STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

WATER RESOURCES
TECHNICAL REPORT
NO. 43

GROUND-WATER HYDROLOGY OF LIVINGSTON, ST. HELENA, AND PARTS OF ASCENSION AND TANGIPAHOA PARISHES, SOUTHEASTERN LOUISIANA

Prepared by
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
In cooperation with
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

1988

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By

Dan J. Tomaszewski

U.S. Geological Survey

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BUDDY ROEMER, Governor

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NEIL L. WAGONER, Secretary

Cooperative projects with the

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

Darwin Knochenmus
District Chief
U.S. Geological Survey
P.O. Box 66492
Baton Rouge, LA 70896-6492

Telephone: (504) 389-0281

Z. "Bo" Bolourchi
Chief, Water Resources Section
Louisiana Department of
Transportation and Development
P.O. Box 94245
Baton Rouge, LA 70804-9245
Telephone: (504) 379-1434

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CONVERSION FACTORS AND ABBREVIATIONS

For the convenience of readers who may prefer to use metric (International System) units rather than the inch-pound units used in this report, values may be converted by using the following factors:

Multiply inch-pound unit	By	To obtain metric unit
inch (in.)	25.40	millimeter (mm)
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/yr)
foot squared per day (ft^2/d)	0.09290	meter squared per day (m^2/d)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
gallon per minute (gal/min)	0.06309	liter per second (L/s)
	5.450	cubic meter per day (m^3/d)
mile (mi)	1.609	kilometer (km)
million gallons per day	3.785X106	liter per day (L/d)
(Mgal/d)	3.785X103	cubic meter per day (m^3/d)
square mile (mi^2)	2.590	square kilometer (km^2)

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

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD 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."

GROUND-WATER HYDROLOGY OF LIVINGSTON, ST. HELENA, AND PARTS OF ASCENSION AND TANGIPAHOA PARISHES, SOUTHEASTERN LOUISIANA

By Dan J. Tomaszewski

ABSTRACT

Livingston and St. Helena Parishes, located in southeastern Louisiana, obtain ground water from the regionally extensive Southern Hills aquifer system. Within this system, nine major freshwater sand beds (sands containing water with less than 250 milligrams per liter of chloride) have been grouped into four aquifer units. From youngest to oldest, the aquifer units are the shallow aquifer unit and aquifer units 1, 2, and 3. Aquifer unit delineation was based on hydraulic head, water-quality, and geophysical data.

Sand beds within these units contain freshwater that extends to 2,500 feet below sea level in northern St. Helena Parish and to 3,200 feet below sea level in southeastern Livingston Parish. In extreme southern Livingston Parish freshwater is present to altitudes of only 500 feet below sea level.

Recharge to the aquifer system occurs in St. Helena Parish and southwestern counties of Mississippi where the shallow aquifer unit receives direct recharge from rainfall and transmits recharge to sands in the underlying units. Ground-water movement in the shallow aquifer unit is generally in a southerly direction from recharge areas. Discharge occurs as pumpage or ground-water leakage in southern Livingston Parish. Ground-water movement in aquifer units 1, 2, and 3 is generally in a southwesterly direction toward pumping centers in the Baton Rouge area.

Water levels in most units are declining about 0.5 to 2.5 feet per year; past water-level declines have been greater than 5 feet per year in sands intensively pumped in the Baton Rouge area. In 1985, ground-water withdrawals totaled about 7 Mgal/d (million gallons per day) in Livingston and St. Helena Parishes, and about 120 Mgal/d were withdrawn in nearby East Baton Rouge Parish.

Hydraulic conductivity of sand within aquifer units ranges from 30 to 200 feet per day. Transmissivity ranges between 3,000 and 32,000 feet squared per day.

Freshwater from the Southern Hills aquifer system is a soft sodium bicarbonate type, although the shallow aquifer unit in St. Helena Parish and northern Livingston Parish contains a mixed ionic type water that has a low concentration of dissolved solids. Chemical analyses of ground water for selected minor elements, insecticides, herbicides, and radionuclides showed that none of these constituents exceed primary or secondary drinking water standards of the U.S. Environmental Protection Agency.

INTRODUCTION

Livingston, St. Helena, and parts of adjoining Ascension and Tangipahoa Parishes are adjacent to and heavily impacted by large ground-water withdrawals in the Baton Rouge area; the withdrawals have caused local or regional declines of water levels in most sand beds. Ground water in Livingston and St. Helena Parishes is primarily obtained from interlayered sand beds, which form a regional aquifer system--the Southern Hills aquifer system (Buono, 1983). The aquifer system is the principal source of drinking water for the northern half of southeastern Louisiana and southwestern Mississippi. Localized shallow sands overlying this regional aquifer system yield smaller amounts of fresh ground water.

Ground-water use in the study area and nearby parishes--East Baton Rouge, East Feliciana, West Feliciana, St. Tammany, Tangipahoa, and Washington--totaled about 200 Mgal/d in 1985 (D.L. Lurry, U.S. Geological Survey, written commun., 1986). Ground-water use is projected to increase and may reach about 280 Mgal/d by the year 2000 (Urban Systems Associates, Inc., 1982). Of the 1985 total, about 120 Mgal/d (60 percent) was used in East Baton Rouge Parish, and approximately 15 Mgal/d (8 percent) was used in Tangipahoa Parish. About 7 Mgal/d (4 percent) was used in Livingston and St. Helena Parishes.

Purpose and Scope

The purpose of this report is to describe the ground-water resources of Livingston and St. Helena Parishes and present information of the hydraulic characteristics and water quality of the aquifer units. The report will complement available information on the heavily pumped aquifers in the Baton Rouge area and Tangipahoa Parish and make available background data for future reference and development of ground-water resources.

Data used in this study were collected, analyzed, and interpreted during the period from October 1982 to September 1985. Reports of previous investigations and basic data were reviewed. Water-well and stratigraphic test-hole data, consisting of geophysical logs, drillers logs, well completion reports, and geologic logs, were compiled and used to identify, correlate, and define the geohydrologic framework. A reconnaissance study of the area was made in September 1983, and field data were collected periodically thereafter. In areas where data were lacking, wells were located and sampled or shallow test holes were drilled for collection of chemical, hydrologic, and lithologic data.

Location and Setting of the Study Area

The study area (fig. 1) includes all of Livingston and St. Helena Parishes and parts of Ascension and Tangipahoa Parishes. Located in the central part of southeastern, Louisiana, Livingston and St. Helena Parishes collectively total about 1,110 mi^2 (square miles) in area. The Amite and Tickfaw Rivers are two major streams, and both flow southward into Lake Maurepas. Hills in St. Helena Parish have an altitude of more than 300 ft (feet) while the southern part of the study area generally contains terraces of low relief approaching sea level. Climate is humid subtropical. At

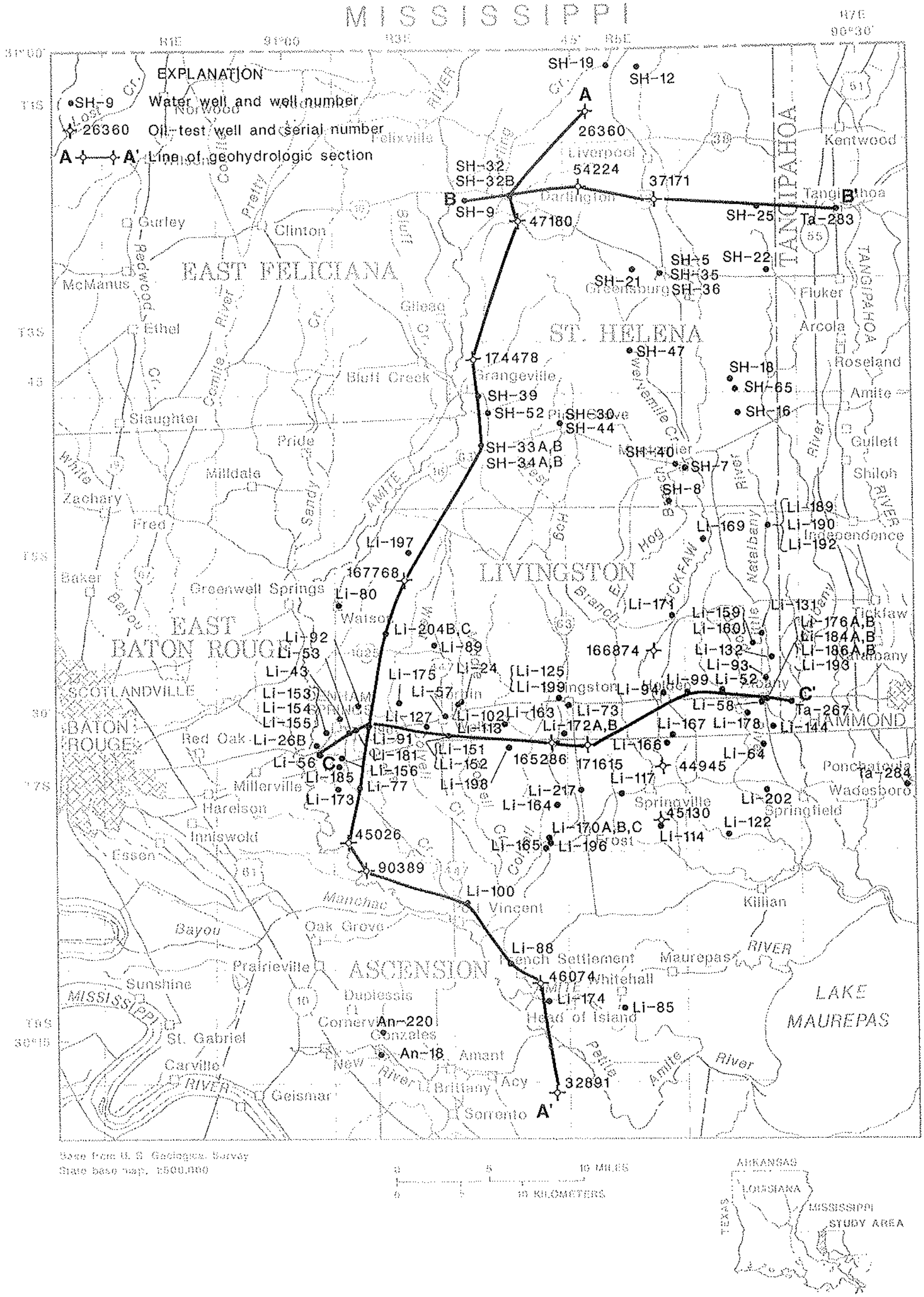

Figure 1.--Location of study area, control wells and lines of geohydrologic sections.

Clinton, about 10 mi (miles) west of the study area, average annual temperature and precipitation are about 19.0 °C and 59 in. (inches), respectively (National Oceanic and Atmospheric Administration, 1982). Average monthly temperatures range from about 10.5 °C in January to about 27.0 °C in July. Precipitation is fairly well distributed throughout the year; the averages range from 3 in. in October to 6.2 in. in March.

Methods of Investigation

Correlation of aquifer units were made using water-level data, geophysical logs of water wells, drillers logs, geologist logs, oil wells, and test holes. Although each unit is composed of one or more areally extensive sand beds, extensive areal correlation of individual sand beds in Livingston and St. Helena Parishes is extremely difficult. Multilayered sand, gravel, and clay deposits interfinger throughout the parishes. Because of the lenticular nature of these deposits, abrupt lateral changes are common.

Where possible, geohydrologic sections in this report were constructed to intersect existing geohydrologic sections contained in previous studies of adjacent parishes. The geohydrology of adjacent parishes is discussed in the following reports: the Baton Rouge area by Meyer and Turcan (1955), Morgan (1961), and Rollo (1969); the Florida Parishes by Winner (1963); East and West Feliciana Parishes by Morgan (1963); the Geismar-Gonzales area by Long (1965); Tangipahoa and St. Tammany Parishes by Nyman and Fayard (1978); and the Gramercy area by Dial and Kilburn (1980). Additional reports on ground-water hydrology in or near the area are listed in "Selected References" of this report.

Water-level data collected in previous studies and during this study were compiled and analyzed. Potentiometric maps were constructed and the approximate direction of ground-water flow was determined. Water-level data were used to delineate water-level trends and construct hydrographs. Because limited aquifer-test data were available in the study area, data from aquifer tests of correlative sands in adjacent areas were used to describe hydraulic characteristics of aquifer units.

Chemical characteristics were determined from analyses available from previous studies and analyses of water samples collected during the study period. During this investigation, samples were analyzed for selected common inorganic constituents, minor elements, organic chemicals, and radionuclides.

Well-Numbering System

Wells inventoried by the U.S. Geological Survey in Louisiana are identified by a parish abbreviation followed by a sequential number. In this report the parish abbreviations An, Li, SH, and Ta refer to Ascension, Livingston, St. Helena, and Tangipahoa Parishes, respectively. Numbers following these abbreviations are assigned sequentially in the order in which a well is inventoried. Oil and gas test wells are identified by a five or six digit serial number. Locations and well numbers of selected wells in the study area are shown in figure 1.

Acknowledgments

The author wishes to acknowledge private well owners, managers of public and industrial water systems, and government agencies who allowed access to their wells or supplied hydrologic data. Drillers working in the area supplied logs and well data. The Louisiana Department of Transportation and Development was especially helpful in providing sites for test drilling used to obtain subsurface geohydrologic information.

The study was made through a cooperative program between the U.S. Geological Survey and the Louisiana Department of Transportation and Development.

GENERAL GEOLOGY

Sediments in Livingston and St. Helena Parishes generally consist of a series of deltaic deposits. The deposits are chiefly composed of unconsolidated interbedded sands and clays which dip and thicken in a southerly or gulfward direction. Changes in sea level, subsidence, and uplift have influenced deposition.

Gulfward land advance and deposition of sediments that now form the Southern Hills aquifer system began during the Miocene age and continued into the Holocene age. Land advances into the gulf, however, were periodically interrupted when gulf waters transgressed inland across previously deposited deltaic plains. The transgression and regression of coastal waters (which resulted from the submergence and emergence of the coastal area caused by changes in sea level during glacial and interglacial intervals) created a complex series of interbedded deltaic sand and clay, part of which now form the aquifer system underlying Livingston and St. Helena Parishes. The aquifer system is further complicated by alluvial incision and subsequent deposition of sediment at coastal margins.

Regional structural features affecting the geology and physiography of Livingston and St. Helena Parishes are the Southern Mississippi Uplift in southwestern Mississippi and the Baton Rouge fault in southern Livingston Parish (Buono, 1983, p. 6). The geology of the area is presented in reports by Fisk (1944) and Howe (1962).

GROUND-WATER HYDROLOGY

In this report, the Southern Hills aquifer system is divided into aquifer units similar to hydraulic zones described by Morgan (1963, p. 16-20). The aquifer units are shown in table 1, figure 2, and on plate 1. Four aquifer units which contain nine sand beds are defined in Livingston and St. Helena Parishes. Each unit is composed of one or more areally extensive sand beds and smaller localized sands; many of the beds are lenticular. The base of a unit is generally defined by the last extensive sand bed in the unit and is generally underlain by an areally extensive clay unit within the sedimentary sequence of freshwater sands. Freshwater, for this report, has less than (<) 250 mg/L (milligrams per liter) chloride.

Table 1.--Correlation of aquifer units in Livingston and St. Helena Parishes with aquifer units in adjacent parishes

System	Series	Southeastern Louisiana[1]	Baton Rouge area,[2] Geismar-Gonzales area,[3] Gramercy area[4]	East Feliciana Parish[5]	Livingston and St. Helena Parishes, this report		Tangipahoa Parish[6]
		Aquifer unit					
Quaternary	Holocene and Pleistocene	Local shallow aquifers	Gonzales-New Orleans aquifer		Shallow aquifer unit	Upper sand bed	Shallow aquifer Gonzales-New Orleans aquifer
		Southern Hills aquifer system	"400-foot" sand	Undifferentiated upland deposit		Lower sand bed	Upper Ponchatoula aquifer
			"600-foot" sand				
Tertiary	Pliocene		"800-foot" sand				Lower Ponchatoula aquifer
			"1,000-foot" sand	Zone 1	Aquifer unit 1	Upper sand bed Lower sand bed	
			"1,200-foot" sand				
			"1,500-foot" sand		Aquifer unit 2	Upper sand bed Middle sand bed Lower sand bed	Kentwood aquifer system: Abita aquifer Covington aquifer
			"1,700-foot" sand	Zone 2			
	Miocene		"2,000-foot" sand				Tchefuncta aquifer
			"2,400-foot" sand	Zone 3	Aquifer unit 3	Upper sand bed	Hammond aquifer Amite aquifer Ramsay aquifer Franklinton aquifer
			"2,800-foot" sand			Lower sand bed	

[1] Buono, 1983. [2] Morgan, 1963. [3] Long, 1965. [4] Dial and Kilburn, 1980. [5] Morgan, 1963. [6] Nyman and Fayard, 1978.

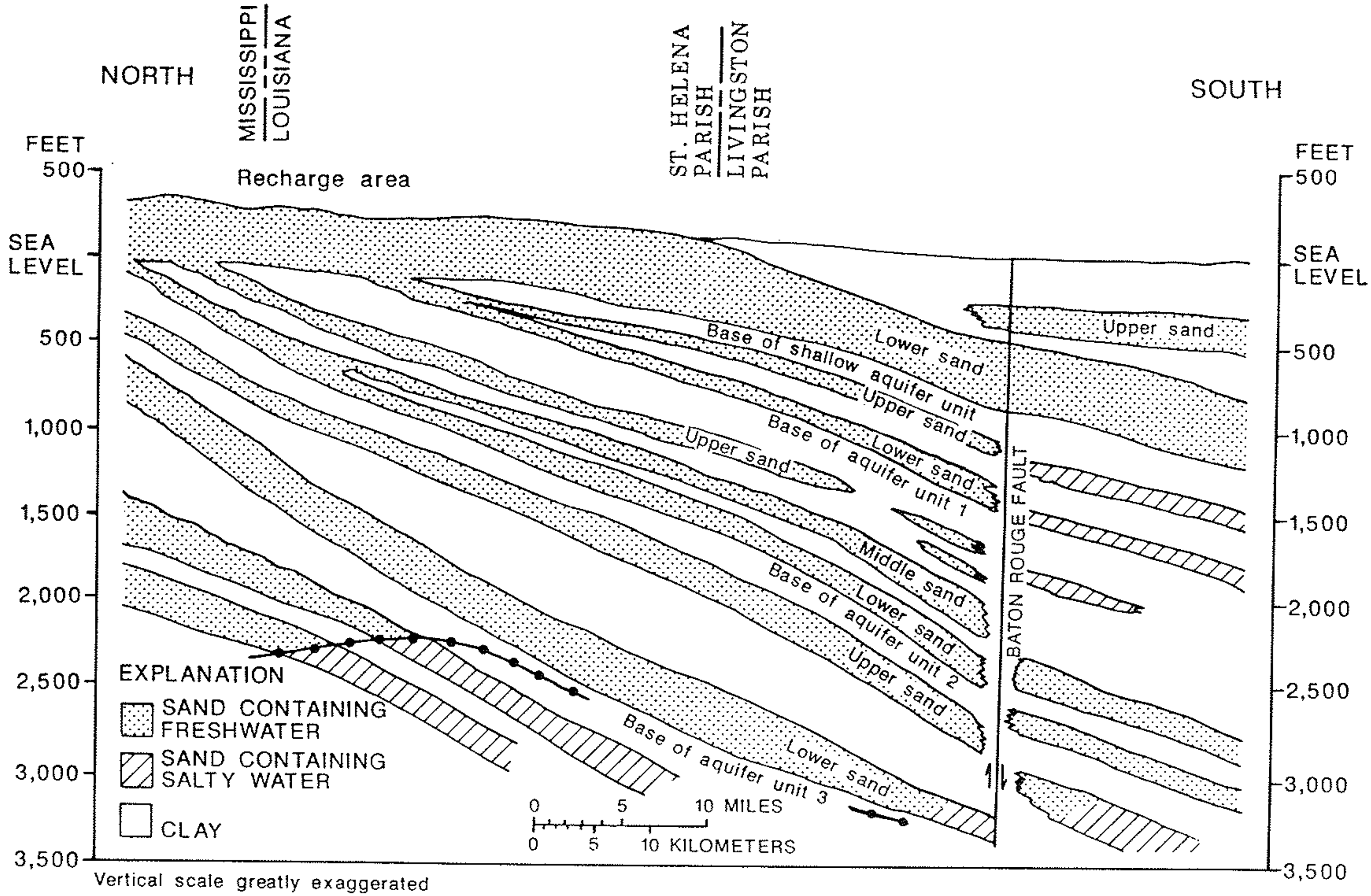

Figure 2.--Generalized geohydrologic section showing fresh and salty ground water in the alternating sands and clays of Livingston and St. Helena Parishes.

Grouping of the sand beds is based on hydraulic head, geophysical, and water-quality data. It is important to emphasize that although the beds are grouped into aquifer units, individual sand beds within the unit may hydraulically interact with each other and that beds in one unit may be in hydraulic contact with sand beds in adjacent units. Thus, aquifer-unit boundaries, as described in this report, are not discrete boundaries which make one unit independent of another.

