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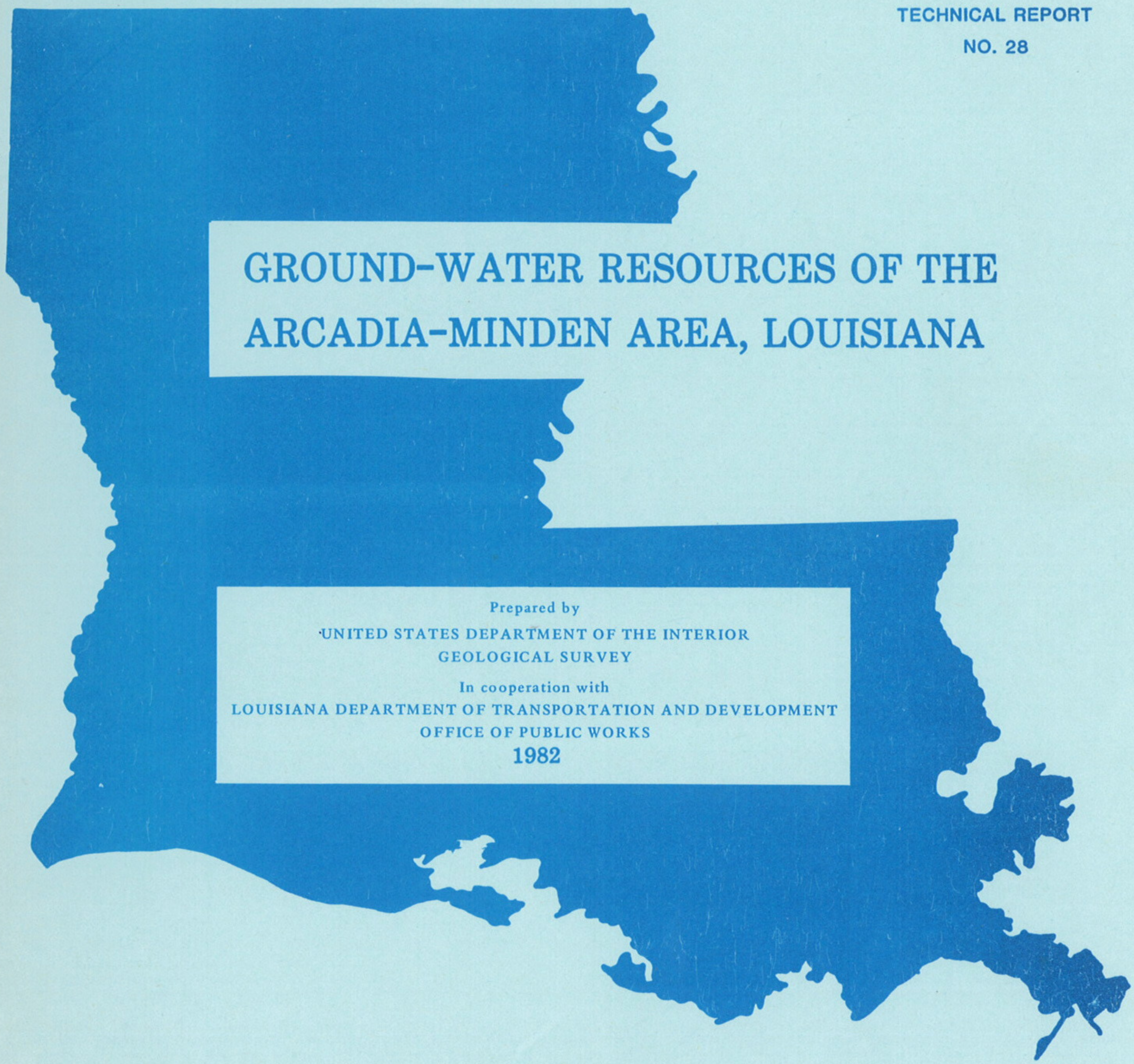

GROUND-WATER RESOURCES OF THE ARCADIA-MINDEN AREA, LOUISIANA

Prepared by
UNITED STATES DEPARTMENT OF THE INTERIOR
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In cooperation with
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1982

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GROUND-WATER RESOURCES OF THE ARCADIA-MINDEN AREA, LOUISIANA

By

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GLOSSARY

Aquifer

A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian aquifer

An aquifer in which water is confined by an overlying clay or fine-grained bed. Water levels in wells screened in the aquifer rise above the top of the aquifer.

Confining bed

A body of relatively "impermeable" material stratigraphically adjacent to one or more aquifers that serve to confine water in the aquifer so that the water level rises above the base of the confining bed.

Hardness

The U.S. Geological Survey classifies hardness as follows: Water having a hardness of 0-60 mg/L is considered soft, 61-120 mg/L is moderately hard, 121-180 mg/L is hard, and more than 180 mg/L is very hard.

Hydraulic conductivity

The volume of water at the existing kinematic viscosity that will move through a unit area of an isotropic porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. Replaces the term "field coefficient of permeability."

Potentiometric surface

A surface, as related to an aquifer, that everywhere coincides with the water level in tightly cased wells penetrating the aquifer.

Specific capacity

The rate of discharge of water from a well divided by the drawdown of water level within the well expressed as gallons per minute per foot of drawdown for a specified period of pumping, usually 24 hours.

Specific yield

The ratio of the volume of water that will drain by gravity from saturated aquifer material to the total volume of the material.

Storage coefficient

The volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in the head.

Transmissivity

The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of the aquifer under a unit hydraulic gradient. It is equal to an integration of the hydraulic conductivities across the saturated part of the aquifer perpendicular to the flow paths. Replaces the term "transmissibility."

Water-table aquifer

An aquifer in which the water table or upper surface of the zone of saturation is unconfined.

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM (SI) OF METRIC UNITS

Multiply inch-pound units	By	To obtain metric units
foot (ft)	0.3048	meter (m)
foot per day (ft/d)	0.3048	meter per day (m/d)
foot per year (ft/yr)	0.3048	meter per year (m/year)
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)
gallon (gal)	3.785	liter (L)
gallon per minute (gal/min)	6.309×10^{-5}	cubic meter per second (m^3/s)
	0.06309	liter per second (L/s)
gallon per minute per foot [(gal/min)/ft]	2.070×10^{-4}	cubic meter per second per meter [(m^3/s)/m]
	0.2070	liter per second per meter [(L/s)/m]
gallon per minute per square mile [(gal/min)/mi^2]	2.436×10^{-5}	cubic meter per second per square kilometer [(m^3/s)/km^2]
	0.02436	liter per second per square kilometer [(L/s)/km^2]
inch (in.)	2.540	centimeter (cm)
	25.40	millimeter (mm)
mile (mi)	1.609	kilometer (km)
million gallons per day (Mgal/d)	3.785×10^3	cubic meter per day (M^3/d)
	3.785×10^6	liter per day (L/d)
square mile (mi^2)	2.590	square kilometer (km^2)

To convert temperature in degree Celsius (°C) to degree Fahrenheit (°F), multiply by 9/5 and add 32.

GROUND-WATER RESOURCES OF THE ARCADIA-MINDEN AREA, LOUISIANA

By G. N. Ryals

ABSTRACT

The Sparta Sand of Eocene age comprises the Sparta aquifer, which yields 97 percent of the water used in the Arcadia-Minden area of north-central Louisiana along Interstate Highway 20 and U.S. Highway 80. The Sparta aquifer underlies all of the area except the extreme southwest corner. Pumpage from the Sparta aquifer in 1980 was 6.2 million gallons per day. Wells with specific capacities of 5 to 10 gallons per minute per foot of drawdown can be developed in this aquifer at most places. The potentiometric surface, which is 220 feet above to 180 feet below the National Geodetic Vertical Datum of 1929, is about 150 to 400 feet above the top of basal sand units of the aquifer; locally it is below the top of the aquifer. The potentiometric surface is declining at the rate of 1/2 to 4 feet per year; however, the rate of decline will decrease with time as hydraulic conditions change from artesian to water table.

Water from the Sparta aquifer may require treatment for iron for public-supply use at or near the outcrop of the Sparta Sand. Northeast and downdip from the outcrop, the water has low iron and higher dissolved-solids concentrations. Generally, the water downdip from the outcrop meets the current standards recommended by the U.S. Environmental Protection Agency for drinking-water.

The Wilcox-Carrizo aquifer is comprised of the Wilcox Group and Carrizo Sand of Paleocene and Eocene age. The aquifer underlies all of the Arcadia-Minden area but contains freshwater only in the southwestern part. This part of the area is relatively undeveloped and pumpage is only 0.2 million gallons per day. Some sand beds can yield 50 gallons per minute or more of water to wells. However, the occurrence of such beds is variable; at some sites, yields of only a few gallons per minute are possible. Freshwater in the aquifer meets the U.S. Environmental Protection Agency drinking-water standards (1976) without treatment except at some sites where iron concentrations are excessive.

The terrace aquifer, which occurs in the western part of the study area, is not utilized for public supply but may be used for stock watering. Water from the terrace aquifer generally is soft and low in iron; however, locally, the water may be hard, corrosive, and high in iron. Yields of wells screened in the terrace aquifer west of the study area range from 10 to 60 gallons per minute. The terrace aquifer may be used to supplement supplies from the Sparta and Wilcox-Carrizo aquifers and for domestic wells.

The Arcadia, Bistineau, Gibsland, Minden, and Vacherie salt domes are disturbances caused by the local intrusion of salt. The vertical salt movements have disrupted the base of freshwater in the Sparta and Wilcox-Carrizo aquifers in the vicinity of the domes; however, the area affected is only about 4 square miles at each dome. Freshwater sands may be absent over a dome, and freshwater may occur to greater depths on the flanks of a dome than in the surrounding area. Test drilling near salt domes is necessary to find sand beds that will yield an adequate water supply.

INTRODUCTION

Along U.S. Highway 80 in northern Louisiana, population density is increasing. The area from Arcadia to Minden located adjacent to Interstate Highway 20 and U.S. Highway 80 (pl. 1) has the potential for further increases in population and in industry. In 1975 the Arcadia-Minden area had a population of about 35,000, an increase of about 3,000 since 1960. Ground water is the principal source of freshwater for this area. Development will require more water; therefore, existing ground-water supplies will need to be expanded, or new ground-water sources developed.

The Arcadia-Minden area comprises approximately 700 mi^2 and includes the northern part of Bienville Parish, the southern part of Claiborne Parish, the western part of Lincoln Parish, and the southeastern part of Webster Parish (pl. 1). The area is mostly rural; is characterized by steep-sided valleys, flat valley floors, and rolling timbered hills; is well drained; and has a humid, subtropical climate.

During the past 25 years, total ground-water pumpage has steadily increased in the study area. The average daily pumpage for the area (table 1) was 6.4 Mgal/d in 1980, which is an 88 percent increase from 3.4 Mgal/d in 1960. The large increase is mostly attributable to increased public-supply pumping. Ground-water pumpage for public supply responds to changes in population and per capita consumption. Industrial pumpage for older installations decreased as a result of improved water-use methods, including water recycling, and as a result of some industrial plants closing. However, total industrial pumpage doubled because of water demands by new industries.

Table 1.--Ground-water pumpage in the Arcadia-Minden area
[In million gallons per day]

Year	Public supplies	Industrial	Rural		Total
			Domestic	Livestock	
1960	1.8	1.1	0.4	0.1	3.4
1965	1.9	1.5	.4	.1	3.9
1970	2.2	.9	.3	.1	3.5
1975	3.4	2.3	.2	.1	6.0
1980	3.8	2.4	.1	.1	6.4

The trend for the past 25 years has been for rural communities to develop public water-supply systems. The number of public-supply systems has more than doubled in the Arcadia-Minden area during this time. More systems probably will be developed; thus, more production wells capable of producing 50 gal/min or more will be needed. As public water-supply pumpage increases, rural-domestic pumpage will decrease because many home wells are abandoned when public-supply systems are available.

The purpose of this study is to describe and evaluate the ground-water resources as an aid in the development of ground-water supplies for the Arcadia-Minden area. By mapping the aquifers and determining their hydrologic characteristics and current water use, the available ground-water supply was evaluated, including the effects of salt structures on the ground-water supply. The hydrologic-data-collection program of the U.S. Geological Survey, conducted in cooperation with the Louisiana Department of Transportation and Development, Office of Public Works, provided much of the ground-water data for the Arcadia-Minden area. The Louisiana Department of Natural Resources, Office of Conservation, provided electrical logs used in mapping the aquifers. City and public water-supply system officials cooperated generously by providing records of wells and records of water use. Several officials allowed wells to be used for observation and tests.

HYDROGEOLOGIC SETTING

Regional hydrologic studies include information on the Arcadia-Minden area, and detailed studies have been made east and west of the area. Regional studies by Cushing, Boswell, and Hosman (1964) describe the Tertiary aquifers in the Mississippi embayment. Reports by Payne (1968, 1970, and 1972) describe the hydrologic significance of the lithofacies of the Sparta Sand, the Cockfield Formation, and the Cane River Formation, respectively. A detailed study by Sanford (1973) evaluates the water resources of the Ruston area, which is east of and adjacent to this study area. Immediately to the west of the Arcadia-Minden area, a study by Snider (in press) evaluates the ground-water resources of the Fillmore-Haughton-Red Chute area.

Freshwater occurs in the Arcadia-Minden area in aquifers of Tertiary (Paleocene and Eocene) and Quaternary (Pleistocene) age (table 2). Within the Arcadia-Minden area, Tertiary formations that contain sand beds capable of yielding 50 gal/min or more for public supply are (from oldest to youngest) the Wilcox Group, the Carrizo Sand, and the Sparta Sand. The Carrizo Sand was deposited over an eroded and irregular Wilcox surface. Because of nondeposition or erosion over some Wilcox highs, the Carrizo Sand is discontinuous. The Wilcox is hydraulically interconnected with the overlying Carrizo Sand; therefore, the Carrizo and the Wilcox are considered to be a single hydrologic unit, called the Wilcox-Carrizo aquifer, in the project area. Formations that consist chiefly of clay (the Midway Group, the Cane River Formation, and the Cook Mountain Formation) are confining beds and separate most of the water-bearing formations, retarding water movement between these formations. The Tertiary beds dip gently to the east because the area is on the west limb of the Mississippi structural trough.

