

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Richland Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Richland 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. In 2014, about 41.73 million gallons per day (Mgal/d) of water were withdrawn in Richland Parish, including about 28.57 Mgal/d from groundwater sources and 13.17 Mgal/d from surface-water sources¹ (table 1). Withdrawals for agricultural use, composed of general irrigation, rice irrigation, aquaculture, and livestock uses, accounted for about 88 percent (36.88 Mgal/d) of the total water

withdrawn (table 2). Other categories of use included public supply, which accounted for about 10 percent (4.38 Mgal/d) of the total water withdrawn and rural domestic which accounted for about 1 percent (0.48 Mgal/d). Water-use data collected at 5-year intervals from 1960 to 2010 and again in 2014 indicate that water withdrawals peaked in 1980 at more than 60 Mgal/d (fig. 2).

¹Water withdrawal data are based on estimated or reported site-specific data and aggregated data, which are distributed to sources. For a full description of water-use estimate methodology, see "Data Collection" in Sargent (2011). Tabulation of numbers in text and tables may result in different totals because of rounding; nonrounded numbers are used for calculation of totals.

Groundwater Resources

The primary freshwater-bearing aquifer in Richland Parish is the Mississippi River alluvial aquifer. The Cockfield aquifer underlies, and is in direct hydraulic connection with, the Mississippi River alluvial aquifer and contains freshwater beneath much of the parish (figs. 1 and 3) but is not pumped as heavily as the alluvial aquifer (table 1). The Sparta aquifer underlies the Cockfield aquifer and contains freshwater in limited areas of

western Richland Parish (figs. 1 and 3). The altitude of the base of fresh groundwater (water having a chloride concentration of 250 milligrams per liter [mg/L] or less) ranges from less than 50 feet (ft) above the National Geodetic Vertical Datum of 1929 (NGVD 29) along the eastern border of the parish in the Mississippi River alluvial aquifer to more than 600 ft below NGVD 29 in the west-central part of the parish in the Sparta aquifer (Smoot, 1988).

