and the final TMDL loads at the MS/AL state line are approximately two-thirds greater than those reported in the proposed TMDL. The allocations in the final TMDL represent the total assimilated loads at the MS/AL state line necessary to achieve water quality standards.

Table 1: OE/DO TMDLs and Reductions Necessary to Meet WQS in Aliceville Reservoir (June – September)

Pollutant	ALABAMA			MISSISSIPPI	TMDL [4]
	Coal Fire Creek Watershed (HUC 3160106) [1, 5]	All other watersheds (HUC 03160101, 03160103, and 03160105) [2, 5]		Aggregate allocation to pollutants from Mississippi at the state border [5]	
	LA	WLA	LA		
CBODu	30% reduction (1,200 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (83,956 lbs/day)	30% reduction (85,156 lbs/day)
TN	30% reduction (17 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (9,606 lbs/day)	30% reduction (9,623 lbs/day)
TP	30% reduction (4 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (1,663 lbs/day)	30% reduction (1,667 lbs/day)

1 The Coal Fire Creek watershed (HUC 03160106) is the only watershed in the Alabama portion of the Tombigbee River basin that does not drain into Mississippi; therefore, loads from this watershed are not reflected in the aggregate allocation to Mississippi.

2 All other watersheds in Alabama (Bull Mountain Creek (03160101), Buttahatchee Creek (03160103), and Luxapallila Creek (03160105)) drain from Alabama to Mississippi before ultimately draining back to Alabama and into Aliceville Reservoir. The only point sources in Alabama discharge to these watersheds.

3 The wasteload allocation of 0 lbs/day recognizes that there are currently no point sources in Alabama that impact dissolved oxygen levels in Aliceville Reservoir. In order to be consistent with this wasteload allocation, any potential future discharges in Alabama can only discharge TN, TP, or CBODu loads within the Basin if they are determined to not have any impact on the dissolved oxygen levels in Aliceville Reservoir.

4 The TMDL is calculated by adding the aggregate allocation at the Mississippi border to the LA for the Coal Fire Creek watershed. The WLA to the Alabama point sources and the LA to the other Alabama watersheds were not added in the TMDL calculation, because their allocations are already reflected in the aggregate allocation to Mississippi.

5 Pollutant trading may occur between the loads allocated to nonpoint sources in Alabama and Mississippi if: (1) MDEQ and ADEM agree to trade; and (2) such trading results in an overall 30% reduction of CBODu/TN/TP loads to Aliceville reservoir.

Table 2: OE/DO TMDLs and Reductions Necessary to Meet WQS in Aliceville Reservoir as an Annual Average

Pollutant	ALABAMA			MISSISSIPPI	TMDL [4]
	Coal Fire Creek Watershed (HUC 3160106) [1, 5]	All other watersheds (HUC 03160101, 03160103, and 03160105) [2, 5]		Aggregate allocation to pollutants from Mississippi at the state border [5]	
	LA	WLA	LA		
CBODu	30% reduction (2,600 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (181,952 lbs/day)	30% reduction (184,552 lbs/day)
TN	30% reduction (29 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (16,311 lbs/day)	30% reduction (16,340 lbs/day)
TP	30% reduction (6 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (2,633 lbs/day)	30% reduction (2,639 lbs/day)

1 The Coal Fire Creek watershed (HUC 03160106) is the only watershed in the Alabama portion of the Tombigbee River basin that does not drain into Mississippi; therefore, loads from this watershed are not reflected in the aggregate allocation to Mississippi.

2 All other watersheds in Alabama (Bull Mountain Creek (03160101), Buttahatchee Creek (03160103), and Luxapallila Creek (03160105)) drain from Alabama to Mississippi before ultimately draining back to Alabama and into Aliceville Reservoir. The only point sources in Alabama discharge to these watersheds.

3 The wasteload allocation of 0 lbs/day recognizes that there are currently no point sources in Alabama that impact dissolved oxygen levels in Aliceville Reservoir. In order to be consistent with this wasteload allocation, any potential future discharges in Alabama can only discharge TN, TP, or CBODu loads within the Basin if they are determined to not have any impact on the dissolved oxygen levels in Aliceville Reservoir.

4 The TMDL is calculated by adding the aggregate allocation at the Mississippi border to the LA for the Coal Fire Creek watershed. The WLA to the Alabama point sources and the LA to the other Alabama watersheds were not added in the TMDL calculation, because their allocations are already reflected in the aggregate allocation to Mississippi.

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2.0 Basis for the §303(d) Listing

Section 303(d) of the Clean Water Act (CWA), as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)], requires states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. TMDLs for all pollutants causing violation of applicable water quality standards are established for each identified water. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants, or other quantifiable parameters for a waterbody, based on the relationship between pollution sources and instream water quality conditions, so that states can establish water-quality based controls to reduce pollution from both point and non-point sources and restore and maintain the quality of their water resources (USEPA, 1991).

Aliceville Reservoir, an impoundment of the Tombigbee River, is located in the Middle Tombigbee-Lubbub hydrologic unit (HUC 03160106) in Pickens County, Alabama and Lowndes County, Mississippi. The reservoir was formed by the closure of Tom Bevill Dam in 1980 and is a part of the Tennessee-Tombigbee waterway. The State of Alabama has identified the segment of the Tombigbee River from Bevill Dam upstream to the Alabama/Mississippi state line (segment ID AL/03160106-0402-102), which is coincident with the Alabama portion of Aliceville Reservoir, as being impaired by flow alteration(s) and organic enrichment/low dissolved oxygen. The beneficial uses identified by Alabama for Aliceville Reservoir are Fish and Wildlife and Swimming (ADEM Admin. Code R. 335-6-11-.02), which jointly cover best usages including propagation of aquatic life, contact and non-contact recreation, and fish consumption. Aliceville Reservoir was originally placed on the 1996 § 303(d) list as not supporting designated uses because water quality monitoring data collected in 1991 showed DO concentrations less than 5 mg/L, and occasionally less than 4 mg/L. More recent data, collected by ADEM in 1999, 2001, 2003 and 2006 and by EPA SESD in 2005, shows that DO values in Aliceville Reservoir continue to drop below 5 mg/L. The listing has been reported on Alabama's 1996 through 2008 § 303(d) lists of impaired waters. The Tennessee-Tombigbee Waterway, which drains from Mississippi to Aliceville reservoir, is not listed as impaired on the 2008 Mississippi § 303(d) List of Waterbodies.

Low dissolved oxygen concentrations are associated with "organic enrichment" – the presence of excess amounts of oxygen-consuming organic matter. Water quality problems are exacerbated by "flow alterations" – specifically the modifications to the natural flow of the Tombigbee River associated with the construction of Bevill Dam, which resulted in increased residence time, decreased velocity, and decreased reaeration within this waterbody segment. Mitigation of flow alteration is not addressed in TMDLs under current regulations.

The purpose of this TMDL is to establish the acceptable loading of organic material from all sources, such that the State of Alabama water quality criterion for dissolved oxygen is not violated.

Usage of waters in the Fish and Wildlife classification is described in ADEM Admin. Code R. 335-6-10-.09(5)(a), (b), (c), and (d).

a) Best usage of waters:

Fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water-contact sports or as a source of water supply for drinking or food processing purposes.

b) Conditions related to best usage:

The waters will be suitable for fish, aquatic life and wildlife propagation. The quality of salt and estuarine waters to which this classification is assigned will also be suitable for the propagation of shrimp and crabs.

c) Other usage of waters:

It is recognized that the waters may be used for incidental water contact and recreation during June through September, except that water contact is strongly discouraged in the vicinity of discharges or other conditions beyond the control of the Department or the Alabama Department of Public Health.

d) Conditions related to other usage:

The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted criteria of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports.

