



Mississippi River Delta Basin

Characterization Report

Louisiana State Reservoir Priority
and Development Program



moffatt & nichol



MWH

BUILDING A BETTER WORLD

Mississippi River Delta Basin

Characterization Report

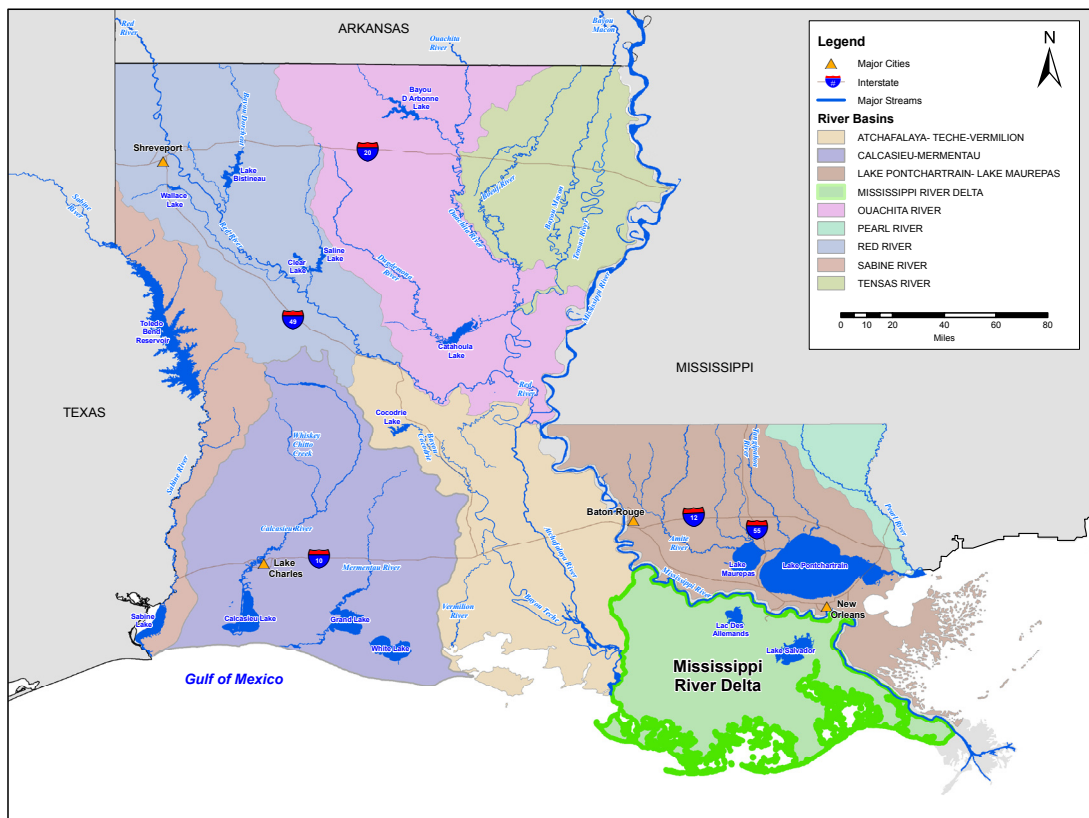
Louisiana State Reservoir Priority
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BASIN CHARACTERIZATION REPORT FOR THE MISSISSIPPI RIVER DELTA BASIN

The Louisiana Department of Transportation and Development (DOTD) is responsible for reviewing and prioritizing proposed reservoir projects for which State of Louisiana (State) funding is being sought, and then recommending projects to the State Legislature. To support reservoir project review, prioritization, and recommendation efforts, DOTD has prepared characterization reports of water resources conditions in each of the nine principal surface water basins in the State. These characterization reports provide an overview of water uses, needs, and concerns, and can be used by applicants for State funding, and by State agencies as they evaluate the applications. The basin characterization reports also contain extensive references that interested parties can use to find more information from Federal, State, and local agencies or other sources. The reports represent a “snapshot” of conditions in early 2009 (or when the references cited in the reports were published).

Based on available data, this basin characterization report provides an overview of the water uses, needs, and key water resources concerns for the Mississippi River Delta Basin (MDB) (**Map 1**). Additional technical information on important issues may be provided in separate technical reports.

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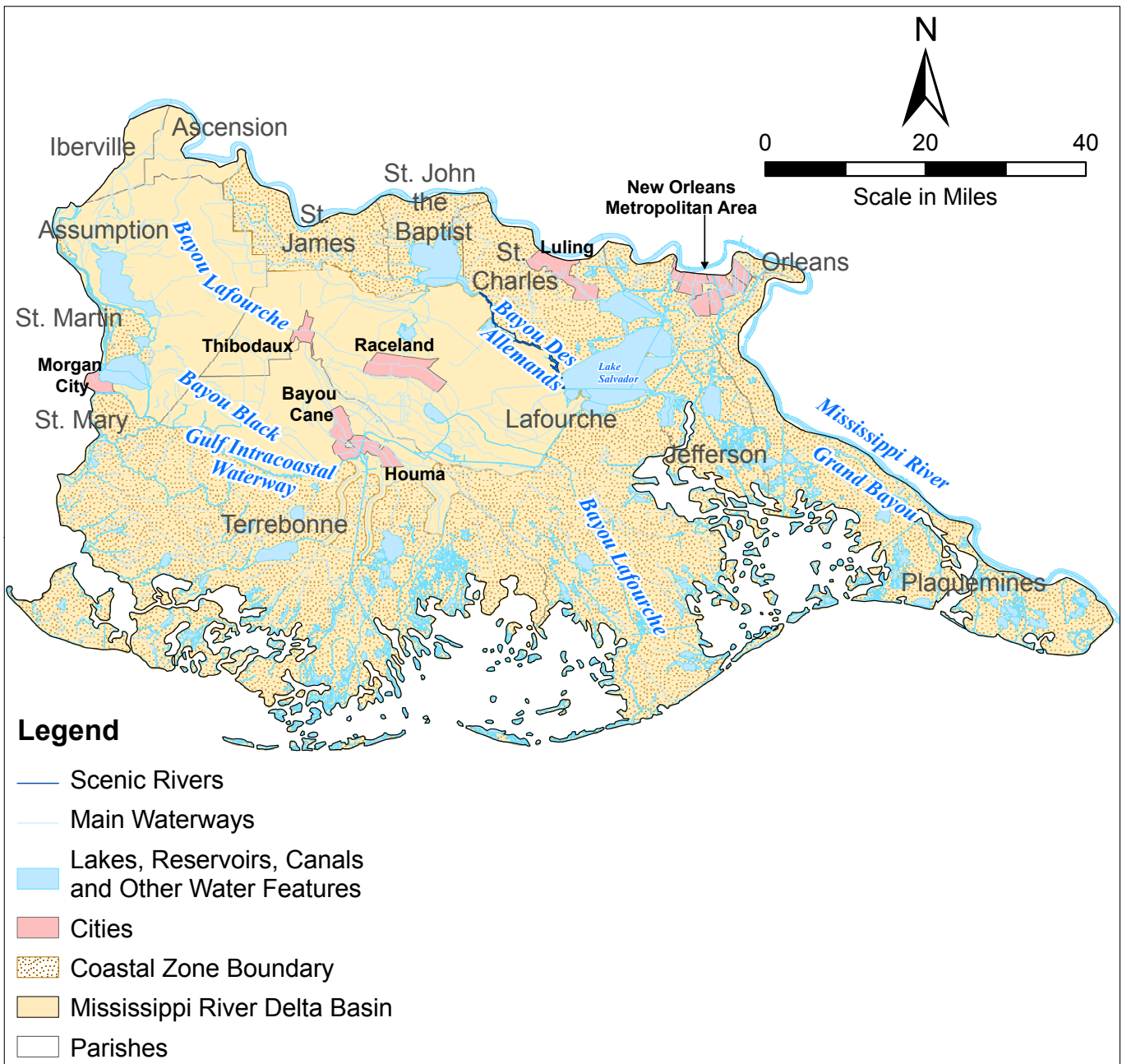
Map 1. Major Surface Water Basins of Louisiana¹

BASIN OVERVIEW

The MDB is located in southeastern Louisiana and has an area of 8,365 square miles (**Map 2**).² The MDB is bounded by the Lake Pontchartrain-Lake Maurepas Basin to the north, the

Atchafalaya-Teche-Vermilion Basin to the west, and the Gulf of Mexico to the south and east. The MDB is characterized by low-lying land, with the only elevation relief provided by natural

levees along the Mississippi River and its distributaries. The southern MDB is in the Coastal Zone, as delineated by the Louisiana Department of Natural Resources (LDNR).



Thirteen parishes are either completely or partly encompassed by the MDB (**Map 2**). The southern part of the New Orleans metropolitan area, Houma, and several smaller cities are within the MDB. Estimated total population in the MDB in 2005 was 523,583. **Table 1** shows the 2005 population distribution in the MDB by parish. **Figure 1** shows historical population in the basin. Population in the MDB increased significantly in the 1960s and 1970s, but has generally remained constant since about 1980. Future population growth within the basin would increase the demand for high quality potable water sources.

Principal economic activities in the MDB are related to oil and gas exploration and processing, but also include food processing and fertilizer manufacturing.⁵ Oil and gas production, petrochemical manufacturing, shipbuilding, tourism, and the arts and entertainment industries are growing in the region.⁶

Table 1. MDB Population by Parish in 2005⁴

Parish	Population
Ascension*	11,493
Assumption	22,859
Iberville*	535
Jefferson*	175,530
Lafourche	91,433
Orleans*	41,063
Plaquemines*	22,907
St. Charles*	23,450
St. James*	8,745
St. John the Baptist*	3,655
St. Martin*	1,615
St. Mary*	14,069
Terrebonne	106,230
TOTAL	523,583

*Parish is located in more than one basin; population estimated for the area within the MDB.

