Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Winn Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Winn 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 In 2014, about 2.74 million gallons per day (Mgal/d) of water were withdrawn in Winn Parish: 2.69 Mgal/d from groundwater sources and 0.05 Mgal/d from surface-water sources[1] (table 1). Withdrawals for public supply accounted for about 71 percent (1.95 Mgal/d) of the total water withdrawn, and industrial use accounted for about 19 percent (0.51 Mgal/d) (table 2). Other categories of use included rural domestic, livestock, and general irrigation. Water-use data collected at 5-year intervals from 1960 to 2010 and again in 2014 indicated that water withdrawals peaked in 2000 at about 3.81 Mgal/d (fig. 2).

[1]Water-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 source of fresh groundwater underlying Winn Parish is the Sparta aquifer (figs. 1, 3). The Cockfield aquifer provides a secondary source of fresh groundwater, and other aquifers have relatively low withdrawals compared to the Sparta and Cockfield aquifers (table 1). The Upland terrace and the Red River alluvial aquifer can provide limited supplies of fresh groundwater in the southwestern part of the parish (Snider and Sanford, 1981). The Carrizo-Wilcox aquifer also may contain limited supplies of freshwater in the northwestern corner of the parish (Smoot, 1986). The altitude of the base of fresh groundwater (water with a chloride concentration of 250 milligrams per liter