Usage of waters in the Swimming classification is described in ADEM Admin. Code R. 335-6-10-.09(3)(a) and (b).

a) Best usage of waters:

Swimming and other whole body water-contact sports. In assigning this classification to waters intended for swimming and water-contact sports, the Commission will take into consideration the relative proximity of discharges of wastes and will recognize the potential hazards involved in locating swimming

> areas close to waste discharges. The Commission will not assign this classification to waters, the bacterial quality of which is dependent upon adequate disinfection of waste and where the interruption of such treatment would render the water unsafe for bathing.
>
> b) Conditions related to best usage:
>
> The waters, under proper sanitary supervision by the controlling health authorities, will meet accepted standards of water quality for outdoor swimming places and will be considered satisfactory for swimming and other whole body water-contact sports. The quality of waters will also be suitable for the propagation of fish, wildlife and aquatic life. The quality of salt waters and estuarine waters to which this classification is assigned will be suitable for the propagation and harvesting of shrimp and crabs.

Alabama's water quality criteria for Fish and Wildlife and Swimming uses (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.) and Admin. Code R. 335-6-10-.09-(3)(c)(4.)) state that "for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/L at all times; except under extreme conditions due to natural causes, it may range between 5 mg/L and 4 mg/L, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels… In the application of dissolved oxygen criteria referred to above, dissolved oxygen shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, dissolved oxygen criteria will be applied at mid-depth."

ADEM's water quality standards applying to nutrients are narrative as stated in ADEM's Administrative Code, Rule 335-6-10-.06:

> The following minimum conditions are applicable to all State waters, at all places and at all times, regardless of their uses:
> (a) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that settle in forming bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use.
> (b) State waters shall be free from floating debris, oil, scum, and other floating materials attributable to sewage, industrial wastes or other wastes in amounts sufficient to be unsightly, or which interfere directly or indirectly with any classified water use.
> (c) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations, which are toxic or harmful to human, animal, or aquatic life to the extent commensurate with the designated usage of such waters.

3.0 Technical Basis for TMDL Development

3.1 Applicable Water Quality Criterion

As described in Section 2.0, the minimum dissolved oxygen (DO) concentration in a stream classified as Fish and Wildlife or Swimming is 5 mg/L, except under extreme conditions due to natural causes where a concentration of 4 mg/L will be allowed. The target is established at a depth of 5 feet in water 10 feet or greater in depth; for those waters less than 10 feet in depth, dissolved oxygen criteria are applied at mid-depth. The target CBODu, TP and TN concentrations may not deplete the daily dissolved oxygen concentration below this level as a result of the decaying process.

Aliceville Reservoir is classified for Fish and Wildlife and Swimming uses. For navigation purposes, flows are controlled to maintain a minimum depth of 9 feet. Depths at the downstream end of the listed reach, just above Aliceville Dam, remain greater than 10 feet. In sum, the primary water quality target is a DO concentration of 5 mg/L or greater at a depth of approximately 5 feet.

3.2 Source Assessment

Both point and nonpoint sources may contribute external loads of BOD, TP and TN to a given water body. These sources of organic enrichment may arise anywhere within the upstream watershed, which constitutes an area of approximately 5,750 square miles in Mississippi and Alabama and comprises six 8-digit USGS watersheds. These watersheds, along with the major streams and rivers, are shown in Figure 1. Major point sources of organic enrichment include wastewater treatment plants and paper mills, both of which are present in the Tombigbee watershed. Potential nonpoint sources of organic loading are numerous and often occur in combination. In rural areas, runoff can transport significant loads of organic material from natural sources and agricultural lands, while onsite wastewater (septic) systems can contribute a steady source of oxygen-consuming wastes to groundwater. Nationwide, poorly treated municipal sewage comprises a major source of organic compounds that decay and create additional organic loading. Urban storm water runoff, wastewater treatment discharges, and sanitary sewer overflows can also be significant sources of organic loading.

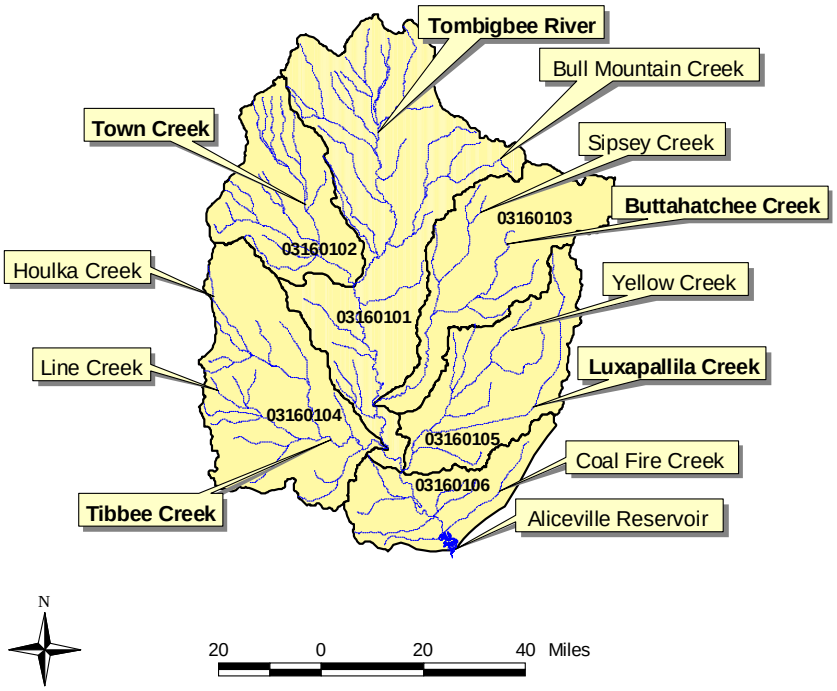

Figure 1: Watersheds Upstream of Aliceville Reservoir

Internal sources of organic enrichment include the biomass of plankton and rooted aquatic plants that grows in a waterway. Plants respire and consume oxygen, and dead plant material is available for digestion by bacteria and zooplankton. However, plants also produce oxygen as a byproduct of photosynthesis. During periods of active growth, aquatic plants may provide a net positive contribution to dissolved oxygen on a daily average basis. Elevated nutrient loads to a watershed may enhance the internal production of organic enrichment.

Oxygen demand is also exerted by organisms that consume organic matter on and in the sediments. The net impact of this process is known as sediment oxygen demand (SOD). SOD arises from the deposition of organic matter to the sediments; it thus tends to reflect a combination of the current and past history of external and internal sources of organic enrichment.

Potential sources of organic loading in the watershed were identified based on an evaluation of current land use/cover information (e.g., urban high density or forested land) and an assessment of current NPDES dischargers to the watershed. The source assessment was used as the basis of development of the model and ultimate analysis of the TMDL allocations. Organic and nutrient loading within the watershed includes both point and non-point sources.

3.2.1 Nonpoint Sources

Nonpoint source contributions of oxygen consuming wastes include runoff from various landuses and septic systems. Landuse information was derived from the National Land Cover Dataset (NLCD), 2001, and is presented in Figure 2. The predominant land uses are forest (55 percent) and agriculture (31 percent). Of the agriculture, the bulk of which is located in Mississippi, approximately 50 percent is pastureland and 50 percent is cropland.

