STATE OF LOUISIANA

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

OFFICE OF PUBLIC WORKS, HURRICANE FLOOD PROTECTION

AND INTERMODAL TRANSPORTATION

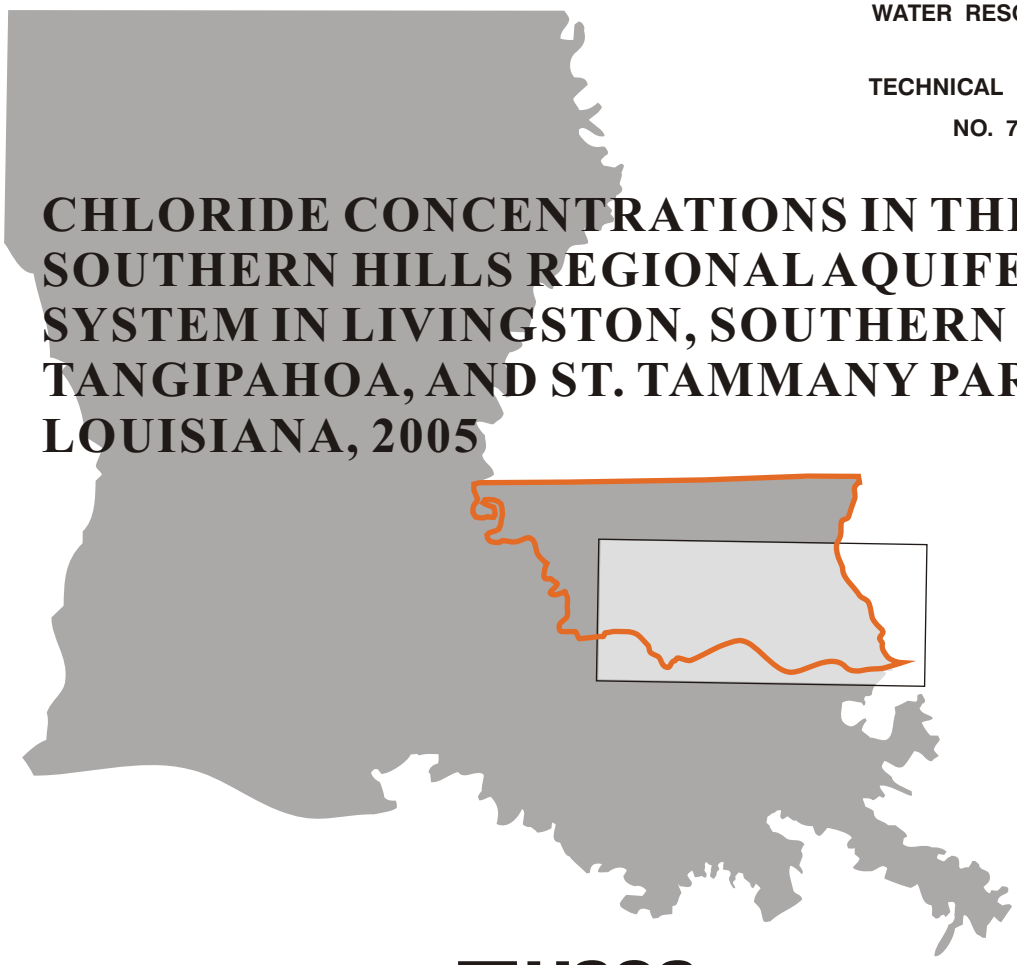
PUBLIC WORKS AND WATER RESOURCES SECTION

WATER RESOURCES

TECHNICAL REPORT

NO. 76

CHLORIDE CONCENTRATIONS IN THE SOUTHERN HILLS REGIONAL AQUIFER SYSTEM IN LIVINGSTON, SOUTHERN TANGIPAHOA, AND ST. TAMMANY PARISHES, LOUISIANA, 2005



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By
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CONVERSION FACTORS, DATUMS, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
inch per year (in/yr)	25.4	millimeter per year (mm/yr)
foot (ft)	0.3048	meter (m)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)

Vertical coordinate information in this report is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).
Horizontal coordinate information in this report is referenced to the North American Datum of 1927 (NAD 27).

Temperature in degrees Fahrenheit (^oF) can be converted to degrees Celsius (^oC) as follows: $^oC = (^oF - 32)/1.8$.

Abbreviated water-quality units:

micrometer (µm)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)
milligrams per liter (mg/L)
milliliter (mL)

CHLORIDE CONCENTRATIONS IN THE SOUTHERN HILLS REGIONAL AQUIFER SYSTEM IN LIVINGSTON, SOUTHERN TANGIPAHOA, AND ST. TAMMANY PARISHES, LOUISIANA, 2005

By Lawrence B. Prakken

ABSTRACT

The Southern Hills regional aquifer system (Southern Hills aquifer system) is a principal source of fresh ground water in Livingston, southern Tangipahoa, and St. Tammany Parishes in southeastern Louisiana. The freshwater system extends from the northern limit of the recharge area in the vicinity of Vicksburg, Mississippi, southward to approximately the Baton Rouge fault. The Baton Rouge fault trends from west to east and extends across southern Livingston, Tangipahoa, and St. Tammany Parishes. Ground water is generally fresh north of the Baton Rouge fault and saline (water with a chloride concentration of at least 250 mg/L [milligrams per liter]) south of the fault. In 2005, 100 wells were sampled for chloride and specific conductance to determine whether saltwater may be encroaching across the Baton Rouge fault into the Southern Hills aquifer system in Livingston, southern Tangipahoa, and St. Tammany Parishes in response to ground-water withdrawals north of the fault. Chloride concentrations exceeded 250 mg/L in water from only 2 of the 100 wells sampled in 2005. The background concentration (level) for chloride in water from the Southern Hills aquifer system is considered to be less than 10 mg/L in this report.

In Livingston Parish, 31 wells were sampled; 26 wells were north of the fault, and 5 wells were south of the fault. North of the fault, chloride concentrations were at background level. South of the fault, chloride concentrations were at background level except at one well, which had a chloride concentration of 56.1 mg/L. A comparison of historical with 2005 chloride data available for two wells located south of the fault indicated no increase in chloride concentrations at these wells.

All wells sampled in southern Tangipahoa Parish were located north of the Baton Rouge fault. Chloride concentrations in all wells sampled in the parish were at background level. A comparison of historical with 2005 chloride data available for six of the wells sampled in the parish indicated no increase in chloride concentrations at the wells.

All wells sampled in St. Tammany Parish were located north of the Baton Rouge fault. Chloride concentrations exceeded background level in 14 wells sampled in the parish. Chloride concentrations greater than background level were detected in the Slidell area in the upper Ponchatoula (3 wells), lower Ponchatoula (6 wells), and the Slidell (1 well) aquifers. Chloride concentrations greater than background level also were detected in the Big Branch aquifer near Lacombe (four wells). A comparison of historical with 2005 chloride data available for 12 of the wells sampled in St. Tammany Parish indicated no increase in chloride concentrations at the wells.

In St. Tammany Parish, four wells screened in the upper Ponchatoula aquifer were sampled in 2005. Three of these wells had chloride concentrations greater than background level. The highest concentration, 39.2 mg/L, was from a well located about 2 miles south of the Slidell airport. An area of chloride

concentrations greater than background level has been illustrated for the upper Ponchatoula aquifer in the Slidell area. The delineation is based on 2005 chloride data and historical chloride data from seven wells. Historical chloride data for the upper Ponchatoula aquifer in the Slidell area provide evidence that chloride concentrations greater than background level have been present for some time and are not a new phenomenon.

In the lower Ponchatoula aquifer, eight wells were sampled in 2005 in the Slidell area; six wells had chloride concentrations greater than background level. The highest chloride concentration, 99.7 mg/L, was from a well located west-southwest of the Slidell airport. An area of chloride concentrations greater than background level in the Slidell area has been illustrated for this aquifer. The delineation is based on 2005 chloride data and historical chloride data from seven wells. Historical chloride data for the lower Ponchatoula aquifer in the Slidell area provide evidence that chloride concentrations greater than background level have been present for some time, and are not a new phenomenon. Chloride concentrations greater than background level in wells screened in the upper and lower Ponchatoula aquifers may be remnant seawater which has not been flushed southward by freshwater recharge as completely as in deeper aquifers.

Chloride concentrations from four wells screened in the Big Branch aquifer exceeded background level. The highest chloride concentration was 1,600 mg/L in water from a well located in Lacombe. The Big Branch aquifer is known to have high chloride concentrations in this area. Chloride concentrations in the other three wells ranged from 38.4 to 465 mg/L. The wells were between Lacombe and Mandeville. An area containing chloride concentrations greater than background level has been illustrated for the Big Branch aquifer near Lacombe. Data collected for this study indicated no increase in chloride concentrations in the Big Branch aquifer. Of five wells screened in the Slidell aquifer in the Slidell area, only one well had a chloride concentration (12 mg/L) greater than background level.

INTRODUCTION

The Southern Hills regional aquifer system (Southern Hills aquifer system), which extends from southwestern Mississippi southward to approximately the Baton Rouge fault (Buono, 1983, p. 5-6, fig. 2), is a principal source of fresh ground water in Livingston, southern Tangipahoa, and St. Tammany Parishes in southeastern Louisiana. The Baton Rouge fault trends from west to east and extends across southern Livingston, Tangipahoa, and St. Tammany Parishes (fig. 1). Ground water is generally fresh north of the Baton Rouge fault and saline (water with a chloride concentration of at least 250 mg/L) south of the fault (Tomaszewski, 1996). West of the three parishes, in East Baton Rouge Parish, saltwater has encroached in response to large (136 Mgal/d in 2000; Sargent, 2002) ground-water withdrawals north of the fault, which have lowered water levels and created a hydraulic gradient for northward flow across the fault (Tomaszewski, 1996). Similar conditions of increasing ground-water withdrawals and declining water levels north of the fault may be inducing saltwater encroachment into the Southern Hills aquifer system in Livingston, southern Tangipahoa, and St. Tammany Parishes. Chloride concentration and specific conductance data are needed to determine whether wells in the Southern Hills aquifer system in the three parishes have been affected by saltwater encroachment. In 2004, the U.S. Geological Survey (USGS), in cooperation with the Louisiana Department of Transportation and Development (DOTD), began a study to document freshwater and saltwater areas north of the Baton Rouge fault in these parishes.