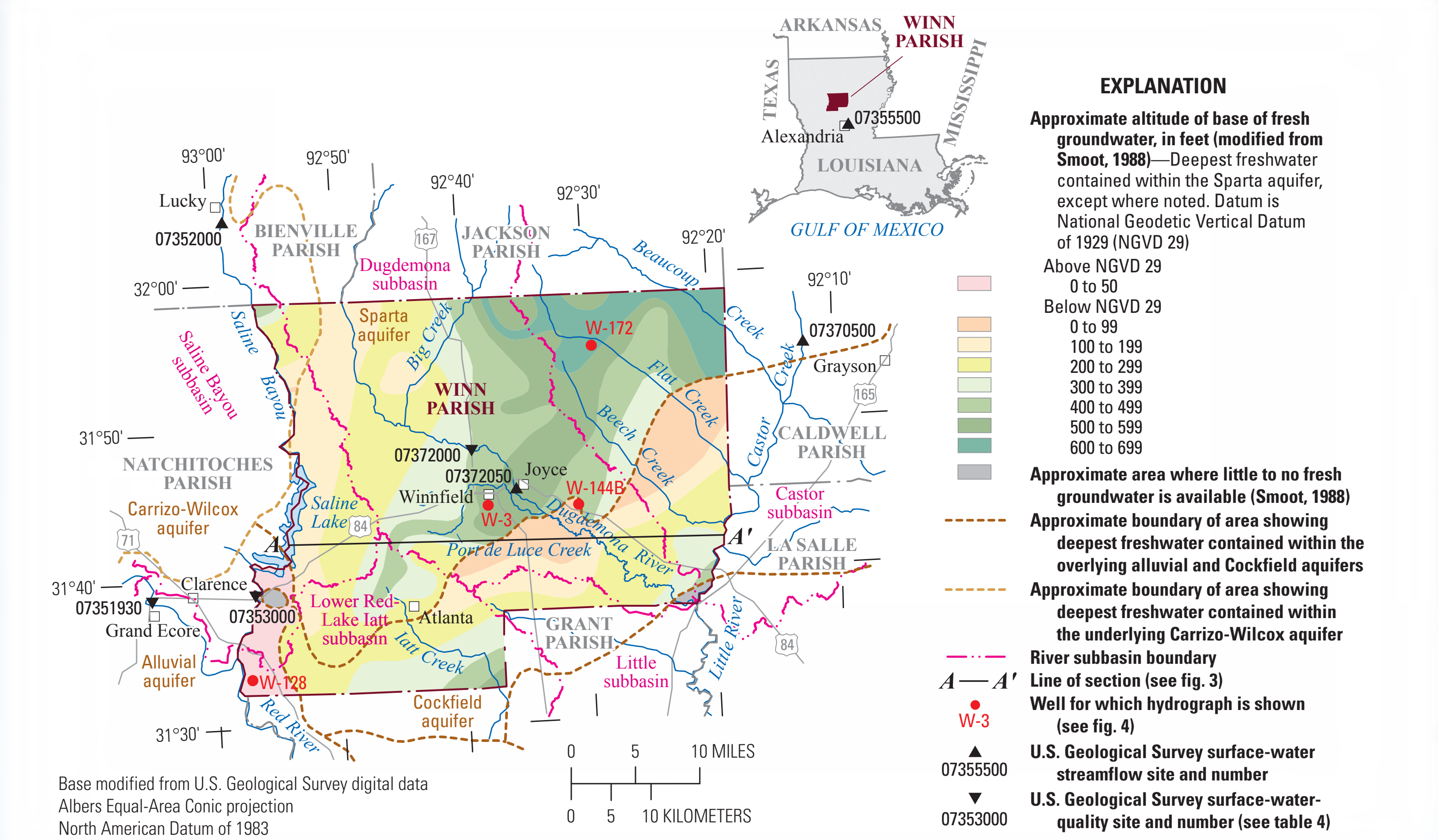

Figure 1. Location of study area, Winn Parish, Louisiana.

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

[<, less than]

Aquifer or surface-water body	Groundwater	Surface water
Cockfield aquifer	0.22	
Red River alluvial aquifer	<0.01	
Sparta aquifer	2.43	
Upland terrace aquifer	0.04	
Miscellaneous surface waters		0.05
Total	**2.69**	**0.05**

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

Use category	Groundwater	Surface water	Total
Public supply	1.95	0.00	1.95
Industry	0.51	0.00	0.51
Rural domestic	0.20	0.00	0.20
Livestock	0.01	0.04	0.05
General irrigation	0.02	0.02	0.03
Total	**2.69**	**0.05**	**2.74**

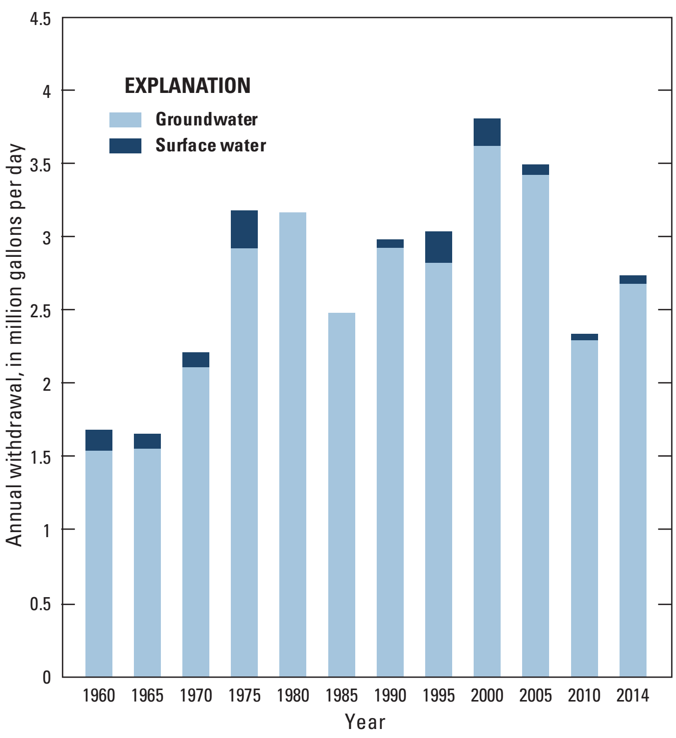

Figure 2. Water withdrawals in Winn Parish, Louisiana, 1960–2014 (U.S. Geological Survey, 2017a; Collier, 2018).

