FINAL

LOWER AMITE RIVER WATERSHED TMDL
FOR BIOCHEMICAL OXYGEN-DEMANDING SUBSTANCES – PHASE I

SUBSEGMENT 040303

SURVEYED AUGUST 6 – 9, 2007

TMDL REPORT

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TECHNICAL SUMMARY

Lower Amite River, Subsegment 040303, is on the 2006 303(d) list and the Consent Decree. The Subsegment was found to be "supporting its designated use of Primary and Secondary Contact Recreation. It was "not supporting" its designated use of Fish and Wildlife Propagation. Lower Amite River was subsequently scheduled for the development of a Total Maximum Daily Load (TMDL) with other listed waters in the Pontchartrain Basin. Lower Amite River, Subsegment 040303 is impaired for dissolved oxygen, nitrate/nitrite, chlorides, and total phosphorus. The suspected cause of impairment were organic enrichment/low DO and the suspected sources were upstream sources. This TMDL report addresses the organic enrichment/low DO impairment.

Subsegment 040303 lies primarily within Livingston Parish with a small portion of the subsegment extending into Ascension Parish near the Amite River Diversion Canal.

LDEQ is utilizing a phased TMDL approach for Lower Amite River as shown in Table 1. This approach provides LDEQ with the opportunity to revise the DO criteria and at the same time, allows LDEQ to develop meaningful and implementable DO TMDLs based upon the appropriate DO criteria and in accordance with the Consent Decree deadlines. At the same time, it will lead to improved water quality while providing local governments and businesses the opportunity to prepare and adjust to the new permit requirements that will be implemented as a result of the TMDLs developed in Phases I and II.

Table 1. Lower Amite River (040303) Phased TMDL Approach

Stage / Phase	DO Criteria (mg/L)	Implementation Date
Phase I	**5.0**	**Phase I implementation required upon EPA approval of the TMDL and subsequent update of the Louisiana's Water Quality Management Plan**
Ecoregion-based UAA developed and DO criteria revised and promulgated		
Phase II	**Appropriate DO criteria based on UAA**	**Phase II implementation required upon EPA approval of the Phase II TMDL and subsequent update of the Louisiana's Water Quality Management Plan**

Phase I will include the development of loading values for the existing DO criteria for the Lower Amite River. However, full implementation of permit limits will occur in a phased manner. Phase I will serve as the first step towards meeting the DO criteria. This approach gives local governments and stakeholders time to make the necessary adjustments to meet these limits. During Phase I, implementation of permit limits will occur in a according to the following strategy:

Phase I Permit Implementation

All TMDL, permitting, and enforcement activities will be conducted in accordance with the Clean Water Act, the Louisiana Environmental Regulatory Code, and applicable state laws.

1. New discharges of oxygen-demanding loads:

   In general, LDEQ may not be able to permit additional discharges of oxygen-demanding loads due to the impaired status of the waterbody. However, in the event that one the following requirements can be attained, LDEQ may permit a new discharge. The typical permit limits will be 5 mg/L BOD_5 / 2 mg/L NH_3 / 5 mg/L DO. Such new facilities may be required to submit an environmental impact assessment to LDEQ's permitting staff, which will conduct a thorough evaluation of the proposed facility based on environmental impacts, economic benefits, an analysis of alternatives, and other pertinent factors.

   a. The facility demonstrates that it will provide a significant load reduction of man-made oxygen-demanding constituents to the impaired watershed(s) serviced by the facility. The facility must also contribute to a reduction in the number of facilities discharging to the watershed(s). Facilities that may be considered for permits under this provision include, but are not limited to:

      i. A facility that will provide improved sewage treatment to multiple subdivisions previously serviced by wastewater treatment plants that are incapable of treating to tertiary limits.

      ii. A facility that will provide sewage treatment to previously unsewered areas in which many of the sanitary discharges from permitted facilities and individual home treatment units were entering an impaired watershed. As a result, the facility would be expected to provide more efficient treatment to the wastewater and reduce the net loading of oxygen-demanding substances in the watershed.

   b. The facility demonstrates that its wastewater will not leave the facility or its property. Significant stormwater events do not apply to this provision. For the purpose of this provision, a significant stormwater event is defined the 25 year, 24 hour rainfall event or its numerical equivalent, as defined by the Southern Regional Climate Center.

i. Facilities that may be considered under this provision include, but are not limited to:

   a. Effluent reduction systems that have been approved by the Louisiana Department of Health and Hospitals.

   b. Wastewater treatment plants equipped with overland flow systems in which the effluent will not leave the facility.

   c. Wastewater treatment plants equipped with holding ponds that will retain the effluent such that the effluent will not leave the facility.

ii. LDEQ recognizes that some local governments are in the process of building or expanding regional sewage collection and treatment systems. In such areas, LDEQ may, on a limited basis, grant permits of limited durations to facilities that agree to tie into a regional collection and treatment system when it becomes available. LDEQ must have absolute assurance that the regional collection system will be available to the facility and the facility will connect to the regional collection system on or before the expiration date of the permit. Such assurance may include a formal agreement between the facility, the owner and operator of the regional wastewater treatment system, and LDEQ. The regional system must have the capacity to treat the additional wastewater. Such a permit may have a duration of less than five years or it may have a five year duration with interim permit limits. The permit will be written based on projected completion dates for the construction of the collection system. The facility will be required to cease all wastewater discharges to the Lower Amite River or connecting waterbodies and transfer the discharge to the regional collection system once the permit or interim limits expire or the collection system is available to the facility, whichever comes first. If the permit or interim limits expire, but, due to unforeseen circumstances, the availability of the collection system has been temporarily delayed, the duration of the permit or interim limits may be extended. If the availability of the collection system has been indefinitely delayed, the facility may be required to cease all discharges to Subsegment

040303. Such facilities may resort to options covered in item 1.b.i. above.

c. LDEQ reassesses Subsegment 040303 (Lower Amite River). LDEQ determines that Subsegment 040303 is meeting the appropriate DO criteria and designated uses.

2. Existing Discharges of oxygen demanding loads:

   The facilities discharging within subsegment 040303 were determined to have no significant inpact on the Lower Amite River. Therefore, the facilities listed in Table 3 will keep their permit existing limits. Existing facilities discovered to be discharging oxygen-demanding loads without LPDES permits as of the TMDL approval date are to be permitted in accordance with the limits established for existing facilities with permits. Unpermitted facilities that are newly activated or reactivated and discharging after the TMDL approval date may be subjected to enforcement actions and may be required to tie into regional collection and treatment systems, if available, or modify their treatment system to meet more stringent permit limits.

3. Nutrient monitoring (i.e. reporting for Total Nitrogen and Total Phosphorus) will be required for individual permits. Nutrient monitoring will be added to each general permit series (LAG530000, LAG540000, LAG560000, and LAG570000) upon the next scheduled renewal of each series.

Phase II will be developed based on the outcome of an ecoregion-based use attainability analysis (UAA) that is currently under development. This UAA is expected to propose new DO criteria for many of the Pontchartrain Basin TMDLs that are currently being developed. This new DO criteria is expected to be developed and promulgated within the next two to three years.

In the event the new criteria is not developed and promulgated within five years from the TMDL approval date, LDEQ intends to proceed in the following manner:

Case 1: The UAA study indicates that the current DO criterion is appropriate - the TMDL will be fully implemented based on the existing DO criteria.
Case 2: The UAA is not likely to be completed and/or approved - the TMDL will be fully implemented based on the existing DO criteria.
Case 3: The UAA is in process and is expected to be approved – Phase II of the TMDL will be postponed for a maximum period of 2 years. If the UAA has not been completed at the end of this period, the UAA status will be reviewed again according to Cases 1 - 3.

LDEQ recognizes there may be many unpermitted sources of oxygen-demanding loading within the Lake Pontchartrain Basin. These sources may include unpermitted facilities (privately owned treatment units for subdivisions or businesses). LDEQ has been locating unpermitted facilities and updating location information on permitted facilities in the Pontchartrain Basin.

The unpermitted facilities are required to apply for the appropriate NPDES (National Pollutant Discharge Elimination System) permits. These unpermitted sources of oxygen-demanding loading may also include individual treatment units for residential homes and small businesses. The ability to accurately quantify the loads provided from these systems is extremely difficult due to lack of reliable information regarding the number of units and the loading provided by each individual unit. These unpermitted sources of loading add to the uncertainty of this TMDL and provide additional justification for the use of the phased TMDL approach.

Modeling has shown that reduced levels of stream flow may be contributing to the low DO impairment for Subsegment 040303. The Amite River Diversion Canal and the associated weir may be contributing to the reduced stream flow in Subsegment 040303. LDEQ recommends that repairs to the diversion weir located near the head of the Amite River Diversion Canal may lead to increased stream flow in Subsegment 040303. An increase in flow would be expected to increase the reaeration potential of the Lower Amite River. As a result, LDEQ would expect the levels of dissolved oxygen to increase and the load reductions required to meet the DO criteria to decrease. Additional runs of the projection model with increased flow were developed to demonstrate this scenario. For more information on the history of this weir see Section 2.4.1. Additional flow measurements from a 2007 study done by the Amite River Basin Commission are located in Appendix G4.

There are no MS4 permits in this watershed.

Facilities addressed in this TMDL are presented in Table 3.

Table 2. Total Maximum Daily Load (Sum of UCBOD[1], UNBOD, and SOD) for a 5.0 mg/L dissolved oxygen standard

ALLOCATION	SUMMER		WINTER	
	% Reduction Required	(MAR-NOV) (lbs/day)	% Reduction Required	(DEC-FEB) (lbs/day)
Point Source WLA		0		0
Point Source Reserve MOS (20%)		0		0
Nonpoint Source Allocation	60	13,312	60	12,130
Nonpoint Source Reserve MOS (20%)		3,327		3034
TMDL		16,639		15,164

Table 3. TMDL Summary 040303 – Point Sources within the watershed but not included in the model

7FACILITY	AI NO./PERMIT NO.	PERMIT EXP. DATE (MM/DD/YY)	OUTFALL DESCRIPTION	RECEIVING WATER	CURRENT EXPECTED FLOW	CURRENT MONTHLY AVERAGE CONCENTRATION LIMITS		TMDL MONTHLY AVERAGE CONCENTRATION LIMITS		
					GPD	BOD5/ CBOD5, mg/L	NH_3-N, mg/L	BOD5/ CBOD5, mg/L	NH_3-N, mg/L	MODELING COMMENTS
Paradise Point Services	42768/ LAG5400550	6/30/13	001	Ditch to Paradise Point Canal to Amite River	22,500	30		30		Not Modeled
French Settlement High School	86831/ LAG541017	6/30/2013	001	Swamp Land to Amite River	10,000	30		30		Not Modeled
St. Joseph Catholic Church	124713/ LAG531973	11/30/2012	001	Ditch to Palmetto Bayou to King George Bayou to Amite River	1,250	30		30		Not Modeled
South Branch Library	144467/ LAG530000	11/30/2012	001	Ditch to Bayou Barbery to Amite River	1,500	30		30		Not Modeled
Maurepas High School	42316/ LAG540062	6/30/2013	001	Ditch to Amite River	6,900	30		30		Not Modeled
French Settlement Elementary School	19439/ LAG540477	6/30/2013	001	Ditch to King George Bayou to Amite River	6,075	30		30		Not Modeled
Gunboat Island Estates	18658/ LAG540314	6/30/2013	001	Unnamed ditch to unnamed swamp to Amite River	10,400	30		30		Not Modeled
French Settlement Post Office	154883/ LAG532520	11/30/2012	001	Ditch to Amite River	500	30		30		Not Modeled
CLIO Recreational Park	152562/	No approved permit	001	Amite River	NA	NA		NA		Not Modeled

EXECUTIVE SUMMARY

This report presents the results of a watershed based, calibrated modeling analysis of the Lower Amite River, subsegment 040303. The modeling was conducted to establish a TMDL for biochemical oxygen-demanding pollutants and nutrients for the Lower Amite River watershed. The model extends from Amite River Diversion Canal and terminates at Lake Maurepas. Lower Amite River is in the Pontchartrain Basin and this study includes Water Quality Subsegment 040303. The land adjacent to the waterbody is primarily wetlands with some pasture and pine/hardwood forest. Land use is residential/recreation along with limited agriculture and forestry.

According to LDEQ's TEMPO and EDMS database systems, there were 8 permitted dischargers and one facility without an approved permit within Subsegment 040303. All of these facilities were either too far away or too small to provide a significant impact to the Lower Amite River. Therefore, these facilities were not included in the model. Limits for these small facilities are generally set by state policy. These dischargers are accounted for as nonpoint loading through the process of calibration. These permit limits for these dischargers will not be modified as a result of this TMDL. However, nutrient monitoring will be required as described in the permitting strategy for the Phase I Permit Implementation.

This subsegment contains only the lower reaches of the Amite River. LDEQ is aware that much of the loading eminates from upstream sources. Tidal influences also impact Subsegment 040303. LDEQ is considering the option of modeling the entire Amite River watershed. Load reductions in upstream subsegments will improve conditions in 040303. As a result of this watershed approach, this TMDL may need to be modified at a later date based upon TMDLs calculated for upstream subsegements.

