2009

WATERSHED IMPLEMENTATION PLAN FOR BAYOU NEZPIQUE

DEQ
LOUISIANA

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Introduction

The Louisiana Department of Environmental Quality (LDEQ) is implementing a Clean Waters Program within the state. The purpose of this water quality initiative is to reduce the number of water bodies that are not fully meeting the goals of the Clean Water Act.

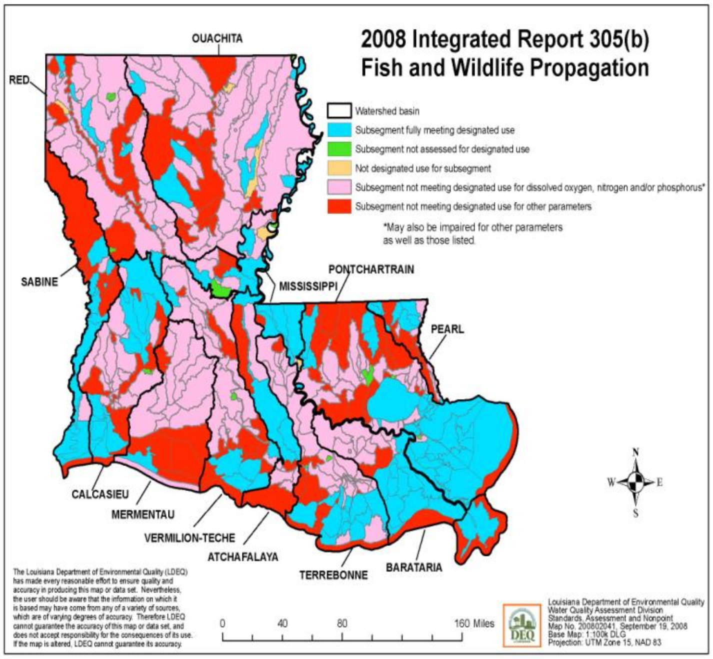


Figure 1: Map of Impaired Watersheds in the State for Fish and Wildlife Propagation.

As this map (Figure 1) clearly shows, there were many water bodies included in the 2008 305(b) Report as not fully meeting the designated uses for fish and wildlife propagation. The pink watersheds include water bodies that are not meeting the fish and wildlife use because of dissolved oxygen or nutrients. The goal of the Clean Waters Program is to work through local stakeholder groups to improve water quality.

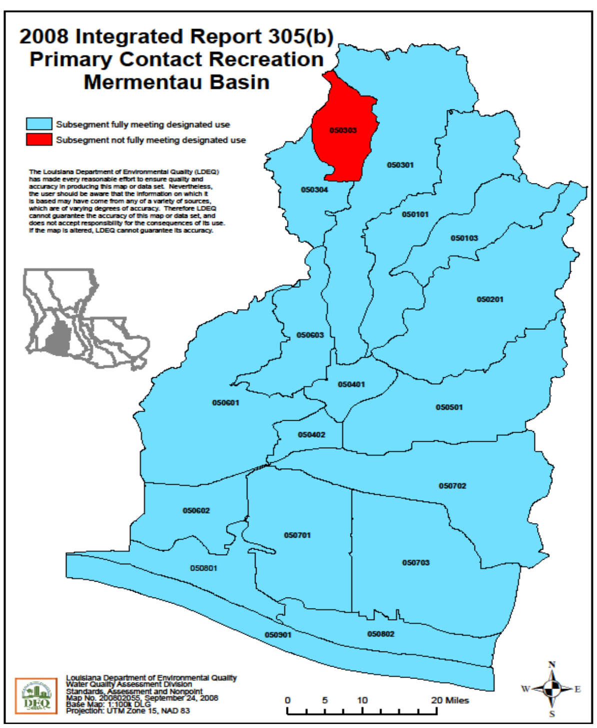


Figure 2: Map of Watersheds Meeting the Swimming Use in the Mermentau River Basin

There have been water quality improvements in the Mermentau River Basin since 2006 for contact recreational uses (i.e. swimming and boating). The map in Figure 2 illustrates how much of the Mermentau River Basin now fully supports primary contact recreation for swimming.

The majority of the water quality problems that exist within the Mermentau River Basin are associated with the fish and wildlife propagation use. LDEQ has worked with many partners within the Mermentau River Basin over the past 20 years to improve water quality. However because of the large number of rice farms and crawfish operations that utilize a lot of water for production, these water quality problems associated with dissolved oxygen and nutrients are difficult to solve. As the waters from the ponds are discharged back into the bayou, they often carry sediment and nutrient loads with them that prevent the bayous from meeting the water quality standard for dissolved oxygen during the summer months. Figure 3 illustrates the extent of these water quality problems and why more work is needed to address them.

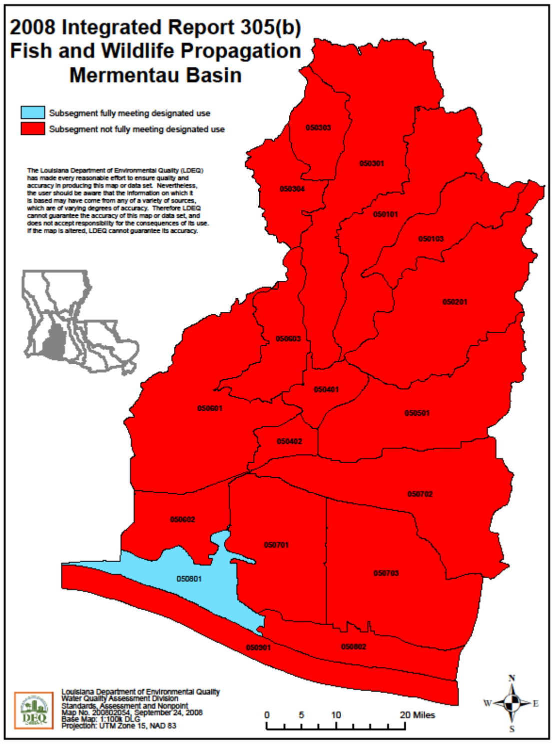


Figure 3: Map of Watersheds not Meeting the Fish and Wildlife Propagation Use

The Bayou Nezpique flows through the Mermentau Basin in southwestern Louisiana. This is the prairie region of the state where rice and crawfish farms have been a dominant part of the landscape for many generations. The upper portion of the Mermentau Basin is forested, but the majority of the basin is in agricultural production except for the marshes that extend from the southern reaches of the basin to the Gulf of Mexico.

Bayou Nezpique flows for 65 miles through the Mermentau River Basin, extending from its northernmost extent to the headwaters of the Mermentau River. The headwaters of the Bayou Nezpique are forested and it has a forested riparian buffer that extends along the entire length of the bayou. (Figure 5).

The Louisiana Department of Environmental Quality (LDEQ) has monitored the water quality in Bayou Nezpique for many years. The water quality north of Basile and northeast of Jennings has historically been relatively good. However, the bayou has consistently been included on the state's 303(d) list of impaired waters because it did not comply with the fish and wildlife propagation goals of the Clean Water Act. As Figure 1 illustrates, there are many water bodies in the state that do not meet these fish and wildlife propagation goals. The reasons for these water quality problems include dissolved oxygen, nitrogen, phosphorus and mercury. Since Bayou Nezpique was included on the state's 303(d) list, LDEQ and USEPA were required to determine what level of pollutant load reductions would be necessary to meet water quality standards and restore the bayou to its fish and wildlife propagation use. Therefore, the Louisiana Department of Environmental Quality (LDEQ) and the United States Environmental Protection Agency (USEPA) developed total maximum daily loads (TMDLs) for these pollutants.

The TMDL provides reduction goals for point and nonpoint source loads to the water body. The TMDL then becomes the basis for what the permitted dischargers will need to do to meet these load reductions in order to be able to continue their discharge to the water body. The TMDL also becomes the basis for what the nonpoint source load reductions need to be to meet water quality standards. The purpose of this watershed plan is to provide information on the water quality data and land-use information that exists and recommendations on the types of best management practices (BMPs) that could be implemented to improve water quality.

This watershed plan was originally written in February 2003, but has been revised to comply with the 9 key elements that were included in USEPA's 2004 Grant Guidelines for Section 319 of the Clean Water Act. USEPA Region 6 has required the states to make these revisions prior to the use of Section 319 incremental funds for project implementation. LDEQ has included the page numbers that include the information where these nine key elements can be found within this plan.

USEPA's Nine Key Elements

USEPA has included nine key elements in their national guidelines for the Nonpoint Source Program and Section 319 grants. The nine key elements include:

a. An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed plan goals identified in the watershed-based plan), as discussed in item (b) immediately below (pages 1-39).
b. An estimate of the load reductions expected for the management measures described under paragraph © below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Estimates should be provided at the same level as in item (a) above (e.g. the total load reduction expected for dairy cattle feedlots; row crops; or eroded stream banks) (pages 39-40).
c. A description of the NPS management measures that will need to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals, identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas in which those measures will be needed to implement this plan (pages 40-43).
d. An estimate of the amounts of technical and financial assistance needed associated costs, and/or the sources and authorities that will be relied upon, to implement this plan. As sources of funding, States should consider the use of their Section 319 programs, State Revolving Loan Funds, USDA's Environmental Incentive Program and Conservation Reserve Program, and other relevant Federal, State, and local and private funds that may be available to assist in implementing this plan (pages 41-44).
e. An information/ education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the NPS management measures that will be implemented (pages 43-45).
f. A schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious (page 45).
g. A description of interim, measureable milestones for determining whether NPS management measures or other control actions are being implemented (page 45).
h. A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards and, if not, criteria for determining if watershed based plans need to be revised (19).
i. A monitoring component to evaluate the effectiveness of implementation efforts over time, measured against the criteria established under item (h) above (19-45).

All of this information is intended to assist the local decision makers and landowners in understanding more clearly what their role needs to be in restoring the designated uses for Bayou Nezpique.

2.0 Watershed Description

In order to understand why the water quality standards in Bayou Nezpique are not being met, LDEQ examined the watershed as a whole to understand where the pollutants are coming from. The Bayou Nezpique flows for 65 miles from its headwaters to the confluence with the Mermentau River and is classified as sub-segment 050301 within the Mermentau River Basin. The Mermentau Basin encompasses the prairie region of the state and a section of the coastal zone. The drainage area for the basin, excluding the gulf water segment is 3,710 square miles. The bayou Nezpique watershed is located in south central Louisiana, has a drainage area of 611.2 square miles and includes portions of four parishes: Evangeline, Acadia, Allen, and Jefferson Davis. The northern part of the watershed is primarily evergreen forests (pine), occupying almost ½ of the watershed. The midsection of the watershed is prairie, characterized by large expanses of rice fields mixed with pastures and scattered areas of oak trees and other mixed hardwoods. The southern portion of the watershed is rice and soybeans mixed with pastures and hay. There is a healthy riparian border of forests along most of the Bayou Nezpique. The slope of the land is generally north to south. Because of its relatively low relief, especially in the prairie areas, the region is characterized by poor drainage and annual backwater flooding of agricultural lands. The towns of Oakdale, Pine Prairie and Oberlin are in the northern half of the watershed and Elton and Basile are along Highway 190.

The Bayou Nezpique Watershed actually contains several smaller watersheds that also have water quality data for them. These watersheds include Bayou Blue and Castor Creek. The headwaters of Bayou Nezpique include the intermittent portion of Beaver Creek. All of the water quality data for these bayous has been examined to try to understand where within the watershed the water quality problems may originate. LDEQ has six water quality monitoring stations located within the Bayou Nezpique and Figures 5-6 indicates where those monitoring sites are located. The 2008 Integrated Report indicates that the main stem of Bayou Nezpique (050301) is fully meeting both the primary and secondary contact recreation uses, but is not meeting the fish and wildlife propagation use. This means that bacteria counts in the bayou are low enough for it to be safe for swimming or boating. The types of water quality problems that persist include lead nitrate/nitrite, total phosphorus, dissolved oxygen, sedimentation, siltation, total suspended solids (TSS), total dissolved solids (TDS) and turbidity. The suspected source of many of these pollutants is agricultural crop production, except for lead which comes from unknown sources.

Castor Creek (050303) was not fully meeting the primary contact recreational uses, but was supporting the secondary contact use. This means that there are bacterial problems that need to be addressed before it is considered safe for swimming, but it is okay for boating. The fish and wildlife propagation use was not met. The suspected sources of these water quality problems were lead and dissolved oxygen. Castor Creek did not have the same types of

Figure 4: Bayou Nezpique

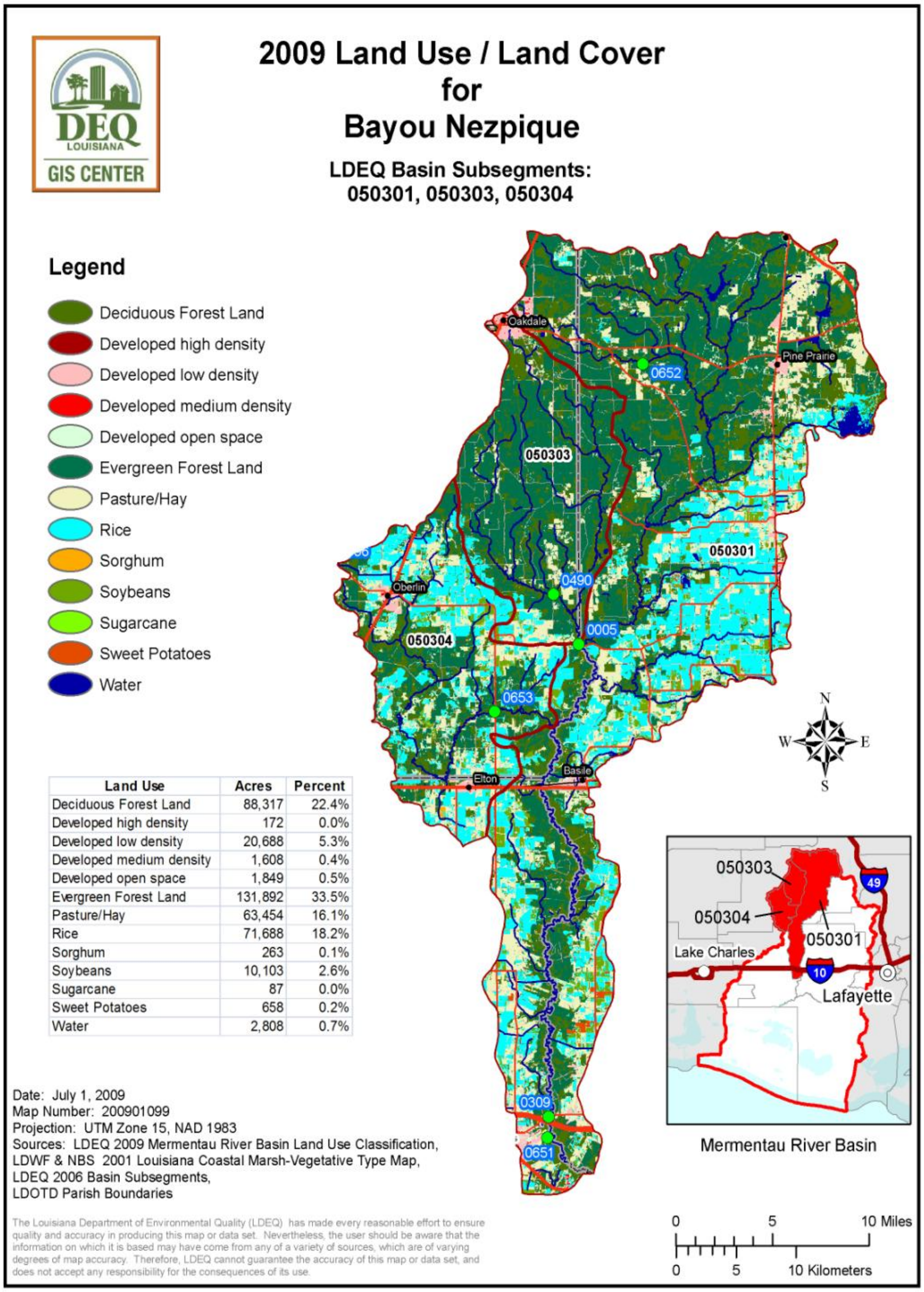
problems with sedimentation, total dissolved solids, nutrients or turbidity as the main stem of Bayou Nezpique. The majority of the Castor Creek watershed is forested with only small amounts of pasture and has rice fields in the vicinity of one of LDEQ's water quality monitoring stations.