In the western part of the area, nearly flat-lying Pleistocene terrace deposits were deposited on the eroded surface of the Sparta Sand, Carrizo Sand, and Wilcox Group. The sand and gravel in the terrace deposits form an aquifer, the terrace aquifer, that probably is capable of yielding 50 gal/min or more at some sites.

The Tertiary aquifers in the Arcadia-Minden area are recharged principally from rainfall on outcrop areas. Freshwater enters the Wilcox-Carrizo aquifer from outcrop areas to the west and southwest of the study area. The Sparta Sand crops out in a northwest-southeast-trending band in the south-central part of the area (pl. 1). Much of the Sparta Sand is covered by terrace deposits in the western part of the area. In addition to direct recharge by rainfall, the Sparta aquifer is recharged by leakage from the terrace deposits. The Cook Mountain Formation, which is mostly clay, contains a basal sand in some areas that also may contribute water to the Sparta. These clay deposits are the dominant outcrops in the eastern two-thirds of the area (pl. 1), and retard the infiltration of rainfall. Deposits of the Cockfield Formation cap many of the hills in the area. Recharge is by vertical infiltration of rainfall, and most discharge is by lateral movement of water to nearby streams. Recharge to the terrace aquifer is by vertical infiltration of rainfall through the soil zone.

In most of the area, the deepest occurrence of freshwater is either in the Wilcox-Carrizo aquifer or the Sparta aquifer (table 2). Although the Wilcox-Carrizo underlies all of the study area, freshwater occurs in the unit in only 25 percent of the area (pl. 2A). The interface between saltwater[1] and freshwater[1] is very irregular.

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[1] In ground-water studies in Louisiana, the U.S. Geological Survey has generally defined saltwater as that containing more than 250 mg/L of chloride. Water containing 250 mg/L or less of chloride is considered fresh. Freshwater has also been defined as containing 1,000 mg/L or less of dissolved solids, which is essentially equivalent to water containing 250 mg/L of chloride.

Table 2.--Geohydrologic units in the Arcadia-Minden area, Louisiana

System	Series	Group	Stratigraphic unit	Description and typical thickness	Hydrologic unit	Hydrologic characteristics
Quaternary	Pleistocene		Terrace deposits (undifferentiated)	Sand, gravel, and some clay. Limited to western part of study area. Thickness probably about 50 ft.	Terrace aquifer	No wells known to screen the aquifer in study area. Average hydraulic conductivity 120 ft/d west of area.
Tertiary	Eocene	Claiborne Group	Cockfield Formation	Fine sand and clay; lignitic. Thickness about 40-140 ft.	Cockfield aquifer	Used mostly for local domestic supplies.
			Cook Mountain Formation	Clay, partly sandy; glauconitic. Thickness about 100-200 ft.	Confining bed	Local sands yield small quantities of water for domestic supplies.
			Sparta Sand	Interbedded, clay and fine to medium sand; lignitic. Thickness about 400-700 ft. Unit is 20-100 percent sand.	Sparta aquifer	Principal aquifer of north-central Louisiana. Hydraulic conductivity typically ranges from 50 -110 ft/d. Well yields of 300-800 gal/min are common.
			Cane River Formation	Clay; glauconitic, lignitic. Thickness about 100-300 ft.	Confining bed	Does not yield water to wells.
			Carrizo Sand	Fine to coarse sand; discontinuous. Thickness 0-150 ft.	Wilcox-Carrizo aquifer	Contains freshwater in about 25 percent of area. Average hydraulic conductivity about 17 ft/d. Well yields range from about 10-100 gal/min.
	Eocene / Paleocene	Wilcox Group	Undifferentiated	Interbedded clay, sand, silt; lignitic. Thickness about 390-850 ft. Unit is 20-30 percent sand.		
	Paleocene	Midway Group	Undifferentiated	Dense clay. Thickness about 600 ft.	Confining bed	Does not yield water to wells.

Most of the freshwater in the Wilcox-Carrizo aquifer is in the southwestern part of the area, but an isolated body of freshwater occurs in Claiborne Parish. This isolated body was mapped on the basis of electrical logs. Freshwater in the Wilcox-Carrizo aquifer ranges from 0 to 1,300 ft below land surface.

The Sparta aquifer contains freshwater throughout the area where the unit is present (pl. 2A). However, basal sands in the eastern part of the area may contain slightly saline water. Freshwater in the Sparta occurs to maximum depths of about 400 ft below NGVD of 1929 (National Geodetic Vertical Datum of 1929) or about 800 ft below land surface.

As shown on plate 2A, abrupt and large differences in the altitude of the base of freshwater occur because the base of freshwater changes from one unit to another. The Wilcox-Carrizo and Sparta are separated by about 200 ft of the Cane River Formation (mostly clay). Where the Wilcox-Carrizo contains no freshwater, the base of freshwater is in the Sparta and is at least 200 ft shallower than in the Wilcox-Carrizo.

The Arcadia, Bistineau, Gibsland, Minden, and Vacherie salt domes occur in the study area (pl. 1). Salt domes are local structural anomalies caused by the vertical intrusion of salt. The top of the salt body (stock) for an individual dome averages about 1 mi in diameter and ranges in depth from 700 to 1,400 ft below land surface. The intrusion of salt has caused faulting and uplift of overlying beds, which has disrupted geologic units from the top of the salt stock to land surface. Each dome affects about 4 mi^2 or a total of about 20 mi^2 in the study area. About 3 percent of the study area is disturbed by the salt intrusions.

The salt domes have a pronounced local effect on the base of freshwater. Generally, freshwater may be absent over the apex of a dome and may occur at greater depths on the flanks of a salt dome than in the surrounding area. As shown by the base of freshwater map (pl. 2A), the Wilcox-Carrizo contains freshwater on the flanks of the Arcadia, Gibsland, and Minden domes; however, in the general area of these domes the Wilcox-Carrizo contains saltwater. Over the apex of the Bistineau, Gibsland, and Vacherie domes, beds of the Midway Group are at or near the surface. Because the Midway contains no sand beds, freshwater probably does not occur over the domes. Locally, freshwater may be present in shallow terrace and alluvial deposits. Although most units of Tertiary age were eroded as uplift occurred at a dome, downfaulted blocks that contain sand beds of Tertiary age may contain freshwater. The hydrologic patterns around salt structures are complex, and a detailed study of each one would be needed to determine hydrogeological conditions. Generally, salt domes are not favorable sites for freshwater wells.

GEOHYDROLOGIC PROPERTIES OF THE PRINCIPAL AQUIFERS

Wilcox-Carrizo Aquifer

Description

The Wilcox-Carrizo aquifer is comprised of the Carrizo Sand and the Wilcox Group; the latter consists of nonmarine sand, silt, clay, and numerous thin lignite beds. The top of the aquifer ranges from about 100 ft above NGVD of 1929 in the southwestern part of the area to 700 ft below NGVD of 1929 in the northeastern part (pl. 2B). Sand beds make up approximately 20 to 30 percent of the Carrizo Sand and Wilcox Group interval. The largely interconnected sand beds range from a few feet to 115 ft in thickness. Lateral extent of sand beds is highly variable (pl. 3). For example, the log of Union Production Company's test well in T. 18 N., R. 8 W. (Walker Unit No. 1, pl. 3, no. 61) shows one massive sand 125 ft in thickness at the top of the unit. By contrast, less than 2 1/2 mi away at the Carter Oil Company test well in T. 18 N., R. 8 W. (R. M. Davis No. 2, pl. 3, no. 59), the Carrizo Sand is absent; and the upper part of the log shows numerous thin sand beds. Sand-grain size is also variable. In the Wilcox Group interval, sand ranges in size from very fine to medium and is silty in many places. Where present, the Carrizo Sand consists of medium to coarse sand.

Hydraulics, Yield, and Water Levels

The hydrologic characteristics of the Wilcox-Carrizo aquifer were determined from pumping tests of five wells in the study area in Webster Parish. Values for hydraulic conductivity from these tests range from 1 to 19 ft/d and, based on the higher three values, averaged 17 ft/d (table 3). The variability is due to differences in the grain size and sorting of the sand. A sand that is 40 ft thick and has a hydraulic conductivity of 17 ft/d would have a transmissivity of 680 ft^2/d.

Water in the aquifer is confined under artesian pressure; therefore, the storage coefficient is estimated to be about 0.0001. Locally, the water in the aquifer may be under water-table conditions where sands are near the surface near salt structures; however, such sands are not extensive and, thus, are not important in the development of water supplies.

Yields of wells greater than 4 in. in diameter range from about 10 to 100 gal/min and average 50 gal/min (table 7). Most public-supply and industrial wells yield more than 50 gal/min. The average specific capacity for the Wilcox-Carrizo in the area is 1.3 (gal/min)/ft of drawdown. Specific capacity is a function of the ability of the aquifer to yield water over a given period of time and is also a function of well construction (including relative amount of

Table 3.--Hydraulic conductivity determined from tests of wells screened in the Wilcox-Carrizo aquifer

Well No.	Sand thickness (ft)	Hydraulic conductivity (ft/d)	Yield (gal/min)	Drawdown (ft)
Wb-265	42	19	25	25.9
Wb-270	36	17	40	35.9
Wb-306A	13	2	25	98.6
Wb-306B	15	1	22	150.5
Wb-329B	29	16	50	17.3

screen compared to aquifer thickness) and the degree of well development. For example, a properly developed 6-in. well with a specific capacity of 1.3 (gal/min)/ft of drawdown would have a drawdown of 38 ft in 24 hours at a pumping rate of 50 gal/min. However, if the well were not properly developed or only partially screened, resulting in a specific capacity of 0.8 (gal/min)/ft of drawdown, the drawdown would be 62 ft after pumping 24 hours at a rate of 50 gal/min.

Water levels in the Wilcox-Carrizo where sands contain freshwater generally range from 10 to 60 ft below land surface or from 135 to 223 ft above NGVD of 1929 (fig. 1). Large pumping centers have not been developed in the Wilcox-Carrizo aquifer, thus water-level fluctuations are small.

Quality of Water

In the study area, water from wells screened in the Wilcox-Carrizo aquifer is generally suitable for public supplies. However, the concentration of iron may exceed the limit (table 4) recommended by the U.S. Environmental Protection Agency (1976), and in some areas the water may have a hydrogen sulfide (H_2S) odor and require treatment for removal of hydrogen sulfide. Freshwater from the Wilcox-Carrizo is soft to moderately hard. About half of the chemical analyses (table 8) of water from the aquifer show iron concentrations that exceed 0.3 mg/L (milligrams per liter). Locally, different sands may contain water with different concentrations of iron. The sand screened in well Wb-306A (pl. 1 and table 8) is separated from that screened in well Wb-306B by 38 ft of clay. Water was collected from each well for chemical analysis. The iron concentration in water from well Wb-306A is 0.12 mg/L; whereas, the concentration for well Wb-306B is 1.3 mg/L. The concentrations of other chemical constituents also can vary from one sand to another. Where two or more sands occur at a site, it may be necessary to complete several test wells to determine the best source for a production well.

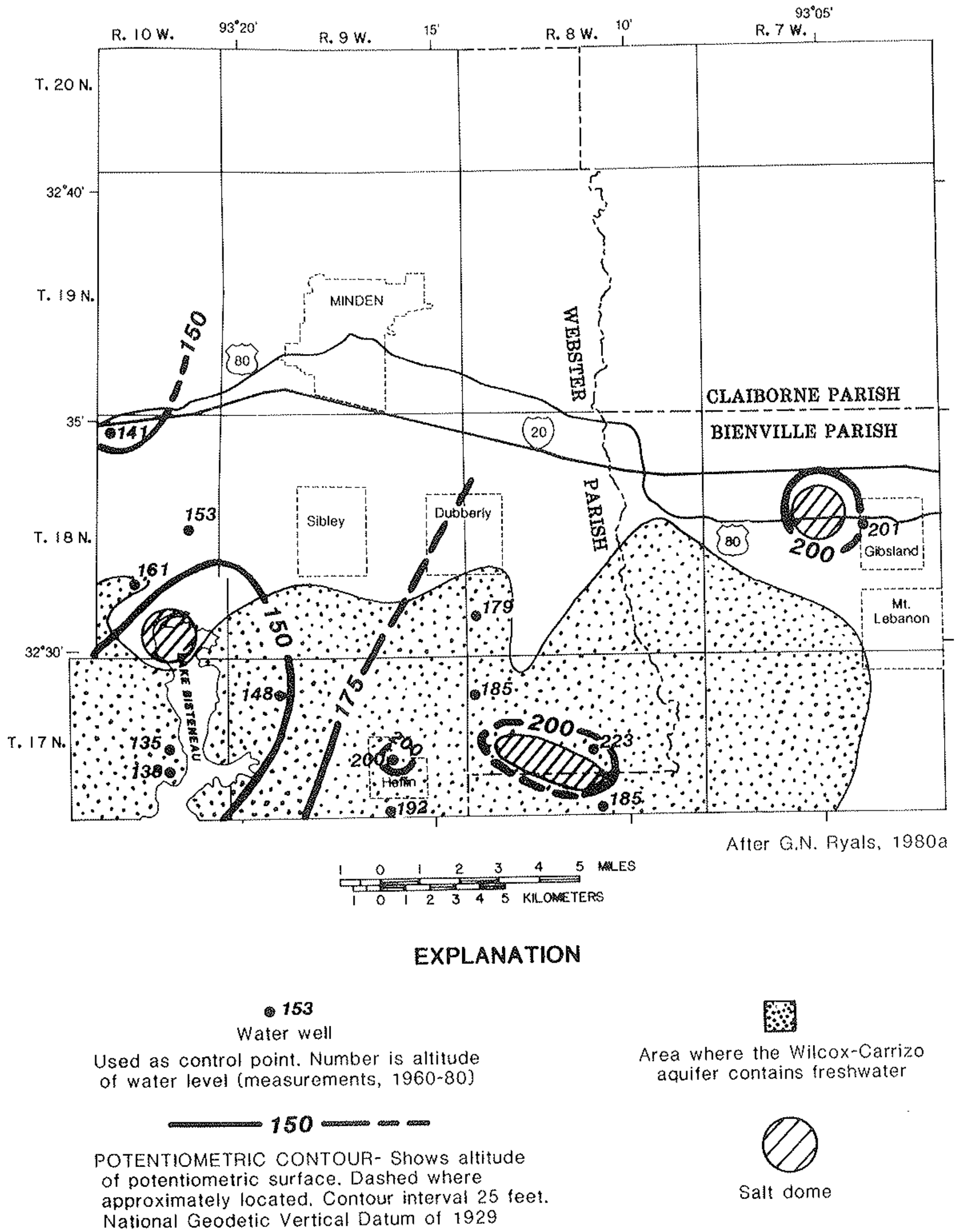


Figure 1.--Potentiometric surface of the Wilcox-Carrizo aquifer.