Input data for the calibration model was developed from data collected during the August 2007 intensive survey; data collected by LDEQ monitoring stations in the watershed; USGS drainage area and low flow publications; and data garnered from several previous LDEQ studies on nonpoint source loadings. The nonpoint source loads included nonpoint loading not associated with flow. A satisfactory calibration was achieved for the main stem. For the projection models, data was taken from ambient temperature and dissolved oxygen records. The Louisiana Total Maximum Daily Load Technical Procedures, Revision 12 have been followed in this study.

The various spreadsheets that were used in conjunction with the modeling program may be found in the appendices. Projections are adjusted to meet the dissolved oxygen criteria by reducing total nonpoint source loads.

This TMDL will implement a phased approach, as shown in Table 1. This report represents Phase I of the TMDL. For Phase I, the Lower Amite River can meet a 5.0 mg/L criteria for dissolved oxygen with a 60% overall reduction in nonpoint loading. This indicates that the DO criterion may be inappropriate.

The DO criteria for this watershed is expected to be addressed in an ecoregion based UAA. Existing ecoregion data suggests that the summer and winter DO criterion should be 2.3 mg/L and 5.0 mg/L, respectively, for the Lower Mississippi River Alluvial Plain Ecoregion. The ecoregion study thus far indicates the summer and winter seasons should be May to November and December to April,

respectively. This recommended criterion was derived through the application of EPA approved statistical methods.

Once this DO criteria is revised, then Phase II of the TMDL will be conducted. This will include the development of new model projections based on the new DO criterion. A new TMDL will be calculated and the report will be revised.

Based on the summer and winter criterion of 2.3 mg/L and 5.0 mg/L respectively, a 25% overall reduction in nonpoint loading is required.

Modeling was limited to low flow scenarios for both the calibration and the projections since the constituent of concern was dissolved oxygen. The model used was LAQUAL, a modified version of QUAL-TX, which has been adapted to address specific needs of Louisiana waters.

A calibrated water quality model for the watershed was developed and projections were modeled to quantify the non-point source load reductions which would be necessary in order for Lower Amite River, subsegment 040303 to comply with its established water quality standards and criteria. This report presents the results of that analysis.

This TMDL establishes load limitations for oxygen-demanding substances and goals for reduction of those pollutants. LDEQ's position is that when oxygen-demanding loads from point and nonpoint sources are reduced in order to ensure that the dissolved oxygen criterion is supported, nutrients are also reduced. The implementation of this TMDL through wastewater discharge permits and implementation of best management practices to control and reduce runoff of soil and oxygen-demanding pollutants from nonpoint sources in the watershed will also reduce the nutrient loading from those sources.

Louisiana does not have numeric nutrient criteria at the present time. The original nutrient impairments for waterbodies in the Pontchartrain Basin were not based on quantitative assessments of historical nutrient data. The impairments were based on evaluative assessments that may have included dissolved oxygen. LDEQ and EPA plan to reevaluate the previous nutrient impairments in the Pontchartrain Basin. As a result, both the EPA and LDEQ expect the nutrient impairments to change from category 5 (impairment exists; TMDL required) to category 3 (insufficient data) for Louisiana's 2010 Integrated Report. Therefore LDEQ believes that TMDLs for dissolved oxygen should adequately address any potential nutrient impairments, in the absence of numeric nutrient criteria and quantitative assessments.

LDEQ is developing numeric nutrient criteria for waterbody types based on ecoregions in accordance with LDEQ's plan "Developing Nutrient Criteria for Louisiana 2006" which can be found at:

> http://www.deq.louisiana.gov/portal/Portals/0/planning/LA%20Nutrient%20Strategy%20Plan%20Final%20FOR%20WEB.pdf.

Water body types for nutrient criteria development in Louisiana are 1) inland rivers and streams; 2) freshwater wetlands; 3) freshwater lakes and reservoirs; 4) big rivers and floodplains/boundary rivers and associated water bodies; and 5) estuarine and coastal waters (including up to Louisiana's three mile boundary in the Gulf of Mexico). Proposed approaches for nutrient criteria development are currently under review by LDEQ and EPA. Nutrient criteria can be implemented upon state promulgation and EPA approval as per 40 CFR 131.21.

Upon development of nutrient criteria, a subsequent quantitative assessment of the waterbodies, and the development of full nutrient models, nutrient limits may be established for all facilities discharging to impaired waterbodies in the Pontchartrain Basin. LDEQ recommends that all facilities discharging to impaired waterbodies take a proactive approach and prepare for the possibility of nutrient limitations in their wastewater discharge permits in the near future. Such a proactive approach should include nutrient monitoring and documentation through facility Discharge Monitoring Reports (DMRs) in order to assess their nutrient loads and the need to modify their treatment processes for nutrient removal.

There is a rock weir located at the confluence of the Amite River and the Amite River Diversion Canal. This weir may be contributing to the water quality problems in subsegment 040303 by diverting most of the stream flow from the Amite River down the Amite River Diversion Canal under low flow conditions. A river's ability to reaerate is based largely on the velocity of the water. This is evident in most, if not all reaeration equations. LDEQ's experience is that the lack of flow reduces the reaeration potential of a waterbody.

The weir and the diversion canal, was constructed by the United States Army Corps of Engineers in the late 1950's and early 1960's under the Authority of the Flood Control Act of August 9, 1955 to protect against floods along the Amite River. According to a 2006 news article published by The Advocate, the weir was originally designed to divert approximately 70% of the flow from the Amite River down the Lower Amite River and approximately 30% of the flow down the Amite River Diversion Canal under average flow conditions in the Amite River. Over time, this weir has become ineffective due to erosion and/or subsidence. According to flow measurements obtained by the Amite River Basin Drainage and Water Conservation District in 2007, over 80% of the flow now proceeds down the Diversion Canal and less than 20% of the flow proceeds down the Lower Amite River. This lack of flow is a probable source of impairment and it has a significant impact on the stream's ability to reaerate. This in turn effects the dissolved oxygen levels that can be maintained. It is recommended that repairs be performed on to this weir to re-establish a more reasonable flow in the Lower Amite River. Once the weir is repaired, the subsegment should resampled and reassessed. For more on the history of this weir see Section 2.4.1. Discharge information for the 2007 project is located in Appendix G4.

According to additional model runs, if the weir were repaired to the original flow diversion as stated above, a 5% reduction of overall nonpoint loading would be required to meet a dissolved oxygen standard of 2.3 mg/L. For a 5 mg/L dissolved oxygen standard, the percent reduction of overall nonpoint would be 50% rather than the current 60%. This is presented in Table 4.

Table 4. Impacts of Weir Repair

DO Criteria (mg/L)	Projected % Reduction Required without wier repair	Projected % Reduction Required with wier repair
5	**60%**	**50%**
2.3/5.0 (proposed summer/winter)	**25%**	**5%**

The watershed does drain areas regulated by MS4 permits. These areas are contained in subsegments located upstream of subsegment 040303. MS4 loads will be addressed in TMDL reports for the appropriate subsegment.

LDEQ will work with other agencies such as local Soil Conservation Districts to implement agricultural best management practices in the watershed through the 319 programs. LDEQ will also continue to monitor the waters to determine whether standards are being attained.

In accordance with Section 106 of the Federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a comprehensive program for monitoring the quality of the state's surface waters. The LDEQ collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial Integrated Report. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ is continuing to implement a watershed approach to the surface water quality monitoring. In 2004 a four year sampling cycle replaced the previous five year cycle. Approximately one quarter of the states watersheds will be sampled in each year so that all of the states watersheds will be sampled within the four year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list.

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1. Introduction

The Lower Amite River is on the current 2006 Integrated Report and the Consent Decree. For Lower Amite River, Subsegment 040303 the suspected causes of impairment are dissolved oxygen, nitrate/nitrite, chlorides, and total phosphorus. The suspected sources for this impairment are upstream sources. All nutrient impairments were based on evaluative assessments. Nutrient data was not used in the nutrient assessments. LDEQ and EPA anticipate the removal of all nutrient impairments in the 2010 303(d). The Lower Amite River is meeting its designated uses of primary and secondary recreation. It is not meeting its designated use of fish and wildlife propagation. Lower Amite River was subsequently scheduled for TMDL development with other listed waters in the Pontchartrain Basin to address this impairment. This report presents the model development and results.

2. Study Area Description

2.1 General Information

"The Lake Pontchartrain Basin, located in southeastern Louisiana, consists of the tributaries and distributaries of Lake Pontchartrain, a large estuarine lake. The basin is bounded on the north by the Mississippi state line, on the west and south by the east bank Mississippi River levee, on the east by the Pearl River Basin and on the southeast by Breton and Chandeleur Sounds. This basin includes Lake Borgne, Breton Sound, Chandeleur Sound and the Chandeleur Islands. The northern part of the basin consists of wooded uplands, both pine and hardwood forests. The southern portions of the basin consist of cypress-tupelo swamps and lowlands and brackish and saline marshes. The marshes of the southeastern part of the basin constitute the most rapidly eroding area along the Louisiana coast. Elevations in this basin range from minus five feet at New Orleans to over two hundred feet near the Mississippi border." (LA DEQ, 2000)

Subsegment 040303 begins at the Amite River Diversion Canal, and terminates at Lake Maurepas. The land adjacent to the waterbody is primarily wetlands with some pasture and pine/hardwood forest. Land use is residential/recreation along with limited agriculture and forestry. This subsegment is tidally influenced. Water flows in either direction depending upon wind conditions and lunar tides. Land use is documented in Table 5 (LADEQ, 1999). A detailed land cover map of Subsegment 040303 is also included in Appendix H2. Average annual precipitation in the segment, based on the nearest Louisiana Climatic Station, is 64 inches based on a 30-year period of record (LSU, 1999). There is a Louisiana average annual precipitation map located in Appendix H3.

Table 5. Land Uses in Segment 040303

Land Type	Acres	Percent Land
Wetland Forest Deciduous	19581.84	40.65
Upland Forest Mixed	5886.56	12.22
Upland Forest Evergreen	5115.96	10.62
Agriculture/Cropland/Grassland	4848.87	10.07
Upland S/S Mixed	4508.60	9.36
Water	1797.61	3.73
Vegetated Urban	1758.70	3.65
Wetland Forest Mixed	1421.32	2.95
Dense Pine Thicket	1298.78	2.70
Upland Forest Deciduous	792.84	1.65
Upland S/S Deciduous	483.49	1.00
Upland S/S Evergreen	192.82	0.40
Wetland S/S Deciduous	177.25	0.37
Wetland Forest Evergreen r	173.91	0.36
Fresh Marsh	115.42	0.24
Wetland S/S Mixed	14.90	0.03

*

2.2 Water Quality Standards

The Water Quality criteria and designated uses for Lower Amite River Watershed are shown in Table 6. As noted in the table, Lower Amite River, Subsegment 040303 has a year round dissolved oxygen standard of 5.0 mg/L.

Table 6. Water Quality Numerical Criteria and Designated Uses

Parameter	Value
Designated Uses*	A B C
DO, mg/L	5.0
Cl, mg/L	25
SO_4, mg/L	10
pH	6.0 – 8.5
BAC**	1
Temperature, deg Celsius	32
TDS, mg/L	150

*USES: A – primary contact recreation; B - secondary contact recreation; C – propagation of fish and wildlife; D – drinking water supply; E – oyster propagation; F – agriculture; G – outstanding natural resource water; L – limited aquatic life and wildlife use.

**200 colonies/100mL maximum log mean and no more than 25% of samples exceeding 400 colonies/100mL for the period May through October; 1,000 colonies/100mL maximum log mean and no more than 25% of samples exceeding 2,000 colonies/100mL for the period November through April.

2.3 Wastewater Discharges

According to LDEQ's TEMPO and EDMS databases, there are eight permitted wastewater dischargers located in this subsegment and one facility without an approved permit. The facilities addressed in this TMDL report are presented in Table 3. They were either too far away or too small to include in the model. All of the facilities discharge less than 25,000 gpd. Generally, the treated effluent must traverse several bayou and/or swamp land before entering the Amite River. It is unlikely that a significant portion of the loading from any of these facilities actually reaches Subsegment 040303. Limits for these small facilities are generally set by state policy. These dischargers are accounted for as nonpoint loading through the process of calibration. The facilities are listed in Table 3. The facilities will remain at their current limits. LDEQ is not able to quantify the number of individual treatment systems in the watershed. Such systems may include, but are not limited to residential homes, small businesses, and camps. LDEQ realizes these individual treatment systems may contribute to the loading.

