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DEPARTMENT OF MINES, MINING AND GEOLOGY

GARLAND PEYTON, Director

THE GEOLOGICAL SURVEY

Bulletin Number 52

GEOLOGY AND GROUND-WATER RESOURCES OF THE COASTAL PLAIN OF EAST-CENTRAL GEORGIA

By

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United States Geological Survey

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LETTER OF TRANSMITTAL

Department of Mines, Mining and Geology

Atlanta, May 7, 1946

To His Excellency, Ellis Arnall, Governor
Commissioner Ex-Officio of State Division of Conservation
Through The Hon. Nelson M. Shipp, Assistant Commissioner

Sir:

I have the honor to submit herewith Georgia Geological Survey Bulletin No. 52, "The Geology and Ground Water Resources of the Coastal Plain of East-Central Georgia," by Philip E. LaMoreaux, Geologist, U. S. Geological Survey.

It was the experience of the Georgia Geological Survey during the war years to receive many requests for strategic ground water information for a number of localities in the State. It has become evident to us of the growing importance of ground water supplies for private, municipal, and industrial demands. A water supply is necessary to even the smallest development. The information in this report should serve to answer the problems concerning ground water in the Coastal Plain area of east-central Georgia.

The report covers the major portion of the hard and soft kaolin mining district of the State. This industry, and many new future industries, will demand large quantities of ground water. Therefore, a knowledge of the ground water resources of this area is of importance for future development in the region. Included with the ground water data is supplemental economic information on fuller's earth, kaolin, and limestone.

It is especially desired to invite your attention to the geologic map of the area covered by this report. This map is considered an outstanding feature of the report, since it portrays the different formations in color and, in addition, designates the location of the producing mines and other economic features.

Very respectfully yours,

GARLAND PEYTON

Director

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GEOLOGY AND GROUND-WATER RESOURCES OF THE COASTAL PLAIN OF EAST-CENTRAL GEORGIA*

By

PHILIP E. LA MOREAUX

Abstract

This report covers an area of about 1,881 square miles in east-central Georgia, including the southern one-third of Jones, Baldwin and Hancock Counties and all of Twiggs, Wilkinson, and Washington Counties. The area is bounded by the Ocmulgee River on the west, the Fall Line on the north, the Ogeechee River on the east and the southern county lines of Twiggs, Wilkinson and Washington Counties on the south. A third river, the Oconee, has a north-south drainage basin in the east-central part of the area.

A major part of the hard and soft kaolin mining district of the State is embraced by this area, and during the period 1941-43 Georgia produced an average of 76.6 percent of the kaolin produced in the United States for filler and ceramic uses. The kaolin industry and lumber milling exert the greatest manpower demand in the area other than farming. Also of importance to the region are its natural resources of limestone, fuller's earth, sand, and gravel.

The area in which a study of the ground water and geology was made is within the Coastal Plain Province, where the strata slope gently to the southeast. Underlying the sedimentary formations of the Coastal Plain are the crystalline basement rocks. The maximum relief in the Piedmont area in northern Baldwin, Jones, and Hancock Counties is about 350 feet and is similar to the relief in the northern part of the Coastal Plain Province in the area of the "Sand Hills" and "Red Hills." South of the "Red Hills" the upland plain tends to be a gently rolling surface which has a maximum relief of about 50 feet, except near the larger rivers where a relief of 150 feet occurs at some places. The area lies in three major drainage basins, which are, in order from east to west, the Ogeechee, Oconee, and Ocmulgee.

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* Prepared under the direction of the United States Geological Survey, in cooperation with the Georgia Geological Survey.

The oldest rocks in the area are the metamorphic and igneous rocks, most of which are of pre-Cambrian age, and which crop out in Jones, Hancock, and Baldwin Counties. These crystalline rocks underlie the Cretaceous and Tertiary formations of the Coastal Plain in this region. The Tuscaloosa formation of Upper Cretaceous age is overlapped by deposits of Jackson age throughout much of the area. Rocks of Paleocene, and lower and middle Eocene age are not represented in east-central Georgia. During late Eocene time, approximately 150 feet to 200 feet of sand, clay, marl and limestone of the Barnwell formation were deposited in a shallow marine sea. Overlying the Barnwell formation in southern Twiggs, Washington and Wilkinson County is a thin residuum of former Oligocene and Miocene formations.

The thick sand and gravel beds of the Tuscaloosa formation are the best source of ground water. Wells in this area range from 15 to 872 feet in depth and yield from a few gallons to as much as 800 gallons of water a minute. The water is used for domestic, stock, municipal and industrial supplies. Many flowing wells have been developed in this aquifer in the flood-plain of the Ocmulgee and Oconee Rivers and their tributaries where topographic and geologic conditions are favorable for artesian flow.

Throughout the outcrop area of the Barnwell formation in east-central Georgia the Irwinton sand member furnishes small supplies of ground water to shallow dug and drilled wells. The primary value of this aquifer is that it is an available source of ground water that may be recovered at a low cost to supply the many small rural, domestic, and stock demands of the area.

The Twiggs clay member of the Barnwell formation becomes calcareous in central and western Washington County. Drilled wells penetrating solution channels in this member recover up to 250 gallons of water a minute. Water from this aquifer generally contains over 200 parts per million dissolved solids. It ranges from 82 to 303 parts per million bicarbonate, and 75 to 252 parts per million total hardness.

The local geographic, geologic, ground-water and quality of water conditions are described in separate sections for each county. Also included in each section are descriptions of representative privately, industrially, and municipally owned wells in the area. Tables of ground-water analyses, well logs, and well data are given in each county section.

INTRODUCTION

Purpose and Scope of Investigation

The present report on the geology and ground-water resources of the Coastal Plain area in east-central Georgia is the first report of a series of systematic investigations that are to be made on the ground-water resources of that part of Georgia in which the Cretaceous deposits are at or near the surface. Bulletin 49, "Artesian Water in Southeastern Georgia," and Bulletin 49-A, "Artesian Water in Southeastern Georgia, Well Records," by M. A. Warren, were published in 1944 and 1945. These reports furnish information on the geology, quantity, quality and occurrence of the ground-water resources. Studies by S. M. Herrick of the ground-water resources of the northern half of Georgia are also in progress. These investigations are being made in cooperation between the Department of Mines, Mining and Geology, Georgia State Division of Conservation and the Geological Survey, U. S. Department of the Interior.

The work is under the general supervision of O. E. Meinzer, Geologist in charge of the Division of Ground Water of the Geological Survey, and Captain Garland Peyton, Director of the Department of Mines, Mining and Geology of the Georgia State Division of Conservation.

Location and Extent of the Area

The area described in this report includes the southern one-third of Jones, Baldwin, and Hancock Counties and all of Twiggs, Wilkinson and Washington Counties. The area is bounded on the east by the Ogeechee River, and on the west by the Ocmulgee River. It is approximately 55 miles long and 20 miles wide, and covers 1,881 square miles. See figure 1.

Field Work

The field work for the report was begun April 1944 and was completed in January 1945. Well records were obtained for 401 wells that furnish water supplies for municipal, industrial, domestic and farm use. These records were compiled from field observations and interviews with well owners and drillers. No attempt was made to obtain records of every well in the area, but attention was given to every town and village supply, and representative well records were obtained throughout the area. Considerable time was spent in re-mapping the geology of the area covered by this report, using as a nucleus the "Strategic Minerals Investigations Preliminary Maps," for the bauxite and kaolin deposits of Twiggs, Washington, and Wilkinson Counties, published by the Geological Survey, U. S. Department of the Interior in 1943. A major part of the time in the field was devoted to the study of the water-bearing formations. Water

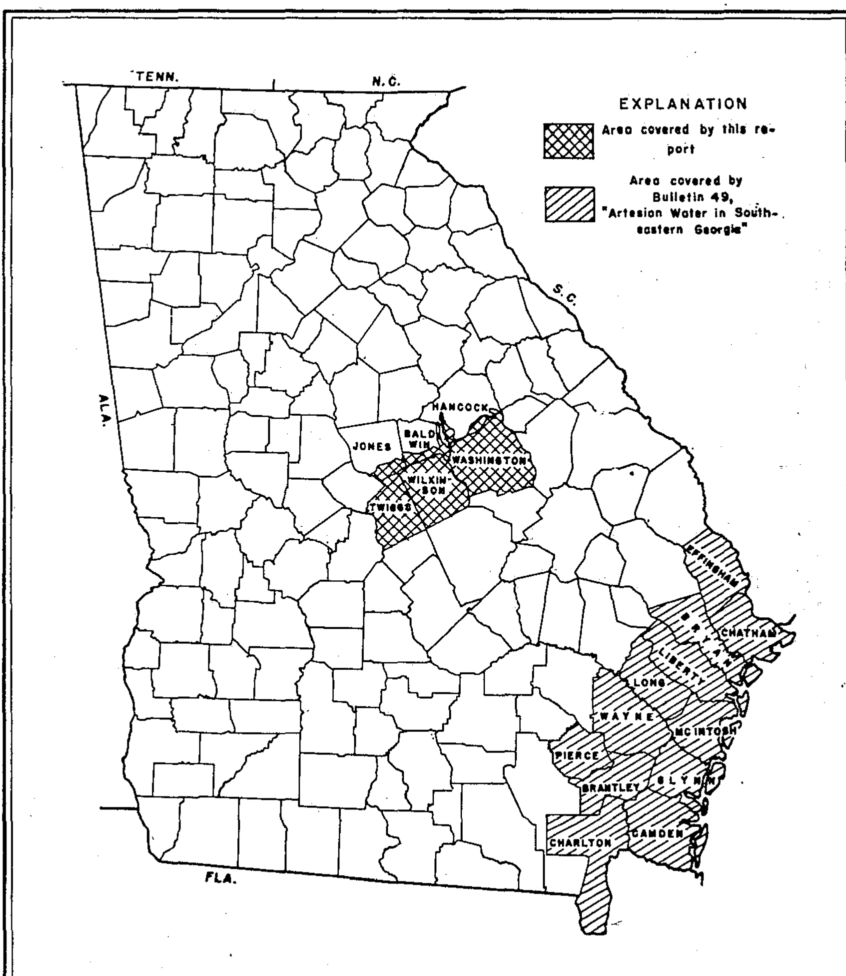

Figure 1. Index map of Georgia showing area covered by this report and area for which cooperative ground-water reports of this series have been published.

samples were collected from 81 wells, and from these, 12 complete chemical analyses and 69 partial analyses were made by Evelyn Holloman, G. W. Whetstone, Wesley M. Noble and W. L. Lamar in the laboratory of the U. S. Geological Survey.

Supplementary data on kaolin, limestone, and fuller's earth were collected for the area and included in the report. Limestone, fuller's earth and kaolin deposits were plotted on plate 1 in the area in east-central Georgia not included in the Strategic Minerals Investigations Maps.

Previous Investigations

The results of the first studies of the geology and ground-water resources of east-central Georgia were published in 1898 by McCallie in a preliminary report on the artesian-well system of Georgia. In it data on eight artesian wells in Washington and Wilkinson Counties were given. In 1909 a second report relating to the ground water of the whole State was published by McCallie. Six years later, in 1915, U. S. Geological Survey Water-Supply Paper 341, by L. W. Stephenson and J. O. Veatch, on the ground waters of the Coastal Plain of Georgia, included information on all six of the counties in the area of this report. Water-Supply paper 912, by William L. Lamar, published in 1940, included data on the industrial quality of water used for the public supplies at Milledgeville, Baldwin County, and Sandersville, Washington County.

An early report on the geology of the area was prepared by Veatch and Stephenson and published in Bulletin 26 of the Georgia Geological Survey in 1911. Cooke and Shearer, in 1918, made a study of the deposits of Claiborne and Jackson age in Georgia, which was published as U. S. Geological Survey Professional Paper 120. In 1943 another report on the geology of the Coastal Plain of Georgia by C. Wythe Cook was published as U. S. Geological Survey Bulletin 941. The Strategic Minerals Investigations Preliminary Maps of Twiggs, Washington, and Wilkinson Counties, Georgia, by W. C. Warren and R. M. Thompson were published in 1943 by the U. S. Geological Survey.

As a basis for locating wells and plotting the geologic and hydrologic features of the area, the county highway maps prepared in 1939 and 1940 by the State Highway Board of Georgia in cooperation with the Federal Works Agency, Public

Road Administration, were used. These maps were supplemented by information from the Milledgeville and Irwinton quadrangles, U. S. Geological Survey topographic maps, and by aerial photographs of parts of Washington, Hancock, and Baldwin Counties.

The following bibliography lists some of the reports that contain information on the geology, geography, and groundwater of east-central Georgia. Specific references are cited at the appropriate places in the text.

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Acknowledgments

The writer is indebted to Captain Garland Peyton, State Geologist, for helpful suggestions and assistance in the preparation of the report; also to his staff in furnishing technical help and information bearing upon the area.

This report would not have been possible without the cooperation of well drillers, well owners, and superintendents of the town water works throughout the area. The information made available by these persons has been most valuable in the interpretation and understanding of the ground-water conditions of east-central Georgia. The writer is especially indebted to W. S. Beiser, Layne-Atlantic Company, Savannah, Georgia, for furnishing information on pumping tests, well installations, well logs and well samples for wells in Washington County. Acknowledgment is also due well drillers Walter Smith, of Tennille; Mark Hall, of Bartow; Barney Dean, of Toomsboro; O. D. Tindall, of McIntyre; and Will Hammock, of R. F. D. 4, Macon. O. D. Holliman, master mechanic for Edgar Brothers, at McIntyre, was very helpful in supplying information on the Company's well field in Wilkinson County. A. R. Mohr, plant superintendent, assisted in giving well data for the Edgar Brothers processing plant at Gardners, Washington County. L. H. Ledford, County Sanitarian, furnished much information on the water supply systems at the public schools in Washington County. E. G.

Dallmus, Chief Maintenance Engineer, supplied the data on the Georgia Kaolin Company's well field at Dry Branch, Georgia.

Among the many citizens of the area who helped in this study are: R. W. Culpepper, J. W. Boone, and T. A. Brundage of Irwinton; George Rawlings and E. P. Wood, of Sandersville; G. E. Mertz, of Tennille; W. C. Wilson, of Davisboro; Frank Lawson, of Huber; and E. R. Hamrick, of Jeffersonville.

Constructive help was received from O. E. Meinzer, V. T. Stringfield, C. W. Carlston, H. H. Cooper, Jr., C. Wythe Cooke, F. S. MacNeil, and S. M. Herrick, of the U. S. Geological Survey; R. W. Smith, of the U. S. Bureau of Mines; and R. M. Harper, of the Alabama Geological Survey.

GEOGRAPHY

Physiographic Divisions

The area described by this report lies within the Coastal Plain and is bounded on the north by the Piedmont Province. In Georgia where the streams descend from the resistant pre-Cambrian crystalline rocks of the Piedmont to the less resistant sands and clays of the Coastal Plain, a zone of falls is present in the courses of the streams. This transition zone, or zone of falls, is called the Fall Line. It ranges from 5 to 10 miles in width and forms a very irregular boundary between the Coastal Plain and the Piedmont.

Otto Veatch[1] in 1911 first used the terms "Fall Line Hills" in reference to two types of hilly upland at the northern edge of the Coastal Plain, the "Sand Hills" and the "Red Hills," which form a northeast-southwest belt across the State at the northern part of the Coastal Plain.

In 1884 R. H. Loughridge[2] used the term "Sand Hills" and "Red Hills" in a report on the cotton production of the State of Georgia. Later, in 1922, R. M. Harper[3] used the same terms on

[1] Veatch, Otto, and Stephenson, L. W., Preliminary report on the geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, pp. 28-30, 1911.

[2] Loughridge, R. H., Report on the Cotton production of the State of Georgia, Tenth Census, vol. 6, pp. 259-307, 1884.

[3] Harper, Roland M., A new method of mapping complex geographic features, illustrated by some maps of Georgia: School Science and Mathematics, vol. 18, pp. 699-702, November, 1918.

a regional map of the southeastern United States to designate the two physiographic divisions included by Veatch[4] in the "Fall Line Hills" region in Georgia. The same terminology is used in this report, and the Coastal Plain Province in east-central Georgia is subdivided into three physiographic divisons based on topography, underlying geologic formations, and soil. The divisions are: the "Sand Hills," "Red Hills," and the "Tifton Upland." The areal extent of these divisions is shown in figure 2.

Sand Hills

The Sand Hills represent the area in which the Tuscaloosa formation crops out in east-central Georgia. These hills form a belt 2 to 8 miles wide along the northern margin of the Coastal Plain except where the Eocene deposits overlap the Tuscaloosa formation. At the place of this overlap, the "Red Hills" project across the Sand Hills to the Piedmont. This makes the Sand Hills area discontinuous at places in Jones, Baldwin, and Hancock Counties.

The relief in the Sand Hills area rarely exceeds 100 to 150 feet, and the broad rolling hills with gentle slopes present no sharp topographic features. The soils are light-colored sand and sandy loams which are productive if properly fertilized. The drainage is to the southeast and southwest in the Sand Hills area, and the drainage pattern is dendritic.

Red Hills

The Red Hills are typically developed in Washington, Wilkinson, and Twiggs Counties, forming a belt of hills about 20 miles wide across east-central Georgia. In southern Jones, Baldwin, and Hancock Counties the Red Hills project across the Sand Hills area to the Piedmont, forming long outliers of Jackson age, which extend as far as 12 miles into the Piedmont Province.

The Red Hills are typically a series of hills, remnants of a former upland plateau, capped by brilliant red sand and sandy loams, a residual product of weathering from Eocene rocks. In the northern part of the Red Hills area the former upland plateau has been cut by streams into a series of elongated north-

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[4] Veatch, Otto, and Stephenson, L. W., Preliminary report on the geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, pp. 28-30, 1911.

east-southwest and northwest-southeast trending hills, on which little of the original surface remains. In the southern part of the Red Hills area some of the upland surface remains and the hills broaden out, losing their elongated characteristics. In the central and southern part of the area where the three members of the Barnwell formation are present, a clay bed ranging in thickness from four to six feet in the top of the Irwinton sand member tends to hold up the original surface of the Eocene rocks. Where this clay bed is cut by erosion the high altitude of the upland plain above the rivers and streams and the weak character of the Irwinton sand member make ideal conditions for deep gullying. Gullies of 100 feet in depth occur at several localities in the Red Hills south of Georgia Highway 24 in Washington County.

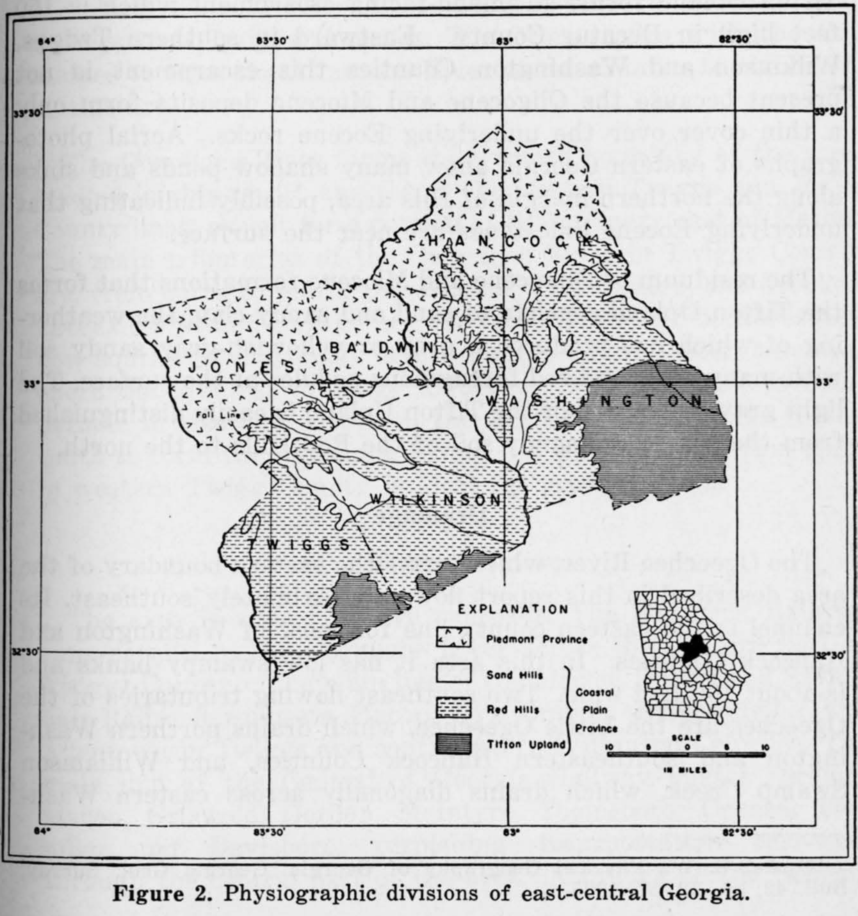

Figure 2. Physiographic divisions of east-central Georgia.

In east-central Georgia the relief in the Red Hills rarely exceeds 200 feet, although in southeastern Wilkinson and southwestern Washington Counties 250 feet of relief occurs at a few places. The drainage in the Red Hills is to the southeast and southwest, and the drainage pattern is dendritic.

Tifton Upland

The Tifton Upland[5] is south of the Red Hills. The topography consists chiefly of gently rolling hills with broad, rounded summits originally covered with forests of long-leaf pine. There is no parallelism of ridges as exhibited by the Red Hills and the relief rarely exceeds 50 feet. There is little dissection by streams, and it is only near the larger rivers that the slopes become steeper. In southwestern Georgia the northern limit of the Tifton Upland forms an inland-facing escarpment which is 150 feet high in Decatur County. Eastward in southern Twiggs, Wilkinson and Washington Counties this escarpment is not present because the Oligocene and Miocene deposits form only a thin cover over the underlying Eocene rocks. Aerial photographs of eastern Georgia show many shallow ponds and sinks along the northern margin of this area, possibly indicating that underlying Eocene limestones are near the surface.

The residuum of Oligocene and Miocene formations that forms the Tifton Upland consists of sand and sandy clay, the weathering of which has produced a gray or yellowish-gray sandy soil with many scattered red ferruginous nodules at the surface. The light gray-yellow soil of the Tifton Upland is easily distinguished from the coarse red sandy soil of the Red Hills to the north.

Drainage

The Ogeechee River, which forms the eastern boundary of the area described in this report flows approximately southeast. Its channel is the eastern county line for most of Washington and Hancock Counties. In this area it has low swampy banks and is about 100 feet wide. Two southeast flowing tributaries of the Ogeechee are the Little Ogeechee, which drains northern Washington and southeastern Hancock Counties, and Williamson Swamp Creek, which drains diagonally across eastern Wash-

[5]Cooke, C. W., Physical Geography of Georgia, Georgia Geol. Survey, Bull. 42, pp. 36, 37, 1925.

ington County. The Ogeechee flows southeast across Georgia from south-central Washington County into St. Catherine's Sound and the Atlantic Ocean about 25 miles south of Savannah.

Although the Oconee River is not the largest river in the area covered by this report, it exerts the greatest drainage influence, because its entire drainage basin lies almost entirely therein. This river is about 200 feet wide and has low swampy banks. At some places in eastern Wilkinson and western Washington Counties the Oconee River flood plain is 5 to 6 miles wide. Southwest-flowing tributaries of the Oconee River in southwestern Hancock and western Washington Counties are Town, Gumm, Bluff, and Buffalo Creeks. Of these four, Buffalo Creek is the largest. Two large southeast-flowing tributaries, Commissioners and Big Sandy Creeks, flow into the Oconee River and drain all of Wilkinson, Baldwin, southeastern Jones, and northeastern Twiggs Counties. The Oconee joins with the Ocmulgee to form the Altamaha River about 45 miles to the south of this area.

The Ocmulgee River forms the western boundary of the area studied in this report and forms the western Twiggs and Jones County lines, except for a portion of Bibb County east of Macon. The main tributaries of the Ocmulgee River in Twiggs County are, from north to south, Dry Branch, Flat, Savage, and Crooked Creeks. Flat and Savage are the most important because they flow southwest diagonally across Twiggs County, and, therefore, exert the greatest drainage influence. The Ocmulgee is comparable in size and nature to the Oconee which it joins to the south to form the Altamaha River. Its wide swampy flood plain in western Twigg County is ideal for growing timber.

Transportation

The area is served by five railroads. The Southern Railway runs parallel to the Ocmulgee River across the western half of Twiggs County. The main line of the Macon, Dublin and Savannah Railroad connects Macon, Dry Branch, Jeffersonville, and Allentown in Twiggs and southwestern Wilkinson Counties. The main line of the Central of Georgia Railway passes through Macon, Griswold, Gordon, McIntyre, Toomsboro, Oconee, Tennille, and Davisboro, furnishing transportation east-west through the central part of the area. A branch of the Georgia

Railroad runs northeast from Macon, and connects James, Milledgeville, Devereux and Sparta, furnishing railroad transportation along the northern margin of the region. The Sandersville Railroad connects Sandersville with Tennille and Wrightsville, and the Tennille Railroad passes through Harrison and makes connections to the south with the Macon, Dublin, and Savannah line in Dublin and with the Southern Railway system at Empire.

The area is fairly well covered by a network of paved highways. U. S. Highway 80 and Georgia Highway 19 link Allentown, Danville and Jeffersonville with Macon and other outside points. The Cochran Short Route (Georgia Highway 87) traverses western Twiggs County and connects Macon to the north with Cochran to the south. Georgia Highway 22 extends northeast to Macon, Milledgeville, Devereux, Sparta and points northeast. Georgia Highway 24 passes through Milledgeville, Sandersville, and Davisboro, and Georgia Highway 29 completes the paved network by connecting Milledgeville with McIntyre, Irwinton, and Dublin. Graded roads connect all other towns within the area, although in rainy weather some of the rural roads become nearly impassable in places.

Population

According to the federal census of 1940[6], the six counties had a total population of 89,657 and an average density of population of only 33.8 inhabitants per square mile, as compared with 53.4 for the entire State. Washington County leads the area with a total population of 24,230 inhabitants, although Baldwin County is most densely populated, having 91.3 persons per square mile. Jones County is the most sparsely populated county in the area.