Table 4.--Summary of chemical and physical properties of water from the Wilcox-Carrizo aquifer

Constituent or physical property	Range	Recommended limits (U.S. Environmental Protection Agency, 1976)
Bicarbonate (HCO_3)---	86 - 540 mg/L	--------------
Chloride (Cl)--------	4.7 - 360 mg/L	250 mg/L
Color (platinum-cobalt units)-------------	0 - 40	15
Dissolved solids-----	130 - 975 mg/L	500 mg/L
Fluoride (F)---------	.1 - 1.4 mg/L	.8-1.0 mg/L
Hardness (as $CaCO_3$)--	2 - 65 mg/L	--------------
Iron (Fe)------------	.01- 4.5 mg/L	.3 mg/L
pH (units)-----------	7.3 - 8.8	6.5-8.5
Specific conductance (micromhos/cm at 25°C)--------------	164 -1,790	--------------
Sodium (Na)----------	16 - 370 mg/L	--------------
Temperature----------	19 - 25.5°C (66-78°F)	--------------

Samples from two wells, Wb-281 and Wb-306A, show fluoride concentrations greater than the recommended limits (tables 4 and 8). Beneficial health effects reportedly occur in areas where water contains natural fluorides; however, excessive amounts of fluoride can cause mottling of teeth.

Present and Potential Development

In the Arcadia-Minden area, the only wells presently completed in sands of the Wilcox-Carrizo aquifer are located in Webster Parish. The wells in Webster Parish yield approximately 0.2 Mgal/d or about 3 percent of the total ground-water pumpage in the area. The village of Heflin, McIntyre Water Works District, the Central Water System, Jenkins Water System, and the Horseshoe Road Water System pump water from the Wilcox-Carrizo (fig. 2). These five public water-supply systems pumped about 0.16 Mgal/d and served about 2,200 people in 1980 (table 9). The rest of the water pumped from the aquifer is for domestic or industrial use.

A major problem concerning development of the Wilcox-Carrizo is the possible increase in chloride concentration in water from wells tapping the aquifer near the downdip limit of freshwater (pl. 2A). Pumpage from wells located near the interface could eventually cause salty water to move into areas containing freshwater. A test well (Wb-265) was drilled to a depth of 200 ft for the Jenkins community at the freshwater-saltwater interface. Water from this well had a chloride concentration of 361 mg/L, which is above the concentration of 250 mg/L recommended by the U.S. Environmental Protection Agency

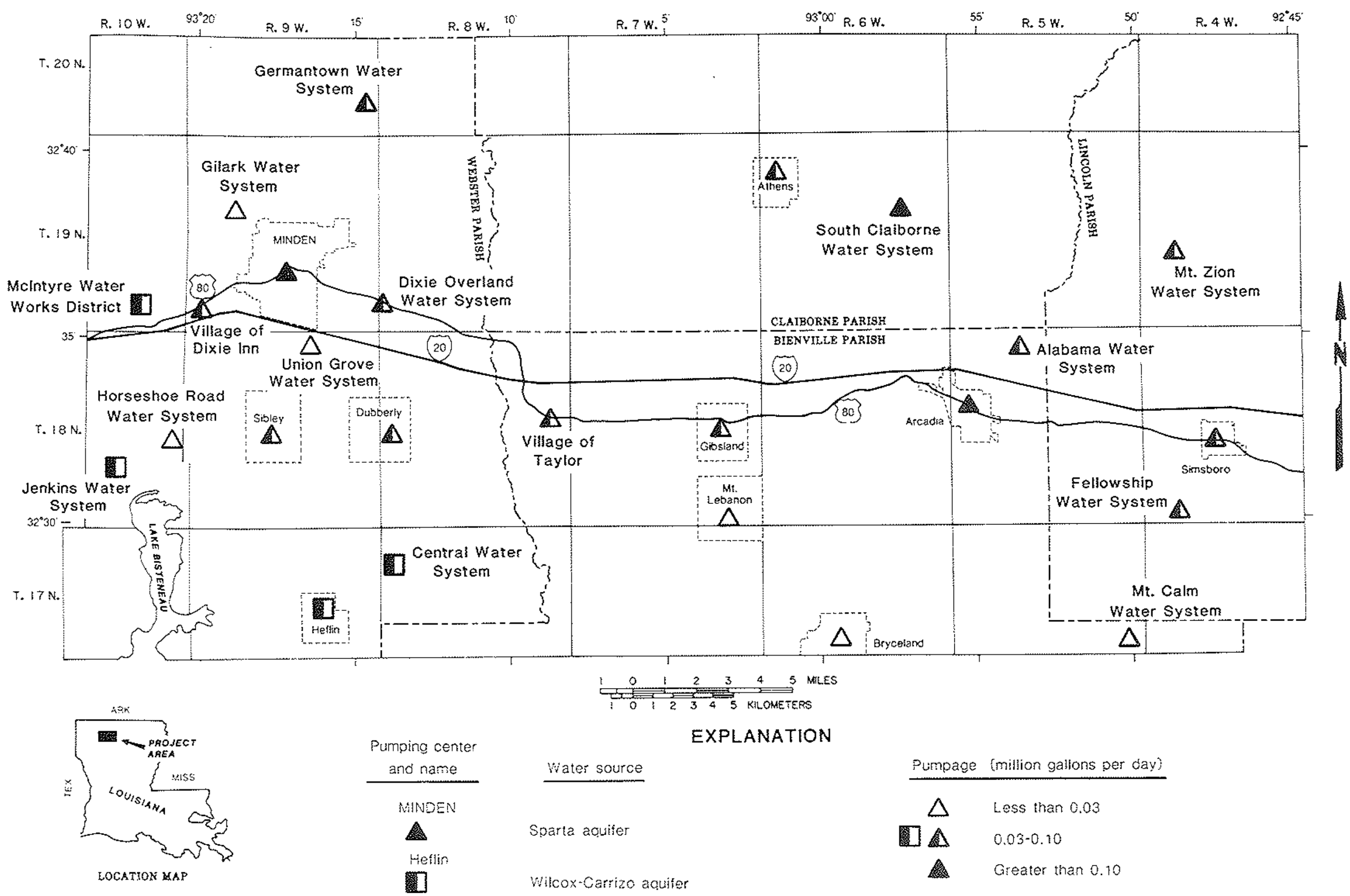


Figure 2.--Location of public water-supply systems and estimated pumpage, 1980.

for public supply. Two public-supply wells (Wb-316 and Wb-317), both drilled to a depth of 225 ft for the Jenkins community 1 mi northwest from the test well, yield freshwater. The maximum estimated rate of ground-water movement in the Wilcox-Carrizo in the vicinity of the Jenkins community is about 25 ft/yr. Thus, if the freshwater-saltwater interface were only one-half mile from the production wells, more than 100 years would be required for saltwater to reach the production wells at a rate of 25 ft/yr. However, the precise location of the freshwater-saltwater interface is not known. In addition, because of the discontinuity of the sand beds, the actual rate of movement is probably much lower.

Large well fields capable of producing 2 Mgal/d or more will be difficult to develop because Wilcox-Carrizo wells are usually low yielding and many wells would be needed. Approximately 28 wells, each well pumping 50 gal/min continuously, would be needed to produce 2 Mgal/d. Such a well field would probably cover many square miles. Because of the variability in thickness and extent of sands beds, a large-scale test-drilling program would also be necessary.

Pumpage from the Wilcox-Carrizo has increased only slightly because population growth in the area where the aquifer is utilized has been small. Projected growth there also is small; therefore, the Wilcox-Carrizo should have the capability to furnish sufficient quantities of water to meet projected needs. Some increase in production can be met by expanding existing systems.

Sparta Aquifer

Description

The Sparta Sand consists of nonmarine massive sand, silty sand, shale, lignitic shale, and some lignite beds. Interconnection of the sand beds causes the Sparta Sand to respond as a single aquifer, the Sparta aquifer. The Sparta Sand ranges from 400 to 700 ft in thickness, and the base of the unit ranges from 300 ft above to 400 ft below NGVD of 1929 within the area (pl. 2C). Sands 100 ft thick are common and may occur at any depth in the formation but generally occur in the middle or basal part. Sand makes up from 20 to 100 percent of the formation; at most places the unit averages between 50- and 75-percent sand.

In Webster Parish the aquifer consists of a massive sand in the lower part and thinly bedded, sandy clay and sand with some lignite in the upper part. Geologic section B-B' on plate 3 shows the vertical distribution of the Sparta Sand in Webster Parish. Sand beds are exceptionally thick at wells Wb-277 and Wb-260 (T. 19 N., R. 9 W., pl. 1). In the eastern part of the study area, individual sand beds range from a few feet to 250 ft in thickness. Sand intervals shown on sections A-A' and B-B' (pl. 3) are typical for the area.

Hydraulics and Yield

The hydrologic properties of the Sparta aquifer were determined from 21 pumping tests in Webster, Lincoln, and Bienville Parishes. Variations in transmissivity and hydraulic conductivity as related to sand thicknesses are given in table 5. The variations given in table 5 agree with the conclusion of Payne (1968) that the hydraulic conductivity of the Sparta generally increases with increased sand thickness. The average hydraulic conductivity for the area is 60 ft/d.

Sands in the Sparta aquifer generally are confined. A storage coefficient of 0.0004, which is typical of artesian aquifers, was determined from a pumping test of well Bi-157 (T. 18 N., R. 7 W.). This value for the coefficient of storage is in agreement with another determined for the Sparta aquifer in Union Parish (Snider and others, 1972, p. 15). Unconfined conditions would be expected in or near the outcrop, although deeper sands might be confined. In the study area, the storage coefficient probably ranges between 0.0001 (artesian conditions) and 0.1 (water-table conditions).

Table 5.--Hydraulic characteristics of the Sparta aquifer as a function of sand thickness

Sand thickness (ft)	Transmissivity range (ft^2/d)	Hydraulic conductivity	
		Range (ft/d)	Average (ft/d)
10-36	390-2,000	17-170[1]	50
37-70	1,500-4,000	33-120	60
70	3,700-9,600	90-130[2]	110

[1] Hydraulic conductivity of 170 ft/d determined in test of well Wb-322, near Minden.

[2] Hydraulic conductivity of 130 ft/d determined in test of well Bi-149A, near Bryceland.

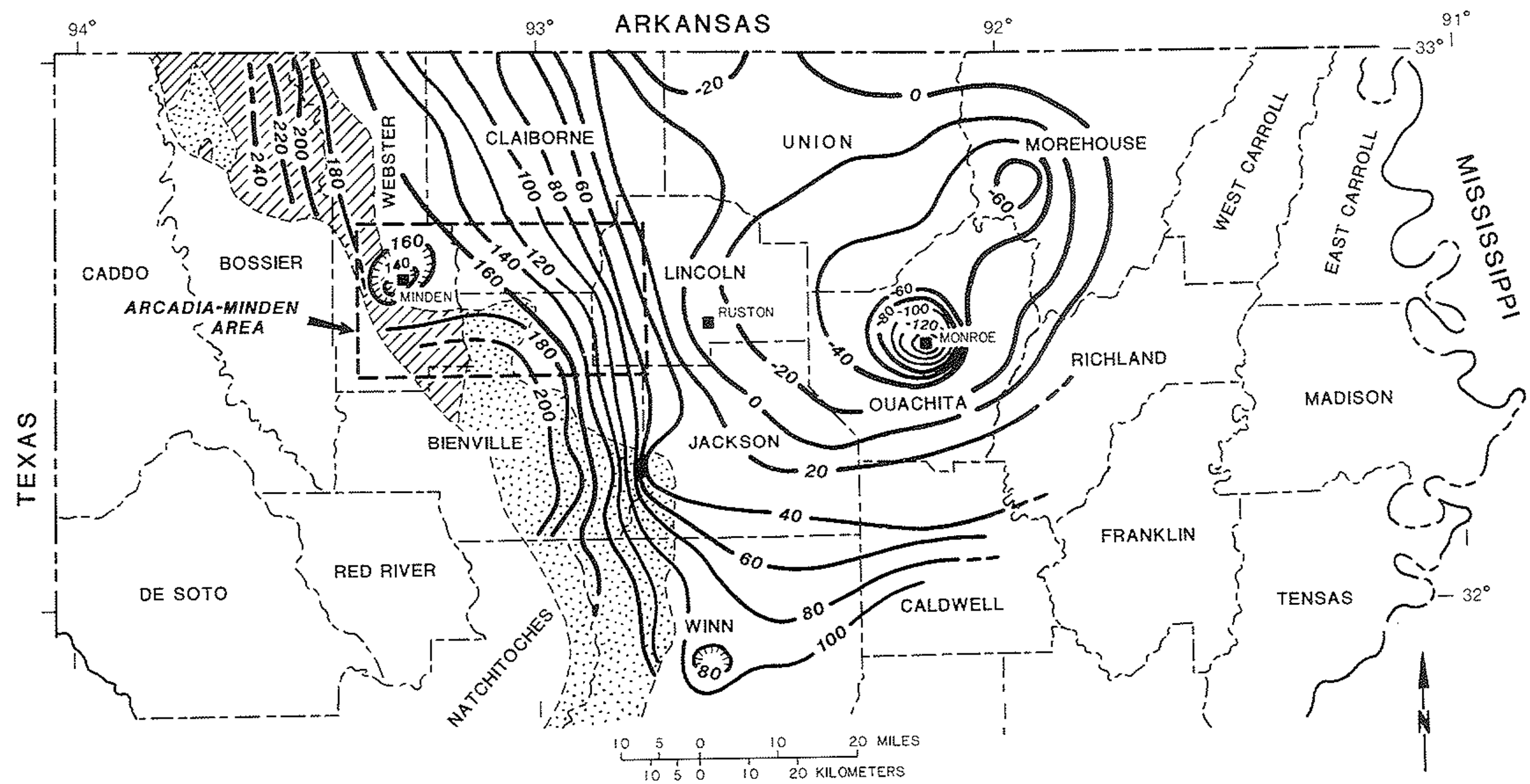
Many industrial and public-supply wells screened in the Sparta aquifer that are greater than 6 in. in diameter yield as much as 300 to 500 gal/min from sands less than 50 ft in thickness; wells yield as much as 800 gal/min from sands greater than 50 ft in thickness. The average yield for production wells screened in the Sparta aquifer in the study area is 500 gal/min.