2.4 Water Quality Conditions/Assessment

Lower Amite River, Subsegment 040303, is on the 2006 303(d) list and the Consent Decree. The Subsegment was found to be "supporting its designated use of Primary and Secondary Contact Recreation. It was "not supporting" its designated use of Fish and Wildlife Propagation. Lower Amite River was subsequently scheduled for the development of a Total Maximum Daily Load (TMDL) with other listed waters in the Pontchartrain Basin. Lower Amite River, Subsegment 040303 is impaired for dissolved oxygen, nitrate/nitrite, chlorides, and total phosphorus. The suspected cause of impairment were organic enrichment/low DO and the suspected sources were upstream sources. Because of this impairment, this subsegment requires the development of a total maximum daily load (TMDL) for oxygen demanding substances.

The survey data was plotted with the last ten years of ambient data at site WQN0228. All survey data values fell within the same range as the ambient data at that station. The plots are presented in Appendix G3.

2.4.1 History of Amite River Weir at Diversion Canal

The Diversion Canal was created under the Flood Control Act of August 9, 1955 to improve drainage on the Amite River, Blind River, Comite River, and Bayou Manchac. The control weir was built to prevent excess diversion of low water flow into the Diversion Canal. In other words, the purpose of the weir was to confine the majority of the streamflow below the confluence with the Amite River Diversion Canal to the Lower Amite River. This would prevent channel degradation on the Lower Amite River. The connection was intended to be a 1500 foot side channel control weir with crest at 0.0 feet mean sea level, stabilized with a 12 inch blanket of coarse gravel. Completion of the weir took place in 1963. Prior to completion of the Diversion Canal and weir, the Amite River at Port Vincent had a bankfull capacity of 11,000 cfsOver time this weir has subsided/eroded and more flow is now diverted down the Diversion Canal than was originally intended. According to Engineers, the weir has degraded some but the actual amount has been difficult to quantify. Flow measurements obtained by the Amite River Basin Commission in 2007, indicate that more that 80% of the flow from the Amite River is being transferred to the Amite River Diversion Canal, leaving less than 20% of the flow in the Lower Amite River. LDEQ suggests that if the weir can be modified in some manner as to cause more flow to once again flow down the old channel, that reaeration in the Lower Amite River will increase and assist in restoring the stream to better water quality.

2.5 Prior Studies

A study was conducted on the Amite River 1980s. This study included over 90 sites. However, with the many changes in hydrology and water quality since then, the study was deemed outdated and a new survey was conducted to establish current conditions.

DEQ has a monthly water quality sampling station on Lower Amite River. Prior to TMDL development, LDEQ Water Quality Site 0228 had a period of record from January 2001 to December 2001 and from January 2006 to December 2006. Additional data became available after the TMDL report was complete and being prepaired for a second public notice period. The additional period of record was from October 2009 to September 2010. The additional temperature data increased the summer 90th percentile temperature by 0.1 degrees Celsius and decreased the winter 90th percentile temperature by 1.8 degrees Celsius. These changes were not expected to change the outcome of the model or the calculated load reductions. Therefore, LDEQ chose to keep the projections using the data collected in 2001 and 2006. Data collected during the Eularian survey conducted in August 2007, included discharge data, cross-section data, field in-situ data, continuous monitor data, and lab water quality data. This data was used to establish the input for the model calibration and is presented in Appendix F.

3. General TMDL Development Process

The development of a TMDL for dissolved oxygen generally occurs in 3 stages. Stage 1 encompasses the data collection activities. These activities may include gathering such information as stream cross-sections, stream flow, stream water chemistry, stream temperature and dissolved oxygen at various locations on the stream, location of the stream centerline and the boundaries of the watershed which drains into the stream, and other physical and chemical factors which are associated with the stream. Additional data gathering activities include gathering all available information on each facility which discharges pollutants in to the stream, gathering all available stream water quality chemistry and flow data from other agencies and groups, gathering population statistics for the watershed to assist in developing projections of future loadings to the water body, land use and crop rotation data where available, and any other information which may have some bearing on the quality of the waters within the watershed. During Stage 1, any data available from reference or least impacted streams which can be used to gauge the relative health of the watershed is also collected.

Stage 2 involves organizing all of this data into one or more useable forms from which the input data required by the model can be obtained or derived. Water quality samples, field measurements, and historical data must be analyzed and statistically evaluated in order to determine a set of conditions which have actually been measured in the watershed. The findings are then input to the model. Best professional judgment is used to determine initial estimates for parameters which were not or could not be measured in the field. These estimated variables are adjusted in sequential runs of the model until the model reproduces the field conditions which were measured. In other words, the model produces a value of dissolved oxygen, temperature, or other parameter which matches the measured value within an acceptable margin of error at the locations along the stream where the measurements were actually made. When this happens, the model is said to be calibrated to the actual stream conditions. At this point, the model should confirm that there is an impairment and give some indications of the causes of the impairment. If a second set of measurements is available for slightly different conditions, the calibrated model is run with these conditions to see if the calibration holds for both sets of data. When this happens, the model is said to be verified.

Stage 3 covers the projection modeling which results in the TMDL. The critical conditions of flow and temperature are determined for the waterbody and the maximum pollutant discharge conditions from the point sources are determined. These conditions are then substituted into the model along with any related condition changes which are required to perform worst case scenario predictions. At this point, the loadings from the point and nonpoint sources (increased by an acceptable margin of safety) are run at various levels and distributions until the model output shows that dissolved oxygen criteria are achieved. It is critical that a balanced distribution of the point and nonpoint source loads be made in order to predict any success in future achievement of water quality standards. At the end of Stage 3, a TMDL is produced which shows the point source permit limits and the amount of reduction in man-made nonpoint source pollution which must be achieved to attain water quality standards. The man-made portion of the NPS pollution is estimated from the difference between the calibration loads and the loads observed on reference or least impacted streams.

4. Calibration Model Documentation

4.1 Program Description

The model used for this TMDL was LA-QUAL, a steady-state one-dimensional water quality model. LA-QUAL has the mechanisms for incorporating tidal fluctuations, dispersion, and algal impacts in the analysis and was particularly suitable for use in modeling Lower Amite River**.** For a history of LA-QUAL, refer to the LA-QUAL for Windows User's Manual (LDEQ, 2007).

4.2 Input Data Documentation

Data collected during an intensive survey conducted from August 6 – 9, 2007, was used to establish the input for the model calibration. The data is presented in Appendix F. The headwater flow could not be measured, therefore, the Louisiana Technical Procedures (LTP) summer default of 0.0023 cms was used.

Field and laboratory water quality data were entered in a spreadsheet for ease of analysis. Upon review of the measured CBOD daily values it became apparent that there were two distinct CBOD components, which had varying ultimate values as well as decay rates and lag times. The first component started its decay almost immediately while the second component had substantial lag times. The total CBOD curve presented in Appendix F5 is the sum of the two first order equations, which were derived using the Microsoft Excel Solver and were based on the measured daily CBOD values. These two CBOD components were modeled separately as CBOD1 and CBOD2 in the LAQUAL model. NBOD simulated organic nitrogen, ammonia nitrogen, and nitrate/nitrite nitrogen. The Louisiana BOD program was applied to the BOD data in a separate spreadsheet and values were computed for each sample taken of ultimate CBOD1, CBOD1 decay rate, CBOD1 lag time, ultimate CBOD2, CBOD2 decay rate, and CBOD2 lag time as well as the NBOD, NBOD decay rate, and NBOD lag time. The survey data was the primary source of the model input data for initial conditions, decay rates, mainstem water temperature, dissolved oxygen loading, headwater temperature, and DO data.

The survey data was also compared to the reference stream data. Most values for conservatives parameters, were higher than the values found in the reference stream data. Similar trends were observed for most of the nutrient parameters. These trends indicate the impact that the lack of flow is having on flushing out nutrients from the Lower Amite River. The reference stream data is provided in Appendix E5.

4.2.1 Model Schematics and Maps

A vector diagram of the modeled area is presented in Figure 1 and Appendix C1. The vector diagram shows the locations of survey stations, the reach/element design, and the dischargers included in the model. An ARCVIEW map of the stream and subsegment showing river kilometers, survey stations, and other points of interest are also included in Figure 2 and Appendix H1.

4.2.2 Model Options, Data Type 2

Six constituents were modeled during the calibration process. These were dissolved oxygen, carbonaceous biochemical oxygen demand components 1 and 2, nitrogenous biochemical oxygen demand, chloride, and conductivity. The continuous monitors did show diurnal swings indicative of algal activity. The algae cycle was not modeled; however, the measured chlorophyll A values were included in the initial conditions. This allowed the model to simulate the oxygen production associated with algae without modeling the entire algal cycle.

4.2.3 Program Constants, Data Type 3

A minimum K_L value of 0.7 m/day was used. This value is a conversion from 2.3 ft/day which is a Louisiana standard minimum. The K_2 maximum was set to 25 1/day at 20^o C which is the EPA Policy in the absence of a measured value.

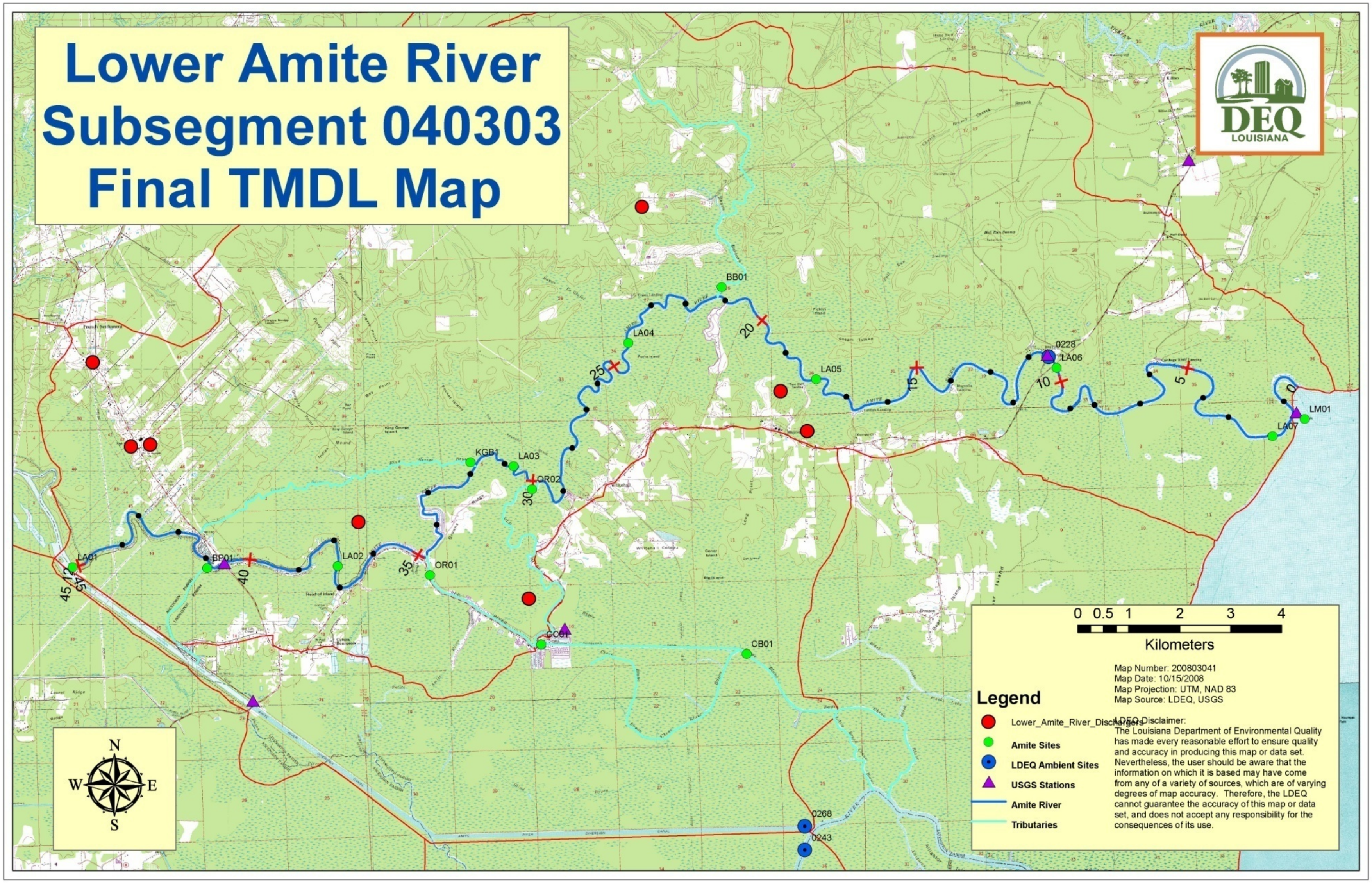
The inihibition control value was set to option 3 which is all rates but sediment oxygen demand. The water column dissolved oxygen demand is assumed to come primarily from facultative bacteria under anoxic conditions and SOD is not influenced by modeled dissolved oxygen levels in the upper water column.

The hydraulic calculation method was set to option 2 or “widths and depths.” This was done because the low slopes in these waterbodies cause a substantial amount of water to be present in some reaches during critical flow. Using a modified Leopold relationship allows the model to predict a more accurate depth and width during low flow.

The settling rate units were set to option 2 which is 1/day. By making the settling rate a velocity, the rate becomes dependent upon the depth.

