Bayou Courtableau
060204
Watershed Implementation Plan

Washington, LA: LA10 Bridge over Bayou Courtableau, Subsegment 060204

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1.0 INTRODUCTION

Section 303(d) of the 1972 Clean Water Act (CWA) required all states to develop a list of their impaired water bodies. The 303(d) list of impaired water bodies consists of those water bodies that do not meet state regulatory water quality standards even with the current pollution controls in place and after point sources of pollution have installed the minimum levels of pollution controls and are in compliance with current permit processes and point source effluent limitations as outlined in Title 33 Environmental Quality Environmental Regulatory Code, Part IX, Water Quality (LDEQ, 2002).

Bayou Courtableau watershed is sub-segment 060204 of the Vermilion-Teche River Basin (Basin 06). Sub-segment 060204 is comprised of Bayou Courtableau and all tributaries, including Bayou Carron, Bayou Wauksha, Grand Gully, and numerous unnamed tributaries west of Bayou Teche; and Little Bayou Darbonne, Big Bayou Darbonne, 3 Diversion Canals, and numerous unnamed tributaries east of Bayou Teche. The west and east sections of Bayou Courtableau come together near Port Barre and flow into Bayou Teche.

Bayou Courtableau flows through the towns of Port Barre and Washington. It empties into the Atchafalaya River, but is discontinuous at the Atchafalaya Basin where it is interrupted by a levee and a flood control structure. About 5 miles upstream from Port Barre, Bayou Waukesha empties into Bayou Courtableau. Approximately 3 miles upstream from the town of Washington, Bayou Courtableau changes its name to Bayou Cocodrie, Bayou Cocodrie has similar characteristic to Bayou Teche, with more willow trees along its banks.

Common plant species found within the Bayou Courtableau watershed include hackberry, cypress, black willow, and Chinese tallow. Bottomland hardwoods are also present, often isolated, but bounded by agricultural lands along both banks of Bayou Courtableau within the watershed. Scattered tracts of cypress swamps are found in many low-lying areas. Common plants include cypress, red maple, and Virginia willow. (Including photographs of these plants and the areas along the bank would be helpful to the reader)

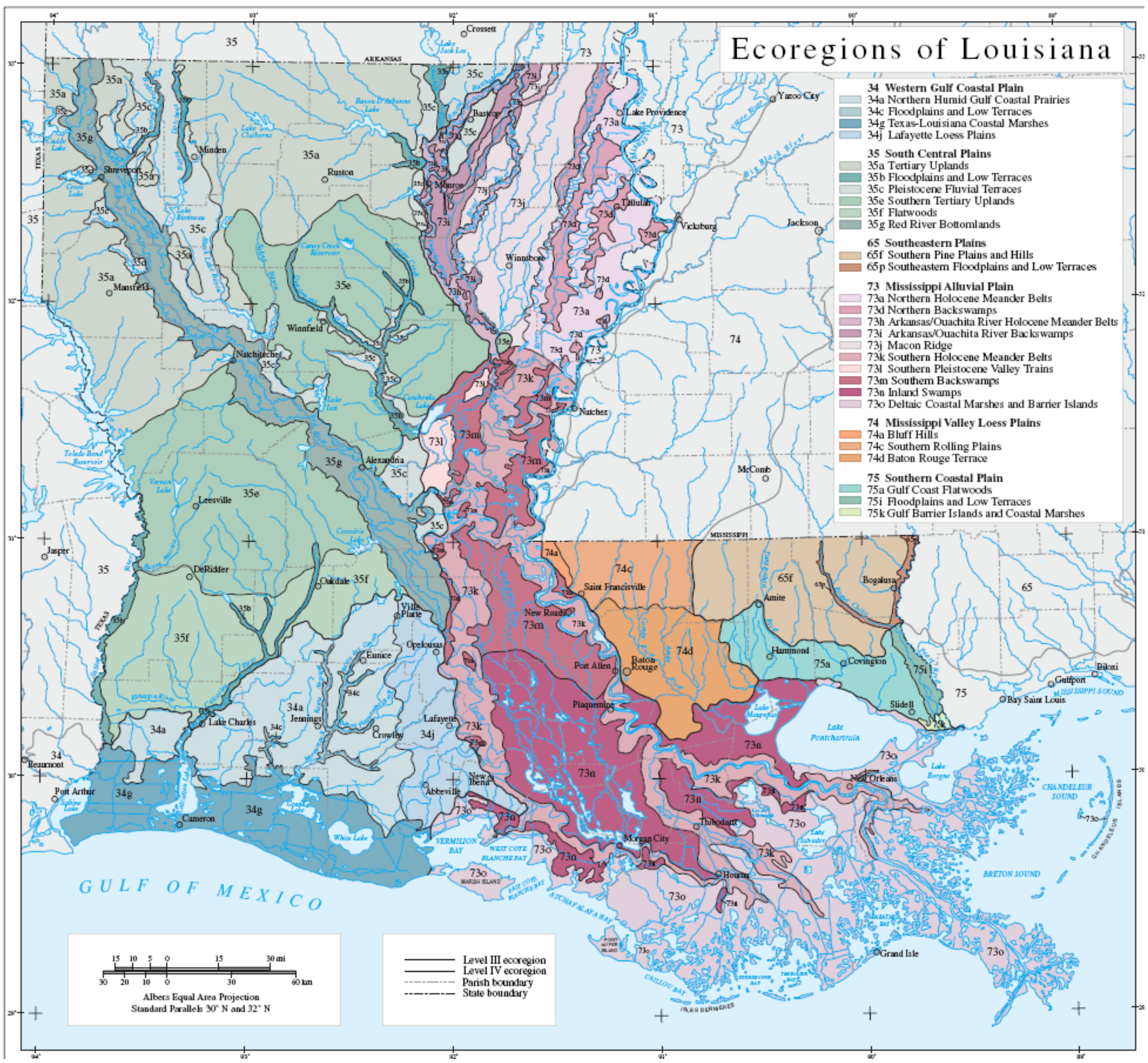
The bayous and rivers of the Vermilion-Teche basin are diverse, with recent studies indicating approximately 59 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 17 species of crawfish (J. Walls, personal communication) found within the basin..

Bayou Courtableau has been extensively hydromodified in all reaches west and east of Bayou Teche. The bayou and its tributaries are dominated by corn, soybean, and sorghum. In the late 1980's and early 1990's, researchers working on Bayou Courtableau indicated that the combined effects of hydromodification and agricultural production inhibited the bayou's natural processes, including reaeration and fish propagation (Smythe and Malone, 1989a-a, 1990).

Bayou Courtableau was listed on the 1999, 2002, and 2004 303(d) lists. The bayou was listed as not supporting any of its designated uses, which included primary contact recreation, secondary contact recreation, and fish and wildlife propagation. However in 2006 and 2008 the bayou had improved and was fully supporting both primary and secondary contact recreation, but was still listed as not supporting fish and wildlife propagation. The suspected causes of these water quality problems included sedimentation or siltation, turbidity and total suspended solids (TSS). The suspected sources of impairment are listed as unknown. Therefore, the Louisiana Department of Environmental Quality (LDEQ) developed and completed a TMDL for dissolved oxygen (DO) and the EPA developed and completed TMDLs for turbidity, TSS, and sedimentation. The CWA requires that states develop TMDLs for the water bodies listed on the 303(d) list. TMDLs provide reduction goals for point and nonpoint source loading into the water body. LDEQ is developing implementation plans for the water bodies/watersheds for which TMDLs have been developed.

1.1 Ecoregion Description: Western Gulf Coastal Plain

Map of Louisiana Ecoregion



Typified by flat plains, this Western Gulf Coastal Plain ecoregion is located in southwestern Louisiana and ranges westward along the eastern coast of Texas. The southern boundary has been modified to coincide with the location of the Intracoastal Waterway. The eastern boundary is the western Atchafalaya levee system. The northern boundary partially concurs with the divide between the Gulf Coast Flatwood and Coastal Plain soil associations and the original EPA delineation. Vegetation is characteristic of the bluestem/sacahuista prairie type (bluestem and cordgrass) and land-use primarily consists of cropland and cropland combined with grazing land. The soil associations represented in this ecoregion are Gulf Coast Flatwoods and Coastal Prairie.

34. Western Gulf Coastal Plain

The principal distinguishing characteristics of the Western Gulf Coastal Plain are its relatively flat topography and grasslands. Inland from this region, the plains are older, more irregular, and are mostly forested in the Louisiana portion (Ecoregion 35) or savanna-type vegetation to the west in Texas (Ecoregion 33). Largely because of this flat land and relatively fertile soil, a higher percentage of the land is in cropland than in the bordering ecological regions. Rice and soybeans are the principal crops across the region, while grain sorghum and cotton are also grown, mostly in the Texas portion. Urban and industrial land uses have expanded greatly in recent decades in some parts of the region, and oil and gas production is common.

The Western Gulf Coastal Plain ecoregion comprised of several sub ecoregions. These include:

34a. Northern Humid Gulf Coastal Prairies
34c. Floodplains and Low Terraces
34g. Texas-Louisiana Coastal Marshes, and
34j. Lafayette Loess Plain.

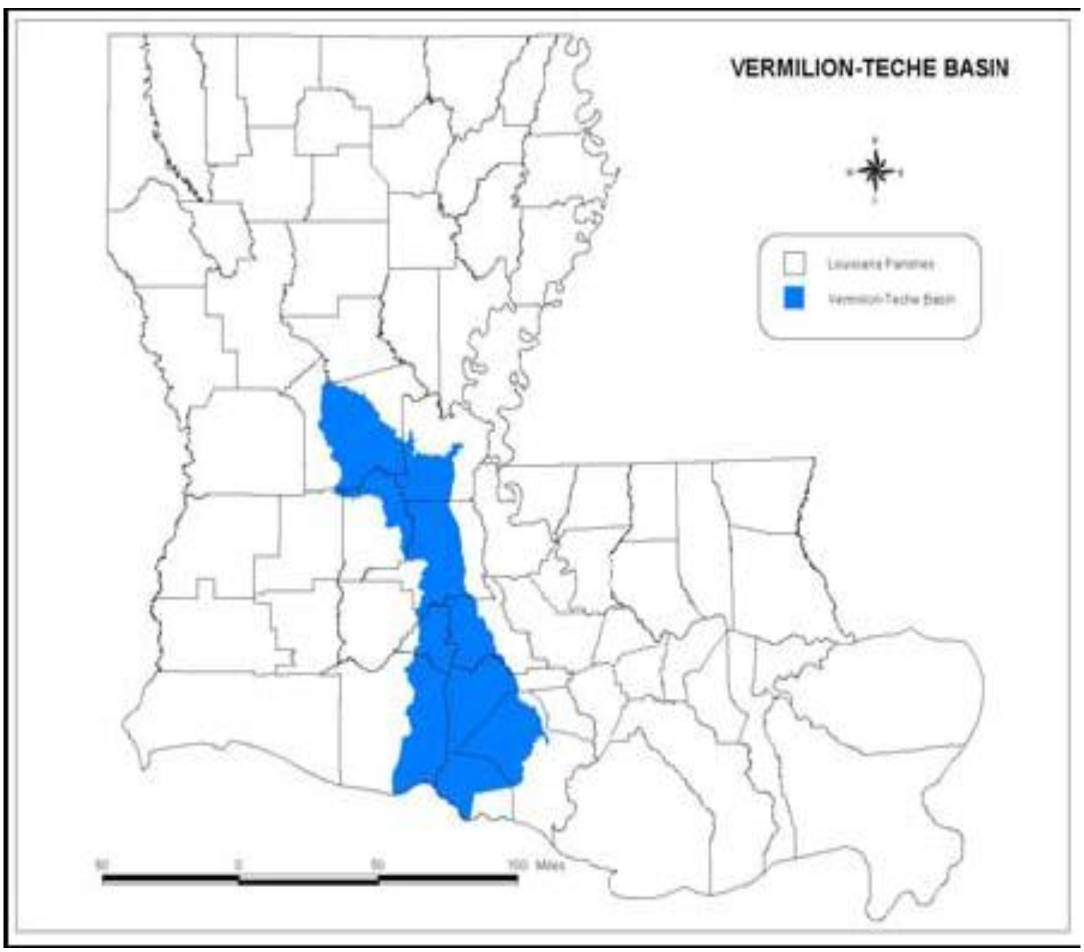
Detail descriptions of each sub-ecoregion can be found in the appendix.

1.2 *Vermilion-Teche River Basin Description*

General Description:

The Vermilion-Teche River Basin lies in south-central Louisiana. The upper end of the basin lies in the central part of the state near Alexandria, and the basin extends southward to the Gulf of Mexico. The basin is bordered on the north and northeast by a low escarpment and the lower end of the Red River Basin. The Atchafalaya River Basin is to the east, and the Mermentau River Basin is to the west (LA DEQ, 1996).

The Vermilion-Teche basin's drainage area covers approximately 4,047 square miles. Habitats within the basin range from the upland pine forests, northwest of Alexandria, to agriculture lands consisting primarily of corn and soybeans, in its northern portion, and rice and sugarcane in its central and southern portion. The coastal zone is mostly freshwater marsh from Bayou Cypremort east to LA Hwy 317. Intermediate and brackish marsh occupies the entire coastal zone west of Bayou Cypremort with small areas of salt marsh on Marsh Island WMA and Paul J. Rainey Wildlife Sanctuary.



Water from the Atchafalaya River is diverted into the Vermilion-Teche River Basin through the Bayou Teche water project. Authorized by the Flood Control Act of 1966, this structure allows the diversion of supplemental fresh water from the Atchafalaya River upstream of Krotz Springs to the head of Bayou Teche at Port Barre. The supplemental fresh water is distributed among Bayou Teche, the Vermilion River, and the west side borrow pit along the Atchafalaya basin protection levee for municipal, industrial, irrigation, and water-quality control uses (COE 1998).

Historically, backwater flooding from the Atchafalaya River would supplement flows in Bayou Courtableau for distribution to Bayou Teche. Construction of the Atchafalaya River levees and the West Atchafalaya Basin Protection Levee (WABPL) began in the 1930s and reduced the amount of possible diversion from the Atchafalaya to Bayou Courtableau, when the connection of Bayou Courtableau with the Atchafalaya was severed. Although the levees retained all low flows in Bayou Courtableau, the area was cut off from water in the backwater area during high water. The Bayou Courtableau weirs, completed in 1942, were designed to divert all low flow under 18.0 feet msl in Bayou Courtableau to Bayou Teche (USACE, 1986). The Bayou Courtableau drainage structure was built in 1956, primarily as a flood control relief structure. The Bayou Courtableau along with the Darbonne Bayou drainage structures, built in 1941, can also be used to divert flow from the Atchafalaya system into Bayou Courtableau. However, construction of the Butte Larose levee extension reduced stages in the floodway to such an extent that diversions through these structures by gravity flow were seldom possible. The reduced flows in Bayou Courtableau essentially affected the entire Vermilion-Teche system south of that point, prompting the construction of a pumping station (USACE, 1986).

The Teche-Vermilion Fresh Water District was authorized under the Flood Control Act of 1966 to augment flows in the Teche-Vermilion system through the reintroduction of Atchafalaya River water. The Teche-Vermilion pumping station and appurtenant control structures were completed in 1982. It is located approximately one mile north of Krotz Springs on the western bank of the Atchafalaya River. Pumping from this station began in early 1983. The purpose of the project was two-fold:

- To restore historical flow, and
- To provide flow to meet the area's water needs by supplementing low water flows in Bayou Teche and the Vermilion River with water from the Atchafalaya River.

The pumping station has a capacity of 1300 cfs of which 500 cfs was considered to be a replacement for water diverted from the area by the Butte Larose levee extension (USAED, 1983; USACE, 1986). Operation of the Teche-Vermilion project is the responsibility of the Teche-Vermilion Fresh Water District. Operation of pumping stations, control of flow, and distribution of water are dependent on the specific needs in the Teche and Vermilion areas, and the availability of water within the system (USACE, 1986; USGS, 1988).

The Teche-Vermilion pumping station pumps water approximately six miles across the West Atchafalaya Basin Floodway, through the WABPL to the WABPL Borrow Pit and down the borrow pit to Darbonne Bayou. From that point, the water travels one mile westward to Bayou Courtableau where the flow splits. Some of the flow is downstream to the Courtableau weirs, Courtableau Drainage Structure, and the Courtableau-Borrow Pit Control Structure, where the gated structure can be opened to provide a small supplemental flow into the WABPL Borrow Pit. Most flows on Bayou Courtableau are diverted to Port Barre where it empties into the origin of Bayou Teche (USACE, 1986). Continued development in the Vermilion-Teche River Basin has required dredging of streams in the drainage basin for flood control management, crop irrigation and, in some instances navigation. Channelization has created uniform water depths, reduced flow gradients and velocities. All of these hydromodification activities have affected DO levels in the streams of the Vermilion-Teche. In all cases, the controlled movement of water is the primary goal in this basin.

A portion of the diversion flow is diverted from Bayou Teche to the Vermilion River headwaters through Bayou Fusilier, which connects the Vermilion River with Bayou Teche at Arnaudville. A slotted low water weir on Bayou Fusilier was built in conjunction with the project to maintain the majority of flow down Bayou Teche. A 17-foot stage is maintained at the Bayou Courtableau control structure on the WABPL from January 1 through the end of February. An 18-foot stage is maintained from March 1 to September 30, and a 16-foot stage from October 1 to December 31 (USACE, 1986; USGS, 1988). If the stage at the Bayou Courtableau structure exceeds these guidelines, excess water is diverted into the Atchafalaya Basin Floodway and diversion pumping from the Atchafalaya River into Bayou Courtableau is temporarily discontinued. From March 1 to September 30, 70% of the augmented flow in Bayou Teche is diverted to the Vermilion River through Ruth Canal and Bayou Fusilier for water quality improvement and rice irrigation. From October 1 through February 28, Bayou Teche receives 70% of the flow and the Vermilion River receives the remaining 30%. These guidelines were established by the USACE and are maintained by the Teche-Vermilion Fresh Water District. Actual flows diverted will vary depending on background water levels and weather conditions in the Bayou Courtableau, Bayou Teche, and Vermilion River watersheds (USGS, 1988).

In March (generally considered the high flow period), the portion of Bayou Courtableau north of Port Barre naturally supplies a discharge of approximately 1700 cfs from the upper basin. This drainage originates in the upper portion of the Vermilion-Teche Basin and passes through Bayou Courtableau as a result of the confluence of Bayous Cocodrie and Boeuf. However, the discharge in Bayou Teche at Arnaudville reaches only approximately 1200 cfs. The excess discharge goes over two weirs from Bayou Courtableau and into the West Atchafalaya Basin Protection Levee (WABPL) Borrow Pit. In this case, flow is west-to-east. This is reverse of the low flow scenario in October, in which the flow in Bayou Courtableau (pumping station side of Bayou Teche) is east-to-west as a result of freshwater diversion from the Atchafalaya River (from the Teche-Vermilion Pumping Station) to sustain flow in the system. Bayou Courtableau east of Port Barre may flow in either direction, depending on whether excess water comes “naturally” from the upper Vermilion-Teche Basin or from the Teche-Vermilion Pumping Station (USACE, 1986)).