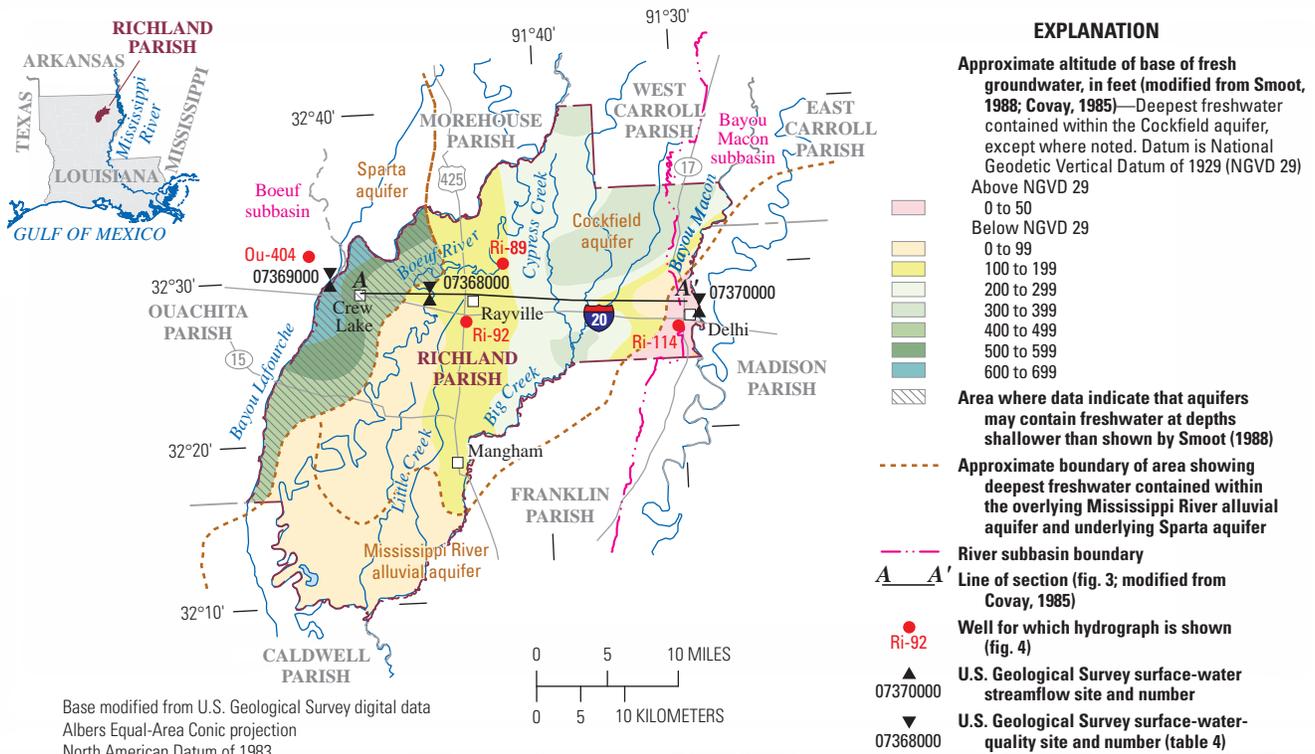


Figure 1. Location of study area, Richland Parish, Louisiana.

Table 1. Water withdrawals, in million gallons per day, by source in Richland Parish, Louisiana, 2014 (Collier, 2018).

Aquifer or surface-water body	Groundwater	Surface water
Mississippi River alluvial aquifer	26.42	
Cockfield aquifer	2.15	
Big Creek		3.03
Boeuf River		6.84
Miscellaneous streams		3.30
Total	28.57	13.17

Table 2. Water withdrawals, in million gallons per day, by use category in Richland Parish, Louisiana, 2014 (Collier, 2018).

Use category	Groundwater	Surface water	Total
Aquaculture	0.02	0.00	0.02
Public supply	4.38	0.00	4.38
Rural domestic	0.48	0.00	0.48
Livestock	0.01	0.01	0.02
Rice irrigation	10.52	0.00	10.52
General irrigation	13.16	13.16	26.31
Total	28.57	13.17	41.73

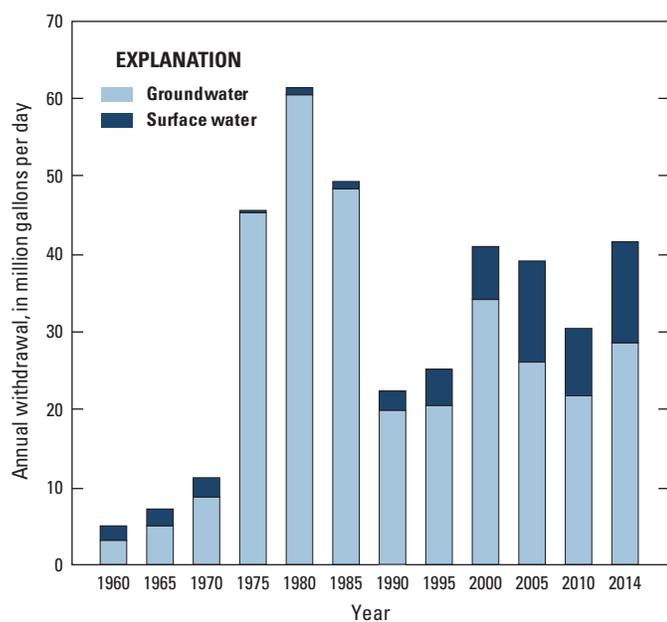


Figure 2. Water withdrawals in Richland Parish, Louisiana, 1960–2014 (Sargent, 2011; Collier, 2018).

Mississippi River Alluvial Aquifer

The Mississippi River alluvial aquifer, which extends across all of Richland Parish, is a large regional aquifer that is present in various States. (In many publications, the aquifer is called the Mississippi River Valley alluvial aquifer.) The Mississippi River alluvial aquifer is composed of the sand and gravel portion of sediments deposited primarily by the Mississippi River. These deposits generally grade from silt and clay at the surface to coarse sand and gravel at the base. The thickness of the Mississippi River alluvial deposit ranges from less than 80 ft along the western border of the parish to greater than 160 ft northwest of Mangham. The altitude of the base of the aquifer ranges from near NGVD 29 east of Delhi, along the northeastern parish border, to more than 80 ft below NGVD 29 northwest of Mangham. In most of the parish, the altitude of the base is from 20 to 60 ft below NGVD 29 (Whitfield, 1975).

