LAKE PEIGNEUR TMDLS FOR DISSOLVED OXYGEN AND NUTRIENTS

April 19, 2002

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FOR DISSOLVED OXYGEN AND NUTRIENTS

SUBSEGMENT 060909

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources (NPS) discharging to the waterbody. This report presents TMDLs that have been developed for dissolved oxygen (DO) and nutrients for Lake Peigneur (Subsegment 060909), located in the Vermilion-Teche basin in southern Louisiana.

Lake Peigneur was listed on the Modified Court Ordered 303(d) List for Louisiana as not fully supporting the designated uses of primary and secondary contract recreation and the propagation of fish and wildlife and was ranked as priority #1 for TMDL development. Lake Peigneur was not included on the 1998 303(d) List, but was later added to the list based on LDEQ assessment data collected during June through December 1998. The suspected causes for impairment cited in the 303(d) List included organic enrichment/low DO and nutrients. The water quality standard for DO is 5 mg/L.

A water quality model (LA-QUAL) was set up to simulate DO, carbonaceous biochemical oxygen demand (CBOD), ammonia nitrogen, and organic nitrogen in Lake Peigneur. The model was calibrated using LDEQ assessment data collected during June – December 1998, data from FTN's synoptic survey in September 2000, and other various information obtained from LDEQ, Corps of Engineers, US Geological Survey (USGS), and local entities. There was no intensive survey data available in this subsegment. The projection simulation was run at critical flows and temperatures to address seasonality as required by the Clean Water Act. Reductions of existing loads from both point sources and NPS were required for the projection simulation to show the DO standard of 5 mg/L being maintained. In general, the modeling in this study was consistent with guidance in the Louisiana TMDL Technical Procedures Manual.

The TMDL for oxygen demanding substances (CBOD, ammonia nitrogen, organic nitrogen, and sediment oxygen demand (SOD)) was calculated using the results of the projection simulation. Both implicit and explicit margins of safety (MOS) were included in the TMDL calculations. The nutrient TMDLs were developed based on Louisiana's water quality standard for nutrients, which states that "the naturally occurring range of nitrogen to phosphorus ratios shall be maintained." The nutrient TMDL was calculated using allowable nitrogen loadings from the projection simulation and applying a naturally occurring nitrogen to phosphorus ratio to determine the allowable phosphorous loadings.

The TMDLs for this subsegment include a wasteload allocation (WLA) for the point sources with minor oxygen demanding discharges within the subsegment. No treatment upgrades are recommended because the oxygen demanding point source discharges are small and exhibit minimal impact on the DO in Lake Peigneur. Nonpoint source reductions of 20% are required in the Lake Peigneur subsegment to meet the water quality standard for DO.

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1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for dissolved oxygen (DO) and nutrients for Lake Peigneur (subsegment 060909). The subsegment was listed on the February 29, 2000 Modified Court Ordered 303(d) List for Louisiana (EPA 2000a) as not fully supporting the designated use of propagation of fish and wildlife. The subsegment was not included on the 1998 303(d) List (LDEQ 1998), but was later added to the list based on LDEQ assessment data collected during June – December 1998. The suspected sources and suspected causes for impairment in the 303(d) List are included in Table 1.1. Lake Peigneur was ranked as priority #1 for TMDL development. The TMDLs in this report were developed in accordance with Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7. The 303(d) Listings for other pollutants in this subsegment are being addressed by EPA and the Louisiana Department of Environmental Quality (LDEQ) in other documents.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern, and the LA is the load that is allocated to nonpoint sources (NPS). The MOS is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions, data inadequacies, and future growth.

Table 1.1. Summary of 303(d) listing of Lake Peigneur (EPA 2000a).

Subsegment Number	Waterbody Description	Suspected Sources	Suspected Causes	Priority Ranking (1 = highest)
060909	Lake Peigneur	Acid mine drainage Non-irrigated crop production Package plants (small flows) Petroleum activities Septic Tanks Surface runoff	Siltation Suspended solids Turbidity Nutrients Organic enrichment/low DO Pathogen indicators	1

2.0 STUDY AREA DESCRIPTION

2.1 General Information

Lake Peigneur is an 1125-acre lake located in Iberia Parish, just north of Delcambre, LA and south of Lafayette, LA. A map of the study area is included in Appendix A. Lake Peigneur's contributing drainage area is primarily from the north. The total watershed includes approximately 10.2 square miles of overland drainage, and is part of the Vermilion-Teche Basin. The area contributing the freshwater inflow to Lake Peigneur is dominated by agriculture, primarily corn, soybeans, and milo. Some urban/suburban areas are located in these agricultural areas. The lake outlet is to the south via the Delcambre Canal, which is tidally influenced. Therefore Lake Peigneur receives freshwater from the northern overland drainage, and receives some saltwater intrusion via the Delcambre Canal. The land use data for the study area is shown in Table 2.1.

Table 2.1. Land uses in subsegment 060909 based on GAP data (USGS 1998).

Land Use Type	% of Total Area
Fresh Marsh	6.8%
Saline Marsh	0.0%
Wetland Forest	5.2%
Upland Forest	3.0%
Wetland scrub/shrub	0.0%
Upland scrub/shrub	0.0%
Agricultural	13.5%
Urban	9.8%
Barren	0.0%
Water	61.7%
TOTAL	100.0%

The typical depth of Lake Peigneur is 3 feet. There are several deep holes located in the lake, including one which has historical significance. In November 1980 there was a large salt mine located on the lake and an explosion blew a hole in the lake approximately 200 feet deep. According to a local source the lake immediately emptied into the salt mine, but was refilled within a matter of days. Luckily no fatalities were reported and the salt mine is no longer in operation. The large crater left by the explosion is not visible but it is reported to be quite deep. This crater is located near Jefferson Island, on the southeast corner of the lake. There are no control structures on Lake Peigneur, and it does not serve as a source of irrigation water. However some of the canals draining into the lake do provide irrigation water when their salinity levels are not elevated.

Table 2.2. Water quality standards and designated uses (LDEQ 2000a).

Subsegment Number	060909
Waterbody Description	Lake Peigneur
Designated Uses:	ABC
Criteria:	
Chloride	N/A
Sulfate	N/A
DO	5 mg/L (year round)
pH	6.5 – 9.0
Temperature	35˚ C
TDS	N/A

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.

2.2 Water Quality Standards

The numeric water quality standards and designated uses for Lake Peigneur are shown in Table 2.2. The primary numeric standard for the TMDLs presented in this report is the DO standard of 5 mg/L year round. Although the chloride concentrations in Lake Peigneur are typically 800 to 1200 mg/L (based on 1998 LDEQ data at station 0688), the subsegment is not classified as estuarine.

For nutrients, there are no specific numeric criteria, but there is a narrative standard that states “The naturally occurring range of nitrogen-phosphorus ratios shall be maintained.... Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters.” (LDEQ 2000a).

2.3 Identification of Sources

2.3.1 Point Sources

A list of NPDES permits that were identified in or near the Lake Peigneur subsegment is included in Appendix B. These permits were identified by searching two sources of information. The primary source was a listing of all the permits in the Vermilion-Teche basin (basin number 06) from the LDEQ static database. The secondary source was a listing of all the permits in the Vermilion-Teche basin (hydrologic units 08080103 and 08080102) from EPA's Permit Compliance System (PCS) on the EPA website. All of the information concerning permit parameters and design flow in Appendix B was obtained by manually retrieving hard copies of the permit files from LDEQ's file room.

Facilities without oxygen demanding parameters in their permit were assumed to exert a negligible oxygen demand in the receiving stream; therefore, these facilities were excluded from any further consideration in this TMDL. All of the facilities with oxygen demanding parameters in their permit were included in the TMDL calculations, but none of them were considered large enough to be modeled explicitly. The remaining oxygen demanding discharges were included in the TMDL by adding their oxygen demand to the total loading simulated in the model.

