WATER RESOURCES OF THE

SANTA FE RIVER BASIN, FLORIDA

By James D. Hunn and Larry J. Slack

U.S. GEOLOGICAL SURVEY

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CONVERSION FACTORS

For those readers who may prefer to use International System of Units (SI) units rather than the customary inch-pound units, the conversion factors for the units in this report are listed below:

Multiply inch-pound unit	By	To obtain SI unit
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
gallon per minute (gal/min)	0.00006309	cubic meter per second (m^3/s)
gallon per minute per foot [(gal/min)/ft]	0.000207	cubic meter per second per meter [(m^3/s)/m]
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile [(ft^3/s)/mi^2]	0.01093	cubic meter per second per square kilometer [(m^3/s)/km^2]
inch per year (in/yr)	25.4	millimeter per year (mm/a)
foot squared per day (ft^2/d)	0.0929	meter squared per day (m^2/d)
degrees Fahrenheit (°F)	0.556 X (°F-32)	degrees Celsius (°C)
micromho per centimeter (umho/cm)	1.000	microsiemens per centimeter (uS/cm)

* *

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 mean sea level. NGVD of 1929 is referred to as sea level in this report.

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ABSTRACT

The Santa Fe River basin, occupying 1,384 square miles in north-central Florida, has large supplies of good quality surface water and ground water. Principal streams include the Santa Fe, Ichetucknee, and New Rivers and Olustee Creek. The principal source of ground water is the Floridan aquifer, a thick sequence of limestone beds, the upper 300 to 800 feet of which contain potable water. Rainfall in the basin averages about 54 inches per year.

In the eastern part of the basin the Floridan aquifer is confined and its confining bed is overlain by a surficial sand aquifer. This part of the basin contains numerous small streams. Potential well yields, although generally less than in the western part of the basin, are more than adequate for present industrial and municipal needs.

The western part of the basin is a karst plain mostly overlain by confining bed sediments that are ineffectual in confining the underlying Floridan aquifer. The western part of the basin has the largest surface-water supplies and the greatest potential for high-yield wells. The Floridan aquifer is recharged directly by rainfall at an estimated average rate of 18 inches per year. Estimated transmissivity of the upper 200 feet of limestone in this part of the basin ranges from about 33,000 to 500,000 feet squared per day. Well yields of 2,000 to 5,000 gallons per minute are possible, depending on well construction.

In the eastern part of the Santa Fe River basin, estimated transmissivity of the upper 200 feet of the confined Floridan aquifer ranges from 21,000 to 36,000 feet squared per day. Well yields of as much as 1,000 gallons per minute are possible. Water-yielding zones, mostly limestone, within the confining bed supply less than 100 gallons per minute to wells. The surficial sand aquifer is another source of water for domestic supplies in much of the eastern part of the basin. It is more than 60 feet thick in parts of Clay and Bradford Counties. The full potential of the surficial aquifer has not been developed.

Spring discharge and diffuse seepage from the Floridan aquifer augment the flow of the Santa Fe River and its two tributary streams in the western part of the basin. The average flow from Ichetucknee Springs, measured in the Ichetucknee River below the springs, is about 360 cubic feet per second. In the eastern part, numerous tributary streams supply small amounts of water to the Santa Fe River and its principal tributary, New River. The base flow of most of the streams in this area is supplied by the surficial aquifer.

Water in the Floridan aquifer and in water-yielding zones of the confining bed is of the calcium-magnesium bicarbonate type. Locally, sulfate is

a major constituent. Water in the surficial aquifer is usually less mineralized but, in places, has color and contains objectionable concentrations of iron, calcium, and magnesium.

The western streams discharge water containing more calcium, magnesium, and bicarbonate, and less color than do the streams of the eastern part of the basin. This is because of the Floridan aquifer water discharge to the western streams.

The difference between the estimated average annual runoff from the Santa Fe basin (about 1,400 million gallons per day) and the estimated water use in the basin (about 17 million gallons per day) is sufficiently great to indicate potential for development of large additional water supplies in the basin.

INTRODUCTION

The Santa Fe River basin, a 1,384-mi^2 tributary basin of the Suwannee River, is the most heavily populated basin within the Suwannee River Water Management District. As a result of suburban development near Gainesville, increased phosphate mining in nearby areas, and the development of recreation along the Santa Fe River, the Santa Fe is one of the more likely basins to experience population growth. An assessment of the water resources of the Santa Fe basin was initiated to provide geologic and hydrologic information relevant to the management of the water resources.

Purpose and Scope

The purpose of this report is to present an analysis of the stream-aquifer system of the Santa Fe River basin, including the quantity and quality of water available from each source and their interrelation. Much information is available in previously published reports, but the basin has not been previously evaluated as a hydrologic unit.

The scope of the study includes: (1) mapping the top and thickness of hydrogeologic units; (2) identifying the source of water for each unit and the way water moves from one unit to another and to streamflow; (3) reevaluating and updating, if practical, aquifer parameters such as transmissivity and recharge rates; (4) obtaining hydrologic data such as flow duration, low-flow frequency, flood frequency, lake levels, and ground-water levels; (5) estimating average discharge for partial-record stations; (6) mapping important water-quality characteristics of the Floridan aquifer and overlying units; (7) determining the relation between stream discharge, selected streamflow quality parameters, and ground-water inflow; and (8) determining the relation between present water use and water availability.

In addition to existing U.S. Geological Survey data and data supplied by the Suwannee River Water Management District, test wells were drilled to evaluate hydrologic characteristics of the Alachua Formation. A network of partial-record surface-water stations was established to correlate flow in the tributaries with flow in the main streams, and the basic data network of observation wells was enlarged.

Previous Investigations

The geology and hydrology of Alachua, Bradford, Clay, and Union Counties were described by Clark and others (1962; 1963; 1964a; 1964b). Meyer (1962) investigated the geology and ground-water resources of Columbia County. Puri and others (1967) mapped and described the geology of Dixie and Gilchrist Counties. The geology and hydrology of the area north of the Santa Fe River basin has been described in a comprehensive report on the Osceola National Forest (Miller and others, 1978) and in a reconnaissance report on Baker County (Leve, 1968). Older reports containing information on the geology and hydrology of the Santa Fe River basin are listed in "Selected References." The geology of the Santa Fe River basin as described in detail in the foregoing reports has been applied to the present investigation. Both Meyer (1962) and Clark and others (1964b) described the hydrogeologic units recognized in the present report. The "surficial aquifer" of the present report corresponds to the "nonartesian aquifer" of Meyer (1962) and the "water-table aquifer" of Clark and others (1962; 1964b). "Water-bearing zones in the confining bed," as used in the present report, are equivalent to the "secondary artesian aquifer" of Meyer (1962) and Clark and others (1962; 1964b). Both Meyer (1962) and Clark and others (1964a) published tables of well records which include the water-yielding unit for each well.

Acknowledgments

The Suwannee River Water Management District furnished much ground-water and water-quality data, especially for the Floridan aquifer, and also information on lake bathymetry. The Florida Bureau of Geology furnished records of wells and lithologic sample studies. Black, Crow, and Eidsness, Inc., furnished copies of its reports on Gainesville powerplant discharge, ground-water quality and movement at the Gainesville well field, and completion data for a new muncipal well at High Springs. The Alachua County Pollution Control Department supplied chemical analyses of water from its observation wells. Mr. Thomas H. Wooten of the Gainesville and Alachua County Regional Utilities Board furnished logs, specific-capacity data, and water-quality data for the wells at the Gainesville powerplant.

GEOGRAPHY

The Santa Fe River basin is part of the Suwannee River basin in north-central Florida. It includes nearly all of Bradford and Union Counties, about one-half of Columbia County, about one-third of both Alachua and Gilchrist Counties, and small parts of Clay, Baker, and Suwannee Counties (fig. 1). It is bounded on the north, south, and west by other parts of the Suwannee River basin; on the northeast by the St. Marys River basin; and on the east and southeast by the St. Johns River basin.

Agriculture, including timber, is the principal land use in the basin. Large areas of wetlands are used for growing pine trees. The basin's population, although small, is increasing, principally around the larger municipalities in the basin. Riverfront and lakefront property are being developed, partly for summer cottages and partly for permanent residences. The larger municipalities in the basin include Lake City, population 9,257; Starke, 5,306; Alachua, 3,561; and High Springs, 2,491, as of 1980 (University of Florida, 1980). Other municipalities in the basin have populations of less than 1,000.

Estimated water use for 1975 in the basin was about 17 Mgal/d. Nearly all of this was ground water.

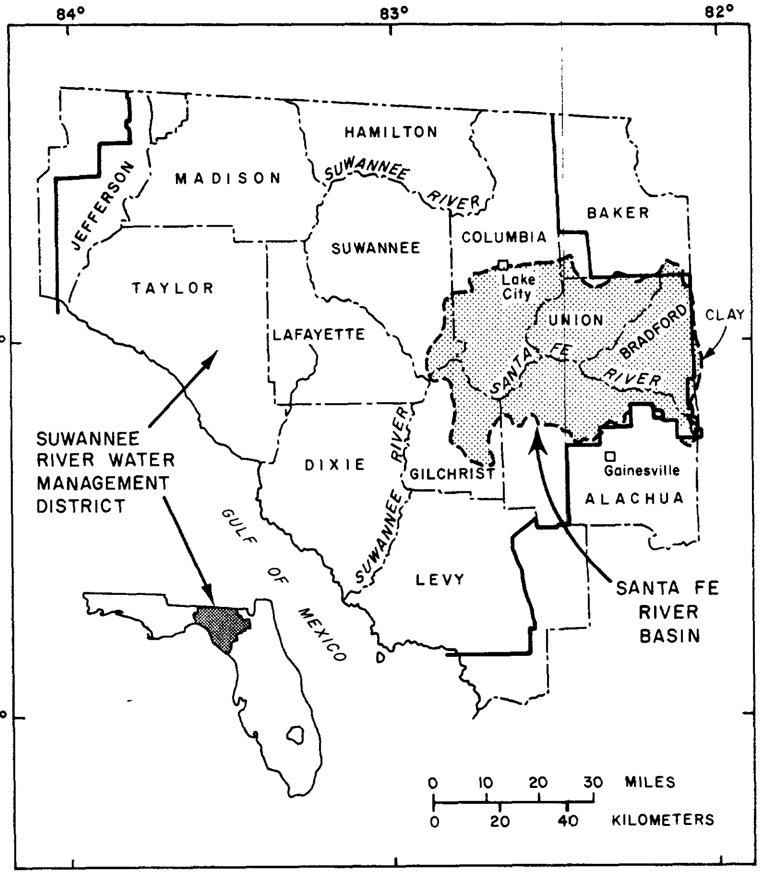


Figure 1.--Location of the Santa Fe River basin.

Topography and Drainage

Land surface ranges from about 10 feet above sea level near the mouth of the Santa Fe River to about 250 feet on Trail Ridge in western Clay County (fig. 2). This ridge, the eastern boundary of the Santa Fe River basin, extends north-south through central Florida and is the most prominent topographic feature of the basin. Another prominent feature is an area of ridges and rolling hills extending from the basin's southern boundary near Hague northwest to Lake City. The physiography and geomorphology of the basin are described by Cooke (1945), Puri and Vernon (1964), and Puri and others (1967). The western third of the basin, including parts of Alachua, Columbia, Gilchrist, and Suwannee Counties, lacks surface drainage except for the Santa Fe and Ichetucknee Rivers; thus, all water that would otherwise run off as streamflow percolates down to the Floridan aquifer and moves through the aquifer to points of discharge. Many streams in the south-central part of the basin lose water to the Floridan aquifer through sinkholes (fig. 3).

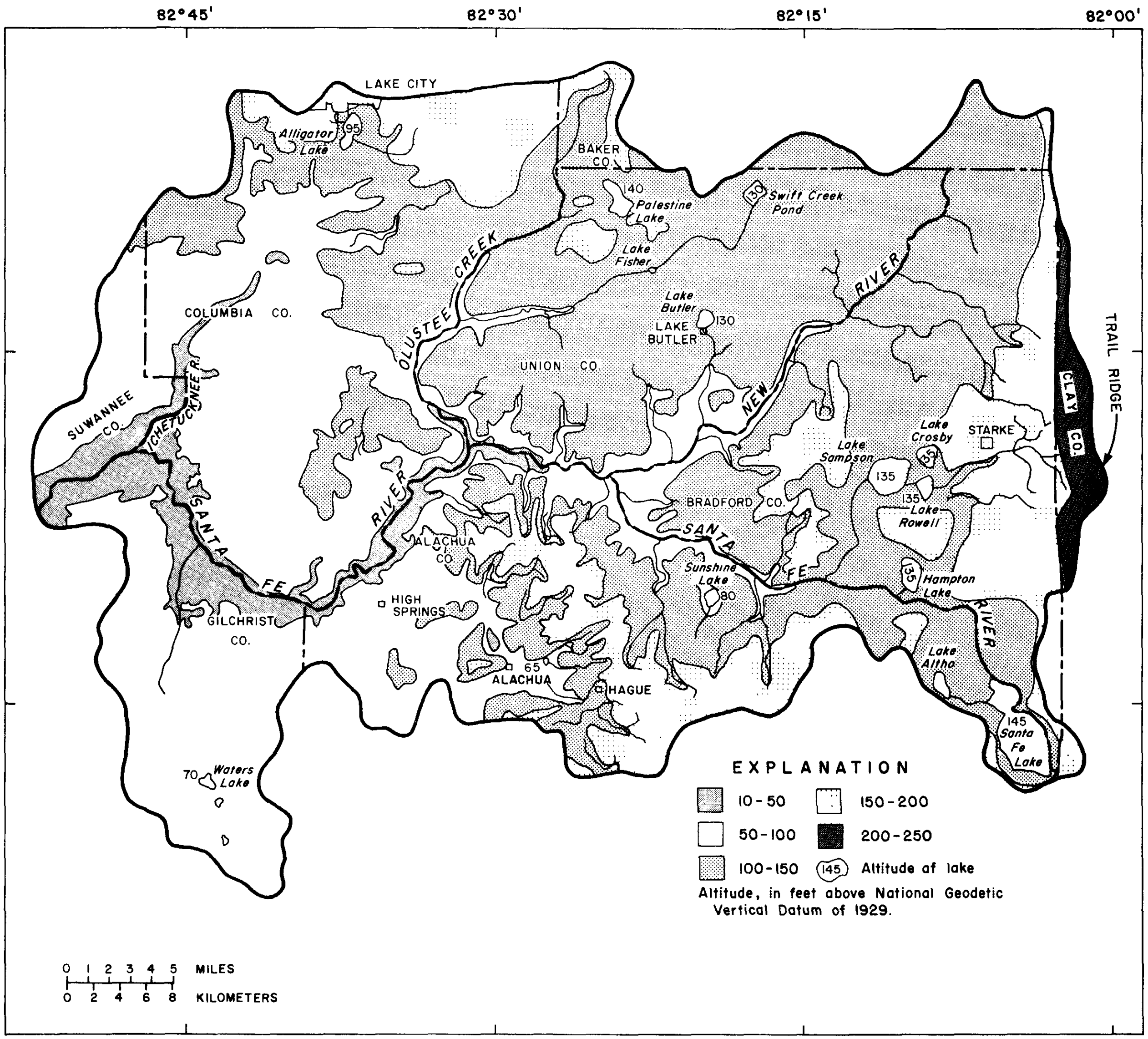


Figure 2.--Topography of the Santa Fe River basin.

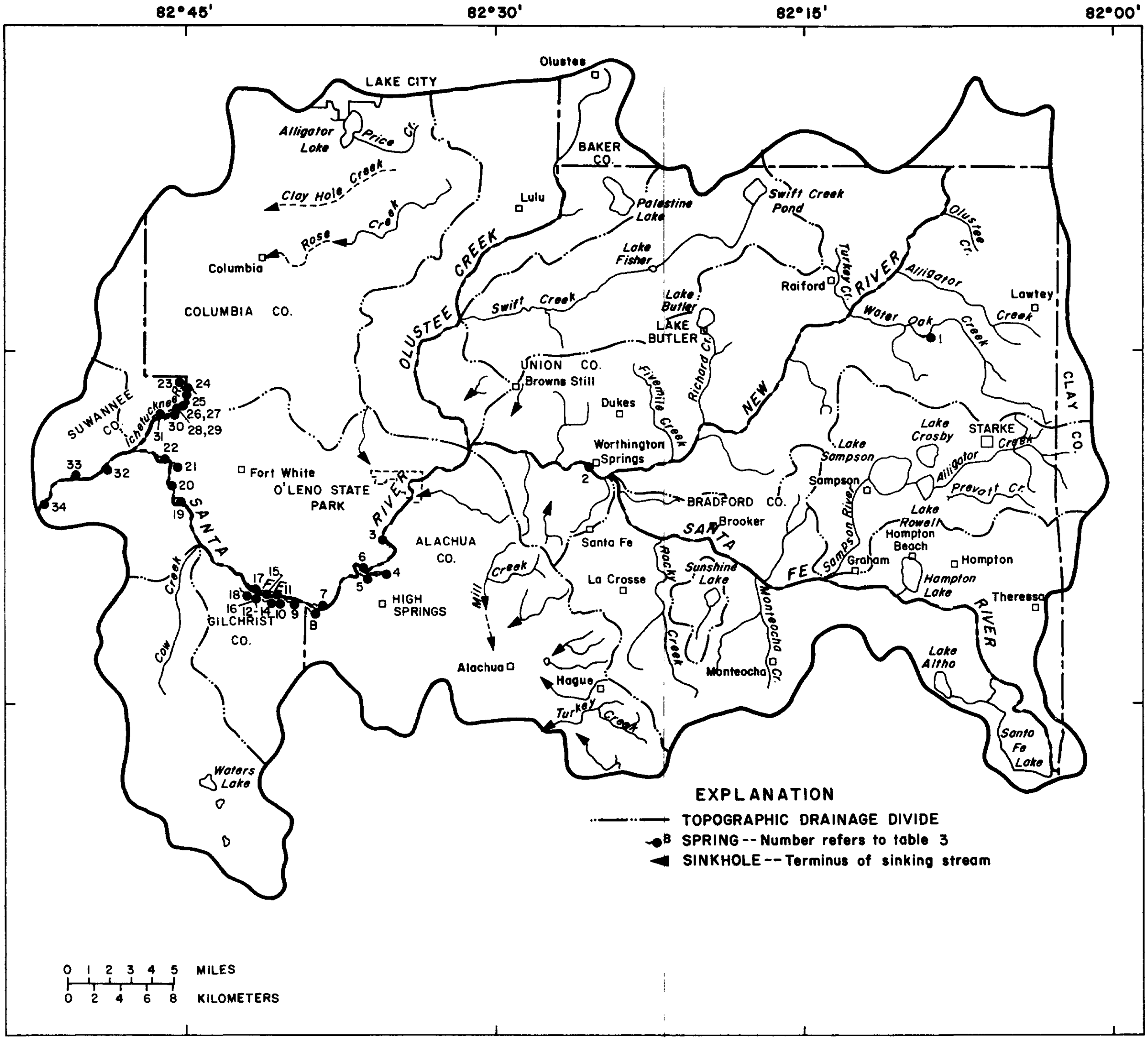


Figure 3.--Drainage features of the Santa Fe River basin.

Map number	Spring name and number	Map number	Spring name and number	Map number	Spring name and number
1	Heilbronn Spring, 02320951, 300125082092000	13	Naked Springs, 294947082405200	24	Cedar Head Spring, 29590082453200
2	Worthington Spring, 02321503, 295532082253300	14	Little Blue Spring, 294950082410000	25	Blue Hole Spring, 295847082453100
3	Resurgence of Santa Fe River, 295225082353000	15	Jonathan Spring, 295004082413000	26	Roaring Springs, 02322689, 295835082453100
4	Hornsby Spring, 295059082353600	16	Devil's Eye Springs, 295006082424900	27	Singing Springs, 295835082452900
5	Darby Spring, 295108082362500	17	July Spring, 295010082414700	28	Boiling Spring, 295825082453700
6	Columbia Spring, 02321977, 295114082364400	18	Ginnie Spring, 295009082420100	29	Grassy Hole Spring, 295810082453600
7	Allen Spring, 294933082385800	19	Wilson Spring, 295359082453100	30	Mill Pond Spring, 02322696, 295804082453700
8	Poe Springs, 02322140, 294933082385800	20	Northbank Spring, 295433082461900	31	Coffee Spring, 295735082462700
9	Lilly Spring, 294946082394200	21	Jamison Spring, 295532082455600	32	Holly Spring, 295503082492700
10	Johnson Spring, 293120082404000	22	The Boil, 295540082461400	33	Betty Spring, 295453082502500
11	Rum Island Spring, 294959082404900	23	Ichetuckenee Spring, 295900082454300	34	Trail Springs, 295354082520000
12	Blue Springs, 294947082405900				

Figure 3.--Drainage features of the Santa Fe River basin.--Continued

Climate

The average annual temperature at Lake City is about 69°F, and at Gainesville, approximately 6 miles south of the study area, about 70°F. Average annual rainfall is about 54 inches at Lake City and about 55 inches at Gainesville. Annual rainfall for the period 1900-1976 ranged from about 30 inches in 1908 to 84 inches in 1964 at Lake City, and from about 33 inches in 1917 to 77 inches in 1964 at Gainesville (Mitchell 1902; U.S. Department of Commerce, 1975). Monthly rainfall is usually greatest from June through September. Rainfall in the basin is derived from weather fronts, local thunderstorms, and seasonal tropical storms. The dependence of average annual rainfall on three different types of storms explains, at least in part, the high variability in annual rainfall.

HYDROGEOLOGY

The Santa Fe basin is underlain by more than 1,000 feet of sedimentary rocks of Tertiary age, the upper 300 to 800 feet of which contain freshwater. The rocks that contain freshwater are the: Lake City Limestone, Avon Park Limestone, and Ocala Limestone all of Eocene age; Suwannee Limestone of Oligocene age; Hawthorn Formation of Miocene age and Alachua Formation of Pliocene age; and unnamed clay and sand deposits of Pliocene to Holocene age (table 1). The limestones and lower part of the Hawthorn Formation form the Floridan aquifer (Parker and others, 1955). The upper part of the Hawthorn Formation, the Alachua Formation, and overlying clay sediments constitute the confining bed over the Floridan aquifer, although limestones within the Hawthorn Formation are locally sources of domestic and farm water supplies. The confining bed in Gilchrist County consists largely of the Alachua Formation and younger sediments. Although still called a confining bed, where thin and discontinuous these sediments are not effective in confining the Floridan aquifer. This situation exists in much of the western part of the Santa Fe basin. In the eastern part of the basin, unconsolidated sand beds above the confining bed form the surficial aquifer. The lithology of the rock units is discussed in detail by Meyer (1962), Clark and others (1964b), Puri and Vernon (1964), Puri and others (1967), and Miller and others (1978).

Figure 4 shows the surficial extent of the hydrogeologic units in the basin. The Floridan aquifer underlies the entire area at the surface or at depth. The confining bed overlies the Floridan aquifer in most of the basin but is missing adjacent to the lower part of the Santa Fe River. The western boundary of the saturated part of the surficial aquifer is approximately a line from Alachua to Lake City. The area of saturation fluctuates laterally with changes of water level in the aquifer. West of this boundary, however, sand and clay persist as an unsaturated mantle covering nearly all the rest of the basin.

Table 1.--Hydrogeologic and geologic units in the Santa Fe River basin

[From Parker and others (1955), Meyer (1962), Puri and Vernon (1964), Clark and others (1964b), Puri and others (1967), and Miller and others (1978)]

Geologic units		Hydrogeologic units (fig.4)		Thickness (feet)
Series	Name	Name	Description	
Holocene Pleistocene Pliocene	Terrace and wind-blown deposits, older coarse clastics, and clay	Surficial aquifer	Very fine to coarse sand and gravel with variable interstitial silt and clay content, and interbedded clay	0-80
Pliocene	Alachua Formation	Confining bed	Interbedded clay, sand, sandstone, and limestone	0-320
Miocene	Hawthorn Formation			
Oligocene	Suwannee Limestone	Floridan aquifer	Permeable limestone, dolomitic limestone, and dolomite. Dolomite content generally increases with depth	900-1,000
Eocene	Ocala Limestone Avon Park Limestone Lake City Limestone Oldsmar Limestone			
Paleocene	Cedar Keys Limestone			

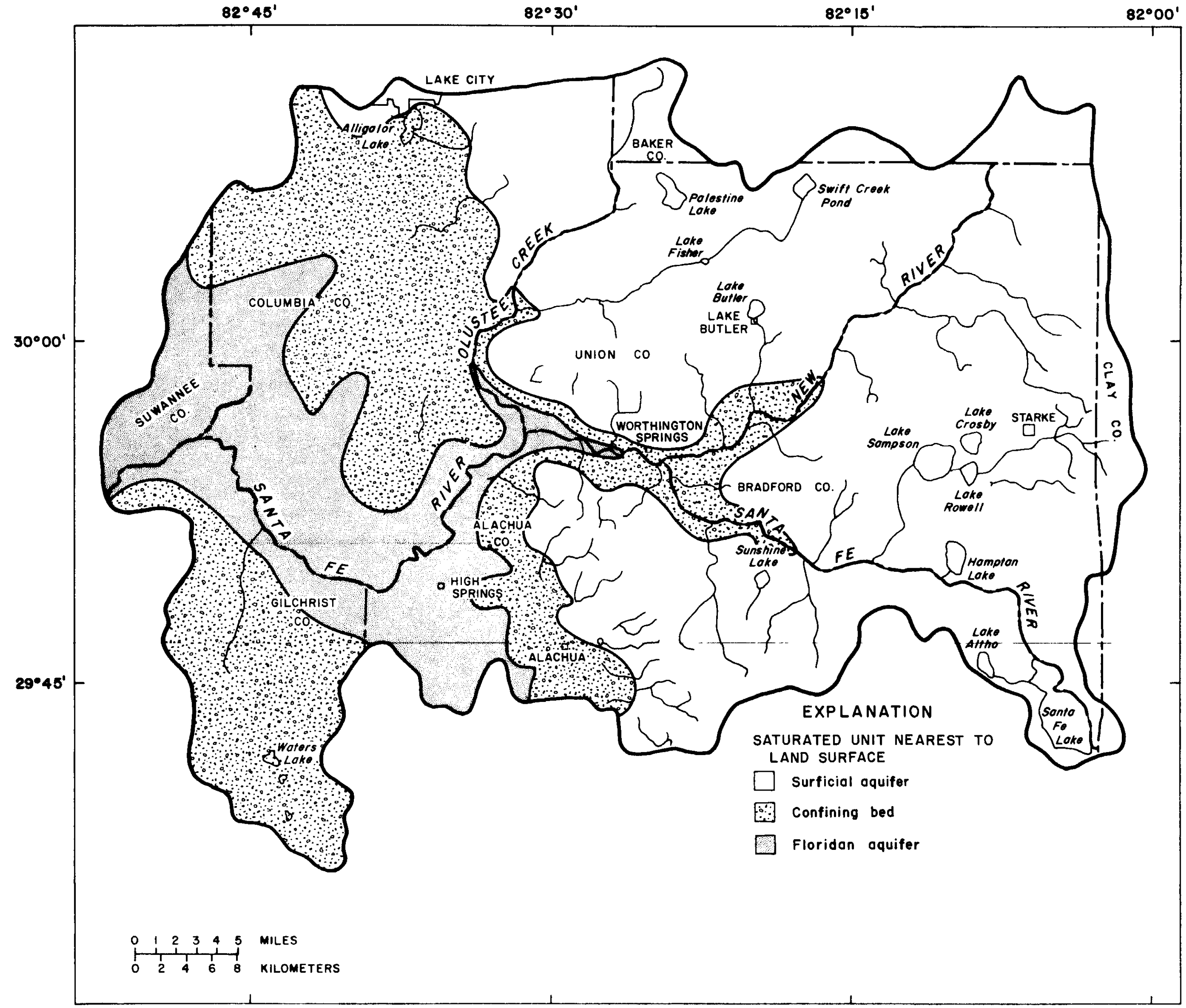


Figure 4.--Hydrogeologic units of the Santa Fe River basin. (Location of boundary between Floridan aquifer and confining bed in Gilchrist County from Puri and others, 1967, plate 1.)

Well data on formation contacts used for mapping the aquifers and confining bed are listed in table 2 which is located at the end of this report. Locations of the wells and test holes are shown in figure 5, and the local well-numbering system is shown in figure 6. There are other numbering systems used in this report. Map numbers, to help the reader identify a hydrologic-data site on the maps of the report, are provided in tables 3 through 9. Most surface-water discharge-measurement sites historically have been identified, within each state, by a name and an 8-digit downstream-order number, such as Santa Fe River near Graham, 02320700 (see table 8). More recently, hydrologic data-collection sites are being given a 15-digit identifying number based on the latitude and longitude of the data site. Once assigned, the number is not subject to change even though more accurate mapping may change the latitude and longitude of the data site. Hydrologic data stored in the computer may be recovered from the U.S. Geological Survey data-storage bank by reference to either the downstream-order number or 15-digit number.

GROUND WATER

Surficial Aquifer

In the Santa Fe basin, the surficial aquifer (fig. 4) is composed mostly of very fine to medium-grained sand, with layers of clay and silt. The aquifer includes some coarse sand and gravel in southeastern Bradford County. The aquifer transects formational boundaries, and includes some Pleistocene to Holocene terrace deposits and windblown sand, and older deposits of Pliocene age and possibly some of the Hawthorn Formation.

The water table lies within 10 feet of land surface, except along the eastern boundary of the basin where depth to the water table is as much as 30 feet. Figure 7 shows the altitude of the water table, developed using topographic maps, with modifications from field checks made during November and December 1975. The base of the aquifer within the basin is the base of the lowermost unconsolidated water-bearing sand. The western boundary of the aquifer, as mapped in figure 4, is the limit of the saturated part of the aquifer, although the sand extends westward covering nearly all the rest of the basin. The saturated thickness of the aquifer is more than 80 feet in parts of Bradford and Clay Counties (fig. 8). Where thicknesses of less than 20 feet are indicated, the aquifer may be missing or the sand may be present but unsaturated on steep slopes.

The surficial aquifer is recharged by local rainfall, and also receives water discharged upward from water-yielding zones in the confining bed in the eastern part of the basin where the head is above that of the surficial aquifer. Clark and others (1964b) show 2-year hydrographs of two surficial-aquifer wells in the Santa Fe River basin that have a total fluctuation of about 4 feet.

Streams crossing the saturated part of the surficial aquifer receive most of their base flow from it. Low-flow measurements made in April 1976 and May 1977 showed gains in streamflow where the streams transect the aquifer. Other discharge from the aquifer includes evapotranspiration, percolation to underlying units, and discharge to wells.