Figure 1. Model Layout

Figure 2. Map of Study Area



Dispersion equation 3 was used to take into account all modes of transport.

The algae oxygen production was set to zero in order to model to a wide variation in dissolved oxygen.

The tide height was set to 0.134 from instrumentation measurements.

4.2.4 Temperature Correction of Kinetics, Data Type 4

The temperature values computed are used to correct the rate coefficients in the source/sink terms for the other water quality variables. These coefficients are input at 20 °C and are then corrected to temperature using the following equation:

$$X_T = X_{20} * \text{Theta}^{(T-20)}$$

Where:

X_T = the value of the coefficient at the local temperature T in degrees Celsius
X_{20} = the value of the coefficient at the standard temperature at 20 degrees Celsius
Theta = an empirical constant for each reaction coefficient

In the absence of specified values for data type 4, the model uses default values. A complete listing of these values can be found in the LA-QUAL for Windows User's Manual (LDEQ, 2007). For this model all values used were LAQUAL default values.

4.2.5 Reach Identification Data, Data Type 8

A diagram of the modeled area is presented in Appendix C1. The vector diagram shows the reach/element design. The modeled area is characterized by 7 sample sites. The model starts at the Amite River Diversion and extends to Lake Maurepas. This calibrated model includes 6 reaches, 349 elements, and one headwater. A digitized map of the stream showing river kilometers, and the August 2007 survey sampling sites are included in Figure 2 and Appendix H1.

4.2.6 Advective Hydraulic Coefficients, Data Type 9

The Leopold equations are used to scale the velocity (U), width (W), and depth (H) of a free flowing stream from a lower value of flow to a higher value or from a higher value of flow to a lower value. Note that the exponents add to one and the coefficients multiply to 1. This is known as the rule of ones. This method is not appropriate for streams which are not dependent entirely on flow such as waterbodies where flow approaches zero, but contain some depth.

$$U = aQ^b \qquad H = cQ^d \qquad W = eQ^f$$

$$b + d + f = 1 \qquad (a)(c)(e) = 1$$

The Leopold equations presume that the water surface width and average depth of a stream are zero at zero flow. Most Louisiana streams, such as Lower Amite River, retain a significant width and depth at zero flow. The equations have therefore been modified to allow for a zero flow width and depth. The rule of ones does not apply to the modified equations. The modified Leopold equations are:

$W = aQ^b + c$ $H = dQ^e + f$ $U = gQ^h$

The width and depths were assumed to be independent of flow. Consequently, the modified Leopold coefficients and exponents were not calculated for this model.

4.2.7 Dispersive Hydraulic Coefficients, Data Type 10

The dispersion was estimated based on the only dye study done during the time of the survey. There were five dye runs conducted during this study. Based on the data retrieved the final dye run was determined to be most representative of the stream. This was because the final dye run had the longest run time. The longer time frame gave the dye a longer time to become more uniformly dispersed in the river. The Kd value was determined to be 1.32. The Kd value was entered into the overlay file under code 32. The range was set to the RKM of the most upstream dye sample sit4e to the most downstream dye sample site for Run 5. All documentation can be found in Appendix F6.

To take into consideration all modes of transport, equation 3, ($D_L = aH^bQ^cV_M^d$) in Laqual was used. Using b=5/6, c=0, and d=1 will take into account all modes of transport in the manner of the Tracor and QUAL2E equations. The value for coefficient “a” was calibrated to within the boundaries of the final dye run by setting all other parameters to the previously mentioned values. All documentation can be found in Appendix F6. The dispersion calibration is presented in Figure 3.

4.2.8 Initial Conditions, Data Type 11

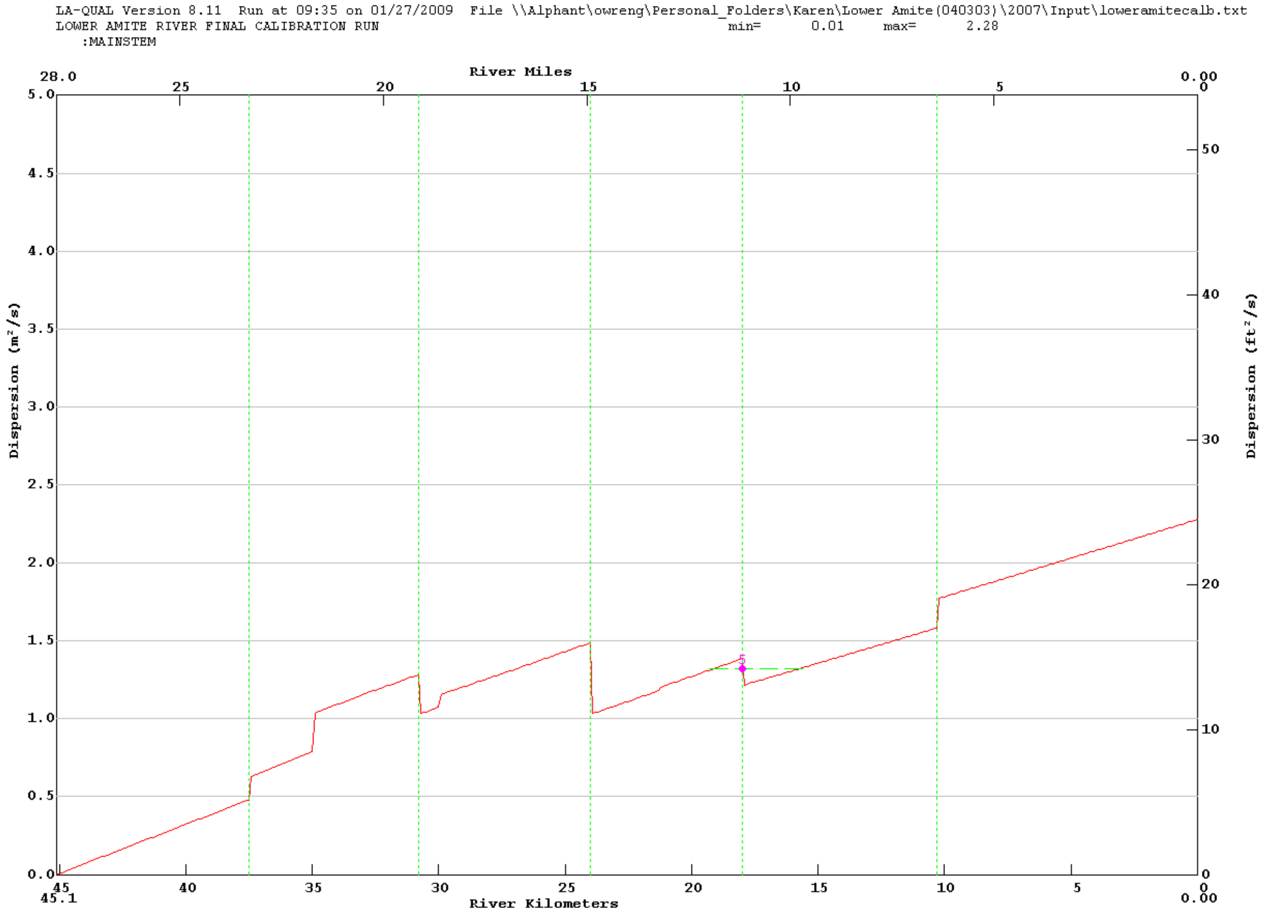
The initial conditions are used to reduce the number of iterations required by the model. The values required for this model were temperature and DO by reach. The input values came from the survey station(s) located closest to the reach.

When the continuous monitoring dissolved oxygen (DO) data for at least one diurnal cycle is available and the diurnal variation is less than 2 mg/L, it is standard practice for LDEQ to calibrate to the mean DO. In this case, a diurnal variation greater than 2 mg/L was encountered. The standard LDEQ practice for this is as follows:

1. Calibrate without simulating algal production as follows:

Range of DO cycle	Calibrate
0 – 2 mg/l	Mean DO for one or more full cycles
2 – 9 mg/l	Minimum DO + 1
>9 mg/l	Minimum DO + 0.11*DO cycle

Figure 3. Dispersion Calibration



These practices were followed for this model.

Chlorophyll a values were also used since the mild effects of algae on the dissolved oxygen concentrations were also simulated with this model. The initial conditions are only a starting point for the model, therefore, all values were set to the measured values. The input data and sources are shown in Appendix B.

4.2.9 Reaeration Rates, Data Type 12

The applicability of the various reaeration equations was examined. The Louisiana Equation considered to be the most the most applicable to Bayou Manchac for all reaches. This equation is based on empirical data collected by the Louisiana DEQ. The equation is stated below.

$$K2 = \underline{0.664\ (1 + 21.52\ V)}$$

D

where: V = stream velocity
D = stream depth

4.2.10 Sediment Oxygen Demand, Data Type 12

The SOD values were achieved through calibration. The SOD value for each reach is shown in Appendix B2. The values were considered to be reasonable for this type of stream.

4.2.11 Carbonaceous BOD Decay and Settling Rates, Data Type 12

The decay rates used were based on the bottle rates from the survey. Review of the measured CBOD daily values revealed two distinct CBOD components, which had varying decay rates and lag times. The first component started its decay almost immediately with decay rates ranging from 0.1620 to 0.5951 per day. The second component had decay rates from 0.0050 to 0.0367 per day. The total CBOD curves presented in Appendix F5 are the sum of the two first order equations, which were derived using the Microsoft Excel Solver and were based on the measured daily CBOD values. These two components were modeled separately as CBOD1 and CBOD2 in the LAQUAL model. The decay rates used were the average value across all reaches. The settling rates were achieved through calibration. The decay and settling rates used for each reach are shown in Appendix F5.

4.2.12 Nitrogenous BOD Decay and Settling Rates, Data Type 15

These rates are labeled NBOD Decay and Settling in the model. The decay rates used were based on the bottle rates from the survey. NBOD decay rates were fairly consistent with main stem rates ranging from 0.0050 to 0.4691. The decay and settling rates used for each reach are shown in Appendix F5.

4.2.13 Incremental Conditions, Data Types 16, 17, and 18

The incremental conditions were used in the calibration to represent nonpoint source loads associated with flows. An incremental flow of ¼(LA05 – Headwater) for reaches 1 – 4 was used. For reaches 5 and 6, the minimal immeasurable flow for that reach was used.

4.2.14 Nonpoint Sources, Data Type 19

Nonpoint source loads which are not associated with a flow are input into this part of the model. These can be most easily understood as resuspended load from the bottom sediments and are modeled as SOD, CBOD1, CBOD2, and NBOD loads. These values are achieved through calibration. The loads determined through calibration were reasonable for this type of waterbody and geometry.

4.2.15 Headwaters, Data Types 20, 21, and 22

There were no headwater flow measurements available from the survey. Thus, the default summer flow as per LTP was used for the headwater flow. This value used was 0.0023 cms. See section 4.3 for a discussion of how flow was calculated. The data and sources are presented in Appendix B2.

4.2.16 Wasteloads, Data Types 23, 24, and 25

A facility review was performed on the subsegment. According to LDEQ's TEMPO and EDMS database systems, there were 8 permitted dischargers and one facility without an approved permit within Subsegment 040303. All of these facilities were either too far away or too small to provide a significant impact to the Lower Amite River. Therefore, these facilities were not included in the model. In these situations, limits for these facilities are generally set by state policy. Due to the fact that these facilities have a minimal impact on the named 303(d) listed waterbody, they were not modeled.

Four tributaries were flowing during the survey and their measured values were included in the model.

4.2.17 Boundary Conditions, Data Type 27

The lower boundary conditions were assumed to be equivalent to the measurements taken at survey station LA07 except for Chlorophyll a. No Chlorphyll a measurement were taken at the site, so the chlorophyll a value for LA06 was used.

4.3 Model Discussion and Results

The calibration model input and output is presented in Appendix B1. The overlay plotting option was used to determine if calibration had been achieved. A plot of the dissolved oxygen concentration versus river kilometer is presented in Figure 4. The calibration points for dissolved oxygen were based on the LDEQ standard operating procedures for calibration to a wide variation of dissolved oxygen. All calibration points were calculated to be one mg/l over the minimum DO for the diurnal cycle. This calibration procedure is based upon the theoretical consideration of production and respiration rates. To accomplish calibration for this procedure, the algae oxygen production was set to zero. The calibration points for CBOD1, CBOD2, and NBOD were the measured values from the water quality samples. The calibration points for conductivity were the insitu readings. The calibration points for the chlorides and chlorophyll A were the measured values from the water quality samples.

An adequate calibration was achieved for DO, CBOD1, CBOD2, and NBOD on the main stem. The calibration model shows that during the August 2007 survey period, the DO standard of 5 mg/l was not being met in any of the modeled reaches. The calibration model minimum DO on the main stem was 2.94 mg/l.

The Louisiana Reaeration Equation was used in this model. Based on the depth and velocity of the water in the Lower Amite River, this equation was determined to be the most appropriate of the 22 equations available within the LAQUAL modeling software. The use of this equation produced a calibration model with reasonable values for both sediment oxygen demand (SOD) and nonpoint loading for a stream in low flow conditions.