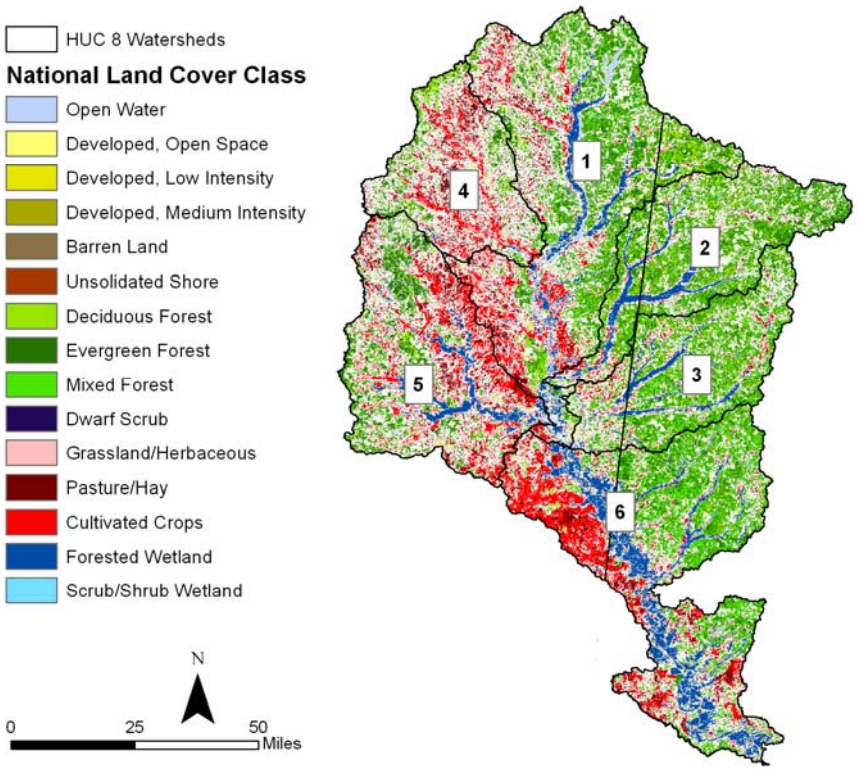

Figure 2: Land Use Classification in the Aliceville Reservoir Watershed

Watersheds 1 through 6 in Figure 2 correspond to the six 8-digit HUCs draining to Aliceville Reservoir. Table 3 summarizes the land use distribution for each of these watersheds.

Table 3: Landuse Distribution for Watersheds Draining to Aliceville Reservoir
(acres and percent)

ID	Watershed Name/HUC	Agriculture – Cropland	Agriculture – Pasture	Barren/ Mining	Forest	Transitional	Urban	Water/ Wetlands
1	Upper Tombigbee 03160101	163,641 (15.7 %)	170,037 (16.4 %)	910 (0.1 %)	642,021 (61.7 %)	38,760 (3.7 %)	11,700 (1.1 %)	12,686 (1.2%)
2	Buttahatchee 03160103	32,572 (5.8 %)	39,774 (7.1 %)	544 (0.1 %)	408,270 (73.1 %)	27,322 (4.9 %)	4,187 (0.7 %)	45,751 (8.2 %)
3	Luxapallila 03160105	41,175 (8.1 %)	42,566 (8.4 %)	238 (0 %)	364,342 (71.6 %)	13,278 (2.6 %)	5,980 (1.2 %)	41,399 (8.1 %)
4	Town 03160102	98,762 (22.2 %)	135,302 (30.4 %)	208 (0 %)	181,173 (40.8 %)	2,032 (0.5 %)	15,809 (3.6 %)	11,232 (2.5 %)
5	Tibbee 03160104	167,024 (23.7 %)	153,196 (21.8 %)	650 (0.1 %)	295,845 (42.0 %)	7,987 (1.1 %)	8,333 (1.2 %)	71,103 (10.1 %)
6	Middle Tombigbee 03160106	188,005 (18.0 %)	134,216 (12.8 %)	1,077 (0.1 %)	485,116 (46.4 %)	18,909 (1.8 %)	4,031 (0.4 %)	213,679 (20.4 %)
Total		691,179 (16.1 %)	675,091 (15.7 %)	3,627 (0.1 %)	2,376,767 (55.3 %)	108,288 (2.5 %)	50,040 (1.2 %)	395,850 (9.2 %)

The predominant land use is forest, followed by agricultural. This watershed is primarily rural, so agricultural loads of organic material during storm wash-off events could be significant. Residential land uses constitute less than 1 percent of the watershed, and loads from onsite wastewater disposal systems are unlikely to be significant relative to other load sources.

3.2.2 Point Sources

ADEM and the Mississippi Department of Environmental Management (MDEQ) maintain databases of current NPDES permits and GIS files that locate each permitted outfall. These databases include municipal, semi-public/private, industrial, mining, industrial storm water, and concentrated animal feeding operations (CAFOs) permits. There are a total of 166 Mississippi and Alabama NPDES permits with BOD effluent limitations in Tombigbee River HUCs 03160101 through 03160106 (USEPA PCS Query, 8/13/07). The majority of these permits are for small facilities.

There are ten major dischargers with BOD effluent limits within the six HUCs upstream of Aliceville Reservoir. Two dischargers without BOD limits (EKA Chemical and Sanderson) are also included because of proximity to the reservoir. EKA Chemical, which manufactures hydrogen peroxide and sodium chlorate (according to MDEQ), has a total organic carbon (TOC) limit from which BOD may be estimated. Sanderson manufactures wood products and also reports its effluent BOD concentration. The two major dischargers closest to Aliceville reservoir are Columbus POTW and Weyerhaeuser Paper Mill. All dischargers are summarized in Table 4 and Figure 3.

Table 4: Major NPDES Permitted Discharges of BOD to the Tombigbee River Upstream of Aliceville Reservoir (HUCs 03160101 and 03160106)

NPDES Permit #	Facility Name	Facility Type	Flow (MGD)	5- day BOD Limit (lb/d)	Ammonia (lb/d)
MS0001783	Bryan Foods	Meat Packing	2.65 [f]	375 [a]	50 / 44 [h]
MS0003158	True Temper Sports/Emhart	Plating	0.346 [m]	78[b]	0.033[L]
MS0045489	Amory POTW	Sewerage	2	751	33[k]
MS0055581	Aberdeen POTW	Sewerage	4	1501,1001[c]	58[f]
AL0048372	Hamilton POTW	Sewerage	2.64 [f]	352	132
MS0020788	West Point POTW	Sewerage	3.5	525 [i] / 876 [j]	58[k]
MS0036111	Tupelo POTW	Sewerage	10.5	2,627	175 [i] / 350 [j]
AL0023400	Winfield POTW	Sewerage	0.353 [f]	225 / 183 [g]	76.7/49.2 [g]
MS0056472	Columbus POTW	Sewerage	10	2,168	500
MS0036412	Weyerhaeuser CPPC	Paper Mill	19 [f]	21,954[d]	192 [f]
MS0040215	EKA Chemical	Chemical	0.655 [f]	32[f]	NA
MS0002216	Sanderson	Wood Products	0.23 [f]	3.3[f]	NA

a. Permitted $CBOD_5$ limit.
b. No BOD_5 limit for pipe 1; table shows average discharge from 8/05 to 12/06.
c. Permitted BOD_5 limit was 1501 through Dec. 2004, then 1001 Jan. 2005 through present.
d. Variable limit based on temperature and flow conditions of the Tombigbee River, table shows monthly average permitted discharge.
e. No BOD limit specified, has a permitted TOC limit of 73 lb/d as of Nov. 2005.
f. No permit limit; table shows average discharge from 1/03 to 12/06.
g. 2003-Aug. 2006 limit, then Sep. 2006 to present limit.
h. 2003-July. 2006 limit, then Aug. 2006 to present limit.
i. Summer limit (May – Oct..)
j. Winter limit (Nov. –Apr.).
k. Estimated ammonia from permitted discharge and assumed ammonia conc. of 2 mg/L.
l. Estimated ammonia from pipe #2 0.002 MGD discharge and assumed ammonia conc. of 2 mg/L.
m. Design flow.