Bayou Blue (050304) was fully meeting both the primary and secondary contact recreational uses, but was not meeting the fish and wildlife use. This means that there were not bacteria contamination problems in Bayou Blue that prevented it from meeting the state's water quality standards for swimming and boating. The pollutant of concern that prevents Bayou Blue from meeting the fish and wildlife propagation use is lead. The source of lead is unknown and seems to be present in several of the water bodies within the Mermentau River Basin. Bayou Blue does not have the same types of problems with fecal coliform bacteria, low dissolved oxygen or nutrients and turbidity as Castor Creek or the main stem of Bayou Nezpique. There is a mixture of land-uses within the Bayou Blue watershed, with large sections in rice production and forestry and smaller acreage of pastures. The town of Oberlin is in the Bayou Blue watershed. LDEQ's water quality sampling station is located in the eastern part of the watershed.

A review of these water quality data and land-use patterns indicate that the sediments, nutrients and turbidity that causes the water quality problems in the main stem of Bayou Nezpique may be coming from sub-segment 050301 which is the eastern portion of the watershed that is south of Pine Prairie and north of Basile.

3.0 Review of Historical Data

One of the first steps in understanding the water quality problems that exist within a watershed is to analyze the historical water quality data that LDEQ has, in order to see if there are annual or seasonal trends in any of the pollutants. Figures 5 and 6 identify the approximate locations of the ambient water quality network monitoring stations throughout the Bayou Nezpique Watershed. There have been six water quality monitoring stations managed by LDEQ over the years. Four of these data collection sites are still active and two provide a historical perspective of the water quality. The oldest water quality data for the Bayou Nezpique Watershed was collected at site 0005 north of Basile in Allen Parish (Table 1). LDEQ does not still collect data at this site but has a historical record from 1978-1998. This data helps us to see the long term trends that occurred at this location. The second water quality monitoring site (0309) provided historical data between 1991-1998 for Bayou Nezpique near Jennings. Sampling at Site 0309 was discontinued in 1998 when a new station (0651) was added that was closer to the base of the watershed. This current site (0651) is located near Jennings and water quality data was collected there on a monthly basis in 1998, 2003 and 2007. The other three sites where LDEQ currently collects water quality data include Site 0652, which provides water quality data for Beaver Creek which is in the northern most part of the Bayou Nezpique Watershed. LDEQ began collecting data at this site in 1998 and continued to collect data during 2003, 2005 and 2008/2009. Site 0490 provides water quality data for Castor Creek (050303) which is a watershed that is primarily forested and drains into Bayou Nezpique just north of where Site 0005 used to be located. Site 0653 is north of Elton and drains Bayou Blue. This watershed has a mixture (050304) of land-uses, including forests, pasture and rice and LDEQ has collected water quality data at this location in 1998, 2003 and 2007. All of these water quality data have been examined to try to understand where within the watershed that the problem areas are that need to have additional work done in them so that nonpoint source pollutants can be reduced and water quality standards met. Some of these data have been presented here to illustrate some of the trends in nutrients, sediment and dissolved oxygen.



Land Use	Acres	Percent
Deciduous Forest Land	88,317	22.4%
Developed high density	172	0.0%
Developed low density	20,688	5.3%
Developed medium density	1,608	0.4%
Developed open space	1,849	0.5%
Evergreen Forest Land	131,892	33.5%
Pasture/Hay	63,454	16.1%
Rice	71,688	18.2%
Sorghum	263	0.1%
Soybeans	10,103	2.6%
Sugarcane	87	0.0%
Sweet Potatoes	658	0.2%
Water	2,808	0.7%

Figure 5: 2008 Land-Use Map of Bayou Nezpique

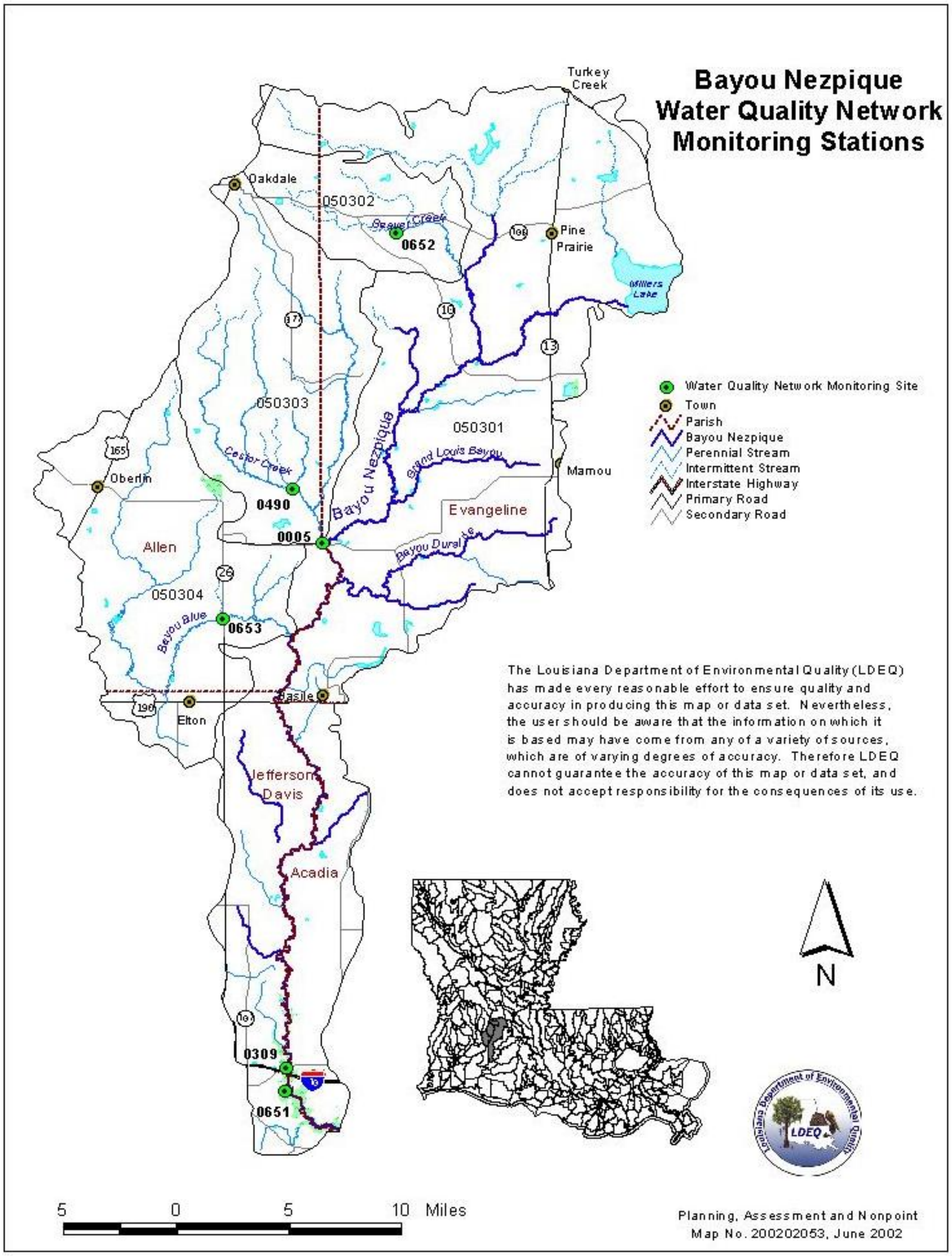
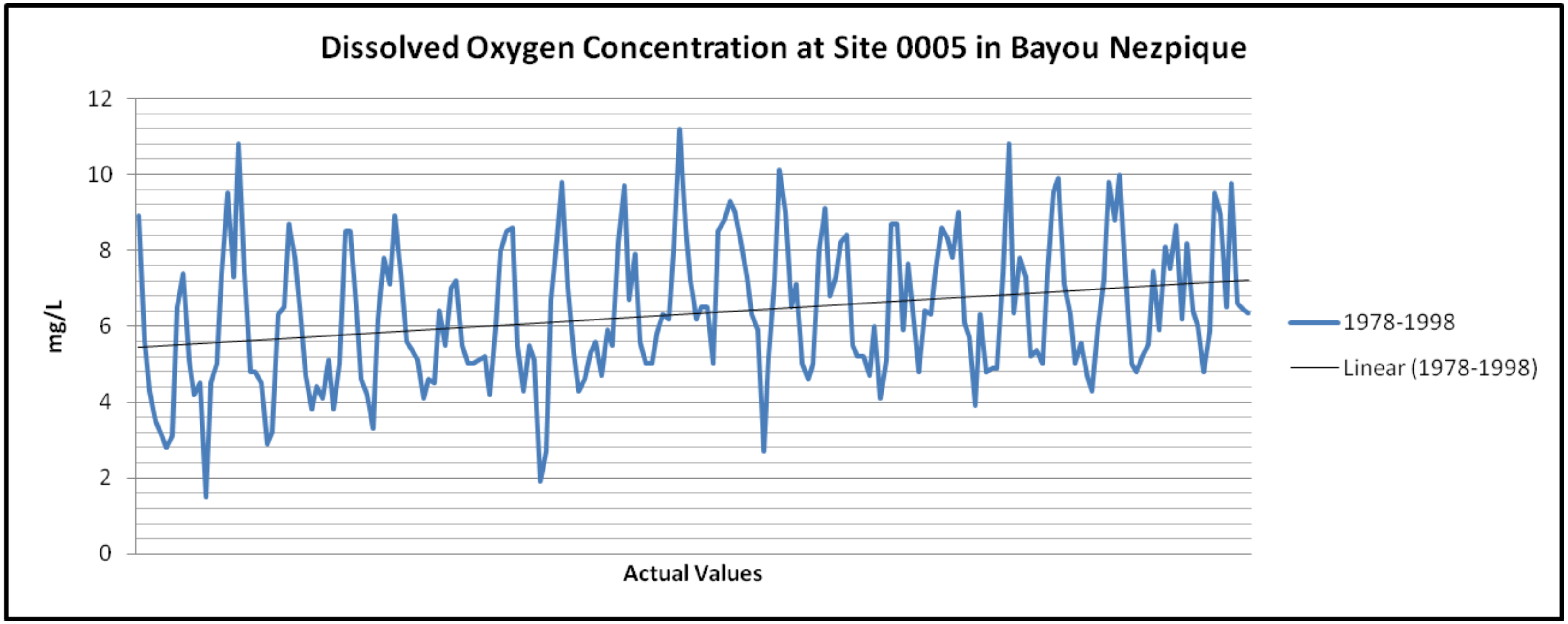


Figure 6: Map of Sampling Sites in Bayou Nezpique Watershed

Table 1. Description of Data Collection History on each Water Quality Network Monitoring Station in the Bayou Nezpique Watershed (sub-segments 050301, 050302, 050303, and 050304)

Water Quality Network Monitoring Station Number	**Sub-segment**	**Description**	***Approximate* History of Data Collection**
0005	050301	Bayou Nezpique North of Basile, LA in Allen Parish	1978-1998: once monthly
0309	050301	Bayou Nezpique near Jennings, LA in Jefferson Davis Parish	1991-1998: once every odd numbered month
0651	050301	Bayou Nezpique east of Jennings, LA in Jefferson Davis Parish	1998: twice monthly from June-December 2003: once monthly 2007: once monthly
0652	050302	Beaver Creek (Headwaters to Boggy Bayou) west of Pine Prairie, LA in Evangeline Parish	1998: twice monthly from June-December; monthly data for 2003, 2005 and 2008/2009
0490	050303	Castor Creek (Headwaters to Bayou Nezpique) east of Oberlin, Louisiana in Allen Parish	1998: twice monthly from June-December; monthly data for 2003 and 2007
0653	050304	Bayou Blue (Headwaters to Bayou Nezpique) south of Soileau, LA in Allen Parish	1998: twice monthly from June-December; monthly data for 2003 and 2007

Figure 7: Historical water quality data for Site 0005 north of Basile on Bayou Nezpique



As Figure 7 illustrates, the trend for dissolved oxygen in Bayou Nezpique at site 0005 is an increasing trend, with a lot of seasonal variability but a steady increase in the minimum values that never drop below 4.0 mg/L. During this same timeframe, the general trend for total suspended solids and total phosphorus showed declining trends, with turbidity and nitrogen remaining fairly constant.

If we move from the top of the watershed to the bottom, we begin by looking at data for Site 0652 which is the Beaver Creek watershed. The water quality data for dissolved oxygen indicated that the annual average was increasing since 1998. However, this may be deceiving because data collection began in June 1998, so the higher concentrations of DO that would typically occur in the winter and spring months were not captured. The concentrations in Beaver Creek in 2009 between January and May were actually a little lower. The maximum values in 2005 and 2008/2009 were 7.6 mg/L and 7.5 mg/L, respectively and the minimum values were 2.17 mg/L and 2.45mg/L, respectively. At the time that this plan was written, LDEQ did not yet have a complete year of the data for 2009, so they will continue to look at these data to see if water quality is remaining fairly constant or is showing a slight decline.

During this same time period, the data for total suspended solids indicates declining values but the nitrogen, phosphorus and turbidity remain fairly consistent.

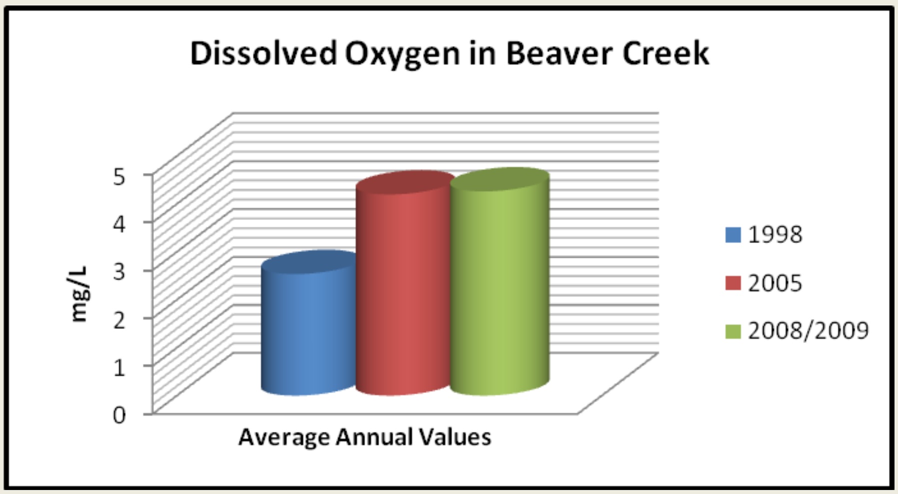


Figure 8: Dissolved Oxygen in Beaver Creek

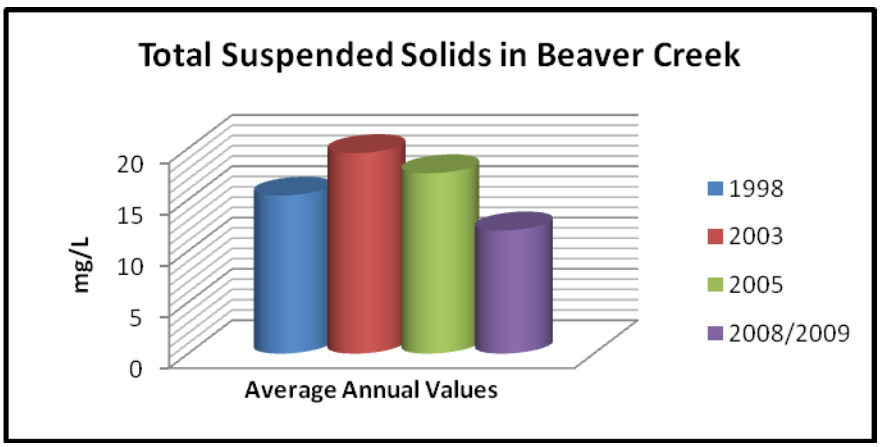


Figure 9: Total Suspended Solids in Beaver Creek

As we move down the watershed to site 0490, which is Castor Creek, the average annual dissolved oxygen concentration between 1998 and 2007 again indicated a slight increasing trend. However the nutrients, total suspended solids and turbidity were all higher in 2007 than in 1999. Both 1998 and 1999 were drought years and 2005 was the year of hurricanes Rita and Katrina so it may be difficult to make real comparisons between these three years of data. If we move south and west to Bayou Blue (site 0653), there is a similar slight increase in the average annual values for dissolved oxygen, but the concentrations of nutrients and turbidity all increase from 2003 to 2007.