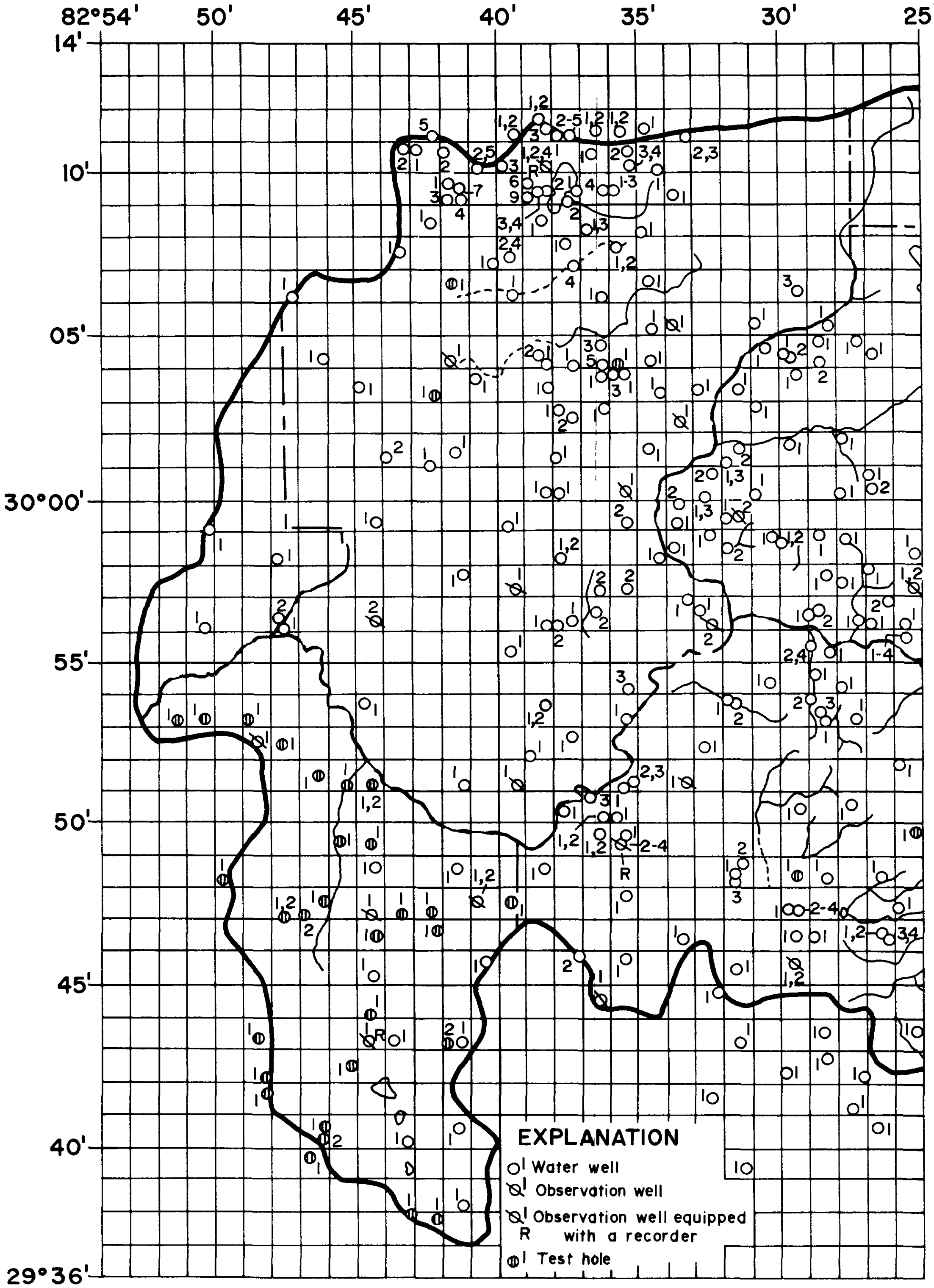
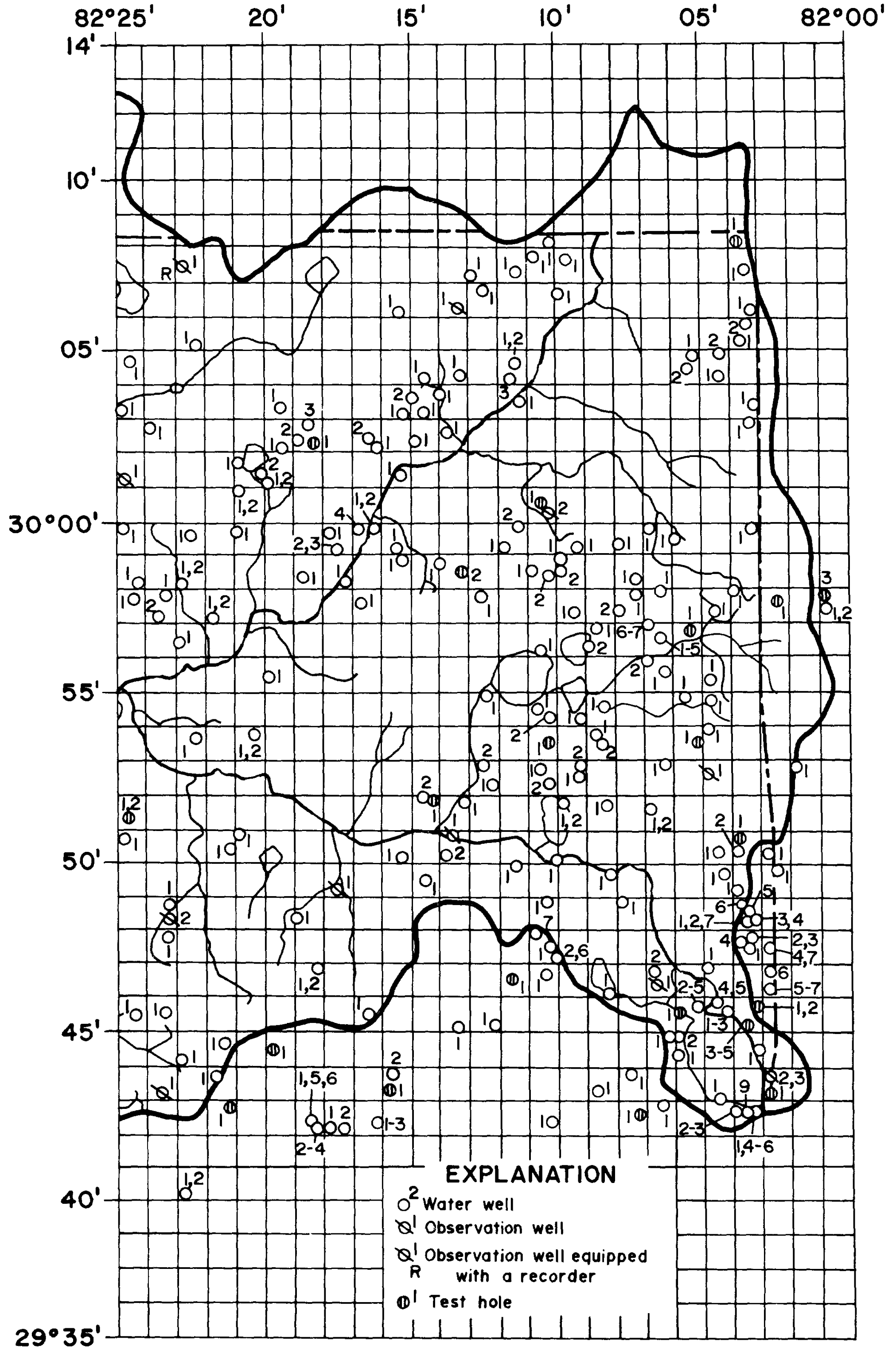


Figure 5.--Locations of wells and test holes in the Santa Fe River basin.

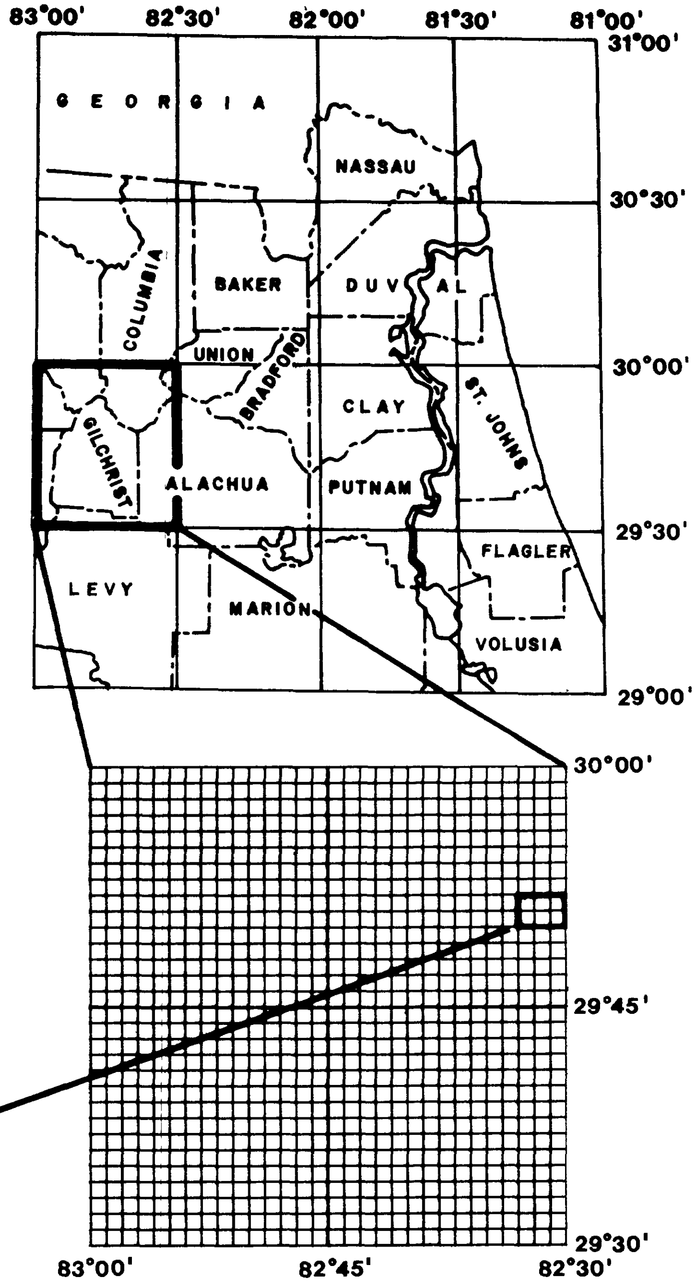


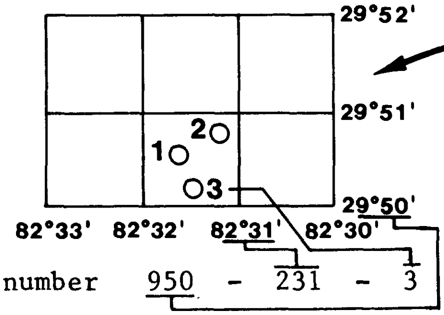
Locations of wells and test holes in the Santa Fe River basin.--Continued

EXPLANATION

The well-numbering system is derived from latitude and longitude coordinates on a statewide grid of 1-minute parallels of latitude and 1-minute meridians of longitude. The wells in a 1-minute quadrangle are numbered consecutively in the order inventoried. The latitude and longitude prefix north and west and the first digit of the degree number are not included in the well number.

The well number is a composite of three numbers separated by hyphens: the first number is composed of the last digit of the degree and the two digits of the minutes that define the latitude on the south side of the 1-minute quadrangle; the second number is composed of the last digit of the degree and two digits of the minutes that define the longitude on the east side of a 1-minute quadrangle; the third number gives the numerical order in which the well was inventoried in the 1-minute quadrangle.





Well number 950-231-3 was the third well inventoried in the 1-minute quadrangle north of the 29°50' parallel of latitude and west of the 82°31' meridian of longitude.

Figure 6.--Local well-numbering system.

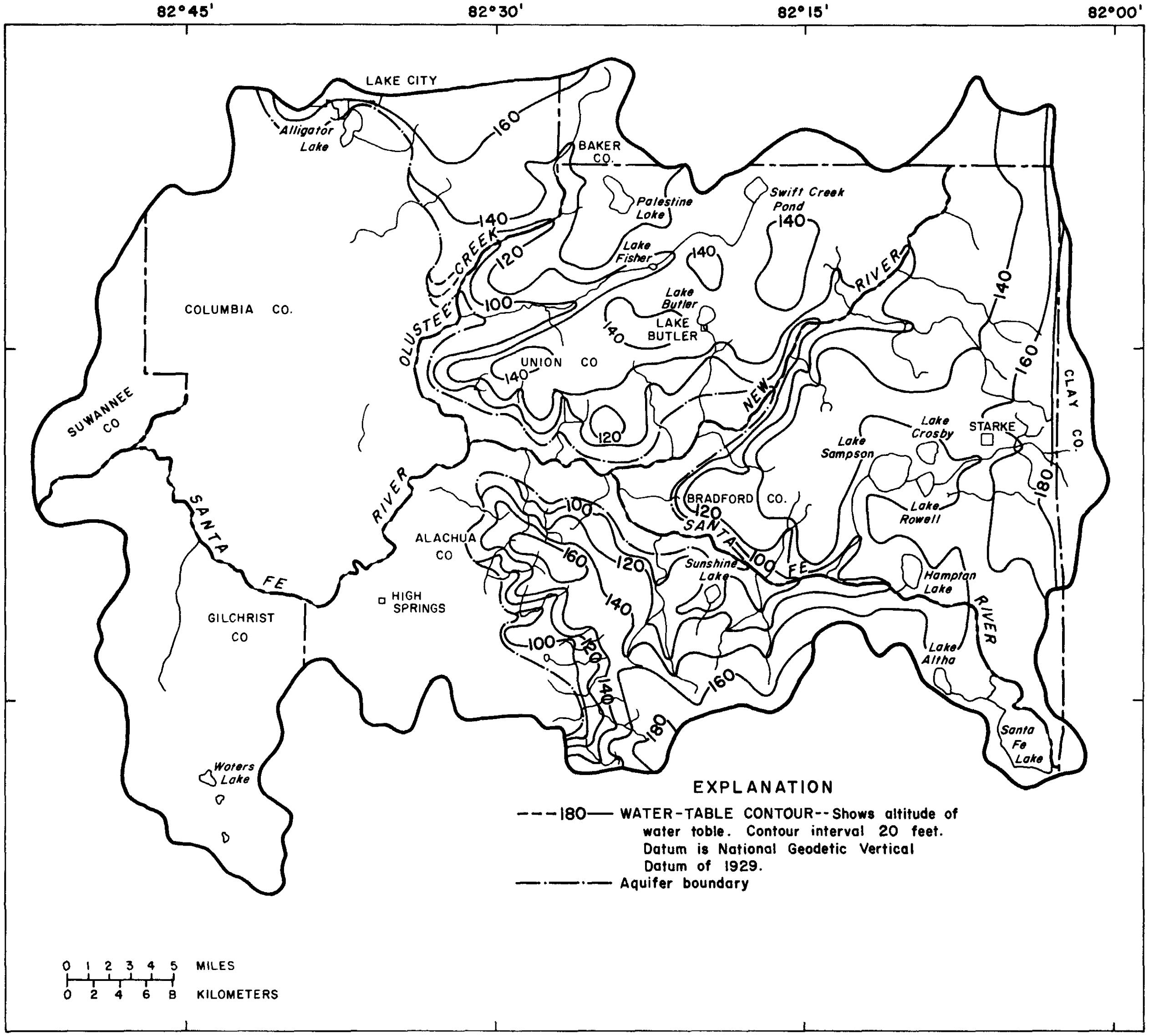


Figure 7.--Altitude of the water table in the surficial aquifer, November-December, 1975.

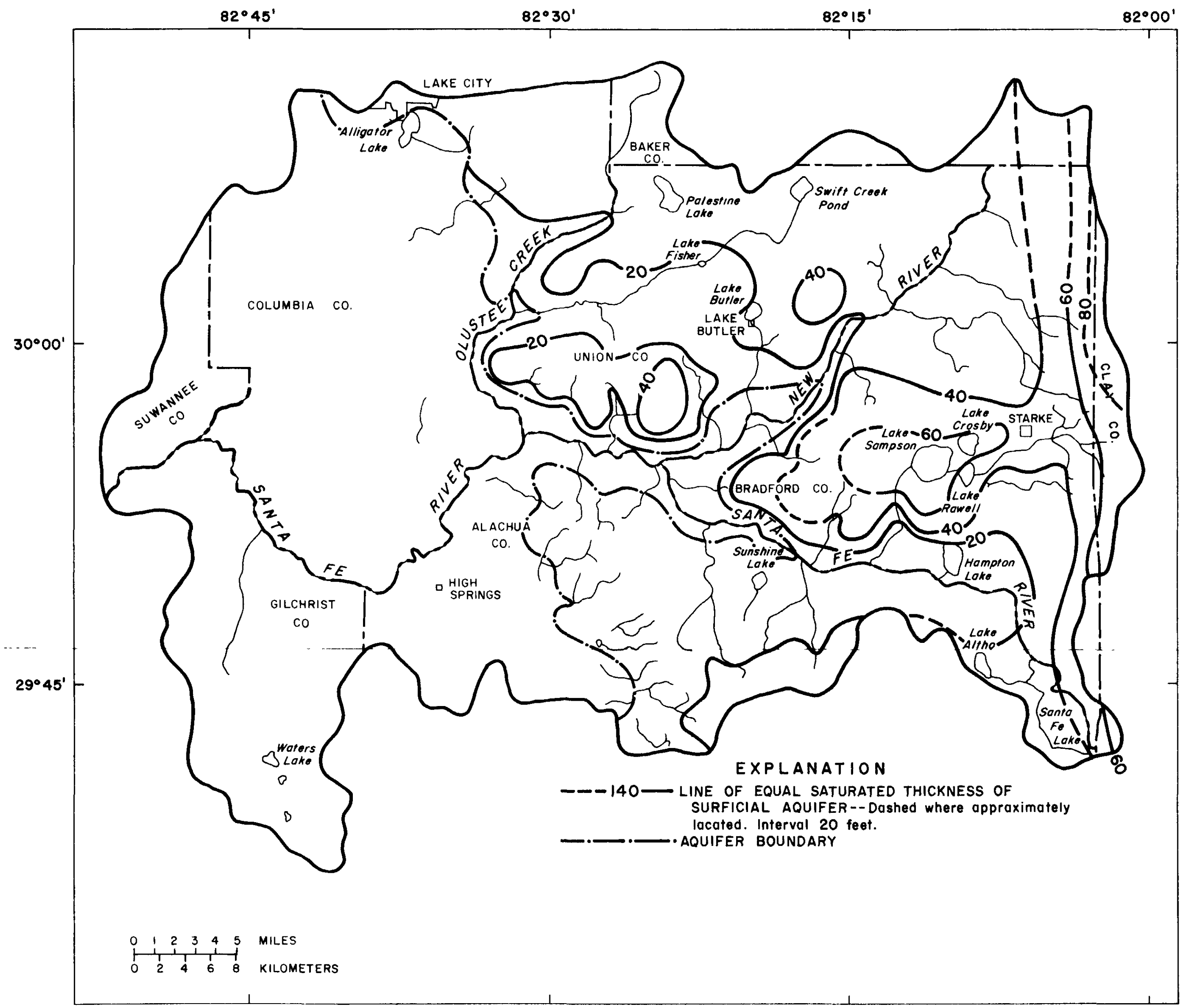


Figure 8.--Saturated thickness of the surficial aquifer, November-December, 1975.

In most of its areal extent the surficial aquifer is a potential source of water for domestic supplies. Possible problems of using the aquifer for water supply, however, include contamination by wastes or other contaminants, such as fertilizers and, where the aquifer is thin, possible depletion of the water supply during droughts. The thicker parts of the aquifer, especially in Clay County and eastern Bradford County, are potential sources for the large supplies needed for such uses as irrigation. Maximum well yields would depend on the method of well construction. Large-diameter dug wells or arrays of smaller diameter wells are possible in the surficial aquifer.

Confining Bed

The Hawthorn Formation is composed of layers of clay, sand, sandstone, and limestone. Limestone near the base of the formation is included in the Floridan aquifer. Sand layers, where they occur at the top of the formation and are not overlain by clay, are included in the surficial aquifer. The remainder of the Hawthorn Formation, and overlying Alachua Formation, and clays (table 1) constitute the confining bed.

The Hawthorn Formation occurs in the north, east, and southeast parts of the basin; and the Alachua Formation occurs in the southwest, primarily in Gilchrist and western Alachua Counties. The confining bed is missing in part of the basin (fig. 4). The boundary of the confining bed, as mapped in figure 9, does not include outliers or thin deposits of the Hawthorn and Alachua Formations that are not effective in sustaining surface ponds and swamps.

As shown in figure 9, streams have eroded the upper part of the unit. The confining bed thins toward the west, as illustrated in figure 10. Sinkholes (fig. 3) have penetrated the unit near the boundary and some of them serve as drains for small streams, diverting streamflow into the Floridan aquifer.

Water-yielding zones in the confining bed are usually limestone but locally are shell beds and possibly sand. The number, and probably the thickness, of these zones appears to increase toward the northeast as the confining bed becomes thicker.

The water-yielding zones of the confining bed are recharged by percolation from overlying deposits and by seepage from streams. Water levels in the confining bed are higher than those in the underlying Floridan aquifer throughout the eastern part of the basin (Clark and others, 1964a), indicating downward leakage to the Floridan aquifer in this area.

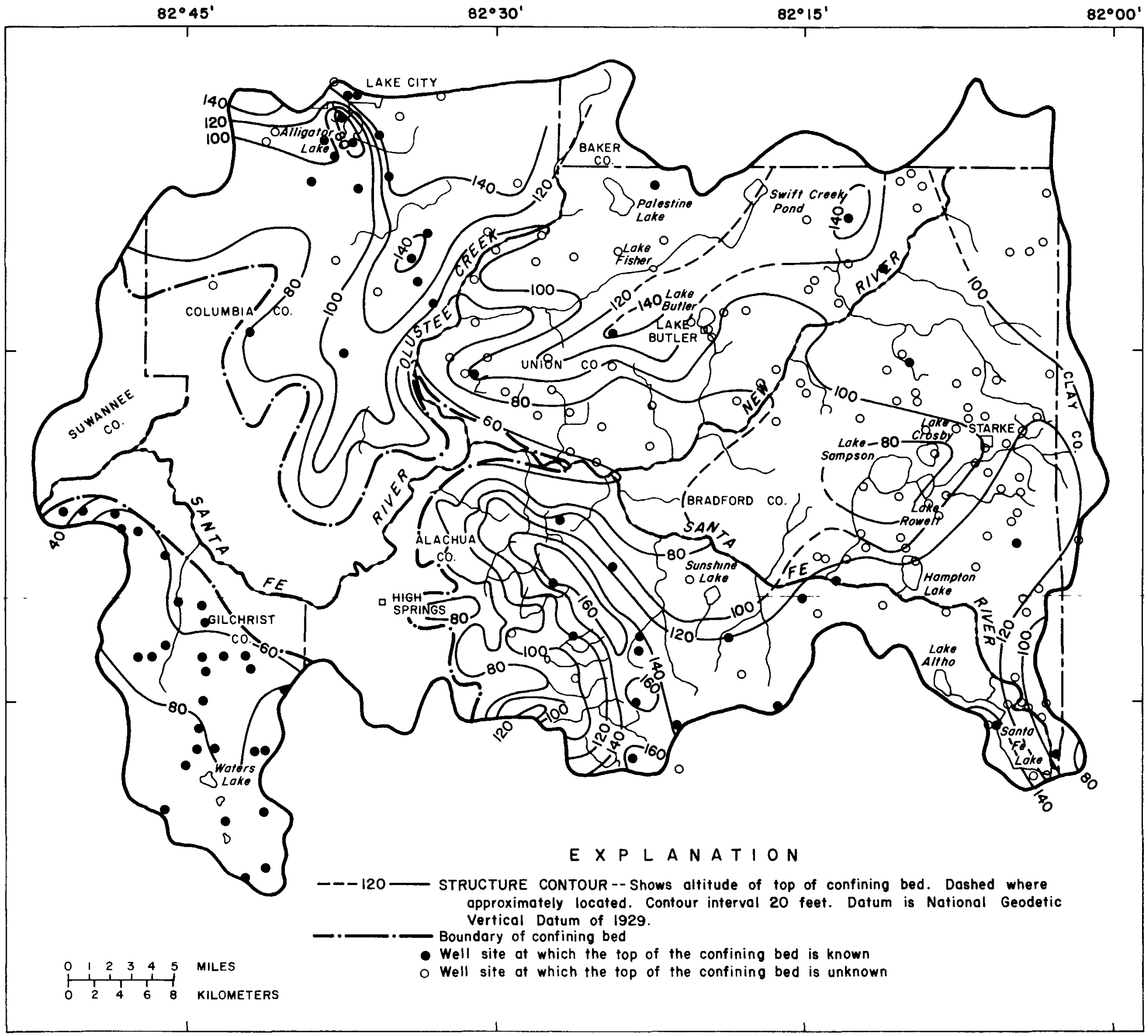


Figure 9.--Altitude of the top of the confining bed.

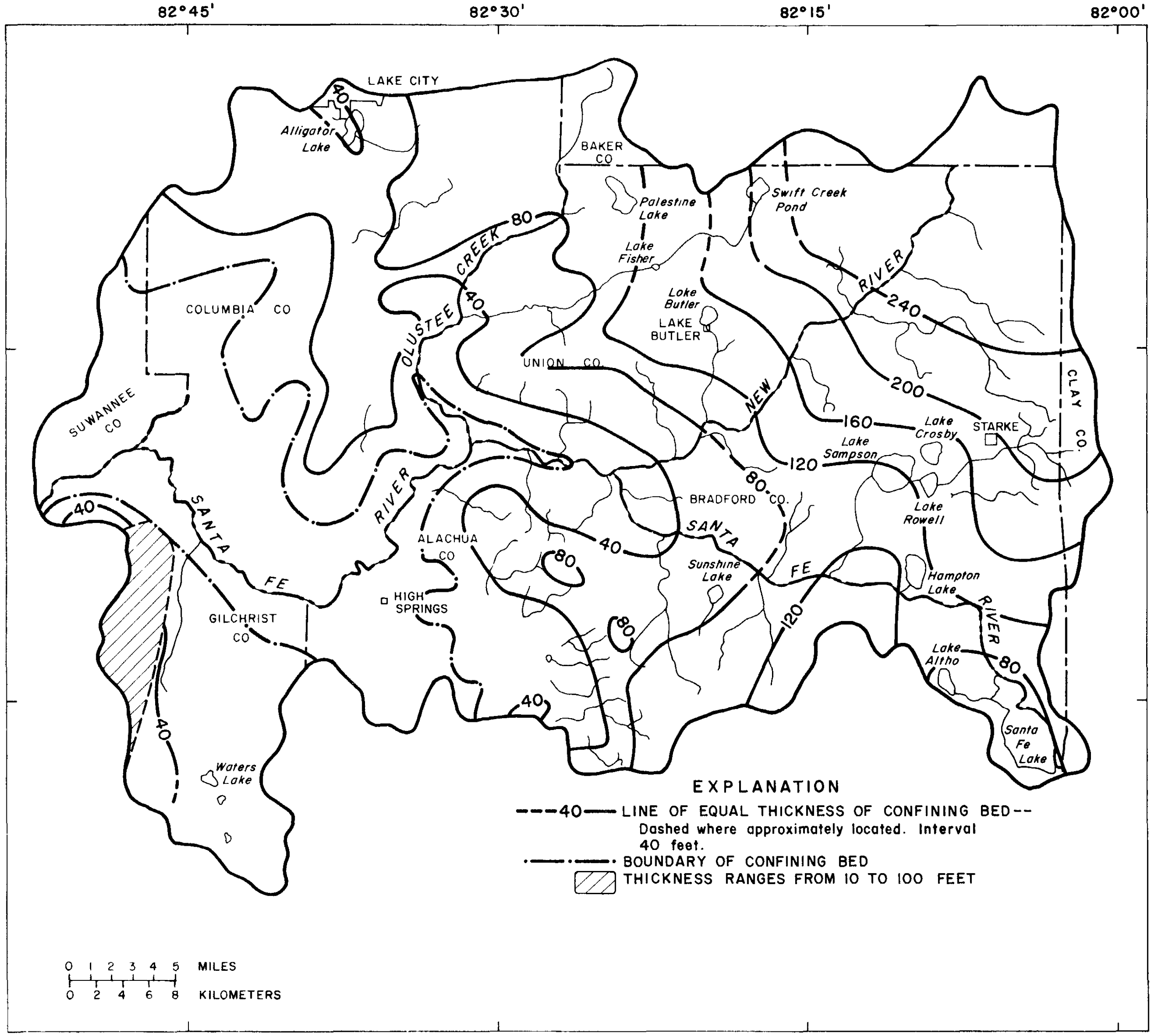


Figure 10.--Thickness of the confining bed.

Discharge from the water-yielding zones of the confining bed is principally leakage to the Floridan aquifer. To the east, some water is presumed to discharge to the surficial aquifer near streams. Near its western boundary, the confining bed becomes thin, and water levels in the underlying Floridan aquifer are below the base of the confining bed. (See section on Floridan aquifer, figure 12, and figure 13.) The low-flow data (Surface-Water section and table 7) indicate that the streams lose water to the confining bed in this area during low flow. They probably lose flow during rising stream stages and gain flow for variable periods of time after peak flows. Heilbronn Spring near Starke (spring 1, fig. 3) discharges from the confining bed. Although its discharge is only about 18 gal/min (Rosenau and others, 1977, p. 75), its presence indicates the possibility for flowing wells in the area. Worthington Spring (spring 2, fig. 3) also discharges from the confining bed (Rosenau and others, 1977, p. 390-392); the spring had a measured flow of 386 gal/min in 1972 but was not observed to flow during the period of this investigation. Santa Fe River water was observed flowing into the spring on two occasions.

The water-yielding zones of the confining bed are used mostly for domestic and farm supplies, and in places for irrigation. In Bradford and eastern Union Counties these zones are the principal source of domestic supplies (Clark and others, 1964b). The potential of the confining bed has not been fully developed in the eastern and northeastern parts of the basin, where it is thickest (fig. 10), because the area is predominantly rural. South of the Santa Fe River, within the basin, very few wells supply water from the confining bed. Most wells tapping the confining bed are 2-inch jetted wells, with the casing seated near the top of the bed and finished open-hole to the depth necessary to obtain the desired yield. Clark and others (1964b) report specific capacities ranging from 0.2 to 10 (gal/min)/ft of drawdown. Although confining bed water-yielding zones do not have the potential to supply large municipal and industrial needs, wells open to more than one zone may supply 50 to 100 gal/min.

The Alachua Formation (Puri and others, 1967) covers most of Gilchrist County within the Santa Fe basin, and part of western Alachua County. Logs of test holes furnished by the Florida Bureau of Geology indicated some sand in the Alachua Formation or in overlying unconsolidated deposits. However, Clark and others (1962) specifically exclude "sand and clayey sand overlying the Ocala Group in southern and western Alachua County" from their "water-table aquifer." Test holes were drilled at six locations in Gilchrist County in order to determine the presence or absence of a surficial aquifer associated with the Alachua Formation. These test holes are listed in table 2 as local numbers 940-246-2, 943-241-2, 943-248-1, 947-244-2, 947-247-2, and 949-244-1. No water was encountered above the Floridan aquifer and no wells in Gilchrist County are known to be producing water from deposits overlying the Floridan aquifer. The unconsolidated deposits found in the test wells, with the exception of 10 feet or less of unsaturated sand at the surface, are considered to be part of an areally extensive confining bed. This material confines water in the Floridan aquifer and supports the ponds, lakes, and swamps of Gilchrist and western Alachua Counties. This confining bed (fig. 4) consists predominantly of noncalcareous fine sand, silt, and clay in varying proportions; it becomes a reddish phosphatic clay near its eastern edge. A green to green-blue clay underlies the sand, silt, and clay in places. In this area, the thickness of the confining bed is extremely variable; maximum thickness is about 100 feet where test drilled. The confining bed is overlain by a few feet of surficial sands that constitute the surficial aquifer in the eastern part of the basin; however, no wells or saturated sands were found. Domestic wells are finished in the Floridan aquifer.