MDB=Mississippi River Delta Basin

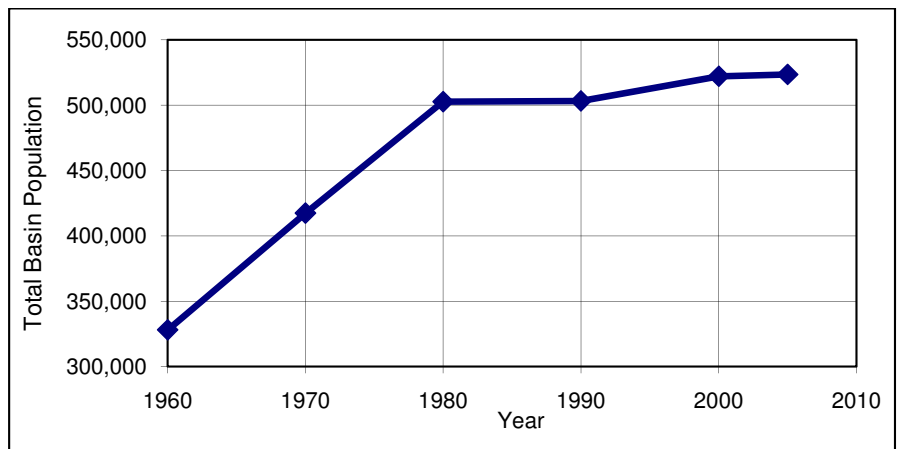


Figure 1. Historical MDB Population

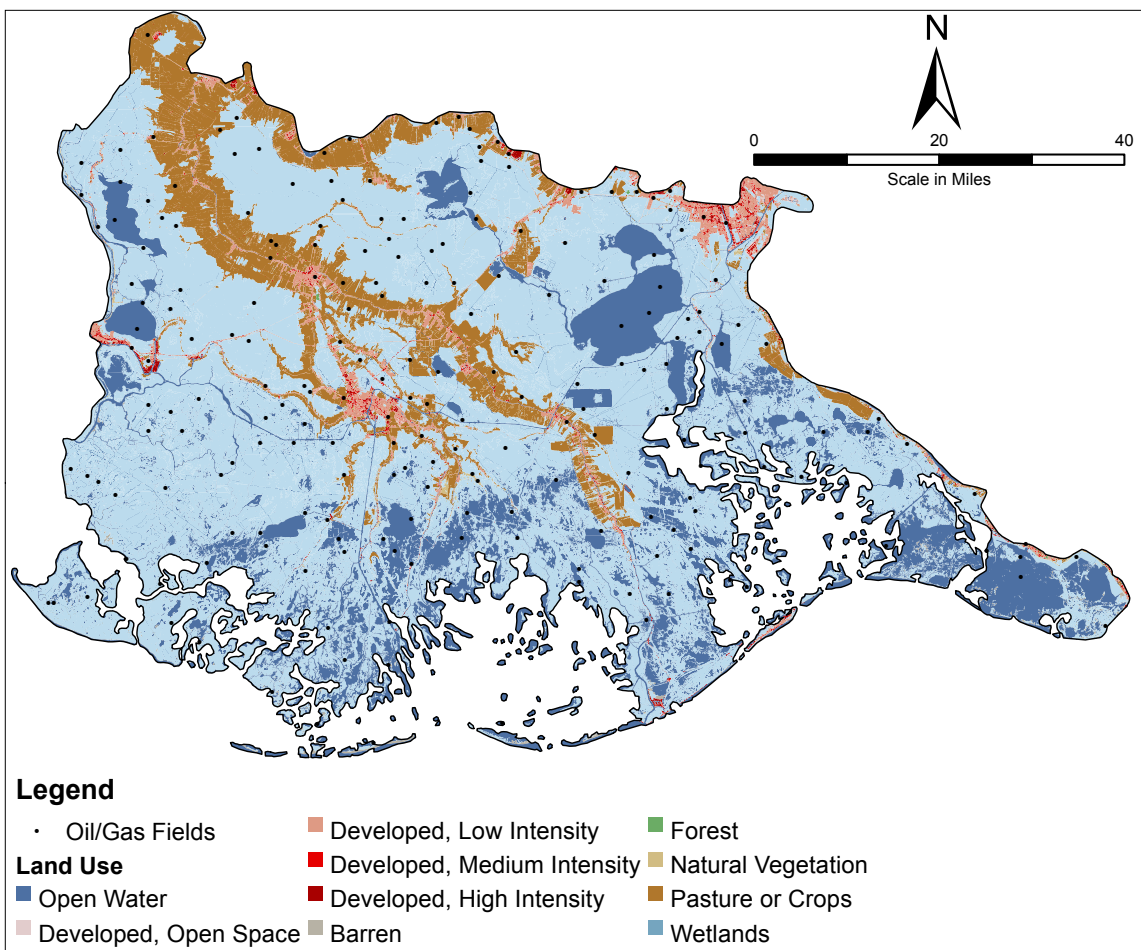


LAND USE AND LEGAL ENTITIES

Map 3 shows 2003 land uses in the MDB. The principal land use is wetlands, with some agricultural land along Bayou Lafourche. Economic modeling for 2020 indicates that forested land uses may decrease between 10 to 20 percent in the eastern MDB, with less reduction in the western MDB. Simultaneously, urban land uses may increase by 25 to 50 percent in the eastern MDB, with smaller increases in the western MDB.⁷

The MDB contains a small amount of land considered Prime Farmland by the Federal Natural Resources Conservation Service (NRCS).⁹ The NRCS must be contacted regarding proposed irreversible conversion of any Prime Farmland for reservoir construction and water storage. Many oil and gas fields are present throughout the basin (**Map 3**). Oil and gas drilling can require large amounts of water for extraction, which then needs to be disposed,

either to surface water or groundwater. Existing oil and gas infrastructure and mineral rights holdings may present potential impediments to development of surface water resources. **Table 2** lists legal entities in the MDB that may affect or be affected by water resource development.



Map 3. MDB Land Uses in 2003⁸

Table 2. MDB Water Resources Legal Entities

Legal Entity	Responsibilities
Regional Planning Commission for Jefferson, Orleans, Plaquemines, St. Bernard, and St. Tammany Parishes	Planning and development in southeast Louisiana
South Central Planning and Development Commission	Planning and development in south central Louisiana

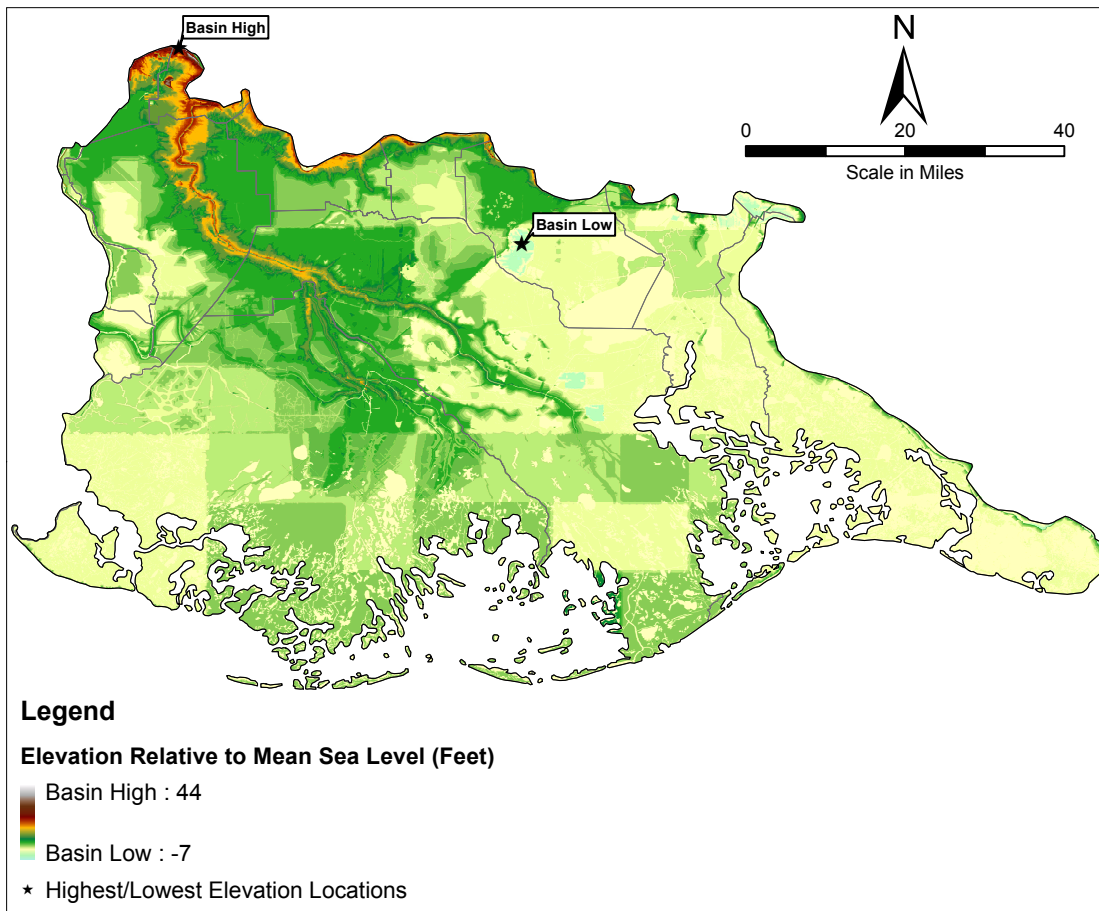
MDB=Mississippi River Delta Basin

PHYSIOGRAPHIC AND CLIMATIC INFORMATION

Map 4 shows general basin topography. The MDB is dominated by the Alluvial Plains physiographic region, which

is characterized by flat lands with interconnecting streams that allow flow between some river basins. The lowest elevation within the MDB

is 2 feet below mean sea level. The highest point is 44 feet above mean sea level, on the northern basin boundary.