The efficiency of a well can be determined by comparing the actual specific capacity to the theoretical specific capacity. For example, in the Sparta, a sand that has a thickness of 50 ft and a hydraulic conductivity of 62 ft/d has a transmissivity of 3,100 ft^2/d. The theoretical specific capacity (Meyer, 1963) of a completely developed 6-in. diameter well screened in the total thickness of a sand with a transmissivity of 3,100 ft^2/d and a storage coefficient of 0.0001 is 10 (gal/min)/ft of drawdown. With a pumping rate of 500 gal/min the well would have a theoretical drawdown of 50 ft after pumping 24 hours. If the well had a measured specific capacity of 4 (gal/min)/ft of drawdown due to poor development, the well would have a drawdown of 125 ft after pumping 24 hours and would be 40 percent efficient. Regional water-level declines coupled with the additional drawdown of a poorly developed well may cause pumps to be lowered, the well redrilled, or yields to be reduced. Values for specific capacity of 5 to 10 (gal/min)/ft of drawdown probably can be expected where sands are at least 50 ft thick and the wells are properly constructed and developed.

Water Levels

In 1980 in the Arcadia-Minden area, the altitude of the potentiometric surface of the Sparta aquifer ranged from 220 ft above to 180 below NGVD of 1929 (fig. 3). In most of the area, differences between water levels in wells in sands at different depths at a specific site are just a few feet because the Sparta sands are connected. However, in local areas where the interconnection is poor, larger differences in water levels exist. Pumpage at Minden has lowered water levels near the well field and created a cone of depression as shown by the closed contours on the potentiometric map (fig. 3).

The potentiometric surface in 1980 (fig. 3) was about 150 to 400 ft above the top of basal sands in the Sparta aquifer. The potentiometric surface has been declining at the rate of 1/2 to 4 ft/yr in the Sparta in northern Louisiana. This decline is the result of large amounts of pumpage from the Sparta, especially in the major pumping centers at Bastrop, Hodge, Monroe, Ruston, and Springhill in Louisiana and at El Dorado and Magnolia in Arkansas. Although Ruston is the nearest major pumping center to the Arcadia-Minden area, pumpage at the larger Hodge and El Dorado pumping centers probably have the greatest influence on the study area. Veatch (1906) reported water levels at Arcadia of 130 ft below land surface. Water levels measured at Arcadia in 1980 are about 230 ft below land surface, a decline of 100 ft in about 75 years. Water levels at Minden have not declined as much as in other areas because of local recharge from the overlying terrace aquifer. Currently, water levels at Minden range from about 50 to 100 ft below land surface compared to about 30 to 50 ft below land surface in 1906.



EXPLANATION

20 POTENTIOMETRIC CONTOUR–Shows altitude of potentiometric surface. Dashed where approximately located. Contour interval 20 feet. National Geodetic Vertical Datum of 1929

Outcrop of Sparta Sand

Subcrop of Sparta Sand covered by terrace deposits

Figure 3.--Potentiometric surface of the Sparta aquifer, spring 1980.

Since the mid-1960's, water levels in wells in the middle and lower sands of the Sparta Sand have been below the clay unit of the Cook Mountain Formation throughout the area. Because sands of the Sparta are interconnected, the upper part of the Sparta is probably undergoing dewatering in the Arcadia-Minden area. Before the regional decline caused water levels to drop below the Cook Mountain Formation, only pumping levels at specific sites were below the Cook Mountain Formation. No air could reach the upper sands in the Sparta; however, when the water levels declined below the Cook Mountain Formation regionally, air entered the system and dewatering of the uppermost sand beds began. Even though water levels continue to decline at the rate of 1/2 to 4 ft/yr in wells in deeper sands, it would take over 100 years before dewatering of the lower producing sands begins. Well yields will decrease as water levels are lowered because of the increase in pumping head and less available drawdown. As pointed out by Sanford (1973), the most permeable sands are in the lower part of the Sparta. According to Sanford, as water levels are lowered below the clay unit of the Cook Mountain Formation and air enters the formation, water-table conditions will prevail. Therefore, the storage coefficient will approach water-table values. As this condition develops, the rate of water-level decline will be reduced. Leakage will occur from sands in the upper part of the Sparta Sand and lower part of the Cook Mountain Formation, which provide a water source having a high storage capacity. Drainage is now contributing to the yield of the lower sands; however, according to Sanford it has not been evaluated quantitatively because of the uncertainity in estimating the actual specific yield of the deposits. Because the upper sands act as a recharge source, the rate of water-level decline in the lower sands will decrease.

Observation wells Cl-136 (T. 19 N., R. 6 W.) and L-113 (T. 18 N., R. 4 W., pl. 1) screened in basal sands have water levels 5 and 60 ft, respectively, below the top of the Sparta aquifer. Hydrographs of these wells (fig. 4) show water-level declines of 3 ft/yr for well L-113 and 2 ft/yr for well Cl-136. The decline at well L-113 reflects pumpage at Simmsboro, and well Cl-136 reflects pumpage at the South Claiborne Water System. Observation well Bi-144 (T. 18 N., R. 5 W., pl. 1), located between wells Cl-136 and L-113, has a water level that is at or slightly above the top of the Sparta. As indicated by the hydrograph of well Bi-144 (fig. 4), between 1970 and 1973 the water-level decline was very great compared to the decline since 1973. The hydrograph of well Bi-144 is similar to that for well L-113. The general trend for all wells in figure 4 reflects the regional water-level trend in the Sparta aquifer.

Water levels in shallow wells in the outcrop area of the Sparta Sand fluctuate seasonally. This is caused by changes in the amount of water in storage as a result of cyclic recharge by precipitation that occurs mainly in winter and spring.

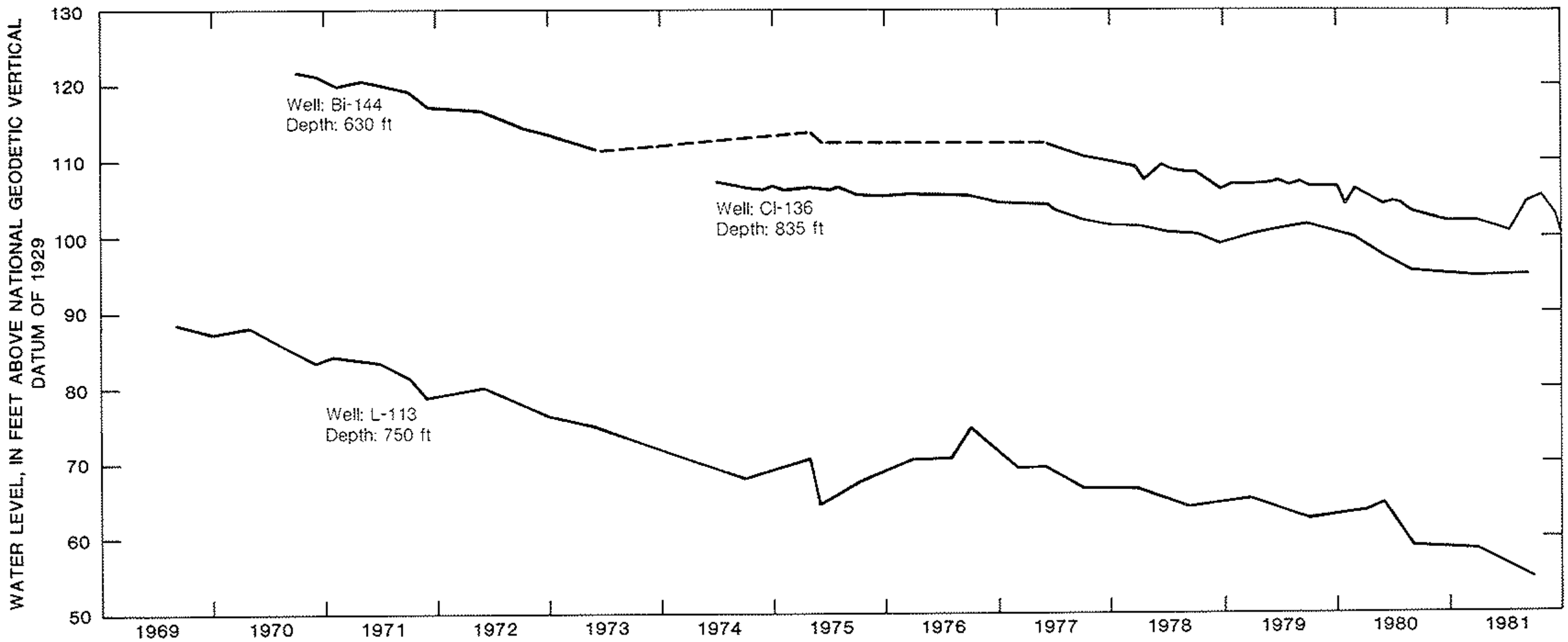


Figure 4.--Water-level trends in wells in the Sparta aquifer.

Quality of Water

Water from the Sparta aquifer is a soft, sodium bicarbonate type. Chemical analyses of water samples from selected wells screened in the Sparta and other aquifers are given in table 8. Downdip from the outcrop of the Sparta the water generally is suitable for public-supply use without treatment. Water in or near the outcrop area may require treatment to remove iron and raise the pH.

Changes in iron concentration, pH, and dissolved solids occur as water in the Sparta aquifer moves downdip. In and immediately downdip from the outcrop area, the water may be corrosive (pH less than 7 units), have iron concentrations greater than 0.3 mg/L, and have a low concentration of dissolved solids. The area where the probability is high that wells will yield water with relatively high iron concentrations and low pH is shown on plate 2C. The iron concentration generally decreases, the pH increases, and the dissolved solids increase (table 6) downdip from this area.

The temperature of water in the Sparta aquifer ranges from 18 to 25°C (64 to 77°F).

Table 6.--Updip and downdip ranges in pH, iron, and dissolved solids in water from the Sparta aquifer

General location	pH units	Iron (mg/L)	Dissolved solids (mg/L
At or near the outcrop--	5.1-7.0	0.3-6.0	30-150
After movement downdip from outcrop----------	7.0-8.5	<.3	150-350

Present and Potential Development

In 1980, 97 percent of the water used in the area was obtained from the Sparta aquifer. Twenty public-supply systems in the Arcadia-Minden area have wells screened in the Sparta aquifer (fig. 2). The city of Minden, which has the largest public supply, pumps an average of 2.58 Mgal/d. Pumpage for the towns of Arcadia and Gibsland, the village of Sibley, and the South Claiborne Water System ranges from 0.06 to 0.2 Mgal/d (table 9).

Well fields capable of producing 1 Mgal/d or more can be developed at most places in the area; however, development of a large well field would affect water levels. Increasing the pumpage by several million gallons per day would accelerate the rate of water-level decline.

Pumpage in 1980 in the area was 6.2 Mgal/d. Should current trends in ground-water pumpage continue, by the year 2000, approximately 8 Mgal/d will be needed from the Sparta aquifer to meet demand. At the current rate of development, future demands can be met by the Sparta aquifer. Large increases in usage can be met by expanding existing water-supply systems by installing additional wells.

Terrace Deposits

Terrace deposits form the terrace aquifer and occur in the western part of the study area (pl. 1). The deposits consist of sand and gravel at the base grading upward to silt and clay. Thickness of the unit is typically 50 ft but may be as much as 100 to 150 ft in places. Although no wells are known to be screened in the terrace aquifer in this area, it is an important source of water in the Fillmore-Haughton-Red Chute area to the west. The terrace aquifer is capable of yielding an adequate supply of water for some domestic and public-supply uses.

The data from development in the Fillmore-Haughton-Red Chute area may be indicative of the potential for development of the terrace aquifer in Webster Parish. The average hydraulic conductivity in that area is 120 ft/d. Thus, a saturated sand 40 ft thick would have a transmissivity of about 5,000 ft^2/d. Most wells screened in the aquifer west of the study area yield between 10 and 60 gal/min. The aquifer is probably under water-table conditions in the Webster Parish part of the area. According to Snider (in press), if the annual rate of rainfall infiltration is 3 in., a continuous yield of about 100 $(gal/min)/mi^2$ is possible in the Fillmore-Haughton-Red Chute area. A sustained yield of 200 to 300 gal/min could be possible if the pumpage cone covered several square miles and the available drawdown was sufficient. Similar yields probably can be obtained at some sites in the Webster Parish part of the study area.

Water from the terrace aquifer may be similar to that from wells west of the area. The water generally requires little treatment; however, water from the aquifer may be corrosive, high in iron, and moderately hard to very hard. Chemical analyses of water from the terrace aquifer in the Fillmore-Haughton-Red Chute area show iron concentrations ranging from 0.05 to 4.4 mg/L, hardness from 49 to 380 mg/L, and pH from 5.4 to 8.2 units.

The terrace is an alternate source of water for some parts of Webster Parish in the study area. It can be used to supplement existing supplies of water from the Wilcox-Carrizo and Sparta aquifers. Near the Bistineau salt dome in an area less than 4 mi^2, the terrace is the only aquifer that contains freshwater. (See pl. 2.)

SUMMARY AND CONCLUSIONS

The Sparta Sand, Carrizo Sand, and sands of the Wilcox Group are the principal sources of ground water for the Arcadia-Minden area. Pumpage from the Sparta and Wilcox-Carrizo aquifers in the study area amounted to 6.4 Mgal/d in 1980. Projected ground-water demands can be met from the two aquifers in the area. The terrace aquifer can be used in the western part of the area to supplement existing supplies.

The Wilcox-Carrizo aquifer contains freshwater in 25 percent of the area and ranges from a few feet to 1,300 ft below land surface. The interface between saltwater and freshwater is irregular, and care should be taken not to locate wells near the interface. Water from the aquifer contains iron and hydrogen sulfide at most places, and treatment may be required for public-supply use. Yields of wells usually are low; however, yields of 50 gal/min are possible in places. Because of the variability in extent and thickness of sand beds, test drilling and aquifer testing would be desirable before developing a production well or well field.