[mg/L] or less) ranges from greater than 600 feet (ft) below the National Geodetic Vertical Datum of 1929 (NGVD 29) in the Sparta aquifer in the northeastern corner of the parish to about the NGVD 29 in the Red River alluvial aquifer in the southwestern corner (fig. 1; Smoot, 1988).

Cockfield Aquifer

The Cockfield aquifer is present in Winn Parish, except in the northwestern part of the parish. Aquifer thickness ranges from 0 to 600 ft, increasing from the northwestern extent to southeastern extent. The altitude of the base of the aquifer ranges from greater than 100 ft above NGVD 29 in the north-central part of the parish to greater than 700 ft below NGVD 29 in the southernmost central part of the parish (Ryals, 1984).

The Cockfield aquifer receives recharge from rainfall in outcrop areas within Winn Parish and parishes to the north. Water in the aquifer generally moves laterally in a southerly-to-southeasterly direction. Vertical movement of water from the Cockfield to underlying aquifers is restricted by clay within a confining layer called the Cook Mountain confining unit (fig. 3), which underlies the Cockfield aquifer (Brantly and Seanor, 1996). In 1993, water-level altitudes in wells screened in the Cockfield aquifer in Winn Parish generally ranged from greater than 160 ft above NGVD 29 in the north-central part of the parish to less than 80 ft above NGVD 29 in the southern part of the parish (Brantly and Seanor, 1996). Water levels at well W-3 (U.S. Geological Survey [USGS] site number 315524092381301), screened in the Cockfield aquifer in Winn Parish, fluctuated slightly but generally remained stable during 1960–92 (fig. 4).

State well-registration records listed 124 active water wells screened in the Cockfield aquifer in Winn Parish in 2016: 111 domestic wells, 3 industrial wells, 3 irrigation wells, and 7 public-supply wells. Well depths ranged from 30 to 500 ft below land surface with reported yields of 3–120 gallons per minute (gal/min) (Louisiana Department of Natural Resources, 2016). In 2014, about 0.22 Mgal/d were withdrawn from the Cockfield aquifer: 0.12 Mgal/d for public supply, 0.09 Mgal/d for rural domestic, and less than 0.01 Mgal/d for general irrigation purposes (Collier, 2018).

Sparta Aquifer

The Sparta aquifer is a regional aquifer underlying various parishes in north-central Louisiana, including most of Winn Parish; however, freshwater is not available in the Sparta aquifer near the southern border of Winn Parish, where the aquifer contains saltwater. The altitude of the aquifer base ranges from about 1,150 ft below NGVD 29 in the southeastern corner of the parish to about 50 ft above NGVD 29 in the northwestern corner. The altitude of the top of the aquifer ranges from greater than 550 ft below NGVD 29 in the southeastern part of the parish to greater than 100 ft above NGVD 29 in the northwestern part of the parish. In general, the composition of the Sparta aquifer varies by depth and location. The aquifer is composed of layers of very fine to medium sand that are interbedded with silt, clay, and lignite, with the thicker sand layers near the base (Brantly and others, 2002). The individual sand layers usually do not continue for great distances, but many of these layers are interconnected and form the larger, spatially extensive aquifer. The aquifer crops out along its western edge in an area extending from the northwestern corner of the State to northwestern Winn Parish, where it is recharged by precipitation. The aquifer generally dips and thickens to the east and southeast. The top of the aquifer generally dips at a rate of 5 to 25 feet per mile (ft/mi), and the base of the aquifer generally dips at a rate of 25 to 50 ft/mi (Brantly and others, 2002).

