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LOUISIANA DEPARTMENT OF TRANSPORTATION & DEVELOPMENT

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of De Soto Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in De Soto Parish, Louisiana (fig. 1), is critical for proper water-supply management. The purpose of this fact sheet is to present information that can be used by water managers, parish residents, and others for stewardship of this vital resource. Information on the availability, past and current use, use trends, and water quality from groundwater and surface-water sources in the parish is presented. Previously published reports (see References Cited section) and data stored in the U.S. Geological Survey's National Water Information System (http://waterdata.usgs.gov/nwis) are the primary sources of the information presented here.

In 2010, about 36.7 million gallons per day (Mgal/d) of water were withdrawn in De Soto Parish, Louisiana, including about 31.9 Mgal/d from surface-water sources and 4.76 Mgal/d from groundwater sources[1] (table 1). Withdrawals for industrial use accounted for about 64 percent (23.6 Mgal/d) of the total water withdrawn (36.7 Mgal/d) (table 2). Other categories of use included public supply, power generation, rural domestic, livestock, and general irrigation. Water-use data collected at 5-year intervals from 1960 to 2010 (fig. 2) indicated that water withdrawals peaked in 2010.

[1]Tabulation of numbers in text and tables may result in different totals because of rounding; nonrounded numbers are used for calculation of totals.

