STATE OF LOUISIANA

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

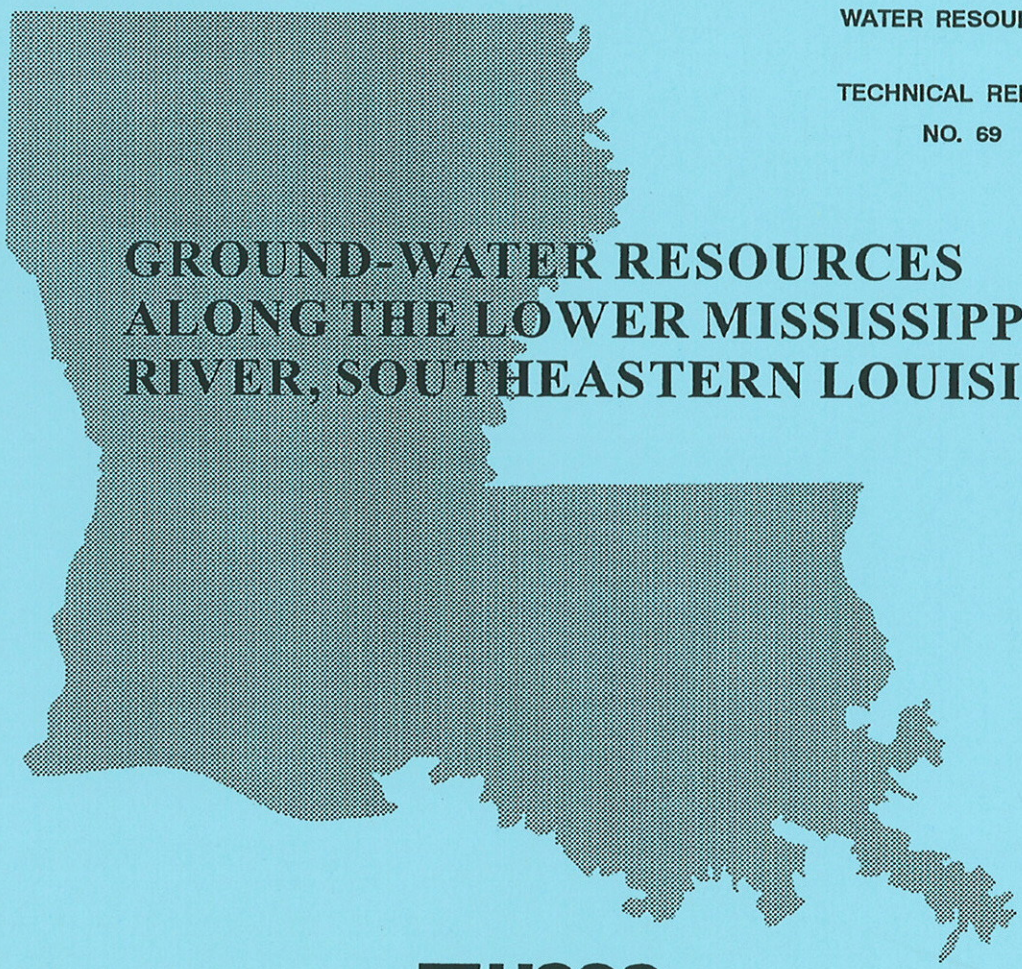
OFFICE OF PUBLIC WORKS AND INTERMODAL

PUBLIC WORKS AND WATER RESOURCES DIVISION

WATER RESOURCES

TECHNICAL REPORT
NO. 69

GROUND-WATER RESOURCES ALONG THE LOWER MISSISSIPPI RIVER, SOUTHEASTERN LOUISIANA



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U.S. GEOLOGICAL SURVEY
In cooperation with the
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2003

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CONTENTS

CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATED WATER-QUALITY UNITS

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
foot per year (ft/yr)	0.3048	meter per year
mile (mi)	1.609	kilometer
million gallons per day (Mgal/d)	3,785	cubic meter per day

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

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Abbreviated water-quality units:
micrograms per liter (µg/L)
milligrams per liter (mg/L)

GROUND-WATER RESOURCES ALONG THE LOWER MISSISSIPPI RIVER, SOUTHEASTERN LOUISIANA

By Dan J. Tomaszewski

ABSTRACT

In the area along the lower Mississippi River between Baton Rouge and New Orleans, Louisiana, aquifers supply freshwater for industrial use and public supply. The ground-water resources in this area include regionally extensive aquifers and locally occurring shallow sands (aquifers), collectively referred to in this report as the New Orleans aquifer system. This aquifer system includes the shallow aquifers, Mississippi River alluvial, Gramercy, Norco, Gonzales-New Orleans, and the "1,200-foot" sand. Clay confining units generally are located at land surface and between the aquifers.

Shallow aquifers are discontinuous and occur locally. Although the shallow aquifers contain freshwater, they are little used and the water is generally high in hardness (121-180 mg/L, milligrams per liter) and iron (equal to or greater than 0.3 mg/L).

The Mississippi River alluvial aquifer is present in St. James, southwest Ascension, and southern St. John the Baptist Parishes. In 1995, pumpage from this aquifer was 5.4 Mgal/d (million gallons per day) in the study area. Water from the aquifer is hard to very hard (greater than 121 mg/L) and exceeds 0.3 mg/L in both iron and manganese concentrations.

The Gramercy aquifer contains freshwater in parts of St. James, St. John the Baptist, and St. Charles Parishes. In 1995, pumpage from the Gramercy aquifer totaled about 6 Mgal/d; about 4.3 Mgal/d was withdrawn in St. James Parish, mostly for industry. Freshwater from the Gramercy aquifer is generally a calcium-magnesium bicarbonate type and moderately hard to very hard (greater than 60 mg/L).

In 1995, pumpage from the Norco aquifer totaled about 13 Mgal/d. About 6.2 Mgal/d was withdrawn in St. John the Baptist Parish, near Reserve; about 3.7 Mgal/d was withdrawn in St. Charles Parish at Norco; and about 3.0 Mgal/d were withdrawn in Ascension Parish.

The Norco aquifer contains freshwater in most of central Ascension Parish. Freshwater in the Norco aquifer also is available near the border between St. John the Baptist and St. Charles Parishes, and extends eastward from Reserve to Norco. A limited area of freshwater is present in northern Jefferson Parish near the Lake Pontchartrain shoreline.

In 1995, pumpage from the Gonzales- New Orleans aquifer totaled about 29 Mgal/d: 5.2 Mgal/d in Ascension Parish, 9.5 Mgal/d in Jefferson Parish, and 12.9 Mgal/d in Orleans Parish. The Gonzales-New Orleans aquifer contains the largest areal distribution of freshwater in the study area; however, much of the freshwater is underlain by saltwater. Areas containing freshwater include much of Ascension Parish, and an area extending from eastern St. John the Baptist Parish into Orleans Parish.

INTRODUCTION

The area along the lower Mississippi River between Baton Rouge and New Orleans in southeastern Louisiana has become extensively industrialized over the last several decades. The availability of the river for shipping, the abundance of petroleum resources, and the location of fresh surface- and ground-water resources have contributed to the attractiveness of the area for industrial development. The ground-water resources in this area include regionally extensive aquifers and locally occurring shallow sands (aquifers), collectively referred to in this report as the New Orleans aquifer system, that supply freshwater for industrial use and public supply (Lovelace and Johnson, 1996). This aquifer system includes the shallow aquifers, the Mississippi River alluvial, Gramercy, Norco, and Gonzales-New Orleans aquifers, and the "1,200-foot" sand (aquifer). Saltwater[1] encroachment into aquifers supplying freshwater for industrial use and public supply has become a major concern of State and local officials in recent years. A study was conducted by the U.S. Geological Survey (USGS), in cooperation with the Louisiana Department of Transportation and Development (DOTD), to describe the extent of aquifers, locations of freshwater, and water-level trends in some of the aquifers. The study provides information and data needed for effective management of ground-water resources. Because saltwater poses a threat to many coastal aquifers, results of the study add to the understanding of saltwater distribution and encroachment in coastal areas of the United States.

Purpose and Scope

This report describes fresh ground-water resources along the lower Mississippi River in southeastern Louisiana in the New Orleans aquifer system. The "1,200-foot" sand is not discussed, as it contains only saltwater throughout the study area. The report documents the areal extent and thickness of the aquifers and the areal extent and location of freshwater and saltwater areas. The report also documents water-level trends at selected wells (declines or recoveries) in the Gramercy, Norco, and Gonzales-New Orleans aquifers.