2.3.2 Nonpoint Sources

Several nonpoint sources were cited as suspected causes of impairment for Lake Peigneur in the 303(d) List (Table 1.1). These nonpoint sources include acid mine drainage, non-irrigated crop production, petroleum activities, septic tanks, and surface runoff.

2.4 Previous Data and Studies

Listed below are previous water quality data and studies in or near the Lake Peigneur subsegment. Locations of selected LDEQ ambient monitoring stations are shown in Appendix A.

1) Data collected by LDEQ for "Lake Peigneur" (station 0688) for mid-June to December 1998. This station is located on Lake Peigneur just west of Jefferson Island, LA.

2) Data collected by LDEQ on Delcambre Canal east of Abbeville, LA (Station 0315) from 1991 through 1998. The station is located at the Highway 14 bridge in Delcambre, LA.

3) Soil Survey Maps supporting a watershed plan developed in the 1970's by the Natural Resource Conservation Service (NRCS) in New Iberia, Iberia Parish, LA (USDA-NRCS).

4) Lake Peigneur TMDL for Fecal Coliform (EPA 2000b).

3.0 CALIBRATION OF WATER QUALITY MODEL

3.1 Model Setup

In order to evaluate the linkage between pollutant sources and water quality, a computer simulation model was used. The model used for these TMDLs was LA-QUAL (version 3.02), which was selected because it includes the relevant physical, chemical, and biological processes and it has been used successfully in the past for other TMDLs in Louisiana. The LA-QUAL model was set up to simulate organic nitrogen, ammonia nitrogen, ultimate carbonaceous biochemical oxygen demand (CBODu), and DO. Phosphorus and algae were not simulated.

This model was set up as a single reach/single element model. Both the length and width were set equal to 2.13 km, which is the square root of the surface area. No tributaries were included in the model. A vector diagram of the model is shown in Appendix C.

3.2 Calibration Period

An intensive field survey was not performed for the study area due to schedule and budget limitations. A synoptic survey of the study area was performed by FTN in September 2000, but only limited data were collected during that survey. The model was calibrated to historical conditions when hydrologic and water quality data were available. The only historical period for which water quality data was collected on Lake Peigneur was the June through December 1998 period when LDEQ collected their assessment data. The LDEQ station for Lake Peigneur is station 0688

The water quality data for this period were retrieved from the LDEQ website. These data are listed in tabular form in Appendix D and the temperature and DO are plotted in Appendix D. The two conditions that usually characterize critical periods for DO are high temperatures and low flows. High temperatures decrease DO saturation values and increase rates for oxygen demanding processes (biochemical oxygen demand (BOD) decay, nitrification, and sediment oxygen demand (SOD)). The purpose of selecting a critical period for calibration is so that the model will be calibrated as accurately as possible for making projection simulations for critical conditions.

Based on the data in Appendix D, the calibration period was selected as August 12 through August 26, 1998 (Julian day 224 to 238). This period represented the most critical period for DO.

The calibration targets (i.e., the concentrations to which the model was calibrated) for each parameter for each LDEQ station were set to the average of the concentrations measured during the calibration period with the exception of organic nitrogen. The organic N calibration value was calculated using the average total Kjeldahl nitrogen (TKN) measured during 1998.

3.3 Temperature Correction of Kinetics (Data Type 4)

The temperature correction factors used in the model were consistent with the Louisiana Technical Procedures Manual (the "LTP"; LDEQ 2000b). These correction factors were:

- Correction for BOD decay: 1.047 (value in LTP is same as model default)
- Correction for SOD: 1.065 (value in LTP is same as model default)
- Correction for ammonia N decay: 1.070 (specified in Data Group 4)
- Correction for organic N decay: 1.020 (not specified in LTP; model default used)
- Correction for reaeration: automatically calculated by the model

3.4 Hydraulics and Dispersion (Data Types 9 and 10)

The hydraulics were specified in the input for the LA-QUAL model using the power functions (width = a * Q^b and depth = c * Q^d + e). Under low flow conditions the depth and width of the reach in the model can be assumed to be independent of flow rate. Therefore, the system was modeled with constant depth and width. This was specified in the model by setting the coefficients and exponents as follows (values for each reach are shown in Appendix E):

- width coefficient (a) = 0.00
- width exponent (b) = 0.00
- width constant (c) = 2,133 m
- depth coefficient (d) = 0.00
- depth exponent (e) = 0.00
- depth constant (f) = 1.0 m

Widths and depths were estimated primarily from topographic maps and information gathered from local sources (see Appendix E).

Tidal dispersion was accounted for by specifying a dispersion coefficient in data group 10 of the model input. The dispersion coefficient for Lake Peigneur was set to 12 m^2/sec, which is based on the values used for the New Iberia Southern Drainage Canal (FTN 2001), which is hydraulically similar to the Lake Peigneur system.

3.5 Initial Conditions (Data Type 11)

The primary parameter that is specified in the initial conditions for LA-QUAL is the temperature for each reach (because temperature was not being simulated). The temperature for Lake Peigneur was set to the average of the measured values at LDEQ station 0688 during the calibration period. The input data and sources are shown in Appendix E.

One other parameter that was specified in the initial conditions was the salinity. Salinity was not simulated in the model (i.e., it was not "turned on" in Data Group 2), but a salinity value was entered as an initial condition so the model would use that value in the calculations for DO saturation. Because salinity data were not included in the LDEQ monitoring data for this subsegment, a salinity value was estimated by averaging the conductivity measurements from the LDEQ data during the calibration period and using a conversion between conductivity and salinity (equation 3-9b in EPA 1985).

For other constituents not being simulated, the initial concentrations were set to zero; otherwise, the model would have assumed a fixed concentration of those constituents and the model would have included the effects of the unmodeled constituents on the modeled constituents (e.g., the effects of algae on DO).

3.6 Water Quality Kinetics (Data Types 12 and 13)

Kinetic rates used in LA-QUAL include reaeration rates, SOD, carbonaceous biochemical oxygen demand (CBOD) decay rates, nitrification rates, and mineralization rates (organic nitrogen decay). The values used in the model input are shown in Appendix D.

Reaeration was specified in the model using a surface transfer coefficient. Because the lake is wide and not sheltered from the wind, the effect of wind on reaeration was included. A wind-aided surface transfer coefficient was calculated using measured wind speeds from the cities of New Orleans and Lake Charles. These wind speeds were averaged over the calibration period, corrected to a height of 0.1 m, and then used to calculate a wind-aided surface transfer coefficient of 0.90 m/day.

The SOD rate was developed through iteration in the calibration. The SOD rate for Lake Peigneur was adjusted so that the predicted DO concentration was similar to the calibration target value. An SOD rate of 1.0 was required to calibrate the Lake Peigneur model with respect to observed DO values. The CBOD decay rate was set to 0.10/day based on LDEQ's guidance for uncalibrated modeling of the Mermentau and Vermilion-Teche basins (LDEQ 2000c) and information in the "Rates, Constants, and Kinetics" publication (EPA 1985).

The mineralization rate (organic nitrogen decay) in the model was set to 0.02/day for the lake. This value was based on information in the "Rates, Constants, and Kinetics" publication (EPA 1985). The nitrification rate was set to 0.10/day, which is consistent with guidance in the LTP based on depth. The combination of these rates is consistent with LDEQ's guidance for uncalibrated modeling of the Mermentau and Vermilion-Teche basins (LDEQ 2000c). The LDEQ guidance specified a default rate of 0.05/day for nitrogenous biochemical oxygen demand (NBOD) decay, which represents the combination of mineralization and nitrification.

One other input value was specified for characterizing the nitrification process. In the program constants section of the model input file (data type 3), the nitrification inhibition option was set to 1 instead of the default of option number 2. With the default option, the nitrification rate drops rapidly when the DO drops below 2 mg/L, which results in an unrealistic build up of ammonia nitrogen at low DO values. Option number 1 provides nitrification inhibition that is similar to what is used in other water quality models such as QUAL2E and WASP (FTN 2000a).