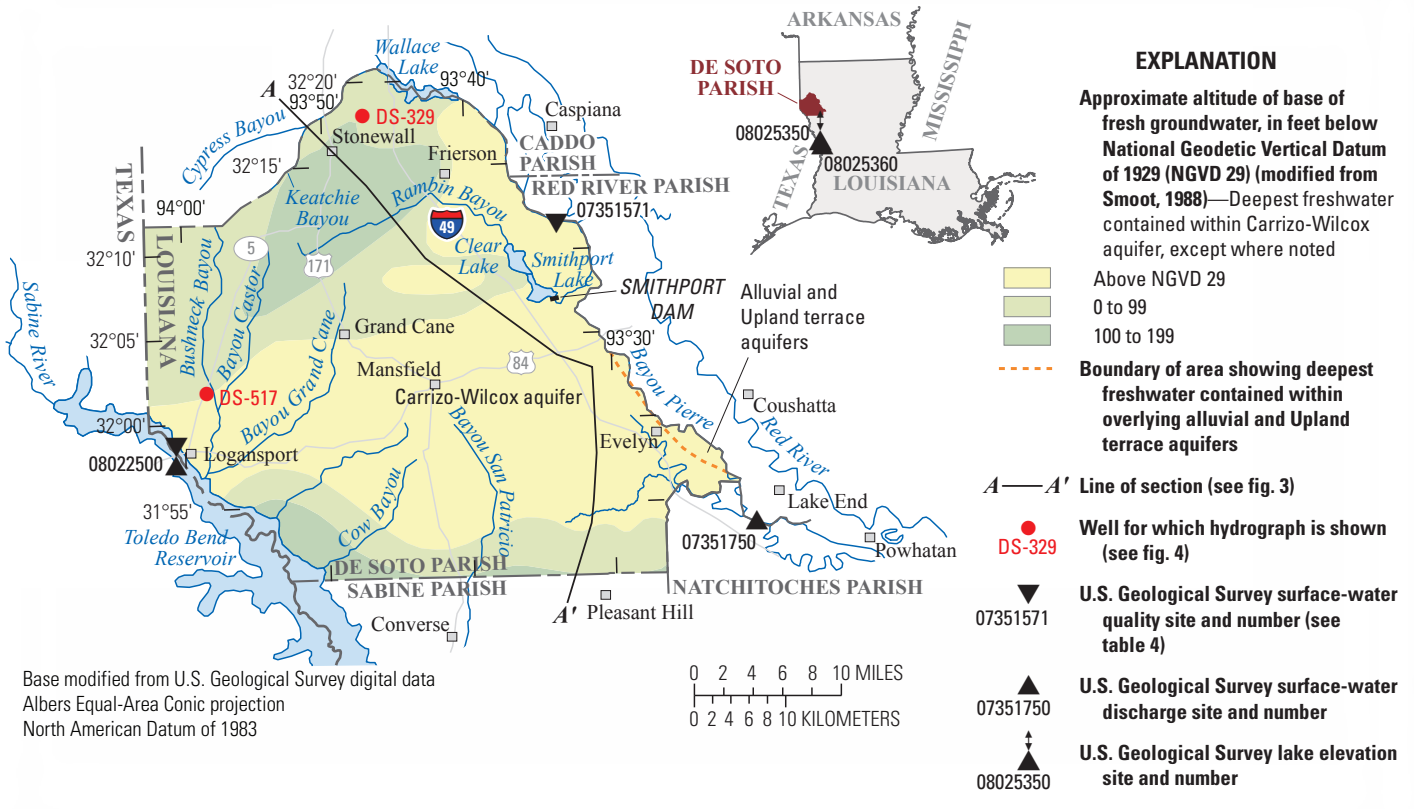

Figure 1. Location of study area, De Soto Parish, Louisiana.

Table 1. Water withdrawals, in million gallons per day, by source in De Soto Parish, Louisiana, 2010 (modified from Sargent, 2011).

Aquifer or surface-water body	Groundwater	Surface water
Red River alluvial aquifer	0.15	
Upland terrace aquifer	0.49	
Carrizo-Wilcox aquifer	4.12	
Toledo Bend Reservoir		27.74
Bayou Pierre		0.11
Bayou Grand Cane		0.08
Other water bodies		3.96
Total	4.76	31.89

Table 2. Water withdrawals, in million gallons per day, by use category in De Soto Parish, Louisiana, 2010 (modified from Sargent, 2011).

Use category	Groundwater	Surface water	Total
Public supply	1.41	1.83	3.24
Industrial	2.53	21.04	23.57
Power generation	0.00	8.76	8.76
Rural domestic	0.63	0.00	0.63
Livestock	0.17	0.06	0.23
General irrigation	0.02	0.20	0.23
Total	4.76	31.89	36.66

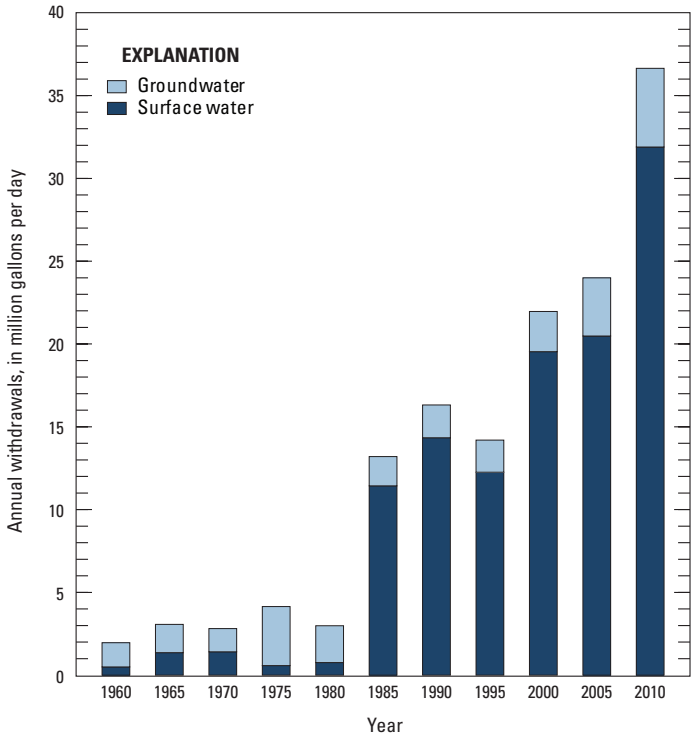

Figure 2. Water withdrawals in De Soto Parish, Louisiana, 1960–2010 (modified from Sargent, 2011).

Groundwater Resources

The primary groundwater resources underlying De Soto Parish include the Red River alluvial aquifer, the Upland terrace aquifer, and the Carrizo-Wilcox aquifer. Fresh groundwater (water having a chloride concentration of 250 milligrams per liter [mg/L] or less) is available throughout most of the parish to depths ranging from about 100 feet (ft) or more above the National Geodetic Vertical Datum of 1929 (NGVD 29) to between about 150 ft and 200 ft below NGVD 29 (fig. 1) (Smoot, 1988).