Description of Study Area

The study area is located in southeastern Louisiana, and extends from western Ascension parish eastward to the Orleans-St. Tammany parish line (fig. 1). It includes all of Ascension, St. James, Orleans and parts of St. John the Baptist, St. Charles, and Jefferson Parishes. The climate is warm and temperate with high humidity. The average (1961-90) annual rainfall is 62 in. At New Orleans, the average annual temperature is 68°F; minimum and maximum average temperatures are 37°F and 92°F (Louisiana State University Southern Regional Climate Center, 1995). Southeastern Louisiana is drained (or crossed) by numerous bayous, rivers and streams. Although the Mississippi River traverses the study area, the extent of the river is within levees. The land surface is flat, and altitudes are 5 ft or less above sea level throughout most of the study area. Generally, natural levee altitudes are slightly more than 15 ft near the Mississippi River. Altitudes are highest (25 ft) near the northern border of Ascension Parish. In parts of Orleans and northern Jefferson Parishes, land-surface altitudes are as much as 5 ft below sea level. Large areas in Ascension, St. James, St. John the Baptist, and St. Charles Parishes consist of swampland.

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[1]In this report, saltwater is defined as water containing chloride concentrations of 250 mg/L or more. Concentrations of chloride greater than 250 mg/L exceed the secondary maximum contaminant level (SMCL) for drinking water (U.S. Environmental Protection Agency, 1977, 1992).

Figure 1. Location of the study area along the lower Mississippi River, southeastern Loiusiana.

Methods of Study

Existing electric-log (e-log) data were obtained from files of the USGS, individual water-well drillers, the DOTD, and the Louisiana Department of Natural Resources. Generally existing map data from previous studies were verified and, when necessary, modified for St. James, St. John the Baptist, St. Charles, Jefferson, and Orleans Parishes. Structure maps for the Norco and Gonzales-New Orleans aquifers in Ascension Parish were constructed from e-log data.

Water-level trends in the Gramercy, Norco, and Gonzales-New Orleans aquifers were determined at selected sites. Pumpage data for 1995 (P.M. Johnson, U.S. Geological Survey, written commun., 1995) were tabulated for the study area to help define major withdrawal centers and to help interpret water-level trends. Water-level data in the study area have been collected routinely by USGS personnel at selected sites as part of a cooperative program between the USGS and DOTD.

The distribution of freshwater in the principal aquifers in Ascension Parish was documented with chloride-concentration data and e-log data. The distribution of freshwater described from previous studies were verified, and when necessary, modified for St. James, St. John the Baptist, St. Charles, Jefferson, and Orleans Parishes. These data also were used to define the freshwater-saltwater interface. In many of the aquifers freshwater overlies saltwater at the base of the aquifer. Generally, saltwater at the base of the aquifer forms a wedge that thickens southward until the entire vertical thickness of the aquifer contains saltwater.

Water quality of the freshwater parts of aquifers was determined from data collected by USGS personnel during and previous to this investigation. General descriptions of freshwater quality are included for each aquifer. National Secondary Drinking Water Regulations[2] mentioned in this report are chloride (250 mg/L), color (15 platinum-cobalt units), iron (0.3 mg/L), manganese (0.05 mg/L), and pH (6.5 to 8.5 standard units) (U.S. Environmental Protection Agency, 2002). Data (water-level, water-quality, pumpage, and e-log data) used for this study are on file at the USGS office in Baton Rouge, Louisiana.

Previous Investigations

Previous reports have described ground-water resources in the study area. A preliminary report by Cardwell and Rollo (1960) summarized available data and described the geology and hydrology in western parts of the study area. Cardwell and others (1963) presented basic ground-water data for parishes along the Mississippi River south of Baton Rouge. Ground-water studies described aquifers in the Geismar-Gonzales area (Long, 1965), the Norco area (Hosman, 1972), and the Gramercy area (Dial and Kilburn, 1980). Historical well-construction and water-quality data for the New Orleans area (Orleans Parish and five surrounding parishes) were summarized by Dial (1983). The New Orleans aquifer system was evaluated as a public water supply for the city of New Orleans (Dial and Sumner, 1989). Tomaszewski (1988) evaluated the hydrogeology and effects of pumpage on the New Orleans aquifer system in northern Jefferson Parish. Walters (1995) mapped the potentiometric surface, spring 1993, of the Gonzales-New Orleans aquifer in the New Orleans area.

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[2]National Secondary Drinking Water Regulations (NSDWR's or secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. U.S. Environmental Protection Agency recommends secondary standards to water systems but does not require systems to comply (U.S. Environmental Protection Agency, 2002).

A study (Kolb, 1962) documented the distribution of soils bordering the Mississippi River, including point-bar deposits and shallow sands throughout the study area. The base of the Mississippi River alluvial aquifer was mapped by Saucier (1994).

Acknowledgments

The author thanks Zahir "Bo" Bolourchi, Chief, Public Works and Water Resources Division, Louisiana Department of Transportation and Development, and his staff for supplying well-construction, well-location, and electric-log data. Additionally, the assistance and cooperation of individuals and industries that allowed data collection from wells and water-well drillers who routinely have reported field data to the USGS are greatly appreciated.

GEOLOGIC SETTING AND GENERAL HYDROGEOLOGY

Sediments that compose the aquifers in the study area were deposited during Pleistocene and Holocene Epochs. These sediments consist of silt, sand, and gravel deposited by rivers and by shoreline transgression and regression. The accumulation of sediments resulted in compaction and subsidence as the weight of overlying sediments increased. Eventually, sediments became a thick wedge of successive layers consisting of gravels, sands, silts, and clays that dip southward. These sediments now compose the New Orleans aquifer system and deeper units in the study area.

The New Orleans aquifer system consists of alternating sand and clay beds from land surface to the base of the "1,200-foot" aquifer (fig. 2; Dial and Sumner, 1989, p. 4). Confining units of clay generally are present at land surface and between the aquifers. Confining units thicken southward and range from a few feet to more than 200 ft in thickness, and may be more than 400 ft thick (Dial and Sumner, 1989, p. 4).

The Gramercy, Norco, and Gonzales-New Orleans aquifers become progressively shallower northward and eventually crop out at land surface or are connected hydraulically with the shallow aquifers. Freshwater recharge from northern areas moves southward in the direction of hydraulic gradient, flushing saltwater. The location of the freshwater interface in the aquifers can indicate the extent of freshwater flushing.

GROUND-WATER RESOURCES

The shallow, Mississippi River alluvial, Gramercy, Norco, and Gonzales-New Orleans aquifers are shown in five hydrogeologic sections in the study area (section locations are shown in plate 1). Two sections extend west-to-east: section A-A′ extends from the Geismar area to the Kenner area (fig. 3), and section A′-A″ extends from the Kenner area to the New Orleans area (fig. 4). Three sections extend north-to-south: section B-B′ in the Geismar-Gonzales area (fig. 5), section C-C′ in the Norco area (fig. 6), and section D-D′ in the New Orleans area (fig.7). The Gramercy, Norco, and Gonzales-New Orleans aquifers extend throughout much of the area, however, they contain limited freshwater resources.

Shallow Aquifers and the Mississippi River Alluvial Aquifer

The shallow aquifers consist of point-bar deposits, distributary-channel deposits, and discontinuous, near-surface sands. Point-bar deposits are located along the Mississippi River (pl. 1). Distributary-channel deposits and discontinuous, near-surface sand beds are distributed locally throughout the study area and overlie the Gramercy aquifer. The Mississippi River alluvial aquifer is present in parts of St. James, Ascension, and St. John the Baptist Parishes (pl. 1).