The confining bed has a water table near land surface and, consequently, has large evapotranspiration losses. In some places material from the confining bed may have reduced the transmissivity of the upper part of the Floridan aquifer by filling openings in the limestone with clay and silt.

Floridan Aquifer

The Floridan aquifer (Parker and others, 1955) is the principal source of water for municipal and industrial use in the Santa Fe basin. This highly productive aquifer consists of several hundred feet of limestone and dolomite. The stratigraphic units constituting the aquifer are, from oldest to youngest: Lake City Limestone, Avon Park Limestone, and Ocala Limestone, all of Eocene age; Suwannee Limestone of Oligocene age; and limestones at the base of the Hawthorn Formation of Miocene age. The aquifer is overlain by the confining bed and surficial aquifer in the eastern part of the basin, and by the confining bed in much of the western part of the basin (fig. 4). The top of the aquifer slopes gently toward the northeast from the central part of the basin (fig. 11). The confining bed's effectiveness in confining the Floridan aquifer does not extend to the limits of the hydrogeologic unit (compare figs. 4 and 11). Very little is known about the confining bed below the Floridan aquifer, but it is presumed to consist of gypsiferous limestone and dolomite in the lower part of the Lake City Limestone and in the upper part of the Oldsmar Limestone (Meyer, 1962; Clark and others, 1964b). Miller and others (1978) extend the base of the Floridan to the base of the Cedar Keys Limestone. The thickness of limestone containing potable water is as little as 300 feet near the Santa Fe River at High Springs (see section on Recharge and Discharge) and increases to more than 800 feet (Causey and Leve, 1976) to the north and to the south of this reach of the river. Part of the aquifer is unconfined in the western basin. About 200 mi^2 of the Floridan aquifer is only partly saturated near the western edge of the main part of the confining bed.

Recharge and Discharge

Recharge to the Floridan aquifer within the Santa Fe basin is mostly from precipitation within the basin, as direct percolation through the overlying confining bed and surficial aquifer. The rate of recharge is much greater where the aquifer is unconfined; there are few streams or lakes and much of the rainfall percolates directly into the Floridan aquifer.

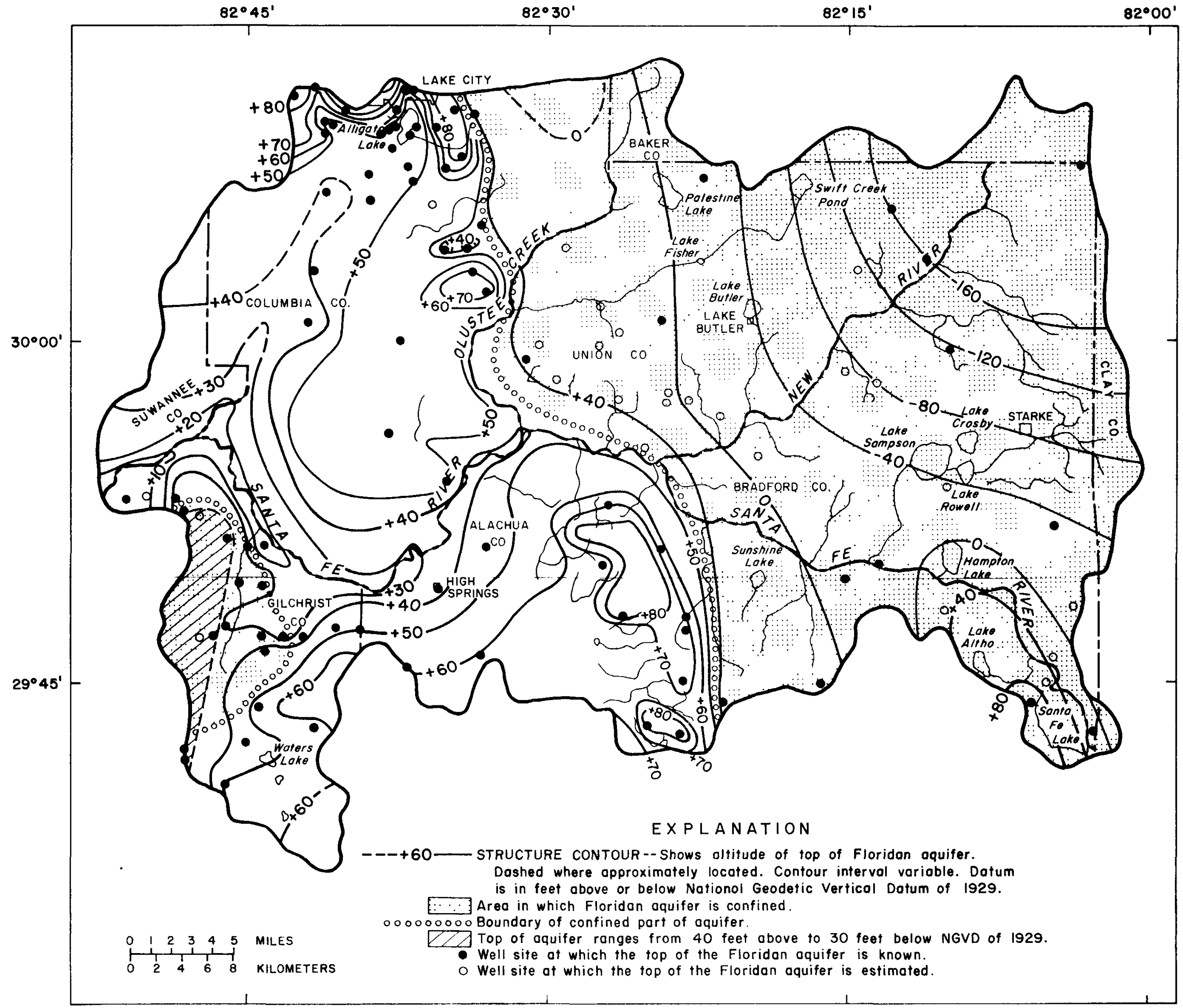


Figure 11.--Altitude of the top of the Floridan aquifer.

Where the Floridan aquifer is confined (fig. 11), the confining bed is capable of supporting a water table within a few feet of land surface, associated with streams, lakes, ponds, and swamps. The rate of recharge to the Floridan aquifer is limited by the thickness and vertical hydraulic conductivity of the confining bed and surficial aquifer, and by the difference in hydraulic head between the water table and the potentiometric surface of the Floridan aquifer. The recharge rate can be increased locally by developing the Floridan aquifer and lowering its potentiometric surface. The increase in the rate of recharge is directly proportional to the increase in head difference between the surficial water table and potentiometric surface in the Floridan aquifer. If the potentiometric surface in the Floridan aquifer is lowered below the base of the confining bed, no further increase in the recharge rate occurs.

The rate of recharge to the confined part of the aquifer in eastern Alachua and southeastern Bradford Counties has been estimated by Clark and others (1964b) to be 1.8 in/yr. The remainder of the average annual rainfall is lost to evapotranspiration and streamflow before reaching the Floridan aquifer. The confined areas of the Floridan aquifer contain two potentiometric highs (fig. 12), one in the southwest (Gilchrist County) and the other in the southeast (Alachua and Bradford Counties) parts of the basin. Isolated potentiometric highs are often considered recharge areas, but they can also be the result of lower aquifer transmissivity relative to surrounding areas. The potentiometric high in Gilchrist County, near the Suwannee and Santa Fe Rivers (fig. 12), is surrounded by unconfined areas and is confined by a bed that supports Cow Creek and numerous ponds and swamps, which discharge much of the rainfall as evapotranspiration. The area surrounding the Gilchrist County potentiometric high is unconfined and, consequently, infiltration is high and surface-water features other than the Santa Fe River are lacking. Recharge to this potentiometric high is less than in surrounding areas because the confining bed restricts infiltration and enhances surface runoff and evapotranspiration. The presence of the high potentiometric levels is, therefore, attributed to relatively low transmissivity compared to that of the surrounding area.

The potentiometric high in eastern Alachua and southeastern Bradford Counties may also be caused, in part, by lower aquifer transmissivity; however, its estimated recharge rate (1.8 in/yr) may be higher than average for the confined part of the Floridan aquifer. Miller and others (1978, p. 82-83) give an estimate of 0.3 in/yr for the Osceola Forest, adjacent to the northern boundary of the Santa Fe basin.

Recharge to the unconfined part of the Floridan aquifer, a well developed karst area, varies with rainfall. During 1959, a year with greater than average rainfall, Clark and others (1964b) estimated recharge to the unconfined part of the Floridan aquifer to be 25 inches.

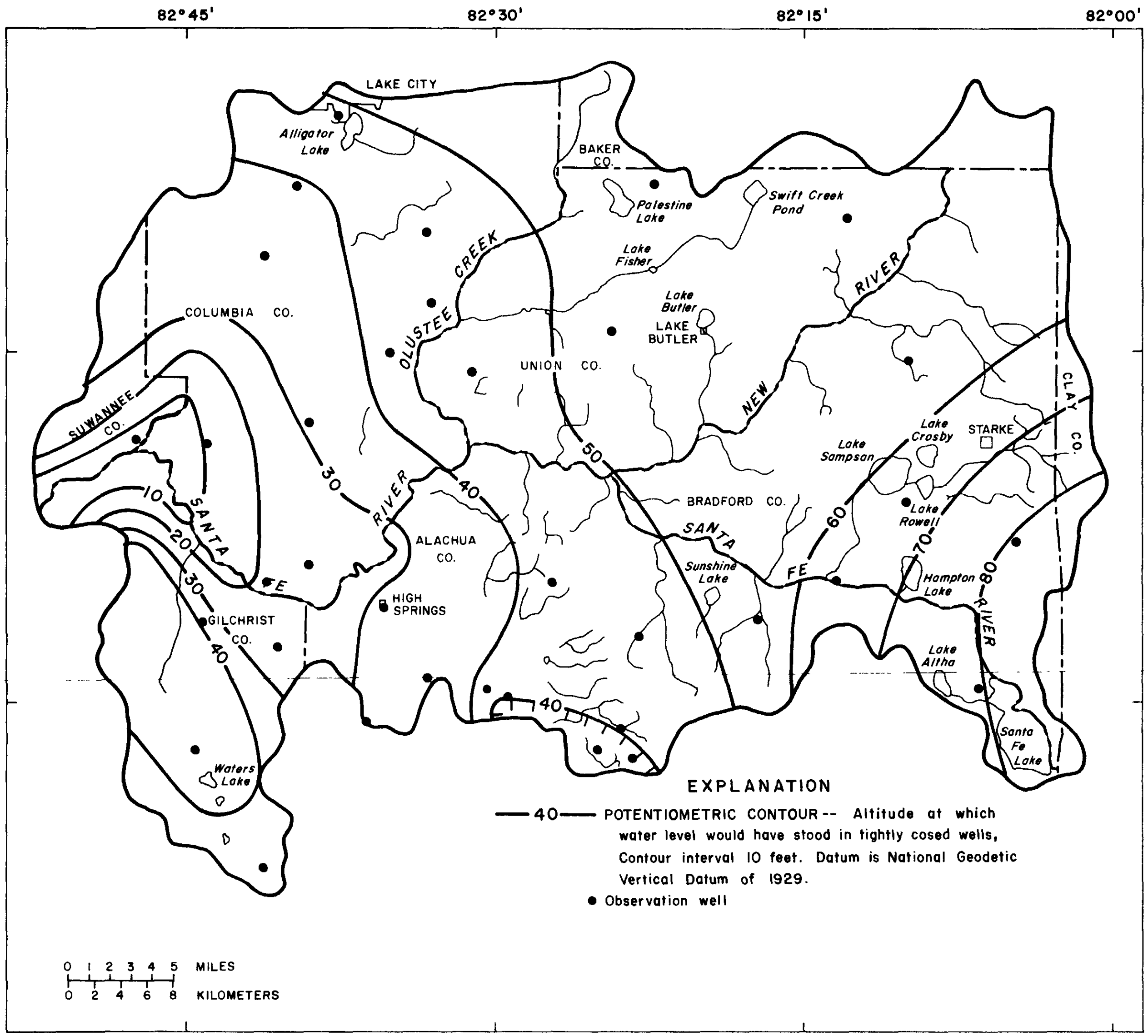


Figure 12.--Altitude of the potentiometric surface of the Floridan aquifer, May 1976 (from Fisk and Rosenau, 1977).

Estimated average recharge to the unconfined part of the aquifer was obtained by using the Ichetucknee Springs drainage area estimated from the potentiometric surface map of Fisk and Rosenau (1977), presented here as figure 12. Ichetucknee Springs drain about 400 mi^2 of the Floridan aquifer, 250 mi^2 of which represent unconfined conditions and 150 mi^2, confined. Assuming a recharge rate of 2 in/yr for the confined part, and using the average measured discharge of the springs (360 ft^3/s), average recharge to the unconfined part of the Floridan aquifer is estimated to be about 18 in/yr.

The Floridan aquifer discharges to the Santa Fe and Ichetucknee Rivers, by evapotranspiration near the rivers where the potentiometric surface is near land surface, and by discharge through wells. Water flows out of the basin through the aquifer to the north and southwest. The contribution to streamflow in the drainage area of Ichetucknee Springs is about 0.9 $(ft^3/s)/mi^2$. Assuming a similar rate for the remainder of the Floridan aquifer, discharge to the Santa Fe River is estimated to average 1,400 ft^3/s. Known springs in the Santa Fe basin and measurements of their discharge are listed in table 3.

Wells completed in the upper 300 feet of the Floridan aquifer generally yield potable water, and aquifer discharge to springs is low in mineral content. Exceptions to this generalization occur near the municipality of High Springs and at Wilson Spring (fig. 3, spring 19). The resurgence (labeled spring 3) of the Santa Fe River, Hornsby Spring (spring 4), and Columbia Spring (spring 6) discharge water with sulfate concentrations in the range of 60 to 70 milligrams per liter (mg/L). Clark and others (1964a) also found high sulfate concentrations during periods of low flow of the Santa Fe River near these springs. On April 14, 1977, the Santa Fe River at O'Leno State Park had a flow of 128 ft^3/s and a sulfate concentration of 30 mg/L. River discharge about ¼ mile downstream of the resurgence was 285 ft^3/s with a sulfate concentration of 70 mg/L. The 157 ft^3/s gain in discharge in the underground reach had a calculated average sulfate concentration of about 100 mg/L. An analysis by Black, Crow, and Eidsness, Inc. (written commun., 1969) of water from a municipal well at High Springs which is open to the Floridan aquifer from 350 to 500 feet, indicated a sulfate concentration of 370 mg/L, an unusually high concentration for wells of this depth.

Two industries near High Springs discharge a sulfate effluent into streams that drain, through sinkholes, into the Floridan aquifer where ground-water flow is toward the Santa Fe River. The quantity of sulfate involved, however, is too small to account for the sulfate load of the Santa Fe River; and the the detection of high sulfate concentrations in the river by Clark and others this industrial development. Nor are the hydrogeologic units overlying the Floridan aquifer important sources of sulfate. The only known source of large amounts of sulfate is deeply circulating water within the Floridan aquifer. The quality of the discharge from Columbia Spring and Hornsby Spring, and probably of the resurgence of the Santa Fe River, varies with discharge. Columbia Spring and Hornsby Spring are known to receive, rather than discharge, water during high river stages.

Table 3.--Springs and spring discharge

[Discharge is from the Floridan aquifer unless otherwise noted and is in cubic feet per second (ft^3/s); e = estimated]

[Data in part from Rosenau and others, 1977]

Map number (fig. 3)	Spring name and number	Discharge (date measured)	Remarks
1	Heilbronn Spring, 300125082092000, 02320951	1e (09/15/76)	Head is more than 2.5 ft above land surface. Discharge is from the confining bed.
2	Worthington Spring, 295532082253300, 02321503	--	Discharge during recession of river stages. Backflows during rising river stages. No exchange of water with river during extreme low flow (10 ft^3/s or less). Discharge is from the confining bed and possibly the Floridan aquifer.
3	Resurgence of Santa Fe River 295225082353000	--	Generally not considered a spring, but contains ground water contributed in 3-mile underground reach of river upstream from resurgence. Approximate gain in flow in this reach: 211 ft^3/s, Feb. 23, 24, 1961; 157 ft^3/s, Apr. 13, 14, 1977. No information on backflow.
4	Hornsby Spring, 295059082353600	250 (04/19/72) 76 (04/25/75)	Privately owned and developed. Used for recreation. Backflows during high river stages.
5	Darby Spring 295108082362500	--	Discharge is below water surface and assumed to be very small. No information on backflow.
6	Columbia Spring, 295114082364400, 02321977		Color of discharge and sinkholes upstream indicate that part of the discharge is river water.

Table 3.--Springs and spring discharge--Continued

Map number (fig. 3)	Spring name and number	Discharge (date measured)	Remarks
--	Poe Springs group		Includes Allen Spring, Poe Springs, Lilly Spring, Johnson Spring, Rum Island Spring, and the Blue Springs group (map numbers 7-18). Backflow has not been observed or reported in any spring of the Poe Springs group.
7	Allen Spring, 294938082384800	--	Briel (1976).
8	Poe Springs, 294933082385800, 02322140	86 (02/19/17) 75 (01/31/29) 31 (03/14/32) 84 (12/13/41) 75 (07/22/46)	Privately owned and developed. Spring opening collapsed or filled.
9	Lilly Spring, 294946082394200	32 (05/09/75)	Several small openings.
10	Johnson Spring, 293120082404000	--	Discharge at mouth of spring run estimated as 50 ft^3/s, May 9, 1975.
11	Rum Island Spring, 294959082404900	50e (05/09/75)	Spring area improved by Columbia County.
--	Blue Springs group		Includes Blue Springs, Naked Springs, Little Blue Spring, Jonathan Spring, Devil's Eye Spring, July Spring, and Ginnie Spring (map numbers 12-18). Privately owned and developed.
12	Blue Springs, 294947082405900	42 (04/28/75)	Cavern that supplies spring collapsed about 50 ft from entrance.
13	Naked Spring, 294947082405200	28 (04/28/75)	Located less than ¼ mi east of Blue Springs. Spring run discharges into Blue Springs run.

Table 3.--Springs and spring discharge--Continued

Map number (fig. 3)	Spring name and number	Discharge (date measured)	Remarks
14	Little Blue Spring, 294950082410000	No flow visible (04/28/75)	Located less than ¼ mi west of Blue Springs. Spring run discharges into Blue Springs run.
15	Jonathan Spring, 295004082413000	--	Briel (1976).
16	Devil's Eye Springs, 295006082414900	--	Two main openings, called "Devil's Eye" and "Devil's Ear." Discharge was under water and may have been greater than 50 ft^3/s, May 12, 1975.
17	July Spring, 295010082414700	58 (05/12/75)	
18	Ginnie Spring, 295009082420100	46 (04/28/75)	Privately owned and developed. Extensive cavern system (W. T. Hurst, Alachua County Pollution Control, oral commun. 1975).
19	Wilson Spring, 295359082453100	20-50e (09/16/76)	Color of water indicates that some of the discharge is river water. The sulfate concentration of 78 mg/L indicates an additional ground-water source.
20	Northbank Spring, 295433082461900	--	Briel (1976).
21	Jamison Spring, 295532082455600	0 (09/16/76) 3e (04/28/77)	Several openings.
22	The Boil 295540082461400	--	Spring located in river bed. Discharges clear water into dark-colored river water. Discharge difficult to measure or estimate, but could be greater than 50 ft^3/s.

Table 3.--Springs and spring discharge--Continued

Map number (fig. 3)	Spring name and number	Discharge (date measured)	Remarks
--	Ichetucknee Springs group, 295709082471000, 0232270	360 average, (1931-76) [1]126 (05/17/46)	In Ichetucknee Springs State Park. Springs and spring run (Ichetucknee River) used for swimming, canoeing, tubing, and scuba diving. No observations or reports of backflow. Ichetucknee Springs group includes Ichetucknee, Cedar Head, Blue Hole, Mission Springs group, Boiling, Grassy Hole, Jamison, Mill Pond, and Coffee, (map numbers 23-31).
23	Ichetucknee Spring, 295902082454300	--	Also known as Ichetucknee Head Spring.
24	Cedar Head Spring, 295900082453200	--	Very small spring.
25	Blue Hole Spring, 295847082453100	--	Cavern system. Also called Jug Spring.
--	Mission Springs	49 (05/17/46)	Includes Roaring Springs and Singing Springs (map numbers 26 and 27).
26	Roaring Springs, 295835082453100, 02322689	--	
27	Singing Springs, 295833082452900	--	
28	Boiling Spring, 295825082453700	--	
29	Grassy Hole Spring, 295810082453600	--	

[1]Includes Ichetucknee Spring, Cedar Head Spring, and Blue Hole Spring.

Table 3.--Springs and spring discharge--Continued

Map number (fig. 3)	Spring name and number	Discharge (date measured)	Remarks
30	Mill Pond Spring, 295804082453700, 322696	22 (05/17/46) 19 (07/11/75)	
31	Coffee Spring, 295735082462700	--	
32	Holly Spring 295503082492700	1e (04/27/77)	
33	Betty Spring, 295453082502400	1e (09/16/76)	
34	Trail Springs 295354082520000	--	Discharge is below river surface and assumed to be very small.

A group of springs downstream from Columbia Spring (fig. 3, spring 6) was identified by Briel (1976) as the Poe Springs group and includes those springs from Poe Springs downstream to, and including, Ginnie Spring (fig. 3, springs 7 through 18, and table 3). Some smaller springs may exist downstream from Ginnie Spring and upstream of the Fort White daily discharge station (number 88, fig. 13). The gain in discharge of the Santa Fe River from the Floridan aquifer between surface-water stations 84 and 88 (fig. 13), which span the Poe Springs group, is about 700 ft^3/s at 90 percent flow duration. Known spring flow probably accounts for no more than 50 percent of this amount. None of these springs have been reported to backflow during high river stages. Their discharge is low in dissolved solids and sulfate.

The ground-water contribution to streamflow between surface-water station 88 and the mouth of the Ichetucknee River is partly from numerous large joints in the limestone streambed. Wilson Spring (spring 19) and The Boil (spring 22) have discharges estimated to be between 10 and 100 ft^3/s. It is not known whether the springs and large joints in this reach backflow during high river stages. Water that discharges from Wilson Spring is high in dissolved solids and sulfate concentrations and has a dark color similar to the river water.

Ichetucknee Springs, a group of at least nine springs (fig. 3, springs 23-31) upstream from station 95, discharge an average of 360 ft^3/s from a drainage area estimated to be 400 mi^2. The water is low in dissolved solids and sulfate. No springs are known between station 95 and the Santa Fe River.

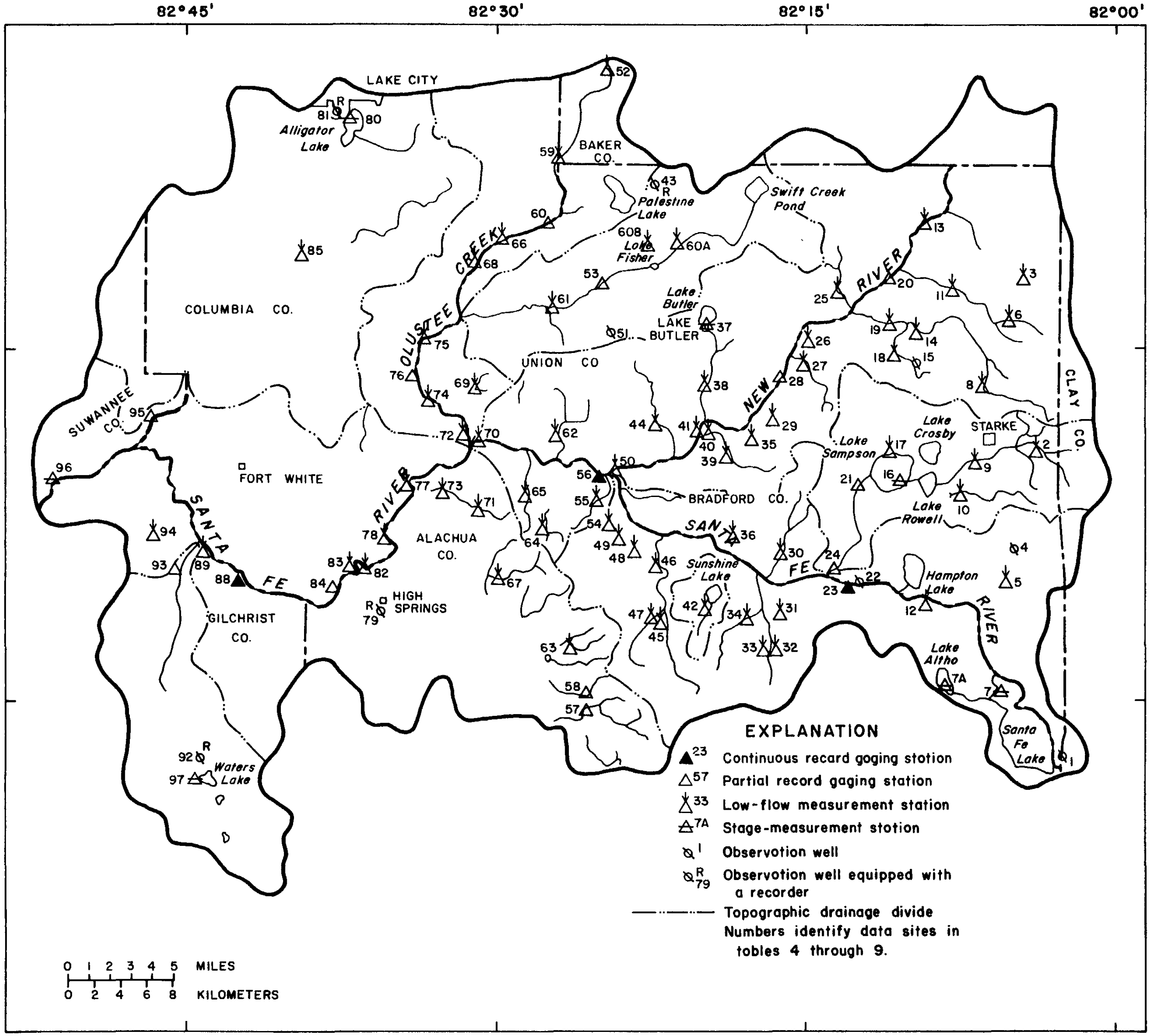


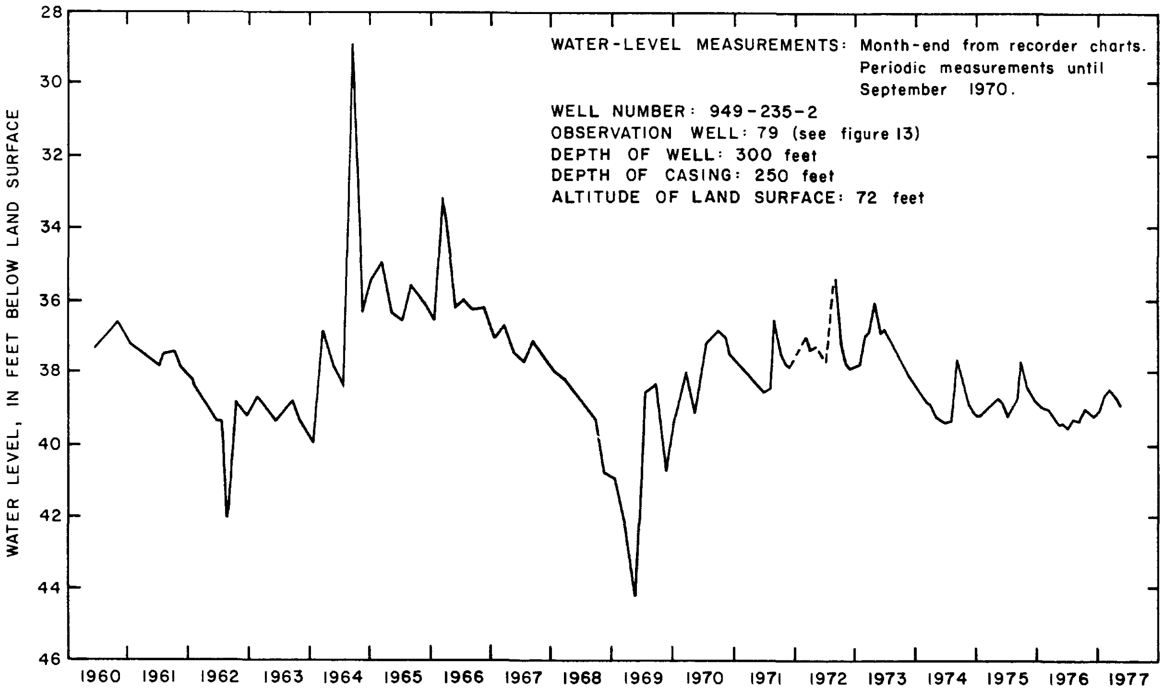
Figure 13.--Locations of surface-water and ground-water measurement sites.

From the mouth of the Ichetucknee River to the Suwannee River, the known springs discharging to the Santa Fe River are small, each discharging probably less than 5 ft^3/s. Although large joints may be present in the channel, the water is too deep and highly colored in nearly all of this reach to permit their detection.

Figures 14-16 show water-level fluctuations in observation wells open to the aquifer. Table 4 lists the observation wells, their locations (fig. 13), and frequency of observation. In general, the magnitude of fluctuations is greatest on the potentiometric highs (fig. 12) and smallest near the Santa Fe River (fig. 13, observation wells 79 and 92). Annual fluctuations of water levels are due largely to variations in rainfall. The hydrographs show a long-term decline in water levels following record high rainfall during the 1960's. The only pumping that might have affected a nearby well (fig. 13, observation well 81) is in Lake City, and it shows little effect. The water levels in observation well 81 may be partially stabilized by perennial infiltration from nearby Alligator Lake, which has surface-water inflow but no outflow. Figure 17 is a 30-year comparison of water levels in observation well 81 with cumulative departure from average annual rainfall at Lake City (Miller and others, 1978). The graphs show a general correlation between water levels and rainfall.

Table 4.--Location of long-term observation wells from which water-level measurements of the Floridan aquifer were obtained

Map number (fig. 13)	Latitude	Longitude	County	Frequency of water-level measurements and period of record
1	29°43'13"	82°02'46"	Clay	Monthly, May-September 1960, Bimonthly, 1975-76.
4	29°52'57"	82°04'57"	Bradford	Semimonthly to bimonthly, September 1959-June 1960, Bimonthly, 1975-76.
15	30°00'20"	82°10'30"	do.	Bimonthly, 1959-78.
22	29°50'55"	82°13'08"	do.	Bimonthly, 1975-76.
43	30°07'47"	82°22'58"	Union	Daily, 1958-78.
51	30°01'01"	82°24'52"	do.	Bimonthly, 1959-78.
79	29°49'28"	82°35'53"	Alachua	Bimonthly, June-September 1970 Daily, 1970-78.
81	30°10'31"	82°38'10"	Columbia	Daily, 1948-78.
92	29°43'30"	82°44'50"	Gilchrist	Bimonthly, July 1964-May 1965 Daily, 1965-78.