Milledgeville is just north of the Fall Line in central Baldwin County, and has a population of 6,778. Sandersville, in central Washington County, with 3,566 inhabitants, is the largest town in the Coastal Plain in east-central Georgia. Only three other towns in the six counties have a population of more than 1,000; they are in order of their size: Sparta, Tennille, and Gordon.

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[6] All 1940 population figures and agricultural statistics obtained from U. S. Department of Commerce, Bureau of Census, Sixteenth Census of the U. S. 1940.

Agriculture

Approximately 65 percent of the total land area in the six counties was devoted to farm land in 1940. Washington and Baldwin Counties ranked first and second with 78 percent and 74 percent of their total area in farms, and Jones last with 53.3 percent in farm land.

General farming and dairying are the leading occupations in the area, but much poultry farming is carried on in Washington, Hancock, and Wilkinson Counties. The principal crops of the area are corn and cotton, but legumes, sugar cane, winter wheat and oats are also of importance. Cattle raising is gaining importance in the area, and the older herds are being improved by the introduction of better breeds. The dairy farms of Baldwin and Washington Counties produced over two million gallons of milk in 1939.

Natural Resources and Industries

East-central Georgia is well endowed with natural resources. It has a plentiful artesian water supply, hard and soft kaolin, fuller's earth, limestone, bauxite, sand, gravel, and timber.

The coarse sand and gravel beds of the Tuscaloosa formation constitute the most productive aquifer in the area. Nearly all the large private, industrial, and municipal wells in the area draw water from this source. Of greatest importance to the rural inhabitants of this area is the Irwinton sand member of the Barnwell formation, because its shallow water-bearing sands provide water to many shallow drilled and dug wells throughout the area. The calcareous facies in the upper part of the Barnwell formation yields quantities of water high in total hardness to many wells in east-central Washington County. The upper sand member of the Barnwell formation furnishes some water to shallow dug wells in the southern part of the area.

During the period 1941-43 Georgia produced an average of 76.6 percent of the China clay or kaolin sold or used by producers in the United States. In 1943, 732,590 short tons, or 78.8 percent of the national output of kaolin was mined in Georgia, a major portion of which was from mining operations in Washington, Wilkinson and Twiggs Counties. Of this national output of kaolin, 59 percent was consumed as a filler by the paper industry, 16 percent by refractories, 9 percent for pottery, and the remainder was used in rubber, paints, cement, high-grade tile, linoleum, kiln furniture, and other products.[7]

Fuller's earth is mined at Pikes Peak, Twiggs County, by the General Reduction Company, and intermittently near Irwinton, Wilkinson County, at the Carswell Estate. The fuller's earth from east-central Georgia is mined from the Twiggs clay member of the Barnwell formation, which ranges in thickness from 25 feet in Washington County to nearly 80 feet in the Pikes Peak area. Most of the fuller's earth of the Twiggs clay is used in bleaching animal and vegetable oils.[8]

Two great demands for limestone are for the manufacture of Portland cement and as an agricultural lime. Previous to this date little limestone has been mined from the six counties within the scope of the report, although there are within the area two localities at which limestone of sufficient calcium and magnesium carbonate content is overlain by so little overburden as to be commercially valuable. A favorable area for prospecting limestone can be found in the uplands just east of Georgia Highway 87 south from Huber to Tarversville in Twiggs County. L. H. Turner, Chemist for the Department of Mines, Mining and Geology of Georgia, made an analysis of a sample of limestone from a quarry 2.1 miles southwest of Sandersville, Washington County, Georgia. This sample contained 92.56 percent calcium carbonate and 1.07 percent magnesium carbonate, and meets the usual specifications for an agricultural lime.

In 1943 the U. S. Geological Survey made a detailed study[9] of the bauxite deposits of Wilkinson County, Georgia. This study estimated bauxite reserves of commercial grade at 25,000 tons and possible reserves of 500,000 tons of material containing 45 per cent or more of Al_2O_3 and 30 percent or less of SiO_2. The bauxite in Wilkinson County occurs in small- and medium-sized kaolin lenses in the upper 20 feet of the Tuscaloosa formation. The most favorable area for prospecting was found to be in the vicinities of Cowpen, Lindsey and Water Ford Branches in the lower part of Big Sandy Creek, and along Dry Branch, Edmonds

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[7] Josephson, G. W., and Linn, A., U. S. Bureau of Mines, Mineral Market Report No. 1163, April 17, 1944.

[8] Mineral resources of Georgia, Geol. Survey of Georgia, 1938.

[9] Warren, W. C., and Thompson, R. M., Bauxite and kaolin deposits of Wilkinson County, Georgia: U. S. Geol. Survey Strategic Minerals Investigations Preliminary Maps, 1943.

Branch and in the area of Toomsboro, Georgia, along the lower part of Commissioners' Creek.

No large deposits of sand and gravel are developed in east-central Georgia, although enough for local supplies can be found at several localities in Twiggs, Wilkinson, and Washington Counties. Fair-sized deposits of light gray, medium- to coarse-grained sand are found along Big Sandy Creek three miles south of Irwinton, Wilkinson County, and in northern Twiggs County. Throughout this area there are other deposits of sand and gravel, although lack of easy transportation makes their development impractical for any large-scale operations.

Excellent timber-growing conditions exist in the area and large tracts of timber grow in the flood plains of the Ocmulgee, Oconee and Ogeechee Rivers, and in the uplands in the Red Hills and Sand Hills area in east-central Georgia.

Climate

East-central Georgia is in an area characterized by a humid, temperate climate with rainfall normally adequate at all seasons. The climate of the area is favorable to the growth of many varieties of crops. Following the winter rains is a drier period during the spring and early summer when cotton and other crops need warmth and little rainfall. The summer rains fall during July and August, at a time when moisture is needed for the growing crops. The lowest rainfall is during September, October, and November, in the fall of the year at harvest time.

A graphic summary of the climate of the Middle Division of Georgia, showing data collected by the United States Weather Bureau at Milledgeville, Baldwin County; and Harrison, Washington County, is presented in Figure 3. In the upper part of the chart three curves represent the average monthly, average highest, and average lowest monthly temperatures in the atmosphere over a 53-year period, 1892-1944. Below the curves two straight lines represent the average length of the growing season at Milledgeville and Harrison, Georgia. The length of these lines is determined by the earliest and latest date in the year on which the temperature was recorded below 32 degrees Fahrenheit. The bar graphs at the bottom indicate the highest, lowest, and mean precipitation for each month, based on data from 1892 to 1944.[10]

Temperature

In the middle climatic division of Georgia the annual mean temperature of the atmosphere is 61.1°F. The lowest temperature during 1944 at Milledgeville, Georgia, was for December, 44.4°F., a departure of —2.9°F. from normal. The highest monthly temperature was for June, 79.6°F., a departure of +0.6°F. from normal. The highest temperature at Milledgeville during 1944 was 100°F., recorded on June 24, 1944. The lowest, 15°F., was recorded on December 3 and 15, 1944. The frost-free, or average growing, season at Milledgeville is from March 20 to November 8, or 233 days long; and at Harrison, the average growing season is from March 29 to November 3, or 219 days long. The longer average growing season at Milledgeville may be explained by the shorter period over which the Harrison Weather Bureau station has been in operation.

Precipitation

The average annual precipitation in 1944, recorded at both Milledgeville and Harrison, Georgia, was 47.32 inches. At Milledgeville in 1944 the greatest monthly rainfall was 10.90 inches during March, and the least monthly rainfall, 1.68 inches, fell in November. During 1944, the Milledgeville weather station recorded 49.93 inches of rainfall, showing a slight increase in precipitation above the average for 1943. The driest year recorded over a 53-year period from 1892 to 1944 for the middle climatic division of Georgia was 1904 when only 33.81 inches of rainfall was recorded for the year. The greatest annual precipitation for this same period was 71.82 inches recorded during 1929.

Table 1 shows the rainfall data for the middle climatic division of Georgia by five-year periods, 1892-1944. This table shows: the five-year mean rainfall; cumulative rainfall average from September 1 to November 30, the three driest months; and the cumulative rainfall averages from December 1 to March 31, the

[10] Climatological data obtained from the climatological report on the "Georgia Section," by R. L. Cornelius, and A. J. Knarr, U. S. Department of Commerce, Weather Bureau, vol. 48, nos. 1-13, 1944.

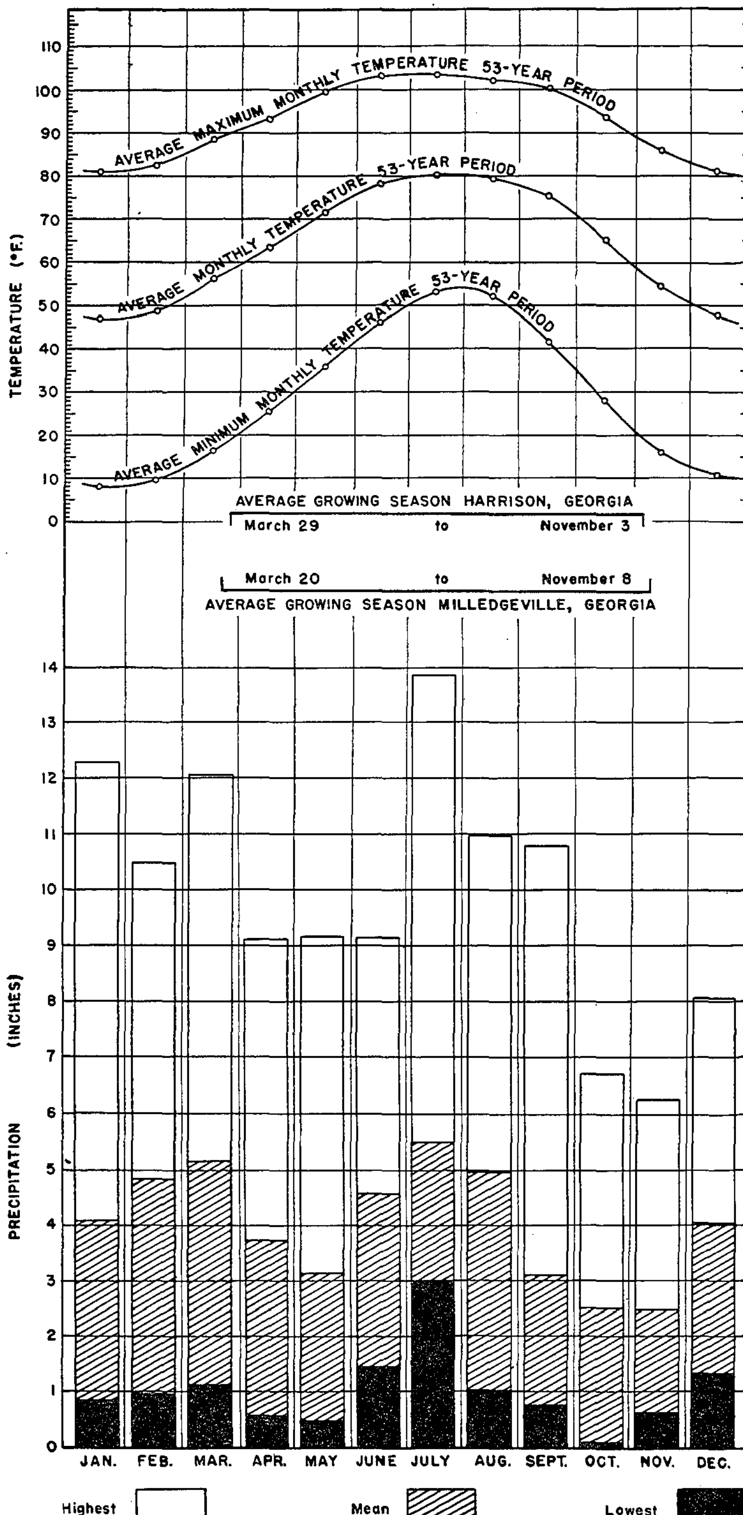

Figure 3. Climatic summary for Milledgeville and Harrison, Georgia. Records precipitation, temperature, growing season for 53-year period, 1892 to 1944. Based on records of the Milledgeville and Harrison stations of the U. S. Weather Bureau.

four months period in which this area receives its greatest precipitation. This period of winter rains may be regarded as the time in which the ground-water supply is most rapidly recharged. The winter precipitation consists for the most part of gentle, steady rainfall, seldom exceeding 1.5 inches a day and occurring during 8 to 15 days out of each of the four winter months. In this area the soil is seldom frozen for any great length of time in the winter and because of the nature of the winter rainfall the precipitation tends to soak into the soil and penetrate downward into underlying formations, replenishing the ground-water resources. Most of the summer rains during July and August are a result of the warm, moist, tropical Gulf air, which is highly unstable, being deflected upward by convectional currents caused by solar heating of the land surface. These summer rains are more torrential in nature, 2 and 3 or more inches of precipitation often falling in a day, and instead of penetrating to the soil and underlying formations, a large part of it leaves the area through surface channels.

Table 1. Precipitation Data for Middle Division By Five-Year Periods, 1892-1944

Period	A. Cumulative Rainfall Averages for 4 Months Period. Jan.-Feb.-Mar. & Dec.	B. Cumulative Rainfall Average for 3 Months Period Sept.-Oct. & Nov.	C. Cumulative Rainfall Average for 2 Months Period July & August	D. Five Year Mean of Annual Rainfall
1892-1896	18.25	7.51	12.48	47.66
1897-1901	18.83	8.92	11.21	49.74
1902-1906	18.64	7.74	10.23	46.04
1907-1911	16.17	9.00	9.43	46.80
1912-1916	16.74	9.73	11.13	48.26
1917-1921	17.65	9.01	11.61	48.06
1922-1926	21.03	8.26	7.98	49.42
1927-1931	18.37	9.80	10.11	50.19
1932-1936	17.20	8.35	9.87	46.43
1937-1941	16.57	5.45	11.09	45.04
1942-1944	22.19	7.64	9.34	51.87

GENERALIZED GEOLOGIC SECTION OF ROCKS IN EAST CENTRAL GEORGIA AND THEIR WATER BEARING PROPERTIES

SYSTEM	SERIES	FORMATION	SYMBOL	SECTION	THICKNESS	CHARACTER OF ROCKS	WATER BEARING PROPERTIES
QUATERNARY	RECENT	Alluvium	Qal		0-50'	Undifferentiated terrace and alluvial deposits consisting of silt, clay, sand and gravel.	Supplies ground water to many shallow dug, driven and drilled wells in the flood-plain area of the Ocmulgee, Oconee and Ogeechee rivers and their tributaries.
TERTIARY	MIOCENE AND OLIGOCENE	Residuum	Thf		60'±	Pink, tan, and gray mottled sandy clay. Probably represents a residuum of former Oligocene and Miocene formations. In southern Washington County — coarse angular sand and fine gravel in a green clayey matrix.	Furnishes very limited supplies of ground water to shallow dug wells in southern Washington, Wilkinson and Twiggs Counties.
	EOCENE (UPPER)	Barnwell formation: Upper sand member	Tj		25'±	Red and brown coarse quartz sand, contains many flat rounded beach pebbles scattered along base of bed.	Supplies a few dug wells in the southern part of the area covered by this report with a limited supply of 2 to 15 gallons of water a minute.
		Barnwell formation: Irwinton sand member			50'±	Gray waxy clay mottled red. Bed ranges from 2-4 feet thick. Light gray and yellow fine to coarse quartz sand interbedded with thin layers of gray and yellow clay. May merge into Sandersville limestone member of the Barnwell formation in central Washington County.	Many shallow dug and drilled wells in area covered by this report recover small domestic and stock supplies from this aquifer. These wells produce from 3 to 15 gallons of water a minute. Water of good quality.
		Barnwell formation: Twiggs clay member			45'	Pale green hackly fullers earth clay with thin white angular quartz sand streaks. Becomes calcareous in eastern Washington County, and may grade upward into Sandersville limestone, member of the Barnwell formation.	In central and eastern Washington County many drilled wells penetrate solution cavities in this member and recover up to 250 gallons of water a minute. Water from this aquifer is relatively high in dissolved solids and total hardness.
					10'	Gray, hackly sandy marl. Very fossiliferous. Ocala limestone (Tivola tongue) interfingers from west.	No record of wells producing from this bed.
					12'	Yellow calcareous sand.	
	?	? Channel sand			0-20'	Channel sands, pink and white medium to coarse quartz sand with many scattered kaolin particles.	Dug wells recover limited supplies of 2 to 6 gallons of water a minute from this aquifer. Water of low mineral content.
CRETACEOUS	UPPER CRETACEOUS	Tuscaloosa formation	Kt		200-600'	Alternating beds of light colored white, gray, tan, purple fine to coarse micaceous sand, sandy clay, and clay. Scattered stringers of gravel and lenses of kaolin.	Supplies many dug wells in the outcrop area of the formation. Furnishes up to 800 gallons a minute to domestic, municipal and industrial wells in southern half of east central Georgia. Water of good quality.
PRE-CRETACEOUS	CRYSTALLINE		pre Kt			Schist, biotite gneiss and granite gneiss of probable pre-Cambrian age, and porphyritic, muscovite and biotite granite of Paleozoic age injected at some localities by dolerite dikes of Triassic age.	Supplies small private, industrial and municipal wells. Individual wells rarely produce over 50 gallons a minute.

Figure 4. Generalized section of the geologic formations in east-central Georgia.

OUTLINE OF GEOLOGY

A generalized section of the geologic formations of east-central Georgia and a generalized statement with regard to the groundwater conditions existing for each formation are shown in Fig. 4.

The oldest rocks exposed in east-central Georgia bordering the area of this report on the north are the metamorphic and igneous rocks of pre-Cretaceous age, which are present in the Piedmont Province in the northern three-quarters of Jones, Baldwin, and Hancock Counties. The contact of the crystalline rocks with the overlying Coastal Plain sediments and the Coastal Plain formations was mapped.

Following the final metamorphism and uplift of the crystalline rocks a long period of erosion took place throughout all but the last or the Upper Cretaceous epoch of the Mesozoic era. During this time the surface of the crystalline rocks was reduced to a peneplane.

The Tuscaloosa formation of Upper Cretaceous age lies unconformably on the peneplaned crystalline rocks and crops out in a discontinuous belt from 2 to 8 miles wide along the northern margin of the Coastal Plain.

Throughout most of east-central Georgia the beds of clay, sand and gravel of the Tuscaloosa formation are overlapped by deposits of upper Eocene age, for rocks of Paleocene and early, middle, and lower Eocene age are not present in much of the area. During late Eocene time, approximately 150 to 200 feet of sand, clay, marl, and limestone were deposited in a shallow marine sea. These upper Eocone deposits which lie unconformably on the Tuscaloosa formation represent the Barnwell formation, which contains the basal Twiggs clay member, the Irwinton sand member, and a thin overlying sand bed, tentatively included as the upper sand member This sand bed may prove to be of Oligocene age. The basal Twiggs clay member of the Barnwell formation is typically composed of pale green hackly clay which grades into gray marl and calcareous sand. The Irwinton sand member is composed of light-gray and yellow loose sand with thin interbedded clay layers. The upper sand member is a thin bed of coarse angular sand with flat polished beach pebbles, present in the upper 10 to 15 feet of the Eocene deposits in this area.

The Irwinton sand and Twiggs clay members of the Barnwell formation are represented by less distinctive deposits in the Barnwell formation farther east. The Twiggs clay may be equivalent to the Santee limestone of South Carolina. The Irwinton sand together with the Twiggs clay merges laterally into the upper part of the Ocala limestone in the western half of Georgia.

Undifferentiated deposits of Miocene and Oligocene age lie uncomformably on beds of Jackson (upper Eocene) age in southern Washington, Wilkinson, and Twiggs Counties.

GENERAL GROUND-WATER CONDITIONS

Source of Ground Water

Ground water is the water below the land surface that issues from or may be pumped from springs or wells. In east-central Georgia ground water is derived almost entirely from precipitation in the form of rainfall, supplemented by an occasional light snowfall during the winter. Atmospheric water in the form of rain or snow falling on the earth's surface begins a hydrologic cycle. After leaving the atmosphere and falling on the earth, some of the water runs off the surface in the form of creeks and rivers, and eventually reaches the ocean. Some of the water falling on the earth's surface seeps into the soil and begins to percolate downward below the land surface. A classification[11] of divisions of subsurface water is shown in figure 5.

Suspended water, or vadose water, is the water in the zone of aeration which lies between the land surface and the zone of saturation. The water passing below the surface into the zone of aeration tends to percolate down into the zone of saturation due to the force of gravity. Counteracting the downward force of gravity in the zone of aeration are the molecular forces which tend to hold the vadose water in suspension and retard its progress toward the zone of saturation. The hydrologic cycle may be shortened by the evaporation or transpiration of surface water or subsurface water and its return to the atmosphere before it reaches the zone of saturation. Some of the water, however, percolates down to the zone of saturation and becomes ground water.

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[11] Meinzer, O. E., Outline of ground water hydrology, U. S. Geol. Survey Water Supply Paper 494, pp. 11-30, 1923.

The term ground water is used to designate the water in the zone of saturation. The upper surface of the zone is called the water table. The ground water feeds the springs, which maintain the fair-weather flow of the streams. Although wells may

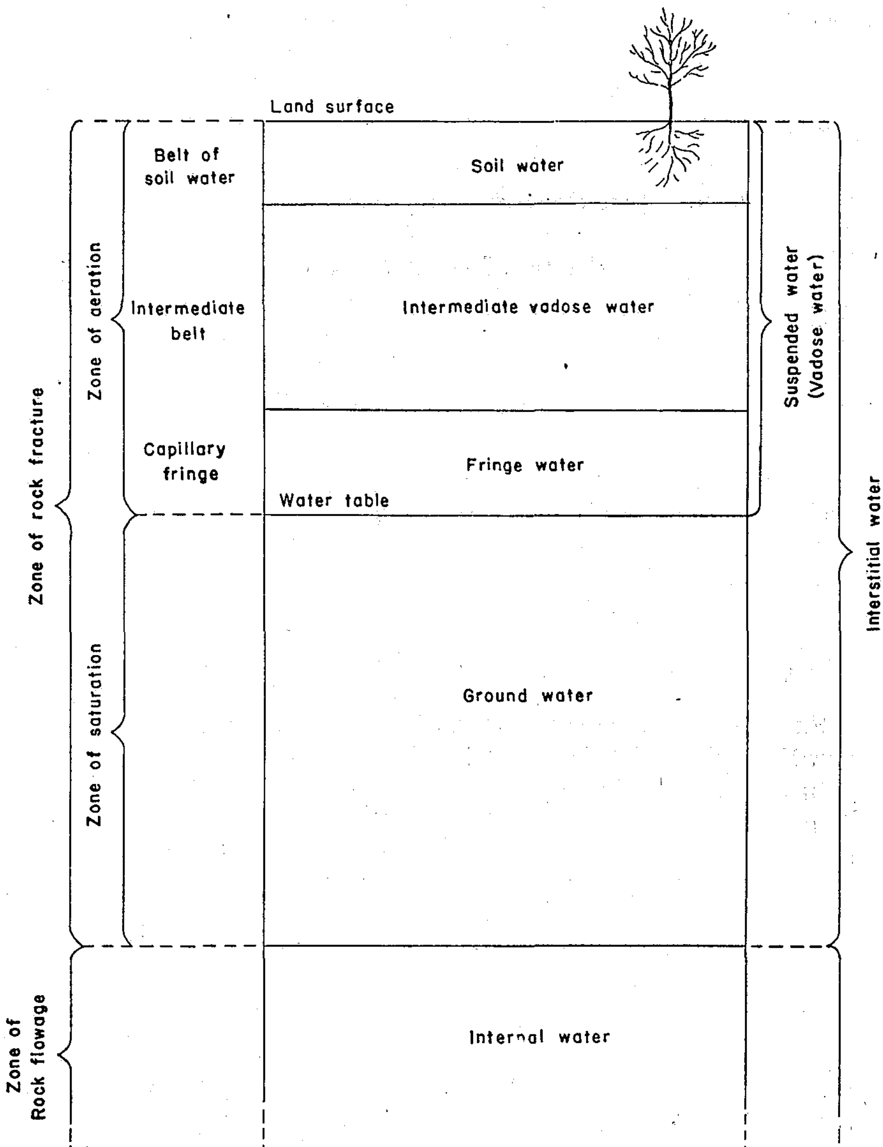

Figure 5. Diagram showing divisions of subsurface water (After O. E. Meinzer, Figure 2, U. S. Geological Survey, Water Supply Paper 494).

penetrate materials which contain suspended or vadose water, water will not be yielded until the zone of saturation is reached.

Storage and Movement of the Ground Water[12]

There are many kinds of rocks that form the earth's crust, and they differ greatly in the number, size, shape, and arrangement of their interstices. These spaces or interstices are the openings through which the liquids and gases, such as water, oil, natural gas or air, are transported. Therefore, the occurrence of water in the rocks of any region is determined by the character, distribution, and structure of the rocks, or in other words, by the geology of that region. Some rocks are characterized by numerous interstices of very small size, others by a few large openings such as fractures or solution channels.

The porosity of a rock is its property of containing interstices. The porosity of a sedimentary deposit depends on the shape, arrangement, degree of assortment, cementation and compaction of the constituent particles since deposition, the removal of mineral matter through solution by percolating waters, and the fracturing of the rock, resulting in joints and other openings. The porosity of a rock determines only how much water a given rock will hold. A rock is said to be saturated when all of its interstices are filled with water.

The best yields of water in east-central Georgia are from sand strata. Water is contained in these beds in the pore spaces between the sand grains. Other openings containing ground water in the rocks in this area are: solution channels or caverns in limestone, and the joints, crevices and open bedding planes which have resulted from the fracturing of the rocks. See figure 6.