Measureable flow was not available for any of the mainstem sites. The only flow measurements obtainable were for tribs. A minimal flow was added to the headwater. The incremental flow was obtained from the flow calculated from a dye study at site 5 and the measured flows on the tributaries. A minimal immeasurable flow was added for sites 5 and 6 as indicated in the documentation. Flow documentation can be found in Appendix F7.

The moderate levels of nonpoint, the lower dissolved oxygen levels, the high color, and high TDS are consistent with a stream that is having a lack of flow to flush it along.

5. Water Quality Projections

A suitable reference stream could not be found. Therefore a no load summer scenario was not performed. The traditional summer critical projection loading scenario were performed at the current annual DO standard using an overall reduction in nonpoint. In addition to the traditional projections, summer and winter projections were performed for DO standard of 2.3 mg/L in the summer and 5.0 mg/L in the winter. This scenario was based on reduced nonpoint loads at summer season critical conditions (i.e., 90^{th} percentile seasonal temperatures and critical flows) in accordance with the LTP.

5.1 Critical Conditions, Seasonality and Margin of Safety

The Clean Water Act requires the consideration of seasonal variation of conditions affecting the constituent of concern, and the inclusion of a margin of safety (MOS) in the development of a TMDL. For the Lower Amite River, subsegment 040303 TMDL, an analysis of LDEQ ambient data has been employed to determine critical seasonal conditions and an appropriate margin of safety.

Critical conditions for dissolved oxygen were determined for Lower Amite River using water quality data from water quality site number 0228 on the LDEQ Ambient Monitoring Network. The 90^{th} percentile temperature for each season and the corresponding 90% of saturation DO was determined. Ambient temperature data, critical temperature and DO saturation determinations are shown in Appendix G1.

Graphical and regression analysis techniques have been used by LDEQ historically to evaluate the temperature and dissolved oxygen data from the Ambient Monitoring Network and run-off determinations from the Louisiana Office of Climatology water budget. Since nonpoint loading is conveyed by run-off, this was a reasonable correlation to use. Temperature is strongly inversely proportional to dissolved oxygen and moderately inversely proportional to run-off. Dissolved oxygen and run-off are also moderately directly proportional. The analysis concluded that the critical conditions for stream dissolved oxygen concentrations were those of negligible nonpoint run-off and low stream flow combined with high stream temperature.

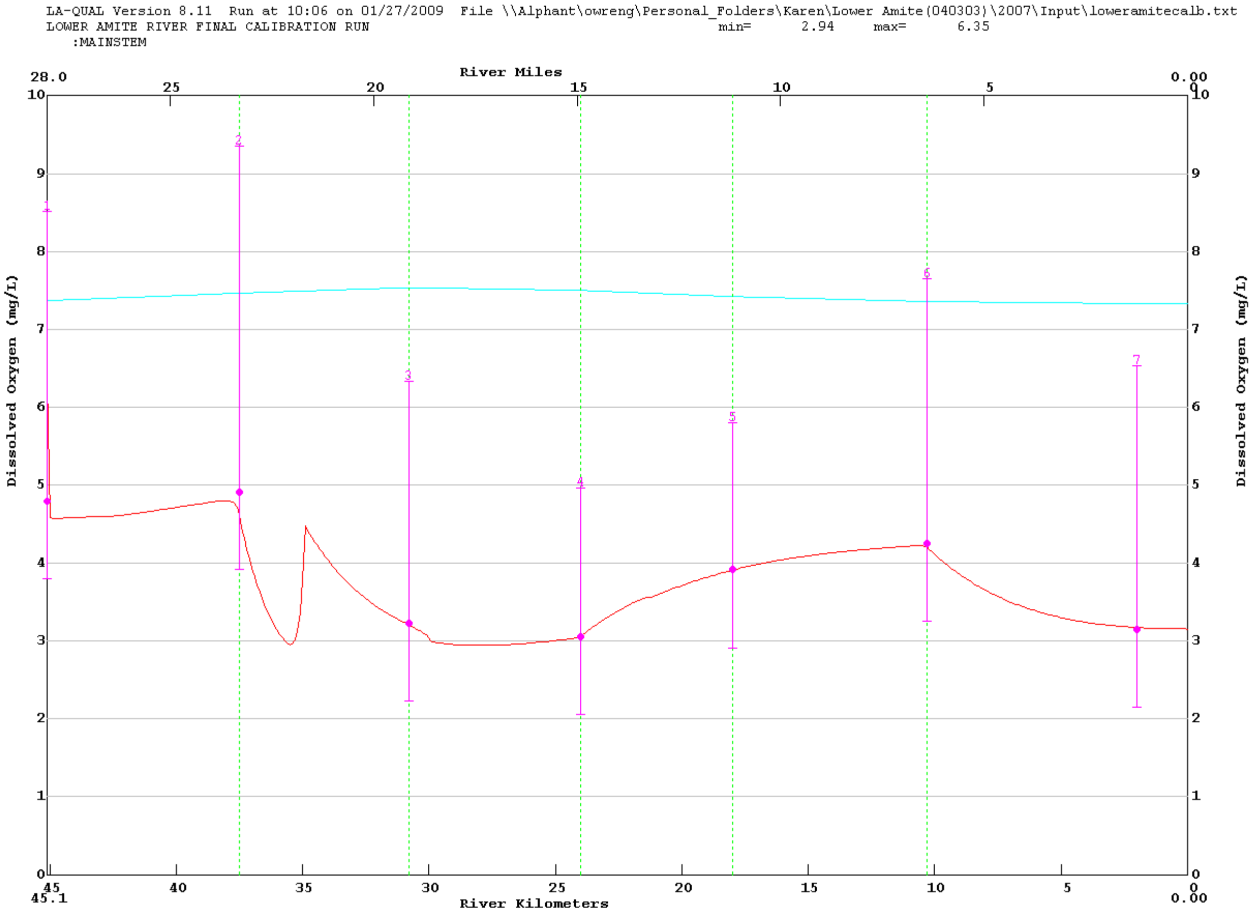
When the rainfall run-off (and non-point loading) and stream flow are high, turbulence is higher due to the higher flow and the temperature is lowered by the run-off. In addition, run-off coefficients are higher in cooler weather due to reduced evaporation and evapotranspiration, so that the high flow periods of the year tend to be the cooler periods. Reaeration rates and DO saturation are, of course, much higher when water temperatures are cooler, but BOD decay rates are much lower. For these reasons, periods of high loading are periods of higher reaeration and dissolved oxygen but not necessarily periods of high BOD decay.

This phenomenon is interpreted in TMDL modeling by assuming that nonpoint loading associated with flows into the stream are responsible for the benthic blanket which accumulates on the stream bottom and that the accumulated benthic blanket of the stream, expressed as SOD and/or resuspended BOD in the calibration model, has reached steady state or normal conditions over the long term and that short term additions to the blanket are off set by short term losses. This accumulated loading has its greatest impact on the stream during periods of higher temperature and lower flow. The manmade portion of the NPS loading is the difference between the calibration load and the reference stream load where the calibration load is higher. The only mechanism for changing this normal benthic blanket condition is to implement best management practices and reduce the amount of nonpoint source loading entering the stream and feeding the benthic blanket.

Critical season conditions were simulated in the Lower Amite River, subsegment 040303 dissolved oxygen TMDL projection modeling by using TMDL projection modeling by using 20% of the 7Q10 for the Amite River at Denham Springs and the 90^{th} percentile temperature. Currently, due to the weir repairs needed at the Diversion Canal, most of the flow is going down the Diversion Canal. Incremental flow was assumed to be zero; model loading was from perennial tributaries, sediment oxygen demand, and resuspension of sediments.

In reality, the highest temperatures occur in July and/or August, the lowest stream flows occur in October and/or November, and the maximum point source discharge occurs following a significant rainfall, i.e., high-flow conditions. The summer projection model is established as if all these conditions happened at the same time. The winter projection model accounts for the seasonal differences in flows and BMP efficiencies. Other conservative assumptions regarding rates and loadings are also made during the modeling process. In addition to the conservative measures, an explicit MOS of 20% was used for all loads to account for future growth, safety, model uncertainty and data inadequacies.

Figure 4. Calibration Model Dissolved Oxygen versus River Kilometer



- numbered points indicate survey stations
- vertical lines indicate beginning of reach
- the horizontal line indicates the DO Criterion
- upper plotted line indicates DO saturation
- lower plotted line indicates calibration model output

5.2 Input Data Documentation

The LTP states that the headwater flow for summer conditions should be 0.1 cfs or the 7Q10, whichever is greater. However, it also states that more appropriate critical conditions may be selected. A 7Q10 value for the Amite River at Denham Springs was calculated to be 316 cfs. Based upon flow measurements taken in a 2007 study by the Amite River Basin Commission, it was found that the flow reaching the Lower Amite River was less than 20%. For the sake of this projection run, it was assumed that only 20% of the flow is reaching the Lower Amite River and the other 80% is being diverted down the Amite River Diversion Canal due to the weir no longer functioning as originally intended. Therefore, the value used for critical conditions were (.2 * 316) cfs = 63.2 cfs = 1.7896 cms. The incremental inflow was assumed to be 0 cms.

For the calibration, only one flow was obtained and that was from a dye study at Site 5 of 5.3234 cms. This was the flow that was used to calibrate the model. This value is obviously much higher than the 7Q10 value of 1.7896 cms. This is not unusual based upon the very definition of a 7Q10. A 7Q10 is the lowest flow obtained during a 7 consecutive day period of record over 10 years of data.

For the 2007 study by the Amite River Basin Commission, the Lower Amite River was found under medium flow conditions, with the flow being measured at 18.60 cms (657 cfs). A low flow measurement was also made at -0.34 cms (-12 cfs). The TMDL survey produced a flow of 5.3234 cms (188 cfs). This flow measured during the TMDL survey is well within the range of flows measured during the 2007 study conducted by the Amite River Basin Commission. For more information see Appendix G4.

Critical conditions include dissolved oxygen, temperature, and flow. Pollutant loading is adjusted in the projection models to meet the dissolved oxygen criteria.

The calibration values were retained for the remaining parameters and used as input values in the summer and winter projections. The model adjusts the input values for SOD, CBOD1 decay, CBOD2 decay, and NBOD decay based upon the input temperature.

5.2.1 Model Options, Data Type 2

Four constituents were modeled during the projection process. These were dissolved oxygen, the two components of carbonaceous biochemical oxygen demand, and nitrogenous biochemical oxygen demand.

5.2.2 Temperature Correction of Kinetics, Data Type 4

The temperature correction factors specified in the LTP are entered in the model.

5.2.3 Reach Identification Data, Data Type 8

The reach-element design from the calibration was used in the projection modeling.

5.2.4 Advective Hydraulic Coefficients, Data Type 9

The hydraulic coefficients, exponents, and constants determined for the calibration were used in the projection model.

5.2.5 Initial Conditions, Data Type 11

The initial conditions were set to the 90th percentile critical season temperature in accordance with the LTP. For the current standard, the temperature was set to 30.50^{o}C for summer and 24.70^{o}C for winter. For summer, the temperature was set to 30.40^{o}C to meet the proposed winter and summer standards for the 2.3 mg/L criteria. For winter, the temperature was set to 16.70^{o}C to meet the proposed winter and summer standards for the 2.3 mg/L criteria. The dissolved oxygen values for the initial conditions were set at the stream criteria (5mg/L) with the exception of the headwater dissolved oxygen value. The headwater DO was set to 90% DO Sat for WQN 0228.

For the current standard, the headwater DO for summer was set to 6.70 mg/L. The headwater DO for winter was set to 7.50 mg/L.

For the proposed standard, the headwater DO for summer was set to 6.80 mg/L. The headwater DO for winter was set to 8.70 mg/L.

5.2.6 Reaeration Rates, Carbonaceous BOD Decay and Settling Rates, Nitrogenous BOD Decay and Settling Rates, Data Type 12 and 15

The reaeration rate equations, CBOD1 and CBOD2 decay and settling rates, NBOD decay and settling rates, and the fractions converting settled CBOD and settled NBOD to SOD were not changed from the calibration.

5.2.7 Sediment Oxygen Demand, Nonpoint Sources, Headwaters, Wasteloads, Data Type 12, 19, 20, 21, 22, 24, 25, and 26

The NPS values were calculated for each projection scenario using a load equivalent spreadsheet. An analysis was made of the calibration NPS and SOD loads in terms of total loading in units of gm-O_2/m^2/day and compared to the reference stream loads in the same terms (which accounted for the width differences between the reference and the modeled streams). Calibration values were used where they were smaller than the reference stream values. The same spreadsheet also calculated load reductions for the headwaters and wasteloads. The values and sources of the input data and the load analyses are presented in Appendix E for each of the projection runs.