2.0 WATERSHED LANDUSE

2.1 Bayou Courtableau Watershed Description

The Bayou Courtableau watershed is sub-segment 060204 of the Vermilion-Teche River Basin . Sub-segment 060204 is comprised of Bayou Courtableau and all tributaries, including Bayou Carron, Bayou Wauksha, Grand Gully, and numerous unnamed tributaries west of Bayou Teche; and Little Bayou Darbonne, Big Bayou Darbonne, 3 Diversion Canals, and numerous unnamed tributaries east of Bayou Teche. The west and east sections of Bayou Courtableau come together near Port Barre and flow into Bayou Teche.

Most of the land in the Vermilion-Teche Basin is used for agriculture, with cleared lands used primarily for pasture and crops. Crop types include sugarcane, soybeans, corn, milo and rice. Crawfish farming is also found in this watershed, introduced as a rotating crop with soybeans and rice throughout the watershed. Current land-use data shows that soybeans account for most of the land-use in the corridor between Opelousas and Lafayette. Sugarcane and woodlands are the chief land-use between Lafayette and Bayou Teche to the east, with sugarcane populating the remainder of the Vermilion-Teche Basin to the West Atchafalaya Basin Protection Levee (WABPL). (Gary, you had covered this earlier in the document.

Land-use in the Bayou Courtableau watershed is primarily forests and agriculture production. As indicated in Table 1, land-use in 1996 indicated that 33.56% of the watershed was in agricultural crops, but had separate categories for pastures/soybeans (15.53%) and aquaculture/rice/water (8.05%). Forestry was the second largest land-use in the watershed with coverage of 35.89%. These two land-uses had a combined coverage of 93.03%. Urbanized areas occupied 1.64% of the watershed. Average annual precipitation in the Bayou Courtableau watershed was 56.91 inches, based on the Louisiana Climatic Station in Crowley.

Table 2 is the 2008 land-use map for Bayou Courtableau. The 2008 land-use for Bayou Courtableau indicated the percent land-use for agriculture decreased to 28.29% with separate categories for pastures/soybeans (14.5%) and aquaculture/rice/water at 13.43%. The amount of land in forestry dropped to 33.8%, while urban increased to 1.85%. The map for 2008 showed a 5.43% increase in rice/aquaculture production, in the upper half of the watershed where forests existed in 1996. . The percentage of shrubs increased between 1996 and 2008. By comparing the land-use between 1996 and 2008, the map appears to show a shift from pastures/soybeans to other types of agriculture in the upper part of the watershed. . Over a period of 12 years, land-use in this watershed has been relatively consistent, except for clearing of 8% of the forests and a similar increase in aquaculture/rice/water. . There are no major industries found in this watershed. . This watershed is sparsely populated, with most of the population centered in two small towns, Washington and Port Barre. Bayou Courtableau is 43 river miles in length, the stream banks along the bayou are very stable, consisting mostly of cypress and other wetland plant species. Stream bank erosion is minimal to non-existent, with no problem areas documented during the site visit to the watershed.

Table 1: 1996 Land-use/land cover in Sub-segment 060204

Land Type	Area (ha) 060204	Percent Landuse 060204
Forest	31,218	33.80
Agriculture	26126	28.29
Pasture/bean	13,409	14.52
Shrubs	7,489	8.11
Urban	1,708	1.85
Aquaculture/rice/water	12,408	13.43

Table 2: 2008 Land-use/land cover in Sub-segment 060204

Land Type	Area (ha) 060204	Percent Landuse 060204
Forest	33,037	35.89
Agriculture	30,894	33.56
Pasture/bean	14,301	15.53
Shrubs	4,917	5.34
Urban	1,510	1.64
Aquaculture/rice/water	7,416	8.05

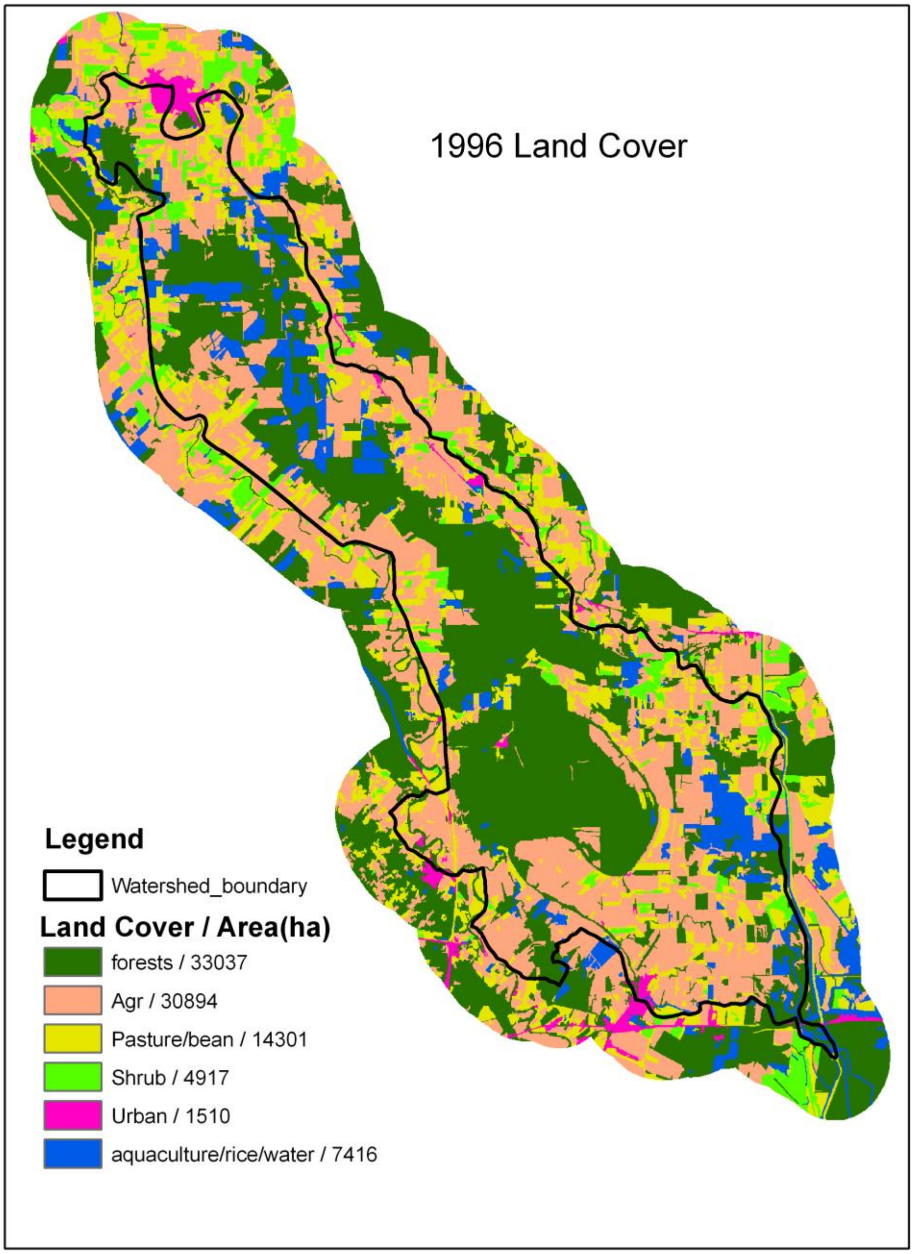


Figure 1: The 1996 Land-use/Land cover for Sub-segment 060204

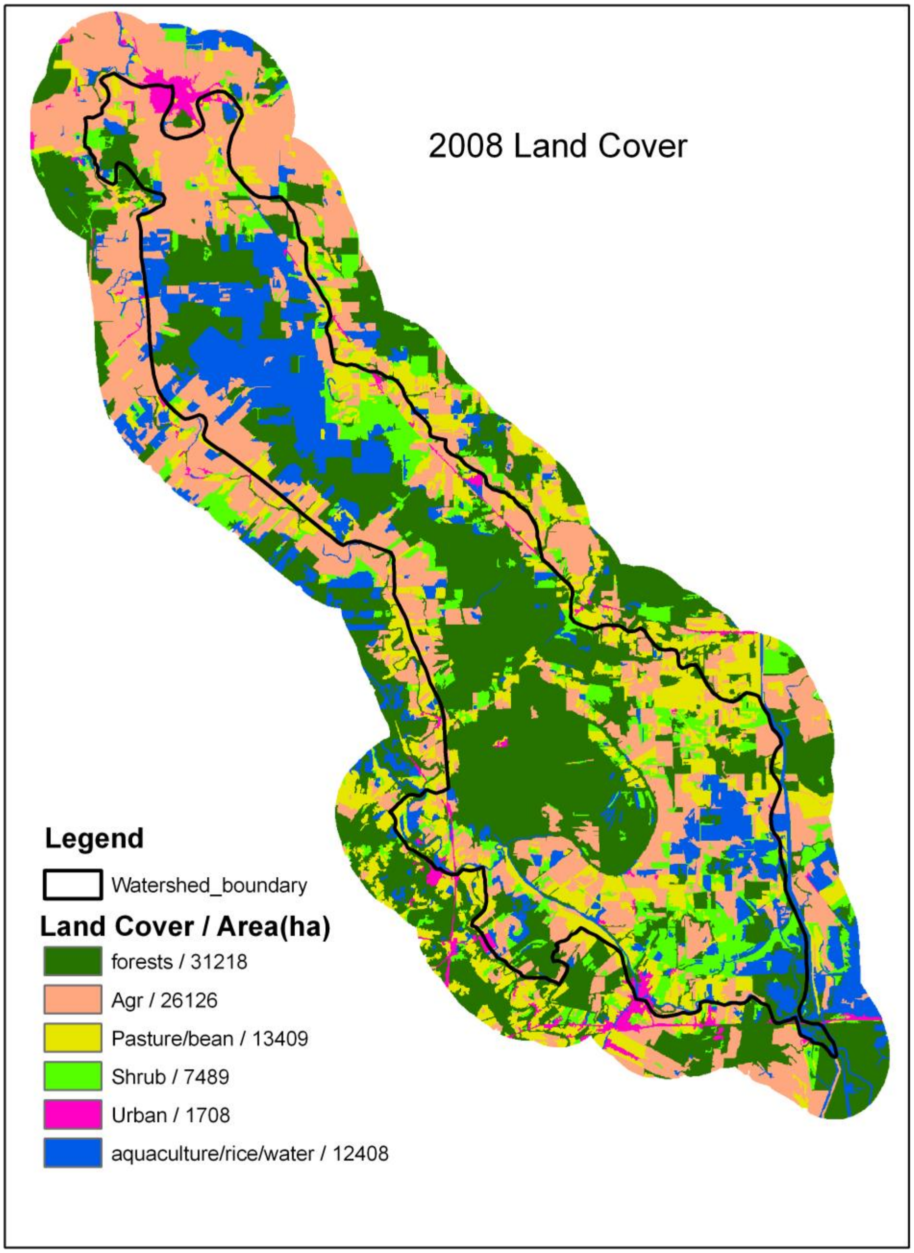


Figure 2: The 2008 Land-use/Land cover for Sub-segment 060204

2.2 *Field Survey of the Bayou Courtableau Watershed*

Bayou Courtableau is located in the Vermilion-Teche Basin, in the Western Gulf Coastal Plain Ecoregion (WGCPE), in south central Louisiana. Bayou Courtableau, in sub-segment 060204, forms at the confluence of Bayous Cocodrie and Boeuf and is the means by which Bayou Teche receives its water. Bayou Courtableau flows from this confluence and terminates at the West Atchafalaya Borrow Pit Canal. While the Vermilion-Teche system has a total drainage area of approximately 2,500 square miles, Bayou Courtableau receives flow from the upper 1,600 square miles (USGS, 1971). Bayou Courtableau is 43 river miles in length.

Aside from the levee ridges that range in height from 5 to 25 feet, the land is relatively flat with an average slope of less than 1 percent. As a result, backwater swamps with standing water and lakes form within meanders scar areas as well as other low-lying and poorly drained areas. These areas consist of thick deposits of clay and silty clay, which have very little drainage potential (USACE, 1986). Throughout the Vermilion-Teche Basin, negligible slopes and wide low relief flood plains characterize both rivers and their tributaries. The relatively flat stream channels provide little reaeration potential. This attribute frequently promotes DO concentrations below 5 mg/L especially during low flow, high temperature conditions.

Several point sources fall within the sub-segment; these facilities were deemed either intermittent storm water or minor discharges and were represented in the nonpoint loading via benthic loads. Limits for these small facilities are generally set by state policy.

West Bayou Courtableau was modeled from its headwaters with Bayou Boeuf and Bayou Cocodrie (River Kilometer 21.6) to its confluence with Bayou Teche (River Kilometer 0.00). West Bayou Courtableau was modeled because the water quality along this portion of Bayou Courtableau was not meeting the 5.0 mg/L dissolved oxygen standard at the City of Washington. East Bayou Courtableau from Bayou Teche to the West Atchafalaya Borrow Pit Canal was not modeled because of the addition of the Teche-Vermillion Fresh Water District Pumping Station. All of the flow from the eastern section of Bayou Courtableau is influenced by the large amount of water being pumped into Bayou Courtableau from the Atchafalaya River. The water quality on East Bayou Courtableau is different from West Bayou Courtableau because it is coming from the Atchafalaya River. There are 5 pumps, each having a capacity to pump 260 cfs. The number of pumps used at any one time depends on seasonal stage elevations. Also, during drought conditions, the amount of water that is being pumped varies. Because of the water quality differences, the permanent man-alterations, and the unpredictable fluctuations in flow, East Bayou Courtableau was not included in this TMDL.

A survey was conducted (July 27-28, 1999) during a period of very dry weather. Bayou Courtableau watershed was in a condition of low flow. There were no tributaries that had a velocity that could be measured with typical survey equipment. Consequently, none of the tributaries were included in the model. The nonpoint source loads included headwater loading and other nonpoint loading not associated with flow.

LDEQ NPS staff visited the watershed on October 17, 2008. The watershed was visited after the effects of two hurricanes made landfall in Louisiana in September 2008. The damage from the storms was still visible with downed trees limiting access to certain locations along the watershed. October is traditionally considered to be a low flow season for any water body in the state, but it was not the case during the tour of the watershed. Water from Hurricanes Gustav and Ike was seen draining out of the swamps and low lying areas in the watershed, making the water level on Bayou Courtableau higher than normal for this time of the year. In addition to water from the hurricanes, Bayou Courtableau normally receives water from the Atchafalaya during the fall months. ; Reverse flow was observed during the site visit, with water leaving the wetland and low-lying areas, flowing into Bayou Courtableau and then reversing its flow into the West Atchafalaya Borrow Pit Canal.

Bayou Darbonne Drainage Structure located on Sub-segment 060204

Waters from West Atchafalaya Borrow Pit Canal enters Sub-segment 060204

Bayou Courtableau is a sparsely populated watershed, with most of the population centered in two small towns, Washington and Port Barre. Stream banks along the bayou are very stable, consisting mostly with cypress and other wetland plant species. Stream bank erosion is minimal, and has not been observed while visiting the watershed. Stream banks along agricultural areas were observed to be very stable, with no visible sign of erosion. Debris was found around the towns and city limits, typical of debris found in most waterways in Louisiana. Land-use in this watershed is considered to be relatively consistent based on land-use/land coverage comparison between 1996 and that of 2008, with no major industries within the watershed.

Debris found on Bayou Courtableau, typical of many waterways in Louisiana

Stable Stream banks found in Bayou Courtableau Watershed

3.0 WATER QUALITY ANALYSIS

3.1 Water Quality Data

Water Quality:

Designated uses for Bayou Courtableau, from its headwaters to the West Atchafalaya Borrow Pit Canal, include primary contact recreation, secondary contact recreation, and the propagation of fish and wildlife. Bayou Courtableau, sub-segment 060204, of the Vermilion-Teche Basin was listed on the 1996, 1998, 2002, and 2004 CWA's Section 303(d) lists. The sub-segment was listed as not supporting any of its designated uses. Therefore, the Louisiana Department of Environmental Quality (LDEQ) and the United States Environmental Protection Agency (USEPA) developed total maximum daily loads (TMDLs) for the bayou. The CWA requires that states develop TMDLs for the water bodies listed on the 303(d) list. TMDLs provide reduction goals for point and nonpoint source loading into the water body.

Subsequently, in 2006 and 2008, the bayou is fully supporting primary and secondary contact recreation but is not supporting fish and wildlife propagation. The suspected causes of impairment are sedimentation or siltation, turbidity and total suspended solids. The suspected sources of impairment are listed as unknown. LDEQ is developing implementation plans for the water bodies/watersheds for which TMDLs have been developed.

Water quality standards are the basis for determining whether a water body meets its designated uses. Both general narrative standards and numerical criteria have been defined. General standards include prevention of objectionable color, taste and odor, solids, toxics, oil and grease, foam, and nutrient conditions as well as aesthetic degradation. The numerical criteria are shown in Table 3.

Table 3: Water Quality Numerical Criteria for Bayou Courtableau in Subsegment 0602041

Water Quality Parameter	Numerical Criteria
Designated Uses	A B C
Dissolved Oxygen, mg/L	3-5*
Chlorides. mg/L	65
Sulfates mg/l	70
pH	6.0 – 8.5
BAC	1**
Temperature, ° C	32
Total Dissolved Solids, mg/L	440

Designated 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

* *Dissolved Oxygen concentration criteria:* *Site-specific seasonal DO Criteria:*
3 mg/L May – September
5 mg/L October - April

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

Section 303(d) of the Clean Water Act requires the identification, listing, ranking and development of TMDLs for waters that do not meet applicable water quality standards after implementation of technology-based controls. Current dissolved oxygen criteria are also shown in Table 3. Water bodies are placed on the 303(d) list based on the comparison of data from ambient monthly samples and the criteria.

3.2 Discharger Inventory

All of the dischargers located in this watershed are small and need not be included in a model of this scale because it is unlikely that they are having an impact on the targeted water body due to the small load and/or the distance from the water body named in the 303(d) lists.

3.3 Point Sources

Several minor point sources fall within the sub-segment. Many of these facilities are either intermittent storm water or minor discharges. Five facilities are known to discharge water into Bayou Courtableau. The combined flow of all these discharges is 72,425 gallons per day (see Table 3).