The Sparta is the most extensive aquifer in the area and supplies 97 percent of all water now used. Freshwater in the Sparta extends to depths of 800 ft below land surface and is a soft, sodium bicarbonate type. At or near the outcrop, water from the Sparta may require treatment for iron removal. Wells with yields of 500 gal/min can be developed at most places. Continuing water-level declines of 1/2 to 4 ft/yr is the major problem in the area. As the water-level decline continues with time and water-table conditions are approached, the rate of water-level decline will decrease as the storage coefficient converts from artesian to water-table conditions.

The terrace aquifer is limited to the western part of the area and is not being used as a source of water for public-supply systems. The quality of water and potential yields of wells probably varies from site to site, but the quality and yields may be good locally. The terrace aquifer could be used as an alternate source of water or to supplement existing supplies from the Wilcox-Carrizo and Sparta aquifers.

Salt-dome structures have caused local disruptions in the base of freshwater. The disruptions interfere with the development of ground-water supplies only locally--generally in areas immediately around the domes.

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HYDROLOGIC DATA

Tables 7-10

Table 7.--Description of selected wells in the Arcadia-Minden area

Abbreviations used in the table are as follows:

Aquifer: S, Sparta Sand
W, Wilcox-Carrizo

Data Available: C, chemical analysis
D, driller's log
E, electrical log
MA, mechanical analysis of sand samples
PT, pumping test

Owner: (m), municipality
WS, water system

Status of Well: D, well destroyed
O, observation well
P, production well

Table 7.--Description of selected wells in the Arcadia-Minden area

Well No.	Owner	Location Sec.	Location T.	Location R.	Year completed	Elevation (ft)	Casing diameter (in.)	Screen Diameter (in.)	Screen Depth interval (ft)	Screen Opening (in.)	Yield (gal/min)	Data available C	D	E	MA	PT	Status of well	Aquifer
BIENVILLE PARISH																		
Bi- 1--	Gibsland (m)-----------	14	18N	7W	1923	270	6	--	-------	-----	60	-	-	-	-	-	O	S
Bi- 2--	-----do----------------	14	18N	7W	1927	260	8	6	428-489	-----	-----	-	x	-	-	-	O	S
Bi- 3--	Arcadia (m)------------	18	18N	5W	1940	340	12	4	522-585	.012	300	x	x	-	-	-	P	S
Bi- 4--	-----do----------------	18	18N	5W	1932	350	6	6	518-585	-----	120	-	x	-	-	-	P	S
Bi- 19--	-----do----------------	18	18N	5W	1950	350	12	8	556-602	.032	500	x	x	x	-	-	P	S
Bi- 34--	Gibsland (m)-----------	14	18N	7W	1946	270	10	6	303-363	.020	80	x	x	-	-	-	P	S
Bi- 35--	-----do----------------	14	18N	7W	1954	260	6	4	426-466	-----	139	x	x	x	-	-	P	S
Bi- 36--	-----do----------------	18	18N	5W	1954	340	12	8	544-594	.032	596	-	x	-	-	x	P	S
Bi- 58--	CONAGRA----------------	12	18N	6W	1959	380	10	6	398-418	-----	190	-	x	x	-	-	P	S
Bi- 59--	-----do----------------	12	18N	6W	1959	380	10	6	{600-620} {630-645}	-----	310	-	x	x	-	-	P	S
Bi- 78--	L. O. Towns------------	36	18N	7W	1957	320	4	2	359-365	-----	-----	x	-	-	-	-	P	S
Bi- 90B-	Taylor Development Co--	13	18N	8W	1965	245	10	6	260-300	.014	150	x	x	-	-	-	P	S
Bi-103--	La Ofc of Public Works-	14	18N	7W	1968	280	4	3	260-280	.016	30	x	x	x	x	x	D	S
Bi-104--	-----do----------------	15	18N	7W	1968	230	4	3	530-540	.016	50	x	x	x	x	x	D	W
Bi-133--	La Office of Highways--	8	18N	7W	1968	240	6	5	320-340	-----	-----	x	-	-	-	-	P	S
Bi-136A-	La Ofc of Public Works-	36	18N	7W	1969	330	4	3	304-316	.012	60	x	x	x	x	x	D	S
Bi-136B-	-----do----------------	36	18N	7W	1969	330	4	3	418-430	.012	46	x	x	x	x	x	D	S
Bi-136C-	-----do----------------	36	18N	7W	1969	330	4	3	500-512	.012	50	x	x	x	x	x	D	S
Bi-137--	-----do----------------	21	17N	6W	1969	270	2	2	400-410	.010	35	x	x	x	x	x	D	S
Bi-138--	Mr. Taylor-------------	22	17N	6W	1963	290	2	2	251-263	-----	-----	x	-	-	-	-	P	S
Bi-139--	La Ofc of Public Works-	28	18N	5W	1969	360	4	4	496-506	.010	15	x	x	x	x	x	D	S
Bi-140--	-----do----------------	28	18N	5W	1970	350	4	3	643-653	.010	24	x	x	x	x	x	D	S
Bi-142--	Girl Scouts of America-	28	18N	5W	1946	350	6	4	554-594	-----	75	x	-	-	-	-	P	S
Bi-144--	U.S. Geological Survey-	4	18N	5W	1970	320	2	2	620-630	.010	66	x	x	x	x	x	O	S
Bi-145A-	La Ofc of Public Works-	14	18N	7W	1970	250	4	2	264-274	.012	50	x	x	x	x	x	D	S
Bi-145B-	-----do----------------	14	18N	7W	1970	250	4	2	400-410	.012	38	x	x	x	x	x	D	S
Bi-147--	Alabama WS-------------	5	18N	7W	1971	380	8	4	391-493	.020	116	-	x	x	-	-	P	S
Bi-148--	E. E. Letlow-----------	5	18N	7W	1967	380	2	2	367-375	-----	-----	x	-	-	-	-	P	S

Table 7.--Description of selected wells in the Arcadia-Minden area--Continued

Well No.	Owner	Location			Year completed	Elevation (ft)	Casing diameter (in.)	Screen			Yield (gal/min)	Data available					Status of well	Aquifer
		Sec.	T.	R.				Diameter (in.)	Depth interval (ft)	Opening (in.)		C	D	E	MA	PT		
Bi-149A-	La Ofc of Public Works-	22	17N	6W	1970	325	4	3	416-426	0.018	40	x	x	x	x	x	D	S
Bi-149B-	-----do----------------	22	17N	6W	1970	325	4	3	491-501	.018	40	x	x	x	x	x	D	S
Bi-157--	Gibsland (m)-----------	14	18N	7W	1973	250	8	6	347-399	.014	125	-	-	-	-	-	P	S
Bi-163--	La Ofc of Public Works-	24	18N	7W	1974	235	4	2	326-336	.010	25	x	x	x	x	x	D	S
Bi-177--	Mt. Lebanon (m)--------	36	18N	7W	1973	330	7	3	494-514	-----	50	-	x	x	-	-	P	S
Bi-191--	Bryceland (m)----------	21	17N	6W	1972	280	7	4	{380-400 410-425}	.020	100	-	-	-	-	-	P	S
Bi-198--	Mt. Calm WS------------	24	17N	5W	1978	329	4	2	456-476	-----	35	-	x	x	-	x	P	S
Bi-217--	Department of Energy---	8	17N	5W	1980	329	6	4	{477-549 579-590}	.016	70	x	x	x	x	x	O	S
Bi-240--	Alabama WS-------------	5	18N	5W	1979	365	8	4	388-488	-----	210	-	x	x	-	-	P	S
	CLAIBORNE PARISH																	
Cl-120--	Athens (m)-------------	7	19N	6W	1964	383	6	4	560-610	-----	85	x	x	x	-	-	P	S
Cl-121--	-----do----------------	7	19N	6W	1964	383	6	4	480-530	-----	110	x	x	x	-	-	P	S
Cl-130--	H. M. Murphy-----------	33	19N	5W	1967	320	2	2	323-329	-----	-----	x	-	-	-	-	P	S
Cl-136--	U.S. Geological Survey-	2	19N	6W	1974	405	2	2	825-835	.010	15	x	x	x	x	x	O	S
Cl-138--	-----do----------------	11	19N	8W	1975	380	2	2	651-662	.018	15	x	x	x	x	x	O	S
Cl-142A-	La Ofc of Public Works-	14	19N	6W	1976	408	4	2	441-461	.018	30	x	x	x	x	x	D	S
Cl-142B-	-----do----------------	14	19N	6W	1976	408	4	3	573-593	.020	33	x	x	x	x	x	D	S
Cl-142C-	-----do----------------	14	19N	6W	1976	408	4	3	692-702	.020	27	x	x	x	x	x	D	S
Cl-145--	South Claiborne WS-----	14	19N	6W	1976	410	6	3	580-610	.018	103	x	x	x	x	x	P	S
Cl-146--	-----do----------------	14	19N	6W	1976	408	6	3	573-602	.018	105	-	-	-	-	x	P	S
Cl-147--	-----do----------------	25	20N	7W	1978	420	6	3	552-567	-----	83	-	x	x	-	-	P	S
	LINCOLN PARISH																	
L- 8---	Lincoln Parish School Board----------------	21	18N	4W	1937	330	6	--	485-525	-----	6	x	x	-	-	-	P	S
L- 34---	Simsboro (m)-----------	21	18N	4W	1957	330	8	4	604-644	-----	115	x	x	-	-	-	P	S

L- 50---	W. P. Williams---------	6	17N	4W	1965	320	4	2	330-360	-----	8	x	x	-	-	-	P	S
L- 53---	B. Gainttes------------	34	18N	5W	1964	380	2	2	532-550	-----	-----	x	-	-	-	-	P	S
L- 67---	Laurens Glass, Inc-----	15	18N	4W	1967	320	8	--	562-622	.016	225	x	x	x	-	-	P	S
L- 70---	Simsboro (m)-----------	21	18N	4W	1969	330	8	5	480-520	.020	149	-	-	-	-	-	P	S
L- 90---	Fellowship WS----------	32	18N	4W	1970	355	8	4	696-742	.020	140	-	-	-	-	-	P	S
L-110---	La Ofc of Public Works-	21	18N	4W	1968	320	4	3	487-499	.012	24	x	x	x	x	x	O	S
L-113---	U.S. Geological Survey-	32	18N	4W	1969	355	4	2	740-750	.010	6	x	x	x	x	x	O	S
L-116---	W. P. Williams---------	6	17N	4W	1968	300	4	2	654-674	.007	-----	x	x	-	-	-	P	S
L-145---	Mt. Zion WS------------	17	19N	4W	1972	260	8	4	497-537	.020	-----	-	-	-	-	-	P	S
L-153---	U.S. Geological Survey-	5	19N	4W	1978	280	2	2	525-535	.012	15	x	x	x	x	-	O	S

WEBSTER PARISH

Wb-157--	Minden (m)-------------	28	19N	9W	1950	185	18	12	279-309	0.030	800	-	-	-	-	-	P	S
Wb-159--	-----do----------------	28	19N	9W	1941	200	18	12	241-305	.024	800	-	-	-	-	-	P	S
Wb-160--	-----do----------------	28	19N	9W	1949	200	18	10	260-291	.030	800	x	-	-	-	-	P	S
Wb-161--	-----do----------------	28	19N	9W	1953	200	18	12	259-291	-----	850	x	x	-	-	-	P	S
Wb-162A-	Dixie Inn (m)----------	31	19N	9W	1975	165	4	--	60- 75	-----	-----	-	-	-	-	-	P	S
Wb-204--	T. B. Norman-----------	24	19N	9W	1962	240	4	4	359-379	-----	-----	x	-	-	-	-	P	S
Wb-218--	Sibley (m)-------------	21	18N	9W	1963	205	10	8	130-170	-----	156	x	-	x	-	-	P	S
Wb-247--	-----do----------------	21	18N	9W	1963	205	12	6	67-107	-----	-----	-	-	-	-	-	P	S
Wb-249--	La Ofc of Public Works-	14	17N	9W	1965	285	4	3	418-438	.025	12	x	x	x	x	x	D	W
Wb-250--	Heflin (m)-------------	14	17N	9W	1965	285	7	3	368-458	-----	75	x	x	x	-	-	P	W
Wb-252--	Dubberly (m)-----------	24	18N	9W	----	260	6	6	160-174	-----	-----	x	-	-	-	-	P	S
Wb-253--	Mr. Bell---------------	19	18N	8W	1955	260	4	--	20- 90	-----	-----	x	-	-	-	-	P	S
Wb-254--	T. C. Thomas-----------	20	18N	8W	----	300	4	--	? - 72	-----	-----	x	-	-	-	-	P	S
Wb-255--	W. M. Brummett---------	8	19N	8W	1961	250	4	4	{328-338 348-372}	-----	-----	x	-	-	-	-	P	S
Wb-259--	La Ofc of Public Works-	19	18N	8W	1967	275	4	2	222-233	.004	-----	x	x	x	x	x	D	S
Wb-260--	Gilark WS--------------	8	19N	9W	1966	262	6	4	412-442	.016	55	x	x	x	-	x	P	S
WB-261--	La Ofc of Public Works-	8	19N	9W	1967	262	4	2	246-257	.020	17	x	x	-	x	-	D	S
Wb-262--	John Shaw III----------	20	19N	9W	1967	230	4	2	330-350	-----	-----	x	-	-	-	-	P	S
WB-263--	La Ofc of Public Works-	22	18N	9W	1968	185	4	3	124-134	.008	30	x	x	x	x	x	D	S
Wb-264--	Minden (m)-------------	28	19N	9W	1966	200	24	16	196-226	.030	1,001	-	x	-	x	x	P	S
Wb-265--	La Ofc of Public Works-	27	18N	10W	1968	180	4	3	191-201	.016	50	x	x	x	x	x	D	W
Wb-266--	-----do----------------	9	18N	9W	1968	205	4	3	161-171	.016	50	x	x	x	x	x	D	S
Wb-269--	Minden (m)-------------	28	19N	9W	1966	200	24	16	230-280	.030	1,000	-	x	x	-	-	P	S
Wb-270--	La Ofc of Public Works-	26	18N	10W	1968	185	4	3	216-226	.016	40	x	x	x	x	x	D	W
Wb-271--	Dubberly (m)-----------	19	18N	8W	1968	278	7	3	185-220	.020	50	x	x	-	-	-	P	S
WB-276--	McIntyre WS------------	35	19N	10W	1968	210	6	4	160-190	-----	100	x	-	-	-	-	P	W
Wb-277A-	La Ofc of Public Works-	21	19N	9W	1968	200	4	4	228-238	.010	70	x	x	x	x	x	D	S