3.7 Nonpoint Source Loads (Data Type 19)

The NPS loads that are specified in the model can be most easily understood as resuspended load from the bottom sediments and are modeled as SOD, benthic ammonia source rate, CBODu loads, and organic nitrogen loads. The SOD (specified in data type 12), the benthic ammonia source rates (specified in data type 13), and the mass loads of organic nitrogen and

CBODu (specified in data type 19) were all treated as calibration parameters; their values were adjusted until the model output was similar to the calibration target values. The values used as model input are shown in Appendix E.

3.8 Headwater and Tributary Flow Rates (Data Types 20 and 24)

The inflows to Lake Peigneur were based on a contributing drainage of 10.2 square miles. The drainage area boundary was developed with the assistance of the New Iberia NRCS and a US Geological Survey (USGS) topographical map. A representative flow per square mile was developed using the average daily flow data during the calibration period at USGS gaging station 08012300, Bayou Queue de Tortue at Riceville, LA. The value (0.83 cfs/sq mi) was then applied to the Lake Peigneur drainage area to calculate the inflow of 8.47 cfs (0.24 m^3/s). Daily data for the calibration period are listed in Appendix D and values used as model input are shown in Appendix E.

3.9 Headwater and Tributary Water Quality (Data Types 21 and 25)

The temperature used in the headwater inflow was the average temperature at the LDEQ station for Lake Peigneur during the calibration period. Concentrations of DO, CBODu, organic nitrogen, and ammonia nitrogen specified in the model were based on average concentrations from eight stations sampled by FTN during the 2000 synoptic survey. These eight stations represented flow from agricultural areas similar to the Lake Peigneur watershed. The organic nitrogen value was set to the difference of TKN minus ammonia nitrogen. The CBODu was estimated as $CBOD_5$ times 4.5, which was the median ratio of CBODu to $CBOD_5$ from LDEQ's long-term BOD analyses during 2000. The values used as model input are shown in Appendix E.

3.10 Point Source Inputs (Data Types 24 and 25)

No point sources were modeled explicitly in the Lake Peigneur model.

3.11 Lower Boundary Condition (Data Type 27)

Because longitudinal dispersion was explicitly specified in data type 10, the model required input values for downstream boundary conditions. The downstream boundary of Lake Peigneur is Delcambre Canal. Observed data were available for the Delcambre Canal during the calibration period. This measured data included DO, TKN, and nitrate+nitrite. Although not available during the specific calibration period, TOC was measured routinely from 1991 to 1998; therefore a historical average was calculated. The input values for CBODu, organic nitrogen and ammonia nitrogen were calculated using measured data for TKN and TOC as described below.

CBODu was estimated from TOC and ammonia nitrogen was estimated from TKN. Relationships between these parameters were developed using data from the FTN synoptic survey in September 2000 and data from LDEQ's long term BOD analyses during 2000. The median ratio of TOC to $CBOD_5$ from the FTN synoptic survey data was 6.0 and the median ratio of CBODu to $CBOD_5$ from the LDEQ long term BOD data was 4.5. Combining these ratios yielded the following relationship that was used to develop model inputs:

CBODu = 0.75 * TOC

Also, the median ratio of ammonia nitrogen to TKN from the FTN synoptic survey data was 0.17. This value was similar to the median ratio of ammonia nitrogen to TKN from the LDEQ data. The organic nitrogen was then determined as TKN minus ammonia nitrogen. This yielded the following relationships that were used to develop model inputs:

Ammonia nitrogen = 0.17 * TKN
Organic nitrogen = 0.83 * TKN

3.12 Model Results for Calibration

Plots of predicted and observed water quality for the calibration are presented in Appendix F and a printout of the LA-QUAL output file is included as Appendix G. The calibration was considered to be acceptable based on the amount of data that were available.

4.0 WATER QUALITY MODEL PROJECTION

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Therefore, the calibrated model was used to project water quality for critical conditions. The identification of critical conditions and the model input data used for critical conditions are discussed below.

4.1 Identification of Critical Conditions

Section 303(d) of the Federal Clean Water Act and EPA's regulations at 40 CFR 130.7 both require the consideration of seasonal variation of conditions affecting the constituent of concern and the inclusion of a MOS in the development of a TMDL. For the TMDLs in this report, analyses of LDEQ long-term ambient data were used to determine critical seasonal conditions. A combination of implicit and explicit MOS was used in developing the projection model.

Critical conditions for DO have been determined for the Vermilion-Teche basin in previous TMDL studies. The analyses concluded that the critical conditions for stream DO concentrations occur during periods with negligible nonpoint runoff, low stream flow, and high stream temperature.

When the rainfall runoff (and nonpoint loading) and stream flow are high, turbulence is higher due to the higher flow and the stream temperature is lowered by the cooler precipitation and runoff. In addition, runoff 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. DO saturation values 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 DO but not necessarily periods of high BOD decay.

LDEQ interprets this phenomenon in its TMDL modeling by assuming that the annual nonpoint loading, rather than loading for any particular day, is responsible for the accumulated benthic blanket of the stream, which is, in turn, expressed as SOD and/or resuspended BOD in the model. This accumulated loading has its greatest impact on the stream during periods of higher temperature and lower flow.

According to the LTP, critical summer conditions in DO TMDL projection modeling are simulated by using the annual 7Q10 flow or 0.1 cfs, whichever is higher, for all headwaters, and 90th percentile temperature for the summer season. Model loading is from point sources, perennial tributaries, SOD, and resuspension of sediments. In addition, all point sources are assumed to be discharging at design capacity.

In reality, the highest temperatures occur in July-August, the lowest stream flows occur in October and November, and the maximum point source discharge occurs following a significant rainfall, i.e., high-flow conditions. The combination of these conditions plus the impact of other conservative assumptions regarding rates and loadings yields an implicit MOS that is not quantified. Over and above this implicit MOS, an explicit MOS of 20% for point sources and 10% for NPS was incorporated into the TMDLs in this report to account for future growth and model uncertainty.

4.2 Temperature Inputs

The LTP (LDEQ 2000b) specified that the critical temperature should be determined by calculating the 90th percentile seasonal temperature for the waterbody being modeled. Because the LDEQ station in the study area has only 6 months of data, LDEQ data from another subsegment were used for this analysis. Long term temperature data from Delcambre Canal (LDEQ station 0315) were used to calculate a 90th percentile summer temperature of 31.0°C. However, the water temperatures for the Lake Peigneur station during June – December 1998 were cooler than temperatures in Delcambre Canal during that time. Therefore, the critical temperature for Lake Peigneur was estimated as the 90th percentile summer temperature for Delcambre Canal (31.0°C) minus the average temperature difference (1.4°C) during June through December 1998 between Delcambre Canal and Lake Peigneur. The critical temperature calculated for Lake Peigneur was 29.6°C. This value was specified in data type 11 in the model input and is shown in Appendix H.

Because Lake Peigneur has a year round standard for DO, a winter projection simulation was not performed. As discussed above, the most critical time of year for meeting a constant DO standard is the period of high temperatures and low flows (i.e., summer).

4.3 Headwater and Tributary Inputs

There are no USGS flow gages and no published 7Q10 flows for the inflow to Lake Peigneur. However, published 7Q10 values were available for the USGS gages for Bayou Bourbeau at Shuteston (07386500) and Bayou Carencro at Sunset (07386000). Both of these gages are in the Vermilion River basin and have a small drainage area where most of the flow is natural runoff rather than water that has been diverted from another basin. The published 7Q10 flow is zero for both of these gages (USGS 1980). Because the drainage areas for these gages (19 mi^2 for Bayou Bourbeau and 37 mi^2 for Bayou Carencro) are larger than the drainage area for the headwater inflow to Lake Peigneur (10.2 mi^2), the 7Q10 flow for the headwater was assumed to be zero. The LTP specifies that the critical flow rate for summer should be set to the 7Q10 flow or 0.1 cfs, whichever is greater. Therefore, the headwater flow rate in the projection simulation was set to 0.1 cfs.

