GEOHYDROLOGY AND SUSCEPTIBILITY OF MAJOR AQUIFERS TO SURFACE CONTAMINATION IN ALABAMA; AREA 11

By Rick D. Castleberry, Richard S. Moreland, and John C. Scott

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Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
520 19th Avenue
Tuscaloosa, Alabama 35401

Copies of this report can be purchased from:

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CONVERSION FACTORS

For use of readers who prefer to use metric (International System) units, conversion factors for inch-pound units used in this report are listed below:

Multiply inch-pound unit	By	To obtain metric unit
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
gallon per minute (gal/min)	0.06308	liter per second (L/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)

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

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ABSTRACT

The U.S. Geological Survey, in cooperation with the Alabama Department of Environmental Management, is conducting a series of geohydrologic studies to delineate the major aquifers and their susceptibility to surface contamination in Alabama. This report delineates and describes the geohydrology and susceptibility of the major aquifers to surface contamination in Area 11--Butler, Conecuh, Covington, Crenshaw, Escambia, and Monroe Counties.

The major aquifers in the area in descending order, are the Pliocene-Miocene, Upper Floridan, Lisbon, Nanafalia-Clayton, and Providence-Ripley. The recharge areas for the aquifers are in Butler, Conecuh, Covington, Crenshaw, Escambia, and Monroe Counties. The largest pumping centers are at Andalusia and Monroeville. Maximum ground-water use at Andalusia is more than 5 million gallons per day. Maximum ground-water use at Monroeville is about 4 million gallons per day. Estimated maximum ground-water withdrawal for all uses in the area is about 44 million gallons per day (1987).

Depressions have developed in the potentiometric surface of the Lisbon aquifer in the vicinities of Andalusia and Opp. Depressions have also formed in the potentiometric surfaces of the Nanafalia-Clayton aquifer in the vicinities of Luverne, Andalusia, Beatrice, and Monroeville, and in the Providence-Ripley aquifer at Greenville.

All recharge areas for the major aquifers are susceptible to contamination from the surface. Large parts of the recharge areas, however, are located in rural terrains used for timberlands, farms, and pastures, and are several miles from pumping centers. These are areas where there are few sources of contamination. The areas that are highly susceptible to contamination are (1) the depressions in the recharge area of the Upper Floridan aquifer that may be sources of direct recharge to the aquifer from the surface and (2) the southwestern part of the study area where gravelly sands of the Citronelle Formation overlie the Miocene Series undifferentiated, and have formed a relatively flat landscape with depressions that restricts surface-water runoff. Future pumpage in these areas may significantly lower the potentiometric surface in the aquifers resulting in direct leakage from the surface to the underlying water-bearing units.

INTRODUCTION

The Alabama Department of Environmental Management (ADEM) is developing a comprehensive program to protect aquifers in Alabama from surface contamination that are defined by the U.S. Environmental Protection Agency (EPA) as "Class I" and "Class II" ground waters (U.S. Environmental Protection Agency, 1984). The U.S. Geological Survey, in cooperation with ADEM, is conducting a series of geohydrologic studies to delineate the major aquifers in Alabama, their recharge areas, and areas susceptible to contamination. This report summarizes these factors for major aquifers in Area 11--Butler, Conecuh, Covington, Crenshaw, Escambia, and Monroe Counties (see plate 1).

Purpose and Scope

The purpose of this report is to describe the geohydrology of the major aquifers and their susceptibility to contamination from the surface. Geologic and hydrologic data compiled as part of previous investigations provided about 75 percent of the data used to evaluate the major aquifers in the area. All wells used for municipal and rural public water supplies were inventoried, and water levels were measured in these wells where possible. Data on water use were compiled during the well inventory. Published and collected water-level data were used to compile generalized potentiometric maps of the aquifers. Areas susceptible to contamination from the surface were delineated partly from geologic maps, topographic maps, and other available data, and partly from field investigations.

Location of the Study Area

The study area is in south Alabama and comprises an area of 5,252 square miles. The area includes the cities of Andalusia, Greenville, Evergreen, Monroeville, Luverne, Atmore, Brewton, Opp, and numerous other small towns and communities (plate 1). The total population of the six-county area was 149,615 in 1980 (Alabama Department of Economic and Community Affairs, 1985). The area is a mixture urban, suburban, and rural. All of the population is dependent on ground water for household use.

Physical Features

The study area includes parts of several physiographic districts of the East Gulf Coastal Plain physiographic section (Sapp and Emplaincourt, 1975) (fig. 1). The northernmost part of Crenshaw County is in the Black Prairie district. This area consists mainly of an undulating, deeply weathered plain developed mainly on marl. Drainage in the area is northward to the Alabama River.

The northeastern part of Butler County and the northern part of Crenshaw County are in the Chunnenuggee Hills district (fig. 1). This area is characterized by sandy cuestas that have fairly steep northward-facing escarpments and gently- to moderately-rolling backslopes. The land surface in the area ranges from about 350 to 600 feet above sea level. Drainage in the area is northward to the Alabama River along the escarpments of the cuestas, but is southward to the Conecuh River along the backslopes.

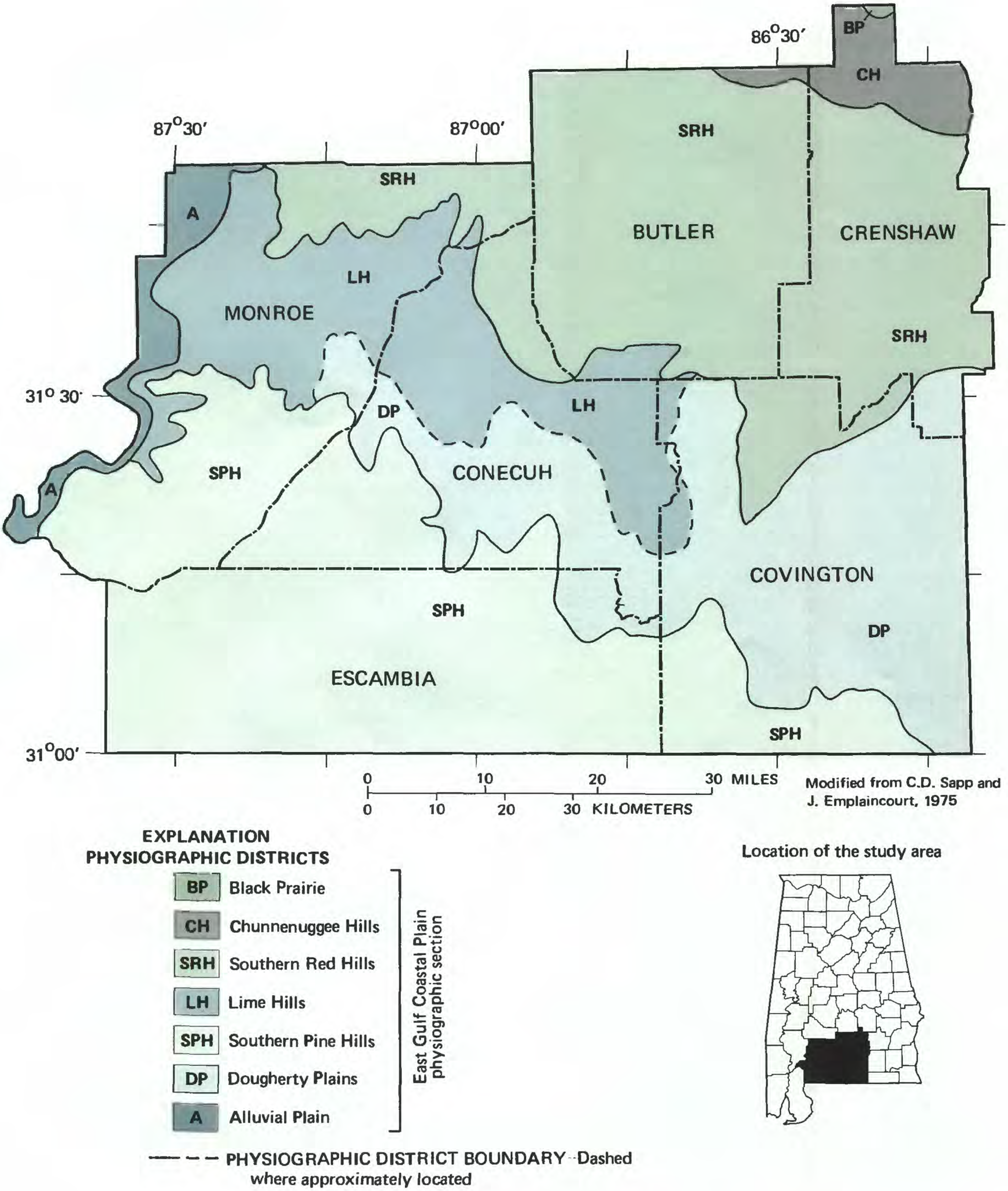


Figure 1.--Physiographic districts of the study area.

The northeastern part of Monroe County, the northern part of Conecuh and Covington Counties, the central part of Crenshaw County, and all except the northeasternmost part of Butler County are in the Southern Red Hills district. This area is characterized by a southward gently-sloping upland of moderate relief. The land surface in the area ranges from about 100 feet above sea level in northern Monroe County to about 450 feet above sea level south of the town of Luverne. Drainage in the area is southward to the Conecuh River and northwest and westward to the Alabama River.

The westernmost part of Monroe County is in the Alluvial Plain district. This area is characterized by broad, flat flood plains and terraces. The area is periodically inundated by floods on the Alabama River. The land surface ranges from about 25 feet above sea level in southwestern Monroe County to about 120 feet above sea level in northwestern Monroe County.

The north central part of Monroe County and the northwestern and eastern part of Conecuh County are in the Lime Hills district. This area consists mainly of a rugged hilly terrain. The land surface ranges from about 100 feet above sea level in creek valleys to as much as 450 feet above sea level on hilltops. Drainage in the area is westward to the Alabama River and southward to the Conecuh River.

The east central part of Monroe County, the northeasternmost part of Escambia County, and the central parts of Conecuh and Covington Counties are in the Dougherty Plain district. This area is dominated by low cuestas of weathered limestone forming residuum. The land surface in the area ranges from 100 to 400 feet above sea level. Drainage in the area is westward to the Alabama River, southward and northward to the Conecuh River, and southward and westward to the Yellow River.

The southern parts of Covington and Monroe Counties, the southwestern part of Conecuh County, and all of Escambia County, except the northeasternmost part are in the Southern Pine Hills district. This area is characterized by an upland in the north with relief of up to 250 feet, sloping gradually southward where the relief is not less than 100 feet. The land surface ranges from 35 to 400 feet above sea level. Drainage is westward to the Alabama River, southward and northward to the Conecuh River, and southward to the Yellow River.

Previous Investigations

Numerous reports that describe the geology and ground-water resources of the study area have been published. Information on the geology of the area was published as early as 1858 in the second biennial report of the Geological Survey of Alabama by Michael Toumey (Toumey, 1858). A detailed description of the geology of Alabama and a revised geologic map were published by the Geological Survey of Alabama in 1926 (Adams and others, 1926).

The first report on ground water in the area was published in 1907 (Smith, 1907). Other reports that contain information on the geology and ground-water resources of the area are "Geologic Map of the Tertiary Formations of Alabama"

(MacNeil, 1946), "Geology and Ground-Water Resources of Escambia County, Alabama" (Cagle and Newton, 1963), "Geologic Map of Butler County, Alabama" (Reed, Newton and Scott, 1967), "Water Availability Map of Butler County, Alabama" (Reed and others, 1967), "Geologic Map of Crenshaw County, Alabama," (McWilliams, Newton, and Scott, 1968), "Water Availability Map of Crenshaw County, Alabama" (McWilliams, Scott, Golden, and Avrett, 1968), "Geologic Map of Conecuh County, Alabama" (Reed, 1968), "Water Availability Map of Conecuh County, Alabama" (Reed and others, 1968), "Geologic Map of Covington County, Alabama" (Turner and Scott, 1968), "Water Availability Map of Covington County, Alabama" (Turner, Scott, McCain, and Avrett, 1968), "Geology of Monroe County, Alabama" (Scott, 1972), and "Water Availability of Monroe County, Alabama" (Scott and others, 1972).

Acknowledgments

The authors wish to thank the many persons who have contributed information and assistance during the field investigation and during the preparation of this report. Special appreciation is extended to the waterworks managers of the ground-water systems in the study area who have helped locate public-supply wells and furnished information on well construction and water use.

GEOHYDROLOGY

Geologic formations that crop out in and underlie the study area range in age from Late Cretaceous to Quaternary (fig. 2). Unconsolidated sediments of Late Cretaceous age crop out in northern Crenshaw County and northeastern Butler County. Sedimentary deposits of Tertiary age crop out in all but the northeasternmost part of the study area. Alluvial and terrace deposits of Quaternary age overlie older sedimentary rocks in and adjacent to the flood plains of the Alabama and Conecuh Rivers, and larger streams in the study area. A generalized subsurface section of formations that underlie the study area is shown in figure 3. The approximate location of this section is shown in figure 2. A summary of the thickness, lithology, and water-bearing properties of each geologic unit underlying the study area is given in table 1.

Cretaceous Formations

Sedimentary deposits of Late Cretaceous age crop out in Butler and Crenshaw Counties and underlie the entire study area (fig. 2). These deposits include the Demopolis Chalk, Ripley Formation, Prairie Bluff Chalk, and Providence Sand of the Selma Group (Eargle, 1950). These formations generally strike northwestward and dip southwestward 30 to 40 feet per mile (fig. 3).

