CHARENTON DRAINAGE AND NAVIGATION CANAL AND WEST COTE BLANCHE BAY TMDLS FOR DISSOLVED OXYGEN AND NUTRIENTS

April 19, 2002

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SUBSEGMENTS 060601 AND 061001

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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 2 subsegments in the lower Vermilion-Teche basin in southern Louisiana.

The 2 subsegments for which TMDLs were developed are:

060601 – Charenton Drainage and Navigation Canal (referred to here as "Charenton Canal"
061001 – West Cote Blanche Bay

These subsegments are in a coastal area where the hydraulic regime is significantly affected by water levels in the Gulf of Mexico. Flow reversals are common during low flow conditions. The Charenton Canal receives water from the West Atchafalaya Borrow Pit Canal via Lake Fausse Pointe and Bayou Teche. There are relatively few point source discharges in these 2 subsegments.

Each of these 2 subsegments was listed on the Modified Court Ordered 303(d) List for Louisiana as not fully supporting the designated use of propagation of fish and wildlife and was ranked as priority #1 for TMDL development. Neither of these 2 subsegments was included on the 1998 303(d) List, but both subsegments were later added to the Modified Court Ordered 303(d) List based on LDEQ assessment data collected during June through December 1998. The causes for impairment cited in the 303(d) List included organic enrichment/low DO for both subsegments, and nutrients for subsegment 060601. The water quality standard for DO is 5 mg/L year round for both subsegments.

A water quality model (LA-QUAL) was set up to simulate DO, CBOD, ammonia nitrogen, and organic nitrogen in both subsegments. 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, and USGS. There were no intensive survey data available for these subsegments. The projection simulation was run at critical flows and temperatures to address seasonality as required by the Clean Water Act. Reductions of existing NPS loads 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.

TMDLs for oxygen demanding substances (CBOD, ammonia nitrogen, organic nitrogen, and sediment oxygen demand) were calculated using the results of the projection simulation. Both implicit and explicit margins of safety 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 TMDLs were calculated using allowable nitrogen loadings from the projection simulation and applying a naturally occurring nitrogen to phosphorus ratio to determine the allowable phosphorus loadings.

Each TMDL for these 2 subsegments includes a wasteload allocation (WLA) for the Town of Baldwin wastewater treatment plant (WWTP) plus an additional WLA for all of the other point sources with minor oxygen demanding discharges within both subsegments. No treatment upgrade was recommended for the Town of Baldwin WWTP due to its relatively minor contribution to the total load. NPS reductions of 90% were required for both subsegments to meet the water quality standard for DO. Complete elimination of the Town of Baldwin WWTP would change the required NPS reductions by less than 1%.

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1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for dissolved oxygen (DO) and nutrients for the 2 subsegments listed in Table 1.1. Each of these 2 subsegments 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. Neither of these subsegments was included on the 1998 303(d) List (LDEQ 1998), but both subsegments were 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. Both subsegments were ranked as priority #1 for TMDL development. The TMDLs in this report were developed in accordance with the 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 these subsegments are being addressed by EPA and the Louisiana Department of Environmental Quality (LDEQ) through other documents.

Table 1.1. Summary of 303(d) listing of the 2 subsegments in the study area (EPA 2000a).

Subsegment Number	**Waterbody Description**	**Suspected Sources**	**Suspected Causes**	**Priority Ranking (1 = highest)**
060601	Charenton Canal – from Charenton Floodgate to Intracoastal Waterway, including Bayou Teche from Charenton to Baldwin	Minor industrial point sources Minor municipal point sources Irrigated crop production Land development Septic tanks Removal of riparian zone Industrial Municipal Non-irrigated crop production	Organic enrichment/low DO Suspended solids Turbidity Nutrients	1
061001	West Cote Blanche Bay	None stated	Organic enrichment/low DO	1

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.

2.0 STUDY AREA DESCRIPTION

2.1 General Information

The study area consists of the Charenton Drainage and Navigation Canal (hereafter referred to as the Charenton Canal) and West Cote Blanche Bay, both of which are located in the lower portion of the Vermilion-Teche basin in southern Louisiana (see map in Appendix A). Most of the flow through the Charenton Canal comes from sources outside the study area rather than from local runoff. The 3 primary inflows to the Charenton Canal during low flow periods are:

- Outflow from Lake Fausse Pointe (enters northern end of Charenton Canal)
- Western portion of Bayou Teche (enters 4 miles downstream of Lake Fausse Pointe)
- Eastern portion of Bayou Teche (enters at Baldwin)

Lake Fausse Pointe and the western portion of Bayou Teche drain a combined area of approximately 2,000 square miles (USGS 1971). Most of the flow in the eastern portion of Bayou Teche is water from the Atchafalaya basin that flows into the Wax Lake Outlet and then flows westward through the West Calumet floodgates into Bayou Teche. Both the western and eastern portions of Bayou Teche flow towards the Charenton Canal most of the time. However, because the area is tidally influenced due to its proximity to the Gulf of Mexico, flow reversals are common. The Charenton Canal drains into West Cote Blanche Bay, which is connected to the Gulf of Mexico by East Cote Blanche Bay.

Another inflow to the Charenton Canal during high flow conditions is the Gulf Intracoastal Waterway (GIWW), which crosses the Charenton Canal. During times of high flows in the Atchafalaya basin, water tends to flow westward from the Atchafalaya River into the GIWW. However, during low flows, there does not appear to be a consistent pattern of flow direction in this portion of the GIWW.

There is little land area within the 2 subsegments in the study area. The Charenton Canal subsegment (060601) includes only a small strip of land along each side of the channel because the surrounding land drains primarily away from the canal rather than towards it. Also, the West

Cote Blanche Bay subsegment (061001) consist only of the bay itself (i.e., it does not include any land area draining to the bay). Land uses for the study area are shown in Table 2.1.

Table 2.1. Land uses in the study area based on GAP data (USGS 1998).

Land Use Type	% of Total Area	
	060601	**061001**
Fresh Marsh	2.7	0.0
Saline Marsh	0.0	0.0
Wetland Forest	17.4	0.0
Upland Forest	3.6	0.0
Wetland Scrub/Shrub	0.2	0.0
Upland Scrub/Shrub	0.0	0.0
Agricultural	12.5	0.0
Urban	41.5	0.0
Barren	0.0	0.0
Water	22.1	100.0
TOTAL	100.0	100.0

2.2 Water Quality Standards

The numeric water quality standards and designated uses for these subsegments 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.