Purpose and Scope

This report describes chloride concentrations in the Southern Hills aquifer system. Chloride and specific conductance data were collected in 2005 from 95 wells screened in the aquifer system, which is located north of the Baton Rouge fault, and 5 wells which were located south of the fault. Data are presented in tables and maps. Areas where chloride concentrations are greater than background

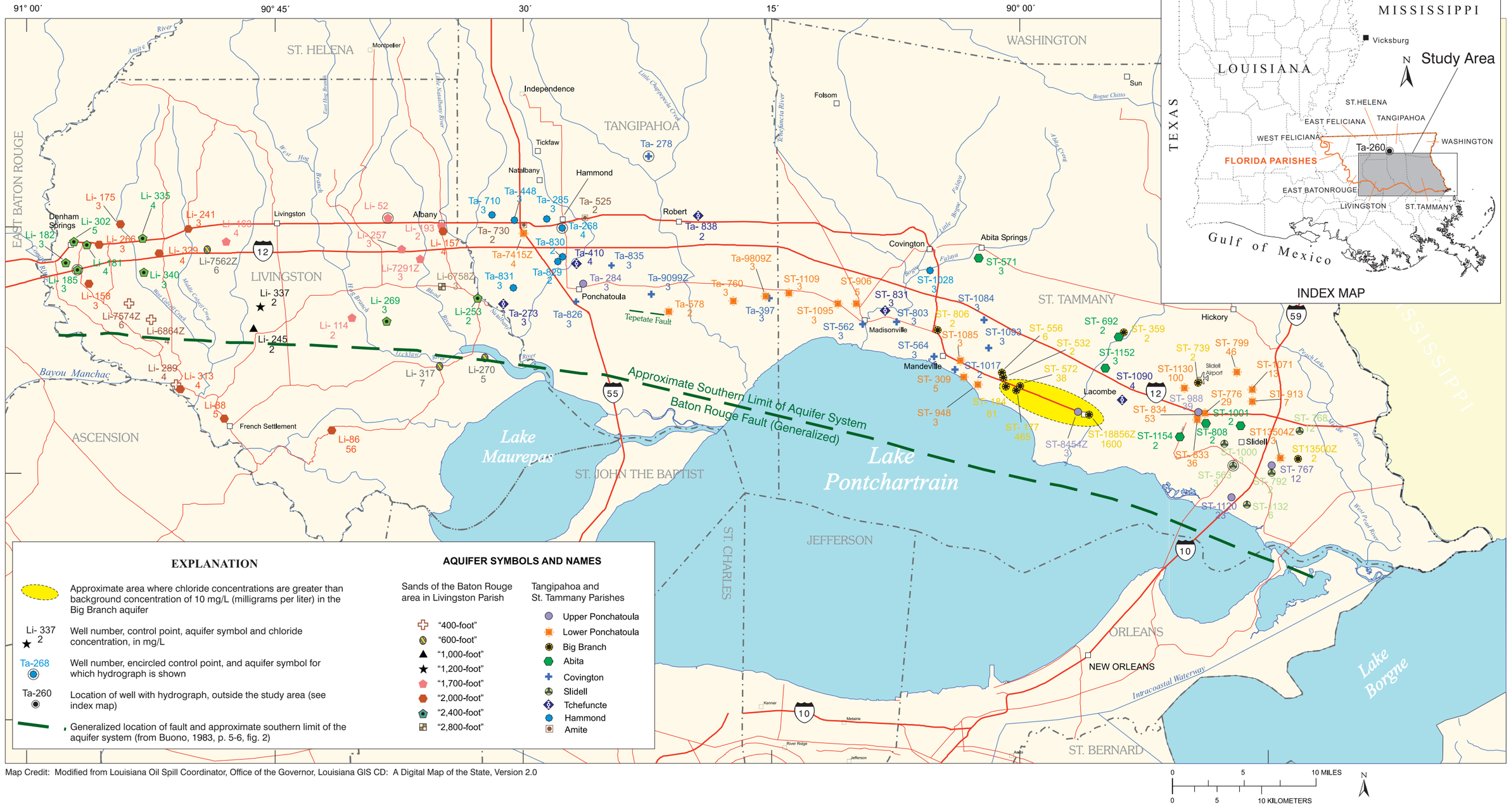

Figure 1. Well locations in the study area and chloride concentrations in water from the Southern Hills regional aquifer system in Livingston, southern Tangipahoa, and St. Tammany Parishes, Louisiana, 2005.

concentration (level) for selected aquifers are identified and shown on maps. The background level for chloride concentrations in water from the Southern Hills aquifer system is considered to be less than 10 mg/L in this report. Historical chloride data were used to help delineate the areas and determine whether concentrations were changing over time. Results of this study may help improve the understanding of saltwater encroachment in similar areas of the United States.

Description of the Study Area

The study area, located in southeastern Louisiana (fig. 1), encompasses all of Livingston and St. Tammany Parishes and southern Tangipahoa Parish and is approximately 2,240 mi^2. Livingston, Tangipahoa, and St. Tammany Parishes are part of a group of parishes known locally as the Florida Parishes. The Florida Parishes are located generally east of the Mississippi River and north of Lakes Maurepas and Pontchartrain in southeastern Louisiana and include eight parishes: East Baton Rouge, East and West Feliciana, St. Helena, Livingston, Tangipahoa, St. Tammany, and Washington Parishes. In this report, the eastern Florida Parishes consist of Tangipahoa, St. Tammany, and Washington Parishes (see index map, fig. 1). The remaining five parishes, including Livingston Parish, are considered the western Florida Parishes. The study area has a temperate, almost subtropical climate with hot, humid summers and mild winters. The mean annual air temperature at Hammond for the 30-year period 1971 to 2000 was 66.7°F, and the mean precipitation for the same period was 64.02 in/yr (National Oceanic and Atmospheric Administration, 2001, p. 9, 12). From 1990 to 2000, some of the largest population increases in the State occurred in St. Tammany (32.4 percent), Livingston (30.2 percent), and Tangipahoa (17.4 percent) Parishes (Louisiana Census Data Center, 2001). The largest population centers in the study area are the city of Slidell (about 25,700), the Hammond-Ponchatoula area (about 22,800), the Covington-Mandeville area (about 19,000), and the town of Denham Springs (8,757) (U.S. Census Bureau, 2003).

Methods of Study

Previous reports and available data were reviewed to determine where saltwater may be present and where saltwater potentially may encroach. Water-quality data available from the DOTD and the Louisiana Department of Health and Hospitals were reviewed. Well construction and well location data from the DOTD were used to identify wells in areas of potential saltwater encroachment (areas with large groundwater withdrawals and located near the Baton Rouge fault). Pumpage data from the USGS were used to determine the location of withdrawal centers. Chloride concentration and specific conductance data on file at the USGS were evaluated. A well selected for sampling met most of the following criteria: near the fault, near or at a withdrawal center, screened in a single aquifer with declining water levels, and previously sampled (for comparison purposes).

A chloride concentration greater than or equal to 250 mg/L was used as an indicator of the presence of freshwater or saltwater. The 250 mg/L concentration is a Secondary Maximum Contaminant Level (SMCL)[1] that the U.S. Environmental Protection Agency (USEPA) has established for chloride in public water systems (U.S. Environmental Protection Agency, 2005a). The background level for the Southern Hills aquifer system was selected based on chloride data collected during this study: 78 percent of the 95 wells sampled north of the fault had chloride concentrations less than 5 mg/L, and 85 percent had concentrations less than 10 mg/L.

[1]Secondary Drinking-Water Regulations Secondary Maximum Contaminant Level (SMCL): Contaminants that affect the aesthetic quality of drinking water. At high concentrations or values, health implications as well as aesthetic degradation may also exist. SMCL's are not Federally enforceable, but are intended as guidelines for the states (U.S. Environmental Protection Agency, 2005a).

Before sample collection, wells were purged to remove stagnant water. Specific conductance and water temperature were monitored using a calibrated field instrument and recorded after readings stabilized. Samples were then collected at or near the wellhead before treatment, pressurization, or storage. A 250-mL filtered-water sample (using a 0.45-micrometer filter) was collected for laboratory analysis of chloride concentration. A 250-mL unfiltered water sample was collected for laboratory measurement of specific conductance. Quality control (QC) samples were collected to ensure sample-collection, sample processing, and laboratory-analytical procedures did not introduce bias into results, and to determine the precision associated with the samples. As part of the QC process, five replicate samples were collected and analyzed for chloride and specific conductance. Another five samples were analyzed for major inorganic ions and acid neutralizing capacity, in addition to specific conductance and chloride concentration to ensure ionic balances were correct. All replicate chloride samples were within 0.9 mg/L of their primary sample. All samples were collected using standard USGS protocols (U.S. Geological Survey, 1997-present) and shipped to the USGS National Water Quality Laboratory in Denver, Colorado, for analysis (Fishman and Friedman, 1989; Fishman, 1993; American Public Health Association, 1998). All data, including QC results which are not presented in this report, are on file at the USGS office in Baton Rouge, Louisiana.

Previous Investigations

Several USGS reports describe ground-water resources in the study area, including chloride and other water-quality data, but not chloride-specific studies. Local aquifers in Livingston Parish were named based on work by Meyer and Turcan (1955) and Morgan (1961). Cardwell and others (1967) described the water resources of the Lake Pontchartrain area, including the quantity and quality of ground water available beneath the lake. Nyman and Fayard (1978) presented general water-quality data (including chloride concentrations) from wells located primarily in Tangipahoa, Washington, and St. Tammany Parishes, and identified and described the individual aquifers in these parishes. Tomaszewski (1988) described aquifers in Livingston and St. Helena Parishes and presented extensive water-quality data, including major inorganic constituents, minor elements, organic chemicals, and radionuclides, from wells in these parishes. Rapp (1994) described the hydrogeology and defined the southern limit of freshwater in the aquifers underlying southern Tangipahoa Parish, adjacent parishes, and northwestern Lake Pontchartrain. Rapp (1994) included water-quality data for 8 wells in St. Tammany Parish and 12 wells in Tangipahoa Parish. Griffith (2003) illustrated the hydrogeologic framework of freshwater aquifers in southeastern Louisiana in a series of 6 north-to-south and 11 west-to-east hydrogeologic sections.