Map 4. MDB Topography¹⁰

Soils in the MDB vary from north to south. In the north, soils are characterized by loamy and clayey low terraces and floodplains, with sandy and loamy alluvial natural levees and low terraces. In the central MDB, soils comprise brackish organic and mineral deltaic deposits. The southernmost coastal area of the MDB has saline organic and mineral deltaic deposits.¹¹

Average annual rainfall throughout the MDB varies geographically from 60 to 65 inches per year, increasing from east to west.¹² **Figure 2** shows historical annual precipitation at Houma, which tends to vary between about 40 and 105 inches per year, with a historical average of about 63 inches per year. Average annual temperature generally

increases from west to east from 68 to 70 degrees Fahrenheit (°F).¹² The average high temperature at Houma during the warmest months, July and August, is 91°F; the average low temperature during the coldest month, January, is 43°F.¹³

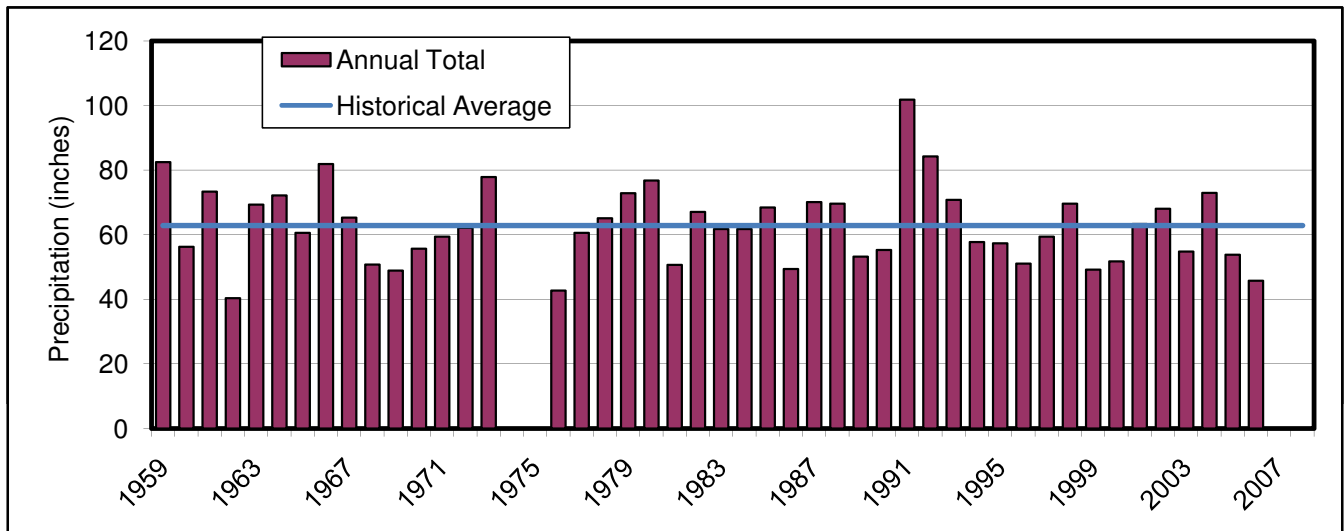


Figure 2. Historical Annual Precipitation at Houma¹²

WATER USE

Water use in the MDB is summarized in **Table 3** by sector, water type, surface water body, and parish, as reported for 2005. **Table 3** is based on water withdrawal data, which may be greater than total water consumptive use. For example, the power generation sector withdraws water for both steam generation and cooling, uses which do not entirely consume the withdrawn water and allow a large percentage of the water to be returned to a waterway. In 2005, water use totaled over 600 million gallons per day (mgd), over 560 mgd of which were surface water. In

2005, power generation used the most surface water, totaling over 515 mgd, followed by public supply and industry. Industrial surface water was used in the MDB for producing paper and food products, as well as petroleum refining. The following municipal water suppliers reported surface water use exceeding 2 mgd.¹⁴

- Assumption Water Works District 1 – 3 mgd
- Gretna Water Works – 3 mgd
- Lafourche Parish Water Works District 1 – 10 mgd

- Plaquemines Parish Water Works – 7 mgd
- St. Charles Water Works District 1 – 4 mgd
- St. Charles Water Works District 2 – 4 mgd
- Terrebonne Water Works District 1 – 9 mgd
- Thibodaux Water System – 3 mgd
- West Jefferson Water Works – 24 mgd
- Westwego Water System – 3 mgd

Only about 10 percent of the total water used in the MDB in 2005 was groundwater. Industry and aquaculture dominated MDB 2005 groundwater withdrawals. The largest industrial use of groundwater in the MDB was for chemical manufacturing. Because groundwater use is not reported by surface water basin, individual parish groundwater use was estimated by

multiplying total parish groundwater use by the percentage of total parish population within the MDB (**Table 3**); actual groundwater use by parish may differ from this estimation.

Figure 3 shows trends in surface water and aquifer water use in the MDB at 5-year intervals from 1990. Both surface and groundwater use fluctuated during

this period. The largest surface water uses fluctuated without any apparent increasing or decreasing trend, including power generation, municipal supply, and industry. Aquaculture use appears to have shifted from surface water to groundwater between 2000 and 2005.

Table 3. Water Use in the MDB in 2005¹⁴

Sector	Surface Water (mgd)	Groundwater (mgd)
Aquaculture	0.0	22.8
General irrigation	0.1	0.1
Industrial	13.2	20.5
Livestock	0.2	0.1
Power generation	515.9	0.4
Public Supply	31.9	0.7
Rural domestic	0.0	0.8
TOTAL	561.3	45.4

Surface Water Body	Use (mgd)
Bayou Lafourche	34.2
Humble Canal	2.2
Gulf Intracoastal Waterway	4.4
Inner Harbor Navigation Canal	18.6
Lake Verret	1.3
Mississippi River Gulf Outlet	499.0
Other (not listed)	2.5
TOTAL	562.2

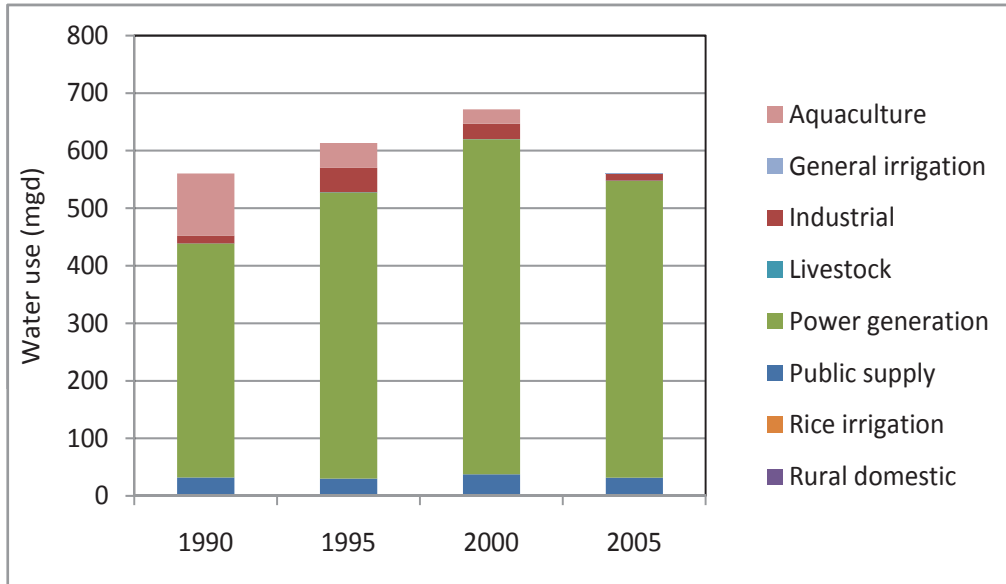
Parish	Surface Water (mgd)	Groundwater* (mgd)
Ascension	1.5	1.5
Assumption	4.8	15.0
Jefferson	0.0	1.1
Lafourche	29.3	13.7
Orleans	515.9	0.5
Plaquemines	1.7	0.0
St. Charles	2.2	2.3
St. James	0.1	9.4
St. John the Baptist	0.9	1.1
St. Mary	0.9	0.9
Terrebonne	4.9	0.0
TOTAL	562.2	45.4

* Groundwater use estimated for parishes with at least five percent of their population within the MDB.

MDB=Mississippi River Delta Basin

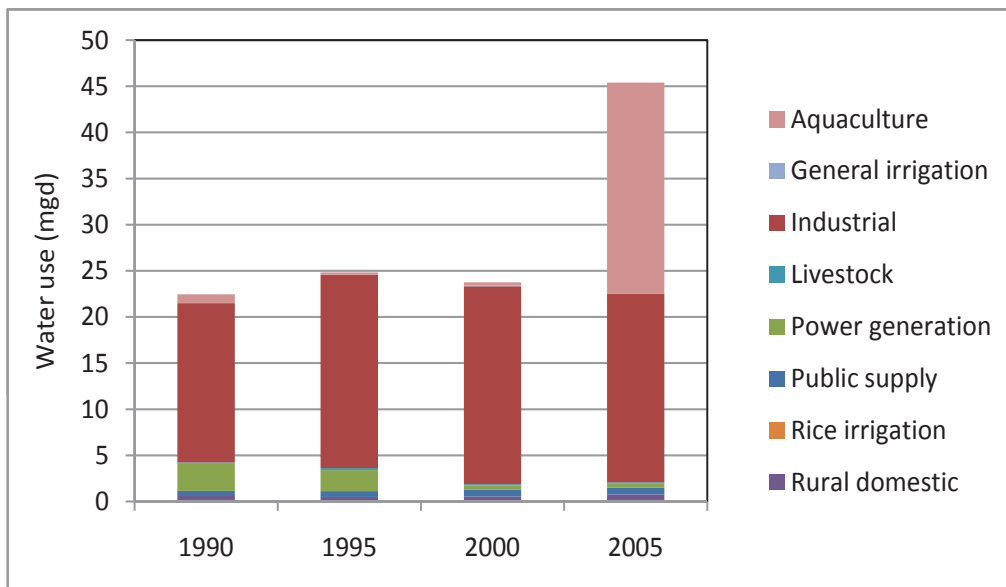
mgd=million gallons per day

Recent Historical Surface Water Use



mgd=million gallons per day

Recent Historical Groundwater Use



mgd=million gallons per day

Figure 3. Trends in Water Use in MDB by Sector¹⁵

Per capita water use in 2005 (based on reported rural domestic and public supply uses, by parish and population) for MDB parishes varied from 46 gallons per capita (person) per day (gpcd) in Terrebonne Parish to 293 gpcd

in Orleans Parish.¹⁴ Typical per capita water use rates in the U.S. range from 100 to 300 gpcd. The large differences between parishes suggest that water may have been withdrawn in some

parishes, but mainly used in others. More representative per capita water use estimates could likely be calculated based on municipal water service provider data.

