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Chloride Concentrations in Ground Water in East and West Baton Rouge Parishes, Louisiana, 2004–05

Scientific Investigations Report 2007–5069

U.S. Department of the Interior
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U.S. Geological Survey
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Conversion Factors, Datums, and Abbreviated Water-Quality Units

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
million gallons per day (Mgal/d)	3,785	cubic meter per day (m^3/d)

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:
°F = (1.8 x °C) + 32

Datums

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).

Abbreviated Water-Quality Units

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chloride in water are given in milligrams per liter (mg/L).

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Chloride Concentrations in Ground Water in East and West Baton Rouge Parishes, Louisiana, 2004–05

By John K. Lovelace

Abstract

Increasing chloride concentrations are a threat to fresh ground-water sources in East Baton Rouge and West Baton Rouge Parishes, Louisiana. Large withdrawals at Baton Rouge have lowered water levels and altered flow patterns in most of the 10 aquifers that underlie the area. Prior to development, freshwater flowed southward to the Baton Rouge fault, an east-west trending growth fault that extends through Baton Rouge and across southeastern Louisiana. Aquifers south of the fault generally contain saltwater. Ground-water withdrawals north of the fault have created gradients favorable for the movement of saltwater from south of the fault into freshwater areas north of the fault.

Water samples were collected from 152 wells during 2004–05 to document chloride concentrations in aquifers underlying East and West Baton Rouge Parishes. The background concentration for chloride in fresh ground water in the Baton Rouge area north of the Baton Rouge fault is generally less than 10 milligrams per liter. Chloride concentrations exceeded 10 milligrams per liter in one or more samples from wells north of the fault screened in the "600-foot," "1,000-foot," "1,200-foot," "1,500-foot," "1,700-foot," "2,000-foot," "2,400-foot," and "2,800-foot" sands. Comparison of the 2004-05 data with historical data indicated that chloride concentrations are increasing at wells in the "600-foot," "1,000-foot," "1,200-foot," "1,500-foot," "2,000-foot," "2,400-foot," and "2,800-foot" sands north of the Baton Rouge fault.

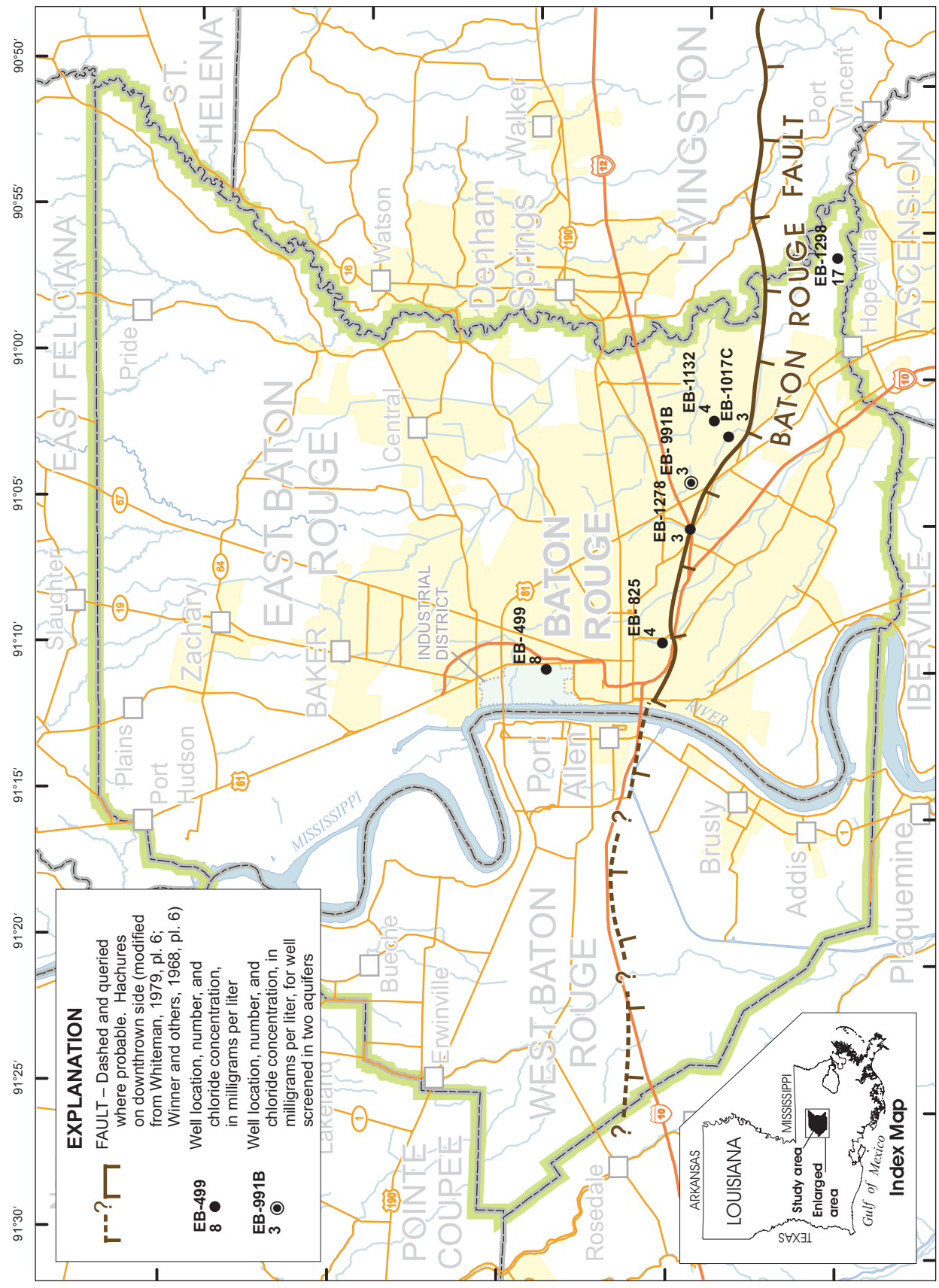
Introduction

Increasing chloride concentrations are a threat to fresh ground-water sources in East and West Baton Rouge Parishes, Louisiana (fig. 1). In 2005, approximately 153 Mgal/d of water was withdrawn from 10 aquifers in East and West Baton Rouge Parishes (fig. 2) (B.P. Sargent, U.S. Geological Survey, written commun., 2007). The aquifers include the "400-foot," "600-foot," "800-foot," "1,000-foot," "1,200-foot," "1,500-foot," "1,700-foot," "2,000-foot," "2,400-foot," and "2,800-foot" sands of the Baton Rouge area. About 70 percent of the water was withdrawn in or near the City of Baton Rouge for public supply or industrial uses (B.P. Sargent, U.S. Geological Survey, written commun., 2007). Large withdrawals at Baton Rouge have lowered water levels and altered flow patterns in most of the 10 aquifers that underlie the area (Tomaszewski, 1996). Prior to development, freshwater flowed southward to the Baton Rouge fault, an east-west trending growth fault that extends through Baton Rouge and across southeastern Louisiana. Aquifers south of the fault generally contain saltwater.[1] Ground-water withdrawals north of the fault have created gradients favorable for the movement of saltwater from south of the fault into freshwater areas north of the fault (Tomaszewski, 1996, p. 1).

Saltwater encroachment, which is the migration of saltwater into a freshwater area, was first documented in an aquifer beneath the Baton Rouge area, the "600-foot" sand, by Meyer and Turcan (1955). Since that time, saltwater encroachment also has been documented in the "800-foot," "1,000-foot," "1,500-foot," and "2,000-foot" sands underlying East and West Baton Rouge Parishes (Morgan and Winner, 1964; Whiteman, 1979; Tomaszewski, 1996). These studies also documented the presence, but not encroachment, of saltwater in the "400-foot," "1,200-foot," and "2,800-foot" sands north of the Baton Rouge fault.

Using data collected through 1992, Tomaszewski (1996) showed that saltwater encroachment had continued in the "1,500-foot" and "2,000-foot" sands. Data collected from 1993 to 2003 from wells in a chloride-monitoring network indicate concentrations of chloride have increased in wells in the "1,000-foot," "1,500-foot," "2,000-foot," "2,400-foot," and "2,800-foot" sands in East and West Baton Rouge Parishes. Data from additional wells are needed to document current (2004–05) chloride concentrations in aquifers underlying the Baton Rouge area. In response to this need, the U.S. Geological Survey (USGS), in cooperation with the Capital Area Ground Water Conservation Commission, began a study in 2004 to document chloride concentrations in selected wells in East and West Baton Rouge Parishes.

[1]For the purposes of this report, saltwater is defined as water containing greater than 250 mg/L chloride. Concentrations of chloride greater than 250 mg/L exceed the Secondary Maximum Contaminant Level (SMCL) for drinking water (U.S. Environmental Protection Agency, 2006). SMCLs are established for contaminants that can adversely affect the aesthetic quality of drinking water. At high concentrations or values, health implications as well as aesthetic degradation also may exist. SMCLs are not federally enforceable, but are intended as guidelines for the states.



Map credit: Modified from Louisiana Oil Spill Coordinator, Office of the Governor, Louisiana GIS CD: A Digital Map of the State, Version 2.0

Figure 1. Location of study area and chloride concentrations in water from wells screened in the "400-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

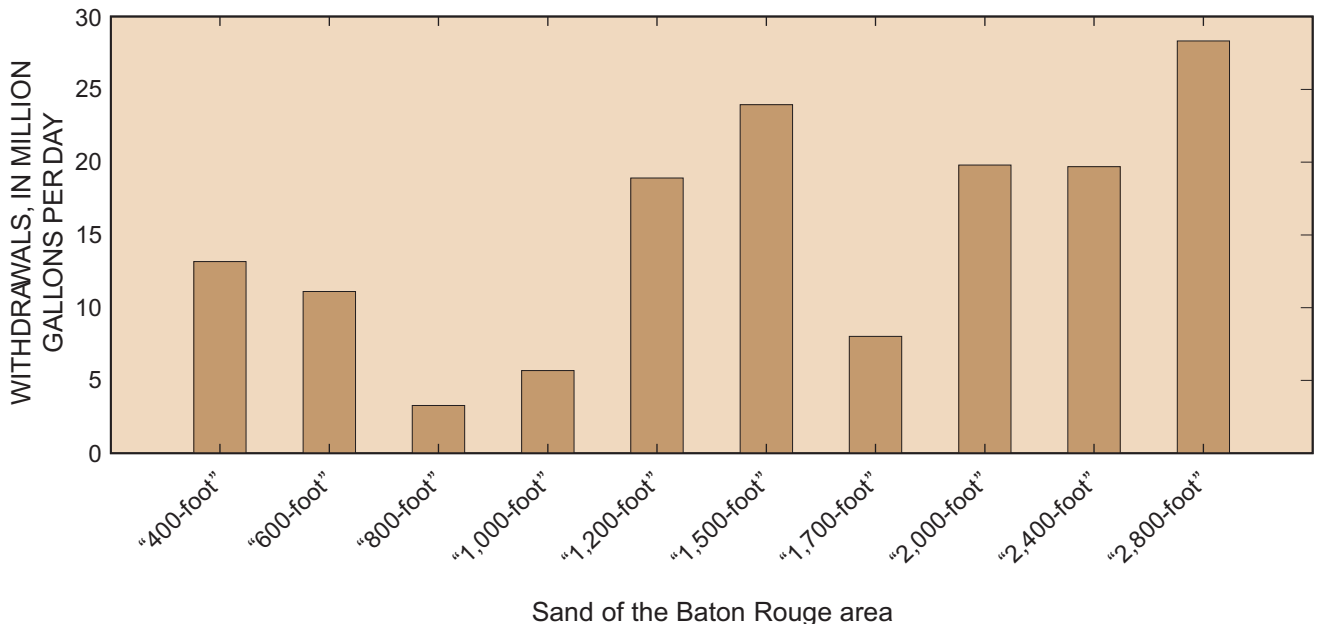


Figure 2. Withdrawals from aquifers in East and West Baton Rouge Parishes, Louisiana, 2005 (B.P. Sargent, U.S. Geological Survey, written commun., 2007).

Purpose and Scope

This report describes current (2004–05) chloride concentrations in ground water in East and West Baton Rouge Parishes. Data were collected from 152 wells, and selected data were collected and analyzed for quality-assurance and quality-control purposes. The data include wells sampled for routine chloride-monitoring purposes during the study period. This report documents and compares differences between historical and 2004–05 data. Well-construction information, specific conductance, and chloride concentrations for wells sampled during 2004–05 are presented by aquifer in a table. In addition, chloride concentrations in water from wells screened in the aquifers are presented on maps. Long-term changes in chloride concentrations at selected wells are presented in graphs. All data presented are stored in the USGS National Water Information System data base and are available at the USGS office in Baton Rouge, La. Information in this report may be useful to State and local water managers and planners and may help improve understanding of water-quality conditions in similar hydrogeologic settings in other areas of the United States.

Description of Study Area

The study area in southeasern Louisiana extends across about 645 mi^2 and includes East and West Baton Rouge Parishes, which are separated by the Mississippi River (fig. 1). East Baton Rouge Parish had an estimated population of 412,000 in 2004 (U.S. Census Bureau, 2005), and large areas of the parish are residential and commercial. West Baton Rouge Parish had an estimated population of 21,880 in 2004 (U.S. Census Bureau, 2005), and much of the Parish is rural with large areas of forested wetlands. Baton Rouge, the largest city in the study area, and several industrial facilities are located along the Mississippi River (fig. 1). The climate in the study area is generally warm and temperate with high humidity and frequent rain. At Baton Rouge, the average annual temperature is 68 ºF, and the average annual rainfall is about 60 in. (National Oceanic and Atmospheric Administration, 1995, p. 5 and 8).

Methods

Wells generally were selected to sample based on their proximity to the Baton Rouge fault or areas of saltwater delineated by Tomaszewski (1996). Many wells were sampled multiple times to determine whether chloride concentrations were changing during the study at the wells. Chloride data collected during this study were compared to historical data to determine whether chloride concentrations were changing over longer periods of time at the wells.