For headwater quality, the DO was set to 90% saturation at the critical temperature (as specified in the LTP). All other water quality concentrations were the same as in the calibration model. The values used as model input are shown in Appendix H.

4.4 Point Source Inputs

There were no point source discharges that were explicitly included in the Lake Peigneur model.

4.5 Nonpoint Source Loads

Because the initial projection simulation was showing low DO values, the NPS loadings were reduced until all of the predicted DO values were equal to or greater than the water quality standard of 5.0 mg/L. The same percent reduction was applied to all components of the NPS loads (SOD, benthic ammonia source rates, and mass loads of CBODu and ammonia nitrogen). The values used as model input in the projection simulation are shown in Appendix H.

4.6 Downstream Boundary

For the projection simulation, the downstream boundary condition for temperature was set to the 90th percentile value for Delcambre Canal adjusted to reflect Lake Peigneur's influence. For DO, the downstream boundary condition was set to the water quality standard (5.0 mg/L) so that the model would not simulate an artificial DO sink due to dispersion with the downstream boundary. The values used as model input in the projection simulation are shown in Appendix H.

4.7 Reaeration

Reaeration for the projection simulation was calculated based on long-term average wind speeds for the months of May through October at New Orleans and Lake Charles (the same stations used for the calibration) were used to calculate a wind-aided reaeration coefficient in the same manner as for the calibration. The months of May through October represent the summer months, or critical summer period, per the LTP. The values used as model input in the projection simulation are shown in Appendix H.

4.8 Other Inputs

The only model inputs that were changed from the calibration to the projection simulation were the inputs discussed above in Sections 4.2 through 4.7. All of the other model inputs (e.g., hydraulic and dispersion coefficients, decay rates, etc.) were unchanged from the calibration simulation.

4.9 Model Results for Projection

Plots of predicted water quality for the projection are presented in Appendix I and a printout of the LA-QUAL output file is included as Appendix J.

For Lake Peigneur, a NPS load reduction of 20% was required to bring the predicted DO values to at least 5.0 mg/L. Reduction of the NPS loads was necessary because there are no point source loads that have an effect on the predicted DO.

The percentage reduction for NPS loads mentioned above represents a percentage of the entire NPS loading, not a percentage of the manmade NPS loading. The NPS loads in this report were not divided between natural and manmade because it would be difficult to estimate natural NPS loads for Lake Peigneur.

5.0 TMDL CALCULATIONS

5.1 DO TMDL

A total maximum daily load (TMDL) for DO has been calculated for Lake Peigneur based on the results of the projection simulation. The DO TMDL are presented as oxygen demand from CBODu, organic nitrogen, ammonia nitrogen, and SOD. A summary of the loads is presented in Table 5.1. TMDL calculations are shown in Appendix K

Table 5.1. DO TMDL for Subsegment 060909 (Lake Peigneur).

Source of Oxygen Demand	Oxygen demand (kg/day) from:				Total oxygen demand (kg/day)
	CBODu	Organic N	Ammonia N	SOD	
WLA for minor point sources	0.98	0	0.61	N/A	1.59
MOS for Point Sources	0.24	0	0.15	N/A	0.40
LA for Nonpoint Sources	6301	157	0.38	6009	12468
MOS for Nonpoint Sources	700	19	0.04	668	1386
Total maximum daily load	7002	176	1.19	6677	13856

The oxygen demand from organic nitrogen and ammonia nitrogen was calculated as 4.33 times the nitrogen loads (assuming that all organic nitrogen is eventually converted to ammonia). The value of 4.33 is the same ratio of oxygen demand to nitrogen that is used by the LA-QUAL model. For the SOD loads, a temperature correction factor was included in the calculations (in order to be consistent with LDEQ procedures).

The WLA for minor point sources represents the loads from one small oxygen demanding discharge that was not explicitly modeled. This WLA was based on current permit limits with no reductions. Because this discharge does not have a permit limit for ammonia nitrogen, the effluent concentration for ammonia nitrogen was assumed based on the BOD_5 permit limit and typical combinations of BOD_5 and ammonia nitrogen listed in the LTP (LDEQ 2000b).

Because the WLAs for minor point sources represented loads from small oxygen demanding discharges that were not simulated in the model, these loads were added to the modeled loads for the TMDL. The MOS for minor point sources was set to 20% of the total minor point source loading. The LAs for NPS were calculated as 90% of the NPS load simulated in the model. The other 10% of the NPS load simulated in the model was designated as an explicit MOS.

5.2 Nutrient TMDL

Because Lake Peigneur was on the 303(d) List for nutrients as well as DO (see Table 1.1), a nutrient TMDL was also developed. As discussed in Section 2.2, Louisiana has no numeric standards for nutrients, but has a narrative standard that states that “the naturally occurring range of nitrogen-phosphorus ratios shall be maintained” (LDEQ 2000a). For this TMDL, nutrients were defined as total inorganic nitrogen (ammonia nitrogen plus nitrate/nitrite nitrogen) and total phosphorus. The value used for the naturally occurring nitrogen to phosphorus ratio was 1.96, which was the median ratio of total inorganic nitrogen to total phosphorus from historical data that was analyzed for a previous nutrient TMDL for the Lake Fausse Pointe/Dauterive Lake system (FTN, 2000b).

The first step in calculating the nutrient TMDL was to determine the loads of total inorganic nitrogen (TIN) that were simulated in the projection model. The loads in the projection model represent the maximum allowable loads that will maintain DO standards. Then the allowable loads of total phosphorus (TP) were calculated by dividing the nitrogen loads by the naturally occurring ratio of TIN to TP (which was 1.96 as discussed above). The resulting loads of TIN and TP for Lake Peigneur are presented in Table 5.2.

Table 5.2. Nutrient TMDL for Subsegment 060909 (Lake Peigneur).

	Ammonia-N (kg/d)	**NO2+NO3-N (kg/d)**	**Inorganic-N (kg/d)**	**Total P (kg/d)**
WLA for minor point sources	0.14	0.09	0.24	0.12
MOS for Point Sources	0.04	0.02	0.06	0.03
LA for Nonpoint Sources	0.09	0.06	0.15	0.08
MOS for Nonpoint Sources	0.01	0.01	0.02	0.01
Total Maximum Daily Load	0.27	0.19	0.46	0.24

5.3 Summary of NPS Reductions and Point Source Upgrades

In summary, the projection modeling used to develop the TMDLs above showed that NPS loads need to be reduced by 20% to achieve the DO standard in Lake Peigneur. No point source upgrades are recommended because there are no point source discharges that have a significant impact on DO in Lake Peigneur.

5.4 Seasonal Variation

As discussed in Section 4.1, critical conditions for DO in Louisiana waterbodies have been determined to be when there is negligible nonpoint runoff and low stream flow combined with high water temperatures. In addition, the models account for loadings that occur at higher flows by modeling sediment oxygen demand. Oxygen demanding pollutants that enter the waterbodies during higher flows settle to the bottom and then exert the greatest oxygen demand during the high temperature seasons.

5.5 Margin of Safety

The MOS accounts for any lack of knowledge or uncertainty concerning the relationship between load allocations and water quality. As discussed in Section 4.1, the highest temperatures occur in July and August, the lowest stream flows occur in October and November, and the maximum point source discharge occurs following a significant rainfall, i.e., high-flow conditions. The combination of these conditions, in addition to other conservative assumptions regarding rates and loadings, yields an implicit MOS that is not quantified. In addition to the implicit MOS, the TMDLs in this report included explicit margins of safety of 20% for point source loads and 10% for NPS loads.