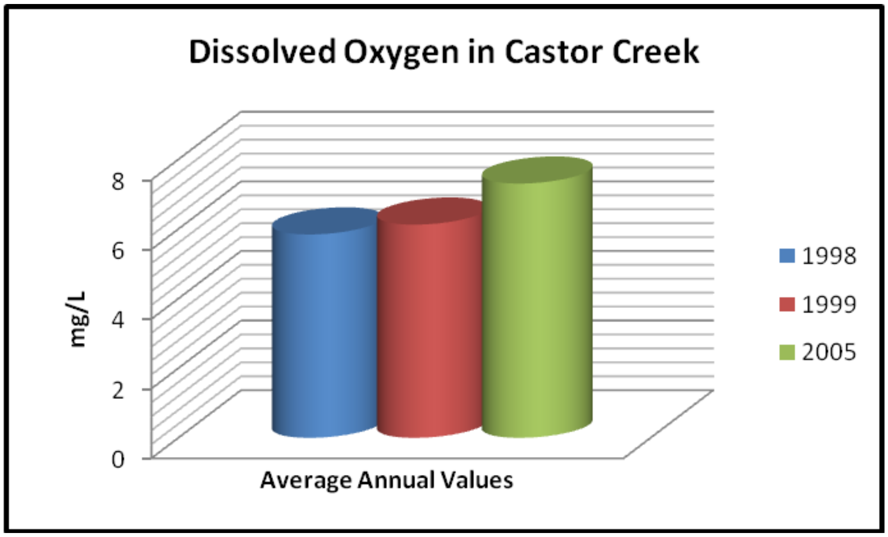


Figure 10: Dissolved Oxygen in Castor Creek

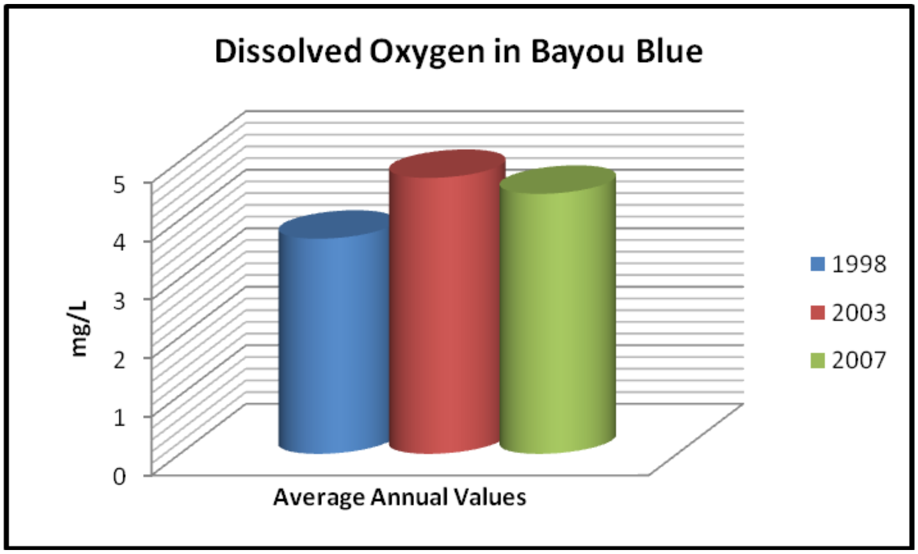


Figure 11: Dissolved Oxygen in Bayou Blue

If we move to the southern most point in the watershed at Site 0651, we see that the average annual concentration of DO has increased since 1998 but declined between 2003 and 2007.
During this same time period, the nutrients, total suspended solids and turbidity all indicated lower concentrations between 2003 and 2007. Some of these data are presented here.

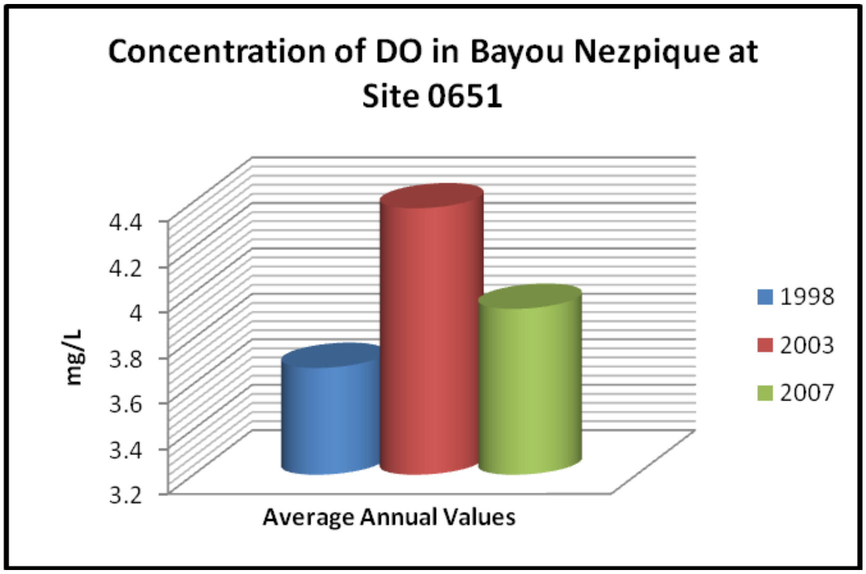


Figure 12: Dissolved Oxygen in Bayou Nezpique at Site 0651

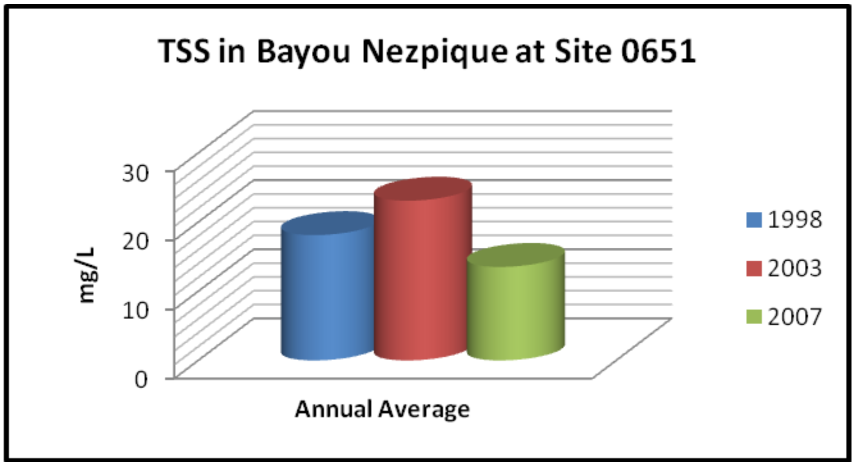


Figure 13: Total Suspended Solids in Bayou Nezpique at Site 0651

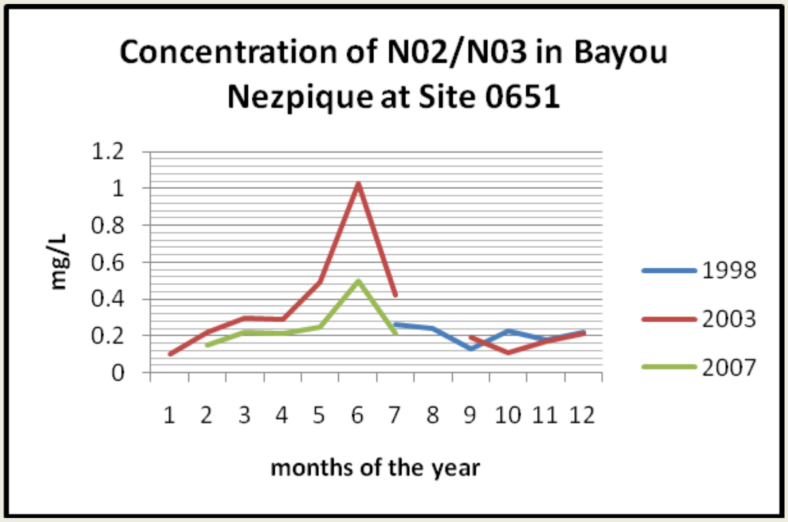


Figure 14: Concentration of N02/N03 in Bayou Nezpique at Site 0651

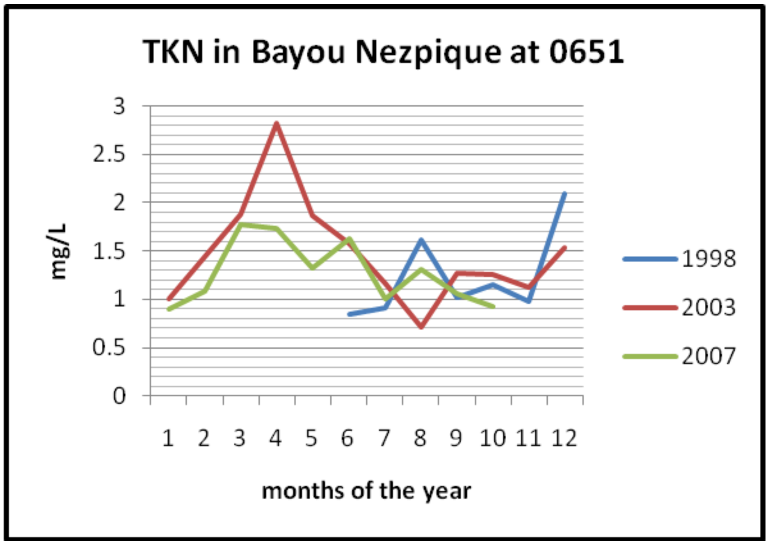


Figure 15: Concentration of TKN in Bayou Nezpique at Site 0651

The other factor that consistently appeared in the data was a peak in turbidity during the months of April-May. These peaks are also in the historical data for sites 0005 and 0309. Whereas the peak values for turbidity are typically between 60-80 NTU for the forested watersheds of Beaver Creek and Castor Creek, the peak values are much higher in watersheds where agricultural runoff and discharges from rice fields are present. In these watersheds, the NTU values are 330-500 NTU. The water quality standard that should not be exceeded for turbidity in the Mermentau River Basin is 150 NTU, so these values in agricultural watersheds need to be reduced.

