

# NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

## Acadian-Pontchartrain Study Unit

### MAJOR WATER-QUALITY ISSUES IN THE ACADIAN-PONTCHARTRAIN STUDY UNIT

The Acadian-Pontchartrain NAWQA study will increase the scientific understanding of surface- and ground-water quality and the natural and human factors that influence water quality. The study also will provide the information needed by water-resource managers to implement effective water-quality management actions and evaluate long-term changes in water quality.

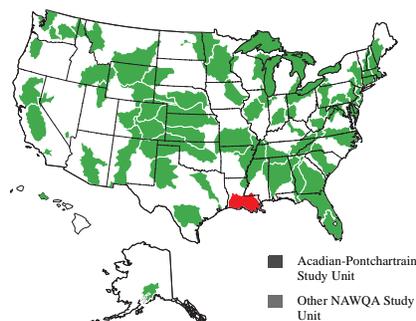


American alligator populations are thriving throughout the southern half of the Acadian-Pontchartrain Study Unit.

Water quality has improved in the Acadian-Pontchartrain Study Unit over the past few decades because of advances in the treatment of municipal and industrial wastes. However, the effects of agriculture, urbanization, and industrialization on the quality of streams, coastal embayments, and ground-water resources remain a primary concern to water-resource managers, planners, State and local governments, and citizen groups. Many of these issues relate to nonpoint-source pollution (pollution generally associated with areally diffuse runoff or seepage) and are the subject of ongoing research and management programs, such as the Louisiana Department of Environmental Quality Nonpoint Source Program, the Barataria-Terrebonne National Estuary Program, Gulf of Mexico Program's Shellfish Challenge, and the efforts of citizen groups to restore the Tangipahoa River to its designated uses. Some of the major water-quality issues that currently face water-resource

### WHAT IS THE NATIONAL WATER-QUALITY ASSESSMENT PROGRAM?

During the past 25 years, industry and government made large financial investments that have resulted in better water quality across the Nation; however, many water-quality issues remain. To address the need for consistent and scientifically sound information for managing the Nation's water resources, the U.S. Geological Survey (USGS) began a full-scale National Water-Quality Assessment (NAWQA) Program in 1991. This program is unique compared to other national water-quality assessment studies in that it integrates the monitoring of the quality of surface and ground waters with the study of aquatic ecosystems. The goals of the NAWQA Program are to (1) describe current water-quality conditions for a large part of the Nation's freshwater streams and aquifers (water-bearing sediments and rocks), (2) describe how water quality is changing over time, and (3) improve our understanding of the primary natural and human factors affecting water quality.



Assessing the quality of water in every location of the Nation would not be practical; therefore, NAWQA Program studies are conducted within a set of areas called study units. These study units are composed of more than 50 important river and aquifer systems that represent the diverse geography, water resources, and land and water uses of the Nation. The Acadian-Pontchartrain area of southern Louisiana and southwestern Mississippi is one such study unit. It has been designed to (1) include many of the important southern Louisiana streams; (2) represent a mixture of urban and rapidly urbanizing, industrial, and large forested areas; (3) represent various agricultural practices; and (4) include the major sole-source aquifers such as the Chicot and Southern Hills aquifer systems.

managers in the Acadian-Pontchartrain Study Unit are as follows:

- Nutrient enrichment of streams, lakes, and embayments, especially in the Lake Pontchartrain Basin.
- Unsuitability of sport and commercial fish for human consumption, caused by elevated tissue concentrations of mercury.
- Bacterial contamination of surface waters in the Lake Pontchartrain Basin.
- Effects of flood-control, agricultural (including forestry), and land

*development practices on loss of riparian and submerged aquatic vegetation.*

- Contamination of ground water, streams, and sediments by trace elements, pesticides, and petroleum products.
- Saltwater encroachment into aquifers and coastal freshwater marshes.
- Protection of ground-water quality in recharge areas of sole-source aquifers to support current beneficial uses and to provide a drinking water supply for future generations.

## STUDY UNIT DESCRIPTION

The Acadian-Pontchartrain Study Unit includes all or parts of 39 parishes in southern Louisiana and 5 counties in southwestern Mississippi. The 26,000 mi<sup>2</sup> (square-mile) study unit extends north to the Red River and the headwaters of the Calcasieu River in west-central Louisiana, and the headwaters of the Amite and Tangipahoa Rivers in southwestern Mississippi; east to the Pearl River; south to the Gulf of Mexico; and west to the Sabine River.