The permeability of a rock is its capacity for transmitting water under pressure and is measured by the rate at which water is transmitted through a given cross section under a given difference of pressure per unit distance. Coarse sand and gravel, if well-sorted, are very permeable and will transmit water readily. Finer sediments, such as silt and clay, may have as high porosity as sand, but because of the small size of the

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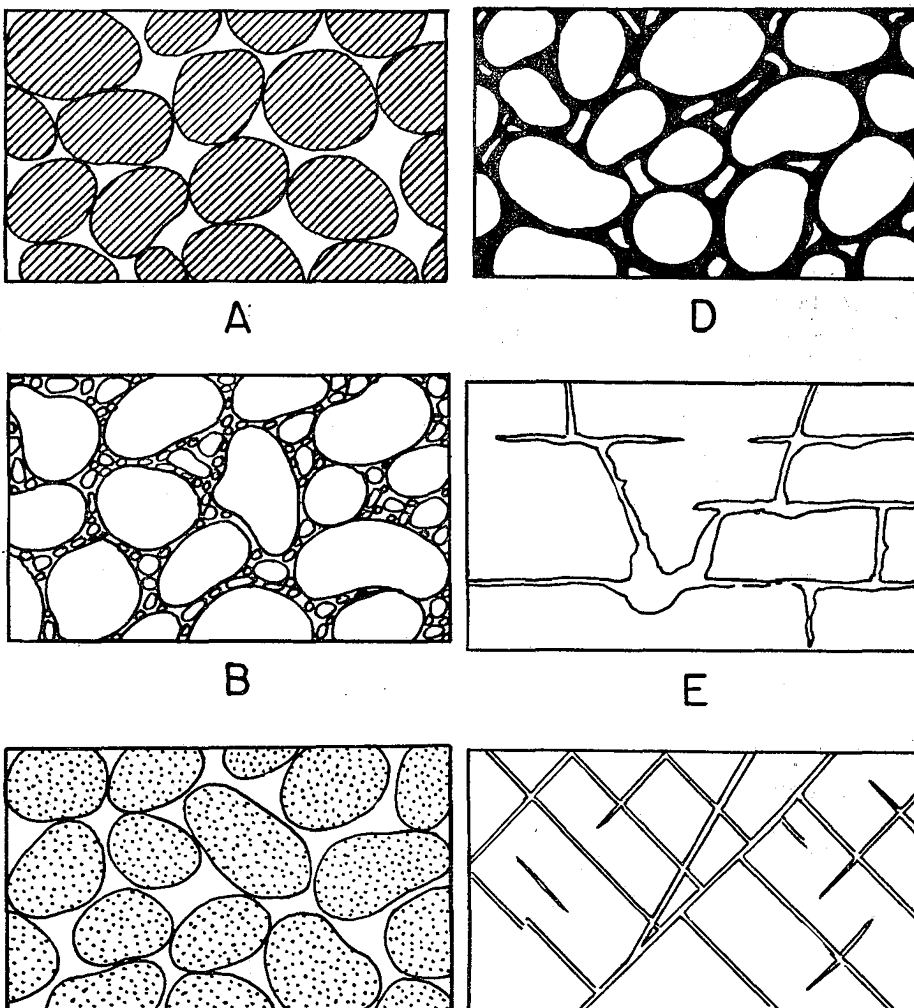
[12] For a detailed treatment of ground water, see Meinzer, O. E., The occurrence of ground water in the United States with a discussion of principles: U. S. Geol. Survey Water Supply Paper 489, pp. 2-3, 28, 1923.

interstices they have only low permeability or may be practically impermeable.



A D B E C F

Figure 6. Diagram showing several types of rock interstices and the relation of rock texture to porosity; A, well-sorted sedimentary deposit having a high porosity; B, poorly sorted sedimentary deposit having low porosity; C, well-sorted sedimentary deposit consisting of pebbles that are themselves porous, so that the deposit as a whole has a very high porosity; D, well-sorted sedimentary deposit whose porosity has been diminished by the deposition of mineral matter in the interstices; E, rock rendered porous by solution; F, rock rendered porous by fracturing. (After O. E. Meinzer, U. S. Geological Survey Water-Supply Paper 489.)

Water Table

The upper surface of the zone of saturation is called the water table, except where this surface is confined by a bed of clay or other relatively impervious material. The water table is rarely a stationary surface, but fluctuates in response to variations in the rate of water withdrawn by pumpage in an area, and by daily, seasonal, and yearly variations of climatic conditions.

Usually there is only one zone of saturation, but at some places in the downward percolation of subsurface water through the zone of aeration its downward progress is arrested by an impervious layer. This causes an upper zone of saturation separate from the true or main ground water body, and the area of this zone of saturation is called a perched water table.

Artesian Conditions

In east-central Georgia the formations of the Coastal Plain consist chiefly of alternating beds of permeable sand and gravel interbedded with more or less impermeable clay and marl. The strata dip to the southeast at the rate of about 15 feet per mile. The principal aquifers are the beds of sand and gravel. In the area of outcrop of these aquifers water from the surface percolates down into the zone of saturation, and under the force of gravity it moves down-dip until it becomes confined between impermeable beds. The weight of the water at higher levels in a confined aquifer exerts a pressure, and when a well penetrates such an aquifer down dip from the intake area, water will rise in the well above the bottom of the confining bed. Wells of this type are called artesian wells. The pressure of ground water due to the weight of water at higher levels in the same zone of saturation is called the hydrostatic pressure. The head of water at a given point in an aquifer may be expressed as the height of a column of water that can be supported by the hydrostatic pressure. The imaginary surface to which artesian water will rise in wells is called the piezometric surface.

Flowing wells result when the head is high enough or the surface is sufficiently low to allow artesian water to overflow at the surface. An area of artesian flow is an area in which the piezometric surface is higher than the land or water surface. Figure 7 is a diagram showing artesian and non-artesian conditions.

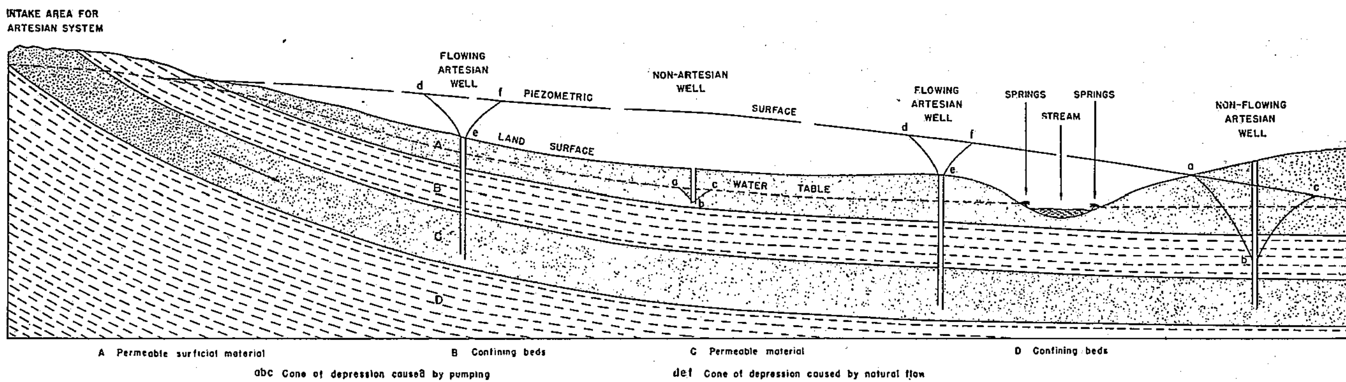


Figure 7. Diagram showing artesian and non-artesian conditions.

The areas of artesian flow in east-central Georgia are shown in plate 2. At the time the field work for this report was completed, January 8, 1945, there were 27 flowing wells; 13 in Washington, 8 in Wilkinson, 5 in Twiggs, and 1 in Baldwin County. These flowing wells ranged from 33 to 1000 feet in depth. No flowing wells were recorded in Jones or Hancock Counties.

RECOVERY

General Features

In the six counties included in this report all but one of the municipal water supplies are obtained from drilled wells. At Milledgeville the public water supply comes from Fishing Creek. Most of the municipal and industrial wells produce ground water from water-bearing sands in the Tuscaloosa formation. Dug wells furnish about 80 per cent of the ground water for rural, domestic, and livestock demands. The rest of the ground water in the area is obtained from springs and drilled wells.

When water is withdrawn from a well the water table or piezometric surface in the vicinity of the well approximates the form of an inverted cone with its apex at the well. (See figure 7.) As the pumping rate increases the drawdown of the water level in the well becomes greater, and the cone of depression becomes larger. Heavy pumping of wells may influence water levels within many hundreds of feet or in some cases several miles. In an artesian aquifer the cone of depression exists only as an imaginary cone whose apex is at the well. (See figure 7.)

The specific capacity of a well is the rate of yield per unit drawdown. The new City water well (Washington 52) at Sandersville was pumped at the rate of 400 gallons per minute, which produced a drawdown of 10 feet. Therefore the specific capacity of this well is 40 gallons a minute per foot of drawdown.

The water level in a well usually drops rapidly at the beginning of a pumping test and declines more slowly during the advanced stage. The decline may continue for many hours or days. Therefore, in making pumping tests to determine the water-bearing capacity of a formation it may be necessary to continue the test for 24 hours or more. When pumping is stopped the process is reversed. The water level in the well rises rapidly at first and more slowly in the later stages of recovery.

Dug Wells

Dug wells furnish a large proportion of the rural ground water consumed in the area. A dug well is a large-diameter well excavated with hand tools. It may or may not have a curbing from top to bottom, depending on the character of the sediments dug through. If a well is dug through a partially cemented material, such as clay or sandy clay, to a water-bearing sand, often all that is used is a sand box at the bottom of the well to keep the sand from caving. If the sediments dug through are composed of loose material, such as sand or gravel, a casing from top to bottom is necessary. Most of the dug wells are lined with wood, brick, stone, cement, or tile curbings, and are from 20 to 60 feet deep. In southwestern Washington County, however, a dug well (123) with a cement curbing is 103 feet deep.

The purpose of the dug well is to furnish an adequate supply of water from a shallow source at a low cost. The large diameter of a dug well produces a reservoir which permits the storing of fairly large quantities of water. Dug wells of 36 and 48 inches in diameter generally furnish an adequate supply for small farming and domestic uses. Well 12 at the Colony Farm, 5½ miles south of Milledgeville, Baldwin County, is a combination dug well and spring. This well has a capacity of 50 gallons per minute. The Southern Railway water tank at Bullard, Twiggs County, is supplied with ground water from well 80. This well is 7½ feet wide, 10 feet long, and 10.9 feet deep.

Bored Wells

Wells that are constructed with hand or power augers are called bored wells. They generally range from 20 to 60 feet in depth. Some bored wells are cased with metal pipe which has been perforated opposite the water bearing formation. They are most practical in areas of unconsolidated sediments where no hard rocks are encountered.

Figure 8 shows the simple hand equipment used in drilling a shallow bored well at Toomsboro. There are few such wells in the flood plain areas of the Ocmulgee and Oconee Rivers and Big Sandy and Commissioners Creeks.

Drilled Wells

Of major importance to this area are the drilled wells that supply most of the industrial and public ground-water supplies. There are also many 2- to 4-inch drilled wells that furnish ground water for domestic and livestock demands.

Figure 8. Simple hand auger equipment used by "Doc" Bostick, at Toomsboro, Wilkinson County, to bore shallow wells. Upon penetrating a water sand a well point is driven into the aquifer, and water is recovered by a hand pump.

Rotary Well Rigs.—The rotary well-drilling method has been used to drill nearly all of the large industrial and municipal water wells more than 4 inches in diameter in this area. The rotary drilled wells are from 100 to 900 feet deep and yield as much as 800 gallons a minute by pumping. The artesian wells that overflow at the surface yield as much as 125 gallons per minute by natural flow.

The hydraulic rotary well-drilling equipment consists of a derrick, cables, and reels for handling tools and casing; a rotary table for rotating the drill pipe and bit, and a pump to circulate the drilling mud. The drilling mud circulates down through the drill pipe, and out the opening in the bit, carrying the drill cuttings up and out of the hole. The drilling mud also prevents the hole from caving until the casing and screens are set.

The cuttings brought up by the drilling mud represent the type of material penetrated. A record of the thickness and character of this material should be kept and samples collected at intervals of a few feet. The samples may then be analyzed and the grain size of the water-bearing sand or sands determined. After determining the grain size the most efficient type and size of screen can be chosen for the well. Sometimes the screens are gravel packed, that is they are in an envelope of carefully selected uniform-sized gravel. Gravel packing is sometimes used in fine-grained sediments to increase the yield of a well.

Cable Tool Rigs.—Most of the wells of small diameter used to furnish water for domestic and farm supplies in this area were drilled by hand or by small power-driven cable-tool or percussion outfits. This type of rig consists of a tripod, pulley, cable, drilling tools, and bailer. In the larger percussion rigs, or churn drills, a walking beam rocks the cable up and down. The tools in smaller rigs are raised and dropped either by hand or by a power-driven drum. The cuttings are lifted to the surface with the aid of a bailer. Figure 9 shows a small hand cable-tool rig used in Wilkinson County and nearby locations.

Jetted wells.—The relatively unconsolidated sediments in the Coastal Plain afford ideal conditions for jetted wells, although in the area covered by this report jetted wells are not common. The process of jetting a well consists of loosening material and elevating it to the surface by water pressure. Water is forced down a pipe inserted inside the casing, and out through the perforations in the end of the bit. The cuttings are washed upward and out of the casing at the surface by the force of water. When a hard layer is encountered with a jetting rig that layer is penetrated by using a drill bit on the drill pipe which is raised and dropped to strike blows, as in the cable-tool percussion equipment. The jetting pipe inserted in the casing is turned slowly, as the drilling proceeds downward so as to insure a straight hole. The casing is usually sunk as fast as the drilling proceeds.

Figure 9. Simple hand driven cable tool rig used by O. D. Tindall of McIntyre, Wilkinson County. Wells of this type are drilled into an aquifer, and screen is set opposite the water-bearing sand. This type of equipment is also used in exploratory test drilling for kaolin lenses in the Coastal Plain of Georgia.

In all drilled wells where screens are set opposite the water-bearing sands care must be taken in choosing the correct type and size of screen. Improperly slotted casings, or home-made screens, often clog up after a few years, reducing the yield, increasing the drawdown, and therefore increasing the cost of recovery.

Driven Wells

The drive-point or driven wells are usually in valleys or other areas underlain by unconsolidated deposits, in which the water table is within 25 feet of the land surface so that a pitcher pump or other types of suction pumps can be used. A driven well generally consists of a 1¼-inch pipe with a screen-covered drive point at the bottom. A post hole digger or auger is usually used in boring a preliminary hole about the same diameter as the well casing. The 1¼-inch pipe with the drive point is then placed in the auger hole and driven into the permeable sand bed. In order to use a pitcher pump the water level in the well has to be within about 25 feet of the land surface because the suction of the pump cannot raise water from a greater depth.

The advantages of a driven well are: (1) Often almost anyone can drive a well using this method, and (2) the equipment necessary is widely distributed and easily acquired in almost any hardware or plumbing establishment.

The disadvantages are: (1) yields are small, (2) the impact of driving may cause couplings to buckle, joints to leak, and sometimes injures the mesh on the drive point, (3) the method is slow and laborious when tough clays or sand clays are encountered, and (4) this type of well is especially subject to surface pollution if it is not properly located.

Springs

Many springs in the area of the Red Hills are a result of water percolating downward under the force of gravity to the upper surface of the impervious Twiggs clay member of the Barnwell formation. The water then moves laterally along the top of the Twiggs clay to an outcrop where it discharges at the surface in the form of springs. Springs of this nature whose water does not issue under artesian pressure, but which are due to an outcrop of the water table are called "gravity springs."

Seepage springs occur under similar conditions in the area in which the Tuscaloosa and Barnwell formations crop out Kaolin and sandy clay lenses in the Tuscaloosa formation and the 3 to 4 feet of clay at the top of the Irwinton sand member of the Barnwell formation are both impervious layers responsible for many small gravity springs.

Nearly all of these springs yield from 3 to 5 gallons of water a minute and many furnish water for small domestic and stock uses. Many springs are intermittent and flow only part of the year, depending on the storage capacity of the catchment area.

Quality of Ground Water

Introduction

Analyses of 81 samples of water from wells in this area show no excessive or harmful amounts of fluoride. The fluoride content ranged from 0.0 to 0.5 part per million, and averaged highest in water samples collected from wells in the crystalline rocks.

Water samples collected from solution channels in the limey facies of the upper part of the Barnwell formation had the highest average calcium, bicarbonate, and sulfate content, and the highest average hardness. The hardest water in the area comes from this aquifer.

The nitrate content of the samples varied greatly from well to well. The sample from the shallow dug wells as a rule contained the greatest amount of nitrate. Water from dug well 45 in Twiggs County contained 56 parts per million of nitrate, and water from eight other wells in the area covered by this report had a nitrate content ranging from 10 to 32 parts per million. Of these nine wells, 4 were shallow dug wells, 3 were shallow drilled wells, and 2 were drilled wells over 100 feet deep. Although nitrate is a comparatively unimportant mineral constituent of waters, it may in some cases indicate contamination by surface wash, sewage, or other organic matter.

Chemical Constituents in Relation to Use[13]

Silica.—(SiO_2) is dissolved from practically all rocks. The extent to which silica is dissolved in water depends upon the conditions of the silica in the rock material, composition of the water, and time of contact. Alkaline waters take more silica

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[13] Adapted in part from Lamar, W. L., Industrial quality of public water supplies in Georgia: U. S. Geol. Survey, Water Supply Paper 912, pp. 7-15, 1940.

in solution than less alkaline waters. Silica in water is troublesome in causing boiler scale in high-pressure boiler plants, but it is believed to have little or no effect on the use of water for other purposes.

Iron.—(Fe) is dissolved from practically all rocks and soils. It is a common constituent of ground water, but should not exceed 0.2 part per million when furnished to consumers. Water containing in excess of 0.2 part per million iron is not suitable on account of the appearance of "red water," or reddish-brown sediment caused by the oxidation of the iron. Water of this nature causes staining on white porcelain fixtures and clothing, and is unsuitable for industrial laundering, beverages, food, paper, ice, and other manufacturing purposes.

The simplest method of removing most of the iron from water is by a process of aeration, followed by coagulation and filtration. This process is practiced at many water purification plants.

Calcium and magnesium.—(Ca) and (Mg) are dissolved from many rocks. Water percolating through the soil generally takes into solution carbonic or organic acids. When water containing these acids comes in contact with limestone, which is essentially calcium carbonate, some of the limestone is dissolved. Calcium sulfate-gypsum—is also a source of calcium in ground water.

Magnesium occurs in lesser amounts than calcium in the ground waters of the area. It may be dissolved from dolomitic limestones.

Hardness in water is caused by both of the elements calcium and magnesium.

Sodium and potassium.—(Na) and (K) are dissolved from practically all rocks and soils. They make up only a very small part of the dissolved mineral content of the ground waters of this area. Ground water recovered from the deeper aquifers is likely to contain more sodium than water from the shallow water-bearing formations, although moderate quantities of sodium and potassium have little or no effect on the suitability of water for domestic and most industrial uses. Soda ash (sodium carbonate), used in the treatment of a few of the waters, increases the sodium content of the finished water.

Carbonate and bicarbonate.—(CO_3) and (HCO_3) in natural waters result from the solution of limestone and other carbonate rocks through the chemical reaction of carbonic and organic acids in waters. Carbonate (CO_3) is not generally present in appreciable quantities in the ground water of east-central Georgia. The bicarbonate (HCO_3) content in water samples collected in this area ranged from 1 to 303 parts per million, being highest in waters from solution cavities in the calcareous facies of parts of the Barnwell formation in eastern Washington County. The bicarbonate in waters in this area has little effect on the use of the water.

Sulfate.—(SO_4) is dissolved from rocks and soils and from material containing gypsum ($CaSO_4 \cdot 2H_2O$). Some sulfate is derived from the oxidation of sulfides. Sulfate-hard water will form a hard boiler scale and may influence the choice of the method of treatment for water used in boilers. Calcium and magnesium in hard water may also influence the choice of a method of water softening, and these elements combined with sulfate will also add to the cost of softening the water. Magnesium, and sodium sulfate if present in sufficient quantities, impart a bitter taste, although sulfate itself has little effect on the general use of a water.

Chloride.—(Cl) In east-central Georgia chloride is dissolved in small quantities from rock materials through which ground water has percolated. The chloride content of waters in this area is very low, ranging from 0.2 to 26 parts per million. Chloride has little effect on the suitability of water, except when it is contained in large enough quantities to give the water a salty taste. Appreciable quantities of chloride in equilibrium with calcium or magnesium may increase the corrosiveness of a water.

Fluoride.—(F) is dissolved from fluoride-bearing minerals in rocks. H. T. Dean[14] of the United States Public Health Service and other investigators report that water that contains 1.0 part per million or more of fluoride is known to be associated with the dental defect known as mottled enamel if the water is used for drinking or cooking during the calcification or formation of the teeth. No well-water sample collected in the

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[14] Dean, H. T., Chronic indemic fluorosis: Jour. Amer. Med. Assoc., vol. 107, pp. 1269-1272, 1936.

area covered by this report contained as much as 1.0 part per million fluoride. Deep-well waters and sodium bicarbonate waters are more likely to contain harmful quantities of fluoride than calcium bicarbonate waters.

Nitrate.—(NO_3) in ground water is generally considered a final oxidation product of nitrogeneous organic material. Nitrate, if contained in large quantities, may indicate the presence of sewage, surface wash, or other organic matter in the water. For most of the water supplies analyzed the nitrate content was less than 1 part per million, although in the samples from a few wells it ranged from 1 to 10 parts per million, and water from 7 wells in the area contained over 10 parts per million.

Total hardness.—The hardness of a water is commonly recognized by its soap-consuming power or the amount of soap required to make a permanent lather. The constituents that cause hardness, generally calcium and magnesium, are the same active agents that cause boiler scale. Water having a hardness of less than 50 parts per million is considered soft. Water having a hardness of 50 to 150 parts per million consumes more soap, and softening is profitable for soap-using industries.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

The areal distribution of the formations underlying the Coastal Plain of east-central Georgia described below is shown on the geologic map in plate 1. A description of the lithology, correlation and water-bearing properties of these formations follow.

Pre-Cretaceous Rocks

Complex crystalline rocks, consisting of weathered biotite gneiss, granite gneiss, and schist of pre-Cambrian age lie beneath and to the north of the sedimentary deposits in the area of this report. Intruded into the pre-Cambrian rocks at some places are dolerite dikes of Triassic age and large bodies of porphyritic granite that are regarded as of late Paleozoic age. In northern Baldwin and Hancock Counties quartzites, slates and volcanics of pre-Cambrian or possibly of Paleozoic age [15]

[15] A. S. Furcron—personal correspondence, Dec. 7, 1945.

crop out in a long narrow southwest-northeastern belt just north of the Fall Line. Following the development of the crytalline rocks, a long period of erosion, which took place prior to the last, or Upper Cretaceous, epoch of the Mesozoic era, reduced the surface of the crystalline rocks to a peneplane. In the latter part of the Mesozoic era, submergence of the land surface took place and the Cretaceous shore line approached near the present-day Fall Line. During the Upper Cretaceous epoch the clays, sandy clays, sand, and gravels of the Tuscaloosa formation were deposited on the crystalline basement complex (see figs. 10 and 11).

Figure 10. Road cut on old Sandersville Road, southeast bank of Buck Creek (Baldwin County) showing the Tuscaloosa formation unconformably lying on quartzites and weathered slates of pre-Cretaceous age.

The crystalline rocks are very highly weathered and the exposed slate, gneiss, granite, and schist are generally soft and friable. A section showing the contact of the Tuscaloosa formation with the underlying crystalline rocks is exposed in a cut at Carrs on the Georgia Railroad.

Section in cut of Georgia Railroad at Atlantic Refractories Fire Brick Company, 0.4 mile southwest of Carrs, Hancock County, Georgia

	Thickness Feet
8. Soil, buff-yellow pebbly.	2
Tertiary (upper Eocene)	
Channel sands	
7. Quartz sand, coarse, angular and sub-angular, arkosic, with many kaolin particles 2 to 4 inches in diameter.	5
6. Kaloin stringer.	½
5. Sand, orange, coarse, sub-angular, arkosic, with many scattered kaolin particles, oval kaolin balls up to 12″ in diameter.	12
Unconformity	
Cretaceous (Upper Cretaceous)	
Tuscaloosa formation	
4. Kaolin lens, gray-white (kaolin lens mined at Atlantic Ref. Co.)	6-25
3. Quartz sand, gray-white, medium-grained, cross-bedded, and micaceous. Grades down into 6 feet of orange arkosic coarse sand and gravel with scattered kaolin particles.	26
2. Sand, purple, coarse and fine gravel, very micaceous in a kaolinitic matrix. This material fills small fissures running down into underlying crystalline rocks.	1-2
Unconformity	
Pre-Cambrian (elevation 505 feet)	
1. Highly weathered granite-gneiss, gray white with streaks of purple.	8

Information reported by the Layne-Atlantic Well Drilling Company on five water wells drilled to the crystalline rocks, Washington County wells 17, 18, 51, 64, 65, indicate the crystalline surface has a southeast slope of 55 feet per mile.

Water Supply.—The crystalline rocks in the Piedmont area, because of their complexity, do not have the continuity of water-bearing beds of those of the Coastal Plain. Finding adequate large supplies of ground water in the outcrop area of these rocks presents a problem, as only rarely do individual wells produce sufficient ground water for industrial or municipal demands. At many localities in the Piedmont, supplies for small towns, villages and industries are obtained from a series of two, three, or more wells.

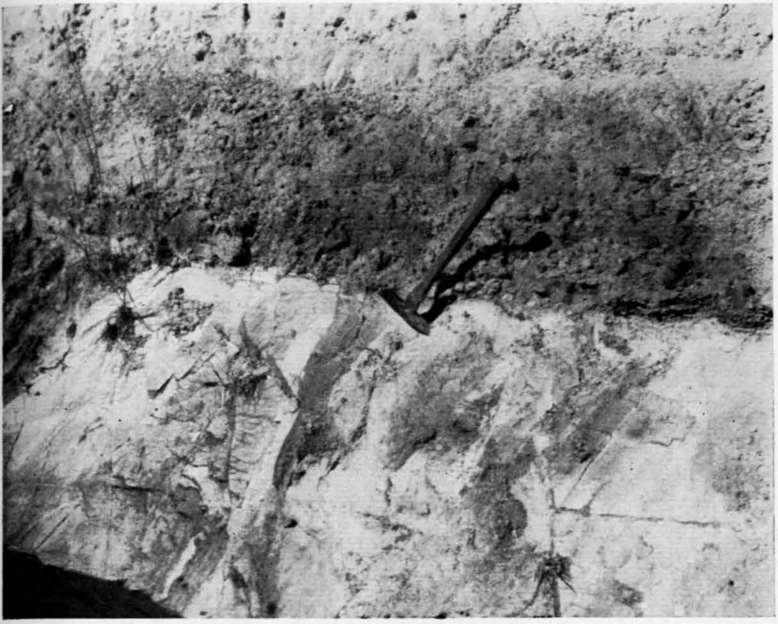

Figure 11. Road cut in Stevens Pottery-Milledgeville Road 1.8 miles northeast of Coopers School (Baldwin County) showing sand and gravel of the Tuscaloosa formation lying unconformably on deeply weathered micaceous schist of pre-Cretaceous age.