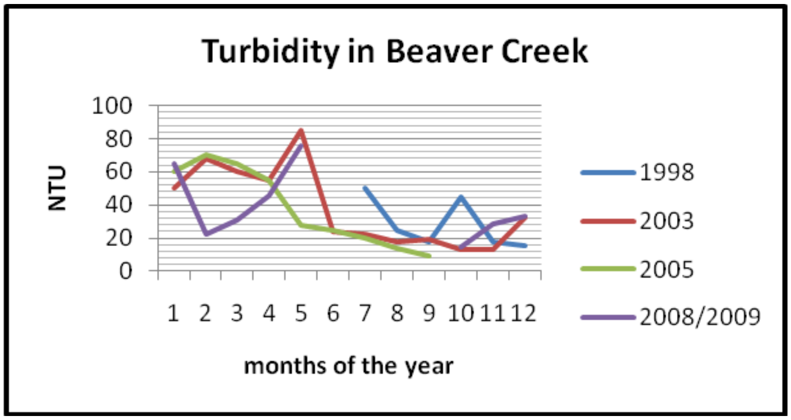


Figure 16: Turbidity in Beaver Creek

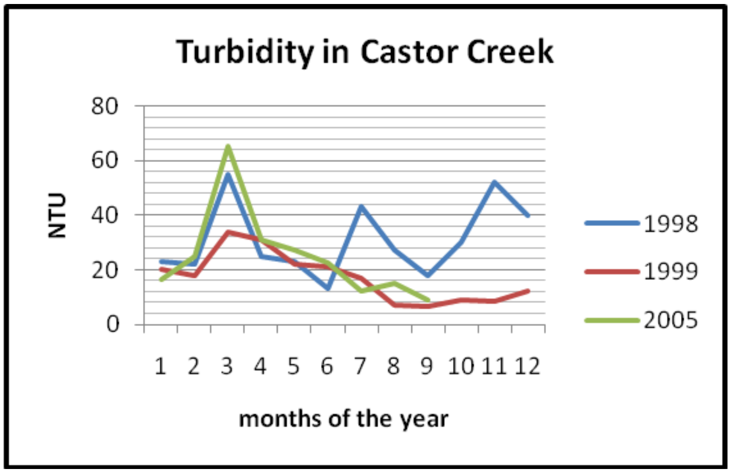


Figure 17: Turbidity in Castor Creek

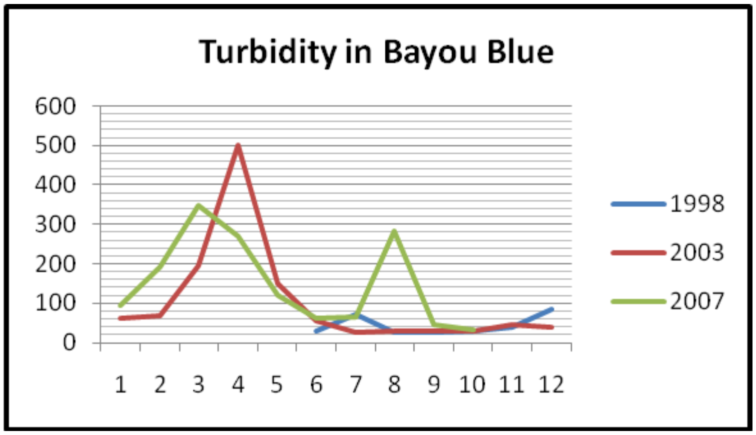


Figure 18: Turbidity in Bayou Blue

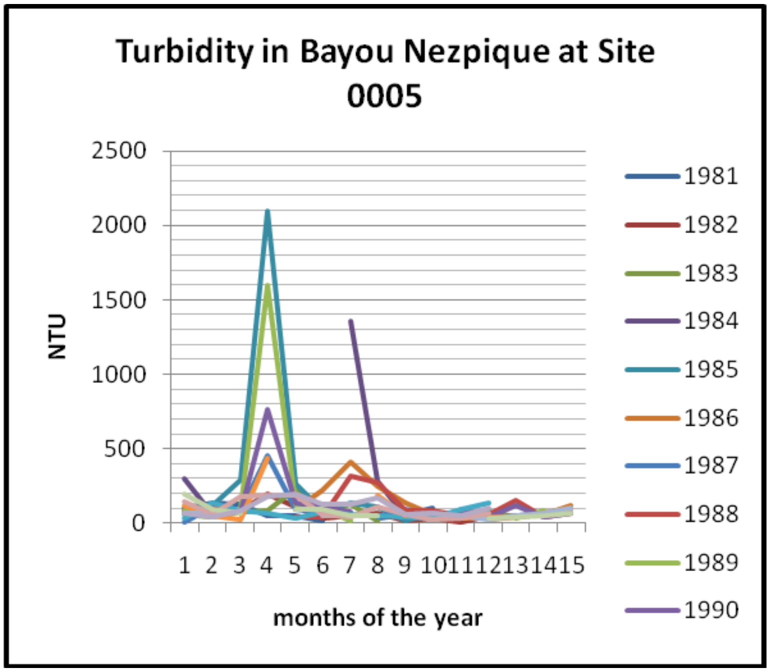


Figure 19: Turbidity in Bayou Nezpique

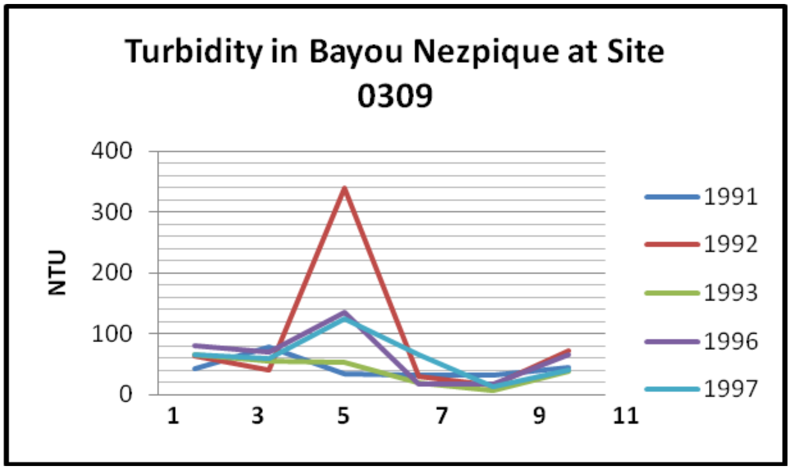


Figure 20: Turbidity in Bayou Nezpique at Site 0309

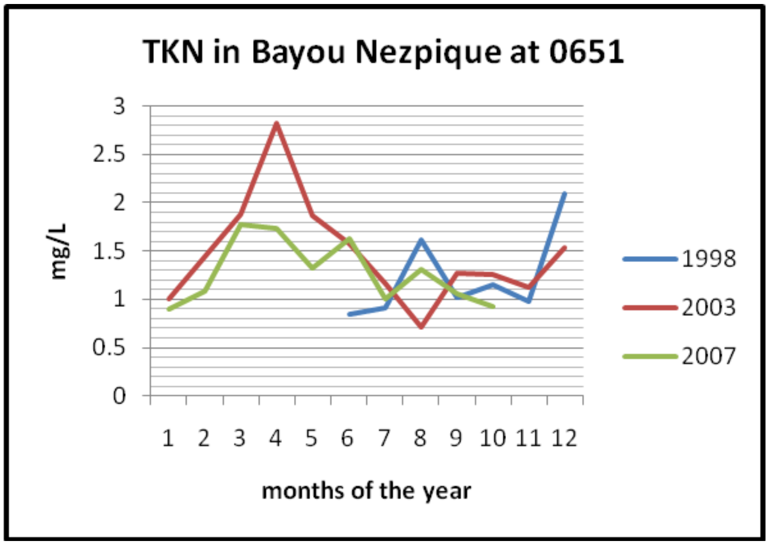


Figure 21: Historical Turbidity in Bayou Nezpique

These data also indicated that the concentration of total suspended solids were higher within the watersheds that had a higher concentration of agricultural fields compared to those watersheds that were primarily forested. Nutrients showed more variation with forested watersheds having similar concentrations of Total Kjeldahl Nitrogen but higher concentrations of Total Phosphorus than agricultural watersheds.

In summary, the water quality data shows a long term trend of improving since 1978 in the Bayou Nezpique Watershed, but there are still signs of high levels of nutrients and turbidity and total suspended solids during the spring months. In agricultural watersheds, these spring peaks appear to correspond with rice field discharges during April and May of the year. In forested watersheds, large rains produce runoff of nutrients that contribute to the total nutrient load in the Bayou Nezpique watershed. Therefore best management practices will be needed in both the forested and agricultural watersheds in order to reduce the amount of sediment and nutrients entering the bayous. The land-use map from 2009 indicates which watersheds are forested and which ones have a high density of rice fields. This map can help identify where the agricultural and forestry best management practices need to be targeted in order to meet in-stream water quality standards and to restore the designated uses.

4.0 Explanation of the TMDL

Since the bayous in the Bayou Nezpique watershed do not fully meet their designated uses, the law requires that a total maximum daily load (TMDL) be developed in order to determine how much of the pollutant load within the watershed will need to be reduced in order to reach water quality standards. A TMDL is the amount of a pollutant that a water body can assimilate without exceeding the water quality standard for that pollutant. An analogy could be made to the speed limit for a highway. If the speed limit is 60-70 mph, then all cars should stay below that speed limit in order to be considered traveling at a safe speed. In the same manner, a water body is only safe for people to swim in if the bacteria fall below a certain level. In the same manner, habitat for fish and wildlife will only remain good if there is a certain level of oxygen in the water body, and the concentration of nutrients and sediments does not exceed water quality standards. If it exceeds these limits, the water bodies are no longer healthy habitats for fish or for people. So the TMDL sets the pollutant limits for the water body. It establishes (1) the waste load allocation (point sources) plus (2) the load allocation (nonpoint sources and natural background sources) plus (3) a margin of safety. The margin of safety allows for any uncertainties in the scientific methods used to derive the TMDL.

In order to improve surface water quality, both point and nonpoint sources of pollution need to be considered. This watershed plan, however, addresses the nonpoint source part of the TMDL. The TMDL document includes the point source permit limits for the permitted dischargers in the Bayou Nezpique watershed. In order to meet the water quality standard for dissolved oxygen in the bayou, the TMDL for Bayou Nezpique required an 85% reduction of all man-made nonpoint sources

Figure 22: Bayou Nezpique

in the four sub-segments during the summer season (March through November), and a 90% reduction of all man-made nonpoint sources during the winter season (December through February). These nonpoint source load reductions were calculated for the critical conditions, meaning the lowest flow and warmest months of the year. If water quality standards are met during these critical months, than it is assumed that they would be met during the rest of the year. These load reductions are exceedingly high, which means that LDEQ will continue to examine the modeling that was done and the water quality standards for the bayou. But the water quality data also indicate that large reductions in sediment and nutrient loading are needed within the bayou if the designated uses are to be restored.

4.1 Origin of Water Quality Data and TMDL Calculation

The TMDL model describes the amount and distribution of oxygen demanding materials or biological oxygen demand (BOD) in the waterway. The ultimate BOD (UBOD) includes both the nitrogen (NBOD) and carbon (CBOD) based forms of BOD. LDEQ models for critical conditions called the "7Q10", which are the 7 consecutive lowest flow days from a 10-year period. The model partitions the BOD load to several different sources and divides the bayou into stream reaches from the headwaters to the mouth of the water body. LDEQ collected water quality samples along the waterway to establish a BOD load and to calibrate the model. Once the total BOD load was determined, it was partitioned into point sources and NPS sources, plus a margin of safety was factored in to accommodate any potential errors. Point sources require a discharge permit, which identified its location and set a limit on the amount of BOD load that could be discharged. The modelers were able to subtract the point source load from the measured and modeled total BOD load. The rest of the BOD load was either assigned to natural or manmade NPS pollution. In the Bayou Nezpique, 4% of the total BOD load was assigned to point sources. This means that the remaining 96% was assigned to either natural or man-made nonpoint source pollution.

5.0 Designated Uses by Sub-segment

The 2008 Integrated 305(b) Report indicated that Bayou Nezpique (050301) was fully meeting the contact recreational uses (i.e. swimming and boating), but was still not meeting the fish and wildlife propagation use. The suspected reasons included dissolved oxygen, nutrients (nitrate/nitrite and phosphorus), total suspended solids (TSS), total dissolved solids (TDS), sedimentation/siltation and turbidity. The suspected sources of these water quality problems are agricultural production. Castor Creek (050303) was not meeting the primary contact recreation use (i.e. swimming), was meeting the secondary contact recreational use (boating) but was not meeting the fish and wildlife propagation use. The suspected causes for these water quality impairments included dissolved oxygen and fecal coliform bacteria. The suspected sources included wildlife other than waterfowl and unknown sources. Bayou Blue (050304) was fully meeting the contact recreational uses, but was not meeting the fish and wildlife propagation use because of lead. Castor Creek and Bayou Nezpique were also listed for lead, so LDEQ will collect clean metals samples to determine if the lead is associated with actual water quality problems or was from metals contamination during the sampling procedure. The source of lead is unknown at this point.

6.0 Water Quality Standards and Antidegradation Policy

Since water quality standards are the basis for determining whether the water body is meeting its designated uses for swimming and fishing, it is important to understand what those standards are and how they are applied to the water body.

Table 2 outlines the designated uses and numerical standards for the water bodies that comprise the Bayou Nezpique Watershed.

Table 2

Sub-segment	**050301**	**050302**	**050303**	**050304**
Stream Description	**Bayou Nezpique - Headwaters to Mermentau River**	**Beaver Creek - Headwaters to Boggy Bayou**	**Castor Creek - Headwaters to Bayou Nezpique**	**Bayou Blue-Headwaters to Bayou Nezpique**
Designated Uses*	A B C F	B C	A B C	A B C
Criteria:				
Cl in mg/L	90	90	90	90
SO_4 in mg/L	30	30	30	30
DO in mg/L	5.0 (Dec-Feb) 3.0 (Mar-Nov)	5.0 (Dec-Feb) 3.0 (Mar-Nov)	5.0 (Dec-Feb) 3.0 (Mar-Nov)	5.0 (Dec-Feb) 3.0 (Mar-Nov)
pH	6.0 – 8.5	6.0 - 8.5	6.0 – 8.5	6.0 – 8.5
BAC**	1	2	1	1
Temperature	32	32	32	32
TDS in mg/L	260	260	260	260

*Uses: A- primary contact recreation; B- secondary contact recreation; C- propagation of fish and wildlife; F- agriculture
**BAC:1- primary contact recreation criteria (No more than 25 percent of the total samples collected on a monthly or near monthly basis shall exceed 400/100 mL. These primary contact recreation criteria shall apply only during the defined recreational period of May 1 through October 31. During the non-recreational period of November 1 through April 30, the criteria for secondary contract recreation shall apply.) 2- secondary contact recreation criteria (No more than 25 percent of the total samples collected on a monthly or near monthly basis shall exceed 2,000/100 mL. The secondary criteria apply all year.

This table illustrates that three of the bayous have use designations for primary and secondary contact recreation and fish and wildlife propagation, but Beaver Creek has only two of those designations, secondary contact recreation and fish and wildlife propagation. Bayou Nezpique also has an agricultural use designation, which means that it can be utilized for agricultural purposes.

The water quality standard that relates to meeting the contact recreational uses is fecal coliform bacteria and the caption under the table explains how the standards are applied through the assessment process to determine whether the water body is meeting the use. Similarly, the water quality standard that relates to fish and wildlife propagation includes dissolved oxygen (DO) concentrations and total dissolved solids (TDS).

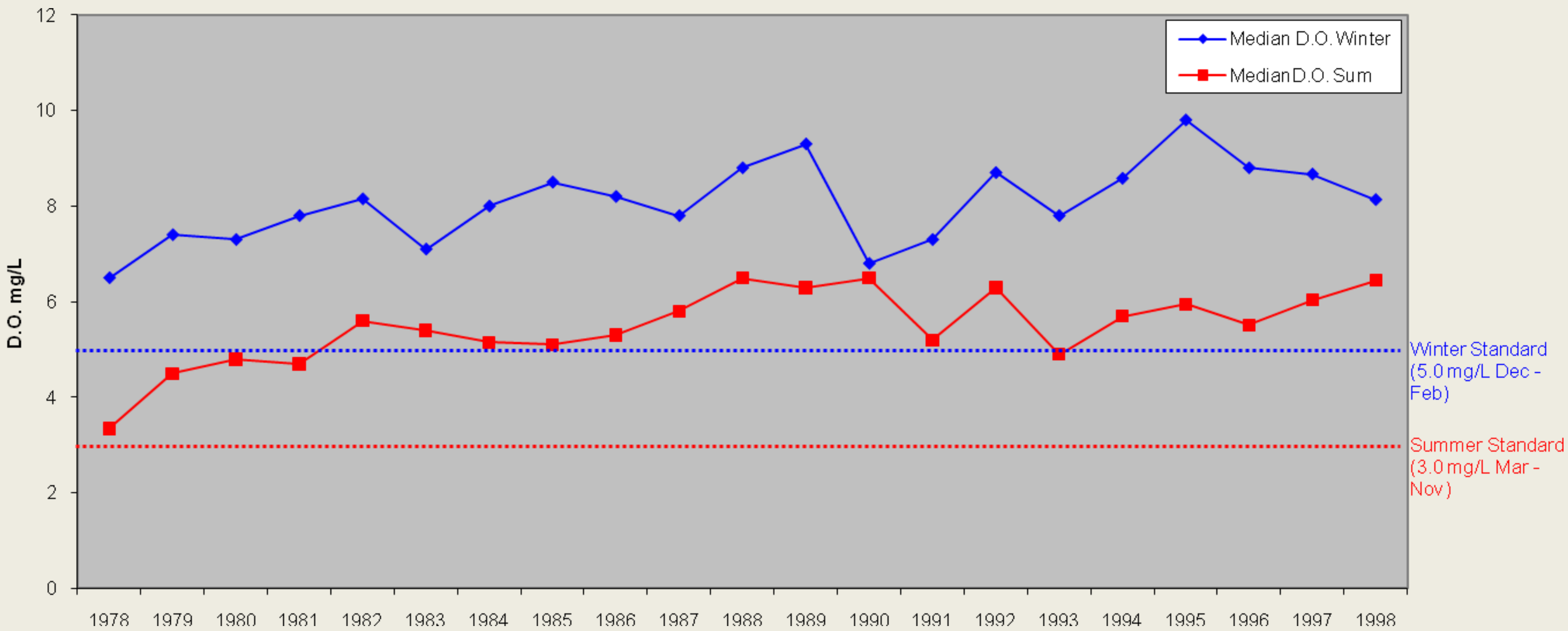
Bayou Nezpique, Beaver Creek, Castor Creek and Bayou Blue have a seasonal standard for dissolved oxygen, meaning that they need to meet the 5.0 mg/L during the winter months and 3.0 mg/L during the summer months in order to protect the fish and wildlife propagation use. The intermittent portion of Beaver Creek has been designated as naturally dystrophic with seasonal criteria of 5.0 mg/L between November and April and 2.0 mg/L between

May and October. All of the water bodies within the Bayou Nezpique watershed have the same water quality standards for TDS, chlorides, sulfates, temperature and pH.

The water quality data indicates that runoff of the majority of oxygen demanding substances coincides with the spring release of sediment-laden impounded water from rice fields (Figure 26). Planting into a flooded seedbed is a common method of rice planting. When this method is used, the rice farmers flood the fields prior to planting and the field is tilled to level the field and muddy the water. This practice, also known as "mudding in", kills any germinated red rice, a variety of rice that is not desirable and competes with commercial rice (LSU Agricultural Center, 2000). Unless the muddied water is held on the field to let the suspended sediments settle out, "mudding in" can result in large amounts of sediment leaving the fields. This soil loss is detrimental to the farmer as well as to any receiving water bodies.

The spring release of water also relates directly with the spike of nutrients and sediments seen in April in the review of the historical data (Figures 26 and 27). Discharges of suspended solids are magnitudes greater during this spring discharge event compared with the drainages for pesticide/fertilizer applications and harvest that occur during the summer and fall seasons. During the fall, root matter anchors sediments in the field while foliage in the impounded water provides surface area for microbial decomposition of organic materials and nitrogenous compounds. Therefore, the summer and fall discharges have relatively lower levels of the sediments leaving the field (Figure 26).