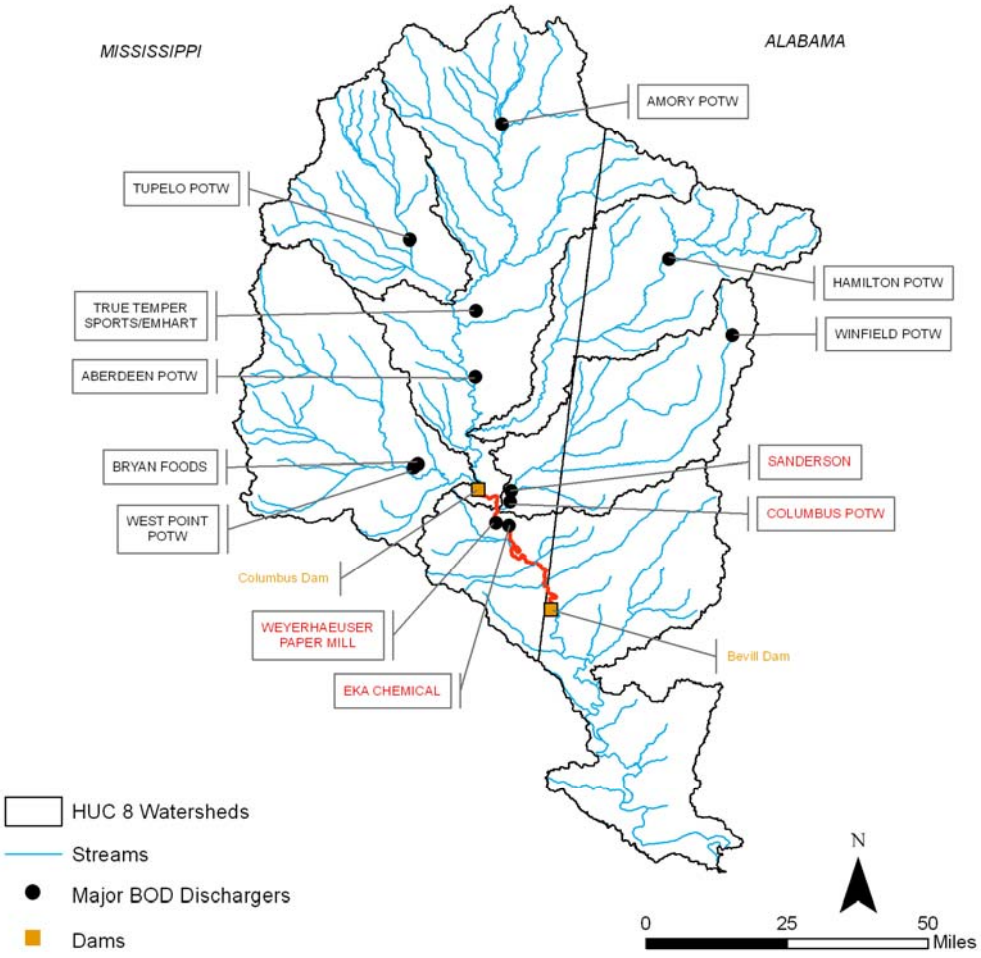

Figure 3: Major Discharges of BOD to the Tombigbee River Above Aliceville Reservoir

Four major point sources in the watershed, indicated in red in Figure 3, contribute oxygen-demanding wastes downstream of Stennis Dam and upstream of Bevill Dam. These four dischargers closer to Aliceville reservoir have a combined BOD limit of 4,846 pounds per day and an ammonia limit of 692 pounds per day. Monthly discharge monitoring report (DMR) data were obtained for Columbus POTW, Weyerhaeuser, EKA Chemical and Sanderson.

The other eight of these major discharges are farther from Aliceville reservoir. Seven are upstream of Stennis Lock and Dam at Columbus and one is far upstream on Luxapallila Creek. These eight dischargers have a total BOD limit of 5,884 pounds per day and an ammonia limit of 549 pounds per day. However, much of the distant discharged BOD and nitrogen load is consumed or settled-out prior to reaching Aliceville Reservoir. The loads from these facilities are a part of model boundary pollutant load conditions, and these eight discharges are not explicitly in the model. To understand the contribution to the boundary pollutant load from these facilities, load estimations outside of the water

quality model were calculated. These estimations are based on distance from the model boundary, flow velocity, and pollutant decay.

The BOD load delivered to the Aliceville pool from the distant, eight dischargers is estimated to be about 33 percent of the actual discharged load due to decay. This ultimately contributes only 1 percent of the total loading to the Aliceville reservoir.

These upstream major dischargers, as well as all minor permitted dischargers, are treated as part of the headwater background load at Stennis Dam for modeling purposes. Existing discharge data for the 12 major NPDES facilities in the watershed are included in Table 5.

Table 5: Existing Discharge (2003-2006) for Major NPDES Facilities to the Tombigbee River Upstream of Aliceville Dam

Facility Name	Facility Type	5- day BOD (lbs/day)	Ammonia (lbs/day)	TN (lbs/day)	TP (lbs/day)
Bryan Foods	Meat Packing	51	7	1297	598
True Temper Sports/Emhart	Plating	78	0.033	0	14
Amory POTW	Sewerage	108	13	83	54
Aberdeen POTW	Sewerage	188	58	377	32
Hamilton POTW	Sewerage	25	1.2	8	64
West Point POTW	Sewerage	66	58	189	17
Tupelo POTW	Sewerage	584	8	49	353
Winfield POTW	Sewerage	22	34	36	5
Columbus POTW	Sewerage	245	34	480	65
Weyerhaeuser CPPC	Paper Mill	2,659	192	700	191
EKA Chemical	Chemical	32	5.3	7.2	7
Sanderson	Wood Products	3.3	NA	NA	NA

3.3 Data Availability and Analysis

A wide range of data and information were used to characterize the watershed and the instream conditions. The categories of data used include physiographic data that describe the physical conditions of the watershed, environmental monitoring data that identify potential pollutant sources and their contribution, and instream water quality monitoring data. This section presents the data sources considered and their use in TMDL development.

3.3.1 Instream Water Quality

Water quality data from MDEQ, ADEM, Environmental Protection Agency Science and Ecosystem Support Division (EPA SESD), and Weyerhaeuser Company was used to characterize this reservoir and calibrate the models. A list of stations is shown in Table 6 and the locations are shown in Figure 4.