Table 4: Dischargers in Sub-segment 060204 on Bayou Courtableau

Dischargers to Bayou Courtableau			
Facility	Permit #	Design Flow (gal/day)	Wasteload Allocation (lb/day)*
Washington Campground	LAG530762	25,000	1.89E08
Tri-Community Nursing Center/Peace Inc.	LAG540553	10,800	8.18E07
Palmetto Elderly Apartments	LAG540556	25,000	1.89E08
Morrow Housing Project	LAG540685	7,500	5.68E07
Washington Elementary School	LAG540896	4,125	3.13E07
	Totals:	72,425	5.49E08

A water quality standard is a definite numerical criterion value or general criterion statement to enhance or maintain water quality and to provide for, and fully protect, the designated uses of a water body (LDEQ, 2003). General and numerical criteria are established to promote restoration, maintenance, and protection of state waters. A criterion for a substance represents the permissible levels for that substance at which water quality will remain sufficient to support a designated use. A complete list of water quality criteria can be found in the Louisiana Administrative Code, Title 3, Part IX, Subpart 1, Chapter 11, and Section 1113.

3.4 Ambient Water Quality Network Monitoring Stations

As shown in Figure 3 on the following page, there are 4 water quality network monitoring stations located in this watershed, not all 4 stations are active at all times. LDEQ maintained the sampling locations (WQN0101, WQN0102, WQN0665, & WQN1197) on Bayou Courtableau as part of the Statewide Water Quality Monitoring Network. Data was collected on a monthly basis, dating back to 1978 for WQN0101 and WQN0102. WQN0665 was added more recently to the network system in 1998, and WQN1197 was established according to special need and purposes, such as for the development of the TMDL. Ambient Network Station Number 58010101 is located east of Port Barre near the northwest wing wall of Bayou Courtableau drainage structure. Ambient Network Station Number 58010102 is located at bridge on State Highway 10 in Washington, Louisiana. Ambient Network Station Number 58010665 is located at Highway 103 in Port Barre, 1 mile north of US190. Ambient Network Station Number 58011197 is located about 1.4 miles southeast of Courtableau, 6 miles west of Krotz Springs, Louisiana. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year.

If samples taken through the ambient sampling program fail to meet water quality criteria, a water body is considered impaired for the designated use(s) to which those criteria apply. Waters of the state are assessed biennially in the Louisiana Water Quality Inventory Integrated Report. This report includes the 303(d) list of impaired water bodies. Bayou Courtableau in sub-segment 060204 has been listed on the 1999, 2002, and 2004 303(d) lists of impaired water bodies. In the 2008 303(d) list, Bayou Courtableau is fully supporting primary and secondary contact recreation, but is not supporting fish and wildlife propagation. The suspected causes of impairment are sedimentation/siltation, total suspended solid, and turbidity. The suspected sources of impairment are listed as unknown. Table 5 lists the use impairment for Bayou Courtableau.

Table 5: Bayou Courtableau Sub-segment 060204 designated use impairments

Subsegment Description	PCR	SCR	FWP	Impaired Use for Suspected Cause	Suspected Causes of Impairment	Suspected Sources of Impairment
Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Sedimentation/Siltation	Source Unknown
Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Total Suspended Solids (TSS)	Source Unknown
Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Turbidity	Source Unknown

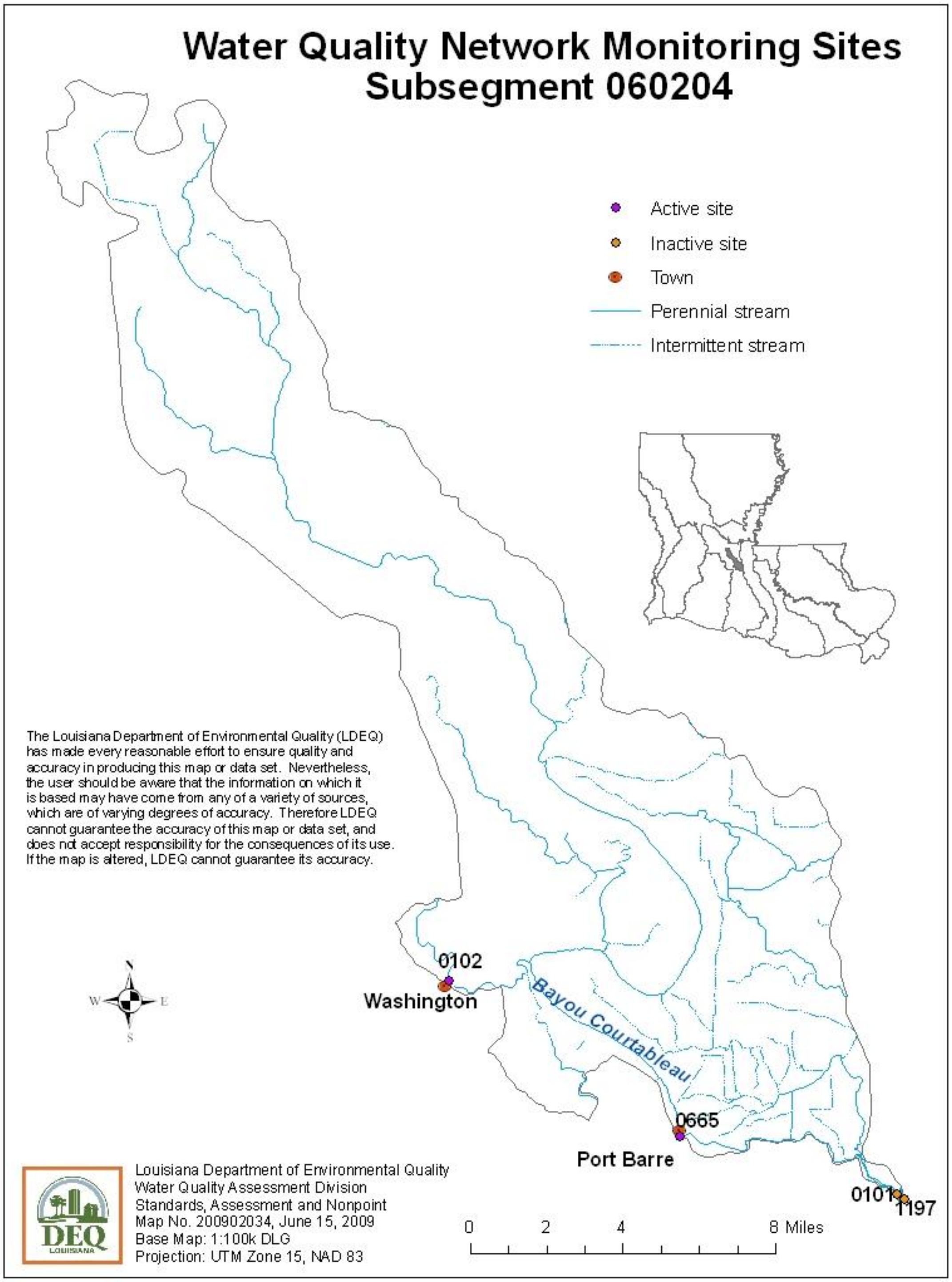
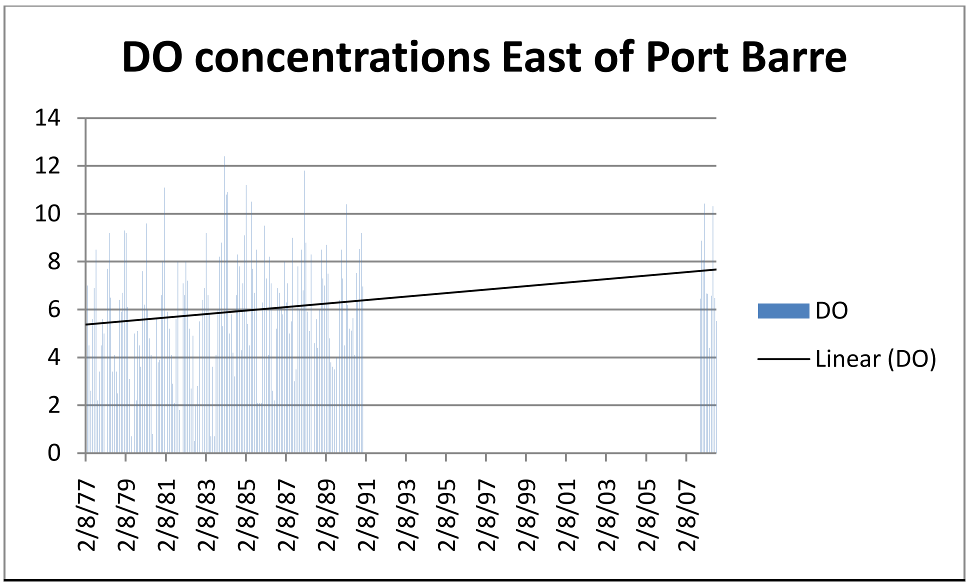


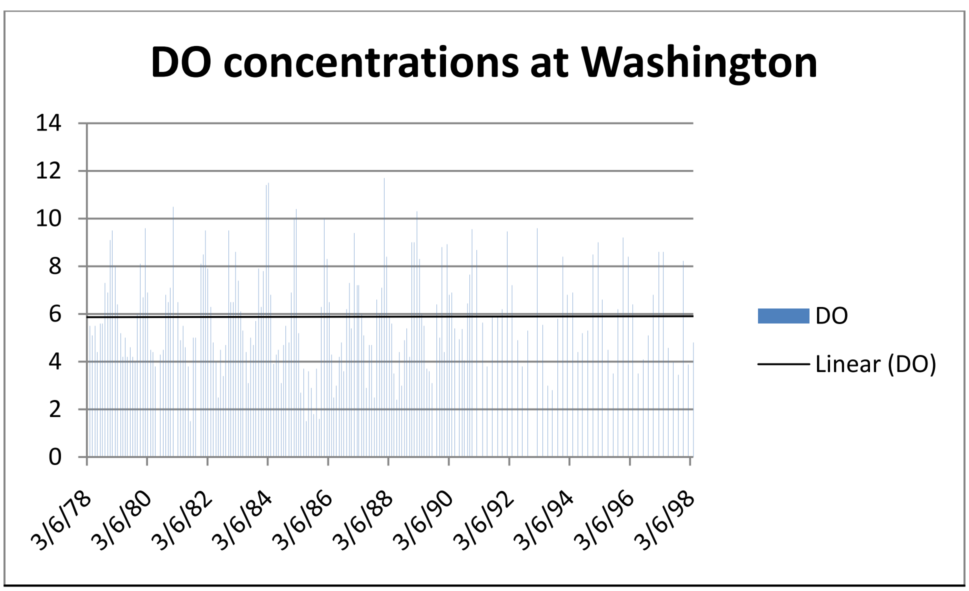
Figure 3: Ambient Network Monitoring Sites for Sub-segment 060204

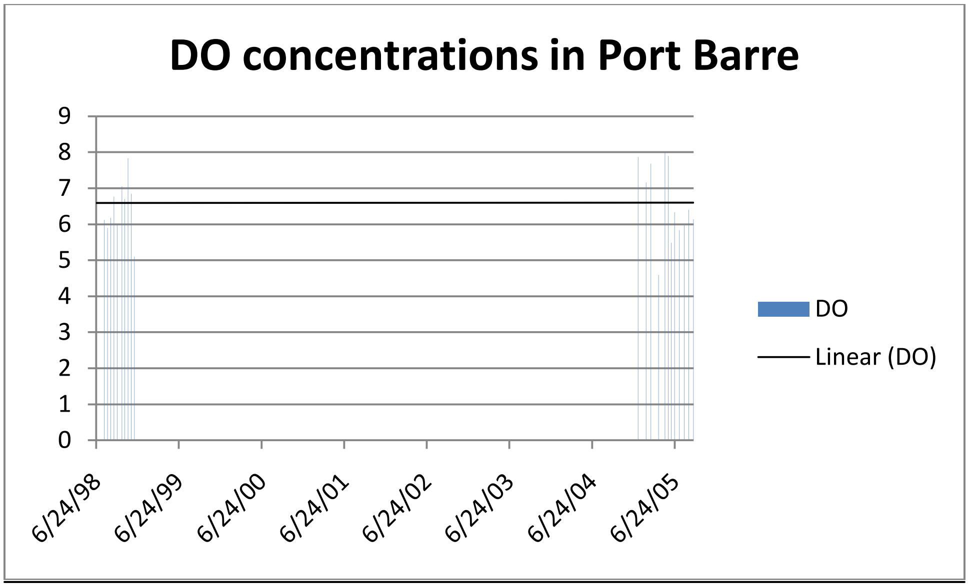
DISSOLVED OXYGEN, DO

This water body was listed initially for DO/organic enrichment and LDEQ did a TMDL for that constituent and determined that a 30 % reduction of man-made nonpoint source pollutants were needed in order to meet the dissolved oxygen standard during the critical flow season of the year. By 2006 and again in 2008, the water body met the DO standard, but is still listed for turbidity/TSS and sedimentation.

The trend analysis of DO for Station 0101 indicated an improving DO concentration from a low trend of about 5 mg/L in 1977 to a high of 7.5 mg/L in 2008. A consistent DO trend of about 6 mg/L was observed for the ambient monitoring station at Washington; and a slightly improving trend of DO concentration for the monitoring station in Port Barre. These data indicated an improving trend for DO concentration in the Bayou Courtableau watershed, resulting in the removal of DO from 2006 and 2008 303(d) list.



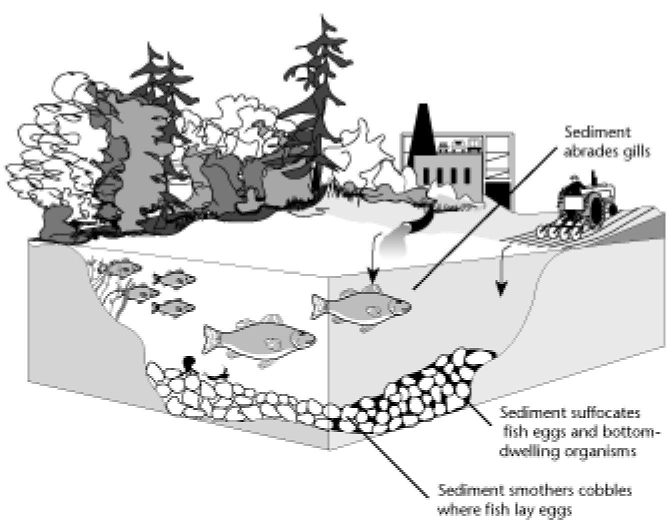



DO concentrations in Port Barre
9
8
7
6
5
4
3
2
1
0
6/24/98
6/24/99
6/24/00
6/24/01
6/24/02
6/24/03
6/24/04
6/24/05
DO
Linear (DO)

SEDIMENTATION AND SILTATION

In a water quality context, sedimentation usually refers to soil particles that enter the water column from eroding land. Sediment consists of particles of all sizes, including fine clay particles, silt, sand, and gravel. Water quality managers use the term "siltation" to describe the suspension and deposition of small sediment particles in water bodies. Sedimentation and siltation can severely alter aquatic communities. Sediment may clog and damage fish gills, suffocate eggs and aquatic insect larvae on the bottom, and fill in the space between bottom cobbles where fish lay eggs. Suspended silt and sediment interfere with recreational activities and aesthetics of water bodies by reducing water clarity. Sediment may also carry other pollutants into water bodies. Nutrients and toxic chemicals may attach to sediment particles on land and be transported with the particles to surface waters where the pollutants may settle with the sediment or detach and become soluble in the water column. Rain washes silt and other soil particles off plowed fields, construction sites, logging sites, urban areas, and strip-mined lands into water bodies. Eroding stream banks also deposit silt and sediment in water bodies. Removal of vegetation on shore can accelerate stream bank erosion.

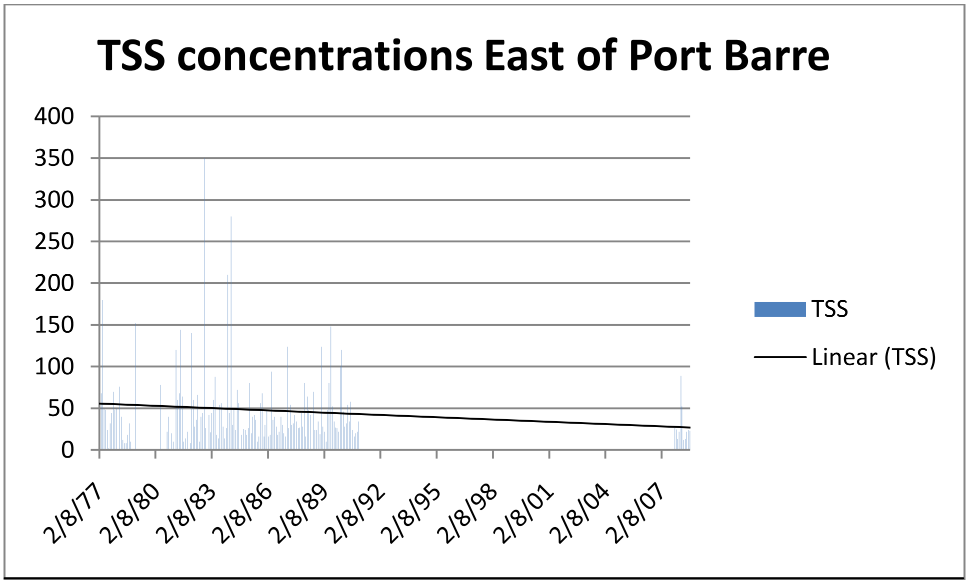
The Effects of Siltation in Rivers and Streams



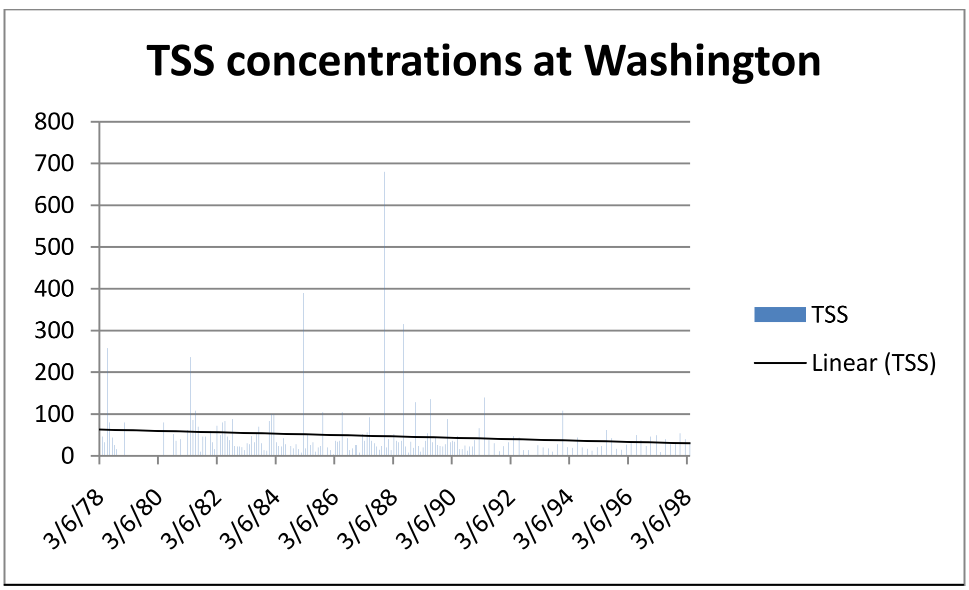
Siltation is one of the leading pollution problems in the Nation's rivers and streams. Over the long term, unchecked siltation can alter habitat with profound effects on aquatic life. In the short term, silt can kill fish directly, destroy spawning beds, and increase water turbidity resulting in depressed photosynthetic rates.