SURFACE WATER

Primary surface water features in the MDB include rivers, streams, bayous, rivers, reservoirs, and canals such as Bayou Lafourche, Lac Des Allemands, Lake Salvador, the Gulf of Mexico, and Fourleague Bay (**Map 5**). **Map 5** also shows the two subwatersheds, or hydrologic unit codes, delineated by the U.S. Geological Survey (USGS) in the MDB.

An extensive amount of surface and groundwater data for Louisiana, including streamflows and lake levels, is available through the USGS National Water Information System (NWIS) Web site. However, little streamflow data is available for the MDB. Most gages in the basin record gage height (stage), not

streamflow. Additionally, most available streamflow records are discontinuous, which does not allow calculation of typical streamflow statistics. Available streamflow and stage data may be obtained directly from the USGS NWIS Web site.¹⁷

Bayou Lafourche is one of the larger streams in the MDB. The majority of flow in Bayou Lafourche is from pumping out of the Mississippi River at Donaldsville.¹⁴

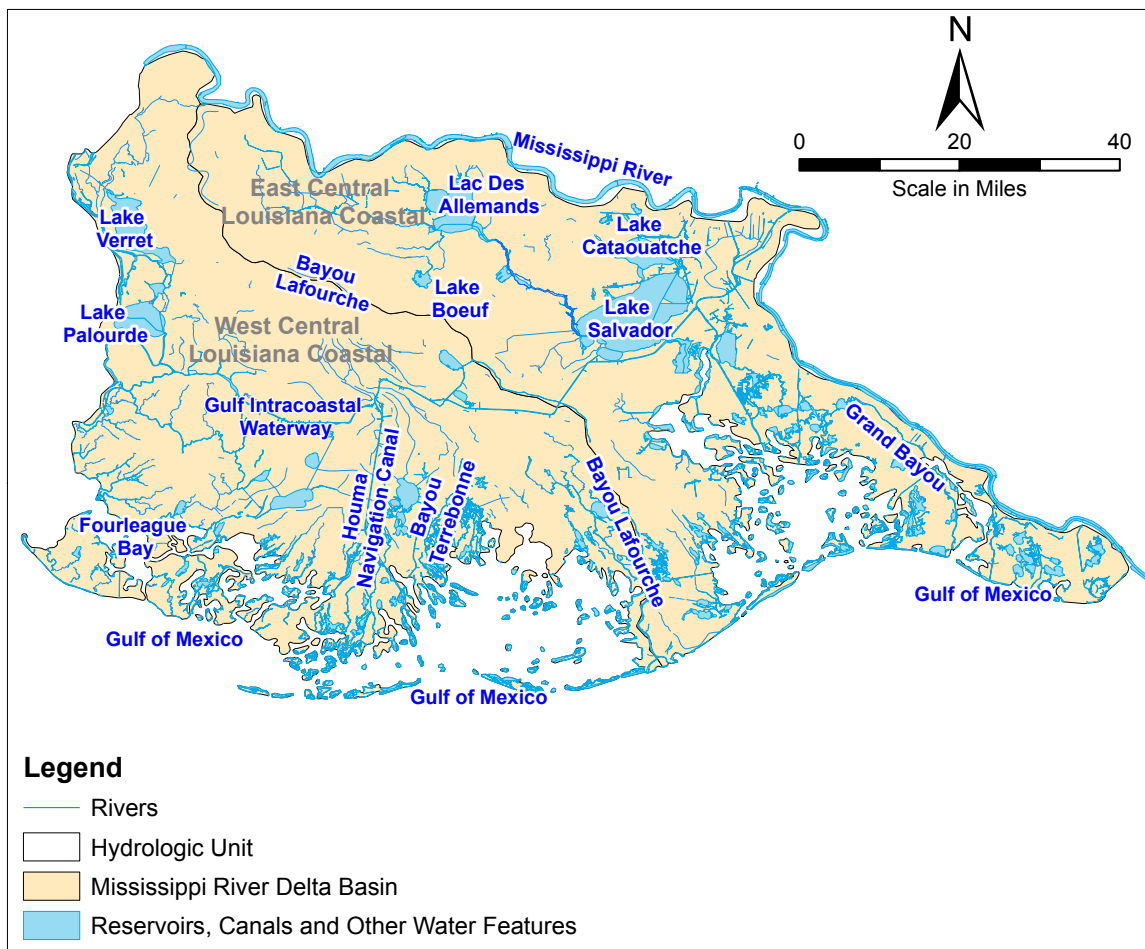
The MDB contains 44.6 miles of streams designated under Louisiana’s Natural and Scenic River System (shown in **Map 2**), as created by the Louisiana Natural and Scenic River Act. These waterways are protected by a permit process and certain prohibitions against channelization, impoundment construction, and channel realignment.¹⁸

The limited published information about lakes and reservoirs in the MDB is summarized in **Table 4**.⁵

Table 4. Characteristics of Major MDB Lakes

Name	Surface Area (acres)	Storage (acre-feet)
Lac Des Allemands	>14,000	NA
Lake Salvador	>44,000	NA

MDB = Mississippi River Delta Basin
NA=not available



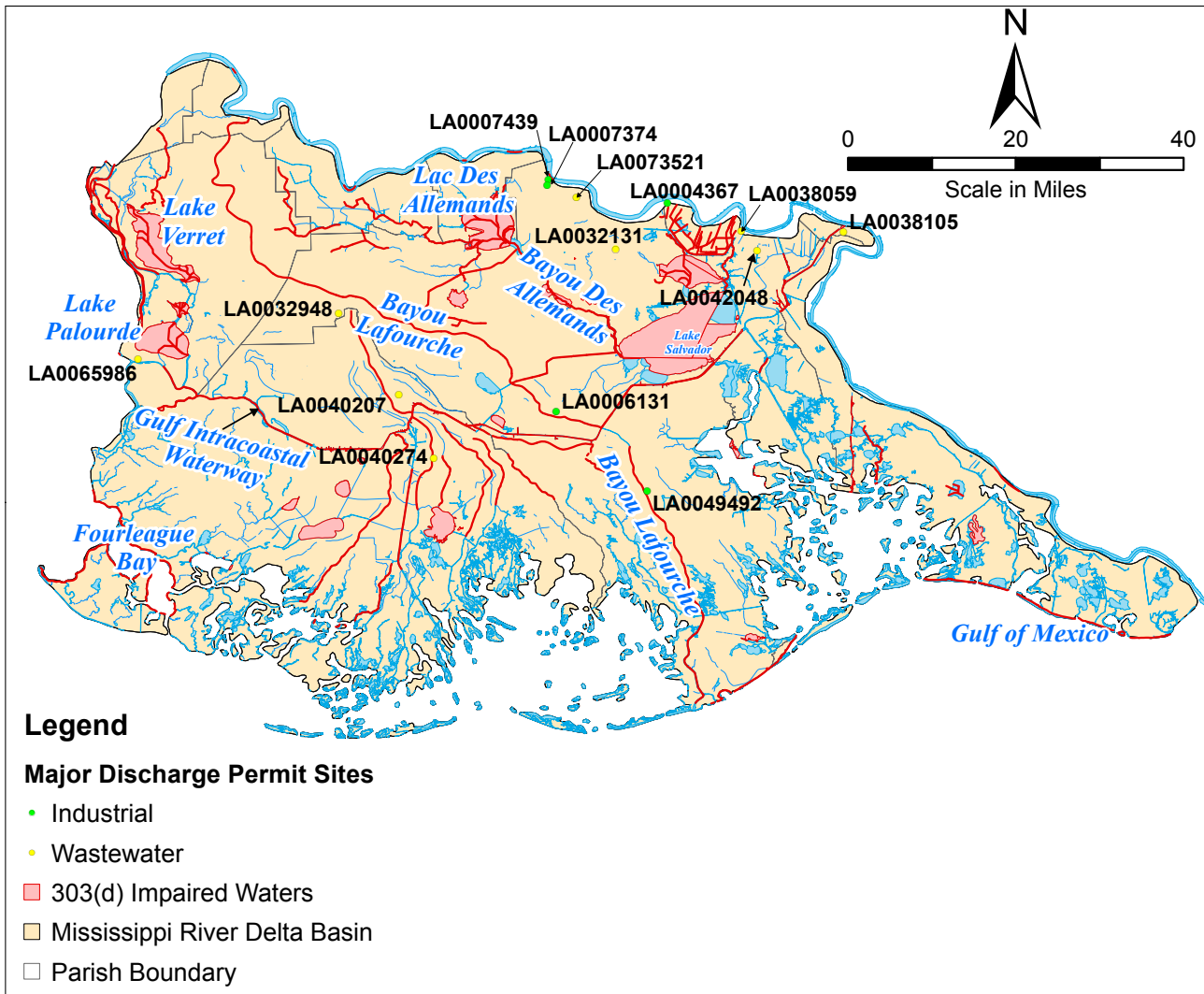
Map 5. Surface Water Features¹⁶

Surface Water Quality

The 303(d) list (named after Section 303(d) of the Federal Clean Water Act) included in Louisiana's Integrated Water Quality Report provides an overview of surface water locations where water quality standards are not met.¹⁹ In these cases, designated uses of the

water bodies, such as fish and wildlife propagation, recreation, or drinking water supply, may be impaired. Stream and lake sub-segments on the 2006 303(d) list for the MDB are shown in **Map 6**. Additional information on all dischargers in Louisiana can be obtained from LDEQ through their public

records request process.²⁰ Design of new reservoirs either impounding impaired waters or discharging to impaired waters would need to consider these water quality challenges and any ongoing or planned water quality improvement projects.