Water samples were collected from wells at a spigot or other discharge outlet; specific conductance and water temperature were measured in the field using methods described in U.S. Geological Survey (1997–present). Samples were sent to the USGS National Water Quality Laboratory in Denver, Colo. for analysis of specific conductance and dissolved chloride concentration using laboratory methods described in Fishman and Friedman (1989). For quality-assurance and quality-control purposes, sequential replicates were collected from 18 wells. Several of the replicates were analyzed for major inorganic ions in addition to specific conductance, temperature, and chloride concentrations. Quality-assurance data for chloride analyses are presented in table 1. Other data are on file at the USGS office in Baton Rouge.

Table 1. Comparison of chloride concentrations in samples and sequential replicates collected for quality assurance purposes.

Well number	Date sampled	Chloride concentration, in milligrams per liter			Percent difference[1] between chloride concentrations in sample and sequential replicate
		Sample	Sequential replicate	Absolute value of the difference between sample and sequential replicate	
EB- 151	11-17-05	2.41	2.56	0.15	6.00
EB- 772	9-02-04	4.18	4.17	0.01	0.31
EB- 813	9-03-04	2.04	2.08	0.04	2.04
EB- 851	9-29-04	2.19	2.18	0.01	0.37
EB- 874	9-03-04	2.19	2.19	0.00	0.00
EB- 917	12-05-05	64.8	69.2	4.40	6.55
EB- 978	9-30-04	11.5	11.5	0.00	0.21
EB- 995	9-17-04	4.72	4.65	0.07	1.52
EB-1004	4-13-05	2.3	2.26	0.04	1.58
EB-1016B	4-13-05	2.52	2.57	0.05	1.85
EB-1123	4-13-05	5.36	4.77	0.59	11.61
EB-1150	9-02-04	167	167	0.00	0.22
EB-1187	9-24-04	2.98	2.99	0.01	0.37
EB-1278	11-10-05	2.66	2.47	0.19	7.53
EB-1303	9-02-04	4.58	4.53	0.05	1.05
WBR- 110	12-23-04	3.27	3.42	0.15	4.51
WBR- 113	12-19-05	221	221	0.00	0.07
WBR- 152	7-14-05	5.07	5.09	0.02	0.35

[1] Percent difference was calculated by multiplying 100 by the absolute value of the difference between the sample and sequential replicate chloride concentrations divided by the average of the sample and sequential replicate chloride concentrations.

In the Baton Rouge area, wells often have multiple screened intervals. In some instances, wells are screened in more than one aquifer. In this report, wells screened in more than one aquifer are included in the discussions and on maps for both aquifers in which the wells are screened, but are listed under separate subheadings that include both aquifer names in the tables.

Acknowledgments

The author gratefully acknowledges the assistance of public-water suppliers, industries, and private well owners who allowed samples to be collected from their wells. A special thanks is given to the Baton Rouge Water Company and Parish Water Company for providing access and knowledgeable escorts to their numerous wells. Thanks to U.S. Geological Survey employees, Michael L. Ross and Robert B. Fendick, Jr., who assisted with sample collection. Thanks also to Zahir "Bo" Bolourchi, Chief, Public Works and Water Resources Section, Louisiana Department of Transportation and Development, for providing well information that was used during this study.

Hydrogeology

Ten freshwater-bearing aquifers beneath the study area were named for their general depth below land surface in the Baton Rouge industrial district (fig. 3) (Meyer and Turcan, 1955, p. 13). These aquifers primarily consist of beds of unconsolidated sand that generally thicken and dip to the south. Although the aquifers vary in thickness and pinch out locally, the aquifers generally are at least 75 ft thick and can be more than 200 ft thick. The confining units between the aquifers consist of clay and silt, and generally are at least 100 ft thick, but may be 500 ft thick in some areas (Tomaszewski, 1996).

Precipitation north of the study area in Louisiana and Mississippi is the primary source of recharge to the aquifers (Morgan, 1963, p. 11–13). Generally, water moves downdip

System	Series	Stratigraphic unit		Aquifer[1] or confining unit	
Quaternary	Holocene	Mississippi River and other alluvial deposits		Mississippi River alluvial aquifer	
	?				
	Pleistocene	Unnamed Pleistocene deposits		Shallow sands	
				Upland terrace aquifer	"400-foot" sand
					"600-foot" sand
Tertiary	Pliocene	Fleming Formation	Blounts Creek Member	"800-foot" sand	
				"1,000-foot" sand	
				"1,200-foot" sand	
	?			"1,500-foot" sand	
				"1,700-foot" sand	
	Miocene		Castor Creek Member	Unnamed confining unit	
			Williamson Creek Member Dough Hills Member Carnahan Bayou Member	"2,000-foot" sand	
				"2,400-foot" sand	
				"2,800-foot" sand	
			Lena Member	Unnamed confining unit	
	?	Catahoula Formation		Catahoula aquifer	
	Oligocene				

[1]Clay units separating aquifers in the Baton Rouge area are discontinuous and unnamed.

Figure 3. Hydrogeologic units in the Baton Rouge area, southeastern Louisiana (modified from Stuart and others, 1994, fig. 5; Lovelace and Lovelace, 1995, fig. 1).

in a southerly direction through the aquifers at rates that range from a few tens of feet per year to several hundreds of feet per year (Buono, 1983, p. 24). The southern limit of freshwater in the aquifers generally is considered to be at or near the Baton Rouge fault (Tomaszewski, 1996, p. 6).

The Baton Rouge fault is a leaky hydrologic barrier to ground-water flow. Strata on the south side of the fault are downthrown, with displacement increasing with depth from a few feet or tens of feet near the surface to about 350 ft at the top of the "2,000-foot" sand (Durham and Peeples, 1956; Whiteman, 1979). Prior to development, which began in the late 1800's (Meyer and Turcan, 1955, p. 51), the Baton Rouge fault impeded southward flow of freshwater. However, by 1960, large cones of depression had developed in several aquifers north of the fault, creating a gradient for northward flow across the fault (Morgan and Winner, 1964). Test drilling and pump tests conducted across the fault in the "600-foot" sand in the early 1970's determined that ground water could move across the fault in response to withdrawals near the fault (Whiteman, 1979).

Chloride Concentrations

Background concentrations of chloride in fresh ground water in the Baton Rouge area north of the fault generally are less than 10 mg/L. A chloride concentration exceeding 10 mg/L often indicates the presence of saltwater near a well, especially when the well is located near the Baton Rouge fault. An exception to this is the "2,800-foot" sand that contains naturally occurring saltwater in the southern half of East Baton Rouge Parish and all of West Baton Rouge Parish. Chloride concentrations in the "2,800-foot" sand near a freshwater-saltwater transition zone in the sand often exceed 10 mg/L but are usually less than 15 mg/L.

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "400-foot" sand									
EB- 499	302914	911023	65	430	330	430	9-29-04	234	8.05
EB- 825	302553	910920	33.57	475	469	475	11-23-04	269	3.49
							11-14-05	270	3.50
EB-1017C	302406	910212	36	567	447	567	9-03-04	302	3.50
							12-17-04	298	3.40
							4-13-05	302	3.49
							11-17-05	287	3.38
EB-1132	302435	910142	43	590	412	590[a]	9-08-04	265	3.61
EB-1278	302501	910526	31	547	537	547	12-01-04	317	2.55
							11-10-05	306	2.66
EB-1298	302105	905600	15	695	560	690	9-17-04	377	19.1
							12-21-05	377	17.1
Well screened in the "400-foot" and "600-foot" sands									
EB- 991B	302508	910354	44	565	445	565	9-08-04	263	3.29
Wells screened in the "600-foot" sand									
EB- 434	302619	911040	45.44	611	551	611	12-14-04	437	49.4
EB- 473	302928	911034	61	692	492	692	9-29-04	272	4.99
EB- 490	302927	911045	62	690	545	690	9-29-04	285	4.45
EB- 793	302719	911032	35.3	687	683	687	11-29-04	408	29.2
EB- 824	302553	910920	33.56	581	575	581	6-30-05	282	3.05
EB- 870	302729	911006	50	692	687	692	11-22-04	290	3.01
							11-15-05	307	8.96
EB- 879	302402	910052	38	664	596	664	9-17-04	300	2.79
							1-05-05	302	2.85
							12-22-05	293	2.91
EB-1018	302426	905907	40	803	622	803[a]	9-17-04	287	4.09
EB-1171	303327	911148	72	445	420	445	9-30-04	268	12.9
EB-1228	302428	910013	30	760	650	760	9-17-04	289	2.95
EB-1300	302813	911035	60	585	555	585	12-30-05	252	4.21
EB-1318	302856	911055	69	607	499	607	9-29-04	296	3.24
WBR- 161	302958	911248	26	650	640	650	6-29-05	287	3.03

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Well screened in the "600-foot" and "800-foot" sands									
EB-1261	302430	910022	40	850	650	850[a]	9-17-04	292	3.04
Wells screened in the "800-foot" sand									
EB-1279	302527	905943	37	882	800	882	9-03-04	279	3.90
EB-1288	302438	910046	40	890	790	890	9-17-04	306	2.65
WBR- 152	302927	911302	23	902	792	902[a]	7-14-05	283	5.07
WBR- 184	302934	911328	27	860	830	860	7-12-05	275	5.47
Well screened in the "800-foot" and "1,000-foot" sands									
EB-1135	302602	910025	40	1,071	822	1,071[a]	9-08-04	286	3.95
Wells screened in the "1,000-foot" sand									
EB- 467	302826	911107	54	1,021	968	1,021	8-16-05	327	2.67
EB- 632	302717	910513	51	1,060	960	1,060	9-02-04	318	2.11
							12-17-04	314	2.10
							11-17-05	303	2.03
EB- 805	302428	910350	46	1,072	1,068	1,072	12-13-04	25,400	9,050
							12-07-05	25,600	9,140
EB- 926	302910	910338	50	980	900	980	9-08-04	281	4.65
EB-1035	302938	910335	50	973	863	973	9-03-04	267	4.43
EB-1123	302910	910348	51	982	872	982[a]	9-08-04	282	4.86
							4-13-05	282	5.36
EB-1220B	302818	910114	47	1,015	940	1,015	9-03-04	276	4.66
EB-1276	302717	910840	47	1,073	913	1,073[a]	9-02-04	318	2.83
EB-1308	302719	910841	47	1,070	1,005	1,065	9-02-04	316	2.84
EB-1328	302437	910143	42	1,140	1,030	1,130	9-08-04	989	222
							12-21-05	1,110	153
WBR- 150	302827	911254	20	1,034	922	1,034[a]	7-14-05	327	6.20
WBR- 164	303002	911858	20	920	860	920	11-19-04	285	4.74
							7-14-05	281	4.93
WBR- 209	302841	911209	27	1,005	915	1,005	7-14-05	289	3.32
Well screened in the "1,000-foot" and "1,200-foot sands									
EB- 772	302721	910549	50	1,214	984	1,214[a]	9-02-04	323	4.18

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "1,200-foot" sand									
EB- 403	302936	911022	64	1,270	1,118	1,270	9-29-04	266	4.69
EB- 523	303021	910800	59	1,206	1,086	1,206[a]	9-03-04	272	4.39
EB- 557	302957	911035	57	1,250	1,160	1,250	9-29-04	223	5.20
EB- 567	302935	911017	63	1,245	1,115	1,245	9-29-04	280	3.99
EB- 576	302917	911032	68	1,270	1,170	1,270	9-29-04	269	4.84
EB- 580	302903	911018	65	1,242	1,182	1,242	9-29-04	301	3.38
EB- 584	302634	910222	40	1,414	1,285	1,414	9-08-04	284	2.79
EB- 621	302500	910525	33	1,487	1,387	1,487	9-03-04	756	135
							12-17-04	697	117
							4-13-05	668	101
							11-17-05	788	157
EB- 629	303343	911225	69	1,025	870	1,025	9-30-04	526	12.1
EB- 649	302947	911023	62	1,250	1,110	1,250	9-29-04	245	5.13
EB- 653	303019	910748	58	1,153	1,030	1,153	9-03-04	279	3.83
EB- 756	303019	910737	57	1,168	1,083	1,168	9-03-04	276	3.88
EB- 925	302602	910025	40	1,470	1,326	1,470[a]	9-08-04	283	3.06
EB- 990	302509	910353	44	1,450	1,310	1,450[a]	9-08-04	312	2.25
							12-17-04	309	2.25
							4-13-05	315	2.26
							11-17-05	297	2.33
EB-1003	302635	910222	40	1,431	1,305	1,431[a]	9-08-04	285	2.90
EB-1016B	302537	910330	47	1,465	1,325	1,465[a]	9-08-04	304	2.54
							4-13-05	305	2.52
EB-1287	302522	910419	45	1,510	1,320	1,500	9-03-04	303	2.58
							4-13-05	301	2.52
EB-1301	302830	911106	55	1,260	1,178	1,260	8-16-05	314	3.16
EB-1312	302436	910142	42	1,515	1,370	1,510	9-08-04	296	2.23
							12-21-05	303	2.33
WBR- 44	302833	911245	23	1,247	1,187	1,247	7-12-05	279	4.43
WBR- 110	302733	911254	20	1,322	1,218	1,322[a]	12-23-04	285	3.27
WBR- 136	302712	911457	20	1,305	1,217	1,305[a]	11-19-04	284	3.19
							12-06-04	286	3.20
							12-20-05	278	3.29