TOTAL SUSPENDED SOLIDS (TSS)

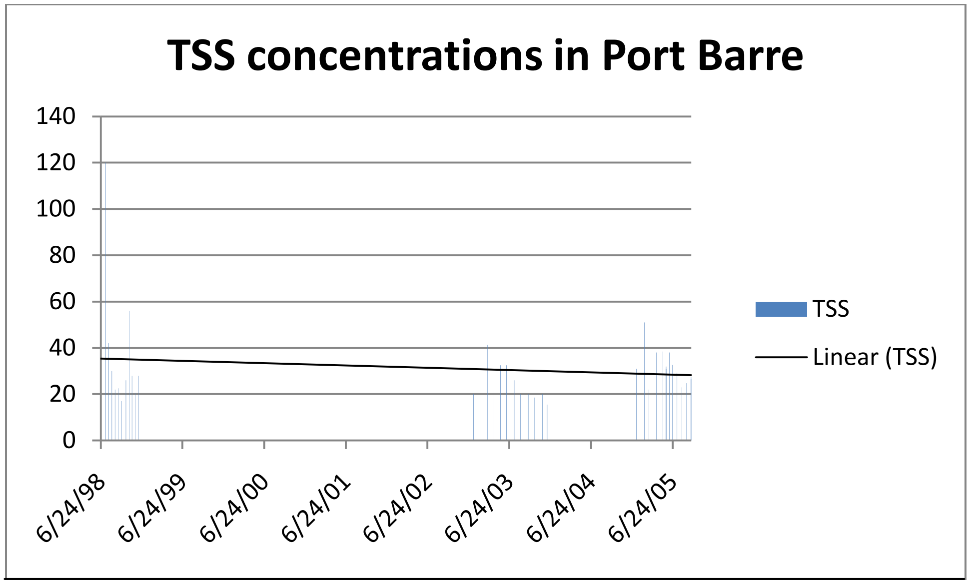
All three ambient network stations in this watershed have recorded a decreasing trend of TSS concentrations. Ambient Network Site 0101 east of Port Barre which has data dating back to February 1977 to August of 2008 indicated a decreasing trend from a high of above 50 mg/L to a low trend of about 25 mg/L.



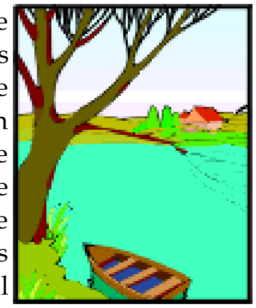
The same decreasing trend was also recorded for Ambient Network Site 0102 at Washington, from a high trend of about 80 mg/L to a low trend of 30 mg/L for reporting period from March of 1978 to April of 1998. There was no data collected at this site since April of 1998.



As for Ambient Network Station 0665 in Port Barre, a decreasing trend of TSS was also recorded at this station. A decreasing trend of TSS for this site is from a high trend of about 40 mg/L to a low trend of less than 30 mg/L. A decreasing trend is based on data collected from June of 1998 to September of 2005.



Total Suspended Solids (TSS) can include a wide variety of material, such as silt, decaying plant and animal matter, industrial wastes, and sewage. High concentrations of suspended solids can cause many problems for stream health and aquatic life.



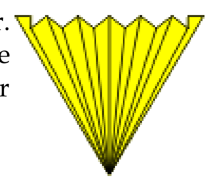
High TSS can block light from reaching submerged vegetation. As the amount of light passing through the water is reduced, photosynthesis slows down. Reduced rates of photosynthesis cause less dissolved oxygen to be released into the water by plants. If light is completely blocked from bottom dwelling plants, the plants will stop producing oxygen and will die. As the plants are decomposed, bacteria will use up even more oxygen from the water. Low dissolved oxygen can lead to fish kills. High TSS can also cause an increase in surface water temperature, because the suspended particles absorb heat from sunlight. This can cause dissolved oxygen levels to fall even further (because warmer waters can hold less DO), and can harm aquatic life in many other ways.

The decrease in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease, and prevent egg and larval development. When suspended solids settle to the bottom of a water body, they can smother the eggs of fish and aquatic insects, as well as suffocate newly hatched insect larvae. Settling sediments can fill in spaces between rocks which could have been used by aquatic organisms for homes.

High TSS in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water. These pollutants may attach to sediment particles on the land and be carried into water bodies with storm water. In the water, the pollutants may be released from the sediment or travel farther downstream.

High TSS can cause problems for industrial use, because the solids may clog or scour pipes and machinery.

Measurement of Total Suspended Solids

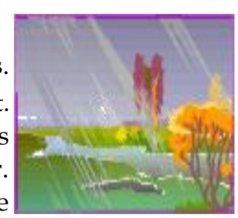


To measure TSS, the water sample is filtered through a pre-weighed filter. The residue retained on the filter is dried in an oven at 103 to 105 C until the weight of the filter no longer changes. The increase in weight of the filter represents the total suspended solids.

TSS can also be measured by analyzing for total solids and subtracting total dissolved solids.

Factors Affecting Total Suspended Solids

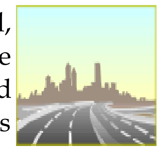
High Flow Rates



The flow rate of the water body is a primary factor in TSS concentrations. Fast running water can carry more particles and larger-sized sediment. Heavy rains can pick up sand, silt, clay, and organic particles (such as leaves, soil, and tire particles) from the land and carry it to surface water. A change in flow rate can also affect TSS; if the speed or direction of the water current increases, particulate matter from bottom sediments may be resuspended.

Soil Erosion
Soil erosion is caused by disturbance of a land surface. Soil erosion can be caused by ***Building and Road Construction, Forest Fires, Logging,*** and ***Mining***. The eroded soil particles can be carried by stormwater to surface water. This will increase the TSS of the water body.

Urban Runoff
During storm events, soil particles and debris from streets and industrial, commercial, and residential areas can be washed into streams. Because of the large amount of pavement in urban areas, infiltration is decreased, velocity increases, and natural settling areas have been removed. Sediment is carried through storm drains directly to creeks and rivers.



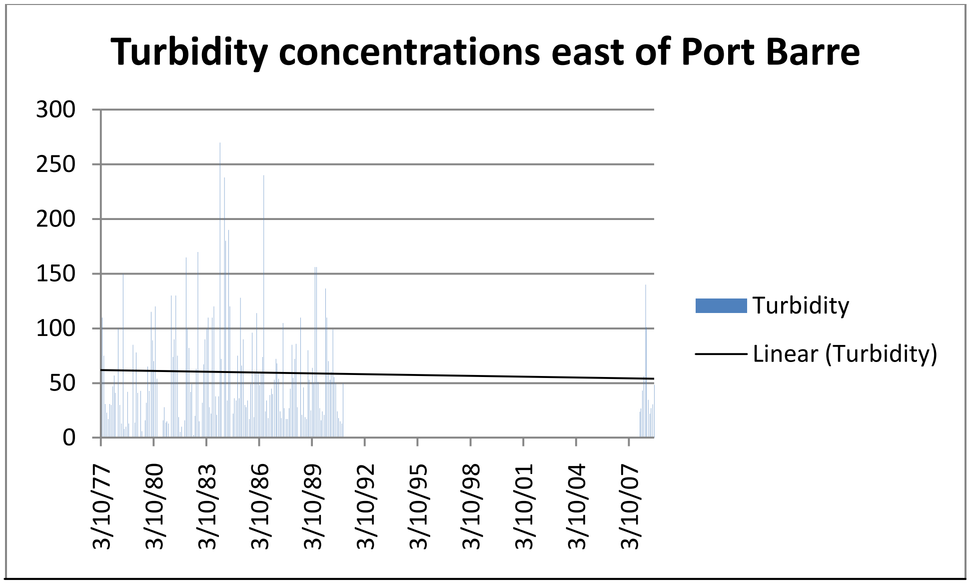
Wastewater and Septic System Effluent
The effluent from Wastewater Treatment Plants (WWTPs) can add suspended solids to a stream. The wastewater from our houses contains food residue, human waste, and other solid material that we put down our drains. Most of the solids are removed from the water at the WWTP before being discharged to the stream, but treatment can't eliminate everything.

Decaying Plants and Animals
As plants and animals decay, suspended organic particles are released and can contribute to the TSS concentration.

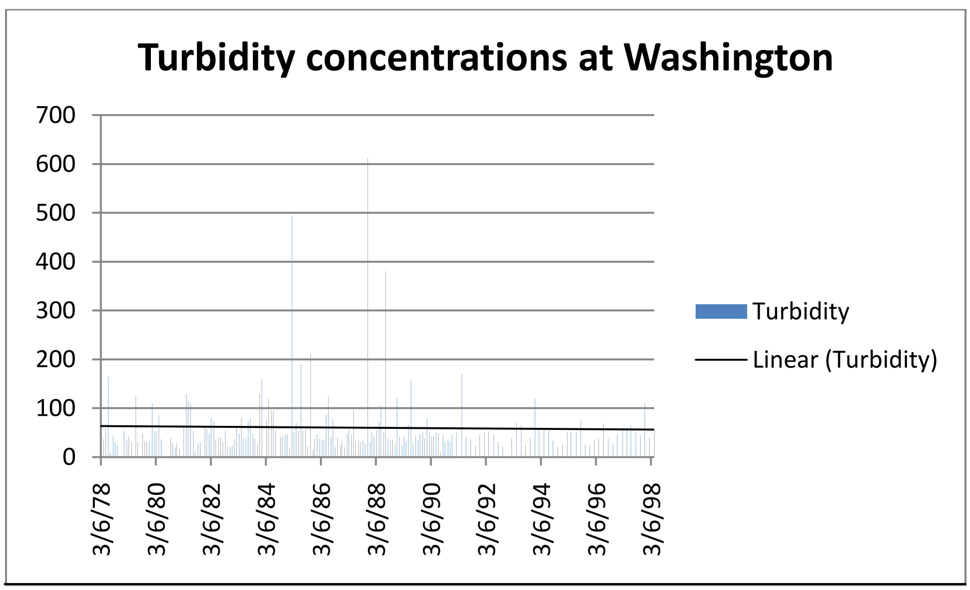
Bottom-Feeding Fish
Bottom-feeding fish (such as carp) can stir up sediments as they remove vegetation. These sediments can contribute to TSS.

TURBIDITY

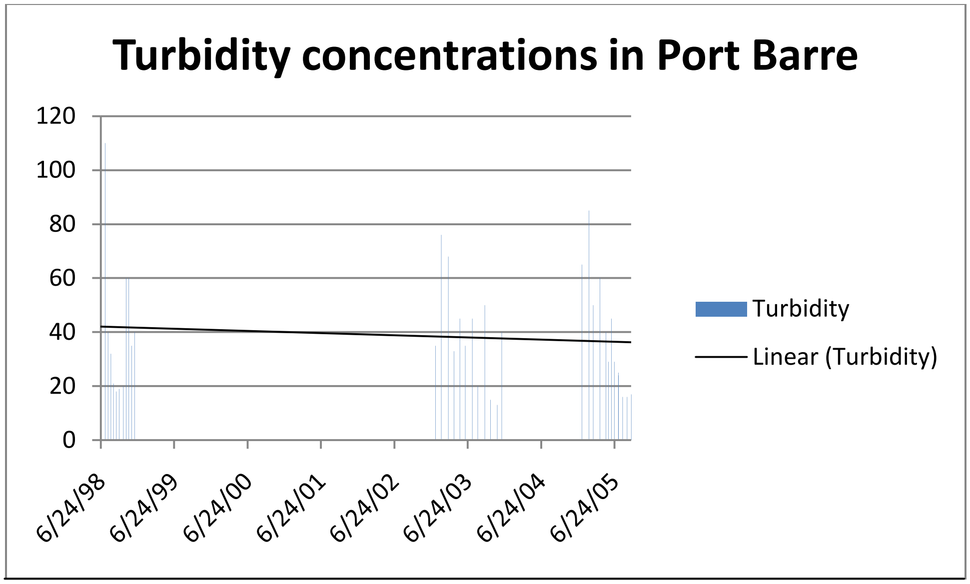
Numerical criteria for turbidity, measured as nephelometric turbidity units (NTU), is established for some of the major water bodies and water body types within the state, but not for every river or bayou. The narrative criteria indicate that turbidity other than the natural origin shall not cause substantial visual contrast with the natural appearance of the waters of the state or impair any designated water use. Bayou Courtableau does not have numerical criteria for turbidity. . Analysis of historical data for turbidity concentration on Ambient Network Site 0101 showed a decreasing trend from a high trend of 60 NTU to a low trend of about 50 NTU. The decreasing trend of this site is based on data collected from March of 1977 to August of 2008. No data was available for this site from January of 1991 to September of 2007.



A decreasing trend is also observed for Ambient Network Site 0101 at Washington for turbidity concentration from a high trend of 70 NTU to a low trend of less than 50 NTU. This observation is based on historical data collected from March of 1978 to April of 1998. No data is currently available for this site from May of 1998 until this date.



For Network Station 0665 in Port Barre, a decreasing trend for turbidity concentration is also recorded. The decreasing trend is based on data collected from June of 1998 to September of 2005. For this ambient site, the high trend for turbidity is above 40 NTU to a low trend of about 35 NTU. No data was available at this site from January of 1999 to December of 2002, the whole year of 2004 and again from October of 2005 to this date.


Turbidity concentrations in Port Barre
120
100
80
60
40
20
0
6/24/98
6/24/99
6/24/00
6/24/01
6/24/02
6/24/03
6/24/04
6/24/05
Turbidity
Linear (Turbidity)

What is turbidity and why is it important?

Turbidity is a measure of water clarity or how much the material suspended in water decreases the passage of light through the water. Suspended materials include soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances. These materials are typically in the size range of 0.004 mm (clay) to 1.0 mm (sand). Turbidity can affect the color of the water. Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than cold. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of DO. Suspended materials can clog fish gills, reducing resistance to disease in fish, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Sources of turbidity include:

- Soil erosion
- Waste discharge
- Urban runoff
- Eroding stream banks
- Large numbers of bottom feeders (such as carp), which stir up bottom sediments
- Excessive algal growth.

Sampling and equipment considerations

Turbidity can be useful as an indicator of the effects of runoff from construction, agricultural practices, logging activities, discharges, and other sources. Turbidity often increases sharply during a rainfall, especially in developed watersheds, which typically have relatively high proportions of impervious surfaces. The flow of storm water runoff from impervious surfaces rapidly increases stream velocity, which increases the erosion rates of stream banks and channels. Turbidity can also rise sharply during dry weather if earth-disturbing activities are occurring in or near a stream without erosion control practices in place.

Regular monitoring of turbidity can help detect trends that might indicate increasing erosion in developing watersheds. However, turbidity is closely related to stream flow and velocity and should be correlated with these factors. Comparisons of the change in turbidity over time, therefore, should be made at the same point at the same flow.

Turbidity is not a measurement of the amount of suspended solids present or the rate of sedimentation of a steam since it measures only the amount of light that is scattered by suspended particles. Measurement of total solids is a more direct measure of the amount of material suspended and dissolved in water.

Turbidity is generally measured by using a turbidity meter. Volunteer programs may also take samples to a lab for analysis. Another approach is to measure transparency (an integrated measure of light scattering and absorption) instead of turbidity. Water clarity/transparency can be measured using a Secchi disk or transparency tube. The Secchi disk can only be used in deep, slow moving rivers; the transparency tube, a comparatively new development, is gaining acceptance in programs around the country but is not yet in wide use.

The sampling schedule for the four year cycle is shown below:

TMDL Sampling Schedule

Basin	First 4-Year Cycle	Second 4-Year Cycle
Mermentau	2004, 2005, 2006, 2007	2008, 2009, 2010, 2011
Vermilion-Teche	2004, 2005, 2006, 2007	2008, 2009, 2010, 2011
Calcasieu River	2004,2005	2008,2009
Ouachita River	2004,2005	2008,2009
Barataria	2004,2005	2008,2009
Terrebonne	2004,2005	2008,2009
Mississippi River	2004,2005	2008,2009
Lake Pontchartrain	2006,2007	2010,2011
Pearl River	2006	2010
Red River	2004,2005,2006,2007	2008,2009,2010,2011
Sabine River	2006,2007	2010,2011
Atchafalaya River	2004,2005	2008,2009

4.0 TMDL FINDINGS

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's (EPA) Water Quality Planning and Management Regulations (Title 40 of the *Code of Federal Regulations* [CFR] Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for impaired water bodies. A TMDL establishes the amount of a pollutant that a water body can assimilate without exceeding its water quality standard for that pollutant. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources (USEPA 1991).

A TMDL for a given pollutant and water body is composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL must include an implicit or explicit margin of safety (MOS) to account for the uncertainty in the relationship between pollutant loads and the quality of the receiving water body and may include a future growth (FG) component. The TMDL components are illustrated using the following equation:

$$TMDL = \sum WLAs + \sum LAs + MOS + FG$$

A TMDL for dissolved oxygen has been developed for the Bayou Courtableau Watershed, based on hydrologic and water quality data available as of November, 1999. Bayou Courtableau was listed on both the 1996 and 1998 Section 303(d) lists as not meeting the water quality standard for dissolved oxygen. Bayou Courtableau was ranked as high priority (priority 1) on both lists for development of a total maximum daily load (TMDL).

West Bayou Courtableau was modeled from its headwaters with Bayou Boeuf and Bayou Cocodrie (River Kilometer 21.6) to its confluence with Bayou Teche (River Kilometer 0.00). West Bayou Courtableau was modeled because the water quality along this portion of Bayou Courtableau was not meeting the 5.0 mg/L dissolved oxygen standard at the City of Washington. East Bayou Courtableau from Bayou Teche to the West Atchafalaya Borrow Pit Canal was not modeled because of the addition of the Teche-Vermillion Fresh Water District Pumping Station. All of the flow from the eastern section of Bayou Courtableau is influenced by the large amount of water being pumped into Bayou Courtableau from the Atchafalaya River. The water quality on East Bayou Courtableau is different from West Bayou Courtableau because it is coming from the Atchafalaya River. There are 5 pumps, each having a capacity to pump 260 cfs. The number of pumps used at any one time depends on seasonal stage elevations. Also, during drought conditions, the amount of water that is pumped varies. Because of the water quality differences, the permanent man-alterations, and the unpredictable fluctuations in flow, East Bayou Courtableau was not included in this TMDL.