State well-registration records listed 1,587 active water wells in De Soto Parish in 2010, including 1,423 domestic, 87 public supply, 46 irrigation, and 31 industrial (Louisiana Department of Natural Resources, 2011). In 2010, categories of use for groundwater withdrawals included public supply, industrial, rural domestic, livestock, and general irrigation (table 2). Recharge to aquifers in the parish is from precipitation, leakage from adjacent aquifers, and seasonal flow from streams. Discharge from the aquifers is by natural seasonal flow into streams, leakage into adjacent aquifers, and withdrawals from wells.

Red River Alluvial Aquifer

Red River alluvial deposits are present in a narrow band, generally less than 1 mile (mi) wide, along the eastern edge of the parish where they flank the Red River. The width of the alluvial deposit in De Soto Parish increases to more than 2 mi east of Smithport Lake and in the southeastern part of the parish near the town of Evelyn, where the alluvium reaches its greatest thickness of about 100 ft along Bayou Pierre. The Red River alluvial aquifer comprises the sands of the alluvium and typically are brown or gray in color (Page and Preé, 1964). Water levels in the alluvial aquifer fluctuate primarily in response to the stage of the Red River and precipitation. Groundwater flow generally is southerly (down valley) and toward the Red River (Whitfield, 1980).

State well-registration records listed two active water wells, both used for irrigation, screened in the Red River alluvial aquifer in De Soto Parish in 2010. Depths of these wells are 59 ft and 65 ft below land surface (Louisiana Department of Natural Resources, 2011). In 2010, withdrawals from the Red River alluvial aquifer in De Soto Parish totaled about 0.15 Mgal/d. Regional studies indicated that water in the Red River alluvial aquifer is very hard[2] and contains high iron concentrations (greater than 300 micrograms per liter [µg/L]) (Page and May, 1964; Tomaszewski, 1992).

Upland Terrace Aquifer

The Upland terrace aquifer is located in narrow (less than 4 mi wide) areas bordering the Red River alluvial aquifer in the northeastern part of the parish and along tributaries of the Sabine River in the southwestern part of the parish. The

[2]Hardness ranges, expressed as milligrams per liter of calcium carbonate, are as follows: 0–60, soft; 61–120, moderately hard; 121–180, hard; greater than 180, very hard (Hem, 1985).

terrace deposits generally consist of basal sands or gravels grading upward into silts and clays and are generally less than 120 ft thick in the parish. The Upland terrace aquifer is the sand and gravel part of the terrace deposits. The aquifer generally is unconfined in De Soto Parish, with the water table fluctuating in response to precipitation (Page and Preé, 1964; Snead and McCulloh, 1984).

State well-registration records listed 32 active water wells screened in the Upland terrace aquifer in De Soto Parish in 2010, including 26 domestic, 4 industrial, and 2 public supply. Depths of these wells ranged from 15 to 194 ft below land surface, with a median depth of 44 ft. Reported yields from wells screened in the Upland terrace aquifer in De Soto Parish ranged from 4 to 250 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2011). In 2010, withdrawals from the Upland terrace aquifer in De Soto Parish totaled about 0.49 Mgal/d, and uses included about 0.11 Mgal/d for public supply, 0.36 Mgal/d for industrial, and 0.02 Mgal/d for rural domestic (Sargent, 2011).

Carrizo-Wilcox Aquifer

The Carrizo-Wilcox aquifer comprises sands and gravels within the Carrizo aquifer and Wilcox aquifer, which are hydraulically connected and considered to be a single aquifer. In De Soto Parish, however, the Carrizo aquifer has eroded away and is not present (Page and Preé, 1964). Sands of the Carrizo-Wilcox aquifer are generally thin and typically yield only moderate supplies of water (40 to 100 gal/min) to public-supply or industrial wells (Snider and Covay, 1987).