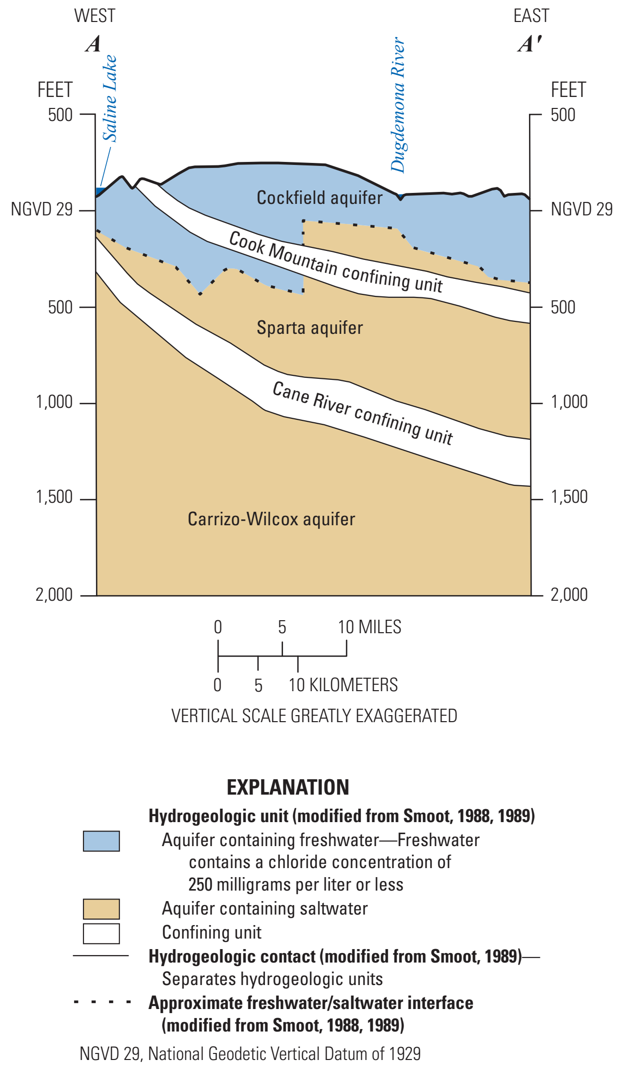

Figure 3. Idealized west-to-east hydrogeologic section through Winn Parish, Louisiana, showing aquifer and confining unit intervals (individual sand and clay layers not shown). Trace of section shown on figure 1.

In 2012, water-level altitudes in wells screened in the Sparta aquifer in Winn Parish ranged from greater than 160 ft above NGVD 29 along the northwestern border to less than 40 ft above NGVD 29 in the northeastern corner of the parish and in a small area north of Winnfield (McGee and Brantly, 2015). These levels indicate a general flow direction towards the east in the western part of the parish and towards the north in the northeastern part of the parish. Water levels at wells W-144B (USGS site number 315450092310102) declined about 30 ft and water levels at W-172 (USGS site number 320541092291601) (fig. 1) declined about 20 ft between about 1990 and 2010, but water levels at both wells remained stable between 2010 and 2016 (fig. 4).

State well-registration records listed 227 active water wells screened in the Sparta aquifer in Winn Parish in 2016: 148 domestic wells, 42 public-supply wells, 21 irrigation wells, and 16 industrial wells. Well depths ranged from 30 to 760 ft below land surface with reported yields ranging from 3 to 1,000 gal/min (Louisiana Department of Natural Resources, 2016). In 2014, about 88 percent (2.43 Mgal/d) of the total water withdrawn in Winn Parish came from the Sparta aquifer: 1.81 Mgal/d for public supply, 0.51 Mgal/d for industry, 0.08 Mgal/d for rural domestic use, and about 0.01 Mgal/d each for livestock and general irrigation (Collier, 2018).