6.0 SENSITIVITY ANALYSES

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 sensitivity analyses were performed by allowing the LA-QUAL model to vary one input parameter at a time while holding all other parameters to their original value. The projection simulation was used as the baseline for the sensitivity analysis. The percent change of the model's minimum DO projections to each parameter is presented in Table 6.1. Each parameter was varied by ±30%, except for temperature, which was varied ±2ºC.

Values reported in Table 6.1 are sorted by percentage variation of minimum DO from smallest percentage variation to largest. Reaeration and initial temperature were the parameters to which DO was most sensitive (6% to 13%). The model results were slightly sensitive to SOD, depth, and BOD decay rate with variations in predicted DO ranging from 3% to 5%. The model was not sensitive to headwater flow or dispersion.

Table 6.1. Summary of results of sensitivity analyses.

Input Parameter	Parameter Change	Predicted minimum DO (mg/L)	Percent Change in Predicted DO (%)
Baseline	-	5.15	N/A
Dispersion	+30%	5.15	<1%
Dispersion	-30%	5.15	<1%
Headwater flow	+30%	5.15	<1%
Headwater flow	-30%	5.15	<1%
Waste Load BOD	+30%	5.15	<1%
Waste Load BOD	-30%	5.15	<1%
Waste Load DO	+30%	5.15	<1%
Waste Load DO	-30%	5.15	<1%
Waste Load flow	+30%	5.15	<1%
Waste Load flow	-30%	5.15	<1%
Waste Load NH3	+30%	5.15	<1%
Waste Load NH3	-30%	5.15	<1%
Waste Load Organic N	+30%	5.15	<1%
Waste Load Organic N	-30%	5.15	<1%
Organic N decay rate	-30%	5.16	<1%
Organic N decay rate	+30%	5.14	<1%
NH3 decay rate	-30%	5.18	1%
Velocity	+30%	5.18	1%
NH3 decay rate	+30%	5.12	1%
Velocity	-30%	5.22	1%
BOD decay rate	+30%	5.00	3%
BOD decay rate	-30%	5.32	3%
Depth	+30%	4.97	3%
Depth	-30%	5.35	4%
SOD (Benthal)	-30%	5.41	5%
SOD (Benthal)	+30%	4.89	5%
Initial Temperature	-2^{o}C	5.45	6%
Initial Temperature	+2^{o}C	4.84	6%
Reaeration	+30%	5.57	8%
Reaeration	-30%	4.48	13%

7.0 OTHER RELEVANT INFORMATION

This TMDL has been developed to be consistent with the antidegradation policy in the LDEQ water quality standards (LAC 33:IX.1109.A).

Although not required by this TMDL, LDEQ utilizes funds under Section 106 of the Federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act to operate an established program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section 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 305(b) report (Water Quality Inventory) and the 303(d) List of impaired waters. This information is also utilized in establishing priorities for the LDEQ NPS program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following establishment 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. The sampling schedule for the first five-year cycle is shown below. The Mermentau and Vermilion-Teche Basins will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins

1999 – Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins

(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

8.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, 40 CFR §130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999 Court Order, this TMDL was prepared under contract to EPA. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information, and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. Responses to these comments and additional information are included in Appendix L. EPA has transmitted this revised TMDL to the Court and to LDEQ for incorporation into LDEQ's current water quality management plan.

9.0 REFERENCES

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APPENDICES A THROUGH K ARE AVAILABLE FROM EPA UPON REQUEST

APPENDIX L

Responses to Comments

COMMENTS AND RESPONSES
LAKE PEIGNEUR
TMDLs FOR DO AND NUTRIENTS
April 19, 2002

EPA appreciates all comments concerning these TMDLs. Comments that were received are shown below with EPA responses inserted in a different font.

GENERAL COMMENTS FROM LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY (LDEQ) (some of these comments may not apply to this report):

In view of LDEQ's TMDL development schedule and the rapidly approaching deadline, LDEQ has made a limited review of the TMDLs published by EPA on October 15, 2001. LDEQ expects to make a more detailed review on at least some of these TMDLs after the first of the year. In the future, LDEQ requests that EPA provide hard copies of the TMDLs and Appendices for LDEQ review. Several electronic files required software which is not used by LDEQ thus making it impossible to review some portions of several TMDLs. Hard copies will insure that the complete official document is being reviewed and will eliminate the time required for LDEQ to try to put together the document from electronic files. In general, LDEQ found these TMDLs to be unacceptable, based on inadequate data and not implementable.

Federal Register Notice: Volume 66, Number 199, pages 52403 - 52404 (10/15/2001)

A. Vermilion River Cutoff DO and Nutrients .pdf
B. Bayou Chene DO .pdf
C. Bayou du Portage DO .pdf
D. Bayou Mallet DO, Nutrients and Ammonia .pdf
E. Bayou Petite Anse DO and Nutrients .pdf
F. Bayou Tigre DO and Nutrients .pdf
G. Big Constance Lake and Mermentau Coastal Bays and Gulf Water TMDLs for DO and Nutrients .pdf
H. Charenton Drainage and Navigation Canal and West Cote Blanche Bay TMDLs for DO and Nutrients.pdf
I. Chatlin Lake Canal/Bayou Du Lac and Bayou Des Glaises Diversion Channel TMDLs for DO and Nutrients.pdf
J. Dugas Canal DO and Nutrients .pdf
K. Franklin Canal DO and Nutrients .pdf
L. Freshwater Bayou Canal DO and Nutrients .pdf
M. Irish Ditch/Big Bayou DO .pdf

N. Lake Arthur, Grand Lake, and Gulf Intracoastal Waterway TMDLs for DO, Nutrients, and Ammonia .pdf
O. Lake Peigneur DO and Nutrients .pdf
P. New Iberia Southern Drainage Canal DO and Nutrients .pdf
Q. Spanish Lake DO .pdf
R. Tete Bayou DO and Nutrients .pdf
S. Bayou Carron DO and Nutrients .pdf
T. West Atchafalaya Basin Protection Levee Borrow Pit Canal DO.pdf

1. Many of these TMDLs are based on models using historical water quality data gathered at a single location rather than survey data gathered at several sites spaced throughout the waterbody. Hydraulic information used was generally not taken at the same time as the water quality data used. The availability of only one water quality data site is not sufficient justification to simulate the subsegment using a one reach, one element model. Additional reaches and elements must be used to represent the subsegment and additional data must be obtained in order for these TMDLs to be valid. The recommended maximum limits cited in the LAQUAL User's Manual for element width and length have been grossly exceeded in many of the models. The spreadsheet calibration and projection graphs that were provided do not match the plots produced by the LA-QUAL model. Please explain why they do not match. The LAQUAL graphics for a few elements produces a graph that does not represent the model output. It's an anomaly of the graphics routine. The calibrations are inadequate due to the lack of a hydrologic calibration and the paucity of water quality data. The resulting TMDLs are invalid. LDEQ does not accept these TMDLs.

Response: The TMDLs were based on existing data plus information that could be obtained with available resources. Each model was developed using the most appropriate hydraulic information and water quality data that were available. The level of detail at which each subsegment was modeled was consistent with the amount of available data. Although having only one element in a model causes inaccuracies in the LAQUAL graphics, having only one element in a model does NOT cause errors in the tabular output (which is what the graphs in the reports are based on). Although LDEQ typically collects more data for model calibration than what was available for calibration of these models, EPA considers these model calibrations and the resulting TMDLs to be valid.

2. LDEQ does not consider any of these waters to be impaired due to nutrients or ammonia. LDEQ does not consider Vermilion River Cutoff (060803), Mermentau Coastal Bays and Gulf Water (050901), Charenton Drainage and Navigation Canal (060601), West Cote Blanche Bay (061001), Bayou Des Glaises Diversion channel (060207), Grand Lake (070701), Gulf Intracoastal Waterway (050702, Lake Peigneur (060909), New Iberia Southern Drainage Canal (060904) and West Atchafalaya Basin Protection Levee Borrow Pit Canal to be impaired by biochemical oxygen-demanding substances. Many of these waters simply have inappropriate

standards and criteria. The resources spent on developing these TMDLs could have been far more effectively and wisely spent on reviewing, approving, and assisting in the development of appropriate standards and criteria for these waters through the UAA process.