Acknowledgments

The author gratefully acknowledges the assistance and cooperation of the many public water suppliers and private well owners who allowed USGS personnel to sample their wells. Additionally, the author thanks Zahir “Bo” Bolourchi, Chief, Public Works and Water Resources Section, Louisiana Department of Transportation and Development, for providing well information used for this study.

HYDROGEOLOGY

The Southern Hills aquifer system is composed of a gulfward dipping and thickening wedge of sediments that generally range in age from Miocene at the base to Pliocene or Pleistocene at the top (fig. 2). The aquifer system includes many named aquifers (sand and gravel deposits) (fig. 2) and clay layers, which act to retard the vertical flow of water between aquifers. The freshwater system extends from the northern limit of the recharge area in the vicinity of Vicksburg, Mississippi (fig. 1 index map), southward to

approximately the Baton Rouge fault (fig. 1) (Buono, 1983, p. 5-6, fig. 2). Freshwater is present to depths greater than 3,000 ft below NGVD 29 north of the Baton Rouge fault in Livingston Parish (Tomaszewski, 1988, p. 34), and to depths of about 2,750 ft below NGVD 29 (Nyman and Fayard, 1978, pl. 9) south of Slidell in St. Tammany Parish. Aquifer thickness in the study area varies; an aquifer may be absent at some locations or merge with an adjacent aquifer at locations where the confining clay layer is missing. Table 1 includes extents of the aquifers in the three parishes. Aquifers in the eastern Florida Parishes have different names than those to the west. The aquifers in the eastern Florida Parishes were named by Nyman and Fayard (1978). Meyer and Turcan (1955) named aquifers in East Baton Rouge Parish, which have been applied to all the western Florida Parishes, as well as West Baton Rouge and Pointe Coupee Parishes. Figure 2 shows a stratigraphic column of hydrogeologic units in the study area.

The Tepetate-Baton Rouge fault system extends throughout the study area and consists of at least two active faults. The Tepetate and Baton Rouge faults each consist of a partially discontinuous network of parallel and en echelon[2] fault sets. The faults are a series of east-to-west trending normal faults, where the southern block has moved downward relative to the northern block. These are reactivated growth faults that dip toward the Gulf of Mexico and generally show increasing displacement with depth. Displacement and deformation of the sediments at the faults can interrupt ground-water flow, resulting in a general reduction in hydraulic interconnectivity, abrupt changes in water levels, and changes in water quality (Griffith, 2003). The effects of the Baton Rouge fault on ground-water flow outside of East Baton Rouge Parish are uncertain (Griffith, 2003).

The location of the Tepetate-Baton Rouge faults are poorly defined within the study area. For this report, a dashed line is used to represent a very generalized location of the Baton Rouge fault (fig. 1). The Tepetate fault is not illustrated in this report except for an area in southern Tangipahoa Parish where a section of the Tepetate fault, located south of well Ta-578 (fig. 1) has been identified.[3] South of this fault section, the lower Ponchatoula aquifer contains brackish water (Rapp, 1994). In St. Tammany Parish, the Baton Rouge fault is located beneath Lake Pontchartrain (Cardwell and others, 1967, pl. 2).

South of the Baton Rouge fault, many of the aquifers contain saltwater (Griffith, 2003, pls. 14, 15). In Livingston Parish, the "400-foot" sand contains freshwater for several miles south of the fault, but apparently becomes salty farther south (Griffith, 2003, pl. 15). No wells are screened between the "600-foot" and "2,000-foot" sands south of the fault in Livingston Parish. The "2,000-foot" sand contains freshwater south of the Baton Rouge fault in Livingston Parish, but the extent of this freshwater is unknown. Three of the four wells screened in the "2,000-foot" sand south of the fault in Livingston Parish were sampled for this report. Precipitation north of the study area in Louisiana and southwestern Mississippi is the principal source of recharge to the Southern Hills aquifer system (Buono, 1983). Additional recharge occurs throughout the aquifer system by vertical leakage from areas of higher hydraulic head to areas of lower hydraulic head (Nyman and Fayard, 1978, p. 10). The direction of ground-water movement in shallow aquifers ("400-foot" and "600-foot" sands and upper Ponchatoula aquifer) is generally down dip and southward (Nyman and Fayard, 1978, p. 22, pl. 6; Kuniansky, 1989, p. 8, fig. 4). Large ground-water withdrawals in East Baton Rouge Parish have resulted in cones of depression forming in the potentiometric surfaces of the deeper aquifers ("1,500-foot," "1,700-foot," "2,000-foot," and "2,400-foot" sands of the Baton Rouge area) and have induced ground-water flow toward the largest withdrawal centers (city of Baton Rouge) (Tomaszewski, 1996; Tomaszewski and Accardo, 2004a, 2004b; Prakken, 2004). In areas of Livingston Parish north of the fault, the effect of large withdrawals is pronounced; ground-water flow is southwestward in the northern part of the parish and west-southwestward near the Baton Rouge fault (Tomaszewski, 1996; Tomaszewski and Accardo, 2004a, 2004b; Prakken, 2004). Withdrawals in East Baton

[2]A group of subparallel, closely-spaced, step-like, overlapping, or staggered arrangement of short faults that collectively form a linear fault zone (Bates and Jackson, 1984, p. 179).

[3]Rapp (1994) identified this section as part of the Baton Rouge fault; however, Griffith (2003) has identified it as part of the Tepetate fault.

System	Series	Stratigraphic unit		Hydrogeologic unit					
					Aquifer system or confining unit	Aquifer or confining unit: Baton Rouge area[1]		Aquifer or confining unit: Eastern Florida Parishes: St. Tammany, Tangipahoa, and Washington Parishes	
Quaternary	Holocene	Mississippi River and other alluvial deposits			Near-surface aquifers or surficial confining unit	Mississippi River alluvial aquifer		Shallow sands	
	?				?				
	Pleistocene	Unnamed Pleistocene deposits		Southern Hills regional aquifer system[2]	Chicot equivalent aquifer system or surficial confining unit	Shallow sands			
						Upland terrace aquifer	"400-foot" sand	Upland terrace aquifer	
							"600-foot" sand	Upper Ponchatoula aquifer	
Tertiary	Pliocene	Fleming Formation	Blounts Creek Member		Evangeline equivalent aquifer system or surficial confining unit	"800-foot" sand		Lower Ponchatoula aquifer	
	?					"1,000-foot" sand			
	Miocene					"1,200-foot" sand		Big Branch aquifer	
						"1,500-foot" sand		Kentwood aquifer system	Kentwood aquifer
									Abita aquifer
						"1,700-foot" sand			Covington aquifer
									Slidell aquifer
			Castor Creek Member		Unnamed confining unit	Unnamed confining unit			
			Williamson Creek Member Dough Hills Member Carnahan Bayou Member		Jasper equivalent aquifer system	"2,000-foot" sand		Tchefuncte aquifer	
						"2,400-foot" sand		Hammond aquifer	
								Amite aquifer	
						"2,800-foot" sand		Ramsay aquifer	
			Lena Member		Unnamed confining unit	Unnamed confining unit			
	?								
	Oligocene	Catahoula Formation			Catahoula equivalent aquifer system	Catahoula aquifer		Franklinton aquifer	

[1]East Baton Rouge, East Feliciana, Livingston, Pointe Coupee, St. Helena, West Baton Rouge, and West Feliciana Parishes.
[2]Buono (1983).

Figure 2. Partial stratigraphic column of hydrogeologic units in southeastern Louisiana.

Table 1. Number and uses of wells by parish and aquifer, general water quality south of the Baton Rouge fault, and aquifer extent.

Aquifer	Number of wells					General water quality south of the Baton Rouge fault	Aquifer extent
	Total[1]	Domestic wells[1]	Public supply wells[1]	South of the Baton Rouge fault[1]	Sampled in 2005		
Sands of the Baton Rouge area in Livingston Parish							
"400-foot" sand	615	523	42	More than 50	3	Generally freshwater, but some areas with saltwater[2,3]	Underlies most of Livingston Parish and merges with the upland terrace aquifer north of Livingston Parish[3]
"600-foot" sand	119	106	5	Less than 20	3	Some freshwater near the fault, but salty farther south[2,3]	Underlies most of Livingston Parish and merges with the upland terrace aquifer north of Livingston Parish[3]
"800-foot" sand	6	5	1	0	0	Some freshwater near the fault, but salty farther south[2,3]	Underlies Livingston Parish[2]
"1,000-foot" sand	8	5	3	0	1	Generally salty[2]	Underlies Livingston Parish[2]
"1,200-foot" sand	7	3	3	0	1	Generally salty[2]	Underlies Livingston Parish[2]
"1,500-foot" sand	3	2	1	0	0	Generally salty[2]	Underlies Livingston Parish[2]
"1,700-foot" sand	43	18	19	0	5	Generally salty[2]	Underlies Livingston Parish[2]
"2,000-foot" sand	24	7	15	4	9	Generally salty, but some areas of freshwater[2]	Underlies Livingston Parish[2]
"2,400-foot" sand	16	3	10	0	8	Generally salty[2]	Underlies Livingston Parish[2]
"2,800-foot" sand	5	0	4	0	1	Generally salty[2]	Underlies Livingston Parish[2]
Aquifers in St. Tammany Parish							
Upper Ponchatoula	2,257	2,056	146	0	4	Generally salty, but some areas of freshwater in upper half of aquifer[3]	Underlies southern St. Tammany Parish. Merges with the upland terrace aquifer about 5 miles north of Covington[3,4]
Lower Ponchatoula	1,465	1,274	129	0	14	Generally salty[3]	Underlies St Tammany Parish[3]
Big Branch	52	36	12	0	10	Generally salty[3]	Underlies St Tammany Parish[3]
Abita	89	60	20	0	6	Generally salty[3]	Underlies St. Tammany Parish. Merges with the Covington aquifer to form the Kentwood aquifer in northern Tangipahoa and Washington Parishes[4]
Covington	92	45	36	0	6	Generally salty[3]	Underlies St. Tammany Parish. Merges with the Abita aquifer to form the Kentwood aquifer in northern Tangipahoa and Washington Parishes[4]