Table 1 includes a brief summary of the aquifer units, major sand beds contained in each unit, and correlation of units with aquifer units in adjacent areas. A more detailed discussion of each aquifer unit and its component sand beds follows.

Shallow Aquifer Unit

The shallow aquifer unit consists of numerous interbedded lenses of gravel, sand, silt, and clay which form two major sand beds containing freshwater. As shown on plate 1, section A-A', in southern Livingston Parish an upper sand bed overlies an extensive lower one. Where the upper and lower sand beds are both present they are separated by clay containing thin sand deposits.

Extent and Thickness

The upper and lower sand beds of the shallow aquifer unit extend into adjacent parishes and can be correlated with aquifer units in adjacent areas. The upper sand bed is correlative with the Gonzales-New Orleans aquifer in the Geismar-Gonzales area of Ascension Parish, Tangipahoa Parish, and the Gramercy area. The Gramercy area, as described by Dial and Kilburn (1980), includes most of St. James Parish, the western half of St. John the Baptist Parish, and the southern part of Ascension Parish. The lower sand bed of the shallow aquifer unit correlates with the undifferentiated upland deposits in East Feliciana Parish and the "400-, "600-, and possibly the 800-foot" sands of the Baton Rouge area. East of the study area in Tangipahoa Parish, the lower sand bed is correlative with the upper Ponchatoula aquifer, and part of the lower Ponchatoula aquifer and is in hydraulic contact with the shallow aquifer described by Nyman and Fayard (1978). The lower sand bed includes the Citronelle Formation in southwestern Mississippi.

Lithologic samples collected from correlative sands in Ascension Parish, the Gonzales-New Orleans aquifer, indicate sediments contained in the upper bed consist of fine to very coarse sand and gravel (Long, 1965, p. 12). The upper sand bed is continuous in areas of Livingston Parish south of the Baton Rouge fault. The upper bed thins or divides into a series of thin lenses of sand a few miles north of the fault (pl. 1, section A-A') and loses identity as a major geohydrologic unit. In areas south of the Baton Rouge fault (pl. 1, section A-A'), the upper sand bed ranges from about 130 to 240 ft in thickness and generally occurs between 200 and 500 ft below sea level. Altitudes of the top and bottom of the upper and lower sand beds of the shallow aquifer unit, as determined from electric and geologist logs at selected sites (fig. 1), are shown in table 2. Approximate sand thickness contained in each

Table 2.--Altitude of the upper and lower sand beds in the shallow aquifer unit in Livingston and St. Helena Parishes

[In feet, above or below sea level]

Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed
Upper sand bed		
Li-88	-278	-515
Li-100	-319	-449
Li-114	[a]-113	-379
Li-196	-205	-368
45026	-252	-417
46074	-305	-485
Lower sand bed		
Li-56	[a]-240	-774
Li-77	[a]-455	-813
Li-88	[a b]-732	-1,118
Li-91	[a]-212	-680
Li-99	-254	-604
Li-100	[a]-563	-1,001
Li-114	[a]-571	-996
Li-151	[a]-241	-761
Li-171	[a]-37	-383
Li-184	-275	-658
Li-204	[a]-81	-448
Lower sand bed--Continued		
SH-9	[a]142	-180
SH-30	[a]155	-277
SH-32	[a]179	-168
SH-33	[a]126	-348
SH-35	180	-11
SH-39	[a]120	-335
SH-40	[a]106	-276
SH-65	97	-121
26360	[a]159	-107
37171	[a]154	-131
45026	[a]-462	-837
46074	[a]-795	-1,135
47180	[c]-35	-95
54224	[a c]-69	-200
90389	[b]-461	-835
165286	[a]-215	-705
166874	[a]-249	-432
167768	-153	-383
171615	[a]-232	-680
174478	[a c]-69	-246

[a] Sand bed contains lenses of clay.
[b] Sand bed contains salty water at base.
[c] Top of log interval.

bed at a particular well can be determined from table 2 by subtracting the altitude of the top of the sand bed from the altitude of the bottom of the bed. The depth below land surface of the sand bed can be determined by adding the altitude of land surface to the altitude of the top and bottom.

Analysis of test-hole samples from selected sites in St. Helena Parish indicates that sediments in the lower bed of the shallow aquifer unit are generally medium to coarse sand interbedded with gravel and clay. Lithologic samples collected during test drilling were from depths less than 100 ft below land surface. Additional lithologic samples indicate that sediments equivalent to the lower bed generally range from fine to medium in adjacent East Baton Rouge Parish (Meyer and Turcan, 1955, p. 28).

The lower sand bed of the shallow aquifer unit is areally extensive throughout the study area. In St. Helena Parish, the lower bed is present at or near land surface (pl. 1, sections A-A', B-B'). This bed extends to about 200 ft or less below sea level in northern parts of the parish increasing to about 300 ft or more below sea level in southern St. Helena Parish. Throughout St. Helena Parish, the base of the lower sand bed dips in a southerly direction at 10 to 15 ft/mi (feet per mile). In Livingston Parish, the dip increases between 25 and 55 ft/mi. Near Interstate Highway 12 (I-12) in central Livingston Parish (pl. 1, section C-C'), the lower sand bed generally occurs between 200 and 800 ft below sea level. South of the Baton Rouge fault the lower sand bed is present 1,000 ft or more below sea level and locally contains salty water.

Thickness of the lower sand bed typically is more than 200 ft in Livingston and St. Helena Parishes. In St. Helena Parish, the lower bed ranges between 150 and 400 ft in thickness. Thickness is generally greater in western St. Helena Parish because of westward thinning of clay and replacement with sand at the base of the interval. Sand thickness also increases in a southerly direction. In Livingston Parish, the lower bed generally is 300 to 400 ft or more in thickness.

Ground-Water Recharge, Movement, and Discharge

The lower sand bed of the shallow aquifer unit receives direct recharge from rainfall in much of St. Helena Parish (fig. 2) and adjacent counties in southwestern Mississippi, where permeable sands are exposed at or near land surface. Recharge from rainfall to the lower sand bed is transmitted down gradient, from higher altitudes in St. Helena Parish and Mississippi to lower altitudes in Livingston Parish, as recharge to the lower sand bed in Livingston Parish. Recharge from the lower bed to the upper bed occurs by vertical leakage through clays separating the upper and lower sand beds of this aquifer unit. Additional recharge to the shallow aquifer unit occurs in Livingston Parish from upward movement of water from the underlying aquifer unit 1 and locally in northern Livingston Parish by downward percolation of water from overlying sand and clay. In much of Livingston Parish, water levels in aquifer unit 1 are higher than water levels in the shallow aquifer unit. Because water levels are higher in aquifer unit 1, vertical leakage into the shallow aquifer unit occurs through the confining clay or in areas where sand lenses connect the units.

Although local recharge occurs from percolation of rainwater through overlying sand and clay in northern Livingston Parish, direct recharge from rainfall to the shallow aquifer unit in most of Livingston Parish is restricted by a surface clay confining unit. In Livingston Parish, clay is generally present at or near land surface. Section A-A' (pl. 1) shows a progressively thickening clay lense covering the upper and lower sand beds. Near the Livingston-St. Helena Parish border, this clay is about 25 ft in thickness and generally thickens southward. Near I-12, in central Livingston Parish (pl. 1, section C-C'), the clay is more than 200 ft thick. This overlying clay unit is generally extensive both in areal distribution and thickness in central and southern Livingston Parish.

Ground-water movement in the shallow aquifer unit is generally in a southerly direction, away from recharge areas in St. Helena Parish. Figure 3 is a potentiometric map of the shallow aquifer unit constructed from data collected in May 1984. Generally, ground water moves perpendicular to the potentiometric contours, moving from higher potentiometric contours to lower potentiometric contours. Hydraulic gradients are about 8 ft/mi in the northern half of the study area (fig. 3). In some areas of St. Helena Parish streams have dissected the land surface, and the lower sand bed is hydraulically connected with these streams (fig. 3). Hydraulic gradients trend toward stream valleys and the shallow aquifer unit locally discharges into these streams, sustaining streamflow. The Amite and Tickfaw Rivers influence ground-water flow in the shallow aquifer unit in St. Helena Parish. Hydraulic gradients may be 20 ft/mi or more near these rivers (fig. 3).

Because an overlying confining bed of clay is present, ground water in the shallow aquifer unit in Livingston Parish is under confined conditions. Hydraulic gradients generally decrease from north to south about 4 ft/mi or less in Livingston Parish, and potentiometric contours are not influenced by stream valleys. However, in northwestern Livingston Parish, the hydraulic gradient is affected by large ground-water withdrawals in the Baton Rouge area. Near Denham Springs and Watson, hydraulic gradients decrease in a general southwesterly direction toward Baton Rouge.

Discharge from the shallow aquifer unit occurs by flow into streams in St. Helena Parish, by upward seepage in southern Livingston Parish, by withdrawals, and by lateral flow into the Baton Rouge area. Withdrawal from the shallow aquifer unit in Livingston and St. Helena Parishes is small. Most of the wells screened in the shallow aquifer unit are used for domestic supply and have a low yield. Table 10 (at back) contains detailed information on selected water wells in the study area. Two industrial wells in St. Helena Parish, SH-19 and -42, have yields of 200 and 85 gal/min (gallons per minute), respectively. Records in adjacent parishes, however, indicate wells with discharges of 500 gal/min or more can be constructed in equivalent sands of the shallow aquifer unit. Water is not withdrawn for industrial use from wells in the shallow aquifer unit in Livingston Parish. Some wells for irrigation, livestock, and public supply yield water from the shallow aquifer unit.

Water Levels

Water levels in the shallow aquifer unit ranged from less than 10 ft above sea level in extreme southern Livingston Parish to more than 250 ft above sea level in northern St. Helena Parish in May 1984 (fig. 3). The altitude of water levels as related to land surface can be determined by algebraically subtracting the water-level measurement from the altitude for that well. The altitude of all wells mentioned in this report is shown in table 10.

Continuous long-term data are not available to describe water-level trends within the shallow aquifer unit in Livingston and St. Helena Parishes. Intermittent water-level data collected at selected sites are shown in table 3. These data indicate no appreciable water-level decline in St. Helena

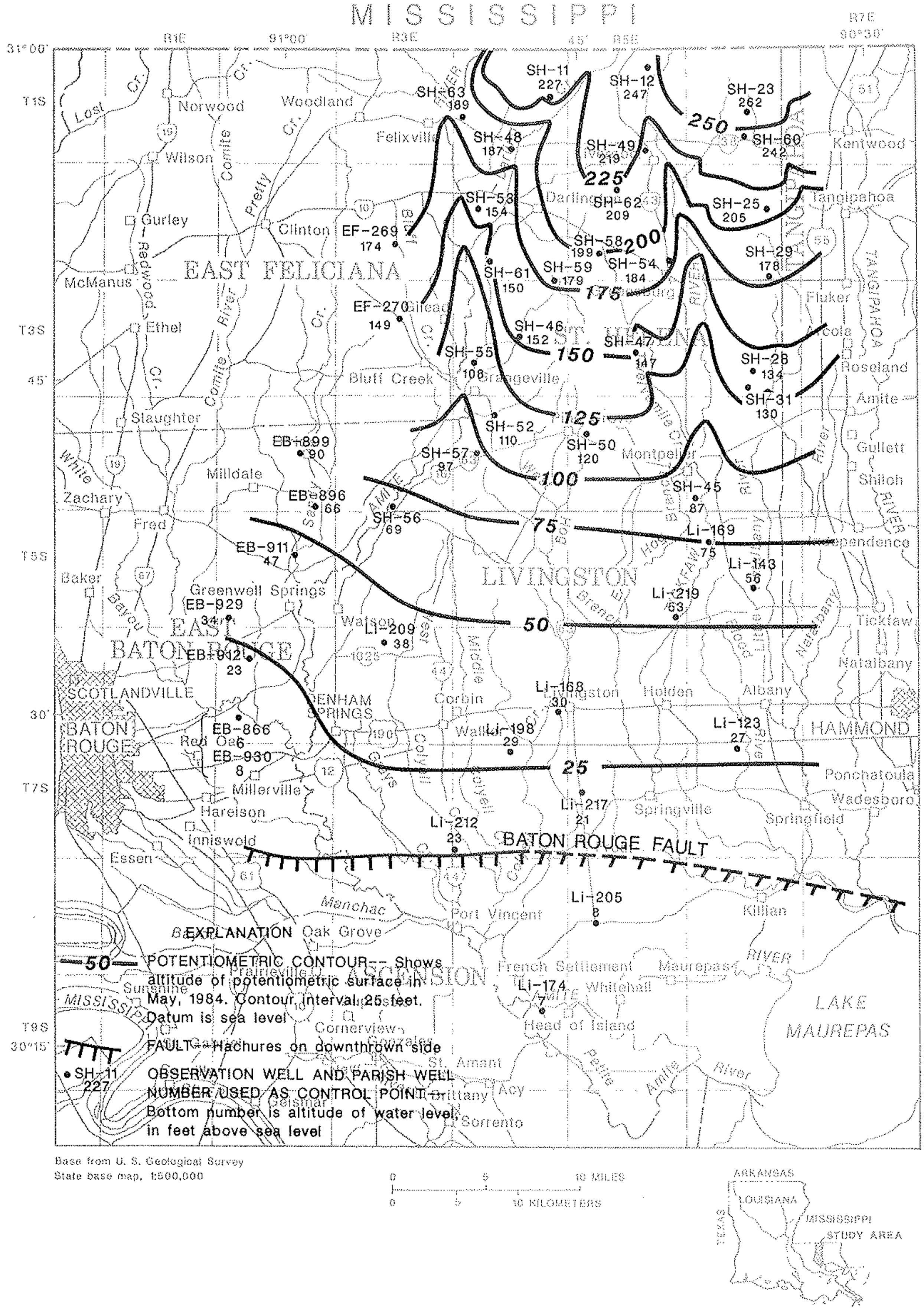

Figure 3.--Potentiometric surface of the shallow aquifer unit, May 1984.

Table 3.--Water levels in the upper and lower sand beds in the shallow aquifer unit in Livingston and St. Helena Parishes

Well number	Date measured	Water level in feet, above sea level
Upper sand bed		
Li-174	8-31-76	7.3
	10-17-83	8.0
	5-15-84	7.20
Lower sand bed		
SH-12	7-11-66	246.19
	10- 7-83	245.41
	5- 4-84	247.09
SH-29	8-21-69	175.16
	10-11-83	177.97
	5-15-84	177.98
Lower sand bed--Continued		
Li-122	7-15-66	24.40
	3-28-84	18.50
Li-164	3- 5-74	25.05
	12-19-84	20.06
Li-167	3- 5-74	40.1
	4- 4-76	38.25
	5-30-84	37.1
Li-169	1973	[a]7.5
	10-14-83	74.93
	5-16-84	74.95

[a] Water level is reported.

Parish and northeastern Livingston Parish. Water levels in St. Helena Parish and northeastern Livingston Parish generally fluctuate a few feet seasonally as a result of varying climatic conditions. In central Livingston Parish, data collected at wells Li-122, -164, and -167 (fig. 1) indicate water-level declines of about 0.2 to 0.4 ft/yr (feet per year) have occurred; declines may be caused by locally increased water withdrawal resulting from irrigation and urbanization along major highways. Large withdrawals in the Ponchatoula and Baton Rouge areas also affect water levels in this area. In southern Livingston Parish, well Li-174 (fig. 1) was measured in August 1976 and again in May 1984; data indicate no decline between measurements.

Aquifer Characteristics

Hydraulic characteristics determined from aquifer tests in adjacent parishes can be used to estimate the general hydraulic properties of equivalent sand beds in the study area. Results of aquifer tests in the "400- and 600-foot" sands of the adjacent Baton Rouge area (Meyer and Turcan, 1955, table 4) indicate that transmissivity ranges from 4,000 to 16,000 ft^2/d (feet squared per day) and that hydraulic conductivity ranges from 30 to 110 ft/d (feet per day). Aquifer characteristics should generally be comparable in the lower sand bed of the shallow aquifer unit. Similar aquifer test results at Ponchatoula in Tangipahoa Parish were in general agreement with those in the Baton Rouge area. Aquifer test results obtained from well Ta-284 indicate transmissivity is 27,000 ft^2/d and hydraulic conductivity is 180 ft/d (Nyman and Fayard, 1978, p. 22).

Table 4.--Altitude of the upper and lower sand beds in aquifer unit 1 in Livingston and St. Helena Parishes

[In feet, below sea level]

Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed	Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed
	Upper sand bed			Lower sand bed	
Li-56	[a]835	955	Li-56	1,165	1,327
Li-77	999	1,053	Li-77	1,223	1,385
Li-91	832	892	Li-91	[a]1,057	1,197
Li-99	904	1,081	Li-99	[a]1,110	1,240
Li-114	1,326	1,401	Li-114	[a]1,471	1,708
Li-151	877	931	Li-151	1,321	1,405
Li-184	900	1,110	Li-184	1,140	1,415
Li-204	642	715	Li-204	878	959
SH-30	372	470	SH-30	536	588
SH-33	404	499	SH-33	583	604
SH-35	[b]134	166	SH-35	[b]233	317
SH-39	[b]400	617	SH-39	[b]400	617
SH-40	[b]407	575	SH-40	[b]407	575
45026	[a]922	1,117	45026	[a]1,282	1,377
165286	[a]841	1,050	165286	[a]1,133	1,404
166874	752	808	166874	898	932
167768	[a]548	633	167768	753	868
171615	[a]680	1,025	171615	1,079	1,360
			174478	444	484

[a] Sand bed contains lenses of clay.
[b] Upper and lower beds are merged.

Pleistocene sands equivalent to those in the upper sand bed have been tested at Gonzales in Ascension Parish. Two aquifer tests in the Gonzales-New Orleans aquifer at wells An-18 and -220 (fig. 1), indicate the transmissivity ranges from 31,000 to 32,000 ft^2/d, and the hydraulic conductivity is about 120 to 140 ft/d (Long, 1965, table 1). Wells An-18 and -220 were screened in sand intervals about 215 and 270 ft in thickness.

Estimates for hydraulic conductivity and transmissivity of sand intervals can be made using test results for correlative sands in adjacent parishes and data from tables 2, 4, 6, and 8. However, aquifer characteristics can change in a short distance, and values obtained for hydraulic conductivity and transmissivity are estimates or ranges that can be expected. For example, suppose a well is planned in the upper sand bed of the shallow aquifer unit near Port Vincent in Livingston Parish; as shown in figure 1, well Li-100 is located nearby. Data collected at well Li-100 (table 2) indicate that the upper sand bed is about 130 ft thick in the vicinity. The estimated hydraulic conductivity of this sand bed, 120 to 140 ft/d (Long, 1965, table 1), which was determined by aquifer tests in adjacent areas, can be multiplied by the total sand thickness to determine the approximate transmissivity for the sand bed. In this instance, the expected transmissivity for the upper sand bed would range from 15,600 to 18,200 ft^2/d.

Water Quality

The shallow aquifer unit of Livingston and St. Helena Parishes can be divided into two distinct areas based on water quality. (See table 11, at back, for representative chemical analyses of water from the shallow aquifer unit.) The first area includes the study area north of Watson (St. Helena Parish and northern Livingston Parish) and is representative of the recharge area for the shallow aquifer unit. Water from the shallow aquifer unit in this area is a mixed ionic type. Major constituents include sodium, calcium, chloride, and bicarbonate.

As indicated by analyses of ground water collected from all wells completed in the shallow aquifer unit in St. Helena Parish and wells Li-169 and -197 in northern Livingston Parish (table 11, fig. 1), the shallow aquifer unit north of Watson contains ground water that has a low concentration of dissolved solids (24 to 55 mg/L). In this area, field pH is generally <6.0 units; measurements range from 5.1 in St. Helena Parish to 6.2 in northern Livingston Parish. Dissolved-iron concentrations are usually low, <50 µg/L (micrograms per liter); analyses shown in table 11 range from <10 to 50 µg/L. Wells constructed with steel casing may incur iron problems because water in the shallow aquifer unit north of Watson is usually corrosive. In northern Livingston Parish and throughout St. Helena Parish, dissolved-manganese concentration generally is <30 µg/L; hardness ranges from about 4 to 14 mg/L[1]; and color generally is ≤20 platinum-cobalt units.

South of Watson (central and southern Livingston Parish), freshwater obtained from the shallow aquifer unit is predominately a soft sodium-bicarbonate type. The shallow aquifer unit is more mineralized than in the northern half of the study area, and dissolved solids range from about 150 to 200 mg/L, except at well Li-171 where dissolved solids are 90 mg/L. Although the pH of water in the shallow aquifer unit may be <6.0, generally, the field pH ranges between 6.2 and 8.3. Water obtained from the shallow aquifer unit in central and southern Livingston Parish may contain dissolved iron ranging from <10 to 2,100 µg/L; dissolved manganese usually ranges from <10 to 560 µg/L. Hardness values between 8 and 63 mg/L can be expected in this area. Color generally is ≤20 but may exceed this in the upper sand bed.

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[1] Hem (1985, p. 159) gives the following classification of hardness: 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 greater than (>) 180 mg/L is very hard. In Louisiana, water that is hard or very hard or that contains an iron concentration exceeding 0.3 mg/L generally is treated for public-supply use.