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).

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

Subsegment	060601	061001
Stream Description	Charenton Canal from Charenton Floodgate to Intracoastal Waterway including Bayou Teche from Charenton to Baldwin	West Cote Blanche Bay
Designated Uses	ABC	ABCE
Criteria:		
Chloride	250 mg/L	N/A
Sulfate	75 mg/L	N/A
DO	5 mg/L (year round)	5 mg/L (year round)
pH	6.0 – 8.5	6.5 – 9.0
Temperature	32 °C	35 °C
TDS	500 mg/L	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.

In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, “That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts.” DO serves as the indicator for the water quality criteria and for assessment of use support. For the TMDLs in this report, the nutrient loading required to maintain the DO standard is the nutrient TMDL.

2.3 Identification of Sources

2.3.1 Point Sources

A list of NPDES permits that were identified in or near Subsegments 060601 and 061001 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 08080102 and 08080103) 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 permits 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 these TMDLs. All of the facilities with oxygen demanding parameters in their permit were included in the TMDL calculations, but only one of them was considered large enough to be modeled explicitly. The remaining oxygen demanding discharges were included in the model implicitly by considering their oxygen demand as part of the NPS loading into the system.

The point source that was explicitly included in the model was the Town of Baldwin Wastewater Treatment Plant (WWTP). The approximate location of the discharger is shown in Appendix A. The permit records, permit applications, and discharge monitoring reports (DMRs) for this facility were examined and appropriate input information for the calibration and projection modeling runs was derived to the maximum extent possible.

Relevant information for the discharge explicitly included in the model is listed below:

	Town of Baldwin WWTP
Permit number:	LA0033294
Receiving stream:	Ditch to Charenton Drainage and Navigation Canal
Design flow:	0.23 mgd
Permit limits:	30 mg/L BOD (monthly average)
Treatment:	Oxidation pond with Lemna system

It should be noted that there was one other point source discharge with a large flow, but it was not explicitly included in the model. This discharge was the Cleco-Teche Power Plant, which withdraws water from the Charenton Canal, uses it for non-contact cooling water, and discharges it back to the Charenton Canal a short distance downstream of the withdrawal point. This discharge was not included in the model because it was assumed to have negligible oxygen demand and the amount of flow being contributed by the discharge was assumed to be similar to the amount flow being withdrawn.

2.3.2 Nonpoint Sources

Several nonpoint sources were cited as suspected sources of impairment in the 303(d) List (Table 1.1). These nonpoint sources include non-irrigated crop production, irrigated crop production, land development, septic tanks, and removal of riparian zone.

2.4 Prior Studies

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

1. Twice-monthly data collected by LDEQ for "Charenton Canal" (station 0674) for mid-June to December 1998.

2. Twice-monthly data collected by LDEQ for "West Cote Blanche Bay" (station 0691) for mid-June to December 1998.

3. Monthly data collected by LDEQ for "Bayou Teche at Adeline" (station 0030) for March 1978 to May 2000. This station is upstream (west) of the Charenton Canal.

4. Bi-monthly data collected by LDEQ for "Lake Fausse Pointe east of New Iberia, LA" (station 0313) for February 1991 to December 1998. This station is near the upstream end of Lake Fausse Pointe.

5. Monthly to bi-monthly data collected by LDEQ for "Bayou Teche at Franklin" (station 0100) for June 1958 to December 1998. This station is east of Charenton Canal.

6. Twice-monthly data collected by LDEQ for "Intracoastal Waterway" (station 0685) for mid-June to December 1998. This station is west of Charenton Canal.

7. Twice-monthly data collected by LDEQ for "East Cote Blanche Bay" (station 0692) for mid-June to December 1998.

8. Bi-monthly data collected by LDEQ for "Vermilion Bay south of New Iberia" (station 0316) for January 1991 to November 1998. This station is west of West Cote Blanche Bay.

9. Bayou Teche watershed TMDL for DO including WLAs for 22 facilities and addressing nutrients (LDEQ 2000d).

10. Bayou Teche TMDL for fecal coliform (EPA 2000b).

11. Bayou Teche TMDL for chloride (EPA 2000c).

12. Bayou Teche TMDL for sulfate (EPA 2000d).

13. Lake Fausse Pointe/Dauterive Lake TMDL for dissolved oxygen and nutrients (FTN 2000a).

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 because algae do not appear to have significant impacts on DO in these subsegments.

A vector diagram of the model is shown in Appendix C. The vector diagram shows the reach/element design and the location of the modeled inflows and point sources.

In general, the number of separate reaches and elements within each branch was minimized. This was done based on expected uniformity of hydraulics and water quality. For example, the entire area of West Cote Blanche Bay was represented as one element in the model because: 1) water quality data are only available at one location and there is no evidence to suggest significant water quality variation throughout the Bay, and 2) the only depth information that is available indicates that the depth of the bay is fairly uniform. The Charenton Canal was divided into multiple reaches only based on changes in depth, width, or flow.

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. Therefore, the model was calibrated to historical conditions when hydrologic and water quality data were available. The only historical period for which water quality data were collected for the 2 subsegments was the June through December 1998 period when LDEQ collected their assessment data. The LDEQ stations for the 2 subsegments in the study area are:

Station 0674 – Charenton Canal (subsegment 060601)

Station 0691 – West Cote Blanche Bay (subsegment 061001)

The water quality data for this period were retrieved from the LDEQ website. These data are listed in tabular form in Appendix D and plots of the temperature and DO are also included 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 (BOD decay, nitrification, and sediment oxygen demand (SOD)). In most systems, low flows cause reaeration rates to be lower. 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 17 to September 22, 1998 (Julian day 229 to 265). 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.