Figure 23. Median Winter (Dec-Feb) and Summer (Mar-Nov) D.O. for the Period 1978-1998 at 0005



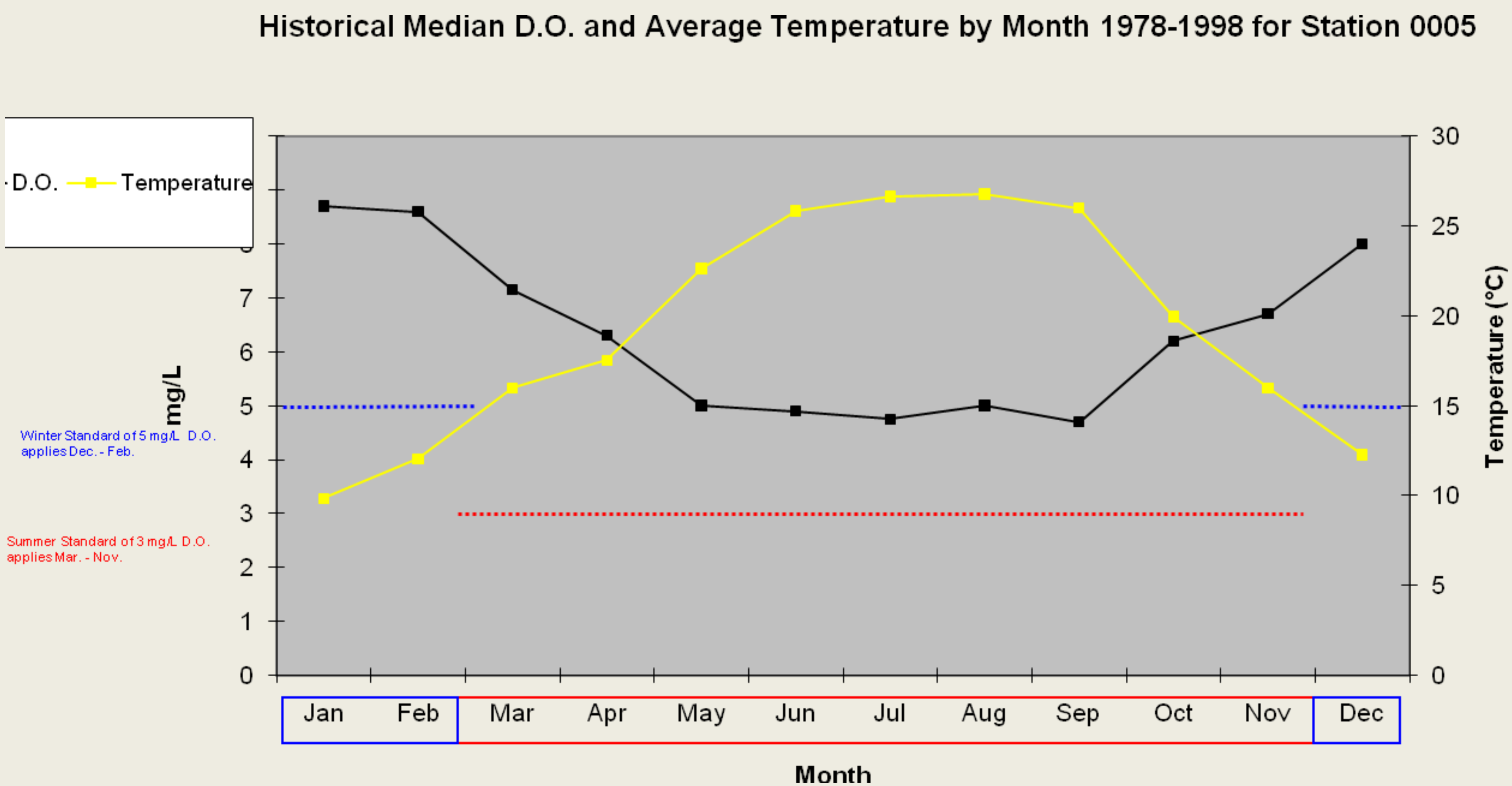


Figure 24. Historical Median D.O. and Average Temperature by Month 1978-1998 for Station 0005

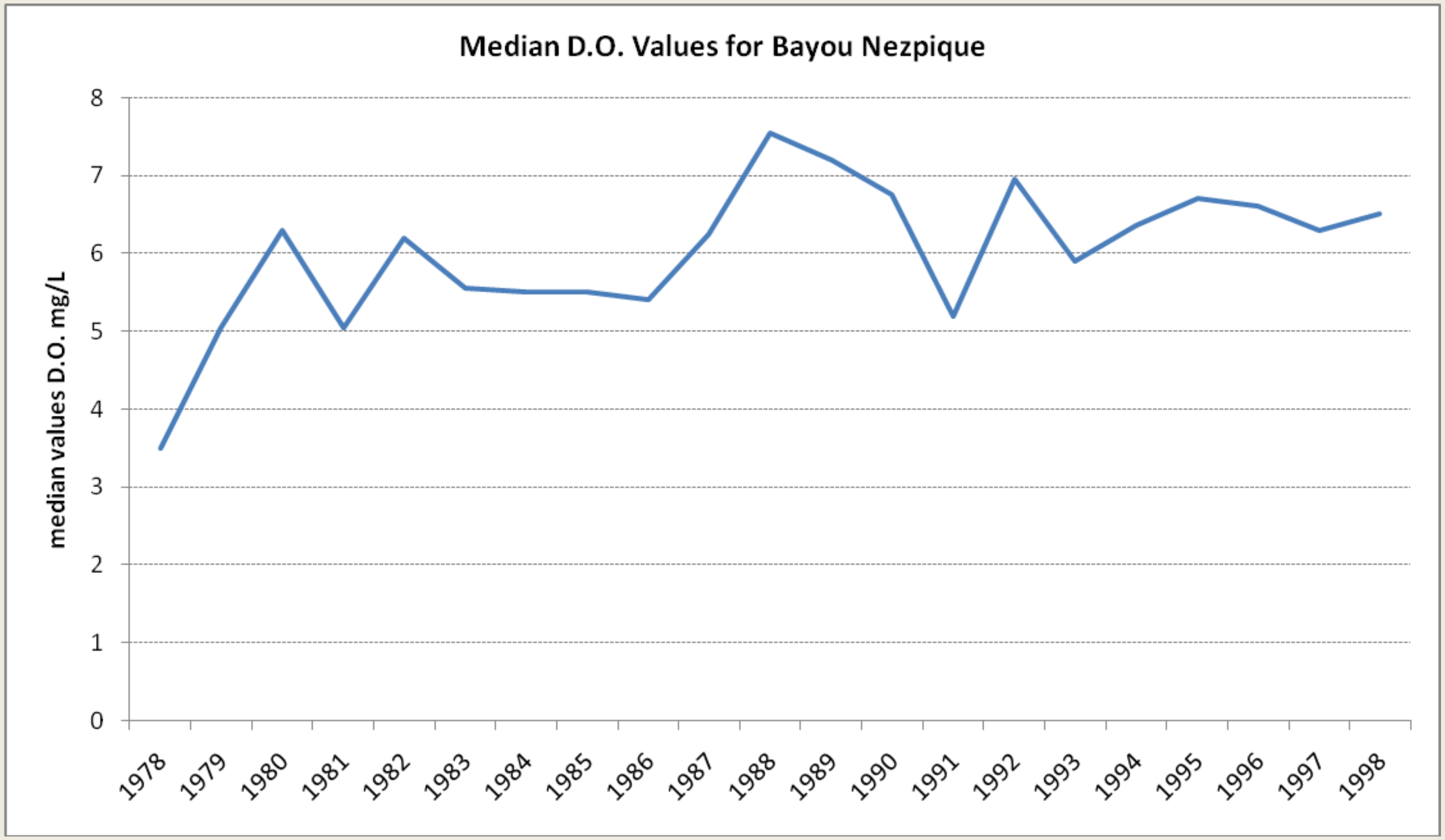


Figure 25. Median Values from 1978-1998 at Site 0005

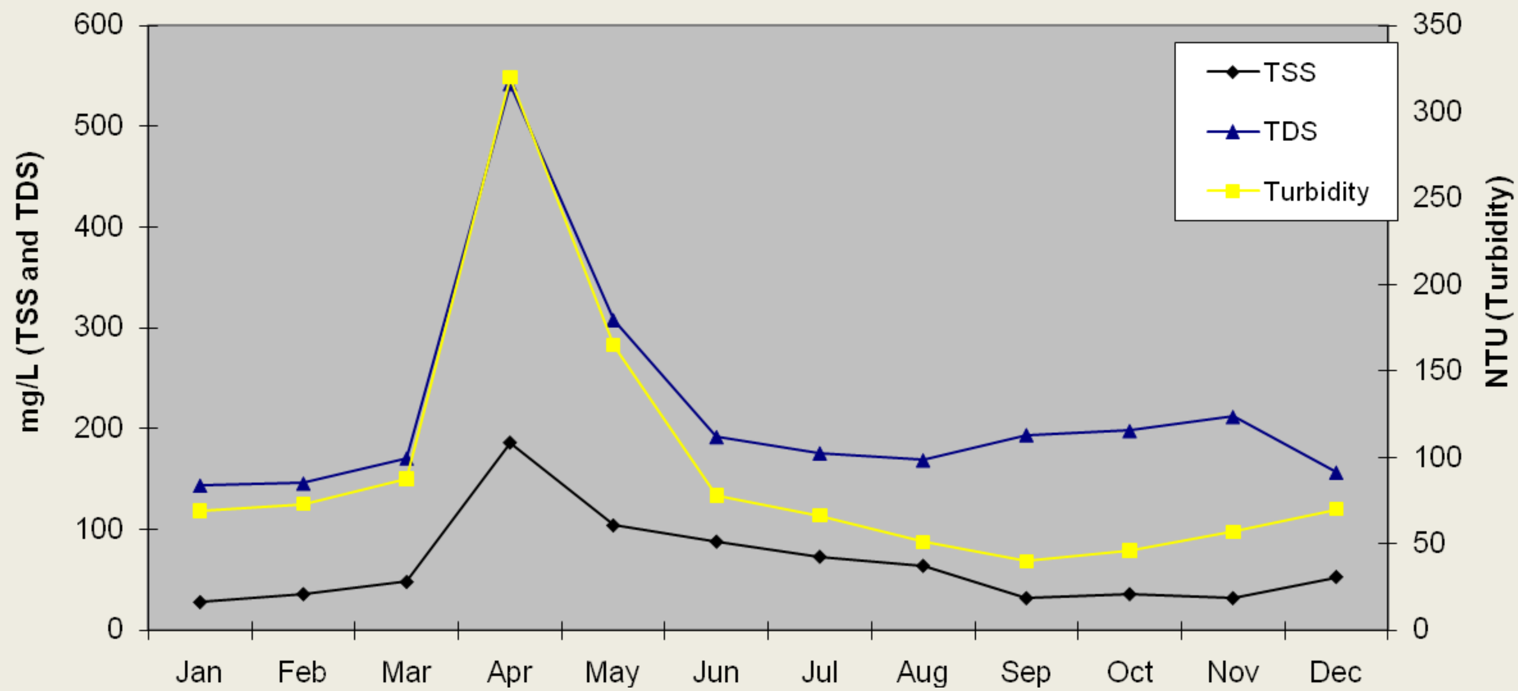


Figure 26. Monthly Trends for Median Values of Turbidity, Total Suspended Solids, and Total Dissolved Solids from 1978-1998

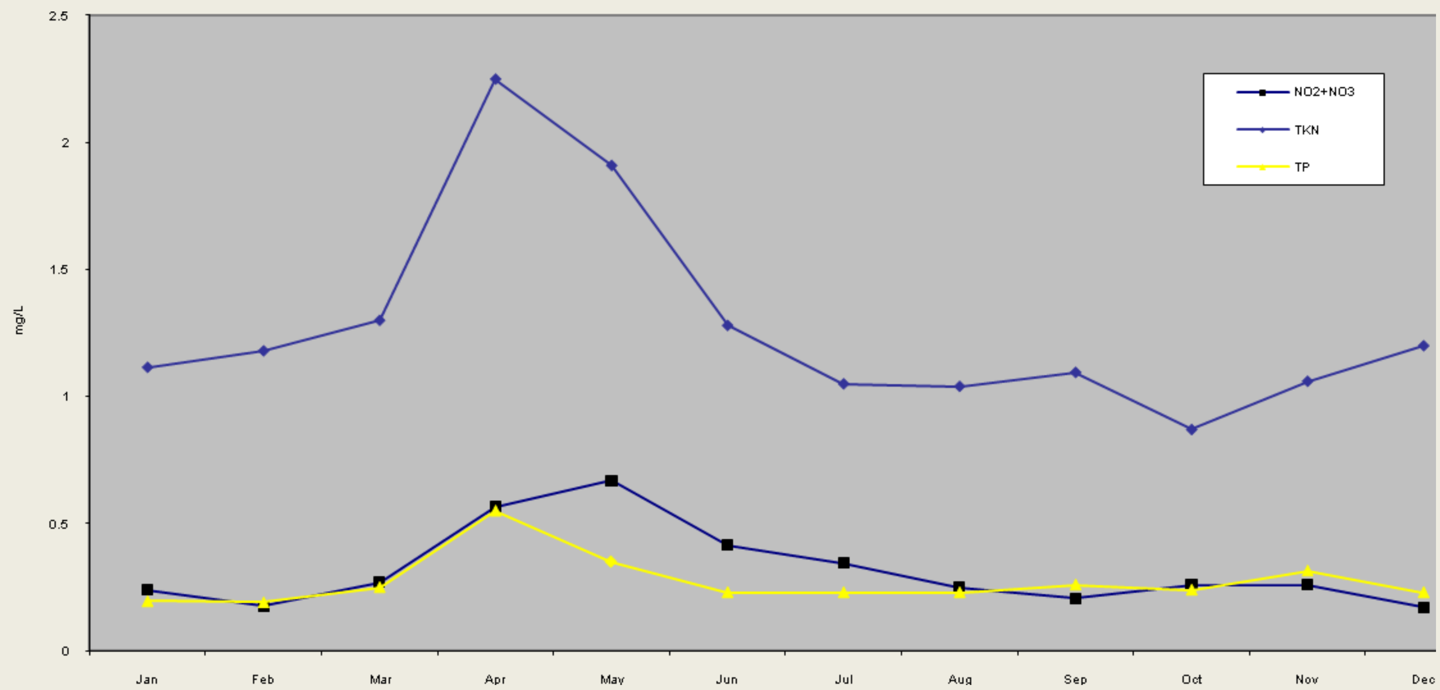


Figure 27. Monthly Trends of Median Nutrient Values from 1978-1998

6.0 **TMDL Description**

Since Bayou Nezpique did not fully meet the D.O water quality standard, LDEQ did a TMDL for the water body. The TMDL model extended from the headwaters near Oakdale and Pine Prairie to the confluence of the Bayou Nezpique with the Mermentau River near Jennings, LA. The Bayou Nezpique watershed includes the following tributaries: Beaver Creek, Boggy Bayou, East and West Forks of Bayou Nezpique, Manwell Gully, Grand Louis Bayou, Castor Creek, Bayou Blue, Roger's Gully, Bayou Duralde, Jennings STP canal, and several unnamed tributaries. The watershed includes water quality sub-segments 050301, 050302, 050303, and 050304. The area is sparsely populated outside the small municipalities and land-use is dominated by silviculture and agriculture in the upper half of the watershed and by agriculture and marsh in the lower half (Figure 5).

7.0 Summary of Other TMDLs Completed by USEPA Region 6

Besides the TMDL for D.O., other TMDLs have been completed for the Bayou Nezpique watershed. These TMDLs were completed by EPA Region 6 for fecal coliform (completed January 19, 2001), nutrients (completed May 3, 2001), and total suspended solids (TSS), turbidity, and siltation (completed May 3, 2001).

A TSS, turbidity, and siltation TMDL was completed in 2001 by EPA Region 6 for the Mermentau headwaters and Mermentau watersheds. The TSS TMDL for the Bayou Nezpique was included in this TMDL. TSS is the measure of the total suspended solids in a water body. The most significant source of TSS and sediment in the Mermentau watersheds is suspended solids in nonpoint source runoff. Much of this sediment load comes from upland areas of the watershed that have agricultural uses. Excess TSS is especially detrimental to the propagation of fish and wildlife use of the water body. For TSS, the TMDL is expressed in terms of percent reduction needed to achieve the target TSS load for each sub-segment. For Bayou Nezpique, the TMDL required a 5% reduction.

The target TSS load was based on a "target" since there is not a water quality criterion or numerical standard for TSS. However, for turbidity, the standard of no greater than 150 nephelometric turbidity units (NTU) has been adopted as part of Louisiana's water quality standards. Given that there is no criterion for TSS in the Louisiana water quality standards and that there is a moderate to strong relationship between turbidity and TSS (see correlation coefficients in the TMDL), the TSS load reductions will allow compliance with State established turbidity criterion.

A TMDL for nutrients was completed in 2001 by EPA Region 6. The State of Louisiana Surface Water Quality Standards has a narrative criterion for nutrients which 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". Numeric criteria for nutrients are now being developed by LDEQ, but have not been finalized. Since D.O. often correlates with nutrient impairments, the nutrient loading required to maintain dissolved oxygen standards will be the nutrient TMDL. As stated previously, the Bayou Nezpique D.O. TMDL requires an 85% reduction of all man-made nonpoint sources in the four sub-segments during the summer season, and a 90% reduction of all man-made nonpoint sources during the winter season.