The primary source of recharge for the alluvial aquifer is the infiltration of precipitation, with secondary sources of recharge from streams and rivers during high stage. Groundwater in the alluvial aquifer generally moves southward in the alluvial aquifer but also moves westward towards the Boeuf River and Bayou Lafourche in western parts of the parish and eastward towards Bayou Macon and Big Creek in eastern parts of the parish. Groundwater discharge is by evapotranspiration, natural leakage into rivers and streams, and well withdrawals (Whitfield, 1975).

In 1990, water levels in wells screened in the Mississippi River alluvial aquifer ranged from greater than 70 ft above NGVD 29 in the northern part of the parish to less than 40 ft above NGVD 29 in the southwestern part of the parish (Seanor and Smoot, 1995). Water levels in the Mississippi River alluvial aquifer at wells Ri-92 and Ri-114 (figs. 1 and 4) generally fluctuated from 1 to 2 ft annually from the early 1970s to 2016, but show little, if any, long-term increasing or decreasing trend.

State well-registration records listed 1,396 active water wells screened in the Mississippi River alluvial aquifer in Richland Parish in 2016: 1,012 irrigation wells, 323 domestic wells, 42 public-supply wells, and 19 industrial wells. Depths of these wells ranged from 23 to 145 ft below land surface, and reported yields ranged from 5 to 3,500 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2016). In 2014, about 26.42 Mgal/d were withdrawn from the Mississippi River alluvial aquifer: 0.02 Mgal/d for aquaculture, 0.47 Mgal/d for rural domestic, 13.16 Mgal/d for general irrigation, 0.01 Mgal/d for livestock, 10.52 Mgal/d for rice irrigation, and 2.24 for public supply (Collier, 2018).

Cockfield Aquifer

The Cockfield aquifer underlies much of Richland Parish. The aquifer is thin or missing in the southwestern part of the parish, and freshwater transitions to saltwater near Delhi (fig. 1). In the area between Rayville and Delhi, the aquifer is composed of fine lignitic sand with thicker sands in the lower part (Covay, 1985). Aquifer thickness ranges from zero to 600 ft. In the freshwater areas, the altitude of base of the aquifer ranges from less than 100 ft below NGVD 29 in the western part of the parish to greater than 500 ft below NGVD 29 in the eastern part (Ryals, 1984; Covay, 1985).

In 1993, a study of water-level altitudes in wells screened in the Cockfield aquifer indicated that levels were between 60 and about 70 ft above NGVD 29 in the northeastern part of Richland Parish with groundwater flow generally toward the south (Brantly and Seanor, 1996). Water levels at well Ri-89, screened in the Cockfield aquifer in Richland Parish, generally fluctuated from about 1 to 2 ft annually during 1969–2016 (fig. 4), and little if