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 reaeration: 1.024 (specified in Data Group 4)
- 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)

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 + c and depth = d * Q^e + f). Under low flow conditions, the water levels throughout the 2 subsegments being modeled are controlled by the Gulf of Mexico. In other words, under low flow conditions, the depths and widths for each 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) = width
- width exponent (b) = 0.0
- width constant (c) = 0.0
- depth coefficient (d) = depth
- depth exponent (e) = 0.0
- depth constant (f) = 0.0

Widths and depths were estimated primarily from topographic maps, a 1999 intensive survey of Lake Fausse Pointe (FTN 2000a), and Corps of Engineers data (see Appendix E).

Tidal dispersion was accounted for by specifying dispersion coefficients in data group 10 of the model input. The dispersion coefficient was set to 50 m^2/s, which is the same value used for the Lake Fausse Pointe TMDL (FTN 2000a). This value is within the range of measured dispersion coefficients for constant density portions of estuaries (Fischer et al. 1979, McCutcheon and Martin 1999). The value of 50 m^2/sec was considered appropriate for all reaches in this model.

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). Except for reach 3, the temperature for each reach was set to the average of the measured values at the appropriate LDEQ station during the calibration period. The temperature for reach 3 was calculated based on conservative mixing of ambient stream water with heated discharges from the Cleco-Teche Power Station. These calculations and the temperatures used as model input are shown in Appendix E.

One other parameter that was specified in the initial conditions was the salinity for each reach. Salinity was not simulated in the model (i.e., it was not "turned on" in Data Group 2), but salinity values were entered as initial conditions so the model would use those values in the calculations for DO saturation. Because salinity data were not included in the LDEQ monitoring data for these subsegments, salinity values were 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, CBOD decay rates, nitrification rates, and mineralization rates (organic nitrogen decay). The values used in the model input are shown in Appendix E.

The O'Connor-Dobbins equation was used for reaeration (option 3 in the model); however, a minimum surface transfer coefficient (K_L) was also specified. A minimum K_L was set because under certain low flow conditions, some of the reaches in the model have velocities so low that reaeration equations such as O'Connor Dobbins equation yield reaeration coefficients that are lower than the minimum values specified in the LTP (0.7 m/day divided by depth). Also, each of the reaches was considered wide enough that wind-aided reaeration might be significant. Therefore, a wind-aided minimum surface transfer coefficient was calculated using the same methodology as used in the Mermentau River model (LDEQ 1999) and in the Lake Fausse Pointe/Dauterive Lake model (FTN 2000b). Daily wind speeds from the Lafayette airport were averaged over the calibration period, corrected to a height of 1 m, and then used to calculate a wind-aided surface transfer coefficient of 1.30 m/day.

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 SOD rates were developed through iteration in the calibration. The SOD rate for each reach was adjusted so that predicted DO concentrations were similar to the calibration target values.

Mineralization rates (organic nitrogen decay) in the model were set to 0.02/day for all reaches. This value was based on information in the “Rates, Constants, and Kinetics” publication (EPA 1985). Nitrification rates were set to 0.10/day for all reaches, which is consistent with guidance in the LTP based on stream 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 (see Figure 3.5 in FTN 2000b). The WASP model was used in the Lake Fausse Pointe TMDL (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 rates, CBOD 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.

These four calibration parameters were adjusted in a specific order based on the interactions between state variables in the model. First, the organic nitrogen loads were adjusted until the predicted organic nitrogen concentrations were similar to the observed concentrations. Organic nitrogen was calibrated first because none of the other state variables affect the organic nitrogen concentrations. Next, the benthic ammonia source rates were adjusted until the predicted ammonia nitrogen concentrations were similar to the observed concentrations. Then the CBODu loads were adjusted until the predicted CBODu concentrations were similar to the observed concentrations. Finally, the SOD rates were adjusted until the predicted DO concentrations were similar to the observed concentrations. The DO was calibrated last because all of the other state variables affect DO.

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

The headwater flow specified in the model represented the flow out of Lake Fausse Pointe. The flow rate was calculated based on a monthly water budget model developed by the Louisiana Office of State Climatology. The monthly water budget model includes precipitation, evapotranspiration, storage, and runoff. The runoff calculated by the model was multiplied by the drainage area of Lake Fausse Pointe and the areas contributing to flow into Lake Fausse Pointe. The flow calculations are shown in Appendix E. The average flow was 1.2 m^3/s, or 42 cfs.

In addition to flows from Lake Fausse Pointe, flows from Bayou Teche enter the Charenton Canal at two locations. As discussed in Section 2.1, water flows into the Charenton Canal from Bayou Teche at both locations. The average flow measured at USGS station 07385700 (Bayou Teche at Keystone Lock and Dam near St. Martinville) during the calibration period (day 229 to 265) was used as input into the model for the western section of Bayou Teche draining into the Charenton Canal. For the eastern section of Bayou Teche, no flow records exist for the calibration period. Therefore, the average flow for August through September from 1985 to 1992 (the only existing period of record) for the USGS gage at Franklin (USGS Station 07385800) was used as flow in the model for the eastern section of Bayou Teche.

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

Concentrations of DO, CBODu, organic nitrogen, and ammonia nitrogen were specified in the model for each headwater and tributary inflow. The values used as model input are shown in Appendix E.

Where available, LDEQ ambient monitoring data were used to specify inflow water quality. At each of the LDEQ stations listed below, water quality measurements during the calibration period were averaged to use as model input for the corresponding inflows.

LDEQ Station	Inflow for which data were used
0313 (Lake Fausse Pointe)	Charenton Canal headwater
0030 (Bayou Teche at Adeline)	Bayou Teche West flow into Charenton
0100 (Bayou Teche at Franklin)	Bayou Teche East flow into Charenton

The LDEQ ambient monitoring data included DO, total organic carbon (TOC), and total Kjeldahl nitrogen (TKN), but not CBOD or ammonia nitrogen. Therefore, 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

3.10 Point Source Inputs (Data Types 24 and 25)

The flows and CBODu concentration for the Town of Baldwin WWTP were based on averages of the values on DMRs for August through October 1998. The CBODu values used for model input were obtained by multiplying the BOD_5 values from the DMRs by an assumed CBODu:BOD_5 ratio of 2.3 (which is consistent with the LTP). For parameters not reported on the DMRs, concentrations were assumed based on typical wastewater values. The values used as model input are shown in Appendix E.

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 lower boundary conditions were assumed to be equivalent to the average August to September 1998 values for LDEQ station 0697, SW Pass of Vermilion Bay (see Appendix E).