System	Series	Aquifer or aquifer system[1]		Thickness	Description and remarks	Water quality
Quaternary	Holocene	New Orleans aquifer system	Shallow sands (aquifers) — Point-bar deposits	Varies. May exceed 100 feet	Fine to very fine sand and silt. Bars accumulate on inside of river bends.	Generally very hard[2] with high iron[3] concentrations.
	? Pleistocene		Shallow sands (aquifers) — Distributary-channel deposits	Generally 50 feet or less	Fine sand. May contain organic debris.	Generally very hard with high iron concentrations.
			Shallow sands (aquifers) — Discontinuous near-surface sands	Varies	Lithology varies. Sands occur locally and pinch out within short distances.	Varies depending on location. Generally contains very hard saltwater.
			Mississippi River alluvial aquifer[4]	Varies 20 to 250 feet	Fine to medium sand at top; grading to coarse sand and gravel in lower part. Hydraulically connected with the Mississippi River.	Hard to very hard with high iron concentrations.
			Gramercy aquifer ("200-foot" sand)	20 to 200 feet	Fine to coarse sand. May contain gravel. Discontinuous with varying thickness. Hydraulically connected with the Mississippi River.	Generally saltwater[5]. Freshwater is available in parts of St. James, St. John the Baptist, and St. Charles Parishes. Freshwater is generally a calcium-magnesium bicarbonate type.
			Norco aquifer ("400-foot" sand)	50 to greater than 250 feet. Generally about 150 feet	Fine to coarse sand. May contain fine gravel.	Generally saltwater except in Ascension Parish, northern Jefferson Parish, and along the border between St. Charles and St. John the Baptist Parishes, where freshwater has low hardness and pH between 7.5 and 8.0 standard units.
			Gonzales-New Orleans aquifer ("700-foot" sand)	Generally 150 to 300 feet	Very fine to medium sand.	Contains saltwater in part of area. Freshwater is soft and low in iron and manganese[6] concentrations; pH averages about 8.0 standard units.
			"1,200-foot" sand (aquifer)	Not determined	Fine to medium sand.	Contains saltwater except in northeast corner of Orleans Parish.

Louisiana Department Of Transportation and Development-U.S. Geological Survey Water Resources Cooperative Program

[1]Clay units separating aquifers in southeastern Louisiana are discontinuous and unnamed.

[2]The U.S. Geological Survey (Hem, 1985, p. 159) classifies hardness as calcium carbonate as follows: Water having a hardness of 0-60 mg/L (milligrams per liter) is considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard, and more than 180 mg/L, very hard.

[3]Iron concentration equal to or greater than 0.3 mg/L is considered high; concentration less than 0.3 mg/L is considered low.

[4]The Mississippi River alluvial aquifer is considered part of the New Orleans aquifer system locally, in parts of Ascension, St. James, and St. John the Baptist Parishes.

[5]In this report, saltwater is defined as water containing chloride concentrations of 250 mg/L or more. Concentrations of chloride greater than 250 mg/L exceed the National Secondary Drinking Water Regulations (U.S. Environmental Protection Agency, 2002).

[6]Manganese concentration equal to or greater than 0.05 mg/L is considered high; concentration less than 0.05 mg/L is considered low.

Figure 2. Hydrogeologic summary of aquifers, lower Mississippi River area in southeastern Louisiana (modified from Dial and Sumner, 1989).

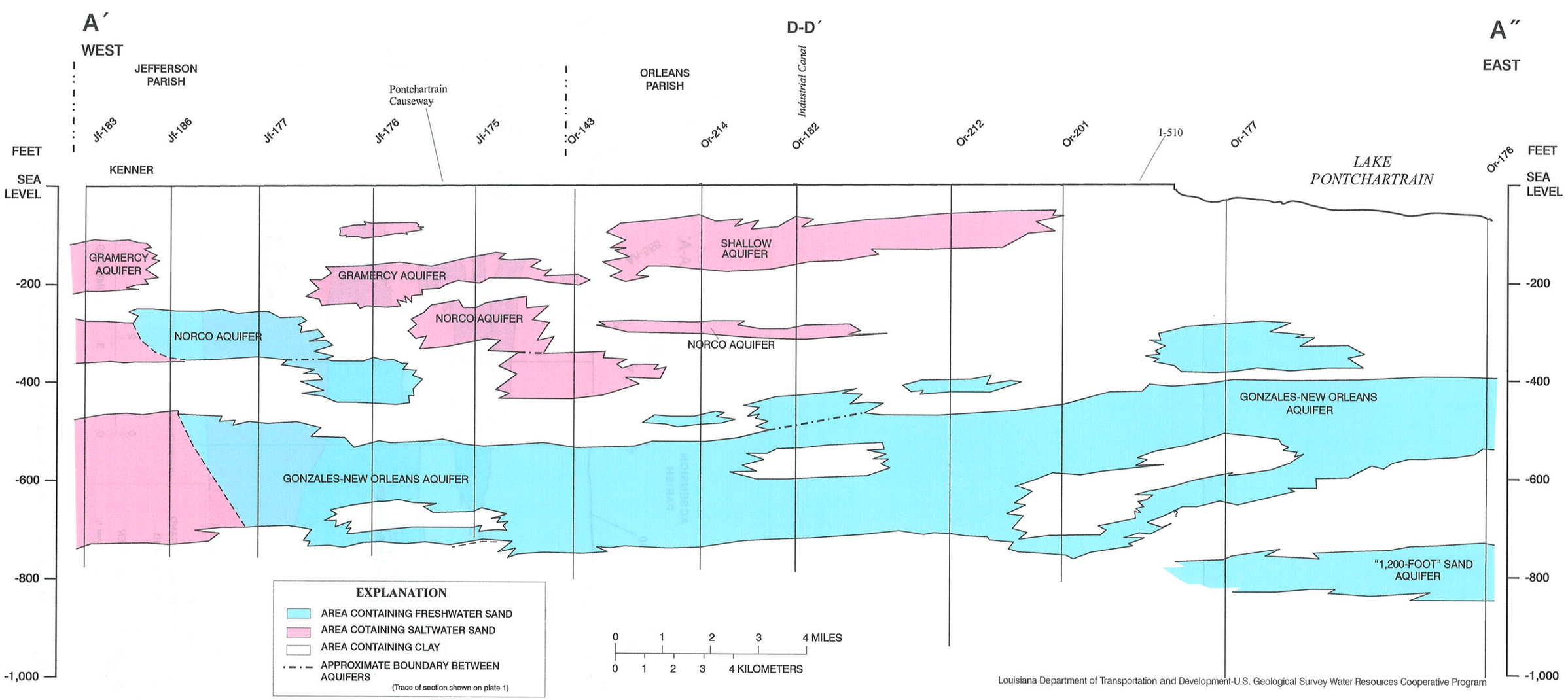

Figure 4. Hydrogeologic section A´-A´´, from the Kenner area to the New Orleans area in southeastern Louisiana.