Response: TMDLs were developed for these subsegments based on the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 and the suspected causes of impairment (organic enrichment/low DO, nutrients, or ammonia) for each subsegment in the EPA Modified Court Ordered 303(d) List.

3. Remove the reference and all references to the unpublished LDEQ document, "Defaults for Uncalibrated Modeling". This is not an acceptable reference and any defaults selected on this basis must be reevaluated and based on acceptable references. Some of the models must be redone because of inappropriately selected defaults. At this time, LDEQ has no plans to revise, complete or publish this document.

Response: The unpublished LDEQ document that is mentioned here was provided to EPA's contractor without any instructions not to use it. The model coefficients listed in that document appear to be reasonable and consistent with values used in other modeling studies in southern Louisiana.

4. The percent reduction of the nonpoint source load must not be reported as an overall average of the individual percent reduction applied to each reach. This approach does not insure that standards will be met in all reaches and will be difficult to implement. In consideration of future implementation plans, LDEQ does not vary the percent reduction required from reach to reach. LDEQ uses a uniform percent reduction within a watershed unless there are unique conditions, such as a general change in landuse, that dictate a further breakdown. These unique conditions must be adequately documented in the report in order to facilitate future implementation plans. Specifying type of land use is helpful in defining nonpoint loading. LDEQ requests a calculation sheet of the NPS reduction percentages and asks that language be added to the report describing the calculation process.

Response: EPA appreciates this comment but believes that an average percent reduction is acceptable. EPA will consider this in future development of TMDLs in Louisiana.

In the lower Mermentau and Vermilion River Basins, much of the nonpoint loading affecting some of these subsegments and adding to their benthic blanket is coming from the tributaries feeding them. Many of the headwater tributaries have recent TMDL's that require dramatic percentage reductions to the nonpoint contributions. By implementing the reductions to nonpoint loads upstream, the current problems in these lower subsegments will be reduced.

Response: EPA recognizes that TMDLs have been developed upstream of several of these subsegments. Implementing upstream reductions in nonpoint loads should require much less reduction of loadings from within these subsegments. The required percent reductions for these subsegments were not intended to be in addition to upstream reductions.

5. The percentage reductions listed were not calculated based on the written procedure described in several TMDLs. These values did not take the MOS into consideration. It is also LDEQ's policy to make a no-man-made load projection run which will estimate the natural background loads. The contractor should include a no-man-made load projection run in each TMDL report.

Response: The percent reductions were calculated by subtracting the projection input value from the calibration input value and then dividing by the calibration input value. This procedure is slightly different than what LDEQ uses but still provides percent reductions that are useful.

6. CBODu and NH3-N were estimated from surrogate parameters rather than actual measured data for most of the TMDLs. Based on the measured data from the last two years of LDEQ water quality surveys, LDEQ objects to the correlation of TOC to CBOD and NH3-N to TKN, unless these correlations are taken from water quality data on the modeled waterbody. Our studies have shown only a moderate correlation between these two parameters within the same waterbody, however when this correlation was attempted across waterbodies extreme variability was seen and the correlation was not judged valid. It is possible that a combination of surrogates will obtain a better correlation, such as TOC along with color, turbidity, pH, etc. LDEQ is currently researching these options.

Response: EPA agrees that it would be ideal to have data collected from the modeled waterbody for relating TOC to CBOD and NH3-N to TKN. However, for these subsegments, there was insufficient data from which these relationships could be developed.

7. LDEQ takes exception to the equating of COD to CBODu in some of the TMDLs. There is no data to support this assumption. No direct correlation has been drawn between these two parameters. The only correlations that have been found are variable and dependant on the type of discharge. LDEQ requests that facilities with only COD limits be removed from the WLA load calculations.

Response: EPA agrees that COD is not an ideal indicator of CBODu. However, EPA believes that most effluents that exert significant COD are likely to exert some oxygen demand in natural waterbodies and therefore the discharges with COD limits should be included in the TMDLs.

8. CBODU and Org-N settling rates were not used. This is not justifiable in areas dominated by agricultural activities and is poor practice for TMDLs on Louisiana waters. The models must be revised to include settling rates.

Response: Without the use of settling rates, all of the pollutant loading remains in the water column where it can consume oxygen. Depending on the model settings for conversion of settled pollutant loading to SOD, the model can be more conservative without settling rates. Other applications of water quality models for TMDLs on southern Louisiana waterbodies have not used settling rates and have been approved by LDEQ.

9. The TMDLs should be for biochemical oxygen-demanding substances instead of DO. DO is an indicator of the impact of biochemical oxygen demanding load, hydrologic modifications, excessive algae blooms, etc.

Response: The TMDLs in Section 5 of each report are already expressed in terms of oxygen demand.

10. Nitrification inhibition option number 2 is valid for Louisiana's waterbodies. Various studies have shown that Louisiana does not have a buildup of NH3-N in its waterbodies. If option 1 was needed for a proper calibration then that should be stated as such.

Response: The nitrification inhibition option was set based on algorithms in other widely used water quality models. Option 1 has been used in other water quality modeling applications for TMDLs on southern Louisiana waterbodies that have been approved by LDEQ.

11. A winter projection model was not developed for most of the TMDLs. Winter projection models must be developed to address seasonality requirements of the Clean Water Act. Where point sources have seasonally variable effluent limitations or such seasonal variations are proposed, a winter projection model is required to show that standards are met year-round.

Response: As discussed in Section 4.2 of each report, summer is the most critical season for meeting the year round standard for DO for this subsegment. Therefore, the summer simulation satisfies the seasonality requirements of the Clean Water Act. Performing additional simulations to evaluate permit limits that are seasonal or hydrograph controlled releases was not required for developing these TMDLs and can be done by LDEQ or by permittees.

12. There was no documentation (LA-QUAL plots) to indicate that the model was calibrated to all hydrologic parameters (i.e. flow, width, depth, time of travel, velocity, chloride balance, etc.). Apparently flow balances were performed, however a flow balance is not a hydrologic calibration. Most of the models must be recalibrated with adequate hydrologic data. Calibration plots for all of the hydrologic parameters must be provided in the appendices.

Response: The values of depth, width, and flow in each model were estimated based upon the most appropriate available information. Hydraulic calibration of each model was not possible due to a lack of data.

13. The calibration and projection plots for dissolved oxygen must be provided in the body of the reports. Additional projection plots for CBODU, NH3-N, and Org-N must be provided in the appendices.

Response: The placement and number of plots in the draft reports are acceptable.

14. The calibration simulation must be used as the baseline for the sensitivity analysis, not the projection simulation. LDEQ requests that all TMDLs be revised in this regard.

Response: The sensitivity analysis can be developed using either the calibration or the projection as a baseline. EPA will consider this in future development of TMDLs in Louisiana.

15. A list of all point source dischargers must be provided in the body of the reports. Only dischargers with flows that reach the named waterbody should be included in the TMDLs.

In several TMDLs, a default 0.001 MGD flow rate was assigned to dischargers where a flow rate was not available. This practice is unacceptable to LDEQ. This default flow rate is extremely low (LDEQ would typically use 0.005 MGD as a minimum) and could strictly limit these dischargers' allowable permit loads when their permits are renewed. Additional research should be done to determine the facility type and anticipated flow rates of these facilities.

Response: The placement of the list of point source dischargers in the draft reports is acceptable. The dischargers with no flow rate information are believed to have very small flow rates representing a very small portion of the total TMDLs. The actual flow rate for each facility can be determined by LDEQ when the facility's permit is being renewed.