A fecal coliform TMDL was completed by EPA Region 6 in 2001. Fecal coliform is an important water quality parameter since it is an indicator of the potential presence of pathogens in the water and is used to assess a water body's primary contact (i.e. swimming or wading) and secondary contact (i.e. boating) recreation uses.

The water quality standards for protection of these uses are listed at the bottom of Table 2. For the purpose of TMDL development, the criteria of 200/100mL for the May – October (summer) season were applied, and a loading curve was developed. The TMDL fecal coliform loading curve is applicable to Bayou Nezpique (sub-segment 050301) and Castor Creek (050303). The results of the TMDL show that an 86% and 70% reduction in fecal coliform loading will be needed to protect the primary contact recreation use in Bayou Nezpique and Castor Creek, respectively. The 2008 Integrated Report indicates that Bayou Nezpique fully meets the water quality standards for fecal coliform, but Castor Creek is still listed as not meeting the primary contact recreational use because of fecal coliform bacteria in the water.

8.0 Similarities Among TMDL Constituents

The suite of constituents addressed in this implementation plan is directly related in that TDS, TSS, and turbidity are oxygen-demanding substances. The D.O. TMDL requires that sources of oxygen-demanding substances be reduced by 85 to 90%. Land uses such as agriculture, forestry, and natural wetlands contribute to the loading of chemical and biological materials to the waterways that both suppress D.O. and increase levels of TSS, TDS, and turbidity. In other words, an implementation plan to reduce oxygen-demanding substances from entering a water body can also serve as an implementation plan to reduce materials that create these turbid conditions in the water body.

9.0 Description of Each Stream Reach

In order to understand which section of the water bodies store the largest part of the pollutant load, LDEQ samples and models the water body by stream reaches. The D.O. TMDL (LDEQ, 1998) divided the main stem and the tributaries into 20 reaches which are described in Table 3 and were drawn as vector diagrams which can be found in Figure 28. In Table 3, "BN" represents the main channel of Bayou Nezpique, and all other entities (tributaries or point source dischargers) were defined as tributaries. Main channel reaches 17 and 18 are the longest reaches at 25.5 km and 27.6 km, respectively.

Reach #	Reach ID	Reach Description	Beginning of reach (km)	End of reach (km)	Width of reach (m)	Length of reach (km)
1	BN	BN Manwell Gully-Reddell POTW	123.8	113.8	1.3	10.0
2	Tributary	BC Upper Beaver CK - Oakdale POTW	39.7	29.7	3.1	10.0
3	Tributary	BC Lower Beaver CK - w/ UP Boggy B	29.7	14.9	3.9	14.8
4	Tributary	PP Pine Prairie Trib	11.5	0.0	1.5	11.5
5	Tributary	BC LWR East Fork/LWR Boggy B	14.9	0.0	4.9	14.9
6	BN	BN UP B. Nezpique w/ W. Fork	113.8	101.0	9.6	12.8
7	Tributary	GL UP Grank Louis - Mamou POTW	14.8	13.6	2.4	1.2
8	Tributary	ES Evangeline POTW Trib	6.0	0.0	1.2	6.0
9	Tributary	GL LWR Grand Louis	13.6	0.0	3.2	13.6
10	BN	BN B. Nezpique w/ Castor Creek	101.0	78.0	7.4	23.0
11	Tributary	BB UP Bayou Blue - Oberlin POTW	48.7	38.9	2.2	9.8
12	Tributary	BB MD Bayou Blue	38.9	21.6	2.2	17.3
13	Tributary	EL Elton POTW Trib	1.9	0.0	1.7	1.9
14	Tributary	BB LWR Bayou Blue	21.6	0.0	5.7	21.6
15	BN	BN UP Middle B. Nezpique	78.0	62.4	9.3	15.6
16	Tributary	BS Basile POTW Trib	3.4	0.0	2.3	3.4
17	BN	BN LWR Middle B. Nezpique #1	62.4	36.9	20.9	25.5
18	BN	BN LWR Middle B. Nezpique #2	36.9	9.3	42.3	27.6
19	Tributary	JE Jennings STP Canal	0.8	0.0	10.8	0.8
20	BN	BN LWR B. Nezpique	9.3	0.0	48.7	9.3

Table 3

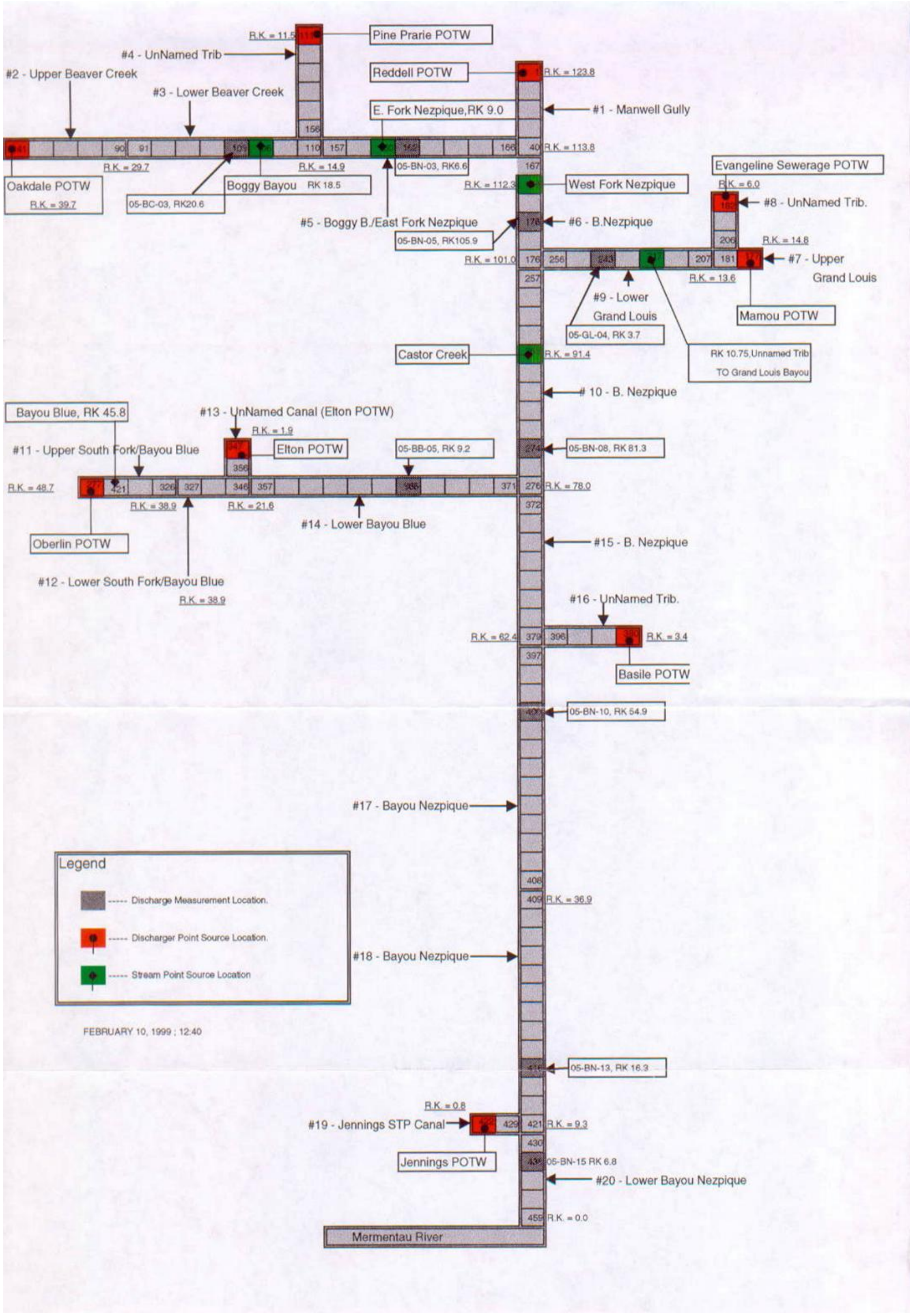


Figure 28: Vector Diagram of Bayou Nezpique for TMDL

10. NPS Sources and Pollution Issues

10.1 Vector Diagrams

Vector Diagrams from the D.O. TMDL are included in Figure 28. This diagram illustrates a straight line representation of the bayous in the Bayou Nezpique Watershed. Through the sampling and modeling that was done to calculate the TMDL for this watershed, there were areas of low DO that need to be addressed. On Manwell Gully and Grand Upper Grand Louis, there were low DO values of 1.96 and 1.01 mg/L, respectively. Both of these low values were probably associated with point source discharges from the wastewater treatment plants for Reddell and Mamou. As we move further south down the diagram, the D.O standard was not met in Lower Bayou Blue where the wastewater treatment plants for Oberlin and Elton discharge. This area also receives nonpoint source runoff from rice fields, forests and pastures. On the main stem of Bayou Nezpique just north of reach 17, the DO is 2.92 mg/L. This stretch of the bayou has received all of the runoff from the rice fields in sub-segment 030501 and the wastewater discharge from the town of Basile which enters from the Un-named tributary. The DO is also low below the discharge of the wastewater treatment plant for Jennings which enters the main stem of Bayou Nezpique just north of reach 20 before the bayou joins with the headwaters of the Mermentau River.

10.2 Graph of Pollutant Load by Stream Reach

The TMDL can provide additional information on which reach of the bayou stores the largest amount of the pollutant load. The TMDL indicated that reach 18 had the highest amount of total loading followed by reaches 17 and 20 (after corrected for km) in the Bayou Nezpique (Figure 29). These reaches are all on the main stem of Nezpique and are located in the lower portion of the watershed. These 3 reaches also have the highest levels of nonpoint (Figure 29) and SOD loading (Figure 30).

The largest percentage of total load is due to nonpoint load at 44% (pages 35-36). This represents the materials which run off of the land and into the stream system. The next biggest contributor to the total load is the sediment oxygen demand (SOD) and headwaters/tributaries categories at 27% and 22%, respectively (pages 35-36). Incremental sources and waste loads are the smallest total loading categories at 4% and 3%, respectively. The sediment oxygen demand is the sediment that is stored on the bottom of the bayou, so this means that reducing the sediment, nutrients and organic based materials will result in improved water quality in Bayou Nezpique. There are also nonpoint source loads entering Bayou Nezpique from Beaver Creek, Castor Creek and Blue Bayou. This means that forestry and agricultural BMPs need to be implemented to reduce the amount of sediment and nutrients entering the main stem of Bayou Nezpique.

The following tables and figures indicate where the biological oxygen demanding pollutant load resides. BOD loads tend to increase towards the bottom of the watershed. This is mainly due to channel slope. The elevation in the upper portion of the watershed is at a maximum of 125 ft above mean sea level and less than 5 ft above mean sea level at the confluence of Bayou Nezpique with the Mermentau River (LDEQ, 1998). The sediments and the BOD loads will collect until a large rain event produces enough hydraulic head to push the material downstream and eventually into the Gulf of Mexico. The lower end of the watershed, from Elton and Basile to the mouth of the bayou has rice, soybeans and forested wetlands. All of these land-uses can contribute sediment, nutrients and organic material to the bayou. The water quality data and graphs indicate that seasonal loading in the spring is the problem that needs to be addressed through BMPs.

Figure 29. Total Loading by Steam Reach in kg/day corrected for kilometer

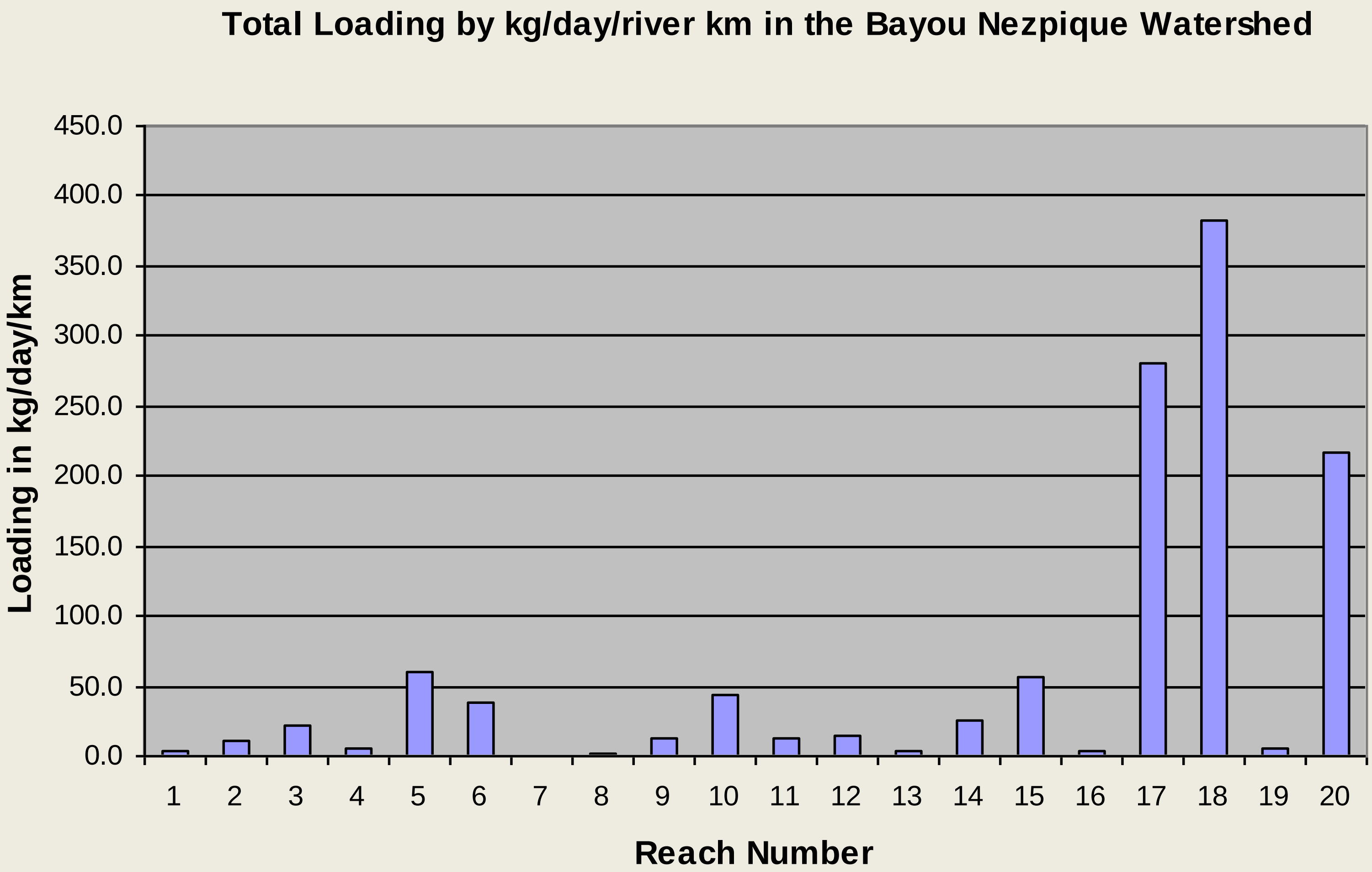


Figure 30. Sediment Oxygen Demand Load by stream reach. BN designates the main stems of Bayou Nezpique.