Demopolis Chalk

The Demopolis Chalk overlies the Mooreville Chalk in the subsurface and crops out in the northernmost part of Crenshaw County (fig. 2). The Demopolis is about 400 to 450 feet thick, but only the upper 25 to 35 feet of the unit is exposed in the study area. The unit generally consists of chalk, marl,

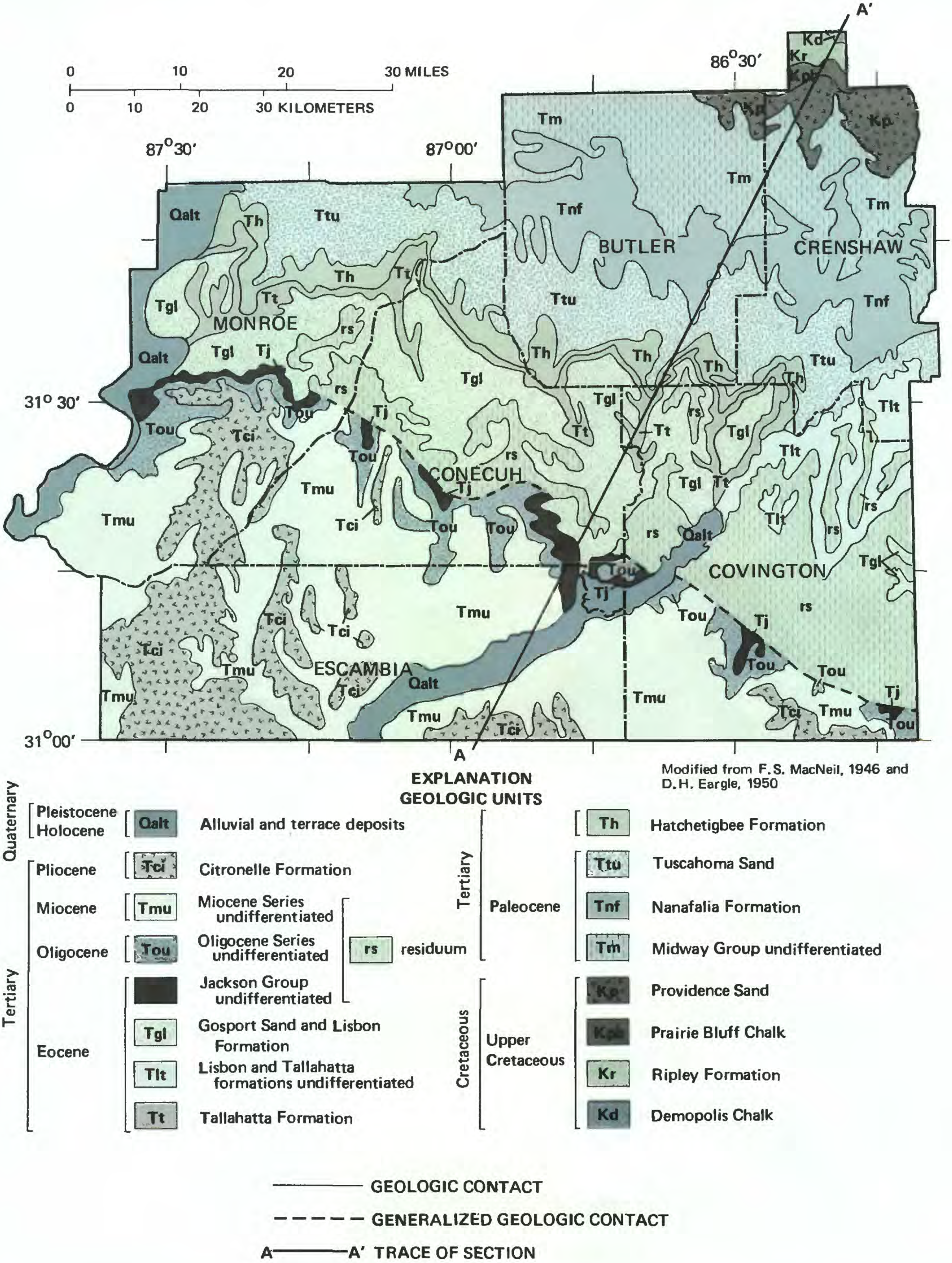


Figure 2.--Generalized geology of the study area.

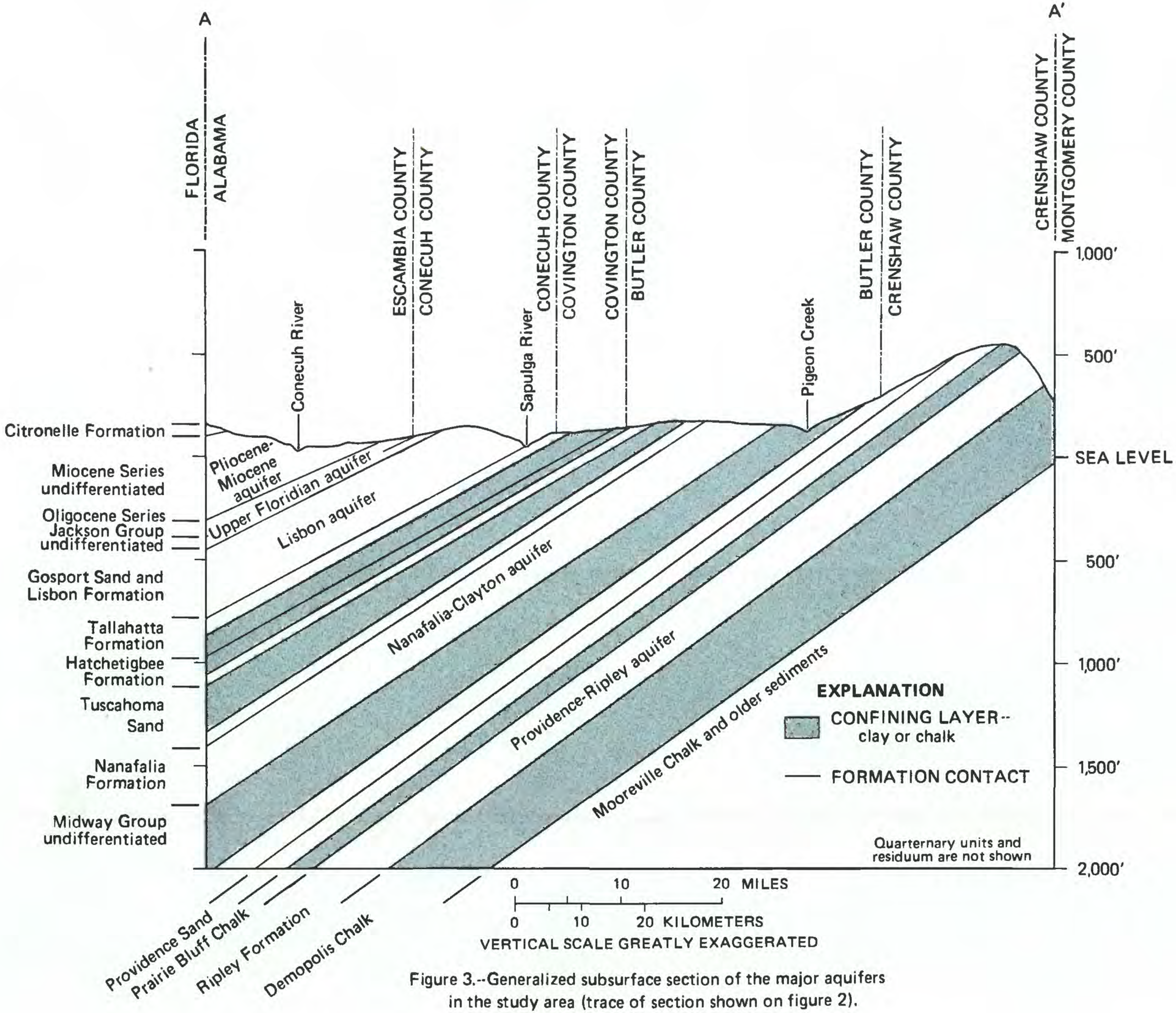


Figure 3.--Generalized subsurface section of the major aquifers in the study area (trace of section shown on figure 2).

calcareous clay, and sandy clay (Eargle, 1950). The Demopolis Chalk is relatively impermeable and is not a source of water in the study area. The unit is a lower confining layer for the Providence-Ripley aquifer.

Ripley Formation

The Ripley Formation overlies the Demopolis Chalk and crops out in northern Crenshaw County (fig. 2) and north of the study area. The formation is about 250 feet thick in the western part of the study area and about 300 feet thick in the eastern part. In the western part of the study area, the Ripley is composed of sand, sandy clay, and calcareous sandstone (Eargle, 1950). In the eastern part of the area, the lower 100 feet of the unit consists mainly of fossiliferous sand, calcareous sandstone, and sandy chalk; the upper part consists mainly of sand, sandy clay, silty fossiliferous clay, and calcareous sandstone beds.

The Ripley Formation is one of the major sources of water in the study area, and for this report, is combined with the Providence Sand to form the Providence-Ripley aquifer. It is the principal source of water for the city of Greenville, town of Georgiana, and the Butler County Water Authority. The town of Fort Deposit, north of the study area in Lowndes County, has wells located in northern Butler County in the Providence-Ripley aquifer (Scott and others, 1986). The towns of Luverne and Rutledge, the Northeast Crenshaw Water and Fire Protection Authority, and Quint-Mar Water and Fire Protection Authority, are supplied by the Providence-Ripley aquifer.

The Providence-Ripley has not been developed as a source of water supply south of Georgiana in Butler County or south of Luverne in Crenshaw County. Available data indicate that the Providence-Ripley is a source of potable water in northeasternmost Monroe County, but the water in northwestern and southern Monroe County may contain more than 1,000 mg/L (milligrams per liter) chloride (Scott and others, 1972). Wells developed solely in the Providence-Ripley aquifer produce from 200 to 600 gal/min (gallons per minute).

Prairie Bluff Chalk

The Prairie Bluff Chalk overlies the Ripley Formation and crops out in northern Crenshaw and northeastern Butler Counties (fig. 2). The Prairie Bluff consists of calcareous sandy clay and fossiliferous sandy chalk (Eargle, 1950). This unit ranges in thickness from 25 feet in the western part of the study area to about 95 feet in eastern Crenshaw County. The Prairie Bluff is relatively impermeable and is not an aquifer in the study area.

Providence Sand

The Providence Sand overlies the Prairie Bluff Chalk, and crops out in northeastern Butler and northern Crenshaw Counties (fig. 2). The Providence is divided into a lower Perote Member and an upper unnamed member in the eastern part of the study area, but is not separated west of Crenshaw County because of the similar lithologies of the members. West of Crenshaw County the Providence Sand consists of thin-bedded to laminated carbonaceous micaceous clay, very fine-grained micaceous sand and silt, and coarse-grained gravelly sand (Eargle, 1950). The Perote Member ranges in thickness from 35 feet in western Crenshaw County to 75 feet in the eastern part. It generally consists of laminated fine-grained sand and silty clay. The upper unnamed member of the Providence ranges in thickness from 35 feet in western Crenshaw County to 75 feet in the eastern part. It consists chiefly of fine- to coarse-grained gravelly sand. The Providence Sand is about 150 feet thick in the eastern part of the study area and is probably absent west of Greenville in Butler County.

The Providence Sand is not a major water source in the study area; however, the upper sand of the formation is combined with the Ripley Formation to form the Providence-Ripley aquifer in this report. The upper unnamed member is a major water source east of the study area. The Perote Member is relatively impermeable, and is not considered to be an aquifer in Alabama.

Tertiary Formations

Tertiary deposits in the study area consist of the Clayton, Porters Creek, Naheola, and Nanafalia Formations and the Tuscahoma Sand of Paleocene age; the Bashi, Hatchetigbee, Tallahatta, and Lisbon Formations, the Gosport Sand, the Moodys Branch Formation, the Yazoo Clay, and the Ocala Limestone of Eocene age; the Oligocene Series undifferentiated; the Miocene Series undifferentiated; and the Citronelle Formation of Pliocene age (MacNeil, 1946). The Tertiary sediments overlie the Providence Sand in northern Crenshaw County and northeastern Butler County, and overlie the Prairie Bluff Chalk westward from the town of Greenville in Butler County. These formations generally strike west-northwestward and dip southward and southwestward 30 to 50 feet per mile (fig. 3).

Clayton, Porters Creek, and Naheola Formations

The Clayton, Porters Creek, and Naheola Formations comprise the Midway Group, and overlie the Providence Sand. The units crop out in northern Butler and north-central Crenshaw Counties (fig. 2). The formations are not differentiated on the geologic map because of their similar lithologies, and because the Naheola is very thin or is absent in all but the northwesternmost part of Butler County. The Clayton Formation generally consists of fine- to medium-grained sand, and fine-grained fossiliferous clayey sand and silt in eastern exposures in the study area (MacNeil, 1946). West of Greenville, the Clayton generally contains beds of limestone, sand, silt, and clay. In the subsurface in the southeastern part of the study area the formation generally consists of fossiliferous sandy limestone. The Clayton ranges in thickness from about 100 feet in eastern Crenshaw County to about 170 feet in Butler County.

The Clayton Formation is a major source of water in the eastern part of the study area, but the unit is relatively impermeable west of Greenville. In this report, the Clayton combined with the Nanafalia Formation, and the basal sand in the Tuscahoma Sand forms the Nanafalia-Clayton aquifer. The Nanafalia-Clayton aquifer is a source of water for the towns of Rutledge, Glenwood, Dozier, Brantley, McKenzie, and Opp.

The Porters Creek Formation overlies the Clayton Formation and generally consists of fine- to medium-grained micaceous clayey sand, sandy clay, and silt (MacNeil, 1946). The Porters Creek ranges in thickness from 70 feet in east central Crenshaw County to more than 250 feet in the subsurface in the southern part of the study area. The Naheola Formation overlies the Clayton Formation and consists of about 20 feet of carbonaceous sandy clay and micaceous clay and silt (MacNeil, 1946).

Wells developed solely in the Clayton Formation produce from 140 to 190 gal/min in central Crenshaw County and may produce more in Covington County. East of the study area wells developed solely in the Clayton may produce as much as 500 gal/min. A well developed in the Clayton in conjunction with the limestone in the Porters Creek Formation at Dozier produces 600 gal/min. Wells developed in the Clayton in conjunction with the Nanafalia produce from 300 to 1,000 gal/min.

The Porters Creek Formation is not a major water source in the study area, but may be used in conjunction with the Clayton in the southern part of Crenshaw County and the northern part of Covington County. Wells developed in the Porters Creek Formation in conjunction with the Clayton Formation produce as much as 600 gal/min. West of Crenshaw County the Porters Creek is relatively impermeable and is not a source of ground water. The Naheola Formation is relatively impermeable and is not an aquifer in the study area.

Nanafalia Formation

The Nanafalia Formation overlies the Midway Group and crops out in a northwestward-trending belt that extends through southern Crenshaw County, central Butler County, and northeasternmost Monroe County (fig. 2). The Nanafalia consists of a basal zone of coarse-grained, gravelly micaceous sand known as the Gravel Creek Sand Member (MacNeil, 1946). This member ranges in thickness from 60 to 80 feet in the northwestern part of Butler County, and from 0 to about 40 feet in central Crenshaw County. The Gravel Creek Sand Member thins towards the center of the study area and is absent from Greenville to about 3 miles west of Rutledge. The Gravel Creek Sand Member is overlain by "Ostrea-thirsae beds" that consist of 20 to 40 feet of fine- to medium-grained glauconitic sand and sandy clay that contain Ostrea-thirsae Gabb and other fossils. This unit is overlain by the Grampian Hills Member that consists of 90 to 110 feet of siltstone, silt, and calcareous sandy clay.

The Nanafalia is one of the major water sources in the study area, and is part of the Nanafalia-Clayton aquifer. It is the sole source of water for the towns of Monroeville, Beatrice, and Vredenburgh; the principal source of water for the towns of McKenzie and Brantley; and a major source of water for the city of Andalusia. The Nanafalia is not a major source of water in southern Conecuh and Monroe Counties because chloride concentrations in the water are more than 250 mg/L (Reed and others, 1968; Scott and others, 1972).

Wells developed solely in the Nanafalia produce from 75 gal/min at Beatrice to as much as 925 gal/min at Monroeville in Monroe County, and as much as 750 gal/min at Andalusia in Covington County. Wells developed in the Nanafalia in conjunction with the Clayton produce from 300 gal/min in southern Butler County to as much as 1,000 gal/min in eastern Covington County. In central Covington County, wells developed in the Nanafalia in conjunction with the overlying Tuscahoma Sand produce as much as 1,000 gal/min. Water-quality data indicate that the water in the Nanafalia is potable and is a potential source of public water-supply in central Conecuh County (Reed and others, 1968).

Tuscahoma Sand

The Tuscahoma Sand overlies the Nanafalia Formation and crops out in a northwestward trending belt in northern Monroe and Conecuh Counties, and southern Butler and Crenshaw Counties (fig. 2). The upper zone of the Tuscahoma generally consists of very fine- to coarse-grained fossiliferous sand and laminated to massive micaceous carbonaceous clay (MacNeil, 1946). Medium- to coarse-grained massive to laminated sand is present in the lower zone of the formation in the eastern part of the study area. The Tuscahoma ranges in thickness from 120 feet at exposures in eastern Crenshaw County to 275 feet at outcrops in northern Monroe County. The unit thickens in the subsurface in the southern part of the study area to as much as 360 feet.