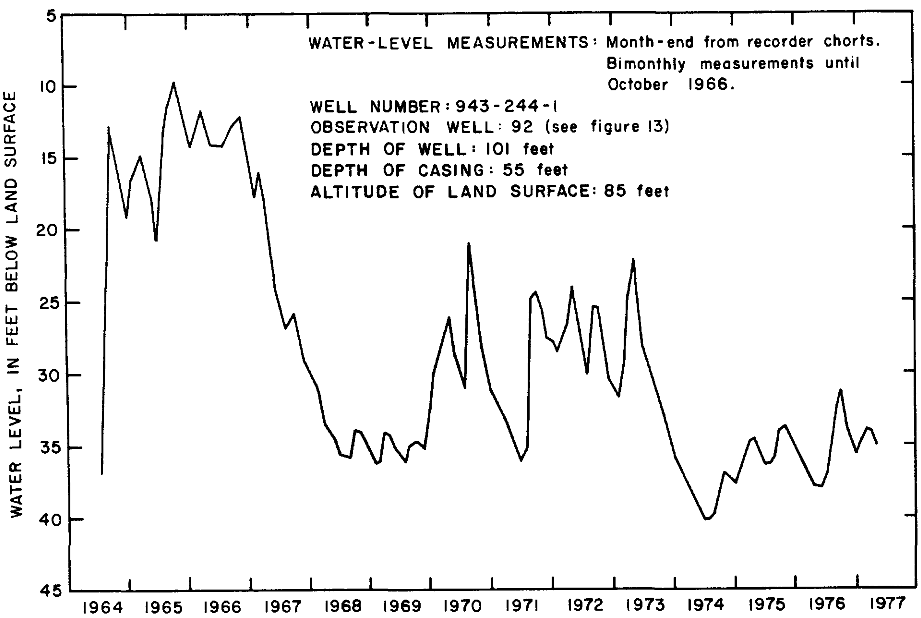
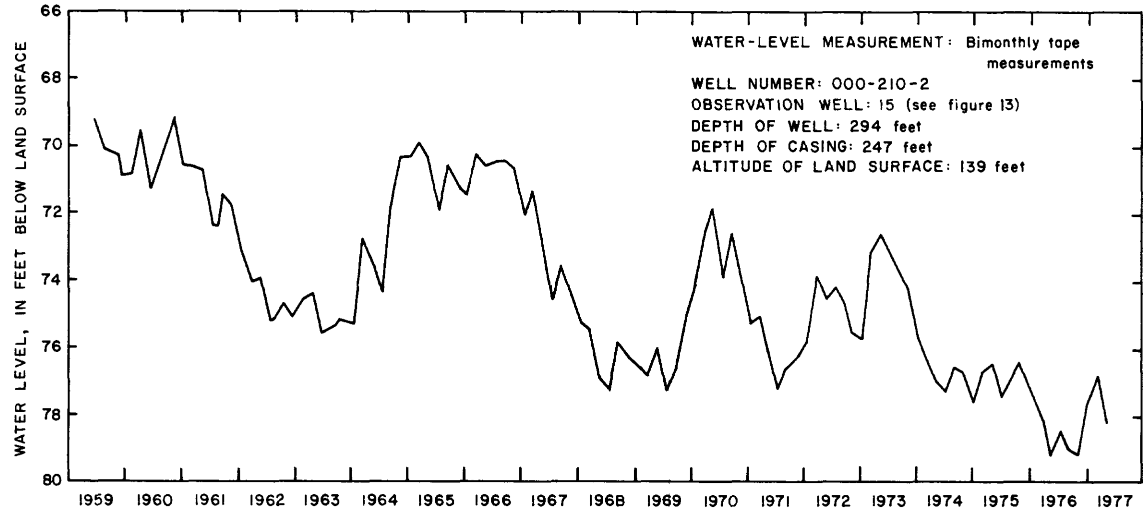


Figure 14.--Hydrographs of observation wells in the Floridan aquifer at wells 79 and 92.



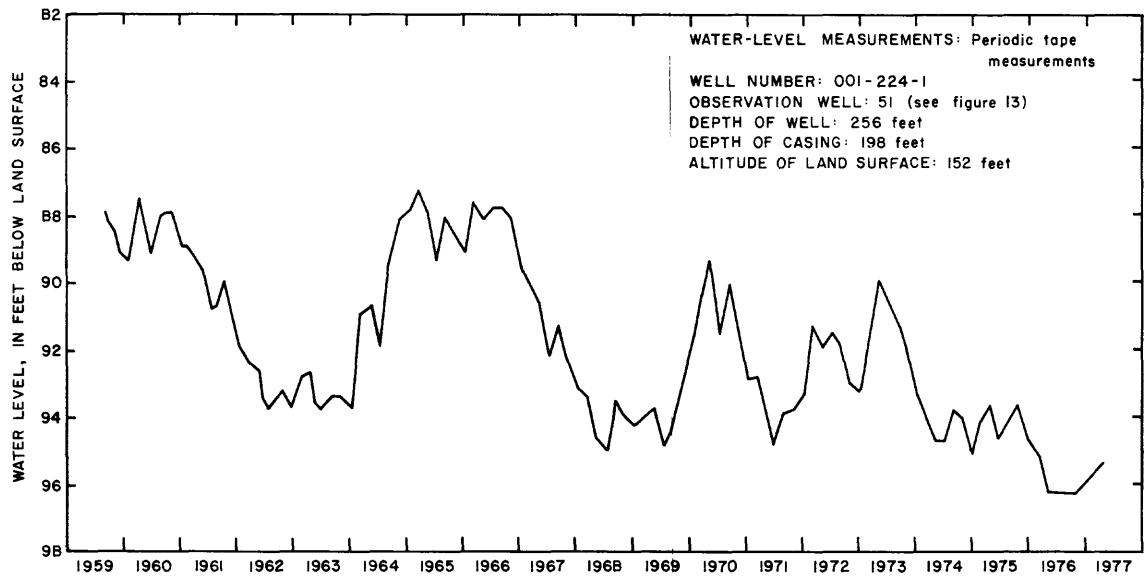
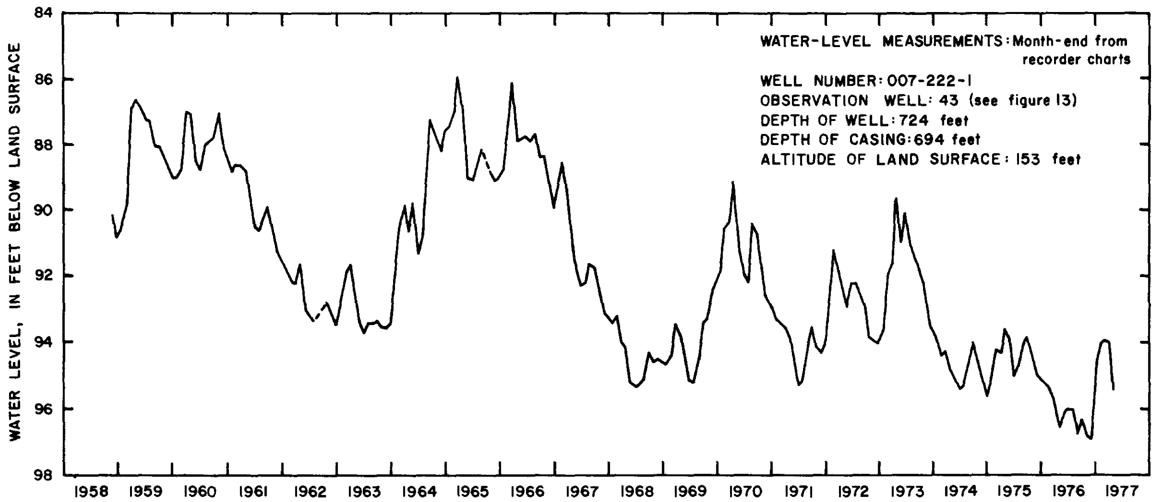


Figure 15.--Hydrographs of observation wells in the Floridan aquifer at wells 15 and 51.



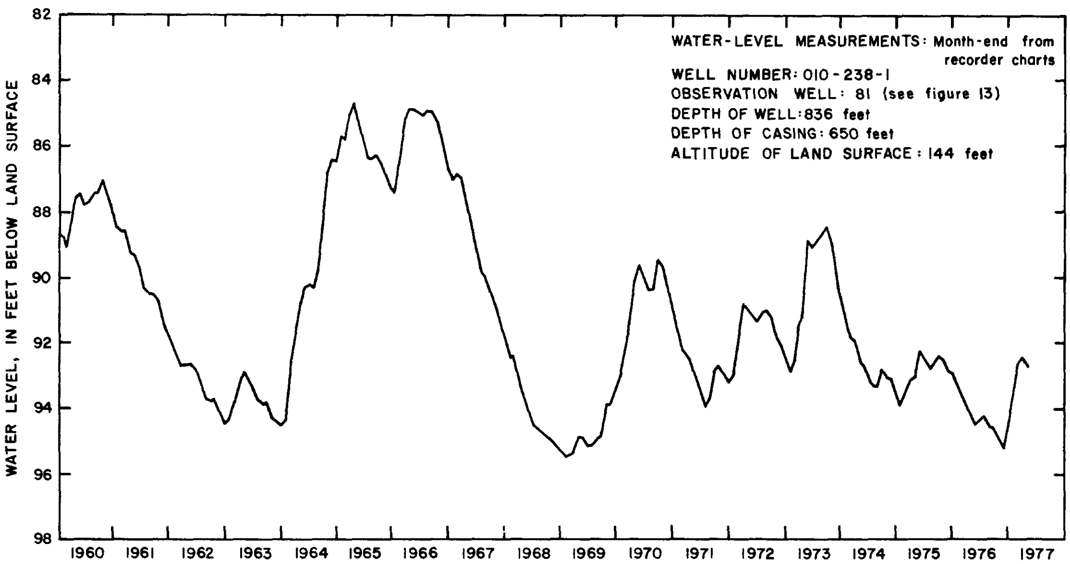
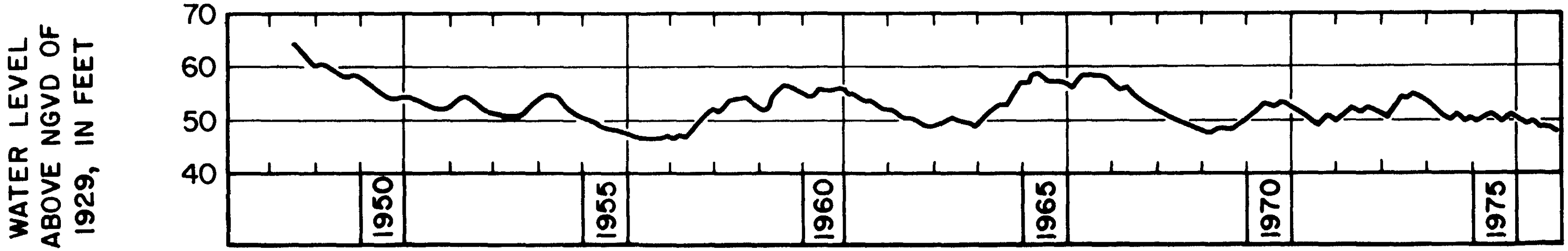
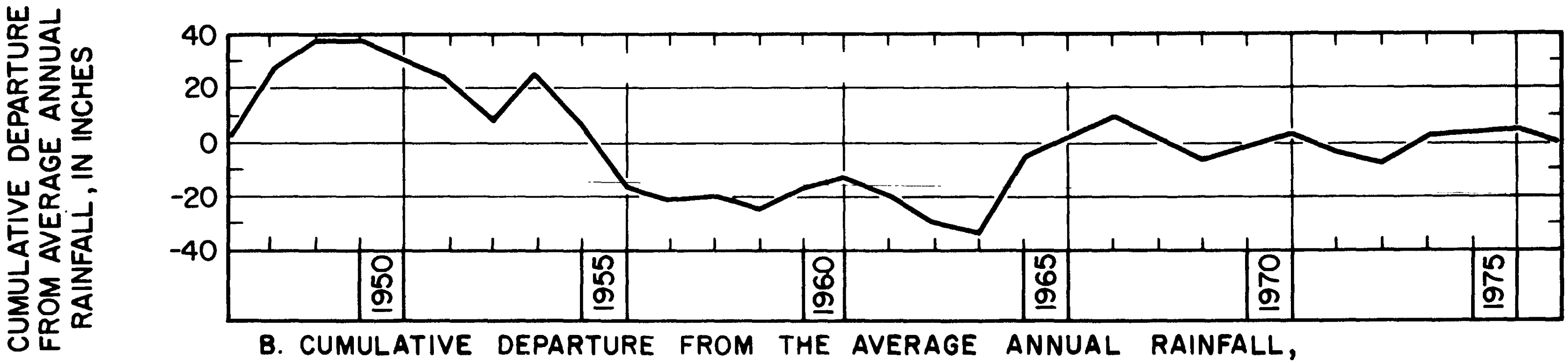


Figure 16.--Hydrographs of observation wells in the Floridan aquifer at wells 43 and 81.



A. HYDROGRAPH OF OBSERVATION WELL 81 AT LAKE CITY, FLORIDA.



B. CUMULATIVE DEPARTURE FROM THE AVERAGE ANNUAL RAINFALL, LAKE CITY, FLORIDA (FROM MILLER AND OTHERS, 1978).

Figure 17.--Rainfall and ground-water levels at Lake City, Florida, 1948-76.

Water-Bearing Properties

Three aquifer tests have been run in the confined part of the Floridan aquifer in or near the Santa Fe basin; at the Sperry plant northeast of Gainesville (Clark and others, 1964b), at Lake City (Meyer, 1962), and in the Osceola National Forest northeast of Lake City (Miller and others, 1978). The calculated transmissivities were 21,000 ft^2/d at the Sperry plant, 36,000 ft^2/d at Lake City, and about 33,000 ft^2/d in the Osceola Forest. Because the wells tested penetrated only about the upper 200 feet of the aquifer at the Sperry plant and at Lake City, and the upper 100 feet in the Osceola Forest, and because the Floridan aquifer is known to be vertically anisotropic, these transmissivity values probably are representative of only the upper part of the confined aquifer. Although no aquifer tests have been made in the unconfined part of the basin, specific-capacity tests suggest transmissivities of 60,000 ft^2/d or more. Clark and others (1964b) indicated that the highest specific capacities known to them [as much as 20,000 (gal/min)/ft] occurred in western Alachua County, where the aquifer is unconfined. Since publication of that report, two specific-capacity tests have become available for the unconfined part of the Floridan aquifer: 108 (gal/min)/ft at a powerplant northwest of Gainesville, and 177 (gal/min)/ft at a new municipal well at High Springs (table 2 and fig. 5, local well numbers 945-223-1 and 949-235-4). Estimated transmissivities are 30,000 and 47,000 ft^2/d, respectively. Using the confined and unconfined recharge rates for the Ichetucknee Springs basin and the average flow of Ichetucknee Springs (360 ft^3/s), the transmissivity of the unconfined part of the Floridan aquifer near the springs can be estimated to be 500,000 ft^2/d. This estimate, however, may reflect the effect of the total thickness of the aquifer on spring discharge, as compared to the effect of penetration of only part of the aquifer by most wells.

Potential for Development

The confined part of the Floridan aquifer (fig. 11) is a potential source of water for users requiring as much as 1,000 gal/min from individual wells. Extensive development of the confined part of the aquifer would increase its recharge by increasing the difference in hydraulic head between the water table in the surficial aquifer and the head in the Floridan aquifer. The maximum possible increase in this head difference is about 3 times in the northeast part of the basin, not taking into account any resulting head changes in the surficial aquifer. The increase in the rate of recharge would be directly proportional to the increased head difference, and would result in decreased discharge to streams and decreased evapotranspiration from the surficial aquifer.

The unconfined part of the aquifer is a potential source of water for users requiring as much as 5,000 gal/min from individual wells. Recharge is derived from local rainfall and could not be increased appreciably by pumping the aquifer, except by inducing infiltration near the Santa Fe River and utilizing runoff from that part of the basin where the aquifer is confined.

Heavy pumping from the confined part of the aquifer, or long-term droughts, could cause sinkhole development by lowering the water pressure that helps to support beds overlying large cavities in the aquifer rock. Sinkhole development may occur in either the confined or unconfined part of the aquifer during drilling of a well, especially if sand is pumped from underground cavities. If drilling activities permit sand to flow downward into cavities in the limestone, surface depressions may develop.

The unconfined part of the aquifer can be contaminated by waste discharge into sinkholes or to streams that drain into sinkholes. The present extent of such contamination is unknown and therefore presumably small, but could increase with industrial and municipal development.

SURFACE WATER

Streamflow

Total runoff from the Santa Fe basin averages about 2,150 ft^3/s or roughly 1,400 Mgal/d. This amount is sufficiently larger than the estimated water use (17 Mgal/d) to indicate an appreciable unused water-supply potential for the basin. The estimated total discharge is the sum of the average discharge of Ichetucknee Springs near Hildreth, about 360 ft^3/s (fig. 13, station 95, and table 5), the Santa Fe River near Fort White, about 1,640 ft^3/s (fig. 14, station 88), and the estimated average discharge from an ungaged area between the aforementioned discharge stations and the mouth of the Santa Fe River. This ungaged area is assumed to contribute the same amount of streamflow per square mile as the Ichetucknee Springs drainage basin, based on similar geology.

Table 5.--Hydrologic stage and discharge station locations and measurement frequency

Map number (fig. 13)	Station name and number[1]	Type and frequency od data
	Streams	
23	Santa Fe River near Graham, 02320700	Daily discharge, 1957-78.
21	Sampson River at Sampson City, 02320800.	Partial record, 1958-76.
24	Sampson River at Graham, 02320815	Partial record, 1958-76.
20	New River near Raiford, 02320900	Partial record, 1958-76.
28	New River near Lake Butler, 02321000	Daily discharge, 1950-71; Partial record, 1975-76.
56	Santa Fe River at Worthington Springs, 02321500.	Daily discharge, 1931-78.

[1]Downstream order number or site number used for U.S. Geological Survey automatic data processing.

Table 5.--Hydrologic stage and discharge station locations and measurement frequency--Continued

Map number (fig. 13)	Station name and number[1]	Type and frequency of data
	Streams--Continued	
60	Olustee Creek near Lulu, 02321600	Partial record, 1965-76.
53	Swift Creek near Lake Butler, 02321700	Daily discharge, 1957-60.
76	Olustee Creek near Providence, 02321800.	Daily discharge, 1957-60.
57	Turkey Creek near Hague, 294445082242500.	Partial record, 1975-76.
58	Turkey Creek tributary at Hague, 02322020.	Partial record, 1975-76.
84	Santa Fe River near High Springs, 02322000	Daily discharge, 1931-71; Partial record, 1975-76.
88	Santa Fe River near Fort White, 02322500	Daily discharge, 1927-30, 1932-78.
93	Cow Creek near Fort White, 02322590	Partial record, 1975-76.
95	Ichetucknee Springs near Hildreth, 02322700.	Partial record, 1929-78.
96	Santa Fe River near Hildreth, 02322800	Daily stage, 1947-78.
	Lakes	
7	Santa Fe Lake near Keystone Heights, 02320600.	Weekly, 1957-78.
7A	Lake Altho at Waldo, 02320630	Daily, March-September 1976.
16	Lake Sampson near Starke, 02320750	Weekly, 1957-78.
37	Lake Butler at Lake Butler, 02321300	Fragmentary record, 1957-65; Weekly, 1965-78.
97	Waters Lake near Trenton, 02322550	Weekly, 1972-78.
80	Alligator Lake at Lake City, 02322600	Weekly, 1965-67, 1972-78; Fragmentary record, 1967-72.

[1]Downstream order number or site number used for U.S. Geological Survey automatic data processing.

Average annual runoff is higher in the western than in the eastern part of the basin (table 6). In the east, the confining bed retards downward percolation of ground water to the Floridan aquifer resulting in a high water table in the overlying surficial aquifer and the existence of many streams, lakes, and swamps; consequently, evapotranspiration losses are greater than in the west. Also, some water that percolates through the confining bed and recharges the Floridan aquifer ultimately discharges to streams in the western part of the basin.

Table 6.--Summary of streamflow data

[e = estimated for water year 1976]

Map number (fig. 13)	Gaging station name and number[1]	Drainage area (mi^2)	Period of record used	Discharge Maximum (ft^3/s)	Discharge Minimum (ft^3/s)	Discharge Average ft^3/s	Discharge Average in/yr
23	Santa Fe River near Graham, 02320700	94.9	1957-76	2,360	0.05	64.1	9.2
21	Sampson River at Sampson City, 02320800	59.7	1958-67 1975-76	325	2.1	35e	8.0
24	Sampson River at Graham, 02320815	74.3	1975-76	189	4.9	41e	7.5
20	New River near Raiford, 02320900	88.1	1958-76	2,060	.40	50e	7.7
28	New River near Lake Butler, 02321000	193	1950-70 1975-76	11,400	.20	117e	8.2
56	Santa Fe River at Worthington Springs, 02321500	575	1931-76	20,000	.50	446	10.5
60	Olustee Creek near Lulu, 02321600	49.1	1965-67 1969-73 1975-76	2,130		28e	7.7
57	Turkey Creek near Hague, 294445082242500		1975-76	4.0	.75	2.6e	--
58	Turkey Creek tributary at Hague, 02320020		1975-76	3.8	1.4	2.8e	--

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 6.--Summary of streamflow data--Continued

Map number (fig. 13)	Gaging station name and number[1]	Drainage area (mi^2)	Period of record used	Discharge Maximum (ft^3/s)	Discharge Minimum (ft^3/s)	Discharge Average ft^3/s	Discharge Average in/yr
84	Santa Fe River near High Springs, 02322000	868	1931-71 1975-76	20,000	31	900e	14.1
88	Santa Fe River near Fort White, 02322500	1,017	1927-30 1932-76	17,000	609	1,643	21.9
93	Cow Creek near Fort White, 02322590	26.2	1975-76	32	.99	9e	4.7
95	Ichetucknee Springs near Hildreth, 02322700	[2]400	1917-75	578	241	360e	12.2

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

[2]Estimated from potentiometric surface map.

Application of Streamflow Data

The entire range of discharge at a gaging station compared with time is shown by the flow-duration curve, which presents the percentage of time that discharges have been equaled or exceeded without considering the length of time that any given discharge has been sustained. Flow-duration curves for six discharge sites are shown in figure 18. The slopes of the curves for stations 84 and 88 are not as steep as for the other stations. The base flow at stations 84 and 88 is discharge from the Floridan aquifer. The other stations (23, 28, 56, and 76) receive discharge only from the surficial aquifer and a minor amount of seepage from the confining bed at base flow. The curves of the latter stations are somewhat parallel, except for station 76, Olustee Creek near Providence. This stream is known to lose water during low-flow periods, and the loss is reflected by a steepening in slope of the curve.

Low-flow frequency data (table 7) indicate the probability of a specific recurrence of minimum average discharge for periods of 3, 7, 14, 30, 60, 120, 183, and 365 days.

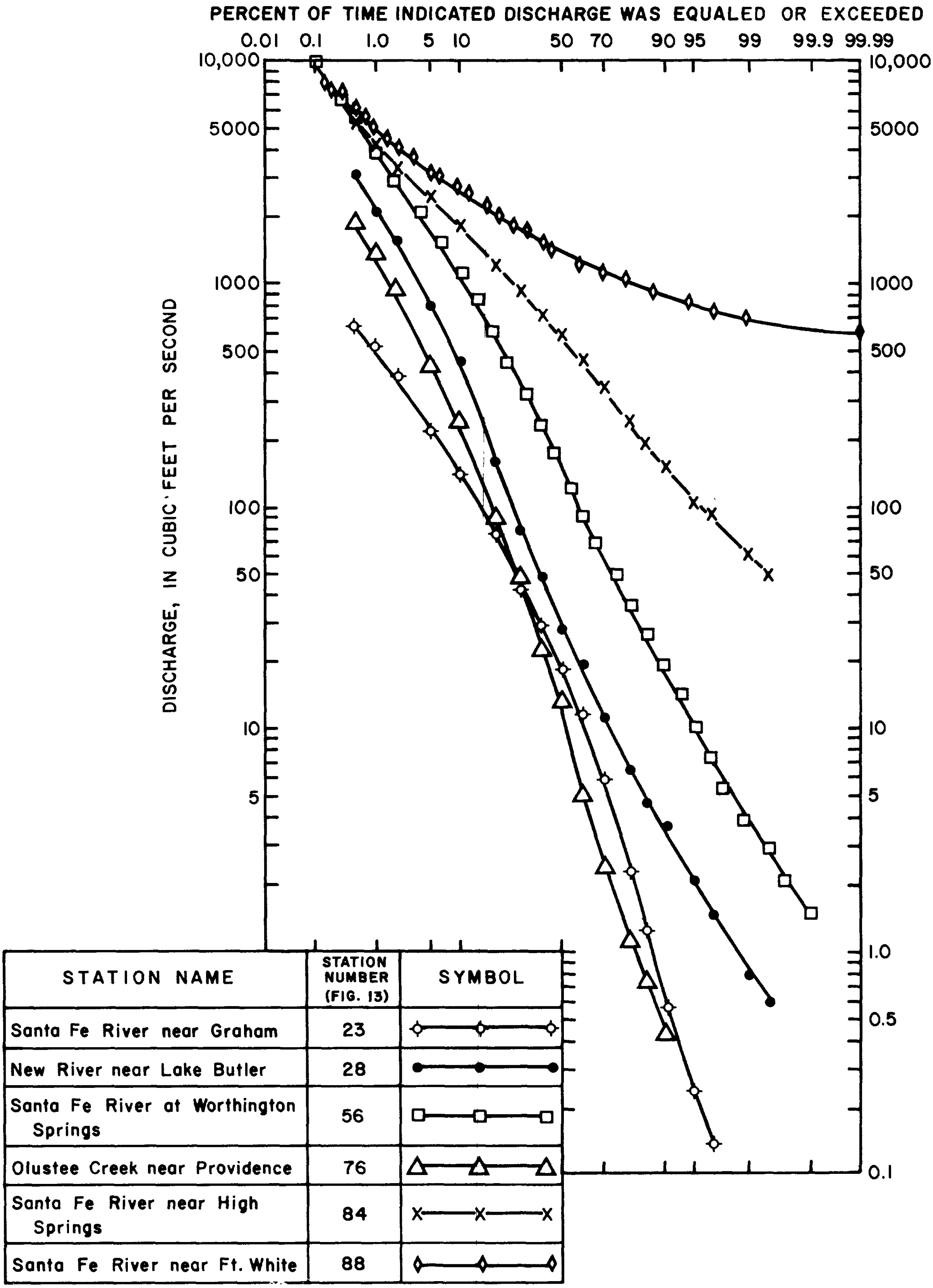


Figure 18.--Flow-duration curves, adjusted to the period 1933-71, for six discharge sites in the Santa Fe River basin.

Table 7.--Low-flow frequency at gaging stations

Map number (fig. 13)	Station name and number (period of record used)	Consecutive days	Discharge, in cubic feet per second, at recurrence interval indicated, in years: 2	5	10	20	50	100
23	Santa Fe River near Graham 02320700 (1958-76)	3	0.9	0.2	0.1	0.06	0.03	0.02
		7	1.1	.3	.1	.1	.04	.02
		14	1.4	.4	.2	.1	.05	.03
		30	2.5	.8	.4	.2	.1	.1
		60	4.5	1.2	.6	.3	.2	.1
		120	13	4.5	2.6	1.6	.9	.6
		183	29	12	6.9	4.3	2.5	1.7
		365	50	25	18	13	8.9	6.9
28	New River near Lake Butler 02321000 (1951-71)	3	1.8	0.8	0.5	0.4	0.2	0.2
		7	2	1	.7	.5	.3	.2
		14	2.5	1.3	.9	.7	.5	.4
		30	3.7	1.9	1.4	1	.7	.6
		60	6.8	3.3	2.2	1.5	1	.7
		120	22	7.9	4.6	2.9	1.8	1.2
		183	58	19	11	6.5	3.6	2.4
		365	155	65	36	21	11	6.4
56	Santa Fe River at Worthington Springs 02321500 (1932-76)	3	11	4.3	2.5	1.6	0.9	0.6
		7	12	5.2	3.2	2.1	1.3	.9
		14	15	7	4.5	3.1	1.9	1.4
		30	21	9.8	6.3	4.2	2.6	1.9
		60	32	15	9.5	6.4	4.1	3
		120	82	31	18	11	6.1	4.1
		183	152	58	33	21	12	8.1
		365	399	210	141	99	64	47
84	Santa Fe River near High Springs 02322000 (1932-71)	3	232	125	89	67	47	38
		7	236	128	91	68	48	38
		14	241	131	94	70	51	40
		30	255	138	99	74	54	43
		60	272	148	107	82	60	49
		120	343	182	129	96	69	55
		183	451	224	152	109	74	57
		365	787	433	298	211	138	102

Table 7.--Low-flow frequency at gaging stations--Continued

Map number (fig. 13)	Station name and number (period of record used)	Consecutive days	Discharge, in cubic feet per second, at recurrence interval indicated, in years					
			2	5	10	20	50	100
88	Santa Fe	3	977	814	747	699	652	624
	River near	7	982	818	750	702	655	627
	Fort White	14	988	822	755	706	659	632
	02322500	30	1,010	832	762	714	667	639
	(1928-30)	60	1,030	851	780	731	685	659
	(1932-76)	120	1,110	892	802	750	695	664
		183	1,230	944	838	766	698	660
		365	1,550	1,200	1,000	944	841	780

Low-flow discharge measurements made during a short period of time are used to estimate the relative availability of water in different drainage basins, and different reaches of the same stream, and to assess areas of ground-water discharge to streams. Low-flow measurements, including observations of no flow, were made at 73 sites in April 1976 and in May 1977 (table 8) when the Santa Fe River was near 90 percent flow duration at Worthington Springs and near Fort White. The measurements at stations 77, 78, 82, and 83 were made at about 80 percent flow duration.