Representative analyses of minor elements and radionuclides in water from selected wells completed in the shallow aquifer unit are shown in table 12 (at back). Minor element and radionuclide concentrations are below recommended limits of the U.S. Environmental Protection Agency (1977) for drinking water.

During this study, water from eight wells (table 13, at back, fig. 1) was analyzed for selected organic chemicals, including insecticides and herbicides; all wells were screened in the upper or lower sand beds of the shallow aquifer unit. Analysis of water from four wells, Li-85, Li-167, SH-47, and SH-52, indicated the presence of insecticides or herbicides (table 13). Chemicals detected in water from well SH-47 were dieldrin, heptachlor, and heptachlor epoxide. Lindane was detected in water from well SH-52, and 2,4-D was detected in water from wells Li-85 and -167. Silvex was also detected in water from well Li-167. Those chemicals, which were detected and for which maximum safe limits for drinking water have been proposed by the U.S. Environmental Protection Agency (1977), occurred in concentrations substantially below the safe limits.

Aquifer Unit 1

Aquifer unit 1 consists of two major areally extensive sand beds, probably of Pliocene age. The upper and lower sand beds in aquifer unit 1 are shown on plate 1, sections A-A' and C-C' and in table 1.

Extent and Thickness

The upper and lower sand beds of aquifer unit 1 are present throughout much of the study area and extend eastward and westward beyond Livingston and St. Helena Parishes. The upper and lower sand beds are correlative with the "1,000- and 1,200-foot" sands of the Baton Rouge area, respectively. East of the study area, in Tangipahoa Parish, aquifer unit 1 sand beds are correlative with the lower Ponchatoula aquifer, and may be hydraulically connected to the Abita aquifer (table 1).

Sand beds in aquifer unit 1 generally dip to the south (pl. 1, section A-A') at about 25 to 55 ft/mi. In northern St. Helena Parish, sand beds of aquifer unit 1 merge into and become part of the shallow aquifer unit (pl. 1, sections A-A' and B-B'). Throughout Livingston Parish and central and southern St. Helena Parish, the upper and lower sand beds are generally separated from the overlying shallow aquifer unit by extensive clays. At well SH-35 in central St. Helena Parish (table 4) sand beds within the unit are between 134 and 317 ft below sea level while at well 171615 in central Livingston Parish (pl. 1, section C-C') the upper and lower sand beds are between 680 and 1,360 ft below sea level. At well 45026, about 7 mi south of Denham Springs (pl. 1, section A-A') the upper and lower sand beds occur between 922 and 1,377 ft below sea level. South of well 45026 sands of aquifer unit 1 contain salty water. Table 4 contains the altitude of the top and bottom of the upper and lower sand beds in aquifer unit 1 at selected well sites throughout Livingston and St. Helena Parishes.

Within aquifer unit 1 the upper and lower sand beds are separated from one another throughout most of the study area by a clay layer (pl. 1, sections

A-A' and C-C'). Interpretations from electrical-log data indicate the upper and lower sand beds although generally separated, locally merge with one another in eastern Livingston Parish and areas of St. Helena Parish. Interpretations of electric logs indicate the upper and lower sand beds merge at well SH-39 near Grangeville (pl. 1, section A-A'). Sand thickness in the upper and lower beds is more than 200 ft at well SH-39. Near Albany at well Li-184 a combined sand thickness of about 500 ft, separated by only 30 ft of clay, is present in the upper and lower beds.

Analyses of correlative sands in adjacent parishes (Morgan, 1961, p. 33-35; Nyman and Fayard, 1978, p. 21-22) and analyses of sand supplied by drillers indicate sand is fine to medium in the upper and lower beds in aquifer unit 1.

Sand thickness in the upper and lower sand beds of aquifer unit 1 vary in all directions but generally increases southward. Thickness of the upper and lower sand beds range from less than 50 ft in northern St. Helena Parish to more than 280 ft in central Livingston Parish. Near Pine Grove in southern St. Helena Parish the upper bed contains about 100 ft of sand. In Livingston Parish, the upper bed is generally present ranging in thickness from about 50 to 100 ft. In central Livingston Parish, near I-12 (table 4, pl. 1, section C-C'), sand thickness contained in the upper bed ranges from about 30 to 210 ft.

The lower sand bed of aquifer unit 1 contains about 50 ft of sand near Pine Grove as determined by an electric log of well SH-30. In Livingston Parish, the lower sand bed usually attains a thickness of about 80 to 150 ft or more. In central Livingston Parish near I-12 (pl. 1, section C-C'), sand thickness in the lower bed ranges between 80 and 280 ft.

Ground-Water Recharge, Movement, and Discharge

Recharge to aquifer unit 1 occurs in northern St. Helena Parish where the upper and lower sand beds are hydraulically connected to the shallow aquifer unit. Recharge enters aquifer unit 1 by downward seepage of water from the shallow aquifer unit. Additional recharge occurs by vertical leakage through intervening clays overlying aquifer unit 1. Ground-water movement from recharge areas in St. Helena Parish is generally in a southerly direction to discharge areas in Livingston Parish and nearby pumping centers in Baton Rouge.

Discharge from aquifer unit 1 occurs in Livingston Parish by upward leakage of water through clays into the overlying shallow aquifer unit and by lateral flow into adjacent sands in the Baton Rouge area. Withdrawals within the study area are small. Generally, water withdrawn from aquifer unit 1 is for domestic use although wells Li-183 and -196 are used for public supply. No withdrawals from aquifer unit 1 have been reported in St. Helena Parish.

Water Levels

Water-level measurements at wells Li-26B, -68, -113, and -142 (fig. 1, table 5) were made in October 1983 as part of this study. Water levels in

Table 5.--Water levels in the lower sand bed in aquifer unit 1 in Livingston Parish

Well number	Date measured	Water level in feet, above or below sea level	Well number	Date measured	Water level in feet, above or below sea level
		Lower sand bed			
Li-26B	10-14-83	-22.03	Li-142	5-19-69	106.7
Li-68	10-20-83	-21.05		5-13-74	97.0
Li-113	10-18-83	32.20		10-13-83	94.0

October 1983 ranged from 22.03 ft below sea level at well Li-26B in western Livingston Parish to 94.0 ft above sea level at well Li-142 in the eastern part of the parish.

Long-term water-level data are available in western Livingston Parish at wells Li-26B and -113 (fig. 4). Well Li-26B is located at Denham Springs about 1 mi east of the Livingston-East Baton Rouge Parish border, and well Li-113 is located at Walker approximately 7 mi east of well Li-26B. Water-level data collected at well Li-26B show declines of about 2.4 ft/yr for the period of record. Water-level changes appear to be small at well Li-113; a general decline of about 0.3 ft/yr are shown by data presented in figure 4. Miscellaneous water-level data collected at well Li-142 at Albany (table 5) indicate water levels in this area have also declined slightly, about 0.3 ft/yr during the last 9 years.

Aquifer Characteristics

Aquifer-test data were not available within the study area for the upper or lower sand beds of aquifer unit 1. Aquifer unit 1 sand beds are not used in St. Helena Parish and only a few wells completed in these beds exist in central Livingston Parish.

Transmissivity and hydraulic conductivity of the upper sand bed can be estimated from data for well Li-196, located near Frost (fig. 1). The transmissivity of the upper sand bed is about 10,000 ft^2/d, estimated from the specific capacity of 19 (gal/min)/ft of drawdown for well Li-196. The hydraulic conductivity is estimated to be about 105 ft/d based on saturated aquifer thickness of 95 ft. In adjacent Tangipahoa Parish, sands correlative with aquifer unit 1 sand beds, the lower Ponchatoula aquifer, have estimated hydraulic conductivities ranging from 35 to 65 ft/d (Nyman and Fayard, 1978, p. 22). Results of aquifer tests in the Baton Rouge area in the correlative equivalent to the lower sand bed indicate the transmissivity ranges from 3,000 to 16,000 ft^2/d, and hydraulic conductivity ranges from 40 to 106 ft/d. Storage coefficients in the Baton Rouge area range from 8.5×10^{-5} to 1.6×10^{-4} (Morgan, 1961, p. 36).

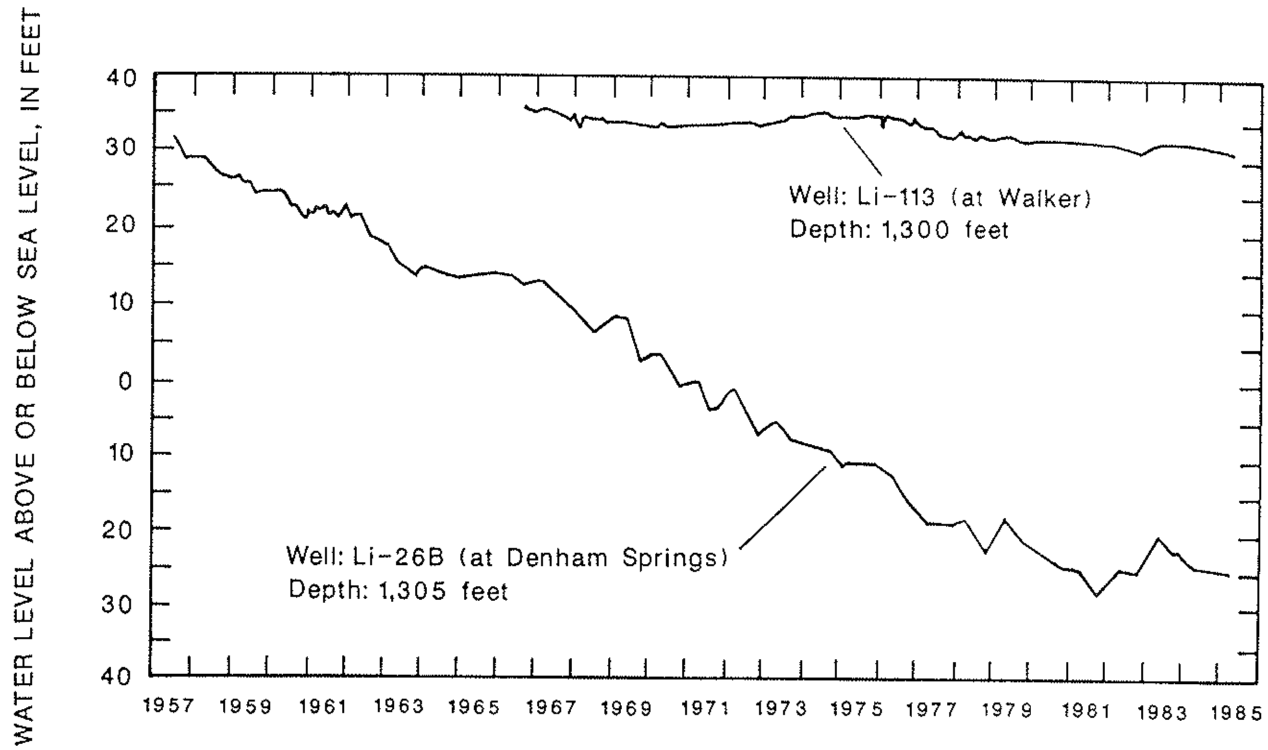

Figure 4.--Hydrographs of wells Li-26B and -113, representative of water levels in the lower sand bed of aquifer unit 1.

Water Quality

Representative chemical analyses of water samples obtained from nine wells (fig. 1) screened in aquifer unit 1 in Livingston Parish are shown in table 11. Three of the samples were collected from wells screened in the upper sand bed near Frost, five were collected in the lower sand bed near U.S. Highway 190, and one from well Li-186B at Albany, was collected at a depth where the two major sand beds of this unit are believed to merge. Water-quality data are not available for aquifer unit 1 in St. Helena Parish.

Water from all wells is a sodium-bicarbonate type. Field pH values range from 6.7 to 8.5 units, and dissolved solids range from 150 to 210 mg/L. Concentrations of dissolved iron range from <10 to 900 µg/L. Iron concentrations vary both areally and with depth, and problems of high iron concentration may locally occur. Dissolved manganese range from <10 to 250 µg/L. Hardness is $\leq$ 25 mg/L for all analyses. Color is $\leq$10 in all samples collected from aquifer unit 1.

Well Li-196 (fig. 1) was sampled for selected minor elements and radionuclides. Results in table 12 indicate none of the analyses exceeded recommended limits of the U.S. Environmental Protection Agency (1977) for public water supply.

Aquifer Unit 2

Three major sand beds, an upper, middle, and lower, define aquifer unit 2 (table 1; pl. 1). The contact of an areally extensive clay layer, at the bottom of the lower sand bed, is used to define the base of aquifer unit 2.

Extent and Thickness

Sand beds of aquifer unit 2 extend throughout St. Helena and Livingston Parishes, into surrounding parishes, and into southwestern Mississippi. The upper, middle, and lower sand beds of aquifer unit 2 are correlative with the "1,500-, 1,700-, and 2,000-foot" sands of the Baton Rouge area, respectively. Eastward in Tangipahoa Parish, aquifer unit 2 sand beds are correlative with sands in the Kentwood aquifer system including the Abita, Covington, and Tchefuncta aquifers (table 1).

Throughout St. Helena Parish and northern Livingston Parish the base of aquifer unit 2 dips southward about 35 to 65 ft/mi. In central Livingston Parish this southward dip increases to about 60 to 80 ft/mi. Freshwater sand beds in aquifer unit 2 range between 260 and 730 ft below sea level in northern St. Helena Parish (pl. 1, section B-B'). Aquifer unit 2 sands are present between about 1,530 and 2,360 ft below sea level in central Livingston Parish, (pl. 1, section C-C'). In southern Livingston Parish, the middle and lower sand beds contain freshwater 2,500 ft below sea level. Data in table 6 shows the altitude of the top and bottom of the upper, middle, and lower sand beds contained in aquifer unit 2 at selected wells.

Analyses of samples collected from the upper sand bed at well Li-184 (fig. 1) indicate that sediments range from medium to fine. In southern St. Helena Parish at Pine Grove, an analysis of the electric log for well SH-30 (fig. 1) indicates that the base of this bed is about 1,100 ft below sea level, and the upper sand bed is more than 300 ft thick. However, sand thickness thins both east and west from this well, as determined from electric logs of wells SH-33 and -40 (table 6 and fig. 1). The upper sand bed in central Livingston Parish near I-12 is present as a discontinuous series of freshwater sand lenses. In this area, this bed ranges in thickness from about 75 to 130 ft, and is between 1,530 and 1,720 ft below sea level (pl. 1, section C-C'). In areas of Livingston Parish south of the Baton Rouge fault (pl. 1, section A-A'), the upper sand bed is discontinuous and contains salty water.

As shown on plate 1, sections A-A' and B-B', the middle sand bed merges with the lower and upper sand beds of aquifer unit 2 in areas of central and northern St. Helena Parish. At Pine Grove, interpretation of the electric-log of well SH-30 (fig. 1) indicate that the middle sand bed is between 1,110 and 1,285 ft below sea level and is about 175 ft thick. The middle bed thins both to the east and west from Pine Grove. In central Livingston Parish, the altitude of the middle sand bed varies from about 1,720 ft below sea level to as much as 2,050 ft below sea level (pl. 1, section C-C'). Sand thickness in this area ranges from 30 to 150 ft (table 6). Near French Settlement, the middle sand bed contains freshwater between 2,645 and 2,705 ft below sea level, as determined from electrical-log data at well Li-88. At the Baton Rouge fault, the middle sand bed is probably adjacent to the lower bed of this unit, possibly because of displacement along the fault unit.

Table 6.--Altitude of the upper, middle, and lower sand beds in aquifer unit 2 in Livingston and St. Helena Parishes

[In feet, below sea level]

Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed	Altitude of top of sand bed	Altitude of base of sand bed	Altitude of top of sand bed	Altitude of base of sand bed
	Upper sand bed		Middle sand bed		Lower sand bed	
Li-56	1,602	1,702	[a]1,747	1,922	1,990	2,355
Li-77	[a]1,581	1,823	1,983	2,071	[b]2,217	2,399
Li-88	(b)		2,645	2,705	(c)	
Li-91	(c)		1,724	1,832	2,004	2,179
Li-99	1,529	1,639	1,724	1,799	(c)	
Li-100	(b)		2,529	2,637	(c)	
Li-114	1,995	2,245	(c)		2,205	2,281
Li-151	1,585	1,717	2,018	2,051	(c)	
Li-184	1,590	1,665	(c)		[a]1,926	2,234
Li-204	(c)		1,476	1,514	1,652	1,810
SH-9	[d]555	732	(d)		(d)	
SH-30	775	1,098	1,110	1,285	1,452	1,495
SH-32	[d]487	730	(d)		(d)	
SH-33	962	981	1,120	1,198	[a]1,244	1,474
SH-35	[d]438	614	(d)		732	794
SH-39	863	1,000	[d]1,057	1,287	(d)	
SH-40	[a]825	1,054	1,154	1,189	1,309	1,420
SH-65	[a] [d]601	978	(d)		1,086	1,110
45026	(b)		[a]2,137	2,242	[a]2,292	2,557
45130	(c)		1,999	2,036	[a]2,199	2,504
47180	[d]565	775	(d)		(d)	
54224	[d]300	705	(d)		(d)	
90389	(b)		2,380	2,435	[a]2,480	2,757
165286	(c)		1,962	2,024	2,167	2,212
166874	[a]1,410	1,581	[a]1,610	1,775	[a]1,820	1,999
167768	1,058	1,203	(c)		1,563	1,703
171615	(c)		1,835	1,985	2,160	2,305
174478	802	898	[d]914	1,048	(d)	

[a] Sand bed contains lenses of clay.
[b] Sand bed contains salty water.
[c] Sand bed is missing on log.
[d] Sand bed is merged with overlying or underlying beds.

Sediment samples collected from the lower bed at Pine Grove indicate that sediments are mostly medium grained sand with small amounts of fine and coarse. The lower, middle, and upper sand beds of aquifer unit 2 merge into a single sand 200 ft or more thick in western and central St. Helena Parish (pl. 1, section A-A'). However, electrical-log data indicate the lower sand bed is separated from overlying upper and middle sand beds by a clay layer throughout eastern St. Helena Parish. The lower bed thins at Pine Grove and then increases in thickness eastward and westward. As determined from electrical-log data from wells SH-30, -33, and -40 (table 6, fig. 1), sand thickness ranges between about 40 and 210 ft and is found between 1,240 and 1,500 ft below sea level. In central Livingston Parish near I-12 (pl. 1, section C-C'), the lower bed is present between 1,926 and 2,234 ft below sea level, and sand thickness ranges from 45 to 365 ft. Near the Baton Rouge fault, at well 90389, the base of the lower sand bed is about 2,757 ft below sea level, and sand thickness is about 260 ft.

Ground-Water Recharge, Movement, and Discharge

Aquifer unit 2 is recharged by water from the shallow aquifer unit in southern Amite County, Mississippi, where sands in aquifer unit 2 merge into the shallow aquifer unit. In areas where these units merge, ground water flows vertically from the shallow aquifer unit into underlying sands of aquifer unit 2. Additional recharge occurs throughout St. Helena Parish by vertical leakage of water from the shallow aquifer unit and aquifer unit 1 through confining clays overlying aquifer unit 2.

Ground-water movement throughout St. Helena Parish and most of Livingston Parish is generally in a southwesterly direction toward pumping centers in Baton Rouge. Figure 5 is a potentiometric map of aquifer unit 2 constructed from water-level data collected during October 1983.

Ground-water discharge from aquifer unit 2 occurs chiefly by withdrawals from correlative sands in the Baton Rouge area, withdrawals in central Livingston Parish, and by vertical leakage into the underlying aquifer unit 3. Well-inventory data collected in Livingston Parish show that about 15 wells currently withdraw ground water from unit 2 for public supply. About one half of these public-supply wells are completed in the middle sand bed. Reported well yields generally range from 150 to 750 gal/min for these 15 wells. The largest reported discharge for an aquifer unit 2 well was 1,900 gal/min free flow from well Li-149 in 1970. This well is screened in the middle sand bed and was reported to yield 2,600 gal/min when pumped with a large capacity turbine pump. Water is not withdrawn from wells in aquifer unit 2 in St. Helena Parish.