The Tuscahoma Sand is not a major source of water in the study area, but a few wells tap the basal sand of the unit in conjunction with the Clayton and Nanafalia Formations, and in conjunction with the Tallahatta Formation in the southeastern part of the study area. Clay in the upper zone of the Tuscahoma constitutes a confining layer between the Nanafalia-Clayton aquifer and the Lisbon aquifer.

Bashi and Hatchetigbee Formations

The Bashi Formation, where present, and the overlying Hatchetigbee Formation overlie the Tuscahoma Sand and crop out in a narrow northwestward-trending belt in northern Covington County, southern Crenshaw and Butler Counties, northern Conecuh County, and northern Monroe County (fig. 2). The Bashi Formation, consists of glauconitic fossiliferous sand and fossiliferous calcareous sandstone generally less than 20 feet thick. The Hatchetigbee consists of carbonaceous thin-bedded to laminated clay and sand, glauconitic fossiliferous sand, and fossiliferous calcareous sandstone (MacNeil, 1946). The formation ranges in thickness from 5 feet in the eastern part of the study area to about 275 feet near the Alabama River.

A few wells are developed in sand beds of the Bashi Formation in conjunction with the Lisbon aquifer. However, the unit generally is not considered a major source of water in the study area. The Hatchetigbee Formation is relatively impermeable and is not a source of ground water.

Tallahatta Formation

The Tallahatta Formation overlies the Hatchetigbee Formation and crops out in a narrow belt in north-central Monroe County, southern Butler and Crenshaw Counties, and northern Conecuh and Covington Counties (fig. 2). The formation is not separated from the Lisbon Formation east of the Conecuh River on the geologic map because of the similar lithologies of the units. The Tallahatta consists of thin-bedded siltstone, clay, and claystone, and coarse-grained sand layers in the top and bottom of the formation (MacNeil, 1946). These sand layers are 15 to 20 feet thick in the vicinity of Evergreen, but are not consistent throughout the study area. Downdip the formation contains thin-bedded sandy fossiliferous limestone. The thickness of the Tallahatta at outcrops ranges from 40 feet in parts of Monroe County to 120 feet in parts of Butler County. The unit thickens in the subsurface to as much as 240 feet.

The Tallahatta is a major source of water in the southern part of the study area, and for this report is considered part of the Lisbon aquifer. It is a major source of water for the towns of Evergreen, River Falls, and Andalusia. The Tallahatta is not a major source of water in Butler and Crenshaw Counties because of its limited areal extent and thinness.

Wells developed solely in the Tallahatta in the Evergreen area produce as much as 350 gal/min. Wells developed in the Tallahatta in conjunction with the Hatchetigbee and Tuscahoma in the Andalusia area produce as much as 500 gal/min.

Lisbon Formation and Gosport Sand

The Lisbon Formation and Gosport Sand overlie the Tallahatta Formation and crop out in a northwestward-trending belt in central Monroe and Conecuh, southern Butler and Crenshaw, and northern Covington Counties (fig. 2). The Lisbon Formation and Gosport Sand are mapped together on the geologic map because of an indistinct boundary and similar lithologies in the weathered outcrop. The Gosport Sand does not extensively crop out east of the Conecuh River. In this area the Gosport and Lisbon unit is mapped with the Tallahatta Formation. The Lisbon Formation and Gosport Sand generally consist of fine-grained sand and sandy clay in the western part of the study area, and fine- to coarse-grained sand in the eastern part (MacNeil, 1946). The sand is interbedded with sporadic beds of sandy limestone and clay. The Lisbon and Gosport range in thickness from 15 feet at exposures to 250 feet in the subsurface.

The Lisbon Formation and Gosport Sand comprise a major source of water in the southeastern part of the study area. In the western part of the study area, the Lisbon Formation and Gosport Sand contain more clay and silt and are not considered to be a major source of water. For this report the Lisbon Formation and Gosport Sand are combined with the Tallahatta Formation, the Bashi Formation, and overlying Moodys Branch Formation to form the Lisbon aquifer. The Lisbon aquifer is the sole source of water for the towns of Brewton and East Brewton, and is a major source of water for the towns of Opp and Florala.

Wells solely developed in the Lisbon aquifer in the southeastern part of the study area produce as much as 350 gal/min. The Lisbon aquifer is also a major source of water east of the study area.

Moodys Branch Formation, Yazoo Clay, and Ocala Limestone

The Moodys Branch Formation, Yazoo Clay, and Ocala Limestone comprise the Jackson Group. The formations overlie the Lisbon and Gosport unit and crop out in an irregular northwestward-trending belt in southeastern and western Covington County and central Conecuh and Monroe Counties (fig. 2). In updip areas the formations weather to residual clay and sand containing chert boulders where mapped as residuum on the geologic map. These formations are not differentiated on the geologic map because of their weathered appearance at outcrops and the thinness of beds.

The Moodys Branch Formation generally consists of fine-to coarse-grained glauconitic calcareous fossiliferous sand in the western part of the study area and of glauconitic fossiliferous sandy limestone in the eastern part (MacNeil, 1946). The formation ranges in thickness from about 5 feet near the Alabama River to as much as 65 feet in the central and eastern part of the study area. The Yazoo Clay generally consists of sandy silty clay and silty sand (MacNeil, 1946). It thins from 50 feet in the eastern part of the study area to 10 feet in Monroe County. The Ocala Limestone consists of sparsely glauconitic fossiliferous sandy limestone throughout the study area (MacNeil, 1946). The Ocala thickens eastward from 25 feet in Monroe County to about 90 feet in Covington County.

For this report, the Moodys Branch Formation is included in the Lisbon aquifer. The Yazoo Clay is relatively impermeable and is not a source of water in Alabama. The Ocala Limestone is a major source of water in the southeastern part of the study area. The Ocala Limestone combined with the Oligocene Series undifferentiated comprises the Upper Floridan aquifer (Miller, 1986). The Upper Floridan aquifer is a source of water for Florala and Lockhart. Near the Alabama River, limestones comprising the Upper Floridan aquifer become thin, and west of the study area the Oligocene and Ocala units are included in the Lisbon aquifer.

Wells developed in the Moodys Branch Formation in conjunction with the Lisbon Formation may produce as much as 350 gal/min. Wells developed in the Ocala Limestone in conjunction with the Oligocene Series produce as much as 750 gal/min in southern Covington County.

Oligocene Series undifferentiated

The Oligocene Series undifferentiated overlies the Jackson Group and crops out in an irregular northwestward-trending belt in southeastern and western Covington County, northeasternmost Escambia County, southeastern and western Conecuh County, and central Monroe County (fig. 2). The Oligocene Series is included in the residuum on the geologic map in updip areas where it is deeply weathered. The residuum consists of a silty sandy clay with fractured chert boulders. The series generally ranges in thickness from 50 feet at the surface to 200 feet in the subsurface. The Oligocene Series consists of indurated to soft fossiliferous limestone in the lower zone, and carbonaceous sandy clay and fossiliferous limestone in the upper zone (MacNeil, 1946).

The Oligocene Series is a major source of water in the southeastern part of the study area and is tapped in conjunction with the Ocala Limestone to form the Upper Floridan aquifer.

Wells developed solely in the Oligocene Series produce as much as 250 gal/min. Wells developed in the Oligocene in conjunction with the Ocala produce as much as 750 gal/min in southern Covington County.

Miocene Series undifferentiated

The Miocene Series undifferentiated overlies the Oligocene Series undifferentiated and crops out in southern Monroe, Conecuh, and Covington Counties, and most of Escambia County (fig. 2). The Miocene Series consists of medium-to coarse-grained gravelly sand, fine-grained micaceous silty sand, mottled sandy clay, and fine-grained silty sandstone (MacNeil, 1946). Updip, deeply weathered beds of this geologic unit are included in the residuum on the geologic map. The Miocene Series ranges in thickness from 50 feet in updip areas to as much as 650 feet in southwestern Escambia County.

The Miocene Series is a major source of water in southern Monroe County and Escambia County, and for this report is combined with the Citronelle Formation to form the Pliocene-Miocene aquifer. It is the sole source of water for the towns of Frisco City, Excel, Uriah, Huxford, Pollard, Flomaton, Freemanville, Canoe, and the city of Atmore. Wells developed solely in the Miocene aquifer produce from 50 to 500 gal/min.

Citronelle Formation

The Citronelle Formation of Pliocene age overlies the Miocene Series undifferentiated and crops out in southern Monroe, Conecuh, and Covington Counties, and western and southern Escambia County. The Citronelle consists of gravel, sand, and sandy clay (MacNeil, 1946). The formation ranges in thickness from 5 to 50 feet.

The Citronelle Formation is not a major source of water in Alabama because of the unit's thinness; however, the Citronelle is hydraulically connected to the underlying Miocene Series and is considered to be part of the Pliocene-Miocene aquifer in this report.

Quaternary Deposits

Quaternary alluvial deposits overlie older formations in the western and south-central part of the study area (fig. 2). These deposits, which underlie flood plains of present and ancestral streams, consist mainly of gravel, sand, silt, and clay. Alluvial deposits along the flood plains of the Alabama and Conecuh Rivers are shown on the geologic map (fig. 2). Terrace deposits are not differentiated from alluvial deposits on the geologic map because of the similar lithologies of the units. The alluvial and terrace deposits range in thickness from 10 to 50 feet. The alluvial deposits are a potential source of large water supplies in the flood plains of the Alabama and Conecuh Rivers, but are not developed for public water supplies.

HYDROLOGY OF THE MAJOR AQUIFERS

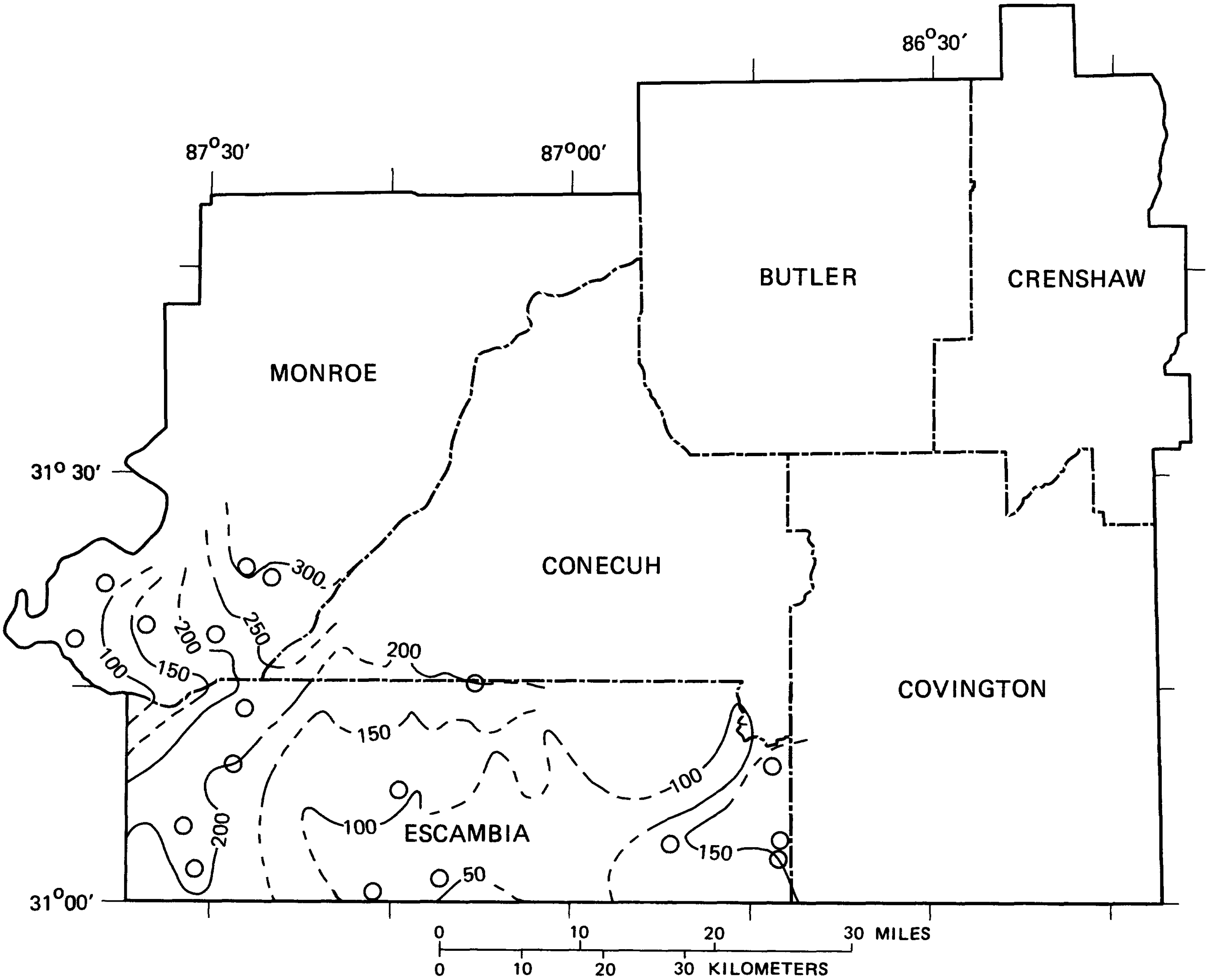
The major aquifers in the study area are sand and gravel beds in the Pliocene-Miocene, Lisbon, Nanafalia-Clayton, and the Providence-Ripley aquifers; and limestone beds in the Upper Floridan aquifer (fig. 3). These aquifers crop out partially north of the study area and in Butler, Conecuh, Covington, Crenshaw, Escambia, and Monroe Counties, and underlie all of the study area. In most parts of the study area, water in the aquifers occurs under artesian conditions. The potentiometric surfaces of the Pliocene-Miocene, and Upper Floridan aquifer (figs. 4 and 5) were constructed from available data. The potentiometric surface of the Lisbon aquifer is modified from Williams, Planert, and DeJarnette (1986b) (fig. 6). The potentiometric surface of the Nanafalia-Clayton aquifer is modified from Williams, DeJarnette, and Planert (1986) (fig. 7). The potentiometric surface of the Providence-Ripley aquifer is modified from Williams, Planert, and DeJarnette (1986a) (fig. 8). Recharge areas for the major aquifers and areas susceptible to surface contamination are shown on plate 1. Also shown on plate 1 are locations of public water-supply wells. Areas of major withdrawals, as indicated by depressions in the potentiometric surfaces, are shown in figures 4 through 8. Construction of wells, water levels, and other pertinent well data are given in table 2.

Recharge and Movement of Ground Water

The source of recharge to the aquifers is rainfall. Average annual rainfall is about 60 inches per year, but a large part runs off during and directly after rainstorms. Most of the remainder is returned to the atmosphere by evapotranspiration; a small part infiltrates to the water table to recharge aquifers. On the basis of low flow of streams, recharge to the Pliocene-Miocene, Upper Floridan, Lisbon, Nanafalia-Clayton, and Providence-Ripley aquifers is at least 3 to 4 inches per year. The recharge areas for the Pliocene-Miocene and Upper Floridan aquifers is in Covington, Escambia, Conecuh, and Monroe Counties (plate 1). The recharge area for the Lisbon aquifer is in Covington, Crenshaw, Butler, Conecuh, and Monroe Counties. The recharge area for the Nanafalia-Clayton aquifer is in Crenshaw, Butler, Conecuh, and Monroe Counties, and the recharge area for the Providence-Ripley aquifer is in Crenshaw and Butler Counties, and slightly north of the study area in Montgomery and Lowndes Counties. These recharge areas consist of rolling sand hills, weathered silty clay terraces, and carbonate terranes, part of which are wooded and part cultivated. Water moves downdip from areas of recharge to areas of natural discharge or areas of ground-water withdrawals, generally perpendicular to the potentiometric contour lines shown in figures 4 through 8.