Groundwater Quality

Groundwater samples were collected in Winn Parish from 64 wells screened in the Sparta aquifer during 1939–2015 and 41 wells screened in the Cockfield aquifer during 1939–83 as part of an ongoing program to monitor the State's groundwater resources. These samples had median hardness[2] values in the soft range. Median values for pH and dissolved-solids concentration exceeded the U.S. Environmental Protection Agency's Secondary Maximum Contaminant Levels[3] (SMCLs) for the Sparta aquifer, whereas median concentrations of chloride, sulfate, iron, and manganese were within the SMCLs (table 3). Median values for concentrations of iron and manganese exceeded the SMCLs in the Cockfield aquifer, whereas median pH and concentrations of chloride, sulfate, and dissolved solids were within the SMCLs.

Surface-Water Resources

Surface-water resources in Winn Parish are present in five drainage subbasins (fig. 1). The Dugdemona subbasin (Hydrologic Unit Code [HUC] 08040303) drains the central part of the parish. The Castor subbasin (HUC 08040302) drains the eastern part of the parish. The Little subbasin (HUC 08040304) drains a small area in the south-central part of the parish and is not discussed further here. The Saline Bayou subbasin (HUC 11140208) drains a narrow strip of land along part of the western border of the parish. Lastly, the Lower Red-Lake Iatt subbasin (HUC 11140207) drains the southwestern part of the parish (fig. 1). In 2014, about 0.05 Mgal/d were withdrawn from miscellaneous streams in these subbasins for livestock (0.04 Mgal/d) and general irrigation uses (less than 0.02 Mgal/d) (tables 1, 2) (Collier, 2018).

Dugdemona Subbasin

The Dugdemona River is the primary drainage of the Dugdemona subbasin. The river flows into the parish at the border of Winn, Jackson, and Bienville Parishes (fig. 1). Numerous tributaries, including Big Creek, increase flow in the river as it courses through the parish before it joins with Castor Creek and forms the Little River near the southeastern corner of the parish (fig. 1). The annual average streamflow of the Dugdemona River near Joyce (USGS site number 07372050) was 785 cubic feet per second (ft^3/s) during 2002–16 from a drainage area of 740 square miles (mi^2), with the highest monthly average streamflow during March (2,256 ft^3/s) and the lowest during September (76.8 ft^3/s) (USGS, 2017b).

Castor Subbasin

The Castor subbasin is drained primarily by Castor Creek which flows in a large arc from Jackson Parish into Caldwell and La Salle Parishes and then along the Winn Parish border. Castor Creek flows in a general south-southwesterly direction after bordering Winn Parish. Tributaries of Castor Creek in Winn Parish, including Beaucoup, Flat, and Beech Creeks, flow in a general southeasterly direction. The average streamflow of Castor Creek near Grayson (USGS site number 07370500) during 1940–70 was 242 ft^3/s (USGS, 1971).

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[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).

[3]The 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).

Table 3. Summary of selected water-quality characteristics for 64 wells screened in the Sparta aquifer during 1939–2015 and 41 wells screened in the Cockfield aquifer during 1939–83 in Winn Parish, Louisiana (U.S. Geological Survey, 2017b).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; µS/cm, microsiemens per centimeter; SU, standard unit; $CaCO_3$, calcium carbonate; µg/L, micrograms 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 (µS/cm at 25 °C)	pH, field (SU)	Hardness (as $CaCO_3$)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered, in µg/L (as Fe)	Manganese, filtered, in µg/L (as Mn)	Dissolved solids, filtered
Sparta aquifer, 1939–2015 (64 wells)										
Median	21.9	50	1,390	8.6	2	160	2.7	60	<4	530
10th percentile	20.2	9.5	755	7.6	1	14	<0.02	19.9	<1.1	297
90th percentile	25.4	160	1,730	8.8	10.8	270	30	260	74	692
Number of samples	119	70	196	79	113	230	83	77	57	87
Percentage of samples that do not exceed SMCLs	NA	19	NA	44	NA	83	100	92	82	34
Cockfield aquifer, 1939–83 (41 wells)										
Median	20.5	17	431	7.5	18	23.5	3.8	440	55	283
10th percentile	20	5	164	6.2	2	4.5	0	60	<3	159
90th percentile	21.4	110	1,070	8.5	114	92	65.8	5,300	236	645
Number of samples	14	31	31	29	44	44	32	26	14	31
Percentage of samples that do not exceed SMCLs	NA	48	NA	72	NA	98	97	42	50	77
SMCL	NA	15	NA	6.5–8.5	NA	250	250	300	50	500