Quality of Water Influenced by Crystalline Rocks.—Six samples of water were collected along the northern margin of the Coastal Plain in Baldwin, Twiggs, and Hancock Counties from wells passing through the sedimentary deposits of the Coastal Plain and penetrating the crystalline rocks beneath. Some of the water in these wells was from the sedimentary deposits, but the quality of every sample was influenced slightly by the crystalline rocks.

Water from the Tuscaloosa formation or overlying channel sands which generally are in contact with the crystallines in this area is low in bicarbonate, fluoride, and total hardness, whereas water from the six wells influenced by the crystalline rocks is slightly higher in mineral content, ranges from 21 to 85 parts per million bicarbonate, 21 to 57 parts per million total hardness, and averages .21 part per million fluoride, 3.1 parts per million iron, and 7.8 parts per million sulfate.

Cretaceous System

(Upper Cretaceous)

Tuscaloosa Formation

In 1887 Smith and Johnston [16] named the Tuscaloosa formation after the town, river, and county of the same name in Alabama. The Tuscaloosa formation in Alabama consists of some 800 feet of light-colored irregularly bedded sands, clays, and gravels, and includes a recently recognized marine zone in its lower half. Earlier workers on the Cretaceous stratigraphy of Georgia who questioned the correlation of the Upper Cretaceous of Georgia with the Tuscaloosa formation of Alabama, assigned the name Middendorf to these beds. In 1936 the name was discarded in favor of Tuscaloosa [17] for the deposits of Upper Cretaceous age in Georgia. At the present time basal Upper Cretaceous beds from North Carolina to Mississippi, and northward into Tennessee are referred to as the Tuscaloosa formation.

In east-central Georgia the Tuscaloosa formation crops out in a belt ranging from 2 to 8 miles in width along the northern margin of the Coastal Plain. This belt of outcrop is made discontinuous by the progressive overlap of younger beds of Jackson age. Typical of this area of outcrop of the formation are broad rolling Sand Hills with gentle slopes and light-colored sandy loam soils. The Tuscaloosa formation also crops out in the valleys of southeastern and southwestern streams where the overlying younger sediments have been stripped away.

In the southern part of the area of this report the Tuscaloosa formation has a maximum thickness of 700 or 800 feet. It thins progressively to the northwest, up dip, to the Fall Line. In a water well drilled for the town of Sandersville, Georgia, at an elevation of 470 feet, the crystalline basement, which was encountered at a depth of 872 feet, is overlain by 605 feet of Tus-

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[16] Smith, E. A., and Johnston, L. C., Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama Rivers. U. S. Geol. Survey Bull. 43, pp. 95-116, 1887.

[17] Cooke, C. W., Geology of the Coastal Plain of South Carolina: U. S. Geol. Survey Bull. 867, p. 17, 1936.

caloosa sediments. Well cuttings and outcrops in this area show the Tuscaloosa to be composed of cross-bedded sand and gravel, and lenses of clay and sandy clay. The sands are predominately light colored, buff, yellow, and gray, micaceous and cross-bedded, and interlensed with light-colored red, purple, gray, and white clay and sandy clay lenses. Some of the clay lenses are as much as 35 or 40 feet thick. Zones of sub-angular to sub-rounded quartz gravel up to 1½ inches in diameter are common in the massive cross-bedded sand. The basal Tuscaloosa formation at the contact with the crystalline rocks contains large angular and sub-angular gravel, cobbles, and boulders 6 and 8 inches in diameter. A section showing typical lithology of the Tuscaloosa formation is exposed in a cut at Mountain Springs flag stop on the Central of Georgia Railway in Jones County, Georgia.

Section exposed in Central of Georgia Railway cut and dirt road cut at Mountain Springs, Jones County, Georgia

	Thickness (Feet)
Eocene (upper Eocene—Beds of Jackson age)	
Barnwell formation	
6. Sand, brownish-red, sub-angular, coarse, clayey. Thin beds of ironstone near base with many flat rounded polished beach pebbles up to 1½ inches in diameter.	12+
5. Clay, gray-green, blocky, waxy, and mottled red.	4+
4. Buff to gray-white soft nodular lime ledge with green clay partings.	¾
3. Sand, yellow, loose fine sub-angular, with many dark sub-angular particles and scattered highly polished rounded quartz granules. Grades down into brownish green medium-grained glauconitic quartz sand in clayey matrix.	15
Channel sand	
2. Quartz sand, buff, medium-grained, and many rounded beauxitic kaolin balls up to 4 feet in diameter.	1-8

Unconformity	Thickness
Upper Cretaceous	(Feet)
Tuscaloosa formation (elevation of contact 489 feet above sea level)	
1. Quartz sand, light-colored, gray-white, fine to coarse sub-angular, cross-bedded, micaceous and interbedded with thin layers of sandy kaolin and kaolin up to 1 foot thick.	20+

The sand, sandy clay, and clay of the Tuscaloosa formation in this area apparently is of continental origin. These deposits are composed of erosional products of the ancient crystalline rocks of the Piedmont, which accumulated in fresh water bodies or possibly near the shore of a shallow marine Cretaceous sea. Because of the scarcity of fossil plants or animal remains in the Tuscaloosa formation it is difficult to determine its exact age. A few poorly preserved plant remains were collected by Stephenson and Thompson [18] from a lens of sandy carbonaceous clay overlain by 19 feet of kaolinitic clay at one of Martin's abandoned clay mines, 1 mile south of Gordon, Wilkinson County. From this collection R. W. Brown recognized a species resembling *Phyllites asplenoides* Berry, fragments of dicotyledonous leaves, and unidentified fruits or seeds. On the basis of a probable specimen of *P. asplenoides* Brown believes this to be a collection of Upper Cretaceous plants.

The Tuscaloosa formation in this area strikes northeast-southwest and dips southeastward about 15 feet per mile. It is overlain uncomformably by the younger Eocene beds which locally, in Jones, Baldwin, and Hancock Counties, entirely overlap the Cretaceous deposits and rest directly on the crystalline rocks.

Kaolin and Bauxite.—In 1943 about 78 percent of the Kaolin produced in the United States was mined in Georgia. Most of this came from western Washington, central and western Wilkinson, and northern Twiggs Counties, but a small amount came from Hancock County near Carr's Station. The entire production from this area is from kaolin lenses in the Tuscaloosa formation (see figs. 12, 13). Bauxite has also been mined in

[18] Stephenson, L. W., and Thompson, R. W., Notes on Cretaceous and adjacent Eocene formations in central and west-central Georgia, pp. 29-30, unpublished.

this area, and Warren [19] states that bauxite bodies ranging from a few inches to 10 feet in thickness and from a few square feet to five acres in extent are present in small-and-medium-sized kaolin lenses lying in the upper 20 feet of the Tuscaloosa formation.

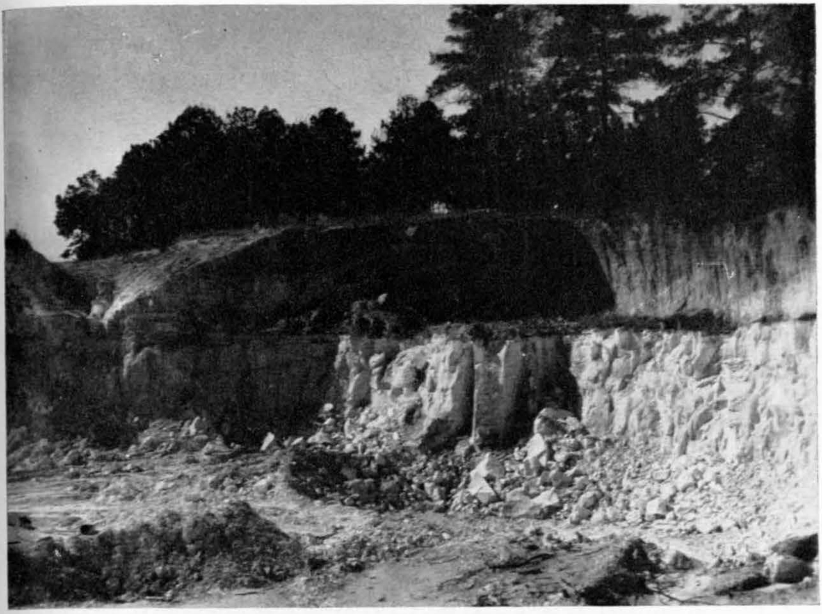

Figure 12. General Refractories Kaolin Mine, Carrs Station, Hancock County. White kaolin of the Tuscaloosa formation overlain by pink coarse sand with many scattered kaolin particles.

Water Supply.—The thick sand and gravel beds of the Tuscaloosa formation are the best source of ground water in east-central Georgia. Many shallow dug wells along the northern margin of the Coastal Plain and to the southwest and southeast along the streams in the area of outcrop of the Tuscaloosa formation yield ground water from this aquifer. Wells drilled to water-bearing sands in the Tuscaloosa formation furnish as much as 800 gallons a minute for domestic, municipal, and industrial use at Sandersville, Deepstep, Oconee, McIntyre, Huber, Jeffersonville, and other nearby localities.

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[19] Warren, Walter C., Bauxite and kaolin deposits of Wilkinson County, Georgia: U. S. Geol. Survey, Strategic Minerals Investigations Preliminary Maps, 1943.

Northwest of a line connecting Sandersville, McIntyre, and Huber, Georgia, the Tuscaloosa formation becomes thinner to the Fall Line, therefore as the sand and gravel beds thin out up the dip and the catchment area decreases, progressively less water should be expected from wells producing from these beds. Southeast of a line connecting Sandersville and Huber, Georgia, supplies of 500 gallons a minute or more may be obtained from the water-bearing beds of the Tuscaloosa formation.

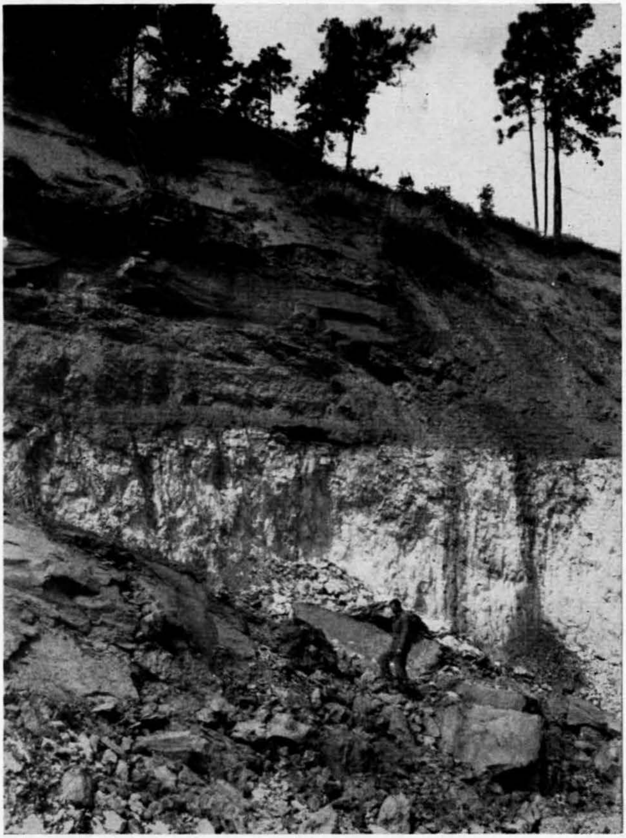

Figure 13. Stevens Pottery kaolin mine, 5.7 miles north of Gordon on Stevens Pottery-Gordon road (Wilkinson County). White kaolin of the Tuscaloosa formation overlain unconformably by 40 feet of calcareous sand and clay of the Barnwell formation.

Where topographic and geologic conditions are favorable, wells penetrating water-bearing sands in the Tuscaloosa formation will overflow. Conditions are favorable for flowing wells in the flood plains of the Ocmulgee and Oconee Rivers, and in the valleys of their tributaries to the point of outcrop of the piezometric surface. (See area of artesian flow, plate 2). At Westlake and Adams Park in southeastern Twiggs County, in the flood plain of the Ocmulgee River, wells penetrating the Tuscaloosa formation have natural flows up to 60 gallons a minute. In the flood plain of the Oconee River flowing wells have been drilled on Indian Island, southern Baldwin County; at Balls Ferry, east-central Wilkinson County; in the Oconee and Gardner area, Washington County; and in the flood plain of the Oconee River in the southeastern corner of Wilkinson County. The northern limit of flowing wells in the flood plain of Buffalo Creek is just north of Deepstep, Georgia, north of Washington County well 64 and south of Washington County well 18. Three flowing wells near Deepstep and two wells at Brooks Springs, in the northern half of the flood plain of Buffalo Creek in Washington County have natural flows of from 30 to 125 gallons a minute. The northern limit of the area of flowing wells in the flood-plain area of Commissioners Creek in Wilkinson County is at Toomsboro. Flowing wells in the flood plain of Big Sandy Creek are possible to a point about 2.5 miles northwest of Big Sandy Creek Bridge on Georgia Highway 29.

Quality of the Water.—In general, waters from the Tuscaloosa formation are low in dissolved mineral content. Analyses of 43 samples of water from the Tuscaloosa formation, chosen to show chemical variations "down dip", along the strike, and at various depths, usually showed a range of 1 to 30 parts per million of bicarbonate, 1 to 10 parts per million of chloride, 0.1 part per million or less of fluoride, 1 to 17 parts per million of sulfate, and less than 6 parts per million of nitrate.

An exception to the general statement is seen in the analyses of five samples of water from well 126 Washington County and Wells 60, 62, 65 and 102 Wilkinson County. These five water samples appear to have been taken from the same aquifer in the Tuscaloosa formation. They had a range from 37 to 96 parts per million of total hardness, and from 53 to 99 parts per million of bicarbonate. They contained from 8 to 17 parts per million of sulfate, 1.9 to 5 parts per million of chloride, and 0.1 part per million or less of fluoride.

Nine analyses were made of water collected from wells penetrating the Tuscaloosa formation at Sandersville (51), Deepstep

(65), Gardner (126), Gordon (24), Dedrich (36), Balls Ferry (62), Dry Branch (17), Jeffersonville (40), and Adams Park (72). Water from these wells contained no carbonate, 1.7 parts per million or less of magnesium, and from 1.1 to 9.1 parts per million of sodium and potassium combined. The silica content of these samples was 9 to 24 parts per million, and calcium, with one exception (Twiggs 40), 1 to 32 parts per million. The Jeffersonville municipal well (Twiggs 40) contained relatively large amounts of bicarbonate, silica, calcium, total hardness, and dissolved solids. The high hardness of water from this well might be explained by an unreported screen set in a calcareous sand in the Eocene deposits which overlie the Tuscaloosa formation at this locality.

The iron content in some artesian water from the Tuscaloosa formation is great enough to cause a reddish stain to form on the sanitary fixtures and clothing, where the water is used for domestic or public supplies. This is the case with the new City water well at Sandersville (well 51).

As water moves down dip in the aquifers of the Tuscaloosa formation it usually dissolves and takes into solution additional chemical constituents. A good example of this is seen by comparing the analysis of the water from well 65 located 3 miles south of Irwinton, with well 102 which is 12 miles southeast, down-dip from well 65. Water from well 65 contained 1.5 parts per million of iron, 64 parts per million of bicarbonate, 8 parts per million of sulfate, 4 parts per million of chloride, and had a total hardness of 63 parts per million. The sample of water from well 102 contained 2.8 parts per million of iron, 99 parts per million of bicarbonate, 17 parts per million of sulfate, 5 parts per million of chloride, and had a total hardness of 96 parts per million.

Eocene Series

(Upper (?) Eocene)

Channel Sands

At many localities along the Fall Line in east-central Georgia where the Eocene strata overlap the Tuscaloosa formation and lie on the crystalline rocks, the sedimentary deposits of the Coastal Plain are represented by a pink and white kaolinitic quartz sand that fills channels in the crystalline rocks of the

Piedmont (see fig. 14). In northern Twiggs, Wilkinson, and Washington Counties, and at many places in southern Jones, Baldwin, and Hancock Counties, similar channel sands overlie the Tuscaloosa formation unconformably.

Figure 14. Exposure in road cut 1 mile east of Black Springs Church on Georgia Highway 22 (Baldwin County) showing pink coarse sand filling a channel in deeply weathered granite.

The channel sands, where they are present, range in thickness from a few inches to 25 feet, and consist of light-pink, gray, and white fine to coarse and gravelly cross-bedded sand through which many white rounded kaolin balls are scattered. In southern Jones County in a section exposed by a cut on the Central of Georgia Railroad at Mountain Springs, and other localities in Wilkinson and Twiggs Counties, rounded pisolitic kaolin boulders as much as 4 feet in diameter are scattered along the base of the channel sand at the contact with the Tuscaloosa formation. (see fig. 15)

The channel sands consist of coarse sand, gravel, and kaolin fragments eroded from the older crystalline rocks and the Tuscaloosa formation. This material was carried in suspension or rolled along stream beds and deposited near shore in a marine sea during Eocene time.

On the north side of Georgia Highway 57, about 0.7 mile west of the Irwinton, Georgia, courthouse, a borrow pit and drainage ditch expose 15 feet of coarse pinkish-gray channel sand overlying unconformably the gray sandy kaolin of the Tuscaloosa formation. At this locality and others in this area, the channel sands contain borings of *Halymenites,* indicating a shallow marine origin. In some sections the channel sands appear to grade upward into the overlying sands which are of definite Jackson age, whereas at other places they are overlain by a

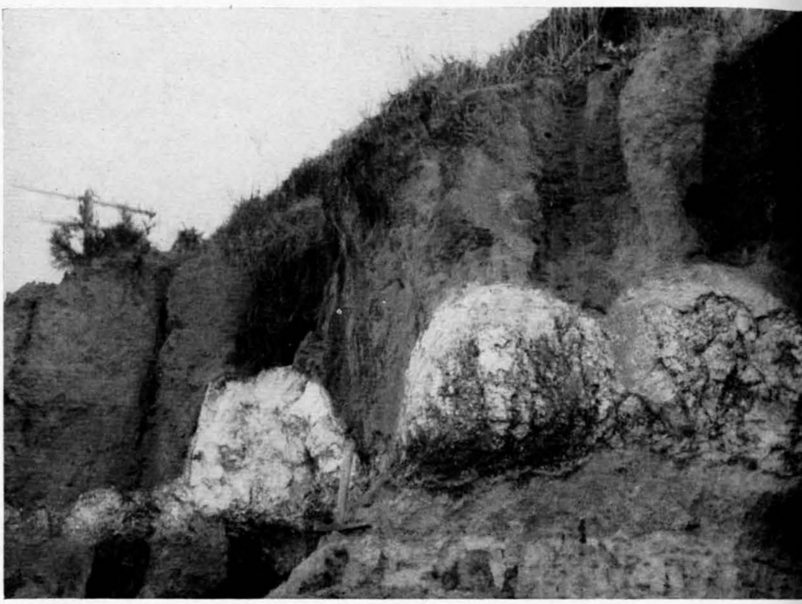

Figure 15. Railroad cut at Mountain Springs on Central of Georgia Railway (Jones County) showing rounded bauxite clay boulders scattered along base of the channel sands.

bed of coarse pebbly sand suggesting an unconformable relationship with the overlying bed. L. W. Stephenson and R. M. Thompson [20] suggest that the channel sands may be remnants of older Eocene deposits, possibly even of pre-Jackson age, such remnants having escaped destruction by the advancing Jackson sea because of their position in channel-like depressions below the level of cutting. As the channel sands locally contain reworked boulders of bauxite, it appears that they were deposited

[20] Stephenson, L. W., and Thompson, R. M., Notes of Cretaceous and adjacent Eocene formations in central and west-central Georgia, pp. 26-28, unpublished.

subsequent to the bauxite-forming period, though conceivably bauxitization might have altered the kaolin cobbles and boulders after they were incorporated in the sands. The channel sands, where present, were mapped with the deposits of Jackson age because of their small extent and because of the possibility of their being of upper Eocene age. The progressive overlap exhibited by these and other units of upper Eocene age suggest their close relationship.

Water Supply.—Because of the discontinuous character of the channel sands, and because of the cementation of the quartz grains in the kaolinitic matrix, these deposits are a poor aquifer for ground water. Along the northern margin of the Coastal Plain in the area of outcrop of the channel sands a few shallow dug wells produce from these deposits, but they furnish supplies that are barely adequate for small domestic and farm use.

The water from this aquifer is very low in dissolved mineral content. Three well water samples were collected; one each from northwestern Hancock (well 17), northeastern Baldwin (well 2), and north-central Wilkinson Counties (well 16). These samples averaged 14.7 parts per million of total hardness, 6.7 parts per million of bicarbonate, 1.7 parts per million of sulfate, 10.7 parts per million of chloride, no fluoride, 10.4 parts per million of nitrate, and 2.5 parts per million of iron.

(Upper Eocene)

Barnwell Formation

The term Barnwell "buhr sands" or Barnwell "phase" was first used by Sloan [21] in 1907 for material consisting of silicified shells and red ferruginous sands that were typically exposed in Barnwell County, South Carolina. Sloan classified these sands as middle Eocene. In 1911 Veatch and Stephenson [22] used the term "Barnwell sand" for the same deposits in Georgia and included the Barnwell with the McBean in the Claiborne group.

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[21] Sloan, Earle, Geology and mineral resources: Handbook of South Carolina, Chapter 5, p. 90, 1907.

[22] Veatch, Otto, and Stephenson, L. W., Preliminary report on the geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, pp. 285-296, 1911.

Cooke and Shearer [23] later found that most of the fauna upon which the Claiborne age of the Barnwell was based also occurred in deposits of Jackson age, so reclassified the Barnwell as of Jackson age.

The Barnwell formation of east-central Georgia has a diverse lithology, and, for convenience of discussion, it has been divided into three members; the basal or Twiggs clay member, the Irwinton sand member, and an unnamed, thin upper member of coarse red sand with flat rounded beach pebbles, tentatively assigned to the Barnwell.

A section exposed in a road cut 1.1 miles southeast of Toomsboro along Georgia Highway 57 on the southeast side of Camp Creek exhibits well the lithology and stratigraphic relationship of the members of the Barnwell formation.

Section exposed in road cut 1.1 miles southeast of Toomsboro on Georgia Highway 57

	Thickness (Feet)
Tertiary (upper Eocene)	
Barnwell formation	
Upper sand member	
10. Sand, red coarse-grained, with scattered flat rounded pebbles at base.	4
Irwinton sand member	
9. Clay, pale greenish-gray, waxy, mottled red.	4
8. Quartz sand, yellowish-tan, massive fine to medium-grained sub-angular with many fine dark angular particles scattered throughout and many thin gray clay partings. Near base of bed clay layers increase in thickness to 6 or 8 inches.	50

[23] Cooke, C. W., and Shearer, H. K., Deposits of Claiborne and Jackson age in Georgia: U. S. Geol. Survey Prof. Paper 120, pp. 41-81, 1918.

Twiggs clay member	Thickness (Feet)
7. Clay, pale green-gray, hackly, blocky, of fuller's earth type, with fine sand streaks. In basal 15 feet the clay becomes more sandy and contains a few poorly preserved pelecypod molds.	42
6. Sand, brown and gray mottled, clayey. Partings of green waxy clay.	8
5. Tan, gray indurated nodular lime ledge.	½
4. Sand, buff-yellow, medium-grained, clayey, calcareous, and fossiliferous.	8
3. Pale greenish-gray indurated fossiliferous nodular lime ledge.	½
2. Clay, pale greenish-gray, hackly, blocky, fossiliferous, and with many white lime nodules scattered throughout.	3
1. Sand, buff-yellow, very fossiliferous, argillaceous, calcareous and glauconitic.	6

Unconformity
Cretaceous

(Elevation of Tertiary-Cretaceous contact approximately 230 feet above sea level.)

Tuscaloosa formation not exposed in section.

[Twiggs clay member]

The type locality of the Twiggs clay member of the Barnwell formation is at Pikes Peak station on the Macon, Dublin, and Savannah Railroad in Twiggs County.

The Twiggs clay was formerly considered to be of Claiborne age, and was called the Congaree clay member of the McBean formation by Veatch and Stephenson [24]. Cooke and Shearer [25] later found fossil evidence indicating the Jackson age of the Congaree clay which they renamed "Twiggs clay" and made a member of the Barnwell formation. In a later report Cooke [26]

[24] Veatch, Otto, and Stephenson, L. W., Preliminary report on the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, p. 265, 1911.
[25] Cooke, C. W., and Shearer, H. K., Deposits of Claiborne and Jackson age in Georgia: U. S. Geol. Survey, Prof. Paper 120, pp. 41-81, 1918.
[26] Cooke, C. Wythe, Geology of the Coastal Plain of Georgia: U. S. Geol. Survey Bull. 941, pp. 61-62, 1943.

adopted the same usage, except that he restored part of the so-called Congaree clay to the McBean formation, and stated that this restored part may be an upper Eocene deposit, intermediate between the Barnwell and McBean.

It was found during this investigation that no part of the so-called Congaree clay or Twiggs clay in east-central Georgia was of Claiborne age, and that the base of the Barnwell formation in this area is the base of the Twiggs clay member, which rests unconformably on the Tuscaloosa formation except where the channel sands are present.