Table 8.--Low-flow discharge measurements

[e = estimated]

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
5	Double Run Creek near Theressa, 02320620	0.2e	04-26-76
		No flow	05-25-77
12	Santa Fe River near Hampton, 02320692	do.	04-26-76
		do.	05-25-77
23	Santa Fe River near Graham, 02320700	0.5	04-26-76
		.2	05-25-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
2	Alligator Creek near Starke, 295610082034600	9.2 No flow	04-26-76 05-25-77
9	Alligator Creek at Starke, 02320732	11.4 7.1	04-26-76 05-25-77
10	Prevatt Creek near Starke, 295440082053600	No flow do.	04-26-76 05-25-77
17	Tributary to Lake Sampson near Starke, 295635082185300	0.2 .003	04-26-76 05-25-77
21	Sampson River at Sampson City, 02320800	1 1e	04-26-76 05-25-77
24	Sampson River at Graham, 02320815	3.2 .7	04-26-76 05-25-77
30	Tributary to Santa Fe River near Graham, 295143082170400	.1e No flow	04-26-76 05-25-77
32	Tributary to Monteocha Creek at Monteocha, 294754082170200	0.06 No flow	04-26-76 05-24-77
33	Monteocha Creek at Monteocha, 02320827	Ponded	04-26-76
34	Little Monteocha Creek near Monteocha, 24923082181000.	0.02	04-26-76
31	Tributary to Monteocha Creek north of Monteocha, 294930082165200	0.2e No flow	04-26-76 05-24-77
36	Tributary to Santa Fe River near Brooker, 295226082184000	0.05 No flow	04-26-76 05-25-77
42	Rhuda Branch south of Sunshine Lake, 2949708200300	0.06 No flow	04-27-76 05-24-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
45	Rocky Creek 3 miles southwest of Sunshine Lake, 294802082221800	Ponded No flow	04-26-76 05-24-77
47	Tributary to Rocky Creek southeast of LaCrosse, 294911082230500	0.1 No flow	04-27-76 05-24-77
46	Rocky Creek near LaCrosse, 02320870	Ponded do.	04-27-76 05-24-77
48	Tributary to Rocky Creek northeast of LaCrosse, 295152082232500	0.6 No flow	04-27-76 05-24-77
49	Tributary to Santa Fe River north of LaCrosse, 295219082244200	0.09 No flow	04-27-76 05-24-77
54	Tributary to Santa Fe River near Santa Fe, 295246082251400	0.1 No flow	04-27-76 05-24-77
3	Tributary to Olustee Creek near Lawtey, 300423082050000	1.4 .2	04-27-76 05-24-77
13	New River at State Highway 125 near Raiford, 300612082094000	.8 No flow	04-27-76 05-25-77
6	Tributary to Alligator Creek near Lawtey, 300328082051800	0.6 No flow	04-27-76 05-24-77
11	Alligator Creek near Lawtey, 02320898	0.3e No flow	04-27-76 05-24-77
20	New River near Raiford, 02320900	3 1.4	04-27-76 05-25-77
25	Turkey Creek near Raiford, 300304082135000	1.9 .4	04-27-76 05-24-77
8	Water Oak Creek near Starke, 02320950	.05e No flow	04-27-76 05-24-77

[1] Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
18	Gum Creek near Lawtey, 300045082111300	0.4	04-26-76
		No flow	05-24-77
19	Water Oak Creek near Lawtey, 02320960	2	04-26-76
		.2	05-24-77
26	Tributary to New River near Raiford, 300117082145500	.4e	04-27-76
		No flow	05-24-77
27	McKinney Branch at SR 235, 300012082152700	1.35	04-27-76
28	New River near Lake Butler, 02321000	16	04-26-76
		4.4	05-25-77
29	Tributary to New River near New River, 295703082172500	.3	04-27-76
		.5e	05-25-77
35	Tributary to New River near Brooker, 295652082185300	.4	04-27-76
		.4e	05-25-77
39	Tributary to New River southwest of New River, 295631082193200	.6e	05-25-77
40	Tributary to New River in section 30 near Brooker, 295654082203200	No flow	04-27-76
		do.	05-25-77
38	Richard Creek near Lake Butler, 02321200	No flow	04-27-76
		do.	05-24-77
41	New River near Brooker, 295700082204400	21	04-27-76
		No flow	05-25-77
44	Fivemile Creek near Dukes, 02321446	0.04	04-27-76
		.001	05-24-77
50	New River near Worthington Springs, 295536082244000	17	04-27-76
		7.2	05-24-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
55	Tributary to Santa Fe River in section 4 near Santa Fe, 295418082252300	0.05 No flow	04-26-76 05-24-77
56	Santa Fe River at Worthington Springs, 02321500	22 9	04-26-76 05-24-77
62	Tributary to Santa Fe River near Worthington Springs, 295645082272100	.6 No flow	04-26-76 05-24-77
63	Stream at County Road east of Alachua, 294759082264500	0.02e .02	04-27-76 05-24-77
64	Tributary to Santa Fe River west of Santa Fe, 295248082280800	.1e No flow	04-26-76 05-25-77
65	Tributary to Santa Fe River near Bland, 295408082290800	0.2 .1e	04-26-76 05-25-77
67	Mill Creek at Alligator Road east of High Springs, 2950400823000	.1 .1e	04-27-76 05-28-77
52	Olustee Creek near Olustee, 301219082250700	.2e No flow	04-26-76 05-25-77
59	Olustee Creek in section 18 near Olustee, 300837082272900	No flow do.	04-26-76 05-25-77
60	Olustee Creek near Lulu, 02321600	0.4 .2	04-27-76 05-25-77
66	Olustee Creek at State Highway 241 near Lulu, 300502082301900	.6 .4	04-26-76 05-25-77
68	Olustee Creek at State Highway 240 near Providence, 300328082315800	1.29 .4	04-27-76 05-25-77
60A	Swift Creek at State Highway S-231 near Lake Butler, 300456082213900	.2 No flow	04-26-76 05-24-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
60B	Tributary to Swift Creek near Lake Butler, 302202082232200	No flow 0.03	04-26-76 05-24-77
61	Swift Creek near Shaws Still, 300220082280200	1.2e No flow	04-27-76 05-24-77
75	Olustee Creek at State Highway 245 near Providence, 300057082333700	No flow do.	04-27-76 05-25-77
74	Olustee Creek at County Road near Providence, 295822082333600	No flow	04-27-76
69	Tributary to Olustee Creek near Providence, 02321894	0.6e .5e	04-27-76 05-25-77
72	Olustee Creek at State Highway 18 near Providence, 295701082315000	No flow do.	04-27-76 05-25-77
70	Santa Fe River near Bland, 295633082302500	No flow	05-25-77
71	Pareners Branch near Bland, 295352082310700	0.4e No flow	04-27-76 05-25-77
73	Pareners Branch near O'Leno State Park, 295419082331200	No flow do.	04-27-76 05-25-77
77	Santa Fe River at O'Leno State Park, 02321898	128	04-13-77
78	Santa Fe River near Traxler, 02321961	285	04-14-77
82	Santa Fe River at U.S. Highway 441 near High Springs, 295110082363100	395	04-14-77
83	Santa Fe River Diversion to Suck Hole, 02321991	217	04-15-77
84	Santa Fe River near High Springs, 02322000	212	05-25-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

Table 8.--Low-flow discharge measurements--Continued

Map number (fig. 13)	Station name and number[1]	Discharge (ft^3/s)	Date
88	Santa Fe River near Fort White, 02322500	895	05-24-77
89	Santa Fe River at State Highway 47 near Fort White, 02322540	1,020	05-25-77
95	Ichetucknee Springs near Hildreth, 02322700	300	05-24-77
96	Santa Fe River near Hildreth, 02322800	1,590	05-24-77

[1]Downstream-order number or site number used for U.S. Geological Survey automatic data processing.

The low flows in some reaches of the streams in the eastern part of the basin have been increased artificially by sewage and industrial-waste discharge, and decreased in other reaches by irrigation pumpage and by impoundments to maintain lake levels.

Flow duration, frequency, and low-flow measurements are only useful for predicting future streamflow characteristics if they reflect stable past stream conditions and are to be applied to the same conditions, making appropriate adjustments for new impoundments, diversions, withdrawals, waste discharges, and climatic changes.

High Flows

The Santa Fe River is subject to flooding from high streamflow within the basin and from backwater from the Suwannee River. The mouth of the Santa Fe River is about 45 miles direct, and more than 50 river miles upstream, from the Gulf of Mexico. Much of the flood plain of the lower Santa Fe River is less than 20 feet above sea level (fig. 2) and is susceptible to backwater from high flows in the Suwannee River. The highest discharges of record for the Santa Fe River (20,000 ft^3/s) have occurred near High Springs and at Worthington Springs (table 8). During periods of flooding and high runoff in the Suwannee River basin, backwater from the Suwannee River reduces peak discharges in the lower reach of the Santa Fe River, and much of the flood flow is retained in storage until the Suwannee River recedes. Figure 19 shows flood-frequency data, calculated according to guidelines (U.S. Water Resources Council, 1967), for the eight gaging stations for which data are available.

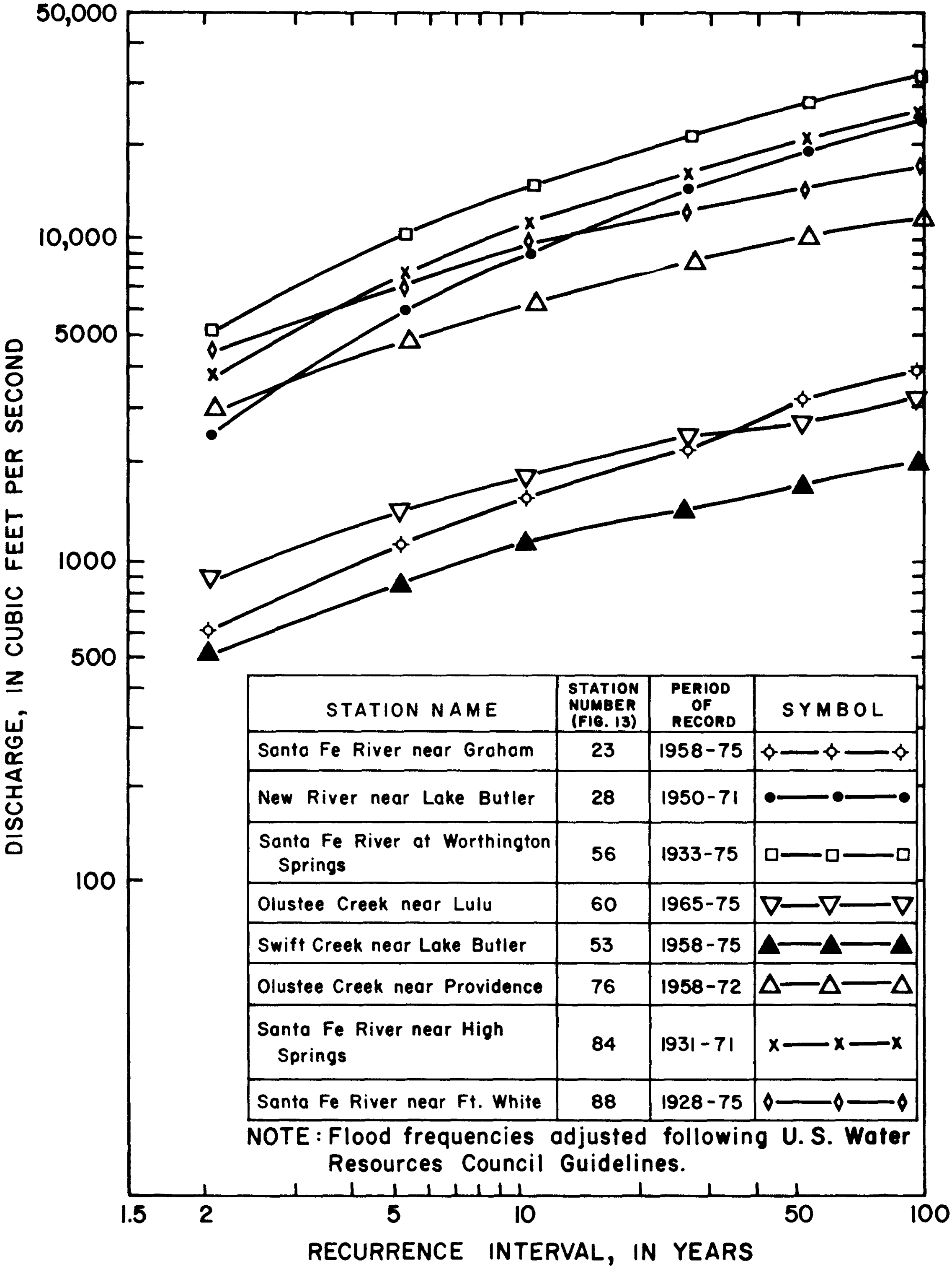


Figure 19.--Flood-frequency curves for eight gaging stations in the Santa Fe River basin.

Lakes

Lakes in the Santa Fe basin (fig. 13) are used primarily for recreation. Most of them occupy shallow topographic depressions in the surficial aquifer. Santa Fe Lake is believed to penetrate the entire thickness of the surficial aquifer, reaching the underlying confining bed. The greatest known lake depth is 28 feet in Santa Fe Lake (oral commun., Richard Musgrove, Suwannee River Water Management District, 1977). Alligator Lake, Sunshine Lake, and the lakes and ponds of Gilchrist County occupy depressions in the confining bed. Because of their small areal extent, shallow depth, and low surface-water inflow, the lakes in the basin are not considered potential sources for large water supplies. Table 9 summarizes information on physical characteristics and lake-level fluctuations for six lakes in the basin.

Table 9.--Summary of lake-level data

[All lakes are in the surficial aquifer except Alligator Lake and Waters Lake which are in the confining bed (fig. 4)]

Map number (fig. 13)	Lake station name and number	Surface area (mi^2)	Drainage area (mi^2)	Period of record used	Lake levels (feet above sea level): Period of record Maximum	Period of record Minimum	10/75-09/76 Maximum	10/75-09/76 Minimum
7	Santa Fe Lake near Keystone Heights, 02320600	8.28	20.9	1957-76	142.62	138.44	141.04	139.62
7A	Lake Altho at Waldo, 02320630	.87	3.39	03/76-09/76	--	--	143.92	143.26
16	Lake Sampson near Starke, 02320750	3.24	59.3	1957-67 1974-76	136.15	130.22	132.39	130.29
37	Lake Butler at Lake Butler, 02321300	.68	3.94	1957-67 1974-76	134.02	128.93	131.65	130.10
80	Alligator Lake at Lake City, 02322600	.54	15.4	1965-76	99.98	90.23	97.58	93.66
97	Waters Lake near Trenton, 02322550	.29	15.7	1972-76	74.68	63.70	71.68	64.90

Surface-Water Resources by Drainage Area

New River

The headwaters of New River are underlain by the surficial aquifer in southeastern Baker County. The stream flows across the confining bed from about 3 miles downstream from the municipality of Raiford (fig. 4) to the mouth, which is about 0.5 mile upstream from the daily discharge station on the Santa Fe River at Worthington Springs (fig. 13). New River is more deeply entrenched than the Santa Fe River above Worthington Springs because the surficial aquifer is generally thicker in the New River basin (fig. 13), and is more easily eroded than the confining bed. New River makes a larger contribution to the discharge of the Santa Fe River at Worthington Springs than does the reach of the Santa Fe River above the mouth of New River.

New River gained flow in the reach crossing the surficial aquifer during April 1976 and May 1977 low-flow measurements. Water apparently was lost to permeable zones in the reach crossing the confining bed (fig. 4) on each of the low-flow measurements. Because losses occurred in different reaches of the streams at different times, they could be explained by withdrawals for irrigation or by unequal distribution of rain showers. However, losses of flow to the confining bed in two tributaries, Richard Creek and the nearby unnamed tributary (fig. 3), cannot be attributed to irrigation. Some losses from New River probably occur during low flow even though the stream shows a net gain. Losses from New River and the two tributaries may ultimately pass through the confining bed into the Floridan aquifer. Worthington Springs, which discharges from a permeable zone in the confining bed (fig. 3), and possibly from the Floridan aquifer, was not flowing when the low-flow measurements were made.

The base flow of New River is sustained by discharge from the surficial aquifer throughout most of its length and by several short tributary streams, upstream of apparent flow losses, that derive their base flow from water-yielding zones in the confining bed. The water in these tributary streams is clear at low flow in contrast to the dark-colored water in streams supplied by the surficial aquifer.

Santa Fe River above Worthington Springs

The headwaters of the Santa Fe River are at Santa Fe Lake and Lake Altho. The river flows northward about 4 miles through a swamp before heading northwest toward its junction with New River (fig. 3). Although no losses of flow are known in this reach, the surficial aquifer is thin except near the lakes, and supplies only a small amount of base flow. In addition, evapotranspiration losses occur from the lakes and swamp and recharge to the Floridan aquifer possibly is greater in the vicinity of the headwaters of the Santa Fe River in eastern Alachua and southeastern Bradford Counties than in most of the artesian or eastern part of the Floridan aquifer. (See section on Recharge and Discharge.) These factors make the Santa Fe River above Worthington Springs a smaller stream at low flow than New River.

The principal tributary of the Santa Fe River above Worthington Springs, other than New River, is Sampson River (fig. 3). This stream is controlled to the extent that it is difficult to determine its natural low-flow characteristics. Sampson River begins east of the municipality of Starke as Alligator Creek, and flows through the outskirts of Starke and through two lakes southwest of Starke before entering the Santa Fe River. The base flow of the stream is supplied by the surficial aquifer and by industrial and municipal discharge. It is also affected by regulation of the height of a dam at the outlet of Lake Sampson, and by irrigation withdrawals below Lake Sampson.

Lesser tributaries to the south of the Santa Fe River are Monteocha Creek and Rocky Creek (fig. 3). Low-flow measurements of these streams and their tributaries are shown in table 8 and, except for one measurement of 0.6 ft^3/s, are less than 0.3 ft^3/s, or the velocity was too low to operate a current meter, indicating ponded water. The base flow of these streams is supplied by the thin surficial aquifer. An additional reason for their small base flow is the presence of a small closed drainage basin between the streams, terminating in Sunshine Lake. Drainage from the lake is probably into the Floridan aquifer.

Olustee Creek

Olustee Creek rises in southwestern Baker County. During April 1976 and May 1977, low-flow measurements were made along the length of Olustee Creek (fig. 13). The data (table 8) show that the stream gained flow across the surficial aquifer from its headwaters to about 2 miles north of the mouth of Swift Creek (fig. 3) and lost flow across the confining bed and the Floridan aquifer from there to the mouth. Olustee Creek is not known to be used as a water supply.

Swift Creek, the only important tributary to Olustee Creek, rises in the swampy area surrounding Swift Creek Pond (fig. 3) and extends as a poorly defined channel through swamps to a point about 2 miles downstream from Lake Fisher, where the channel becomes and remains well defined to the mouth. Swift Creek does not flow in extremely dry weather. The surficial aquifer supplies the base flow of the stream, to a point where the stream flows across the confining bed, about 1 mile upstream from the mouth. The stream may lose water in the reach across the confining bed, but the ponded water near the mouth prevents determination of loss of flow.

Palestine Lake (fig. 3) has been observed by Richard Musgrove of the Suwannee River Water Management District to drain westward into Olustee Creek (oral commun., 1976). The lake was also observed (Clark and others, 1964b) to drain into the St. Marys River basin to the north. The difference in elevations of the two lake outlets is, apparently, so small that drainage may occur in either direction; perhaps depending on stream stage and rainfall beyond the Palestine Lake basin.

Santa Fe River below Worthington Springs excluding Olustee Creek

The Santa Fe River flows across the Floridan aquifer from a point near Worthington Springs to its confluence with the Suwannee River. The aquifer supplies nearly all of the base flow of this reach of the Santa Fe River. The river may receive limited recharge from the confining bed near Worthington Springs and in Gilchrist County, and from sand overlying the confining bed. It is recharged by several large springs (table 3, fig. 3) and it alternately gains and loses flow at least as far downstream as station 89 (fig. 13). Because the potentiometric map (fig. 12) shows ground-water flow toward the river, it is assumed that the river has a variable subsurface component of discharge which is not measured at gaging stations. This component was measured as more than 200 ft^3/s at O'Leno State Park (station 77) and at a sinkhole near High Springs. At O'Leno State Park, the river flows underground for about 3 miles. Water moving up from the Floridan aquifer either discharges directly to the river or moves downstream as a subsurface component. Loss from surface discharge into the limestone also has been observed between stations 88 and 89 (fig. 13).

Ichetucknee River.--This stream is fed by at least nine springs above gaging station 95 (fig. 13). The drainage area of the springs is not defined by surface topography but has been estimated from the potentiometric map (fig. 12) of the Floridan aquifer for purposes of estimating recharge to the unconfined part of the Floridan aquifer. The drainage area includes Rose Creek, a small stream that drains underground in one or two places (fig. 3), depending on the amount of discharge; and Clay Hole Creek, which is shown on most published maps of the area, but which is dry most of the time. Alligator Lake at Lake City, within the drainage area of Ichetucknee River, drains vertically into the Floridan aquifer, along with a short tributary, Price Creek. The minimum discharge of record for the Ichetucknee River is 241 ft^3/s (U.S. Geological Survey, 1976).

Sinking streams south of the Santa Fe River.--Several small streams drain through sinkholes (fig. 3) into the Floridan aquifer near the western edge of the surficial aquifer (fig. 4) south of the Santa Fe River; two carry industrial wastes. Most of the base flow of these streams is supplied by the surficial aquifer, and by small springs and seeps from the confining bed. Water in the streams and in water-yielding zones in the shallow subsurface in this area is perched above the Floridan aquifer.

Cow Creek.--This stream rises from the confining bed and overlying surficial sands in the southwest part of the Santa Fe basin (fig. 3). A chemical analysis of the water from the stream indicates near saturation with calcium carbonate. Because the confining bed and surficial sands in this area are noncalcareous, much of the base flow of Cow Creek is upward discharge from the limestone rocks of the Floridan aquifer. The artesian head in the Floridan aquifer is high enough to supply upward discharge through the confining bed to the stream in this area (fig. 12).

WATER QUALITY

Factors Affecting Chemical Quality

The quality of the water in the streams and aquifers of the Santa Fe basin is generally satisfactory for most uses. Because of the low population density and lack of extensive industrial development the effect of man on water quality is minimal. Quality of water is affected principally by natural factors. The principal natural factor active in the basin is rainwater containing dissolved carbon dioxide and organic acid acting as a solvent on soil and rocks. Manmade factors, such as municipal and industrial wastes, urban runoff, and fertilizer use, presently have their greatest effects on surface water. The surficial aquifer in the eastern part of the basin and the Floridan aquifer may be affected by development in the future, as the population grows. The increased use and reuse of water from the unconfined aquifer may result in increased dissolved minerals and nutrients specific to the users' waste byproducts. The Floridan aquifer in most of the eastern part of the basin is protected from direct infiltration of contaminants by the confining bed.

The significance of dissolved mineral constituents and properties of water is discussed in the annual water-data reports (U.S. Geological Survey, 1976, for example) and by Hem (1970).

Ground-Water Quality

The solution of limestone ($CaCO_3$) or dolomite [$CaMg(CO_3)_2$] by natural waters in the presence of carbon dioxide (CO_2) is probably the largest single factor responsible for the chemical character of fresh ground water in Florida. Whereas limestone and dolomite are only slightly soluble in pure water, their solubility increases in water that contains carbon dioxide derived from the atmosphere and, to a much larger extent, soil air as the water percolates through the soil and the unsaturated zone above the water table. Carbon-dioxide concentrations in soil air--primarily resulting from plant respiration and decay of plant material--are commonly one to two orders of magnitude greater than in atmospheric air. Sulfate derived from the solution of gypsum ($CaSO_4 \cdot 2H_2O$) and anhydrite ($CaSO_4$) is a principal constituent of ground water in part of the Santa Fe basin. The concentration of dissolved solids in ground water depends to a large extent on the length of time that ground water is in contact with the rocks.

Surficial aquifer.--The quality of water from wells in the surficial aquifer varies areally and with thickness of aquifer penetrated by the well. The upper 30 feet of the aquifer receive recharge from rainfall and discharge much of this water to nearby streams and to evapotranspiration. This shallow zone has been leached by circulating ground water, and wells completed in it generally produce water low in dissolved solids. Figures 20 and 21 show the general distribution of dissolved solids and hardness concentrations of water in the surficial aquifer. The highest dissolved solids and hardness values were obtained in central Bradford County, in one of the thickest parts of the aquifer, from wells completed below the 30-foot depth or shallow zone. In an area of equal thickness along the Bradford-Clay County line (fig. 8), the wells sampled were less than 30 feet deep and dissolved solides were less than

100 mg/L (fig. 20); concentrations at greater depths should be higher because of longer residence time in the aquifer. Sulfate concentrations in water samples taken from the surficial aquifer were less than 25 mg/L.

The quality of water from wells in the surficial aquifer is influenced by the proximity of the water table to land surface. Recharge may be induced from nearby streams, ponds, and swamps. Land-use practices such as waste disposal, the use of agricultural chemicals, and recycling of irrigation water, may affect the quality of surficial aquifer water. In addition, there is the potential for local upward leakage of more mineralized water from the confining bed.

Confining bed.--Most recharge to the confining bed occurs as downward percolation of water from the surficial aquifer. Water-yielding zones in the confining bed are calcareous, and percolation through them to streams or to the Floridan aquifer is slow in most places. The distribution of dissolved-solids concentrations and hardness shown by figures 22 and 23, respectively, is believed to be related to a large extent to the rate of circulation of water through these water-yielding zones. Sulfate concentrations in water samples taken from water-yielding zones in the confining bed were less than 10 mg/L.

Wells completed in water-yielding zones in the confining bed are, in most places, presumed less likely to be contaminated by manmade waste products than are wells in the surficial aquifer or in the unconfined part of the Floridan aquifer. The presence of a confining bed over an aquifer or water-yielding zone retards downward movement of contaminants.

Floridan aquifer.--Water in the upper part of the Floridan aquifer is mostly of the calcium-magnesium bicarbonate type. The most common undesirable characteristic of this water is hardness. Concentrations of sulfate exceeding drinking water standards of 250 mg/L are found generally below the upper 200 feet of the aquifer. The source of the sulfate is believed to be gypsum in the lower part of the Floridan aquifer.

The relation between sulfate concentrations and circulation of ground water has been discussed in the section on Recharge and Discharge of the Floridan aquifer. The lower part of the Santa Fe River, from its mouth upstream nearly to the mouth of Olustee Creek, and the entire length of the Ichetucknee River, constitute the principal discharge area of the Floridan aquifer within the Santa Fe basin. In the vicinity of these streams the hydraulic gradient within the Floridan aquifer is upward, and some water from deep circulation can discharge to streams. Figures 24, 25, and 26 show high dissolved-solids, hardness, and sulfate concentrations, respectively, along these streams. Another significant area of mineralized water occurs as a northwest-southeast trending zone in north-central Alachua County. It, too, could be the result of the upward movement of deeply circulating sulfate waters in the Floridan aquifer rather than the consequences of man's waste products. As discussed in the section on Recharge and Discharge, water samples collected by Clark and others (1964a), prior to industrial development in the area, were found to contain high concentrations of dissolved solids, hardness, and sulfate. And samples more recently collected by the Suwannee River Water Management District in the same area, and upgradient of the industrial development, contained high concentrations of the same constituents.

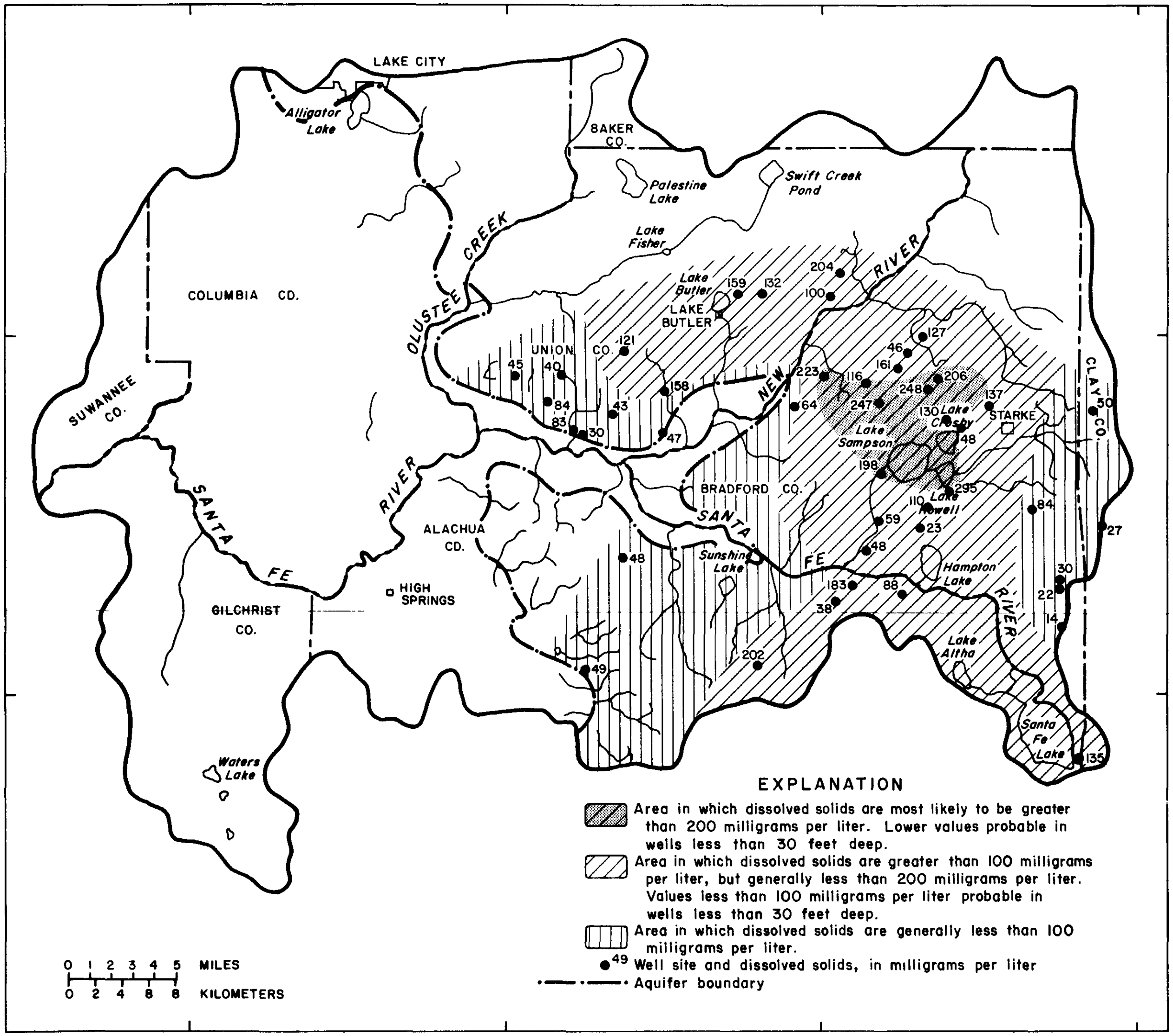


Figure 20.--Dissolved solids in water of the surficial aquifer.

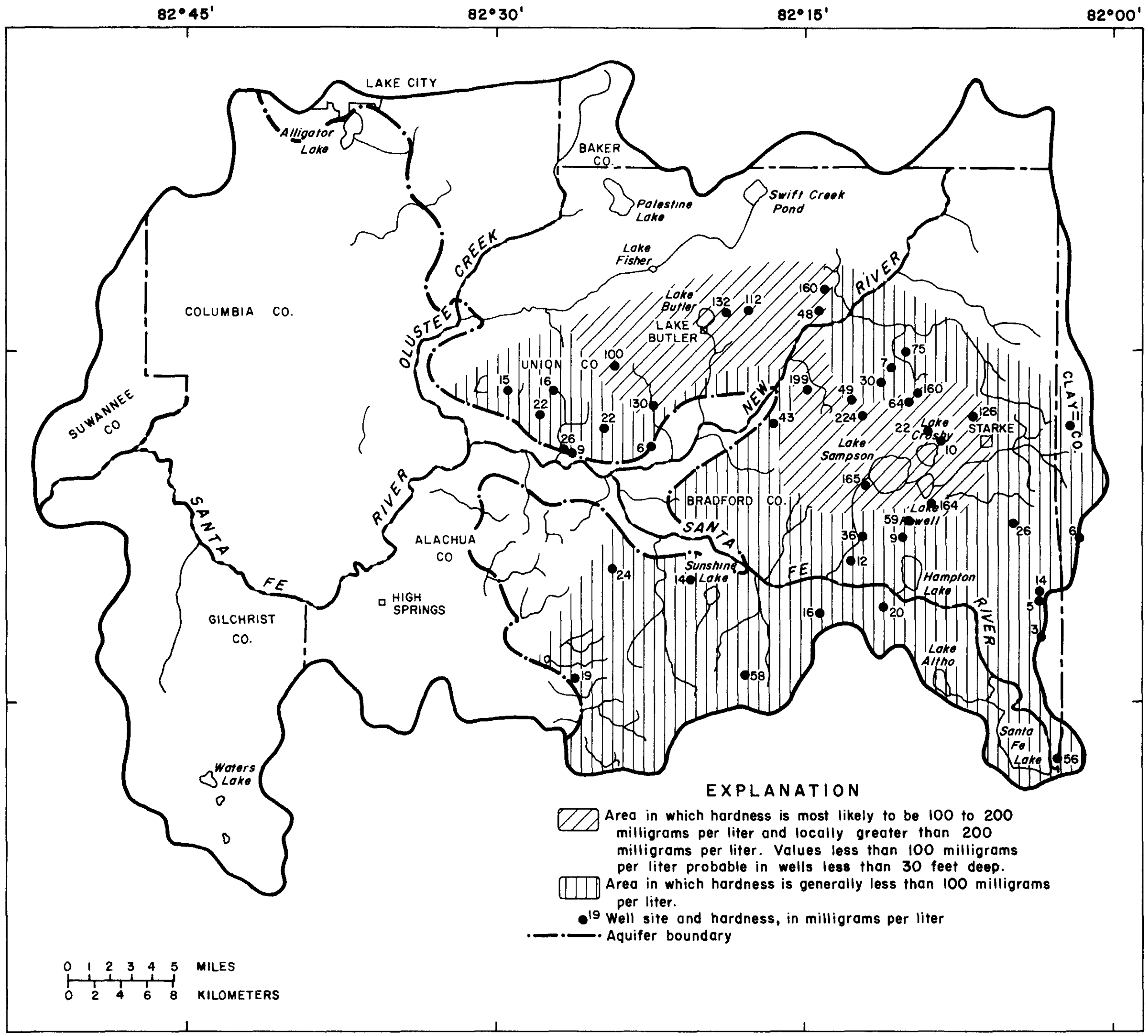


Figure 21.--Hardness of water of the surficial aquifer.