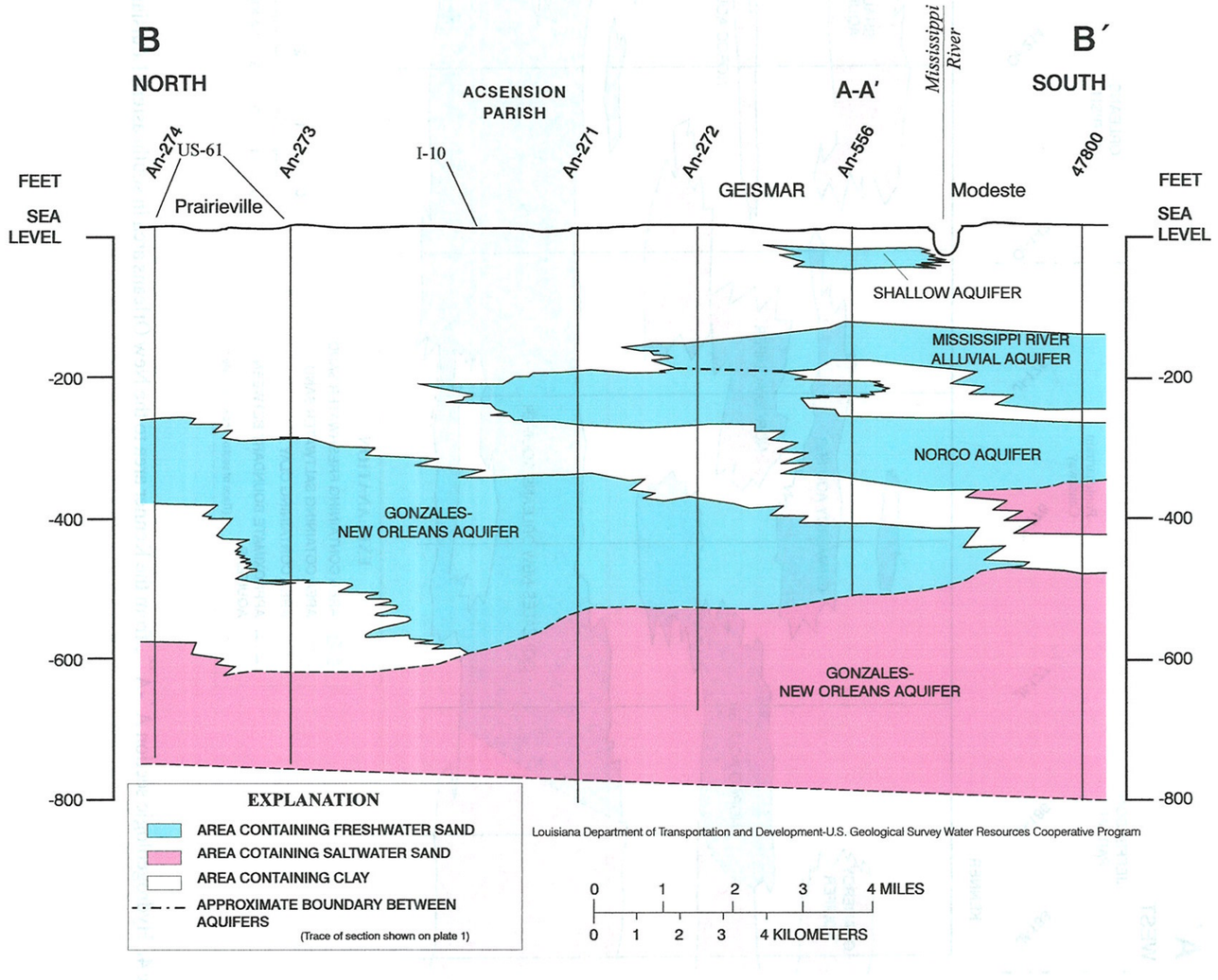

Figure 5. Hydrogeologic section B-B´, Geismar-Gonzales area in southeastern Louisiana.

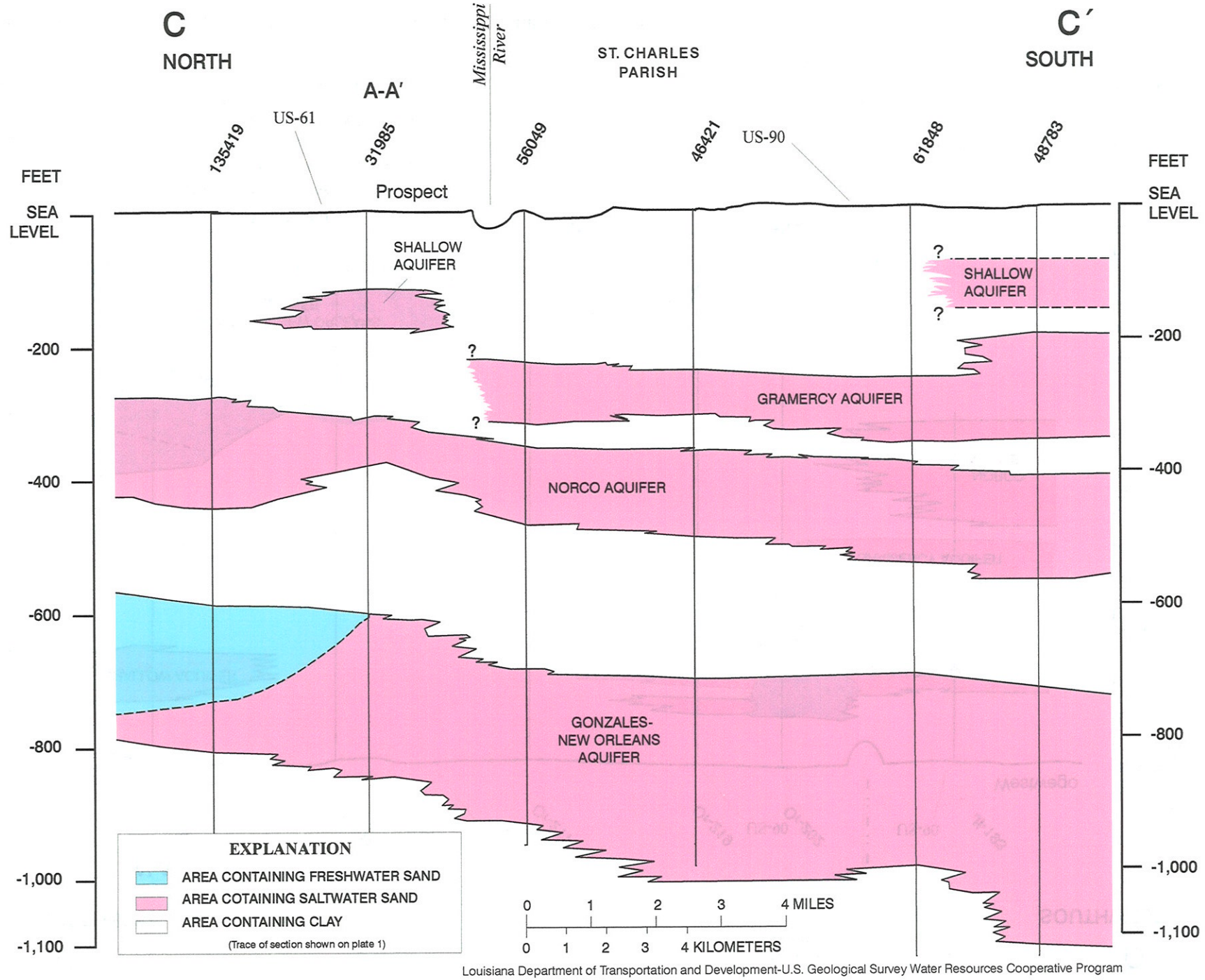

Figure 6. Hydrogeologic section C-C´, Norco area in southeastern Louisiana.

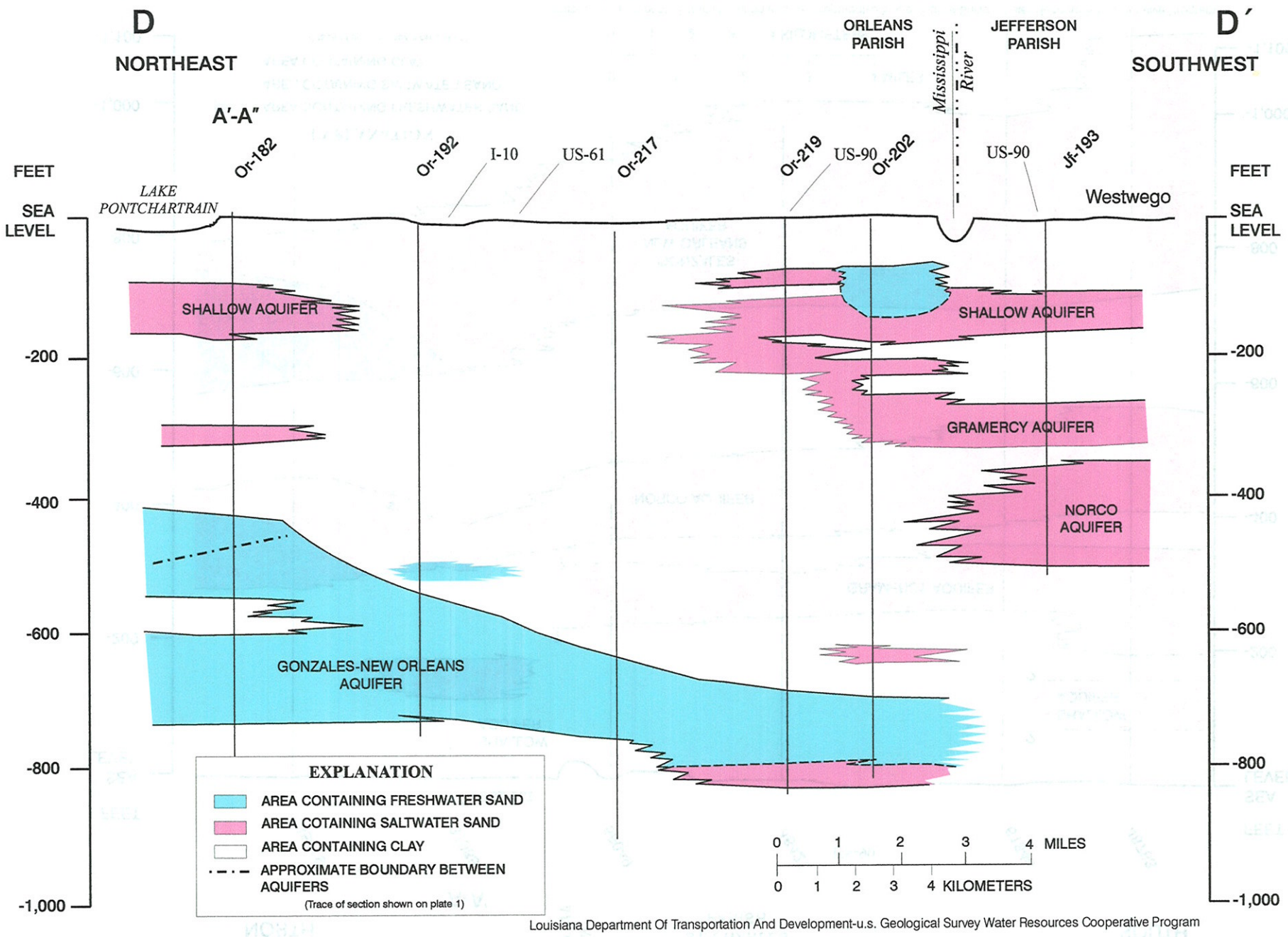

Figure 7. Hydrogeologic section D-D′, New Orleans area in southeastern Louisiana.