In northern Washington and southern Jones, Baldwin, and Hancock Counties, the Twiggs clay member of the Barnwell formation consists of about 25 feet of pale-green hackly clay, of the fuller's earth type, but to the south and southwest in western Washington and Wilkinson Counties it thickens gradually, and locally includes 20 to 40 feet of green hackly clay which grades down into 10 feet of gray marl, which in turn grades at some localities into 15 feet of calcareous sand at the base of the member. Near the type locality at Pikes Peak station in Twiggs County, the Twiggs clay member attains its maximum thickness of nearly 80 feet.

All of these lithologic types of the Twiggs clay member of the Barnwell formation were probably deposited in a shallow sea, and the various facies within such a short distance of each other resulted because of slight changes in depth, temperature, and various conditions of deposition. As is to be expected, a slightly different fauna is present in each of the facies. The pale-green hackly clay contains a very few poorly preserved pelecypod and gastropod molds. The gray and brownish gray marl zone of the Twiggs, however, is rich in both macro-fossils and foraminifera. A section showing the stratigraphic relationship and lithology of the Twiggs clay member in northern Washington County is seen in a road cut in the south bank of Keg Creek, 4.2 miles southeast of Deepstep, Georgia, on the Sandersville-Deepstep road.

Section in a road cut 4.2 miles southeast of Deepstep on the Sandersville-Deepstep road

	Thickness (Feet)
Tertiary (upper Eocene)	
Barnwell formation	
Upper sand member	
7. Sand, red, coarse sub-angular with fine gravel in a thin clay matrix. Scattered highly polished curvilinear pebbles at base.	12
Irwinton sand member	
6. Clay, pale green, waxy with red mottling.	6
5. Sand, yellow, fine to medium-grained, cross-bedded, mealy, with thin clay streaks up to 5 inches thick near base.	38
Twiggs clay member	
4. Clay, of fuller's earth type, pale green, massive, blocky, finely micaceous, with thin fine sand streaks. Lower 20 feet becomes more sandy, fossiliferous and contains many white lime nodules.	46
3. Marl, gray-tan, highly fossiliferous. Contains *Panope* and other pelecypod molds, *Pecten* sp., *Cardium* sp., *Venericardia* sp., *Turritella* sp., and gastropod molds.	1
Channel sands	
2 Quartz sand, green coarse, sub-angular, and glauconitic.	4
Unconformity	
Cretaceous	
Tuscaloosa formation	
1. Kaolin, gray-white, mottled yellow, and iron-stained. Slightly micaceous and with scattered angular coarse quartz grains.	40

The Twiggs clay member of the Barnwell formation is conformably overlain by the Irwinton sand member, and in east-central Georgia dips southeast about 15 feet per mile. West of the Ocmulgee River it becomes more calcareous and merges laterally into the Ocala limestone; east of the Ogeechee River it tongues into the lower part of the Barnwell formation of eastern Georgia, and may be equivalent to the Santee limestone of South Carolina.

Fuller's Earth.—The fuller's earth mined from the Twiggs clay member of the Barnwell formation in east-central Georgia is used in bleaching animal and vegetable oils. Near Pikes Peak station in Twiggs County the Twiggs clay attains its maximum thickness of about 80 feet and has been mined by the General Reduction Company. In central Wilkinson County 1 mile north of Irwinton, Georgia, a bed of fuller's earth has been mined intermittently on the Carswell estate. Thick exposures of fuller's earth were also observed: (see plate 1) in the area north of Georgia Highway 57, east of Little Sandy Creek in Twiggs County, near Fitzpatrick in Twiggs County, in the vicinity of Stevens Pottery kaolin pit in northwestern Wilkinson County, in the vicinities of Big Sandy, Porters Branch, and Maiden Creeks west of Georgia Highway 29 in Wilkinson County, and in northern Wilkinson County exposed in creek beds on both sides of the Toomsboro-Milledgeville road between the Homer Jones and Leo Stubbs properties. There are also thick exposures of fuller's earth in western Washington County south of Deepstep and east of Buffalo Creek.

Limestone.—In western Twiggs County in the area along Georgia Highway 87 (Cochran Short Route) limestone outcrops were observed. These outcrops are exposures of the Ocala limestone which interfingers from the west with the Twiggs clay member of the Barnwell formation. In northwestern Twiggs County two samples of limestone from the Lawson property 2 miles east of Huber, Georgia, contained an average calcium carbonate equivalent to 92.3 percent.

Ground Water.—In the Sandersville area and to the east toward Davisboro the Twiggs clay member of the Barnwell formation becomes more calcareous, and grades upward into the Sandersville limestone. Ground water percolating through these beds in the upper half of the Barnwell formation has dissolved some of the calcareous material, and channels and sink holes have thus been formed. Wells penetrating the solution cavities yield supplies of ground water up to 150 gallons a minute, but the water from this aquifer is high in hardness and dissolved solids, and is unsuitable for use without treatment in boilers and for laundering.

Flowing wells from this aquifer are possible in the flood plain of Williamson Swamp Creek and its tributaries in east-central Washington County. Well 90 at Sun Hill is 80 feet deep, flows 3 gallons a minute, and has a hydrostatic head of 4.5 feet above land surface. Due east 7 miles from well 90 near the bridge over Williamson Swamp Creek at Davisboro two wells, 34 and 36, are both 90 feet deep and each flows 6 gallons a minute from the same aquifer. Well 35, drilled in 1894 [27] south 100 yards across Williamson Swamp Creek from well 34, on the B. L. Brown property, was recorded as flowing 5 gallons at that time. It was flowing 3 gallons a minute on April 4, 1944.

In Twiggs, Wilkinson, Baldwin, and Jones Counties the clay facies of the Twiggs consists of the more typical pale green fuller's earth type of clay and is not a source of ground water, although a few wells recover very limited water supplies from a basal calcareous sand of the Barnwell formation in this area.

Quality of Water.—Eleven samples of water from the calcareous beds in the upper half of the Barnwell formation in Wilkinson, Washington, and Twiggs Counties were relatively high in dissolved solids. The bicarbonate ranged from 82 to 303 parts per million, and the hardness from 75 to 252 parts per million. Complete analyses were made of water samples from two wells, 54 and 55, of the City of Sandersville. The samples from these two wells contained an average of 29.5 parts per million of silica, 70 parts per million of calcium and 4.1 parts per million of sodium and potassium combined. The sulfate content of the eleven samples ranged from 2 to 27 parts per million.

[Irwinton sand member]

During this investigation it was noted that many dug wells throughout the "Red Hills" area obtained their water from a persistent bed of fine to coarse unconsolidated sand, the Irwin-

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[27] McCallie, S. W., A preliminary report on the artesian well system of Georgia: Geol. Survey of Georgia Bull. 7, p. 136, 1898.

ton sand member of the Barnwell formation, which lies conformably on the Twiggs clay member. It was also noted that the sand capped many of the uplands in the northern half of the area of outcrop of deposits of Jackson age (see Plate 1). The sand bed ranges in thickness from about 10 feet along the northern margin of the outcrop area of the Barnwell formation to a maximum of 52 feet in the vicinity of Irwinton.

Several good exposures of the Irwinton are present at the type locality in gullies on the Hatfield property 150 yards west of a cemetery which is 0.3 mile south of the courthouse at Irwinton along Georgia Highway 29.

Section exposed in gullies on old Hatfield Place, Irwinton, Georgia

	Thickness (Feet)
Colluvium	
4. Red coarse clay.	14+
Tertiary (upper Eocene)	
Barnwell formation	
Irwinton sand member	
3. Clay, gray, waxy, mottled red.	3
2. Sand, yellow and gray, loose, fine to medium-grained, interbedded with many tough yellow clay layers. Many fine dark particles scattered throughout sand.	41
Twiggs clay member	
1. Clay, pale-green, hackly, of fuller's earth type, and with thin beds of fine angular quartz sand.	20+

In southern Washington, Wilkinson, and Twiggs Counties in the area where the coarse red sandy clay residuum of Oligocene and Miocene formations caps the hills, thick sections of yellow and light gray fine to medium cross-bedded sand (Irwinton) can be seen in road cuts and gullies. As in the gully exposure at the type locality, the Irwinton sand member of the Barnwell formation in Washington, Wilkinson, and Twiggs Counties consists of light-colored yellow, gray, and white fine to medium-grained micaceous quartz sand interbedded with thin gray and yellow clay layers, and an occasional bed of coarse white sand with carbonaceous zones. Up the dip the Irwinton sand thins to about 15 to 20 feet, becomes coarse-grained at some localities, and has an increasing number of clay beds. In southern Jones, Baldwin, Hancock and northern Washington Counties it contains about equally thick alternating beds of fine, medium or coarse sand and yellow and gray clay layers. In east-central and southern Washington County the Irwinton sand contains thin siliceous limestone layers. A soft white limestone called the Sandersville limestone member of the Barnwell [28] is exposed in a quarry and several sink holes three-fourths of a mile southwest of the courthouse at Sandersville. This limestone contains an abundance of *Periarchus quinquefarius* (Say), a *Pecten* sp., and many pelecypod and gastropod molds. The Sandersville limestone member is believed to be equivalent in part to the Irwinton sand member, but possibly represents a still younger bed of Jackson age.

A section showing the Irwinton sand member of the Barnwell formation in west-central Washington County is exposed in a small creek gully 0.8 mile south on a dirt road from the bridge over Buffalo Creek on Georgia Highway 24. The gully runs nearly parallel to and is about 150 yards east of the dirt road.

Section in creek gully just east of Buffalo Creek. West of Sandersville (air line) 8 miles

	Thickness (Feet)
Colluvium	
10. Medium and coarse red sandy clay.	20
Tertiary (upper Eocene)	
Barnwell formation	
Irwinton sand member	
9. Clay, gray, waxy, mottled red.	4
8. Sand, light-colored, yellow, white, and gray, loose, fine coarse, sub-angular, containing thin beds of tough yellow plastic clay scattered throughout. Occasional thin streaks of carbonaceous matter.	34

[28] Cooke, C. Wythe, Geology of the Coastal Plain of Georgia: U. S. Geol. Survey Bull. 941, p. 62, 1943.

Twiggs clay member	Thickness (Feet)
7. Clay, pale-green, hackly, blocky, of fuller's earth type, with thin beds of white fine angular quartz sand.	22
6. Marl, tan, fine sandy.	5
5. Marl, gray, blocky, fossiliferous.	10
4. Marl, buff, blocky, fossiliferous.	4
3. Sandy clay, brownish-gray, blocky, fossiliferous, grades upward into green sandy clay.	5
2. Sandy clay, dark greenish-gray, hackly.	11
Unconformity	
Cretaceous	
Tuscaloosa formation	
1. Kaolin, white, massive, blocky, contains many scattered angular quartz grains.	15+

The gully in which the above section was measured is typical of many gullies developed in the loose Irwinton sand (see fig. 16.)

The Irwinton sand member of the Barnwell formation lies conformably on the Twiggs clay member, and is in turn overlain, with possible unconformity, by a coarse red sand containing scattered rounded, flat, polished beach pebbles. (the upper sand member of the formation). East of the Ogeechee River the Irwinton sand member is represented by less distinctive deposits in the Barnwell formation. West of the Ocmulgee River the Irwinton sand member, together with the Twiggs clay, probably grades laterally into the upper part of the Ocala limestone in western Georgia.

Limestone.—On the old Oconee road 1.6 miles southwest of the Courthouse at Sandersville, and directly under the power line half a mile southwest of the Champion Clay plant, is an abandoned quarry in the Sandersville limestone. (see fig. 17) Three samples of this limestone, analyzed by Lawrie H. Turner, Chemist, Georgia Department of Mines, Mining and Geology, had an average calcium carbonate equivalent of 93.2 percent.

Water Supply.—The Irwinton sand, because of its loose and well-sorted nature, serves as an excellent aquifer for ground water in east-central Georgia. It is underlain by the more impervious Twiggs clay member which stops the downward percolation of ground water and forces it to move laterally through the Irwinton sand. The Irwinton sand member of the Barnwell formation is not a large producer, but it does yield an adequate supply for domestic and stock use to many shallow wells in the Red Hills area. Many springs issue at the base of the Irwinton sand from the top of the Twiggs clay in this same area.

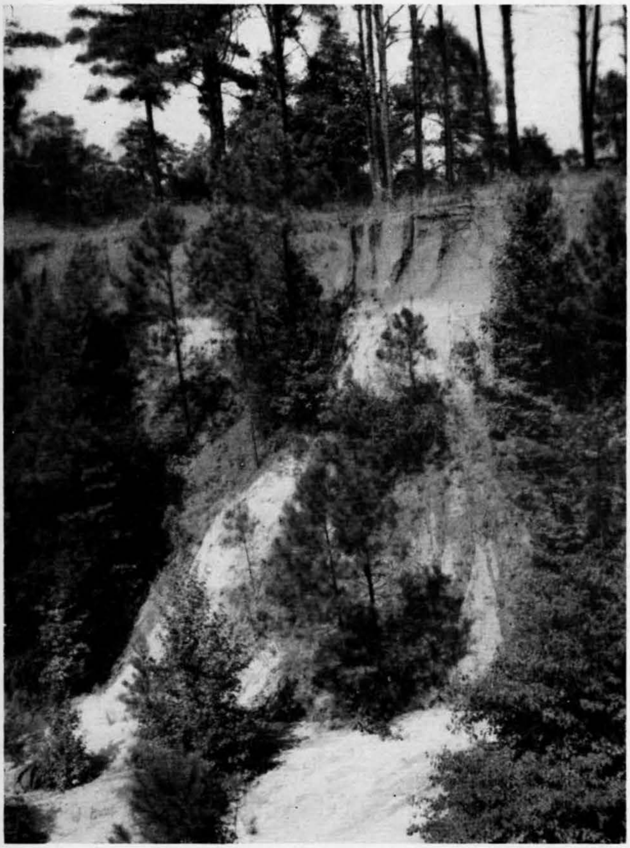

Figure 16. Gully formed by a small branch of Buffalo Creek 0.8 mile south on a dirt road from the bridge over Buffalo Creek on Georgia Highway 24.

The following are examples of wells producing from the Irwinton sand (see plate 2): Twiggs County well 2 is 85 feet deep and has a capacity of 3 gallons a minute; Twiggs County well 16 is 51.6 feet deep and has an approximate capacity of 2 gallons a minute; Wilkinson County well 55 is 92 feet deep and has a capacity of 3 gallons a minute; Wilkinson County well 71 is 59.8 feet deep and has a capacity of 2.5 gallons a minute. Many of the wells of the above type are dug into the Twiggs clay, and the part of the well dug into the clay is used as a storage basin. Most of the wells are cased with wood, brick, cement, and terra cotta tiling, but a few have only a sand box built into the lower few feet of the well to keep the loose sand from caving.

Figure 17. Sandersville limestone quarry 1.6 miles southwest of Sandersville on old Oconee road.

Down the dip from the outcrop area of the upper Eocene deposits, in southern Washington, Wilkinson, and Twiggs Counties, drilled wells that penetrate the Irwinton sand yield quantities of ground water large enough to furnish small industrial and municipal demands. The Tennille public water supply is furnished by wells 82 and 83, both of which are 125 feet deep. These wells are equipped with turbine pumps and have reported capacities of 225 and 300 gallons a minute from this aquifer.

Quality of Water.—Analyses of samples from representative wells ranging from 52 to 130 feet deep show that water from this aquifer is low in dissolved solids, generally containing less than 30 parts per million of bicarbonate, 2 parts per million of sulfate, 6 parts per million of chloride, 0.1 part per million of fluoride, and 30 parts per million of total hardness.

Wells 82 and 83 at Tennille recover water from the Irwinton sand. Water from well 82 contained only 7.0 parts per million of bicarbonate, 3 parts per million of sulfate, 0.1 part per million of fluoride, 5.4 parts per million of nitrate, and had a total hardness of 16 parts per million.

Thin beds of calcareous sandstone in the Irwinton sand member of the Barnwell formation crop out in the vicinity of Buck Creek in southwestern Wilkinson County. Further evidence possibly indicating an originally calcareous nature of this aquifer in southwestern Wilkinson and southeastern Twiggs Counties is reflected in the character of the water as shown by the analysis of a water sample from Twiggs County well 42. Water from this well is reported to come from a sandy limestone bed in the Irwinton sand at a depth of 110 feet. The sandy limestone is underlain by blue-gray Twiggs clay. The water from this well had 186 parts per million of total hardness, and contained 225 parts per million of bicarbonate, 0.22 part per million of iron, 6 parts per million of sulfate, 0.1 part per million of nitrate, and no fluoride.

[Upper sand member]

In the southern and central half of the area of outcrop of upper Eocene deposits, a coarse red sand overlies the thin clay bed at the top of the Irwinton sand member of the Barnwell formation. Characteristic of this bed in the area of the report are the flat polished beach pebbles scattered along the base of the bed. These pebbles are believed to be derived from flat fragments of the many resistant quartz veins in the weathered schist and gneiss of the Piedmont north of the Coastal Plain in eastern Georgia. The pebbles range from ¼ inch to 2 inches in diameter, and were probably rounded by wave action along a beach.

The upper coarse pebbly sand is nearly everywhere highly weathered, and seldom exceeds 20 feet in thickness, although in its southern area of outcrop near the contact of the deposits of Jackson age with the undifferentiated Oligocene and Miocene residuum, it may thicken to a maximum of 25 or 30 feet. The exact thickness of this bed is hard to determine because of the residual nature of both the upper coarse red sand and the younger beds above. The member may have originally been an upper Eocene limestone which is now represented only by a weathered coarse red angular quartz sand. Because its lithology is similar to the typical Barnwell formation of eastern Georgia and South Carolina, it is believed that this bed probably represents a thin upper member of the Barnwell formation in east-central Georgia.

A section exposed in a tramway and road cut 1.8 miles southwest of Gordon, 0.1 mile east of the intersection of Georgia Highways 18 and 57 shows the relationship of the upper sand member with the rest of the Barnwell formation, and its characteristic lithology of coarse red sand with scattered flat rounded beach pebbles.

Section in Gordon Clays Tramline cut on Georgia Highway 57, and continued in a road cut on Georgia Highway 18 about 1.8 miles southwest of Gordon

	Thickness (Feet)
Colluvium (exposed in tramway cut)	
8. Reddish brown coarse sub-angular sandy clay with scattered brown iron pellets.	4
Tertiary (upper Eocene)	
Barnwell formation	
Upper sand member	
7. Sand, pink, cross-bedded coarse and granular, sub-angular to sub-rounded, interbedded with thin gray clay stringers. At the base of the bed are found many flat rounded highly polished quartz pebbles as much as 2 inches in diameter, and stringers of fine gravel.	12½
Irwinton sand member	
6. Clay, alternatingly bedded with thin beds of buff-yellow fine-grained quartz sand. Clay weathers into purple flakes. The sand beds thicken and grade downward into bed below.	5
(Offset 0.1 mile east to road cut on Georgia Highway 18).	
5. Sand, red, coarse, grades downward into 31 feet of yellow cross-bedded fine-grained quartz sand with thin gray clay partings which become thicker near base of bed.	46

Twiggs clay member	Thickness (Feet)
4. Clay, pale green, hackly, blocky, of fuller's earth type, with fine sand streaks. (Offset down gully 20 yards west of tramway cut). Clay contains more fine and medium-grained sand in basal 20 feet. Tan gray-green and fossiliferous at base.	42
3. Clayey sand, mottled red, brown, and gray, with scattered granules and sub-angular gravel up to ¾ inch in diameter.	10
(Upper (?) Eocene)	
Channel sands	
2. Sand, pink and white, cross-bedded, fine to coarse, with clay balls up to 2 inches in diameter.	12
Unconformity	
Cretaceous	
Tuscaloosa formation	
1. Sandy kaolin, gray, blocky, overlying gray-white cross-bedded micaceous coarse quartz sand.	25+

Water Supply.—Because of the thinness and highly weathered nature of the upper sand member in this area only a small amount of water is obtained from this aquifer. Most of the wells penetrating these sands are shallow dug wells in the southern part of the outcrop area of the Barnwell formation. These wells generally produce from 2 to 10 gallons a minute. Samples of water collected and analyzed from the upper sand member had 36 to 108 parts per million of total hardness, and contained 51 to 136 parts per million of bicarbonate, and minor amounts of iron, nitrate, fluoride, chloride, and sulfate.

Oligocene and Miocene series

Residuum

Residuum of Oligocene and Miocene formations overlies rocks of Eocene age in the south-central part of Washington County, near Nicklesville and Allentown in Wilkinson County, and in the southern part of Twiggs County. This residuum consists of mottled pink and gray coarse sandy clay that weathers into grayish-yellow sandy soil with scattered red ironstone nodules along the surface.

The exact location of the contact between the Barnwell formation and the residuum of Oligocene and Miocene formations, formerly mapped as Hawthorn and Flint River formations, [29] is hard to ascertain because of the highly weathered nature of the residuum and the underlying upper sand member of the Barnwell. Up dip along the northern margin of the area of their outcrop the Oligocene and Miocene deposits form a thin layer covering Eocene beds, and in places fill sink holes in those beds. Mapping of the contact between these units is, therefore, generalized and can be done only by observing changes in the soil and topography, and noting, where exposed, the upper sand member of the Barnwell.

The new Sandersville public water well (51) drilled by Layne-Atlantic in 1944, at the City reservoir 1.6 miles south of Sandersville, penetrated 60 feet of mottled pink, gray, white, and pale green sandy clay of Oligocene and Miocene age overlying the Barnwell formation. The Miocene and Oligocene deposits thicken to a maximum of 70 or 80 feet in southern Washington County.

In southern Washington County in the vicinity of Harrison many road cuts expose beds of coarse angular quartz sand in a pale-green clayey matrix. These beds weather into light-colored sandy soils with scattered white quartz granules and fine angular gravel. Previously this material was named the Altamaha grit [30] and the "rolling wire grass area" in which the beds crop out was called the Altamaha grit region.[31]

Water Supply.—The undifferentiated deposits of Oligocene and Miocene formations consist mainly of sandy clay in the area of this report and therefore are not a good aquifer. A few shallow dug wells obtain water from thin sand beds in this unit, but the supply is very small and furnishes barely enough for small domestic and stock use.

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[29] Cooke, C. W., Geology of the Coastal Plain of Georgia: U. S. Geol. Survey Bull. 941, pp. 77, 84-89, 1943.

[30] Dall, H., and Harris, G. D., the Neocene of North America, U. S. Geol. Survey Bull. 84, pp. 81, 82, 1892.

[31] Harper, R. M., A Phytogeographical sketch of the Altamaha Grit Region of the Coastal Plain of Georgia: Ann. N. Y. Acad. Sci., vol. 17, part 1, pp. 18-19, Sept. 1906.

Quaternary

Alluvium and undifferentiated terrace deposits

In east-central Georgia alluvium and undifferentiated terrace deposits lie unconformably on older rocks in the vicinities of the Ocmulgee, Oconee, and Ogeechee Rivers and their tributaries. These deposits consist mainly of unconsolidated silt, clay, sand, and gravel, which have been derived from the adjacent older crystalline rocks of the Piedmont and deposits of the Coastal Plain.

Most of the terrace and flood-plain areas in this region are swampy and subject to overflow in times of heavy rainfall. They are areas of oxbow lakes and wide meandering streams. The relief does not exceed 20 feet.

Water Supply.—Only shallow wells in the flood-plain area recover ground water from these beds. The sand and gravels of recent age are good ground-water aquifers and furnish medium quantities of water of low mineral content.

COUNTY DESCRIPTIONS

In the pages that follow, the geography, geology, and ground-water conditions are described by county in alphabetical order. The public, industrial, and local supplies in the Coastal Plain area of this report are described in detail, and tables of representative wells, chemical analyses, and well logs are given. Little time in the field was given to the study of the geology and ground water of the Piedmont in northern Baldwin, Hancock, and Jones Counties, and only a generalized statement on the resources of the crystalline area is given.

The wells for which data were collected are consecutively numbered by counties; the well tables follow the individual county descriptions. The number of each well in the well tables corresponds with the well numbers in plate 2. The wells are numbered in order from the northeast corner of a county to the west and back to the east. The well numbers in the well tables and in plate 2 correspond to the numbers used in the chemical analysis tables and in the text of the report. A well number in plate 2 followed by the letter C or P signifies that a complete or a partial analysis, respectively, for that well can be found in the tables of chemical analyses in the county descriptions.

If information concerning the ground-water conditions of a particular locality is desired, plate 2 will show the number of the wells for which data may be found in the tabulated records in the individual county descriptions. If there are no wells shown in the vicinity of the desired locality or if additional information on the geology and ground water of a locality is needed, reference may be made to plate 1 to determine what geologic formations underlie the locality in question. Reference can then be made to the sections on water-bearing formations in that locality, for general information on the ground-water conditions and to the section on Quality of Water for the general chemical content of the ground water.

Baldwin County

[Area 265 square miles. Population 24,900]

Geography

Baldwin County is in the north-central part of the area described in this report. Approximately 72 percent of the population is rural and in 1940 the county had an average of 91.3 inhabitants per square mile. During the period 1930-1940 the population increased 5.7 percent. Milledgeville, the county seat, is located near the Fall Line, in the Piedmont province. Only two small towns, Stevens Pottery and Coopers, are located in the Coastal Plain in the southern one-third of the area.

Agriculture is the principal industry, and 74 percent, or 125,-539 acres were in farmland in the county in 1940. On these farms 19,907 acres were cultivated in corn and 6,188 acres in cotton during this same period. Winter wheat and oats are also of agricultural importance to the area. According to the Federal census of 1940, there were 16 manufacturing establishments in the county, whose annual products were valued at $1,946,147.

The northern two-thirds of Baldwin County lies within the Piedmont Province, while the southern third of the county is south of the Fall Line in the Coastal Plain. The maximum relief for the entire area is about 400 feet. The greatest land surface elevation is in the northeastern part of the county in the area where the Eocene deposits overlap the igneous rocks of the Piedmont, whereas the lowest elevation is in the southeastern part of the area in the floodplain of the Oconee River.

In the Piedmont area the soils are typically deep red residual clays and the more angular topography of this area is in sharp contrast to the broad rolling hills with gentle slopes and the light-colored sandy soils of the Coastal Plain. The relief of the Sand Hills area in southern Baldwin County does not exceed 150 feet.