Water Levels

Water levels in Livingston Parish ranged from about 18 ft below sea level at well Li-77 near Denham Springs, to about 109 ft above sea level at well Li-131 north of Albany (fig. 5). Well Li-77 is screened in the lower sand bed, and well Li-131 is screened in the middle sand bed. Well Li-100, located south of the Baton Rouge fault at Port Vincent, had a water level about 65 ft

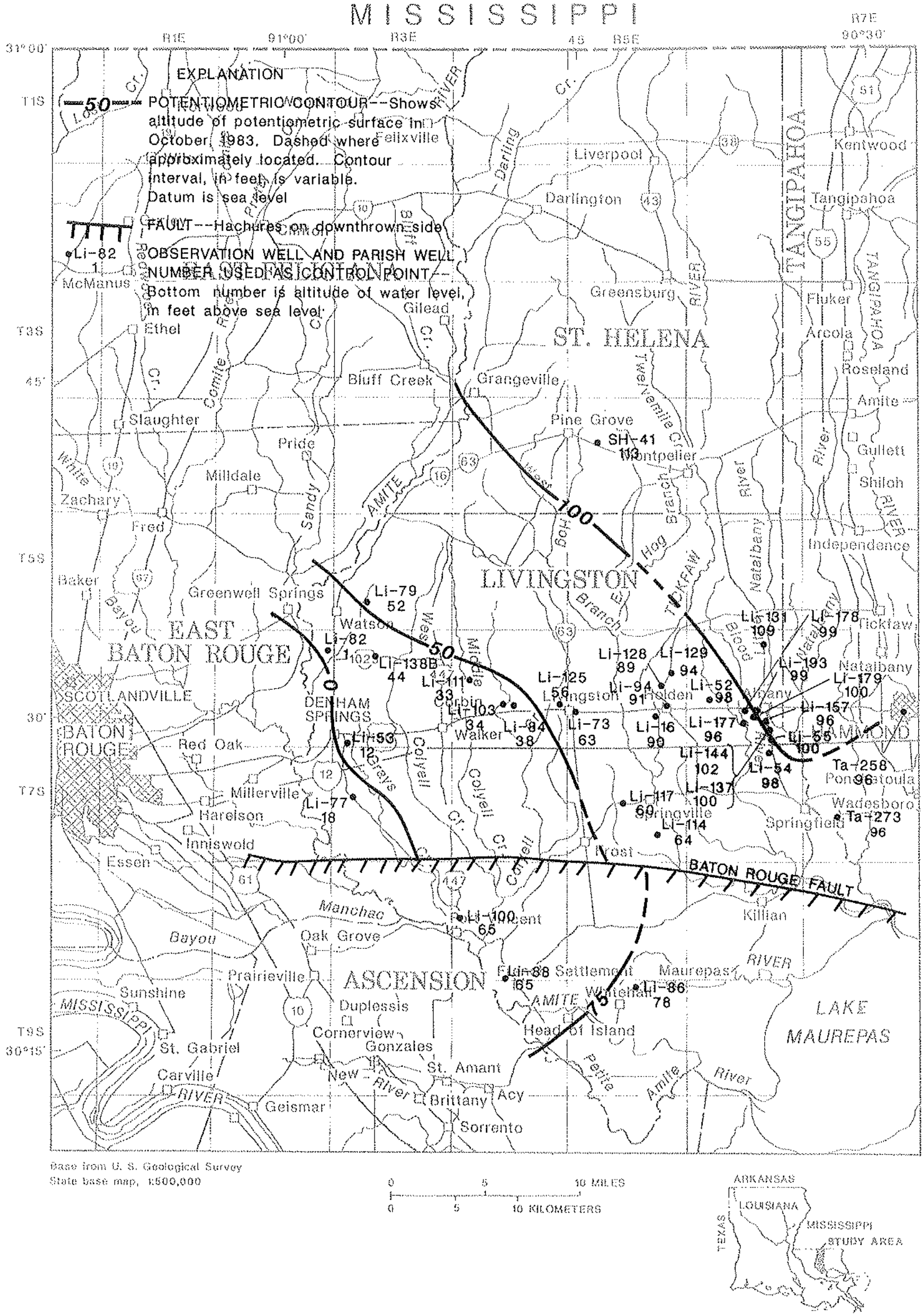

Figure 5.--Potentiometric surface of aquifer unit 2, October 1983.

above sea level. This well is believed to be screened in the middle sand bed. In northern St. Helena Parish, water levels probably reach 150 ft or more above sea level near Greensburg.

Water levels have declined in unit 2 since the early 1950's (fig. 6). Water-level declines have varied during intervals as a result of changes in rates of ground-water withdrawal in the Baton Rouge area. At well Li-43 water levels declined an average of about 6.2 ft/yr, 1957-73. Declines during the years 1958-64 averaged about 5.0 ft/yr, but during the interval 1965-70, water-level declines nearly doubled and averaged about 9.7 ft/yr. Water-level data collected at nearby well Li-92, which is screened in the same bed and is located about 1 mi northeast of well Li-43, indicate water-level declines averaged about 0.4 ft/yr, 1975-84.

At well Li-54 water levels have been measured since 1954. Average water-level declines were about 2.3 ft/yr, 1954-77. However, during the interval 1967-70 yearly declines nearly doubled this average as a result of increased ground-water withdrawal in the Baton Rouge area. Water-level data collected 1978-84 at well Li-54 indicate average declines were only about 0.3 ft/yr. Water-level data presented for well Li-52, located 4 mi northwest of well Li-54, show similar water-level trends to those for well Li-54. Water-level data indicate an average water-level decline of about 2.3 ft/yr, 1951-78. Since 1979 water-level trends have been erratic at well Li-52.

Aquifer Characteristics

Aquifer-test data collected from aquifer unit 2 are available at only one site in the study area. Well Li-43 is screened in the lower sand bed which is about 175 ft thick. This well was pumped at a rate of 625 gal/min for 4-1/2 hours. The observed specific capacity was about 8.5 (gal/min)/ft of drawdown. Aquifer test results of well Li-43 indicate the lower sand bed has a transmissivity of about 18,000 ft^2/d and an average hydraulic conductivity of about 100 ft/d. Results of aquifer tests in the correlative sand in the Baton Rouge area are summarized in table 7.

Although aquifer-test data are not available in the study area to describe the hydraulic characteristics of the upper and middle sand beds of aquifer unit 2, estimates can be made from data available in adjacent parishes. Aquifer test results for the Baton Rouge area (Morgan, 1961, p. 39-45) should closely resemble hydraulic characteristics of correlative sand beds in aquifer unit 2. These are summarized in table 7.

Water Quality

Chemical analyses of ground water obtained from aquifer unit 2 in Livingston and St. Helena Parishes (fig. 1) are shown in table 11. Ground water from aquifer unit 2 is a soft sodium-bicarbonate type. Hardness is $\leq$32 mg/L. Color is <20 units except at well Li-131 which has a color of 70 units. In St. Helena Parish, limited chemical data are available. However, chemical data collected during test drilling prior to this study from wells SH-33B and -34A indicate that sand beds of unit 2 in St. Helena Parish contain

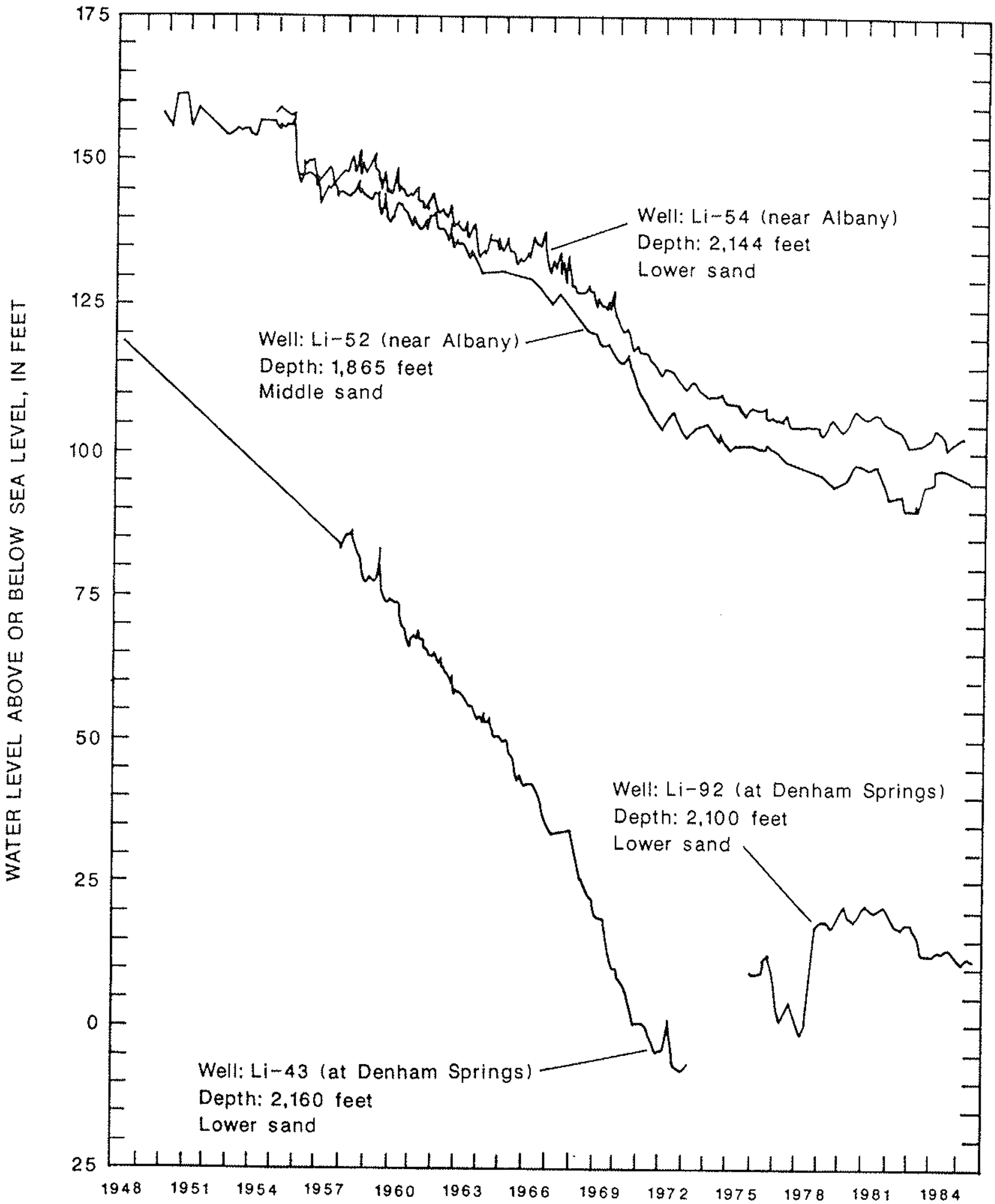

Figure 6.--Hydrographs of wells Li-43, -52, -54, and -92, representative of water levels in the middle and lower sand beds of aquifer unit 2.

Table 7.--Hydraulic characteristics of correlative sand beds in aquifer unit 2 as determined by aquifer tests in the Baton Rouge area

Aquifer unit 2 sand beds in Livingston and St. Helena Parishes	Correlative aquifer in the Baton Rouge area	Transmissivity (feet squared per day)	Hydraulic conductivity (feet per day)
Upper------------	"1,500-foot" sand	10,000-12,000	123-155
Middle-----------	"1,700-foot" sand	4,300	32
Lower------------	"2,000-foot" sand	21,000-32,000	150-200

slightly acidic water with field pH values ranging from about 6.2 to 6.3 units. Ground-water samples collected at wells SH-33B and -34A have dissolved-solids concentrations of 140 mg/L and dissolved-iron concentrations range from 740 to 1,000 µg/L; dissolved manganese range from 220 to 240 µg/L.

In Livingston Parish, the field pH of water from aquifer unit 2 generally ranges from 7.1 to 8.9. Concentrations of dissolved solids range from 160 to 230 mg/L in Livingston Parish. Dissolved-iron concentrations are generally $\leq$400 µg/L but locally exceed 1,000 µg/L at wells Li-131 and -159. Manganese generally is <300 µg/L.

Results of four analyses for selected minor elements and three analyses for radionuclides collected in Livingston Parish (fig. 1) from the middle and lower sand beds of aquifer unit 2 are shown in table 12. Results indicate recommended limits for public water-supply sources, as set by the U.S. Environmental Protection Agency (1977), were not exceeded for any constituent.

Aquifer Unit 3

The deepest freshwater sands in St. Helena Parish and in the northern half of Livingston Parish occur within aquifer unit 3. In central and northern Livingston Parish and throughout St. Helena Parish two major freshwater sand beds, an upper and lower, define this unit (pl. 1). The occurrence of freshwater below the upper and lower sand beds of aquifer unit 3 is limited to deeper sands in northern St. Helena Parish. Because groundwater is not withdrawn from these deeper sands and they are not extensive throughout the study area, these sands are not discussed in detail.

Extent and Thickness

The upper and lower sand beds of aquifer unit 3 extend east, west, and north of the study area. The upper and lower sand beds of aquifer unit 3 are correlative with the "2,400- and 2,800-foot" sands of the Baton Rouge area, respectively. To the west, the upper and lower sand beds are correlative with sands contained in the Hammond, Amite, and Ramsay aquifers in Tangipahoa Parish.

The upper sand bed of aquifer unit 3 contains freshwater throughout areas north of the Baton Rouge fault. The upper bed dips in a southerly direction between 40 and 60 ft/mi in St. Helena Parish. In Livingston Parish, this dip increases to about 60 to 80 ft/mi. North of Pine Grove, the upper bed is composed of a series of sand lenses and correlation is difficult. As shown on plate 1, section B-B', the upper bed is composed of sand lenses which range between 15 and 150 ft in thickness in northern St. Helena Parish and occur between 800 to 1,100 ft below sea level. Sand thickness generally increases southward. In southern St. Helena Parish, as interpreted from electrical-log data collected at wells SH-30, -33, and -40 (table 8), the upper sand bed is divided into two units by a clay layer 200 ft or more in thickness. Sand in this bed is between 65 and 170 ft in total thickness and occurs between 1,500 and 2,000 ft below sea level. In central Livingston Parish near I-12 (pl. 1, section C-C'), the upper sand bed generally is present about 2,300 to 2,650 ft below sea level. In this area, thickness of the upper sand bed ranges from about 90 to 300 ft or more although clay lenses may be present within the sand. Near the Baton Rouge fault in western Livingston Parish, interpretations of electrical-log data collected at well 45026 indicate that the base of this bed is about 2,900 ft below sea level and sand thickness is about 125 ft.

The last extensive freshwater sand bed extending from St. Helena Parish into central Livingston Parish is the lower bed of aquifer unit 3. This bed dips southward (pl. 1, section A-A') between 40 and 80 ft/mi throughout the study area. In St. Helena Parish near Grangeville, about 100 ft of sand is present between 2,150 and 2,250 ft below sea level. Similar to the upper sand bed the lower bed is lenticular in northern St. Helena Parish. The lower bed contains sand lenses from less than 25 ft to more than 100 ft in thickness at about 1,400 to 2,000 ft below sea level (pl. 1, section B-B'). In central Livingston Parish, the lower sand bed is between 2,650 ft and 3,050 ft below sea level (pl. 1, section C-C'). Sand in this bed attains a maximum thickness of nearly 300 ft but generally is less. Southward near Springville, the lower sand bed contains brackish water near the base. South of the Baton Rouge fault, the lower sand bed contains salty water.

Ground-Water Recharge, Movement, and Discharge

Recharge to aquifer unit 3 occurs from downward movement of water from the shallow aquifer unit in the outcrop area and from vertical leakage from the overlying aquifer unit 2. Aquifer unit 3 extends into southern Mississippi where the upper and lower sand beds are near land surface and are directly connected with the overlying shallow aquifer unit in Amite, Franklin, and Lincoln Counties. In areas where aquifer unit 3 is in hydraulic connection with the shallow aquifer unit, recharge water moves from the shallow aquifer unit into the upper and lower sand beds of aquifer unit 3. This recharge is transmitted downdip into St. Helena and Livingston Parishes. Additional recharge from vertical leakage from aquifer unit 2 occurs throughout St. Helena Parish and northern Livingston Parish. As shown in figures 5 and 7, the overlying aquifer unit 2 contains higher hydrostatic heads throughout St. Helena Parish and in northern Livingston Parish than the underlying aquifer unit 3. In these areas, ground-water leaks through intervening clays into the underlying aquifer unit 3.

Table 8. --Altitude of the upper and lower sand beds in aquifer unit 3 in Livingston and St. Helena Parishes

[In feet, below sea level]

Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed	Well or permit number	Altitude of top of sand bed	Altitude of base of sand bed
	Upper sand bed			Lower sand bed	
Li-56	[a]2,430	2,526	Li- 91	[a]2,990	3,044
Li-91	[b]2,297	2,634	Li-184	2,751	2,902
Li-151	[b]2,310	2,649	Li-204	[b]2,491	2,519
Li-184	2,387	2,498	SH-9	[b]1,425	1,975
Li-204	[b]2,044	2,293	SH-32	[b]1,780	1,908
SH-9	990	1,140	SH-35	(c)	
SH-30	[b]1,683	2,005	SH-65	1,744	1,997
SH-32	1,013	1,045	26360	[a]1,195	1,510
SH-33	[b]1,595	2,017	37171	[b]1,516	1,866
SH-35	1,303	1,397	44945	2,784	2,915
SH-39	[a]1,670	1,789	45026	(d)	
SH-40	[b]1,499	1,864	45130	2,976	3,085
26360	895	1,005	54224	1,750	1,815
37171	906	921	165286	[b]2,681	3,010
44945	[b]2,409	2,684	167768	[b]2,583	2,885
45026	2,760	2,890	171685	2,667	2,907
45130	2,569	2,824	174478	[b]2,159	2,529
54224	920	960			
90389	2,965	3,025			
166874	[b]2,146	2,413			
167768	[b]1,863	2,103			
171685	[a]2,405	2,515			
174478	[b]1,529	1,752			

[a] Bottom of log interval.
[b] Sand bed contains lenses of clay.
[c] Sand bed is missing on log.
[d] Sand bed contains salty water.

Ground-water movement in aquifer unit 3 generally is in a southwesterly direction toward pumping centers in Baton Rouge. Figure 7 is a potentiometric map constructed from water-level data collected in October 1983 from wells screened in the upper sand bed.

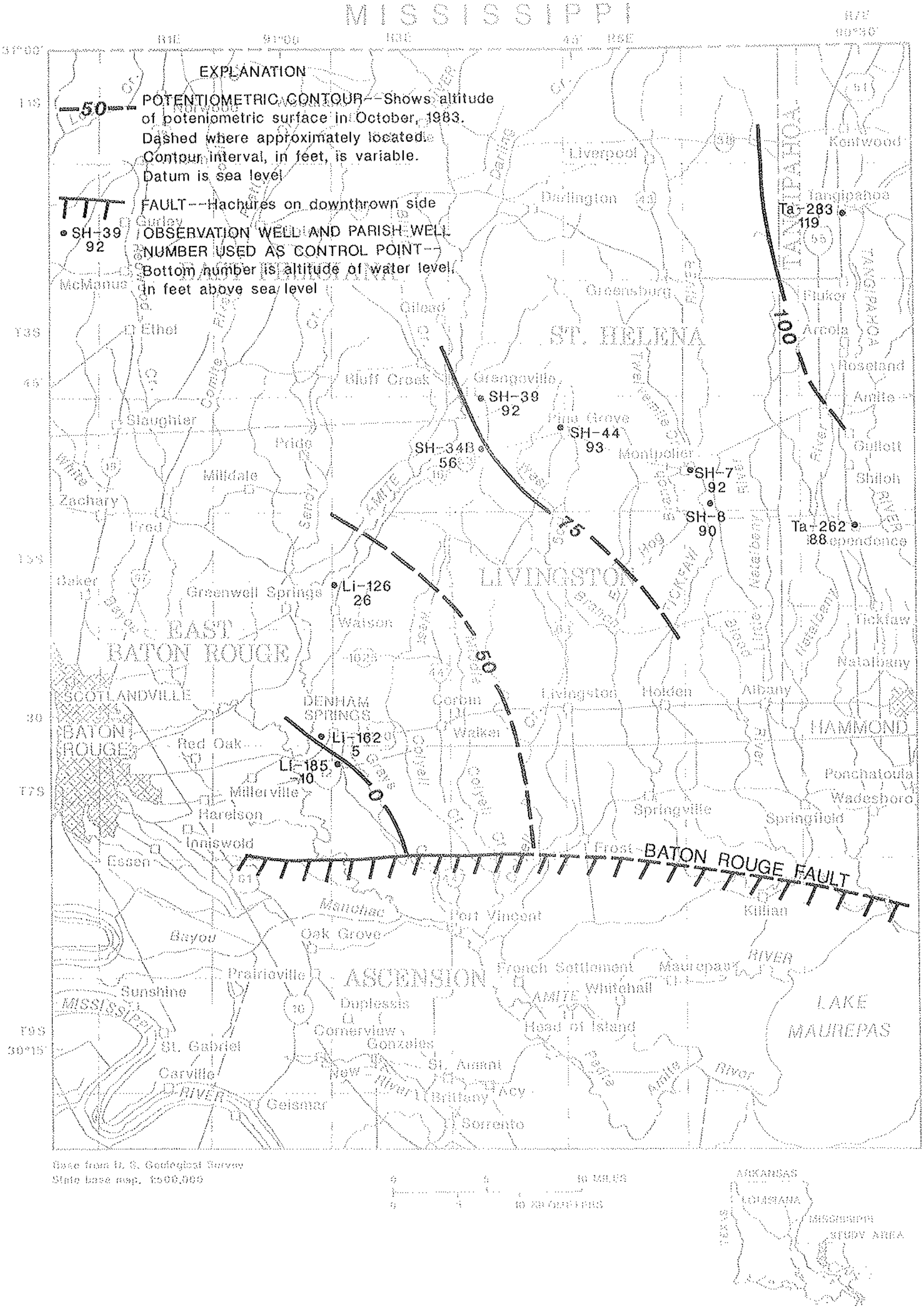

Figure 7.--Potentiometric surface of the upper sand bed of aquifer unit 3, October 1983.