Table 1. Number and uses of wells by parish and aquifer, general water quality south of the Baton Rouge fault, and aquifer extent.—Continued

Aquifer	Number of wells					General water quality south of the Baton Rouge fault	Aquifer extent
	Total[1]	Domestic wells[1]	Public supply wells[1]	South of the Baton Rouge fault[1]	Sampled in 2005		
Aquifers in St. Tammany Parish—Continued							
Slidell	30	5	25	0	5	Generally salty[3]	Underlies southeastern St. Tammany Parish. Interfingers with the Covington aquifer north of a line between Abita Springs and Hickory, or grades to clay. Thin or missing in southwestern St. Tammany Parish[4]
Tchefuncte	41	16	20	0	2	Generally salty[3]	Underlies St. Tammany Parish[1]
Hammond	22	7	11	0	1	Generally salty[3]	Underlies St. Tammany Parish[4]
Amite	4	1	3	0	0	Generally salty[3]	Underlies St. Tammany Parish[4]
Aquifers in Tangipahoa Parish							
Upper Ponchatoula	925	794	38	5	1	Some freshwater near the fault, but salty farther south[3,4]	Underlies southern Tangipahoa Parish. Merges with the upland terrace aquifer about 7.5 miles north of Hammond, Louisiana[3]
Lower Ponchatoula	51	35	7	0	4	Generally salty[3,4]	Underlies Tangipahoa Parish[3]
Big Branch	2	0	0	0	0	Generally salty[3]	Underlies southern Tangipahoa Parish, but is discontinuous[3]
Abita	11	4	0	0	0	Generally salty[3]	Underlies southern Tangipahoa Parish. Merges with the Covington aquifer to form the Kentwood aquifer in northern Tangipahoa and Washington Parishes[4]
Covington	29	16	9	0	4	Generally fresh[3,4]	Underlies southern Tangipahoa Parish. Merges with the Abita aquifer to form the Kentwood aquifer in northern Tangipahoa and Washington Parishes[4]
Tchefuncte	12	4	5	0	3	Generally fresh[3,4,5]	Underlies southern Tangipahoa Parish. Is generally absent in northern Tangipahoa Parish[4]
Hammond	27	9	15	0	7	Generally salty[4]	Underlies Tangipahoa Parish[4]
Amite	40	6	31	0	2	Generally salty[4]	Underlies Tangipahoa Parish[4]

[1]Number of wells based on active wells listed in the Louisiana Department of Transportation and Development well-registration data base.
[2]Tomaszewski, 1988.
[3]Griffith, 2003.
[4]Nyman and Fayard, 1978.
[5]Rapp, 1994.

Rouge Parish have less effect in Tangipahoa Parish and no effect in St. Tammany Parish (Prakken, 2004). In southern Tangipahoa Parish, the direction of ground-water flow generally is southward toward withdrawal centers in the Hammond-Ponchatoula area (Prakken, 2004). In St. Tammany Parish, the flow generally is south to southeastward toward withdrawal centers in the Covington-Mandeville and Slidell areas (Prakken, 2004).

WATER WITHDRAWALS AND LEVELS

The population centers in the study area also are withdrawal centers. The population increases have been accompanied by increased withdrawals of ground water during the same period (Lovelace, 1991; Sargent, 2002). Withdrawals increased by 63 percent in Livingston Parish, 40 percent in St. Tammany Parish, and 35 percent in Tangipahoa Parish. In St. Tammany Parish, ground-water withdrawals for public-supply and industrial use were about 6.7 Mgal/d in the Covington-Mandeville area and 9.6 Mgal/d in the Slidell area. These withdrawals accounted for about 65 percent of the total ground water withdrawn in St. Tammany Parish in 2000 (Sargent, 2002; B.P. Sargent, U.S. Geological Survey, written commun., 2006). In 2000, public-supply use in Denham Springs was about 5.3 Mgal/d, or about 44 percent of the total ground water withdrawn in Livingston Parish. Ground-water withdrawals for public-supply and industrial use in the Hammond-Ponchatoula area were about 6.1 Mgal/d in 2000, about 34 percent of the total ground water withdrawn in Tangipahoa Parish (Sargent, 2002). Water-level data from selected wells in southeastern Louisiana indicate that water levels in the deeper, heavily pumped aquifers declined about 1 to 2 ft/yr during the period 1990 to 2000 (Tomaszewski and others, 2002). In 1988, the Southern Hills aquifer system was declared a sole source aquifer[4] by the USEPA.

Water-level trends in the study area have been documented by Tomaszewski and others (2002). Historical and current (2005) water-level data indicate declining water levels. Hydrographs for six wells representative of water levels in the deeper aquifers of the Southern Hills aquifer system are presented in figure 3. Five of the six wells are within the study area and are identified in figure 1. Well Ta-260 is north of the study area; the location is shown on the index map in figure 1. Hydrographs (fig. 3) which illustrate water levels in the study area are available from the USGS at the following Internet address: http://waterdata.usgs.gov/la/nwis/gw

CHLORIDE CONCENTRATIONS

In 2005, 100 wells were sampled for determination of chloride concentration and specific conductance. Twenty-five of the wells had been sampled previously; thus, historical chloride data were available for comparative purposes. Figure 1 shows well locations and corresponding chloride concentrations for samples collected in 2005. Table 1 presents by parish and aquifer, the total number of active (unplugged) wells, number of active domestic wells and public-supply wells, number of wells located south of the Baton Rouge fault, number of wells sampled in 2005, general comments regarding water quality south of the Baton Rouge fault, and a description of aquifer extent. Table 2 lists well-location and construction information, and chloride concentration and specific conductance data for wells sampled. Chloride concentrations exceeded the SMCL of 250 mg/L in only 2 of the 100 wells sampled, wells ST-177 and ST-18856Z, which are located in St. Tammany Parish and screened in the Big Branch aquifer.

[4]A Sole Source Aquifer is an aquifer designated by the U.S. Environmental Protection Agency as the "sole or principal source" of drinking water for a given service area; that is, an aquifer which is needed to supply 50 percent or more of the drinking water for that area and for which there are no reasonably available alternative sources should the aquifer become contaminated (U.S. Environmental Protection Agency, 2005b).

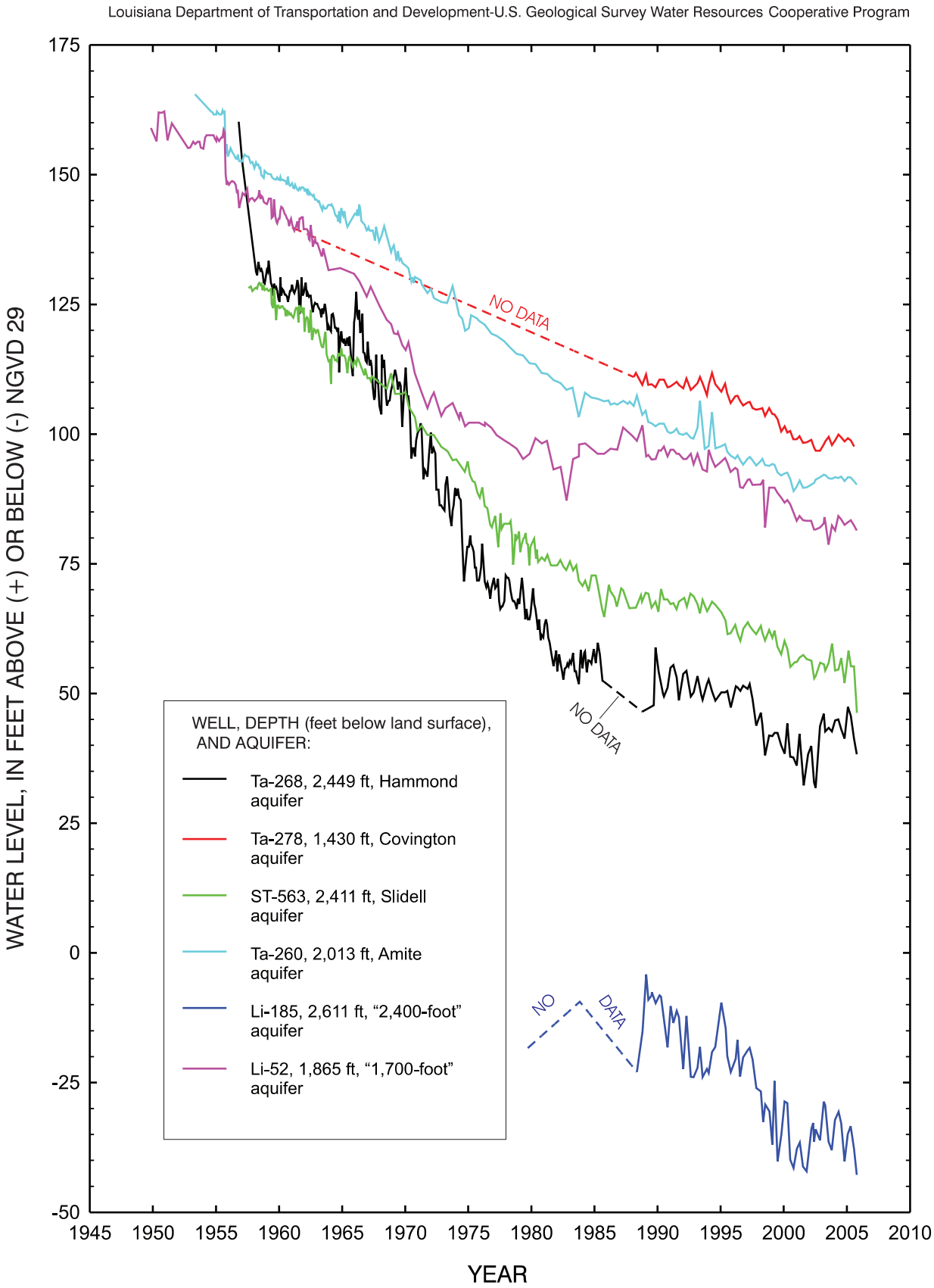

Figure 3. Water-level declines in deeper freshwater aquifers in Livingston, southern Tangipahoa, and St. Tammany Parishes, Louisiana.