The aquifer outcrops throughout De Soto Parish except in areas where it is overlain by alluvial or Upland terrace deposits. Aquifer thickness ranges from less than 100 ft in the northeastern and eastern parts of the parish to over 700 ft along the southern boundary (fig. 3; Page and Preé, 1964; Ryals, 1984). The aquifer contains freshwater to a maximum depth of between about 150 ft and 200 ft below NGVD 29 (fig. 1). Water in the Carrizo-Wilcox aquifer occurs under both unconfined (water-table) and confined (artesian) conditions. Unconfined conditions result where sand beds outcrop at or near land surface; confined conditions occur in deeper sands. The aquifer generally receives recharge from precipitation in outcrop areas and from overlying sediments in areas where the aquifer is confined (Page and Preé, 1964).

In 1991, water levels in the Carrizo-Wilcox aquifer in De Soto Parish ranged from about 260 ft above NGVD 29, near the Texas State line in northwestern De Soto Parish, to about 140 ft above NGVD 29 along the eastern boundary of the parish (Seanor and Smoot, 1995). In most of the parish, groundwater flows from west to east and discharges into the Red River alluvial valley. In southwestern De Soto Parish, groundwater flow is from east to west toward the Sabine River valley. Water levels in wells DS-329 and DS-517 (fig. 1) fluctuated about 1 to 4 ft annually and saw an overall decline from 2005 to 2012 (fig. 4).

State well-registration records listed 1,384 active water wells screened in the Carrizo-Wilcox aquifer in De Soto Parish in 2010, including 1,239 domestic, 81 public supply, 39 irrigation, and 25 industrial. Depths of these wells ranged from 10 to 431 ft below land surface, with a median depth of 210 ft. Reported yields from wells screened in the Carrizo-Wilcox aquifer in De Soto Parish ranged from 1 to 350 gal/min (Louisiana Department of Natural Resources, 2011).

In 2010, withdrawals from the Carrizo-Wilcox aquifer in De Soto Parish totaled about 4.12 Mgal/d and included about 1.30 Mgal/d for public supply, 2.03 Mgal/d for industrial, 0.61 Mgal/d for rural domestic, 0.16 Mgal/d for livestock, and 0.02 Mgal/d for general irrigation (Sargent, 2011). A statistical summary of selected water-quality characteristics for freshwater samples collected from 158 wells screened in the Carrizo-Wilcox aquifer in De Soto Parish is presented in table 3. Median values of freshwater constituents from the Carrizo-Wilcox aquifer