A survey was conducted (July 27-28, 1999) during a period of very dry weather. The Bayou Courtableau watershed was in a condition of low flow. There were no tributaries that had a velocity that could be measured with typical survey equipment. Consequently, none of the tributaries were included in the model.

4.1 TMDL Conclusion

A TMDL establishes load limitations for oxygen-demanding substances and goals for reduction of those pollutants. When oxygen-demanding substances are controlled and limited in order to ensure that the dissolved oxygen criterion is supported, nutrients are also controlled and limited. The implementation of this TMDL through wastewater discharge permits and implementation of best management practices to control and reduce runoff of soil and oxygen-demanding pollutants from nonpoint sources in the watershed will also control and reduce the nutrient loading from those sources.

A TMDL model for this watershed was initiated based on the DO criteria of 5.0 mg/L throughout the year. Projections show that compliance with the current dissolved oxygen criteria will require a 30% reduction of man-made nonpoint loading year-round. Due to diurnal variations in dissolved oxygen, the time of day, in which the assessment samples were taken was an important factor in determining whether the water body was in compliance with the DO criteria.

5.0 SOURCES OF NONPOINT SOURCE POLLUTION LOADING AND IDENTIFICATION OF HIGH PRIORITY AREAS

Section 319 of the Clean Water Act was enacted to specifically address problems related to NPS pollution. The objective of the Act is to restore and maintain the chemical, physical and biological integrity of the nation's water. Nonpoint source pollution often results from many different sources with no specific solution to rectify the problem. Therefore, to be able to identify all types of land-use and land coverage areas within the watershed is the key to managing the sources of nonpoint source pollution. Land-use activities such as agriculture, silviculture, urban, and hydromodification can contribute to pollutant loads to the water body.

Bayou Courtableau was listed on the court ordered 303(d) list for not meeting the fish and wildlife propagation use. The suspected causes of impairment associated with fish and wildlife propagation are sedimentation/siltation, total suspended solid, and turbidity. The suspected sources of impairment are listed as unknown. Table 5 below listed the use impairment for Bayou Courtableau watershed. Bayou Courtableau is currently meeting primary contract and secondary contract recreational uses.

An approved TMDL report by EPA on the Bayou Courtableau watershed was based on the 1996 and 1998 303(d) lists as being impaired due to organic enrichment/low DO. The 2008 list indicated that dissolved oxygen is no longer the source of impairment for this water body. Although there are 5 minor municipal point source discharges in the watershed, all of these facilities are either intermittent storm water or minor discharges, and the overall discharges from these facilities are unlikely to have an impact on the Bayou Courtableau.

2006 & 2008 303 (d) List of Suspected Causes and Sources of Impairments

Subsegment Number	Subsegment Description	PCR	SCR	FWP	Impaired Use for Suspected Cause	Suspected Causes of Impairment	Suspected Sources of Impairment
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Sedimentation/Siltation	Source Unknown
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Total Suspended Solids (TSS)	Source Unknown
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Turbidity	Source Unknown

5.1 Agriculture

Landuse in the Bayou Courtableau watershed is fairly homogeneous. As indicated within the Watershed Landuse Section on page 13, land-use/land coverage in 1996 indicated agriculture, consisting of pasture/soybeans, shrubs aquaculture/rice/ water combined for 57.14%. Forestry was the second leading commodity in the watershed with coverage of 35.89%. These two land-uses have a combined coverage of 93.03%. Urbanized areas occupied 1.64% in this watershed.

Agriculture such as row crops can be found all over the watershed. Rice and sugarcane are mostly concentrated on the mid to southern section of the watershed. Crawfish which is a rotating crop with rice also dominated the mid to southern section of the watershed. Other row crops such as corn, soybeans, cotton, and sorghum are scattered throughout the Bayou Courtableau watershed. Besides row crops, pasture is also common within the watershed.

State water quality assessments continue to show that nonpoint source pollution is the leading cause of impairment in surface waters of the U.S. According to these assessments, agriculture is the most wide-spread source of pollution for rivers and lakes. Agriculture impacts 18% of the assessed river miles and 14% of the assessed lake acres. The states' reports also indicate that agriculture impacts 48% of impaired river miles and 41% of impaired lake acres (EPA, 2002).

The primary agricultural NPS pollutants are nutrients, sediment, animal wastes, salts, and pesticides. Agricultural activities also have the potential to directly impact the habitat of aquatic species through physical disturbances caused by livestock or equipment. Although agricultural NPS pollution is a serious problem nationally, a great deal has been accomplished over the past several decades in terms of sediment and nutrient reduction from privately-owned agricultural lands. Much has been learned in the recent past about more effective ways to prevent and reduce NPS pollution from agricultural activities.

5.1.1 Row Crop

More than 50% of the Bayou Courtableau watershed is used for growing row crops. The common practice for preparing row crops is soil tillage. Erodible soils that have a "K-factor" (soil erodibility factor) greater than 0.4 are more susceptible to erosion when tilled or devoid of vegetation. When rainfall occurs, the soil can be easily washed into the receiving stream. This sediment runoff is often laden with fertilizers, pesticides and herbicides that can result in NPS pollutant loading into the river. Since the flow rate on Bayou Courtableau is slow and sluggish, sediments deposit and accumulate on the stream bottom. When fields are cultivated all the way to the edge of a stream or drainage way, there is no buffer or filtration zone for the runoff coming off the fields. Herbicides are the most common form of weed control and may be utilized as much as five times per year. They are used for weed control in the fields, along the edges of the fields and drainage ditches. The edge of fields and drainage ways are usually kept "barren", offering almost no conservation of nutrients and soil. The bare stream banks and canals or ditches can result in increased erosion to the bayou.

The 2008 land-use/ land cover map indicates that almost the entire center portion of this watershed is forested. Forestry activities such as timber harvesting or clear cutting can impact water quality, causing elevated turbidity and TSS concentrations in the receiving streams. The 2008 land-use map also showed the perimeter, and especially the headwaters and the southeast portions of the watershed to be heavily utilized for row crop production. BMP implementation and cost-share assistance can be targeted in the agricultural areas to improve water quality. Other observation on the 2008 land-use map seems to demonstrate the conversion of more agricultural lands to shrub than there was in 2006. Such a change in land-use may have resulted in improving dissolved oxygen concentrations in the Bayou Courtableau Watershed, and the removal of DO from the recent 303(d) list of impairments.

5.1.2 Sugarcane

Sugarcane is considered a row crop and soil tillage is the most common form of practice for preparing this type of row crop agriculture. When rain occurs, the soil can be easily washed into the receiving water body. Sediment runoff often laden with fertilizer, pesticides, herbicides and insecticides can result in nonpoint source pollutant loading into the river. Most rivers, streams, and bayous in Louisiana are small gradient and low flow; the nonpoint source load can deposit and accumulate on the stream bottom. Warm temperatures increase the rate that pollutants degrade, consuming dissolved oxygen in the receiving waters.

Most agricultural fields are cultivated all the way to the edge of the stream, with no filter strip or buffer zone for treatment of runoff from the fields. The edge of field and drainage ways are often sprayed with herbicides and kept barren, offering no conservation practices of nutrient and soil loss. These bare stream banks, streams, canals or drainage ditches can result in stream bank erosion, contributing to nonpoint source pollution into the receiving waters.

5.1.3 Pastureland

Pasture requires a large amount of fertilizer in order to provide healthy food supplies and the production of hay. Excessive use of fertilizer and untimely application of nutrients, can contribute to runoff of nonpoint source pollutants into receiving waters. When livestock are allowed access to stream banks, it increases stream bank erosion and the deposition of fecal bacteria into rivers or bayous, resulting in low dissolved oxygen and elevated fecal coliform in the receiving stream. Sediment runoff into rivers also increases turbidity of water, thereby reducing light penetration, impairing photosynthesis, altering oxygen relationship which in turn reduces food supplies to certain aquatic organisms.

5.2 Urban and Suburban Development Impacts

Although there is very little urbanized areas in the Bayou Courtableau watershed, urban and suburban development within the United States is considered one of the most significant contributors to nonpoint source impairment. The conversion of other land-use types to residential or urban developments impacts water quality throughout the United States. Based on the 2006 and 2008 land-use/land cover assessment, urbanized areas occupied 1.64% of the total land-use area in the Bayou Courtableau watershed.

The process of urbanization increases impervious surface areas, such as roof tops, streets, parking lots and sidewalks where water can not infiltrate. Urbanization also disturbs natural land cover and alters natural drainage patterns. All these factors lead to an increase in the quantity and velocity of runoff, leading to an increase in erosion potential as well as flooding. Pollutants that are present between rainfall events in the atmosphere prior to a storm and which accumulate on imperious surfaces are generally carried away 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 and dirties streets and sidewalks, petroleum residues from automobiles, exhaust products, heavy metal and tar residuals from roads, chemicals applied for fertilization, weed and insect controls, and sediments from construction sites. The dumping of chemicals such as used motor oil and antifreeze into storm sewers is another source of urban/suburban nonpoint source pollution. Other sources of urban NPS pollution could be related to illegal hookup of storm drains to sanitary sewers, causing increased volume of flow to waste water treatment plant, leading to more frequent overflow of sewage into receiving water bodies.

5.3 Onsite Disposal Systems (Septic Tanks) Impacts

Both the 2006 and 2008 303(d) list did not identify sanitary sewer overflows as a source of impairment to fish and wildlife propagation in the Bayou Courtableau watershed. However, treating human waste with an approved, properly maintained sewage treatment system is required of all homes, camps, and businesses, and is a major step in maintaining the purity of surface and ground waters. In areas not connected to a municipal treatment system, the most common treatment method is the conventional septic tank leach line system. Septic tank systems consist of two major components: a treatment unit or septic tank and a disposal unit or soil absorption system. Failing individual waste disposal systems, whether due to lack of septic tank maintenance, poor design, improper installation or soil type suitability, are a major source of nonpoint source pollution. Improperly maintained septic systems can contaminate ground water and surface water with nutrients and pathogens. Ensuring that the septic system continues to function properly is important in reducing leaks and potential nonpoint source pollution.

Another component to the pollution caused by onsite disposal systems is the inadequate enforcement of the State Sanitary Code. No disposal system should be installed without first obtaining a permit from the State Health Officer. The Department of Health and Hospitals regulations describe the acceptable capacities, materials, and construction of septic tanks, field lines, sand filters and oxidation ponds.

2006 & 2008 303 (d) List of Suspected Causes and Sources of Impairments

Subsegment Number	Subsegment Description	PCR	SCR	FWP	Impaired Use for Suspected Cause	Suspected Causes of Impairment	Suspected Sources of Impairment
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Sedimentation/Siltation	Source Unknown
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Total Suspended Solids (TSS)	Source Unknown
LA060204_00	Bayou Courtableau-From headwaters to West Atchafalaya Borrow Pit Canal	F	F	N	FWP	Turbidity	Source Unknown

6.0 NONPOINT SOURCE POLLUTION SOLUTIONS

6.1 Agriculture

The primary agricultural nonpoint source pollutants are nutrients, sediment, animal wastes, and pesticides. Agricultural activities also have the potential to directly impact the habitat of aquatic species through physical disturbances caused by livestock or equipment. Although agricultural NPS pollution is a serious problem nationally, a great deal has been accomplished over the past several decades in terms of sediment and nutrient reduction from privately-owned agricultural lands. Much has been learned in the recent past about more effective ways to prevent and reduce NPS pollution from agricultural activities. The implementation of agricultural management measures will reduce the generation on nonpoint source pollutants from agricultural activities and minimize the transport of pollutants from agricultural land to surface and ground waters.

Agricultural Best Management Practices, BMPs

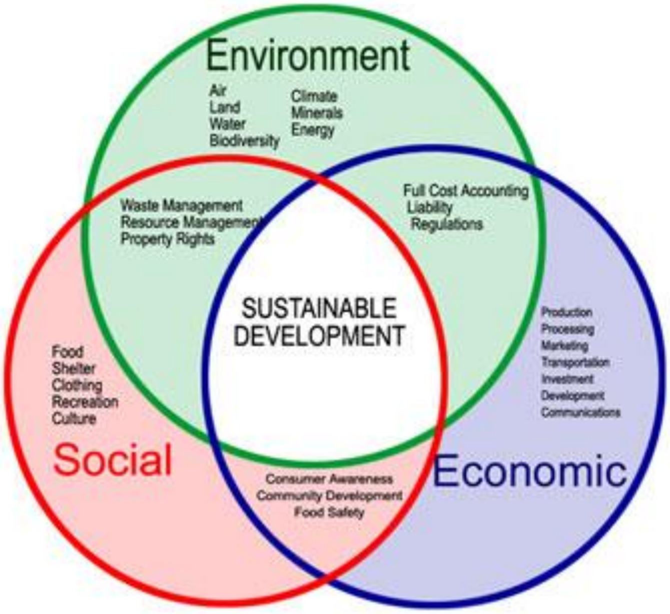
BMPs are designed to enhance the sustainability of agricultural resources and minimize the impact caused by modern agricultural techniques.

In general, there are four fundamental types of agriculture BMPs, these are:

1. **Input Reduction -** Reducing inputs of chemicals, fertilizers, manures and pesticides, foreign microbes, sediments, etc. is a key element of agricultural BMPs. The less a potentially harmful substance is used in agriculture, the less likely it is to affect other parts of the environment.
2. **Nutrient management -** limiting the amount of fertilizer such that it does not exceed what the crop can absorb and use. Applications of materials in excessive quantities may find their way to enter surface and ground water.
3. **Integrated Pest Management -** is a management strategy that includes an understanding of the target pest and use of a combination of physical, chemical, biological and cultural controls. Proper storage, mixing and handling of pesticides are also essential in minimizing risk to the environment.
4. **Control Erosion and Runoff -** particularly on the prairies, excess spring runoff can lead to extensive flooding. To counteract this, many techniques may be employed - shelterbelts, retention ponds, continuous cropping, etc. Grassed waterways (swamps / bogs / deltas) can trap sediments and can filter out noxious chemicals.

Sustainable Agriculture

Some of the most negative impacts of agricultural practices can be mitigated through BMPs. However, in order to be truly sustainable over the long term, soil, air and water quality all must be maintained.



Overall, best management practices vary in effectiveness and cost potential. Implementing effective and sustainable BMPs is the real challenge.

Precision Farming to Control Nonpoint Pollution from Agriculture

The Precisely Tailored Practice

Precision farming, also known as site-specific management, is a fairly new practice that has been attracting increasing attention both within and outside the agricultural industry over the past few years. It is a practice concerned with making more educated and well-informed agricultural decisions. Precision farming provides tools for tailoring production inputs to specific plots (or sections) within a field. The size of the plots typically ranges from one to three acres, depending on variability within the field and the farmer's preference. By treating each plot as much or as little as needed, farmers can potentially reduce the costs of seed, water, and chemicals; increase overall crop yields; and reduce environmental impacts by better matching inputs to specific crop needs. Rather than applying fertilizer or pesticides to an entire field at a single rate of application, farmers first test the soil and crop yields of specific plots and then apply the appropriate amount of fertilizer, water, and/or chemicals needed to alleviate the problems in those sections of the field. Precision farming requires certain technology, which is an added cost, as well as increased management demands.

Precision farming is changing the way farmers think about their land. They are increasingly concerned not with the average needs of the entire field, but with the actual needs of specific plots, which can fluctuate from one square meter to the next. The practice of precision farming acknowledges the fact that conditions for agricultural production vary across space and over time. With this in mind, precision farmers are now making management decisions more specific to time and place rather than regularly scheduled and uniform applications.

The Computer-Aided Approach

The approach of precision farming involves using a wide range of computer-related information technologies, many just recently introduced to production agriculture, to precisely match crops and cultivation to the various growing conditions. The key to successfully using the new technologies available to the precision farmer to maximize possible benefits associated with this approach is information. Data collection efforts begin before crop production and continue until after the harvest. Information-gathering technologies needed prior to crop production include grid soil sampling, past yield monitoring, remote sensing, and crop scouting. These data collection efforts are even further enhanced by obtaining precise location coordinates of plot boundaries, roads, wetlands, etc., using a global positioning system (GPS).

Other data collection takes place during production through "local" sensing instruments mounted directly on farm machinery. Variable rate technology (VRT) uses computerized controllers to change rates of inputs such as seed, pesticides, and nutrients through planters, sprayers, or irrigation equipment. For example, soil probes mounted on the front of fertilizer spreaders can continuously monitor electrical conductivity, soil moisture, and other variables to predict soil nutrient concentrations and accordingly adjust fertilizer application "on-the-fly" at the rear of the spreader. Other direct sensors available include yield monitors, grain quality sensors, salinity meter sleds, weather monitors, and spectroscopy devices. Optical scanners can be used to detect soil organic matter, to recognize weeds, and to instantaneously alter the amount or application of herbicides applied.

The precision farmer can then take the information gathered in the field and analyze it on a personal computer. The personal computer can help today's farmer organize and manage the information collected more effectively. Computer programs, including spreadsheets, databases, geographic information systems (GIS), and other types of application software, are readily available. By tying specific location coordinates obtained from the GPS in with the other field data obtained, the farmer can use the GIS capability to create overlays and draw analytical relationships for site-specific patterns of soils, crop yields, input applications, drainage patterns, and other variables of interest over a particular distance or time period.

GIS can also be integrated with other decision support systems (DSS), such as process models and artificial intelligence systems, to simulate anything from crop growth and financial expectations to the generation and movement of nutrients and pesticides through the environment. Today's precision farmer can also use expert systems, information systems based on input from human experts, to retrieve advice on when to spray for specific pests, when to till, and so forth. These systems are continuously modified for the farmer's field based on past, current, and expected conditions represented by soil, weather, pest level, and other data input from the GIS.

The Technology-Driven Future

Further technological advances will make the coming years decisive for the precision farming industry. There's no saying what the future holds for this new era of agricultural production. Listed below are just a few of the technological advances projected to affect the agriculture industry in the years to come:

- Onboard grain quality analyzers will check both physical and chemical attributes (including smell);

- High-precision soil testing will move from the lab to the field, with fiber optic spectrometers attached to real-time onboard computers;
- Micro-ecology will be tested along with water runoff and air samples;
- Immunochemical assays will measure chemical residues on leaf surfaces or monitor plant health and productivity;
- A wide range of sensors, monitors, and controllers such as shaft monitors, pressure transducers, and servo motors will be used to collect accurate data;
- Weather monitors will be mounted on sprayers, or "talk" directly to local weather station networks as they simultaneously change droplet size or spray patterns, as well as rates and products, on the go;
- Remote imaging technologies will be used to assess crop health and management practice implementation;
- Guidance on control systems will guarantee straight rows, control depth, and optimize inputs;
- Crop models will optimize economic and environmental variables. Farmers will buy insurance directly from the underwriter, who will also rely on remote sensing and risk modeling; and
- Wearable computers with voice recognition and head-mounted displays will guide farmers through equipment maintenance and crop scouting.