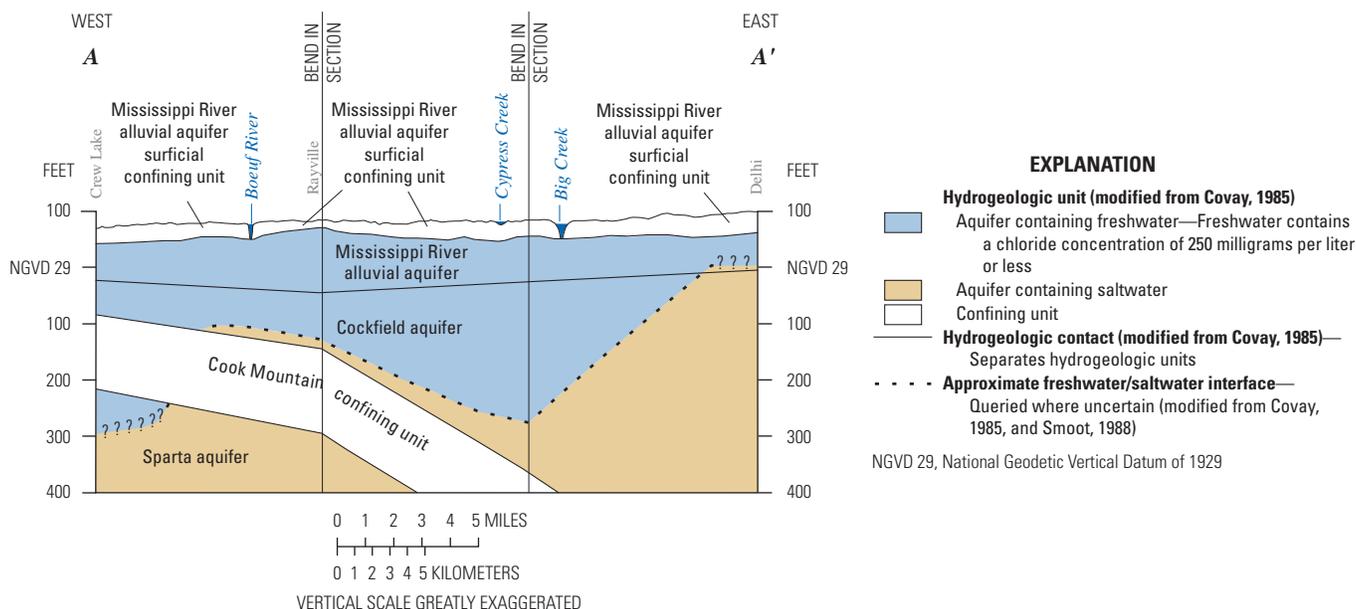


Figure 3. Idealized west-to-east hydrogeologic section through Richland Parish, Louisiana, showing aquifer and confining unit intervals (individual sand and clay layers not shown). Trace of section shown on figure 1.

any long-term increasing or decreasing trend was observed (U.S. Geological Survey, 2016). These annual fluctuations are similar to those in the overlying Mississippi River alluvial aquifer because of the direct hydraulic connection between the aquifers.

State well-registration records listed 20 active water wells screened in the Cockfield aquifer in Richland Parish in 2016: 5 domestic wells, 13 public-supply wells, and 2 industrial wells. Well depths ranged from 189 to 490 ft below land surface, and reported yields ranged from 25 to 1,001 gal/min (Louisiana Department of Natural Resources, 2016). In 2014, about 2.15 Mgal/d were withdrawn from the Cockfield aquifer: about 2.14 Mgal/d for public supply and less than 0.01 Mgal/d for rural domestic (Collier, 2018).

Sparta Aquifer

The Sparta aquifer is a large and heavily developed regional aquifer that extends from Louisiana into Arkansas. Although it underlies much of Richland Parish, the aquifer contains freshwater only in a limited area in the western part of the parish (figs. 1 and 3). The base of the aquifer ranges from more than 900 ft below NGVD 29 in the northeastern part of the freshwater area to less than 800 ft below NGVD 29 in the southwestern part. The top of the aquifer ranges from about 300 ft below NGVD 29 in the northeastern part of the freshwater area to less than 150 ft below NGVD 29 in the southwestern part. The Sparta aquifer is confined by massive clay layers above (Cook Mountain confining unit) and below (Cane River confining unit). In general, the aquifer consists of very fine to medium sand in its lower half and silty clay, lignite, and clay in its upper half. Sand beds within the aquifer can vary from being 100 percent sand to up to 50 percent clay (Brantly and others, 2002).

In 2012, altitudes of water levels in wells screened in the Sparta aquifer in Richland Parish were between about zero and 20 ft below NGVD 29, and the direction of groundwater flow was generally to the west-northwest toward pumping centers in neighboring Ouachita Parish (McGee and Brantly, 2015). Water levels at well Ou-404 (fig. 4), located about 1 mile west of Richland Parish in Ouachita Parish, declined more than 25 ft

from 1965 to 2006, but rebounded about 10 ft during 2006–16. The rebound was probably caused by decreased withdrawals in Ouachita Parish. Between 2005 and 2014, withdrawals from the Sparta aquifer in Ouachita Parish declined from 22.32 to 18.47 Mgal/d. No withdrawals from the Sparta aquifer in Richland Parish were reported for 2014 (Collier, 2018), and State well-registration records listed only one active well, which was for domestic use and screened at a depth of 400 ft (Louisiana Department of Natural Resources, 2016).