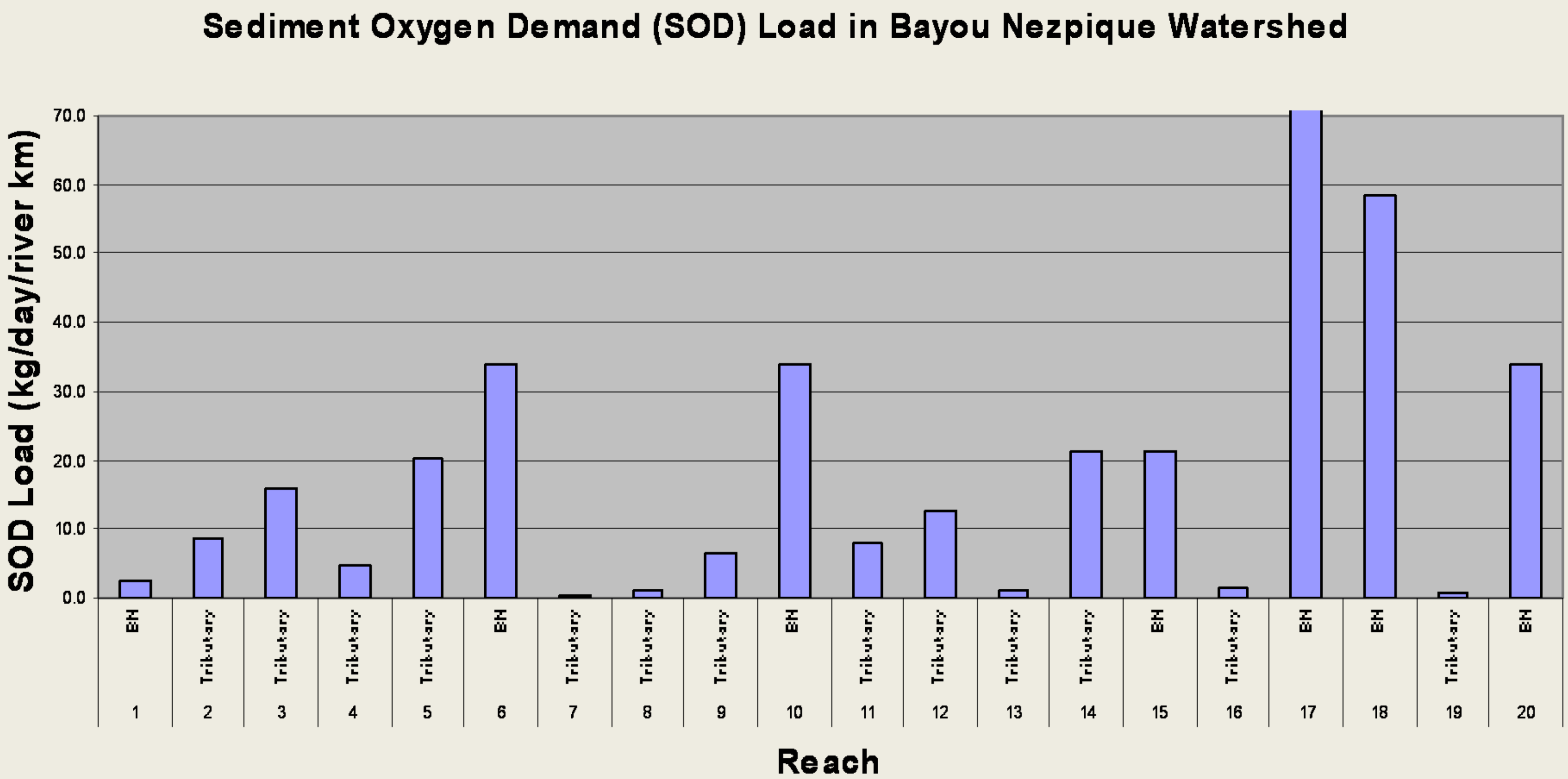


Table 6. Summer Projections Minimum Dissolved Oxygen for Each Reach.

Reach Number	DO Criteria @ Minimum DO Location, mg/l	Minimum DO in Reach, mg/l	Location of Minimum DO, River Kilometers
1	3	3.11	121.55-121.3
2	2	3.9	31.9-29.7
3	2	2.99	23.78-23.040
4	3	3.66	8.0-6.25
5	3	3.72	13.41
6	3	3.61	101.0
7	3	3.91	13.6
8	3	3.69	4.32-4.08
9	3	4.05	13.328
10	3	3.79	96.4
11	5	3.58	45.956
12	5	3.87	38.035
13	5	3.74	0.0
14	5	3.78	18.72
15	3	3.21	70.2
16	3	2.99	0.0
17	3	2.92	58.152
18	3	5.01	34.788
19	3	3.68	0.2
20	3	3.61	0.0

Figure 2. *Summer Projection Model Dissolved Oxygen versus River Kilometer*

Figure 31: Table from TMDL for Bayou Nezpique for minimum DOs during the Summer Months, by Reach

The TMDL indicated that with the 85% reductions in man-made nonpoint source pollutants, the minimum DO levels in Bayou Nezpique during the summer months would be at reaches 3, 16 and 17. The TMDL indicated that with the 90% reductions in man-made nonpoint source pollutants, that the minimum DO levels in Bayou Nezpique during the winter months would be at reach 16 in order to maintain the winter water quality standard for DO of 5.0 mg/L. Both of these tables were taken from the TMDL so their Figure and Table numbers are out of order for this document.

Table 7. Winter Projections Minimum Dissolved Oxygen for Each Reach.

Reach Number	DO Criteria @ Minimum DO Location, mg/l	Minimum DO in Reach, mg/l	Location of Minimum DO, River Kilometers
1	5	6.38	117.8-116.55
2	3	5.91	39.5
3	5	5.98	22.3-19.34
4	5	6.79	2.75-0.00
5	5	6.6	13.41
6	5	6.82	102.28-101.00
7	5	6.39	13.6
8	5	6.7	1.2-0.00
9	5	6.56	13.328
10	5	6.84	91.8
11	5	5.66	45.956
12	5	6.31	38.035
13	5	6.36	0.00
14	5	5.96	15.84
15	5	5.91	62.4
16	5	4.98	0.2
17	5	5.44	53.904
18	5	6.16	34.788
19	5	5.24	0.30
20	5	5.77	0.00

Figure 3. Winter Projection Model Dissolved Oxygen versus River Kilometer 4.3

Figure 32: Table from TMDL for Bayou Nezpique for Minimum DOES in Winter Months by Reach

Table 4

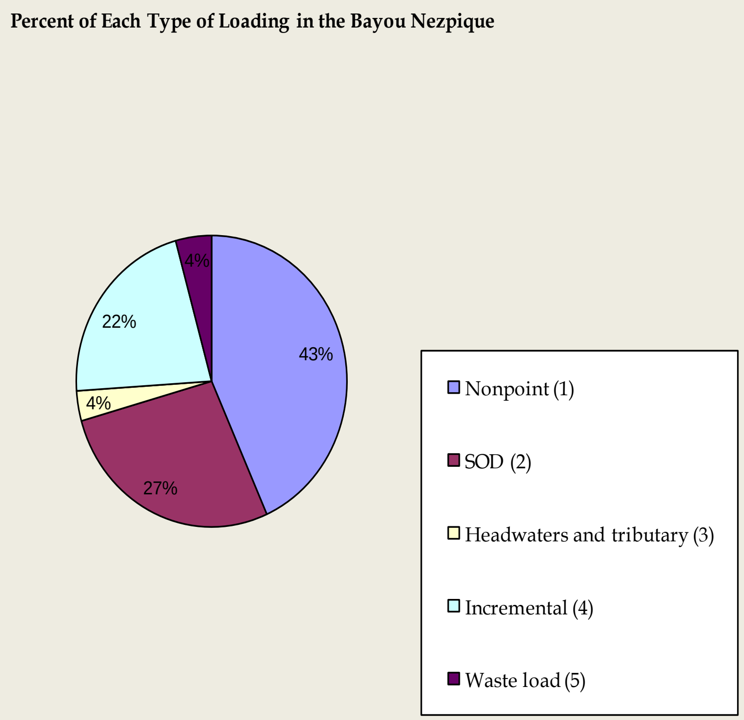
Distribution of Load for Oxygen Demanding Substances in the Bayou Nezpique Watershed

Source	kg/day	Percent of total load
Nonpoint (1)	6977.72	43%
SOD (2)	4383.73	27%
Headwaters and tributary (3)	540.00	3%
Incremental (4)	3510.47	22%
Waste load (5)	685.46	4%
Total	16097.38	100%

(1) Nonpoint load is the materials running off of watershed into stream system.
(2) Sediment oxygen demand (SOD) is the benthic load that resides on the stream bottom.
(3) Headwaters and tributaries are the loading from tributaries and headwater.
(4) Incremental load includes ground water, rain events, and tributaries.
(5) Waste loads are the amount of pollutants discharge in from industrial and municipal point sources in the waterway.

10.3 Discussion of Benthic Load and SOD

DO is most strongly affected by temperature, and there is a strong inverse correlation between temperature and DO (Figure 24). As water temperatures increase, decay rates also increase. Decay occurs through the activities of microbes in the benthic load, the accumulated layers of sediment and debris that blankets the streambed. Oxygen is demanded by these microbial colonies in order to fuel their biodegradation of organic matter. It is during periods of high temperature and low stream flow that the benthic load has its greatest and most disproportionately negative effect upon stream oxygen levels. This resuspended load is not associated with a flow. In the TMDL model, this benthic load is expressed as resuspended biological oxygen demand (BOD), sediment oxygen demand (SOD), and/or (CBOD). Therefore, SOD is a significant portion of the loading (Figure 30).


Percent of Each Type of Loading in the Bayou Nezpique
4%
22%
43%
4%
27%
Nonpoint (1)
SOD (2)
Headwaters and tributary (3)
Incremental (4)
Waste load (5)

11. 0 Land Uses

Land uses such as agriculture, silviculture, urban, and even natural ecosystems contribute to the loading of chemical and biological elements to the waterways. Hydromodification affects the transport of water through the stream networks and often reduces the capacity of riparian zones to retain sediments on the stream bank. Home sewage from faulty septic systems also contributes to the nutrient and organic loadings to the waterways. In the table below, land uses in the Bayou Nezpique Watershed are shown. Agriculture and forest land are the dominant land uses and are the most likely contributors of NPS loadings in Bayou Nezpique. Hydromodification and home sewage can also be major contributors to NPS loading; however, these are not reflected on the table since they are not considered land-use categories. Discussed below are the suspected sources that contribute oxygen-demanding substances to the Bayou Nezpique and its tributaries (Table 5).

Land Use Type	Number of Acres	Percent of Total Area
Developed (high Density)	172	0.0
Developed (medium density)	1,608	0.4
Developed (low density)	20,688	5.3
Developed (open Space)	1,849	0.5
Deciduous Forest	88,317	22.4
Evergreen Forest	131,892	33.5
Pasture/Hay	63,454	16.1
Rice	71,688	18.2
Sorghum	263	0.1
Soybeans	10,103	2.6
Sugarcane	87	0.0
Sweet Potatoes	658	0.2
Water	2,808	0.7
Total	**393,587**	**100**

11.1 Agricultural Areas

The primary agricultural crop in the Bayou Nezpique Watershed is rice, alternated with either soybeans or crawfish. Depending on the degree of cultivation, rain events can suspend sediments, fertilizers, and pesticides and transport them from agricultural fields to the reaches of the bayou. Runoff from fields soon after tillage, fertilizer applications, and other field operations can contain greater levels of sediments and pollutants. During the late winter and early spring, large volumes of very turbid water have been observed flowing downstream in the waterways, and this has been associated with planting activities in adjacent rice fields. The cumulative effect of agricultural nonpoint pollutants result in potentially damaging concentrations of nitrogen, phosphorus, sediments, turbidity, and pesticide residue in the water bodies. Agriculture is 37.2% of the watershed and based on the water quality data is suspected as contributing a substantial portion of the nonpoint source load to the bayou. (Table 5). Forestry occupies 55.9% of the watershed, so these two land-uses combined represent 93.1% of Bayou Nezpique watershed. LDEQ updated these land-use data in 2008-9. The primary mechanism to reduce the amount of nonpoint pollutants entering the water body is for producers to adopt Best Management Practices (BMPs) in order to meet TMDL objectives for the watershed. These BMPs are specific to each of the land uses.

11.2 Developed Areas

The land-use classification that was finalized in 2008 divided developed areas within the Bayou Nezpique Watershed into high, medium, low density and open space. As you can see from Table 6, most of the developed areas are low density which describes the rural landscape and small communities that exist within the Bayou Nezpique watershed. These small communities can still contribute significant amounts of nonpoint source pollution to the bayous. Water quality monitoring studies in urban areas have shown that the highest pollutant loading and concentrations usually occur during rainfall events in the first runoff of rain, commonly referred to as the "first flush". As areas are urbanized, impervious surfaces such as streets, parking lots, and rooftops, are increased. These smooth, impenetrable surfaces allow little or no detention or infiltration of storm water.

Pollutants that are present between rainfall events in the atmosphere prior to a storm which accumulate on streets, parking lots and roofs are generally carried away in the first 0 to 1 inch of rainfall in moderate to heavy storms. Urban nonpoint source pollution is the result of precipitation washing the surfaces of urbanized areas. As precipitation falls on urban areas, it picks up contaminants from the air, littered streets and sidewalks, petroleum residues from automobiles, heavy metals and tar from roads, chemicals applied for fertilization, weed and insect control, and sediments from construction sites. The dumping of chemicals such as used motor oil and antifreeze into storm sewers is another source of urban NPS pollution. Illegal hookups of storm drains to sanitary sewers can result in increased volumes of flow to waste water treatment plants causing more frequent overflows of sewerage into receiving waters.

During urbanization, pervious spaces, including vegetated and open forested areas, are converted to land uses that usually have increased areas of impervious surface, resulting in increased runoff volumes and pollutant loading. While urbanization may enhance the use of property under a wide range of environmental conditions, urbanization typically results in changes to the physical, chemical, and biological characteristics of the watershed. As population density increases, there is a corresponding increase in pollutant loading generated from human activities. These pollutants typically enter surface waters via runoff without undergoing treatment.

Urbanization has a profound impact not only on water quality, but on the hydrologic characteristics of watersheds as well. In undeveloped natural drainage areas, the volume and rate of storm water runoff from a particular rainfall event is primarily determined by the natural detention and infiltration characteristics of the land, and is related to topography, soil types, and vegetative cover. With less detention and infiltration due to impervious surfaces, runoff volume increases, as well as, the rate of storm water runoff. Flooding and stream channel degradation in urbanizing watersheds has obvious adverse impacts upon public convenience, safety, and aesthetics, but there are some significant adverse impacts on water quality as well. When streams overflow their banks, there is an increased opportunity for pollutants including trash and debris to enter the flow of water. Erosion of the stream channel represents a significant source of sediment pollution, and the loss of vegetation along stream banks reduces the pollutant assimilation capacity of a stream.

11.3 Hydromodification

Hydrologic modifications are defined as those activities which are designed to affect natural stream flow. These types of modifications include bank stabilization, channel alignments, high-flow cutoff devices, in-stream construction, dredging, locks and dams, levees, spillways, and impoundments. Dredging, channel modifications, and impoundments are the most serious contributors to the nonpoint source pollution problem. Currently, all of these activities are being pursued in Louisiana waters, mainly for purposes of navigation and flood protection in coastal areas.

The hydrological modifications and also the naturally occurring dystrophic conditions of the Bayou Nezpique were discussed in the Dissolved Oxygen Use Attainability Analysis (UAA) for the Mermentau River Basin (LDEQ 1998). The UAA states that the East Fork of Bayou Nezpique is influenced by man-made Miller's Lake. There is channel maintenance for 25 miles to the junction of Bayou Nezpique and Bayou des

Cannes (completed in 1935). Also, dredging has deepened and widened the channel considerably just above and below Interstate Highway 10. In addition to the man-made influences on the Bayou Nezpique, there are naturally dystrophic conditions due to several factors. The critical (7Q10) low flow was calculated as 0.4 cfs (LDEQ, 1998), and with an average slope of less than 1%, there is limited reaeration due to natural stream geometry.

11.4 HOME SEWAGE

A significant portion of Louisiana's NPS pollution can be attributed to sewerage runoff from homes, camps, and businesses that are not connected to municipal sewerage treatment facilities. It is estimated that 1,323,600 people in Louisiana treat and dispose of their sewerage with individual waste disposal systems, and that over 50% of these systems are malfunctioning because of incompatible soil types or lack of maintenance. These failing systems are a major cause for water quality degradation in Louisiana's scenic streams and fresh water aquifers.

The Louisiana Department of Health and Hospitals (LDHH) keeps records of the number of permits received for installation of new on-site sewage treatment systems. They also have records of inspections done of existing systems and where those on-site systems have been replaced. These records are kept for each parish in the state.