Although precision farming has not yet been widely adapted to date, this practice continues to attract increasing attention both on and off the farm. Much of the off-the-farm enthusiasm for precision farming can be attributed to the eminent good sense of matching input application to plant needs. Precision farming is simply a more finely tuned version of the kinds of BMPs already recommended at the field level. Because this technology is still somewhat new to the industry, there is much more to learn about the potential overall impact of precision farming on water quality relative to conventional techniques. But one thing is certain: precision farming has the potential to enhance economic return (by cutting costs and raising yields) and to reduce environmental risk (by reducing the impacts of fertilizers, pesticides, and erosion).

6.2 Urban Area Management Measures

People and their actions are the most significant sources and causes of urban runoff and pollution. Uncontrolled or treated runoff from the urban environment and from construction activities can run off the landscape into surface waters. This runoff can include such pollutants as sediments, pathogens, fertilizers/nutrients, hydrocarbons, and metals. Pavement and compacted areas, roofs, reduced tree canopy, and open space increase runoff volumes that rapidly flow into our waters. This increase in volume and velocity of runoff often causes stream bank erosion, channel incision, and sediment deposition in stream channels. In addition, runoff from these developed areas can increase stream temperatures that along with the increase in flow rate and pollutant loads, negatively affect water quality and aquatic life.

Other common sources of urban pollution include improperly sited, designed, and maintained onsite wastewater treatment (septic) systems, pet wastes, lawn and garden fertilizers and pesticides, household chemicals that are improperly disposed of, automobile fluids, road deicing/anti-icing chemicals, and vehicle emissions.

The following information is a summary of the management measures described in the USEPA guidance document, National Management Measures to Control Nonpoint Source Pollution from Urban Areas, 2005 (http://www.epa.gov/owow/nps/urbanmm/). This guidance helps citizens and municipalities in urban areas protect bodies of water from polluted runoff that can result from everyday activities. These scientifically sound techniques are widely accepted practices in many urban areas around the globe.. The guidance will also help states to implement their NPS control programs and municipalities to implement their Phase II Storm Water Permit Programs. There are new references available on green infrastructure and smart growth, two of which can be found on the websites below:

http://cfpub2.epa.gov/npdes/greeninfrastructure/munichandbook.cfm

http://www.planningexcellence.org/

Cities and parishes within Louisiana may be able to apply to the Center for Planning Excellence for grants to assist with smart growth plans, more information about low impact development and smart growth is available on their website.

The implementation of management measures for urban runoff will reduce the generation of nonpoint source pollutants from existing development and control runoff and treat pollutants associated with new development and redevelopment. The implementation of the following management measures will also result in more consistent and widespread implementation of existing state NPS programs.

Pollutants Typically Found in Urban Runoff

COMMON URBAN RUNOFF POLLUTANT	SOURCE	AVERAGE CONCENTRATE	NONPOINT SOURCE IMPACTS
Sediment	Urban/ Suburban	80 mg/l Average	Fills in ponds and reservoirs with mud; contributes to decline of submergent aquatic vegetation by increasing turbidity and reducing the light available for photosynthesis, and covers or reduces spawning beds.. Acts as a sink for nutrients and toxicants and as a source when disturbed and resuspended.
Total Phosphorus	Urban/ Suburban	1.08 mg/l 0.26 mg/l	A contributing factor cited in eutrophication (nutrient over-enrichment) in receiving water bodies and subsequent algal blooms. Algal blooms contribute to the decline of submerged aquatic vegetation by reducing light available for photosynthesis, further degrade water quality by decreasing the level of dissolved oxygen (DO), increase Biological Oxygen Demand (BOD), and may cause changes in the composition of plankton and fish species.
Total Nitrogen	Urban/ Suburban	13.6 mg/l 2.00 mg/l	Like total phosphorus, contributes to eutrophication and algal blooms, though more typically in salt water bodies.
Chemical Oxygen Demand(COD)	Urban/ Suburban	163.0 mg/l 35.6 mg/l	Decreases the concentration of dissolved oxygen (DO). Low DO concentration and anaerobic conditions (complete absence of DO) can lead to fish kills and unpleasant odors. Primarily released as organic matter in the "first flush" of urban runoff after storm.
Bacteria	Urban/ Suburban	Avg.-200 to 240,000 MPN/L	High concentrations can lead to aquifer contamination and closure of shellfish harvesting areas and prevent swimming, boating, or other recreational activities.
Zinc	Urban/ Suburban	0.397 mg/l 0.037 mg/l	Chronically exceeds EPA water quality criteria. Many fish species highly sensitive to zinc. Primary cultural source is the weathering and abrasion of galvanized iron and steel.
Copper	Urban/ Suburban	0.105 mg/l 0.047 mg/l (Nationwide Avg.)	Chronically exceeds EPA water quality criteria. Primary cultural source is as a component of anti-fouling paint for boat hulls and in urban runoff, from the leaching and abrasion of copper pipes and brass fittings. An important trace nutrient, it can bioaccumulate, and thereby, create toxic health hazards within the food chain and increase long term ecosystem stress.
Lead	Urban/ Suburban	0.389 mg/l 0.018 mg/l	Lead from gasoline burning in automobiles is less of a problem today because of unleaded gasoline use. However, lead from scraping and painting bridges and overpasses remains. Chronically exceeds EPA water quality criteria. Attaches readily to fine particles that can be bioaccumulated by bacteria and benthic organisms while feeding. Lead has adverse health impacts when consumed by humans.
Oil and Grease	Urban/ Suburban	Avg. 2-10 mg/l	Toxicity contributes to the decline of zooplankton and benthic organisms. Accumulates in the tissues of benthic organisms; a threat to humans when consumed directly or when passed through the food chain. Primary cultural source is automobile oil and lubricants.

Arsenic	Urban/ Suburban	Avg. 6.0 Fg/l	An essential trace nutrient. Can be bioaccumulated; creates toxic health hazards within the food chain and increases long term stress for the ecosystem. Accumulates within tidal, freshwater areas, increasing the toxicity for spawning and juvenile fish. Primary cultural source is fossil fuel combustion.
Cadmium	Urban/ Suburban	Avg. 1.0 Fg/l	Primary cultural source is metal electroplating and pigments in paint. Can be bioaccumulated; creates toxic health hazards within the food chain and increases long-term toxic stress for the ecosystem.
Chromium	Urban/ Suburban	Avg. 5.0Fg/l	Primary cultural source is metal electroplating and pigments in paint. Can be bioaccumulated; creates toxic health hazards within the food chain and increases long-term toxic stress for the ecosystem.
Pesticides	Urban/ Suburban	Avg. <0.1 Fg/l	Primary urban source is runoff from home gardens and lawns. Can bioaccumulate in organisms and create toxic health hazards within the food chain. Also has been found as a contaminant in aquifers.

Highway Runoff Constituents and Their Primary Sources

	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material, lubricating oil and grease, bearing wear)
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guard rails, bridges, etc.), moving engine parts
Copper	Metal plating, bearing and brush wear, moving engine parts, brake lining wear, fungicides and insecticides
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anti-cake compounds (ferric ferrocyanide, sodium ferrocyanide, yellow prussiate of soda) used to keep deicing salt granular

Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

Not all urban BMPs can remove both particulate and soluble pollutants. The choice of a particular BMP or series of BMPs depends on many factors. The quantity of storm water, types of pollutants expected, site location (residential, commercial, industrial), site topography, land costs, installation costs, and maintenance requirements will all affect BMP selection.

Several fundamental uncertainties still exist with respect to urban BMPs, including toxicity of residuals trapped by the practice; the interaction of groundwater with BMPs, and the long-term BMP performance.

One BMP that is critical to improving urban storm water quality is public education. Many urban residents are not aware that storm sewers do not carry runoff to treatment plants, but rather directly to nearby rivers. Residents should also understand that while the actions of a single person may seem insignificant, when combined with similar actions of hundreds or thousands of other residents, the potential to pollute their local waters is very real. The quart of oil dumped down a storm drain by one person on a given Saturday may be repeated hundreds of times that day.

Local development plans, ordinances and regulations may also play a role. Plans or regulations may encourage or mandate set backs from water bodies, treatment of runoff from construction sites or impervious areas, or percent allowable impervious area on a given lot size. Zoning requirements may be modified, if necessary, to allow residential development styles that reduce impervious areas and increase green space

URBAN BMP LIST

(Direct control practices and indirect prevention practices)

The following is a list of the practices for urban BMPs. Direct management practices are usually structural practices installed for the purposed of treating contaminated storm water. Indirect management practices are often non-structural methods that focus on pollutant reduction at the source or the use of existing natural features, such as vegetation, to reduce pollutants in stormwater runoff.

Most practices work best with a specific type of pollutant, for example sediments or dissolved metals. When considering a practice or group of practices for a site, the decision on what practices to adopt will depend on many factors including the pollutants to be removed, the cost of the practice, site location and size. The information below addresses some common scenarios and list the BMPs that may be most appropriate to that activity. More detailed information about urban BMPs can be located at:

http://deq.state.wy.us/wqd/watershed/Downloads/NPS%20Program/92171.pdf

Direct Management Practices

1. Extended Detention Ponds
2. Wet Ponds
3. Storm Water Wetlands
4. Multiple Pond Systems
5. Infiltration Trenches
6. Infiltration Basins
7. Porous Pavement
8. Concrete Grid Pavement
9. Sand Filters
10. Grassed Swales
11. Filter Strips
12. Sediment Traps
13. Wind Erosion Controls
14. Check Dams - Filter Fence
15. Steep Slope Terraces
16. Water Quality Inlets/Oil Grit Separator
17. Stream bank Stabilization – Structural w/ Vegetation
18. Miscellaneous BMPs for Urban Construction

Indirect Management Practices (Reduction/Prevention)

19. Direct Runoff Away From Natural Channels
20. Proper Disposal of Accumulated Sediment
21. Proper Snow Removal and Storage
22. Herbicide/Pesticide/Fertilizer Management
23. Protect Natural Vegetation and Riparian Vegetation
24. Recycling
25. Litter Removal
26. Street Sweeping
27. Exposure Reduction

Locating detention ponds, infiltration basins, infiltration trenches, sand filters, and storm water injection wells within a wellhead protection area is discouraged. Sediment disposal and snow storage are also discouraged in wellhead protection areas.

RUNOFF FROM CONSTRUCTION SITES

INTRODUCTION
Construction contributes pollutants in a number of ways but it primarily increases sediment in surface waters. Vegetation removal on site exposes soils to the elements, thereby increasing erosion. Fuel, oil, and other lubricants from equipment can contaminate ground water as well as surface waters, if carried in runoff.

CONDITIONS
- Residential homesite construction
- Commercial building construction
- Industrial complex construction
- Any type of construction in an urban area
- Recreation facilities
- Parking lot construction

PRACTICES

Direct Management Practices
11. Filter Strips
12. Sediment Traps
13. Wind Erosion Controls
14. Check Dams - Silt Fence
15. Steep Slope Terraces
17. Stream bank Stabilization - Structural and Vegetative
18. Miscellaneous BMPs for Urban Construction

Indirect Management Practices (Reduction/Prevention)
19. Direct Runoff Away From Natural Channels
20. Proper Disposal of Accumulated Sediment
21. Proper Snow Removal and Storage
22. Herbicide/pesticide/fertilizer Management
23. Protect Natural Vegetation and Riparian Vegetation
24. Recycling
25. Litter Removal
27. Exposure Reduction

RECYCLING

Environmental Problem

Improper waste management can increase pollutant loadings in runoff to surface waters and leaching to ground waters. Improper management of household hazardous wastes typically occurs due to unawareness of proper disposal methods or lack of disposal alternatives.

Management Options

Onsite management of yard wastes by homeowners who compost lawn and yard wastes such as leaves, grass clippings and woody wastes. Many municipalities and counties offer **composting facilities** to residents at little or no charge. Composting reduces landfill volumes and the need for fertilizer by increasing soil nutrients and organic matter.

Developing a convenient, low-cost **household hazardous waste collection** program encourages proper disposal of potential pollutants. Products typically collected by these programs are used oil and antifreeze, unwanted paint and unneeded household chemicals (cleaners, pesticides, herbicides, etc.). Some jurisdictions offer free **product exchange** programs where homeowners who drop off unneeded, potentially hazardous materials may also pick up other products that may be useful to them.

Promote pollution prevention as a means of waste reduction within business and government. Pollution prevention includes recycling as a means of waste reduction, but also includes strategies to reduce use of hazardous materials such as product substitution. For many businesses, recycling also cuts expenses as input materials are reused or converted to new uses within the same business or as a product for another business.

LITTER REMOVAL

Environmental Problem

Litter enters surface waters via wind and runoff events. Litter and yard wastes can clog storm water control and conveyance structures making the devices ineffective in storm water pollutant control. Contaminants such as plastics and styrofoam degrade slowly, while presenting environmental risks to fish and wildlife. Pet feces (from dogs, cats, horses, etc.) can contribute fecal coliform bacteria to surface waters. Fecal coliform are a potential human health hazard for drinking water supplies and contact recreation, such as fishing or swimming.

Management Options

Promote litter removal programs such as Adopt-a-Highway and city/park/river clean-up days within the community. Encourage local pride within the community through civic organizations to promote individual actions affecting litter removal.

Municipal facilities maintenance programs and commercial and industrial storm water permittees should regularly clean inlets, catch basins, outlets and any other necessary areas within storm water conveyance and collection areas.

Encourage residents to "scoop the poop" when they walk their pets. Some parks in larger cities provide bags for dog walkers. Animals, such as horses, cows, etc., should be watered away from streams, ponds or lakes to prevent direct entry of fecal material.

STREET SWEEPING

Environmental Problem

Particles accumulate along streets and in parking lots that are washed into surface waters by storm events.

Management Options

Mechanical broom sweepers are effective at removal of curbside litter and street particles greater than 400 micro m in size. Vacuum sweepers are more effective on small particles, but can not be used on wet streets. Removing smaller particles helps to reduce transport of sediment-bound pollutants. In areas such as downtown business districts sweepers may be one of the few options for particle removal.

Disposal of street sweeping waste may pose a problem because of possible high levels of lead, zinc, copper and other wastes from automobile traffic. Testing of sweepings may be appropriate to determine disposal alternatives. Some municipalities and industries have found that street sweepings can be used as cover in sanitary landfills.

EXPOSURE REDUCTION

Environmental Problem

Runoff that directly contacts stored materials or inventory can transport pollutants to surface or ground water.

Management Options

Industries, municipalities and homeowners can reduce pollution by reducing or **eliminating exposure** by simply moving materials indoors or removing materials, products, devices and outdoor manufacturing activities that may contribute pollution to runoff. Particularly, removal of rarely used materials that are stored outdoors can be simple and effective.

An **inventory** of the items on municipal, commercial and industrial sites that are exposed to rain may provide a useful starting point for exposure-reduction activities. Examples are raw material stockpiles, stored finished products, and machinery or engines which leak fuel or oil.

The partial or total **covering** of stockpiled or stored material loading/unloading areas, or processing operations, waste storage areas will reduce or eliminate potential pollutants in runoff. For sites that are only partially covered directing storm water "run-on" away from materials will also reduce pollutant loading in storm water.

Changes in **inventory management** to a "just-in-time" (JIT) method will reduce the amount of materials exposed to storm water at any given time. JIT uses precise scheduling of materials and products in and out of a site to keep the amount of raw materials and products on hand to a minimum, reducing waste, storage costs and potential pollutants exposed to storm water.

Good housekeeping involves maintaining equipment to be free of leaks, removing empty materials containers, removing trash, sweeping of parking lots and roads, disposal of unused equipment. All these activities reduce exposure of pollutants to storm water.

Training and prevention programs prepare employees to prevent spills and to respond quickly when spills do occur.

EDUCATION

Much of urban nonpoint source pollution is the result of cumulative actions by many individuals, businesses and industries. The reduction of NPS pollution, in turn, depends on the choices and actions of individuals, businesses, and industries. Often individuals and business owners are not aware that storm drains deliver runoff to nearby water bodies without treatment. Nor are many aware that some of their common practices (over-fertilization, material storage, etc.) may contribute to pollution. Community education is one of the most effective ways of preventing storm water pollution.

Businesses, developers, and homeowners are all part of the NPS pollution puzzle and public awareness programs must be tailored to meet the individual needs and interests of each segment of the community. For example, programs for homeowners might focus on the use of lawn chemicals and disposal of common household wastes such as motor oil, cleaners, and herbicides. Business-oriented programs might stress good housekeeping and chemical reuse strategies. Any education program should provide not only concrete information about pollutant sources and causes, but also specific information about storing, using, and disposing of materials which may cause storm water pollution.

Involve community groups when possible. School or youth groups may be interested in stenciling storm drains with a message such as, "Dump No Waste; Drains to River." Educational materials or presentations can be made available at a variety of community forums such as fairs, Earth Day events, town meetings, service organizations, and local festivals. "Adopt-a-River" type programs may be adapted to include educational efforts on the effects of pollution in storm water runoff.

Storm drain stenciling marker found at a new subdivision adjacent to Bayou Courtableau off of Woodland Drive

Information on storm water best management practices and educational materials are available from many sources. Federal, state and many local governments may have written material or information on internet web pages. Many private organizations are also involved in improving urban water quality and public education. Louisiana Department of Environmental Quality also has water-quality grants available annually for watershed implementation projects and educational programs. Depending on the source of the grants, they may be awarded to state or local government units, schools, non-governmental organizations (clubs, conservation groups, *et cetera*) or individuals. Demonstration and assessment types of projects must have an educational component. For more information on grant availability and requirements, contact the Nonpoint Source Program Coordinator at the Louisiana Department of Environmental Quality, Water Quality Assessment Division, 225-219-3585.

6.3 Home Sewage BMPs

Wastewater contains several undesirable pollutants. Pathogens, which can be in the form of bacteria, viruses, or mold spores, are disease-causing agents that are normally present in large numbers in sewage wastes. Pathogens can enter drinking water supplies creating a potential health hazard. Nutrients and organic matter entering waterways can lead to tremendous growth in the quantity of aquatic microorganisms. Metabolic activity of these microbes can reduce oxygen levels in the water causing aquatic life to suffocate. Failing home septic systems have the potential to cause significant problems in the watershed by contributing nutrients, organic matter and fecal coliform bacteria. Prevention practices include proper installation, location, size, and operation maintenance. Septic systems should not be installed without obtaining the proper permits from the State Health Officer. In addition, sewer systems should be inspected and pumped out every 3-5 years by a licensed professional.