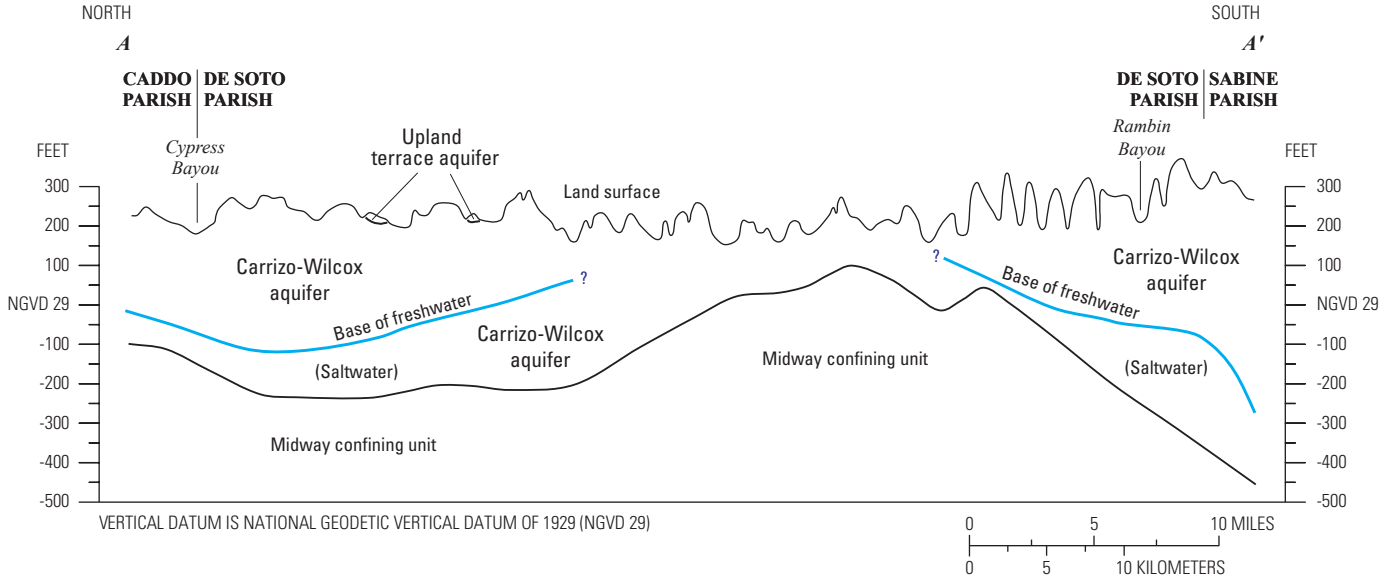

Figure 3. Generalized north-to-south hydrogeologic section through De Soto Parish, Louisiana (modified from Page and Preé, 1964). Individual sand and clay layers not shown. Trace of section shown on figure 1.