Table 6: Water Quality Stations in Aliceville Reservoir

Station	Agency	Station Name	First Date	Last Date	# Obs
1A	ADEM	Lower Aliceville Reservoir, deepest point in main river channel	05/13/1992	10/31/2006	3,834
2A	ADEM	Upper Aliceville Reservoir near state line	04/19/2001	10/31/2006	3,857
3A	ADEM	Aliceville Reservoir Coal Fire Creek Embayment	04/19/2001	10/31/2006	3,013
AVP01	MDEQ	Aliceville pool at state line	06/24/2003	09/28/2004 11:30	837
AVP02	MDEQ	Aliceville pool at Greens Creek	06/24/2003	09/28/2004	725
AVP03	MDEQ	Aliceville pool below Luxapalilla Creek	06/24/2003	09/28/2004	627
CFO25	EPA	Coal Fire Creek	08/14/2005	08/16/2005	895
JC315S	EPA	James Creek at Tenn-Tom Waterway river mile 315.8	08/13/2005	08/15/2005	636
LCO2	EPA	Luxapallila Creek near mouth	08/13/2005	08/15/2005	825
TT304	EPA	Tenn-Tom Waterway downstream of Bevill Lock & Dam	08/15/2005	08/17/2005	632
TT307	EPA	Tenn-Tom Waterway in Aliceville Pool	08/15/2005	08/17/2005	785
TT310	EPA	Tenn-Tom Waterway near MS-AL state line	08/15/2005	08/17/2005	648
TT314	EPA	Tenn-Tom Waterway near US 49 Bridge	08/15/2005	08/17/2005	660
TT319	EPA	Tenn-Tom Waterway near Harrison Bend	08/13/2005	08/15/2005	795
TT324	EPA	Tenn-Tom Waterway below Weyerhaeuser	08/13/2005	08/15/2005	805
TT327	EPA	Tenn-Tom Waterway above Weyerhaeuser near marker buoy	08/13/2005	08/15/2005	800
TT332	EPA	Tenn-Tom Waterway near Highway 82 Bridge	08/13/2005	08/15/2005	810
TT336	EPA	Columbus Pool near Stennis Lock & Dam	08/11/2005	08/13/2005	880
TT340	EPA	Tenn-Tom Waterway near Highway 50 Bridge	08/15/2005	08/17/2005	885
TTFA02S	EPA	Tenn-Tom Waterway Flow Augmentation Channel	08/11/2005	08/13/2005	815
327.8	Weyerhaeuser	Tenn-Tom at river mile 327.8	08/01/2003	10/24/2006	302
327.0	Weyerhaeuser	Tenn-Tom at river mile 327.0	08/01/2003	10/24/2006	302
316.3	Weyerhaeuser	Tenn-Tom at river mile 316.3	08/01/2003	10/24/2006	302
308.1	Weyerhaeuser	Tenn-Tom at river mile 308.1	08/01/2003	10/24/2006	293
1A	Weyerhaeuser	ADEM station 1A at Aliceville Dam forebay	08/01/2003	10/24/2006	278
2A	Weyerhaeuser	ADEM station 2A at state line	08/01/2003	10/24/2006	277

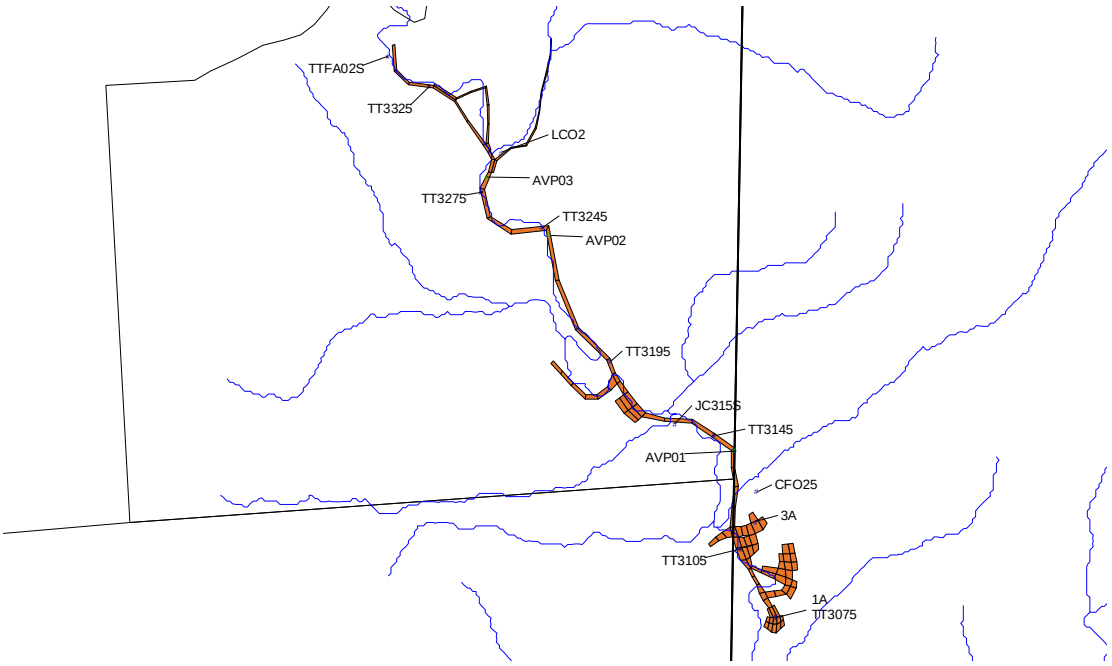

Figure 4: Model of Aliceville Reservoir showing water quality monitoring stations

Based on monitoring conducted by ADEM during the past 5 years, the DO measured at a depth of five feet at Aliceville Dam sagged each summer and fell below the water quality standard of 5 mg/L in 2003, 2004 and 2006. The DO farther upstream at the stateline followed a similar cycle with a summer sag, however it remained above 5 mg/L. A detailed analysis of available data is provided in the "Aliceville Reservoir Low DO Modeling Report, July 2008" (Modeling Report).

3.3.2 Other Available Data

Additional data sources were used to set-up the models. Sources included USGS topographic maps, NHD area and waterbody GIS coverages, and US Army Corps of Engineers shoreline coverages to define the model surface area and lay out the model grid. Bathymetry for the Tombigbee River and Aliceville Reservoir collected by the US Army Corps of Engineers and ADEM was used to define channel geometry for the reservoir. Hourly flows from USGS gages downstream of Stennis Lock and Dam (USGS 02441390) and Bevill Lock and Dam (USGS 02444160), and daily flow for Luxapallila Creek (USGS 2443500) were used to drive the hydraulics of the system. Surface water elevation of the Aliceville pool from the US Army Corps of Engineers was used to calibrate the EFDC model and correct the flows. The EFDC model volumes were also compared to US Army Corps of Engineers storage volume to elevation tables for Aliceville Reservoir to make sure the model represented this relationship.

EFDC and WASP require climate data that includes air temperature, relative humidity, precipitation, barometric pressure, solar radiation and cloud cover. Climate data from the Golden Triangle Regional Airport (WBAN 53893) station near Columbus, MS was used in the models.

4.0 Model Development

Establishing the relationship between instream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading, the linkage of loads to ambient impacts, and evaluation of potential changes to water quality resulting from implementation of various management options. The linkage relationship for a TMDL can be developed using a variety of techniques ranging from qualitative assumptions based on scientific principles to numerical computer modeling. For the Aliceville TMDL, qualitative assumptions and quantitative models were used. This section describes the numerical modeling techniques developed to simulate the loading of organic material and nutrients and the resulting instream response of dissolved oxygen. Details on model calibration are presented in the Modeling Report.