Prevention:

If a home is located in an area subject to periodic flooding such as in a floodplain or where sewage backups have occurred, the homeowner should implement "all feasible measures" to prevent/minimize the nature and extent of impacts from such situations. Such actions can be preventive or pro-active.

Preventive actions include:

1. Waterproofing the building foundation and/or sealing cracks in foundation floor or walls; and
2. Installing a check valve or shut-off valve on the building sewer close to where it enters the structure. This will protect your home from sewage back-ups due to surcharging conditions in the municipal sewerage system.

Pro-active measures include:

1. Purchasing or installing a pump (e.g. sump pump) to pump out water that collects in the low point of the structure;
2. Ensure that building gutter downspouts and drains are directed away from the foundation and toward low points away from the home; and
3. If minor flooding occurs, follow the water to its point-of-entry and seal cracks or defects to the extent possible.

Remember, an ounce of prevention is worth more than a pound of cure. Flood insurance is also vitally important where properties are known to be in floodplains or flood prone areas. More information on prevention and flood insurance is available on the FEMA website.

Potential problems

1. Excessive dumping of cooking oils and grease can fill up the upper portion of the septic tank and can cause the inlet drains to block. Oils and grease are often difficult to degrade and can cause odor problems and difficulties with the periodic emptying.
2. Flushing non-biodegradable hygiene products such as sanitary towels and cotton buds will rapidly fill or clog a septic tank; these materials should not be disposed of in this way.
3. The use of waste macerators or grinders for disposal of waste food can cause a rapid overload of the system and early failure.
4. Certain chemicals may damage the working of a septic tank, especially pesticides, herbicides, materials with high concentrations of bleach or caustic soda (lye) or any other inorganic materials such as paints or solvents.

5. Roots from trees and shrubbery growing above the tank or the drain field may clog and or rupture them.
6. Playgrounds and storage buildings may cause damage to a tank and the drainage field. In addition, covering the drainage field with an impervious surface, such as a driveway or parking area, will seriously affect its efficiency and possibly damage the tank and absorption system.
7. Excessive water entering the system will overload it and cause it to fail. Checking for plumbing leaks and practicing water conservation will help the system's operation.
8. Even well maintained septic tanks release mucus-producing anaerobic gut bacteria to the drainage field. The mucus "slime" will slowly clog the soil pores surrounding the drain pipe and percolation can slow to the point where backups or surfacing effluent can occur. This slime is called biomat and such a failure is referred to as "Biomat failure".
9. If the system is damaged or malfunctions, contact your local health or environmental authority before attempting any repairs. Improper repair can result in costly mistakes and potential health hazards.
10. Septic tanks by themselves are ineffective at removing nitrogen compounds that can cause algae blooms in receiving waters; this can be remedied by using a nitrogen-reducing technology.[1

Caring for a Septic System

(Conventional Septic System, Innovative/Alternative (I/A) System, or Cesspool)

The accumulated solids in the bottom of the septic tank should be pumped out *every three years* to prolong the life of your system. Septic systems must be maintained regularly to stay working.

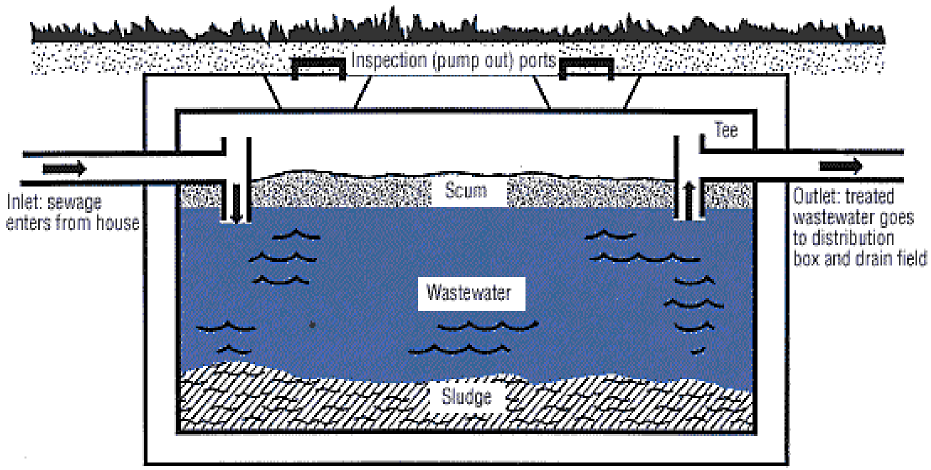
Neglect or abuse of your system can cause it to fail. Failing systems can

- cause a serious health threat to your family and neighbors,
- degrade the environment, especially lakes, streams and groundwater,
- reduce the value of your property,
- be very expensive to repair, and
- put thousand of water supply users at risk if you live in a public water supply watershed and fail to maintain your system.

Be alert to these warning signs of a failing system:

- sewage surfacing over the drainfield (especially after storms),
- sewage back-ups in the house,
- lush, green growth over the drainfield,

- slow draining toilets or drains,
- sewage odors.



Tips to Avoid Trouble

DO have your tank pumped out and system inspected every 3 to 5 years by a licensed septic contractor (listed in the yellow pages).

DO keep a record of pumping, inspections, and other maintenance. Use the back page of this brochure to record maintenance dates.

DO practice water conservation. Repair dripping faucets and leaking toilets, run washing machines and dishwashers only when full, avoid long showers, and use water-saving features in faucets, shower heads and toilets.

DO learn the location of your septic system and drainfield. Keep a sketch of it handy for service visits. If your system has a flow diversion valve, learn its location, and turn it once a year. Flow diverters can add many years to the life of your system.

DO divert roof drains and surface water from driveways and hillsides away from the septic system. Keep sump pumps and house footing drains away from the septic system as well.

DO take leftover hazardous household chemicals to your approved hazardous waste collection center for disposal. Use bleach, disinfectants, and drain and toilet bowl cleaners sparingly and in accordance with product labels.

DON'T allow anyone to drive or park over any part of the system. The area over the drainfield should be left undisturbed with only a mowed grass cover. Roots from nearby trees or shrubs may clog and damage your drain lines.

DON'T make or allow repairs to your septic system without obtaining the required health department permit. Use professional licensed contractors when needed.

DON'T use commercial septic tank additives. These products usually do not help and some may hurt your system in the long run.

DON'T use your toilet as a trash can by dumping nondegradables down your toilet or drains. Also, don't poison your septic system and the groundwater by pouring harmful chemicals down the drain. They can kill the beneficial bacteria that treat your wastewater. Keep the following materials out of your system:

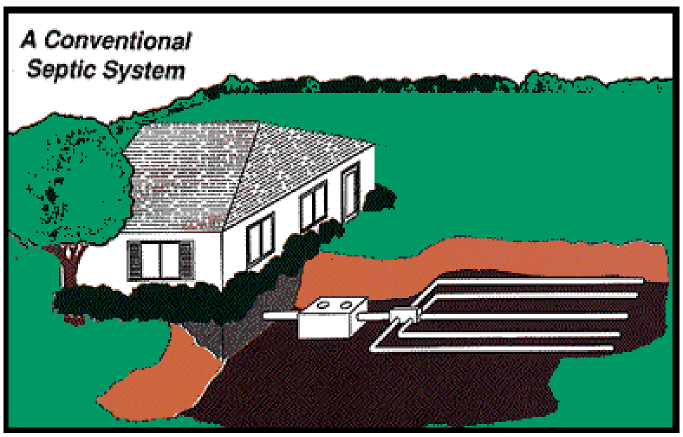
NONDEGRADABLES: Grease, disposable diapers, plastics, etc.

POISONS: Gasoline, oil, paint, paint thinner, pesticides, antifreeze, etc.

Septic System Explained

Septic systems are individual wastewater treatment systems (conventional septic systems, innovative/alternative (I/A) systems, or cesspools) that use the soil to treat small wastewater flows, usually from individual homes. They are typically used in rural or large lot settings where centralized wastewater treatment is impractical.

There are many types of septic systems in use today. While all systems are individually designed for each site, most systems are based on the same principles.



A Conventional Septic System

A conventional septic system consists of a septic tank, a distribution box and a drainfield, all connected by pipes, and called conveyance lines.

A septic system treats household wastewater by temporarily holding it in the septic tank where heavy solids and lighter scum are allowed to separate from the wastewater. This separation process is known as primary treatment. The solids stored in the tank are decomposed by bacteria and later removed, along with the lighter scum, by a professional septic tank pumper.

After partially treated wastewater leaves the tank, it flows into a distribution box, which separates this flow evenly into a network of drainfield trenches. Drainage holes at the bottom of each line allow the wastewater to drain into gravel trenches for temporary storage. This effluent then slowly seeps into the subsurface soil where it is further treated and purified (secondary treatment). A properly functioning septic system does not pollute the groundwater.

7.0 MAKING THE IMPLEMENTATION PLAN WORK

In order to reduce the NPS load in the Bayou Courtableau watershed (Subsegment 060204) and to restore its designated uses so that it is no longer listed on the 303(d) list, BMPs and/or other conservation practices will need to be implemented. This will require programs that provide technical assistance, funding, incentives, as well as those programs that foster a sense of stewardship. Many of these programs that are designed to assist the landowner are already in place. The LDEQ's Nonpoint Source Program provides monies distributed through the USEPA under Section 319 of the CWA. These funds are utilized to implement BMPs for all types of land-uses within the watershed in order to reduce and/or prevent the NPS pollutants and achieve the bayou's designated uses. The USDA and NRCS are federal government agencies that have several such programs made available by way of the Farm Security and Rural Investment Act of 2002. These programs are made available through the local Soil and Conservation District (SWCD). The NRCS has a list of BMPs for almost all types of programs to facilitate their use.

Parish-wide cooperation and coordination will be necessary in order to protect water quality within the Bayou Courtableau watershed. Though challenging, it is an opportunity for leaders, officials, and local citizens to come together for a common interest. As a result, people develop new relationships which will benefit the community and their watershed. The watershed approach helps build new levels of cooperation and coordination, which is necessary to successfully control NPS loading and thus restore and protect Bayou Courtableau.

Every stakeholder within a watershed partnership brings important information, viewpoints, and ideas to the group. Local citizens have a good idea of problems within their watershed. They are able to provide input when practical solutions are developed. Much of the valuable historical information essential to watershed planning, concerning past land-use and associated problems, can be provided by local citizens. Environmental scientists, biologists, engineers, and resource managers can provide their technical expertise as well. The partnership works together to prioritize problem areas and develop viable solutions. The water body itself helps promote cooperation among stakeholders in the watershed partnership because most people want to protect and restore their natural resources for future generations. The locally based watershed partnership provides an avenue for stakeholders to communicate with each other, share resources, work on common goals, and assist in bringing funding into the area for special projects, BMP cost-share programs, and overall education.

7.1 Regulatory Authority

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Sec. 101; PL 100-4). Section 319 directs the governor of each state to prepare and submit a nonpoint source management program for reduction and control of pollution from nonpoint sources to navigable waters within the state by implementation of a four-year plan, submitted within 18 months of the day of enactment (LDEQ, 2000).

In response to the federal law, the State of Louisiana passed the Revised Statute 30:2011, which had been signed by the Governor in 1987, as Act 272. Act 272 designated the Louisiana

Department of Environmental Quality (LDEQ) as the Lead Agency to develop and implement of the State's Nonpoint Source Management Plan. LDEQ's Office of Water Resources (OWR) was charged with the responsibility to protect and preserve the quality of waters in the State and has developed the nonpoint source management program, ground water quality program and a conservation and management plan for estuaries. These programs and plan were developed in coordination with the appropriate state agencies such as the Department of Natural Resources, Department of Wildlife and Fisheries, Department of Agriculture and Forestry and the State Soil and Water Conservation Committees in various jurisdictions (La.R.S. 30:20). LDEQ's Office of Water Resources is therefore responsible for receiving federal funds to ensure clean water, providing matching state funds when required and complying with terms and conditions necessary to receive federal grants.

The water quality standards are described in LAC 33:IX.1101.D in chapter 11 (LDEQ, 2003). These standards are applicable to surface waters of the state and are utilized through the waste load allocation and permit process to develop effluent limitations for point source discharges to surface waters of the state. The water quality standards also form the basis for implementing the best management practices for control of nonpoint sources of water pollution.

Chapter 11 also describes the anti-degradation policy (LAC 33:IX.1109.A.2) which states that the administrative authority will not approve any wastewater discharge or certify any activity for federal permit that would impair water quality or use of state waters. Waste discharges must comply with applicable state and federal laws for the attainment of water quality goals. Any new, existing, or expanded point source or nonpoint source discharging into state waters, including land clearing, which is the subject of a federal permit application, will be required to provide the necessary level of waste treatment to protect state waters as determined by the administrative authority. Further, the highest statutory and regulatory requirements shall be achieved for all existing point sources and best management practices (BMPs) for nonpoint sources. Additionally, no degradation shall be allowed in high-quality waters that constitute outstanding natural resources, such as waters of ecological significance as designated by the office. Those water bodies presently designated as outstanding resources are listed in LAC 33:IX.1123.

7.2 Actions Being Implemented by LDEQ

LDEQ is presently designated as the lead agency for implementation of the Louisiana Nonpoint Source Program. LDEQ Nonpoint Source Unit provides USEPA §319(h) funds to assist in implementation of BMPs and to address water quality problems on Sub-segment listed on the §303(d) list. 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 nonpoint source projects which are active throughout the state.

Several LDEQ 319 projects have been or are being implemented in the Vermilion-Teche River Basin. Most of these projects target agriculture or urban pollutants and include both BMP implementation and educational components. An educational awareness program can help to inform local citizens and parish officials on the importance of BMPS implementation to improve water quality.

In addition, LDEQ in collaboration with the LSU's School of Renewable Natural Resources is currently implementing a 319 project entitled: "Identifying Critical Nonpoint Source Areas of Pollution in Bayou Courtableau". The objective of this project is to conduct a computational analysis of hydrology and water quality across the Bayou Courtableau watershed. The immediate goal of this project is to identify suspected areas and agricultural activities that may cause high sediment and nutrient export to Bayou Courtableau. Results gained from this project will provide crucial information on what actions need to be taken in order to develop effective strategies and plans to monitor and improve water quality conditions within the Bayou Courtableau watershed.

7.3 Actions Being Implemented by other Agencies

The U.S. Department of Agriculture (USDA) and Natural Resource Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices and/or BMPs on privately owned land to reduce soil erosion, improve water quality, and enhance crop land, forest land, wetlands, grazing lands and wildlife habitat. The new " Food, Conservation, and Energy Act of 2008 ", also known as the 2008 Farm Bill provides funding to various conservation programs for each state by way of the NRCS and the State's local Soil and Water Conservation Districts (SWCD). The 2008 Farm Bill is approximately 50 percent larger than its predecessor, the 2002 Farm Bill, with 15 titles and more than 600 provisions. In total, 170 regulatory actions and over 100 reports and studies have been identified that the Department is required to complete to fully implement this important legislation. Within weeks of its enactment USDA began delivering program benefits for 2008 and efforts continue today to ensure the delivery of additional program benefits in 2009.

Although most of these programs are designed to assist agriculture, there may be cases where the 2008 Farm Bill may be utilized for conservation practices for other land-use. A complete list of agriculture BMPs is provided by the NRCS in their "Field Office Technical Guide Handbook". The handbook includes a description of each BMP and their recommended uses. Each BMP is listed by a code, i.e. Field Border (386). The following includes a brief summary of the programs available through the local SWCD under the oversight of USDA and NRCS. The descriptions of the programs are general and based on information available at that time; key points subject to change as rules established:

Conservation Programs:

The 2008 Farm Bill under the provision of the conservation program, made available funding for conservations programs in FY 2008, including an additional $200 million for the Environmental Quality Incentives Program (EQIP), to help farmers and ranchers nationwide to solve natural resource problems; $150 million for the Wetlands Reserve Program (WRP); and $7.5 million for Agricultural Management Assistance (AMA). USDA made available more than $4 billion for conservation program funding in FY 2009, including $1.8 billion for the Conservation Reserve Program (CRP), $1 billion for the EQIP, $570 million for the WRP, $100 million for the Farm and Ranchland Protection Program (FRPP), and $74 million for the Wildlife Habitat Incentives Program (WHIP).

Agricultural Management Assistance Program

This program provides cost share assistance to agricultural producers who will voluntarily address issues such as water management, water quality, and erosion control by incorporating conservation into their farming operations. Such practices might include constructing an irrigation structure, planting trees to improve water quality, or resource conservation practices such as soil erosion control.

Environmental Quality Incentives Program (EQIP)

EQIP was reauthorized in the 2008 Farm Bill to provide a voluntary conservation program for farmers or ranchers that promote agricultural production and environmental quality as compatible goals. This program offers financial and technical assistance to eligible participants in developing management practices on their agricultural land.

Conservation Reserve Programs (CRP)

The 1985 Farm Bill established CRP as a voluntary program to protect highly erodible and environmentally sensitive lands. CRP provides technical and financial assistance to eligible farmers and ranchers (on a voluntary basis) to addresses soil, water and related natural resource concerns to protect highly erodible and environmentally sensitive lands.

Watershed Operations

Watershed Operations is a voluntary program under the authority of the Watershed Protection and Flood Prevention Act of 1054 (P.L. 83-566 and by the Flood Control Act of 1944 (P.L. 78-534). Under this program, the NRCS provides technical and financial assistance to states, local governments and tribes to implement authorized watershed project plans for the purpose of watershed protection, flood mitigation, soil erosion reduction, irrigation water management, sediment control, fish and wildlife enhancement and wetlands creation and restoration.

Rapid Watershed Assessments

NRCS is encouraging the development of rapid watershed assessments in order to increase the speed and efficiency to guide conservation implementation. In a nut shell, this program will provide quick and inexpensive plans for setting priorities in a watershed and taking action.

Wetlands Reserve Program (WRP)

This voluntary program provides technical and financial assistance from the NRCS to help landowners in protecting, restoring and enhancing wetlands on their property. The goal of this program is to achieve the greatest wetland functions and values along with optimum wildlife habitat on all wetlands enrolled in the program.

Wildlife Habitat Incentives Program (WHIP)

WHIP is a voluntary program for those interested in developing and improving wildlife habitat primarily on private land. Technical assistance and up to 75% cost share assistance is provided in order to establish and improve fish and wildlife habitat. A WHIP agreement between NRCS and the participant generally last from 5 to 10 years.

Conservation Security Program (CSP)

CSP is a new national incentive payment program for maintaining and increasing farm and ranch stewardship practices. The CSP is designed to correct a policy disincentive in which independently conducted resource stewardship has disqualified many farmers from receiving conservation program assistance. Features an optional "tiered" level of farmer participation where higher tiers receive greater funding for greater conservation practices.