Major discharge from aquifer unit 3 occurs as lateral ground-water flow into correlative sands in the Baton Rouge area; however, small withdrawals from the upper and lower sand beds occur locally in St. Helena Parish and central Livingston Parish. Well-inventory data indicate 12 wells screened within aquifer unit 3 presently withdraw water in St. Helena Parish (table 10). Ten of these wells are constructed in the upper sand bed of this unit, and two are screened in the lower sand bed (table 10). Ground-water withdrawal from these beds is predominately for public supply. Available data indicate that water is withdrawn from about 10 wells in aquifer unit 3 sand beds in Livingston Parish. Additional wells screened in aquifer unit 3 probably exist, but no information has been obtained. Most wells in Livingston Parish are used for public supply and are located in northwestern parts of this parish (Denham Springs, Watson, and surrounding communities).

The largest reported discharge from a well completed in aquifer unit 3 was about 1,300 gal/min for well Li-162. Located in the Denham Springs area, this well is screened in the upper sand bed and is used for public supply. Well SH-8 also screened in the upper bed near Montpelier had a reported discharge of 1,200 gal/min. Most reported yields were about 800 gal/min or less for wells screened in the upper bed of this aquifer unit 3.

Water Levels

Selected water-level data collected as part of this study from wells screened in aquifer unit 3 are shown in table 9. Limited data were available for only a few wells completed in aquifer unit 3 in northwestern Livingston Parish. Water-level data are not available in most areas throughout this parish as wells are not generally completed to these depths. In St. Helena Parish, most wells completed in the upper sand bed are found in the southern half of the parish. Water-level data collected from wells screened in the upper and lower beds of this aquifer unit ranged from about 10 ft below to 95 ft above sea level in St. Helena and Livingston Parishes (table 9, fig. 7). The lowest water levels were measured in the Denham Springs area from wells screened in the upper sand bed. Well SH-65 near Hillsdale had the highest measured water level, 95 ft (table 9) above sea level in 1984. Water levels in the lower sand bed ranged from about 30 ft above sea level near Watson to about 80 ft above sea level near Darlington.

Table 9.--Water levels in the upper and lower sand beds in aquifer unit 3 in Livingston and St. Helena Parishes

Well number	Date measured	Water level in feet, above or below sea level	Well number	Date measured	Water level in feet, above or below sea level
	Upper sand bed			Lower sand bed	
Li-185	11- 3-83	-9.42	Li-74	10-24-83	33.0
SH-5	5-17-84	93.08	Li-91	11- 3-83	53.0
SH-40	5- 9-84	91.96	SH-9	10- 6-83	82.78
SH-65	5- 9-84	95.32	SH-66	10-19-83	81.26

Figure 7 is a potentiometric map constructed with water-level data collected from the upper sand bed of aquifer unit 3 in October 1983. Throughout most of St. Helena Parish water levels were about 90 ft above sea level. In southwestern St. Helena Parish, however, the potentiometric surface of this sand has been reduced by 30 to 40 ft when compared to other areas of this parish. In southwestern St. Helena Parish and in northwestern Livingston Parish, near Denham Springs and Watson, water levels in this bed are significantly lower because of withdrawals in the Baton Rouge area.

Declines in water levels have occurred in the upper and lower sand beds of aquifer unit 3. Water-level data collected at well SH-7 (figs. 1 and 8) indicate average water-level declines of about 2.5 ft/yr have occurred in the upper sand bed since 1955. The decline in this bed is a result of a regional water-level decline caused by withdrawals in nearby parishes including Tangipahoa and East Baton Rouge.

Declines in well SH-9 (figs. 1 and 8) have averaged about 1.2 ft/yr, 1960-84. Although this well is screened in the lower sand bed which is not heavily pumped in the study area, declining water levels are a result of withdrawals from correlative sands in East Baton Rouge Parish.

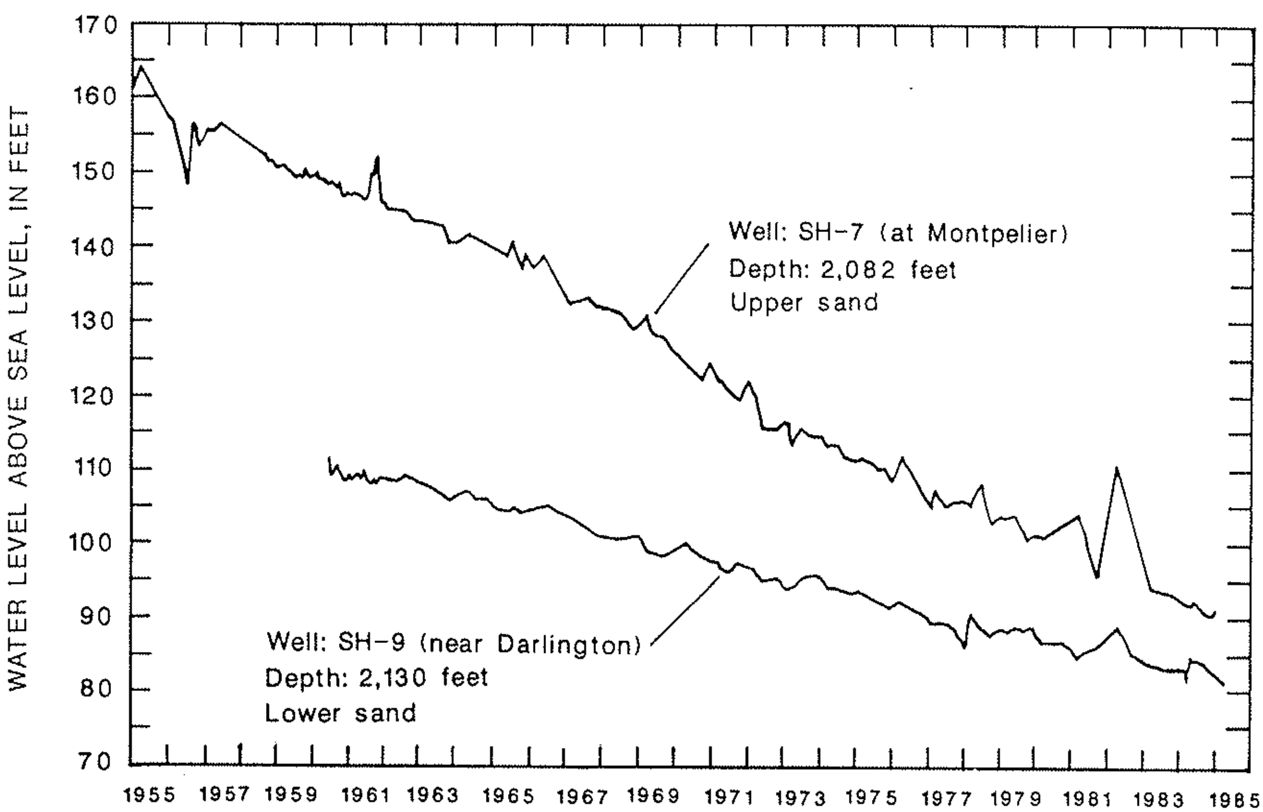

Figure 8.--Hydrographs of wells SH-7 and -9, representative of water levels in the upper and lower sand beds of aquifer unit 3.

Aquifer Characteristics

Estimations for the transmissivity and hydraulic conductivity in the upper sand bed were made from specific-capacity data collected at well Li-181. Transmissivity for the 116 ft thick sand interval was estimated to be about 11,000 ft^2/d. The hydraulic conductivity at this site was estimated to be 95 ft/d. Transmissivity and hydraulic conductivity values obtained at well Li-181 are in general agreement with values determined in the "2,400-foot" sand in the Baton Rouge area. An aquifer test in the Baton Rouge area indicates that the transmissivity and hydraulic conductivity of the "2,400-foot" sand are 13,000 ft^2/d and 80 ft/d, respectively (Morgan, 1961, p. 50). Data were not available within the study area to determine aquifer characteristics of the lower sand bed.

Water Quality

Selected chemical analyses of water samples obtained from wells constructed in aquifer unit 3 throughout the study area (fig. 1) are shown in table 11. Twenty-four of these samples were collected from wells screened in the upper sand bed, five from wells screened in the lower bed.

Freshwater obtained from the upper and lower sand beds in aquifer unit 3 is a sodium-bicarbonate type. Dissolved solids generally range from 180 to 300 mg/L, except wells Li-91 and SH-33a have dissolved-solids concentrations of 580 and 930 mg/L, respectively (table 11). Compared to all other analyses well Li-91 contains a higher chloride concentration, 57 mg/L. The field pH of water from wells screened in aquifer unit 3 ranges from 7.2 to 9.4. Hardness is <20 mg/L for analyses shown in table 5. Dissolved-iron concentration generally is <250 µg/L; however, concentrations exceeding 900 µg/L have been observed. Dissolved-manganese concentration is present in amounts typically <100 µg/L and has not exceeded 350 µg/L. Color generally is ≤30 units.

Results of ground water sampled as part of this study for selected minor elements and radionuclides from aquifer unit 3 are shown in table 12. None of the minor element or radionuclide analyses exceeded recommended limits of the U.S. Environmental Protection Agency (1977) for drinking water. Samples collected at six sites were analyzed for selected minor elements. Ground-water samples collected at five sites were analyzed for selected radionuclides.

Base of Freshwater

The chloride concentration, <250 mg/L, used to define the base of freshwater was based on interpretations of electric logs and analysis of chemical data. A map constructed from these data defining the base of fresh ground water is shown in figure 9. In northern St. Helena Parish, freshwater is present to altitudes of 2,500 ft below sea level while in extreme southern Livingston Parish, freshwater is present to altitudes of only 500 ft below sea level. The base of freshwater generally occurs within Miocene formations and may be 3,200 ft or more below sea level in southeastern Livingston Parish.

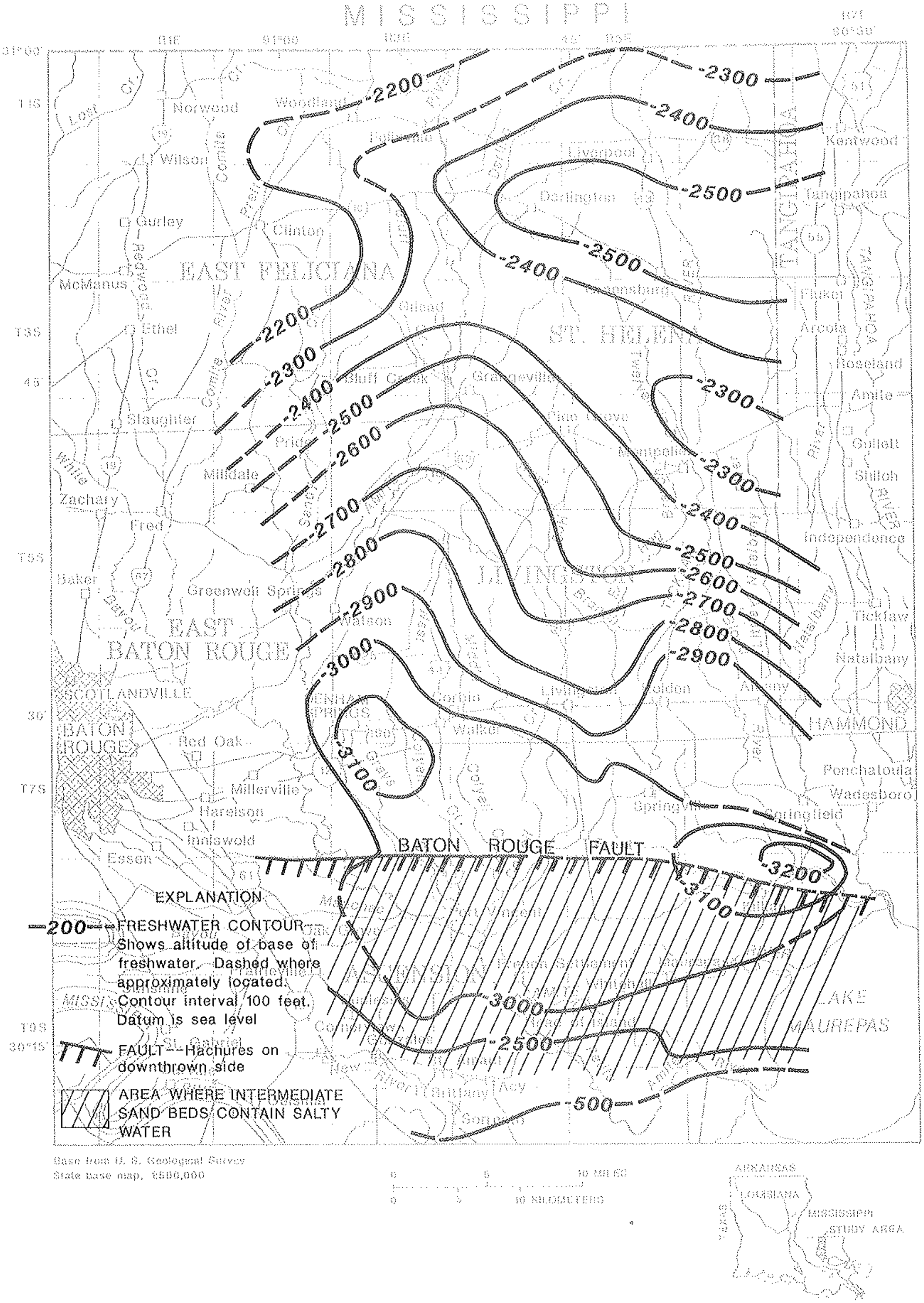

Figure 9.--Altitude of base of fresh ground water.

Throughout St. Helena Parish, freshwater generally extends to 2,300 to 2,700 ft below sea level. However, in the extreme northeastern part of the parish, freshwater occurs from a minimum of about 2,100 ft below sea level to a maximum of 2,575 ft below sea level near the city of Greensburg. In northeastern Livingston Parish sands containing freshwater extend to 2,400 ft below sea level; depths to the base of freshwater increase both to the west and to the south. Near the towns of Denham Springs and Killian, freshwater occurs to more than 3,100 ft below sea level.

In southern Livingston Parish, sands in intermediate aquifer units may contain salty water. As shown in figure 9 and on plate 1, the Baton Rouge fault may act as a barrier restricting southward flushing of salty water from beds of sands of aquifer unit 1, the upper sand of aquifer unit 2, and all beds in aquifer unit 3. The Baton Rouge fault is a freshwater-saltwater boundary through southern Livingston Parish. Aquifer units containing salty water in intermediate-depth sand beds include aquifer units 1 and 2 (fig. 9). Although limited electrical-log data for southern Livingston Parish are available, an electric log about 2 mi west of Frost indicates all sand beds encountered to about 1,110 ft below sea level contain freshwater. At well Li-86, about 8 mi south of Frost, sands about 700 ft below sea level contain salty water, and major freshwater sands are not encountered again until about 2,860 ft below sea level.

SUMMARY AND CONCLUSIONS

A regionally extensive aquifer system, the Southern Hills aquifer system, is the principal source of drinking water for Livingston and St. Helena Parishes in southeastern Louisiana. The system is composed of interlayered sand beds, chiefly deltaic, ranging in age from Miocene to Holocene. In Livingston and St. Helena Parishes, four aquifer units containing nine areally extensive sand beds have been delineated within this system. Hydraulic head, geophysical, and water-quality data were used to group sand beds in the aquifer units, which are the shallow unit, and units 1, 2, and 3. Freshwater within the aquifer system extends to 2,500 ft below sea level in northern St. Helena Parish and to 3,200 ft below sea level in southeastern Livingston Parish. In extreme southern Livingston Parish, freshwater is present to altitudes of only 500 ft below sea level. The Baton Rouge fault may act as a barrier restricting southward flushing of salty water from sand beds of aquifer unit 1, the upper bed of aquifer unit 2, and all beds in aquifer unit 3.

Recharge from rainfall to the aquifer system occurs throughout most of St. Helena Parish and southwestern counties of Mississippi. Rainfall is received directly by the shallow aquifer unit and is transmitted to underlying aquifer units 1, 2, and 3 as they successively merge into or near the shallow aquifer unit in northern St. Helena Parish and in the southwestern Mississippi counties of Amite, Franklin, and Lincoln. Ground-water movement in the shallow aquifer unit is generally in a southerly direction from recharge areas. Discharge from the shallow aquifer unit occurs as pumpage or ground-water leakage in southern Livingston Parish. In aquifer units 1, 2, and 3, ground-water movement is in a southwesterly direction toward large pumpage centers in the Baton Rouge area.

Ground-water withdrawals totaled about 7 Mgal/d in Livingston and St. Helena Parishes in 1985. Wells completed in the shallow aquifer unit and aquifer unit 1 sand beds, are primarily low yielding and most withdrawals are for domestic use. Sands in aquifer units 2 and 3 supply ground water for public-supply, domestic, and industrial use. Large ground-water withdrawals in East Baton Rouge Parish, about 120 Mgal/d in 1985, caused significant water-level declines in sand beds in aquifer units 1, 2, and 3. Intensively pumped sand beds had water-level declines averaging more than 5 ft/yr in parts of Livingston Parish near Baton Rouge. Declines since 1980 are generally less than 0.5 ft/yr in most sand beds. Water-level declines between 1 to 2.5 ft/yr, however, continue in aquifer unit 3 sand beds in St. Helena Parish. The hydraulic conductivity of sands within aquifer units ranges from 30 to 200 ft/d. Transmissivity ranges between 3,000 and 32,000 ft^2/d.

Most fresh ground water throughout the study area is a soft sodium-bicarbonate type. However, sand beds of the shallow aquifer unit in St. Helena Parish and northern Livingston Parish contain a mixed ionic type water with a low concentration of dissolved solids. Chemical analyses of ground water for selected minor elements, insecticides, herbicides, and radionuclides showed that none of these constituents exceed primary or secondary drinking water standards of the U.S. Environmental Protection Agency. However, all aquifer units may locally contain water with concentrations of naturally occurring chemicals such as dissolved iron or dissolved manganese, which may limit the use of water without treatment.

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BASIC DATA

TABLES 10 - 13

TABLE 10.--RECORDS OF SELECTED WATER WELLS IN LIVINGSTON AND ST. HELENA PARISHES

[AQUIFER UNIT: S, SHALLOW. SAND BED: U, UPPER; M, MIDDLE; L, LOWER. USE OF SITE: Z, DESTROYED; W, WITHDRAWAL; U, UNUSED; T, TEST; O, OBSERVATION. USE OF WATER: U, UNUSED; H, DOMESTIC; P, PUBLIC SUPPLY; N, INDUSTRIAL; T, INSTITUTIONAL; C, COMMERCIAL; S, STOCK; D, DAIRY; ALTITUDE IS **REFERENCED TO** SEA LEVEL]

LOCAL WELL NUMBER	LOCATION SEC. T. R.	AQUIFER UNIT	SAND BED	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (FEET)	CASING DIAM-ETER (INCHES)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	DISCHARGE (GALLONS PER MINUTE)	DATE DISCHARGE MEASURED	USE OF SITE	USE OF WATER
					LIVINGSTON PARISH							
LI-16	S 26 T 6S R 5E	2	M	1939	35	4	1720	1700	350	1939	W	H
LI-23	S 30 T 6S R 4E	S	L	1938	46	2	266	246	--	--	W	H
LI-24	S 30 T 6S R 4E	2	U	1938	47	2.5	1322	1283	--	--	W	H
LI-26B	S 67 T 7S R 2E	1	L	1937	37	2	1305	1289	--	--	O	U
LI-43	S 44 T 6S R 3E	2	L	1948	45	6	2160	2072	625	1957	U	U
LI-46B	S 45 T 6S R 3E	3	U	1949	50	4	2528	2440	200	1949	W	P
LI-52	S 20 T 6S R 6E	2	M	1949	46	3	1865	1825	300	--	W	H
LI-53	S 45 T 6S R 3E	2	M	1953	46	4	1714	1674	--	--	Z	U,P
LI-54	S 2 T 7S R 6E	2	L	1954	33	2.5	2144	2104	--	--	W	H
LI-55	S 39 T 6S R 6E	2	L	1954	35	3	2030	1990	--	--	W	H
LI-56	S 68 T 7S R 2E	3	U	1955	39	4	2612	2572	--	--	W	P
LI-57	S 25 T 6S R 3E	2	M	1956	46	6	1900	1840	608	1956	W	P
LI-58	S 40 T 6S R 6E	2	M	1947	40	4	1913	1853	350	1947	W	P
LI-59	S 51 T 7S R 6E	2	L	1956	35	2	2196	2156	--	--	W	H
LI-68	S 43 T 7S R 2E	1	L	1947	30	6	1508	--	10	--	W	R
LI-73	S 30 T 6S R 5E	2	L	1958	40	6	1925	1802	725	1958	W	P
LI-74	S 61 T 6S R 2E	3	L	1959	50	7	2693	2633	--	--	W	C
LI-77	S 17 T 7S R 3E	2	L	1953	37	2.5	2444	2404	--	--	U	U
LI-79	S 29 T 5S R 3E	2	L	1956	71	3	1628	1608	--	--	U	U
LI-80	S 49 T 5S R 3E	2	M	1955	66	3	1492	1454	--	--	U	U
LI-82	S 64 T 6S R 2E	2	M	1955	56	2.5	1650	1610	--	--	Z	U,P
LI-84	S 22 T 6S R 4E	2	L	1961	44	3	1965	1935	120	1962	W	C
LI-85	S 16 T 9S R 5E	S	U	1962	5	4	405	365	50	1962	W	P
LI-86	S 3 T 9S R 5E	2	L	1962	10	4	2943	2903	285	1962	W	U
LI-88	S 40 T 8S R 4E	2	L	1962	15	4	2715	2675	279	1962	W	P