The Acadian-Pontchartrain Study Unit contains rolling hills, deltaic plains, and hardwood-dominated bottomland. Elevations in the study unit range from sea level in the coastal marshes of southern Louisiana to just over 600 feet above sea level in Mississippi. The area is classified as subtropical, and average annual precipitation ranges from 55 to 62 inches per year. Average annual air temperatures in the study unit range from 64°F (degrees Fahrenheit) in the northern part to 70°F in the southern part.

An estimated 3.1 million people lived in the study unit in 1990, of which more than two-thirds were located in the three largest urban areas: New Orleans, Baton Rouge, and Lafayette. In 1990, the major land-use categories were cropland interspersed with pasture and woodlands or forest, 47 percent; marshland, 27 percent; swamp, 19 percent; open water, 5 percent; and irrigated land and urban areas, 1 percent each. Dairy farming and timber production are the primary agricultural activities in southeastern Louisiana and southwestern Mississippi. Important agricultural products of southwestern Louisiana include timber; crops such as rice, soybeans, sugarcane, and corn; catfish and crawfish; and beef. Major nonagricultural activities in the study unit include oil and gas exploration and production, petrochemical industries, and marine transport industries. The Port of South Louisiana at LaPlace is the largest port by tonnage in the United States; New Orleans and Baton Rouge are the fourth and sixth largest ports, respectively. Major industrial areas are located along the Mississippi River between Baton Rouge and New Orleans and along the Calcasieu River near Lake Charles.

The Mississippi River and the Atchafalaya River Swamp divide the study unit and, because of their size, are major influences on the water quality in some areas of the study unit. However, because much of the water in the Mississippi and Atchafalaya Rivers originates outside the study unit, the Acadian-Pontchartrain study will not directly address water-quality issues concerning these two rivers or the adjoining

alluvial aquifers. Other programs within the USGS, such as the National Stream Quality Accounting Network, monitor the Mississippi and Atchafalaya Rivers.

Principal streams in the study unit that originate in sandy forested hill country include the Tchefuncte, Tangipahoa, Tickfaw, Amite, and Calcasieu Rivers; others such as Bayous Lafourche, Grosse Tete, and Teche, and the Vermilion and Mermentau Rivers originate in deltaic silty-clay farm country. Natural lakes are common: the largest is Lake Pontchartrain, which forms the northern boundary of New Orleans.

Most surface waters, not part of the Mississippi-Atchafalaya Rivers tributary system, are low-gradient, low-ionic strength, colored-water streams. The study unit contains 27 of the 51 scenic streams and rivers identified as part of Louisiana's Natural and Scenic Rivers Program. Swimming, fishing, and boating are popular activities on most waterbodies. Navigation also is a major use of many of the larger streams, and ship channels are located along reaches of the Tchefuncte, Tangipahoa, Tickfaw, Amite, Mississippi, Atchafalaya, Vermilion, Mermentau, and Calcasieu Rivers, and Bayous Lafourche and Teche. Surface-water withdrawals totalled about 7,800 Mgal/d (million gallons per day) in 1995 and were used primarily for power generation, industrial processes, agriculture, and public supply. Most of the surface water used in the study unit is withdrawn from the Mississippi River or its distributaries.

The study unit is underlain by the Chicot aquifer system, Evangeline aquifer, and Jasper aquifer system west of the Mississippi River; and the Chicot equivalent, Evangeline equivalent, Jasper equivalent, and Catahoula equivalent aquifer systems east of the Mississippi River (also collectively referred to as the Southern Hills aquifer system). These aquifers are composed of alternating beds of unconsolidated gravel, sand, silt, and clay. Beds in the aquifers dip and thicken southward. Recharge occurs primarily from rainfall, and recharge potential is higher in the northern part of the study unit. The Chicot and Southern Hills aquifer systems are designated as sole-source aquifer systems by the U.S. Environmental Protection Agency. In 1995, pumpage from wells in the Chicot and Chicot equivalent aquifer systems totalled 660 Mgal/d. Heavy pumping from these two aquifer systems has substantially altered water levels and caused saltwater encroachment near the cities of Lake Charles and Baton Rouge.