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
Livingston Parish												
Li-86	301739	904135	12220BR	1962	10	2,943	2,903	2,943	40	4/29/1962	78.0	--
Li-86										5/15/1962	100	--
Li-86										5/17/1962	100	1,180
Li-86										3/26/1984	66.0	997
Li-86										3/11/2005	56.1	970
Li-88	301821	904805	12220BR	1962	15	2,715	2,675	2,715	40	9/07/1962	4.0	341
Li-88										9/13/1962	8.0	--
Li-88										1/08/1964	4.5	326
Li-88										4/14/1966	3.0	348
Li-88										3/22/2005	4.81	386
Li-114	302430	904023	12117BR	1967	16	2,300	2,280	2,300	20	3/18/2005	2.02	287
Li-157	302946	903452	12220BR	1972	30	2,230	2,200	2,230	30	10/17/1972	3.6	190
Li-157										3/10/2005	3.75	199
Li-158	302634	905616	12220BR	1972	32	2,375	2,285	2,375	90	3/23/2005	2.92	361
Li-163	302908	904758	12117BR	1973	35	2,068	--	--	--	3/05/1974	2.0	252
Li-163										3/18/2005	3.54	253
Li-175	303012	905421	12220BR	1974	50	1,866	1,816	1,866	50	9/20/1976	4.1	267
Li-175										3/21/2005	3.18	269
Li-181	302854	905623	12224BR	1978	45	2,432	2,340	2,432	92	3/23/2005	3.63	257
Li-182	302750	905739	12224BR	1978	41	2,634	2,552	2,634	82	3/23/2005	3.47	269

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
Livingston Parish—Continued												
Li-185	302724	905658	12224BR	1979	37	2,611	2,531	2,611	80	9/07/1984	5.0	265
Li-185										12/19/1986	3.1	283
Li-185										6/07/1988	3.0	265
Li-185										7/21/1989	6.2	270
Li-185										11/27/1990	5.3	262
Li-185										3/23/2005	3.27	275
Li-193	303005	903458	12117BR	1979	36	1,701	1,647	1,701	54	10/09/1979	1.9	--
Li-193										9/07/1984	2.0	263
Li-193										3/07/2005	2.14	265
Li-241	302954	905016	12220BR	1986	46	2,266	2,200	2,266	66	3/15/2005	3.35	257
Li-245	302350	904620	12110BR	1973	11	1,070	--	--	--	4/20/2005	2.37	303
Li-253	302541	903247	12224BR	1947	15	2,500	--	--	--	3/10/2005	2.26	617
Li-257	302840	903723	12117BR	1988	37	1,842	1,736.85	1,842	105.15	3/07/2005	3.18	242
Li-266	302856	905539	12220BR	1989	43	2,195	2,095	2,195	100	3/21/2005	2.64	317
Li-269	302416	903816	12224BR	1990	12	2,864	2,779	2,822	64	3/09/2005	2.73	335
							2,843	2,864				
Li-270	302203	903220	11206BR	1990	12	634	614	634	20	4/07/2005	4.95	258
Li-289	302026	905100	11204BR	1990	7	700	690	700	10	4/07/2005	3.75	317
Li-302	302908	905711	12224BR	1994	50	2,420	2,345	2,420	75	3/23/2005	5.32	260

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
Livingston Parish—Continued												
Li-313	302009	905045	12220BR	1997	10	2,650	2,570	2,650	80	4/05/2005	3.63	324
Li-317	302130	903504	11206BR	1999	10	690	630	690	60	3/30/2005	6.62	251
Li-329	302824	905202	12220BR	1974	30	2,140	2,090	2,140	50	3/15/2005	4.47	261
Li-335	302916	905300	12224BR	2000	40	2,600	2,355	2,600	245	3/15/2005	3.77	248
Li-337	302506	904556	12112BR	2003	25	1,400	1,300	1,400	100	3/29/2005	2.15	322
Li-340	302713	905256	12224BR	2004	30	2,560	2,500	2,560	60	4/05/2005	3.46	272
Li-6758Z	302623	903457	12228BR	1996	10	2,725	2,665	2,725	60	3/09/2005	2.82	261
Li-6864Z	302421	905230	11204BR	1997	30	380	350	380	30	4/12/2005	3.65	296
Li-7291Z	302804	903615	12117BR	2000	30	1,715	1,675	1,715	40	3/11/2005	3.26	290
Li-7562Z	302837	904907	11206BR	2001	40	560	530	560	30	4/12/2005	5.69	177
Li-7574Z	302520	905350	11204BR	2002	30	360	330	360	30	4/12/2005	5.77	293
St. Tammany Parish												
ST-7	301632	894654	121PNCLL	1929	7	1,080	1,020	1,080	60	9/12/1939	17.0	--
ST-7										5/20/1942	18.0	--
ST-8	301632	894657	112PNCLU	1909	7	610	--	--	--	9/12/1939	24.0	--
ST-9	301711	894651	121PNCLL	1939	10	885	--	--	--	12/12/1968	18.0	582
ST-29	301943	894556	121PNCLL	1940	26	1,280	--	--	--	4/07/1942	10.0	--
ST-35	302314	894512	112PNCLU	1933	25	310	--	--	--	4/08/1942	7.0	--
ST-36	302222	894531	112PNCLU	1940	23	301	--	--	--	4/08/1942	3.0	--

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
St. Tammany Parish—Continued												
ST-95	301514	894607	112PNCLU	1928	10	600	--	--	--	4/18/1950	22.0	584
ST-117	301807	894907	121PNCLL	--	15	900	--	--	--	4/18/1950	24.0	639
ST-177	302005	900015	121BGBC	1938	12	1,688	1,608	1,688	80	1/26/1939	550	--
ST-177										6/13/2005	465	1,770
ST-184	302018	900052	121BGBC	1938	15	1,681	--	--	--	6/16/2005	80.6	617
ST-309	302053	900325	121PNCLL	--	5	1,049	--	--	--	6/16/2005	5.05	256
ST-359	302336	895345	121BGBC	1939	27	1,235	1,195	1,235	40	6/08/2005	2.26	550
ST-428	302633	894653	112PNCLU	1938	25	265	--	--	--	4/18/1950	5.0	395
ST-532	302052	900102	121BGBC	1949	17	1,519	--	--	--	1/23/1956	3.0	335
ST-532										3/02/1965	7.8	314
ST-532										12/19/1968	2.8	288
ST-532										8/15/1988	2.2	327
ST-532										7/17/1989	2.9	343
ST-532										5/18/2005	2.42	338
ST-548	301320	894919	121PNCLL	1950	6	1,207	1,177	1,207	30	7/01/1954	30.0	--
ST-556	302108	900106	121BGBC	1956	17	1,514	1,454	1,514	60	11/10/1965	2.8	296
ST-556										12/19/1968	3.0	289
ST-556										8/05/1985	2.8	295
ST-556										5/18/2005	5.52	348

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

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Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
St. Tammany Parish—Continued												
ST-562	302406	900931	120CVGN	1957	4	1,900	1,840	1,900	60	7/30/1957	4.5	291
ST-562										12/05/1963	3.5	274
ST-562										4/01/1971	3.8	280
ST-562										5/17/2005	2.88	282
ST-563	301529	894709	120SLDL	1957	10.24	2,411	2,262	2,322	128	10/15/1959	2.2	376
							2,343	2,411				
ST-563										11/17/1961	3.5	389
ST-563										12/05/1963	2.8	380
ST-563										6/09/1965	2.4	433
ST-563										7/26/1965	2.4	433
ST-563										12/17/1968	9.0	397
ST-563										11/25/1980	4.4	415
ST-563										8/03/1983	3.7	430
ST-563										12/01/1983	2.0	--
ST-563										7/16/1985	2.8	--
ST-563										10/07/1985	3.4	434
ST-563										5/26/2005	2.65	433
ST-564	302207	900512	120CVGN	1957	10	2,105	1,984	2,035	101	7/23/1957	6.0	298
							2,055	2,105				

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
St. Tammany Parish—Continued												
ST-564										7/25/1957	7.0	293
ST-564										11/21/1957	4.0	362
ST-564										12/05/1963	3.0	368
ST-564										8/05/1985	3.4	315
ST-564										5/12/2005	3.10	365
ST-571	302807	900231	120ABIT	1960	30	1,505	1,465	1,505	40	2/05/1960	3.8	224
ST-571										7/25/1968	3.0	223
ST-571										8/20/1985	3.4	240
ST-571										5/11/2005	2.95	224
ST-572	302020	900000	121BGBC	1960	19	1,501	1,471	1,501	30	7/29/1960	64.0	516
ST-572										12/05/1963	83.0	557
ST-572										10/28/1966	87.0	598
ST-572										12/19/1968	73.0	563
ST-572										6/21/2005	38.3	476
ST-580	301652	895634	112PNCLU	1962	5	500	--	--	--	8/02/1963	35.0	696
ST-580										6/16/1965	36.0	698
ST-580										12/18/1968	30.0	688
ST-666	302453	894729	112PNCLU	1967	45	349	329	349	20	3/03/1970	3.3	289
ST-673	301536	894312	121PNCLL	1967	6	925	905	925	20	2/12/1970	4.0	535