LI-89	S 12 T 6S R 3E	2	M	--	58	3	1620	--	--	--	W	P
LI-91	S 32 T 6S R 3E	3	L	1964	44	3	3081	3051	103	1964	W	H
LI-92	S 48 T 6S R 3E	2	L	1964	51	--	2100	--	--	--	W	P
LI-93	S 23 T 6S R 6E	1	L	1937	42	2	1384	1360	25	1965	W	H
LI-94	S 39 T 6S R 5E	2	M	1955	40	2	1730	1700	40	1965	W	T
LI-100	S 58 T 8S R 4E	2	L	1965	7	3	2648	2608	150	1965	W	P
LI-102	S 30 T 6S R 4E	2	L	1960	48	2	2247	2227	--	--	W	H
LI-103	S 21 T 6S R 4E	2	M	1959	42	2	1796	1766	--	--	W	H
LI-111	S 18 T 6S R 4E	2	L	1966	52	3	2170	2140	60	1966	W	C
LI-113	S 30 T 6S R 4E	1	L	1942	48	3	1300	--	--	--	O	U
LI-114	S 40 T 7S R 5E	2	L	1967	16	3	2300	2280	75	1967	W	H
LI-117	S 16 T 7S R 5E	2	M	1960	20	2	2000	--	--	--	W	H
LI-122	S 45 T 7S R 6E	S	L	1952	11	1.5	500	490	--	--	W	H
LI-123	S 4 T 7S R 6E	S	L	1960	27	1.5	520	--	--	--	W	H
LI-125	S 24 T 6S R 4E	2	L	1955	41	3	1844	1804	--	--	W	H
LI-126	S 45 T 5S R 3E	3	U	1957	75	2	2085	2054	--	--	W	P
LI-127	S 35 T 6S R 3E	2	M	1960	40	3	1884	1854	--	--	W	P
LI-128	S 38 T 6S R 5E	2	M	1962	47	2	1658	1598	--	--	W	H
LI-129	S 13 T 6S R 5E	2	M	1962	53	2	1616	1596	--	--	W	H
LI-131	S 2 T 6S R 6E	2	M	--	56	--	1700	--	--	--	W	H
LI-132	S 11 T 6S R 6E	2	U	1962	50	2.5	1360	1320	--	--	W	H
LI-137	S 39 T 6S R 6E	2	U	1964	37	2.8	1836	1806	--	--	W	H
LI-138B	S 9 T 6S R 3E	2	M	1967	68	3	1661	1621	--	--	W	P
LI-142	S 37 T 6S R 6E	1	L	1961	35	2	1300	1280	--	--	W	C
LI-143	S 27 T 5S R 6E	S	L	--	63	2	114	104	--	--	U	U
LI-144	S 39 T 6S R 6E	2	M	1969	37	3	1731	1701	120	--	W	H
LI-148	S 23 T 6S R 6E	S	L	--	42	2	51	45	--	--	U	U
LI-149	S 42 T 7S R 6E	2	M	1970	15	.8	1898	1779	1900	1970	W	S
LI-151	S 36 T 6S R 3E	3	U	1972	34	2	2570	2560	--	--	T	U
LI-152	S 36 T 6S R 3E	1	L	1972	35	2	1420	1410	33	1972	T	U
LI-153	S 59 T 6S R 2E	2	L	1972	52	2	2165	2145	21	1972	T	U
LI-154	S 59 T 6S R 2E	2	U	1972	48	2	1525	1515	23	1972	T	U
LI-155	S 59 T 6S R 2E	1	L	1972	46	2	1255	1245	23	1972	T	U
LI-156	S 37 T 7S R 3E	2	M	1968	36	6	1755	1695	600	1968	W	P
LI-157	S 37 T 6S R 6E	2	L	1972	30	3	2230	2200	138	1972	W	P
LI-159	S 10 T 6S R 6E	2	U	1973	53	2	1490	1480	37	1973	W	H
LI-160	S 10 T 6S R 6E	1	L	1973	53	2	1285	1275	30	1973	T	U
LI-161	S 16 T 7S R 3E	S	L	1973	35	2	380	365	--	--	W	H
LI-162	S 59 T 6S R 2E	3	U	1973	46	9.6	2505	2405	1330	1973	W	P
LI-163	S 34 T 6S R 4E	2	L	1973	35	--	2068	--	--	--	W	P

TABLE 10.--RECORDS OF SELECTED WATER WELLS IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION SEC. T. R.	AQUIFER UNIT	SAND BED	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (FEET)	CASING DIAMETER (INCHES)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	DISCHARGE (GALLONS PER MINUTE)	DATE DISCHARGE MEASURED	USE OF SITE	USE OF WATER
LIVINGSTON PARISH--CONTINUED												
LI-164	S 24 T 7S R 4E	S	U	1967	21	2	315	--	--	--	W	H
LI-165	S 35 T 7S R 4E	1	U	1959	26	2.5	1092	1072	--	--	W	H
LI-166	S 2 T 7S R 5E	S	L	1973	35	4	620	600	--	--	W	P
LI-167	S 41 T 6S R 5E	S	L	1973	34	4	620	600	--	--	W	P
LI-168	S 25 T 6S R 4E	S	L	1971	42	2	235	--	--	--	W	H
LI-169	S 39 T 5S R 6E	S	L	1973	85	4	260	245	--	--	W	P
LI-170A	S 35 T 7S R 4E	1	U	1975	11	2	1068	1058	20	1975	T	U
LI-170B	S 35 T 7S R 4E	S	L	1975	11	2	610	600	30	1975	T	U
LI-170C	S 35 T 7S R 4E	S	U	1975	11	2	310	300	30	1975	T	U
LI-171	S 36 T 5S R 5E	S	L	1975	60	2	275	265	20	1975	T	U
LI-172A	S 36 T 6S R 4E	S	L	1975	33	2	495	485	29	1975	T	U
LI-172B	S 36 T 6S R 4E	S	L	1975	33	2	290	280	43	1975	W	P
LI-173	S 41 T 7S R 3E	S	L	--	35	6	631	--	--	--	W	P
LI-174	S 11 T 9S R 4E	S	U	1976	4	2	441	431	--	--	W	H
LI-175	S 22 T 6S R 3E	2	M	1974	50	4	1866	1816	--	--	W	P
LI-176A	S 40 T 6S R 6E	1	L	1978	40	4	1333	1313	17	1978	T	U
LI-176B	S 40 T 6S R 6E	S	L	1978	40	4	560	540	50	1978	T	U
LI-177	S 28 T 6S R 6E	2	M	1970	35	4	1777	--	60	1978	W	H
LI-178	S 27 T 6S R 6E	2	M	1971	40	6	1900	--	60	1978	W	H
LI-179	S 27 T 6S R 6E	2	L	1956	40	4	2021	1981	10	1978	W	H
LI-181	S 48 T 6S R 3E	3	U	1978	45	8	2432	2340	800	1978	W	P
LI-183	S 10 T 6S R 6E			1973	53	3	1285	1245	--	--	W	P
LI-184A	S 40 T 6S R 6E	3	L	1979	40	2	2930	2910	32	1979	T	U
LI-184B	S 40 T 6S R 6E	3	U	1979	40	2.4	2459	2449	30	1979	T	U
LI-185	S 38 T 7S R 3E	3	U	1980	37	8	2611	2531	805	--	W	P
LI-186A	S 40 T 6S R 6E	2	M	1979	40	--	1670	1660	38	1979	T	U
LI-186B	S 40 T 6S R 6E	1	U,L	1979	40	2.4	1039	1029	22	1979	T	U
LI-189	S 11 T 5S R 6E	3	U	1979	84	2.4	2340	2320	20	1979	T	U
LI-190	S 11 T 5S R 6E	3	U	1979	84	2	2155	2135	21	1979	T	U
LI-193	S 40 T 6S R 6E	2	M	1979	36	6	1701	1647	569	--	W	P

LI-195	S 27 T 5S R 3E	2	U	--	73	4	1280	--	--	--	W	H
LI-196	S 36 T 7S R 4E	1	U	1983	25	4	1065	1015	151	1983	W	P
LI-197	S 14 T 5S R 3E	S	L	1981	80	4	300	280	50	1981	W	P
LI-198	S 3 T 7S R 4E	S	L	--	35	4	600	--	--	--	W	P
LI-199	S 24 T 6S R 4E	2	L	1983	40	8	1900	1800	750	1983	W	P
LI-202	S 42 T 7S R 6E	S	U	1984	15	4	347	317	--	--	W	I
LI-204B	S 4 T 6S R 3E	3	U	1984	60	--	2347	2307	--	--	T	U
LI-204C	S 4 T 6S R 3E	2	L	1984	60	--	1830	1790	--	--	T	U
LI-205	S 20 T 8S R 5E	S	U	1962	20	2	330	--	--	--	U	U
LI-209	S 9 T 6S R 3E	S	L	1974	59	2	305	290	--	--	W	H
LI-212	S 31 T 7S R 4E	S	--	--	25	4	--	--	--	--	W	P
LI-217	S 18 T 7S R 5E	S	U	1984	24	2	130	120	--	--	W	H

ST. HELENA PARISH

SH- 5	S 59 T 2S R 5E	3	U	1954	220	4	1683	1633	300	--	W	P
SH- 7	S 51 T 4S R 6E	3	U	1955	124	2.5	2082	2052	60	--	W	P
SH- 8	S 36 T 4S R 5E	3	U	1956	98	6	2120	2059	1200	--	W	N
SH- 9	S 73 T 2S R 4E	3	L	1960	165	2.5	2135	2106	70	--	W	H,S
SH-11	S 77 T 1S R 4E	S	L	--	242	8	25	--	--	--	W	H
SH-12	S 3 T 1S R 5E	S	L	--	262	4	52	47	--	--	W	H
SH-16	S 10 T 4S R 6E	S	L	--	165	4	165	--	--	--	W	T
SH-18	S 28 T 3S R 6E	3	U	1954	205	2.5	1963	1931	--	--	W	T
SH-19	S 4 T 1S R 5E	S	L	1958	318	8	170	150	200	1958	W	N
SH-21	S 34 T 2S R 5E	3	U	1967	250	3	1608	1568	--	--	W	P
SH-22	S 35 T 2S R 6E	S	L	--	253	4	170	160	--	--	W	H
SH-23	S 15 T 1S R 6E	S	L	--	330	8	74	--	--	--	W	H
SH-25	S 14 T 2S R 6E	S	L	--	268	4	118	108	--	--	W	D
SH-27	S 21 T 3S R 6E	S	L	1960	210	4	165	157	--	--	W	H
SH-28	S 27 T 3S R 6E	S	L	1962	183	4	116	106	12	--	W	H
SH-29	S 34 T 2S R 6E	S	L	--	270	4	150	140	--	--	U	U
SH-30	S 12 T 4S R 4E	3	U	1969	155	1.9	1865	1855	23	--	T	U
SH-31	S 33 T 3S R 6E	S	L	--	213	4	170	160	--	--	W	H
SH-32A	S 77 T 2S R 4E	3	--	1970	205	2	2390	2380	35	--	T	U
SH-32B	S 77 T 2S R 4E	3	L	1970	205	4	2013	1993	54	--	T	U
SH-33A	S 45 T 4S R 4E	3	U	1973	146	2	2155	2145	20	--	T	U
SH-33B	S 45 T 4S R 4E	2	L	1973	146	2	1590	1575	27	--	T	U
SH-34A	S 45 T 4S R 4E	2	L	1973	146	2	1320	1305	25	--	T	U
SH-34B	S 45 T 4S R 4E	3	U	1973	146	2	1805	1775	25	--	W	P
SH-35	S 59 T 2S R 5E	3	--	1973	200	2	2495	2485	17	--	T	U

TABLE 10.--RECORDS OF SELECTED WATER WELLS IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION SEC. T. R.	AQUIFER UNIT	SAND BED	YEAR COMPLETED	ALTITUDE OF LAND SURFACE (FEET)	CASING DIAM-ETER (INCHES)	DEPTH OF WELL (FEET)	DEPTH TO FIRST OPENING (FEET)	DISCHARGE (GALLONS PER MINUTE)	DATE DISCHARGE MEASURED	USE OF SITE	USE OF WATER
					ST. HELENA PARISH--CONTINUED							
SH-36	S 59 T 2S R 5E	3	U	1973	200	2	1595	1585	20	--	T	U
SH-37	S 35 T 2S R 6E	S	L	1967	245	4	175	158	--	--	W	S
SH-39	S 61 T 4S R 4E	3	U	1977	130	2	1870	1850	--	--	W	P
SH-40	S 43 T 4S R 5E	3	U	1980	131	6	2067	--	--	--	W	P
SH-41	S 17 T 4S R 5E	2	L	1980	160	2	1600	1570	--	--	W	H
SH-42	S 13 T 3S R 5E	S	L	1983	180	--	150	110	85	--	W	N
SH-44	S 12 T 4S R 4E	3	U	1970	151.86	--	1865	--	--	--	W	P
SH-45	S 48 T 4S R 6E	S	L	--	99	4	50	--	--	--	W	H
SH-46	S 41 T 3S R 4E	S	L	--	185	4	120	--	--	--	W	D
SH-47	S 49 T 3S R 5E	S	L	--	192	4	110	--	--	--	W	H
SH-48	S 43 T 1S R 4E	S	L	--	245	--	--	--	--	--	W	H
SH-49	S 51 T 1S R 5E	S	L	--	240	4	30	--	--	--	W	H
SH-50	S 37 T 4S R 5E	S	L	--	152	4	210	--	--	--	W	D
SH-52	S 69 T 4S R 4E	S	L	--	142	4	100	85	--	--	W	H
SH-53	S 37 T 2S R 4E	S	L	--	170	8	25	--	--	--	W	H
SH-54	S 57 T 2S R 5E	S	L	1984	235	4	100	--	--	--	W	H
SH-55	S 50 T 3S R 4E	S	L	1984	120	4	180	165	--	--	W	H
SH-56	S 50 T 4S R 3E	S	L	1984	77	4	160	145	--	--	W	H
SH-57	S 45 T 4S R 4E	S	L	1957	114	4	45	--	--	--	W	H
SH-58	S 54 T 2S R 5E	S	L	--	242	4	130	--	--	--	W	H
SH-59	S 1 T 3S R 4E	S	L	1981	268	4	114	99	--	--	W	H
SH-60	S 27 T 1S R 6E	S	L	--	291	4	100	--	--	--	W	D
SH-61	S 48 T 2S R 4E	S	L	1958	160	10	50	--	--	--	W	H
SH-62	S 37 T 2S R 5E	S	L	--	287	10	84	--	--	--	U	U
SH-63	S 68 T 1S R 4E	S	L	--	200	10	20	20	--	--	W	H
SH-65	S 33 T 3S R 6E	3	U	1984	197	12	2012	1942	--	--	W	P
SH-66	S 77 T 2S R 4E	3	L	1985	205	6	2000	--	--	--	W	P

TABLE 11.--SELECTED COMMON CONSTITUENTS IN GROUND WATER IN LIVINGSTON AND ST. HELENA PARISHES

[SAND BED: U, UPPER; M, MIDDLE; L, LOWER. L, LABORATORY MEASUREMENT SUBSTITUTED FOR FIELD MEASUREMENT; µS, MICROSIEMENS PER CENTIMETER AT 25 °C; °C, DEGREES CELSIUS; MG/L, MILLIGRAMS PER LITER; µG/L, MICROGRAMS PER LITER; ALTITUDE IS REFERENCED TO SEA LEVEL]

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	SAND BED	DEPTH OF WELL (FEET)	ALTITUDE OF LAND SURFACE (FEET)	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (µS)	FIELD PH (STAND-ARD UNITS)	TEMPER-ATURE ATURE (DEG °C)	COLOR (PLAT-INUM-COBALT UNITS)	HARD-NESS (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
							SHALLOW AQUIFER UNIT						
LI-85	9S	5E	16	U	405	5	84-05-30	624	8.3	23.5	2	63	16
LI-170C	7S	4E	35	U	310	11	75-02-18	222	7.0	21.0	40	50	15
LI-174	9S	4E	11	U	441	4	76-08-31	298	7.6	22.0	5	20	7.7
LI-202	7S	6E	42	U	347	15	84-12-18	173	6.4	20.5	30	31	9.0
LI-217	7S	5E	18	U	130	24	84-12-18	311	7.5	--	0	56	15
SH-12	1S	5E	3	L	52	262	84-03-14	22	5.6 L	19.5	20	4	.95
SH-16	4S	6E	10	L	165	165	84-03-20	45	5.4 L	21.5	15	8	1.8
SH-19	1S	5E	4	L	170	318	67-01-17	23	5.4	20.0	10	4	1.1
SH-22	2S	6E	35	L	170	253	69-11-25	32	5.6	20.5	5	7	1.7
SH-25	2S	6E	14	L	118	268	84-05-21	28	5.2	22.5	10	5	1.2
SH-37	2S	6E	35	L	175		75-07-02	31	5.6	21.0	4	6	1.5
SH-47	3S	5E	49	L	110	192	84-05-21	55	5.2	24.0	5	6	1.4
SH-52	4S	4E	69	L	100	142	84-05-21	49	5.1	23.0	5	7	1.8
LI-161	7S	3E	16	L	380	35	74-04-05	224	6.7	20.5	0	60	16
LI-166	7S	5E	2	L	620	35	74-03-05	231	8.2	--	0	19	5.3
LI-167	6S	5E	41	L	620	34	84-05-30	246	7.3	23.5	15	8	2.3
LI-169	5S	6E	39	L	260	85	74-03-07	61	6.1	--	0	13	4.2
				L	260	85	84-05-24	56	6.2	21.0	5	13	3.2
LI-170B	7S	4E	35	L	610	11	75-02-13	240	7.2	23.0	20	49	14
LI-171	5S	5E	36	L	275	60	75-03-20	113	5.9	20.0	0	27	7.0
LI-172A	6S	4E	36	L	495	33	75-09-17	169	6.5	21.5	4	33	10
LI-172B	6S	4E	36	L	290	33	75-09-22	163	6.2	20.5	0	31	9.2
LI-173	7S	3E	41	L	631	35	76-03-24	237	7.0	23.0	0	44	10
				L	631	35	76-07-23	234	6.8	23.0	5	50	15
LI-176B	6S	6E	40	L	560	40	78-09-26	146	6.4	24.0	5	31	9.8
LI-197	5S	3E	14	L	300	80	84-03-22	56	5.9	20.5	5	14	3.3
LI-198	7S	4E	3	L	--	35	84-05-30	188	6.7	22.5	15	37	11

TABLE 11.--SELECTED COMMON CONSTITUENTS IN GROUND WATER IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	SAND BED	DEPTH OF WELL (FEET)	ALTITUDE OF LAND SURFACE (FEET)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (µS)	FIELD PH (STANDARD UNITS)	TEMPERATURE (DEG °C)	COLOR (PLATINUM-COBALT UNITS)	HARDNESS (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
							AQUIFER UNIT 1						
LI-165	7S	4E	35	U	1090	26	74-03-05	276	8.0	--	--	5	--
LI-170A	7S	4E	35	U	1060	11	75-02-03	284	8.1	25.0	0	17	4.0
LI-186B	6S	6E	40	U/L	1030	40	79-06-15	191	6.7	25.0	5	24	5.2
LI-196	7S	4E	35	U	1060	25	84-03-28	298	8.5	25.0	8	7	1.9
LI-93	6S	6E	23	L	1380	42	65-08 24	178	6.9	26.5	10	9	3.0
LI-152	6S	3E	36	L	1420	35	72-02-23	258	8.0	25.5	5	4	1.1
LI-155	6S	2E	59	L	1250	46	72-03-23	232	7.2	25.5	5	16	5.6
LI-160	6S	6E	10	L	1280	53	73-06-01	181	7.0	25.5	5	8	2.4
LI-176A	6S	6E	40	L	1330	40	78-09-11	212	6.9	27.0	5	10	3.0

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY FIELD (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NITRATE TOTAL (MG/L AS NO3)	IRON, DISSOLVED (µG/L AS FE)	MANGANESE, DISSOLVED (µG/L AS MN)	CARBON, ORGANIC TOTAL (MG/L AS C)
								SHALLOW AQUIFER UNIT--CONTINUED									
LI-85	9S	5E	16	84-05-30	5.5	91	1.4	132	3.7	97	.10	46	340	--	78	140	.40
LI-170C	7S	4E	35	75-02-18	3.1	26	3.2	97	4.6	8.0	.10	34	150	.19	2100	460	--
LI-174	9S	4E	11	76-08-31	.20	61	1.8	136	3.0	10	.20	43	210	.03	360	120	--
LI-202	7S	6E	42	84-12-18	2.0	22	3.8	69	5.2	6.5	.20	57	150	--	2000	280	--
LI-217	7S	5E	18	84-12-18	4.5	48	1.9	147	.8	6.4	.10	25	190	.31	130	140	1.1
SH-12	1S	5E	3	84-03-14	.45	3.0	.40	--	2.2	3.4	<.10	9.9	24	--	--	2	.40
SH-16	4S	6E	10	84-03-20	.77	5.8	.60	--	.4	5.0	<.10	12	35	--	7	<1	.20
SH-19	1S	5E	4	67-01-17	.30	3.9	.10	--	.4	3.9	.00	10	24	--	0	--	--
SH-22	2S	6E	35	69-11-25	.70	4.5	.50	10	.0	3.9	.00	12	29	.10	50	30	--
SH-25	2S	6E	14	84-05-21	.53	3.1	.30	4	<.2	3.9	<.10	10	--	--	4	<1	<.10