Groundwater Quality

Samples of fresh groundwater were collected during 1941–2015 from 82 wells screened in the Mississippi River alluvial aquifer and during 1945–88 from 29 wells screened in the Cockfield aquifer as part of an ongoing program to monitor the State’s groundwater resources. These samples were generally within the U.S. Environmental Protection Agency’s Secondary Maximum Contaminant Levels² (SMCLs) for pH, color, and sulfate concentration (table 3). The median hardness values of 380 mg/L for the Mississippi River alluvial aquifer and 100 mg/L for the Cockfield aquifer were within the very hard³ range and the moderately hard range, respectively. Manganese concentrations in both aquifers exceeded the SMCL of 50 micrograms per liter (µg/L) for more than 60 percent of samples. Iron concentrations exceeded the SMCL of 300 µg/L in more than 50 percent of samples from the Cockfield aquifer and more than 30 percent of samples from the Mississippi River alluvial aquifer; however, iron concentrations in the Mississippi River alluvial aquifer locally exceeded seven times the SMCL.

²The SMCLs are Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration), aesthetic effects (such as taste, odor, or color), or technical effects (such as damage to water equipment or reduced effectiveness of treatment for other contaminants) of potential constituents of drinking water. SMCLs were established as guidelines by the U.S. Environmental Protection Agency (2016).

³Hardness 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).

Table 3. Summary of selected water-quality characteristics for freshwater from 82 wells screened in the Mississippi River alluvial aquifer (1941–2015) and 29 wells screened in the Cockfield aquifer (1945–88) in Richland Parish, Louisiana (U.S. Geological Survey, 2016).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; $\mu\text{S}/\text{cm}$, microsiemens per centimeter; SU, standard unit; CaCO_3 , calcium carbonate; $\mu\text{g}/\text{L}$, microgram per liter; <, less than; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016); NA, not applicable]

	Temperature (°C)	Color (platinum cobalt units)	Specific conductance, field ($\mu\text{S}/\text{cm}$ at 25 °C)	pH, field (SU)	Hardness (as CaCO_3)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered, in $\mu\text{g}/\text{L}$ (as Fe)	Manganese, filtered, in $\mu\text{g}/\text{L}$ (as Mn)	Dissolved solids, filtered
Mississippi River alluvial aquifer (82 wells)										
Median	19.8	10	1,080	7.3	380	170	14	100	250	286
10th percentile	18.5	0	304	6.4	61.5	20.5	1.8	1.2	<1	155
90th percentile	21.2	10	1,440	7.7	500	235	35	2,140	825	614
Number of samples	76	20	115	35	146	229	41	55	26	22
Percentage of samples that do not exceed SMCLs	NA	100	NA	89	NA	100	100	69	35	86
Cockfield aquifer (29 wells)										
Median	20.3	5	746	7.7	100	41	<0.9	320	70	396
10th percentile	20	0	417	6.9	5	9.6	<0.2	30	<10	248
90th percentile	22.3	16.5	1,060	8.2	210	120	10	721	188	641
Number of samples	16	28	28	21	36	36	29	24	22	28
Percentage of samples that do not exceed SMCLs	100	89	100	100	100	100	100	46	36	61
SMCL	NA	15	NA	6.5–8.5	NA	250	250	300	50	500