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "1,200-foot" sand—Continued									
WBR- 148	302702	911851	14	1,304	1,294	1,304	11-19-04	343	2.42
							11-22-05	334	2.47
WBR- 207	302732	911224	26	1,332	1,235	1,330[a]	12-23-04	298	2.77
							7-20-05	300	2.69
							12-20-05	292	2.90
Well screened in the "1,200-foot" and "1,500-foot" sands									
EB-1297	302521	910417	45	1,635	1,405	1,630[a]	9-03-04	327	2.65
							12-17-04	323	2.57
							4-13-05	328	2.52
							11-17-05	311	2.78
Wells screened in the "1,500-foot" sand									
EB- 413	302642	910832	49	1,745	1,511	1,745[a]	9-02-04	355	11.5
							12-17-04	353	12.3
							4-13-05	365	13.6
							11-17-05	347	14.8
EB- 510	302751	910925	57	1,605	1,525	1,605	9-02-04	312	11.2
							4-13-05	316	11.2
EB- 657	302751	910932	59	1,618	1,512	1,618[a]	9-02-04	299	2.89
							4-13-05	290	2.99
EB- 658	302745	910924	59	1,604	1,497	1,604	9-02-04	448	51.1
							4-13-05	470	55.8
EB- 726	302746	910917	55	1,601	1,495	1,601	9-02-04	294	3.50
							4-13-05	296	3.49
EB- 771	302646	910838	48	1,739	1,641	1,739[a]	9-02-04	338	6.46
							12-17-04	333	7.07
							4-13-05	344	8.06
							11-17-05	328	9.14
EB- 773	303132	911032	57	1,395	1,298	1,395[a]	9-03-04	276	3.09
EB- 917	302614	910830	47	1,736	1,731	1,736	12-15-04	455	50.5
							12-05-05	496	64.8
EB- 918	302547	910744	40	1,834	1,829	1,834	12-16-04	3,020	915
							12-06-05	3,340	1,010

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05. —Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "1,500-foot" sand—Continued									
EB- 927	302717	910839	47	1,511	1,431	1,511	9-02-04	315	2.70
							12-17-04	311	2.70
							4-13-05	317	2.69
							11-17-05	300	2.84
EB- 938	302749	910928	56	1,599	1,512	1,599	9-02-04	394	14.6
							12-17-04	396	17.5
							4-13-05	407	18.6
							11-17-05	433	32.4
EB- 939	302750	910920	54	1,592	1,497	1,592	9-02-04	289	3.52
							4-13-05	292	3.53
EB- 961	302717	910514	50	1,541	1,441	1,541	9-02-04	279	3.96
EB- 977	303335	911222	71	1,340	1,250	1,340	9-30-04	252	3.58
EB- 984	303326	911148	72	1,320	1,232	1,320[a]	9-30-04	249	3.15
WBR- 112	302550	911241	25	2,205	2,105	2,205	10-28-04	680	88.3
							1-14-05	685	90.4
							4-15-05	670	86.6
							7-12-05	660	80.7
							10-12-05	634	81.8
							12-19-05	640	82.7
WBR- 113	302547	911232	28	2,242	2,148	2,242[a]	10-28-04	1,260	247
							4-15-05	1,280	257
							7-12-05	1,230	235
							10-12-05	--	220
							12-19-05	1,170	221
WBR- 132	302505	911320	20	2,082	2,012	2,082	12-02-04	467	43.6
							7-11-05	436	37.0
							12-20-05	414	34.2
WBR- 173	302456	911302	25	2,194	2,124	2,194	12-02-04	461	38.1
							7-11-05	480	48.3
							12-20-05	478	50.5
Well screened in the "1,500-foot" and "1,700-foot" sands									
EB-1295C	302405	910219	40	1,840	1,655	1,837[a]	9-03-04	532	44.3
							4-13-05	552	50.3

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "1,700-foot" sand									
EB- 804A	302428	910350	46	1,950	1,946	1,950	12-8-05	372	2.34
EB- 873	302721	910548	50	1,884	1,764	1,884	9-02-04	308	4.07
EB-1303	302824	910540	50	1,707	1,600	1,700	9-02-04	290	4.58
WBR- 139	303603	912047	29	1,375	--	--	11-19-04	324	2.50
							7-14-05	--	2.59
WBR- 176	303229	912146	20	1,458	1,295	1,458[a]	11-19-04	341	2.22
							7-14-05	342	2.22
WBR- 177	303227	912414	23	1,444	1,384	1,444	11-19-04	341	2.45
							7-14-05	343	2.44
WBR- 181	302644	911212	28	1,900	1,768	1,900[a]	12-06-04	301	2.61
							1-13-05	299	2.62
							12-19-05	299	2.71
Wells screened in the "2,000-foot" sand									
EB- 549	302926	911126	52	2,079	1,859	2,079	8-02-05	373	1.97
EB- 587	302900	911056	65	2,110	1,990	2,110	9-29-04	278	3.38
EB- 630	302651	911124	45	2,253	2,015	2,253[a]	9-03-04	1,030	205
							12-08-04	1,000	185
							4-13-05	780	125
							11-17-05	1,100	245
EB- 722	302946	911035	58	2,059	1,915	2,059	9-29-04	282	3.46
EB- 774	302718	910839	47	2,143	2,033	2,143[a]	9-02-04	289	2.93
							4-13-05	290	2.86
EB- 783B	302502	911136	26	2,675	2,670	2,675	12-01-04	3,440	755
							11-14-05	3,310	759
EB- 788	302925	911117	55	2,150	1,913	2,150[a]	8-02-05	345	2.27
EB- 792B	302605	910806	45	2,286	2,282	2,286	12-14-04	386	2.10
							12-06-05	373	2.22
EB- 810	302854	911037	67	2,130	2,030	2,130	9-29-04	276	3.31
EB- 814	302749	910916	55	2,168	2,040	2,168	9-02-04	292	2.95
							4-13-05	294	2.90
EB- 851	302901	911111	67	2,119	1,984	2,119	9-29-04	324	2.19
EB- 855	302847	911056	65	2,208	2,042	2,208[a]	9-29-04	295	2.86
EB- 856	303000	911017	55	2,040	1,900	2,040[a]	9-29-04	287	3.50

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "2,000-foot" sand—Continued									
EB- 874	302750	911110	50	2,250	2,121	2,250a	9-03-04	372	2.19
							12-08-04	377	2.23
							4-13-05	415	2.14
							5-10-05	420	2.11
							6-16-05	424	2.1
							11-17-05	348	2.17
EB- 878	302721	910547	50	2,178	2,000	2,178[a]	9-02-04	289	2.93
EB- 884	302904	911018	65	2,120	1,985	2,120	9-29-04	275	3.51
EB- 962	302943	911023	60	2,066	1,916	2,066	9-29-04	286	3.46
EB-1028	302605	911009	40	2,238	2,223	2,238	12-15-04	1,170	257
							12-09-05	1,210	266
EB-1150	302653	911037	57	2,242	2,186	2,242	9-02-04	904	167
							12-08-04	927	164
							12-29-05	914	167
EB-1151	302930	911115	62	2,042	1,888	2,042[a]	8-02-05	336	2.44
EB-1306	303234	910115	57	1,753	1,693	1,753	9-17-04	262	3.85
EB-1313	302931	911110	65	2,080	1,885	2,080	8-02-05	304	3.10
EB-1319	302108	905600	15	2,750	2,530	2,740[a]	9-17-04	438	7.85
							12-21-05	464	7.87
WBR- 102B	302806	911726	18	2,100	2,096	2,100	6-30-05	395	2.06
WBR- 111	302550	911241	25	2,650	2,610	2,650	7-12-05	678	3.31
Wells screened in the "2,000-foot" and "2,400-foot" sands									
EB- 151	302641	910858	50	2,658	2,157	2,658[a]	9-02-04	347	2.43
							12-17-04	343	2.44
							4-13-05	350	2.41
							11-17-05	333	2.41
EB- 733	302647	910833	48	2,637	2,070	2,637[a]	9-04-04	354	2.53
							12-17-04	349	2.49
							4-13-05	358	2.47
EB-1253	302652	911124	46	2,687	2,000	2,667[a]	9-03-04	424	2.82
							12-08-04	438	2.83
							11-17-05	401	3.06

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "2,400-foot" sand									
EB- 351	302937	911023	60	2,434	2,358	2,434[a]	9-29-04	323	2.80
EB- 654	303021	910748	58	2,382	2,270	2,382	9-02-04	286	3.48
EB- 751	302716	910838	48	2,595	2,495	2,595	9-02-04	330	2.56
							4-13-05	334	2.54
EB- 769	303021	910737	55	2,362	2,250	2,362	9-02-04	285	3.69
EB- 804B	302428	910350	46	2,762	2,758	2,762	12-13-04	721	111
							12-07-05	748	129
EB- 813	302749	911111	59	2,536	2,440	2,536	9-03-04	377	2.18
							4-13-05	380	2.04
EB- 928	303018	910756	56	2,375	2,305	2,375	9-02-04	286	3.51
EB-1004	302634	910221	40	2,605	2,415	2,605[a]	9-08-04	322	2.25
							4-13-05	325	2.30
EB-1025	302537	910328	45	2,674	2,569	2,674	9-08-04	417	3.56
							5-10-05	418	4.01
EB-1027	303424	911229	73	1,926	1,883	1,926	9-24-04	298	3.63
EB-1032	303034	910023	47	2,334	2,248	2,334	9-17-04	252	3.61
EB-1039	302518	910414	40	2,697	2,597	2,697	9-03-04	416	2.36
							4-13-05	420	2.41
EB-1149	302653	911037	57	2,694	2,550	2,694[a]	9-02-04	394	2.27
							12-08-04	410	2.27
							4-13-05	397	2.27
							11-17-05	375	2.42
EB-1252	302647	910830	51	2,625	2,535	2,625	9-02-04	344	2.52
							4-13-05	348	2.46
EB-1262	302818	910114	47	2,570	2,420	2,570	9-03-04	279	3.51
WBR- 100B	302643	911216	29	2,448	2,444	2,448	11-22-04	377	4.65
							6-29-05	375	5.47
							11-16-05	373	6.00
Wells screened in the "2,400-foot" and "2,800-foot" sands									
EB- 995	303158	910337	57	2,520	2,155	2,520[a]	9-17-04	277	4.72
EB-1187	303314	910935	60	2,405	1,965	2,405[a]	9-24-04	458	2.98

Table 2. Selected data, including specific conductance values and chloride concentrations, for wells in East and West Baton Rouge Parishes, Louisiana, 2004-05.—Continued

[NAD 27, North American Datum of 1927; NGVD 29, National Geodetic Vertical Datum of 1929; --, no data]

Well number	Latitude (NAD 27)	Longitude (NAD 27)	Altitude of land surface, in feet above NGVD 29	Well depth, in feet	Depth to top of screen(s), in feet	Depth to bottom of screen(s), in feet	Date sampled	Specific conductance, field, in microsiemens per centimeter at 25° Celsius	Chloride concentration, in milligrams per liter
Wells screened in the "2,800-foot" sand									
EB- 568	303332	910758	70	2,457	2,377	2,457	9-24-04	419	2.21
EB- 623	303233	910349	60	2,652	2,560	2,652[a]	9-17-04	736	12.8
EB- 700	303130	910731	62	2,557	2,507	2,557	9-24-04	566	8.03
							1-05-05	570	8.05
							12-22-05	550	8.20
EB- 723	303313	911202	71	2,512	2,402	2,512[a]	8-08-05	562	6.20
EB- 730	303305	910800	60	2,461	2,395	2,461	9-24-04	500	2.31
EB- 750	303141	911148	60	2,643	2,563	2,643	9-03-04	742	67.2
							12-17-04	733	67.2
							4-13-05	763	68.3
							11-17-05	708	66.8
EB- 798	303133	911031	60	2,647	2,524	2,647[a]	9-03-04	1,280	240
							12-17-04	1,230	230
							4-13-05	1,240	227
							11-17-05	1,280	262
EB- 830	303814	910409	90	2,190	2,075	2,190[a]	9-24-04	448	2.68
EB- 859	303311	911048	70	2,440	2,340	2,440	9-30-04	470	2.51
EB- 860	303311	911050	70	2,435	2,334	2,435	9-30-04	534	4.08
EB- 922	303259	910658	66	2,600	--	--	9-24-04	569	3.83
EB- 978	303341	911225	70	2,540	2,430	2,540	9-30-04	525	11.5
EB-1268	303335	911237	70	2,504	2,335	2,500[a]	9-30-04	530	12.9
EB-1292	303327	911145	70	2,420	2,340	2,420	9-30-04	484	3.23

[a] Multiple screened intervals.

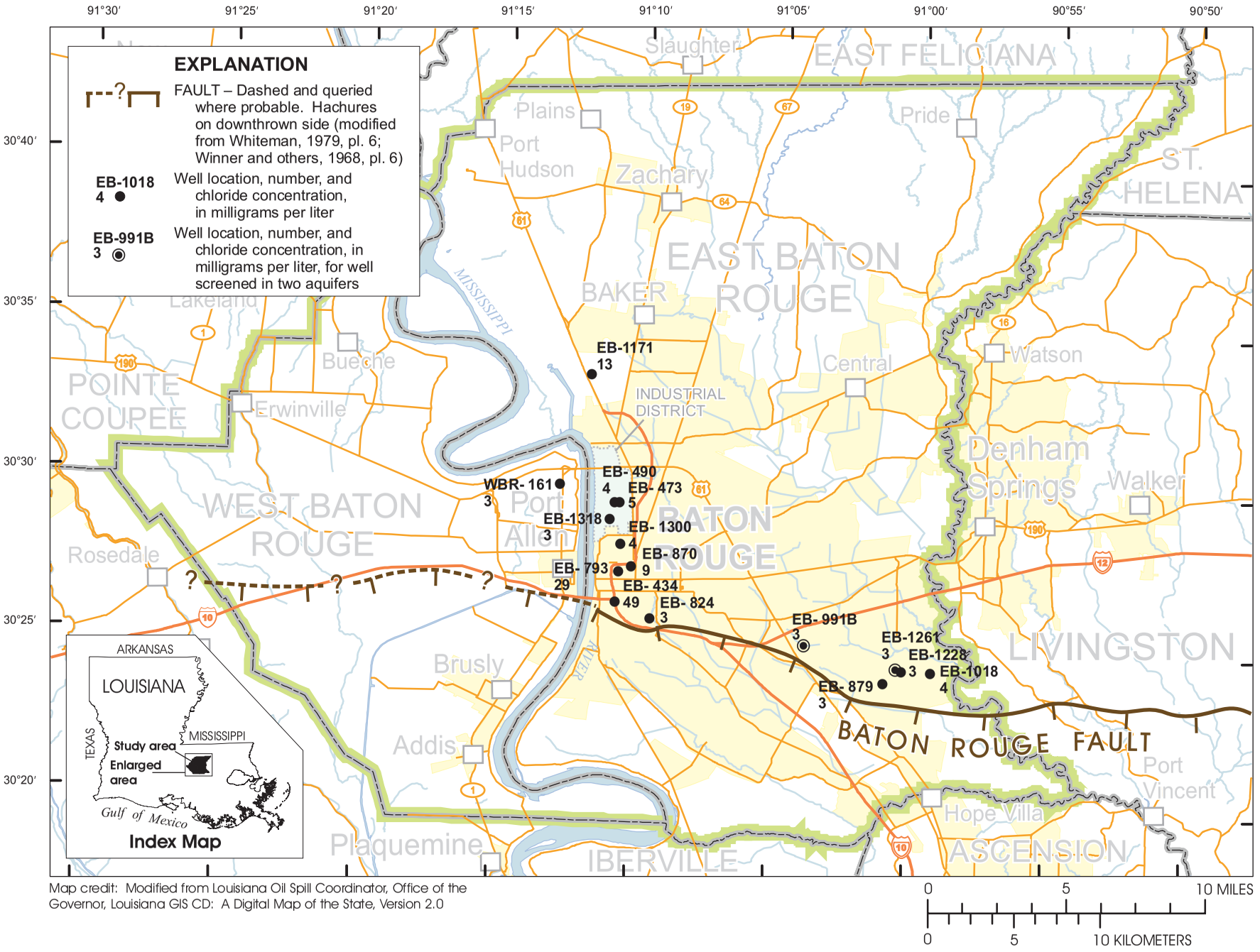


Figure 4. Chloride concentrations in water from wells screened in the "600-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