SH-37	2S	6E	35	75-07-02	.60	3.6	.40	10	1.3	4.1	<.10	11	28	.13	<10	20	--
SH-47	3S	5E	49	84-05-21	.49	8.5	.20	6	.3	8.5	<.10	11	34	--	7	5	<.10
SH-52	4S	4E	69	84-05-21	.69	5.8	.60	6	<.2	10	<.10	12	--	--	7	1	<.10
LI-161	7S	3E	16	74-04-05	4.9	22	3.3	94	3.0	10	.10	51	170	.00	250	210	--
LI-166	7S	5E	2	74-03-05	1.4	47	3.2	112	6.2	3.0	.20	15	150	.10	<10	20	--
LI-167	6S	5E	41	84-05-30	.64	49	1.5	107	9.8	3.8	.10	50	180	--	970	77	.20
LI-169	5S	6E	39	74-03-07	.60	4.0	1.7	21	<1.0	2.6	<.10	20	45	.10	20	3	--
				84-05-24	1.1	5.3	1.6	20	.8	4.7	<.10	19	48	--	13	2	<.10
LI-170B	7S	4E	35	75-02-13	3.4	33	2.5	105	6.2	5.8	.10	51	180	.06	770	470	--
LI-171	5S	5E	36	75-03-20	2.3	10	2.8	37	2.0	9.6	<.10	34	90	.02	80	<10	--
LI-172A	6S	4E	36	75-09-17	2.0	21	3.4	70	6.9	5.1	<.10	65	160	.00	200	<10	--
LI-172B	6S	4E	36	75-09-22	1.9	24	2.4	71	2.4	4.9	.10	59	150	.02	200	200	--
LI-173	7S	3E	41	76-03-24	4.6	34	3.6	107	7.2	6.4	.10	56	190	.00	540	560	--
				76-07-23	3.1	34	2.7	100	8.4	6.0	.20	48	180	.22	510	540	--
LI-176B	6S	6E	40	78-09-26	1.6	17	4.7	58	2.4	7.8	.30	58	140	.31	780	100	--
LI-197	5S	3E	14	84-03-22	1.3	6.7	1.7	21	2.9	6.3	<.10	20	55	--	16	7	.30
LI-198	7S	4E	3	84-05-30	2.3	21	3.0	73	6.4	6.7	.10	58	150	--	1200	21	.20

AQUIFER UNIT 1--CONTINUED

LI-165	7S	4E	35	74-03-05	--	--	--	--	--	5.0	--	--	--	--	<10	25	--
LI-170A	7S	4E	35	75-02-03	1.7	62	.70	134	9.6	2.6	.20	32	190	.00	20	<10	--
LI-186B	6S	6E	40	79-06-15	2.7	31	2.6	82	1.8	4.2	.20	58	160	.10	820	190	--
LI-196	7S	4E	35	84-03-28	.59	68	.60	147	11	3.2	.20	37	210	--	35	17	.10
LI-93					.40	31	1.6	70	2.8	3.8	.20	67	150	.22	80	30	--
LI-152	6S	3E	36	72-02-23	.30	64	1.1	130	8.8	4.1	.20	43	200	.00	210	60	--
LI-155	6S	2E	59	72-03-23	.50	52	1.2	112	10	4.1	.30	51	190	.00	570	250	--
LI-160	6S	6E	10	73-06-01	.50	42	1.1	82	10	4.4	.20	63	170	.00	220	20	--
LI-176A	6S	6E	40	78-09-11	.60	44	1.9	93	8.8	3.1	.10	56	170	.50	900	60	--

TABLE 11.--SELECTED COMMON CONSTITUENTS IN GROUND WATER IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	SAND BED	DEPTH OF WELL (FEET)	ALTITUDE OF LAND SURFACE (FEET)	DATE OF SAMPLE	SPECIFIC CONDUCTANCE (µS)	FIELD PH (STANDARD UNITS)	TEMPERATURE (DEG °C)	COLOR (PLATINUM-COBALT UNITS)	HARDNESS (MG/L AS CACO3)	CALCIUM DISSOLVED (MG/L AS CA)
							AQUIFER UNIT 2						
LI-24	6S	4E	30	U	1300	47	67-02-16	272	8.4	--	5	0	.20
LI-132	6S	6E	11	U	1360	50	69-11-25	264	7.8	25.0	5	4	1.0
LI-154	6S	2E	59	U	1520	48	72-03-16	266	8.6	26.5	5	3	.50
LI-53	6S	3E	45	M	1710	46	71-09-02	251	7.8	31.0	0	0	.40
LI-57	6S	3E	25	M	1900	46	68-06-19	253	8.4	29.5	5	3	.60
LI-58	6S	6E	40	M	1900	46	71-10-18	--	8.4	29.0	--	--	--
				M	1910	40	60-02-04	241	8.6	30.5	0	3	.80
				M	1910	40	78-10-31	245	7.9	31.0	--	0	--
LI-80	5S	3E	49	M	1490	66	84-12-12	244	7.9	27.0	0	2	.60
LI-89	6S	3E	12	M	1620	58	83-08-10	222	7.2	29.0	17	2	.36
LI-94	6S	5E	39	M	1730	40	65-08-24	237	7.1	26.5	10	19	5.4
LI-117	7S	5E	16	M	2000	20	84-04-04	263	8.6	29.5	15	4	1.4
LI-127	6S	3E	35	M	1880	40	68-01-19	261	7.8	--	5	0	.00
LI-131	6S	6E	2	M	1700	56	69-11-25	154	7.2	--	70	24	8.3
LI-144	6S	6E	39	M	1730	37	69-08-29	279	8.5	31.0	0	0	.20
LI-156	7S	3E	37	M	1750	36	72-05-04	274	8.5	--	10	4	1.5
LI-159	6S	6E	10	M	1490	53	73-05-29	192	7.1	27.0	5	32	10
LI-175	6S	3E	22	M	1860	50	76-09-20	267	8.6	29.5	5	0	.20
LI-178	6S	6E	27	M	1900	40	78-10-31	263	8.0	28.0	0	0	<.10
LI-186A	6S	6E	40	M	1670	40	79-06-07	264	8.3	28.0	10	0	<.10
LI-193	6S	6E	40	M	1700	36	79-10-09	--	8.4	--	2	0	.20
				M	1700	36	84-09-07	263	8.2	--	0	3	1.0
SH-33B	4S	4E	45	L	1590	146	73-03-19	138	6.3	26.5	5	19	5.8
SH-34A	4S	4E	45	L	1320	146	73-03-06	137	6.3	25.5	8	25	7.0
				L	1320	146	73-03-23	137	6.2	25.5	8	25	7.0

LI-54	7S	6E	2	L	2140	33	66-12-13	227	7.7	29.0	5	9	3.1
LI-73	6S	5E	30	L	1920	40	60-01-26	213	7.8	28.0	5	14	4.3
				L	1920	40	68-07-09	214	8.1	28.0	5	14	4.6
				L	1920	40	84-09-07	211	7.3	29.5	0	20	7.0
				L	1920	40	84-12-12	218	7.2	29.5	5	13	4.2
LI-88	8S	4E	40	L	2710	15	62-09-07	341	8.4	--	5	4	.80
LI-92	6S	3E	48	L	2100	51	67-02-23	--	7.8	--	2	12	--
				L	2100	51	68-06-19	237	7.9	30.5	5	12	2.7
LI-100	8S	4E	58	L	2640	7	68-06-25	312	8.9	35.5	5	4	1.5
LI-102	6S	4E	30	L	2240	48	66-09-21	261	7.6	--	5	0	.20
LI-111	6S	4E	18	L	2170	52	66-11-22	261	7.5	--	5	2	.70
LI-125	6S	4E	24	L	1840	41	66-12-13	246	8.4	--	10	0	.00
LI-153	6S	2E	59	L	2160	48	72-03-13	240	7.9	30.0	5	7	2.4
LI-163	6S	4E	34	L	2060	35	74-03-05	252	8.0	--	0	5	1.5
LI-199	6S	4E	24	L	1900	40	84-12-12	245	7.6	29.0	0	8	2.2
LI-204C	6S	3E	4	L	1830	60	84-10-05	234	7.8	28.5	0	14	4.6

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	MAGNESIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY FIELD (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTI-TUENTS, DIS-SOLVED (MG/L)	NITRO-GEN, NITRATE TOTAL (MG/L AS NO3)	IRON, DIS-SOLVED (µG/L AS FE)	MANGA-NESE, DIS-SOLVED (µG/L AS MN)	CARBON, ORGANIC TOTAL (MG/L AS C)
AQUIFER UNIT 2--CONTINUED																	
LI-24	6S	4E	30	67-02-16	.10	63	.30	125	8.4	6.0	.30	43	200	--	20	--	--
LI-132	6S	6E	11	69-11-25	.40	63	1.2	129	8.6	3.7	.40	45	200	.20	170	20	--
LI-154	6S	2E	59	72-03-16	.40	67	.20	131	9.4	4.0	.30	42	210	.00	360	20	--
LI-53	6S	3E	45	71-09-02	.00	62	.30	120	8.2	3.3	.20	52	200	.10	760	100	--
LI-57	6S	3E	25	68-06-19	.40	61	.30	122	9.4	4.8	.30	69	220	--	150	--	--
				71-10-18	--	--	--	--	--	--	--	--	--	--	80	100	--
LI-58	6S	6E	40	60-02-04	.20	60	.60	110	19	4.6	.40	35	190	--	--	--	--
				78-10-31	--	--	--	--	--	3.0	--	--	--	--	20	--	--
LI-80	5S	3E	49	84-12-12	.02	55	.30	108	8.2	3.7	.30	47	180	.01	30	4	.20
LI-89	6S	3E	12	83-08-10	.16	54	.60	106	8.8	4.0	.30	66	200	--	80	13	--
LI-94	6S	5E	39	65-08-24	1.3	41	1.5	102	6.8	3.6	.10	50	170	--	430	30	--
LI-117	7S	5E	16	84-04-04	.11	60	.60	125	10	3.2	.20	29	180	--	7	23	.60
LI-127	6S	3E	35	68-01-19	.00	61	.20	121	8.6	3.7	.30	53	200	--	60	--	--
LI-131	6S	6E	2	69-11-25	.80	26	2.9	70	6.6	4.2	.20	62	160	.10	5600	270	--
LI-144	6S	6E	39	69-08-29	.10	70	.80	134	14	1.7	.20	27	200	.00	80	60	--

TABLE 11.--SELECTED COMMON CONSTITUENTS IN GROUND WATER IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY FIELD (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NITRATE TOTAL (MG/L AS NO3)	IRON, DISSOLVED (µG/L AS FE)	MANGANESE, DISSOLVED (µG/L AS MN)	CARBON, ORGANIC TOTAL (MG/L AS C)
								AQUIFER UNIT 2--CONTINUED									
LI-156	7S	3E	37	72-05-04	.10	66	.60	138	9.6	4.4	.10	23	190	.00	10	20	--
LI-159	6S	6E	10	73-05-29	1.7	32	2.5	89	11	5.2	.20	56	170	.20	1200	950	--
LI-175	6S	3E	22	76-09-20	.10	73	.30	140	9.0	4.1	<.10	54	230	.00	<10	<10	--
LI-178	6S	6E	27	78-10-31	<.10	60	.60	123	11	1.0	.20	34	180	.19	70	30	--
LI-186A	6S	6E	40	79-06-07	<.10	60	.40	115	12	1.0	.20	32	180	.08	40	20	--
LI-193	6S	6E	40	79-10-09	.04	61	--	120	10	1.9	.20	30	180	--	120	--	--
				84-09-07	.10	63	.20	--	11	2.0	.30	32	180	.09	20	16	.10
SH-33B	4S	4E	45	73-03-19	1.1	23	1.7	57	8.2	3.8	.20	63	140	.00	1000	240	--
SH-34A	4S	4E	45	73-03-06	1.8	19	2.5	59	7.2	3.7	.20	58	140	.00	740	220	--
				73-03-23	1.8	19	2.5	59	7.2	3.7	.20	58	140	.00	740	220	--
LI-54	7S	6E	2	66-12-13	.30	49	2.3	103	8.8	4.1	.10	45	170	--	200	--	--
LI-73	6S	5E	30	60-01-26	.80	42	1.3	98	.8	4.4	.40	50	160	--	--	--	--
				68-07-09	.60	46	1.0	99	8.6	3.4	.20	58	180	--	310	--	--
				84-09-07	.70	44	1.3	--	7.6	3.8	.30	62	190	.12	880	260	.30
				84-12-12	.60	45	1.8	95	7.8	3.8	.20	56	180	.03	750	230	.10
LI-88	8S	4E	40	62-09-07	.50	80	.80	162	10	4.0	.20	18	220	--	--	--	--
LI-92	6S	3E	48	67-02-23	--	52	.90	94	--	7.3	.20	--	190	--	0	250	--
				68-06-19	1.3	54	.80	115	7.2	3.8	.20	40	180	--	150	--	--
LI-100	8S	4E	58	68-06-25	.10	76	.40	154	11	3.8	.20	21	210	--	40	--	--
LI-102	6S	4E	30	66-09-21	.10	61	.40	120	12	3.6	.40	47	200	--	570	--	--
LI-111	6S	4E	18	66-11-22	.10	61	.40	--	10	4.7	.40	51	200	--	240	--	--
LI-125	6S	4E	24	66-12-13	.00	56	11	114	10	4.4	.10	38	190	--	910	--	--
LI-153	6S	2E	59	72-03-13	.20	59	.80	122	6.8	4.2	.40	41	190	.00	430	200	--
LI-163	6S	4E	34	74-03-05	.30	58	.40	121	8.6	2.0	.20	49	190	.10	60	90	--
LI-199	6S	4E	24	84-12-12	.50	51	1.4	109	9.0	3.5	.20	55	190	.01	160	250	.10
LI-204C	6S	3E	4	84-10-05	.60	50	1.5	110	6.6	3.8	.30	51	180	.08	90	210	--

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	SAND BED	DEPTH OF WELL (FEET)	ALTITUDE OF LAND SURFACE (FEET)	DATE OF SAMPLE	SPE-CIFIC CON-DUCT-ANCE (µS)	FIELD PH (STAND-ARD UNITS)	TEMPER-ATURE ATURE (DEG °C)	COLOR (PLAT-INUM-COBALT UNITS)	HARD-NESS (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
							AQUIFER UNIT 3						
SH-5	2S	5E	59	U	1680	220	68-06-20	279	8.8	28.0	5	0	.00
				U	1680	220	83-08-10	276	8.2	29.5	20	3	.91
SH-7	4S	6E	51	U	2080	124	78-10-25	337	8.9	30.0	0	2	.30
SH-18	3S	6E	28	U	1960	205	67-01-11	330	9.4	25.0	10	5	1.0
				U	1960	205	84-03-22	408	9.3	26.5	16	2	.79
SH-21	2S	5E	34	U	1600	250	67-12-05	--	7.9	--	10	0	--
				U	1600	250	84-03-21	301	8.6	26.5	9	1	.28
SH-30	4S	4E	12	U	1860	155	69-12-20	448	9.0	26.5	5	2	.70
SH-33A	4S	4E	45	U	2150	146	73-03-06	1420	8.6	29.0	20	4	1.5
SH-34B	4S	4E	45	U	1800	146	73-03-29	386	8.7	27.0	5	4	1.0
				U	1800	146	84-03-22	454	8.9	28.0	14	3	1.0
SH-36	2S	5E	59	U	1590	200	73-05-21	279	9.0	26.5	10	4	1.6
SH-44	4S	4E	12	U	1220	152	84-03-20	423	8.3	23.0	30	0	.20
LI-46B	6S	3E	45	U	2520	50	72-05-04	257	8.3	--	0	8	3.2
LI-56	7S	2E	68	U	2610	39	72-05-04	318	8.6	--	0	2	1.0
LI-151	6S	3E	36	U	2570	35	72-02-04	205	7.2	--	5	17	5.0
LI-184B	6S	6E	40	U	2450	40	79-05-29	218	7.8	32.0	10	0	<.10
LI-185	7S	3E	38	U	2610	37	84-09-07	265	8.6	31.0	0	10	4.0
LI-189	5S	6E	11	U	2340	84	79-10-02	261	8.5	29.0	0	4	1.0
LI-190	5S	6E	11	U	2150	84	79-10-17	234	8.3	28.0	0	12	3.5
LI-192	5S	6E	11	U	2150	84	80-04-28	227	--	--	0	13	5.0
				U	2150	84	80-05-05	--	--	31.5	--	--	--
LI-204B	6S	3E	4	U	2600	60	84-08-17	--	7.4	31.0	--	9	2.6
				U	2600	60	84-08-23	--	7.5	31.0	--	10	3.2
SH-9	2S	4E	73	L	2130	165	60-06-28	430	8.0	28.5	30	4	--
				L	2130	165	61-06-16	416	7.7	28.5	20	4	1.3
SH-32B	2S	4E	77	L	2010	205	70-09-15	367	8.2	--	10	3	1.2
LI-91	6S	3E	32	L	3080	44	64-03-23	866	8.7	35.5	70	3	1.0
LI-184A	6S	6E	40	L	2930	40	79-05-21	515	9.1	33.5	10	0	<.10

TABLE 11.--SELECTED COMMON CONSTITUENTS IN GROUND WATER IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	POTASSIUM, DISSOLVED (MG/L AS K)	ALKALINITY FIELD (MG/L AS CACO3)	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	NITROGEN, NITRATE TOTAL (MG/L AS NO3)	IRON, DISSOLVED (µG/L AS FE)	MANGANESE, DISSOLVED (µG/L AS MN)	CARBON, ORGANIC TOTAL (MG/L AS C)
AQUIFER UNIT 3--CONTINUED																	
SH-5	2S	5E	59	68-06-20	.00	69	.20	141	8.8	2.2	.30	26	190	--	--	--	--
				83-08-10	.07	68	.30	141	8.4	2.1	.50	32	200	--	20	3	--
SH-7	4S	6E	51	78-10-25	.30	78	.50	158	6.4	1.6	.40	24	210	.30	20	<10	--
SH-18	3S	6E	28	67-01-11	.60	89	.50	--	11	2.5	.50	26	240	--	30	--	--
				84-03-22	.09	94	.30	203	12	4.0	.50	25	260	--	4	2	1.1
SH-21	2S	5E	34	67-12-05	--	69	.60	138	--	5.1	.60	--	--	--	20	0	--
				84-03-21	.12	71	.30	150	8.8	3.8	.40	31	210	--	13	9	.50
SH-30	4S	4E	12	69-12-20	.10	110	.60	--	9.4	3.8	.50	19	300	.00	190	350	--
SH-33A	4S	4E	45	73-03-06	.10	380	.90	812	6.2	4.2	3.6	21	930	.10	70	<10	--
SH-34B	4S	4E	45	73-03-29	.40	94	.90	194	8.4	4.9	.60	28	250	.00	70	<10	--
				84-03-22	.18	110	.60	236	8.0	3.8	.80	24	290	--	9	11	.90
SH-36	2S	5E	59	73-05-21	<.10	66	.20	14	8.2	2.2	.30	31	200	.10	80	<10	--
SH-44	4S	4E	12	84-03-20	.03	99	.30	201	11	4.5	.40	19	260	--	16	5	.70
LI-46B	6S	3E	45	72-05-04	.00	62	.80	130	9.2	4.3	.10	37	190	.00	10	40	--
LI-56	7S	2E	68	72-05-04	.00	82	.50	167	10	3.4	.20	23	230	.00	40	20	--
LI-151	6S	3E	36	72-02-84	1.1	41	2.5	97	8.2	3.7	.20	69	190	.00	920	220	--
LI-184B	6S	6E	40	79-05-29	<.10	50	.40	98	6.6	2.2	.30	74	190	.06	470	<10	--
LI-185	7S	3E	38	84-09-07	.10	62	.50	--	8.2	5.0	.30	31	190	.16	10	30	.20
LI-189	5S	6E	11	79-10-02	.40	60	.60	128	8.4	2.9	.00	34	190	.05	70	0	--
LI-190	5S	6E	11	79-10-17	.80	49	1.0	115	6.2	2.5	.00	60	200	.05	60	50	--
LI-192	5S	6E	11	80-04-28	.10	48	1.0	105	4.8	4.2	.20	65	190	.47	240	69	--
				80-05-05	--	--	--	--	--	--	--	--	--	--	60	--	--
LI-204B	6S	3E	4	84-08-17	.60	50	1.1	--	8.0	4.1	.30	62	190	.11	100	160	--
				84-08-23	.50	45	1.0	98	8.2	4.0	.30	62	180	.30	240	180	--
SH-9	2S	4E	73	60-06-28	--	--	--	--	--	6.0	--	--	--	--	--	--	--
				61-06-16	.20	99	1.2	--	5.4	4.9	.70	11	250	--	--	--	--
SH-32B	2S	4E	77	70-09-15	.00	91	.40	--	9.2	4.5	.60	17	240	.10	250	120	--
LI-91	6S	3E	32	64-03-23	.10	220	.90	405	2.0	57	.80	23	580	--	--	--	--
LI-184A	6S	6E	40	79-05-21	<.10	120	.70	253	.8	1.0	.50	23	300	.10	40	<10	--