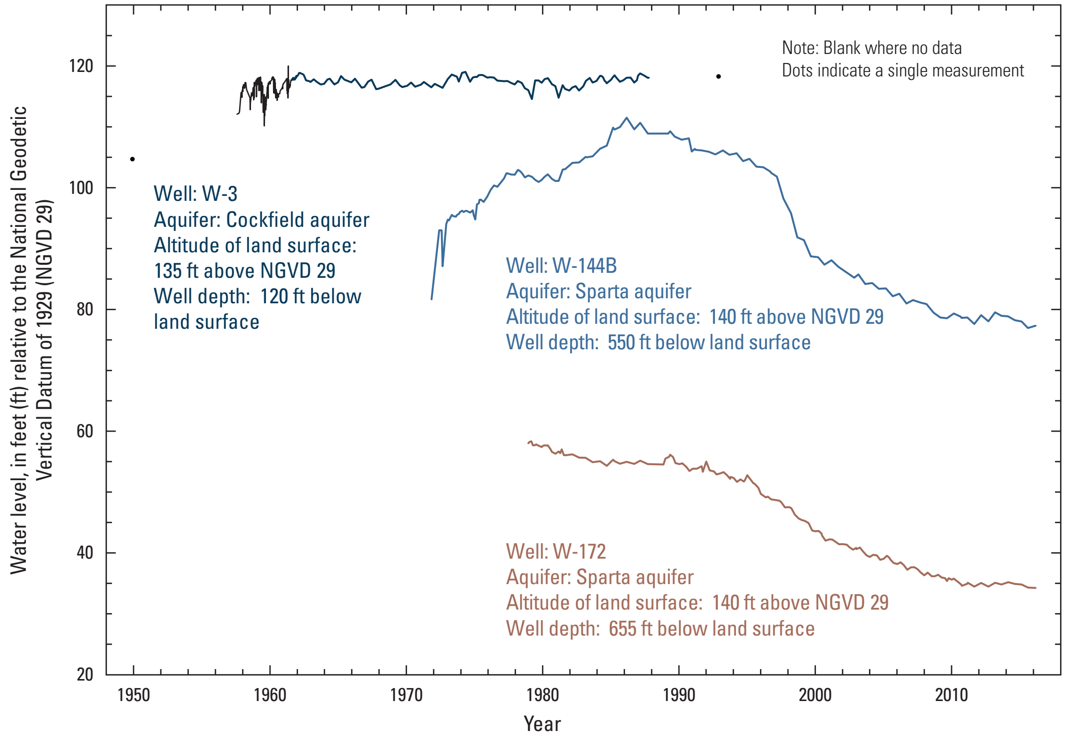

Figure 4. Water levels in well W-3 screened in the Cockfield aquifer and W-144B and W-172 screened in the Sparta aquifer in Winn Parish, Louisiana (see figure 1 for well location; U.S. Geological Survey, 2017b).

Saline Bayou and Lower Red-Lake Iatt Subbasins

The Saline Bayou subbasin is adjacent to the western border of Winn Parish and empties into the Lower Red-Lake Iatt subbasin (fig. 1). Saline Bayou is the primary drainage for the Saline Bayou subbasin and flows along most of the western border of Winn Parish including into and out of Saline Lake. Saline Bayou finally empties into the Red River in the Lower Red-Lake Iatt subbasin. Various small creeks and other drainages are also present in these subbasins, including Iatt Creek, which flows in a southeasterly direction near Atlanta. The annual average streamflow for Saline Bayou near Lucky (USGS site number 07352000) was 172 ft^3/s from a drainage area of 154 mi^2 during 1940–2016, with the highest monthly average during February (325 ft^3/s) and the lowest monthly average during August (31 ft^3/s) (USGS, 2017b). The average streamflow of the downstream site, Red River at Alexandria (USGS site number 07355500), was 30,770 ft^3/s during 1928–82 (Carlson and others, 1983).