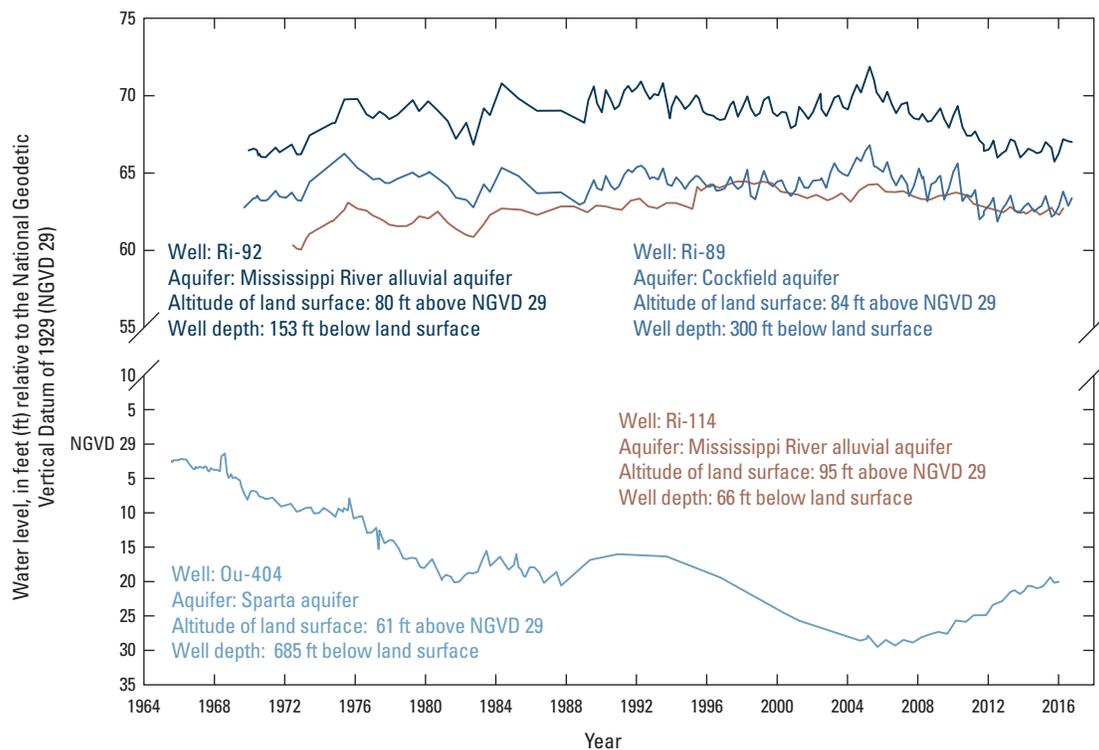


Figure 4. Water levels in wells Ri-92 and Ri-114 screened in the Mississippi River alluvial aquifer, well Ri-89 screened in the Cockfield aquifer, and well Ou-404 screened in the Sparta aquifer, located in or near Richland Parish, Louisiana (see figure 1 for well location; U.S. Geological Survey, 2016).

Surface-Water Resources

Numerous surface-water resources in Richland Parish are present in two drainage subbasins and flow in a general southerly direction. The Boeuf subbasin (Hydrologic Unit Code [HUC] 08050001) drains the majority of the parish, and the Bayou Macon subbasin (HUC 08050002) drains the land adjacent to the northeastern border of the parish (fig. 1) (U.S. Geological Survey, 2016). In 2014, 3.30 Mgal/d were withdrawn from miscellaneous streams for general irrigation (3.29 Mgal/d) and livestock (0.01 Mgal/d) (table 1) (Collier, 2018).

Boeuf Subbasin

The Boeuf subbasin covers the majority of Richland Parish. Major streams in the subbasin in the parish include Bayou Lafourche, the Boeuf River, Little Creek, and Big Creek. These streams drain in a general southerly direction and partially align with the western and eastern borders of the parish (fig. 1). The annual average discharge during 1938–2015 was 268 cubic feet

per second (ft³/s) at the Boeuf River near Girard (site number 07368000; fig. 1). During this same period, the highest monthly average discharge was 504 ft³/s in February, and the lowest was 85 ft³/s during August (U.S. Geological Survey, 2016). During 1938–2016, the average annual discharge for Bayou Lafourche near Crew Lake (site number 07369000), located on the border with Ouachita Parish, was 1,922 ft³/s (U.S. Geological Survey, 2016). In 2014, 6.84 Mgal/d were withdrawn from the Boeuf River and 3.03 Mgal/d were withdrawn from Big Creek for general irrigation use (table 1) (Collier, 2018).