Table 7.--Description of selected wells in the Arcadia-Minden area--Continued

Well No.	Owner	Location Sec.	Location T.	Location R.	Year completed	Elevation (ft)	Casing diameter (in.)	Screen Diameter (in.)	Screen Depth interval (ft)	Screen Opening (in.)	Yield (gal/min)	Data available C	D	E	MA	PT	Status of well	Aquifer
Wb-277B-	La Ofc of Public Works-	21	19N	9W	1968	200	4	4	278-288	0.010	73	x	x	x	x	x	D	S
Wb-278--	-----do----------------	26	19N	9W	1968	190	4	4	188-198	.010	81	x	x	x	x	x	D	S
Wb-279--	-----do----------------	33	19N	9W	1968	200	4	4	196-206	.010	79	x	x	x	x	x	D	S
Wb-280--	-----do----------------	28	19N	9W	1968	190	4	4	266-276	.010	75	x	x	x	x	x	D	S
Wb-281--	-----do----------------	7	17N	8W	1969	240	4	4	452-462	.040	38	x	x	x	x	x	D	W
Wb-285--	U.S. Geological Survey-	31	19N	8W	1969	340	4	2	598-608	.018	38	x	x	x	x	x	O	S
Wb-286--	-----do----------------	31	19N	8W	1970	340	4	2	548-558	.020	23	x	-	-	-	-	O	S
Wb-290--	C. L. Hendrick---------	22	17N	9W	----	210	2	2	172-178	-----	-----	x	-	-	-	-	P	W
Wb-297A-	Dixie Overland---------	31	19N	8W	1970	340	6	3	{501-523 540-561}	-----	80	x	-	-	-	-	P	S
Wb-297B-	-----do----------------	31	19N	8W	1971	340	6	3	{538-560 599-620}	-----	-----	-	-	-	-	-	P	S
Wb-300--	H. W. Davenport--------	29	19N	9W	1970	190	5	2	210-240	.018	70	x	x	-	-	-	P	S
Wb-302--	La Ofc of Public Works-	34	19N	10W	1971	190	--	--	-------	-----	-----	-	-	-	-	-	D	-
Wb-305--	-----do----------------	32	18N	9W	1971	220	--	--	-------	-----	-----	-	-	-	-	-	D	-
Wb-306A-	-----do----------------	5	17N	9W	1971	200	4	3	382-392	.020	25	x	x	x	x	x	D	W
Wb-306B-	-----do----------------	5	17N	9W	1971	200	4	3	430-440	.020	22	x	x	x	x	x	D	W
Wb-310--	-----do----------------	28	19N	9W	1971	180	4	3	219-229	.012	27	x	x	x	x	x	D	S
Wb-311--	-----do----------------	28	19N	9W	1971	180	4	3	185-195	.012	40	x	x	x	x	x	D	S
Wb-312--	-----do----------------	8	18N	8W	1972	260	4	4	306-316	.014	34	x	x	x	x	x	D	S
Wb-313A-	-----do----------------	1	18N	9W	1972	280	4	4	144-154	.020	36	x	x	x	x	x	D	S
Wb-313B-	-----do----------------	1	18N	9W	1972	280	4	3	442-452	.012	13	x	x	x	x	x	D	S
Wb-314--	Dresser Minerals-------	5	17N	8W	1972	300	8	8	110-230	-----	420	x	-	-	-	-	P	S
Wb-315--	-----do----------------	5	17N	8W	1972	160	8	8	119-190	.018	500	x	x	x	x	x	P	S
Wb-316--	Jenkins WS-------------	26	18N	10W	1968	185	4	2	215-225	.020	-----	-	x	x	-	-	P	W
Wb-317--	-----do----------------	26	18N	10W	1970	180	5	2	215-225	.020	48	-	x	-	-	-	P	W
Wb-319A-	La Ofc of Public Works-	1	18N	9W	1973	286	4	3	396-408	.020	50	x	x	x	x	x	D	S
Wb-319B-	-----do----------------	1	18N	9W	1973	286	4	3	452-462	.020	42	x	x	x	x	x	D	S
Wb-320A-	-----do----------------	25	19N	9W	1973	300	4	3	457-468	.020	50	x	x	x	x	x	D	S
Wb-320B-	-----do----------------	25	19N	9W	1973	300	4	3	632-644	.020	50	x	x	x	x	x	D	S

Wb-321A-	-----do----------------	30	20N	8W	1973	335	4	3	550-560	.020	43	x	x	x	x	x	D	S
Wb-321B-	-----do----------------	30	20N	8W	1973	335	4	3	610-620	.020	50	x	x	x	x	x	D	S
Wb-322--	J. R. Bishop-----------	26	19N	9W	1973	240	4	3	464-474	-----	50	x	x	x	x	x	P	S
Wb-328--	La Ofc of Public Works-	25	20N	9W	1974	370	4	2	595-605	.020	30	x	x	x	x	x	D	S
Wb-329A-	-----do----------------	30	18N	8W	1974	245	4	3	130-140	.020	54	x	x	x	x	x	D	S
Wb-329B-	-----do----------------	30	18N	8W	1974	245	4	3	480-490	.020	50	x	x	x	x	x	D	W
Wb-334--	-----do----------------	22	17N	9W	1974	240	4	3	267-277	.018	35	x	x	x	x	x	D	W
Wb-336A-	-----do----------------	14	17N	10W	1975	162	4	3	109-119	.020	1	x	x	x	x	x	D	W
Wb-336B-	-----do----------------	14	17N	10W	1975	162	4	3	238-248	.020	23	x	x	x	x	x	D	W
Wb-337--	-----do----------------	23	17N	10W	1975	145	4	3	222-232	.020	25	x	x	x	x	x	D	W
Wb-341--	U.S. Forest Service----	33	20N	9W	1968	240	8	8	400-470	.016	-----	x	-	x	-	-	D	S
Wb-342--	U.S. Geological Survey-	21	18N	9W	1975	170	--	--	-------	-----	-----	x	-	-	-	-	D	-
Wb-343--	-----do----------------	22	18N	9W	1975	180	--	--	-------	-----	-----	x	-	-	-	-	D	-
Wb-345--	-----do----------------	28	18N	9W	1975	200	1	1	87- 92	.010	10	x	x	-	-	-	D	S
Wb-346--	-----do----------------	16	18N	9W	1975	220	--	--	------	-----	-----	-	x	-	-	-	D	-
Wb-347--	Sibley (m)-------------	21	18N	9W	1975	200	8	4	93-113	.018	82	-	x	-	-	-	P	S
Wb-349--	Minden (m)-------------	28	19N	9W	1974	180	24	16	223-263	.030	1,200	-	x	-	-	-	P	S
Wb-354--	Sibley (m)-------------	21	18N	9W	1972	205	7	4	{100-140 144-159}	.020	50	-	x	-	x	-	P	S
Wb-357--	Dixie Inn (m)----------	31	19N	9W	1975	165	4	2	147-167	.018	70	-	x	-	-	-	P	S
Wb-358--	Heflin (m)-------------	14	17N	9W	1973	285	6	2	372-403	.018	-----	-	-	x	-	-	P	W
Wb-359--	Dubberly (m)-----------	1	18N	9W	1974	280	6	2	134-154	-----	40	-	-	-	-	-	P	S
Wb-361--	Central WS-------------	12	17N	9W	1969	240	4	2	424-454	-----	44	-	-	-	-	-	P	W
Wb-362--	Germantown WS----------	25	20N	9W	1975	370	4	2	591-611	-----	70	-	-	-	-	-	P	S
Wb-365--	Union Grove WS---------	3	18N	9W	1969	240	6	3	242-263	.020	-----	-	x	-	-	-	P	S
Wb-376--	Dixie Metals, Inc------	14	17N	9W	1977	260	4	4	{110-120 120-140}	{.010 .020}	70	x	-	-	-	-	P	S
Wb-377--	McIntyre WS------------	35	19N	10W	1977	210	4	2	154-174	-----	49	-	x	-	-	-	P	W
Wb-381--	Horseshoe Road WS------	24	18N	10W	1977	200	4	4	234-244	-----	35	-	x	-	-	-	P	W
Wb-397--	Germantown WS----------	25	20N	9W	1978	370	6	3	590-615	.012	150	-	x	-	-	-	P	W
Wb-406--	Dixie Overland WS------	31	19N	8W	1973	340	6	3	620-640	-----	-----	-	x	-	-	x	P	S

Table 8.--Chemical analyses of water from selected wells in the Arcadia-Minden area

Well No.	Location Sec.	T.	R.	Date of sample	Depth of well, (ft)	Specific conductance (µmhos)	pH (units)	Temperature (°C)	Color (platinum-cobalt units)	Hardness (mg/L as $CaCO_3$)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissovled (mg/L as Na)	Potassium, dissolved (mg/L as K)	Bicarbonate (mg/L as HCO_3)	Carbonate (mg/L as CO_3)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, sum of constituents, dissolved (mg/L)	Nitrogen, nitrate total (mg/L as NO_3)	Nitrogen, nitrate dissolved (mg/L as NO_3)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)
SPARTA AQUIFER Bienville Parish																									
BI- 19	18	18N	5W	3- 5-68	602	75	5.8	23.0	0	15	3.0	1.8	6.3	4.8	26	0	7.0	4.8	0.1	38	80	----	0.10	1,400	---
BI- 34	14	18N	7W	4-19-57	363	42	5.5	21.5	---	5	1.2	.5	5.2	.9	10	0	4.4	3.2	.1	14	35	----	.00	-----	---
BI- 35	14	18N	7W	3- 4-68	466	44	5.6	22.0	5	10	2.0	1.2	4.9	.7	11	0	4.8	4.0	.1	12	35	----	.10	390	---
BI- 78	36	18N	7W	9-19-68	365	207	6.0	21.0	5	60	16	4.9	12	2.1	46	0	11	13	.1	37	142	----	23	1,200	---
BI-103	14	18N	7W	3-21-68	280	45	5.8	21.0	5	11	2.8	1.0	5.0	.4	8	0	10	3.0	.0	11	37	----	.00	420	---
BI-133	8	18N	7W	6- 4-69	340	96	6.2	----	0	26	6.4	2.4	8.3	2.1	32	0	10	6.7	.1	17	69	.00	-----	3,500	90
BI-136A	36	18N	7W	2-20-69	316	123	6.8	----	15	32	8.7	2.5	9.5	4.3	50	0	14	3.0	.1	33	100	.00	-----	1,400	70
BI-136B	36	18N	7W	2-27-69	430	122	6.6	----	20	11	2.8	1.0	21	3.1	51	0	13	5.0	.1	18	89	.10	-----	2,400	30
BI-136C	36	18N	7W	3- 5-69	512	341	7.6	22.0	15	0	.0	.0	83	1.8	181	0	24	5.4	.5	17	221	.00	-----	460	40
BI-137	21	17N	6W	7- 7-69	410	158	7.0	----	5	12	3.7	.7	28	2.2	64	0	13	7.2	.0	49	136	.10	-----	1,300	50
BI-138	22	17N	6W	7- 7-69	263	422	7.5	----	5	140	40	10	31	4.6	186	0	51	8.0	.0	18	256	1.1	-----	190	80
BI-139	28	18N	5W	12-23-69	506	66	5.5	----	5	12	3.4	.9	4.5	5.2	22	0	2.4	4.3	.0	31	63	.00	-----	3,400	100
BI-140	28	18N	5W	1-23-70	653	50	5.4	23.5	0	8	1.6	1.0	6.3	2.4	21	0	5.2	2.5	.0	24	53	.00	-----	2,300	70
BI-142	28	18N	5W	1-27-70	594	38	4.9	23.5	0	9	2.7	.5	3.5	1.9	13	0	3.2	1.7	.0	20	40	.00	-----	1,500	60
BI-144	4	18N	5W	8-21-70	630	191	7.4	----	20	22	5.4	2.1	33	4.5	74	0	24	6.8	.0	57	169	.00	-----	530	50
BI-145A	14	18N	7W	10-13-70	274	39	5.8	20.0	50	8	2.8	.2	2.0	.7	7	0	5.2	2.7	.0	12	33	.30	-----	300	40
BI-145B	14	18N	7W	10-08-70	410	43	6.0	21.0	35	15	3.8	1.3	2.1	.8	12	0	5.2	3.9	.0	12	35	.10	-----	520	40
BI-148	5	18N	5W	8- 6-70	375	292	7.9	----	5	29	8.2	2.1	57	2.9	167	0	18	3.2	.1	14	188	1.0	-----	20	50
BI-149A	22	17N	6W	11-18-70	426	144	6.8	21.0	20	28	7.5	2.2	17	4.0	59	0	14	7.0	.1	57	138	.00	-----	900	50
BI-149B	22	17N	6W	11-12-70	501	159	6.7	21.5	5	26	7.6	1.7	21	3.6	60	0	19	6.0	.1	62	151	.00	-----	1,400	100
BI-163	24	18N	7W	7-23-74	336	95	6.0	20.5	0	12	2.9	1.2	12	6.9	30	0	17	4.2	.1	23	85	.00	-----	3,100	40
BI-217	8	17N	5W	5-29-80	590	250	6.2	22.0	30	54	17	2.8	25	3.9	100	0	35	7.9	.1	60	201	----	-----	2,500	70
Claiborne Parish																									
CL-120	7	19N	6W	7-17-68	610	496	7.7	22.0	5	6	2.0	0.2	110	1.3	230	0	45	13	0.2	8.0	296	----	0.10	1,100	---
CL-121	7	19N	6W	7-17-68	530	531	7.8	22.0	10	8	3.0	.1	130	1.2	242	0	71	14	.2	12	350	----	.10	70	---
CL-130	33	19N	5W	8- 6-70	329	385	8.1	----	5	15	3.0	1.8	86	3.1	201	0	29	5.0	.1	14	242	1.0	-----	30	0
CL-136	2	19N	6W	5-29-74	835	371	8.0	----	120	4	1.1	.3	81	1.4	173	0	25	11	.3	14	220	.51	-----	270	0
CL-138	11	19N	8W	3-14-75	661	372	8.2	----	30	7	1.8	.6	85	1.1	183	0	19	11	.1	11	220	.30	-----	230	0
CL-142A	14	19N	6W	7-16-76	461	227	8.5	----	25	10	2.2	1.0	49	1.2	112	0	15	4.2	.3	19	147	.17	-----	60	0
CL-142B	14	19N	6W	7-12-76	593	172	6.7	----	5	5	1.8	.1	36	1.4	75	0	16	4.5	.2	50	147	.00	-----	70	0
CL-142C	14	19N	6W	7- 1-76	702	227	7.8	----	10	8	2.5	.4	49	1.0	110	0	15	3.7	.3	33	159	.00	-----	50	0
CL-145	14	19N	6W	10-20-76	610	213	6.9	23.5	0	19	6.1	.9	38	3.5	102	0	20	3.1	.2	35	157	.21	-----	450	60
Lincoln Parish																									
L- 8	21	18N	4W	3-16-60	525	190	7.4	21.0	10	0	0.0	0.0	45	2.3	112	0	1.8	4.8	0.1	7.4	123	----	1.0	-----	---
L- 34	21	18N	4W	6-14-68	644	215	7.1	----	15	10	3.5	.3	45	1.5	106	0	11	9.1	.2	43	166	----	.00	760	---
L- 50	6	17N	4W	11-15-67	360	618	7.6	----	15	8	1.6	1.0	140	.7	250	0	86	13	.4	10	377	----	1.6	220	---
L- 53	34	18N	5W	1-18-68	550	188	7.7	----	5	34	12	1.0	25	2.9	88	0	15	4.9	.1	50	154	----	.40	500	---
L-110	21	18N	4W	12-12-68	499	222	7.2	----	10	8	2.5	.4	49	3.7	117	0	14	4.5	.1	32	164	----	.10	300	---
L-113	32	18N	4W	8-12-69	750	340	7.1	25.0	0	14	3.6	1.2	73	2.0	126	0	55	7.9	.1	45	250	.10	-----	170	20
L-116	6	17N	4W	7-15-69	674	258	6.9	----	5	1	.4	.0	59	1.1	128	0	22	4.5	.1	37	187	.00	-----	680	10
L-153	5	19N	4W	10-17-78	535	411	---	----	0	75	23	4.3	56	4.7	170	0	55	6.0	.1	31	264	.19	-----	20	210