Map 6. MDB Impaired Waters from 303(d) List and Major Permitted Discharge Sites²¹

Table 5 summarizes the number of stream and lake sub-segments on the 2006 303(d) list, and identifies impaired uses and the parameters causing impairment. Most of the major water bodies in the MDB are impaired; the greatest number of stream and lake sub-segments are considered impaired for nutrients and low dissolved oxygen. Fish and wildlife propagation is the most frequently affected use in the MDB.

Municipal sources, including septic tanks, package wastewater treatment

plants, storm runoff, and combined sewer overflows, cause most nutrient and many low dissolved oxygen and fecal coliform impairments. Boat discharges are also a source of bacterial contamination in the Intracoastal Waterway and Bayou Terrebonne.

Nonnative plants impair many of the lakes and some of the rivers in the MDB. Lac Des Allemands, Lake Salvador, Lake Verret, and Lake Boeuf are the larger lakes impaired by non-native aquatic plants.

Surface waters in the MDB are also affected by saltwater encroachment from the Gulf of Mexico. Saltwater can travel up stream channels and hinder the functioning of municipal intakes. Saltwater encroachment in the Mississippi River affects municipal water supplies for Plaquemines Parish, particularly when flows in the Mississippi River are low.⁵

Table 5. Summary of MDB Surface Water Quality Impairments¹⁹

Impaired Use	Sub-segments
Fish and wildlife propagation	136
Oyster propagation	13
Primary contact recreation	6
Outstanding natural resource	5

FWP=fish and wildlife propagation
 MDB=Mississippi River Delta Basin
 ONR=outstanding natural resource
 OYS=oyster propagation
 PCR=primary contact recreation (swimming)

Parameter Causing Impairment (affected use)	Sub-segments
Nutrients (FWP)	43
Dissolved Oxygen (FWP)	33
Nonnative Aquatic Plants (FWP)	25
Fecal Coliform (OYS and PCR)	19
Total Dissolved Solids (FWP)	9
Chloride (FWP)	8
Sulfates (FWP)	8
Turbidity (FWP and ONR)	8
Total Suspended Solids (FWP and ONR)	4
High pH (FWP)	2
Mercury (FWP)	1

Permitted Surface Water Discharges

The Louisiana Department of Environmental Quality (LDEQ) issues permits for discharges of municipal and industrial wastewater. Permitted discharges classified as “major” by the U.S. Environmental Protection Agency (USEPA) (generally those with flow greater than 1 mgd) are shown in **Map 6**. Major municipal wastewater

discharges are summarized in **Table 6** and major industrial permitted discharges in **Table 7**. Dischargers that are physically located in the MDB, but discharge to the Mississippi River, are not listed. The Terrebonne Parish Houma North facility has the largest municipal discharge at 16 mgd, followed by the New Orleans West Bank facility, with a permitted discharge of 10 mgd. Permitted industrial dischargers

include power facilities, industrial chemical facilities, and refineries; each discharges between 1 and 15 mgd. Discharge permit conditions are based on receiving-water low-flow quantity and quality. Future water development projects that change low-flow quantity or quality at the discharge location could affect the ability of permit holders to comply with permit conditions.

Table 6. Major Municipal Wastewater Discharge Permits in the MDB²²

Discharger	Permit Number	Permitted Flow (mgd)	Receiving Water	Parish
Marrero	LA0042048	9.6	Jefferson	Jefferson
Morgan City	LA0065986	4.5	Bayou Boeuf	Saint Mary
New Orleans West Bank	LA0038105	10.0	Orleans Canal/Mississippi River	Orleans
Saint Charles Parish (Luling)	LA0032131	2.6	George Cousin Canal	St. Charles
St. Charles Parish Council	LA0073521	1.7	Providence Canal	St. Charles
Terrebonne Parish Houma North	LA0040207	16.0	Louis Canal-Bayou Terrebonne	Terrebonne
Terrebonne Parish Pollution Control (South)	LA0040274	8.0	Houma Navigation Canal	Terrebonne
Thibodaux, City of	LA0032948	8.0	Phillips Canal/Terrebonne	Lafourche
Westwego, City of	LA0038059	4.5	WPCA Canal	Jefferson

Information presented in this table is directly from USEPA (2009a). For detailed explanation, this reference should be consulted.
 mgd=million gallons per day
 MDB=Mississippi River Delta Basin

Table 7. Major Industrial Discharge Permits in the MDB²²

Discharger	Permit Number	Permitted Flow (mgd)	Receiving Water	Type	Parish
Cytec Industries	LA0004367	6.8	Lake Cataouatche	Industrial organic chemicals	Jefferson
Energy Louisiana LLC - Waterford 1 and 2 Generating Plant	LA0007439	13.1	Forty Arpent Canal/ Mississippi River	Electric services	St. Charles
Killona Energy Center	LA0007374	14.9	Arpent Canal to Mississippi	Electric services	St. Charles
Loop INC	LA0049492	1.6	Bayou Lafourche, Moreau	Crude petroleum pipelines	Lafourche
Valentine Paper Incorporated	LA0006131	2.4	Intracoastal Waterway/ Barataria	Paper mills	Lafourche

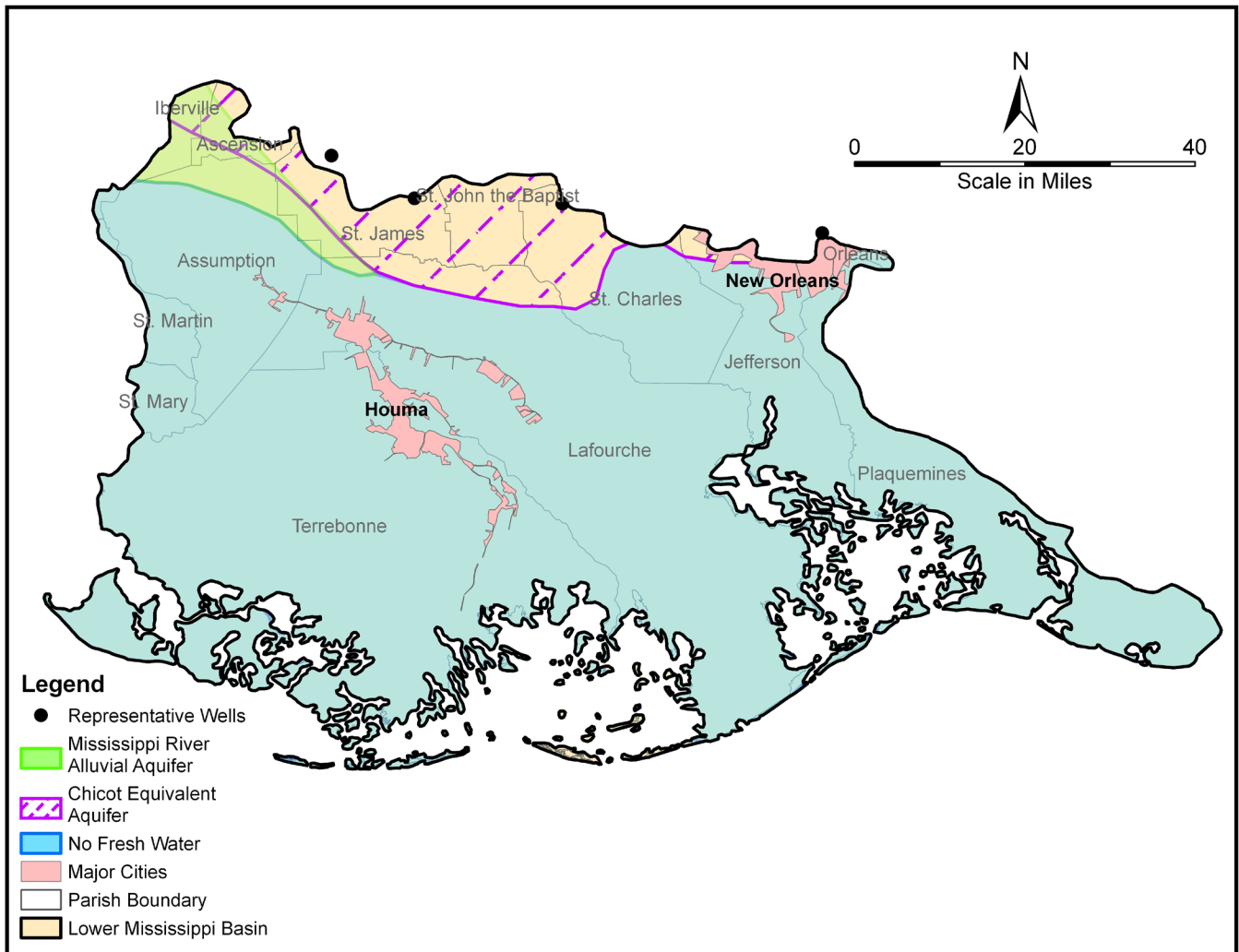
Information presented in this table is directly from USEPA (2009a). For detailed explanation, this reference should be consulted.
 LLC=limited liability company
 mgd=million gallons per day
 MDB=Mississippi River Delta Basin

GROUNDWATER

The State has registered about 500 water wells in the MDB,¹⁷ most of which are completed in the Mississippi River Alluvial Aquifer and Chicot Equivalent

Aquifer. Each of these major aquifers underlies a small area in the northern MDB (**Map 7**). Characteristics of the major MDB aquifers are summarized in

Table 8. Figure 4 shows groundwater levels in the aquifer units of the Chicot Equivalent Aquifer present in the MDB.