Natural Discharge and Ground-Water Withdrawals

Part of the recharge is discharged to rivers and other streams that are entrenched into the aquifers. This natural discharge is especially notable in Butler, Conecuh, and Escambia Counties where southward flowing streams are cut deeply into the aquifers.

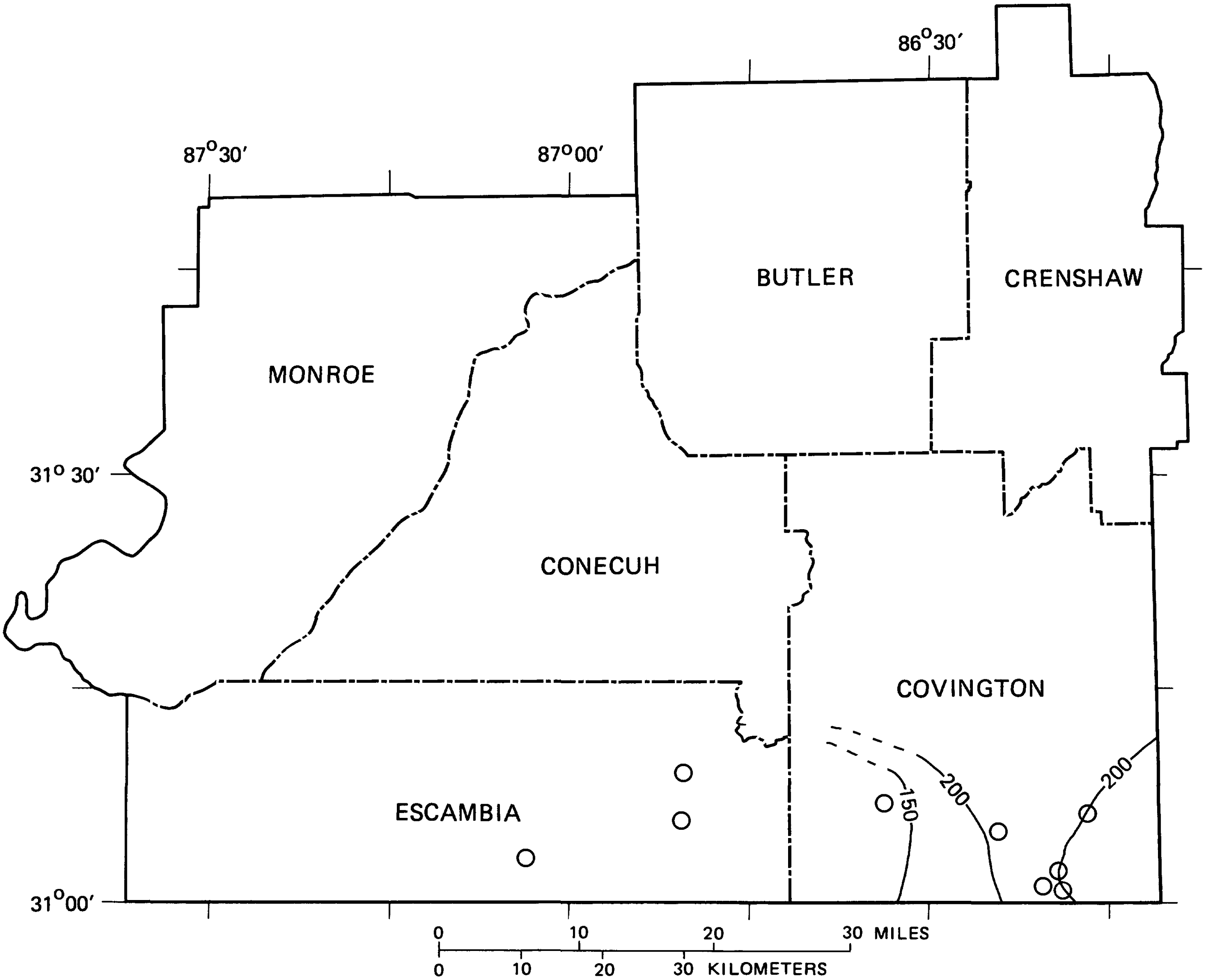


EXPLANATION

— 100 — — POTENTIOMETRIC CONTOUR--Shows altitude of the potentiometric surface for the Pliocene—Miocene auqifer. Dashed where inferred. Contour interval 50 feet.

O WELL IN WHICH WATER LEVEL WAS MEASURED

Figure 4.--Configuration of the potentiometric surface in the Pliocene-Miocene aquifer in fall, 1982.

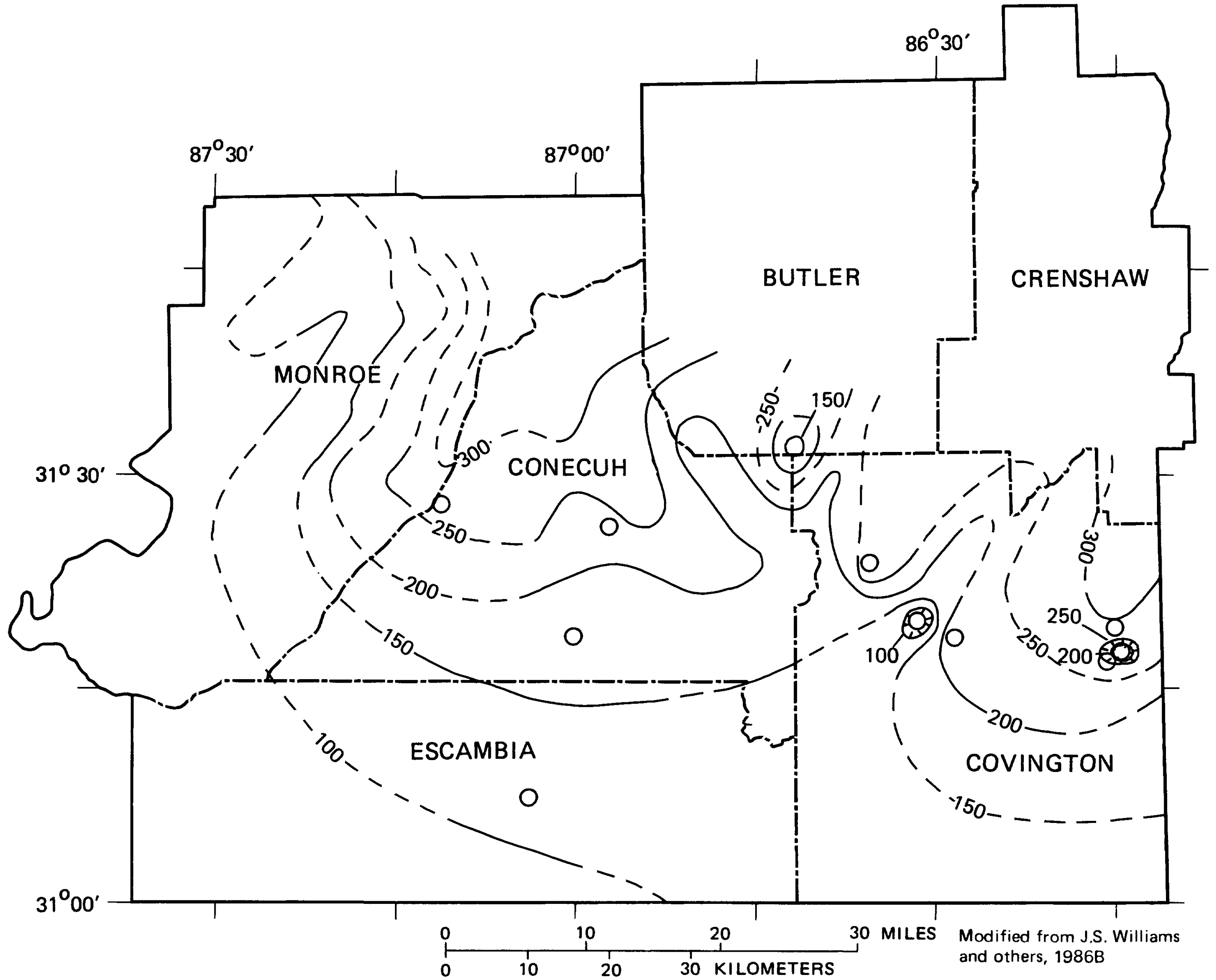


EXPLANATION

—— 200 — — POTENTIOMETRIC CONTOUR--Shows altitude of the potentiometric surface for the Upper Floridan aquifer. Dashed where inferred. Contour interval 50 feet. Datum is sea level

○ WELL IN WHICH WATER LEVEL WAS MEASURED

Figure 5.--Configuration of the potentiometric surface in the Upper Floridan aquifer in fall, 1982.

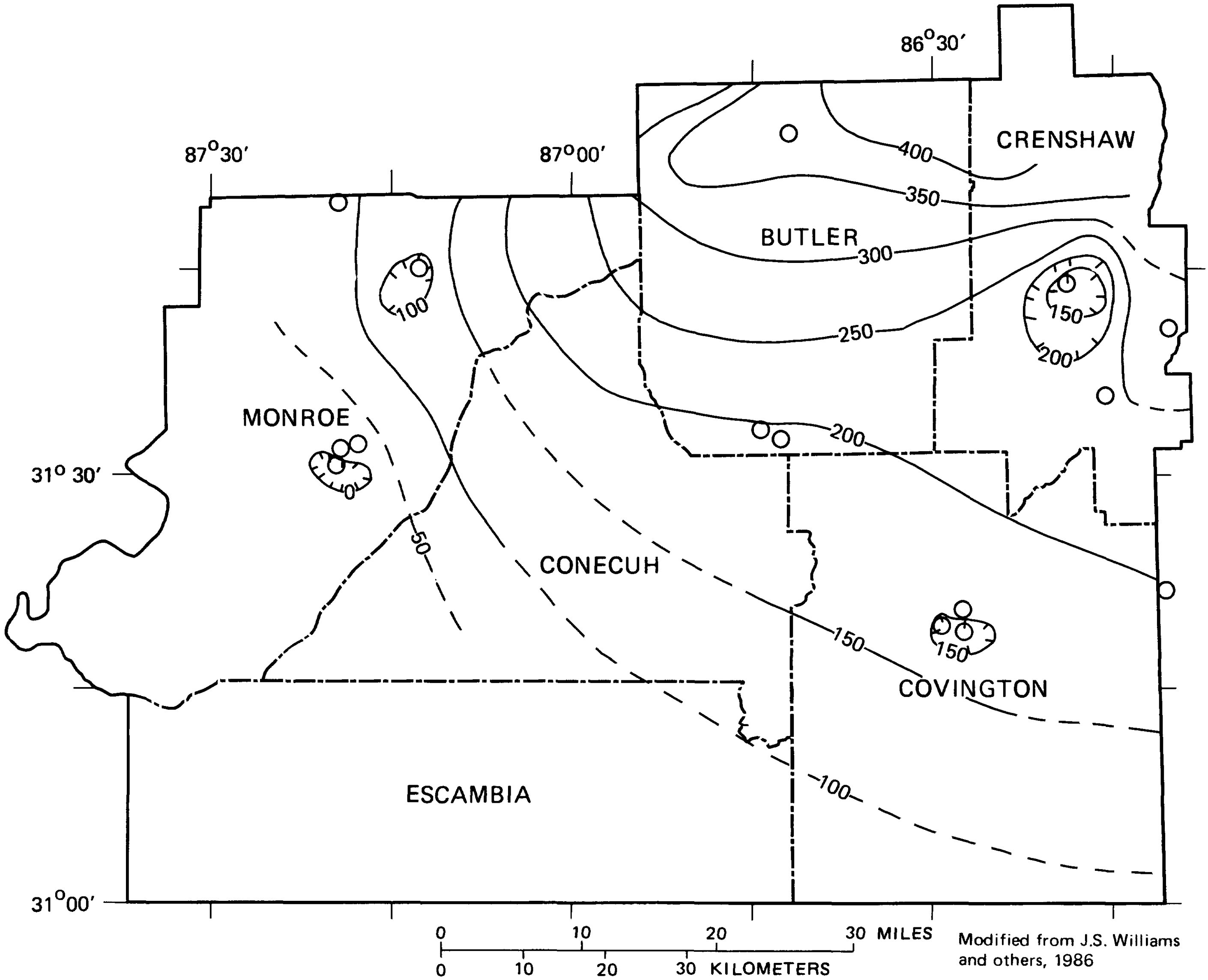


EXPLANATION

—— 100 — — POTENTIOMETRIC CONTOUR--Shows altitude of the potentiometric surface for the Lisbon aquifer. Dashed where inferred. Hachures indicate depression. Contour interval 50 feet. Datum is sea level

○ WELL IN WHICH WATER LEVEL WAS MEASURED

Figure 6.--Configuration of the potentiometric surface in the Lisbon aquifer in fall, 1982.

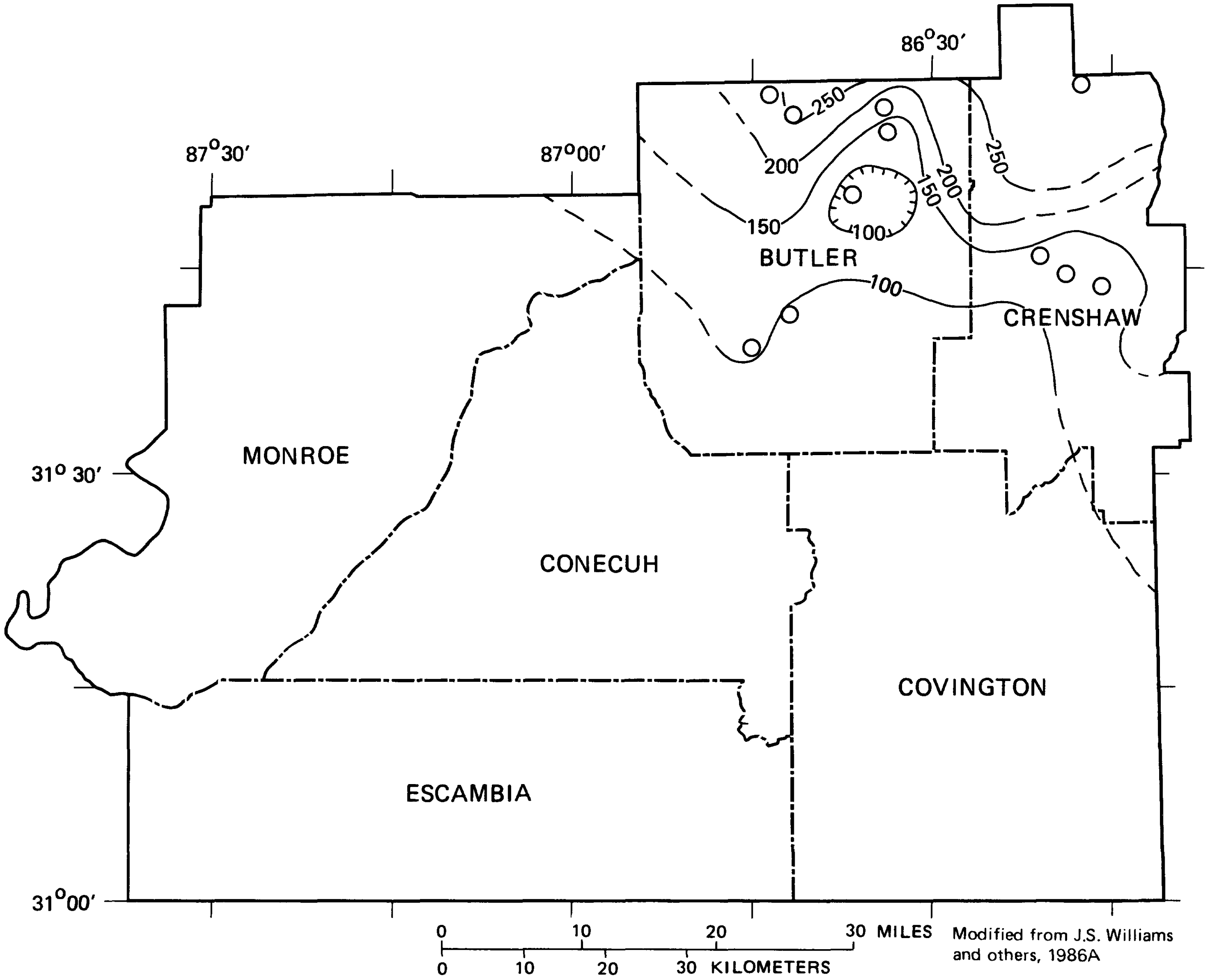


EXPLANATION

—— 100 – – POTENTIOMETRIC CONTOUR--Shows altitude of the potentiometric surface for the Nanafalia-Clayton aquifer. Dashed where inferred. Hachures indicate depression. Contour interval 50 feet. Datum is sea level

○ WELL IN WHICH WATER LEVEL WAS MEASURED

Figure 7.--Configuration of the potentiometric surface in the Nanafalia-Clayton aquifer in fall, 1982.