TABLE 12.--SELECTED MINOR ELEMENTS AND RADIONUCLIDES IN GROUND WATER AT SELECTED SITES IN LIVINGSTON AND ST. HELENA PARISHES

[µG/L, MICROGRAMS PER LITER; PCI/L, PICOCURIES PER LITER]

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	ALUMINUM, DISSOLVED (µG/L AS AL)	ARSENIC DISSOLVED (µG/L AS AS)	BARIUM, DISSOLVED (µG/L AS BA)	BORON, DISSOLVED (µG/L AS B)	CADMIUM DISSOLVED (µG/L AS CD)	CHROMIUM, DISSOLVED (µG/L AS CR)	COPPER, DISSOLVED (µG/L AS CU)	LEAD, DISSOLVED (µG/L AS PB)	MERCURY DISSOLVED (µG/L AS HG)
							SHALLOW AQUIFER UNIT						
LI-85	9S	5E	16	84-05-30	<10	<1	--	40	<1	<10	<1	1	<.1
LI-167	6S	5E	41	84-05-30	<10	1	--	30	<1	<10	<1	1	<.1
LI-169	5S	6E	39	84-05-24	<10	<1	--	<20	<1	10	16	2	<.1
LI-197	5S	3E	14	84-03-22	<10	<1	--	<20	<1	10	7	3	<.1
SH-12	1S	5E	3	84-03-14	--	--	--	--	--	--	--	--	--
SH-16	4S	6E	10	84-03-20	<10	1	--	<20	<1	<10	13	5	<.1
SH-47	3S	5E	49	84-05-21	<10	<1	--	<20	<1	<10	6	3	.1
							AQUIFER UNIT 1						
LI-196	7S	4E	35	84-03-28	<10	<1	--	40	<1	<10	5	7	<.1
							AQUIFER UNIT 2						
LI-73	6S	5E	30	84-09-07	10	<1	29	<20	<1	<10	<1	2	<.1
LI-86	9S	5E	3	84-03-26	<10	<1	--	520	<1	<10	<1	3	.4
LI-89	6S	3E	12	83-08-10	--	--	--	--	--	--	--	--	--
LI-117	7S	5E	16	84-04-04	20	1	--	30	2	10	<1	1	<.1
LI-193	6S	6E	40	84-09-07	30	<1	9	30	<1	<10	1	5	<.1
							AQUIFER UNIT 3						
LI-185	7S	3E	38	84-09-07	20	<1	28	30	<1	<10	3	1	<.1
SH-5	2S	5E	59	83-08-10	--	--	--	--	--	--	--	--	--
SH-18	3S	6E	28	84-03-22	<10	<1	--	180	<1	<10	1	1	<.1
SH-21	2S	5E	34	84-03-21	<10	<1	--	150	<1	<10	1	4	<.1
SH-34B	4S	4E	45	84-03-22	<10	1	--	360	<1	10	3	1	.1
SH-44	4S	4E	12	84-03-20	10	1	--	180	<1	<10	1	6	.2
SH-66	2S	4E	77	84-03-21	10	1	--	250	<1	<10	2	5	<.1

TABLE 12.--SELECTED MINOR ELEMENTS AND RADIONUCLIDES IN GROUND WATER AT SELECTED SITES IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	SILVER, DIS-SOLVED (µG/L AS AG)	ZINC, DIS-SOLVED (µG/L AS ZN)	GROSS ALPHA, DIS-SOLVED (µG/L AS U-NAT)	GROSS BETA, DIS-SOLVED (PCI/L AS CS-137)	GROSS BETA, DIS-SOLVED (PCI/L AS SR/YT-90)
				SHALLOW AQUIFER UNIT					
LI-85	9S	5E	16	84-05-30	2	7	--	--	--
LI-167	6S	5E	41	84-05-30	5	220	--	--	--
LI-169	5S	6E	39	84-05-24	<1	9	--	--	--
LI-197	5S	3E	14	84-03-22	<1	6	--	--	--
SH-12	1S	5E	3	84-03-14	--	--	<.6	.8	.7
SH-16	4S	6E	10	84-03-20	<1	9	<.8	1.1	1.0
SH-47	3S	5E	49	84-05-21	<1	4	--	--	--
				AQUIFER UNIT 1					
LI-196	7S	4E	35	84-03-28	1	5	<4.0	<2.3	<2.0
				AQUIFER UNIT 2					
LI-73	6S	5E	30	84-09-07	<1	11	--	--	--
LI-86	9S	5E	3	84-03-26	1	51	<13	<8.3	<7.1
LI-89	6S	3E	12	83-08-10	--	--	<2.6	<1.4	<1.2
LI-117	7S	5E	16	84-04-04	2	<3	<3.3	<2.0	<1.7
LI-193	6S	6E	40	84-09-07	<1	<3	--	--	--
				AQUIFER UNIT 3					
LI-185	7S	3E	38	84-09-07	<1	4	--	--	--
SH-5	2S	5E	59	83-08-10	--	--	<2.9	<1.7	<1.5
SH-18	3S	6E	28	84-03-22	<1	<3	<5.5	<3.0	<2.6
SH-21	2S	5E	34	84-03-21	1	5	--	--	--
SH-34B	4S	4E	45	84-03-22	<1	<3	<6.3	<3.6	<3.1
SH-44	4S	4E	12	84-03-20	<1	<3	<5.6	<3.3	<2.9
SH-66	2S	4E	77	84-03-21	1	7	<4.9	<3.0	<2.6

TABLE 13.--SELECTED ORGANIC CHEMICALS, INSECTICIDES, AND HERBICIDES IN THE SHALLOW AQUIFER UNIT IN LIVINGSTON AND ST. HELENA PARISHES

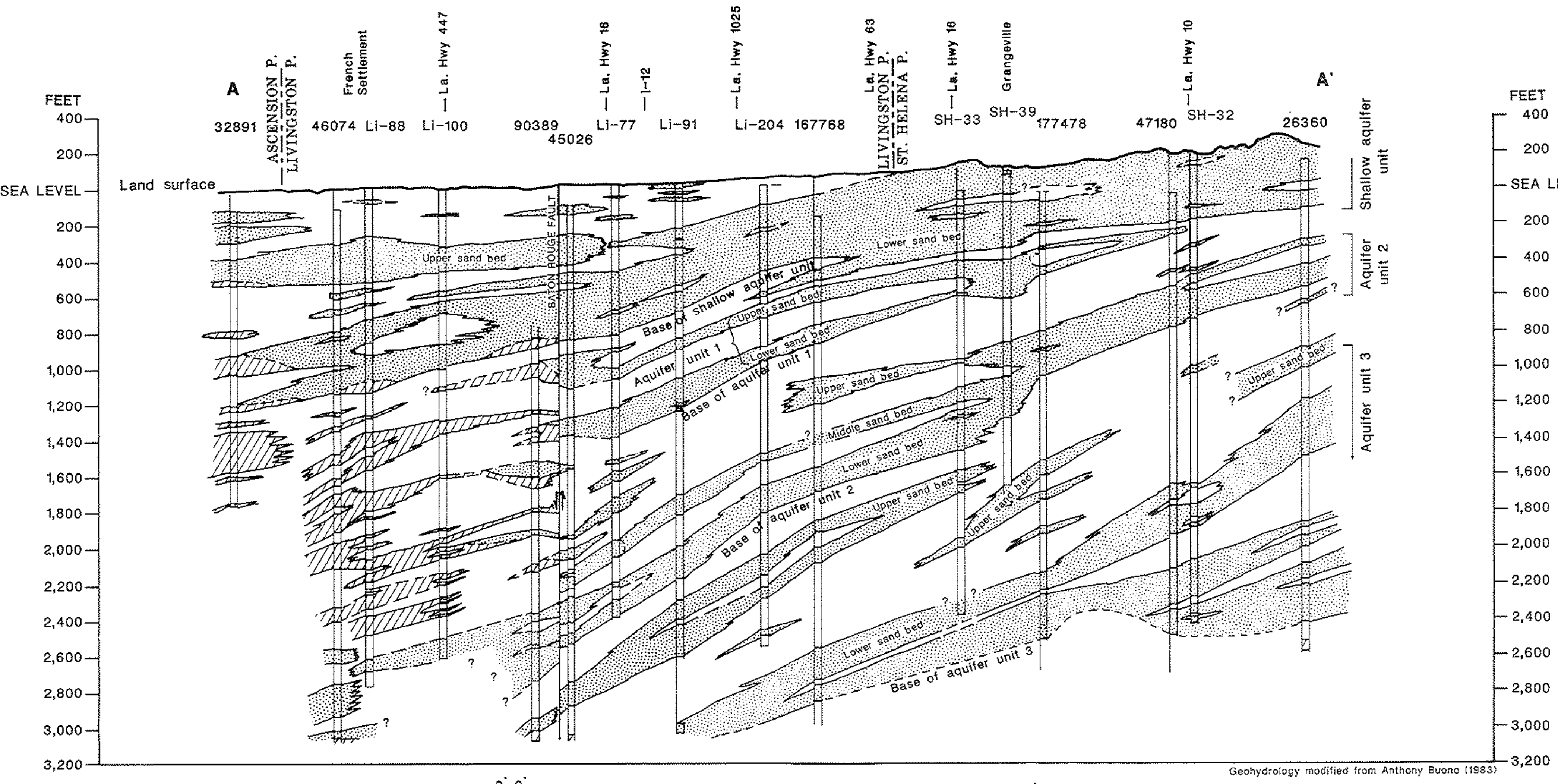
[µG/L, MICROGRAMS PER LITER]

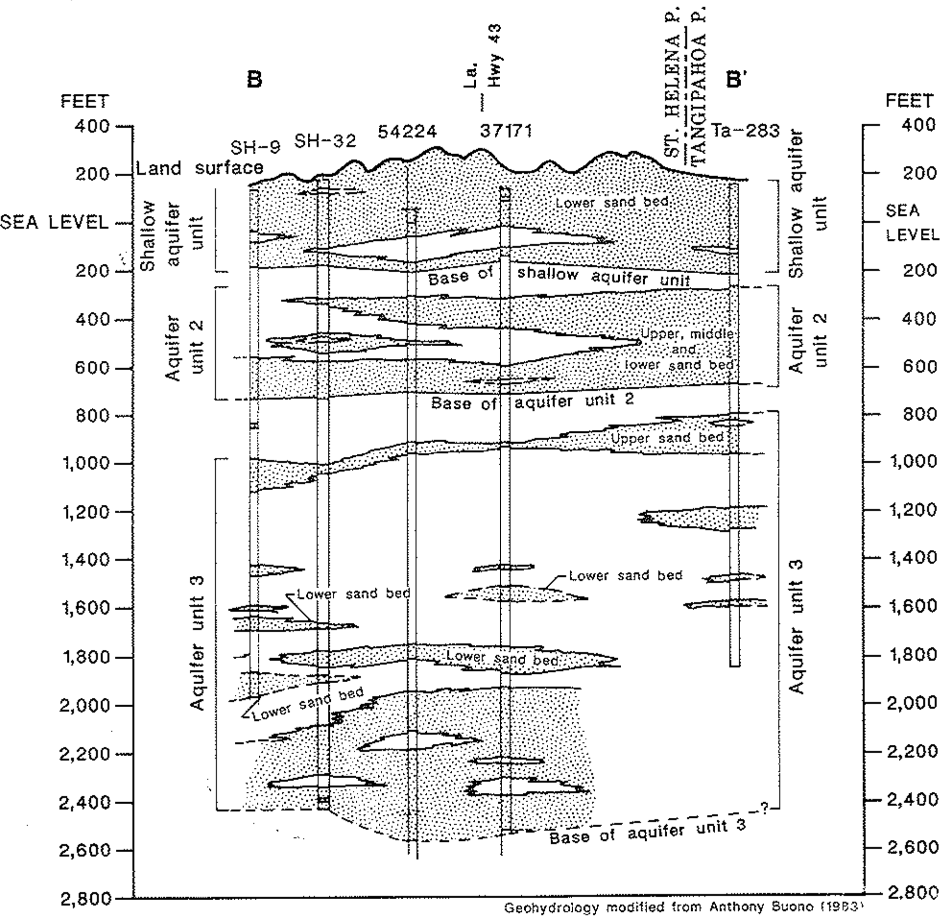
LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	PCB, TOTAL (µG/L)	ALDRIN, TOTAL (µG/L)	CHLOR-DANE, TOTAL (µG/L)	DDD, TOTAL (µG/L)	DDE, TOTAL (µG/L)	DDT, TOTAL (µG/L)	DI-AZINON, TOTAL (µG/L)	DI-ELDRIN TOTAL (µG/L)	ENDO-SULFAN, TOTAL (µG/L)
LI-85	9S	5E	16	84-05-30	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
LI-167	6S	5E	41	84-05-30	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
LI-169	5S	6E	39	84-05-24	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
LI-197	5S	3E	14	84-03-22	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
SH-12	1S	5E	3	84-03-14	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
SH-16	4S	6E	10	84-03-20	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001
SH-47	3S	5E	49	84-05-21	<.1	<.001	<.1	<.001	<.001	<.001	<.01	.004	<.001
SH-52	4S	4E	69	84-05-21	<.1	<.001	<.1	<.001	<.001	<.001	<.01	<.001	<.001

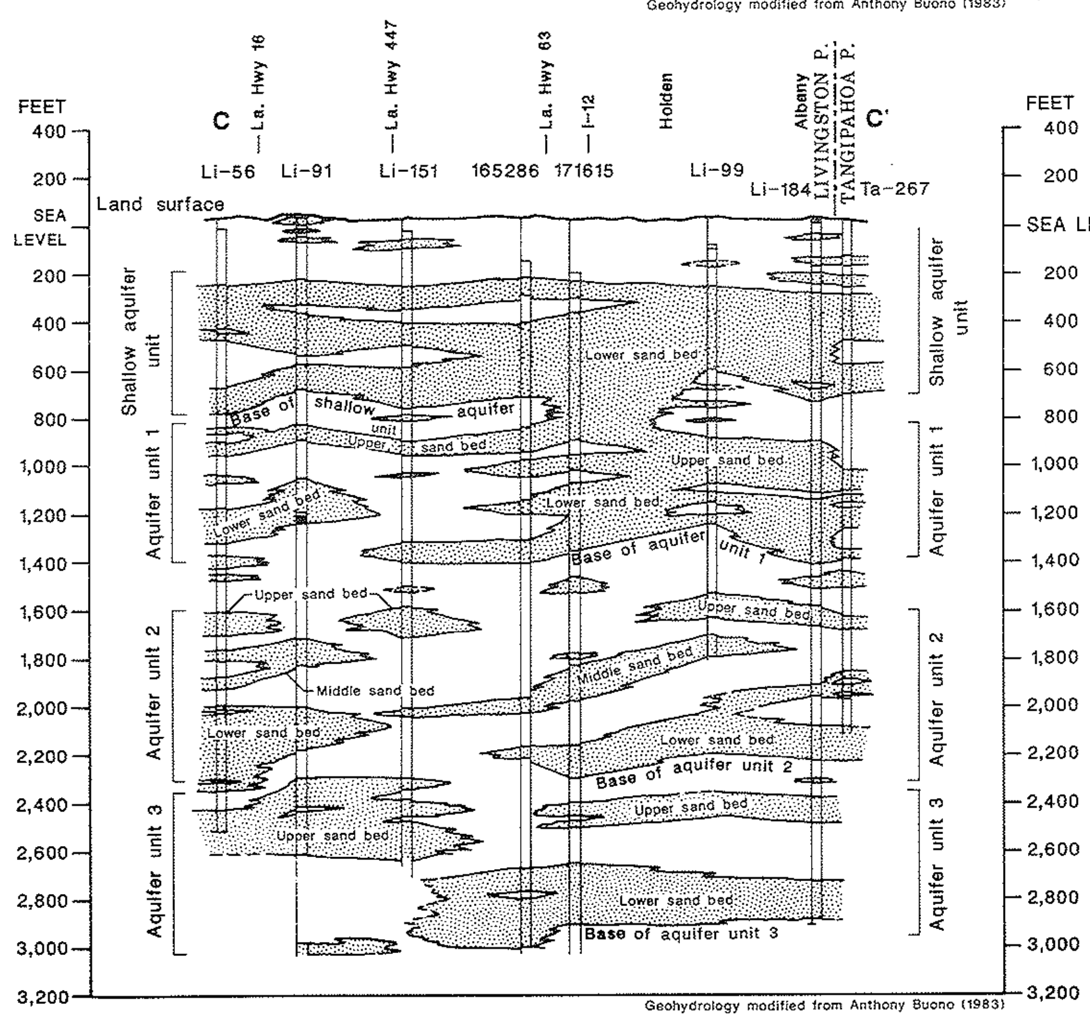
LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	ENDRIN, TOTAL (µG/L)	ETHION, TOTAL (µG/L)	HEPTA-CHLOR, TOTAL (µG/L)	HEPTA-CHLOR EPOXIDE TOTAL (µG/L)	LINDANE TOTAL (µG/L)	MALA-THION, TOTAL (µG/L)	METH-OXY-CHLOR, TOTAL (µG/L)	METHYL PARA-THION, TOTAL (µG/L)	METHYL TRI-THION, TOTAL (µG/L)
LI-85	9S	5E	16	84-05-30	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
LI-167	6S	5E	41	84-05-30	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
LI-169	5S	6E	39	84-05-24	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
LI-197	5S	3E	14	84-03-22	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
SH-12	1S	5E	3	84-03-14	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
SH-16	4S	6E	10	84-03-20	<.001	<.01	<.001	<.001	<.001	<.01	<.01	<.01	<.01
SH-47	3S	5E	49	84-05-21	<.001	<.01	.001	.001	<.001	<.01	<.01	<.01	<.01
SH-52	4S	4E	69	84-05-21	<.001	<.01	<.001	<.001	.003	<.01	<.01	<.01	<.01

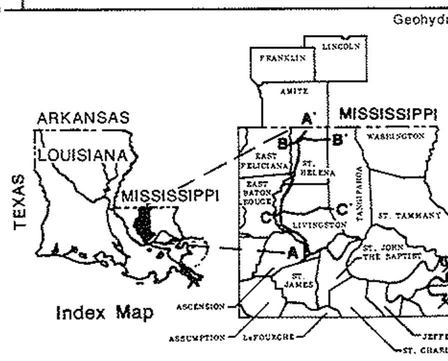
TABLE 13.--SELECTED ORGANIC CHEMICALS, INSECTICIDES, AND HERBICIDES IN THE SHALLOW AQUIFER UNIT IN LIVINGSTON AND ST. HELENA PARISHES--CONTINUED

LOCAL WELL NUMBER	LOCATION T.	R.	SEC.	DATE OF SAMPLE	MIREX, TOTAL (µG/L)	NAPHTHA-LENES, POLY-CHLOR. TOTAL (µG/L)	PARA-THION, TOTAL (µG/L)	PER-THANE TOTAL (µG/L)	TOX-APHENE, TOTAL (µG/L)	TOTAL TRI-THION (µG/L)	2,4-D, TOTAL (µG/L)	2,4,5-T TOTAL (µG/L)	SILVEX, TOTAL (µG/L)
LI-85	9S	5E	16	84-05-30	<.01	<.10	<.01	<.1	<1	<.01	.16	<.01	<.01
LI-167	6S	5E	41	84-05-30	<.01	<.10	<.01	<.1	<1	<.01	.12	<.01	.06
LI-169	5S	6E	39	84-05-24	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01
LI-197	5S	3E	14	84-03-22	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01
SH-12	1S	5E	3	84-03-14	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01
SH-16	4S	6E	10	84-03-20	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01
SH-47	3S	5E	49	84-05-21	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01
SH-52	4S	4E	69	84-05-21	<.01	<.10	<.01	<.1	<1	<.01	<.01	<.01	<.01

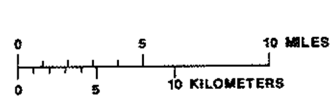








Index Map



Vertical scale greatly exaggerated

EXPLANATION

- FRESHWATER SAND
- SALTWATER SAND
- CLAY
- 32891 OIL-TEST WELL SERIAL NUMBER
- LI-88 WATER WELL NUMBER
- — — — BASE OF FRESH GROUND WATER

GEOHYDROLOGIC SECTIONS A–A', B–B', AND C–C'
IN ASCENSION, LIVINGSTON, ST. HELENA, AND TANGIPAHOA PARISHES,
SOUTHEASTERN LOUISIANA