Map 7. Spatial Extents of Major MDB Aquifers²³

Table 8. Overview of MDB Major Aquifer Characteristics²

Aquifer	Range of Thickness of Freshwater Interval (feet)	Typical Well Yields (gpm)	Hydraulic Conductivity (feet/day)	Specific Capacity (gal/min/ft of drawdown)	Depth to Groundwater in 2005 (feet) ¹⁷
Mississippi River Alluvial	50 – 500	500 – 4,000 7,000 (large capacity)	10 – 530	5 – 90	0 – 15
Chicot Equivalent	50 – 1,100	500 – 1,000 3,500 (large capacity)	10 – 200	10 – 200	5 – 60

gpm=gallons per minute
gal/min/ft=gallons per minute per foot of drawdown
MDB=Mississippi River Delta Basin

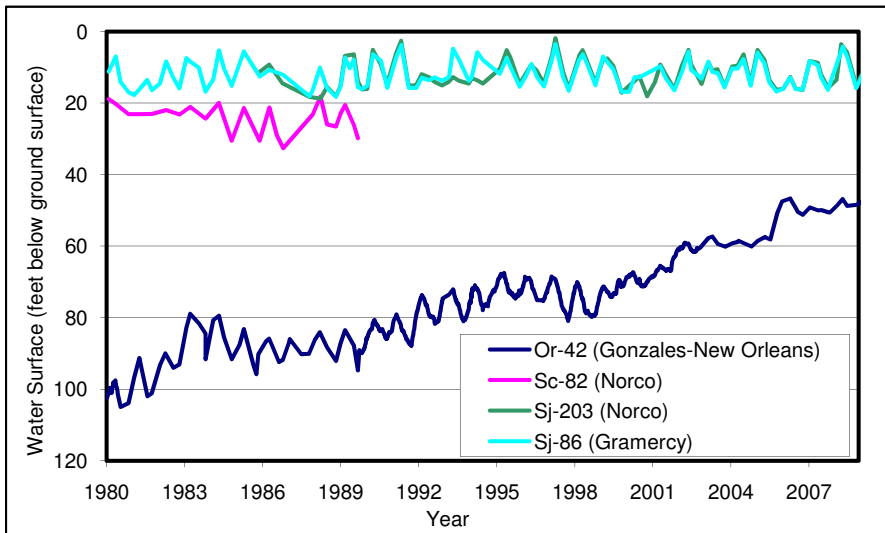


Figure 4. Historical Trends in Groundwater Levels in Representative Wells in Units of the Chicot Equivalent Aquifer¹⁷

The Chicot Equivalent Aquifer is part of the Southern Hills Aquifer System, and aquifer units in this system are given local names based on location and depth.²⁴ In the MDB, the Chicot Equivalent Aquifer includes the Gramercy, Norco, and Gonzales-New Orleans aquifers, and the 1,200-foot sand of the New Orleans aquifers although the last is not heavily used in the MDB. As shown in **Figure 4**, groundwater levels in the Chicot Equivalent Aquifer units have generally remained constant or have increased since 1980. Within these overall trends, groundwater levels in the Chicot

Equivalent Aquifer units exhibit distinct fluctuations due to seasonal rainfall variation, which is characteristic of surficial aquifers.

The Gonzales-New Orleans aquifer unit of the Chicot Equivalent Aquifer is the primary source of freshwater in the area surrounding New Orleans. In 1990, a total of 33 mgd was withdrawn from the Gonzales-New Orleans aquifer unit. During that time, a large amount of groundwater drawdown occurred, centered northeast of downtown New Orleans (north of the MDB).²⁵ However, municipalities now rely more heavily on

surface water instead of groundwater, and areas of the aquifer have recharged in Orleans Parish (Well Or-42 in **Figure 4**).

The Mississippi River Alluvial Aquifer is primarily used for irrigation and aquaculture in the MDB.²⁶ This aquifer is hydraulically connected to the Mississippi River and its major streams. This aquifer is recharged by direct infiltration of rainfall, lateral and upward movement of water from adjacent and underlying aquifers, and overbank stream flooding. Like the Chicot Equivalent Aquifer, groundwater levels in the Mississippi River Alluvial Aquifer fluctuate seasonally in response to precipitation and river stage. Because of rapid recharge from surface water, groundwater levels in the Mississippi River Alluvial Aquifer have not shown long-term change.

Groundwater Quality

Groundwater quality issues in the major MDB aquifers reported in the 2005 and 2006 LDEQ Baseline Monitoring Program (BMP) reports are summarized in **Table 9**.²⁷ Water in five wells in the Mississippi River Alluvial Aquifer exceeded the Federal primary drinking water standard for arsenic in 2006; however, none of these wells are located in the MDB. No water in any of the wells tested as part of the Chicot Equivalent Aquifer BMP exceeded Federal primary drinking water standards. Water in some wells in both aquifers exceeded secondary drinking water standards for pH, chloride, total dissolved solids (TDS), color, and iron (**Table 9**). Although no Federal or State standard has been established for chloroform, a volatile organic compound, it was detected in very low levels in one Chicot Equivalent Aquifer well; however, this well is not located in the MDB. Additionally, saltwater encroachment is a concern for aquifers in the New Orleans area in the northern MDB.⁵

Table 9. Summary of Secondary Drinking Water Standards Exceedences in Major MDB Aquifers

Aquifer	pH	TDS	Color	Chloride	Iron
Mississippi River Alluvial	■	■	■		■
Chicot Equivalent	■	■	■	■	■

■ – One or more wells exceeded the secondary standard
 MDB=Mississippi River Delta Basin
 TDS=total dissolved solids



FLOODING

Low-lying areas of the MDB are subject to periodic flooding due to intense rainfall, abnormally high tides in the Gulf of Mexico, hurricanes or lesser tropical disturbances, and combinations of these events. Historic flood damage has been substantial in the MDB, particularly in Jefferson Parish. At elevations below sea level, pumping is the only effective method for dewatering the land surface after flooding.⁵

Ten of the parishes wholly or partially located in the MDB (Ascension, Assumption, Iberville, Jefferson, Lafourche, Plaquemines, St. James,

St. John the Baptist, St. Charles, and Terrebonne) have become participants in the National Flood Insurance Program (NFIP), offered through the Federal Emergency Management Agency (FEMA). As part of the NFIP, FEMA prepares Flood Insurance Studies (FIS) and Flood Insurance Rate Maps (FIRM) for rivers and bayous prone to damaging floods in a parish; member communities regulate development in floodplains. These studies and maps document flooding problems within parishes and delineate 100-year flood zones along major waterways. Some 100-year flood zones are available as digital geographic

information system layers; detailed maps and reports can be obtained from FEMA.

USGS has estimated flood flow magnitudes for different return periods at streamflow gages throughout the State. The USGS analysis is only valid for rural, unaltered waterways and, therefore, the analysis is generally not valid for gaged waterways in the MDB, which are controlled by levees, dikes, and other hydraulic structures. **Table 10** lists peak discharges for major waterways, as reported in the FISs reviewed as part of this basin characterization.

Table 10. Estimated Peak Flow Discharges in the MDB²⁹

Location	Flood Magnitude (cfs)			
	2-year	10-year	100-year	500-year
Bayou Pierre Part at mouth	NA	600	1,100	1,300
Mississippi River at river mile 10-82	NA	1,250,000	1,250,000	NA
Mississippi River at St. Charles Parish boundary	NA	1,375,000	1,500,000	NA

cfs=cubic feet per second
 MDB=Mississippi River Delta Basin
 NA=not available

ENVIRONMENTAL AND CULTURAL ISSUES

Environmental and cultural resources are important elements of the quality of life in Louisiana and can affect siting and operation of water resource facilities, as regulated by Federal and State permitting requirements. As shown in **Map 2**, the southern MDB is designated by LDNR as being in the Coastal Zone. Existing environmental issues in the Coastal Zone, such as loss of wetlands and land subsidence, can affect water resources facilities, such as reservoirs.³⁰

Habitat and Wildlife

The MDB includes parts of the Mississippi Alluvial Plain and the South Eastern Plains ecoregions.³¹ Each ecoregion contains a range of habitats, some of which are associated with species of conservation concern. The Louisiana Wildlife Action Plan prioritizes particular terrestrial habitat types within each ecoregion for conservation.¹⁸

Terrestrial species Federally listed as threatened or endangered that may reside in the MDB are the Louisiana