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 PROJECTIONS

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 an 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-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 none of the LDEQ stations in the study area has more than 6 months of data, LDEQ data from other susbsegments were used for this analysis. The 90th percentile summer temperature for Bayou Teche at Adeline (LDEQ station 0030) was used as a baseline temperature and adjusted to estimate a 90th percentile temperature for each subsegment. The amount of the adjustment was the difference between the average temperature measured at station 0030 during LDEQ's assessment period of June to December 1998, and the average temperature of the station representing the given subsegment during the same period. The stations used to represent the subsegments/model reaches were as follows:

1. Station 0674 represented the upper two reaches of the Charenton Canal (model segments C1 and C2); and

2. Station 0691 represented West Cote Blanche Bay (model segment WC).

The effect of cooling water discharges from the Cleco-Teche Power Plant was accounted for in the temperature of the Charenton Canal between Bayou Teche East and West (model segment C3). Temperature calculations are shown in Appendix H. The initial DO concentrations were set to the water quality standard of 5.0 mg/L, which is consistent with previous studies (e.g., LDEQ 2000d). All other initial conditions were the same as in the calibration run. These values were specified in data type 11 in the model input and are shown in Appendix H.

Because the 2 subsegments in the study area have 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

The inputs for the headwaters and tributaries for the projection simulation were based on guidance in the LTP as well as output from projection models of upstream waterbodies (in previously completed TMDLs). According to the LTP, the critical flow rates for summer should be set to either the 7Q10 flow or 0.1 cfs, whichever is higher. Also, the LTP specifies that the DO concentration for headwater and tributary inflows should be set to 90% saturation at the critical temperature. The values used as model input in the projection simulation are shown in Appendix H.

The headwater flow from Lake Fausse Pointe into the Charenton Canal was set to 0.2 m^3/s, which is the 7Q10 value used in the Lake Fausse Pointe TMDL report (FTN 2000a). The 7Q10 flow from the Bayou Teche Watershed TMDL (LDEQ 2000d) of 9.04 m^3/s (319 cfs) was used for the inflow from Bayou Teche West. The flow for Bayou Teche East was set to 2.31 m^3/s, which was calculated by multiplying the Bayou Teche West flow (9.04 m^3/s) by the ratio of Bayou Teche East to West flows from the calibration model. This was done because there are no published 7Q10 values for the eastern portion of Bayou Teche.

Headwater input concentrations were set to the values from the Lake Fausse Pointe TMDL (FTN 2000a). For Bayou Teche West, the temperature, DO, and CBODu were set to projection model results from the Bayou Teche TMDL (LDEQ 2000d). The other input values for Bayou Teche West (e.g., organic N, etc.) were kept at calibration values. For Bayou Teche East, DO was set to the 90% saturation value at 29.3°C (the temperature derived using the method described in Section 4.2). All other parameters were kept at calibration values.

4.4 Point Source Inputs

The Town of Baldwin WWTP flow was set to 125% of its design flow in order to incorporate an explicit margin of safety for the point source WLA. Temperature for the Town of Baldwin WWTP was set equal to the temperature of the element it discharges into (model segment C3). Dissolved oxygen was set to 2.0 mg/L in accordance with the LTP, and CBODu was set to the current $CBOD_5$ permit limit of 10 mg/L times an assumed CBODu:$CBOD_5$ ratio of 2.3. All other parameters were kept at the calibration values. Input values for wasteloads are shown in Appendix H.

4.5 Nonpoint Source Loads

Because the initial projection simulation was showing low DO values in several reaches, 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. Within each reach, the same percent reduction was applied to all components of the nonpoint source loads (SOD and mass loads of CBODu and organic 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 same as the critical temperature for West Cote Blanche Bay. This was done so that the model would not change the temperature that was specified for West Cote Blanche Bay. For DO, the downstream boundary condition was set to the water quality standard (5.0 mg/L), assuming that the downstream waterbody was meeting standards for DO. Values for other parameters were the same as in the calibration simulation. The values used as model input in the projection simulation are shown in Appendix H.

4.7 Other Inputs

The only model inputs that were changed form the calibration to the projection simulation were the inputs discussed above in Sections 4.2 through 4.6. All of the other model inputs (e.g., hydraulic and dispersion coefficients, decay rates, reaeration rates, etc.) were unchanged from the calibration simulation.

4.8 Model Results for Projection

Plots of predicted water quality for the projection are shown in Appendix I and a printout of the model output for the projection is presented in Appendix J.

5.0 TMDL CALCULATIONS

5.1 DO TMDLs

A total maximum daily load (TMDL) for DO has been calculated for each subsegment in the study area based on the results of the projection simulation. The DO TMDLs are presented as oxygen demand from CBODu, NBOD (decay of organic nitrogen and ammonia nitrogen), and SOD. Summaries of the loads for each subsegment are presented in Tables 5.1 and 5.2.

The NBOD loads were calculated as 4.33 times the sum of organic nitrogen and ammonia nitrogen (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 WLAs for minor point sources represent the loads from small oxygen demanding discharges that were not explicitly modeled. The calculations for the WLAs for minor point sources are shown in Appendix K. In general, these WLAs were based on current permit limits with no reductions. For discharges with no available flow information, a design flow of 0.001 MGD was assumed. For discharges with no permit limits for ammonia nitrogen, effluent concentrations for ammonia nitrogen were assumed based on the BOD_5 permit limits and typical combinations of BOD_5 and ammonia nitrogen listed in the LTP (LDEQ 2000b). For discharges that have permit limits for COD but not BOD_5, the COD values were assumed to be similar to ultimate BOD.

Because the WLAs for minor point sources represented loads that were not simulated in the model, these loads were added to the total loads simulated in the model. The LAs 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 for NPS. The explicit MOS for point sources was set to 20% of the total point source loading.

Table 5.1. DO TMDL for Subsegment 060601 (Charenton Canal).