EXPLANATION

—— 100 – – POTENTIOMETRIC CONTOUR--Shows altitude of the potentiometric surface for the Providence-Ripley aquifer Hachures indicate depression. Contour interval 50 feet. Datum is sea level

O WELL IN WHICH WATER LEVEL WAS MEASURED

Figure 8.--Configuration of the potentiometric surface in the Providence-Ripley aquifer in fall, 1982.

Most of the remainder of the recharge is discharged through wells, mainly at large pumping centers. The largest pumping centers in the study area include the cities of Andalusia and Monroeville (figs. 6 and 7). The capacity of Andalusia's well system is more than 5 Mgal/d (million gallons per day) (1987). The capacity of Monroeville's well system is about 4 Mgal/d (1987).

Other large pumping centers and their estimated capacities (1987) are Fort Deposit (whose wells are located in Butler County), 1 Mgal/d; Greenville, 3.5 Mgal/d; Butler County Water Authority, 1 Mgal/d; Union Camp Corporation, 1.5 Mgal/d; rural water systems in Butler County, 1.25 Mgal/d; Evergreen, 2 Mgal/d; rural water systems in Conecuh County, 1 Mgal/d; Opp, 3 Mgal/d; rural water systems in Covington County, 2 Mgal/d; public water systems in Crenshaw County, 3 Mgal/d; Atmore, 3.5 Mgal/d; Brewton, 3 Mgal/d; rural water systems in Escambia County, 6 Mgal/d; and rural water systems in Monroe County, 2 Mgal/d. The total maximum withdrawal for public water supplies in the area is estimated to be 37 Mgal/d.

Ground water is used for irrigation in southern parts of the study area. Maximum withdrawals for irrigation are estimated to be about 5 Mgal/d. These withdrawals are sporadic depending on rainfall deficiencies during the growing season. Estimated total self-supplied (domestic wells) ground-water use in the study area is about 1 Mgal/d. This estimate is based on percentage of each county that is not supplied by public water systems, the rural population in each county, and an estimated per-capita water use of 100 gal/d (gallons per day).

Available data indicate that ground-water withdrawals for industrial uses total less than 1 Mgal/d. This total does not include water supplied to industries by public water systems.

Total maximum withdrawals of ground water for all uses in the study area in 1987 are estimated to be about 44 Mgal/d.

Effects of Withdrawals from the Aquifers

Large long-term withdrawals of ground water have resulted in the formation of depressions on the potentiometric surfaces of the Lisbon, Nanafalia-Clayton, and Providence-Ripley aquifers (figs. 6-8). Depressions on the potentiometric surfaces of the Pliocene-Miocene aquifer and of the Upper Floridan aquifer have not been detected in the area (figs. 4 and 5). Depressions have formed in the Lisbon aquifer in the vicinities of Andalusia and Opp (fig. 6). Depressions in the Nanafalia-Clayton aquifer have formed in the Luverne, Andalusia, Beatrice, and Monroeville areas, and a depression has started to form in the aquifer in the vicinity of the town of McKenzie (fig. 7). An extensive depression has formed in the Providence-Ripley aquifer in the vicinity of Greenville (fig. 8).

SUSCEPTIBILITY OF THE AQUIFERS TO SURFACE CONTAMINATION

All of the areas of recharge for the major aquifers are susceptible to surface contamination (plate 1). However, throughout a large part of the area, recharge areas are in rural terrains that are used for timberlands, farms, or pastures. These recharge areas are several miles from areas where withdrawals are being made. These rural areas consist mainly of sand hills and intermediate streams. In some parts of the Upper Floridan aquifer recharge area, depressions have developed on the land surface as a result of solution of underlying carbonate rocks. Some parts of the Pliocene-Miocene aquifer recharge area, where the Citronelle Formation overlies the Miocene Series, consist of a relatively flat terrain containing broad, shallow depressions on the land surface.

The areas that are highly susceptible to contamination from the surface are 1) the depressions in the Upper Floridan aquifer recharge area, and 2) in the vicinity of Atmore in the southwestern part of the study area where the relatively thin Citronelle Formation overlies the Miocene Series and has formed a generally flat landscape with depressions on the land surface (see plate 1). The Upper Floridan aquifer recharge area in southern Covington County contains sporadic depressions in the landscape that are collecting basins for surface-water runoff. This area is not shown as highly susceptible to contamination on plate 1 because of the small number of depressions and their limited areal extent. These areas may be sources of direct recharge to the aquifer from the surface, and nearby ground-water withdrawals could cause depressions in the water surface inducing leakage from the surface to the aquifer.

In the southwestern part of the study area the Citronelle Formation has formed a relatively flat terrain with depressions on the land surface, resulting in very little surface-water runoff. The Citronelle is a relatively thin unit overlying the Pliocene-Miocene aquifer. Public-water supply wells at the town of Atmore are screened in the aquifer less than 150 feet below land surface. Some beds of clay are present between the surface and the top of the aquifer, but the Citronelle consists primarily of gravel and coarse sand. Depressions on the water surface in the aquifer caused by ground-water withdrawals may induce vertical leakage from the surface to the aquifer.

Pumpage in the vicinity of Atmore from the Pliocene-Miocene aquifer and in the vicinity of Florala from the Upper Floridan aquifer has not caused noticeable depressions on the potentiometric surfaces of these aquifers. However, these areas are assumed to be highly susceptible to contamination because future pumpage in the area could result in the formation of depressions in the potentiometric surfaces of the Pliocene-Miocene and Upper Floridan aquifers (plate 1).

SUMMARY AND CONCLUSIONS

The major aquifers in Area 11 in southern Alabama are the Pliocene-Miocene, Floridan, Lisbon, Nanafalia-Clayton, and Providence-Ripley aquifers. The recharge areas for the aquifers are located mainly in Butler, Conecuh, Covington, Crenshaw, Escambia, and Monroe Counties. The aquifers consist of sand and gravel beds, except for the Upper Floridan which consists of limestone. In most parts of the area, water in the aquifers occurs under artesian conditions.

The Pliocene-Miocene aquifer is a major source of water supply in Escambia and Monroe Counties. The aquifer is used by the towns of Frisco City, Excel, Uriah, Huxford, Pollard, Flomaton, Freemanville, and Canoe, and by the city of Atmore.

The Upper Floridan aquifer (Oligocene Series and Ocala Limestone) is a source of water supply in Covington County. It is the sole source of water for the town of Lockhart.

The Lisbon aquifer is pumped extensively in the central and eastern parts of the study area. It is a major source of water for the towns of Evergreen, River Falls, Brewton, East Brewton, Opp, and the city of Andalusia, and it is used in conjunction with the Upper Floridan aquifer at Florala.

The Nanafalia-Clayton aquifer is a major source of water supply in Monroe, Covington, Butler, and Crenshaw Counties. It is the exclusive source of water for the towns of Monroeville, Beatrice, and Vredenburgh; and a major source of water for the towns of McKenzie, Brantley, Rutledge, Glenwood, Dozier, and Opp, and the city of Andalusia.

The Providence-Ripley aquifer is a major source of water in Butler and Crenshaw Counties. It is the principal source of water for Greenville, Georgiana, and the Butler County Water Authority. It is a major source of water for the towns of Luverne and Rutledge, and Northeast Crenshaw County and Quint-Mar Water and Fire Protection Authorities. The town of Fort Deposit (located in Lowndes County) also pumps water from the Providence-Ripley in northern Butler County.

The largest pumping centers in the study area are Andalusia and Monroeville. Maximum ground-water pumpage at Andalusia is more than 5 Mgal/d. Maximum pumpage in the Monroeville area is about 4 Mgal/d. Maximum ground-water withdrawals for all uses in the study area was estimated to be about 44 Mgal/d in 1987.

Large long-term withdrawals of ground water have resulted in the formation of depressions on the potentiometric surfaces of the Lisbon, Nanafalia-Clayton, and Providence-Ripley aquifers. Depressions have developed in the potentiometric surface of the Lisbon aquifer in the vicinities of Andalusia and Opp. Depressions have also formed in the potentiometric surface of the Nanafalia-Clayton aquifer in the vicinities of Luverne, Andalusia, Beatrice, and

Monroeville. Ground-water withdrawals in the vicinity of Greenville have formed a depression in the potentiometric surface of the Providence-Ripley aquifer.

All the recharge areas for the major aquifers are susceptible to surface contamination. However, recharge areas throughout most of the study area are used for timberlands, farms, and pastures, and are several miles from pumping centers. Areas highly susceptible to contamination are 1) depressions on the surface of the Upper Floridan aquifer that are formed by solution of carbonate rocks, and 2) the southwestern part of the study area in the vicinity of Atmore where the relatively thin Citronelle Formation overlies the Miocene Series, and has formed a generally flat landscape with depressions on the land surface. Lowering of the potentiometric surfaces of the Pliocene-Miocene aquifer or the Upper Floridan aquifer may result in vertical leakage of water from the surface to the aquifers in these areas.

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Table 1.--Generalized section of geologic formations in the study area and their water-bearing properties

System	Series	Group	Stratigraphic unit	Thickness (feet)	Lithology	Aquifer	Water-bearing properties
Quaternary	Holocene and Pleistocene		Alluvium and terrace deposits	10-50	Gravel, sand, silt, and clay		Potential source of large water supplies in the flood plains of the Alabama and Conecuh Rivers, but are not developed for public-water supply.
Tertiary	Pliocene		Citronelle Formation	5-50	Gravel, sand, and sandy clay	Pliocene/Miocene aquifer	Not a major aquifer in the study area because of the unit's thinness but is hydraulically connected to the Miocene Series undifferentiated.
Tertiary	Miocene		Miocene Series undifferentiated	50-650	Medium- to coarse-grained gravelly sand, fine-grained micaceous silty sand, mottled sandy clay, and fine-grained silty sandstone; deeply weathered silty sandy clay with fractured chert boulders forms residuum in updip exposures	Pliocene/Miocene aquifer	Wells produce 50 to 500 gal/min, also a major aquifer south and southeast of the study area.
Tertiary	Oligocene		Oligocene Series undifferentiated	50-200	Lower zone of indurated to soft fossiliferous limestone; upper zone of carbonaceous sandy clay and fossiliferous limestone; deeply weathered silty sandy clay with fractured chert boulders forms residuum in updip exposure	Upper Floridan aquifer	Source of water supply in southeast Covington County; wells produce 250 gal/min.
Tertiary	Eocene	Jackson Group	Ocala Limestone	25-90	Sparsely glauconitic fossiliferous sandy limestone; updip areas weather to a residual clay and sand containing chert boulders	Upper Floridan aquifer	Source of water supply in southeast Covington County; wells developed in conjunction with the Oligocene Series produce as much as 750 gal/min.
Tertiary	Eocene	Jackson Group	Yazoo Clay	10-50	Sandy silty clay, and silty sand; updip areas weather to a residual clay and sand containing chert boulders		Relatively impermeable; not a source of ground water.
Tertiary	Eocene	Jackson Group	Moodys Branch Formation	5-65	Fine- to coarse-grained glauconitic calcareous fossiliferous sand and sandy limestone; updip areas weather to a residual clay and sand containing chert boulders	Lisbon aquifer	Wells developed in conjunction with the Lisbon Formation produce as much as 350 gal/min.
Tertiary	Eocene	Claiborne Group	Gosport Sand and Lisbon Formation undifferentiated	15-250	Fine- to coarse-grained sand and sandy clay	Lisbon aquifer	Source of water supply in eastern Escambia County and southern Covington County; wells produce as much as 350 gal/min; not a major aquifer in the western part of the study area because the unit becomes less permeable.
Tertiary	Eocene	Claiborne Group	Tallahatta Formation	40-240	Upper and lower zones of coarse-grained sand; middle zone of thin-bedded siltstone, clay, and claystone	Lisbon aquifer	Source of water supply in central Conecuh County, eastern Escambia County, and Covington County; wells produce as much as 350 gal/min; not a major aquifer in the western part of the study area because water contains more than 1,000 mg/L dissolved solids.