Two significant efforts have applied QUAL2E in the past to this section of the Tombigbee River. Based on comments received, the model was redone to provide a better representation of the reservoir. The modeling supporting this TMDL included a 3-D hydrodynamic model, a watershed loading model, and an eutrophication water quality model.

4.1 Environmental Fluid Dynamics Code (EFDC)

Environmental Fluid Dynamics Code (EFDC) was used to model three dimensional hydrodynamics for Aliceville reservoir. The hydrodynamic model was setup as 113 grid cells to accurately represent the Aliceville Reservoir and Tombigbee River system. The cell size varies, but each is approximately 760 meters long (half a mile) and 280 meters wide with an average area of 170,000 square meters. The model cells are shown in Figure 4. Each segment was subdivided into one to five vertical layers based on the normal depth; so deeper pools are divided into five layers and shallow river segments are represented as a single layer. The EFDC model is used to simulate the dynamic flow and water temperature from Stennis Lock and Dam to Bevill Lock and Dam and write this information to a Water Quality Analysis Simulation Program (WASP) hydrodynamic input file. More details about the development of this EFDC model of Aliceville Reservoir can be found in the report “Tombigbee River and Aliceville Reservoir: Three Dimensional Hydrodynamic Modeling Report” (Tetra Tech, 2007). This report covers the initial setup and calibration of the Aliceville reservoir EFDC model for January 2003 through September 2005. For this TMDL, the EFDC model was expanded to include the period to September 2006.

Through the hydrodynamic linkage file, the two models are linked and WASP computes the water quality for each layer of each EFDC cell. EFDC and WASP were setup for about 32 miles of the Tombigbee Waterway from Stennis Lock and Dam in Columbus, Mississippi to the Aliceville Reservoir Pool impounded by Bevill Lock and Dam, in Pickens, Alabama. The eutrophication module of WASP is then used to simulate dissolved oxygen, nutrients, BOD and phytoplankton. The models were setup to simulate the conditions from January 2003 to September 2006. This period represents the current

pollutant loads discharged from point and non-point sources. It also includes periods of wet, normal and dry precipitation patterns, that influence dissolved oxygen dynamics.

4.2 Water Quality Analysis Simulation Program (WASP)

The Water Quality Analysis Simulation Program (WASP) model was setup to evaluate the effect of BOD, nutrients, algae, and other oxygen demanding substances on DO processes. The Water Quality Analysis Simulation Program version 7 (WASP7) is an enhancement of the original WASP (Di Toro et al., 1983; Connolly and Winfield, 1984; Ambrose, R.B. et al., 1988). This model helps users interpret and predict water quality responses to natural phenomena and man-made pollution for various pollution management decisions. WASP7 is a dynamic compartment-modeling program for aquatic systems, including both the water column and the underlying benthos. The time-varying processes of advection, dispersion, point and diffuse mass loading, and boundary exchange are represented in the basic program.

Water quality processes are represented in special kinetic subroutines that are either chosen from a library or written by the user. WASP is structured to permit easy substitution of kinetic subroutines into the overall package to form problem-specific models. WASP7 comes with two such models -- TOXI for toxicants and EUTRO for conventional water quality. Earlier versions of WASP have been used to examine eutrophication of Tampa Bay; phosphorus loading to Lake Okeechobee; eutrophication of the Neuse River and estuary; eutrophication and PCB pollution of the Great Lakes, eutrophication of the Potomac Estuary, kepone pollution of the James River Estuary, volatile organic pollution of the Delaware Estuary, and heavy metal pollution of the Deep River, North Carolina (Wool, et al., 2001). In addition to these, numerous applications are listed in Di Toro et al., 1983.

The flexibility afforded by the Water Quality Analysis Simulation Program is unique. WASP7 permits the modeler to structure one, two, and three-dimensional models; allows the specification of time-variable exchange coefficients, advective flows, waste loads and water quality boundary conditions. The eutrophication module of WASP7 was applied in the development of these TMDLs.

4.3 Past QUAL2E Model Applications to the Tombigbee River

Two significant modeling efforts have been completed in the past on this section of the Tombigbee River. Both of these efforts involved application of QUAL2E, which is a one-dimensional steady-state modeling tool. Data and information from these models, along with comments from the public, were considered in developing the EFDC/WASP model used for this TMDL.

The first application was undertaken by Weyerhaeuser in 1987-1989. The modeling was initiated in support of a proposed expansion of the Weyerhaeuser Columbus Mississippi facility from 6 to 26 MGD, conversion to a kraft process, and relocation of the discharge from Cedar Creek to the Tennessee-Tombigbee waterway (Weyerhaeuser, 1988). Weyerhaeuser collected data during 1987, including dye studies for travel time and

measurements of sediment oxygen demand, and built and calibrated a QUAL2E model for the Tombigbee River between Stennis Lock and Dam at Columbus, Mississippi and a point 4 miles below Bevill Lock and Dam (Aliceville Reservoir). The calibration appeared to yield an adequate fit to observed data. Because of the large load from the proposed discharge and the low assimilative capacity of the river under summer low flow conditions, the modeling was used to develop a proposal for effluent limitations that varied as a function of flow and temperature in the receiving water.

MDEQ and ADEM accepted the results of the Weyerhaeuser QUAL2E modeling and MDEQ issued a NPDES permit to Weyerhaeuser containing the proposed variable effluent limitations. EPA reviewed the permit in March of 1989 and submitted several concerns. These prompted some minor revisions to the model and a variety of additional runs and sensitivity analyses (Weyerhaeuser, 1989). The final effluent limitations in the Weyerhaeuser permit were based on the 1989 modeling.

Another QUAL2E modeling effort, covering the entire Tennessee-Tombigbee waterway, was conducted in the early 1990s. The Tombigbee River upstream of Bevill Dam, including Aliceville Reservoir, is included in the Upper Tombigbee model (Shindala et al., 1991). A second model was developed for the Tombigbee from Aliceville to Gainesville, Alabama (Homan et al., 1995). The Upper Tombigbee model replaced QUAL2E estimates of flow velocity with a proprietary linkage to a HEC-2 model.

5.0 Development of Total Maximum Daily Load

This section presents the estimated TMDL developed for organic enrichment and dissolved oxygen for Aliceville Reservoir. A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality criteria, in this case Alabama's water quality criteria for aquatic life. TMDLs can be expressed in terms of mass per time or by other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly of explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. Conceptually, this definition is denoted by the equation:

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

The TMDL is presented as a daily load in pounds of CBODu, TP and TN.

5.1 Numeric Targets for TMDL

TMDL endpoints represent the instream water quality targets used in quantifying TMDLs and their individual components. For Aliceville Reservoir, the water quality target is defined in terms of the Alabama water quality criterion for dissolved oxygen. As discussed in Section 2.2, Alabama's water quality criteria state that,

> "for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/L at all times; except under extreme conditions due to natural causes, it may range between 5 mg/L and 4 mg/L, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels… In the application of dissolved oxygen criteria referred to above, dissolved oxygen shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, dissolved oxygen criteria will be applied at mid-depth."

In Aliceville Reservoir, the most severe dissolved oxygen depletion is observed immediately above Bevill Dam. Water depth here is greater than 10 feet; therefore, the critical point for application of the dissolved oxygen criterion is in the reservoir immediately upstream of the dam, at a depth of 5 feet.

Critical conditions for application of the dissolved oxygen criterion are provided in Section 5.3. Meeting the 5 mg/L criterion under critical flow and temperature conditions ensures that the criterion will be met at all times throughout the year.