LDEQ has collected and measured the CBOD and NBOD oxygen demand loading components for a number of years. These loads have been found in all streams including the non-impacted reference streams. It is LDEQ's opinion that much of this loading is attributable to run-off loads which are flushed into the stream during run-off events, and subsequently settle to the bottom in our slow moving streams. These benthic loads decay and breakdown during the year, becoming easily resuspended into the water column during the low flow/high temperature season. This season has historically been identified as the critical dissolved oxygen season.

LDEQ simulates part of the non-point source oxygen demand loading as resuspended benthic load and SOD. The calibrated non-point loads, UCBOD, UNBOD and SOD, are summed to produce the total calibrated benthic load. The total calibrated benthic load is then reduced by the total background benthic load (determined from LDEQ's reference stream research) to determine the total manmade benthic loading. The manmade portion is then reduced incrementally on a percentage basis to determine the necessary percentage reduction of manmade loading required to meet the water body's dissolved oxygen criteria. These reductions are applied uniformly to all reaches sharing similar hydrology and land uses.

Following the same protocol as the point source discharges, the total reduced manmade benthic load is adjusted for the margin of safety by dividing the value by one minus the margin of safety. This adjusted load is added back to the total background benthic value to obtain the total projection model benthic load. This total projection benthic load is then broken out into its components of SOD, resuspended CBOD and resuspended NBOD by multiplying the total projection benthic load by the ratio of each calibrated component to the total calibrated benthic load.

LDEQ has found variations in the breakdown of the individual CBOD and NBOD components. While the total BOD is reliable, the carbonaceous and nitrogenous component allocation is subject to the type of test method. In the past, LDEQ used a method which suppressed the nitrogenous component to obtain the carbonaceous component value, which was then subtracted from the total measured BOD to determine the nitrogenous value. The suppressant in this method was only reliable for twenty days thus leading to the assumption that the majority of the carbonaceous loading was depleted within that period of time. The test results supported this assumption. A new method was found in Standard Methods for testing long term BODs and was implemented in 2000. This new method was necessary because the nitrogen suppressant started failing around day seven and the manufacturer of the suppressant will only guarantee it's potency for a five-day period. LDEQ felt a five-day test would not adequately depict the water quality of streams.

This proposed method is a sixty-day test which measures the incremental total BOD of the sample while at the same time measuring the increase in nitrite/nitrate in the sample. This increase in nitrite/nitrate allows LDEQ to calculate the incremental nitrogenous portion by multiplying the increase by 4.57 to determine the NBOD daily readings. These NBOD daily readings are then subtracted from the daily reading for total BOD to determine the CBOD daily values. A curve fit algorithm is then applied to the daily component readings to obtain the estimated ultimate values of each component as well as the decay rate and lag times of the first order equations.

LDEQ implemented the new test method over the last several survey seasons. The results obtained using the new method showed that a portion of the CBOD first order equation does begin to level off prior to the twentieth day, however a secondary CBOD component begins to use dissolved oxygen sometime between day ten and day twenty-five. This secondary CBOD component was not being assessed as CBOD using the previous method but was being included in the NBOD load. Thus the CBOD and NBOD component loading used in the reference stream studies is not consistent with the results using the new proposed sixty-day method and the individual values should not be used to determine background values for samples processed using the new test methods. However, the sum of CBOD and NBOD should be about the same for both new and old test methods. For this reason LDEQ decided to use the sum of reference stream benthic loads as background values.

Lower Amite River could meet the 5 mg/L dissolved oxygen standard with a 60% reduction in overall loading. The resuspended total nonpoint CBOD and NBOD loading was reduced by 25% for all reaches in the summer critical projection scenario to meet a proposed summer water quality criterion of 2.3 mg/L dissolved oxygen. Since LDEQ assumes these benthic loads are long-term loads brought to the stream by various sources throughout the year, the same percentage reductions were made in the winter projection model as were in the summer critical projection model.

The reductions were determined using the calibrated values for nonpoint CBOD1, CBOD2, and NBOD. These values were summed by reach, as justified above and adjusted for the margin of safety. Each reach's total benthic nonpoint load was then reduced to meet the dissolved oxygen criteria in each reach. Using the ratios determined in calibration, this reduced total nonpoint load was then broken into its components of CBOD1, CBOD2, NBOD, and SOD. The percentage reduction within the mainstem was calculated based on the comparison of the reduced total nonpoint benthic load to the calibration total nonpoint benthic load. These calculations are shown in Appendix E. The value and sources of CBOD1, CBOD2, and NBOD for each projection run are presented in Appendix F5.

5.2.8 Boundary Conditions, Data Type 27

The lower boundary conditions were set at the 90^{th} percentile critical season temperature, the dissolved oxygen criteria, and the measured stream UCBOD and UNBOD loads for all projections and scenarios.

5.3 Model Discussion and Results

There were no appropriate reference streams for this waterbody. Therefore a no-load projection could not be run. Overall reductions were taken instead to meet criteria. It is recommended that the current DO criterion be reevaluated. The ecoregion study thus far indicates the recommended critical season criteria of May – November for the Upper Mississippi River Alluvial should be 2.3 mg/L. This recommended criterion was derived through the application of EPA approved statistical methods. Lower Amite River is one of the reference streams for this ecoregion. This TMDL supports the revision of the summer season criterion for DO. The projection model input and output data sets are presented in Appendix D. If the standard is changed, a more reasonable reduction in man-made loading will be required for summer. For winter projections, the Lower Amite River can meet a 5.0 mg/L dissolved oxygen criteria with even a 25% reduction in man-made loading.

5.3.1 No-Load Projection

There were no appropriate reference streams for this waterbody. Therefore a no-load projection could not be run.

5.3.2 Summer Projection

Current DO standard of 5.0 mg/L required the removal of 60% of the man-made load. Alternate summer critical season projections were run at different standards.

For the 2.3 mg/L standard, a 25% reduction in man-made loading is required. Graphs for the summer projections are presented in Figures 5 and 6.

5.3.3 Winter Projection

Alternate winter runs were made at the same level of reduction as the summer runs. A graph of the dissolved oxygen concentration versus river kilometer for the winter projections are presented in the following figures 7 and 8. Both winter runs meet and exceed a 5.0 mg/L DO criteria.

5.4 Calculated TMDL, WLAs and LAs

5.4.1 Outline of TMDL Calculations

An outline of the TMDL calculations is provided to assist in understanding the calculations in the Appendices. Slight variances may occur based on individual cases.

5.4.2 Lower Amite River Subsegment 040303 TMDL

TMDLs for the biochemical oxygen demanding constituents (CBOD, NBOD, and SOD), have been calculated for the summer and winter critical seasons based on proposed dissolved oxygen criteria. They are presented in Appendix A by reach. A summary of the loads is presented in Table 2.

6. Sensitivity Analysis

All modeling studies necessarily involve uncertainty and some degree of approximation. It is therefore of value to consider the sensitivity of the model output to changes in model coefficients, and in the hypothesized relationships among the parameters of the model. The LAQUAL model allows multiple parameters to be varied with a single run. The model adjusts each parameter up or down by the percentage given in the input set. The rest of the parameters listed in the sensitivity section are held at their original projection value. Thus the sensitivity of each parameter is reviewed separately. A sensitivity analysis was performed on the calibration. The sensitivity of the model's minimum DO projections to these parameters is presented in Appendix I2. Parameters were varied by +/- 30%, except temperature, which was adjusted +/- 2 degrees Centigrade.

Values reported in Appendix I2 are percentage variation of minimum DO in the main stem of Lower Amite River. As shown in Table 7, initial temperature, benthal demand, stream reaeration, lower boundary DO, and stream depth are the parameters to which DO is most sensitive. The model is slightly sensitive to insensitive to the remaining parameters.

7. Conclusions

This TMDL establishes load limitations for oxygen-demanding substances and goals for reduction of those pollutants. LDEQ's position is that when oxygen-demanding loads from point and nonpoint sources are reduced in order to ensure that the dissolved oxygen criterion is supported, nutrients are also reduced. The implementation of this TMDL through wastewater discharge permits and implementation of best management practices to control and reduce runoff of soil and oxygen-demanding pollutants from nonpoint sources in the watershed will also reduce the nutrient loading from those sources.

Figure 5. Summer Projection at 60% Removal of Overall Loads to meet 5.0 mg/L DO Criteria

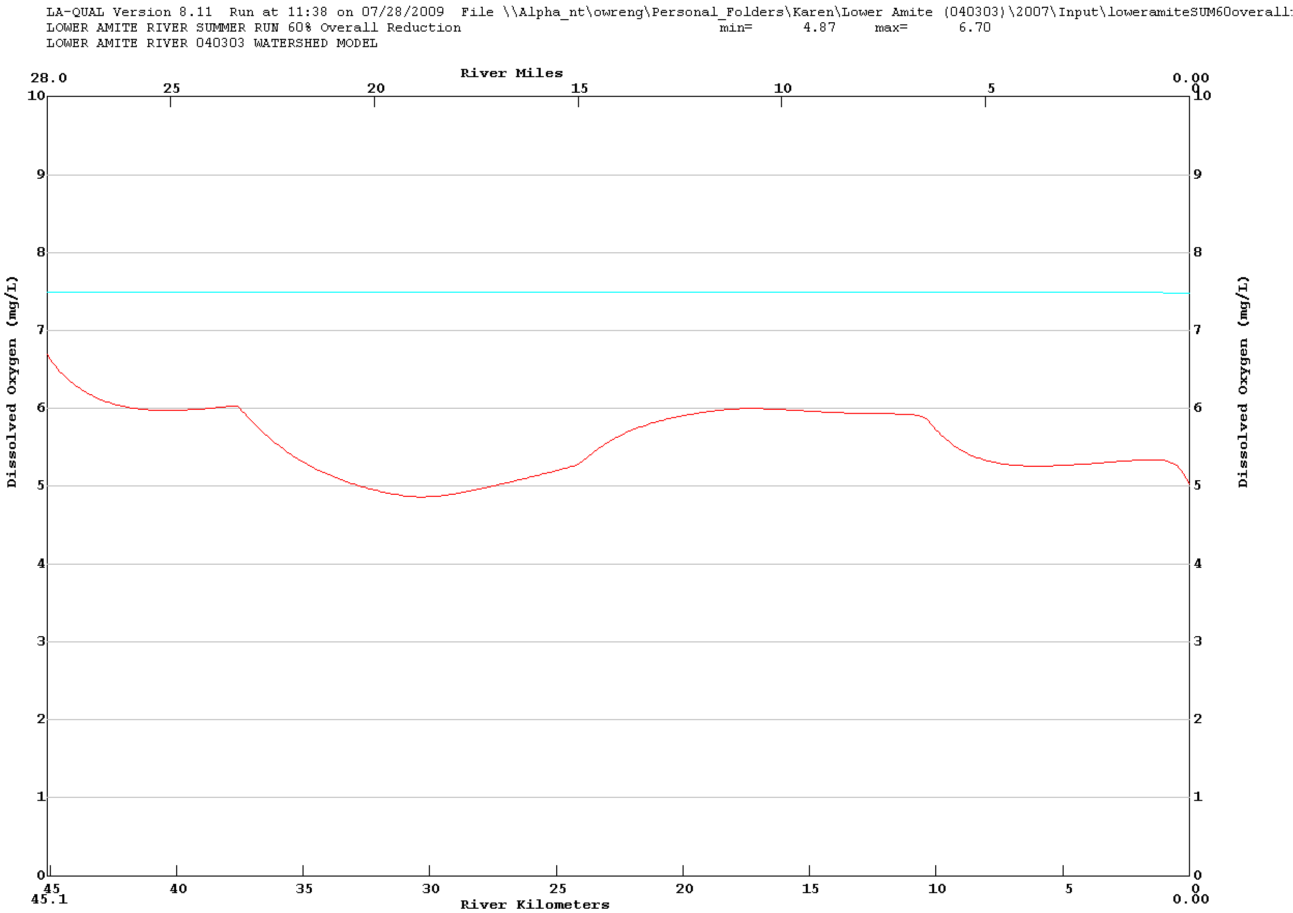


Figure 6. Summer Projection at 25% Removal of Overall Loads to meet 2.3 mg/L DO Criteria