Table 1.--Generalized section of geologic formations in the study area and their water-bearing properties--Continued

System	Series	Stratigraphic unit			Thickness (feet)	Lithology	Water-bearing properties	
Tertiary	Eocene	Wilcox Group	Hatchetigbee Formation		5-260±	Carbonaceous thin-bedded to laminated clay and sand	Lisbon aquifer	Relatively impermeable; not a source of ground water.
Tertiary	Eocene	Wilcox Group	Bashi Formation		20±	Glauconitic fossiliferous sand and fossiliferous sandstone	Lisbon aquifer	A few wells are developed in conjunction with the Lisbon aquifer in Covington County.
Tertiary	Paleocene	Wilcox Group	Tuscahoma Sand		120-360	Lower zone of medium to coarse-grained massive to laminated sand; upper zone of very fine- to coarse-grained fossiliferous sand and laminated to massive micaceous carbonaceous clay	Relatively impermeable; not a source of ground water. Lower zone is a source of ground water in Covington County, with some wells developed in conjunction	with Nanafalia-Clayton aquifer.
Tertiary	Paleocene	Wilcox Group	Nanafalia Formation	Gampian Hills Member	90-110	Siltstone, silt, and sandy clay	Nanafalia/Clayton aquifer	Relatively impermeable; not a source of ground water.
Tertiary	Paleocene	Wilcox Group	Nanafalia Formation	"Ostrea thirsae beds"	20-40	Fine- to medium-grained sandy clay with abundant Ostrea thirsae Gabb and other fossils	Nanafalia/Clayton aquifer	Relatively impermeable; not a source of ground water.
Tertiary	Paleocene	Wilcox Group	Nanafalia Formation	Gravel Creek Member	60-80	Coarse-grained, gravelly micaceous sand	Nanafalia/Clayton aquifer	Source of large water supplies in Monroe, Covington, and Butler Counties. Wells produce 75 to 925 gal/min. Water in Escambia and southern Conecuh Counties contains more than 250 mg/L chloride; not an aquifer in southern Monroe County because unit is relatively impermeable.
Tertiary	Paleocene	Midway Group	Naheola Formation		20±	Carbonaceous sandy clay and micaceous clay and silt	Nanafalia/Clayton aquifer	Relatively impermeable; not a source of ground water.
Tertiary	Paleocene	Midway Group	Porters Creek Formation		70-250	Fine- to medium-grained micaceous clayey sand, sandy clay and silt, and limestone	Nanafalia/Clayton aquifer	Source of water supply in southern Crenshaw County; wells developed in conjunction with the Clayton produce 600 gal/min. Not an aquifer in other parts of the study area because unit becomes relatively impermeable.
Tertiary	Paleocene	Midway Group	Clayton Formation		100-170	Fine- to medium-grained sand, and fine-grained fossiliferous clayey sand and silt, and limestone	Nanafalia/Clayton aquifer	Wells produce 140 to 190 gal/min in the eastern part of the study area; relatively impermeable west of Greenville.
Cretaceous	Upper Cretaceous	Selma Group	Providence Sand	Upper unnamed member	35-75	Fine- to coarse-grained gravelly sand	Providence/Ripley aquifer	Not a major aquifer in the study area; east of the study area the Providence is a major aquifer.
Cretaceous	Upper Cretaceous	Selma Group	Providence Sand	Perote Member	35-75	Laminated fine-grained sand and silty clay	Providence/Ripley aquifer	Relatively impermeable; not a source of ground water.
Cretaceous	Upper Cretaceous	Selma Group	Prairie Bluff Chalk		25-95	Calcareous sandy clay and fossiliferous sandy chalk	Providence/Ripley aquifer	Relatively impermeable; not a source of ground water.
Cretaceous	Upper Cretaceous	Selma Group	Ripley Formation		250-300	Sand, sandy clay, and calcareous sandstone, and fossiliferous sand and sandy chalk	Providence/Ripley aquifer	Source of water in Crenshaw, Butler, and northeasternmost Monroe Counties; wells produce 200 to 600 gal/min; water in Conecuh, Covington, Escambia, and southern Monroe Counties contain more than 1,000 mg/L chloride.
Cretaceous	Upper Cretaceous	Selma Group	Demopolis Chalk		400-450	Chalk, marl, calcareous clay, and sandy clay	Relatively impermeable; not source of ground water.	

Table 2.--Records of public water-supply wells in the study area

Note: Well numbers correspond to those shown on plate 1.

Geographic coordinate number: Latitude (DDMMSS), Longitude (DDMMSS), and sequential number (xx).

Depth of well and water level: Depth of well given in feet; reported water levels are in feet above(-) or below land surface; measured water levels are in feet and tenths.

Well diameter: casing diameter in inches.

Water-bearing unit: Kr, Ripley Formation; Kpu, upper unnamed member of the Providence Sand; Tm, Midway Group;Tc, Clayton Formation; Tpc, Porters Creek Formation; Tnf, Nanafalia Formation; Ttu, Tuscahoma Sand; Th, Hatchetigbee Formation; Tt, Tallahatta Formation; Tl, Lisbon Formation; Tj, Jackson Group; Tmb, Moodys Branch Formation; To, Ocala Limestone; Tou, Oligocene Series undifferentiated; Tmu, Miocene Series undifferentiated.

Altitude of land surface: Altitudes given in feet above sea level, from topographic maps.

Methd of lift: N, none; S, submergible; T, turbine.

Use of well: I, industrial; P, public water supply; U, unused.

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measure-ment	Method of lift	Use of well	Remarks
1	315745086170201	Quint-Mar Water and Fire Protection Authority	Powell Drilling Co., Inc. 1967	291	6 4	Kr	420	85.0 89.1	3/07/67 6/19/87	T	U	"Lapine Well." Casing: 6 in. from surface to 257 ft; 4 in. from 253 to 270 ft. Screen: 4 in. from 270 to 291 ft. Reported drawdown 65 ft when pumped 23 hours at 125 gal/min in 1967. D-01.
2	315530086343801	Town of Fort Deposit	Acme Drilling Co., Inc. 1970	522	12 8 6	Kr	520	306 354 365	1970 5/05/82 1/27/86	T	P	Well 2. Casing: 12 in. from surface to 411 ft; 8 in. from 411 to 461 ft. Screen: 6 in. from 461 to 522 ft. Reported drawdown 34 ft when pumped at 302 gal/min in 1970. B-03.
3	315504086345401	Town of Fort Deposit	Acme Drilling Co., Inc. 1970	444	12 8 6	Kr	420	240 276 279 295	1970 12/11/79 5/05/82 1/22/86	T	P	Well 1. Casing: 12 in. from surface to 300 ft; 8 in. from 280 to 390 ft; 6 in. from 403 to 408 ft. Screen: 6 in. from 390 to 403 ft and from 408 to 444 ft. Reported drawdown 37 ft when pumped at 302 gal/min in 1970. B-04
4	314936087190501	Vreden-burgh Water System	Layne Central Co., Inc. 1948	270	12 6	Tnf	150	46.7	5/30/67	T	P	Well 1. Casing: 12 in. from surface to 235 ft; 6 in. from 180 to 240 ft. Screen: 6 in. from 240 to 270 ft. Reported drawdown 20.8 ft when pumped 30 min at 222 gal/min in 1967.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
5	314935087190401	Vredenburgh Water System	Gray Artesian Well Co. 1912	320	10	Tnf	148	62.8	4/17/86	T	P	Well 2. Used as standby supply. Casing: 10 in. from surface to 85 ft. None below.
6	314908086403301	Butler County Water Authority	Layne Central Co., Inc. 1979	708	16 8	Kpu (?) Kr	395	255 240	2/00/79 6/04/79	T	P	Well 1. Casing: 16 in. from surface to 560 ft; 8 in. from 490 to 565 ft, 580 to 615 ft, and 675 to 683 ft. Screen: 8 in. from 565 to 580 ft, 615 to 675 ft, and 683 to 708 ft. Reported drawdown 55 ft when pumped 24 hrs at 530 gal/min in 1979. H-02.
7	314952086400401	Greenville Water Works	Layne Central Co., Inc. 1972	680	16 8	Kpu (?) Kr	410	256	2/00/72	T	P	Well 4. Casing: 16 in. from surface to 580 ft. Screen: 8 in. from 580 to 680 ft. Reported drawdown 36 ft when pumped 8 hrs at 503 gal/min in 1972. H-01.
8	314914086380601	Greenville Water Works	Layne Central Co., Inc. 1956	661	12 8	Kr	375	189	1956	T	P	Well 2. Casing: 12 in. from surface to 503 ft; 8 in. from 443 to 508 ft, and 568 to 601 ft. Screen: 8 in. from 508 to 568 ft, and 601 to 661 ft. Reported drawdown 60 ft when pumped 8 hrs at 530 gal/min in 1956. H-7
9	315045086373801	Greenville Water Works	Layne Central Co., Inc. 1961	623	16 12 8	Kr	465	277	3/10/61	T	P	Well 3. Casing: 16 in. from surface to 518 ft; 8 in. from 458 to 522 ft, and 542 to 563 ft. Screen: 8 in. from 522 to 542 ft and 563 to 623 ft. Reported drawdown 88 ft when pumped 8 hrs at 500 gal/min in 1961. H-4

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
10	314947086364201	Greenville Water Works	Layne Central Co., Inc. 1942	577	12 8	Kr	360	236.5 304.8	5/29/64 7/14/86	T	P	Well 1. Casing: 12 in from surface to 460 ft; 8 in. from 460 to 473 ft, 493 to 525 ft, and 545 to 557 ft. Screen: 8 in. from 473 to 493 ft, 525 to 545 ft, and 557 to 577 ft. Reported drawdown 156 ft when pumped 24 hrs at 575 gal/min in 1942. H-12
11	315052086122701	Northeast Crenshaw Water and Fire Protection Authority	Powell Drilling Co., Inc. 1974	360	8 3	Kr	361	147	2/00/74	T	P	"Petrey Well." Casing: 8 in. from surface to 315 ft; 3 in. from 290 to 315 ft, 325 to 338 ft, and 348 to 349 ft. Screen: 3 in. from 315 to 325 ft, 338 to 348 ft, and 349 to 360 ft. Reported drawdown 21 ft when pumped 12 hrs at 108 gal/min in 1974. G-02
12	314415086183601	Rutledge Water Works	Powell Drilling Co., Inc. 1984	585	16 8	Kr	369	224 235.0	9/09/84 7/15/86	T	P	Well 2. Casing: 16 in. from surface to 514 ft; 8 in. from 464 to 517 ft and 537 to 554 ft. Screen: 8 in. from 517 to 537 ft and 554 to 585 ft. Reported drawdown 49 ft when pumped 24 hrs at 351 gal/min on 9/04/84. K-05.
13	314346086184801	Rutledge Water Works	Powell Drilling Co., Inc. 1963	245	8	Tc	352	70 80.8	4/22/63 7/15/86	T	P	Well 1. Casing: 8 in. from surface to 157 ft. None below. Reported drawdown 97 ft when pumped 12 hrs at 181 gal/min in 1963. K-03.
14	314556086210101	Quint-Mar Water and Fire Protection Authority	Powell Drilling Co., Inc. 1983	533	16 8	Kr	375	232 260.5	8/00/83 7/15/86	T	P	Well 2. Casing: 16 in. from surface to 471 ft; 8 in. from 426 to 472 ft. Screen: 8 in. from 472 to 533 ft. Reported drawdown 70 ft when pumped 24 hrs at 250 gal/min in 1983. K-03.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
15	314608086212201	Quint-Mar Water and Fire Protection Authority	Layne Central Co., Inc. 1978	640	12 6	Kr	390	211	2/23/78	T	P	Well 1. Casing: 12 in. from surface to 475 ft; 6 in. from 425 to 560 ft. Screen: 6 in. from 560 to 640 ft. Reported drawdown 125 ft when pumped 24 hrs at 305 gal/min in 1978.
16	314401087121001	Beatrice Water System	Layne Central Co., Inc. 1961	468	8 4	Tnf	263	126.8 201.4	6/16/67 4/17/86	S	P	Well 2. Casing: 8 in. from surface to 378 ft; 4 in. from 348 to 381 ft. Screen: 4 in. from 381 ft to 468 ft. Reported drawdown 119 ft when pumped 30 min at 75 gal/min in 1967. J-6
17	314406087123301	Beatrice Water System	Layne Central Co., Inc. 1961	448	8 6	Tnf	255	--	---	S	P	Well 1. Casing: 8 in. from surface to 424 ft; 6 in. from 408 to 428 ft. Screen: 6 in. from 428 to 448 ft. Reported drawdown 156 ft when pumped 30 min at 75 gal/min in 1967. J-5.
18	314022086424901	Union Camp	Layne Central Co., Inc. 1944	861	16 8	Kr	265	17 91	1946 10/30/65	T	P, I	Well 1. Used as temporary public water supply. Casing: 16 in. from surface to 740 ft; 8 in. from 656 to 761 ft. Screen: 8 in. from 761 to 861 ft. Reported drawdown 57 ft when pumped 12 hrs at 614 gal/min in 1965. Q-4
19	314028086422801	Union Camp	Layne Central Co., Inc. 1968	827	20 10	Kr	270	99	2/00/68	T	P, I	Well 2. Used as temporary public-water supply Casing: 20 in. from surface to 722 ft; 10 in. from 642 to 727 ft. Screen: 10 in. from 727 to 827 ft. Reported discharge of 602 gal/min in 1968. Q-03.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
20	314036086415101	Butler County Water Authority	Layne Central Co., Inc. 1968	838	12 6	Kr	335	175 242.1 246.7 240.2	3/00/68 11/02/83 11/28/84 7/14/86	T	P	Well 2. "Chapman Well." Casing: 12 in. from surface to 793 ft; 6 in. from 718 to 798 ft. Screen: 6 in. from 798 to 838 ft. Reported drawdown 47 ft when pumped 8 hrs at 250 gal/min in 1968. R-01.
21	314250086155701	Luverne Water and Sewer Department	Layne Central Co., Inc. 1952	567	16 8	Kr	335	97 164.8 195 203.7	2/00/53 11/01/76 11/06/84 7/15/86	T	P	Well 1. Casing: 16 in. from surface to 492 ft; 8 in. from 432 to 497 ft. Screen: 8 in. from 497 to 567 ft. Reported drawdown 65 ft when pumped 8 hrs at 530 gal/min in 1953. L-5
22	314250086155601	Luverne Water and Sewer Department	Gray Artesian Well Co., Inc. 1943	345	12	Tc Kpu(?)	335	34	11/00/43	T	U	Abandoned Well Casing: 12 in. from surface to 90 ft. None below. Reported drawdown 80 ft when pumped 48 hrs at 250 gal/min in 1943. L-6
23	314248086153501	Luverne Water and Sewer Department	Layne Central Co., Inc. 1967	590	16 8	Kr	345	147	4/04/67	T	P	Well 2 Casing: 16 in. from surface to 515 ft; 8 in. from 455 to 520 ft. Screen: 8 in. from 520 to 590 ft. Reported drawdown 59 ft when pumped 8 hrs at 503 gal/min. L-01
24	313959086101301	Glen-wood Water Works	Campbell Drilling Co., Inc. 1963	202	8	Tc	278	9.5	7/21/86	S	P	Casing: 8 in. from surface to 75 ft. None below. Reported drawdown 33.4 ft when pumped 2.5 hrs at 142 gal/min in 1963. Well flowed in 1963. N-3
25	313447086153001	Brantley Water Works	L.A. Killough Jr. 1945	210	6	Tpc	280	34	1964	T	U	Well 1 Casing: 6 in. from surface to 127 ft. None below. Reported drawdown 32 ft when pumped 12 hrs at 156 gal/min in 1946. T-5

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
26	313517086152901	Brantley Water Works	Layne Central Co., Inc. 1975	250	30 24 16 8	Tnf Tc	303	53 54.9	7/01/75 4/18/86	T	P	Well 3. Casing: 30 in. from surface to 25 ft; 24 in. from surface to 95 ft; 16 in. from 95 to 145 ft; 8 in. from 185 to 200 ft, and 220 to 230 ft. Screen: 8 in. from 145 to 185 ft, 200 to 220 ft, and 230 to 250 ft. Reported drawdown 51 ft when pumped 3 hrs at 439 gal/min in 1975. T-01
27	313450086154501	Brantley Water Works	L.A. Killough Jr. 1945	178	6	Tpc	285	34	1964	T	U	Well 2. Casing: 6 in. from surface to 117 ft. None below. Reported drawdown 32 ft when pumped 12 hrs at 156 gal/min in 1956. T-5
28	313754086442301	Georgiana Water Works and Sewer Board	Acme Drilling Co., Inc. 1971	1,076	18 12 6	Kr	330	178	7/00/71	T	P	Well 1. Casing: 18 in. from surface to 40 ft; 12 in. from surface to 976 ft. Screen: 6 in. from 976 to 1,076 ft. Reported draw-down 36 ft when pumped 8 hrs at 360 gal/min in 1971. Q-01
29	313814086443701	Georgiana Water Works and Sewer Board	Powell Drilling Co., Inc. 1982	1,030	12 6	Kr	290	179 194.5 193.4 183.7	2/00/82 9/03/82 5/01/84 4/22/86	T	P	Well 2. Casing: 12 in. from surface to 917 ft; 6 in. from 832 to 916 ft. Screen: 6 in. from 916 to 1,030 ft. Reported drawdown 56 ft when pumped 24 hrs at 615 gal/min in 1982. Q-02
30	313324086492101	Town of Garland	-- 1911	280	4	Ttu	211	-4.5 -2.8	7/29/46 5/26/64	S	P	Supplies several homes. Casing: 4 in. from surface to unde-termined depth. Measured flow 1.5 gal/min on 5/26/64. X-4
31	313137087191801	Monroe-ville Water Service	Layne Central Co., Inc. 1955	1,365	16 10	Tnf	413	272 397.8	1955 4/17/86	T	P	"Cherry St." well Casing: 16 in. from surface to 1,194 ft; 10 in. from 1,110 to 1,195 ft. Screen: 10 in. from 1,195 to 1,365 ft. Reported drawdown 132 ft when pumped 8 hrs at 900 gal/min in 1955. U-3