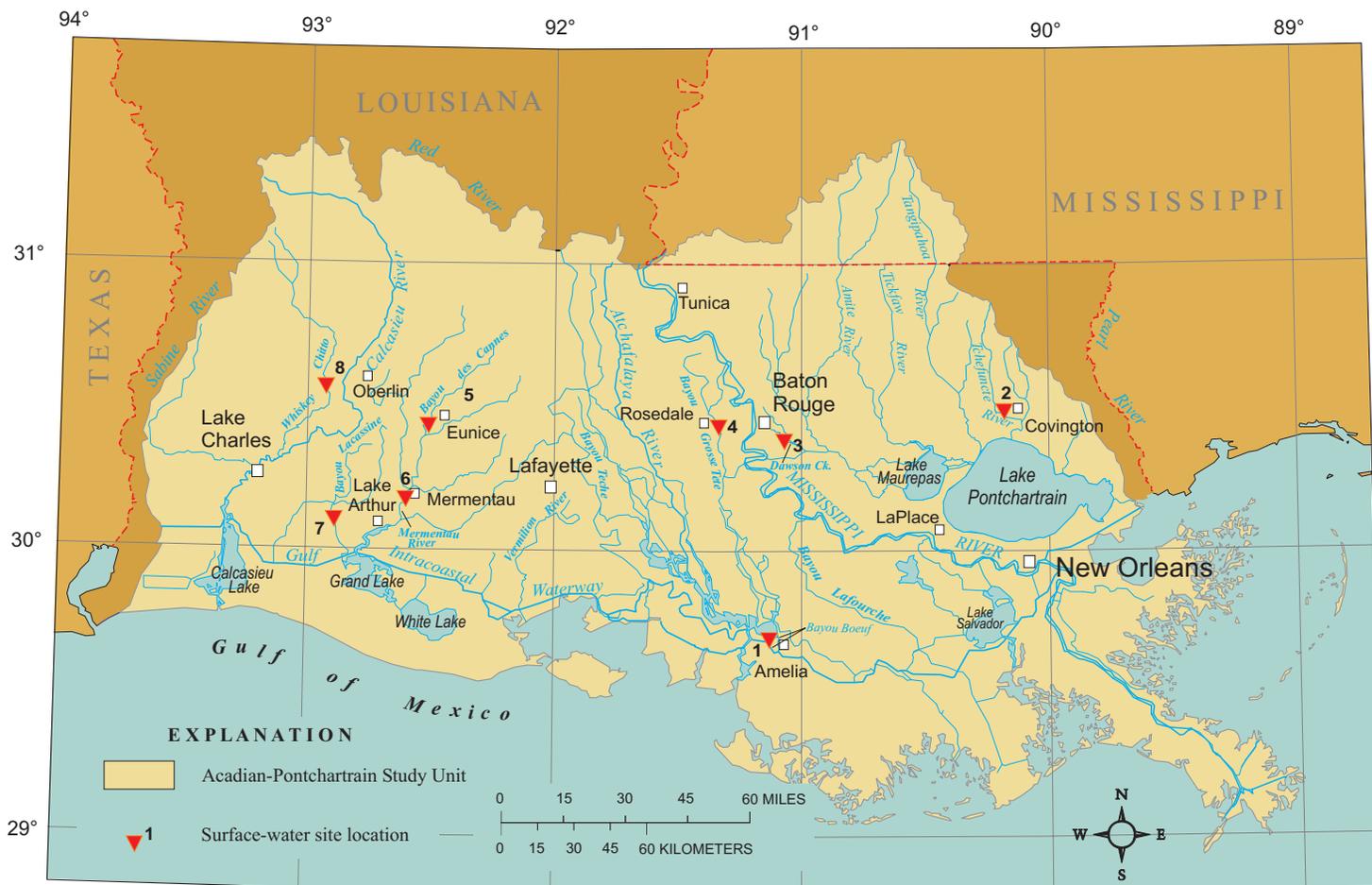
*Lake Fausse Pointe, surrounded by a bald cypress forest. Louisiana cypress swamps are threatened by hydrologic modifications, salt-water intrusion, and herbivory by nutria, an introduced rodent.*