Bayou Macon Subbasin

The primary drainage of the Bayou Macon subbasin in Richland Parish is Bayou Macon, which drains a relatively narrow strip of land adjacent to the parish border near Delhi (fig. 1). The average discharge during 1934 to 1992 was 975 ft³/s at Bayou Macon near Delhi (site number 07370000; fig. 1) (U.S. Geological Survey, 2016).

Table 4. Summary of selected water-quality characteristics for Bayou Lafourche near Crew Lake, Bayou Macon near Delhi, and the Boeuf River near Girard, Louisiana (U.S. Geological Survey, 2016).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; µS/cm, microsiemens per centimeter; SU, standard unit; CaCO₃, calcium carbonate; µg/L, microgram per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016); NA, not applicable]

	Temperature (°C)	Color (platinum cobalt units)	Specific conductance, field (µS/cm at 25 °C)	Oxygen, dissolved	pH, field (SU)	Hardness (as CaCO ₃)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO ₄)	Iron, filtered, in µg/L (as Fe)	Dissolved solids, filtered
Bayou Lafourche near Crew Lake (1964–96) ¹										
Median	19	30	325	6.7	7.3	90.5	29.5	16.5	90	198
10th percentile	9	10	153	6.0	6.7	45.6	8.6	8.1	55	110
90th percentile	29	96	640	10.3	7.8	227	76	33	125	384
Number of samples	57	53	58	8	58	54	54	54	4	53
Percentage of samples that do not exceed SMCLs	NA	36	NA	NA	95	NA	100	100	100	100
Bayou Macon near Delhi (1952–98) ²										
Median	21.6	20	298	8.2	7.3	120	15	16	NA	174
10th percentile	9	10	105	5.2	6.8	42	3.5	4.1	NA	81.1
90th percentile	29	60	556	10.1	7.8	225	36	26.5	NA	336
Number of samples	56	51	75	33	73	66	66	66	5	48
Percentage of samples that do not exceed SMCLs	NA	45	NA	NA	97	NA	100	100	100	100
Boeuf River near Girard (1943–96) ³										
Median	20	20	249	6.7	7.2	97	19.5	17	80	216
10th percentile	9.6	5	98	4.0	6.5	35.6	3.6	5.2	68	86.7
90th percentile	27.7	90	594	9.4	7.9	244	98.6	61.3	248	510
Number of samples	47	78	49	24	84	47	82	80	5	58
Percentage of samples that do not exceed SMCLs	NA	46	NA	NA	94	NA	100	100	80	88
SMCL	NA	15	NA	NA	6.5–8.5	NA	250	250	300	500

¹U.S. Geological Survey site number 07369000 (see fig. 1).

²U.S. Geological Survey site number 07370000 (see fig. 1).

³U.S. Geological Survey site number 07368000 (see fig. 1).

Surface-Water Quality

Water samples were collected from Bayou Lafourche near Crew Lake (site number 07369000) during 1964–96, Bayou Macon near Delhi (site number 07370000) during 1952–98, and Boeuf River near Girard (site number 07368000) during 1943–96 (fig. 1) as part of an ongoing program to monitor the State’s surface-water resources. These samples were generally within SMCLs for pH and concentrations of chloride and sulfate (table 4). Median hardness values were within the moderately hard range. Median values for dissolved-oxygen concentration were greater than 6.5 mg/L; 5 mg/L is considered the minimum value for a diverse population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008). Median values for color were greater than the SMCL (15 platinum cobalt units) for all three sites.

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This fact sheet has been prepared by the U.S. Geological Survey (USGS), in cooperation with the Louisiana Department of Transportation and Development (DOTD), as part of a program to document water use, availability, and quality in the parishes of Louisiana. Information on the availability, past and current water use, use trends, and water quality from groundwater and surface-water sources in the parish is presented here. Previously published reports (see References Cited section) and data stored in the USGS National Water Information System (U.S. Geological Survey, 2016) are the primary sources of the information presented here. Special thanks are given to Doug Taylor, Director, and Zahir “Bo” Bolourchi (retired), DOTD Cooperative Program with the USGS.

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