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
32	313104087191301	Monroeville Water Service	Layne Central Co., Inc. 1952	1,394	16 10	Tnf	425	260 434.4	1952 4/17/86	T	P	"Popular St." well. Casing: 16 in. from surface to 1,247 ft; 10 in. from 1,167 to 1,252 ft. Screen: 10 in. from 1,252 to 1,394 ft. Reported drawdown 145 ft when pumped 8 hrs at 900 gal/min in 1952. Z-2
33	313217087184201	Monroeville Water Service	Layne Central Co., Inc. 1974	1,270	18 10	Tnf	367	302 336	7/01/74 11/02/84	T	P	"Hammond St." well. Casing: 18 in. from surface to 1,140 ft; 10 in. from 1,180 to 1,190 ft and 1,220 to 1,240 ft. Screen: 10 in. from 1,140 to 1,180 ft, 1,190 to 1,220 ft, and 1,240 to 1,270 ft. Reported drawdown 106 ft when pumped 17 hrs at 838 gal/min in 1974.
34	313042087183701	Monroeville Water Service	Layne Central Co., Inc. 1964	1,387	16 10	Tnf	430	313	1964	T	P	"Drewery Rd." well. Casing: 16 in. from surface to 1,240 ft; 10 in. from 1,160 to 1,243 ft. Screen: 10 in. from 1,243 to 1,387 ft. Reported drawdown 401 ft when pumped 24 hrs at 933 gal/min in 1964.
35	313124087182801	Monroeville Water Service	Layne Central Co., Inc. 1981	1,275	18 10	Tnf	363	334	11/24/84	T	P	"Ivey St." well. Casing: 18 in. from surface to 1,135 ft; 10 in. from 1,045 to 1,140 ft, 1,190 to 1,200 ft, 1,240 to 1,250 ft, and 1,275 to 1,290 ft. Screen: 10 in. from 1,140 to 1,190 ft, 1,200 to 1,240 ft, and 1,250 to 1,275 ft. Reported drawdown 92 ft when pumped 12 hrs at 818 gal/min in 1981.
36	313228086432101	McKenzie Water Board	Acme Drilling Co., Inc. 1978	758	12 6	Tnf Tc	450	256	10/17/78	T	P	Well 2. Casing: 12 in. from surface to 728 ft; 6 in. from 670 to 728 ft. Screen: 6 in. from 728 to 758 ft. Reported drawdown 37 ft when pumped 8 hrs at 305 gal/min on 10/17/78. W-01

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
37	313223086425801	McKenzie Water Board	W.J. Bozeman 1945	751	8 6 4	Tnf Tc	450	220 240	10/04/45 1/28/53	T	U	Abandoned Well. Casing: 8 in. from surface to 94 ft; 6 in. from 84 to 650 ft and 660 to 741 ft. Screen: 6 in. from 650 to 660 ft; 4 in. from 741 to 751 ft. Reported drawdown 22 ft when pumped 3 hrs at 30 gal/min in 1945. W-5
38	313225086425401	McKenzie Water Board	Acme Drilling Co., Inc. 1965	763	12 6	Tnf Tc	450	240 277.7 284.4 275.9	7/03/65 11/10/83 11/07/84 4/23/86	T	P	Well 1. Casing: 12 in. from surface to 738 ft; 6 in. from 691 to 738 ft. Screen: 6 in. from 738 to 763 ft. Reported drawdown 38 ft when pumped 21 hrs at 354 gal/min. W-02
39	312938086215601	Dozier Water Works	Acme Drilling Co., Inc. 1956	586	8	Tpc Tc	243	-3	1956	T	P	Casing: 8 in. from surface to 319 ft. None below. Reported drawdown 36 ft when pumped 12 hrs at 600 gal/min in 1956. Flowed 30 gal/min prior to test.
40	312423086363101	Red Level Water Works	Smith Well and Supply Co., Inc. 1981	145	16 8	Tl Tt	340	65 70	3/01/81 4/11/83	T	P	Casing: 16 in. from surface to 110 ft; 8 in. from 70 to 115 ft. Screen: 8 in. from 115 to 145 ft. Reported drawdown 24 ft when pumped 10 hrs at 150 gal/min in 1981. F-01
41	312608086570701	Evergreen Water Works	Layne Central Drilling Co., Inc.	---	--	--	300	---	---	T	P	Well 2. Construction data not available.
42	312603086571101	Evergreen Water Works	Layne Central Drilling Co., Inc. 1956	180	16 10	Tt	285	71 66.4 66.3	4/10/56 11/06/84 4/25/86	T	P	Well 1. Casing: 16 in. from surface to 145 ft. 10 in. from 95 to 150 ft. Screen: 10 in. from 150 to 180 ft. Reported drawdown 27.7 ft. when pumped at 351 gal./min. in 1956. S-2
43	312629086585501	Evergreen Water Works	Layne Central Drilling Co., Inc.	---	--	--	305	136.2	7/29/86	T	P	Well 3. Construction data not available.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
44	312447087000901	Fairview Water System	Acme Drilling Co., Inc. 1972	196	12 6	Tl	230	33	12/10/71	T	P	Casing: 12 in. from surface to 166 ft. 6 in. from 122 to 166 ft. Screen: 6 in. from 166 to to 196 ft. Reported drawdown 8 ft. when pumped 4 hrs. at 305 gal./min. in 1971.
45	312435087142001	Repton Water Works	Layne Central Drilling Co., Inc. 1962	199	12 8 6	Tou To	355	102	1963	S	P	Casing: 12 in. from surface to 170 ft. 8 in. from 129 to 170 ft. 8 in. to 6 in. swage from 170 to 174 ft. Screen: 6 in. from 174 to 199 ft. V-4
46	312543087202701	Excel Water System	Alton Powell Drilling Co., Inc. 1965	130	8 6	Tmu	403	41.8	6/14/67	S	P	Casing: 8 in. from surface to 109 ft; 6 in. from 103 to 112 ft and 117 to 120 ft. Screen: 6 in. from 112 to 117 ft and 120 to 130 ft. Reported drawdown 10 ft when pumped at 200 gal/min in 1987. HH-2
47	312602087235501	Frisco City Water Works	Gray Artesian Well Co., Inc. 1935	124	10	Tmu	412	67.7	6/13/67	T	U	Abandoned well. Casing: 10 in. from surface to 124 ft. Perforated from 86 to 124 ft. Reported drawdown 5.5 ft while pumping 106 gal/min in 1935. Z-12
48	312602087235601	Frisco City Water Works	Gray Artesian Well Co., Inc. 1953	129	16 10 8	Tmu	412	67.6 70.1	4/26/85 4/18/86	T	U	Abandoned well. Casing: 16 in. from surface to 86 ft; 10 in. from 65 to 89 ft. Screen: 8 in. from 89 to 129 ft. Reported drawdown 18 ft when pumped 18 hrs at 300 gal/min in 1953. Z-13
49	312554087242001	Frisco City Water Works	Acme Drilling Co., Inc. 1962	130	18 12	Tmu	413	69.9	6/13/67	T	P	Well 2. Casing: 18 in. from surface to 100 ft. Screen: 12 in. from 100 to 130 ft. Reported drawdown 34 ft when pumped 8 hrs at 383 gal/min in 1967. HH-3

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
50	312518087245201	Frisco City Water Works	Acme Drilling Co., Inc. 1970	135	18 12	Tmu	407	87 84.1	4/04/70 8/01/86	T	P	Well 1. Casing: 18 in. from surface to 105 ft; 12 in. from 65 to 105 ft. Screen: 12 in. from 105 to 135 ft. Reported drawdown 14 ft when pumped 7 hrs at 351 gal/min in 1970.
51	312255087254001	Uriah Water System	Earl Etheridge 1964	165	6 4	Tmu	390	119	1964	T	U	Megargel well. Casing: 6 in. from surface to 143 ft. Screen: 4 in. from 143 to 165 ft. Reported drawdown 8 ft when pumped 36 hrs at 104 gal/min in 1964.
52	311824087295201	Uriah Water System	Logan Drilling Co., Inc.	171	--	Tmu	350	105	1962	T	P	Well 1. Reported discharge 56 gal/min in 1962. KK-3
53	311828087294701	Uriah Water System	Mason Supply Co., Inc. 1971	295	14 8 6	Tmu	353	126	8/01/86	T	P	Well 2. Casing: 14 in. from surface to 44 ft; 8 in. from surface to 260 ft. Screen: 6 in. from 260 to 295 ft. Reported drawdown 17 ft when pumped 10 hrs at 104 gal/min in 1970.
54	312016087063601	Alabama Highway Department	Alabama Highway Department 1968	270	6	To	343	137	6/27/68	S	P	I-65 rest area northbound. Casing: 6 in. from surface to 200 ft. None below. Reported drawdown 9.2 ft when pumped at 30.2 gal/min in 1968.
55	312221087030601	Alabama Highway Department	Alabama Highway Department 1968	250	6 4	Tl	231	38 37.2	7/02/68 8/09/83	S	P	I-65 rest area southbound. Casing: 6 in. from surface to 240 ft. Screen: 4 in. from 240 to 250 ft. Reported drawdown 24 ft when pumped at 25 gal/min in 1968.
56	311818087013401	Castleberry Water System	Layne Central Co., Inc. 1978	326	12 6	Tl	175	-18 -6.7	11/09/78 7/30/86	T	P	Casing: 12 in. from surface to 282 ft; 6 in. from 212 to 286 ft. Screen: 6 in. from 286 to 326 ft. Reported drawdown 45 ft when pumped 25 hrs at 350 gal/min in 1978.

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
57	312059086320001	River Falls Water System	Acme Drilling Co., Inc. 1966	256	7 4	Tt Th	160	-10 flow	5/09/66 5/06/86	T	P	Casing: 7 in. from surface to 208 ft; 4 in. from 172 to 208 ft, 227 to 232 ft, and 237 to 241 ft. Screen: 4 in. from 208 to 227 ft, 232 to 237 ft, and 241 to 256 ft. Reported drawdown 136 ft when pumped 8 hrs at 108 gal/min on 5/06/86. Flowed 10 gal/min prior to test.
58	312020086311801	Andalusia Water Works	Layne Central Co., Inc. 1948	485	18 10	Tt Th Ttu	160	-30	7/27/49	T	P	Well 5. Casing: 18 in. from surface to 332 ft; 10 in. from 277 to 343 ft, 373 to 383 ft, and 423 to 455 ft. Screen: 10 in. from 343 to 373 ft, 383 to 423 ft, and 455 to 485 ft. Reported drawdown 142 ft when pumped at 510 gal/min in 1949. Well flowed 137 gal/min prior to test.
59	312008086311201	Andalusia Water Works	Layne Central Co., Inc. 1948	519	18 10	Tt Th Ttu	170	-30 81.9 90.9 83.5	3/05/48 11/22/83 5/02/84 4/25/86	T	P	Well 4. Casing: 18 in. from surface to 357 ft; 10 in. from 305 to 364 ft and 404 to 449 ft. Screen: 10 in. from 364 to 409 ft and 449 to 519 ft. Reported drawdown 184 ft when pumped at 510 gal/min in 1948. N-3
60	312001086305001	Andalusia Water Works	Layne Central Co., Inc. 1964	916	18 10	Ttu Tnf	185	7 48.2 46.1	4/20/65 11/22/83 5/02/84	T	P	Well 6. Casing: 18 in. from surface to 376 ft; 10 in. from 321 to 381 ft and 421 to 856 ft. Screen: 10 in. from 381 to 421 ft and 856 to 916 ft. Reported drawdown 114 ft when pumped at 1,002 gal/min in 1965.
61	311938086292301	Andalusia Water Works	Griner Drilling Co., Inc. 1987	---	--	--	260	--	---	N	P	Well 9. Under development for public water supply.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
62	311817086285801	Andalusia Water Works	Layne Central Co., Inc. 1942	331	18 8	Tj Tl Tt	325	136 114.9 115.7 115	11/04/42 11/22/83 11/04/84 4/29/86	T	U	Well 1. Casing: 18 in. from surface to 120 ft; 8 in. from surface to 132 ft, 152 to 157 ft, 177 to 185 ft, 195 to 211 ft, 231 to 248 ft, and 268 to 321 ft. Screen: 8 in. from 132 to 152 ft, 157 to 177 ft, 185 to 195 ft, 211 to 231 ft, 248 to 268 ft, and 321 to 331 ft. Reported discharge 80-100 gal/min in 1964.
63	312004086280801	Andalusia Water Works	Layne Central Co., Inc. 1969	1,074	24 18 10	Tnf	350	158 206 211	9/25/70 4/21/83 11/22/83	T	P	Well 7. Casing: 24 in. from surface to 104 ft; 18 in. from surface to 1,009 ft; 10 in. from 929 to 1,014 ft. Screen: 10 in. from 1,014 to 1,074 ft. Reported drawdown 87 ft when pumped 8 hrs at 750 gal/min in 1970. M-01
64	311931086272701	Andalusia Water Works	Layne Central Co., Inc. 1977	1,090	18 10	Tnf	347	191 226 231.4	12/00/77 11/08/84 4/29/86	T	P	Well 8. Casing: 18 in. from surface to 990 ft; 10 in. from 1,000 to 1,010 ft. Screen: 10 in. from 990 to 1,000 ft and 1,010 to 1,090 ft. Reported drawdown 35 ft when pumped 8 hrs at 754 gal/min in 1977. M-02
65	311649086155801	Opp Utilities Board	Layne Central Co., Inc. 1958	255	18 10 8	Tl	290	35	4/01/58	T	P	"Monroe St." well. Casing: 18 in. from surface to 80 ft; 10 in. from surface to 109 ft; 8 in. from 109 to 110 ft, 120 to 145 ft, and 160 to 178 ft. Screen: 8 in. from 110 to 120 ft, 145 to 160 ft, 178 to 208, and 245 to 255 ft. Reported drawdown 85 ft when pumped 8 hrs at 320 gal/min in 1958. K-03