16. LDEQ does not agree with the minor point sources loads being subtracted from the NPS load as was done in several of the TMDLs. The pollutant loads being addressed are non-conservative loads. Many of these dischargers are located on small tributaries to the 303(d) waterbody which have recovered prior to entering into that system. Thus they are not contributing to the pollutant loads in the impaired waterbody. LDEQ's current procedure is to add these loads to the WLA portion of the TMDL.

Response: In the reports for which this comment is applicable, the TMDL calculations have been revised so that these loads are added to the WLA portion of the TMDL (same as LDEQ's procedure). For most of the draft reports, the TMDL calculations already used LDEQ's procedure of adding the minor point sources to the modeled loads.

17. Proper justification must be provided when using a nonpoint source margin of safety value other than the typical LDEQ value of 20%.

Response: The nonpoint margin of safety (MOS) was set to 10% based on other TMDLS on southern Louisiana waterbodies that have either been developed by LDEQ or approved by LDEQ. Eleven TMDL reports from LDEQ's website were reviewed to examine the explicit MOS for nonpoint sources. All 11 of these TMDLs were for oxygen demanding substances in the Mermentau or Vermilion-Teche basins. The explicit MOS for nonpoint sources was set to 20% for 2 reports, 10% for 3 reports, and 0% for 6 reports. Therefore, the value of 10% was considered to be a typical value that did not need special justification.

18. LDEQ has major concerns relating to the use of a one dimensional steady state model in coastal bays, lakes and estuaries. These systems are typically dominated by tides and winds and do not behave like riverine systems. LAQUAL can be used to simulate estuarine systems with riverine characteristics and some tidal influences; however to use it in these applications exceeds the model's recommended input limitations and appears to produce a meaningless output. Also the systems' unique hydrological characteristics do not adapt well to LAQUAL's one-dimensional capabilities. A multi-dimensional model such as WASP should be used for these waters. While a dynamic model would be preferred, a steady-state multi-dimensional model would be acceptable if it adequately addresses tidal influences. LDEQ objects to the use of LAQUAL in determining TMDLs for coastal bays, lakes and estuaries.

Response: A one dimensional steady state model such as LAQUAL was considered to be appropriate for all of these subsegments based on the amount of data that were available. Proper application of a multi-dimensional model or a dynamic model would require much more data and is simply not necessary for these waterbodies. For large, wide waterbodies, WASP will yield the same results as LAQUAL if the configuration of elements and model coefficients are the same between the two models.

19. The report uses the term synoptic survey multiple times. Please describe in detail what area this survey encompassed as well as site locations and what parameters were tested. Also, the raw data from this survey must be included in the appendices as support for the model inputs and calculations.

Response: A description of the synoptic survey and a summary of the data have been added to the appendices for each report in which those data are used.

20. In many of the calibration models the average water quality data from several LDEQ stations were used. It has been LDEQ's experience that a better calibration can be accomplished by using a single day's water quality and flow data. The additional daily values could then be used to perform multiple verifications of the model parameters before proceeding to the projection

stage. The flow data should be collected at the same time as the water quality data in order for the model to be valid.

Response: The models were calibrated to averages over multiple sampling events to minimize the effects of any single field measurement that might be of questionable quality or indicative of conditions that may have lasted only a very short time. For large systems with long residence times, using only a single snapshot of water quality data is often not representative of steady state conditions for that system.

21. Grammatical errors and misspelled words were found in these reports.

Response: The reports have been reviewed for grammar and spelling.

22. There does not appear to be any significant anthropogenic source of nutrients from agriculture, silviculture, aquaculture or urban runoff in many of these subsegments. Therefore, any occurrence of low DO is almost certainly natural. As a result, a UAA for the area is necessary to reset the DO standard. A TMDL is unwarranted for these subsegments,and LDEQ takes exception to EPA generating TMDLs which are impossible to implement.

Response: EPA is required to generate these TMDLs based on the Modified Court Ordered 303(d) List and the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7.

23. LDEQ's nutrient standard is based on total phosphorus (TP) and total nitrogen (TN), not total inorganic nitrogen (TIN). Since phosphorus is not the limiting constituent in Louisiana, the nutrient allocations must be in terms of TN and only TN.

Response: LDEQ's nutrient standard (LAC 33:IX.1113.B.8) does not specify that nitrogen to phosphorus ratios should be based on total nitrogen. However, EPA will consider this in future development of TMDLs in Louisiana.

In the coastal areas, the nitrogen to phosphorus ratio used was based on freshwater streams and is not applicable to brackish Gulf waters. LDEQ takes exception to the calculation of a TMDL based on TN/TP ratios derived from waterbodies other than the modeled waterbody. It is LDEQ's experience that the natural allowable TN/TP ratio is waterbody-specific and can vary dramatically between streams.

Response: EPA agrees that it would be ideal to have a large database of nitrogen to phosphorus ratios for each waterbody. However, because these subsegments have only limited nutrient data, the previously developed nitrogen to phosphorus ratio that was used in the draft reports is considered acceptable.

LDEQ has not adopted the EPA recommended ammonia criteria (1999) and takes exception to its use in this TMDL. In general, LDEQ does not accept EPA's use of national guidance for TMDL endpoints. The nationally recommended criteria do not consider regional or site-specific conditions or species and may be inappropriately over protective or under protective. No ammonia nitrogen toxicity has been demonstrated or documented in any of the waterbodies in these TMDLs. The general criteria (in particular, LAC 33:IX.1113.B.5) require state waters be free from the effects of toxic substances.

Response: Ammonia TMDLs were developed for two subsegments based on the requirements of Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 and the fact that the Modified Court Ordered 303(d) List included ammonia as a suspected cause of impairment for those two subsegments. National guidance for ammonia toxicity was used in the absence of any numerical state water quality standards for ammonia.

24. The implicit margin-of-safety must not be quantified.

Response: The text of the reports has been revised to eliminate any quantification of the implicit margin of safety.

25. EXECUTIVE SUMMARIES: Add summary tables of the WLAs, LAs, and TMDLs showing the allocations and margins of safety.

Response: The summary tables of the WLAs, LAs, and TMDLs can be easily found in Section 5 of each report and do not need to be repeated in the executive summary.

26. Temperature Correction of Kinetics: A temperature correction factor was set for reaeration. It is LDEQ's standard practice to allow LAQUAL to calculate this factor. There is more guidance on this in the LAQUAL User's Manual.

Response: The temperature correction factor was reaeration was set to the value of 1.024 based on guidance in Section 3.3.8 of the LTP.

27. Water Quality Kinetics: The Louisiana reaeration equation was used on reaches that are outside the maximum depth that it was designed for. A more appropriate reaeration equation must be selected.

Response: The Louisiana equation yielded reaeration coefficients that appeared more reasonable than coefficients from other equations.

28. Water Quality standards and designated uses tables did not include the BAC (bacterial criteria) values.

Response: The water quality standards for bacteria are not relevant for these TMDLs.

29. The statement was made in the Initial Conditions paragraphs in several of the reports that temperature was specified because the temperature was not being simulated. The section then states, "For constituents not being simulated, the initial concentrations were set to zero …". Initial conditions provide a starting point for the iterative solution of modeled constituents. They also provide values for constituents that are needed as input but are not being simulated.

Response: EPA appreciates this comment.

30. Several reports describe the benthic ammonia source rate as a calibration parameter; however a review of the data type 13 calibration input section indicates a value of zero for this parameter, in all reaches.

Response: The benthic ammonia source rate was used as a calibration parameter; the value of that parameter that provided the best fit between predicted and observed values was zero.

31. Calibration, and Projection, Data type 27: A salinity value was set to zero in the boundary conditions for both the calibration and the projection models in several of the TMDLs. With this value set to zero the model will automatically adjust the values of the lowest reach's elements to the value set in the boundary conditions. Since most of the models were one-reach, one-element models, the model automatically set the element salinity to zero, thus calculating an inaccurate value for the DO saturation.

Response: The only models where salinity was set to zero in the downstream boundary conditions were those models where salinity was not considered high enough to have a significant impact on DO saturation.