The Oconee River flows from the north central to the southeast corner of Baldwin County and with its tributaries, Little River, Fishing, Town, and Gumm Creeks it drains the entire area. The flood-plain deposits of the Oconee River widen from less than a mile in central and north-central Baldwin County to nearly 5 miles in the southwestern corner of the county.

Geology

The rocks that underlie the northern two-thirds of the county are the old metamorphic and igneous rocks of the Piedmont. In a few places these rocks are overlain by narrow tongues of sand and clay, which belong to the Barnwell formation of Eocene age (see map, plate 1). The crystalline rocks in this area are biotite gneiss and schist of the Carolina gneiss, and slates and quartzites of pre-Cambrian or possible early Paleozoic age. Injected into these rocks at some localities are dolerite dikes of Triassic age.[32]

The rocks of the Piedmont are deeply weathered, and only the more resistant of these rocks remain at the surface. The rest are weathered into a fairly deep residual soil. The complex nature of the crystalline rocks makes difficult any generalized statement on its geologic nature or characteristic water-bearing properties.

The Tuscaloosa formation, of Upper Cretaceous age, crops out almost everywhere south of the Fall Line in Baldwin County. The Tuscaloosa formation thins to a few feet of coarse irregularly bedded clay, sand, and gravel along the northern margin of the Fall Line. It thickens to the southeast, down the dip, to a maximum of about 200 feet along the southeastern Baldwin County line.

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[32] Geologic Map of Georgia: Georgia Division of Mines, Mining and Geology, 1939.

Thin outliers of the Barnwell formation overlap the Tuscaloosa formation and in two places extend over the crystalline rocks of the Piedmont. These outliers consist of cross-bedded kaolinitic channel sand and the bedded sand and clay of the Irwinton sand and Twiggs clay members of the Barnwell formation. Their entire thickness rarely exceeds 75 feet in this county.

A section showing the lithology of the channel sands, Tuscaloosa formation, and underlying crystalline rocks is exposed in a road cut on the southeast bank of Buck Creek 5.1 miles (air line) southeast of Milledgeville, Baldwin County.

Section in road cut of old Sandersville Road 5.1 miles (air line) southeast of Milledgeville

	Thickness (Feet)
Eocene (upper Eocene)	
Channel sands	
5. Sand, pinkish-red, fine to medium-grained, cross-bedded with thin white clay layers and rounded clay balls up to 1 inch in diameter.	24
Unconformity (poorly exposed contact)	
Upper Cretaceous	
Tuscaloosa formation	
4. Sandy clay, mottled red, gray and yellow, with scattered sub-angular to sub-rounded quartz gravel 1/8-to 1/2-inch in diameter.	10
3. Quartz sand, gray, pink, and white, medium to coarse-grained, cross-bedded, micaceous, and with many gravel stringers. Interbedded lenses of purple, red, and gray, finely sandy micaceous clay.	79
2. Sandy clay, light-gray, micaceous, grades down into basal bed of angular to sub-angular quartz sand.	2
Unconformity	
Pre-Cambrian	
Crystalline rocks	
1. Gray, tan, and yellow alternating hard quartzites and soft highly weathered slates.	33

Ground Water

Most of the water supplies in the Piedmont area are obtained from shallow dug wells in the residual soils. These wells yield relatively small supplies. The public supply of Milledgeville is taken from Fishing Creek. In the Coastal Plain area nearly all the water supplies are obtained from the sands and gravels of the productive Tuscaloosa formation. Small supplies of ground water are recovered from shallow dug wells in this formation in the vicinity of the Fall Line, but down the dip in the southern part of Baldwin County, where the Tuscaloosa formation thickens to about 200 feet, larger supplies are obtained from drilled wells. The drilled wells at Stevens Pottery and Indian Island yield up to 150 gallons a minute from this aquifer.

The Barnwell formation furnishes sufficient ground water to shallow dug wells for small domestic and stock supplies in the northeastern and southwestern part of the county. The yield from these dug wells rarely exceeds 3 gallons a minute.

Quality of Ground Water

In Baldwin County 8 well-water samples were collected for analysis. Sample "a" is an analysis of a composite 10-day sample collected from the Oconee River, and is included for comparison (see table at end of section on Baldwin County).

The water samples from 4 wells in the Tuscaloosa formation and 1 well in the Barnwell formation were very low in dissolved mineral matter and hardness. They had only 16 parts per million or less of total hardness, 4 parts per million or less of sulfate, 0.3 or less part per million of iron, and 3 parts per million or less of chloride. The samples of water from wells 3, 15, and 17, situated along the Fall Line, apparently are mixtures of water from the Tuscaloosa formation and the crystalline rocks. The analyses of these waters showed higher quantities of fluoride, and bicarbonate and greater degrees of hardness than normally are present in the waters from the Tuscaloosa or Barnwell formation in this County.

Local Supplies

Milledgeville (population 6,778) has the only public water supply system in Baldwin County. It is in the southern margin of the Piedmont province and takes its entire water supply from Fishing Creek. During 1945 the combined public supply, plus the water supply used by the Naval Ordnance plant and the Reynolds Corporation, slightly exceeded 27,000,000 gallons a month.

To facilitate discussion of the ground water of the Coastal Plain area of Baldwin County the area has been divided into southwestern, southeastern, and northeastern sections.

The southwestern section includes the area in the Coastal Plain in Baldwin County west of the Oconee River.

Stevens Pottery and Coopers, the two villages in this section, do not have a centralized public water supply. In the vicinity of Stevens Pottery much of the water for private use is taken from a well installed for industrial use at the General Refractories Company. This well (17) is 240 feet deep and appears to recover water from both the crystalline rocks and the Tuscaloosa formation. It originally produced 200 gallons a minute in 1938, but the yield has since dropped to 150 gallons a minute. A log of well 17 was not available, but information given by the Company superintendent indicates that the basement crystalline rocks are at a depth of 120 feet below a land surface which is 465 feet above sea level.

Another well in the vicinity (15) at Cooperville School is 210 feet deep and also appears to recover water from both the crystalline rocks and the Tuscaloosa formation. This well is only pumped at the rate of 6 gallons a minute, which is a large enough supply to meet the demands for school consumption.

Well 18 in the southwestern part of the section was drilled to a depth of 53 feet and is believed to recover water from the channel sands, which are nearly 20 feet thick in the vicinity of the well. The yields of this well and of shallow dug wells drawing ground water from the channel sands in this area rarely exceed 3 gallons a minute.

Most of the other of the ground water supplies in the Stevens Pottery-Coopers area are obtained from shallow dug wells penetrating water-bearing sands in the Tuscaloosa formation.

The southeastern quarter of Baldwin County includes all the Coastal Plain area east of the Oconee River and south of Georgia Highway 24. In the northeastern part of southeastern Baldwin County (see plate 1) the Tuscaloosa formation is overlain by thin deposits of the Barnwell formation. Shallow dug wells 20 to 50 feet deep in this area provide domestic and stock supplies. Well 9, on the old Sandersville road, is 192 feet deep and can be pumped at the rate of 6 gallons a minute for 24-hour periods. Well 7 is 250 feet deep and has a natural artesian flow of 27.7 gallons a minute. It has a hydrostatic head of 10 feet above land surface. This well is located on Indian Island in the flood plain of the Oconee River. It yields water from the Tuscaloosa formation, and formerly furnished the water supply for a swimming pool. The whole southeastern corner of the county is in the area of outcrop of the Tuscaloosa formation and the alluvium of the Oconee River. Many shallow dug wells yield from 3 to 8 gallons of water a minute from these deposits.

Log of well 7 located on Indian Island
(Authority J. W. Schinholser, owner)

	Depth (feet)		Depth (feet)
Surface soil	0-6	Medium gravel and sand	85-150
Blue gummy clay	6-85	Sand and thin beds of clay	150-250

The northeastern quarter of the county includes an area in which the Eocene deposits overlap the Tuscaloosa formation to the Piedmont. The rural water supplies are from shallow dug wells in the Irwinton sand member of the Barnwell formation and the channel sands. The wells range in depth from 25 to 50 feet and have yields of 1 to 3 gallons a minute. Two dug wells, 4 and 6, and a drilled well, 5, draw water supplies from the Tuscaloosa formation. These wells range in depth from 20 to 76 feet, and furnish rural domestic and stock requirements.

Records of Wells

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industridal; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	On StateHgy. 22, 2.4 mi S of Town Creek.	Tom Robinson	37.80	48	38	Channel sand
2	NE 1.5 mi. from intersection State Hgy. 22–24.	J. E. Christian	33.7	48	33	Channel sand
3	NW of Gumm Creek 6.8 mi. on State Hgy. 24.	Union Power School.	190	2	190	Tuscaloosa & crystalline rocks
4	N 1.4 mi. from well 5	J. E. Berry	35	48		Tuscaloosa
5	N. 1.7 mi. from well 6	F. I. Wilkinson	76	2	74	Tuscaloosa
6	N. 1.4 mi. from Gumm Creek bridge on State Hgy. 24.	W. E. Hodges	20	48		Tuscaloosa
7	Indian Island, S. E. Baldwin Co.	J. W. Schinholser	250	2½	250	Tuscaloosa
8	NW 1.6 mi. from Town Creek bridge on State Hgy. 24.	J. W.Schinholser	44	48	40	Tuscaloosa
9	NW 3.5 mi. from well 8 on old Sandersville Rd.	Grady Butler	192	2	140	Tuscaloosa
10	S 4.4 mi. on Vinson Hgy. from State Hgy. 29.	Carl Vinson	110	2	110	Tuscaloosa
11	S 1.1 mi. of well 10	Luther Herrin	86	2	81	Tuscaloosa
12	Colony Farm	State of Ga.	12.3	96	12.23	Tuscaloosa
13	SW .7 mi. on Stevens Pottery rd. from State Hgy. 29.	W. B. Richards	50	2	45	Channel sand
14	SW 2.9 mi. from well 13	J. R. Commanie	96	48	96	Tuscaloosa
15	Coopers	Cooperville	210	2		Tuscaloosa & crystalline rocks
16	Stevens Pottery	General Refractories.	45	24	36	Tuscaloosa
17	Stevens Pottery	General Refractories	240	6	184	Tuscaloosa & crystalline rocks
18	SW 2.1 mi. from Stevens Pottery.	J. F. Hall	65	2	61	Channel sand
19	W. 2.3 mi. from Stevens Pottery.	R. W. Ivey	42.3	48	8	Tuscaloosa
20	S .6 mi. from well 19	Elizabeth Ivey	96	2	91	Tuscaloosa
21	NW 2 mi. from Stevens Pottery.	W. T. Weaver	24.4	36	24	Tuscaloosa
22	SW .7 mi. from well 21	W. T. Weaver	45	36	45	Tuscaloosa
23	.4 mi. E of well 24	Richard Vinion	25	48	25	Crystalline rocks
24	E. 0.6 mi. on State Hgy. 49 from Jones County.	Lawrence Hill	32.4	48	14	Channel sand

in Baldwin County

Power: E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
BH	DS	Top of shelf	+.2	572	−35.3	4–24–45	Discharge 3. T. 65°F.
BCE	DS	Top of shelf	+ 3.2	548	−31.4	11–8–44	Discharge 3. Partial analysis.
TE	PS	Top of curb	+.4	413	−65	11–24–44	Discharge 8. Partial analysis.
CE	DS	Land surface	0.0	390	−31	11–5–44	Discharge 3. T. 64° F.
CH	DS	Land surface	0.0	330	−54	11–5–44	T. 64°F.
BCE	DS	Top of shelf	+2.9	315	−16	11–5–44	Discharge 3. T. 68° F.
F	S	Top of casing	+.6	255	+10	11–6–44	Partial analysis. Discharge 27.7.
TE	DS	Land surface	0.0	302	−40	11–6–44	Discharge 3. T. 65° F.
CE	DS	Land surface	0.0	459	−65	11–6–44	Discharge 6. T. 65°F.
CE	ID	Land surface	0.0	403	−69	11–6–44	Discharge 8.
CE	DS	Land surface	0.0	387	−65	11–6–44	Partial analysis. Discharge 8.
CE	PS	Top of curb	.82	381	−5.38	11–8–44	Partial analysis. Combination spring and dug well. Discharge 50.
CH	DS	Land surface	0.0	510	−26	11–6–44	Screen set 45′–50′. T. 65°F.
CH	DS	Top of curb	+3.9	489	−90.1	11–6–44	T. 65°F.
CH	PS	Land surface	0.0	407	−195	11–6–44	Partial analysis. Discharge 6.
BH	DS	Top tile curb	+3.2	465	−34.2	11–6–44	T. 65°F.
TE	IPS	Land surface	0.0	465	−165	11–6–44	Partial analysis. Discharge 150.
CG	DS	Land surface	0.0	465	−53	10–14–44	Discharge 3. T. 67°F.
BH	DS	Top of curb	+2.3	480	−40.3	11–6–44	T. 64°F.
CE	DS	Land surface	0.0	495	−74	11–6–44	Partial analysis. Discharge 4.
BH	DS	Land surface	0.0	--------	−20	11–6–44	T. 65°F.
CE	DS	Land surface	0.0	--------	−30	11–6–44	Discharge 3. T. 66°F.
BH	DS	Top of curb	+3.1	--------	−20.1	11–6–44	--------------------
BH	DS	Land surface	0.0	--------	−22.4	11–6–44	T. 64°F.

Analyses of Ground Waters from Baldwin County

(Analyzed by A. T. Ness and Evelyn Holloman. Parts per million. Numbers at heads of columns correspond to numbers in table and in plate 2)

Number	2	3	7	11	12	15	17	20	a
Geologic horizon	Channel and	Crystalline rocks & Tuscaloosa	Tuscaloosa	Tuscaloosa	Tuscaloosa	Crystalline rocks & Tuscaloosa	Crystalline rocks & Tuscaloosa	Tuscaloosa	Surface Water
Silica (SiO_2)									15
Iron (Fe)	.09	.39	.02	.22	.02	.76	5.8	.32	.10
Calcium (Ca)									4.8
Magnesium (Mg)									2.4
Sodium & Potassium (Na+K)									6.7
Carbonate (CO_3)									0
Bicarbonate (HCO_3)	4.0	60	5.0	1.0	3.0	64	85	16	29
Sulphate (SO_4)	2	4	4	1	1	11	7	2	3.0
Chloride (Cl)	3	3	2	2	10	2	2	3	3.1
Fluoride (F)	.0	.3	.0	.0	.0	.2	.3	.0	.0
Nitrate (NO_3)	5.6	.1	.1	6.5	32	.1	0.2	10	.60
Dissolved Solids									51
Total Hardness	8	40	8	6	16	30	57	16	22
Date of collection, 1944	11–8	11–24	11–6	11–6	11–10	11–6	11–4	11–6	Jan, 1938*
Temperature, °F.	65	63	66	65	67	67	66	64	

* Composite 10-day sample—Oconee River—raw water.

Hancock County

[Area 485 square miles. Population 12,764]

Geography

Hancock County lies in the northeast corner of the area described in the report. The population is largely rural and averages 26.3 inhabitants per square mile. During the period 1930-40 the population increased by 2.3 percent. Sparta, the county seat, has a population of 1,872 inhabitants. In the Piedmont area in the northern two-thirds of this county are the villages of Sparta, Powelton, Mayfield, Jewel, Culverton, and Granite Hill. In the southern third, or Coastal Plain area, are the villages of Devereux, Carrs, and Linton.

In 1940 the county had 211,606 acres, or 68.2 percent of the area, in farmland. On the 1,679 farms in the county, 34,663 acres were cultivated in corn and 13,241 acres in cotton. Winter wheat and oats were also of agricultural importance. The poultry farms of the county raised 82,636 chickens in 1940. During the same period there were 24 manufacturing establishments in the area whose annual products were valued at $798,421. Natural resources of major importance are timber, building stone, and kaolin.

The northern two-thirds of Hancock County is in the Piedmont Province. This area has a maximum relief of 350 to 400 feet and is characterized by deep-red residual soils. There is little break in the surface features between the Piedmont and the Coastal Plain Provinces, and the relief and topographic features are similar in the two regions except that land forms in the Coastal Plain or the southern one-third of the county are more rounded and smooth, whereas the Piedmont is more dissected by rain gullies and small ravines.

Outstanding in this region is the relief exhibited in the area of overlap of the Eocene deposits in the vicinty and to the west of Devereux. This relief is caused by a tongue of Eocene material extending 14 miles north from the Washington-Hancock County line (see fig. 18). The remainder of the Coastal Plain sediments form a discontinuous belt across the southern part of the county. The maximum relief of this area is about 200 feet.

The Oconee River forms most of the western Hancock County boundary line and with its tributaries, Buffalo, Town, and Shoulderbone Creeks, drains all the central and western part of the area. The Ogeechee River forms the eastern county boundary line and with its tributaries, Little Ogeechee River, Powell and Fulsome Creeks, drains the eastern third of the area.

Figure 18. East view across Piedmont from the Devereux outlier in western Hancock County

Geology

The northern two-thirds of Hancock County is in the area of outcrop of pre-Cambrian granite gneiss, biotite gneiss, and schist intruded at some places by dolerite dikes of Triassic age. Also present in this area are three narrow east-west trending belts of slate, quartzite and volcanics.

Overlying the crystalline metamorphic and igneous rocks of the Piedmont in the southern one-third of the county are the unconsolidated rocks of the Coastal Plain. In the western part of the county in the vicinity of Carrs and Devereux the Tuscaloosa formation does not exceed 50 feet in thickness, and consists of white kaolinitic clay, light-colored sands, and gravel.

With the exception of the Mayfield outlier and several thin exposures of Cretaceous rocks in the vicinity of Carrs, Devereux, and Linton, the entire section of Coastal Plain sediments in the southern third of Hancock County is represented by the overlapping deposits of Eocene age. The Eocene deposits are represented by the pink and white coarse kaolinitic channel sands overlain in the southeastern and south-central parts of the county by the Twiggs clay and Irwinton sand members of the Barnwell formation. The entire thickness of these beds rarely exceeds 75 to 100 feet in this area. A section showing the lithology and stratigraphic relationship of these units in eastern Hancock County is as follows:

Section exposed in a road cut 3.3 miles south on dirt road from Jewell, Hancock County

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Irwinton sand member	
4. Sand, brownish-tan, fine to medium-grained, cross-bedded, and with thin clay streaks and clay balls near base.	35
Twiggs clay member	
3. Clay, yellow, tough, plastic, fine sandy, micaceous.	6
Channel sand	
2. Sand, orange, cross-bedded, angular, coarse, arkosic. Bed contains many scattered kaolin particles and gravel up to 3 inches in diameter.	8
Uncomformity	
Pre-Cambrian	
1. Granite, highly weathered.	10

Ground Water

In the northern two-thirds of Hancock County shallow wells 20 to 60 feet deep in the residual clayey soils of the Piedmont provide enough water for small domestic and stock supplies. Most of these shallow dug wells produce about 1 to 3 gallons a minute, and a few produce as much as 5 gallons a minute.

Drilled wells in the crystalline area yield sufficient ground water for small municipal and industrial demands, but rarely do drilled wells in this area produce more than 50 gallons a minute. Because of the complexity of the crystalline rocks, no generalized statement of ground-water conditions can be given for the area.

In southwestern and southeastern Hancock County the southeastward sloping surface of the crystalline rock is buried beneath thin deposits of clay, sand, and gravel of the Coastal Plain except where exposed by stream erosion. The Coastal Plain sediments do not exceed 200 feet in thickness at any locality in the area, and therefore only limited amounts of ground water can be recovered from them. These sand and gravel beds of the Coastal Plain form part of the intake area of the Tuscaloosa and Barnwell formation, and have developed little or no artesian pressure.

Quality of Ground Water

Water samples were collected from five wells in the Coastal Plain area in southern Hancock County. Well 8 at Linton, is 150 feet deep and recovers its entire water supply from the crystalline rocks. Comparison of water from this well with the other 4 well waters collected from the Tuscaloosa formation and the channel sands in this area indicates a slightly higher mineral content for water in the crystalline rocks than for water from unconsolidated deposits far up the dip along the northern margin of the Coastal Plain Province.

Local Supplies

Sparta (population 1,872) has a municipally owned and operated water works, originally installed in 1912. Three drilled wells furnish ground water from the crystalline rocks. The wells have individual capacities of 30, 70 and 70 gallons a minute, although the two 70-gallon wells are located so near each other that when their pumps are operated simultaneously their combined yield does not greatly exceed 70 gallons a minute. These wells are pumped into a 93,000-gallon reservoir. From the reservoir the water is pumped into an 80,000-gallon elevated tank by two electrically driven centrifugal pumps with capacities of 500 and 200 gallons a minute. From the tank, water is distributed to the town through 8-inch, 6-inch, and 4-inch mains.

The average daily consumption for all purposes at Sparta is about 70,000 gallons. A maximum daily consumption of about 80,000 gallons occurs during the summer months.

To facilitate discussion of the ground water in the Coastal Plain in southern Hancock County, a unit is made of the southeastern half of the County east of Buffalo Creek, and another unit west of Buffalo Creek.

The seven wells in southeastern Hancock County for which data were collected range from 29.6 to 192 feet in depth. All but two of these wells are dug wells, recovering ground water from the channel sands and the Irwinton sand member of the Barnwell formation. Four of these five wells recovering water from the Barnwell formation use a bucket and hand windlass as a method to recover water from the well, therefore no estimate could be made as to their capacity. Well 4 had an electric pump and could be pumped at the rate of 3.6 gallons a minute. Well 1, drilled in 1936 to a depth of 192 feet, recovers water from both the Tuscaloosa formation and the crystalline rocks, and has a capacity of 7.5 gallons a minute. The driller's log of this well is as follows:

Log of well 1 at Mayfield, Hancock County, Georgia

(Authority, E. R. Whaley, owner)

	Depth (feet)		Depth (feet)
Top soil	0-3	Rock	90-132
Red clay	3-52	Fine white sand	132-142
Fine white sand	52-90	Rock	142-192

In the western part of southeastern Hancock County another well, drilled in 1932 to a depth of 90 feet, probably recovers water from a thin bed of sand and gravel in the Tuscaloosa formation. The 10 feet of screen in this well is set from 80 to 90 feet, and the capacity of the well is 1.5 gallons a minute.

In southwestern Hancock County well data were collected for 14 wells, all but two of which were dug wells ranging in depth from 27 to 82 feet. These shallow dug wells obtained water from the Tuscaloosa formation, the channel sands, and Irwinton sand member of the Barnwell formation. The coarse

Records of Wells in

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industrial; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	NW 3 mi. from Mayfield	E. R. Whaley	192	6	142	Tuscaloosa & crystalline rocks.
2	NW 2.9 mi. from Jewell	W. T. Frasier	34.4	36	25	Channel sand
3	SE 4.4 mi. from Culverton.	Will Hataway	63.2	48	60	Irwinton sand
4	S 4.3 mi. from Jewell	B.H. Yardborough	39.5	48	8	Channel sand
5	S 1.9 mi. from well 3	Jefferson Std. Bank Ins. Co.	44.9	48	44	Channel sand
6	S 0.4 mi. from well 7	W. L. Wilson	29.6	48	--------	Irwinton sand
7	SE 6.2 mi. from Sparta	J. H. Archer	90	2	80	Tuscaloosa
8	Linton, Ga	J. H. Trawick	150	3	150	Crystalline rocks.
9	SW 4.1 mi. from Linton	S. E. Blizzard	65	48	--------	Irwinton sand
10	S 1.2 miles from well 11	2nd. Beulah Church.	82	2	77	Channel sand
11	SE 1.4 mi. from well 12	Mrs. T. L. Brown	38.6	48	38	Channel sand
12	S 3.2 mi. from Devereux	H. L. Kennedy	58	36	25	Tuscaloosa
13	S. 1 mi. from Devereux	R. L. Waddell	50.7	--------	--------	Tuscaloosa
14	Devereux	Charles Coleman	63	48	62	Tuscaloosa
15	W 0.8 mi. from Devereux.	Mrs. Katie Nelson	46.6	48	--------	Tuscaloosa
16	W. 1.7 mi. from Devereux.	W. E. Bass	48.3	36	48	Tuscaloosa
17	NW 2.8 mi. from Devereux.	Mamie Warren	82	48	77	Channel sand
18	N 0.7 mi. from well 17	Warren Chapel Jr. High Scl.	42.5	48	3	Channel sand
19	S 1.4 mi. from well 16	A.O.Hutchings	72.5	48	65	Tuscaloosa
20	NW 1.3 mi. from Carrs	C. C. Pounds	27	36	27	Tuscaloosa
21	S 0.9 mi. from Carrs	James H. Arnold	50.9	48	3	Tuscaloosa

sand of the Tuscaloosa formation appears to be the most productive ground-water aquifer in this region. Wells 15, 16, and 19 yield approximately 4 gallons a minute, well 13 yields 6 gallons a minute, and well 14 yields 7 gallons a minute from this aquifer. Because the Coastal Plain sediments in this area are in the form of outliers and tongues overlapping the Piedmont

Hancock County

Power: E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
CE	DS	Land surface	0.0	--------	−65	11–10–44	Partial analysis. Discharge 7.5.
BH	DS	Top well curbing	+2.8	--------	−32	11–24–44	--------
BH	DS	Top well shelf	+2.0	--------	−59.2	11–24–44	T. 64° F.
CE	DS	Top wood curbing.	+1.2	--------	−27.3	11–11–44	T. 65° F.
BH	DS	Top well shelf	+3.5	--------	−37.8	11–11–44	T. 65° F.
BH	DS	Top well shelf	+3.6	--------	−26.3	11–24–44	T. 64° F.
CW	DS	Land surface	0.0	--------	−75	11–24–44	Screen set 80–90 ft. Discharge 1.5.
CE	DS	Land surface	0.0	--------	−45	11–2–44	Partial analysis. Discharge 8.
BH	DS	Top wood curb	+2.9	503	−53.5	11–24–44	--------
CH	PS	Top cement curb	+ .1	480	−65	11–24–44	Screen set 77–82 ft. Discharge 3.
CG	DS	Top well shelf	+2.8	--------	−34.8	11–24–44	Discharge 8. T. 64° F.
BH	DS	Top well shelf	+2.6	611	−52.6	11–24–44	--------
CE	DS	Top cement curb	+ .6	620	−50.2	11–24–44	Discharge 6.
CE	DS	Land surface	0.0	64	−59	11–24–44	Partial analysis. Discharge 7.
CE	DS	Top wood shelf	+4.3	--------	−38.2	11–24–44	Discharge 4.
CW	DS	Top of tile curb	+3	619	−43.3	11–24–44	Discharge 4.
CH	DS	Top cement curb	+ .2	635	−76	11–24–44	Partial analysis. Screen set 77–82 ft.
BH	PS	Top well shelf	+3.1	--------	−34.4	11–24–44	T. 64° F.
TE	DS	Top well shelf	+3.3	600	−69	11–24–44	Discharge 4.
BH	DS	Top well shelf	+3.0	500	−20.7	11–24–44	--------
BH	DS	Top well shelf	+3.2	563	−49.1	11–24–44	Partial analysis. T. 63° F.

rocks, little or no artesian pressure is built up, and therefore flowing wells from the Coastal Plain sediments in Hancock County are not probable.