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
66	311834086152001	Opp Utilities Board	Layne Central Co., Inc. 1967	500	24 12 8	Th	335	124 138.1	11/03/67 4/14/83	T	P	"Highway 331" well. Casing: 24 in. from surface to 155 ft; 12 in. from 93 to 449 ft; 8 in. from 449 to 450 ft. Screen: 8 in. from 450 to 500 ft. Reported drawdown 138 ft when pumped 8 hrs at 302 gal/min in 1967. K-01
67	311703086151101	Opp Utilities Board	Layne Central Co., Inc. 1961	185	24 18 10	Tl	309	59 68.6	1/00/62 4/15/83	T	P	"Park" well. Casing: 24 in. from surface to 127 ft; 18 in. from surface to 130 ft; 10 in. from 130 to 132 ft, 142 to 150 ft, and 170 to 175 ft. Screen: 10 in. from 132 to 142 ft, 150 to 170 ft, and 175 to 185 ft. Reported drawdown 55 ft when pumped 8 hrs at 329 gal/min in 1962. K-5
68	312112086114201	Opp Utilities Board	Layne Central Co., Inc. 1974	910	16	Tnf Tc	382	156 190.5 186.4 190.1	10/02/74 4/14/83 11/10/83 11/09/84	T	P	"Highway 84" well. Casing: 16 in. from surface to 680 ft. None below. Reported drawdown 128 ft when pumped at 1,043 gal/min in 1974. L-01
69	311623086161001	Opp Utilities Board	Killough Drilling Co., Inc. 1971	252	16 8 6	Tl	270	26 20.1	6/16/71 4/15/83	T	P	"8th St." well. Casing: 16 in. from surface to 125 ft; 8 in. from 95 to 130 ft; 6 in. from 140 to 150 ft, 165 to 180 ft, 200 to 212 ft, and 217 to 242 ft. Screen: 6 in. from 130 to 140 ft, 150 to 165 ft, 180 to 200 ft, 212 to 217 ft, and 242 to 252 ft. Reported drawdown 72 ft when pumped 24 hrs at 246 gal/min in 1971. L-01
70	311315087274201	Huxford Water and Fire Protection Authority	Mason Supply Co., Inc. 1969	232	6 4	Tmu	335	134 125.3	1970 7/31/86	S	P	Casing: 6 in. from surface to 198 ft; 4 in. from 197 to 202 ft. Screen: 4 in. from 202 to 232 ft. Reported drawdown 12 ft when pumped 4 hrs at 135 gal/min in 1970.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
71	310925087275601	Alabama Department of Corrections	Graves Well Drilling Co., Inc. 1981	178	12 8 6	Tmu	311	--	---	T	P	Atmore Prison Farm well 1. Casing: 12 in. from surface to 137 ft; 8 in. from surface to 137 ft. Screen: 6 in. from 137 to 178 ft.
72	310923087275601	Alabama Department of Corrections	Gray Artesian Co., Inc. 1941	203	22 12	Tmu	311	90	9/00/41	T	P	Atmore Prison Farm well 2. Casing: 22 in. from surface to 82 ft; 12 in. from surface to 82 ft. Screen: from 82 ft to undetermined depth. Reported drawdown 70 ft when pumped 3 hrs at 312 gal/min in 1941.
73	310802087265901	Alabama Department of Corrections	Layne Central Co., Inc. 1967	352	18 10	Tmu	290	103	1967	T	P	Holman Prison well 1. Casing: 18 in. from surface to 289 ft; 10 in. from 249 to 292 ft and 302 to 322 ft. Screen: 10 in. from 292 to 302 ft and 322 to 352 ft. Reported drawdown 25 ft when pumped 8 hrs at 402 gal/min in 1967.
74	310804087265501	Alabama Department of Corrections	Layne Central Co., Inc. 1967	352	18 10	Tmu	293	108 112.2	1967 6/14/87	T	P	Holman Prison well 2. Casing: 18 in. from surface to 282 ft; 10 in. from 240 to 283 ft and 303 to 332 ft. Screen: 10 in. from 283 to 303 ft and 332 to 352 ft. Reported drawdown 27 ft when pumped 8 hrs at 400 gal/min in 1967.
75	310558087163801	McCall Water System	Graves Well Drilling Co., Inc. 1982	275	16 8	Tmu	205	108	6/23/82	T	P	Well 2. Casing: 16 in. from surface to 223 ft; 8 in. from 192 to 220 ft. Screen: 8 in. from 220 to 275 ft. Reported drawdown 28.5 ft when pumped 1.5 hrs at 760 gal/min in 1982.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
76	310608087050601	Brewton Water Works	Layne Central Co., Inc. 1957	731	16 10	Tl	161	32.1	4/25/57	T	P	"Alco" well. Casing: 16 in. from surface to 596 ft; 10 in. from 596 to 600 ft and 650 to 691 ft. Screen: 10 in. from 600 to 650 ft and 691 to 731 ft. Reported drawdown 147.5 ft when pumped 16 hrs at 787 gal/min in 1957. 0-150
77	310732087042301	Brewton Water Works	Layne Central Co., Inc. 1947	661	16 10	Tl	153	22.5 31.6 35.0	2/03/57 11/04/83 4/24/86	T	P	"Hospital" well. Casing: 16 in. from surface to 512 ft; 10 in. from 452 to 517 ft, 537 to 560 ft, and 590 to 641 ft. Screen: 10 in. from 517 to 537 ft, 560 to 590 ft, and 641 to 661 ft. Reported drawdown 231 ft when pumped 6 hrs at 790 gal/min in 1948. 0-95
78	310545087034901	East Brewton Water and Sewage	Layne Central Co., Inc. 1974	710	18 10	Tl	95	-22 -14	9/26/74 7/30/86	T	P	"Highway 29" well. Casing: 18 in. from surface to 615 ft; 10 in. from 540 to 620 ft and 670 to 690 ft. Screen: 10 in. from 620 to 670 ft and 690 to 710 ft. Reported drawdown 16 ft when pumped 4 hrs at 503 gal/min in 1975.
79	310927087034501	Brewton Water Works	Layne Central Co., Inc. 1974	770	18 10	Tl	215	16	1/08/75	T	P	"North Brewton" well. Casing: 18 in. from surface to 565 ft; 10 in. from 485 to 570 ft, 590 to 620 ft, 640 to 666 ft, and 681 to 710 ft. Screen: 10 in. from 570 to 590 ft, 620 to 640 ft, 666 to 681 ft, and 710 to 770 ft. Reported drawdown 55 ft when pumped 8 hrs at 805 gal/min in 1975.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
80	310558087031701	East Brewton Water and Sewage Board	Layne Central Co., Inc. 1949	709	10 8 6	Tl	162	21 31 51.9	1/00/50 5/06/57 7/30/86	T	U	Abandoned well. Casing: 10 in. from surface to 17 ft; 8 in. from 17 to 615 ft; 6 in. from 607 to 618 ft and 638 to 679 ft. Screen: 6 in. 618 to 638 ft and 679 to 709 ft. Reported drawdown 58 ft when pumped 8 hrs at 302 gal/min in 1950. 0-174
81	310528086173501	Alabama Highway Department	Alabama Highway Department 1975	173	4	Tou	255	56.7	3/12/75	S	P	Highway 331 Florala rest area. Casing: 4 in. from surface to 143 ft. Screen: 4 in. from 143 to 173 ft. Reported drawdown 1.7 ft when pumped 15 hrs at 37.5 gal/min on 3/13/75. U-01
82	310220086185601	Florala Water Works and Sewer	Acme Drilling Co., Inc. 1977	315	18 16	Tou To	300	97 96.4 97.2 94.8	6/20/77 11/22/83 6/25/85 6/09/87	T	P	Well 1. Casing: 18 in. from surface to 140 ft; 16 in. from 92 to 142 ft. None below. Reported drawdown 1 ft when pumped 21 days at 310 gal/min in 1977. CC-01
83	310018086192501	Florala Water Works and Sewer	Layne Central Co., Inc. 1961	316	18	Tou To	262	39 35.6 32.4 31.8	3/30/61 11/03/81 11/08/84 6/09/87	T	U	Well 3. Casing: 18 in. from surface to 186 ft. None below. Reported drawdown 5 ft when pumped 8 hrs at 410 gal/min in 1961. CC-3
84	310017086192701	Florala Water Works and Sewer	Layne Central Co., Inc. 1947	597	16 8	Tmb Tl Tt Th	265	38 38.4 38.6	1947 11/23/83 11/08/84	T	P	Well 2. Casing: 16 in. from surface to 320 ft; 8 in. from 277 to 339 ft, 369 to 469 ft, 484 to 510 ft, 530 to 560 ft, and 570 to 582 ft. Screen: 8 in. from 339 to 369 ft, 469 to 484 ft, 510 to 530 ft, 560 to 570 ft, and 582 to 592 ft. Reported drawdown 68 ft when pumped 8 hrs at 350 gal/min in 1947. Used as stand by well in 1987. CC-4

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
85	310045086204801	Lockhart Water Works	---	360	4	Tou	280	70 51.9	1/00/63 7/30/86	T	P	"Old" well. Casing: 4 in. from surface to 110 ft. None below. Reported discharge 250 gal/min in 1963. CC-1
86	310049086205201	Lockhart Water Works	---	---	--	Tou	292	80.5	4/13/83	T	P	"New" well. Well construction undetermined. Reported discharge 145 gal/min in 1963. CC-2
87	310329087040301	Riverview Water Works	Acme Drilling Co., Inc. 1972	442	6 4	Tmu	72	Flowing	2/05/72	T	P	Casing: 6 in. from surface to 362 ft; 4 in. from 318 to 362 ft. Screen: 4 in. from 362 to 442 ft. Reported drawdown 90 ft when pumped 1 hr at 232 gal/min on 2/05/72.
88	310338087101501	McCall Water System	Artesian Well Co., Inc. 1971	700	8 5 4	Tou To	194	---	---	T	P	Well 1. Casing: 8 in. from surface to 600 ft; 4 in. from 570 to 630 ft. Screen: 5 in. from 630 to 660 ft; 4 in. from 660 to 700 ft.
89	310135087102901	Pollard Water System	Acme Drilling Co., Inc. 1981	258	12 6	Tmu	62	0 -5	10/10/81 7/31/86	T	P	Casing: 12 in. from surface to 233 ft; 6 in. from 192 to 233 ft. Screen: 6 in. from 233 to 258 ft. Reported drawdown 25 ft when pumped 24 hrs at 383 gal/min on 10/10/81.
90	310110087150201	Flomaton Water Works	Alton Powell Drilling Co., Inc. 1973	286	12 8 6	Tmu	212	143	3/05/73	T	P	Well 2. Casing: 12 in. from surface to 215 ft; 8 in. from 175 to 218 ft; 6 in. from 229 to 234 ft and 255 to 266 ft. Screen: 6 in. from 218 to 229 ft, 234 to 255 ft, and 266 to 286 ft. Reported drawdown 45.5 ft when pumped 6 hrs at 281 gal/min on 3/05/73.
91	310012087154701	Flomaton Water Works	Gray Artesian Well Co., Inc. 1942	148	10 8	Tmu	75	6.2 7.5	11/04/85 4/23/86	T	U	Abandoned well at church. Casing: 10 in. from surface to 36 ft; 8 in. from 36 to 118 ft. Screen: 8 in. from 118 to 148 ft. Reported discharge 350 gal/min in 1945. X-107

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
92	310013087160501	Flomaton Water Works	Sellers Well and Pump Co., Inc. 1952	141	10	Tmu	79	17	9/10/52	T	P	Well 1. Casing: 10 in. from surface to 102 ft. Screen: 8 in. from 102 to 141 ft. Reported drawdown 15 ft when pumped 1 hr at 760 gal/min in 1953. X-106
93	310005087164801	Flomaton Water Works	Acme Drilling Co., Inc. 1982	266	12 8 6	Tmu	200	124	3/23/82	T	P	Well 3. Casing: 12 in. from surface to 230 ft; 8 in. from 185 to 226 ft. Screen: 6 in. from 226 to 266 ft. Reported drawdown 16 ft when pumped 23 hrs at 457 gal/min on 3/23/82.
94	310133087245201	Canoe Water and Fire Protection Authority	Sellers Well and Pump Co., Inc. 1967	90	6 4	Tmu	285	30	5/22/67	S	P	Casing: 6 in. from surface to 70 ft; 4 in. from 68 to 70 ft. Screen: 4 in. from 70 to 90 ft. Reported drawdown 24 ft when pumped 8 hrs at 160 gal/min in 1967.
95	310019087290601	Atmore Utility Board	Layne Central Co., Inc. 1959	183	24 16 12	Tmu	270	23	1959	T	P	"Lindberg" well. Casing: 24 in. from surface to 103 ft; 16 in. from surface to 113 ft. Screen: 12 in. from 113 to 183 ft. Reported drawdown 35 ft when pumped 8 hrs at 1,022 gal/min in 1959.
96	310149087293902	Atmore Utility Board	------ 1948	250	12 8	Tmu	295	41.8	4/29/48	T	P	"Trammel South" well. Casing: 12 in. from surface to 210 ft; 8 in. from 139 to 207 ft. Screen: 8 in. from 207 to 250 ft. Reported drawdown 13 ft when pumped 36 hrs at 356 gal/min in 1948.
97	310149087293901	Atmore Utility Board	Gray Artesian Well Co., Inc. 1935	130	8	Tmu	295	18 41.1	8/21/45 4/24/86	T	P	"Trammel North" well. Casing: 8 in. from surface to 92 ft. None below. Reported discharge 250 gal/min in 1967.
98	310107087302401	Atmore Utility Board	Acme Drilling Co., Inc. 1981	180	24 16 12	Tmu	275	22	4/11/80	T	P	"Filmore Drive" well. Casing: 24 in. from surface to 117 ft; 16 in. from 57 to 115 ft. Screen: 12 in. from 115 to 180 ft. Reported drawdown 45 ft when pumped 24 hrs at 970 gal/min in 1980.

Table 2.--Records of public water-supply wells in the study area--Continued

Well number	Geographic coordinate number	Well owner	Driller and year drilled	Well depth (feet)	Well diam. (inches)	Water bearing unit	Altitude of land surface	Water level: Above(-) or below land surface	Water level: Date of measurement	Method of lift	Use of well	Remarks
99	310139087310601	Atmore Utility Board	Layne Central Co., Inc. 1967	183	24 16 12	Tmu	285	58 59.5	11/17/67 7/31/86	T	P	"Carpet Road" well. Casing: 24 in. from surface to 109 ft; 16 in. from surface to 113 ft. Screen: 12 in. from 113 to 183 ft. Reported drawdown 26.5 ft when pumped 8 hrs at 800 gal/min in 1967.
100	310132087313901	Atmore Utility Board	Acme Drilling Co., Inc. 1981	149	14 10 8	Tmu	262	47	1/00/81	T	P	"Dee's Drive" well. Casing: 14 in. from surface to 120 ft; 10 in. from 65 to 119 ft. Screen: 8 in. from 119 to 149 ft. Reported drawdown 36 ft when pumped 19.5 hrs at 572 gal/min in 1981.
101	310121087320201	Atmore Utility Board	Acme Drilling Co., Inc. 1981	160	14 10 8	Tmu	275	48	1/00/81	T	P	"Byrne Drive" well. Casing: 14 in. from surface to 130 ft; 10 in. from 82 to 129 ft. Screen: 8 in. from 129 to 160 ft. Reported drawdown 28 ft when pumped 6 hrs at 584 gal/min in 1981.
102	310534087322401	Freemanville Water System Inc.	Griner Drilling Co., Inc. 1982	262	18 10	Tmu	295	49 58.4 52.5	9/15/82 2/08/83 7/31/86	T	P	Casing: 18 in. from surface to 222 ft; 10 in. from 152 to 222 ft. Screen: 10 in. from 222 to 262 ft. Reported drawdown 52 ft when pumped 24 hrs at 524 gal/min in 1983.