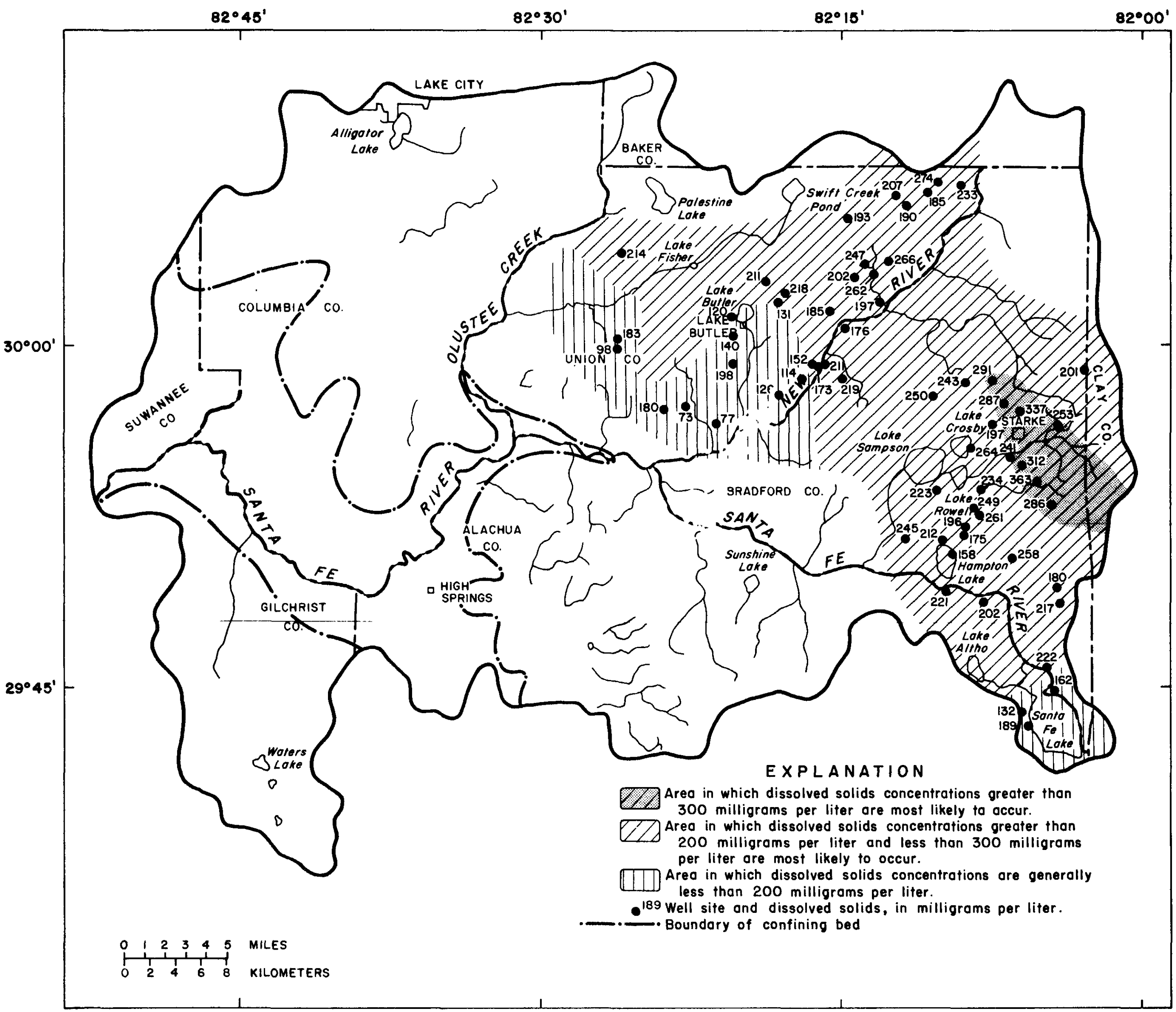


Figure 22.--Dissolved solids in water of the confining bed.

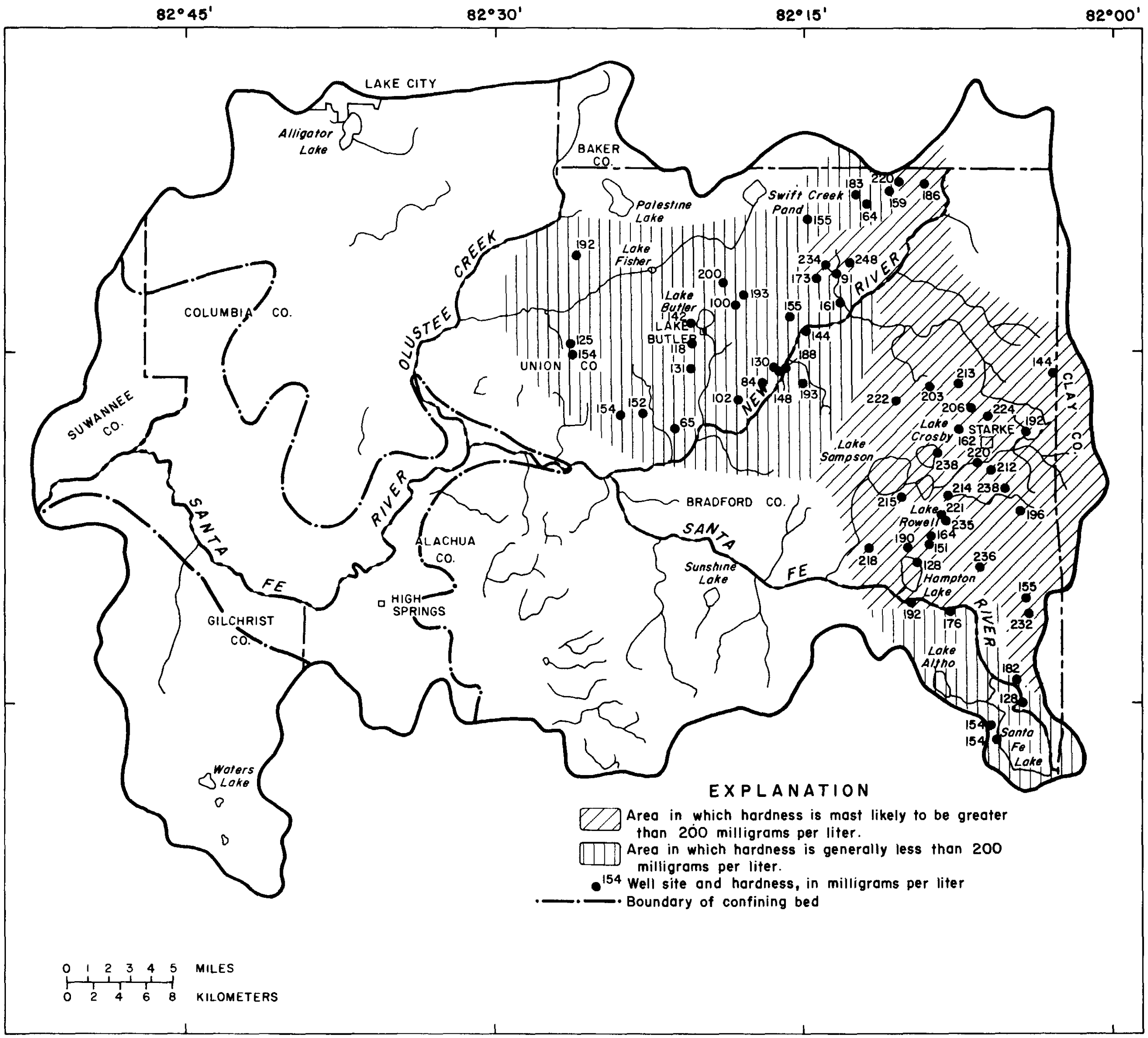


Figure 23.--Hardness of water of the confining bed.

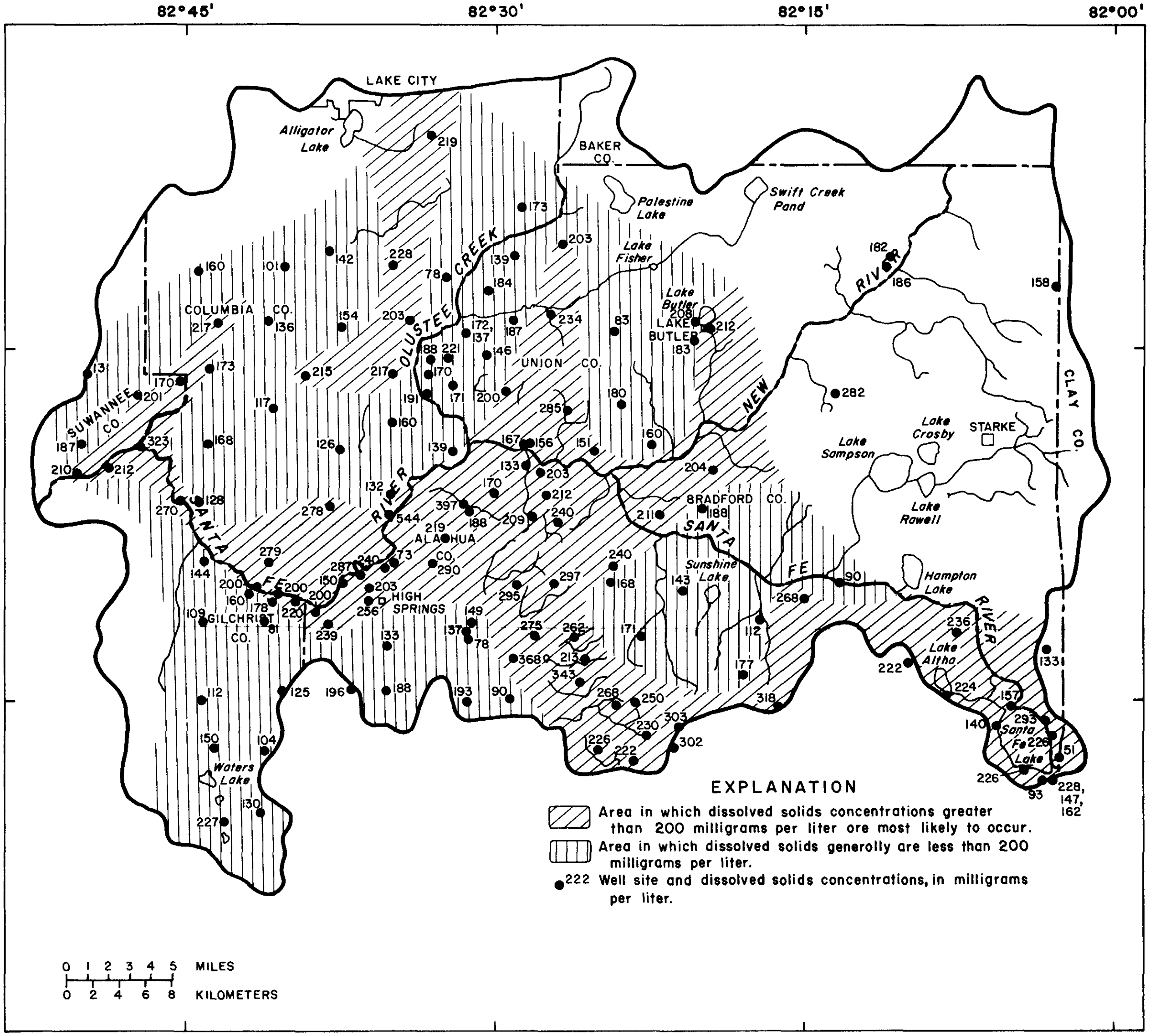


Figure 24.--Dissolved solids in water in the upper 200 feet of the Floridan aquifer.

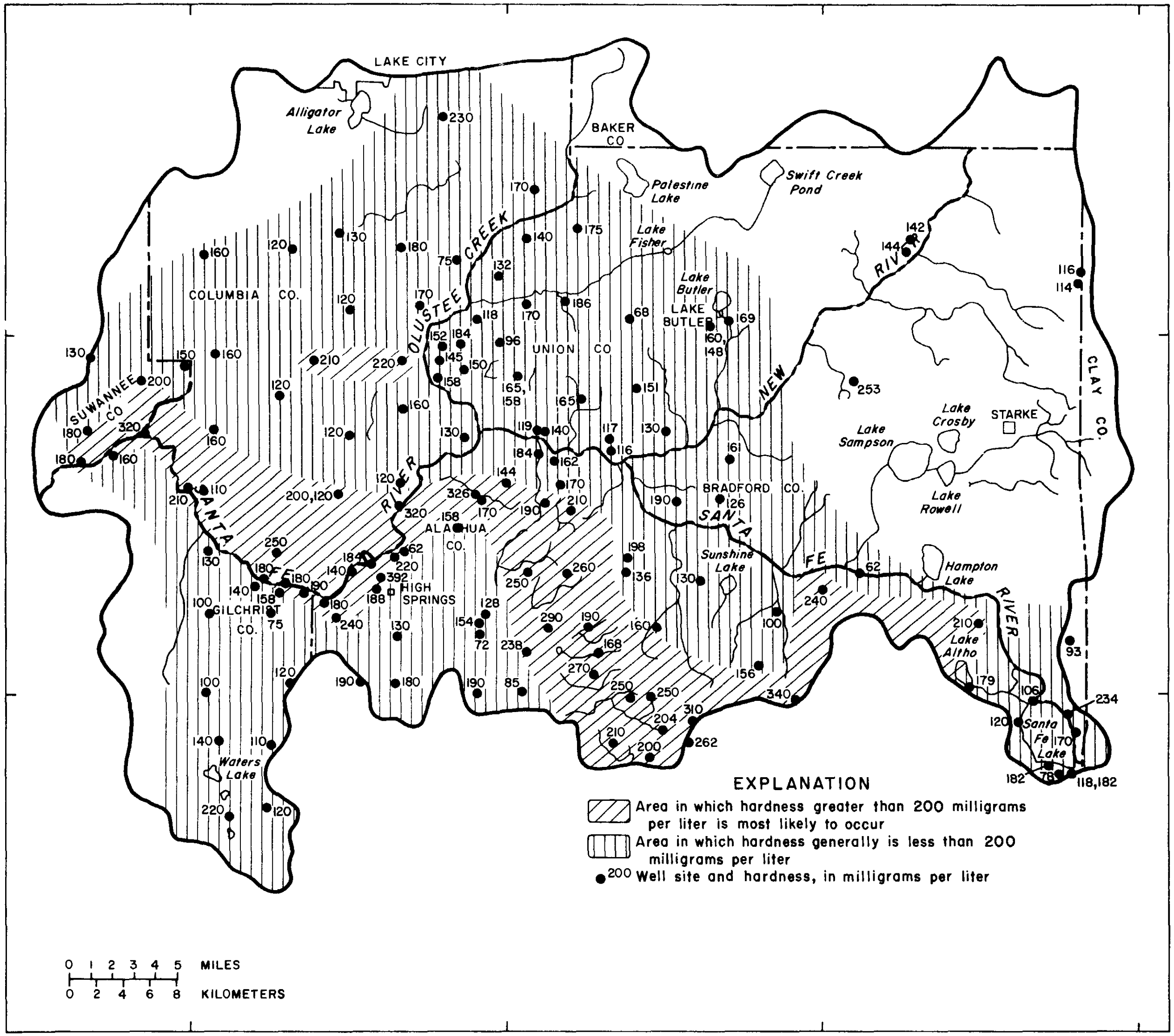


Figure 25.--Hardness of water in the upper 200 feet of the Floridan aquifer.

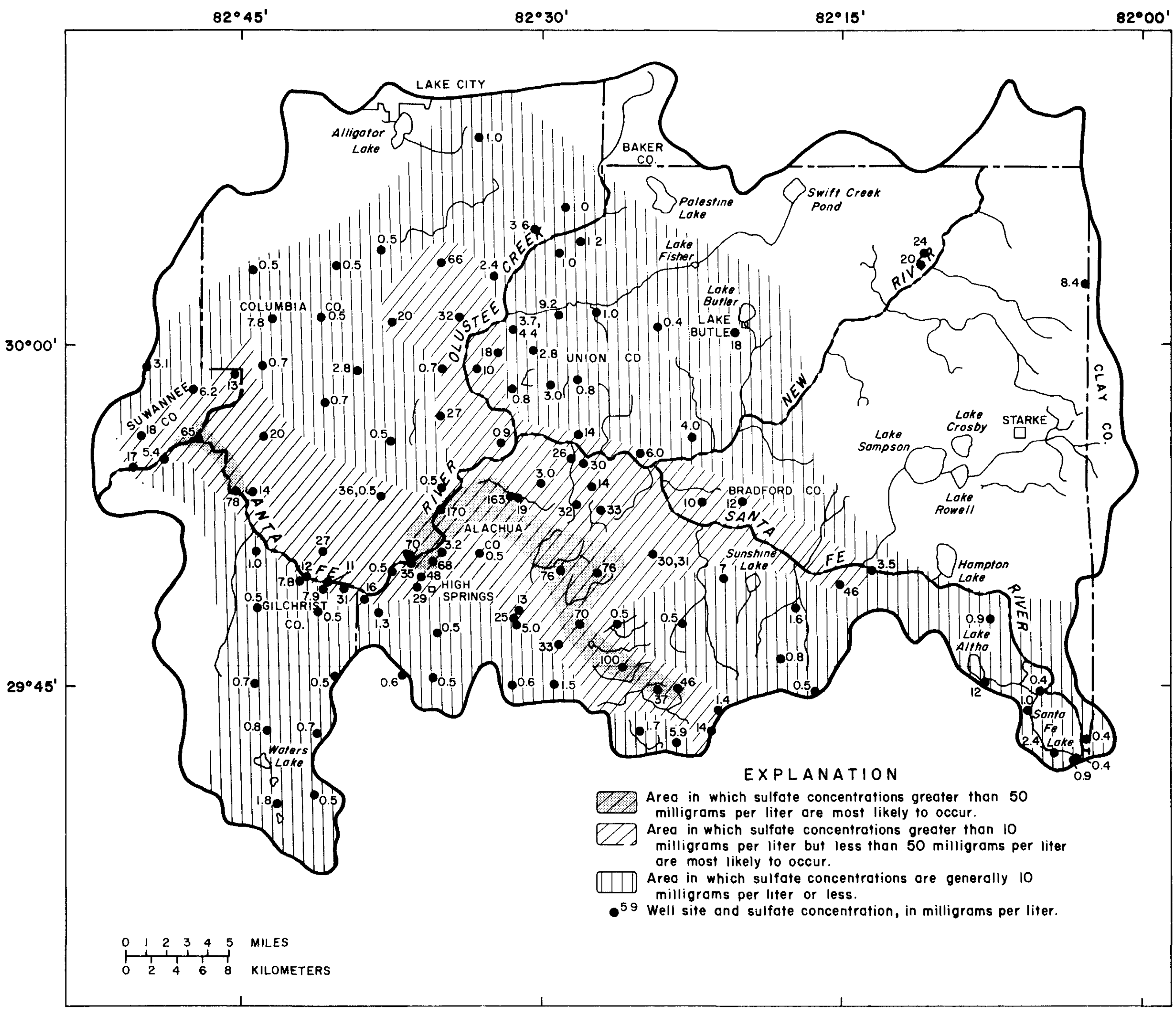


Figure 26.--Sulfate in water in the upper 200 feet of the Floridan aquifer.

The unconfined part of the Floridan aquifer, like the surficial aquifer, is vulnerable to contamination from manmade waste deposited on the land surface or in streams. Few contamination problems have occurred in the past because of the low population density, but as the basin develops some are likely to occur.

Surface-Water Quality

The quality of water in the lakes of the basin is influenced mostly by ground-water inflow, overland flow, swamp discharge, and direct rainfall. Water in the swamps consists of rainwater and discharge from the surficial aquifer. Decay of vegetation in swamp areas is considered to be the principal source of dissolved organic material in the surface water of the basin. The quality of water in the Santa Fe River is influenced by outflow from the lakes and swamps plus additional ground-water discharge and overland flow.

Clark and others (1964b) present the results of extensive collection and analysis of water-quality data for the streams and lakes of the basin from 1957 through 1960. The discussion below emphasizes the relations between water quality and the sources of water in the Santa Fe River. Water samples collected since 1960 indicate that the quality of surface water in the basin has not noticeably changed since that time. The locations of all the surface-water stations in the Santa Fe River basin for which water-quality data are available are shown in figure 13.

Santa Fe Lake is located at the headwaters of the Santa Fe River. The lake has a very small drainage area and receives some inflow from swamps. The water quality of Santa Fe Lake has remained relatively constant, based on 32 samples collected from July 1957 to October 1976. The specific conductance has ranged from 50 to 78 micromhos per centimeter (umho/cm) at 25°C. The lake water is predominantly sodium chloride type, but with moderate amounts of hardness, bicarbonate, and sulfate. Chloride concentrations have varied little, from 9.0 to 13 mg/L. Color has ranged from 10 to 50 platinum-cobalt (Pt-Co) units. The dissolved-solids concentration average of 43 mg/L, determined from residue on evaporation (ROE) at 180°C, exceeded the sum of inorganic constituents (mineral matter) average of 30 mg/L, indicating that moderate amounts of organic material are dissolved in the water. The outflow from the lake is the beginning of the Santa Fe River, which flows through a large swamp north of the lake before reaching the gaging and sampling site, Santa Fe River near Graham (fig. 13, station 23).

Dissolved solids (ROE) in the Santa Fe River near Graham averaged 94 mg/L, which is more than 2 times the dissolved solids (ROE) in Santa Fe Lake. Flow from lakes and swamps accounts for most of the surface-water inflow to the Santa Fe River upstream from Graham. The average concentration of mineral matter is about the same at Graham as in Santa Fe Lake (41 and 30 mg/L, respectively), however, the range in concentration of mineral matter is much greater in the river, 132 mg/L as compared to 30 mg/L in Santa Fe Lake, indicating that the river has received ground-water inflow. Color at Graham averaged 242 Pt-Co units, more than 7 times the color in the lake, a result of inflow from swamps.

The calcium plus magnesium hardness and the dissolved mineral matter tend to increase in direct proportion to increases in specific conductance for the Santa Fe River near Graham (fig. 27). Although dissolved solids (ROE) generally increase with increased specific conductance, the relation is not linear. A logarithmic best fit is shown in figure 28. This is true because dissolved solids (ROE) represent the total of inorganics (which vary directly with conductance) plus organics (which are unrelated to conductance).

As shown in figure 27, dissolved solids (ROE) for the Santa Fe River near Graham usually are about 2 times the sum of inorganics, indicating the presence of large amounts of organics. The dissolved solids, organic matter, iron concentrations, and hardness are the factors most likely to affect water use.

The average concentration of iron in the Santa Fe River near Graham was 396 micrograms per liter (ug/L), or about 2½ times the concentration in Santa Fe Lake. The higher iron concentrations are probably associated with the higher concentrations of organic substances. Organic matter tends to hold iron in solution by chelation, complexing, and reduction of ferric to ferrous iron.

The relation of specific conductance to discharge for the Santa Fe River near Graham is shown in figure 28. In general, specific conductance is less at high than at low flow, because the ground-water component of discharge is diluted or nonexistent at high flows. Because the availability of soluble minerals depends on conditions antecedent to a particular rainfall or storm, such as season, rainfall intensity, and other climatic factors, there is some variability in the conductance-discharge relation. After the initial flushing, storm runoff that is relatively free of dissolved solids, and therefore low in specific conductance, dilutes the water in the stream; thus, with increased discharge there is a decrease in conductance.

The cumulative frequency of various quality parameters is shown in figures 29 and 30. A cumulative frequency curve shows the percentage of samples having a characteristic equal to or greater than the indicated amount.

The average concentration of dissolved solids (ROE) in the Santa Fe River is about the same at Worthington Springs (station 56) and at Graham (station 23), but at Worthington Springs the water contains slightly more mineral matter and less organic matter than at Graham. The sulfate and silica concentrations at Worthington Springs are almost 3 times and 2 times, respectively, those at Graham. The average chloride is 1.0 mg/L less at Worthington Springs than at Graham.

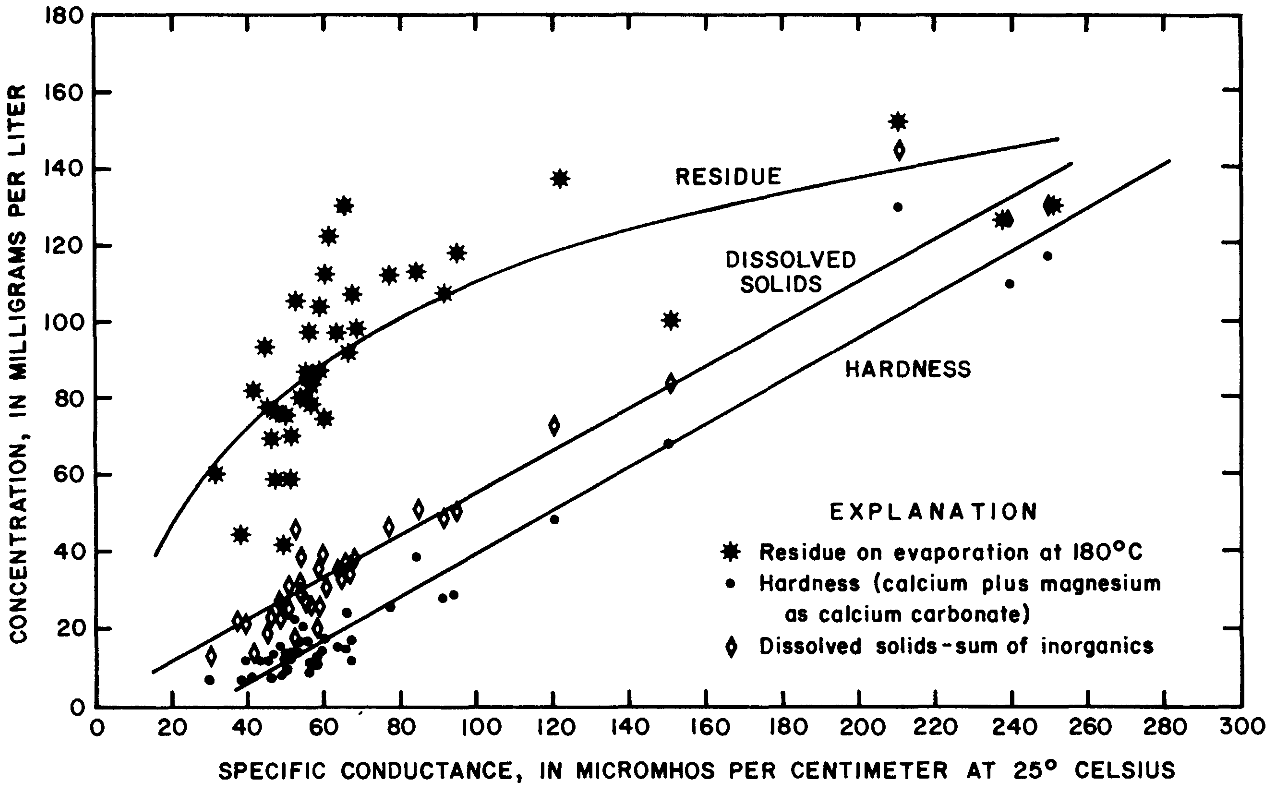


Figure 27.--Hardness and dissolved solids (residue on evaporation and sum) in relation to specific conductance of the Santa Fe River water near Graham (station 23).

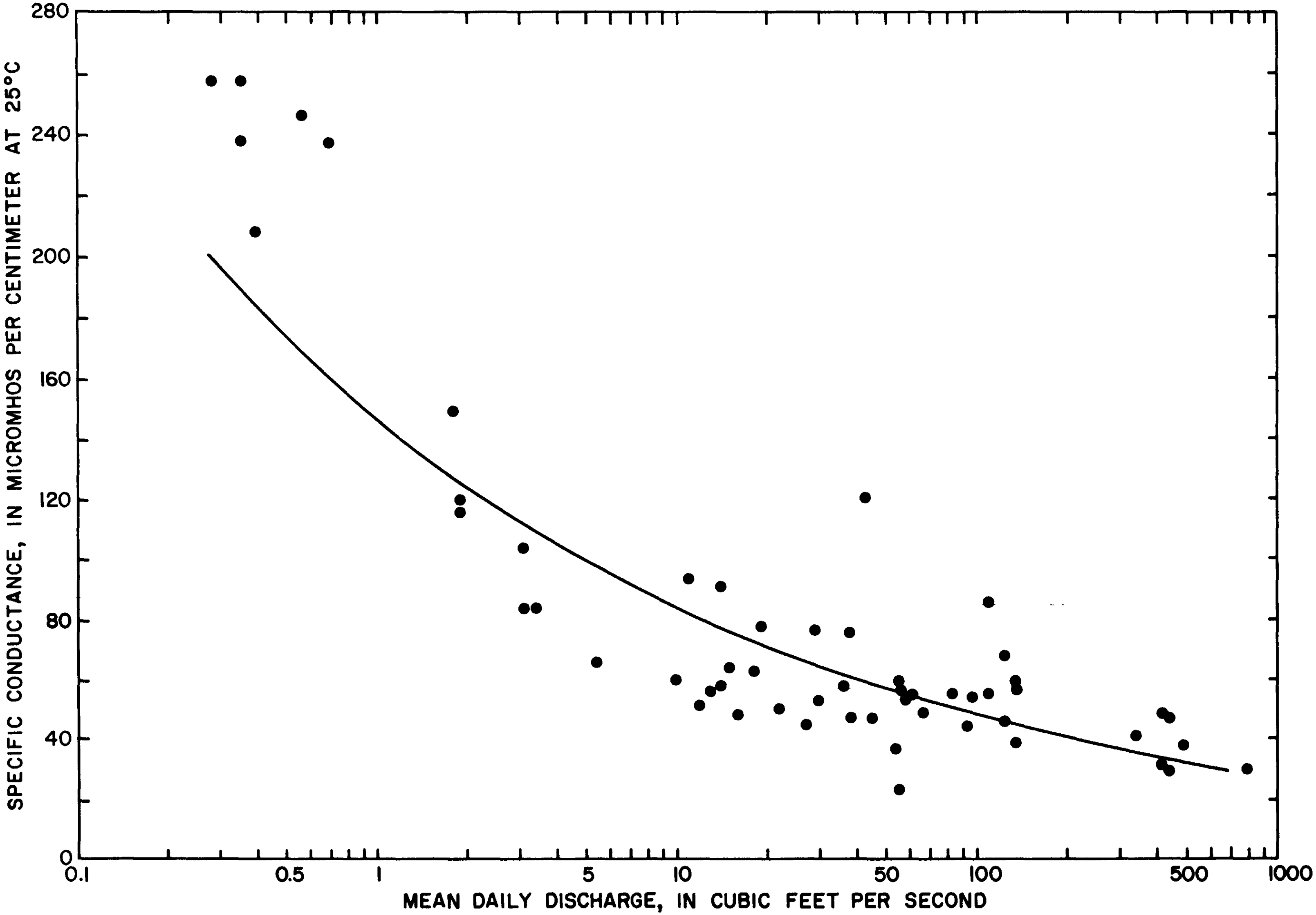


Figure 28.--Relation of specific conductance to discharge for the Santa Fe River near Graham (station 23).