Extent and Thickness

The shallow aquifers are present locally in the study area and generally are shallower than 200 ft below sea level. Because freshwater-bearing shallow aquifers are only present locally, they do not supply large quantities of freshwater. Point-bar deposits consist of fine sand and can be more than 100 ft thick (Hosman, 1972, p. 18). Distributary-channel deposits consist of fine, silty sand and generally are less than 50 ft thick (Hosman, 1972, p. 18).

The Mississippi River alluvial aquifer is a regional aquifer that extends throughout south- central Louisiana. The aquifer underlies the western part of the study area (pl. 1). Depth to the base of the aquifer ranges from less than 100 ft to about 250 ft below sea level in the study area (fig. 3). The aquifer ranges in thickness from 20 to 250 ft.

Withdrawals and Water Levels

Withdrawals (1995) from the shallow aquifers in the study area totaled 0.8 Mgal/d. Most withdrawals (0.65 Mgal/d) were in Ascension Parish (P.M. Johnson, U.S. Geological Survey, written commun., 1995). Within the study area, withdrawals (1995) from the Mississippi River alluvial aquifer totaled 5.4 Mgal/d and occurred in Ascension Parish; about 4.8 Mgal/d were withdrawn for industrial use in the Philadelphia Point area (pl. 1). Previous investigators have documented that water levels fluctuate 10 to 15 ft seasonally and correspond to the stages of the Mississippi River (Dial and Kilburn, 1980, p. 10-11).

Water Quality

Although the shallow aquifers contain freshwater locally, they are little used because of the poor quality of the water. Water from the aquifers generally is hard[3] and has high iron[4] concentrations. Water from the Mississippi River alluvial aquifer generally is fresh; however, the freshwater can be underlain by saltwater (fig. 3). Furthermore, water in the aquifer is hard to very hard and concentrations of both iron and manganese commonly exceed 0.3 mg/L. The shallow aquifers contain no freshwater near the Lake Pontchartrain shoreline in Orleans Parish (fig. 4).

Gramercy Aquifer

The Gramercy aquifer contains freshwater in parts of St. James, St. John the Baptist, and St. Charles Parishes (pl. 2). The aquifer contains no freshwater in Jefferson Parish, and is absent in most of Ascension and Orleans Parishes (Dial and Sumner 1989, fig. 9). A clay layer of varying thickness (10 to 50 ft) generally separates the Gramercy aquifer from the underlying Norco aquifer (Dial and Sumner, 1989, p.13). The Gramercy and Norco aquifers merge where the clay layer is missing in areas of St. Charles, St. John the Baptist, and St. James Parishes (Hosman, 1972, p. 32; Dial and Kilburn, 1980, pl. 3).

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[3]The U.S. Geological Survey (Hem, 1985, p. 159) classifies hardness as calcium carbonate as follows: Water having a hardness of 0 to 60 mg/L, considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard, and more than 180 mg/L, very hard

[4]Iron concentration equal to or greater than 0.3 mg/L is considered high; concentration less than 0.3 mg/L is considered low.

Extent and Thickness

The Gramercy aquifer extends from St. James Parish southward and eastward into Jefferson Parish (pl. 2). Regionally, the aquifer dips and thickens in a southerly direction. The aquifer is thin or absent in northern St. James Parish, and the area south of Lake Maurepas and Lake Pontchartrain in St. John the Baptist and St. Charles Parishes.

The top of the aquifer, although variable, is generally between 100 and 250 ft below sea level (pl. 2). Thickness of the aquifer ranges from less than 100 to 200 ft or more. The aquifer contains fine to coarse sand and can contain gravel (Hosman, 1972, p. 19; Dial and Kilburn, 1980, p. 12).

Withdrawals and Water Levels

Withdrawals from the Gramercy aquifer totaled about 6 Mgal/d (1995). In St. James Parish, about 4.3 Mgal/d were withdrawn, mostly for industrial use (about 2.9 Mgal/d in the Gramercy area, and about 1.1 Mgal/d near the town of St. James). Approximately 1.6 Mgal/d were withdrawn in St. John the Baptist Parish; most (about 1.4 Mgal/d) was withdrawn near Gramercy for industrial use. Withdrawals in St. Charles and Orleans Parishes were less than 0.02 Mgal/d each (Lovelace and Johnson, 1996).

Water levels fluctuate 10 to 15 ft seasonally (fig. 8) in well SJ-86 at Vacherie (pl. 2) and in well SJB-145 near Gramercy (pl. 2). Water levels in the Gramercy aquifer reach seasonal highs in the spring and lows in the fall. Seasonal highs and lows correspond to stages of the Mississippi River (Dial and Kilburn, 1980, p. 15). No long-term water-level declines have occurred at wells SJ-86 or SJB-145.

Distribution of Freshwater and Water Quality

Although the Gramercy aquifer contains saltwater in much of the study area (pl. 2), two large areas contain freshwater. Freshwater extends southeastward from Central in St. James Parish, toward Lafourche Parish (pl. 2). A second area containing freshwater extends southeastward from Gramercy in St. James Parish to Lac Des Allemands area in St. John the Baptist Parish, and western St. Charles Parish. A small area of freshwater also is located south of Norco.

Freshwater from the Gramercy aquifer generally is a calcium-magnesium bicarbonate type (Dial and Kilburn, 1980, p. 12; Hosman, 1972, p. 23). Generally, water from the aquifer is moderately hard to very hard. Freshwater quality in the aquifer can vary in response to inflow from adjacent sands and aquifers (Dial and Kilburn, 1980, p.12). Near Belmont in St. James Parish, the aquifer contains water that is soft, commonly has iron concentrations that are less than 0.3 mg/L, and has pH that range from 7.5 to 8.1 standard units (Cardwell and others, 1963, table 5; Dial and Kilburn, 1980, p. 12, table 4).

Norco Aquifer

Freshwater areas in the Norco aquifer include much of Ascension Parish, and a large area on the border between St. John the Baptist and St. Charles Parishes (pl. 3). The Norco aquifer is thin or absent in extreme northern Ascension Parish, a small area in northern Jefferson Parish, and most of Orleans Parish. A clay bed as much as 200 ft thick generally separates the Norco aquifer from the underlying Gonzales-New Orleans aquifer (Dial and Sumner, 1989, p. 13).