	Oxygen Demand (kg/day) from:			Total Oxygen Demand (kg/day)
	CBODu	NBOD	SOD	
WLA for Town of Baldwin WWTP	20	25	n.a.	45
WLA for minor point sources	5	3	n.a.	8
MOS for Point Sources	5	6	n.a.	11
LA for Nonpoint Sources	3630	3248	344	7222
MOS for Nonpoint Sources	403	361	38	802
Total Maximum Daily Load	4063	3643	382	8088

Table 5.2. DO TMDL for Subsegment 061001 (West Cote Blanche Bay).

	Oxygen Demand (kg/day) from:			Total Oxygen Demand (kg/day)
	CBODu	NBOD	SOD	
WLA for minor point sources	0.024	0.015	n.a.	0.038
MOS for Point Sources	0.005	0.003	n.a.	0.008
LA for Nonpoint Sources	471600	70146	77449	619195
MOS for Nonpoint Sources	52400	7794	8605	68799
Total Maximum Daily Load	524000	77940	86054	687994

5.2 Nutrient TMDLs

Because one of the subsegments in the study area was on the 303(d) List for nutrients as well as DO (see Table 1.1), nutrient TMDLs were 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 these TMDLs, 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 2000a).

The first step in calculating the nutrient TMDLs 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 each subsegment are presented in Tables 5.3 and 5.4.

Table 5.3. Nutrient TMDL for Subsegment 060601 (Charenton Canal).

	Total Inorganic Nitrogen (kg/day)	Total Phosphorus (kg/day)
WLA for Town of Baldwin WWTP	6.0	3.1
WLA for minor point sources	1.0	0.5
MOS for Point Sources	1.0	0.5
LA for Nonpoint Sources	1066.7	545.2
MOS for Nonpoint Sources	118.5	60.6
Total Maximum Daily Load	1193.2	609.9

Table 5.4. Nutrient TMDL for Subsegment 061001 (West Cote Blanche Bay).

	Total Inorganic Nitrogen (kg/day)	Total Phosphorus (kg/day)
WLA for minor point sources	0.011	0.006
MOS for Point Sources	0.002	0.001
LA for Nonpoint Sources	15629	7988
MOS for Nonpoint Sources	1737	888
Total Maximum Daily Load	17366	8876

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 as follows to maintain the DO standard:

90% – Subsegment 060601 (Charenton Canal)
90% – Subsegment 061001 (West Cote Blanche Bay)

The projection model was run assuming no treatment upgrade for the Town of Baldwin WWTP due to its relatively minor contribution to the total load. Complete elimination of the Town of Baldwin WWTP would change the required NPS reductions by less than 1%.

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 SOD. 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-August, the lowest stream flows occur in October-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 LA-QUAL 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. The projection simulation was used as the baseline for the sensitivity analysis. The percent change of the model's minimum DO projections to these parameters 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. Wasteload DO (e.g. DO from tributaries and point sources) was the parameter to which the model was most sensitive (15%). Other parameters creating variations in the model results were reaeration (4% to 6%) and wasteload BOD (4%). The model was least sensitive to headwater flow and dispersion.

Table 6.1. Summary of results of sensitivity analysis.

Input Parameter	Parameter Change	Predicted minimum DO (mg/L)	Percent Change in Predicted DO (%)
Baseline	-	5.01	N/A
Dispersion	+30%	5.01	<1
Headwater flow	+30%	5.02	<1
Dispersion	-30%	5.01	<1
Headwater flow	-30%	5.01	<1
Organic N decay rate	-30%	5.03	<1
Waste Load Organic N	-30%	5.03	<1
Organic N decay rate	+30%	5.00	<1
Waste Load Organic N	+30%	5.00	<1
NH3 decay rate	+30%	4.98	1
Waste Load flow	+30%	4.98	1
SOD	-30%	5.05	1
SOD	+30%	4.98	1
Waste Load NH3	+30%	4.98	1
NH3 decay rate	-30%	5.05	1
Waste Load NH3	-30%	5.05	1
Velocity	+30%	4.96	1
Waste Load flow	-30%	5.09	2
Velocity	-30%	5.12	2
BOD decay rate	+30%	4.90	2
Depth	+30%	4.91	2
BOD decay rate	-30%	5.16	3
Initial Temperature	-2oC	5.17	3
Initial Temperature	+2oC	4.86	3
Waste Load BOD	+30%	4.84	3
Depth	-30%	5.16	3
Waste Load BOD	-30%	5.19	4
Reaeration	+30%	5.21	4
Reaeration	-30%	4.74	5
Waste Load DO	-30%	5.75	15
Waste Load DO	+30%	4.28	15

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 J ARE AVAILABLE FROM EPA UPON REQUEST

APPENDIX K

Responses to Comments

COMMENTS AND RESPONSES
CHARENTON DRAINAGE AND NAVIGATION CANAL AND
WEST COTE BLANCHE BAY 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. <u>Calibration, and Projection, Data type 27</u>: 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 m3/sec is the same as zero flow.

33. <u>Hydraulics and Dispersion</u>: 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 CHARENTON DRAINAGE AND NAVIGATION CANAL AND WEST COTE BLANCHE BAY:

1. Executive Summary, page i, paragraph 3: Paragraph states that four subsegments were later added to the list. Should that be two subsegments? Also which list were these subsegments added too?

Response: The text has been corrected by deleting "all 4 subsegments were added to the list" and replacing it with "both subsesgments were later added to the Modified Court Ordered List".

2. 2.1 General Information, page 2-1, bullet list:

   a. The Gulf of Mexico should be added as an inflow into the system due to its tidal effects.

Response: The bullet list includes only advective inputs to the system; the influence from the Gulf of Mexico is considered to be primarily dispersive exchange that was accounted for in the model through the lower boundary conditions.

   b. Also paragraph 3 states that the Intracoastal Waterway's flows were inconsistent and thus it was not added into the model. It would be prudent to choose the most conservative of these patterns and apply it during the projection run, instead of ignoring the GIWW.

Response: Based on the limited data that were available, the quantity of flow in the Intracoastal Waterway was small; therefore, its effect on the Charenton Canal was assumed to be minimal.

3. 2.3.1 Point Sources, page 2-4, paragraph 3: Why wasn't the power generator's discharge added to the systems flow? The model did increase the temperature in this reach, which was appropriate, however the facility's flow rate would have increased the

system's total advective flow by 60%, which would have a dramatic effect on the system's overall stream velocity.