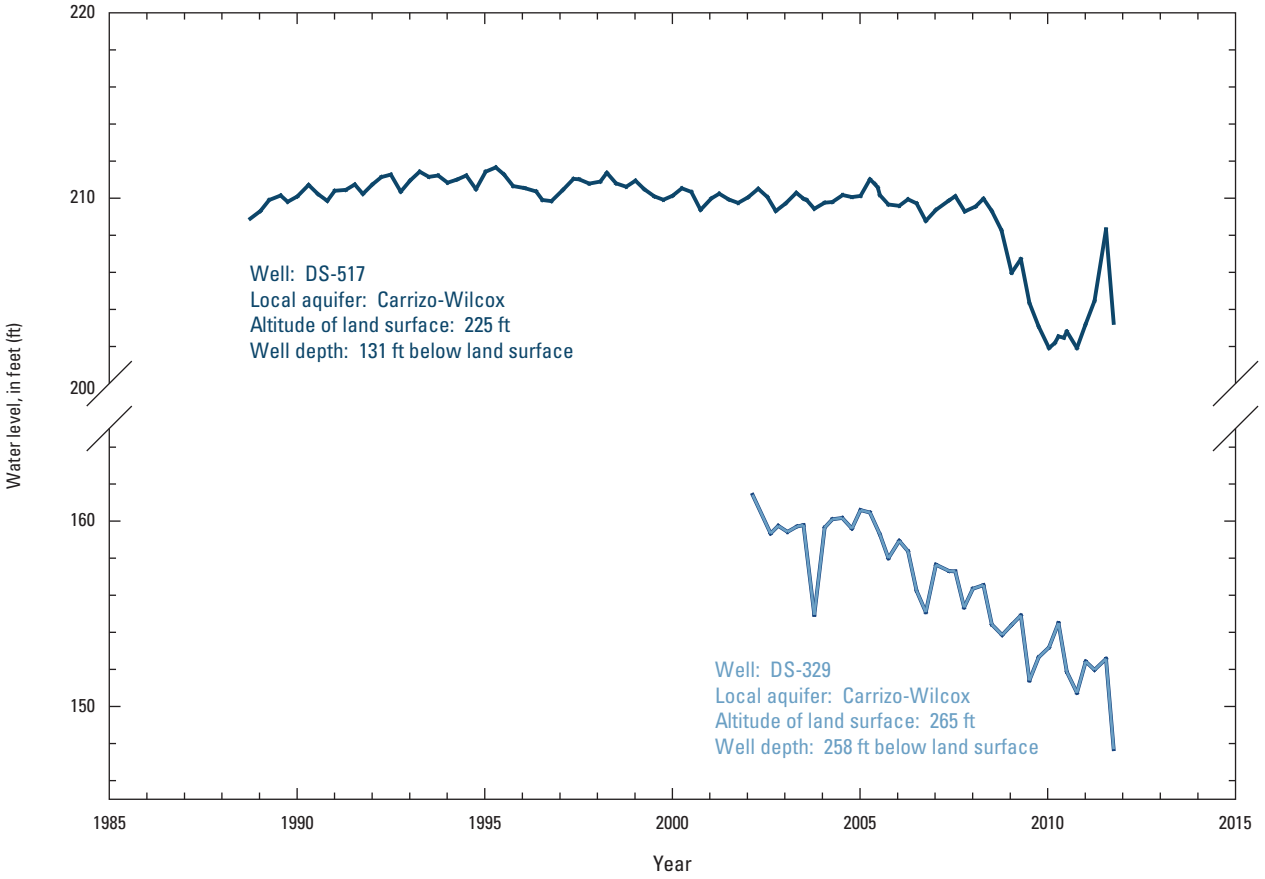

Figure 4. Water levels in wells DS-329 and DS-517 screened in the Carrizo-Wilcox aquifer in De Soto Parish, Louisiana (see fig. 1 for well locations; U.S. Geological Survey, 2011). Altitude of land surface and water level is measured in feet (ft) above the National Geodetic Vertical Datum of 1929.

were within the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels (SMCLs)[3] for color, pH, chloride, iron, manganese, and dissolved solids. The median value for hardness fell into the soft range. Locally, iron concentrations can greatly exceed the SMCL of 300 µg/L.

Surface-Water Resources

In 2010, about 31.9 Mgal/d of surface water were withdrawn in De Soto Parish. Industrial use accounted for about 66 percent (21.0 Mgal/d) of the total water withdrawn. Other uses included public supply, power generation, livestock, and general irrigation (table 2). Toledo Bend Reservoir on the Sabine River is the primary source of fresh surface water in the parish, providing about 87 percent (27.7 Mgal/d) of all surface-water withdrawals in the parish (table 1). Other notable streams in the parish include Bayou Pierre, Keatchie Bayou, Cypress Bayou, Bayou Grand Cane, and Bayou San Patricio. Other water bodies in the parish include Wallace Lake, Clear Lake, and Smithport Lake. U.S. Highway 171 (fig. 1) approximately follows the drainage divide between the Red River and Sabine River systems. Streams on the east eventually discharge into the Red River through Bayou Pierre and its tributaries, and those to the west discharge into the Sabine River (Page and Preé, 1964).

Toledo Bend Reservoir was constructed primarily for water supply, hydroelectric power generation, and recreation. The reservoir was completed in 1969 and normally covers an area of about 185,000 acres at full-pool stage (Sabine River Authority of Louisiana, 2011). Lake elevation and discharge gage-site records indicate that lake storage at conservation level is 4,472,900 acre-feet, and mean-annual runoff from 1972 to 2012 was 4,017,000 acre-feet (site numbers 08025350 and 08025360, located at the south end of Toledo Bend Reservoir [fig. 1]; U.S. Geological Survey 2013a). The reservoir extends from the dam site, up the Sabine River, for about 65 mi to just north of Logansport. The mean discharge for the Sabine River at Logansport (site number 08022500) prior to the completion of Toledo Bend Reservoir was 3,325 cubic feet per second (ft^3/s) for the period 1904–60. In 1961, the drainage area was heavily regulated, and average discharge from 1961 to 1967 was 2,252 ft^3/s (U.S. Geological Survey, 2013a).

Water samples analyzed during 1971–85 indicated that water in the Sabine River at Logansport was soft to moderately hard (table 4) and did not exceed the SMCLs for concentrations of chloride and sulfate. Iron concentrations were below the SMCL for 89 percent of samples. Dissolved-oxygen concentrations were generally greater than 5 mg/L (U.S. Geological Survey, 2013b). This concentration is considered the minimum value for a diversified population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008).

[3]The SMCLs are nonenforceable Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water. At high concentrations or values, health effects as well as aesthetic degradation may occur. SMCLs were established as guidelines for the States by the U.S. Environmental Protection Agency (1992).

Table 3. Summary of selected water-quality characteristics of freshwater in the Carrizo-Wilcox aquifer in De Soto Parish, Louisiana (U.S. Geological Survey, 2013b).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; PCU, platinum cobalt units; µS/cm, microsiemens per centimeter; SU, standard units; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; <, less than; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency, 2011; NA, not applicable]