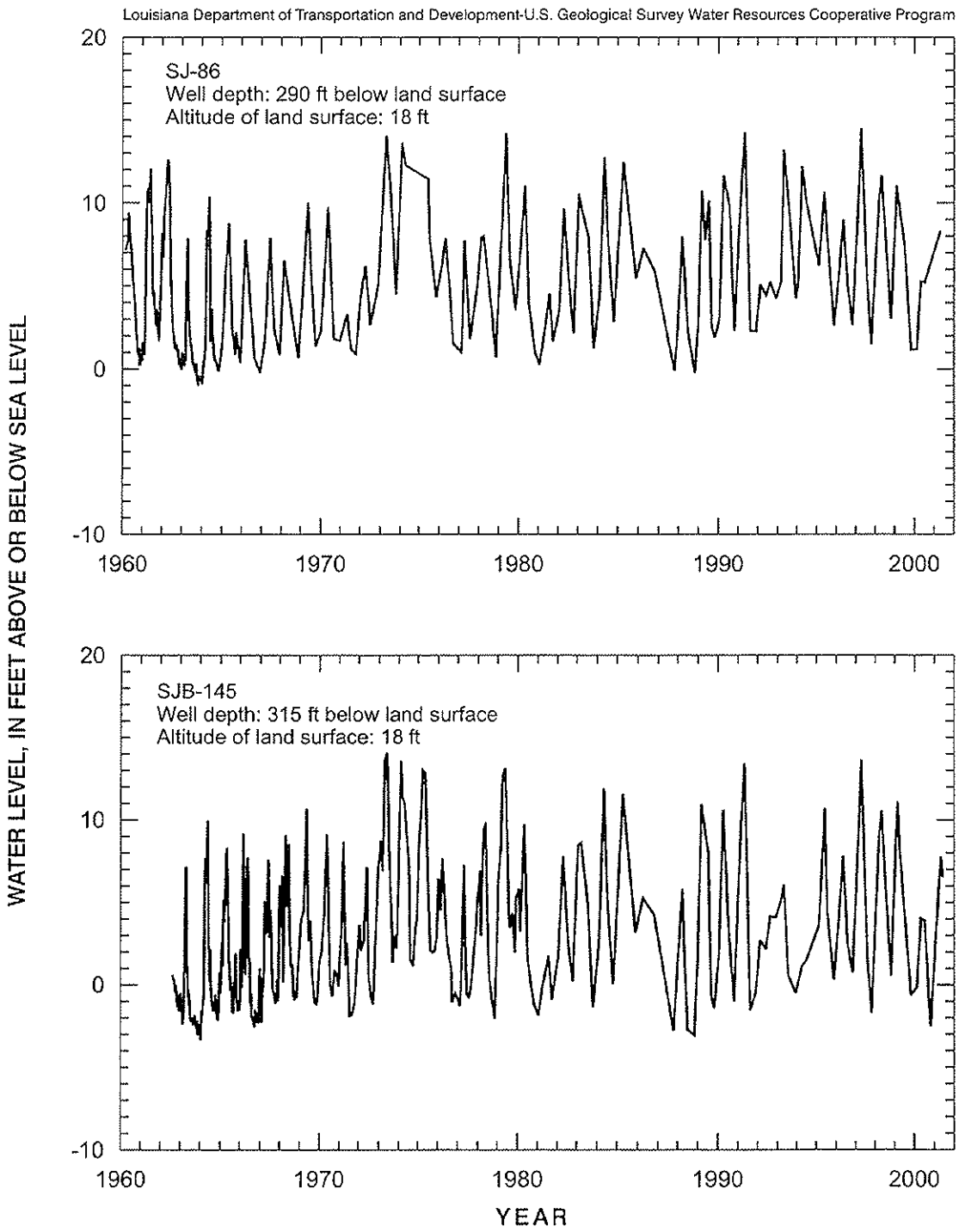

Figure 8. Water levels in wells SJ-86 and SJB-145 completed in the Gramercy aquifer, lower Mississippi River area in southeastern Louisiana (see pl. 2 for location).

Extent and Thickness

The Norco aquifer is present west of Orleans Parish with the exception of extreme northern Ascension Parish and locally in Jefferson Parish (at well Jf-195). The aquifer abruptly thins in western Orleans Parish and is absent throughout most of this Parish (pl. 3). Depth to the top of the aquifer ranges from less than 100 ft in part of Ascension Parish to more than 400 ft in the southern part of the study area. Regionally, the aquifer dips in a southerly direction.

Thickness of the Norco aquifer ranges from about 50 ft or less in northern Ascension and Jefferson Parishes to 250 ft or more in St. John the Baptist and Jefferson Parishes. The aquifer is less than 150 ft thick in most of the study area. Sediments composing the aquifer include fine to coarse sand and possibly fine gravel (Dial and Kilburn, 1980, p. 17; Hosman, 1972, p. 29).

In northern Ascension Parish, the top of the Norco aquifer generally is less than 150 ft below sea level. Depth to the top of the aquifer generally increases southward from about 200 ft below sea level in central Ascension Parish to about 300 ft below sea level near the Mississippi River. The aquifer ranges in thickness from about 20 to 170 ft in Ascension Parish. The aquifer is less than 100 ft thick in much of central Ascension Parish. In southern Ascension Parish, the aquifer thickens to 150 ft or more near the Mississippi River.

The Norco aquifer is present in most of northern Jefferson Parish. The top of the aquifer is about 250 to more than 300 ft below sea level, and the aquifer is about 100 ft thick in the area containing freshwater (pl. 3). Depth to the top of the aquifer increases southward to about 350 ft below sea level south of the Mississippi River. The aquifer ranges in thickness from less than 50 to 150 ft in Jefferson Parish. The aquifer is present only in a small area near the western part of Orleans Parish.

Withdrawals and Water Levels

Withdrawals from the Norco aquifer totaled about 13 Mgal/d in the study area in 1995. About 6.2 Mgal/d were withdrawn in St. John the Baptist Parish, near Reserve, for industrial use. About 3.7 Mgal/d were withdrawn in St. Charles Parish, at Norco, for industrial use. About 3.0 Mgal/d were withdrawn in Ascension Parish: 2.1 Mgal/d for industrial use and about 0.8 Mgal/d for public supply. Industrial withdrawals were near Sorrento (0.7 Mgal/d) and Geismar (1.0 Mgal/d). Withdrawals from the aquifer in St. James Parish were less than 0.01 Mgal/d. No water was withdrawn from the aquifer in Jefferson and Orleans Parishes.

Data from wells at Kenner (well Jf-186) and Central (well SJ-203) indicate that water levels in the Norco aquifer were stable (no long-term water-level decline) at these sites during the period of record (fig. 9 and pl. 3), although seasonal fluctuations occur at both wells. Water levels range from about sea level to 5 ft below sea level at well Jf-186 in northwestern Jefferson Parish, and from about sea level to 18 ft above sea level at well SJ-203 in northwestern St. James Parish. Since 1960, water levels recovered about 35 ft in well SC-14 at Norco in St. Charles Parish due to decreased ground-water withdrawals. Withdrawals at Norco were about 9.5 Mgal/d in 1965 (Hosman, 1972, p. 43).

Distribution of Freshwater and Water Quality

The Norco aquifer contains freshwater in most of central Ascension Parish (pl. 3); however, freshwater can be underlain with saltwater near the Mississippi River. Freshwater from the aquifer in central Ascension Parish is moderately hard. Chloride concentrations generally range from 12 to 40 mg/L, and iron concentrations commonly exceed 0.3 mg/L (Long, 1965, p. 40) in central Ascension Parish. A narrow lobe of freshwater extends southward along the Mississippi River from Ascension Parish into St. James Parish.