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

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St. Tammany Parish—Continued												
ST-692	302320	895403	120ABIT	1969	32	1,620	1,590	1,620	30	2/12/1970	2.7	292
ST-692										6/24/2005	2.45	288
ST-739	302031	894924	121BGBC	1976	25	1,576	1,566	1,576	10	1/22/1976	1.9	441
ST-739										5/26/2005	2.05	423
ST-740	302031	894924	121PNCLL	1976	25	818	808	818	10	1/22/1976	64.0	768
ST-767	301530	894449	112PNCLU	1979	10	616	578	616	38	6/02/2005	12.1	564
ST-768	301736	894307	120SLDL	1976	15	2,412	2,312	2,412	100	5/27/2005	12.0	471
ST-776	301840	894850	121PNCLL	1982	16	887	862	887	25	9/24/1982	32.0	626
ST-776										5/23/2005	29.4	668
ST-792	301504	894448	120SLDL	1980	6.6	2,361	2,255	2,361	106	6/02/2005	2.41	413
ST-799	302111	894655	121PNCLL	1981	31	870	840	870	30	6/21/2005	46.2	716
ST-803	302415	900728	120CVGN	1981	15	1,973	1,923	1,973	50	6/27/2005	2.83	300
ST-806	302343	900459	121BGBC	1984	17	1,470	1,430	1,470	40	6/02/2005	2.46	324
ST-808	301804	894847	120ABIT	1981	15	1,955	1,855	1,955	100	6/17/2005	2.20	325
ST-831	302455	900809	122TCFC	1981	7	2,481	2,401	2,481	80	2/11/1981	4.8	--
ST-831										5/16/2005	3.17	233
ST-833	301816	894919	121PNCLL	1985	15	1,210	1,130	1,210	80	5/26/2005	35.6	657
ST-834	301838	894918	121PNCLL	1985	16	1,170	1,090	1,170	80	5/26/2005	52.6	668
ST-906	302520	900954	121PNCLL	1986	6	1,190	1,160	1,190	30	6/27/2005	4.96	215

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
St. Tammany Parish—Continued												
ST-913	301924	894558	121PNCLL	1986	23	770	740	770	30	6/03/2005	7.08	593
ST-948	302025	900233	121PNCLL	1988	5	1,270	1,230	1,270	40	6/16/2005	3.13	249
ST-988	301845	894915	112PNCLU	1990	18	510	490	510	20	5/23/2005	39.2	601
ST-1000	301648	894740	120SLDL	1990	7	2,322	2,211	2,322	111	6/17/2005	2.76	399
ST-1001	301756	894641	120ABIT	1984	15	1,955	1,875	1,955	80	6/02/2005	1.91	340
ST-1017	302120	900356	120CVGN	1989	7	1,977	1,872	1,924	87	5/12/2005	2.30	332
							1,942	1,977				
ST-1028	302721	900527	122HMND	1990	20	2,610	2,560	2,610	50	5/11/2005	2.68	294
ST-1071	302007	894559	121PNCLL	1991	27	944	864	944	80	5/27/2005	12.6	598
ST-1084	302422	900212	120CVGN	1994	27	1,975	1,865	1,875	60	5/17/2005	2.61	268
							1,895	1,935				
							1,965	1,975				
ST-1085	302154	900337	121PNCLL	1994	15	850	810	850	40	6/27/2005	3.29	177
ST-1090	301928	895350	122TCFC	1995	19	2,700	2,600	2,700	100	6/23/2005	3.76	379
ST-1093	302240	900153	120CVGN	1995	22	1,900	1,740	1,900	160	5/16/2005	2.75	265
ST-1095	302520	901101	121PNCLL	1996	10	900	840	900	60	6/27/2005	3.12	226
ST-1109	302559	901358	121PNCLL	1997	15	1,140	1,015	1,035	83	6/27/2005	3.25	192
							1,077	1,140				
ST-1120	301333	894715	112PNCLU	1998	10	737	637	737	100	5/24/2005	23.0	605

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
St. Tammany Parish—Continued												
ST-1130	302011	895004	121PNCLL	1999	26	1,090	949	1,010	101	5/23/2005	99.7	865
							1,050	1,090				
ST-1132	301307	894619	120SLDL	2000	0	2,605	2,475	2,535	100	5/24/2005	6.24	482
							2,565	2,605				
ST-1152	302125	895451	120ABIT	2002	25	1,840	1,740	1,840	100	6/27/2005	2.56	289
ST-1154	301715	895021	120ABIT	2002	10	1,810	1,720	1,810	90	6/17/2005	2.30	457
ST-8454Z	301846	895630	112PNCLU	1993	17	530	510	530	20	6/03/2005	3.48	258
ST-13500Z	301553	894313	121BGBC	1999	5	1,630	1,600	1,630	30	5/27/2005	2.13	433
ST-13504Z	301556	894417	121PNCLL	1999	10	930	900	930	30	5/24/2005	2.71	600
ST-18856Z	301833	895551	121BGBC	1983	11	1,547	1,517	1,547	30	6/07/2005	1,600	5,460
Tangipahoa Parish												
Ta-268	302957	902740	122HMND	1956	35	2,449	2,365	2,449	84	10/21/1956	6.0	252
Ta-268										2/12/1957	3.0	261
Ta-268										7/26/1968	3.0	275
Ta-268										5/04/2005	3.67	215
Ta-273	302519	903114	122TCFC	1960	11	2,329	2,289	2,329	40	4/14/1966	3.2	357
Ta-273										12/13/1968	3.1	350
Ta-273										5/03/2005	2.58	358
Ta-284	302633	902623	112PNCLU	1963	26	608	542	608	66	1963	6.1	--

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
Tangipahoa Parish—Continued												
Ta-284										7/24/1968	3.6	275
Ta-284										8/09/1983	2.9	262
Ta-284										7/12/1985	3.0	275
Ta-284										4/27/2005	2.55	272
Ta-285	303029	902836	122HMND	1964	40	2,416	2,316	2,372	90	9/02/1964	5.0	229
							2,382	2,416				
Ta-285										10/01/1964	5.0	227
Ta-285										8/09/1983	3.2	214
Ta-285										7/12/1985	3.0	222
Ta-285										5/04/2005	2.91	223
Ta-397	302540	901510	120CVGN	--	10	1,857	1,827	1,857	30	3/03/1970	3.9	247
Ta-397										4/10/1990	2.6	236
Ta-397										4/15/2005	3.11	252
Ta-410	302747	902649	122TCFC	--	26	2,160	2,130	2,160	30	5/03/2005	3.65	219
Ta-448	303025	903033	122HMND	1980	40	2,460	2,360	2,460	100	4/22/2005	2.89	219
Ta-525	303035	902619	122AMIT	1984	40	2,743	2,663	2,743	80	5/04/2005	2.24	435
Ta-578	302452	902115	121PNCLL	1990	6	840	800	840	40	1/17/1991	2.0	246
Ta-578										4/21/2005	2.50	243
Ta-710	303045	903155	122HMND	1991	45	2,430	2,350	2,430	80	4/14/2005	3.08	212
Ta-730	303009	903000	122AMIT	1991	35	2,674	2,574	2,674	100	5/04/2005	2.00	392

Table 2. Description of wells and chloride and specific conductance data from the Southern Hills regional aquifer system in Livingston, St. Tammany, and southern Tangipahoa Parishes, Louisiana.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929. Aquifer codes for sands of the Baton Rouge area: 11204BR, "400-foot" sand; 11206BR, "600-foot" sand; 12110BR, "1,000-foot" sand; 12112BR, "1,200-foot" sand; 12117BR, "1,700-foot" sand; 12220BR, "2,000-foot" sand; 12224BR, "2,400-foot" sand; and 12228BR, "2,800-foot" sand. Other aquifer codes: 112PNCLU, upper Ponchatoula; 121PNCLL, lower Ponchatoula; 121BGBC, Big Branch; 120ABIT, Abita; 120CVGN, Covington; 120SLDL, Slidell; 122TCFC, Tchefuncte; 122HMND, Hammond; and 122AMIT, Amite. Casing material: G, galvanized iron; I, iron; P, plastic; S, steel; or Z, other. --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Aquifer code	Year well constructed	Altitude of land surface, in feet above NGVD 29	Well depth, in feet below land surface	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Total screen length, in feet	Date sampled	Chloride concentration, in milligrams per liter[1]	Specific conductance, field, in microsiemens per centimeter at 25° Celsius
Tangipahoa Parish—Continued												
Ta-760	302531	901720	121PNCLL	1991	13	700	660	700	40	4/27/2005	2.68	248
Ta-826	302528	902651	120CVGN	1982	11	1,997	1,917	1,997	80	4/27/2005	2.76	325
Ta-829	302754	902756	122HMND	1996	18	2,640	2,587	2,602	35	4/27/2005	2.04	346
							2,620	2,640				
Ta-830	302812	902739	122HMND	1995	25	2,665	2,590	2,665	75	4/14/2005	2.25	354
Ta-831	302618	903037	122HMND	1995	20	2,585	2,485	2,585	100	4/14/2005	3.36	311
Ta-835	302740	902442	120CVGN	1998	25	1,900	1,800	1,900	100	4/14/2005	2.98	289
Ta-838	303041	901927	122TCFC	2000	30	2,190	2,095	2,190	95	4/14/2005	2.37	523
Ta-7415Z	302937	903000	121PNCLL	1992	40	730	700	730	30	4/22/2005	3.77	187
Ta-9099Z	302555	902218	120CVGN	1997	13	2,030	2,000	2,030	30	4/15/2005	2.67	313
Ta-9809Z	302547	901523	121PNCLL	1998	15	1,230	1,200	1,230	30	4/15/2005	3.04	176

[1]2005 chloride concentrations generally are reported to a higher degree of accuracy than prior data due to improved laboratory methods.

All chloride concentrations were at background level for the 26 wells sampled north of the Baton Rouge fault in Livingston Parish (fig. 1, table 2). A comparison of historical with 2005 chloride data available for 5 wells sampled north of the fault (wells Li-157, Li-163, Li-175, Li-185, and Li-193) indicated no substantial increase in chloride concentrations. In addition, five wells located south of the fault in Livingston Parish were sampled to determine whether an increase in chloride concentrations would indicate freshwater areas south of the fault were decreasing in extent. South of the fault, 3 wells screened in the "2,000-foot" sand (wells Li-86, Li-88, and Li-313) and 2 wells screened in the "400-foot" and "600-foot" sands (wells Li-289 and Li-317) were sampled. Chloride concentrations were at background level for wells sampled south of the fault except at well Li-86, which had 56.1 mg/L. A comparison of historical with 2005 data for wells Li-86 and Li-88 indicated no increase in chloride concentrations.