5.2 Existing Conditions

The calibrated water quality model provides the basis for performing the TMDL analysis. The first step in the analysis is the simulation of baseline conditions. Baseline conditions represent existing nonpoint source and NPDES discharge loading conditions and

permitted point source discharge conditions. Table 7 below shows existing discharges for the major NPDES permitted facilities upstream of Aliceville Dam.

Table 7: Existing Discharge (2003-2006) for Major NPDES Facilities upstream of Aliceville Dam

Facility Name	Facility Type	5- day BOD (lbs/day)	Ammonia (lbs/day)	TN (lbs/day)	TP (lbs/day)
Bryan Foods	Meat Packing	51	7	1297	598
True Temper Sports/Emhart	Plating	78	0.033	0	14
Amory POTW	Sewerage	108	13	83	54
Aberdeen POTW	Sewerage	188	58	377	32
Hamilton POTW	Sewerage	25	1.2	8	64
West Point POTW	Sewerage	66	58	189	17
Tupelo POTW	Sewerage	584	8	49	353
Winfield POTW	Sewerage	22	34	36	5
Columbus POTW	Sewerage	245	34	480	65
Weyerhaeuser CPPC	Paper Mill	2,659	192	700	191
EKA Chemical	Chemical	32	5.3	7.2	7
Sanderson	Wood Products	3.3	NA	NA	NA

The non-point source water quality loading from the tributaries was estimated with BASINS PLOAD. Estimated BOD, nitrogen, and phosphorus loads for this section of the Tombigbee River downstream of Stennis Dam at Columbus are shown in Table 8. Details on how these values were calculated are included in the Modeling Report.

Table 8: Estimated Nonpoint Source Loads from Stennis Dam to Bevill Dam

Parameter	Total Load in kg/year (and average lbs/day)
BOD	1,225,874 (7404)
TN	228,674 (1381)
TP	47,703 (288)

5.3 Critical Conditions

As discussed in Section 2.2, Alabama's water quality criteria for Fish and Wildlife and Swimming uses (ADEM Admin. Code R. 335-6-10-.09-(5)(e)(4.) and Admin. Code R. 335-6-10-.09-(3)(c)(4.)) state that "for a diversified warm water biota, including game fish, daily dissolved oxygen concentrations shall not be less than 5 mg/L at all times; except under extreme conditions due to natural causes, it may range between 5 mg/L and 4 mg/L, provided that the water quality is favorable in all other parameters. The normal seasonal and daily fluctuations shall be maintained above these levels… In the application of dissolved oxygen criteria referred to above, dissolved oxygen shall be measured at a depth of 5 feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, dissolved oxygen criteria will be applied at mid-depth."

The critical conditions can be defined as the environmental conditions requiring the largest reduction to meet standards. By achieving the reduction for critical conditions, water quality criteria should be achieved during all times. The DO is lowest during

summer conditions, which include low flows and high temperatures. The TMDL addresses the worst summers in the 2003 through 2006 period.

Since Aliceville Reservoir is impaired for organic enrichment and low dissolved oxygen, a number of processes that affect DO needed to be considered. These include BOD discharged directly from facilities, SOD from the accumulation of organic material over long periods of time, excess primary production resulting from excess available nutrients, and aquatic plant management activities. Although low DO occurs during high temperature, low flow conditions, when reaeration is minimal and retention times are long, it should be kept in mind that this resultant low DO lags introduction of pollutants in space and time. That fact must be considered when evaluating critical conditions. In this case, the complex water quality issue was evaluated by simulating a four year period containing wet, normal, and dry conditions. Both wet events and dry events were analyzed in this Jan. 2003 through Aug. 2006 period.

5.4 Margin of Safety (MOS)

There are two methods for incorporating a Margin of Safety into a TMDL: 1) by implicitly incorporating the MOS through use of conservative modeling assumptions in the development of allocations, and 2) by explicitly specifying a portion of the TMDL as the MOS based on an analysis of uncertainty in modeling results. The Aliceville TMDL contains an implicit MOS that is obtained through conservative modeling assumptions, including addressing the worst case conditions in the four year period from 2003 through 2006. In this TMDL the following information was considered in determining the margin of safety.

- The worst case condition in the four year simulation from 2003 through 2006 was addressed to meet standards.
- Decreases in loads throughout the watershed due to other approved TMDLs are expected to improve the DO at the model boundaries and decrease the pollutant loads at the model boundaries.
- The model demonstrates that implementation of the TMDL will result in average TN concentrations of 0.37 mg/L, which is less than the EPA recommended ambient water quality criteria recommendations for lakes and reservoirs in nutrient ecoregion IX (0.397 mg/L TN) (EPA, 1998).

5.5 Seasonal Variation

Seasonal variation is incorporated into the TMDL development because the models were setup to simulate the conditions throughout each year from January 2003 to September 2006. This period represents the current pollutant loads discharged from point and non-point sources. It also includes periods of wet, normal and dry precipitation patterns that influence dissolved oxygen dynamics. Therefore, seasonal variation is incorporated into the TMDL analysis in a manner that ensures year-round protection of water quality standards.

5.6 TMDL Results

In order to achieve the applicable water quality standards, the TMDL estimated by these models requires a reduction of 30 percent from the total existing loads of CBODu, TN, and TP that enter Aliceville Reservoir. The sources of CBODu, TN, and TP originate in two states, Alabama and Mississippi. The TMDL is composed of three categories of allocations: 1) a wasteload allocation for the point sources in Alabama; 2) a load allocation for the nonpoint sources in Alabama; and 3) an aggregate allowable pollutant load, which includes both the point and nonpoint contributions, to Mississippi sources in the Tombigbee River watershed at the state border (see sections 3.2.1 and 3.2.2. for more information).

The category of the load allocation for Alabama nonpoint sources is divided into two subcategories to distinguish the nonpoint sources loads in Alabama that enter Mississippi before ultimately draining back to Alabama across the state border. The load allocation to the Coal Fire Creek watershed addresses nonpoint source loads that enter Aliceville Reservoir without crossing into or out of Mississippi. The load allocation to all other watersheds within Alabama (i.e., the Bull Mountain, Buttahatchee, and Luxapillila watersheds) address loads from Alabama that drain into Mississippi before ultimately draining back into Alabama across the state border. In addition, the Hamilton WWTP and the Winfield WWTP discharge to the Buttahatchee and Luxapillila watersheds, respectively; therefore, these wasteloads also drain to Mississippi before ultimately draining back into Alabama across the state border. The distinction of Alabama loads that enter Mississippi is important, because the aggregate allocation to pollutants from Mississippi at the state border reflects some of the point and nonpoint source loads that originate in Alabama.

Based on an analysis of the readily available data and information, the CBODu, TN, and TP loads from the two existing point source facilities in Alabama (i.e., Hamilton WWTP and Winfield WWTP) are determined not to have an impact on water quality in Aliceville Reservoir. This determination is made in consideration of the magnitude of the loads from these facilities, the fate and transport of such loads from the significant distance upstream from Aliceville Reservoir, and analysis of water quality data in the Buttahatchee Creek and Luxapalliala Creek watersheds. Therefore, these facilities are not subject to the wasteload allocation.

The aggregate allocation to Mississippi reflects the allowable loads at the Alabama/Mississippi border, rather than the allowable loads at their point of origin. The loads and wasteloads upstream from the state border within both Mississippi and Alabama will experience fate and transport processes through settling, decay, and assimilation in the upstream waters before entering Aliceville Reservoir; therefore, the sum of the loads from the point and nonpoint sources entering the watershed will be greater in magnitude than the loads draining from Mississippi into Alabama at the state line.