Webster Parish

WB-160	28	19N	9W	11- 3-59	291	190	6.0	20.0	10	28	7.1	2.5	23	2.9	32	0	19	22	0.1	24	122	----	5.6	-----	---
WB-161	28	19N	9W	6-12-68	291	179	7.1	----	10	22	5.8	1.8	29	1.2	57	0	13	13	.1	22	125	----	11	150	---
WB-204	24	19N	9W	11- 1-67	379	285	7.3	----	10	80	22	6.1	28	3.2	147	0	18	6.6	.1	13	169	----	-----	400	---
WB-218	21	18N	9W	9-30-67	170	56	6.1	19.5	10	7	2.0	.5	7.2	2.9	22	0	1.0	4.0	.0	32	61	----	.10	1,100	---
WB-252	24	18N	9W	9-20-66	174	67	6.3	21.0	0	12	2.9	1.2	6.0	2.2	27	0	.4	3.7	.1	29	59	----	.10	1,100	---
WB-253	19	18N	8W	9-20-66	90	26	4.2	20.0	0	5	1.5	.3	1.9	.8	3	0	1.2	2.0	.1	16	27	----	1.8	40	---
WB-254	20	18N	8W	9-20-66	72	42	6.6	20.0	0	15	5.0	.6	1.6	.6	19	0	.8	.5	.1	20	40	----	1.6	60	---
WB-255	8	19N	9W	1-17-67	372	268	6.9	----	0	63	25	.1	32	3.5	157	0	7.6	4.1	.1	17	166	----	.10	1,200	---
WB-259	19	18N	8W	2-27-67	233	62	5.9	20.0	0	12	2.9	1.2	5.1	4.7	26	0	.0	3.7	.1	27	58	----	.10	2,200	---
WB-260	8	19N	9W	7-18-68	442	273	7.5	20.0	10	57	21	1.1	40	2.1	149	0	15	7.8	.2	30	190	----	.10	2,900	---
WB-261	8	19N	9W	3- 8-67	257	219	7.1	21.0	5	68	19	4.9	20	4.6	130	0	.2	4.3	.1	20	137	----	.10	2,100	---
WB-262	20	19N	9W	11- 1-67	350	224	6.7	----	10	65	13	7.9	23	3.0	120	0	9.0	6.8	.1	25	147	----	.10	2,000	---
WB-263	22	18N	9W	1-15-68	134	104	6.6	20.0	15	2	.6	.1	23	.9	55	0	.4	4.9	.0	39	96	----	.00	240	---
WB-266	9	18N	9W	4-26-68	171	95	6.1	20.5	5	25	6.0	2.4	6.0	5.5	52	0	.2	3.0	.1	52	101	----	.10	3,600	---
WB-271	19	18N	8W	7-18-68	220	66	6.8	19.0	10	8	2.6	.4	11	2.2	32	0	3.6	4.7	.1	31	72	----	.10	1,700	---
WB-277A	21	19N	9W	9- 9-68	238	196	6.7	20.0	60	42	13	2.3	24	1.7	99	0	10	5.0	.1	38	143	----	.00	2,000	---
WB-277B	21	19N	9W	9-12-68	288	248	7.2	20.5	30	29	9.0	1.6	45	2.2	122	0	16	7.0	.2	31	172	----	.10	950	---
WB-278	26	19N	9W	9-18-68	198	193	6.7	19.5	90	29	8.5	1.9	28	2.9	87	0	15	7.0	.1	36	142	----	.00	3,200	---
WB-279	33	19N	9W	9-25-68	206	246	7.8	20.0	15	12	4.6	.1	54	.8	132	0	12	7.9	.1	22	166	----	.00	460	---
WB-280	28	19N	9W	10- 1-68	276	202	7.7	20.0	10	4	.9	.4	46	.8	116	0	5.6	5.0	.1	37	153	----	.00	140	---
WB-285	31	19N	8W	12-19-69	608	269	7.3	24.0	5	18	5.8	.9	51	2.9	140	0	11	7.0	.2	17	165	.30	-----	100	80
WB-286	31	19N	8W	1- 2-70	558	323	7.8	23.5	5	15	5.5	.3	68	2.7	160	0	27	6.4	.2	11	200	.10	-----	20	40
WB-300	29	19N	9W	1-27-71	240	74	6.4	----	5	12	3.2	1.0	9.0	1.2	27	0	6.0	3.7	.1	25	64	1.6	-----	280	0
WB-310	28	19N	9W	11-17-71	229	53	6.4	18.0	5	4	1.3	.2	8.8	1.9	26	0	.0	3.3	.0	23	52	.00	-----	200	0
WB-311	28	19N	9W	11-24-71	195	116	5.7	20.0	5	16	4.1	1.4	15	2.7	26	0	15	11	.1	25	89	2.1	-----	150	0
WB-312	8	18N	8W	4-14-72	316	123	6.0	20.5	35	6	1.4	.6	26	2.2	68	0	2.0	4.0	.1	18	87	.10	-----	500	20
WB-313A	1	18N	9W	5- 3-72	154	49	5.3	20.0	5	10	2.2	1.1	3.8	1.4	9	0	3.2	4.5	.1	23	45	1.6	-----	220	10
WB-313B	1	18N	9W	4-26-72	452	136	6.6	22.5	25	7	1.9	.5	27	1.9	74	0	.2	6.6	.1	38	112	.10	-----	720	20
WB-314	5	17N	8W	5-24-78	230	41	5.7	19.5	0	6	2.0	.2	2.7	1.5	8	0	1.6	2.0	.0	16	33	3.3	-----	20	10
WB-315	5	17N	8W	10- 4-72	190	29	5.7	19.5	5	5	1.5	.3	2.0	1.5	9	0	.2	1.6	.0	17	29	.60	-----	20	0
				5-24-78	190	27	5.9	19.5	1	6	2.0	.2	2.4	1.1	5	0	2.0	2.4	.0	15	29	----	-----	100	0
WB-319A	1	18N	9W	5- 1-73	308	78	5.3	19.5	0	16	3.9	1.5	6.2	2.5	16	0	10	6.3	.1	18	56	.00	-----	2,300	130
WB-319B	1	18N	9W	4-27-73	462	247	7.2	21.5	0	36	11	2.1	40	3.7	129	0	12	7.0	.2	12	152	.00	-----	590	80
WB-320A	25	19N	9W	5-15-73	468	73	5.9	22.0	30	16	4.2	1.3	7.0	2.3	36	0	1.2	3.2	.0	45	83	.40	-----	3,500	120
WB-320B	25	19N	9W	5- 9-73	644	230	7.5	23.0	0	23	8.8	.3	44	1.9	126	0	7.2	6.9	.1	36	167	.00	-----	340	---
WB-321A	30	20N	8W	6-18-73	560	168	6.5	23.0	5	34	9.4	2.6	22	3.4	85	0	6.2	8.2	.1	55	149	.10	-----	3,500	140
WB-321B	30	20N	8W	6-12-73	620	201	6.7	----	10	19	2.2	3.3	40	1.7	102	0	8.2	10	.2	56	172	.20	-----	970	50
WB-322	26	19N	9W	11-15-73	474	275	8.4	----	0	20	6.0	1.2	57	2.0	154	0	8.4	6.6	.1	17	174	.10	-----	-----	10
WB-328	25	20N	9W	7- 8-74	605	227	6.7	23.5	0	16	3.6	1.7	46	1.8	116	0	8.4	8.0	.2	50	177	.00	-----	500	70
WB-329A	30	18N	8W	7-24-74	140	38	5.1	20.0	60	7	1.9	.5	5.1	1.2	12	0	4.4	4.0	.0	14	37	.12	-----	550	0
WB-341	33	20N	9W	12-17-75	470	280	6.8	----	0	58	20	2.0	36	3.9	136	0	20	7.2	.8	27	184	.59	-----	200	330
WB-345	28	18N	9W	9- 3-75	92	48	5.5	----	0	17	5.9	.6	4.4	3.3	9	0	16	3.8	.0	26	64	.03	-----	360	40
WB-376	14	17N	9W	5-24-78	140	79	5.8	20.0	1	10	3.0	1.5	9.8	2.2	14	0	5.6	9.7	.1	36	74	----	-----	130	5

WILCOX-CARRIZO AQUIFER
Bienville Parish

BI-104	15	18N	7W	4- 4-68	540	320	8.1	25.5	10	65	18	4.9	30	7.1	100	0	5.0	33	0.1	18	166	-----	0.60	4,500	---

Webster Parish

WB-249	14	17N	9W	9-20-65	438	308	7.7	----	30	9	2.1	0.9	68	1.4	176	0	0.0	10	0.1	11	181	-----	0.20	440	0
WB-250	14	17N	9W	7-11-68	458	305	8.1	23.0	15	9	1.9	1.0	70	3.3	178	0	4.2	9.2	.1	9.7	187	-----	.00	190	---
WB-265	27	18N	10W	4-15-68	201	1,790	8.1	21.0	10	50	14	3.6	370	10	412	0	.0	360	.9	12	975	-----	.20	1,100	---
WB-270	26	18N	10W	7-12-68	226	1,060	7.6	21.0	40	17	4.8	1.2	240	1.7	412	0	4.4	130	.7	10	595	-----	.10	340	---
WB-276	35	19N	10W	7-17-68	190	164	7.6	19.0	10	55	15	4.3	16	.9	86	0	2.2	13	.1	36	130	-----	.10	-----	---
WB-281	7	17N	8W	2-11-69	462	689	8.3	----	30	6	1.4	.6	180	2.0	428	12	3.8	10	1.3	9.6	432	.20	-----	190	0
WB-290	22	17N	9W	11- 7-69	178	237	7.3	----	5	16	4.9	.9	48	2.7	134	0	4.4	6.9	.2	11	145	.00	-----	1,100	50
WB-306A	5	17N	9W	3-12-71	392	842	8.5	----	20	15	4.0	1.2	210	2.6	540	19	.4	6.3	1.4	12	525	.20	-----	120	190
WB-306B	5	17N	9W	3- 4-71	440	684	8.7	24.0	20	8	2.0	.7	160	1.6	399	19	.0	6.0	.4	13	404	.10	-----	1,600	110
WB-329B	30	18N	8W	7-17-74	490	409	8.8	----	40	2	.5	.2	100	1.6	255	0	3.0	5.0	.5	8.9	246	.65	-----	60	0
WB-334	22	17N	9W	10-17-74	277	310	8.5	22.0	10	3	.8	.2	72	2.7	179	0	2.6	6.0	.2	12	185	.01	-----	100	0
WB-336A	14	17N	10W	2-17-75	119	907	7.5	----	0	33	7.6	3.4	190	3.9	441	0	.2	71	.7	10	504	.16	-----	10	0
WB-336B	14	17N	10W	2- 7-75	248	907	8.7	21.5	30	6	1.8	.4	210	1.6	501	27	1.2	21	.5	10	521	.70	-----	50	0
WB-337	23	17N	10W	2-13-75	235	1,020	8.7	21.0	30	6	1.8	.4	240	1.9	528	24	1.0	38	.8	10	577	.22	-----	40	0
WB-361	12	17N	9W	5-24-78	454	479	8.2	22.5	7	2	.5	.3	120	1.4	300	1	2.5	4.7	.7	12	291	-----	-----	90	0

Table 9.–Availability of ground water at population centers

[AQUIFER: Sparta, Sparta Sand; Wilcox, Wilcox-Carrizo aquifer]