All wells sampled in southern Tangipahoa Parish were located north of the Baton Rouge fault (fig. 1, table 1). Chloride concentrations in all wells were at background level. A comparison of historical with 2005 chloride data for six of the wells sampled in southern Tangipahoa Parish indicated no increase in chloride concentrations.

All wells sampled in St. Tammany Parish were located north of the Baton Rouge fault (fig. 1). Chloride concentrations exceeded background level in 14 wells sampled in the parish. Four of these wells were located in or near Lacombe (fig. 1) and were screened in the Big Branch aquifer. The other 10 wells were located in the Slidell area and were screened in three aquifers: the upper Ponchatoula aquifer (3 wells), lower Ponchatoula aquifer (6 wells), and the Slidell aquifer (1 well). A comparison of historical with 2005 chloride data for 12 of the wells sampled in St. Tammany Parish indicated no increase in chloride concentrations.

In St. Tammany Parish, four wells screened in the upper Ponchatoula aquifer were sampled in 2005. Three of these wells, located in the Slidell area, had chloride concentrations greater than the background level; concentrations for wells ST-988, ST-1120, and ST-767 were 39.2, 23.0, and 12.1 mg/L, respectively. The highest concentration, 39.2 mg/L, was from well ST-988, located about 2 mi south of the Slidell airport. The lowest concentration, 3.48 mg/L, was from well ST-8454Z, located in Lacombe. Historical chloride data were unavailable for these four wells. An area of chloride concentrations greater than background level is shown in figure 4 for the upper Ponchatoula aquifer in the Slidell area. The delineation is based on 2005 chloride data and historical chloride data from seven wells: wells ST-8, ST-35, ST-36, ST-95, ST-428, ST-580, and ST-666. The area is about 21 mi^2 but is poorly defined due to insufficient chloride data; the area may be considerably larger. Historical chloride data for the upper Ponchatoula aquifer in the Slidell area provide evidence that chloride concentrations greater than background level have been present for some time and are not a new phenomenon. Chloride concentrations were 24 mg/L from well ST-8 in 1939; 22 mg/L from well ST-95 in 1950; and 35, 36, and 30 mg/L from well ST-580 in 1963, 1965, and 1968, respectively. Additional data are needed to determine whether chloride concentrations are increasing in the upper Ponchatoula aquifer in the Slidell area.

In the lower Ponchatoula aquifer, eight wells were sampled in the Slidell area in 2005. Chloride concentrations were greater than background level for six of the wells: wells ST-776 (29.4 mg/L), ST-799 (46.2 mg/L), ST-833 (35.6 mg/L), ST-834 (52.6 mg/L), ST-1071 (12.6 mg/L), and ST-1130 (99.7 mg/L). The highest chloride concentration, 99.7 mg/L, was in water from well ST-1130, located west-southwest of the Slidell airport. An area of chloride concentrations greater than background level is shown in figure 5 for the lower Ponchatoula aquifer in the Slidell area. The delineation is based on 2005 chloride data and historical chloride data from seven wells: wells ST-7, ST-9, ST-29, ST-117, ST-548, ST-673, and ST-740. The area is about 43 mi^2 but is poorly defined due to insufficient chloride data to the west and north; the area may be considerably larger. Historical chloride data were available for only one well, ST-776, sampled in 2005; the chloride concentrations of 32 mg/L in 1982 and 29.4 mg/L in 2005 indicated no increase. Historical chloride data for the lower Ponchatoula aquifer in the Slidell area provide evidence

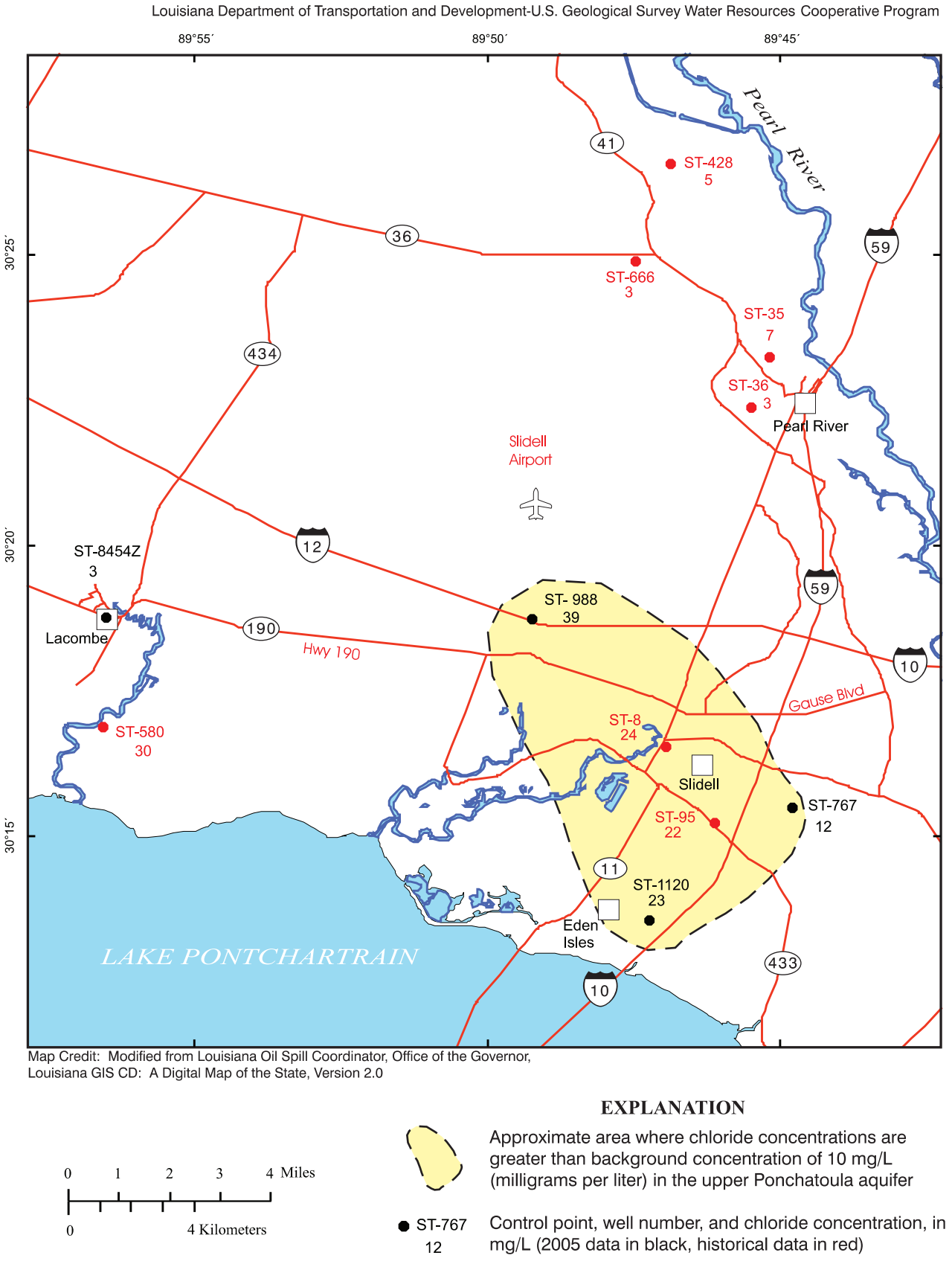

Figure 4. Chloride concentrations in water from the upper Ponchatoula aquifer, Slidell area, Louisiana.