Saltwater movement north of the fault is affected by aquifer permeability, depressions or ridges in the base of the aquifer, and the slope of the base of the aquifer (Tomaszewski, 1996, p. 6). Hydraulic gradients, which are affected by withdrawals in the study area, also affect the direction and rate of saltwater movement. Because saltwater is denser than freshwater, saltwater encroaches into a freshwater aquifer as a wedge, and the leading edge moves along the base of the aquifer as a thin layer. Because large-diameter production wells typically have screens that are several tens of feet long, water withdrawn from the well is a mixture of water entering the screen at various depths along the screen. When chloride concentrations at such wells exceed 10 mg/L, it probably is an indication that a thin layer of saltwater with a higher chloride concentration is present at the base of the aquifer, but is being mixed in the well with overlying freshwater that also is entering the screen.

Of the 152 wells sampled during 2004–05, chloride concentrations exceeded 10 mg/L in samples from 23 wells located north of the Baton Rouge fault, which indicated the possible presence of saltwater in 8 of the 10 aquifers. Comparison of the sample results with historical data indicated that chloride concentrations are increasing at wells north of the Baton Rouge fault in seven of the aquifers. Summaries of findings for each aquifer are presented in the following sections. Selected well data and chloride concentrations from the sampled wells are presented in table 2. For the purposes of this report, the last chloride concentration measured from a well was used on maps when multiple samples had been collected from that well during the study.

"400-Foot" Sand

Samples were collected from five wells located just north of the Baton Rouge fault, one well in the Baton Rouge industrial district, and one well south of the fault (fig. 1, table 2). Chloride concentrations at wells north of the fault did not exceed background concentrations, and no increase in chloride concentrations was indicated at the wells. The downthrown sands on the south side of the fault, which oppose the "400-foot" sand on the north side of the fault, mostly contain freshwater in East Baton Rouge Parish, and the only real threat of saltwater encroachment into the "400-foot" sand north of the fault is from upward migration of saltwater from the underlying "600-foot" sand (Whiteman, 1979, p. 36). A large-diameter well, EB-1298, located south of the fault in the southeast corner of East Baton Rouge Parish, was sampled and had a chloride concentration of 17.1 mg/L. No increase in chloride concentrations was indicated at well EB-1298.

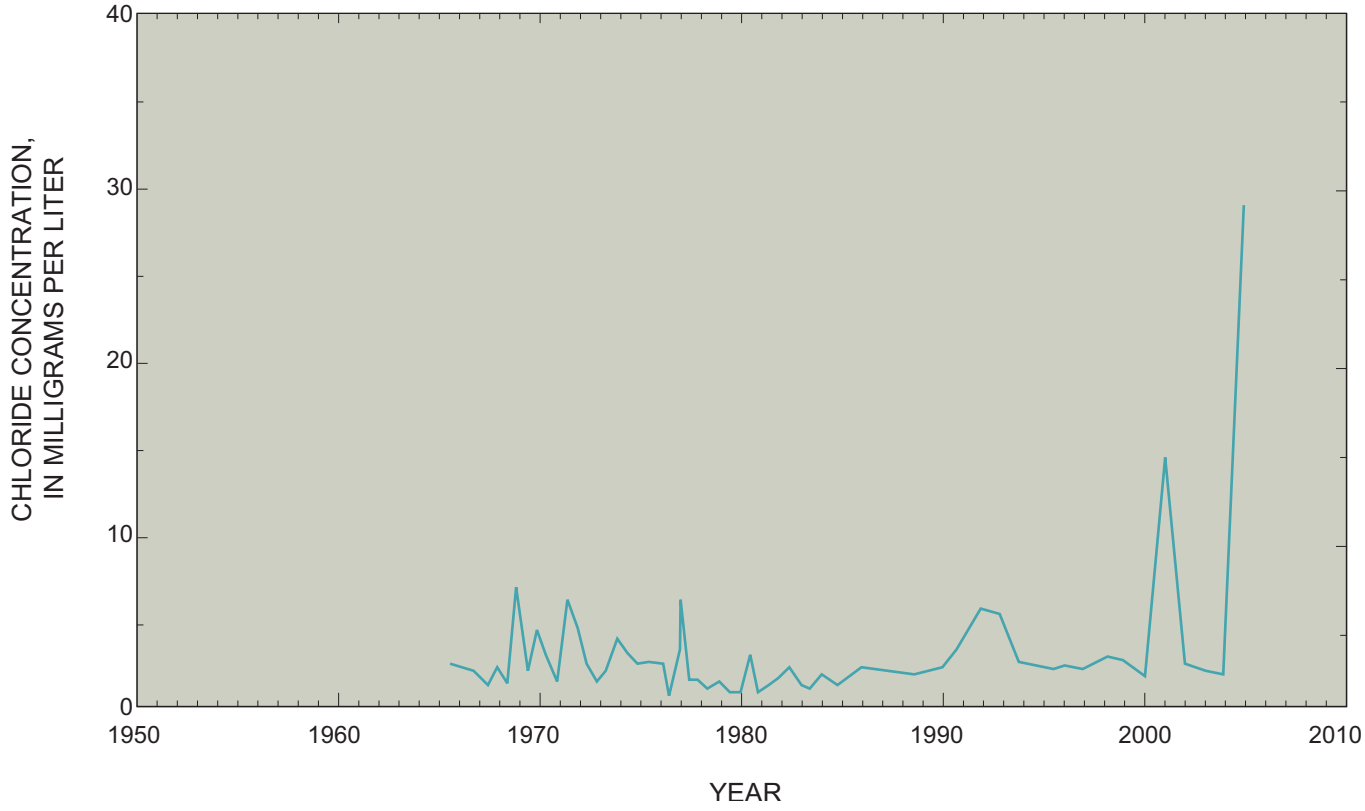


Figure 5. Chloride concentrations in water from well EB-793 screened in the "600-foot" sand of the Baton Rouge area, Louisiana (see fig. 4 for well location).

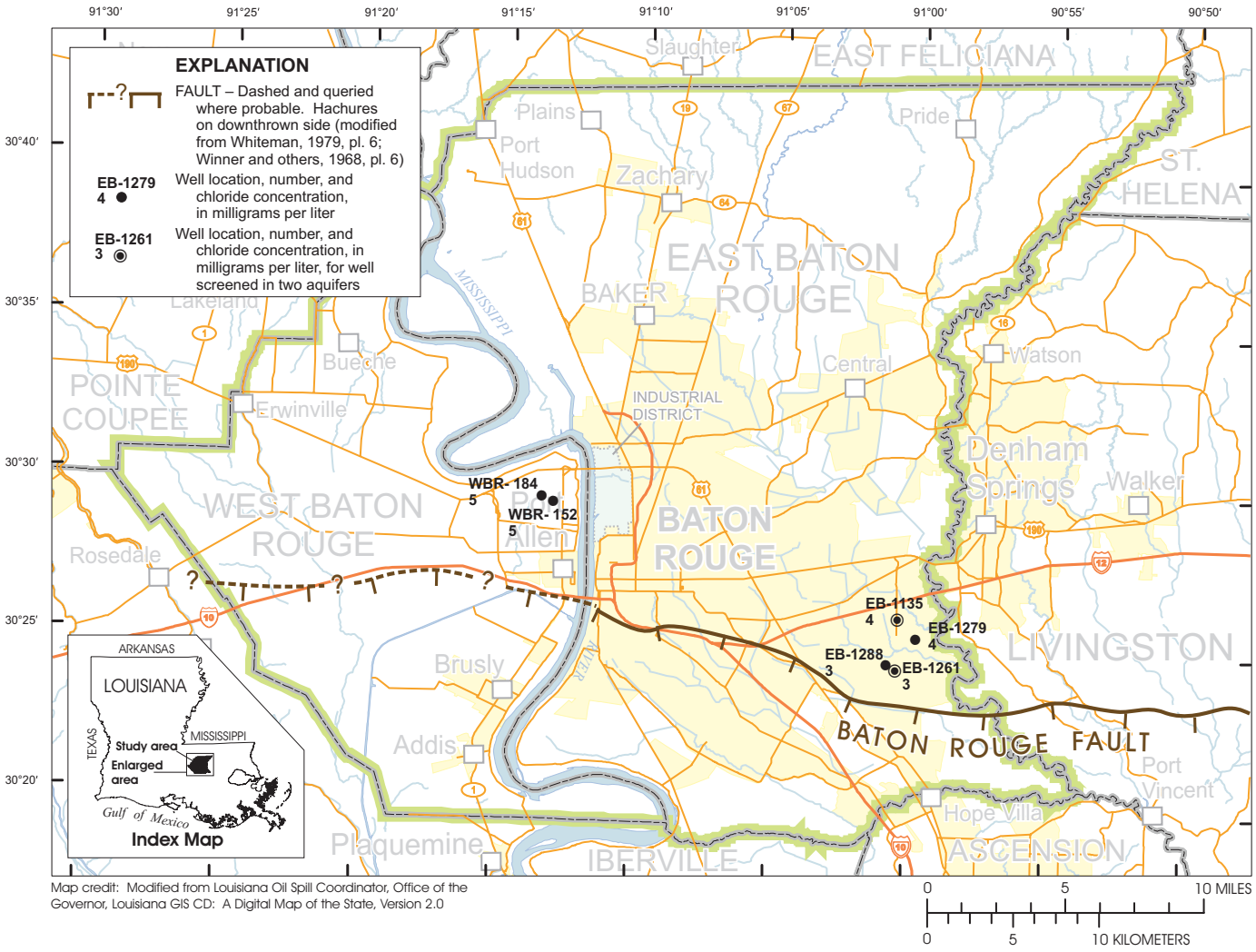


Figure 6. Chloride concentrations in water from wells screened in the "800-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

"600-Foot" Sand

Samples were collected from 15 wells located north of the Baton Rouge fault. Chloride concentrations exceeded background concentrations at two wells, EB-434 (49.4 mg/L) and EB-793 (29.2 mg/L), located between the fault and the industrial district, and at well EB-1171, located north of the industrial district (fig. 4). Increasing chloride concentrations at well EB-793 (fig. 5), located at the leading edge of the saltwater defined by Whiteman (1979), could indicate northward advancement of saltwater toward the Baton Rouge industrial district.

"800-Foot" Sand

Samples were collected from two wells located near Port Allen, La., in West Baton Rouge Parish and four wells in southeastern East Baton Rouge Parish. Chloride concentrations did not exceed background concentrations at any sampled wells (fig. 6, table 2). No increase in chloride concentrations was indicated.

"1,000-Foot" Sand

Chloride concentrations at 13 of 15 sampled wells did not exceed background concentrations (fig. 7, table 2). The chloride concentration at well EB-805, located just north of the Baton Rouge fault, was 9,140 mg/L, the highest chloride concentration determined during the study. Chloride concentrations at well EB-805 have increased continuously since 1965, indicating saltwater leakage across the fault (fig. 8). Chloride concentrations at well EB-1328, located about 2.5 mi east of well EB-805, were as high as 222 mg/L (table 2).