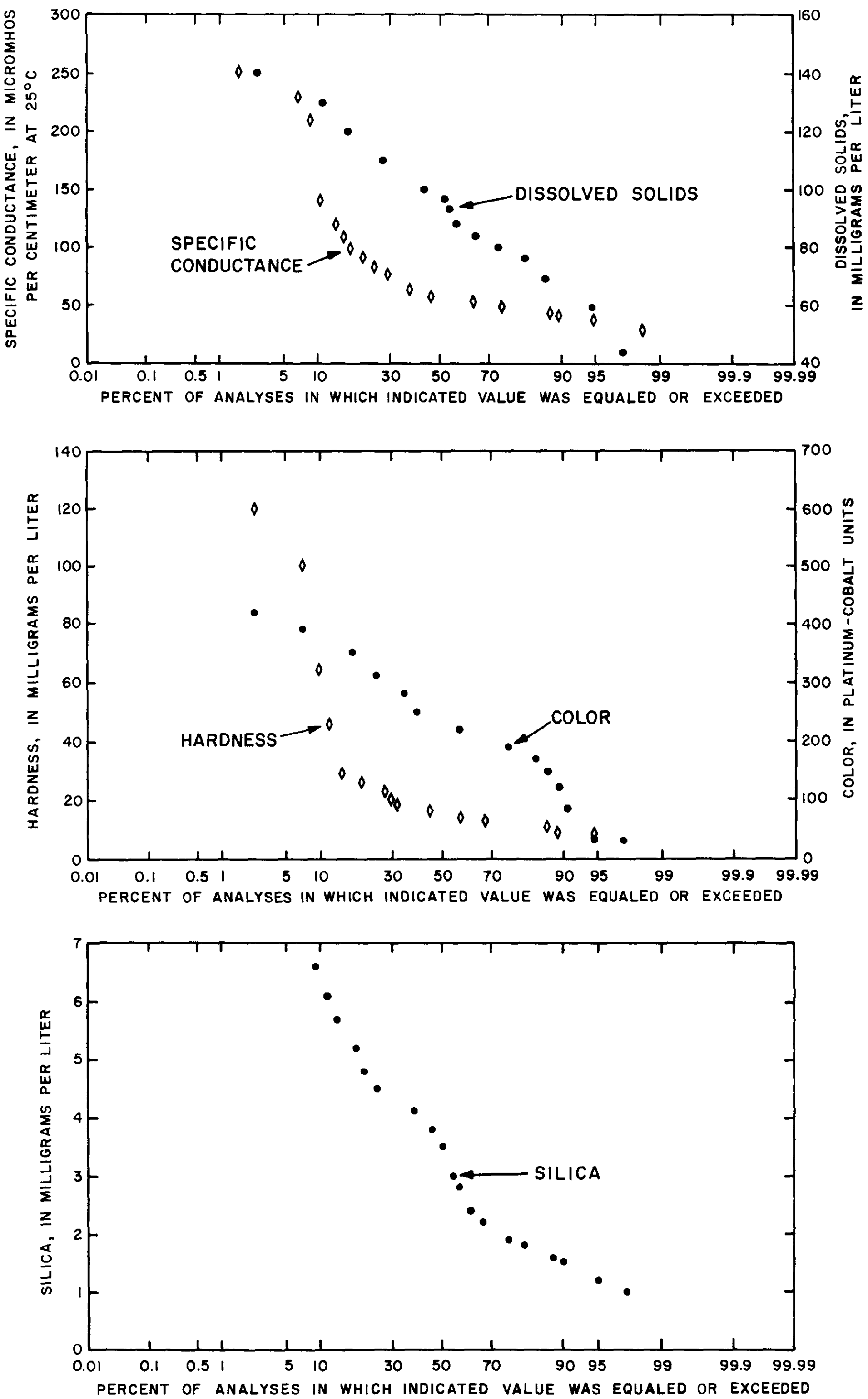


Figure 29.--Cumulative frequency of specific conductance, dissolved solids (residue on evaporation), hardness, color, and silica for the Santa Fe River at Graham (station 23).

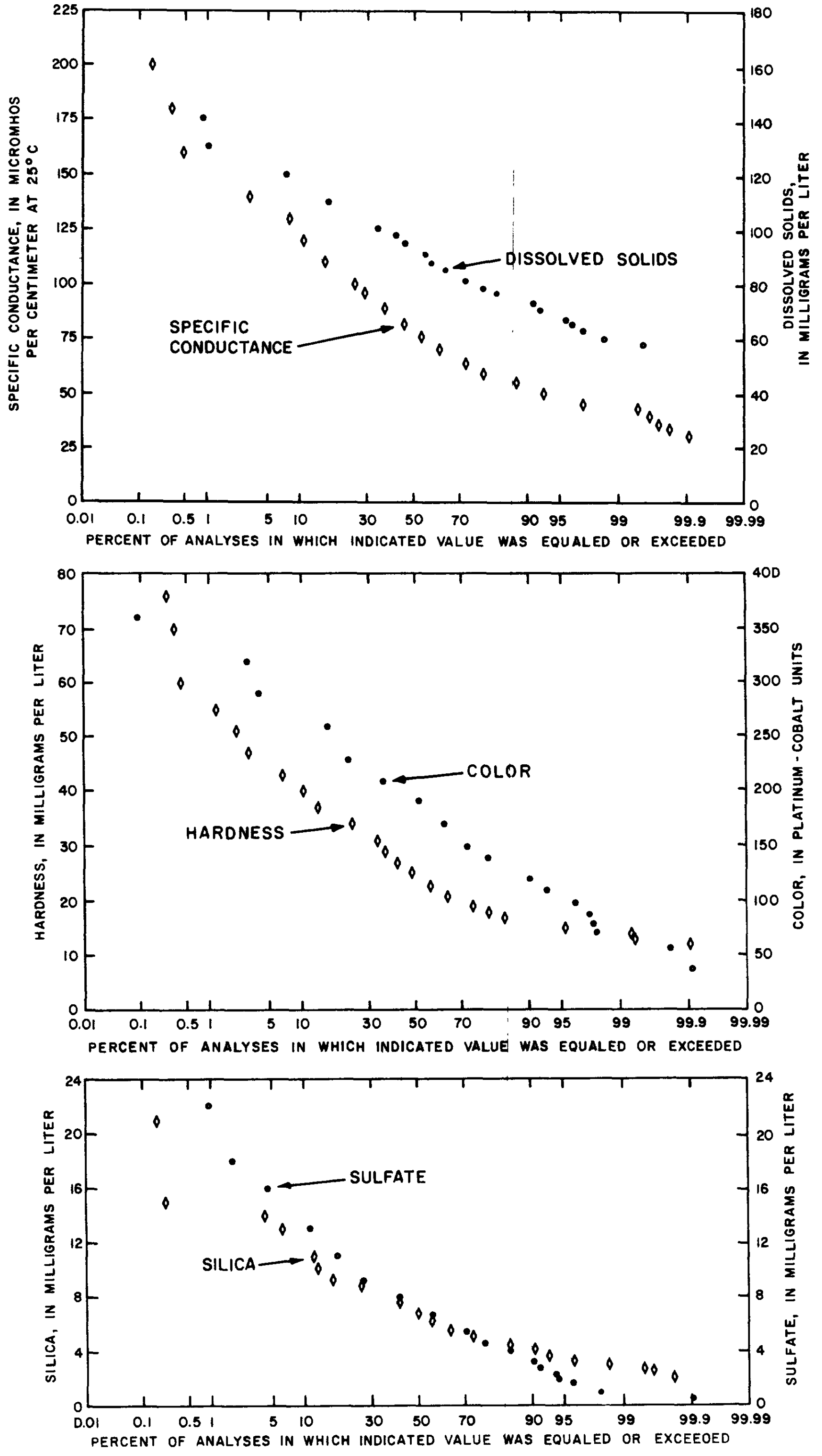


Figure 30.--Cumulative frequency of specific conductance, dissolved solids (residue on evaporation), hardness, color, silica, and sulfate for the Santa Fe River at Worthington Springs (station 56).

The average concentration of mineral matter dissolved in the water at Olustee Creek near Providence (fig. 13, station 76) is about 35 percent less than that of Santa Fe River at Worthington Springs (station 56). The concentration of dissolved solids (ROE) in Olustee Creek water averaged 86 mg/L, of which 31 mg/L was inorganic matter and 55 mg/L was organic matter. Nitrate, nitrite, organic nitrogen, and chloride concentrations were about the same at both sites, but sulfate and silica were about 53 and 29 percent less, respectively, for Olustee Creek than for the Santa Fe River.

The Santa Fe River goes underground about 4 miles downstream from the mouth of Olustee Creek, and emerges again about 3 miles farther downstream. From the river's emergence to the gaging and sampling station near High Springs (fig. 13, station 84) the river water is more mineralized than at any place upstream or downstream. The average concentration of inorganic and organic substances dissolved in the Santa Fe River water at High Springs is 171 and 18 mg/L, respectively. Calcium plus magnesium bicarbonate and, to a lesser extent, calcium sulfate account for most of the dissolved solids. Organic matter, however, is considerably less concentrated in the river at High Springs (station 84) than at Graham (station 23) and Worthington Springs (station 56).

The changes in Santa Fe River quality are due almost entirely to differences in quality of ground-water inflow and overland runoff. Natural factors are sufficiently different within the basin to cause most of the water-quality variations observed.

Color is the most esthetically objectionable characteristic of surface water in the basin. Iron content and hardness, locally, may be problems.

SUMMARY

The availability of water in the Santa Fe basin is more than adequate for present needs. Estimated water use in the basin was 17 Mgal/d in 1977, a very small part of the estimated average discharge of the Santa Fe River at its mouth of 1,400 Mgal/d. Important sources of water in the basin are the Floridan aquifer, water-yielding zones in the confining bed, the surficial aquifer, and the stream system.

The western part of the basin is a karst area containing the greatest potential supplies of ground water and surface water. The principal source of ground water is the Floridan aquifer, a sequence of limestone units as much as 1,000 feet thick. The Floridan aquifer is overlain in much of the western part of the basin by the confining bed that, except in part of Gilchrist County, does not function effectively as a confining layer because it is commonly thin and breached by sinkholes. Where the Floridan aquifer is unconfined, rainfall percolates directly into the aquifer. Recharge is estimated to be 18 in/yr. Aquifer transmissivity is estimated to range from 33,000 to 500,000 ft^2/d; individual wells may be pumped as much as 5,000 gal/min. The Floridan aquifer discharges naturally to the Santa Fe and Ichetucknee Rivers, the main surface drainage features of the basin. Cow Creek, a small tributary to the Santa Fe River, drains the area in Gilchrist

County where the Floridan aquifer is confined. Several large springs contribute to the flow of the Santa Fe and Ichetucknee Rivers. The average discharge of Ichetucknee Springs, measured in the river below the springs, is about 360 ft^3/s. The average discharge of the Santa Fe River at Fort White, about 9 miles upstream from the mouth of the Ichetucknee River, is about 1,640 ft^3/s. The base flow of both streams is sustained by discharge from the Floridan aquifer, which conveys ground water from most of the Santa Fe basin and adjacent parts of Suwannee and Alachua Counties which are outside the basin. The two rivers are used extensively for recreation.

In the eastern part of the basin, the Floridan aquifer is overlain by the confining bed, which effectively confines the aquifer. The confining bed, in turn, is overlain by a surficial aquifer. The transmissivity of the Floridan aquifer in this area is estimated to range from 21,000 to 36,000 ft^2/d. Recharge to the Floridan aquifer percolates through the overlying confining bed at a rate estimated to be 1.8 in/yr. Discharge from the Floridan aquifer to streams is small, occurring only to the Santa Fe River downstream from Worthington Springs. Ground-water discharge is mostly to the western part of the basin, but also northeast to the St. Johns River basin.

The confining bed over the Floridan aquifer consists of interbedded clay, sand, sandstone, and limestone becoming more than 300 feet thick in the northeastern part of the basin. It contains water-bearing limestone layers that supply less than 100 gal/min to wells, mostly in Bradford and Union Counties. Water in the confining bed is derived from the overlying surficial aquifer and by seepage from streams. Where it crops out, the confining bed receives recharge from rainfall, especially in Gilchrist County. Natural discharge from the confining bed is directly to streams and into the Floridan and surficial aquifers.

The surficial aquifer is composed mostly of very fine to medium-grained silty sand with interbedded layers of clay and silt. These sediments overlie the entire basin but have a perennially saturated zone only where underlain by less permeable constituents of the confining bed. Saturated thickness of the surficial sediments increases toward the east, reaching about 80 feet near the Clay County line. Recharge to the surficial aquifer is derived from local rainfall and from streams during high flows. Natural discharge consists of evapotranspiration, seepage to streams, and percolation to or through the underlying confining bed. The water table of the surficial aquifer generally lies within 10 feet of land surface, commonly intersecting the surface with the resultant occurrence of ponds, lakes, streams, and swamps. The aquifer supplies water to many wells for domestic purposes, mostly in Bradford and Union Counties. Well yields, large enough for commercial and some industrial use, could be developed by unconventional methods such as large-diameter dug wells and water collectors, especially near the eastern boundary of the basin.

Streams in the eastern part of the basin are numerous, but small. Average discharge of the Santa Fe River at Worthington Springs is about 450 ft^3/s, representing discharge from most of the eastern part of the basin. Streams in this area are used mostly for irrigation of crops and livestock watering.

Quality of water in the Santa Fe basin is generally satisfactory for most uses. Water from the surficial aquifer is for the most part not highly mineralized, but locally may contain high concentrations of iron, calcium, and magnesium. Water percolating from the surficial aquifer through the confining bed becomes more highly mineralized with calcium, magnesium, and bicarbonate. The Floridan aquifer also contains water of the calcium-magnesium bicarbonate type. Streams in the western part of the basin, because of the large inflow from the Floridan aquifer, contain more calcium, magnesium, and bicarbonate, and less color than the streams in the eastern part of the basin.

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Table 2.--Well and test hole data

Site number: Number used for U.S. Geological Survey automatic data processing

Local well number: Well-numbering system used in older reports and figure 5 of this report. This system is explained in figure 6.

Use: D, domestic; In, industrial; Ir, irrigation; N, none; P, public supply; O, observation; St, stock; T, test

Source of well record: G, Florida Bureau of Geology; SR, Suwannee River Water Management District; U, U.S. Geological Survey [Clark and others (1964a), Meyer (1962), and later data]

Source of water analysis: SR, Suwannee River Water Management District; U, U.S. Geological Survey

Water-yielding unit: F, Floridan aquifer; C, confining bed; S, surficial aquifer

Site number	Local well number	Depth (feet)	Casing		Altitude of			Use	Source of		Water yielding unit
			Diameter (inches)	Depth (feet)	Land surface (feet)	Top of confining bed (feet)	Top of Floridan aquifer (feet)		Well record	Water analysis	
Alachua and Gilchrist Counties											
293722082422001	937-242-1	59	--	--	112	112	--	T	G	--	--
293731082430001	937-243-1	49	--	--	83	83	--	T	G	--	--
293825082413001	938-241-1	100	4	74	87	87	--	D	SR	--	F
293931082312001	939-231-1	103	4	40	94	84	78	St	SR	--	F
293957082464501	939-246-1	45	--	--	66	66	26	T	G	--	--

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294011082223601	940-222-1	152	4	63	157	137	67	Ir	SR	--	F
294010082225001	940-222-2	170	4	122	162	162	104	Ir	SR	--	F
294015082261101	940-226-1	123	4	63	95	85	67	D	SR	--	F
294036082412401	940-241-1	--	--	--	86	86	--	D	SR	SR	F
294006082430701	940-243-1	170	4	158	85	85	--	D	SR	SR	F
294050082461501	940-246-1	40	--	--	86	86	51	T	G	--	--
294031082462101	940-246-2	102	--	--	97	97	--	T	U	--	--
294150082270301	941-227-1	202	4	63	163	153	113	D	SR	--	F
294153082324901	941-232-1	125	--	--	89	--	--	D	U	--	F
294145082482701	941-248-1	3,753	16-10	970	88	88	-22	T	G	--	--
294250082031001	942-203-1	111	4	105	160	--	--	D	U	--	F
294231082034601	942-203-2	17	4	--	147	<130	--	N	U	--	S
294233082034301	942-203-3	10	1¼	--	147	<137	--	N	U	--	S
294240082032504	942-203-4	365	4	--	161	--	--	N	U	U	F
294240082032505	942-203-5	136	2	--	155	--	--	D,Ir	U	U	F
294240082032506	942-203-6	154	2	110	145	--	--	D,Ir	U	U	F
294247082033201	942-203-9	162	4	125	146	--	--	D	SR	SR	F
294252082063001	942-206-1	60	3	60	170	--	--	D	U	--	C
294240082071501	942-207-1	24	1¼	24	--	--	--	T	U	U	S
294215082101501	942-210-1	82	2	--	120	--	--	D	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294207082163201	942-216-1	447	10	175	150	--	--	N	U	--	F
294215082161601	942-216-2	350	12	160	150	--	--	In	U	--	F
294217082162201	942-216-3	522	20	153	150	--	--	P	U	--	F
294209082174101	942-217-1	530	24	173	160	155	10	P	U	--	F
294209082173101	942-217-2	520	24	180	161	148	16	P	U	--	F
294219082181801	942-218-1	500	24	190	165	155	0	P	U	U	F
294209082175201	942-218-2	475	24	185	161	151	-32	P	U	--	F
294209082180301	942-218-3	540	24	217	164	154	-51	P	U	--	F
294209082181801	942-218-4	540	24	190	164	154	-45	P	U	--	F
294228082181801	942-218-5	521	24	189	165	155	-10	P	U	--	F
294237082181801	942-218-6	538	24	180	164	159	4	P	U	--	F
294255082211001	942-221-1	13	1¼	10	188	<175	--	T	U	U	S
294210082270201	942-227-1	330	11	97	175	--	--	Ir	U	--	F
294257082282101	942-228-1	162	4	120	133	129	76	D	SR	--	F
294219082295501	942-229-1	140	4	110	92	77	52	D	SR	--	F
294203082453201	942-245-1	45	--	--	82	82	42	T	G	--	F
294220082481301	942-248-1	81	--	--	88	88	36	T	G	--	F
294310082043001	943-204-1	160	2	--	155	--	--	D,Ir	U	U	F
294340082073001	943-207-1	150	4	95	171	--	--	D,St	U	U	F
294315082084001	943-208-1	79	2	70	--	--	--	D	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing Diameter (inches)	Casing Depth (feet)	Altitude of Land surface (feet)	Altitude of Top of confining bed (feet)	Altitude of Top of Floridan aquifer (feet)	Use	Source of Well record	Source of Water analysis	Water yielding unit
294320082155001	943-215-1	18	1¼	15	165	147	--	T	U	U	S
294355082154502	943-215-2	270	4	195	160	--	--	D	U	U	F
294340082213001	943-221-1	230	4	121	191	--	--	D	U	U	F
294311082233901	943-223-1	165	4	83	177	172	94	D,	SR	SR	F
294318082250301	943-225-1	175	--	--	173	--	143	Ir	G,SR,U	SR	F
294304082283101	943-228-1	125	--	--	128	--	--	D	U	--	F
294322082322501	943-232-1	207	8	103	--	--	--	Ir	U	--	F
294307082411101	943-241-1	--	--	--	95	95	--	D	SR	SR	F
294331082412701	943-241-2	79	2	76	90	90	52	T	U	--	F
294323082434601	943-243-1	235	--	--	76	76	--	D	SR	SR	F
294330082445001	943-244-1	101	6	55	85	85	--	O	U	--	F
294343082482801	943-248-1	107	2	--	90	90	-13	T	U	--	--
294410082055501	944-205-1	58	1¼	--	140	--	--	P	U	U	C
294456082055901	944-205-2	180	4	142	162	157	82	D	SR	SR	F
294445082061501	944-206-1	60	3	40	182	142	--	D	U	U	C
294440082200201	944-219-1	802	16	--	177	--	--	T	U	--	F
294446082211601	944-221-1	200	4	143	169	129	29	D	SR	SR	F
294410082224501	944-222-1	165	4	100	189	--	--	D	U	U	F
294448082320601	944-232-1	100	4	73	91	--	66	D	SR	--	F
294428082362901	944-236-1	106	4	75	90	--	--	D,O	SR	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294423082442801	944-244-1	40	--	--	86	86	59	T	G	--	--
294542082-54401	945-205-1	22	1¼	20	144	--	--	T	U	--	S
294510082121501	945-212-1	448	6	195	156	--	--	Ir	U	U	F
284500082132201	945-213-1	180	4	160	149	136	- 6	D	SR	--	F
294530082163201	945-216-1	220	4	163	169	131	9	--	SR	SR	F
294534082232101	945-223-1	440	14	185	184	176	104	In	U	U	F
294531082241401	945-224-1	--	4	--	176	--	--	D	SR	SR	F
294541082292901	945-229-1	--	--	--	166	--	--	D	SR	SR	F
294533082294401	945-229-2	--	4	--	133	--	--	D,O	SR	--	F
294530082313901	945-231-1	60-80	2	--	90	--	--	D	SR	SR	F
294552082352501	945-235-1	--	--	--	92	--	--	D	SR	SR	F
294553082370001	945-237-2	140	4	120	94	--	59	D	SR	SR	F
294550082403101	945-240-1	137	--	--	97	97	--	D	SR	SR	F
294519082442201	945-244-1	65	--	65	70	70	--	D	SR	SR	F
294640082064501	946-206-1	154	4	141	170	--	--	D,O	SR,U	--	F
294647082063201	946-206-2	199	4	165	159	--	--	D	U	--	F
294605082081501	946-208-1	210	2	--	155	--	--	D,Ir	U	U	F
294650082105001	946-210-1	60	1¼	60	150	> 90	--	D	U	U	C
294624082112601	946-211-1	18	1¼	15	155	< 137	--	T	U	--	S
294650082181501	946-218-1	14	24	--	159	< 145	--	N	U	U	S

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing		Altitude of			Use	Source of		Water yielding unit
			Diameter (inches)	Depth (feet)	Land surface (feet)	Top of confining bed (feet)	Top of Floridan aquifer (feet)		Well record	Water analysis	
294655082181502	946-218-2	140	4	98	154	--	--	D	U	U	F
294640082263001	946-226-1	17	4	17	158	<141	--	D	U,SR	U,SR	S
294632082255301	946-226-2	427	12	87	152	--	--	In	U	--	F
294625082260503	946-226-3	422	--	190	151	--	--	In	G,SR	U	F
294646082260801	946-226-4	430	12	180	151	--	--	In	G,SR	--	F
294622082290801	946-228-1	142	8	--	104	--	--	N	U	--	F
294635082194001	946-229-1	120	4	--	90	--	--	D	U	--	F
294631082334801	946-233-1	100	4	85	90	--	61	D	SR	--	F
294609082425301	946-242-1	38	--	--	64	64	<26	T	G	--	--
294656082442601	946-244-1	29	--	--	66	66	44	T	G	--	--
294726082101001	947-210-1	255	6	175	157	--	--	P	U	U	F
294710082101002	947-210-2	60	3	43	154	--	--	D	U	U	C
294724082100301	947-210-6	39	3	--	155	>116	--	N	U	--	C
294750082105007	947-210-7	60	2	--	160	>100	--	D,Ir	U	U	C
294751082231101	947-223-1	277	10	89	160	154	69	D	SR	--	F
294720082255501	947-225-1	134	4	65	145	--	--	D	U	U	F
294714082294401	947-229-1	378	8	--	76	--	--	P	U	--	F
294720082292002	947-229-2	363	10	100	70	--	--	P	U	U	F
294706082291001	947-229-3	--	--	--	80	--	--	In	U	--	F
294720082292004	947-229-4	260	12	214	85	--	--	In	U	U	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294752082352401	947-235-1	--	--	--	73	--	--	D	SR	SR	F
294702082393001	947-239-1	29	--	--	66	--	44	T	G	--	--
294703082405301	947-240-1	25	--	--	75	--	58	T	G	--	--
294701082402201	947-240-2	94	4	--	82	--	--	D,O	SR	--	F
294702082424201	947-242-1	34	--	--	67	67	38	T	G	--	--
294700082435601	947-243-1	25	--	--	65	65	--	T	G	--	--
294721082443001	947-244-1	59	2	56	61	61	31	O	U	--	--
294750082462501	947-246-1	3,366	16-8	1,106	70	70	30	T	G	--	--
294713082462001	947-246-2	35	--	--	65	65	37	T	G	--	--
294713082472501	947-247-1	74	--	--	72	72	--	T	G	--	--
294714082473401	947-247-2	95	2	92	74	74	--	T	U	--	--
294859082074701	948-207-1	210	--	--	142	--	--	D	SR	SR	F
294856082101101	948-210-1	116	4	--	156	--	<40	N	U	--	C
294820082185701	948-218-1	120	4	80	140	120	--	D	SR	SR	F
294832082230001	948-223-1	400	8	--	160	--	--	Ir	U	--	F
294839082230702	948-223-2	180	4	162	164	164	79	D,O	SR	SR	F
294813082263301	948-226-1	220	4	162	147	144	107	D	SR	SR	F
294828082282301	948-228-1	--	--	--	140	--	--	D	SR	SR	F
294829082294901	948-229-1	13	1¼	10	153	<140	--	T	U	--	S
294830082313501	948-231-1	238	--	--	92	--	--	P	U	U	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294850082312002	948-231-2	129	4	109	99	--	--	St	U	U	F
294812082313901	948-231-3	90	--	60	134	--	--	P	SR	SR	F
294847082381201	948-238-1	70-80	--	40	70	--	--	--	SR	SR	F
294841082412801	948-241-1	--	--	--	72	--	--	--	SR	SR	F
294841082441401	948-244-1	--	--	--	55	55	--	D	SR	SR	F
294810082495501	948-249-1	74	--	--	79	79	--	T	G	--	--
294935082081001	949-208-1	67	2	40	145	>105	--	D,St,Ir	U	U	C
294955082113001	949-211-1	40	2	--	150	<110	--	D,Ir	U	U	S
294935082144001	949-214-1	18	30	--	157	<139	--	D,St	U	U	S
294923082174501	949-217-1	140	4	120	100	--	--	D,O	SR	SR	F
295001082245801	949-225-1	3,219	16	1,673	158	--	--	T	U	--	--
294928082355302	949-235-1	75	6	--	65	--	--	N	U	--	F
294928082355301	949-235-2	300	--	250	72	--	--	O	U	--	F
294928082355303	949-235-3	243	12	238	70	--	--	P	U	--	F
294928082355304	949-235-4	500	16-10	365	70	--	20	P	U	--	F
294950082363001	949-236-1	250	8	90	43	--	--	--	U	U	F
294950082363002	949-236-2	300	10	--	74	--	--	In	U	U	F
294946082443101	949-244-1	49	2	46	50	50	36	T	U	--	F
294950082455501	949-245-1	77	--	--	44	44	38	T	G	--	--
295010082102001	950-210-1	65	2	--	135	--	--	D,Ir	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295015082135002	950-213-2	--	--	--	150	--	--	D,SR,Ir	U	U	S
295009082152301	950-215-1	180	4	--	147	147	-11	D	SR	SR	F
295050082205901	950-220-1	18	1¼	15	137	<119	--	P	U	U	S
295026082210301	950-221-1	125	--	--	146	--	--	D	SR	SR	F
295040082244001	950-224-1	223	10	204	143	--	--	In	U	U	F
295037082273501	950-227-1	160	4	98	163	163	69	D	SR	SR	F
295028082290701	950-229-1	165	--	135	156	--	--	--	SR	SR	F
295000082354001	950-235-1	148	2	--	67	--	--	N	U	--	F
295015082362001	950-236-1	70	4	--	65	--	--	Ir	U	U	F
295015082362002	950-236-2	85	4	58	67	--	--	N	U	U	F
295050082364503	950-236-3	72	2	--	55	--	--	D	U	U	F
295031082374601	950-237-1	--	--	--	53	--	--	D	SR	SR	F
295115082244501	951-224-1	18	1¼	15	137	<119	--	T	U	U	S
295145082244002	951-224-2	175	4	144	135	120	10	D	U,SR	U,SR	F
295136082253601	951-225-1	350	10	119	150	--	--	Ir	U	--	F
295129082332601	951-233-1	85	4	58	66	--	46	D,O	SR	SR	F
295110082354001	951-235-1	225	4	43	43	--	--	D	U	U	F
295106082353702	951-235-2	235	6	42	46	--	--	P	U	--	F
295121082350301	951-235-3	--	--	--	61	--	--	D	SR	SR	F
295118082443301	951-244-1	40	--	--	40	--	5	T	G	--	--