Master Farmer Program

The Louisiana State University Agricultural Center developed the Master Farmer Program. This voluntary program is based on educating farmers about environmental stewardship, resource based production and resource management. Becoming a certified Master Farmer involves classroom instruction on water quality regulations, conservation practices, crop specific best management practices and implementation, and USDA conservation funding. Participants will visit model farms to view the implementation of best management practices in reducing sediment runoff. Finally, a farm specific conservation plan will be developed. Becoming a "master farmer" can set an example for the agricultural community to become involved in implementing best management practices and in helping to control nonpoint source pollution. Economically and effective best management practices can make a huge impact on reducing the agriculture's contribution to the water quality problems in the Bayou Courtableau Watershed.

In addition to the programs mentioned, the following organizations have signed a Memorandum of Understanding (MOU) with LDEQ within the state's NPS Management Plan that each will aid 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
- Louisiana Forestry Association
- US Fish and Wildlife Service
- USDA Forest Service
- US Army Corps of Engineers
- US Geological Survey
- Federal Emergency Management Agency
- Louisiana Farm Bureau Federation

7.4 Implementation and Maintenance

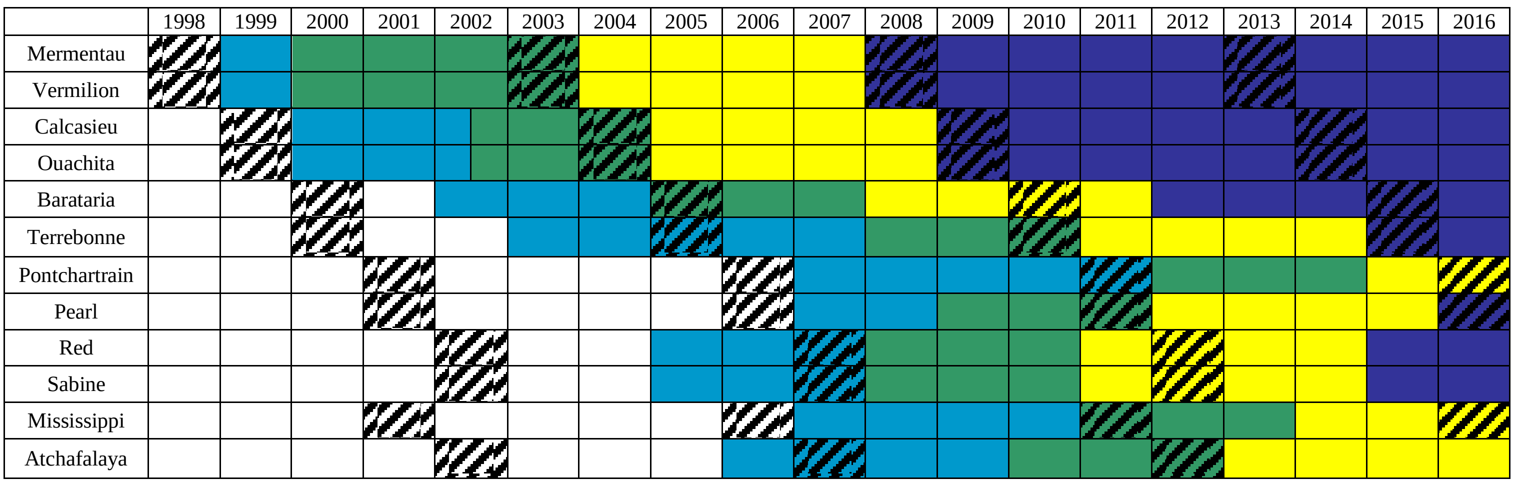
Citizens, commercial businesses, and even local and state agencies can implement and maintain efficient BMPs by taking the conservative approach to many everyday landscaping events. For example, fertilizing and sufficiently seeding grass to promote long-term stabilization of soil surfaces and planting wildflower cover (a practice used by many highway departments to provide aesthetically pleasing vegetation along roadways) greatly reduces the potential for erosion by securing the surfaces with plant roots. Other practices such as sodding and mulching can also be applied and have similar effective results.

Implementing change is the key to adopting best management practices and improving water quality. The implementation of management measures, best management practices and conservation practices to reduce nonpoint source pollution in the Bayou Courtableau Watershed will require the cooperation of citizens, stakeholders and local governments. Programs are available to provide technical assistance, funding, and incentives. The USDA and the NRCS are federal government agencies that have several programs made available by way of the Food, Conservation, and Energy Act of 2008. These programs are made available through the local Soil and Water Conservation Districts (SWCD).

Public participation and voluntary action in Bayou Courtableau are vital to the protection of the watershed. Citizens need to be informed of the objectives for implementing BMPs and how they work to benefit the community and themselves. A public education program can greatly improve the feasibility of implementing BMPs to protect water quality. Informed citizens can be helpful in supporting and assisting monitoring and enforcement programs.

8.0 TIMELINE FOR IMPLEMENTATION

The NPS Implementation Plan for the Bayou Courtableau Watershed in Sub-segment 060204 outlines a 4-year management plan to reduce NPS pollutants reaching the waterway. LDEQ intensively samples each watershed in the state once every 4 years to see if the water bodies are meeting water quality standards. Prior to 2004, water bodies were sampled once every 5 years. Therefore, sampling began during 1999 for the Vermilion-Teche Basin, including Bayou Courtableau, occurred again in 2008. The data from previous samplings is to be used as a baseline to measure the rate of water quality improvement in samples taken in subsequent years. If no improvement in water quality is witnessed, LDEQ will revise the NPS Implementation Plan to include additional corrective actions to bring the waterway into compliance. Additional BMPs and or other options will be employed, if necessary, until water quality standards are achieved and Bayou Courtableau is restored to its designated uses.



1. Black Stripes = Collect Water Quality Data to Develop Total Maximum Daily Loads (TMDLs) and to Track Water Quality Improvement at the Watershed Level [Objective 1]
2. Light Blue = Develop Total Maximum Daily Loads for the Watersheds on the 303(d) List [Objective 2]
3. Green = Develop Watershed Management Plans to Implement the NPS Component of the TMDL [Objective 3]
4. Yellow = Implement the Watershed Management Plans [Objectives 4-8]
5. Dark Blue = Develop and Implement Additional Corrective Actions Necessary to Restore the Designated Uses to the Water Bodies [Objective 9-10]

8.1 Tracking and Evaluation

As stated in the Louisiana Nonpoint Management Plan, program tracking will be done at several levels to determine if the watershed approach is an effective tool to reduce nonpoint source pollution and improve water quality. The following actions will be taken to determine the effectiveness of this approach:

1. Tracking of management measures outlined within the Watershed Restoration Action Strategy (short-term)

2. Tracking of BMPs implemented as a result of Section 319 Program, EQIP, or other sources of cost-share and technical assistance within the watershed (short term);
3. Tracking progresses in reducing nonpoint source pollutants, such as solids, nutrients, and organic carbon from the various landuse (rice, soybeans, crawfish farms) within the watershed (short-term);
4. Tracking water quality improvement in the bayou (i.e. decreases in total organic carbon, total dissolved oxygen) (short and long term)
5. Documenting results of the tracking to the Nonpoint Source Interagency Committee, residents within the watershed, and EPA (short and long term);
6. Submitting semi-annual and annual reports to EPA which summarize results of the watershed restoration action strategies (short and long term); and
7. Revising LDEQ's web-site to include information on the progress made in the watershed restoration actions, nonpoint source pollutant load reductions, and water quality improvement in the bayou (short and long term).

9.0 SUMMARY OF THE WATERSHED IMPLEMENTATION PLAN

In order to restore its water uses for Bayou Courtableau watershed in sub-segment 060204, it requires a concerted effort from all stakeholders, including federal, state, and local government, private and public groups, and most importantly, the communities and local citizens. A person who lives in the watershed is a stakeholder and stands to benefit from their contribution toward protecting the waters. The fundamental value of outreach/social marketing efforts is to increase essential environmental understanding, build watershed constituencies, and provide key support for an array of other environmental protection strategies. As part of natural resource protection, local cities, other agencies, and non-government organizations are encouraged to conduct public education and outreach activities to promote stewardship, water quality, recycling, and general sustainability.

Public education and outreach strategies are the key elements for achieving the goal and objective of improving water quality in the Bayou Courtableau watershed, and are a necessary tool to promote the understanding and the support efforts to implement BMPs. The educational component may accelerate a greater concern for the environment, and thereby encourage the communities to take action without additional environmental regulations imposed on the communities. Awareness of these problems is needed along with education about the various Best Management Practices (BMPs) for business owners and homeowners in general. More information on Nonpoint Source Pollution (NPS) can be found at LDEQ's NPS website at http://nonpoint.deq.louisiana.gov. Successful outcomes are more likely when citizens understand what is occurring and why. When stakeholders volunteer to demonstrate conservation practices on their lands they should receive positive recognition and other incentives; therefore, positively reinforcing others to do the same.

Achieving a clean water goal without inhibiting the developments in the Bayou Courtableau watershed would require all the stakeholders an ownership of the watershed. The educational component of the NPS program can be a major tool to achieving water quality objective.

REFERENCES

Louisiana Department of Environmental Quality. 1996. “Water Quality Inventory,” State of Louisiana Water Quality Management Plan, Volume 5, Part B. LA DEQ Office of Water Resources, Water Quality Management Division, Baton Rouge, Louisiana, p. A-32.

Louisiana Department of Environmental Quality. 2005. Environmental Regulatory Code Title 33 Part IX. Water Quality. Baton Rouge, Louisiana.

Louisiana Department of Environmental Quality, 2006. 2005 Landuse/Land Cover Classification Terrebonne Basin. Baton Rouge, Louisiana.

Louisiana Department of Environmental Quality. 1992. A comprehensive review of ecoregion delineation and characterization for the management of water resources in Louisiana. Office of Water Resources. Water Quality Management Division and Water Pollution Control Division. (DRAFT 1: November 1992). Baton Rouge, LA.

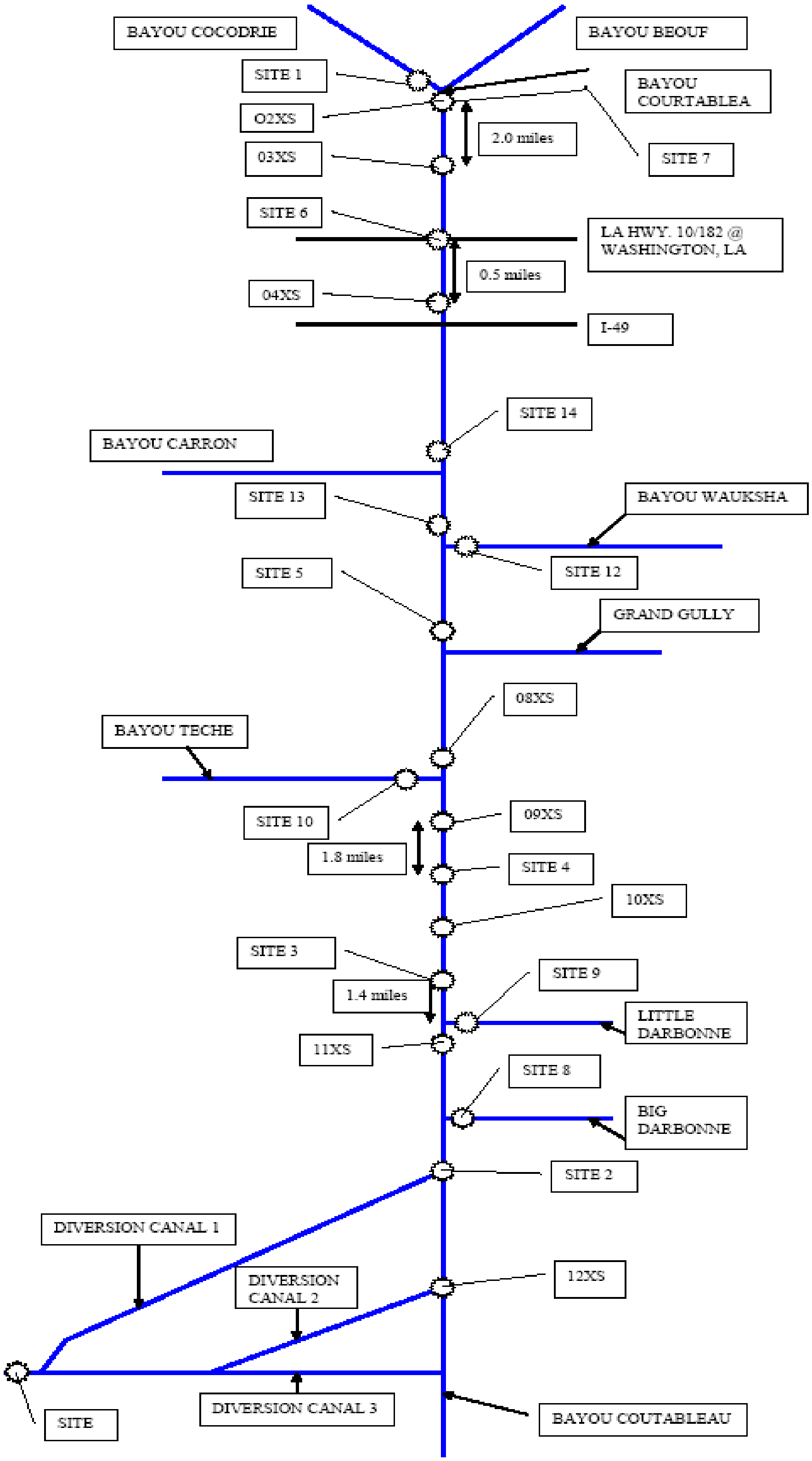
APPENDIX

34a. Quaternary-age deltaic sands, silts, clays, and gravel underlie much of the **Northern Humid Gulf Coastal Prairies** on this gently sloping coastal plain. The original vegetation was mostly tallgrass grasslands with gallery forests along streams. Little bluestem, big bluestem, yellow Indiangrass, brownseed paspalum, and switchgrass were dominant grasses, in a mixture with hundreds of other herbaceous species across these prairies. Almost all of the coastal prairies have been converted to cropland, pasture, crawfish aquaculture, or urban landuse. Some loblolly pines, and historically "islands" of longleaf pine, occur in the northern part of the region in the transition to Ecoregion 35. Soils in the Louisiana portion are mostly poorly or somewhat poorly drained Alfisols with silt loam or silty clay loam texture, while some Vertisols and Mollisols also occur. Pimple mounds of loamy sand were prevalent across the prairie terrace, providing micro-habitat variation.

34c. Covering the Holocene alluvial floodplain deposits of the larger and wider streams or bayous, the **Floodplains and Low Terraces** ecoregion is distinct from the surrounding prairie uplands of Ecoregion 34a. The region in Louisiana has some similarities to the floodplain forests of Ecoregion 35b to the north. In most of Ecoregion 34c, however, the floodplains and low terraces have a different bottomland forest than the floodplains of Ecoregion 35. Bottomland forests of pecan, water oak, live oak, and elm are typical, with some bald cypress on larger streams. In Louisiana, the region includes the Mermentau River and its larger tributaries, as well as parts of Lacassine Bayou and tributary streams. Large portions of forest have been removed. Current land cover is a mix of wetland deciduous forest, upland mixed and deciduous forest, along with some cropland and pasture. Soils in the Louisiana portion are mostly very poorly and poorly drained Alfisols and Entisols with silt loam or very fine sandy loam surface textures.

34g. The **Texas-Louisiana Coastal Marshes** region is characterized by extensive freshwater and saltwater coastal marshes, few bays, and lack of barrier islands. There are many rivers, lakes, bayous, tidal channels, and canals. The streams and rivers that supply nutrients and sediments to this region are primarily from the humid pine belt of Ecoregion 35. Soils are very poorly drained Histosols and Entisols with muck or clay surface textures. The region, called the Chenier Plain in Louisiana, is almost treeless. The cheniers, or narrow ridges paralleling the shoreline, rise to about five feet in elevation but occupy only about three percent of the region. Live oaks and hackberries are dominant canopy species on many of the ridges, with an understory of palmetto and prickly pear cactus. Extensive cordgrass marshes occur in the more saline areas with maidencane and sawgrass on fresh marshes. The estuaries and marshes support abundant marine life, supply wintering grounds for globally significant populations of ducks and geese, and provide habitat for small mammals and alligators. Brown shrimp and white shrimp are commercially important. Sport fishery species such as red drum, black drum, southern flounder, and spotted seatrout occur in the coastal bays.

34j. The **Lafayette Loess Plains** had coastal prairie natural vegetation similar to Ecoregion 34a, but are capped with a loess veneer associated with the Mississippi Valley. Well to poorly drained Alfisols and Mollisols with silt loam surface textures developed on the late Pleistocene-age terraces. The historical vegetation dominated by big bluestem, little bluestem, yellow Indiangrass, switchgrass, and other herbaceous species has been replaced by crops of rice, soybeans, cotton, sugarcane, sweet potatoes, and wheat, along with crawfish aquaculture. Urban expansion in the area has been substantial. There is more pasture compared to the large extent of small grains production in Ecoregion 34a to the west. Narrow hardwood forests occur along some streams and lowlands.


BAYOU COCODRIE
BAYOU BEOUF
SITE 1
BAYOU COURTABLEA
O2XS
2.0 miles
03XS
SITE 7
SITE 6
LA HWY. 10/182 @ WASHINGTON, LA
0.5 miles
04XS
I-49
SITE 14
BAYOU CARRON
SITE 13
BAYOU WAUKSHA
SITE 12
SITE 5
GRAND GULLY
08XS
BAYOU TECHE
SITE 10
09XS
1.8 miles
SITE 4
10XS
SITE 3
SITE 9
1.4 miles
LITTLE DARBONNE
11XS
SITE 8
BIG DARBONNE
SITE 2
DIVERSION CANAL 1
DIVERSION CANAL 2
12XS
SITE
DIVERSION CANAL 3
BAYOU COUTABLEAU

Ambient Network Station Number 58010101 is located east of Port Barre near the northwest wing wall of Bayou Courtableau drainage structure. This site is located at Latitude 30°32’8”, Longitude 91°51’34”.

Ambient Network Station Number 58010102 is located at bridge on State Highway 10 in Washington, Louisiana. This site is located at Latitude 30°37’5”, Longitude 92°3’20”.

Ambient Network Station Number 58010665 is located at Highway 103 in Port Barre, 1 mile north of US190. This site is located at Latitude 30°33’29”, Longitude 91°57’17”.

Ambient Network Station Number 58011197 is located about 1.4 miles southeast of Courtableau, 6 miles west of Krotz Springs, Louisiana. This site is located at Latitude 30°32’1”, Longitude 91°51’23”. This is an none active monitoring site.