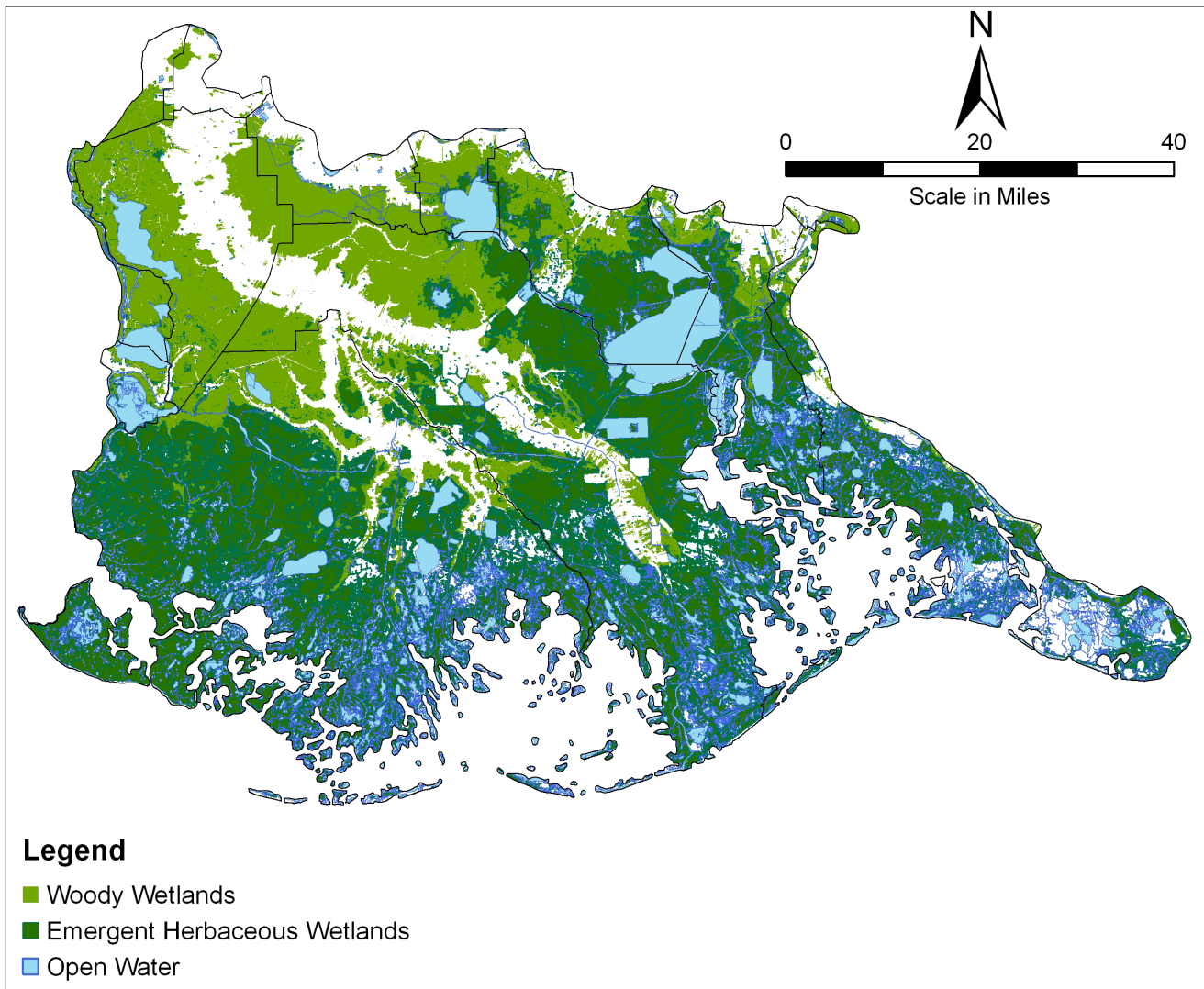
black bear, red-cockaded woodpecker, brown pelican, and piping plover.³² The Federal Endangered Species Act gives the U.S. Fish and Wildlife Service (USFWS) the authority to protect listed species and their habitat. USFWS has mapped critical habitat areas for the piping plover in the MDB.³³

Aquatic habitats in the MDB support about 57 species of freshwater fishes, 12 species of mussels, and 10 species of crawfish.¹⁸ Species of state concern in the MDB include two freshwater fish

species and two reptile species. The State regulates aquatic habitat through surface water quality standards in water bodies designated for fish and wildlife propagation.³⁴ The Louisiana Wildlife Action Plan does not prioritize aquatic habitats for conservation. USFWS has identified several subwatersheds within the MDB containing surface waters important for conservation of the fat pocketbook mussel, Gulf sturgeon, and pallid sturgeon, which are Federally listed as threatened or endangered species.³⁵

Wetlands are an important environmental resource throughout the United States, and especially in Louisiana. Alteration of these areas often requires a Federal Section 404 permit through the U.S. Army Corps of Engineers (USACE). **Map 8** shows areas of wetlands in the MDB. About 22 percent of the MDB's surface area, or 982 square miles, is woody wetlands (i.e., areas where forest or shrubland vegetation accounts for a large portion

of the cover, and the soil is periodically saturated or inundated) and about 39 percent, or 1,725 square miles, is emergent herbaceous wetlands (i.e., areas where perennial herbaceous vegetation accounts for most of the cover, and the soil is periodically saturated or inundated).³⁶ Wetland area in the MDB has been reduced by several factors, such as drainage for development, enclosure within levees, and dredging for oil and gas canals.⁵



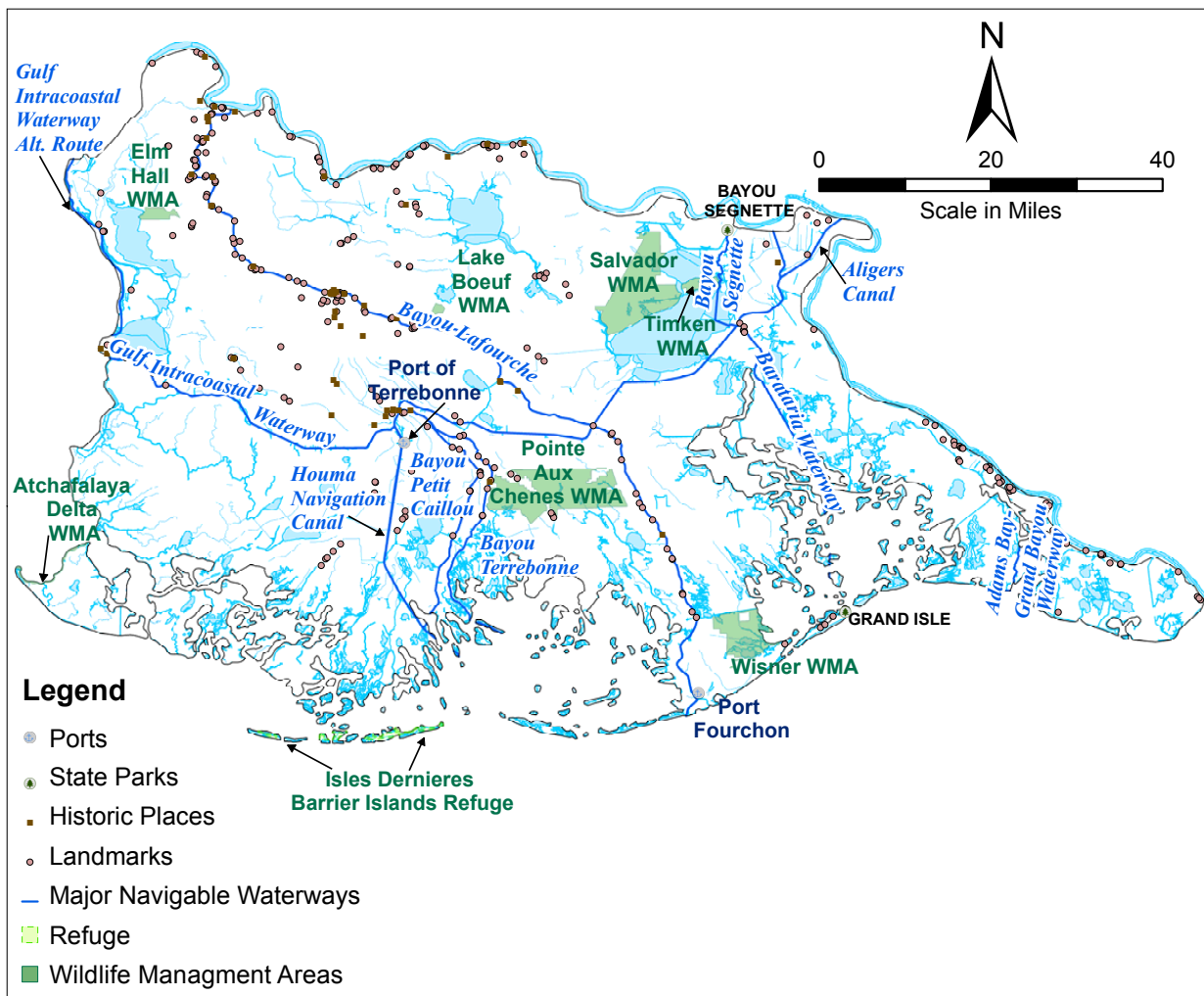
Map 8. Wetlands in the MDB²²

Cultural Resources

Information on cultural issues and resources is provided by parish-level organizations. Prehistoric (before European colonization) and historic sites are registered with the Louisiana Department of Culture, Recreation, and Tourism (LCRT) and the National Register of Historic Places (NRHP). Featured historic sites in the basin include churches, banks, houses, and

schools. There are 62 historic points in the MDB, as shown in **Map 9**. No archaeological sites are listed on the NRHP for the MDB.³⁷ Generalized locations of known cultural resources that could affect reservoir siting or operations are available from the NRHP. Additional information is available from the LCRT, Office of Cultural Development, Division of Historic Preservation.

The only Federally recognized Native American tribe in the MDB is the Chitimacha Tribe. State-recognized tribes in the MDB are the United Houma Nation, the Biloxi-Chitimachi Confederation/Bayou Lafourche Band, the Point-Au-Chien Tribe, the Isle de Jean Charles Band, and the Grand Caillou/Dulac Band.³⁸ Potentially affected tribes must be notified of any proposed reservoir plans.



Map 9. Cultural and Recreational Resources and Navigable Waterways in the MDB³

RECREATION, NAVIGATION, AND HYDROPOWER

The MDB is used extensively for water-oriented recreation. Fishing, canoeing, and boating are popular recreational activities in the area.⁵ Several Wildlife Management Areas in the MDB serve as hunting and camping grounds for the general public. Specific recreational resources of regional value are shown in **Map 9**.