Response: A paragraph has been added to the end of Section 2.3.1 explaining that the discharge from the Cleco-Teche power plant consists of cooling water that is withdrawn from the Charenton Canal. Because some of the cooling water is likely lost to evaporation, the discharge should not be larger than the withdrawal and therefore should not increase the flow or velocity in the stream.

4. <u>3.1 Model Setup, page 3-1, paragraph 3</u>:

   a. Paragraph states, "The Charenton Canal was divided into multiple reaches only because the depth and width vary somewhat between the upper and lower portions". If this is the case why are the width values used in the model equivalent in all reaches with the exception of West Cote Blanche Bay? Also the two middle reaches have the same depth value.

Response: The statement has been revised as follows: "The Charenton Canal was divided into multiple reaches based on changes in depth, width, or flow".

   b. Paragraph states that the entire bay was treated as a single element reach due to no evidence suggesting significant water quality variations throughout the bay. With only one sampling station there is also no evidence to suggest that there are not significant water quality variations within the bay. The sampling site was on the north shore and could be dramatically different from the water quality closer to the Gulf.

Response: Because LDEQ apparently considered data from this station (0691) to be representative enough for assessing the entire bay, it was considered appropriate to calibrate the model for the entire bay to those same data.

   c. What data source was the basis of the statement that the bay has a uniform depth?

Response: Depth for West Cote Blanche Bay was based on bathymetric contours on USGS 1:100,000 topographic maps.

5. <u>3.4 Hydraulics and Dispersion (Data Types 9-10), page 3-3, paragraph 2</u>: How were the depth values estimated from the data sets quoted?

Response: The topographic maps were used to visually estimate the average depth for West Cote Blanche Bay. The 1999 intensive survey data for Lake Fausse Pointe were used to estimate the depth and width for reach 1 (the data used here was a cross section measurement in the Charenton Canal just downstream of Lake Fausse Pointe). The Corps of Engineers data consisted of centerline depth measurements along the Charenton Canal; these measurements were averaged and then divided by the ratio of average depth to maximum depth from the cross section just downstream of Lake Fausse Pointe.

6. <u>3.4 Hydraulics and Dispersion (Data Types 9-10), page 3-3, paragraph 3</u>: The contractor chose a numeric dispersion factor based on the value determined in the Lake Fausse Pointe TMDL (FTN, 2000a). The LDEQ ambient sites data includes chlorides, sulfates and other known conservatives. This data should have been used to determine the dispersion factor during the calibration process.

Response: The dispersion coefficient from the Lake Fausse Pointe model was considered acceptable due to the proximity of that system.

7. 3.6 Water Quality Kinetics (Data Types 12-13), page 3-4, paragraph 2:

   a. It is stated that the average daily wind speed used in the wind reaeration equation was adjusted from the airport's ten-meter height value to a one-meter height value. LDEQ suggests that a 0.1-meter height would be more appropriate and consistent with previous LDEQ TMDLs.

Response: Several literature sources have been reviewed and no published recommendation has been found for what height the wind speeds should be adjusted. A height of one meter was considered to be acceptable for these TMDLs. EPA will consider this in future development of TMDLs in Louisiana.

   b. The equation used to adjust the reaeration K_L was appropriate within the navigation canal, however aren't there more appropriate reaeration equations for lakes that would apply to reach 4?

Response: Based on the information presented along with the KL adjustment equation in the Rates, Constants, Kinetics manual (EPA 1985), the equation should be applicable for both lakes and streams.

8. <u>3.8 Headwater and Tributary Flow Rates (Data Types 20 and 24), page 3-6, paragraph 1 & 2</u>: An average flow was used in this calibration. Due to the high peak flows skewing the average, it is not generally acceptable to use an average flow value over long periods of time. A median value is more widely used in those situations.

Response: The average flow was used in order to represent the total loading of pollutants to the system during the calibration period. Although the median would allow a better representation of typical velocities, it was considered more important to accurately represent inflow loadings than stream velocities (since reaeration was controlled by wind rather than stream velocity).

9. 3.9 Headwater and Tributary Water Quality (Data Types 21 and 25), page 13, paragraph 5: The terms described in the ratios appear to be out of order. Using the order currently listed would give a different equation than the one listed below the paragraph.

Response: The text has been corrected to state that 6.0 was the ratio of TOC to CBOD5, not vice versa.

10. Calibration, and Projection, Data type 3: A value was not input for the estimated tidal range at the boundary point. Without an input tidal range the model will not calculate the tidal prism and adjust the model velocity for the tidal influences.

Response: Even without this input, the model still calculates dispersive exchange at the downstream boundary.

11. Projection, Data type 3: Why wasn't the K_L minimum adjusted for the average critical season wind speed. It appears that the value was just carried over from the calibration model.

Response: Using the same KL for the calibration and projection was considered acceptable for these TMDLs. However, EPA will consider this in future development of TMDLs in Louisiana.

COMMENTS FROM LDEQ PRIOR TO PUBLIC COMMENT PERIOD:

1. 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 should 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 Appendix D.

2. In the calibration model an average of the flows and 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.

Response: See response to comment 20 in LDEQ General Comments above.

3. Numerous grammatical errors and misspelled words were found in this report.

Response: The report has been reviewed for grammar and spelling.

4. Executive Summary, page i, paragraph 3: Paragraph states that four subsegments were later added to the list. Should that be two subsegments? Also which list were these subsegments added too?

Response: See response to comment 1 in LDEQ Specific Comments above.

5. 2.1 General Information, page 2-1, bullet list:

   A. Shouldn't the Gulf of Mexico also be added as an inflow into the system due to its tidal effects?

Response: See response to comment 2A in LDEQ Specific Comments above.

   B. Also paragraph 3 states that the Intracoastal Waterway's flows were inconsistent and thus it was not added into the model. Wouldn't it be prudent to choose the most conservative of these patterns and apply it during the projection run, instead of ignoring the GIWW?

Response: See response to comment 2B in LDEQ Specific Comments above.

6. 2.3.1 Point Sources, page 2-4, paragraph 3: Why wasn't the power generator's discharge added to the systems flow? The model did increase the temperature in this reach, which was appropriate, however the facility's flow rate would have increased the system's total advective flow by 60%, **which would have a dramatic effect on the system's overall stream velocity.**

Response: See response to comment 3 in LDEQ Specific Comments above.