Analyses of Ground Waters from Hancock County

(Analyzed by Evelyn Holloman. Parts per million. Numbers at heads of columns correspond to numbers in table and in plate 2)

Number	1	8	14	17	21
Geologic horizon	Tuscaloosa & crystalline rocks	Crystalline rocks	Tuscaloosa	Channel sand	Tuscaloosa
Silica (SiO_2)	----	----	----	----	----
Iron (Fe)	.85	11	.16	7.0	.57
Calcium (Ca)	----	----	----	----	----
Magnesium (Mg)	----	----	----	----	----
Sodium & Potassium (Na + K)	----	----	----	----	----
Carbonate (CO_3)	----	----	----	----	----
Bicarbonate (HCO_3)	44	46	6.0	7.0	33
Sulphate (SO_4)	7	12	1	2	2
Chloride (Cl)	2	3	7	26	1
Fluoride (F)	.2	.2	.0	.0	.0
Nitrate (NO_3)	.0	.1	11	22	.1
Dissolved Solids	----	----	----	----	----
Total Hardness	30	32	12	22	27
Date of collection, 1944	11–10	12–2	11–24	11–24	11–24
Temperature, °F.	65	63	64	65	63

Jones County

[Area 402 square miles. Population 8,331]

Geography

Jones County forms the northwestern corner of the area covered by this report. It is bounded on the west by the Ocmulgee River, on the north by Jasper and Putnam Counties, on the east by Baldwin County, and on the south by Twiggs County. Jones is the most thinly populated county in the area described, having only 20.7 inhabitants per square mile. During the period 1930-1940 there was a 7.4 percent decrease in its population.

Agriculture is the leading occupation in the area, and in 1940 approximately 53 percent, or 137,112 acres, were devoted to farmland. On the 740 farms of the county, 34,663 acres were cultivated in corn and 13,241 acres in cotton. Poultry farms raised 46,536 chickens during the same period, and winter wheat, oats, and cattle also rank high in agricultural value.

Slightly more than the northern three-quarters of Jones County is in the Piedmont Province. The principal towns of this area are: Gray, population of 698; East Julliette, population 300; and three other small villages—James, Haddock, and Wayside. Almost the entire western quarter of the area is included in the Piedmont National Wildlife Refuge and the Chattahoochee National Forest.

There are no towns or villages in the Coastal Plain area in the southern one-quarter of Jones County, although there are several small concentrations of inhabitants near McWilliams, Van Buren, and Postell stations on the Central of Georgia Railway.

The relief of the Piedmont in this area probably does not exceed 350 feet. The development of the present land surface of the Piedmont has been brought about almost entirely by the action of stream erosion, which has slowly worn down the land surface to almost a plane. This region has deep red clayey soils which gully rapidly when the vegetation is removed.

There are two physiographic subdivisions in the Coastal Plain area in southern Jones County, the Sand Hills and the Red Hills (see figure 2). The Sand Hills parallel, from east to west, Commissioners, Slash, and Big Sandy Creeks, and represent the area of outcrop of the Tuscaloosa formation. In the southwestern part of the area the Tuscaloosa formation is not overlapped by younger beds of upper Eocene age, and the Sand Hills are adjacent to the Piedmont. The Sand Hills are broad rolling hills with gentle slopes and light-colored sandy soils, and the maximum relief of the area is about 100 to 150 feet.

In the Red Hills or uplands between the stream valleys, the soils are generally bright red sandy loams derived from the sand, sandy clay, and clay of the Barnwell formation. Little original surface or flat land remains at the summit level in this area along the northern margin of the Fall Line, because the streams have cut into these deposits, leaving only narrow hills paralleling the streams of the area. The relief of the Red Hills area is about 200 feet.

Nearly all of southern, eastern, and central Jones County is drained to the southeast by Big Sandy, Commissioners, and Big Cedar Creeks, which are tributaries of the Oconee River. The western and northwestern parts of the county are drained to the southwest by Falling and Walnut Creeks, which flow into the Ocmulgee River.

Geology

The crystalline metamorphic and igneous rocks of the Piedmont crop out in the area to the north of the Coastal Plain in Jones County. These rocks consist of granite gneiss, biotite gneiss, and schist of probable pre-Cambrian age injected at some localities by dolerite dikes of Triassic age. In northwestern Jones County, in the vicinity of East Julliette, hornblende gneiss of probable pre-Cambrian age crops out. The surface of the crystalline rocks slopes to the southeast and in the southern quarter of the county is covered by the Coastal Plain deposits.

The sedimentery deposits of the Coastal Plain attain a maximum thickness of about 200 feet in southwestern Jones County. The Tuscaloosa formation thickens to the southeast from a few feet along the Fall Line to a maximum of 120 feet of alternating clays, sand, and gravel at the southern Jones County line, and constitutes the best water-bearing formation in the county. The channel sands in this area consist of light-colored coarse cross-bedded quartz sand with scattered kaolin balls. These deposits are not persistent throughout the area, and where present range from a few inches to 20 feet in thickness. The Twiggs clay member of the Barnwell formation, where not eroded away by streams, is about 40 feet thick and consists of pale-green blocky clay, of the fuller's earth type, which grades down into a basal 10 feet of olive-green fossiliferous clay with scattered lime nodules. The Irwinton sand member of the Barnwell, up the dip in Jones County, changes in lithology from a sand with thin clay layers to alternating beds of sand and clay.

A section far up dip in the area in which the Cretaceous beds are just beginning to come out from under the overlap in southwestern Jones County, shows the Irwinton sand to be composed of alternating beds of clay and sand.

Section exposed in road cut from Pitts Chapel corners west to top of hill at Mixon's store, which is 1.3 miles northeast of Postell, Georgia on Georgia Highway 49, Jones County

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Irwinton sand member	
6. Quartz sand, fine yellow and gray, sub-angular with thin clay streaks and scattered fine dark angular particles. Grades down into 21 feet of fine sandy gray clay and fine sand.	45
Twiggs clay member	
5. Clay, pale gray-green, blocky, waxy, of the fuller's earth type, with thin, fine sandy streaks. Grades down into a basal 10 feet of olive green blocky very fossiliferous clay with many white lime nodules and tan glauconitic, fossiliferous sand streaks.	41
Channel sand	
4. Sandy clay, mottled red, brown and green-gray. Grades down into coarse sand with clay streaks and many bauxitic kaolin boulders up to 2½ feet in the basal 4 feet.	14
Unconformity	
Upper Cretaceous	
Tuscaloosa formation	
3. Clay, mottled gray, purple and red, containing many scattered angular quartz grains (continue section in road cut east to creek .1 mile from Pitts Chapel corners).	20
2. Arkosic sand, brown and tan, with much angular gravel. A 4-foot bed of dark gray clay at base.	19
Unconformity	
Crystalline rocks	
1. Granite, light gray-green and yellow, highly weathered.	10+

Ground Water

Wells that recover ground water from the complex crystalline rocks of the Piedmont in northern Jones County are of two types. Wells of the first type, which furnish most of the rural ground-water supplies, are the shallow dug wells with large infiltration surfaces along which ground water may percolate from the weathered upper part of the crystalline rocks and be recovered from the well. Wells of the second type, drilled wells, range from 2 to 6 inches in diameter, and from 60 to not more than 300 feet in depth. These drilled wells penetrate sufficient water-bearing fractures or joints in the crystalline rocks to produce ground water for small municipal, domestic, and livestock requirements.

Ground-water supplies in the Coastal Plain Province in Jones County come mainly from two aquifers, the Tuscaloosa formation and the channel sands. The supply obtained from either of these aquifers is small because the beds are thin and the intake area is small in this region along the Fall Line. The clay, sand, and gravel of the Tuscaloosa formation does not exceed 120 feet in thickness and the channel sands range from a few inches to a maximum of 20 feet in this area. The ground water contained in these aquifers is recovered from shallow dug and drilled wells and is used to supply small domestic and stock demands. The yields from the shallow dug wells in the channel sands range from ½ to 3 gallons a minute, while the dug and shallow drilled wells in the Tuscaloosa formation produce up to 20 gallons a minute.

Well 17 at Mixon's store was dug to a depth of 52.2 feet and yields water from the Irwinton sand member of the Barnwell formation. This well was dug to the top surface of the Twiggs clay member. Many springs issue from the top of the Twiggs clay member in this vicinity and to the south and southwest of well 17.

Quality of Ground Water

The ground water from the Tuscaloosa formation, channel sands, and Irwinton sand member of the Barnwell formation is very low in total dissolved solids. The ground water in this part of the Coastal Plain is low in mineral content because southern Jones, Baldwin, and Hancock Counties are in the area of outcrop, or intake area, for these aquifers. In other words, atmospheric and surface water entering the ground in this area just begins its downward percolation in the rocks. Recovery of this water takes place before the percolating ground water comes in contact with and takes into solution much mineral matter. Analyses of 6 water samples from wells in this area showed a range from 9 to 15 parts per million of total hardness, 8.0 to 14 parts per million of bicarbonate, 2 to 19 parts per million of chloride, .05 to 12 parts per million of iron, less than 5 parts per million of sulfate and nitrate, and no fluoride.

Local Supplies

In southeastern Jones County the channel sands nearly everywhere overlap the Tuscaloosa formation to the Piedmont. The combined thickness of the sedimentary deposits generally does not exceed 50 feet in the vicinity of the Fall Line and dug wells 20 to 50 feet deep yield up to 5 gallons of water a minute for small rural demands. Along the southern Jones County line the intake area for the Tuscaloosa formation has increased and the water-bearing beds have thickened sufficiently so that properly constructed wells should yield from 20 to 30 gallons of water a minute from this aquifer. Wells 4 and 5 are examples of shallow drilled wells penetrating water sands of the Tuscaloosa formation in this area. These two wells are 97 and 108 feet deep respectively. Wells deeper than 120 feet in this area would enter the basement crystalline rocks.

The Tuscaloosa formation crops out in an area parallel to Commissioners, Crooked, Slash, Sandy and Swift Creeks. Many shallow wells range from 15 to 50 feet in depth, and recover from 3 to 10 gallons of water a minute for domestic and stock supplies.

Well 23 in southwestern Jones County is 85 feet deep. It was dug to the top of the Twiggs clay member of the Barnwell formation and recovers its supply from the Irwinton sand member of the formation. Well 25 is only 29.2 feet deep and obtains ground water from a perched water table in the Irwinton sand member. Drilled well 24 in this area was originally 208 feet deep. The water from this well, as reported by its owner, always contained an excessive amount of iron. At present the well is not in use.

Records of Wells

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industrial; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	On State Hgy. 49 0.9 mi. W of Baldwin Co.	J. C. Bivins	25.8	36		Channel sand
2	SE 2.9 miles from James on old Gordon Rd.	J. B. Moore, Jr.	25.9	36		Channel sand
3	SE 4.6 miles from James on new Gordon Rd.	H. A. Crockren	40.0	46		Channel sand
4	S 0.5 mi. from well 3	J. L. Lieb	108	2	108	Tuscaloosa
5	SE 1.4 mi. from Mountain Springs.	J. B. McCook	97	2	92	Tuscaloosa
6	SW 2.1 mi. from well 3	R. F. Effidge	41.1	48	41	Tuscaloosa
7	S 1.2 mi. from James	Mand Griffin	28.3	36	28	Channel sand
8	W 1.3 mi. from well 7	G. E. Eldridge	31.5	48	31	Channel sand
9	SW 1.9 mi. from well 7	C. L. Balkcom	65	36		Channel sand
10	SE 0.5 mi. from well 9	A. E. Balkcom	64	2	59	Tuscaloosa
11	On N side of road, Mountain Springs.	Morgan Siler	25.7	36		Tuscaloosa
12	McWilliams	D. T. Sterling	96	2	91	Tuscaloosa
13	Griswold	D. T. Sterling	63	48	63	Tuscaloosa
14	Griswold	School	54	3	44	Tuscaloosa
15	Griswold	Charlie Harris	134	2	129	Tuscaloosa
16	NW 2 mi. from Mountain Springs.	I. A. Parker	65.	48		Tuscaloosa
17	Mixon's Store near Pitts Chapel.	O. C. Mixon	52.2	48	52	Irwinton sand
18	W. 0.3 mi. from well 17	A. L. Roberts	44.8	48		Tuscaloosa
19	Postell	J. C. Wells	60	18	60	Tuscaloosa
20	Postell	J. W. Watson	31.2	36	31	Tuscaloosa
21	NE 1.2 mi. from well 22	M. E. Wells	72	2	67	Tuscaloosa
22	On State Hgy. 49 at Bibb Co. Line.	R. R. Durrett	110	2	105	Tuscaloosa
23	E. of Bibb Co. line 1 mi. on State Hgy. 57.	C. B. Washburn	85	36	85	Tuscaloosa
24	E 0.2 mi. from well 23	O. R. Kitchens	208	2	203	Tuscaloosa
25	E 0.4 mi. from well 23	O. R. Kitchens	29.2	48		

in Jones County

Power: E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
CE	DS	Top tile curb	+3.2	--------	−22.9	12–8–44	Partial analysis. Discharge 2.
CE	DS	Top well shelf	+2.6	500	−22.8	12–8–44	Discharge 3. T. 64° F.
BH	DS	Top well shelf	+3.4	530	−38.3	12–8–44	Discharge 2. T. 64° F.
CE	DS	Land surface	0.0	475	−30	12–16–44	Partial analysis. T. 63° F.
CH	DS	Top cement cover.	+.6	--------	−84	11–30–44	Screen set 92–97 feet. T. 64° F.
BH	DS	Top well shelf	+3.5	480	−38.6	12–5–44	T. 64° F.
CE	DS	Top tile curb	+.4	585	−23.5	12–8–44	Discharge 3.
CE	DS	Top well shelf	+2.4	585	−27.5	12–9–44	T. 64° F.
CE	DS	Top cement curb	0.0	520	−60	11–30–44	Discharge 3. T. 64° F.
CH	DS	Top cement curb	+.3	500	−48	11–30–44	Partial analysis. Screen set 59–64 ft.
BH	DS	Top brick curb	+.52	465	−20.8	12–5–44	T. 64° F.
CH	DS	Top pump base	+.2	500	−54.2	12–5–44	Discharge 3. Screen set 91–96 feet.
CE	DS	Top cement curb	+.35	443	−24.2	12–5–44	Discharge 5.
TE	DS	Land surface	0.0	470	−32	12–5–44	Partial analysis. Discharge 20. Screen set 44–54 feet.
CH	DS	Land surface	0.0	--------	−97	12–9–44	Discharge 3.
CH	DS	Land surface	0.0	--------	−25	12–8–44	Discharge 2. T. 64° F.
CH	DS	Top well shelf	+2.8	570	−44.8	12–5–44	Partial analysis. T. 65° F.
BH	DS	Top well shelf	+2.9	575	−39.3	12–5–44	Partial analysis. Discharge 6.
CG	DS	Land surface	0.0	572	−55.5	12–2–44	Discharge 3.
CE	DS	Top well shelf	+5.2	549	−28.9	12–5–44	Discharge 3. T. 64° F.
CE	DS	Top casing	+.4	--------	−60	12–5–44	Screen set 67–72 ft. Discharge 8.
C	DS	Land surface	0.0	--------	−90	12–5–44	Screen set 105–110 ft.
CE	DS	Top brick curb	+1.5	--------	−82.5	12–9–44	Discharge 4.
C	N	Land surface	0.0	--------	−35	12–9–44	--------------------
CE	------	--------------	--------	--------	−26.4	12–9–44	Discharge 6. T. 63° F.

Log of well 24 in southwestern Jones County

(Authority O. R. Kitchens)

	Depth (feet)		Depth (feet)
Light sandy soil	0-6	Coarse white sand and gravel	105-115
Sand and thin clay layers	6-85	Hard rock layer	?
Blue clay	85-105	Sand	115-209

The Coastal Plain sediments have thinned to about 40 feet in the vicinity of Postell on the Central of Georgia Railway in the northern part of southwestern Jones County. Ground water from this area probably comes from thin sand and gravel beds in the Tuscaloosa formation, and because the intake area is small, the thin water-bearing beds only carry small amounts of ground water.

Analyses of Ground Waters from Jones County

(Analyzed by Evelyn Holloman and G. W. Whetstone. Parts per million. Numbers at heads of columns correspond to numbers in table and plate 2).

Number	1	4	10	14	17	18
Geologic horizon	Channel sand	Tuscaloosa	Tuscaloosa	Tuscaloosa	Irwinton sand	Tuscaloosa
Silica (SiO_2)	--------	--------	--------	--------	--------	--------
Iron (Fe)	.34	12 [a]	6.6 [b]	.05	.06	.32
Calcium (Ca)	--------	--------	--------	--------	--------	--------
Magnesium (Mg)	--------	--------	--------	--------	--------	--------
Sodium & Potassium (Na + K)	--------	--------	--------	--------	--------	--------
Carbonate (CO_3)	--------	--------	--------	--------	--------	--------
Bicarbonate (HCO_3)	8.0	13	10	14	10	8.0
Sulphate (SO_4)	3	2	1	1	2	2
Chloride (Cl)	19	2	3	2	4	6
Fluoride (F)	.0	.0	.0	.0	.0	.0
Nitrate (NO_3)	2.9	.5	2.4	2.1	3.8	4.4
Dissolved Solids	--------	--------	--------	--------	--------	--------
Total Hardness	9	14	12	15	15	12
Date of collection, 1944	12–8	12–8	11–30	12–5	12–5	14–5 [c]
Temperature, °F.	61	63	64	65	65	64

[a] Sample turbid when collection.
[b] Includes iron in sediment present at time of collection.
[c] Slightly milky when collected.

Twiggs County

[Area 365 square miles. Population 9,117]

Geography

Twiggs County is in the southwestern corner of the area of this report, near the exact center of the State of Georgia. The population is largely rural and averages about 25 persons per square mile. During the period 1930-1940 it had an increase in its total population of 8.9 percent. Jeffersonville is the county seat and the largest town. Other small centers of population and trade are: Danville, Dry Branch, Fitzpatrick, Bullard, Huber, and Adams Park.

Agriculture is the important occupation in the county with about 55 percent of the total area in farmland. Of the 1,014 farms of the county 25,374 acres were devoted to corn and 8,473 acres to cotton in 1940. The growing of legumes, sugar cane, and the raising of cattle are gaining in agricultural importance to the area.

Twiggs, with its kaolin mining centers of Dry Branch and Huber, is one of three counties which produce approximately 75 percent of the national output of kaolin. Deposits of limestone and fuller's earth may also prove to be of greater commercial value to the region in the future. Limestone has been mined on the Lawson property 2 miles west of Huber, and limestone beds of high enough quality to be used as an agricultural lime, and sufficient thickness are to be found south of Huber in the Red Hills area east of Georgia Highway 87 (Cochran short route). The Twiggs clay member of the Barnwell formation attains its maximum thickness near Pikes Peak where it is mined for use as a bleaching clay. The Twiggs clay beds to the south along U. S. Highway 80 in the vicinities of Fitzpatrick and Ripley are a possible source of fuller's earth.

The Red Hills and Sand Hills areas become more rugged and exhibit a greater relief east of the Ocmulgee River than in western Georgia. Formerly the land surface of this area was an upland plain with a gently undulating surface. Streams, the tributaries of the Ocmulgee and Oconee Rivers, began to cut into this plain dissecting it in long southeastward and southwestward-trending patterns. U. S. Highway 80 and Georgia

Highway 19 generally follow the drainage divide between these two river systems. The surface of the upland plain not yet dissected stands 560 feet above sea level at Fitzpatrick and slopes gently down to about 450 feet above sea level at Danville in southeastern Twiggs County. The major streams of the area have cut through the Eocene sand and clay and into the underlying Tuscaloosa formation. The minimum elevation in the floodplain of the Ocmulgee River in southwestern Twiggs County is about 210 feet above sea level, therefore, the maximum relief for the county does not greatly exceed 350 feet. A marked change is noted as one passes from the red soils and parallel hills of the Red Hills into the gently rolling hills with broad rounded summits and light yellow sandy loams of the Tifton upland. This area has few gullies and the hills are generally not higher than 50 to 60 feet. The surface of the Tifton upland slopes to the southeast at about 5 to 6 feet per mile. In the south-central part of the county sinks and ponds are not uncommon. These ponds are shallow, usually elongated or elliptical depressions ranging from less than an acre to many acres, and are generally overgrown with cypress and other plants.

Eastern Twiggs County is drained by Big Sandy and Turkey Creeks, which flow to the southeast into the Oconee River. Central and western Twiggs County is drained by Dry Branch, Flat, Savage, and Shellstone Creeks, which flow to the southwest into the Ocmulgee River.

Geology

All of Twiggs County is south of the Fall Line in the Coastal Plain Province. The crystalline rocks are buried several hundred feet under deposits of the Tuscaloosa formation of Upper Cretaceous age and where present, under the Barnwell formation of Eocene age. Only two wells (25, 27) penetrate through the Tuscaloosa formation to the underlying crystalline rocks in this area.

The Tuscaloosa formation crops out over one-quarter of the land surface area in the northern half of the county, and is exposed in northwest-southeast trends along Big Sandy, Ugly, Alligator, and other creeks tributary to the Oconee River. In the northwestern and western parts of the county, Savage, Flat, Dry Branch and other tributaries of the Ocmulgee River, are working headward in a northeastern direction, stripping away the overlying younger deposits and exposing the Tuscaloosa formation in long northeast-southwest bands.

The Tuscaloosa formation consists of approximately 250 to 300 feet of clay, sand, and gravel in the northern part of the county. It thickens rapidly down the dip to the southeast to possibly 800 or 900 feet at the southern county line. The log of well 19, owned by Georgia Kaolin Company at Dry Branch, shows typical lithology encountered in wells drilled in the Tuscaloosa formation in this area.

Log of well 19, Georgia Kaolin Company, Dry, Branch, Georgia
(Authority, E. G. Dallmus)

	Depth (feet)		Depth (feet)
Overburden, trash and fill	0-8	White sand	180-200
Sand	8-16	White sand about the size of rice	200-203
Red clay	16-20	White sand	203-215
White clay	20-23	Yellow clay, iron stained	215-225
Cream clay, sand and mica	23-27	Red and white stained clay	225-237
Dark colored sand	27-28	White sand	237-265
Fuller's earth and sand	28-30	Pink clay	265-269
White sand mica, very little clay	30-75	White sand	269-279
White sand	75-120	Pink clay	279-285
Gravel	120-127	White sand, a little gravel	285-295
Cream-colored fine sand	127-135	Pink clay	295-303
Sand and cream clay	135-145	White sand and gravel	303-310
Coarse sand	145-170	Pink clay	310-313
Sand and gravel	170-180		

The Barnwell formation overlies the Tuscaloosa formation and crops out over three-quarters of the land area in Twiggs County. In southeastern and south-central Twiggs County the Barnwell formation is in turn overlain by a residuum of Oligocene and Miocene formations.

In northern Twiggs County the Twiggs clay member of the Barnwell formation overlies the Tuscaloosa formation unconformably and consists of 35 to 45 feet of pale-green fuller's earth clay with thin sand pockets scattered throughout. Overlying the Twiggs clay member with apparent conformity, the Irwinton sand member of the Barnwell consists of light-gray and yellow fine-grained quartz sand with thin beds of tough plastic clay.

In north-central and western Twiggs County the Twiggs clay member of the Barnwell becomes more calcareous and changes in part from a pale-green hackly clay to a gray hackly fossiliferous marl. Westward the Twiggs clay becomes more calcareous and merges laterally into the Ocala limestone. A section showing this transition is exposed at Georgia Kaolin Pit No. 1 about 3 miles east of Dry Branch in north-central Twiggs County.

Section at Georgia Kaolin Company Pit No. 1

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Upper sand member	
14. Sand, firm, massive, coarse, gritty, mottled gray and somewhat pebbly in lower half, brownish-red in upper half.	6
Irwinton sand member	
13. Clay, gray, purple, waxy, mottled red.	2-5
12. Sand, loose, white and yellow, fine-grained, interbedded with thin layers of purple clay.	20
11. Clay, light gray, bentonitic.	8
10. Sand, pink, buff and gray, in a fine clay matrix.	6
Twiggs clay member	
9. Marl, gray, fossiliferous, blocky.	6
8. Greenish gray nodular lime ledge.	½
7. Marl, buff and gray, medium hard, sandy fossiliferous.	4
6. Greenish-gray nodular lime ledge.	½
5. Marl, bluish-gray, massive, blocky, fossiliferous.	25
4. Clay, hackly pale green.	4
Ocala limestone	
3. Limestone, cream-colored, very fossiliferous, massive, becomes sandy in lower part. Contains *Periarchus pileus-sinensis* (Ravenel), abundant in lower part; bryozoa abundant in upper part. *Pecten spillmani* and *Ostrea* sp.	18
2. Sand, buff, medium-grained.	12

	Thickness (Feet)
Unconformity	
Upper Cretaceous	
Tuscaloosa formation	
1. Kaolin, white, massive, blocky.	14+

In Twiggs County the Ocala limestone thickens to the south and west. In a limestone quarry on Weatherly's Farms in Bleckley County, near the southwestern corner of Twiggs County, it attains a thickness of 30 feet, and 10 miles due west of the Weatherly's Farms Quarry, at Clinchfield, it thickens to nearly 60 feet. In north-central and western Twiggs County the Irwinton sand ranges from 35 to 40 feet in thickness, and is more clayey than elsewhere, consisting of interbedded fine micaceous quartz sand and light-colored tough clay.