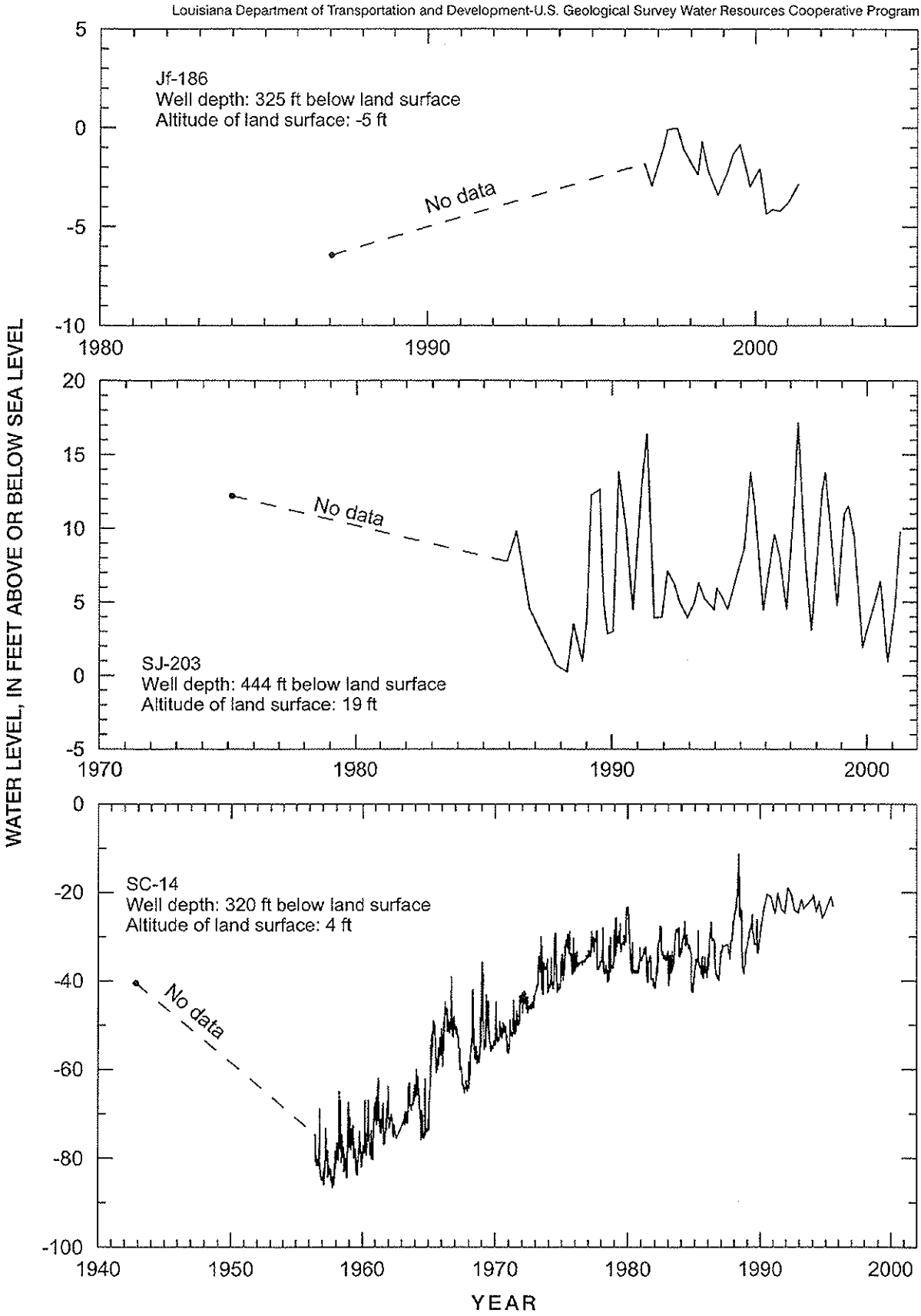

Figure 9. Water levels in wells Jf-186, SJ-203, and SC-14 completed in the Norco aquifer, lower Mississippi River area in southeastern Louisiana (see pl. 3 for location).

The Norco aquifer contains freshwater near the border between St. John the Baptist and St. Charles Parishes. Freshwater extends from Lake Pontchartrain southward to Lac Des Allemands. Freshwater in this area is soft, and iron concentrations generally are less than 0.5 mg/L. Color ranges from 5 to 180 color units (Hosman, 1972, p. 35).

In northern Jefferson Parish, freshwater in the Norco aquifer is limited to a small area near the Lake Pontchartrain shoreline (pl. 3, fig. 4). Analysis of water from well Jf-186 (Dial and Tomaszewski, 1988, table 1) completed in the Norco aquifer indicated that freshwater at this site is moderately hard; iron concentrations are high (exceed 0.3 mg/L); and color exceeds 15 color units. Manganese concentrations are low (less than 0.05 mg/L).

Gonzales-New Orleans Aquifer

The Gonzales-New Orleans aquifer contains the largest areal distribution of freshwater in the study area; however, much of the freshwater is underlain by saltwater. Areas containing freshwater include much of Ascension Parish and the eastern part of the study area extending from eastern St. John the Baptist Parish into Orleans Parish.

The presence of the Gonzales-New Orleans aquifer has been documented in parishes adjacent to the study area (southern East Baton Rouge, Livingston, Tangipahoa, and St. Tammany Parishes: Nyman and Fayard, 1978, pl. 1; Tomaszewski, 1988, p. 8). In these parishes, the aquifer becomes shallower and thinner, and pinches out or merges with shallow sand beds. The Gonzales-New Orleans aquifer is not distinguishable west of the study area in Iberville Parish (Whiteman, 1972, pl. 2).

Extent and Thickness

The Gonzales-New Orleans aquifer is continuous throughout the study area (pl. 4). The aquifer dips in a southerly direction. Generally (with the exception of Ascension Parish), the top of the aquifer is 450 ft below sea level in northern areas and increases to 700 ft below sea level south of the Mississippi River. In northern Ascension Parish, the top of the aquifer is about 250 ft below sea level.

Thickness of the aquifer ranges from 150 to 300 ft throughout most of the study area. The minimum (less than 100 ft) and maximum (greater than 400 ft) aquifer thicknesses occur in northwestern Ascension Parish. Sediments in the Gonzales-New Orleans aquifer range from very fine to medium sand (Dial and Kilburn, 1980, p. 21; Hosman, 1972, p. 46).

Withdrawals and Water Levels

Withdrawals from the Gonzales-New Orleans aquifer totaled about 29 Mgal/d in the study area in 1995. Withdrawals from the aquifer in St. Charles Parish totaled about 1.2 Mgal/d. Less than 0.1 Mgal/d was withdrawn in St. John the Baptist Parish, and no withdrawals were reported in St. James Parish.

Withdrawals from the aquifer in Ascension Parish totaled approximately 5.2 Mgal/d in 1995. About 2.1 Mgal/d were withdrawn by industry near Geismar. Withdrawals for domestic use and public supply totaled about 3.0 Mgal/d. Most withdrawals for domestic use and public supply are from numerous small-diameter wells, located in the central and northern parts of the parish. Large-diameter wells (withdrawing about 1.2 Mgal/d for public supply) are used by the town of Gonzales.

In Jefferson Parish, withdrawals from the Gonzales-New Orleans aquifer totaled about 9.5 Mgal/d in 1995. Most of the withdrawals (8.5 Mgal/d) were for industrial use and were south of the Mississippi River in the Avondale and Westwego areas, in or adjacent to areas containing saltwater.

Withdrawals from the aquifer in Orleans Parish totaled about 12.9 Mgal/d in 1995. Largest reported withdrawals were for industry and were in the Michoud (7.3 Mgal/d) and the Industrial Canal areas (3.0 Mgal/d). About 2 Mgal/d were withdrawn in the downtown New Orleans area.

Water levels fluctuate seasonally throughout Ascension Parish (about 8 ft/yr at well An-267, fig. 10) and correspond to stages of the Mississippi River. Water levels fluctuate seasonally about 5 ft at well Jf-156 (fig. 10). Seasonal water-level fluctuations in Jefferson Parish are caused by seasonal withdrawals from the aquifer (Rollo, 1966, p. 23-24).

Data from wells at Norco (SC-9), Metairie (Jf-156), and Orleans Parish (Or-42) generally indicate that water levels in the Gonzales-New Orleans aquifer fluctuate less than 10 ft seasonally (fig. 10). Data collected at wells Or-42 and Jf-156 indicate that water levels have recovered since 1975, as a result of decreased pumping in the New Orleans area.

Distribution of Freshwater and Water Quality

Large volumes of freshwater are contained in the Gonzales-New Orleans aquifers in Ascension, Jefferson, and Orleans Parishes (pl. 4). Throughout most of St. James, St. John the Baptist, and St. Charles Parishes, freshwater areas are underlain by saltwater. The aquifer contains freshwater throughout its vertical thickness in northern Ascension Parish. In central Ascension Parish, the aquifer contains freshwater underlain with saltwater. Thickness of the saltwater layer at the base of the aquifer increases southward and westward. The aquifer contains only saltwater near the Mississippi River in the western two-thirds of the study area (pl. 4).

Freshwater in the aquifer is a mixed sodium bicarbonate-chloride type that is soft and generally has low iron concentrations (Hosman, 1972, p. 48; Dial and Kilburn, 1980, p. 21; Dial and Tomaszewski, 1988, p. 15). Manganese concentrations vary. In areas where the water is more highly mineralized, the water is a sodium chloride type and hardness is greater. In Ascension Parish water from the Gonzales-New Orleans aquifer is soft to moderately hard (Long, 1965, p. 12). Freshwater from the aquifer generally has concentrations of manganese that exceed 0.05 mg/L in Ascension Parish. Iron concentrations generally are less than 0.3 mg/L; manganese concentrations generally are greater than 0.05 mg/L. In the area where the aquifer contains freshwater throughout the vertical thickness, chloride concentrations generally are less than 10 mg/L. Throughout the remainder of the parish, chloride concentrations in freshwater overlying saltwater varied.

The Gonzales-New Orleans aquifer is not heavily developed in northern Jefferson Parish and in parts of Orleans Parish. Freshwater withdrawals from the aquifer in Jefferson and Orleans Parishes probably are limited because of high color. Color in freshwater from the aquifer in Jefferson Parish generally ranges from 50 to 120 color units (Dial and Tomaszewski, 1988, p. 17-18). Iron and manganese concentrations generally are low (less than 0.3 and .05 mg/L, respectively) in freshwater in northern Jefferson Parish. Chloride concentrations generally exceed 50 mg/L.