*Leveling rice fields in preparation for planting can result in periodic discharges of high-turbidity and high-nutrient water into surrounding waterways. The Acadian-Pontchartrain Study Unit contains over 400,000 acres of rice fields.*



*Well drilling at Bluebonnet Swamp Nature Center in Baton Rouge. The well will be used both for age-dating shallow ground water and as an interpretive exhibit for visitors.*



## SCHEDULE OF STUDY ACTIVITIES

ACTIVITY	YEAR													
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Planning and study design	■	■												
High-intensity monitoring														
Report preparation														
Low-intensity monitoring														

The Acadian-Pontchartrain study is one of several NAWQA studies that began in Federal fiscal year 1997. Planning, study design, and analysis of existing data were done during the first 2 years, which is consistent in all NAWQA studies. After the 2-year planning period, surface- and ground-water and biological data will be collected intensively for 3 years (termed the high-intensity monitoring phase). A low-intensity monitoring phase will follow for 6 years, during which water quality will be monitored at selected sites and areas assessed during the high-intensity monitoring phase. This combination of high- and low-intensity-monitoring phases allows the NAWQA Program to examine trends in water quality over time.

During the planning period, existing data and results from previous studies are reviewed to understand the primary physical, chemical, and biological factors that affect water quality in the study unit and to identify the need for additional data. An evaluation of how land use and land cover, soils, geology, physiography, climate, and drainage characteristics may influence water quality is to be included in technical and nontechnical reports. Information obtained from reviews of previous studies, along with field observations of current monitoring stations and proposed sampling sites, and field reconnaissance data, are used to design a sampling program for the study unit.

During the high-intensity monitoring phase, physical, chemical, and biological data are collected for selected areas at local and regional scales to describe the quality of water throughout the study unit. Measurements are made to determine water chemistry in streams and aquifers; the quantity of suspended sediment and the quality of bed sediment in streams; the variety and number of fish, benthic invertebrates, and algae in streams; and the presence of contaminants in fish tissues. Individual streams and aquifers, chemical constituents, and biological species are selected for sampling to represent the principal water resources and water-quality concerns in the study unit and the Nation. A series of technical and nontechnical reports describing results of high- and low-intensity monitoring phase data collection and analysis is planned.

## ASSESSING WATER QUALITY IN THE ACADIAN-PONTCHARTRAIN STUDY UNIT

The NAWQA Program is designed to assess the status of and trends in the quality of the Nation's ground- and surface-water resources and to relate the status and trends to the natural and human factors that affect the quality of water. The design of the program balances the unique assessment requirements of individual study units with a nationally consistent design and data collection structure that incorporates a multiscale, interdisciplinary approach. Surface- and ground-water studies are done at local (a few square miles to hundreds of square miles) and regional (thousands of square miles) scales to understand the water-quality conditions and issues within a study unit.

An occurrence and distribution assessment is the largest and most important component of the initial data collection in each study unit. The goal of this assessment is to characterize, in a nationally consistent manner, the broad-scale geographic and seasonal distributions of water-quality conditions in relation to major contaminant sources and background conditions. The following discussions describe the typical surface- and ground-water monitoring components of the occurrence and distribution assessment, and specific aspects of the Acadian-Pontchartrain study.

### Surface Water

The national study design for surface waters focuses on water-quality conditions in streams using three interrelated components—water-column studies, bed-sediment and fish-tissue studies, and ecological studies. Water-column studies monitor physical and chemical characteristics, which include suspended sediment, major inorganic ions, nutrients, organic carbon, and dissolved pesticides, and their relation to hydrologic conditions, sources, and transport. Most surface water is monitored at sites termed either basic-fixed sites or intensive-fixed sites, according to the frequency of the sampling. The sampling sites are selected to determine the quality of water in relation to important environmental settings in the study unit. The Acadian-Pontchartrain study unit has eight basic-fixed sites. Tchefuncte River near Covington, Dawson Creek at Baton Rouge, Bayou Boeuf at Amelia, Bayou Grosse Tete at Rosedale, Bayou des Cannes near Eunice, Mermentau River at Mermentau, Bayou Lacassine near Lake Arthur, and Whiskey Chitto Creek near Oberlin. Basic-fixed sites are sampled monthly and at high-flows for 2 years of the 3-year high-intensity phase. The intensive-fixed sites are monitored more frequently (as often as weekly) for at least 1 year, to characterize short-term variations of water quality. During 1999, all eight basic-fixed sites will be operated as intensive-fixed sites. In 2000, three of the eight sites will be sampled as intensive-fixed sites.