The 10 major navigable waterways within the MDB are listed in **Table 11**. The Barataria Bay Waterway and adjacent waters below Lafitte are used extensively by commercial fishermen and oystermen, and are also sites of special water-based recreation events.³⁹

Bayou Terrebonne is a 6-foot-deep channel that originates at the Gulf Intracoastal Waterway (GIWW) near Houma, Louisiana. Crude petroleum is the major cargo on this waterway, which also serves as an access route for fishing and hunting in the coastal region. The average annual traffic from 1986 through 1995 was 230,000 tons.³⁹

Bayou Petit Caillou is a 5-foot-deep channel from Robinson Canal to the Head of Bayou Little, completed in 1929. Average annual traffic in the bayou from 1986 through 1995 was 880,000 tons, consisting mostly of crude petroleum.³⁹

The Adams Bay – Grand Bayou Waterway, from Doullut Canal, near Empire, to the Gulf of Mexico, serves the area’s large fishing fleet and offshore oil operations. The area of the Waterway from Empire to the Gulf of Mexico is also heavily used throughout the year for fishing and hunting. Average annual traffic from 1986 through 1995 was over 1 million tons.³⁹

Navigation in Bayou Lafourche extends for over 100 miles north from the Gulf of Mexico. Average annual traffic on Bayou Lafourche from 1986 through 1995 was almost 2 million tons.³⁹

The Bayou Segnette Waterway runs from Westwego to the GIWW. The waterway provides larger modern fishing and shrimping boats with a shorter, more direct route to packing and canning industries on Bayou Segnette.³⁹

The Houma Navigation Canal is 15 feet deep, and was completed in 1962. The channel allows navigation from the GIWW near the west side of Houma to the Gulf of Mexico. Annual traffic on the Houma Navigation Canal between 1986 and 1995 averaged over 1 million tons. The oil industry is the predominate user of the waterway.³⁹

The GIWW is a 1,300-mile-long, man-made canal that runs along the Gulf of Mexico coastline, from Texas’s southernmost tip at Brownville to St. Marks, Florida. Primarily used for shipping, the GIWW links all Gulf Coast ports, and provides access from these ports to the national inland waterway system. In Louisiana, the GIWW stretches 306 miles along the Louisiana coastline from the Pearl River to the Sabine River, and is maintained at a depth of 12 feet. In 2006, a total of approximately 84 million tons of cargo was transported through the GIWW in Louisiana.⁴² The GIWW Alternate Route (Morgan City/Port Allen) extends from the GIWW at Morgan City to the

Table 11. Summary of Navigable Waterways in MDB

River	Outflow	Navigable Depth (feet) ⁴⁰	Navigable Length (miles)
Adams Bay - Grand Bayou Waterway from Empire to Gulf of Mexico	Gulf of Mexico	12	11
Algiers Canal	GIWW	12	10
Barataria Bay Waterway	Gulf of Mexico	12	36
Bayou Lafourche	Gulf of Mexico	12	107
Bayou Petit Caillou	Gulf of Mexico	5	28
Bayou Segnette Waterway	GIWW	9	14
Bayou Terrebonne	Gulf of Mexico	7	38
GIWW	NA – traverses MDB	12	96
GIWW Alternate Route – Morgan City/Port Allen	GIWW	12	25
Houma Navigation Canal	Gulf of Mexico	15	55

GIWW=Gulf Intracoastal Waterway
 MDB=Mississippi River Delta Basin
 NA=not applicable

Mississippi River via the Atchafalaya and Old rivers. It provides a shortcut from the Gulf of Mexico to the upper Mississippi River, shortening the route by 172 miles and easing port congestion at New Orleans. Average annual traffic from 1986 through 1995 was over 10 million tons.³⁹

The Algiers Canal is a 12-foot deep channel from the Mississippi River to the GIWW. The canal was designed as an alternate route for the GIWW to help alleviate traffic south of the Harvey Lock area. A lock is located on the canal at the outlet to the Mississippi River.³⁹

Two ports are located within the MDB: the Port of Terrebonne and Port Fourchon. The Port of Terrebonne is located on the Houma Navigation Canal. Tenants of the Port of Terrebonne are marine fabricators as well as oil and gas service companies needing maritime facilities.⁴³ Port Fourchon is the southernmost port in Louisiana. It is the intermodal support base for over half the domestic oil and gas activity in the Gulf of Mexico, the Louisiana Offshore Oil Port (LOOP), substantial commercial fishing interests, and significant recreational activities. Pipe, drilling fluids, energy exploration and production equipment, and energy services are among the most common cargoes handled, along with personnel. Over 30 million tons of cargo were handled at Port Fourchon in 2006.⁴⁴

No hydropower projects exist in the MDB, and there is limited opportunity for hydropower development in the basin.⁴⁵

INTERBASIN AND INTERSTATE ISSUES

There are no interstate compacts affecting water resources in the MDB, although the problems of reservoir drawdown and saltwater intrusion in the Southern Hills Aquifer System are

regional, interstate concerns. Coastal issues are concerns in the MDB as well as in other basins and states along the Gulf of Mexico.³⁰



SUMMARY OF WATER RESOURCES NEEDS

To identify and prioritize statewide water resources issues, a needs assessment of each of the nine major surface water basins within Louisiana was performed. Because the needs assessment provides the foundation for developing reservoir priority evaluation criteria, it focuses on needs that can be addressed by surface water reservoirs. At the same time, the integrated nature of water resources management requires evaluating issues that could not necessarily be solved, but could be affected, by a reservoir.

Based on the existing compiled information, eight categories of State water resources needs that could be addressed or affected by construction of surface water reservoirs were identified and evaluated. Evaluation criteria were developed for each category

to allow interbasin comparison of needs. To maintain objectivity in the evaluation process, evaluation criteria were developed based on factors that could be evaluated as quantitatively as possible across all basins. High, medium, and low levels of current need were defined based on differences in these factors between basins. Future needs in each basin were assessed by determining whether each current need was increasing, constant, or decreasing. The evaluation criteria are described in detail in the main body of the Statewide Perspective on Water Management Report, to which this basin characterization is an appendix.

The assessed needs in the MDB are summarized below. Details of the assessed needs for all nine major Louisiana surface water basins, as well

as a comparison of statewide needs by issue, are presented in the Statewide Perspective on Water Management Report.

Assessed needs in the MDB are shown in **Table 12**, and are discussed below in general order of need, from high-level needs (colored red in **Table 12**) to low-level needs (colored green in **Table 12**).

Due to existence of widespread surface water quality impairments and heavy industrial activity along waterways in the Delta, surface water quality was evaluated as a high-level need. A majority of the major surface waters in the MDB are considered impaired by LDEQ. Common impairments include nutrients, dissolved oxygen, and nonnative plants. Urban sources such as sanitary sewer overflows, storm runoff, package wastewater treatment plants, as well as heavy industrial activity, are major causes of impairment.

Flood control was ranked as a high-level need. Widespread areas of potential flooding are present in the MDB, threatening a population of over half a million people. Comprehensive flood control projects have been conducted or are in the planning stages, but the risk of flood damage to highly populated areas is substantial, as demonstrated by recent hurricanes. Significant ongoing subsidence, combined with potential sea-level rise, threatens the viability of future flood control projects as well.

Navigation was evaluated as a high-level need with increasing importance in the future. Two major ports and over 400 miles of navigable waterways, including the GIWW, are present in the MDB, accommodating 30 million tons of commercial traffic annually. Funds have been requested for multiple future dredging projects, and Congressional authorization is pending for an \$887 million hurricane-protection lock and floodgate to protect the GIWW from storm surges.

Environmental protection was ranked as a medium-level need. Several environmental issues have been identified that threaten protection of existing water resources and/or constrain future development of additional water supplies. These include the presence of widespread wetland and naturally vegetated areas covering over 60 percent of the basin; areas considered Prime Farmland; 45 miles of State-designated Natural and Scenic Rivers; and three aquatic and several terrestrial threatened and endangered species. Extensive

reaches of surface water are designated as having impaired water quality. Although most of these impairments are related to aquatic habitat, some affect usability of water for other purposes. Furthermore, many water resources of the MDB are heavily used for industrial purposes or are situated near industrial activities, which can pose a risk of environmental contamination.

Little groundwater is used in the MDB, and groundwater supply was evaluated as a low-level need. However, saltwater intrusion affects groundwater quality on the northern basin margin near New Orleans, and groundwater quality was evaluated as a medium-level need.

Recreation was ranked as a medium-level need. The MDB has the third-highest population of any basin in the State, suggesting high demand for recreational facilities. The MDB has many lakes and access to the Mississippi River and its tributaries, which likely meet the existing and future need.

Table 12. Assessed Water Resources Needs in the MDB

Category	Current	Future
Surface Water Supply	medium	↑
Surface Water Quality	medium	↑
Groundwater Supply	low	–
Groundwater Quality	medium	–
Flood Control	high	↑
Environmental Protection and Enhancement	medium	↑
Recreation	medium	–
Navigation	high	↑

MDB=Mississippi River Delta Basin
 Red = high-level need; Yellow=medium-level need; Green=low-level need
 ↑ = increasing importance
 – = same importance
 ↓ = decreasing importance

ABBREVIATIONS

°F	degrees Fahrenheit
BMP	Baseline Monitoring Program
cfs	cubic feet per second
DOTD	Louisiana Department of Transportation and Development
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GIWW	Gulf Intracoastal Waterway
gpcd	gallons per capital per day
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LOOP	Louisiana Offshore Oil Plant
MDB	Mississippi River Delta Basin
mgd	million gallons per day
NFIP	National Flood Insurance Program
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWIS	National Water Information System
State	State of Louisiana
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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