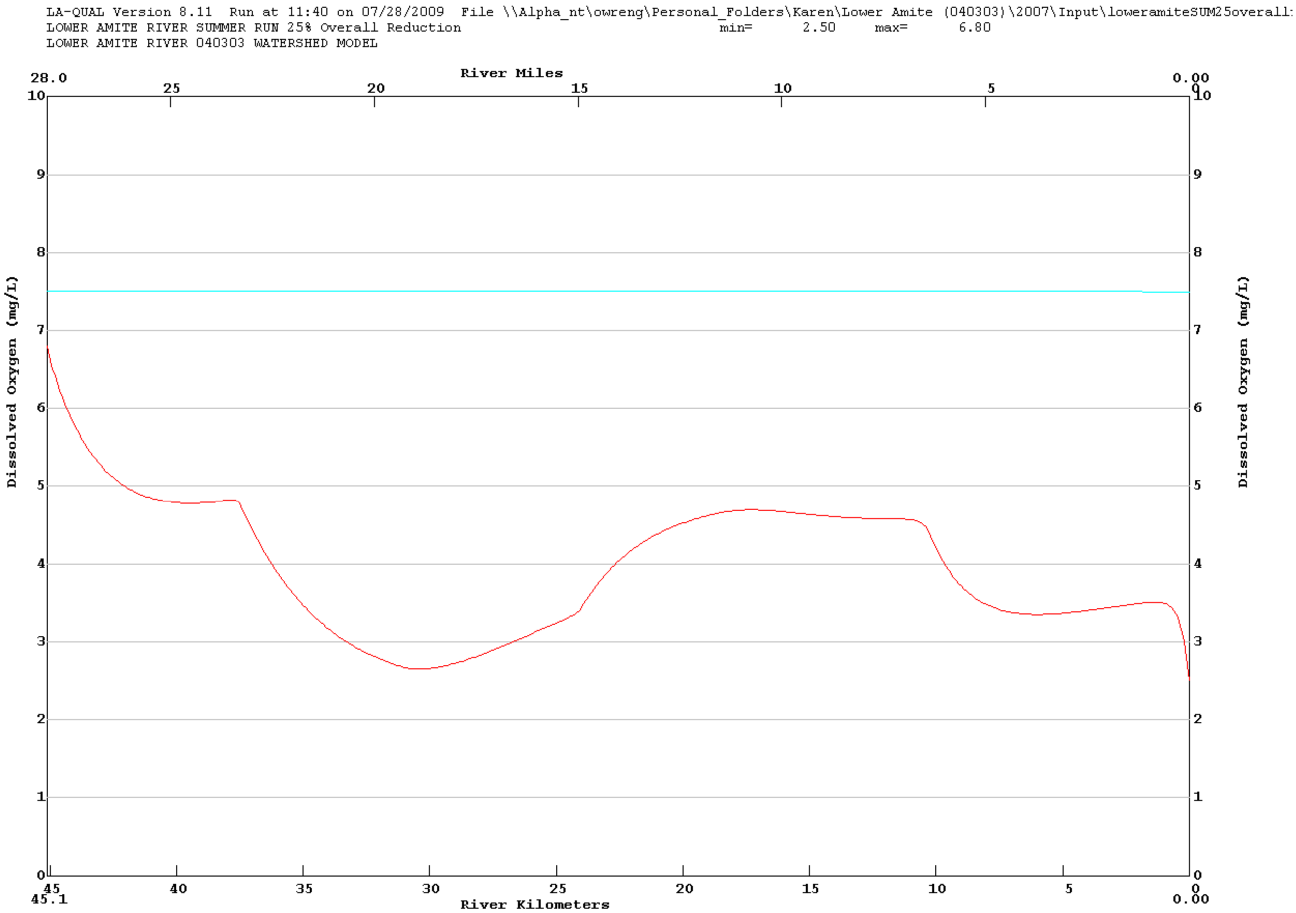


Figure 7. Winter Projection at 60% Removal of Man-Made NPS Loads to meet 5.0 mg/L DO Criteria for Summer Season

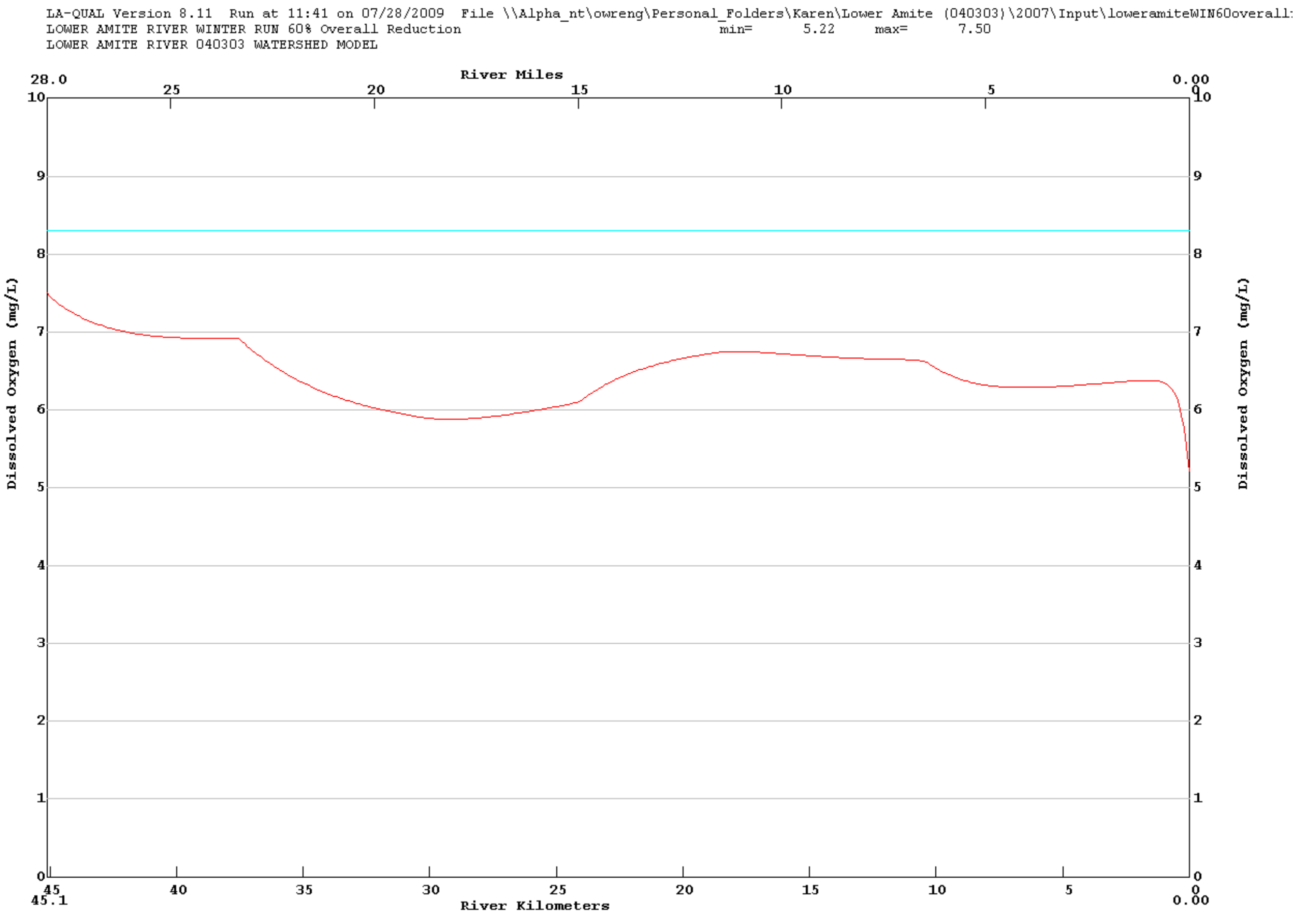


Figure 8. Winter Projection at 25% Removal of Man-Made NPS Loads to meet 2.3 mg/L DO Criteria for Summer Season

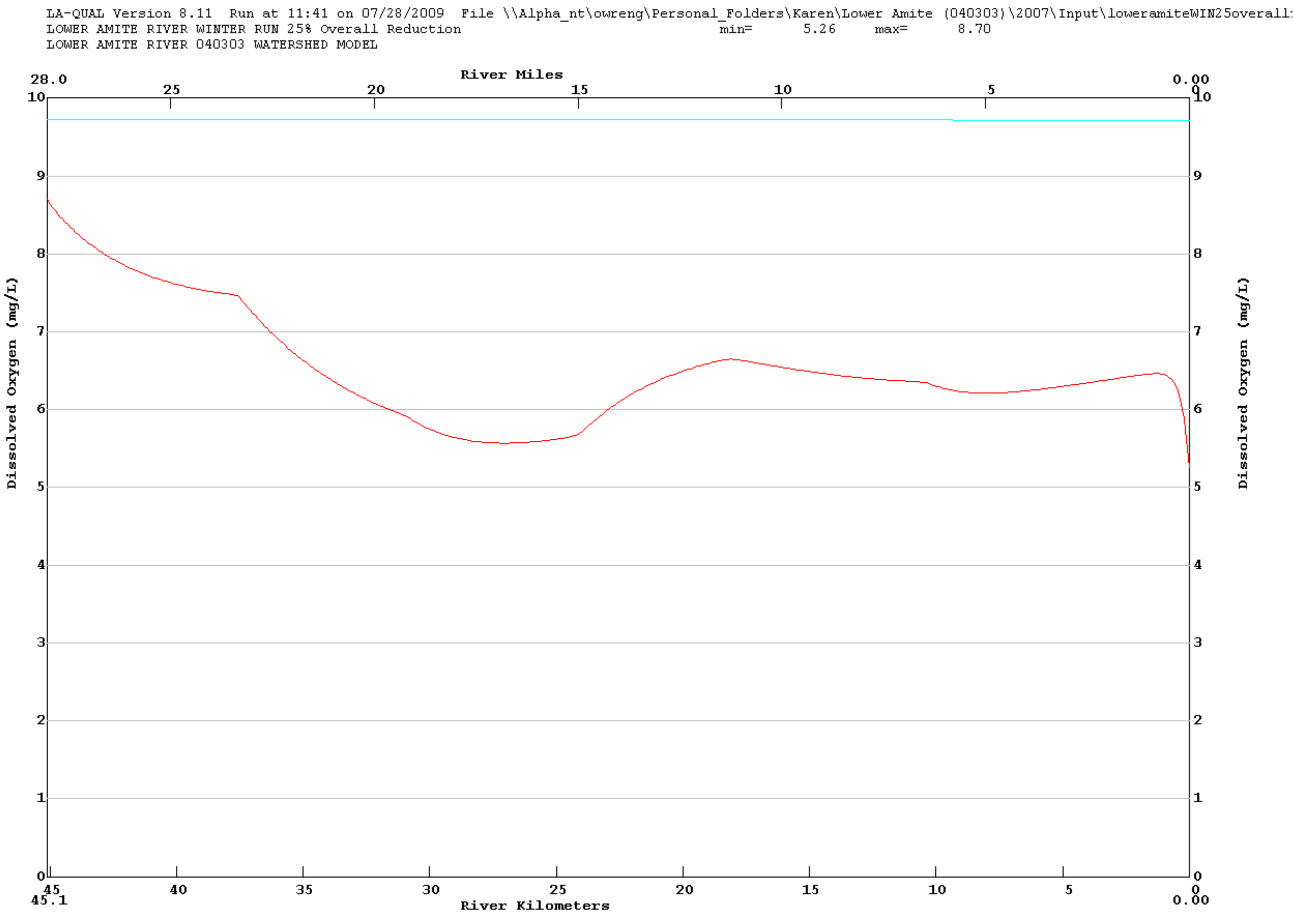


Table 7. Summary of Calibration Model Sensitivity Analysis

SENSITIVITY ANALYSIS SUMMARY

:MAINSTEM
LOWER AMITE RIVER FINAL CALIBRATION RUN

Plot 1   Base Model Minimum DO = 2.94

Parameter	%Param Chg	Min D.O.	%D.O. Chg	%Param Chg	Min D.O.	%D.O. Chg
Stream Baseflow	30.	3.07	4.3	-30.	2.66	-9.4
Initial Chorophyll a	30.	2.94	0.0	-30.	2.94	0.0
Stream Velocity	30.	2.78	-5.6	-30.	3.02	2.8
Initial Temperature	2.	2.56	-12.8	-2.	3.30	12.3
CBOD Aerobic Decay Rate	30.	2.70	-8.0	-30.	3.15	7.0
CBOD2 Aerobic Decay Rate	30.	2.80	-4.8	-30.	3.10	5.6
CBOD Settling Rate	30.	2.96	0.7	-30.	2.92	-0.8
CBOD2 Settling Rate	30.	2.94	0.0	-30.	2.94	0.0
NBOD Decay Rate	30.	2.86	-2.6	-30.	3.02	2.8
NBOD Settling Rate	30.	2.96	0.8	-30.	2.92	-0.8
Benthal Demand	30.	2.52	-14.3	-30.	3.24	10.3
Stream Dispersion	30.	2.94	0.1	-30.	2.90	-1.4
Stream Reaeration	30.	3.48	18.4	-30.	1.81	-38.3
Headwater Flow	30.	2.94	0.0	-30.	2.94	0.0
Headwater DO	30.	2.94	0.0	-30.	2.94	0.0
Headwater CBOD	30.	2.94	0.0	-30.	2.94	0.0
Headwater CBOD2	30.	2.94	0.0	-30.	2.94	0.0
Headwater NBOD	30.	2.94	0.0	-30.	2.94	0.0
Stream Depth	30.	2.38	-18.9	-30.	3.44	17.0
Wasteload Flow	30.	2.96	0.7	-30.	2.79	-5.1
Wasteload Temperature	2.	2.94	0.0	-2.	2.94	0.0
Wasteload DO	30.	2.98	1.5	-30.	2.68	-8.9
Wasteload CBOD	30.	2.80	-4.7	-30.	2.96	0.5
Wasteload CBOD2	30.	2.86	-2.7	-30.	2.95	0.5
Wasteload NBOD	30.	2.90	-1.2	-30.	2.95	0.4
Lower Boundary Temperature	2.	2.94	0.0	-2.	2.94	0.0
Lower Boundary DO	30.	2.94	0.0	-30.	2.57	-12.6
Lower Boundary CBOD	30.	2.94	0.0	-30.	2.94	0.0
Lower Boundary CBOD2	30.	2.94	0.0	-30.	2.94	0.0
Lower Boundary NBOD	30.	2.94	0.0	-30.	2.94	0.0

A calibrated water quality model and projection models were developed to quantify the load reductions which would be necessary in order for Lower Amite River, subsegment 040303 to comply with its established water quality standards and criteria. This report presents the results of that analysis.