Within the four parish area of Allen, Acadia, Evangeline and Jefferson Davis, LDHH has a record of 7680 individual on-site systems installed or replaced. This includes septic systems and aerobic treatment units. There were also site inspections and plan reviews for installation of systems. These records of system installation and inspection describe their activity from 1991-2009. Within this same four parish area, there were more than 27,541 individual actions taken by LDHH relative to home sewage systems.

11.5 Silviculture

While forest land (55.9%) is largest land use in the Bayou Nezpique watershed, therefore can be an important contribution to nonpoint source pollution where silviculture is practiced. Silviculture is defined as the cultivation, harvest, and transport of lumber. Silviculture can contribute to nonpoint source pollution especially when poor or no management practices are followed.

Without adequate controls, forestry operations may degrade several water quality characteristics in water bodies receiving drainage from forestlands. Pollution from silviculture operations can include sediments, nutrients, and forest chemicals such as herbicides, insecticides, and fungicides). Additionally, organic debris resulting from forestry activities can adversely affect water quality by causing increased biological oxygen demand, which results in decreased dissolved oxygen levels. LDEQ works with LDAF's Office of Forestry to survey the extent of forestry best management practices (BMPs) utilized in the various parishes across the state. The most recent statewide survey indicated greater than 90% compliance rate with forestry BMPs. The next survey is being done in 2009-2010 with the results expected by fall of 2010.

12.0 Best Management Practices

12.1 Status of Baseline BMP Implementation

Information was provided by the Louisiana Department of Agriculture and Forestry (LDAF) to the LDEQ Nonpoint Source Program detailed the amounts and types of BMPs already established in the Mermentau Basin between 2005-2008. The numbers reported that USDA implemented 75,400 acres of BMPs through EQIP, 1121 acres through CRP, 35 acres through CSP, 665 acres for WRP, 458 acres for WHIP and 227 acres for GRP. Another 61,286 acres of BMPs have been established through Louisiana's Nonpoint Source Program (funded through USEPA §319(h) Program).

LDAF's Office of Soil and Water Conservation (OSWC) is working with farmers and landowners within the Bayou Nezpique Watershed to implement additional practices to reduce the agricultural nonpoint source pollutant loads. Some of these practices include: Laser Leveling, Grade Stabilization, Nutrient Management, Pesticide Management, Shallow Water Management and Irrigation Water Management. During 2009-2011, they will be working on the implementation of these BMPs.

12.2 BMPs to be used for Load Reduction by Land Use

Best Management Practices (BMPs) for agriculture are defined as "practices used by agricultural producers to control the generation and delivery of pollutants from agricultural activities to water resources of the state and thereby reduce the amount of agricultural pollutants entering surface and ground waters" (LSU Agricultural Center, 2000). In the arena of nonpoint source pollution, where there are few regulations in the form of permits to discharge, BMPs become one of the most important methods for controlling runoff pollution.

Many entities have been involved in recommending the most effective and up-to-date BMP practices possible. These BMPs are the culmination of years of research and demonstrations conducted by agricultural scientists and engineers and have been used routinely by many landowners to protect their soil and water resources.

For the Bayou Nezpique, additional BMPs will need to be implemented to bring the water bodies addressed in the D.O. and other TMDLs into compliance with their standards and designated uses. For rice producers in the Bayou Nezpique Watershed, the "Rice Production Best Management Practices Manual" (LSU Agricultural Center, 2000) provides a well-researched framework for effective nonpoint source control where rice is produced.

LDEQ has provided quite a bit of federal funding through Section 319 of the Clean Water Act to quantify the pollutant loads that come from rice field discharges. Two of the BMPs that indicate they could help the rice farmers achieve a 50% load reduction in sediment entering the bayou is clear field rice and precision leveling. Earlier work on rice fields in the 1990's also indicated that simply by holding the flood waters for 15 days in the spring prior to release would reduce the sediments leaving the field by 50-75%, Therefore, LDEQ recommends that these BMPs be utilized in combination with others to reduce the nonpoint source loads from the rice fields. If all of the fields within the watershed implemented, BMPs, there might still be a dissolved oxygen problem because of natural loading from the forested wetlands, but both the turbidity and the dissolved oxygen levels would improve with these management practices.

Additionally, as technology advances, certain farming practices and BMPs may gradually become obsolete or replaced by other methods. For example, the development, through genetic engineering, of herbicide resistant rice may change the way that rice is produced in Louisiana (Williams et. al, 2002). If the practice of "mudding in" were no longer needed to control red rice, a significant decrease in the nonpoint source load would be expected. Also, a reduction in the quantity of water used would likely result. Dry land planting of rice may allow farmers to get away from water management of rice during the planting phase, thereby reducing many of the water quality problems that exist with this crop in southwestern Louisiana.

For all entities involved in silviculture operations, the "Recommended Forestry Best Management Practices for Louisiana" manual has been and will continue to be an invaluable source of information and recommendations (Louisiana Department of Environmental Quality, 2000). The wide expanse of riparian area along the Bayou Nezpique helps to buffer the stream temperature and filter many of the pollutants that may flow through these upland and wetland forested areas during rain and flood events. Therefore maintaining these forested buffers and riparian areas should be a high priority for this watershed.

12.3 BMP Implementation to achieve TMDL Load Reductions

The data that LDEQ obtains from sampling the Mermentau basin (including Bayou Nezpique) has been analyzed to determine whether water quality has improved as a result of BMP implementation. In 2007, as LDEQ collected water quality data, it has been used to determine if the implementation of management measures suggested in the implementation plan and promoted across the watershed have been effective. Corrective actions will continue to be implemented, as necessary, with the goal of meeting water quality standards by the year 2012-2014.

13.0 Making the Implementation Plan Work

13.1 Actions to be implemented by DEQ

Louisiana's Nonpoint program completed a 3-year cooperative agreement with the Evangeline and St. Landry Soil and Water Conservation Districts (SWCDs). These §319(h) funds allocated $484,750 of federal funds to be used for cost-share incentives, technical assistance and education on four water body sub-segments, one of which was Bayou Nezpique (050301). This project resulted in 49 producers establishing BMPs on 6,748 acres of land. Practices implemented by the producers were BMPs, which were originally developed by NRCS and are included in the NRCS Field Office Technical Guide. BMPs recommended for rice and soybeans, and utilized as part of this project, included Conservation Crop Rotation, Residue Management, Riceland Water Quality Improvement, and Nutrient Management, among others. Perhaps one of the most important BMPs that can be utilized is Riceland Water Quality Improvement. The purpose of this practice is to improve the quality of discharge water entering receiving bodies of water. This practice can be accomplished by water planting in previous crop residue, by retaining the floodwater in a closed levee system for a specified period after soil-disturbing activities, or by clear water planting into a prepared seedbed. As seen in the analysis of historical data from the Bayou Nezpique (Figures 26 and 27), there is a peak in the amount of sediment and nutrients in receiving water bodies following the release of sediment-laden floodwater after spring rice planting. These peaks result in the violation of water quality standards. Also, additional oxygen demanding materials on the bottom of a water body can compromise the amount of dissolved oxygen in the water for extended periods, long after it has been deposited.

Another project that should improve the Bayou Nezpique began in June 2002. This large-scale project, called the Bayou Durald-Lower Nezpique Land Treatment Watershed Project, was a 10-year, $7 million federally funded project. Specifically, the project covered a 160,000 acre area of land in Acadia, Evangeline, and Jefferson Davis parishes. As part of this project, landowners entered into cost-sharing agreements with NRCS to install practices to reduce soil erosion and improve water quality. Specifically, some practices to be used in the project could include pipe drops, erosion control structures, irrigation land leveling, and vegetated filter strips to act as buffers. Hopefully, the water quality benefits of a project of this magnitude will be eventually seen as an improvement in the in-stream water quality measurements as LDEQ samples throughout the Mermentau Basin. Between 2004-2009, NRCS implemented these types of practices within the Bayou Nezpique Watershed:

Conservation Cover (327)	487.9 ac.
Fencing (382)	14,007 feet
Grade Stabilization Structure (410)	276 no.
Irrigation Land-Leveling (464)	12,271.2 ac.
Irrigation Water Manage. (449)	14,569.2 ac.
Irrigation Water Convey. (430EE)	139,879 ft.
Nutrient Manage. (590)	11,262.6 ac.

Pest Manage. (595)	10,624 ac.
Residue Manage. Sea. (344)	18,393.3 ac.

The LDEQ works with the Louisiana Department of Agriculture and Forestry (LDAF) OSWC on implementation of the agricultural portion of the NPS Management Plan. LDAF applies directly to USEPA for a portion of the Section 319 grant each year to implement agricultural BMPs in 303(d) listed watersheds that have had TMDLs and watershed plans completed. USEPA §319(h) funds are utilized to sponsor cost sharing, monitoring, and education projects. These monies are available to all private, for profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal agencies, or agencies of the State. Presently, LDEQ is cooperating with such entities on approximately 20 nonpoint source projects which are active throughout the state. Within the Bayou Nezpique Watershed, LDAF OSWC and the Evangeline SWCD are currently implementing through a FY 2008 Section 319 grant a Water Quality Protection Project. Through this watershed protection project, they plan to work with approximately 100 farms on BMP implementation.

Listed in the table below (Table 6) are the practices and amount of acres that is being targeted for this project.

BMPs	Total Cost per acre/per structure	Number	Acres	Cost-share Rates
Conservation Crop Rotation	$15/acre ($5/year)		10,000	0%
Dry Seeding	$10/acre/year		1,000	0%
Fencing	$1.70/foot	5,880		60%
Grade Stabilization Structure	$950/structure	60		60%
Heavy Use Area Protection	$850/structure	10		60%
Irrigation Land Leveling	$400/acre		3,275	50%
Irrigation Water Management	$6/acre/year		9,000	0%
Nutrient Management	$15/acre/($5/year)		10,000	50%
Pasture and Hayland Planting	$200/acre		60	60%
Pest Management	$15/acre/($5/year)		10,000	50%
Prescribed Grazing	$5/acre/year		250	0%
Irrigation Water Conveyance	$8/ft	7,500		50%
Record Keeping	$1.50/acre ($.50/year)		10,000	50%
Residue Management, Seasonal	$15/acre ($7.50/year)		3,000	0%
Shallow Water Area for Wildlife	$5/acre		3,000	0%
Tree/Shrub Establishment	$150/acre		65	50%
Watering Facility	$450	10		60%
Irrigation, Tailwater Recovery	$50,000/tailwater	1		50%

This table also lists the costs for implementing these practices as required in element (d) of the 2004 Grant Guidelines.

This project also includes an education and outreach component as required in element (e) of EPA's guidelines. The schedule for their implementation is 2009-2013. The work plan for this project included an annual completion schedule to meet these timelines. The project will also include educational components so that the local landowners and farmers will learn more about their water quality and what needs to be done there to reduce nonpoint source pollutants and restore the designated uses.

13.2 Actions to be Implemented by Other Agencies

In addition to the work done with Section 319 funds, USDA offers private landowners financial, technical and educational assistance to implement conservation practices including measures to reduce soil erosion, to improve water quality, enhance wetlands and wildlife habitat, and to improve the management of crop, forest and grazing lands. One of these programs is the Conservation Reserve Program (CRP). It is designed to encourage producers and landowners to convert highly erosive cropland to vegetative cover such as native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive annual rental payments for the term of the multi-year contract. The Conservation Reserve Enhancement Program (CREP) combines the resources of the CRP program with that of the State government for the purpose of increasing program participation in targeted watersheds. This program focuses on reducing NPS pollution, improving water quality and restoring wildlife habitat. The Environmental Quality Incentives Program (EQIP) is another source of funding available to the producers and landowners for conservation practices.

In addition to the programs mentioned, the following organizations have signed an MOU with LDEQ within the state's NPS Management Plan that each will work with LDEQ in achieving the goals of the management plan:

Louisiana Department of Agriculture and Forestry
Louisiana Department of Health and Hospitals
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Transportation and Development
Louisiana Department of Natural Resources
Louisiana State University Agricultural Center
Natural Resources Conservation Service
USDA – Farm Services Agency
US Fish and Wildlife Service
USDA Forest Service
US Army Corps of Engineers
US Geological Survey

Another program, which was initiated by the LSU Agricultural Center, is the Louisiana Master Farmer Program. The objective of the Master Farmer Program is to encourage on-the-ground BMP implementation with a focus on environmental stewardship. As outlined in the D.O. TMDL, it will require between an 85% to 90% reduction in NPS pollution. LSU AgCenter is promoting the Master Farmer Program to help farmers address environmental stewardship through voluntary, effective, and economically achievable BMPs. The program is being implemented through a multi-agency/private organization partnership which includes USDA NRCS, LDAF OSWC, the LSU AgCenter and Louisiana Cooperative Extension Service (LCES), LDEQ, Louisiana Farm Bureau and agricultural producers.

The Master Farmer Program has three components: environmental stewardship, agricultural production, and farm management. The environmental stewardship component will have three phases. Phase I focuses on the environmental education and crop specific BMPs and their implementation. Phase II of the environmental component includes in-the-field viewing of implemented BMPs on "Model Farms." Farmers are able to see farms that document BMP effectiveness in reducing sediment runoff. Phase III involves the development and implementation of farm-specific, comprehensive conservation plans by the participants. A Master Farmer must complete all three phases in order to become a certified Master Farmer.

This program focuses on water quality improvement and protection and will support efforts to increase BMP implementation throughout the Bayou Nezpique watershed. Master Farmers set an example for the rest of the agricultural community to work closely with NRCS and SWCD staff to identify potential problems that may impact water quality in the watershed. The Master Farmer Program assists in the distribution of information on new and innovative ways to reduce soil and nutrient loss from their fields and to use Integrated Pest Management Practices. They keep informed of the water quality monitoring occurring in the watershed and alerted of any degradation or improvements. The Master Farmer Program will allow participating agencies to observe the acceptance of BMPs throughout the watershed, and it will help LDEQ observers track the implementation of resource management plans.

13.3 Public Participation of Stakeholders

There have been stakeholders involved in the Bayou Nezpique Watershed Program. Through several Section 319 Projects, there have been educational programs with the local landowners which included field days and farm tours of where agricultural BMPs have been implemented. Through the Local SWCDs, their educational programs have included water quality focus on nonpoint source pollution. The Master Farmer Program continues to be beneficial in getting information to landowners and farmers and building participation in local programs. Both of the Section 319 projects that have been and will be implemented in the Bayou Nezpique Watershed have educational programs associated with them, as described in this watershed plan.

LDEQ has hired a watershed coordinator that is housed within the Acadiana Resource Conservation and Development District (R.C. &D) office. The coordinator will be working with the local soil and water conservation districts, the NRCS, the local work groups and other interested citizens to determine what level of BMP implementation and water quality monitoring will be needed to restore the fish and wildlife propagation use. All of these efforts will help to reach the goals of the Clean Waters Program and restore water quality in Bayou Nezpique.

14.0 Timeline of Milestones to Achieve Watershed Goals

Bayou Nezpique, since it is located in the Mermentau Basin followed the schedule with the TMDL completed in 1999-2000. BMP implementation through Section 319 projects began in 2001 with a second project beginning in 2008. The ambient water quality data that was collected in 2003 and 2007 was the first data since 1998 to track whether water quality was improving as a result of BMP implementation. Those data indicated that water quality had improved for some parameters such as fecal coliform bacteria, but still indicates problems with nutrients and sediments entering the bayou. LDEQ has revised the implementation plan to include additional Section 319 projects to bring the water body into compliance. Additional BMPs will be employed, if necessary, beginning in 2009-2010 and increase until water quality standards are achieved by 2012-2014. The long-term goal for restoring the waterway is 2014.

LDEQ will continue to monitor Bayou Nezpique on a four-year cycle to determine whether water quality has improved enough to remove it from the 303(d) list. In addition to that data, a more targeted water quality monitoring approach with sampling closer to where the projects are being implemented may be necessary to track whether water quality is improving. LDEQ also reports annually through the NPS Annual Report on the extent of BMP implementation in the Mermentau River Basin. If new water quality data has been collected, then that information is also reported. If water quality data indicates an improvement, then a Success Story is written and published on EPA's national website. Watershed planning and implementation is a long-term, recurring process that involves many partners, but LDEQ is pleased with the progress and work that has been done in Louisiana.

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APPENDIX 2

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