Although Aliceville Reservoir is not specifically identified as impaired for nutrients on Alabama's § 303(d) list, reductions to TP and TN are necessary to meet a minimum DO

concentration of 5 mg/L. Based upon information currently available, the reductions and associated allocations for TP and TN are not expected to cause or contribute to excursions of water quality standards to any downstream waterbodies.

Table 9 shows the maximum daily loads that will meet and maintain water quality standards during the critical conditions experienced each summer (June – September). Loads for non-summer months can be higher than those in , as long as the annual average does not exceed the allocations in Table 10.

Table 9: OE/DO TMDLs and Reductions Necessary to Meet WQS in Aliceville Reservoir (June – September)

Pollutant	**ALABAMA**			**MISSISSIPPI**	**TMDL** [4]
	Coal Fire Creek Watershed (HUC 3160106) [1, 5]	All other watersheds (HUC 03160101, 03160103, and 03160105) [2, 5]		Aggregate allocation to pollutants from Mississippi at the state border [5]	
	LA	**WLA**	**LA**		
CBODu	30% reduction (1,200 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (83,956 lbs/day)	30% reduction (85,156 lbs/day)
TN	30% reduction (17 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (9,606 lbs/day)	30% reduction (9,623 lbs/day)
TP	30% reduction (4 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (1,663 lbs/day)	30% reduction (1,667 lbs/day)

1 The Coal Fire Creek watershed (HUC 03160106) is the only watershed in the Alabama portion of the Tombigbee River basin that does not drain into Mississippi; therefore, loads from this watershed are not reflected in the aggregate allocation to Mississippi.

2 All other watersheds in Alabama (Bull Mountain Creek (03160101), Buttahatchee Creek (03160103), and Luxapallila Creek (03160105)) drain from Alabama to Mississippi before ultimately draining back to Alabama and into Aliceville Reservoir. The only point sources in Alabama discharge to these watersheds.

3 The wasteload allocation of 0 lbs/day recognizes that there are currently no point sources in Alabama that impact dissolved oxygen levels in Aliceville Reservoir. In order to be consistent with this wasteload allocation, any potential future discharges in Alabama can only discharge TN, TP, or CBODu loads within the Basin if they are determined to not have any impact on the dissolved oxygen levels in Aliceville Reservoir.

4 The TMDL is calculated by adding the aggregate allocation at the Mississippi border to the LA for the Coal Fire Creek watershed. The WLA to the Alabama point sources and the LA to the other Alabama watersheds were not added in the TMDL calculation, because their allocations are already reflected in the aggregate allocation to Mississippi.

5 Pollutant trading may occur between the loads allocated to nonpoint sources in Alabama and Mississippi if: (1) MDEQ and ADEM agree to trade; and (2) such trading results in an overall 30% reduction of CBODu/TN/TP loads to Aliceville reservoir.

Table 10: OE/DO TMDLs and Reductions Necessary to Meet WQS in Aliceville Reservoir as an Annual Average

Pollutant	ALABAMA			MISSISSIPPI	TMDL [4]
	Coal Fire Creek Watershed (HUC 3160106) [1, 5]	All other watersheds (HUC 03160101, 03160103, and 03160105) [2, 5]		Aggregate allocation to pollutants from Mississippi at the state border [5]	
	LA	WLA	LA		
CBODu	30% reduction (2,600 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (181,952 lbs/day)	30% reduction (184,552 lbs/day)
TN	30% reduction (29 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (16,311 lbs/day)	30% reduction (16,340 lbs/day)
TP	30% reduction (6 lbs/day)	0% reduction (0 lbs/day) [3]	30% reduction	30% reduction (2,633 lbs/day)	30% reduction (2,639 lbs/day)

1 The Coal Fire Creek watershed (HUC 03160106) is the only watershed in the Alabama portion of the Tombigbee River basin that does not drain into Mississippi; therefore, loads from this watershed are not reflected in the aggregate allocation to Mississippi.

2 All other watersheds in Alabama (Bull Mountain Creek (03160101), Buttahatchee Creek (03160103), and Luxapallila Creek (03160105)) drain from Alabama to Mississippi before ultimately draining back to Alabama and into Aliceville Reservoir. The only point sources in Alabama discharge to these watersheds.

3 The wasteload allocation of 0 lbs/day recognizes that there are currently no point sources in Alabama that impact dissolved oxygen levels in Aliceville Reservoir. In order to be consistent with this wasteload allocation, any potential future discharges in Alabama can only discharge TN, TP, or CBODu loads within the Basin if they are determined to not have any impact on the dissolved oxygen levels in Aliceville Reservoir.

4 The TMDL is calculated by adding the aggregate allocation at the Mississippi border to the LA for the Coal Fire Creek watershed. The WLA to the Alabama point sources and the LA to the other Alabama watersheds were not added in the TMDL calculation, because their allocations are already reflected in the aggregate allocation to Mississippi.

5 Pollutant trading may occur between the loads allocated to nonpoint sources in Alabama and Mississippi if: (1) MDEQ and ADEM agree to trade; and (2) such trading results in an overall 30% reduction of CBODu/TN/TP loads to Aliceville reservoir.

6.0 Conclusions

The allocations described in this TMDL report will ensure protection of the applicable water quality standards in Aliceville Reservoir. The State of Alabama is strongly encouraged to continue proceeding with the development of numeric nutrient criteria for all waters of the State, including Aliceville Reservoir. As part of this process, EPA recommends that ADEM coordinate with MDEQ in conducting studies in order to verify the allocations in the TMDL.

ADEM and MDEQ, through their NPDES permitting processes and nonpoint source management programs, are strongly encouraged to develop a plan to implement the TMDL. 40 CFR § 122.44(d)(1)(vii)(B) requires that NPDES permits should ensure that water quality-based effluent limitations are consistent with the assumptions and requirements of any applicable TMDL. MDEQ is encouraged to use the water quality models referenced in this report and any additional data and information to implement the aggregate allocation assigned at the Alabama/Mississippi border in a manner that ensures compliance with 40 CFR § 122.44(d)(1)(vii)(B) and Alabama's applicable water quality standards as expressed in this TMDL.

It is recommended that the Aliceville Reservoir watershed be considered a priority for riparian buffer zone restoration and other nutrient reduction BMPs. The implementation of these BMP activities should significantly reduce the nutrient load entering the river. These activities, coupled with establishing appropriate water quality based limits consistent with the TMDL, will provide improved water quality for the support of aquatic life in the water bodies and should ensure the attainment of the applicable water quality standards. As part of this process, MDEQ is encouraged to consider TN, TP, and CBOD reductions identified in other TMDLs that it previously established for impaired waters in the Tombigbee River basin.

7.0 Public Participation

This TMDL was proposed for public review and comment for a 90-day period, beginning October 31, 2007. EPA distributed information regarding the public notice of the TMDL by e-mail to members of the public who have requested that ADEM and MDEQ include them on a TMDL mailing list. The draft TMDL document was also available for review on EPA Region 4's website: (http://www.epa.gov/Region4/water/tmdl/Alabama/).

All comments received during the public notice period are a part of the public record for this TMDL. EPA has fully considered these comments as described in a responsiveness summary, which is also part of the public record.

EPA acknowledges and appreciates the all of the comments, data, and information provided by the members of the public, which added significant value to the process of establishing this TMDL.

8.0 References

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