	Temperature (°C)	Color, (PCU)	Specific conductance, field (µS/cm at 25 °C)	pH, field (SU)	Hardness (as $CaCO_3$)	Chloride, filtered (as Cl)	Iron, filtered (µg/L as Fe)	Manganese, filtered (µg/L as Mn)	Dissolved solids, filtered
Carrizo-Wilcox aquifer, 1941–2004 (158 wells)									
Median	21.0	6	645	8.0	20	42	180	30	404
10th percentile	19.5	0	305	6.5	2	12	10	<10	200
90th percentile	22.0	40	1,390	8.7	170	170	4,200	190	810
Number of samples	83	126	125	113	158	158	108	93	128
Percentage of samples that do not exceed SMCLs	NA	71	NA	77	NA	100	58	67	70
SMCLs									
	NA	15	NA	6.5–8.5	NA	250	300	50	500

Table 4. Summary of selected water-quality characteristics for the Sabine River at Logansport and Bayou Pierre below Caspiana, Louisiana (U.S. Geological Survey, 2013b).

[Values are in milligrams per liter, except as noted. µS/cm, microsiemens per centimeter; °C, degrees Celsius; SU, standard units; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency, 2011; NA, not applicable]

	Specific conductance, field (µS/cm at 25 °C)	Oxygen, dissolved	pH, field (SU)	Hardness (as $CaCO_3$)	Calcium, filtered (as Ca)	Magnesium, filtered (as Mg)	Sodium, filtered (as Na)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered (µg/L as Fe)
Sabine River at Logansport, 1971–85[1]										
Median	321	8.4	6.9	60	16	4.4	34	53	30	100
10th percentile	203.6	6.2	6.5	34	8.6	3.1	17.6	24.6	18.6	10
90th percentile	498.4	11.1	7.4	75	21.4	5.9	66	93.6	38.8	290
Number of samples	47	44	47	47	47	47	47	47	47	19
Percentage of samples that do not exceed SMCLs	NA	NA	96	NA	NA	NA	NA	100	100	89
Bayou Pierre below Caspiana, 1979–83[2]										
Median	394	7.6	7.1	130	31	13	35	39	39	30
10th percentile	150	5.3	6.5	42	11	3.7	12	13	17	7
90th percentile	940	10.2	7.8	350	79	38	65	72	78	160
Number of samples	59	58	59	59	59	59	59	59	59	17
Percentage of samples that do not exceed SMCLs	NA	NA	90	NA	NA	NA	NA	100	100	94
SMCLs										
	NA	NA	6.5–8.5	NA	NA	NA	NA	250	250	300

[1]Site number 08022500 (U.S. Geological Survey, 2013b; specific data at http://nwis.waterdata.usgs.gov/usa/nwis/qwdata/?site_no=08022500).

[2]Site number 07351571 (U.S. Geological Survey, 2013b; specific data at http://nwis.waterdata.usgs.gov/usa/nwis/qwdata/?site_no=07351571)..

The average discharge for Bayou Pierre near Lake End (site number 07351750) (fig. 1) was 921 ft^3/s for the period 1981–2010, and the drainage area is about 860 square miles (mi^2) (U.S. Geological Survey, 2013a). Water samples collected and analyzed during 1979–83 indicated that water in Bayou Pierre below Caspiana (site number 07351571) (fig. 1) ranges from soft to very hard (table 4) and generally does not exceed the SMCLs for pH or concentrations of chloride, sulfate, and iron. Dissolved-oxygen concentrations generally are greater than 5 mg/L. The drainage area at this site is about 340 mi^2 (U.S. Geological Survey, 2013b).

Wallace Lake, which straddles the boundary between De Soto and Caddo Parishes (fig. 1), is a flood-control reservoir, but a conservation pool is maintained at all times. The elevation of the conservation pool is 142 ft above NGVD 29, which yields a surface area of about 3.6 mi^2 (2,300 acres) and an average depth of about 3.4 ft. The reservoir has a drainage area of about 260 mi^2. Smithport Dam, near the mouth of Rambin Bayou, forms Clear and Smithport Lakes, which have a combined surface area of 2,250 acres at the spillway elevation of 129.4 ft (Page and Preé, 1964; Shampine, 1971).

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By Lawrence B. Prakken and Vincent E. White

For additional information, contact:

Director, USGS Louisiana Water Science Center
3535 S. Sherwood Forest Blvd., Suite 120
Baton Rouge, LA 70816
E-mail: dc_la@usgs.gov
Fax: (225) 298–5490
Telephone: (225) 298–5481
Home Page: http://la.water.usgs.gov

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