A discharger inventory was conducted using the LDEQ EDMS and TEMPO systems. There are eight permitted wastewater dischargers located in this subsegment. The existing point sources have little to no impact on the main stem of the Lower Amite River and require no changes to their permitted discharges. However, in order to reduce the loading in this subsegment in a fair and consistent manner, the limits for these facilities may be modified to match limits established for facilities of comparable size and type for upstream subsegments.

LDEQ is utilizing a phased TMDL approach for Lower Amite River as shown in Table 1. This approach provides LDEQ with the opportunity to revise the DO criteria and at the same time, allows LDEQ to develop meaningful and implementable DO TMDLs based upon the appropriate DO criteria and in accordance with the Consent Decree deadlines. At the same time, it will lead to improved water quality while providing local governments and businesses the opportunity to prepare and adjust to the new permit requirements that will be implemented as a result of the TMDLs developed in Phases I and II.

Phase I will include the development of loading values for the existing DO criteria for the Lower Amite River. However, full implementation of permit limits will occur in a phased manner. Phase I will serve as the first step towards meeting the DO criteria. This approach gives local governments and stakeholders time to make the necessary adjustments to meet these limits. During Phase I, implementation of permit limits will occur in a according to the following strategy:

Phase I Permit Implementation

All TMDL, permitting, and enforcement activities will be conducted in accordance with the Clean Water Act, the Louisiana Environmental Regulatory Code, and applicable state laws.

1. New discharges of oxygen-demanding loads:

   In general, LDEQ may not be able to permit additional discharges of oxygen-demanding loads due to the impaired status of the waterbody. However, in the event that one the following requirements can be attained, LDEQ may permit a new discharge. The typical permit limits will be 5 mg/L BOD_5 / 2 mg/L NH_3 / 5 mg/L DO. Such new facilities may be required to submit an environmental impact assessment to LDEQ's permitting staff, which will conduct a thorough evaluation of the proposed facility based on environmental impacts, economic benefits, an analysis of alternatives, and other pertinent factors.

   a. The facility demonstrates that it will provide a significant load reduction of man-made oxygen-demanding constituents to the impaired watershed(s) serviced by the facility. The facility must also contribute to a reduction in the number of facilities discharging to the watershed(s). Facilities that may be considered for permits under this provision include, but are not limited to:

      i. A facility that will provide improved sewage treatment to multiple subdivisions previously serviced by wastewater treatment plants that are incapable of treating to tertiary limits.

      ii. A facility that will provide sewage treatment to previously unsewered areas in which many of the sanitary discharges from permitted facilities and individual home treatment units were entering an impaired watershed. As a result, the facility would be expected to provide more efficient treatment to the wastewater and reduce the net loading of oxygen-demanding substances in the watershed.

b. The facility demonstrates that its wastewater will not leave the facility or its property. Significant stormwater events do not apply to this provision. For the purpose of this provision, a significant stormwater event is defined the 25 year, 24 hour rainfall event or its numerical equivalent, as defined by the Southern Regional Climate Center.

   i. Facilities that may be considered under this provision include, but are not limited to:

      d. Effluent reduction systems that have been approved by the Louisiana Department of Health and Hospitals.

      e. Wastewater treatment plants equipped with overland flow systems in which the effluent will not leave the facility.

      f. Wastewater treatment plants equipped with holding ponds that will retain the effluent such that the effluent will not leave the facility.

   ii. LDEQ recognizes that some local governments are in the process of building or expanding regional sewage collection and treatment systems. In such areas, LDEQ may, on a limited basis, grant permits of limited durations to facilities that agree to tie into a regional collection and treatment system when it becomes available. LDEQ must have absolute assurance that the regional collection system will be available to the facility and the facility will connect to the regional collection system on or before the expiration date of the permit. Such assurance may include a formal agreement between the facility, the owner and operator of the regional wastewater treatment system, and LDEQ. The regional system must have the capacity to treat the additional wastewater. Such a permit may have a duration of less than five years or it may have a five year duration with interim permit limits. The permit will be written based on projected completion dates for the construction of the collection system. The facility will be required to cease all wastewater discharges to the Lower Amite River or connecting waterbodies and transfer the discharge to the regional collection system once the permit or interim limits expire or the collection system is available to the facility, whichever comes first. If the permit or interim limits expire, but, due to unforeseen circumstances, the availability of the collection system has been temporarily delayed, the duration of the permit or interim limits may be extended. If the availability of the collection system has been indefinitely delayed, the facility may be required to cease all discharges to Subsegment 040303. Such facilities may resort to options covered in item 1.b.i. above.

c. LDEQ reassesses Subsegment 040303 (Lower Amite River). LDEQ determines that Subsegment 040303 is meeting the appropriate DO criteria and designated uses.

2. Existing Discharges of oxygen demanding loads:

   The facilities discharging within subsegment 040303 were determined to have no significant inpact on the Lower Amite River. Therefore, the facilities listed in Table 3 will keep their existing permit limits. Existing facilities discovered to be discharging oxygen-demanding loads without LPDES permits as of the TMDL approval date are to be permitted in accordance with the limits established for existing facilities with permits. Unpermitted facilities that are newly activated or reactivated and discharging after the TMDL approval date may be subjected to enforcement actions and may be required to tie into regional collection and treatment systems, if available, or modify their treatment system to some to meet more stringent permit limits.

3. Nutrient monitoring (i.e. reporting for Total Nitrogen and Total Phosphorus) will be required for individual permits. Nutrient monitoring will be added to each general permit series (LAG530000, LAG540000, LAG560000, and LAG570000) upon the next scheduled renewal of each series.

Phase II will be developed based on the outcome of an ecoregion-based use attainability analysis (UAA) that is currently under development. This UAA is expected to propose new DO criteria for many of the Pontchartrain Basin TMDLs that are currently being developed. This new DO criteria is expected to be developed and promulgated within the next two to three years.

In the event the new criteria is not developed and promulgated within five years from the TMDL approval date, LDEQ intends to proceed in the following manner:

Case 1: The UAA study indicates that the current DO criterion is appropriate - the TMDL will be fully implemented based on the existing DO criteria.
Case 2: The UAA is not likely to be completed and/or approved - the TMDL will be fully implemented based on the existing DO criteria.
Case 3: The UAA is in process and is expected to be approved – Phase II of the TMDL will be postponed for a maximum period of 2 years. If the UAA has not been completed at the end of this period, the UAA status will be reviewed again according to Cases 1 - 3.

LDEQ recognizes there may be many unpermitted sources of oxygen-demanding loading within the Lake Pontchartrain Basin. These sources may include unpermitted facilities (privately owned treatment units for subdivisions or businesses). LDEQ has been locating unpermitted facilities and updating location information on permitted facilities in the Pontchartrain Basin. The unpermitted facilities are required to apply for the appropriate NPDES (National Pollutant Discharge Elimination System) permits. These unpermitted sources of oxygen-demanding loading may also include individual treatment units for residential homes and small businesses. The ability to accurately quantify the loads provided from these systems is extremely difficult due to lack of reliable information regarding the number of units and the loading provided by each individual unit. These unpermitted sources of loading add to the uncertainty of this TMDL and provide additional justification for the use of the phased TMDL approach.

Modeling has shown that reduced levels of stream flow may being a like contributor to the low DO impairment for Subsegment 040303. The Amite River Diversion Canal and the associated weir may be contributing to the reduced stream flow in Subsegment 040303. The canal and weir were originally built to reduce flooding. Research has indicated the weir, as originally designed, was supposed to divert 70% of the flow down the Lower Amite River and 30% of the flow down the Amite River Diversion Canal during normal flow conditions. Over time this weir has become ineffective due to erosion and/or subsidence. Presently, over 80% of the flow now routes down the Diversion Canal and less than 20% of the flow routes down the Lower Amite River. Lack of streamflow in Subsegment 040303 as a probable cause of the low DO impairment. Lack of flow has a significant impact on the reaeration of this stream. This in turn effects the dissolved oxygen levels that can be maintained.

LDEQ recommends that repairs to the diversion weir located near the head of the Amite River Diversion Canal may re-establish a more reasonable flow in Subsegment 040303. An increase in flow may increase the reaeration potential of the Lower Amite River. As a result, the load reductions required to meet the DO criteria may be decreased. Once the weir is repaired, the subsegment should resampled and reassessed. According to additional model runs, if the weir were repaired, only a 5% reduction overall load would be required to meet a dissolved oxygen standard of 2.3 mg/L. For a 5 mg/L dissolved oxygen standard, the percent reduction of overall load would be 50% rather than the current 60%.

Based on a summer DO criterion of 2.3 mg/L and 5.0 mg/L in the winter, Phase II will require a 25% reduction of the overall loading, without any repairs to the weir.

Louisiana does not have numeric nutrient criteria at the present time. The original nutrient impairments for waterbodies in the Pontchartrain Basin were not based on quantitative assessments of historical nutrient data. The impairments were based on evaluative assessments that may have included dissolved oxygen. LDEQ and EPA plan to reevaluate the previous nutrient impairments in the Pontchartrain Basin. As a result, both the EPA and LDEQ expect the nutrient impairments to change from category 5 (impairment exists; TMDL required) to category 3 (insufficient data) for Louisiana's 2010 Integrated Report. Therefore LDEQ believes that TMDLs for dissolved oxygen should adequately address any potential nutrient impairments, in the absence of numeric nutrient criteria and quantitative assessments.

LDEQ is developing numeric nutrient criteria for waterbody types based on ecoregions in accordance with LDEQ's plan "Developing Nutrient Criteria for Louisiana 2006" which can be found at:

http://www.deq.louisiana.gov/portal/Portals/0/planning/LA%20Nutrient%20Strategy%20Plan%20Final%20FOR%20WEB.pdf.

Water body types for nutrient criteria development in Louisiana are 1) inland rivers and streams; 2) freshwater wetlands; 3) freshwater lakes and reservoirs; 4) big rivers and floodplains/boundary rivers and associated water bodies; and 5) estuarine and coastal waters (including up to Louisiana's three mile boundary in the Gulf of Mexico). Proposed approaches for nutrient criteria development are currently under review by LDEQ and EPA. Nutrient criteria can be implemented upon state promulgation and EPA approval as per 40 CFR 131.21.

Upon development of nutrient criteria, a subsequent quantitative assessment of the waterbodies, and the development of full nutrient models, nutrient limits may be established for all facilities discharging to impaired waterbodies in the Pontchartrain Basin. LDEQ recommends that all facilities discharging to impaired waterbodies take a proactive approach and prepare for the possibility of nutrient limitations in their wastewater discharge permits in the near future. Such a proactive approach should include nutrient monitoring and documentation through facility Discharge Monitoring Reports (DMRs) in order to assess their nutrient loads and the need to modify their treatment processes for nutrient removal.

The LDNR is conducting several projects in the area of the Lower Amite River subsegment (040303). One such project is the Amite River Diversion Canal Modification Project. This project will include the construction of gaps in the existing dredged material banks of the Amite River Diversion Canal. The object is to allow floodwaters to introduce additional nutrients and sediment into the western portions of the Maurepas Swamp. Another such project is the Mississippi River Diversion at convent/Blind Rivers. This project includes the construction of a small siphon(s) over the Mississippi River levee or a concrete multibarrel box culvert in the Mississippi River in the vicinity of Convent, LA. The objective is to introduce additional freshwater, nutrients, and fine sediment from the Mississippi River into Maurepas Swamp and the surrounding areas. Neither project is expected to significantly impact water quality in the Lower Amite River subsegment.

LDEQ has developed this TMDL to be consistent with the state antidegradation policy (LAC 33:IX.1109.A).

LDEQ will work with other agencies such as local Soil Conservation Districts to implement agricultural best management practices in the watershed through the 319 programs. LDEQ will also continue to monitor the waters to determine whether standards are being attained.

In accordance with Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a comprehensive program for monitoring the quality of the state's surface waters. The LDEQ collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial Integrated Report. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ is continuing to implement a watershed approach to surface water quality monitoring. In 2004 a four year sampling cycle replaces the previous five year cycle. Approximately one quarter of the states watersheds will be sampled each year so that all of the state's watersheds will be sampled within the four year cycle. This will allow LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated by LDEQ and approved by EPA, waterbodies may be added to or removed from the 303(d) list.

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