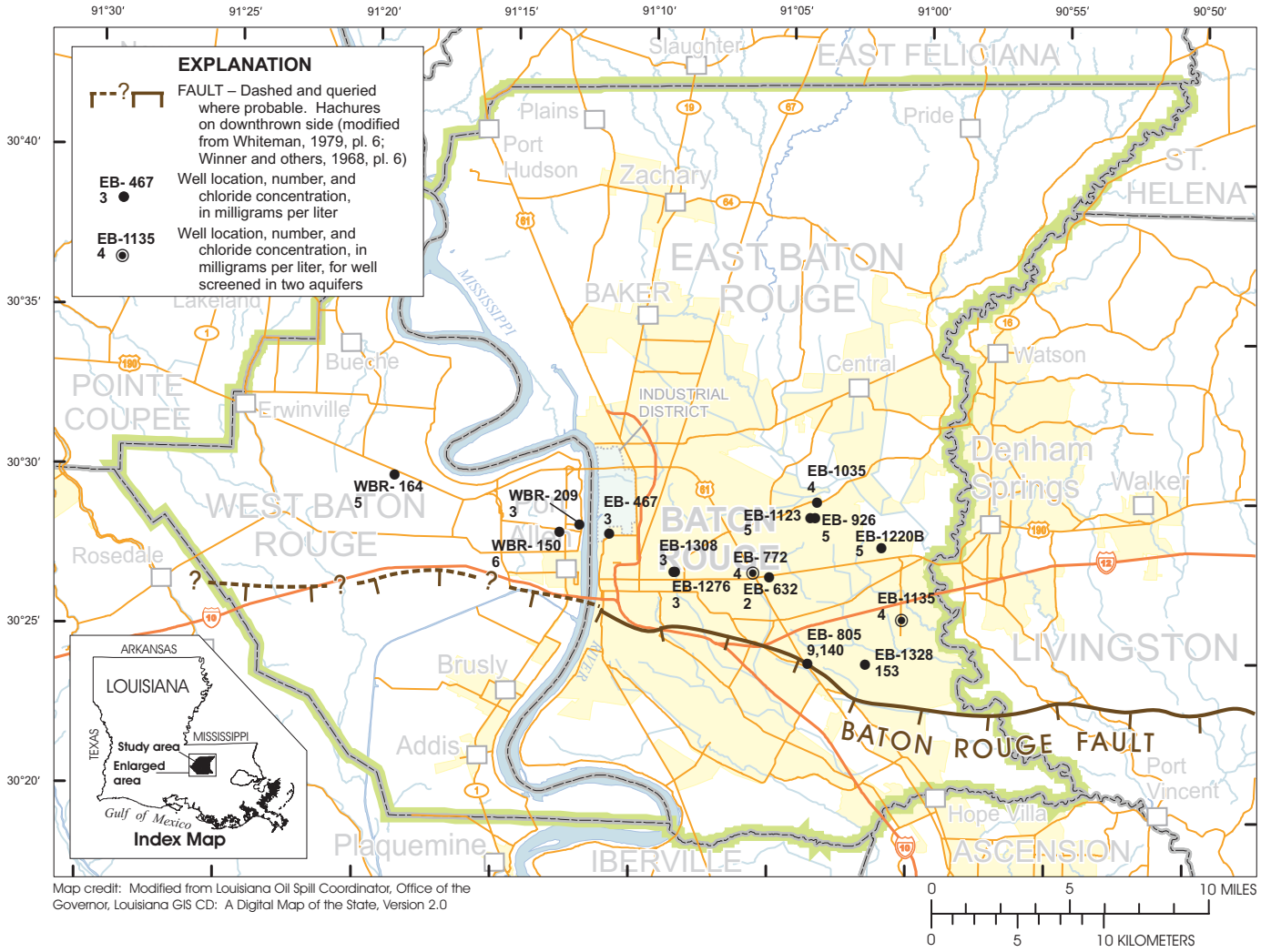


Figure 7. Chloride concentrations in water from wells screened in the "1,000-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

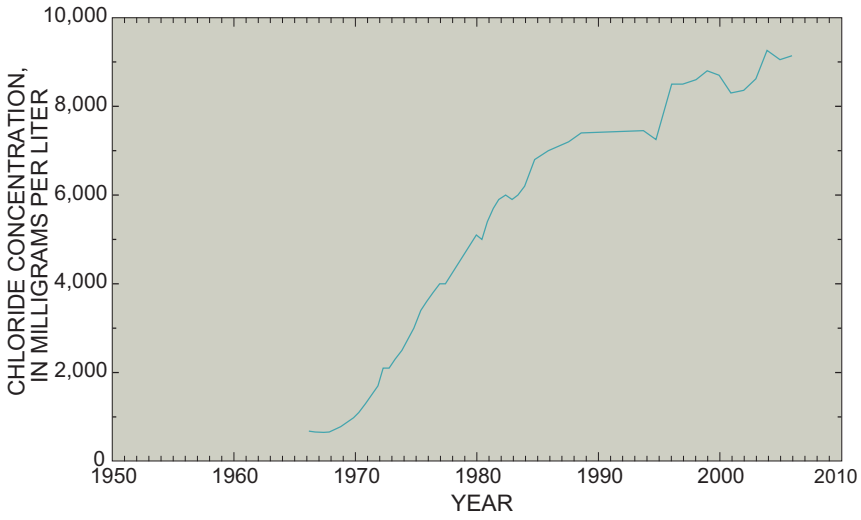


Figure 8. Chloride concentrations in water from well EB-805 screened in the "1,000-foot" sand of the Baton Rouge area, Louisiana (see fig. 7 for well location).

"1,200-Foot" Sand

Chloride concentrations at 24 of 26 sampled wells did not exceed background concentrations (fig. 9, table 2). Chloride concentration at well EB-629, located north of the industrial district, was 12.1 mg/L. Chloride concentrations at well EB-621, located just north of the Baton Rouge fault, have exceeded background concentrations since the late 1970's, but had not exceeded 60 mg/L until 2004. Chloride concentrations at the well increased to more than 150 mg/L in 2005 (fig. 10). The increase in chloride concentrations at well EB-621 indicates continued saltwater leakage across the fault in the "1,200-foot" sand.

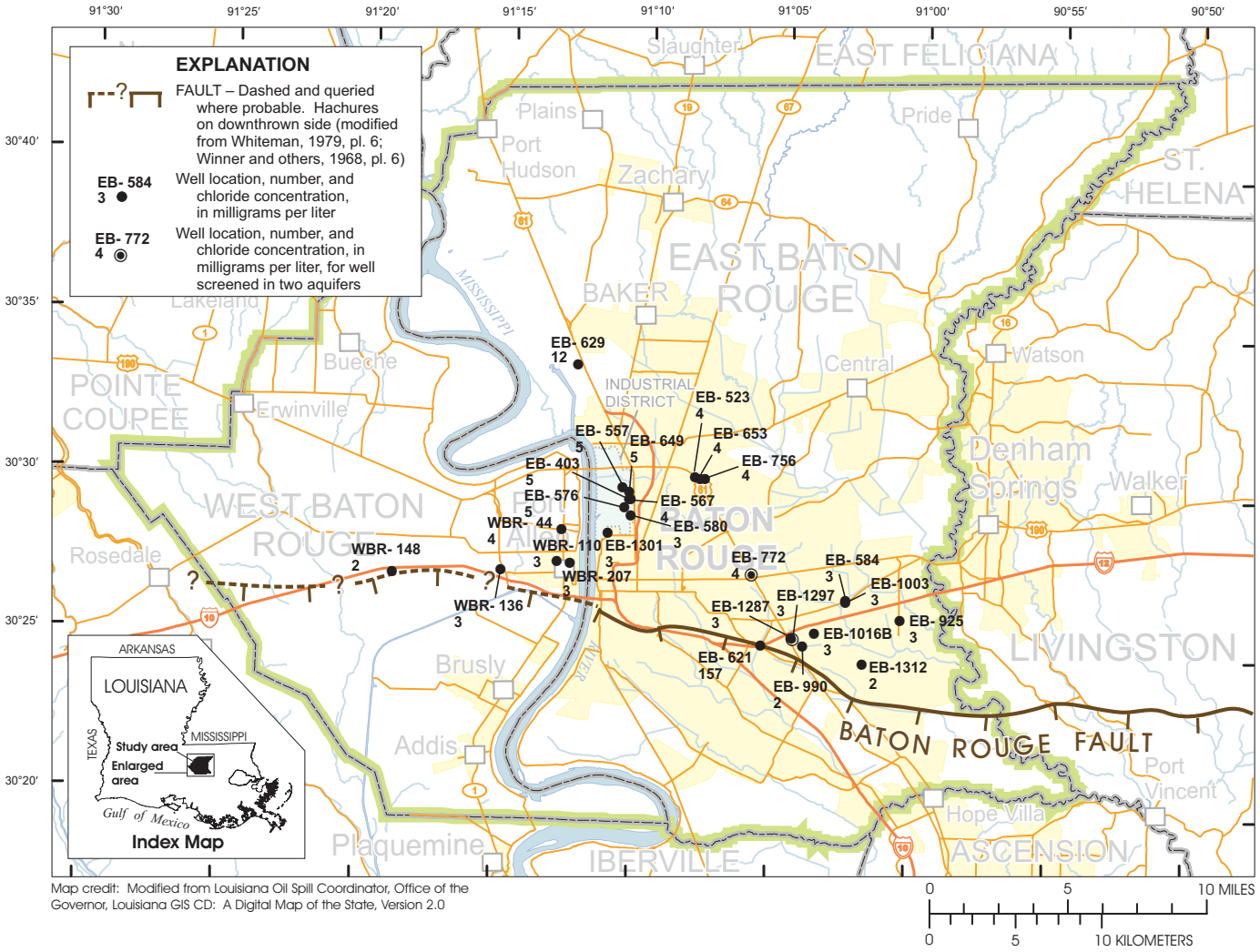


Figure 9. Chloride concentrations in water from wells screened in the "1,200-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

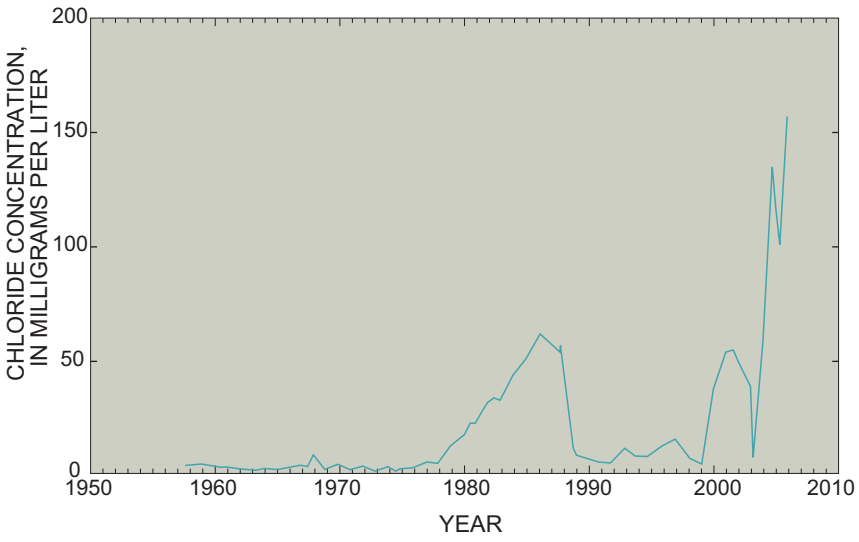


Figure 10. Chloride concentrations in water from well EB-621 screened in the "1,200-foot" sand of the Baton Rouge area, Louisiana (see fig. 9 for well location).

"1,500-Foot" Sand

Chloride concentrations at 11 of 21 sampled wells exceeded background concentrations (fig. 11, table 2). In East Baton Rouge Parish, chloride concentrations exceeded background concentrations at wells EB-413, EB-510, EB-658, EB-917, EB-918, EB-938, and EB-1295C. Chloride concentrations at wells EB-917 and EB-918, located just north of the Baton Rouge fault, have continued to increase and currently (2004–05) are at 64.8 and 1,010 mg/L (fig. 12). Chloride concentrations also have increased at wells EB-413 (14.8 mg/L), EB-771 (9.14 mg/L), EB-510 (11.2 mg/L), and EB-658 (55.8 mg/L), indicating that saltwater is moving northward (figs. 13 and 14). Well EB-1295C is

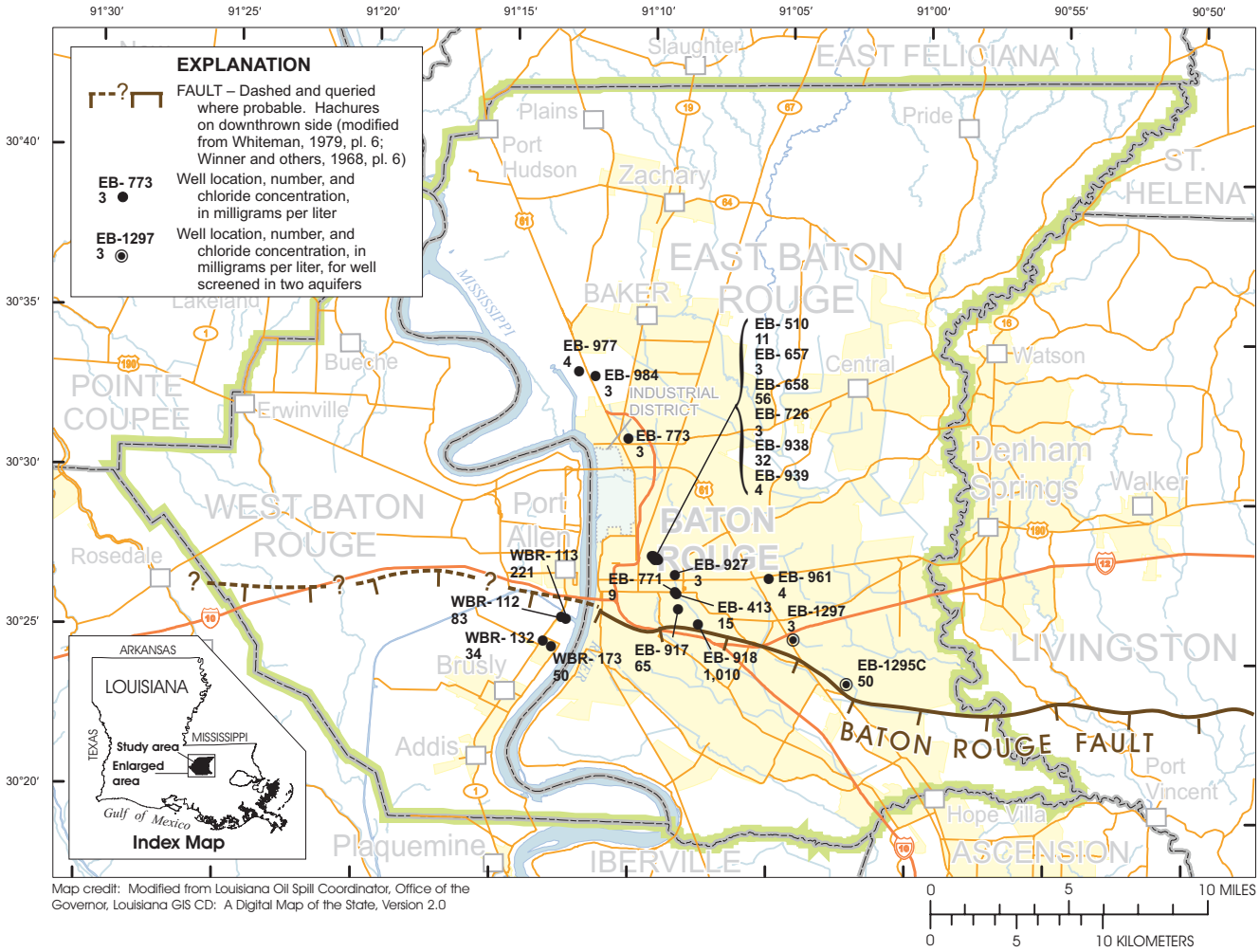


Figure 11. Chloride concentrations in water from wells screened in the "1,500-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