7. 3.1 Model Setup, page 3-1, paragraph 1: This is an older version of the LAQUAL model. It would be appropriate to update FTN's model version.

Response: The older version of LAQUAL yields the same results as the newer version. EPA will consider this in future development of TMDLs in Louisiana.

8. 3.1 Model Setup, page 3-1, paragraph 2: The vector diagram shows only the reach layout and does not include element #'s. In this case each of the reaches is a one-element reach, however they should be labeled correctly.

Response: Displaying individual element numbers is not necessary for the vector diagram. All labeling of the vector diagram is correct.

9. <u>3.1 Model Setup, page 3-1, paragraph 3</u>:

   A. Paragraph states "The Charenton Canal was divided into multiple reaches only because the depth and width vary somewhat between the upper and lower portions". If this is the case why are the width values used in the model equivalent in all reaches with the exception of West Cote Blanche Bay? Also the two middle reaches have the same depth value.

Response: See response to comment 4A in LDEQ Specific Comments above.

   B. Paragraph states that the entire bay was treated as a single element reach due to no evidence suggesting significant water quality variations throughout the bay. With only one sampling station there is also no evidence to suggest that there are not significant water quality variations within the bay. The sampling site was on the north shore and could be dramatically different from the water quality closer to the Gulf.

Response: See response to comment 4B in LDEQ Specific Comments above.

   C. What data source was the basis of the statement that the bay has a uniform depth?

Response: See response to comment 4C in LDEQ Specific Comments above.

10. <u>3.3 Temperature Correction for Kinetics (Data Type 4), page 3-2</u>: The temperature correction for reaeration is listed as 1.024. It is LDEQ's standard procedure to allow the LAQUAL model to calculate this temperature correction factor.

Response: See response to comment 26 in LDEQ General Comments above.

11. <u>3.4 Hydraulics and Dispersion (Data Types 9-10), page 3-3, paragraph 2</u>: How were the depth values estimated from the data sets quoted?

Response: See response to comment 5 in LDEQ Specific Comments above.

12. <u>3.4 Hydraulics and Dispersion (Data Types 9-10), page 3-3, paragraph 3</u>: The contractor chose a numeric dispersion factor based on the value determined in the Lake Fausse Pointe TMDL (FTN, 2000a). The LDEQ ambient sites data includes chlorides, sulfates and other known conservatives. This data should have been used to determine the dispersion factor during the calibration process.

Response: See response to comment 6 in LDEQ Specific Comments above.

13. <u>3.5 Initial Conditions (Data Type 11), page 3-4, paragraph 3</u>: Statement made by report inaccurate, several values were input into this section that were not described in the report. Also it is sometimes appropriate to include Chlorophyll a values in this section, when you are not actively modeling the algal cycle. By entering a value here the model can simulate the algal production of dissolved oxygen and will add this to the estimated dissolved oxygen value predicted by the model.

Response: For this model, all of the statements in Section 3.5 are correct. The example of including chlorophyll in the initial conditions to affect DO was mentioned in the draft report, but that effect was not used in this model.

14. <u>3.6 Water Quality Kinetics (Data Types 12-13), page 3-4, paragraph 2</u>:

A. It is stated that the average daily wind speed used in the wind reaeration equation was adjusted from the airport's ten-meter height value to a one meter height value. LDEQ suggests that a 0.1 meter height would be more appropriate and consistent with previous LDEQ TMDLs.

Response: See response to comment 7A in LDEQ Specific Comments above.

B. The equation used to adjust the reaeration KL was appropriate within the navigation canal, however aren't there more appropriate reaeration equations for lakes that would apply to reach 4?

Response: See response to comment 7B in LDEQ Specific Comments above.

15. <u>3.6 Water Quality Kinetics (Data Types 12-13), page 3-5, paragraph 4</u>:

A. The contractor chose 0.02 per day as the Organic Nitrogen decay rate. LDEQ concurs with Texas' TNRCC procedures that, without any available measured decay rates, this value should be set to a default of 0.05 per day. FTN's model states that LDEQ's guidance has specified a default decay rate value of NBOD of 0.05 per day. The decay rate from organic nitrogen to ammonia is the restricting decay rate in the nitrogenous process, thus the NBOD rate should be approximately equal to the organic nitrogen decay rate.

Response: The value of 0.02/day for the organic nitrogen decay rate was consistent with published literature (EPA 1985) and has been used in other water quality models that have been approved by LDEQ for TMDLs for southern Louisiana waterbodies.

B. LDEQ's LTP does not specify a nitrification rate only a NBOD decay rate, which includes both the nitrification rate as well as mineralization.

Response: The draft report was consistent with this comment.

C. What LDEQ guidance specified a default NBOD rate of 0.05/day? Either reference verbal guidance from LDEQ or reference Texas' TNRCC procedures.

Response: The LDEQ guidance that specified the default NBOD decay rate of 0.05/day was a one page unpublished document that was provided to the contractor at the beginning of the project. See also the response to comment 3 of the LDEQ General Comments above.

D. Why wasn't a settling rate used for the CBOD and the Organic Nitrogen?

Response: See response to comment 8 in LDEQ General Comments above.

16. <u>3.6 Water Quality Kinetics (Data Types 12-13), page 3-5, paragraph 5</u>: It is LDEQ's standard procedure to use the default nitrification inhibition option 2. The increase in ammonia nitrogen at the low DO values could be compensated for with algal or macrophyte inputs.

Response: See response to comment 10 in LDEQ General Comments above.

17. <u>3.7 Nonpoint Source Loads (Data Type 19), page 3-6, paragraph 1</u>: How were the benthic ammonia source rates specified in data type 13?

Response: Text describing procedure for calibrating benthic ammonia source rates has been added to Section 3.7.

18. <u>3.8 Headwater and Tributary Flow Rates (Data Types 20 and 24), page 3-6, paragraph 1 & 2</u>: An average flow was used in this calibration. Due to the high peak flows skewing the average, it is not generally acceptable to use an average flow value over long periods of time. A median value is more widely used in those situations.

Response: See response to comment 8 in LDEQ Specific Comments above.