Water system	Aquifer	Well No.	Depth of well(s) (ft)	Depth to top of Sparta (ft)	Depth to base of Sparta (ft)	Depth to top of Wilcox-Carrizo (ft)	Depth to base of fresh-water	Average daily pumpage, 1980 (Mgal/d)	Population served	Remarks
Bienville Parish										
Alabama Water System-----	Sparta	Bi-147, 240--	493	265	[a]800	------	[a]800	0.052	735	
Village of Bryceland-----	Sparta	Bi-191-------	425	55	550	------	535	.014	160	
Village of Taylor--------	Sparta	Bi-90B-------	300	0	[a]450	[a]650	1,000	.031	400	Located near freshwater-saltwater interface in Wilcox-Carrizo aquifer.
Town of Arcadia----------	Sparta	Bi-19, 36----	594, 602	200	[a]780	------	[a]780	.187	3,700	
Mt. Calm Water System----	Sparta	Bi-198-------	476	[a]100	[a]700	------	[a]700	.012	200	
Town of Gibsland---------	Sparta	Bi-34, 35, 157--------	399-466	0	470	------	435	.056	1,380	
Town of Mt. Lebanon------	Sparta	Bi-177-------	514	0	[a]600	------	520	.014	184	
Claiborne Parish										
South Claiborne Water System-----------------	Sparta	Cl-145, 146 147--------	567-610	295	750	------	710	0.143	2,100	
Village of Athens--------	Sparta	Cl-120, 121--	530, 610	[a]200	[a]800	[a]1,100	1,200	.048	427	Wilcox may contain freshwater but no water-quality data are available.
Lincoln Parish										
Fellowship Water System--	Sparta	L-90---------	762	230	825	------	765	0.038	500	
Mt. Zion Water System----	Sparta	L-145--------	537	[a]200	700	------	[a]550	.036	800	
Village of Simsboro------	Sparta	L-34, 70-----	520, 644	210	795	------	725	.064	700	
Webster Parish										
Central Water System-----	Wilcox	Wb-361-------	454	----	----	385	590	0.034	450	
Dixie Overland Water System-----------------	Sparta	Wb-297B, 406-	620, 640	220	[a]740	------	[a]740	.056	600	
Germantown Water System--	Sparta	Wb-362, 397--	611, 615	155	680	------	685	.082	1,100	
Gilark Water System------	Sparta	Wb-260-------	442	0	455	------	455	.016	200	
Jenkins Water System-----	Wilcox	Wb-316, 317--	225	----	----	210	235	.036	600	
McIntyre Water Works District---------------	Wilcox	Wb-276, 377--	190, 174	----	----	[a]330	[a]200	.036	500	
Town of Dubberly---------	Sparta	Wb-271, 359--	154, 220	0	260	------	255	.048	650	
City of Minden-----------	Sparta	Wb-157, 159, 160, 161, 264, 269, 349---------	206-309	[a]60	315	------	300	2.578	15,332	Sands capable of meeting increased demands are available; preferred areas are north or east of Minden where sands are thicker.
Horseshoe Road Water System-----------------	Wilcox	Wb-381-------	244	----	----	[a]200	[a]250	.008	150	
Union Grove Water System-	Sparta	Wb-365-------	263	10	[a]270	------	[a]270	.022	300	
Village of Dixie Inn-----	Sparta	Wb-162A, 357-	75, 167	45	[a]215	------	[a]215	.044	500	
Village of Heflin--------	Wilcox	Wb-250, 358--	403, 458	----	----	370	[a]460	.049	500	
Village of Sibley--------	Sparta	Wb-247, 218 354, 347---	107, 170	50	170	------	170	.076	1,312	Freshwater-saltwater interface in Wilcox is at southern edge of Sibley.

[a]Estimated.

Table 10.--Petroleum wells and test wells used for geologic control

Map No. (pl. 1)	Location Sec.	T.	R.	Operator	Well name	Elevation
1	19	20N	4W	Atlantic Refining Co	M. J. Derryberry Gas Unit No. 1	145
2	26	20N	4W	Hunt Oil Co	Lewis Realty Corp No. B-9	133
3	30	20N	4W	Atlantic Refining Co	G. R. Green No. 1	176
4	28	20N	5W	Hassie Hunt Trust	G. E. Sims No. 2	305
5	31	20N	5W	A. J. Hodges Industries	Darrett Unit No. 1	281
6	34	20N	5W	H. W. Klein	A. H. Sims No. 1	201
7	25	20N	6W	Union Products Co	Coleman No. A-1	318
8	28	20N	6W	Skelly Oil Co	Will Dick No. 1	397
9	30	20N	6W	-----do	Halsey-Bishop-Lewis No. 1	351
10	33	20N	6W	-----do	Henry No. B-1	356
11	36	20N	6W	Union Products Co	White No. A-1	246
12	29	20N	7W	David Crowe Trustee	L. Kimbell No. 1	298
13	34	20N	7W	Continental Oil Co	Mrs. Willie Baker No. 1	300
14	36	20N	7W	M. A. Halsey et al	Hudson No. 1	397
15	20	20N	8W	A. D. Turner Estate	L. L. Green No. 1	416
16	22	20N	8W	Jones & Linam	Joe Camp No. 1	277
17	32	20N	9W	George Belchic, Jr	Prater No. 1	246
18	10	19N	5W	H. W. Klein et al	Penix Hood Unit No. 1	300
19	17	19N	5W	Franks-Gilster Nemours Corp	Penix No. 1	246
20	19	19N	6W	T. L. Mydland	Cleo Fay Marks No. 1	277
21	24	19N	6W	R. J. Caraway	Clayton Spurlock No. 1	427
22	30	19N	6W	State's Oil Co	Dance No. 1	367
23	20	19N	7W	Carter Oil Co	Stella Caldwell No. 1	280
24	28	19N	7W	-----do	Gandy No. 1	345
25	30	19N	7W	B. S. & M. Drilling Co	Feitel No. 1	291
26	31	19N	7W	McCalman Drilling Co	Mary C. Weller No. 1	309
27	32	19N	7W	Trans-Texas Drilling Co	Drake No. 1	279
28	33	19N	7W	Lockwood & Lunsford	Hunter No. 1	305
29	34	19N	7W	-----do	F. H. Drake No. 1	217
30	17	19N	8W	Ross Prod. Co. & Charles T. Beaird	Hatchett No. 1	360
31	19	19N	8W	Pan-American Petroleum Corp	F. E. McDown No. E-1	364
32	19	19N	8W	-----do	Robert W. Grigsby No. 1	339
33	21	19N	8W	-----do	Anna A. Hudson No. 1	377
34	21	19N	8W	-----do	I. W. Youngblood No. 1	352

Table 10.--Petroleum wells and test wells used for geologic control--Continued

Map No. (pl. 1)	Location Sec.	T.	R.	Operator	Well name	Elevation
35	12	19N	10W	James Muslow	Drake No. 1	181
36	14	19N	10W	Reliance Trust	Alvin Johnson No. 1	163
37	15	18N	4W	Natural Gas & Oil Co	Napper No. 1	337
38	19	18N	4W	Carter Oil Co	W. E. Dowling No. 1	317
39	22	18N	4W	-----do	Marvin Matthews No. 1	355
40	16	18N	5W	Enterprise Products Co	Disposal Well No. 2	310
41	20	18N	5W	-----do	Water Well No. 2	320
42	20	18N	5W	Warren Oil Co	Arcadia L.P.G. Storage No. 1	308
43	21	18N	5W	Enterprise Products Co	Brine Injection Well No. 2	305
44	29	18N	5W	-----do	Freshwater Well No. 1	300
45	14	18N	6W	Wheless Drilling Co	J. R. Giddens No. 1	423
46	22	18N	6W	Petroleum Inc	Mrs. Margaret A. Dixion No. 1	323
47	4	18N	7W	McCalman Drilling Co	Hutton Estate No. 1	223
48	5	18N	7W	Skelly Oil Co	D. S. Kendricks No. 1	288
49	6	18N	7W	C. S. Sentell	IDA Milner No. 2	279
50	17	18N	7W	Hercules Petroleum Co. Inc	I.C.G.R.R. No. 1	228
51	32	18N	7W	Southwest Natural Products Co	Louis M. White et al. No. 1	302
52	1	18N	8W	Lockwood & Lunsford	Woodward Walker No. B-2	265
53	20	18N	8W	Harry W. Bass	Rickerson Gas Unit No. 1	323
54	21	18N	8W	Phillips Petroleum Co	Perryman No. 1	272
55	22	18N	8W	J. S. Rushing	Jones Unit No. 1	220
56	23	18N	8W	-----do	Mason No. 1	236
57	26	18N	8W	Carter Oil Co	W. C. Gleason No. 1	195
58	27	18N	8W	-----do	Bates Monzingo No. 1	200
59	27	18N	8W	-----do	R. M. Davis No. 2	201
60	29	18N	8W	Atlantic Refining Co	Butler Unit No. 1	259
61	30	18N	8W	Union Products Co	Walker Unit No. 1	260
62	33	18N	8W	Carter Oil Co	J. E. Johnson No. 1	303
63	34	18N	8W	-----do	Joe Feldman No. 1	218
64	35	18N	8W	-----do	Leta Styles No. 1	194
65	35	18N	8W	-----do	Emma Stark No. 2	228
66	25	18N	9W	Atlantic Refining Co	G. F. Vice Unit No. 1	237
67	25	18N	9W	-----do	Connell Unit No. 1	220
68	26	18N	9W	-----do	Leroy-Connell No. 1	265

69	27	18N	9W	-----do-----------------------------	Grace B. Cooke No. 1-----------	222
70	36	18N	9W	-----do-----------------------------	Batton No. 1--------------------	269
71	25	18N	10W	H. L. Hunt------------------------	Willie Ward No. 1--------------	195
72	2	17N	4W	Murphy Corp-----------------------	Frazie No. 1-------------------	337
73	11	17N	4W	Ark-La Gas Co---------------------	Hays No. 1---------------------	318
74	12	17N	6W	Lion Oil Co-----------------------	Mable No. 1--------------------	343
75	13	17N	6W	-----do-----------------------------	Ozley No. 1--------------------	270
76	14	17N	6W	-----do-----------------------------	Colbert No. 1------------------	331
77	4	17N	7W	Atlantic Refining Co---------------	Youngblood Oil Unit IV No. 1----	281
78	13	17N	7W	Pierce & Crow---------------------	E. W. Merritt No. 2------------	239
79	24	17N	7W	Bomar Inc-------------------------	E. W. Merritt No. 1------------	298
80	2	17N	8W	Carter Oil Co---------------------	Daisy Wardward No. 1-----------	204
81	3	17N	8W	-----do-----------------------------	Colbert-Davis Unit No. 1--------	219
82	23	17N	8W	Garfield Pasternek-----------------	Woodward Walker No. 1----------	186
83	9	17N	8W	Stewart Oil Co--------------------	-----do------------------------	300
84	16	17N	8W	-----do-----------------------------	Test Hole No. 1----------------	280
85	3	17N	9W	Atlantic Refining Co---------------	Gray-West Unit No. 1-----------	244
86	4	17N	9W	-----do-----------------------------	Drew Unit No. 1----------------	174
87	4	17N	9W	-----do-----------------------------	R. A. Reed No. 1---------------	180
88	5	17N	9W	-----do-----------------------------	Drew No. B-1-------------------	205
89	8	17N	9W	Kin Ark Oil Co--------------------	M. Braswell No. 1--------------	171
90	16	17N	10W	W. J. McEllwee--------------------	Willis No. 1-------------------	205

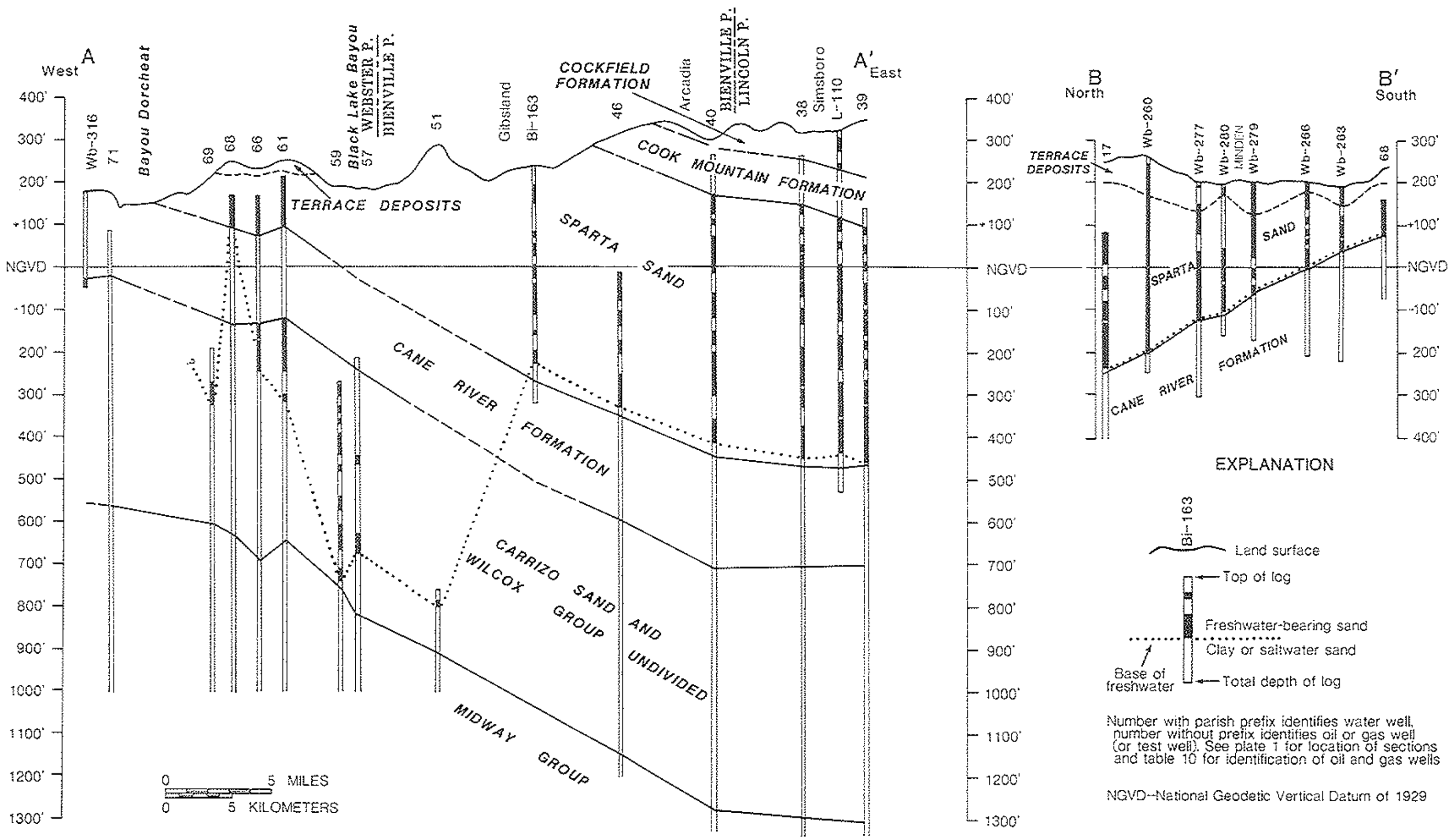

PLATE 3. GEOLOGIC SECTIONS OF THE ARCADIA-MINDEN AREA, LOUISIANA.