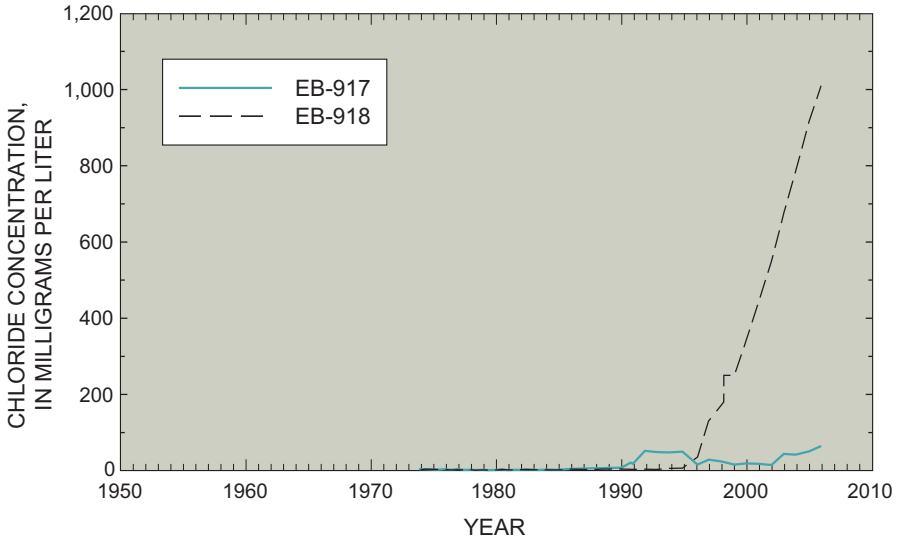


Figure 12. Chloride concentrations in water from wells EB-917 and EB-918 screened in the "1,500-foot" sand of the Baton Rouge area, Louisiana (see fig. 11 for well locations).

screened in both the "1,500-foot" sand and the deeper "1,700-foot" sand, and it is not known which aquifer is the source of the saltwater at the well.

Tomaszewski (1998) documented an area in West Baton Rouge Parish where the "1,500-foot" sand locally contains freshwater south of the fault. Chloride concentrations have increased at all four wells sampled in the area (figs. 15 and 16). Saltwater may be encroaching toward the wells from the surrounding saltwater areas (Tomaszewski, 1998, p. 13).

"1,700-Foot" Sand

Chloride concentrations at seven of eight sampled wells did not exceed background concentrations (fig. 17,

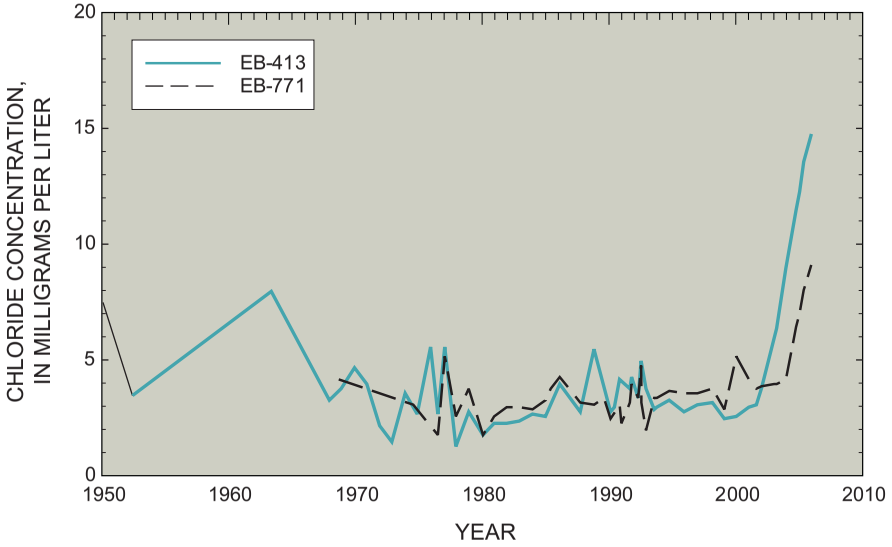


Figure 13. Chloride concentrations in water from wells EB-413 and EB-771 screened in the "1,500-foot" sand of the Baton Rouge area, Louisiana (see fig. 11 for well locations).

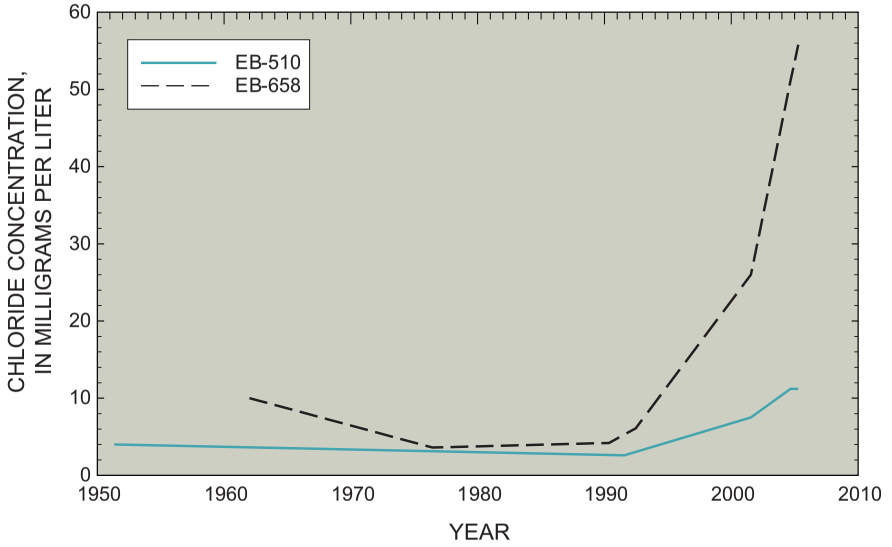


Figure 14. Chloride concentrations in water from wells EB-510 and EB-658 screened in the "1,500-foot" sand of the Baton Rouge area, Louisiana (see fig. 11 for well locations).

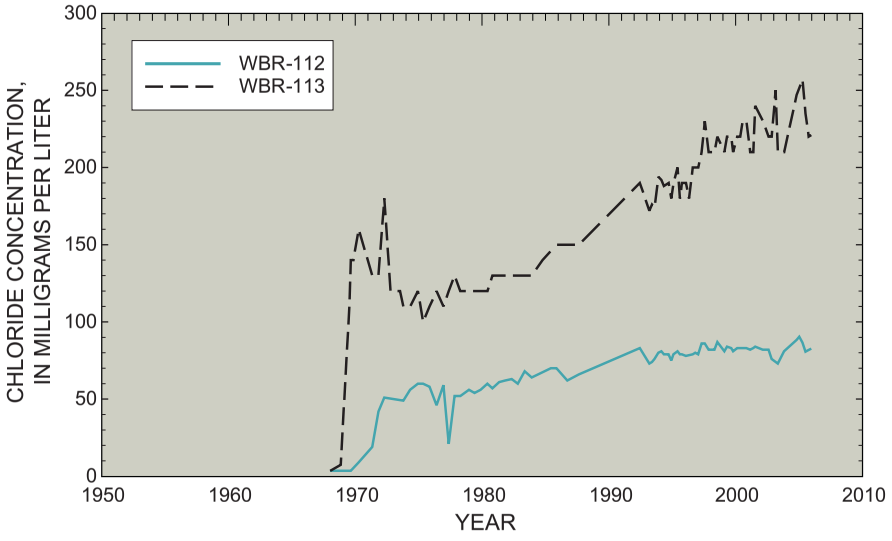


Figure 15. Chloride concentrations in water from wells WBR-112 and WBR-113 screened in the "1,500-foot" sand of the Baton Rouge area, Louisiana (see fig. 11 for well locations).

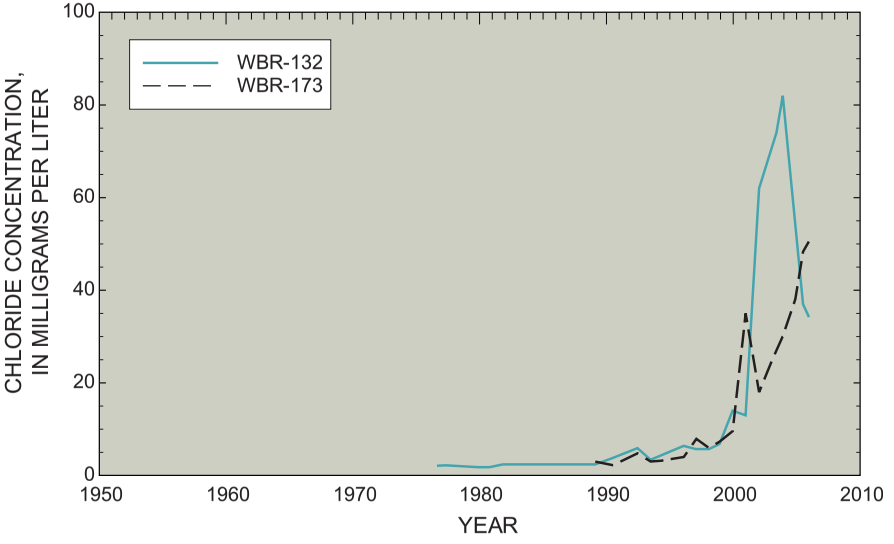


Figure 16. Chloride concentrations in water from wells WBR-132 and WBR-173 screened in the "1,500-foot" sand of the Baton Rouge area, Louisiana (see fig. 11 for well locations).

table 2). The chloride concentration was 50.3 mg/L at well EB-1295C, which is screened in both the "1,500-foot" and "1,700-foot" sands. It is not known which aquifer is the source of the saltwater at the well, and historical data for the well are insufficient to determine whether chloride concentrations at the well are changing over time.

"2,000-Foot" Sand

Samples were collected from 25 wells located north of the Baton Rouge fault and 3 wells located south of the fault (fig. 18, table 2). North of the fault, chloride concentrations exceeded background concentrations at three wells, EB-630, EB-1028, and EB-1150, located between the fault and the industrial district. Chloride concentrations at the wells exceeded 100 mg/L and have increased (fig. 19). Movement of saltwater in the "2,000-foot" sand toward withdrawal centers in the industrial district was documented by Tomaszewski (1996). The chloride concentration at well EB-783B, located

Photograph by Dennis K. Demcheck, USGS, September 2007

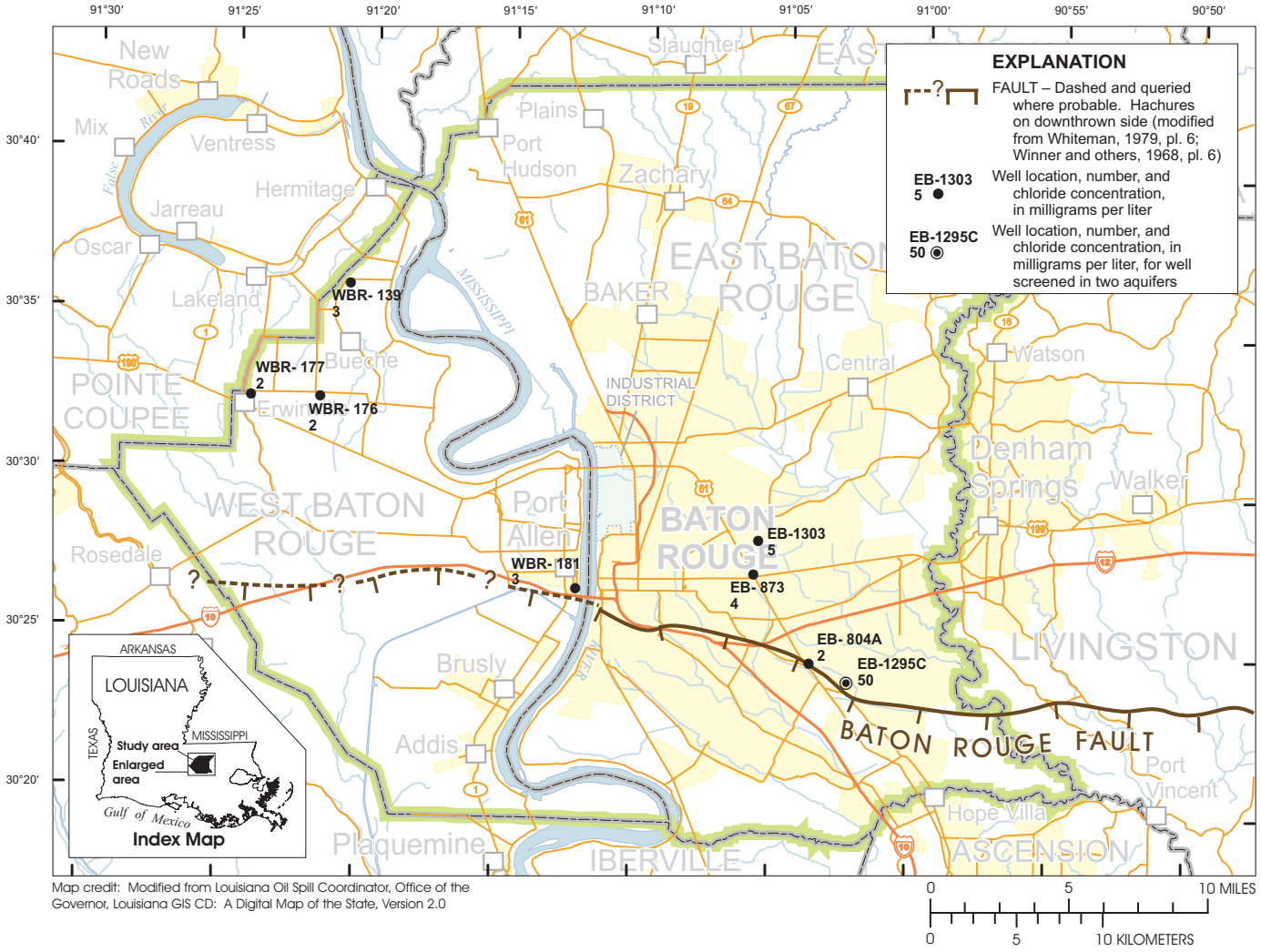


Figure 17. Chloride concentrations in water from wells screened in the "1,700-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