19. <u>3.9 Headwater and Tributary Water Quality (Data Types 21 and 25), page 13, paragraph 5</u>: The terms described in the ratios appear to be out of order. Using the order currently listed would give a different equation than the one listed below the paragraph.

Response: See response to comment 9 in LDEQ Specific Comments above.

20. <u>4.1 Identification of Critical Conditions: page 4-2, paragraph 5</u>: Instead of design flow LDEQ tries to use the anticipated flows where ever possible. Many times a facility's design capacity is much larger than its anticipated flow based on the number of homes within the community.

Response: Using design flow results in a more conservative TMDL.

21. <u>4.2 Temperature Inputs, page 16, paragraph 3</u>: It is LDEQ's practice to run both a winter and summer projection. The addition of a winter projection run is required.

Response: See response to comment 11 in LDEQ General Comments above.

22. <u>4.5 Nonpoint Source Loads, page 4-4, paragraph</u>:

A. Much of the nonpoint loading affecting these subsegments and adding to their benthic blanket is coming from the tributaries feeding them. Most of these headwater tributaries have recent TMDLs 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. Most of the land in the vicinity of the lower subsegments is marsh where a reduction in nonpoint loads is meaningless. This should be taken into consideration as these subsegments are addressed.

Response: See second response to comment 4 in LDEQ General Comments above.

B. LDEQ's policy is to address background loads. It is also LDEQ's policy to make a No-Load projection run which will require the estimation of these background loads. The contractor should include a No-Load projection run in this model report.

Response: A no-load projection run does not provide any information needed to calculate the components of a TMDL; therefore, it is not required.

23. <u>5.0 DO TMDLs, page 5-1, paragraph 3 & 4</u>:

A. A default 0.001 MGD flow rate was assigned to dischargers where a flow rate was not available. 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: See response to comment 15 in LDEQ General Comments above.

B. The percentage reductions listed, when checked against the calibration and projections input datasets, were calculated incorrectly. These values did not take the MOS into consideration.

Response: See response to comment 5 in LDEQ General Comments above.

C. LDEQ does not agree with the minor point sources loads being subtracted from the NPS load. The pollutant loads being addressed in this TMDL are non-conservative loads. Many of these dischargers are located on small tributaries to the 303(d) waterbody and 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: See response to comment 16 in LDEQ General Comments above.

D. Paragraph 4 was very difficult to follow and determine what load was the final LA. Also once a final LA is determined, it would need to be compared to the calibration NPS load, taking into consideration the MOS, to determine the true NPS percentage load reductions.

Response: This paragraph has been revised because the TMDL calculations have been revised so that the minor point source loads are now added to the modeled loads rather than subtracted from the NPS load allocation (see response to comment 16 in LDEQ General Comments above).

24. 5.2 Nutrient TMDLs, page 5-2, paragraph 1:

A. LDEQ's regulatory language should be interpreted as follows: the ratio of nitrogen to phosphorus is the ratio of the Total Nitrogen to Total Phosphorus. The report incorrectly compares soluble nitrogen to Total Phosphorus.

Response: See first response to comment 23 in LDEQ General Comments above.

B. FTN should not have calculated a phosphorus load at all. LDEQ takes exception to the calculation of a phosphorus TMDL load based on TN/TP ratios derived from other waterbodies. It is LDEQ's experience that the natural allowable TN/TP ratio is waterbody-specific and can vary dramatically between streams. In this case the flow from the Lake Fausse Pointe system is less than 6% of the total advective flow entering the system, thus natural allowable TN/TP ratio for the 060601 subsegment's waterbody could be very different from the values determined for the Lake Fausse Pointe system. **Please remove any phosphorus load calculations from this report!**

Response: See responses to comment 23 in LDEQ General Comments above.

25. 5.5 Margin of Safety, page 5-4, paragraph 1: The explicit MOS used for the non-point sources was 10%. When the MOS percent used is less than the LDEQ standard 20%, a justification statement should be made in the report.

Response: See response to comment 17 in LDEQ General Comments above.

26. <u>6.0 Sensitivity Analysis, page 6-1, paragraph 1</u>, The sensitivity analysis was run against the projection model instead of the calibration model. It is LDEQ's policy to use the calibration model as the baseline for the sensitivity analysis.

Response: See response to comment 14 in LDEQ General Comments above.

27. <u>Calibration, Data type 3</u>: No conservative was used. Chlorides or some other conservative should have been used to hydrologically calibrate the flows and dispersion.

Response: A stream flow balance using a conservative material such as chlorides or conductivity is useful only when there are multiple sources of flow being combined with significantly different concentrations of the conservative material. If the different sources of inflow have similar concentrations, the flow balance does not provide accurate results. Also, there must be flow data for at least one of the inflow sources and concentration data for all of the inflow sources. Because none of these conditions existed for this system, a flow balance using a conservative material was not performed.

28. <u>Calibration, and Projection, Data type 27</u>: A salinity value was set to zero in the boundary conditions for both the calibration and the projection models. 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 this reach only had one element the model automatically set it to zero, thus calculating an inaccurate value for the DO saturation.

Response: Because the typical salinities for these waterbodies are low, the effect of salinity on DO saturation was determined to be very small and was therefore neglected.

29. <u>Calibration, and Projection, Data type 3</u>: A value was not input for the estimated tidal range at the boundary point. Without an input tidal range the model will not calculate the tidal prism and adjust the model velocity for the tidal influences.

Response: See response to comment 10 in LDEQ Specific Comments above.

30. <u>Projection, Data type 3</u>: Why wasn't the K_L minimum adjusted for the average critical season wind speed. It appears that the value was just carried over from the calibration model.

Response: See response to comment 11 in LDEQ Specific Comments above.

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).

SPECIFIC COMMENTS FROM LSU AG CENTER FOR CHARENTON DRAINAGE AND NAVIGATION CANAL AND WEST COTE BLANCHE BAY:

The establishment of a requirement of 90% reduction in NPS loadings on a stream segment with only a narrow strip of land along its banks and on a Bay with no land drainage seems out of the achievable range. We suggest the DO standard of 5 mg/L be reviewed and that studies on what the impact of reducing the loading from the upstream areas might accomplish.

Response: See response for second part of comment 4 from LDEQ General Comments above.