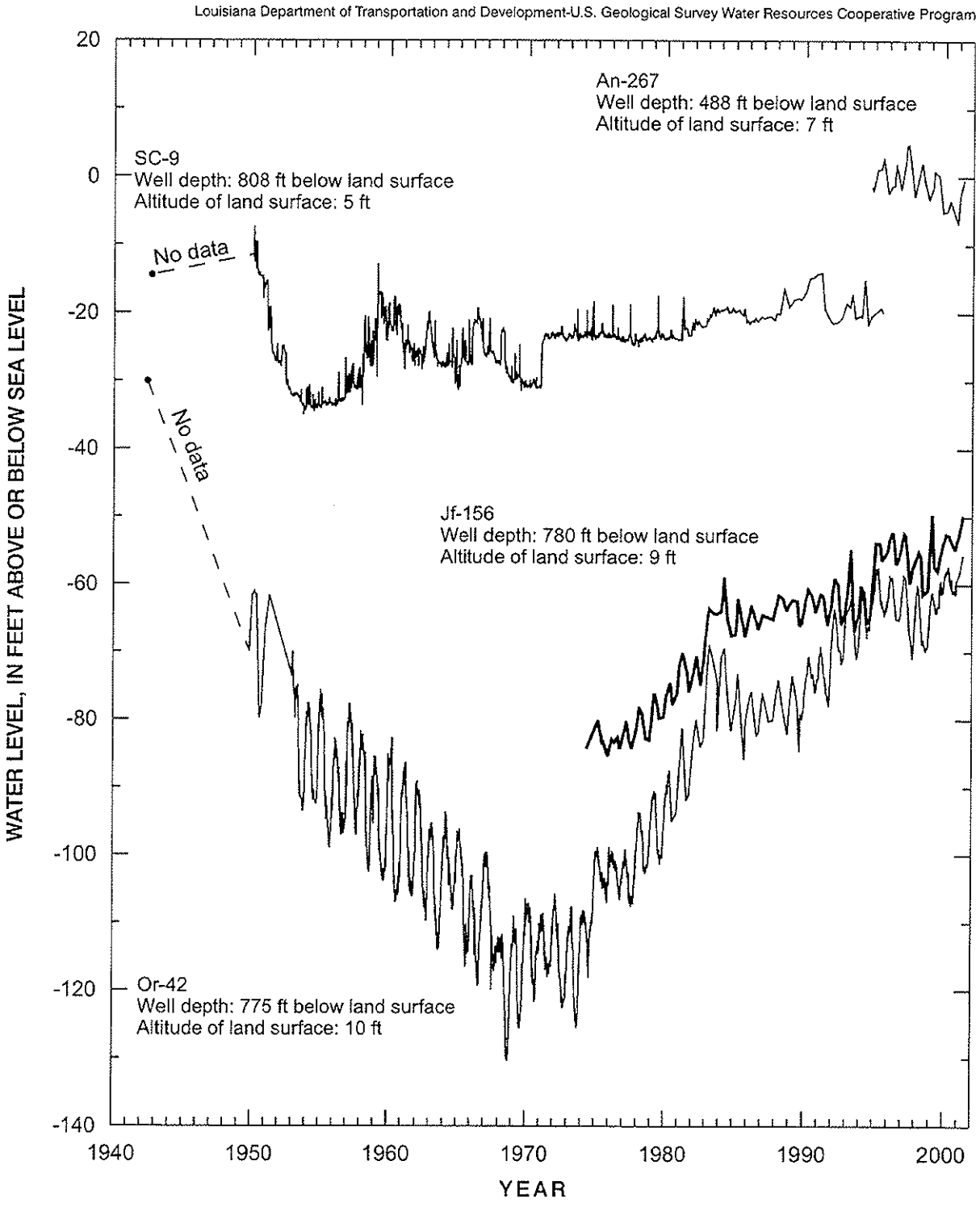

Figure 10. Water levels in wells An-267, SC-9, Jf-156, and Or-42 completed in the Gonzales-New Orleans aquifer, lower Mississippi River area in southeastern Louisiana (see pl. 4 for location).

SUMMARY

Aquifers in the New Orleans aquifer system supply freshwater for industrial use and public supply in the area along the lower Mississippi River between Baton Rouge and New Orleans in southeastern Louisiana. The New Orleans aquifer system consists of the succession sand and clay beds that contain freshwater in the local shallow aquifers and the Mississippi River alluvial, Gramercy, Norco, and the Gonzales-New Orleans aquifers. Confining units of clay generally are located at land surface and separate each aquifer.

Shallow aquifers occur locally and are discontinuous. Although the shallow aquifers contain freshwater, they are little used due to poor water quality. The total water withdrawal was about 0.8 Mgal/d (million gallons per day) in 1995. Water from shallow aquifers generally is high in both hardness (121-180 mg/L, milligrams per liter) and iron (equal to or greater than 0.3 mg/L).

The Mississippi River alluvial aquifer is present in St. James, southwest Ascension and southern St. John the Baptist Parishes. In 1995, pumpage from this aquifer was 5.4 Mgal/d. Water levels fluctuate 10 to 15 feet seasonally and follow closely the stages of the Mississippi River. Water from the aquifer is hard to very hard (greater than 121 mg/L) and exceeds 0.3 mg/L in both iron and manganese concentrations.

The Gramercy aquifer contains freshwater in parts of St. James, St. John the Baptist, and St. Charles Parishes. In 1995, pumpage from the Gramercy aquifer totaled about 6 Mgal/d. In St. James Parish, about 4.3 Mgal/d were withdrawn, mostly for industry. Water levels in the Gramercy aquifer reach seasonal highs in the spring and lows in the fall, corresponding with stages of the Mississippi River. No long-term trends (declines or recoveries) were noted.

Freshwater from the Gramercy aquifer is generally a calcium-magnesium bicarbonate type and moderately hard to very hard (greater than 60 mg/L). Freshwater quality in the Gramercy aquifer can vary in response to inflow from adjacent sands and aquifers. Near Belmont in St. James Parish water that is soft (less than 60 mg/L hardness) and has low iron concentrations is present. The pH ranges from 7.5 to 8.1 standard units.

The Norco aquifer is present west of Orleans Parish, with the exception of northernmost Ascension Parish and locally in Jefferson Parish. In 1995, pumpage from the Norco aquifer totaled about 13 Mgal/d. About 6.2 Mgal/d were withdrawn in St. John the Baptist Parish, near Reserve; 3.7 Mgal/d were withdrawn in St. Charles Parish at Norco; and about 3.0 Mgal/d were withdrawn in Ascension Parish. Water-level data from sites at Kenner and Central indicate that water levels in the Norco aquifer are stable in these areas.

Freshwater is available from the Norco aquifer in most of central Ascension Parish. Freshwater in the Norco aquifer also is available near the border between St. John the Baptist and St. Charles Parishes, and extends eastward from Reserve to Norco. The Norco aquifer contains a limited area of freshwater in northern Jefferson Parish near Lake Pontchartrain.

The Gonzales-New Orleans aquifer contains the largest areal distribution of freshwater in the study area; however, much of the freshwater is underlain by saltwater. Areas containing freshwater include much of Ascension Parish, and an area extending from eastern St. John the Baptist Parish into Orleans Parish.

In 1995, pumpage from the Gonzales-New Orleans aquifer totaled about 29 Mgal/d: 5.2 Mgal/d in Ascension Parish, 9.5 Mgal/d in Jefferson Parish, and 12.9 Mgal/d in Orleans Parish. In Jefferson Parish most of the pumpage (8.5 Mgal/d) was for industry and was withdrawn south of the Mississippi River in the Avondale and Westwego area, adjacent to or in areas containing saltwater.

Water levels in wells completed in the Gonzales-New Orleans aquifer ranged from approximately 2 feet below to 5 feet above sea-level in central and northern Ascension Parish. The slight depression in water levels centered around the town of Gonzales indicates that present day pumpage in that area has little impact on water levels. Major withdrawals in Orleans Parish reduce the water levels in the aquifer to about 100 feet below sea level in the Industrial Canal area and provide a gradient to induce movement of ground water from surrounding areas.

Water in the Gonzales-New Orleans aquifer ranges from very fresh to very salty in the study area. Generally, freshwater areas contain a mixed sodium bicarbonate-chloride type water that is soft and low (less than 0.3 mg/L) in iron.

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