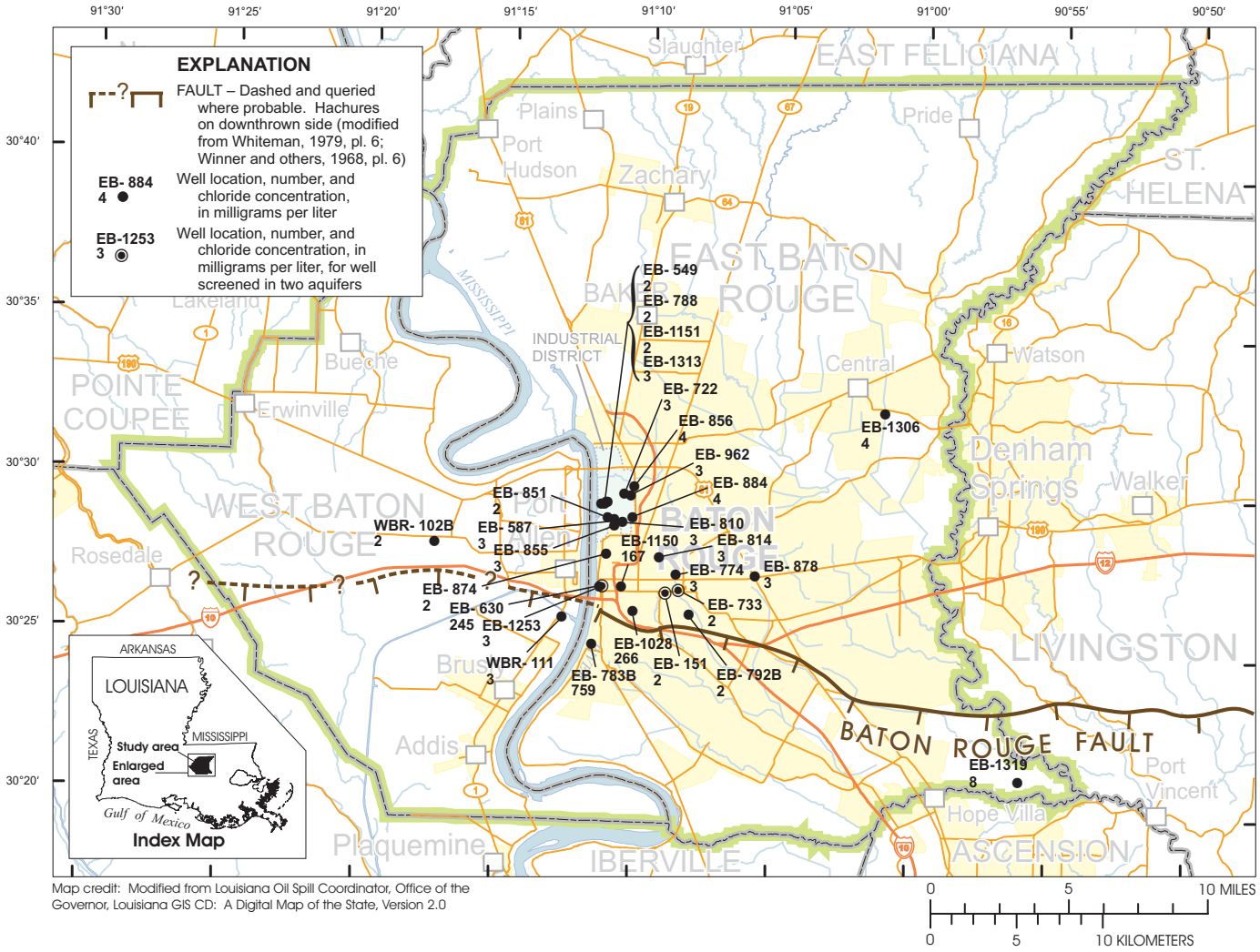


Figure 18. Chloride concentrations in water from wells screened in the "2,000-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

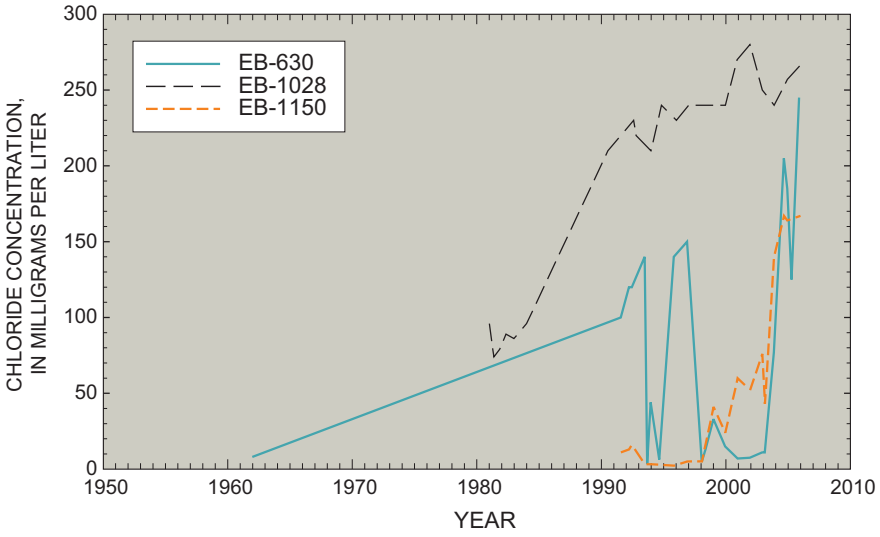


Figure 19. Chloride concentrations in water from wells EB-630, EB-1028, and EB-1150 screened in the "2,000-foot" sand of the Baton Rouge area, Louisiana (see fig. 18 for well locations).

about 2 mi south of well EB-630 and south of the Baton Rouge fault, was 759 mg/L.

"2,400-Foot" Sand

Chloride concentrations at 20 of 21 sampled wells did not exceed background concentrations (fig. 20, table 2). Chloride concentrations at well EB-804B, located just north of the Baton Rouge fault in south-central East Baton Rouge Parish, exceeded 100 mg/L and have increased since about 1993, indicating that saltwater is moving across the fault in that area (fig. 21).

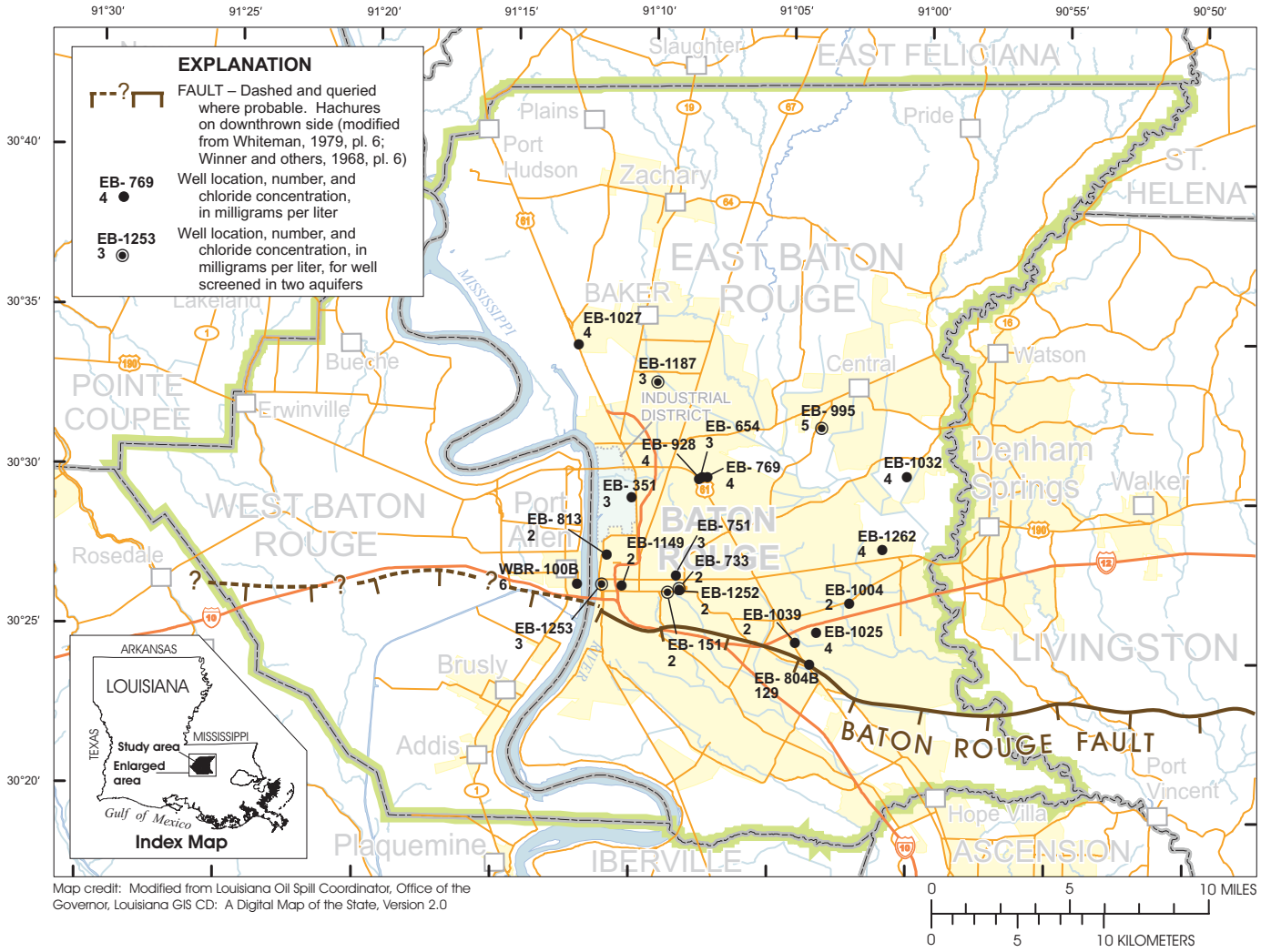


Figure 20. Chloride concentrations in water from wells screened in the "2,400-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

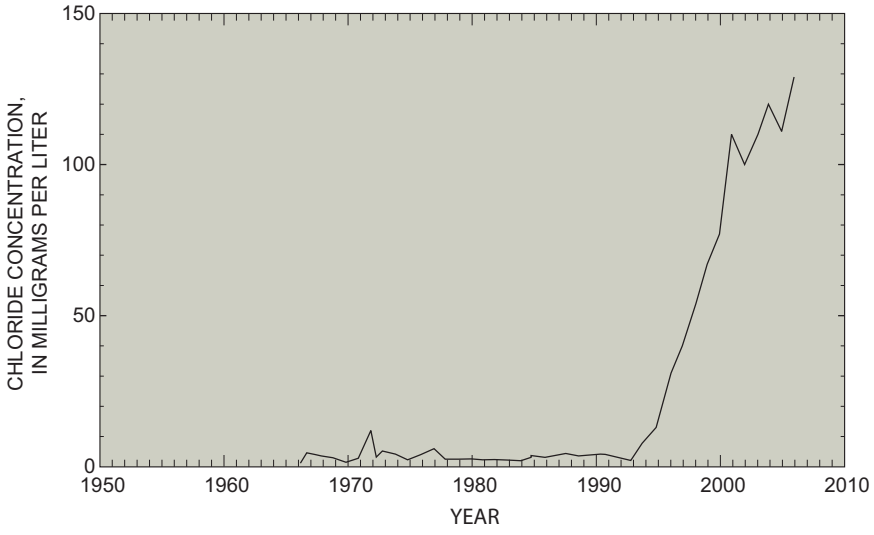


Figure 21. Chloride concentrations in water from well EB-804B screened in the "2,400-foot" sand of the Baton Rouge area, Louisiana (see fig. 20 for well location).