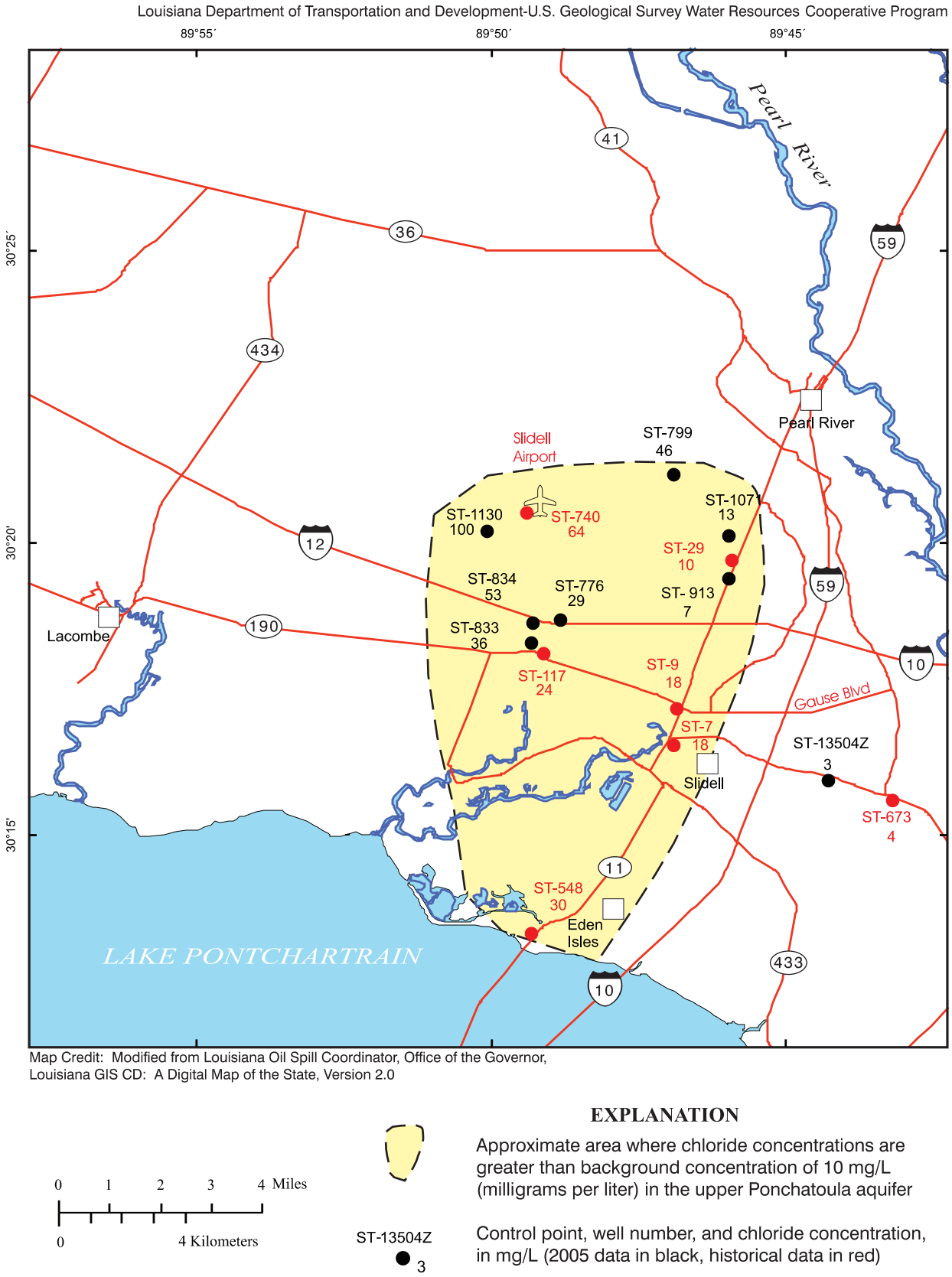

Figure 5. Chloride concentrations in water from the lower Ponchatoula aquifer, Slidell area, Louisiana.

that chloride concentrations greater than background level have been present for some time and are not a new phenomenon. Chloride concentrations were 17 and 18 mg/L from well ST-7 in 1939 and 1942, respectively; 18 mg/L from well ST-9 in 1968; 24 mg/L from well ST-117 in 1950; 30 mg/L from well ST-548 in 1954; and 64 mg/L from well ST-740 in 1976. Additional data are needed to determine whether chloride concentrations are increasing in the lower Ponchatoula aquifer in the Slidell area. Chloride concentrations greater than background level in wells screened in the upper and lower Ponchatoula aquifers may be remnant seawater, which has not been flushed southward by freshwater recharge as completely as in deeper aquifers.

Chloride concentrations from four wells screened in the Big Branch aquifer exceeded background level. The highest chloride concentration was 1,600 mg/L in water from well ST-18856Z, located in Lacombe (fig. 1). The Big Branch aquifer is known to have high chloride concentrations in this area (Nyman and Fayard, 1978, p. 30). The next highest chloride concentration was 465 mg/L in water from well ST-177, located between Lacombe and Mandeville. A chloride concentration of 550 mg/L collected at well ST-177 in 1939 indicated no increase in chloride concentrations. In 2005, nearby wells ST-184 and ST-572 had chloride concentrations of 80.6 and 38.3 mg/L. Historical chloride concentrations at well ST-572 were greater than the 2005 concentration. An area of chloride concentrations greater than background level is shown in figure 1 for the Big Branch aquifer near Lacombe. This area is poorly defined due to insufficient chloride data, particularly to the east of well ST-18856Z; the area may be considerably larger. Data collected for this study indicated no increase in chloride concentrations in the Big Branch aquifer.

Nyman and Fayard (1978, p. 30) explained the elevated chloride concentrations in the Big Branch aquifer in the Lacombe area as apparently resulting from "incomplete flushing, rather than saltwater encroachment, because the aquifer is discontinuous to the south." Recent work by Stoessell and Prochaska (Ronald K. Stoessell, Department of Geology and Geophysics, University of New Orleans, oral and written communs., 2005) suggests that the source of saltwater in the Big Branch aquifer is deep marine formation fluids which contain dissolved recrystallized halite from salt diapirs. These fluids have apparently moved up fault planes to enter the aquifer.

Chloride concentrations ranged from 2.41 to 12.0 mg/L for five wells (ST-563, ST-768, ST-792, ST-1000, and ST-1132) screened in the Slidell aquifer in the Slidell area. Only well ST-768, which had a chloride concentration of 12 mg/L, was greater than the background level. A comparison of historical with 2005 chloride data for well for ST-563 indicated no increase in chloride concentrations.

SUMMARY

The Southern Hills regional aquifer system (Southern Hills aquifer system) is a principal source of fresh ground water in Livingston, southern Tangipahoa, and St. Tammany Parishes in southeastern Louisiana. The freshwater system extends from the northern limit of the recharge area in the vicinity of Vicksburg, Mississippi, southward to approximately the Baton Rouge fault. The Baton Rouge fault trends from west to east and extends across southern Livingston, Tangipahoa, and St. Tammany Parishes. Ground water is generally fresh north of the Baton Rouge fault and saline (water with a chloride concentration of at least 250 mg/L [milligrams per liter]) south of the fault. In 2005, 100 wells were sampled for chloride and specific conductance to determine whether saltwater may be encroaching across the Baton Rouge fault into the Southern Hills aquifer system in Livingston, southern Tangipahoa, and St. Tammany Parishes in response to ground-water withdrawals north of the fault. Of the 100 wells sampled, 95 were located north of the Baton Rouge fault.

The background concentration (level) for chloride in water from the Southern Hills aquifer system is considered to be less than 10 mg/L for this report. Chloride concentrations exceeded 250 mg/L in only 2 of the 100 wells sampled in 2005. All chloride concentrations were at background level in the 26 wells sampled north of the Baton Rouge fault in Livingston Parish. Historical chloride data were available for five of the wells sampled north of the fault. A comparison with 2005 chloride data indicated no substantial increase in chloride concentrations. South of the fault in Livingston Parish, five wells were sampled; chloride concentrations were at background level except at well Li-86, which had 56.1 mg/L of chloride. A comparison of historical with 2005 chloride data for wells Li-86 and Li-88, located south of the fault, indicated no increase in chloride concentrations at the wells.

All wells sampled in southern Tangipahoa Parish were located north of the Baton Rouge fault. Chloride concentrations in all the wells were at background level. A comparison of historical with 2005 chloride data for six of the wells sampled in the parish indicated no increase in chloride concentrations at the wells.

All wells sampled in St. Tammany Parish were located north of the Baton Rouge fault. Chloride concentrations exceeded background level in 14 wells sampled. Four of these wells were located in or near Lacombe and were screened in the Big Branch aquifer. The other 10 wells were located in the Slidell area and were screened in three aquifers: the upper Ponchatoula aquifer (3 wells), lower Ponchatoula aquifer (6 wells), and Slidell aquifer (1 well). A comparison of historical with 2005 chloride data for 12 of the wells sampled in St. Tammany Parish indicated no increase in chloride concentrations at the wells.

In St. Tammany Parish, four wells screened in the upper Ponchatoula aquifer were sampled in 2005. Three of these wells, located in the Slidell area, had chloride concentrations greater than the background level; concentrations for wells ST-988, ST-1120, and ST-767 were 39.2, 23.0, and 12.1 mg/L, respectively. The highest concentration, 39.2 mg/L, came from well ST-988, located about 2 miles south of the Slidell airport. The lowest concentration, 3.48 mg/L, came from well ST-8454Z, located in Lacombe. Historical chloride data are unavailable for these four wells. An area of chloride concentrations greater than background level has been illustrated for the upper Ponchatoula aquifer in the Slidell area. The delineation is based on 2005 chloride data and historical chloride data from seven wells. This area occupies about 21 square miles but is poorly defined due to a lack of chloride data; the area may be considerably larger. Historical chloride data for the upper Ponchatoula aquifer in the Slidell area provide evidence that chloride concentrations greater than background level have been present for some time and are not a new phenomenon. Additional data are needed to determine whether chloride concentrations are increasing in the upper Ponchatoula aquifer in the Slidell area.

In the lower Ponchatoula aquifer, eight wells were sampled in 2005 in the Slidell area; six wells had chloride concentrations greater than background level. The highest chloride concentration, 99.7 mg/L, was in water from well ST-1130 located west-southwest of the Slidell airport. An area of chloride concentrations greater than background level has been illustrated for the lower Ponchatoula aquifer in the Slidell area. This delineation is based on 2005 chloride data and historical chloride data from seven wells. This area is about 43 square miles but is poorly defined due to insufficient chloride data to the west and north; the area may be considerably larger. Historical chloride data were available for only one well, ST-776 sampled in 2005; the chloride concentrations of 32 mg/L in 1982 and 29.4 mg/L in 2005 indicated no increase. Historical chloride data for the lower Ponchatoula aquifer in the Slidell area provide evidence that chloride concentrations greater than background level have been present for some time, and are not a new phenomenon. Additional data are needed to determine whether chloride concentrations are increasing in the lower Ponchatoula aquifer in the Slidell area. Chloride concentrations greater than background level present in wells screened in the lower and upper Ponchatoula aquifers may be remnant seawater which has not been flushed southward by freshwater recharge as completely as in deeper aquifers.

Chloride concentrations from four wells screened in the Big Branch aquifer exceeded background level. The highest chloride concentration was 1,600 mg/L in water from well ST-18856Z, located in Lacombe. The Big Branch aquifer is known to have high chloride concentrations in this area. Chloride concentrations in the other three wells ranged from 38.3 to 465 mg/L. The wells are located between Lacombe and Mandeville. An area of chloride concentrations greater than background level has been illustrated for the Big Branch aquifer near Lacombe. This area is poorly defined due to insufficient chloride data, particularly to the east of well ST-18856Z; the area may be considerably larger. Data collected for this study indicated no increase in chloride concentrations in the Big Branch aquifer.

Five wells (ST-563, ST-768, ST-792, ST-1000, and ST-1132) screened in the Slidell aquifer in the Slidell area had chloride concentrations ranging from 2.41 mg/L to 12.0 mg/L. Only well ST-768, which had a chloride concentration of 12 mg/L, was greater than background level. A comparison of historical with 2005 chloride data for well ST-563 indicated no increase in chloride concentrations.

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