Basic-fixed or intensive-fixed sites can be either indicator or integrator sites. Indicator sites represent relatively homogeneous, small

basins (less than 100 mi<sup>2</sup>) associated with specific environmental settings, such as a particular land use that may affect water quality. Integrator sites are established at downstream points in large (thousands of square miles) relatively heterogeneous drainage basins with complex combinations of land-use settings. Indicator sites typically are located in the drainage basins of integrator sites. Bayou Boeuf at Amelia and Mermentau River at Mermentau are integrator sites; the other six are indicator sites.

Water samples are collected at many sites as part of synoptic (short-term) studies of specific water-quality conditions or issues during a specific hydrologic period (for example during low streamflow). Synoptic studies provide greater spatial coverage and allow investigators to assess whether the basic-fixed or intensive-fixed sites are representative of streams throughout the study unit. Bed-sediment and fish-tissue studies assess trace elements and hydrophobic organic contaminants at about 20 sites to determine their occurrence and distribution in the study unit. Ecological studies evaluate the relations among physical, chemical, and biological characteristics of streams. Aquatic biological communities at the basic- and intensive-fixed sites are surveyed during the 3-year high-intensity monitoring phase. These surveys are done along a delineated stream reach and include a habitat assessment of the site and annual surveys of the fish, algal, and benthic invertebrate communities. Additionally, ecological sampling may be integrated with surface-water synoptic studies to provide greater spatial coverage and to assess whether the biological communities at basic- and intensive-fixed sites are representative of streams throughout the study unit.

### Ground Water

The national study design for ground water focuses on water-quality conditions in major aquifers, with emphasis on recently recharged ground water associated with recent and current human activities, by using study-unit surveys, land-use studies, and flowpath studies. Ground-water samples are analyzed for major inorganic ions, nutrients, pesticides, volatile organic compounds, and trace elements. Study-unit surveys are used to assess the water quality of the major aquifer systems of each study unit. About 30 wells in each of 2 to 3 aquifers are randomly selected to be sampled for study-unit surveys. Land-use studies focus on recently recharged shallow aquifer systems so that the influences of land-use practices and natural conditions can be assessed. Typically, about 30 new observation wells are drilled at randomly selected sites within each land-use type and aquifer for land-use surveys. The first land-use study in the Acadian-Pontchartrain study will focus on the rice-growing area of southwestern Louisiana. Results from the land-use studies can be compared with results from the general study-unit survey to determine the effects of particular land uses on ground-water quality. Flowpath studies use transects and groups of clustered, multilevel observation wells to examine specific relations among land-use practices; ground-water flow; and contaminant occurrence, transport, and interactions between ground and surface water.

## COMMUNICATION AND COORDINATION

Communication and coordination between the U.S. Geological Survey and other scientific and land- and water-management organizations are critical components of the NAWQA Program. Each study unit maintains a liaison committee consisting of representatives from Federal, State, and local agencies, universities, the private sector, watershed organizations, and those who have water-resource responsibilities and interests. Committee activities include the exchange of information about regional and local water-quality issues, identification of sources of data and information, assistance in the design and scope of study products, and the review of study planning documents and reports. The liaison committee for the Acadian-Pontchartrain study was formed in 1997.

The overall success of the Acadian-Pontchartrain NAWQA study will depend on the advice, cooperation, and information from the public and many Federal, State, regional, and local agencies, concerned about Louisiana's water resources. The assistance and suggestions of all are welcomed.

## SUGGESTIONS FOR FURTHER READING

- Gilliom, R.J., Alley, W.M., and Gurtz, M.E., 1995, Design of the National Water-Quality Assessment Program: Occurrence and distribution of water-quality conditions: U.S. Geological Survey Circular 1112, 33 p.
- Leahy, P.P., Rosenshein, J.S., and Knopman, D.S., 1990, Implementation plan for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 90-174, 10 p.

## FOR MORE INFORMATION

Information on technical reports and hydrologic data related to the NAWQA Program can be obtained from:

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