"2,800-Foot" Sand

Wells screened in the "2,800-foot" sand generally are located in the northern half of East Baton Rouge Parish because the "2,800-foot" sand contains saltwater from the Baton Rouge fault to about 2 mi north of the fault. A zone of transition from saltwater to freshwater farther extends from about 2 to 7 mi north of the fault and ends just north of the Baton Rouge industrial district (Tomaszewski, 1996, p. 27). Chloride concentrations at 11 of 16 sampled wells located north of the transition zone did not exceed background

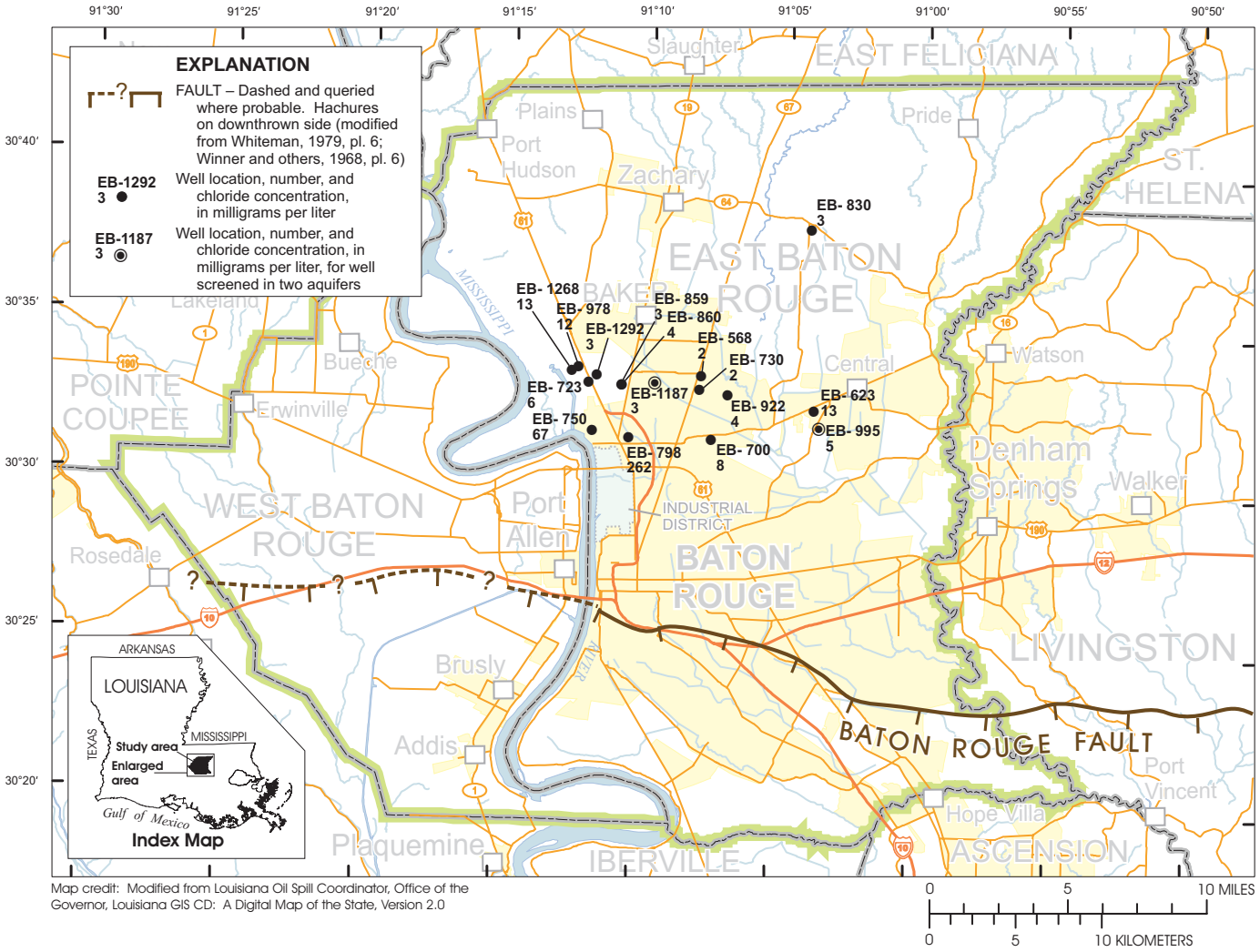


Figure 22. Chloride concentrations in water from wells screened in the "2,800-foot" sand of the Baton Rouge area in East and West Baton Rouge Parishes, Louisiana, 2004–05.

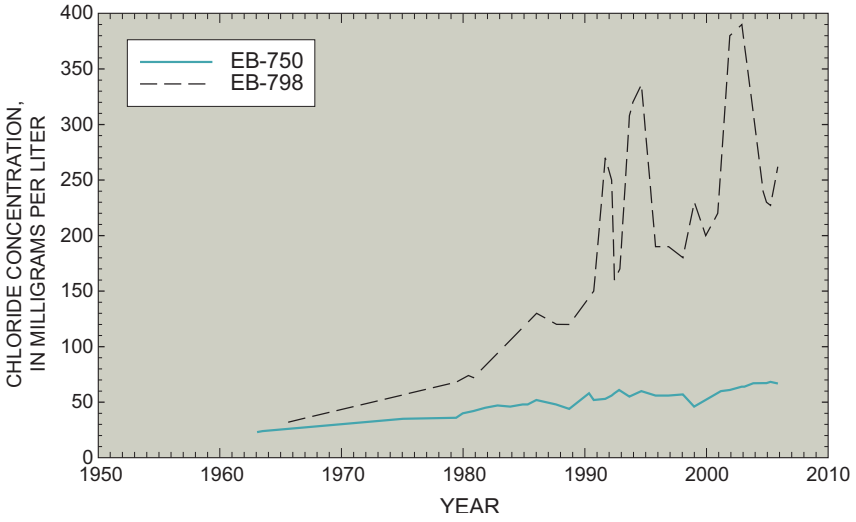


Figure 23. Chloride concentrations in water from wells EB-750 and EB-798 screened in the "2,800-foot" sand of the Baton Rouge area, Louisiana (see fig. 22 for well locations).

concentrations (fig. 22, table 2). Chloride concentrations at wells EB-623, EB-978, and EB-1268 ranged from 11.5 to 12.9 mg/L. Chloride concentrations at two of the southernmost wells, EB-750 and EB-798, were greater than background concentrations (67.2 and 262 mg/L) and increasing (fig. 23). Because these wells are located within the freshwater-saltwater transition zone (Tomaszewski, 1996, p. 29), the increasing chloride concentrations could be due to upconing of saltwater from the base and do not necessarily indicate that saltwater in the "2,800-foot" sand is moving northward in the area.

Summary

Increasing chloride concentrations are a threat to fresh ground-water sources in East and West Baton Rouge Parishes, Louisiana. Large withdrawals at Baton Rouge have lowered water levels and altered flow patterns in most of the 10 aquifers that underlie the area. Prior to development, freshwater flowed southward to the Baton Rouge fault, an east-west trending growth fault that extends through Baton Rouge and across southeastern Louisiana. Aquifers south of the fault generally contain saltwater. Ground-water withdrawals north of the fault have created gradients favorable for the movement of saltwater from south of the fault into freshwater areas north of the fault.

By 1992, saltwater encroachment had been documented in the "600-foot," "800-foot," "1,000-foot," "1,500-foot," and "2,000-foot" sands underlying East and West Baton Rouge Parishes. The presence of saltwater, but not encroachment, also had been documented in the "400-foot, "1,200-foot," and "2,800-foot" sands north of the Baton Rouge fault. Data collected from 1993 to 2003 from wells on a chloride-monitoring network indicate concentrations of chloride have increased in wells in the "1,000-foot," "1,500-foot," "2,000-foot," "2,400-foot," and "2,800-foot" sands in East and West Baton Rouge Parishes.

Water samples were collected from 152 wells during 2004–05 to document chloride concentrations in aquifers underlying East and West Baton Rouge Parishes. Chloride concentrations exceeded 10 mg/L (milligrams per liter) in samples from 23 wells located north of the Baton Rouge fault and indicated the possible presence of saltwater in 8 of the 10 aquifers. Comparison of the sample results with historical data indicated that chloride concentrations are increasing at wells north of the Baton Rouge fault in seven of the aquifers.

Chloride concentrations at wells screened in the "400-foot" sand north of the Baton Rouge fault did not exceed background concentrations and no increase in chloride concentrations was indicated at the wells. A large-diameter well, EB-1298, screened in the "400-foot" sand south of the fault in the southeast corner of East Baton Rouge Parish, was sampled and had a chloride concentration of 17.1 mg/L. No increase in chloride concentrations was indicated at well EB-1298.

Chloride concentrations exceeded background concentrations at two wells, EB-434 (49.4 mg/L) and EB-793 (29.2 mg/L), screened in the "600-foot" sand and located between the fault and the industrial district, and at one well located north of the industrial district. Increasing chloride concentrations at well EB-793 could indicate northward advancement of saltwater toward the Baton Rouge industrial district.

The chloride concentration at well EB-805, screened in the "1,000-foot" sand and located just north of the Baton Rouge fault, was 9,140 mg/L, the highest chloride concentration determined during the study. Chloride concentrations at well EB-805 have increased continuously since 1965, indicating saltwater leakage across the fault. Chloride concentrations at well EB-1328, located about 2.5 miles east of well EB-805, were as high as 222 mg/L.

Chloride concentrations at well EB-621, located just north of the Baton Rouge fault, have exceeded background concentrations since the late 1970's, but had not exceeded 60 mg/L until 2004. Chloride concentrations at the well increased to more than 150 mg/L in 2005. The increase in chloride concentrations at well EB-621 indicates continued saltwater leakage across the fault in the "1,200-foot" sand.

Chloride concentrations at 11 of 21 sampled wells screened in the "1,500-foot" sand exceeded background concentrations. Chloride concentrations at wells EB-917 and EB-918, located just north of the Baton Rouge fault, have continued to increase and currently (2004–05) are at 65 and 1,010 mg/L. Chloride concentrations also have increased at wells EB-413 (14.8 mg/L), EB-771 (9.14 mg/L), EB-510 (11.2 mg/L), and EB-658 (55.8 mg/L), indicating that saltwater is moving northward in the "1,500-foot" sand. Chloride concentrations also increased in four wells sampled south of the fault in West Baton Rouge Parish in the area where the "1,500-foot" sand locally contains freshwater south of the fault.

Chloride concentrations in the "2,000-foot" sand exceeded background concentrations at three wells, EB-630, EB-1028, and EB-1150, located between the fault and the industrial district. Chloride concentrations at the wells exceeded 100 mg/L and have increased. Saltwater in the "2,000-foot" sand is moving toward withdrawal centers in the industrial district.

Chloride concentrations at well EB-804B, screened in the "2,400-foot" sand and located just north of the Baton Rouge fault in south-central East Baton Rouge Parish, exceeded 100 mg/L. Chloride concentrations at the well have increased since about 1993, indicating that saltwater is moving across the fault in that area.

Wells screened in the "2,800-foot" sand generally are located in the northern half of East Baton Rouge Parish because the "2,800-foot" sand contains saltwater from the Baton Rouge fault to about 2 miles north of the fault. A zone of transition from saltwater to freshwater farther extends from about 2 to 7 miles north of the fault and ends just north of the Baton Rouge industrial district. Chloride concentrations at two of the southernmost wells, EB-750 and EB-798, were greater than background concentrations (67.2 and 262 mg/L) and increasing. Because these wells are located within the freshwater-saltwater transition zone, the increasing chloride concentrations could be due to upconing of saltwater from the base and do not necessarily indicate that saltwater in the "2,800-foot" sand is moving northward in the area.

Selected References

Buono, Anthony, 1983, The Southern Hills regional aquifer system of southeastern Louisiana and southwestern Mississippi: U.S. Geological Survey Water-Resources Investigations Report 83–4189, 38 p.

Durham, C.O., Jr., and Peeples, E.M. III, 1956, Pleistocene fault zone in southeastern Louisiana [abs.]: Transactions of the Gulf Coast Association of Geological Societies, v. 6, p. 65–66.

Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p. [Also available online at URL http://pubs.water.usgs.gov/twri/. Chapters originally published from 1997–99; updates and revisions are ongoing and are summarized at URL http://water.usgs.gov/owq/FieldManual/mastererrata.html]

Lovelace, J.K., and Lovelace, W.M., 1995, Hydrogeologic unit nomenclature and computer codes for aquifers and confining units in Louisiana: Louisiana Department of Transportation and Development Water Resources Special Report no. 9, 12 p.

Meyer, R.R., and Turcan, A.N., Jr., 1955, Geology and ground-water resources of the Baton Rouge area, Louisiana: U.S. Geological Survey Water-Supply Paper 1296, 138 p.

Morgan, C.O., 1961, Ground-water conditions in the Baton Rouge area, 1954–59, with special reference to increased pumpage: Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works Water Resources Bulletin no. 2, 78 p.

Morgan, C.O., 1963, Ground-water resources of East Feliciana and West Feliciana Parishes, Louisiana: Louisiana Department of Public Works, 58 p.

Morgan, C.O., and Winner, M.D., Jr., 1964, Salt-water encroachment in aquifers of the Baton Rouge area—preliminary report and proposal: Louisiana Department of Public Works, 37 p.

National Oceanic and Atmospheric Administration, 1995, Climatological data annual summary—Louisiana: Asheville, N.C., Environmental Data Service, 23 p.

Stuart, C.G., Knochenmus, Darwin, and McGee, B.D., 1994, Guide to Louisiana's ground-water resources: U.S. Geological Survey Water-Resources Investigations Report 94–4085, 55 p.

Rollo, J.R., 1969, Saltwater encroachment in aquifers of the Baton Rouge area, Louisiana: Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works Water Resources Bulletin no. 13, 45 p.

Tomaszewski, D.J., 1996, Distribution and movement of saltwater in aquifers in the Baton Rouge area, Louisiana, 1990–92: Louisiana Department of Transportation and Development Water Resources Technical Report no. 59, 44 p.

Tomaszewski, D.J., 1998, Hydrogeology and the effects of pumpage on the "1,500-foot" sand south of the Baton Rouge fault, near Brusly, Louisiana, 1996: Louisiana Department of Transportation and Development Water Resources Technical Report no. 65, 22 p.

Tomaszewski, D.J., and Anderson, M.L., 1995, Data from wells in a chloride monitoring network, Baton Rouge area, Louisiana, 1965–94: Louisiana Department of Transportation and Development Water Resources Basic Records Report no. 19, 40 p.

U.S. Census Bureau, 2005, State and county quickfacts: accessed December 12, 2005, at URL http://quickfacts.census.gov/qfd/states/22000.html

U.S. Environmental Protection Agency, 2006, Drinking water contaminants: accessed December 28, 2006, at URL http://www.epa.gov/safewater/contaminants/index.html

U.S. Geological Survey, (1997–present), National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, 2 v., variously paged. [Also available online at URL http://pubs.water.usgs.gov/twri/. Chapters originally published from 1997–99; updates and revisions are ongoing and are summarized at URL http://water.usgs.gov/owq/FieldManual/mastererrata.html]

Whiteman, C.D., Jr., 1979, Saltwater encroachment in the "600-foot" and "1,500-foot" sands of the Baton Rouge area, Louisiana, 1966–78, including a discussion of saltwater in other sands: Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report no. 19, 49 p.

Winner, M.D., Jr., Forbes, M.J., Jr., and Broussard, W.L., 1968, Water resources of Pointe Coupee Parish, Louisiana: Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works Water Resources Bulletin no. 11, 110 p.

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