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295108082443401	951-244-2	--	--	--	39	--	--	D	SR	SR	F
295122082452201	951-245-1	10	--	--	34	--	30	T	G	--	--
295132082461101	951-246-1	40	--	--	62	62	37	T	G	--	--
295225082324001	952-232-1	171	4	--	160	--	--	D	U	U	F
295245082474701	952-247-1	70	--	--	79	79	<9	T	G	--	--
295213082482301	952-248-1	83	4	76	65	65	-5	D	SR	--	F
295314082271401	953-227-1	165	4	81	177	162	102	D	SR	SR	F
295258082282201	953-228-1	230	8	--	173	--	--	Ir	U	--	F
295352082285301	953-228-2	--	8	--	156	--	--	Ir	U	--	F
295332082283801	953-228-3	110	--	--	168	--	--	--	SR	SR	F
295350082315001	953-231-1	171	4	78	158	--	--	D	U	U	F
295341082312501	953-231-2	150	--	--	142	--	--	D	SR	SR	F
295328082485001	953-248-1	40	--	--	67	67	32	T	G	--	--
295327082501501	953-250-1	45	--	--	52	52	<7	T	G	--	--
295327082513501	953-251-1	30	--	--	36	36	9	T	G	--	--
295415082275001	954-227-1	165	4	--	155	--	--	In	U	U	F
295454082283801	954-228-1	156	4	--	137	--	--	D	U	--	F
295420082302001	954-230-1	162	4	--	160	--	--	D	U	U	F
295515082281001	955-228-1	110	4	--	65	--	--	St	U	U	F
295530082285002	955-228-2	156	4	--	135	--	--	Ir	U	U	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295530082285003	955-228-3	166	4	--	135	--	--	D	U	U	F
205530082285004	955-228-4	145	4	--	135	--	--	D	U	U	F
Clay and Bradford Counties											
294320082024501	943-202-1	20	1¼	17	174	--	--	T	U	U	S
294335082025502	943-202-2	159	4	124	--	--	--	T	U	U	F
294313082024601	943-202-3	259	4	204	180	90	6	O	U	--	F
294420082031001	944-203-1	160	2	134	--	--	--	D, Ir	U	U	F
294551082031301	945-203-1	22	1¼	20	129	<107	--	T	U	--	S
294531082032601	945-203-2	27	1¼	25	144	--	--	T	U	--	S
294513082034801	945-203-3	52	1¼	50	155	<103	--	T	U	--	S
294500082020004	945-203-4	32	1¼	30	154	--	--	T	U	--	S
294520082042801	945-203-5	186	2	141	150	--	--	P	U	U	F
294540082041701	945-204-1	83	2	--	152	--	--	N	U	--	C
294531082041201	945-204-2	23	1¼	--	147	<124	--	N	U	--	S
294539082042901	945-204-3	30	2	--	147	<117	--	N	U	--	S
294540082045401	945-204-4	85	2	52	143	>91	--	N	U	--	C
294555082045005	945-204-5	98	2	64	145	--	--	N	U	U	C
294545082051502	945-205-2	154	2	147	144	--	--	N	U	U	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
294545082051503	945-205-3	84	2	--	145	--	<61	D,Ir	U	--	C
294538082051101	945-205-5	26	2	26	145	<119	--	N	U	--	C
294622082505702	946-202-5	46	2	42	115	<69	--	D,Ir	U	--	C
294659082030101	946-202-6	400	10	250	158	--	--	P	U	--	F
294619082025801	946-202-7	160	2	154	115	--	--	D,Ir	U	--	F
294655082045501	946-204-1	94	2	84	145	>61	>51	D,Ir	U	U	C
294726082024901	947-202-4	71	2	--	145	--	--	N	U	--	C
294705082020407	947-202-7	31	2	--	145	<114	--	N	U	U	S
294739082032601	947-203-1	186	2	161	150	--	--	D,Ir	U	--	F
294755082032602	947-203-2	25	4	--	125	--	--	N	U	U	S
294759082030801	947-203-3	29	1¼	--	128	<99	--	N	U	--	S
294746082034601	947-203-4	21	2	--	140	<119	--	N	U	--	S
294805082032401	948-203-1	40	1¼	38	131	<91	--	N	U	U	S
294857082032702	948-203-2	173	2	167	119	--	--	D,Ir	U	U	F
294808082031203	948-203-3	28	1¼	--	135	--	--	N	U	U	S
294812082030904	948-203-4	126	2	106	135	--	--	D	U	U	C
294825082032301	948-203-5	57	2	57	130	<73	--	N	U	--	S
294846082033806	948-203-6	14	2	--	145	--	--	N	U	U	S
294801082032401	948-203-7	52	3	--	135	<83	--	N	U	--	S
294955082300201	949-202-1	474	10	198	165	--	>-33	P	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing		Altitude of			Use	Source of		Water yielding unit
			Diameter (inches)	Depth (feet)	Land surface (feet)	Top of confining bed (feet)	Top of Floridan aquifer (feet)		Well record	Water analysis	
294857082034501	949-203-1	174	2	152	170	--	<- 4	D,Ir	U	--	C
294930082042001	949-204-1	128	2	100	160	>60	--	D,Ir,St	U	U	C
295010082024001	950-202-1	535	8	243	180	--	--	P	U	--	F
295050082035001	950-203-1	28	1¼	26	173	<145	--	T	U	U	S
295010082035502	950-203-2	18	1¼	--	173	--	--	D,Ir	U	U	S
295010082043001	950-204-1	74	2	54	160	>106	--	D,Ir	U	U	C
295055082130801	950-213-1	206	4	172	142	130	-17	O	U	U	F
295130082064501	951-206-1	64	2	--	160	--	--	D	U	U	C
295130082064502	951-206-2	70	2	40	160	>120	--	D	U	U	C
295144082081701	951-208-1	228	6	105	145	--	--	N	U	--	F
295135082094501	951-209-1	70	2	50	145	>95	--	D,Ir,St	U	U	C
295124082092001	951-209-2	25	1	--	149	<124	--	N	U	--	S
295140082131001	951-213-1	11	2	--	145	<134	--	N	U	U	S
295142082141501	951-214-1	27	1¼	23	142	<115	--	T	U	--	S
295145082142001	951-214-2	55	2	55	150	>95	--	N	U	--	C
295245082015501	952-201-1	17	1¼	15	181	<164	--	T	U	U	S
295257082045701	952-204-1	284	4	234	177	139	-28	O	U	--	F
295250082061101	952-206-1	90	2	--	162	>72	--	N	U	--	C
295218082090301	952-209-1	89	6	--	148	--	--	In	U	U	C
295250082090502	952-209-2	93	2	--	150	--	--	D,Ir	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295240082104001	952-210-1	13	36	--	143	<130	--	N	U	U	S
295215082101502	952-210-2	66	1½	--	141	>75	--	N	U	U	C
295215082120501	952-212-1	64	2	48	150	>102	--	D	U	U	C
295255082123502	952-212-2	48	1¼	--	137	<89	--	D,Ir,St	U	U	S
295350082045001	953-204-1	85	2	63	175	>112	--	D,Ir,St	U	U	C
295325082050501	953-205-1	20	1¼	18	175	<155	--	T	U	U	S
295340082084001	953-208-1	95	2	60	153	>93	--	D,P	U	U	C
295325082082502	953-208-2	90	2	--	152	--	--	N	U	U	C
295330082101501	953-210-1	25	1¼	23	154	--	--	T	U	U	S
295322082200301	953-220-1	486	8	120	124	--	--	In	U	U	F
295322082200302	953-220-2	200	4	99	124	--	--	--	U	--	F
295346082221101	953-222-1	--	--	127	111	--	--	D	SR	SR	F
295437082044001	954-204-1	68	2	58	172	>114	--	N	U	--	C
295450082053501	954-205-1	70	2	70	170	>100	--	D,Ir	U	U	C
295430082082001	954-208-1	80	2	--	145	>65	--	D,Ir	U	U	C
295410082091001	954-209-1	60	1¼	--	152	<92	--	D,Ir	U	U	S
295425082103501	954-210-1	90	2	--	150	>60	--	D,Ir,St	U	U	C
295410082100801	954-210-2	208	4	176	151	--	-57	D	SR	--	F
295455082123001	954-212-1	72	1¼	--	141	<69	--	D	U	U	S
295524082044101	955-204-1	75	2	--	172	>97	--	D,Ir	U	--	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295535082062001	955-206-1	100	2	60	162	>102	--	D,Ir	U	U	C
295555082065502	955-206-2	70	2	58	148	>90	--	D,Ir	U	U	C
295525082194501	955-219-1	175	10	117	141	--	>-24	D,Ir	U	U	F
295659082052101	956-205-1	25	1¼	23	165	<140	--	T	U	--	S
295634082062501	956-206-1	610	10	170	167	--	--	P	U	--	F
295634082062502	956-206-2	529	5	500	170	--	--	N	U	--	F
295634082062503	956-206-3	580	10	166	--	--	--	N	U	--	F
295634082062504	956-206-4	90	2	60	166	>106	--	N	U	--	C
295634082062505	956-206-5	64	6	--	166	--	--	N	U	--	C
295649082064201	956-206-6	503	10	278	169	--	--	P	U	--	F
295646082064302	956-206-7	607	18	280	165	--	--	P	U	--	F
295650082085001	956-208-1	17	1¼	--	142	<125	--	Ir	U	U	S
295615082085502	956-208-2	86	1¼	--	152	>66	--	D,Ir,St	U	U	C
295623082111001	956-210-1	350	10	--	175	--	--	--	U	--	F
295725082004501	957-200-1	309	5	209	203	--	-106	D	U	U	C
295725082004502	957-200-2	100	4	--	203	<103	--	N	U	--	C
295725082004503	957-200-3	12	1¼	10	203	--	--	T	U	--	S
295730082022301	957-202-1	20	1¼	18	221	--	--	T	U	U	S
295752082035901	957-203-1	80	2	66	175	>109	--	N	U	--	C
295715082043001	957-204-1	76	2	65	178	>113	--	D,Ir	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295755082062501	957-206-1	85	2	70	168	>98	--	D,Ir	U	U	C
295755082071001	957-207-1	20	1¼	--	152	<132	--	D,Ir	U	U	S
295720082075002	957-207-2	60	--	44	165	>121	--	D,Ir	U	U	C
295710082092001	957-209-1	17	1¼	--	145	<128	--	D	U	U	S
295750082124001	957-212-1	51	2	--	142	<91	--	D,St	U	U	S
295740082164001	957-216-1	42	1	--	147	<105	--	D,St,Ir	U	U	S
295815082071501	958-207-1	75	2	--	165	>90	--	D,Ir	U	U	C
295850082095001	958-209-1	36	2	31	150	<114	--	Ir	U	U	S
295842082095201	958-209-2	40	4	35	150	<110	--	Ir	U	--	S
295830082105001	958-210-1	69	2	64	145	>81	--	D,Ir	U	U	C
295825082102002	958-210-2	20	--	--	148	--	--	D,Ir,St	U	U	S
295845082135501	958-213-1	200	4	140	154	--	>-46	D,Ir	U	U	F
295835082131002	958-213-2	18	1¼	15	152	--	--	T	U	U	S
295855082151501	958-215-1	50	1	--	160	<110	--	D,Ir,St	U	U	S
295812082170601	958-217-1	3,167	16	3,167	130-140	--	--	T	G	--	--
295945082031501	959-203-1	115	2	85	188	>103	--	D,Ir,St	U	U	C
295932082054301	959-205-1	55	1¼	--	160	<105	--	D,Ir,St	U	--	S
295950082065401	959-206-1	58	1½	50	152	<94	--	D,Ir	U	--	S
295917082075001	959-207-1	65	2	--	152	>87	--	D,Ir	U	U	C
295910082091001	959-209-1	94	4	--	143	--	--	D,Ir,St	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295915082114501	959-211-1	25	1¼	--	145	--	--	D,Ir,St	U	U	S
295955082111502	959-211-2	26	2	--	142	<116	--	D,Ir,St	U	U	S
295915082152001	959-215-1	80	1¼	--	145	>65	--	D,Ir	U	U	C
295950082162001	959-216-1	130	2	--	144	--	--	D,Ir	U	U	C
295955082155201	959-216-2	12	30	--	144	--	--	D,Ir	U	--	S
300035082103001	000-210-1	30	1¼	28	140	<110	--	T	U	U	S
300020082103001	000-210-2	294	4	247	139	105	-117	O	U	--	F
300135082154001	001-215-1	75	2	--	121	--	--	D,Ir	U	U	C
300256082025901	002-203-1	725	16	330	200	--	--	In	U	--	F,C
300319082025901	003-203-1	774	16	442	195	--	--	In	U	U	F
300340082111301	003-211-1	700	12	275	129	--	--	P	U	--	F
300424082041001	004-204-1	102	2	95	158	--	--	D	U	--	C
300455082040001	004-204-2	100	2	92	159	>67	--	D	U	--	C
300500082050901	004-205-1	85	1¼	71	147	>76	--	D	U	--	C
300452082052001	004-205-2	104	1¼	104	145	--	--	D	U	--	C
300527082032901	005-203-1	111	2	105	170	>65	--	D	U	--	C
300557082304401	005-203-2	129	2	--	185	--	--	D	U	--	C
300626082030001	006-203-1	189	2	155	210	--	--	D	U	--	S
300724082032401	007-203-1	140	2	98	192	>94	--	D	U	--	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing		Altitude of			Use	Source of		Water yield-ing unit
			Diam-eter (inches)	Depth (feet)	Land sur-face (feet)	Top of con-fining bed (feet)	Top of Flor-idan aqui-fer (feet)		Well record	Water anal-ysis	
					Union County						
295545082252501	955-225-1	110	4	60	113	>53	--	D	U	U	F
295532082252001	955-225-3	53	2	48	100	--	>47	D	U	--	F
295630082225001	956-222-1	25	1¼	25	105	<80	--	D	U	U	S
295610082253001	956-225-1	126	4	78	110	--	--	In	U	U	F
295615082264801	956-226-1	15	1¼	--	101	<86	--	D	U	U	S
295648082261001	956-226-2	350	8	270	124	--	--	Ir	U	--	F
295625082271001	956-227-1	12	1¼	12	108	--	--	D	U	U	S
295629082285501	956-228-1	65	2	53	88	--	--	D	U	U	F
295643082283801	956-228-2	93	--	--	105	--	--	D	SR	SR	F
295710082214501	957-221-1	112	4	82	88	--	<-24	D,St	U	U	C
295715082213502	957-221-2	79	2	--	88	--	--	N	U	U	C
295755082231001	957-223-1	120	4	88	120	--	<0	D	U	U	C
295715082232601	957-223-2	291	10	103	141	--	--	Ir	U	--	F
295750082241501	957-224-1	125	4	--	135	--	<10	D	U	U	C
295710082251201	957-225-1	18	1¼	15	150	<132	--	T	U	U	S
295701082253001	957-225-2	130	4	105	--	--	--	D,O	SR	--	F
295752082264901	957-226-1	147	6	86	142	>56	>5	D,St	U	U	F
295722082274301	957-227-1	330	10	125	132	--	--	Ir	U	--	F
295750082282001	957-228-1	25	1¼	25	152	<127	--	D	U	U	S
295830082183001	958-218-1	85	2	42	117	>75	--	D	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295815082225001	958-222-1	10	--	--	98	<88	--	N	U	U	S
295815082225002	958-222-2	52	1¼	--	98	--	--	D	U	--	C
295810082241201	958-224-1	128	4	96	121	>25	>- 7	D	U	U	F
295807082250001	958-225-1	309	10	138	145	--	--	Ir	U	--	F
295855082274001	958-227-1	30	1¼	30	140	<110	--	D	U	U	S
295855082283401	958-228-1	--	--	--	150	--	--	D	SR	SR	F
295845082295501	958-229-1	112	2	112	139	--	>27	D	U	U	F
295847082295002	958-229-2	22	1¼	21	139	<117	--	D,St	U	U	S
295848082301901	958-230-1	15	1¼	15	148	--	--	P	U	--	S
295805082314101	958-231-2	90	2	84	92	--	--	D	U	U	F
295857082322101	958-232-1	130	--	--	124	--	--	D	SR	SR	F
295835082334501	958-233-1	205	4	--	89	--	--	D	U	U	C
295950082165004	959-216-4	60	2	42	104	>62	--	D	U	U	C
295931082272801	959-217-1	225	6	--	116	--	--	Ir	U	--	F
295907082173201	959-217-2	61	2	--	116	--	--	D	U	--	C
295912082172103	959-217-3	56	2	25	112	>87	--	D	U	U	C
295950082205001	959-220-1	88	4	70	123	--	--	D	U	U	C
295922082223601	959-222-1	450	--	--	135	--	--	D	SR	SR	F
295955082244501	959-224-1	87	1¼	--	154	>67	--	D	U	U	C
295929082320401	959-231-1	28	1¼	25	135	<107	--	D	U	--	S

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295932082311701	959-231-2	150	4	98	137	117	39	D,O	SR	--	F
295921082333501	959-233-1	106	4	80	130	--	--	D	U	U	F
295955082333002	959-233-2	131	4	78	134	--	--	D	U	U	F
300050082205501	000-220-1	265	4	84	135	--	--	P	U	U	F
300051082205002	000-220-2	95	2	--	138	--	--	D	U	U	C
300050082264001	000-226-1	108	2	86	148	--	<40	D,St	U	U	C
300030082265002	000-226-2	69	2	--	146	--	--	N	U	U	C
300010082274501	000-227-1	142	4	17	156	>139	>14	D	U	--	F,C
300010082305001	000-230-1	120	4	60	145	>85	>25	D	U	U	F
300011082322701	000-232-1	15	1¼	--	146	--	--	D	U	--	S
300034082322101	000-232-2	113	4	--	118	--	--	D	U	--	F
300005082324003	000-232-2	165	4	90	153	>63	--	D	U	U	F
300110082195501	001-219-1	357	12	--	145	--	--	P	U	U	F
300108082204301	001-219-2	402	10	30	145	>115	--	P	U	--	F,C
300145082205501	001-220-1	71	2	--	142	--	--	D	U	U	C
300124082200201	001-220-2	60	2	42	146	>104	--	D	U	--	C
300101082245201	001-224-1	256	4	198	152	144	9	O	U	U	F
300155082274501	001-227-1	110	3	70	125	>55	>15	D	U	--	F,C
300148082292401	001-229-1	115	--	--	115	--	--	D	SR	SR	F
300105082315501	001-231-1	145	4	90	131	--	--	D,St	U	U	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
300105082315501	001-231-2	98	2	60	119	>59	--	D	U	U	C
300135082312502	001-231-3	145	--	90	139	--	--	D	SR	SR	F
300235082133501	002-213-1	75	2	35	122	>87	--	D	U	U	C
300215082145501	002-214-1	55	1¼	42	124	--	--	D	U	U	S
300200082216004	002-216-1	99	1¼	--	151	--	--	D	U	U	C
300244082161800	002-216-2	96	2	--	151	--	--	D	U	--	C
300219082181101	002-218-1	26	1¼	23	134	<108	--	T	U	U	S
300230082184002	002-218-2	78	1¼	78	142	--	--	D	U	U	C
300255082181803	002-218-3	70	2	60	133	>73	--	D	U	U	C
300210082191501	002-219-1	47	1¼	45	148	<101	--	D	U	U	S
300254082235501	002-223-1	175	6	--	146	--	--	N	U	--	F
300255082305001	002-230-1	136	4	--	130	--	--	D	U	U	F
300348082134501	003-213-1	100	2	58	130	>72	--	D	U	U	C
300310082143001	003-214-1	53	1¼	--	130	--	--	D	U	U	S
300340082145002	003-214-2	165	2	45	132	>87	<-33	D	U	U	C
300312082152401	003-215-1	17	1¼	17	148	<131	--	P	U	--	S
300325082191501	003-219-1	--	2	--	150	--	--	D	U	U	C
300322082245001	003-224-1	396	8	70	134	--	--	Ir	U	--	F
300348082292001	003-229-1	20	1¼	20	164	--	--	D	U	--	S
300328082313601	003-231-1	25	1¼	20	138	<118	--	D	U	--	S

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
300440082112001	004-211-1	612	12	281	132	--	--	P	U	U	F
300422082112401	004-211-2	518	12	195	132	--	--	N	U	--	F
300410082113003	004-211-3	430	12	288	127	117	-160	Ir	U	U	F
300420082131001	004-213-1	102	1¼	60	130	>70	--	D	U	U	C
300415082142001	004-214-1	96	2	70	138	--	--	D	U	U	C
300437082242801	004-224-1	40	2	31	143	<103	--	D	U	--	S
300435082263001	004-226-1	75	2	63	148	>85	--	D	U	U	C
300455082271001	004-227-1	175	2	140	148	--	--	D	U	U	F
300455082283501	004-228-1	158	4	--	142	--	--	N	U	U	F
300408082280901	004-228-2	18	1¼	15	140	<122	--	D	U	--	S
300432082300001	004-229-1	17	1¼	17	160	--	--	P	U	--	S
300436082294301	004-229-2	155	--	--	158	--	>3	D	SR	SR	F
300431082302701	004-230-1	30	1¼	20	138	<108	--	D	U	--	S
300512082220801	005-222-1	35	1¼	--	144	<109	--	P	U	--	S
300518082280801	005-228-1	38	1¼	--	148	<110	--	P	U	--	S
300635082095701	006-209-1	51	2	--	139	<88	--	P	U	--	C
300650082122001	006-212-1	80	2	63	146	--	--	D	U	--	C
300615082130501	006-213-1	310	4	226	149	145	-161	O	SR	--	F
300610082151101	006-215-1	140	2	69	148	>79	--	D	U	U	C
300745082093001	007-209-1	65	1¼	40	146	>106	--	D	U	U	C

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing		Altitude of			Use	Source of		Water yielding unit
			Diameter (inches)	Depth (feet)	Land surface (feet)	Top of confining bed (feet)	Top of Floridan aquifer (feet)		Well record	Water analysis	
300750082104501	007-210-1	62	2	48	142	>94	--	D	U	U	C
300725082111501	007-211-1	180	2	--	142	--	-38	D	U	U	C
300715082125001	007-212-1	135	2	74	146	--	--	D	U	U	C
300747082225801	007-222-1	724	8	694	153	113	- 7	O	U	--	F
300815082034501	008-203-1	3,171	10-8	2,760	175	--	-380	T	G	--	--
300806082101101	008-210-1	35	1¼	35	144	<109	--	D	U	--	S
				Columbia and Suwannee Counties							
295114082393801	951-239-1	140	4	103	65	--	--	O	SR	--	F
295113082410201	951-241-1	--	--	--	45	--	--	D	SR	SR	F
295257082372601	952-237-1	200	10	40	72	--	--	Ir	U	--	F
295225082381101	952-238-1	200	10	42	62	--	--	Ir	U	--	F
295304082351301	953-235-1	--	--	--	--	--	--	D	SR	SR	F
295341082381501	953-238-1	--	--	--	92	--	--	D	SR	SR	F
295310082381501	953-238-2	--	--	--	72	--	--	D	SR	SR	F
295357082444801	953-244-1	--	--	--	46	--	--	D	SR	SR	F
295409082352101	954-235-3	70	4	37	68	--	54	D	SR	SR	F
295528082393301	955-239-1	125	4	100	105	--	--	P	U	--	F
295703082324401	956-232-1	147	2	--	146	--	--	D	U	--	F
295600082321601	956-232-2	86	4	--	77	--	--	P,O	SR	SR	F
295600082332501	956-233-1	156	4	80	138	--	--	D	U	--	F
295635082362701	956-236-2	120	4	60	126	--	--	D	U	--	F
295638082373301	956-237-1	140	4	80	143	--	--	D	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
295605082375401	956-237-2	--	--	--	108	--	--	D	SR	SR	F
295630082380001	956-238-1	150	4	88	147	--	55	D	U	--	F
295618082440901	956-244-2	75	4	50	61	--	--	D,O	SR	SR	F
295618082473601	956-247-1	50	--	--	28	--	--	D	SR	SR	F
295615082475401	956-247-2	55	4	42	25	--	--	D	SR	--	F
295603082500801	956-250-1	68	--	--	48	--	--	D	SR	SR	F
295711082351301	957-235-2	--	--	--	150	--	--	D	SR	SR	F
295723082361901	957-236-2	150	4	60	146	--	--	D	U	--	F
295707082393701	957-239-1	130	4	98	100	--	--	D,O	SR	--	F
295744082410401	957-241-1	--	--	--	88	--	--	D	SR	SR	F
295809082335401	958-234-1	186	4	63	77	--	--	D	U	--	F
295803082371201	958-237-1	212	4	60	179	--	--	D	U	--	F
295801082374301	958-237-2	142	4	--	117	--	--	D	U	--	F
295819082474301	958-247-1	--	--	--	57	--	--	D	SR	SR	F
295911082351101	959-235-2	80	--	--	80	--	--	D	SR	SR	F
295914082393501	959-239-1	--	--	--	--	--	--	D	SR	SR	F
295927082440901	959-244-1	100	--	--	55	--	--	D	SR	SR	F
295906082501201	959-250-1	65	--	--	60	--	--	D	SR	SR	F
300019082355401	000-235-1	120	4	107	77	--	--	D,O	SR	--	F
300037082370501	000-237-1	87	2	80	103	103	53	D	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing Diameter (inches)	Casing Depth (feet)	Altitude of Land surface (feet)	Altitude of Top of confining bed (feet)	Altitude of Top of Floridan aquifer (feet)	Use	Source of Well record	Source of Water analysis	Water yielding unit
300022082375301	000-238-1	235	10	90	95	--	--	Ir	U	--	F
300131082234301	001-234-1	--	--	--	100	--	--	D	SR	SR	F
300115082375701	001-237-1	--	--	--	85	--	--	D	SR	SR	F
300131082412001	001-241-1	--	--	--	90	--	--	D	SR	SR	F
300114082423301	001-242-1	95	3	63	88	84	28	D	U	--	F
300124082435401	001-243-2	--	--	--	63	--	--	D	SR	SR	F
300221082332601	002-233-1	120	4	100	126	118	82	D,O	SR	--	F
300302082360101	002-236-1	15	1¼	15	159	<144	--	--	U	--	S
300238082372001	002-237-1	140	4	63	152	--	--	D	U	--	F
300238082372002	002-237-2	126	2	111	152	--	--	--	U	--	F
300317082325301	003-232-1	100	--	--	137	--	--	D	SR	SR	F
300324082342701	003-234-1	150	4	86	144	132	70	--	U	--	F
300354082352901	003-235-1	--	--	--	112	--	--	D	SR	SR	F
300349082355501	003-235-3	105	4	50	130	--	--	--	U	--	F
300355082360801	003-236-1	173	4	120	143	--	--	D,St	U	--	F
300338082381001	003-238-1	150	10	85	83	--	--	Ir	U	--	F
300348082404001	003-240-1	--	--	--	75	--	--	D	SR	SR	F
300331082420401	003-242-1	46	2	43	60	--	42	T	U	--	F
300333082443701	003-244-1	--	--	--	80	--	--	D	SR	SR	F
300427082343901	004-234-1	154	4	110	147	146	36	D	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
300401082352901	004-235-1	2,929	7 5/8	1,376	130	--	40	T	G	--	--
300455082360701	004-236-3	125	4	55	109	--	--	D	U	--	F
300428082360201	004-236-5	101	4	62	100	--	--	--	U	--	F
300402082371601	004-237-1	165	4	80	157	--	--	D,St	U	--	F
300412082375501	004-238-1	180	4	88	171	>83	--	D	U	--	F
300429082382701	004-238-2	--	--	--	--	--	--	--	SR	SR	F
300409082415001	004-241-1	80	4	50	57	--	--	D,O	SR	--	F
300429082462601	004-246-1	156	4	48	96	--	--	D	U	--	F
300525082305901	005-230-1	15	--	--	121	<106	--	D	SR	SR	S
300542082332101	005-233-1	140	4	121	143	138	62	D,O	SR	--	F
300523082341801	005-234-1	128	4	64	142	--	--	D	U	--	F
300628082293001	006-229-3	53	--	--	157	--	--	D	SR	SR	C
300658082343501	006-234-1	140	4	120	124	--	--	D	U	--	F
300610082362801	006-236-1	102	2	80	136	--	>36	--	U	--	F
300647082390501	006-239-1	280	6	135	92	--	42	Ir	U	--	F
300648082413901	006-241-1	3,050	8	1,316	86	--	30	T	G	--	--
300626082465701	006-247-1	150	10	90	121	--	--	Ir	U	--	F
300755082352001	007-235-1	135	4	--	150	--	--	D	U	--	F
300748082353601	007-235-2	167	4	102	140	140	70	D	U	--	F
300759082374301	007-237-1	162	4	74	105	--	35	D	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
300735082372601	007-237-4	185	4	105	91	90	49	D	U	--	F
300730082391001	007-239-2	143	4	63	92	92	47	D	U	--	F
300751082391801	007-239-4	100	4	82	80	71	10	D	SR	--	F
300741082401901	007-240-1	148	4	95	102	--	--	D	U	--	F
300743082431401	007-243-1	150	4	--	162	--	--	D,St	U	--	F
300809082345601	008-234-1	185	4	84	146	--	81	D	U	--	F
300821082365401	008-236-1	109	4	73	105	--	--	D,St	U	--	F
300815082365201	008-236-3	175	4	--	103	--	--	D	U	--	F
300842082381601	008-238-1	137	4	130	108	107	43	D	U	--	F
300826082422301	008-242-1	254	4	84	104	--	--	D,St	U	--	F
300920082333401	009-233-1	--	--	--	184	--	--	D	SR	SR	F
300948082354901	009-235-1	205	4	84	164	--	--	St	U	--	F
300950082354801	009-235-2	88	2	--	167	--	<79	D	U	--	C
300948082354902	009-235-3	225	4	90	167	--	--	--	U	--	F
300930082354301	009-236-4	2,827	8	768	164	144	79	T	G	--	--
300950082370001	009-237-1	305	4	180	109	64	-10	--	U	--	F
300910082374001	009-237-2	250	8	96	105	--	35	D	U	--	F
300940082381501	009-238-2	320	6	105	130	--	45	--	U	--	F
300929082382001	009-238-3	145	4	--	130	--	35	--	U	--	F
300929082382002	009-238-4	160	4	--	130	--	35	--	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
300937082384801	009-238-6	158	4	--	167	--	--	D	U	--	F
300901082385901	009-238-9	168	4	108	120	118	59	D	U	--	F
300955082415101	009-241-1	150	4	84	126	--	46	--	U	--	F
300934082415101	009-241-3	148	4	112	118	117	67	D	U	--	F
300925082412101	009-241-4	198	4	115	147	--	--	--	U	--	F
300916082415201	009-241-7	140	4	95	102	99	47	D	SR	--	F
301016082340901	010-234-1	372	10	162	183	--	23	P	G	--	F
301101082355601	010-235-2	115	4	104	190	--	--	D	U	--	C
301046082352001	010-235-3	225	4	110	189	--	84	D,In	U	--	F
301045082351601	010-235-4	19	1¼	19	175	<156	--	--	U	--	S
301103082360901	010-235-6	350	4	120	190	--	--	In	U	--	F
301031082381001	010-238-1	836	12	650	144	--	58	O	U	--	F
301028082380901	010-238-2	360	10	180	101	71	-74	P	G	--	F
301004082380701	010-238-4	225	4	84	110	--	--	D	U	--	F
301105082390801	010-239-3	174	4	42	174	--	--	D	U	--	F
301043082402601	010-240-2	225	4	84	165	--	103	D	U	--	F
301018082402801	010-240-5	138	4	100	159	--	--	D,St	U	--	F
301045082413901	010-241-2	137	4	93	147	--	--	--	U	--	F
301059082423901	010-242-1	200	5½	110	162	--	--	D	U	--	F
301059082430501	010-243-2	358	4	64	155	--	100	--	U	--	F

Table 2.--Well and test hole data--Continued

Site number	Local well number	Depth (feet)	Casing: Diameter (inches)	Casing: Depth (feet)	Altitude of: Land surface (feet)	Altitude of: Top of confining bed (feet)	Altitude of: Top of Floridan aquifer (feet)	Use	Source of: Well record	Source of: Water analysis	Water yielding unit
301119082333301	011-233-2	167	4	--	192	--	--	D	U	--	C
301119082333302	011-233-3	16	1¼	16	192	<176	--	--	U	--	S
301131082345201	011-234-1	265	4	110	200	--	--	In	U	--	F
301126082353201	011-235-1	97	4	--	200	--	--	--	U	--	C
301113082351801	011-235-2	110	4	--	200	--	--	D	U	--	C
301114082362401	011-236-1	205	4	147	195	--	--	D	U	--	F
301115082361901	011-236-2	305	4	150	197	--	--	D	U	--	F
301107082374701	011-237-1	300	16-12	145	188	148	48	P	G	--	F
301108082372401	011-237-2	275	12	157	185	175	55	P	G	--	F
301102082373201	011-237-3	310	12	126	186	151	--	P	U	--	F
301104082372701	011-237-4	125	4	--	185	155	65	--	G	--	F
301101082370501	011-237-5	175	4	130	163	159	75	D	U	--	F
301156082381701	011-238-1	35	4	35	190	155	--	--	U	--	S
301159082381901	011-238-2	255	4	127	190	--	108	D	U	--	F
301148082381001	011-238-3	400	15	105	198	--	103	P	G	--	F
301117082390701	011-239-1	225	4	110	185	--	117	D,P	U	--	F
301104082392401	011-239-2	139	4	78	180	--	80	D	U	--	F
301044082421001	011-242-5	165	4	121	147	146	69	D	U	--	F