Saline Lake was created in 1933 and was enlarged in 1959. The lake has an average depth of 7 ft and a maximum depth of 16 ft. The lake is about 7,000 acres and has a watershed area of about 420 mi^2. The lake was created to improve wildlife, fishing, and recreational activities. A dam and spillway structure regulate the lake, and water levels typically fluctuate annually from about 2 to 3 ft (Louisiana Department of Wildlife and Fisheries, 2017).

Surface-Water Quality

Surface-water samples were collected from Dugdemona River near Winnfield (USGS site number 07372000) during 1944–75, Saline Bayou near Clarence (USGS site number 07353000) during 1953–78, and Red River at Grand Ecore (USGS site number 07351930) during 1987–2000 as part of an ongoing program to monitor the State's surface-water resources (fig. 1). Sample analysis indicated that median pH and median concentrations of chloride, sulfate, and dissolved solids were within SMCLs (table 4). Median values for color exceeded the

Table 4. Summary of selected water-quality characteristics for samples from the Dugdemona River near Winnfield, Saline Bayou near Clarence, and Red River at Grand Ecore, Louisiana (U.S. Geological Survey, 2017b).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; µS/cm, microsiemens per centimeter; SU, standard unit; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016); NA, not applicable; <, less than; —, not sampled; USGS, U.S. Geological Survey]

	Temperature (°C)	Color (platinum cobalt units)	Specific conductance, field (µS/cm at 25 °C)	Dissolved oxygen	pH, field (SU)	Hardness (as $CaCO_3$)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered, in µg/L (as Fe)	Manganese, filtered, in µg/L (as Mn)	Dissolved solids, filtered
Dugdemona River near Winnfield (1944–75)[1]											
Median	20	145	216	7	7	24	10	19	360	40	185
10th percentile	9.1	63.5	81	4.9	6.2	14	4.1	6.4	216	40	82
90th percentile	27	465	718	9.1	7.6	43	25.4	54	610	888	546
Number of samples	53	78	63	43	78	61	75	78	5	3	62
Percentage of samples that do not exceed SMCLs	NA	0	NA	NA	79	NA	100	100	40	67	87
Saline Bayou near Clarence (1953–78)[2]											
Median	19.7	20	152	8.4	7	22	30	5.8	875	<105	94
10th percentile	9.6	10	69	5.0	6.2	14	10	2.2	215	<29	66
90th percentile	29.9	50	1,650	11.4	7.5	127	454	10.7	1,540	<181	581
Number of samples	42	57	104	4	104	104	104	104	2	2	52
Percentage of samples that do not exceed SMCLs	NA	47	NA	NA	75	NA	87	100	50	50	87
Red River at Grand Ecore (1987–2000)[3]											
Median	20	30	474	8.5	7.6	123	57	59	—	—	277
10th percentile	11.5	10	236	6.5	7.2	67	20	22	—	—	139
90th percentile	30	100	1,170	10.8	8.1	300	160	160	—	—	700
Number of samples	151	147	154	147	155	152	154	152	—	—	152
Percentage of samples that do not exceed SMCLs	NA	30	NA	NA	100	NA	99	99	—	—	70
SMCL	NA	15	NA	NA	6.5–8.5	NA	250	250	300	50	500

[1]USGS site number 07372000 (see fig. 1).

[2]USGS site number 07353000 (see fig. 1).

[3]USGS site number 07351930 (see fig. 1).

SMCL. The median values for dissolved-oxygen concentration were at least 7 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).

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This fact sheet has been prepared by the 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 (USGS, 2017b) 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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