32. It is not LDEQ's standard procedure to use a zero headwater flow. You may not have input a headwater flow, but the model did. Without a headwater flow the model would have crashed and not run. The model's programming allows for a 0.0000001 cms flow rate when the modeler has not input a headwater flow.

Response: Only two simulations (calibrations for Spanish Lake and Big Constance Lake) used a zero headwater flow. For all practical purposes, 0.0000001 m^3/sec is the same as zero flow.

33. Hydraulics and Dispersion: The use of constant widths and depths requires proper justification.

Response: The widths and depths were justified in Section 3 of each report.

34. Several reports state that algae were not simulated because algae did not appear to have significant impacts. What was the evidence for this statement? Did the contractor have any Chlorophyll a measurements?

Response: This statement was based on general knowledge of the Mermentau and Vermilion-Teche basins as well as a limited amount of diurnal DO data collected in these basins.

SPECIFIC COMMENTS FROM LDEQ FOR LAKE PEIGNEUR:

A. Lake Peigneur DO and Nutrients .pdf

1. Page 3-2, 3.2 Calibration Period, fourth paragraph: The last sentence says that TKN was not measured during the calibration period. However, there is TKN data for August 12 & 26, 1998. The spreadsheet has the data and the calculated average during the calibration period.

Response: Correction made

2. Page 3-2, 3.4 Hydraulics and Dispersion, first paragraph: The width and depth equations are written incorrectly.

Response: Correction made

3. Page 3-5, 3.8 Headwater and Tributary Flow Rates: The first sentence should have "square miles".

Response: Correction made

4. Page 4-3, 4.3 Headwater and Tributary Inputs, first paragraph, second to last sentence: "…whichever is smaller." should be "…whichever is greater."

Response: Correction made

5. The incident which caused the lake to drain was not an explosion. A hole was made in the lake bottom by an oil drilling rig.

Response: EPA appreciates the comment

GENERAL COMMENTS FROM LOUISIANA STATE UNIVERSITY (LSU) AG CENTER
(some of these comments may not apply to this report):

Through this letter the Louisiana State University AgCenter would like to submit official comments on TMDLs for dissolved oxygen and nutrients associated allocations for waterbodies in:

- Vermilion River Cutoff
- Bayou Chene
- Bayou Petite Anse
- Bayou Tigre
- Big Constance Lake and Mermentau Coastal Bays and Gulf Water
- Charenton Drainage and Navigation Canal and West Cote Blanche Bay
- Chatlin Lake Canal/Bayou Du Lac and Bayou Des Glaises Diversion Channel
- Dugas Canal
- Franklin Canal
- Freshwater Bayou Canal
- Irish Ditch/Big Bayou
- Lake Arthur, Grand Lake, and Gulf Intracoastal Waterway
- Lake Peigneur
- New Iberia Southern Drainage Canal
- Spanish Lake
- Tete Bayou
- Bayou Carron
- West Atchafalaya Basin Protection Levee Borrow Pit Canal

The number of different TMDLs sent out for comment at the same time may overwhelm the public's ability to comment. With only 30 days to prepare and submit comments it is impossible for a qualified faculty member to review the supporting data in depth and attend to his(her) official responsibilities. I realize that the agency is under time constraints on completing these, but I earnestly request that more time per proposed TMDL be given in the future.

We must make several other general comments and objections that apply to most of the proposed TMDLs. In many cases the data used to calibrate the models for the stream segments was collected in the fall of 2000 near the end of a three year drought. Historic low flows were often commented on in the text of the TMDL. Low flows result in a biased estimate of the natural ability of the stream to reaerate and cleanse itself of pollutants. Low flows also enable the benthic blanket to accumulate and remain in place undisturbed causing overstatement of the benthic oxygen demand and the SOD which were in many cases the primary oxygen demand loads in the stream. While it is true that the high flows that come from storm events carry more organic and sediment loads into the stream, the high flow rates also scour material from the bottoms and move it on to a final deposit at the stream terminus. It was thus that most of Louisiana and all of our coastal areas were built. Prolonged drought conditions do not allow this natural cleansing to occur. Thus it is our belief that the part of the oxygen demand load attributed to benthic and sediments is overstated and that new data must be collected during normal rainfall conditions and the models re-calibrated.

Response: The Louisiana water quality standards are applicable during all flow conditions greater than the 7Q10. Because 7Q10 flow is frequently the most critical condition for maintaining the DO standard, it is desirable to collect field data for model calibration during times when the hydrology is as close as possible to 7Q10 conditions. It is believed that the flow conditions for these waterbodies may have been near 7Q10 conditions, but probably not lower than 7Q10 flows. Therefore, the summer-fall 1998 data is desirable for model calibration.

In far too many of the proposed TMDLs the phrase *"an intensive field survey was not conducted for the study area due to schedule and budget limitations"* was found. If municipalities, agriculture, and business entities are to be asked to make large commitments of funds, time and effort to resolve our water quality problems they deserve to have the benefit of a serious study of the problem. We request that all of the proposed TMDLs that contain this statement have this problem corrected and that TMDLs be prepared based on complete studies.

Response: There is no requirement for collecting a certain amount of data to make a TMDL valid. If additional data are collected in the future by LDEQ, other agencies, or local stakeholders, then those data can be evaluated at the time and the implementation of the TMDL can be altered as necessary. As outlined in the 1991 EPA document titled "Guidance for Water Quality-Based Decisions: The TMDL Process", developing and implementing TMDLs is a process and not a one-time event.

In several of the proposed TMDLs data was used that is 9 or 10 years old from studies on point source discharges. While the data is probably high quality it assumes that no change in the plant or its load have occurred in the last decade. This assumption may not be defensible. In the TMDLs where a treatment plant was included in the model the margin of error was calculated by using 125% of the design capacity. This assumes a plant will perform at the same level when it is operated in excess of its design load. This assumption is also questionable.

Response: For several subsegments, old data sets were used for calibration because they provided more extensive data than newer data sets. However, all of the projection runs simulated point source discharges based on the most recent information available. Simulating point source discharges at 125% of design flow is simply a way of incorporating an explicit margin of safety and does not assume that the facility can actually treat that much wastewater.

The standard for dissolved oxygen (DO) was held at 5 mg/L in some steams on a year round basis, even if it received or discharged into a stream with 5 mg/L winter and 2 or 3 mg/l summer standards. Other streams had a year DO oxygen standard of 4 mg/L. We strongly suggest that a review be made of the DO standards for all of the streams in south Louisiana that are shallow, sluggish, and subject to tidal influence and that uniform standards be set. In view of the remarks that achieving a DO of 5 mg/L was impossible in some of the streams that had little loading from human activities, we believe that the summer standard of 2 mg/L is much more applicable to these streams.

Response: The TMDLs are required to be developed for the existing DO standard, which is 5 mg/L year round for many of these subsegments. If the DO standard is revised in the future for any of these subsegments, the TMDL and implementation can be altered as necessary as part of the TMDL process.

Many of these TMDLs were drafted by an out of state contractor and do not appear to be as well researched as those drafted by LDEQ. Very little data was included in the contractor drafted TMDLs summaries as compared to the ones prepared by or in conjunction with LDEQ. Additionally, the bulk of the text appeared to be standard wording in all documents with short relevant inserts. We would request that if outside contractors be used in future TMDL assessments that they be held to the same standard of information inclusion that LDEQ provides. Stream diagrams and maps are often needed when reviewing descriptive text on stream location, tributary insert, and exact location.

Response: These TMDLs contain all the required components of a TMDL and the level of detail is considered acceptable. Because these TMDLs could not be funded at the same level as most of LDEQ's DO TMDLs, the analysis and documentation was not as extensive as most of LDEQ's DO TMDLs. However, some of the information that was mentioned in the comment (stream diagrams and maps) was included in the reports, but they were placed in the appendices (which were available from EPA upon request).