In central and southeastern Twiggs County the Twiggs clay is typically pale green, hackly blocky clay of the fuller's earth type, ranging from 30 to 50 feet in thickness. The Irwinton sand caps many of the hills in this area and ranges from 35 to 40 feet in thickness. A typical section for this area is exposed in a road cut on the south bank of Ugly Creek in east-central Twiggs County.

Section exposed in road cut 2.2 miles south of Myricks Mill, south bank of Ugly Creek

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Upper sand member	
5. Sand, red, coarse, clayey, and with typical curvilinear quartz pebbles along base.	35
Irwinton sand member	
4. Clay, red, waxy, sandy, mottled gray.	4
3. Sand, yellow-gray and tan, cross-bedded, fine-grained and with many thin clay partings.	35
Twiggs clay member	
2. Clay, pale green, of the fuller's earth type, with thin fine white sand streaks and lime nodules near base.	45
Unconformity	
Upper Cretaceous	
Tuscaloosa formation	
1. Sandy clay, light gray-white, micaceous.	15+

The undifferentiated Miocene and Oligocene deposits overlie unconformably the Barnwell formation in the south-central and southeastern one-fifth of the county. The soils of this area are light-yellow sandy clays containing many scattered reddish-brown iron pellets. The undifferentiated Miocene and Oligocene deposits consist of mottled pink, gray, and white clayey sands and sandy clays. Nowhere do they exceed 50 feet in thickness in this area.

Ground Water

One well (27) in Twiggs County is reported to recover ground water from the crystalline basement complex. This well was drilled in 1919 on the Frank Lawson property at Huber to supply ground water for an army camp. It is 1000 feet deep and has a natural artesian flow of 75 gallons a minute. The water is clear, has a slight taste of sulphur and ranges in temperature from 66° to 67° Fahrenheit.

The sand and gravel beds of the Tuscaloosa formation are unquestionably the most productive sources of ground water in the area. The public water supply at Jeffersonville is obtained from this aquifer, as are many of the local domestic and rural supplies throughout the county. The largest and most productive wells drawing from the Tuscaloosa formation are the industrial wells at the Georgia Kaolin plants near Dry Branch and at the Sgoda Corporation at Huber. These wells range from 8 to 20 inches in diameter, from 158 to 313 feet in depth, and produce from 300 to 500 gallons a minute. The ground water from the Tuscaloosa formation in northern Twiggs County is fairly low in dissolved minerals.

In west-central and southwest Twiggs County in the flood plain of the Ocmulgee River, at Adams Park and Westlake stations on the Southern Railway, drilled wells (68, 69, 72) penetrating water sands in the Tuscaloosa formation at depths of 98 to 300 feet have natural artesian flows of 20 to 60 gallons a minute.

Well 40 is the source of water for the public supply at Jeffersonville. This well is 533 feet deep and was drilled through approximately 200 feet of sediments of the Barnwell formation and 333 feet into the Tuscaloosa formation. It is pumped at the rate of 50 gallons a minute.

In the Uplands, or Red Hills, area of Twiggs County in the area of outcrop of the Irwinton sand and upper sand members of the Barnwell formation, most of the local ground water supplies are for small domestic and farm use. Adequate quantities of ground water to meet these demands can be obtained by means of shallow dug wells ranging from 20 to 60 feet deep. Typical examples of wells in this area are 2, 16, 20, 35, and 37, in northern central and eastern Twiggs County.

Where the residuum of the Oligocene and Miocene formations forms a thin cover over the Eocene deposits in southern Twiggs County, many shallow wells penetrate the upper sand member of the Barnwell formation. Dug wells in this aquifer produce from 1 to 10 gallons of water a minute.

In the vicinity of Huber, Georgia, and south in the flood plain of the Ocmulgee River, many shallow dug, driven and drilled wells obtain ground water from the river alluvium. Wells 24, 28, 29, and 30 in the vicinity of Huber range in depth from 22 to 40 feet and produce from 1 to 6 gallons of water a minute. Well 29 is 33 feet deep and penetrates a water sand below a thin clay bed. This well flows about 1 gallon a minute. At Bullard station on the Southern Railway, a large dug well 10.9 feet deep is used to supply a water tank.

Quality of Water

Well 27 at Huber is reported to recover ground water from the crystalline basement complex in this area. The analysis of water from this well shows a relatively small amount of dissolved mineral content, and 21 parts per million of total hardness. Bicarbonate and sulfate were 21 parts and 6 parts, respectively. This water contained only 0.1 part per million ot fluoride as against 0.3 part per million of fluoride in most of the ground water analyzed from wells developed in the crystalline rocks in Baldwin, Jones, and Hancock Counties. The temperature and chemical analysis of this water would suggest that its main source is the Tuscaloosa formation.

In discussing the quality of water from the Tuscaloosa formation in Twiggs County, the depth and location of the well with regard to the dip of the formation must be considered.

Most of the shallow wells drawings from the Tuscaloosa formation recover ground water of very low mineral content. The Tuscaloosa water from wells under 100 feet deep, generally contains less than 1 part per million of iron (exceptions to this are wells 22, 82, and 84), 5 to 28 parts per million of bicarbonate less than 2 parts per million of sulfate, 1 to 10 parts per million of chloride, 0.1 to 9.2 parts per million of nitrate, 0.1 or less part per million of fluoride, and has 6 to 21 parts per million of total hardness.

The water from wells more than 100 feet deep in the Tuscaloosa formation in Twiggs County averaged slightly higher in dissolved minerals than the water from the wells less than 100 feet deep in the same formation. The total hardness of the deep well water averaged 49.7 parts per million as compared with 12.4 parts per million in the shallow well water. The water in the deeper wells averaged 52.5 parts per million of bicarbonate as compared with 11.8 parts per million in the shallow wells. Sulfate in the deep well waters averaged 5.6 parts per million as compared with 1.4 parts per million in the shallow well waters. The chloride and nitrate content of water in the deeper wells averaged slightly less than that in the shallow wells.

Ground water from the Irwinton sand member of the Barnwell formation is of great importance to the rural areas throughout most of Twiggs County. The water from this bed contains very little dissolved mineral matter. It generally has less than 1 part per million of iron, less than 1 part per million of sulfate, from 2 to 3 parts per million of chloride, 0.1 part per million or less of fluoride, and, unless contaminated, 3 parts per million or less of nitrate. The bicarbonate and the total hardness of water from this aquifer vary considerably with regard to the location of the well. In northern, western, and central Twiggs County the water from this aquifer has a low total hardness and contains small amounts of bicarbonate. In southeastern Twiggs County the Irwinton sand contains a few thin siliceous limestone layers. Wells 42 and 46 obtain water from the Irwinton sand in this area. Analyses of water from these wells show an average of 47 parts per million for total hardness and 180.5 parts per million for bicarbonate.

In southern Twiggs County several shallow wells yield small amounts of water of good quality from the upper sand member of the Barnwell formation. This water is very low in dissolved mineral content, averaging less than 0.7 part per million of iron, 23 parts per million of total hardness, 4.3 parts per million of bicarbonate, 2 parts per million of sulfate, 11.3 parts per million of chloride, and 0.07 part per million of fluoride. The nitrate content of a sample of water from each of wells 51 and 45 was 8.4 parts and 56 parts, respectively. High nitrate content often indicates organic contamination.

In the flood plain of the Ocmulgee in the Huber area many wells recover ground water from shallow water sands in the river alluvium. An analysis of water from well 88 yielding ground water from the alluvium showed the water to be very low in total dissolved solids.

Local Supplies

Jeffersonville, Danville, Dry Branch, Fitzpatrick, and Tarversville are all supplied with ground water. Jeffersonville has the only municipally owned water supply system in the county, but well 20 at Dry Branch furnishes ground water to Twisco Heights, a housing project of the Georgia Kaolin Company. Privately owned wells furnished ground water to the other small villages in the area.

Jeffersonville (population 804) is supplied entirely from one drilled well (Twiggs 40) owned by the town. The water is pumped into a reservoir and tower tank and from there distributed under pressure into the mains. The well was drilled in 1924 by the Gray Artesian Well Company to a depth of 533 feet. It obtains water from the Tuscaloosa formation, supplemented possibly by a water-bearing sand in the Barnwell formation. The static water level in this well is 200 feet below land surface. An electric two-stroke reciprocating pump furnishes approximately 60,000 gallons of water per day during the summer months, and 30,000 gallons per day during the winter months.

Danville (population in Twiggs County 160) is in the southeastern corner of Twiggs County. Part of the village is in Wilkinson County. The village has no centralized public water system and domestic and stock requirements are supplied by privately owned dug and drilled shallow wells. The drilled wells in the vicinity penetrate water sands in the Irwinton sand member at depths of 90 to 150 feet. Well 46 is 4 inches in diameter, 190 feet deep and is pumped at the rate of 7 gallons a minute. The static water level in this well is 40 feet below land surface and after 24 hours pumping at 7 gallons a minute the reported drawdown is 4 feet. The shallow wells in this area range from 25 to 40 feet in depth and the quantity of ground water that can be obtained from these wells is very small. Well 47 has a small electric, piston pump and can only be pumped for 30 minutes at the rate of 3 gallons a minute before the supply is depleted.

Dry Branch is in the north-central part of the County on the Twiggs-Bibb County line. It is unincorporated and has no centralized water supply system. Many shallow drilled wells in the Dry Branch area penetrate water-bearing sands in the Tuscaloosa formation at depths of from 35 to 100 feet below land surface. These wells range in capacity from 4 to 10 gallons a minute.

Wells 17, 18, 19, 20, and 23 in the same vicinity belong to the Georgia Kaolin Company. They all have casings 10 inches or more in diameter, range from 158 to 313 feet in depth, and penetrate water-bearing sands in the Tuscaloosa formation.

Well 17 at the Georgia Kaolin Plant No. 1 is 291 feet deep. This well is equipped with a 3-stage turbine which has a capacity of 500 gallons a minute. After pumping at the rate of 500 gallons a minute for a 24-hour period, it has a drawdown of 13 feet. Therefore, the specific capacity of the well is 38.5 gallons a minute per foot of drawdown. The log of well 17 at the Georgia Kaolin Company is as follows:

Log of Georgia Kaolin Well 17, Dry Branch, Georgia

(Authority, E. G. Dallmuss)

	Depth (feet)		Depth (feet)
Clay	0-25	Water sand	145-180
Sand	25-30	Water sand	180-190
White sand	30-60	Hard rock	190-220
Clay	60-65	Water sand	220-240
Water sand	65-135	Rock-water	240-291
Clay	135-145		

Well 18 at the Georgia Kaolin plant is 306 feet deep, 10 inches in diameter and has a capacity of 300 gallons a minute. The land surface elevation at well 18 is 14 feet higher than that at well 17 and the static water levels of both wells stand

346 feet above sea level. The log of the Georgia Kaolin well No. 18 is as follows:

Log of Georgia Kaolin Well 18 at Dry Branch, Georgia

(Authority, E. G. Dallmuss)

	Depth (feet)		Depth (feet)
Mixed soil	1-10	Sand	92-130
Chalk	10-19	Soft clay	130-140
Yellow clay	19-24	Sand	140-202
Fine sand	24-44	Red clay	202-226
Sandy clay	44-48	Sand	226-274
Sand	48-88	Red clay	274-289
Kaolin	88-92	Sand	289-306

Well 20 at Twisco Heights, a housing project of the Georgia Kaolin Company at Dry Branch, Georgia, was drilled in April 1941 to a depth of 238 feet. It was drilled through approximately 150 feet of sand and clay of the Barnwell formation and penetrated 50 feet of gray water-bearing sand in the Tuscaloosa formation. The initial water level of the well was reported to stand at 170 feet below land surface. The well was originally pumped at the rate of 42.5 gallons a minute and had a drawdown of 43 feet. The present pumping rate is 30 gallons a minute.

Fitzpatrick and Ripley on U. S. Highway 80 in north-central Twiggs County have similar ground water conditions. Both are in the uplands in the area of outcrop of the upper sand member of the Barnwell formation. Shallow dug wells 40 to 55 feet deep recover small domestic and stock supplies up to 3 gallons a minute from the Irwinton sand member of the Barnwell formation. A drilled well, owned by J. C. Soloman at Fitzpatrick (34) is 252 feet deep and recovers ground water from solution channels in the Ocala limestone, which wedges in from the west at the base of the Twiggs clay member of the Barnwell formation in this area. A sample of water from this well contained 303 parts per million of bicarbonate and 252 parts per million of total hardness. For ground water supplies greater than 15 gallons a minute in this vicinity, it would be necessary to drill wells 300 to 700 feet deep to water-bearing sands in the Tuscaloosa formation.

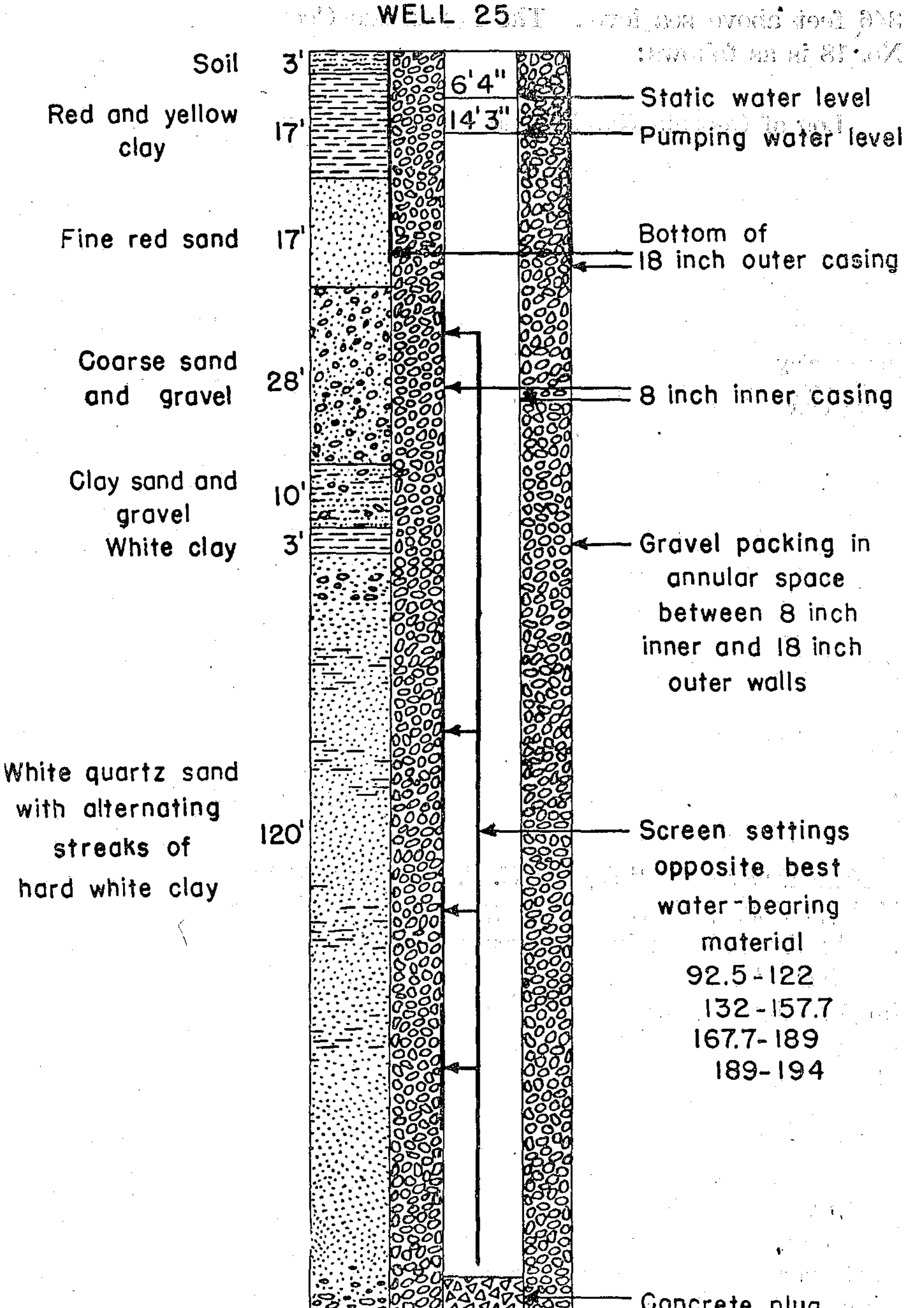

Figure 19. Log and construction details of Huber Kaolin Co. (Sgoda Corp.) well at Huber, Ga.

In the vicinity of Huber and Reeds on the Southern Railway in northwestern Twiggs County most of the ground water for domestic and stock use comes from small shallow drilled and driven wells 20 to 54 feet deep in the alluvium of the Ocmulgee River. These wells have capacities of from 2 to 8 gallons of water a minute.

The largest demand for ground water in the Huber area is for the Sgoda Kaolin plant and the surrounding office and housing units belonging to the company. Well 25 was drilled in October 1938 to a depth of 194 feet, and furnishes this entire supply. This well is an example of good well construction in sand and gravel aquifers, the log and construction details of which are shown in figure 19. A summary of the construction of this well is briefly as follows: An 18-inch hole was drilled to a depth of 194 feet, a record being kept of the types of material penetrated. Inside the 18-inch hole, 8-inch screens, to which were attached sections of blank 8-inch casing, were set opposite the most productive water-bearing sands and gravels. These screens were set from 38-48 feet, 92.5-122 feet, 132-157.7 feet, 167.7-189 feet, and 189-194 feet. The bottom well screen was closed with a concrete plug. Carefully selected clean gravel of uniform size was placed into the space between the 18-inch hole and 8-inch string of casing and screens, filling the entire space. A pumping test was run on the well October 18, 1938. The static water level was 6 feet 4 inches below land surface. The pumping water level was 14 feet 3 inches below the land surface when the well was pumped at a rate of 465 gallons a minute. Well 25 is now being pumped at the rate of 550 gallons a minute.

Westlake and Adams Park are small stations on the Southern Railway in southwestern Twiggs County in the flood plain and river terrace area of the Ocmulgee River. Three flowing wells have been drilled in the Tuscaloosa formation in this area. Well 72 at Adams Park was drilled in 1909 to a depth of 360 feet. This well is reported to have flowed 60 gallons a minute when drilled, but the flow had decreased to about 30 gallons a minute on November 9, 1944. Well 60 was reported to be 98 feet deep and to have a hydrostatic head of 20 feet above the land surface. This well has since been plugged with a wooden plug, the casing has corroded, and the water now flows up around the outside of the casing. Well 68 at Westlake is 300 feet deep and flows

Records of Wells

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industrial; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	NW 0.7 mi. from Big Sandy Creek Bridge on State Hgy. 57.	C. H. Kitchens	69.5	48	69	Tuscaloosa
2	NE 1.5 mi. from well 3	W. B. Smith	85	18	85	Irwinton sand
3	NE 0.5 mi. from Big Sandy Creek Bridge on S. Hgy. 57.	Addie Ward	40	48	--------	Channel sand
4	E 1.6 mi. from Bibb Co. on State Hgy. 57.	Morgan Moore	76	2	71	Tuscaloosa
5	E 0.2 mi. from Big Sandy bridge on State Hgy. 57.	W. J. Hammock	25	2	20	Alluvium
6	SE 0.4 mi from well 5	J. E. Cannon	16	48	4	Alluvium
7	SW 0.8 mi. from Big Sandy Bridge on State Hgy. 57.	Dan Gardner	34	3	29	Tuscaloosa
8	At house next to New Haven Church.	Lizzie Mae Crosby	85	2	80	Tuscaloosa
9	SE 0.6 mi. from well 8	Lizzie Mae Crosby	104.5	2	99.5	Tuscaloosa
10	S 0.8 mi. from well 9	Lizzie Mae Crosby	52	3	47	Tuscaloosa
11	SE 1.7 mi. from well 5	Ed Chambers	82	2	77	Tuscaloosa
12	SE 2 mi. from well 11	Steve Ethridge	49	2	44	Tuscaloosa
13	SE 1.2 mi. from well 10	H. E. Cannon	60	2	55	Tuscaloosa
14	Myricks Mill, Ga	C. C. Humphries	76	3	66	Tuscaloosa
15	N 5.2 mi. from Jeffersonville.	D. Y. Caleb	20.3	48	20	Tuscaloosa
16	NE 2 mi. from Fitzpatrick.	F. H. Mercer	51.6	48	50	Irwinton sand
17	East Well, plant 1, Dry Branch.	Ga. Kaolin Co	291	10	240	Tuscaloosa
18	E 500 yds. from well 17	Ga. Kaolin Co	306	10	306	Tuscaloosa
19	E 50 ft. from well 18	Ga. Kaolin Co	313	10	307	Tuscaloosa
20	Twisco Hgts., Dry Branch.	Ga. Kaolin Co	238	10	238	Tuscaloosa
21	Dry Branch	T. J. Johnson	37	2	32	Tuscaloosa
22	S 0.7 mi. from well 21	A. J. Land, Jr.	85	2	80	Tuscaloosa
23	Plant 2, Dry Branch	Ga. Kaolin Co	158	10	158	Tuscaloosa
24	S 0.7 mi. on S Hgy. 87 from Bibb Co. line.	Geo. E. Ray	22	48	--------	Alluvium
25	Huber, Ga.	Sgoda Corp.	194	18–8	194	Tuscaloosa

in Twiggs County

Power: E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
BH	DS	Top well shelf	+2.6	--------	−68.5	12–9–44	T. 64°F.
CH	DS	Top cement cover.	+.8	--------	−72	12–9–44	Discharge 3. T. 63°F.
BH	DS	Top well shelf	+3.1	460	−28.5	12–9–44	T. 65°F.
CH	DS	Land surface	0.0	442	−49	12–9–44	Screens set 71–76 ft. T. 66°F.
CE	S	Land surface	0.0	393	−12	12–9–44	Partial analysis. Discharge 15.
BH	D	Top well shelf	+4	--------	−12.1	12–9–44	--------------------
CH	DS	Land surface	0.0	--------	−18	12–9–44	--------------------
CH	D	Land surface	0.0	--------	−65	12–9–44	Partial analysis. Discharge 6.
CH	DS	Land surface	0.0	--------	−85	12–9–44	Discharge 6. T. 61°F.
CG	D	Land surface	0.0	--------	−37	12–9–44	Screen set 47–52 ft. Discharge 6.
CH	D	Land surface	0.0	--------	−62	12–9–44	T. 61° F.
CH	D	Land surface	0.0	--------	−41	12–9–44	T. 61° F.
CH	D	Land surface	0.0	--------	−42	12–9–44	T. 60° F.
CE	I	Land surface	0.0	--------	−36	12–9–44	Screen set 66–76 ft. Discharge 10.
BH	DS	Top well shelf	+2.9	360	−18.5	12–16–44	T. 64° F.
BH	DS	Top well shelf	+3.0	520	−49.5	12–16–44	Discharge 2. T. 64° F.
TE	I	Land surface	0.0	411	−65	3–25–37	Complete analysis. Discharge 500.
TE	I	Land surface	0.0	425	−79	12–31–44	Discharge 300. T. 65° F.
------	N	Land surface	0.0	415	−69	3–25–44	--------------------
TE	PS	Land surface	0.0	--------	−170	1–4–45	Partial analysis.
CE	D	Land surface	0.0	--------	−17	12–23–44	Partial analysis. Discharge 7.
CE	D	Land surface	0.0	--------	−78	12–22–44	Partial analysis. Discharge 4.
TE	I	Land surface	0.0	--------	--------	12–22–44	Discharge 150.
CS	I	Land surface	0.0	--------	−15	12–22–44	Discharge 6. T. 62° F.
TE	IP	Land surface	0.0	272.2	−6.4	10–18–38	Partial analysis. Discharge 465.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
26	Huber, Ga.	Mrs. Mamie Denson.	35	2	30	Alluvium
27	S 500 yds. from well 26	Frank Lawson	1000	10–8	1000	Crystalline rocks & Tuscaloosa.
28	SE 1 mi. from Huber, Ga.	Frank Lawson	40	2	35	Alluvium
29	S 1.6 mi. from Huber, Ga.	Frank Lawson	33	2	28	Alluvium
30	SE 1.6 mi. from Huber, Ga.	Frank Lawson	54	2	49	Alluvium
31	N 4 mi. from Bullard School.	M. D. Durden	138	2	133	Tuscaloosa
32	SW 4.2 mi. from Fitzpatrick, Ga.	Sam King	26.8	48	4	Channel sand
33	Fitzpatrick, Ga.	J. C. Soloman	90	2	85	Irwinton sand
34	Fitzpatrick, Ga.	J. C. Soloman	252	3	247	Tuscaloosa
35	Ripley, Ga.	Mrs. John Day	49	48	--------	Irwinton sand
36	SW 2.5 mi. from well 35	James Shannon	80	2	75	Irwinton sand
37	N 3.9 mi. from Jeffersonville, Ga.	Mrs. Whitiker	36.1	48	--------	Irwinton sand
38	N 2.1 mi. from Jeffersonville, Ga.	Ross M. Horn	39.3	48	39	Irwinton sand
39	NE 1.6 mi. from Jeffersonville, Ga.	Nash Robert	49.5	48	4	Irwinton sand
40	Jeffersonville Water Works.	Jeffersonville, Ga.	533	8	533	Tuscaloosa
41	E 1.2 mi. from Jeffersonville, Ga.	C. A. Duggan	50	36	44	Irwinton sand
42	E 1.2 mi. from Jeffersonville, Ga.	C. A. Duggan	110	3	110	Irwinton sand
43	SE 2.1 miles from well 42	J. M. Getty	48.3	48	4	Upper sand member.
44	NW 4.2 mi. from Danville, Ga.	M. U. Holliday	31.9	48	4	Upper sand member.
45	NW 1.8 mi. from Danville, Ga.	J. V. Terry	40.9	48	40	Upper sand member.
46	Danville, Ga.	C. R Faulk	190	4	90	Irwinton sand
47	Danville, Ga.	M. H. Stevens	32.6	48	32	Upper sand member.
48	SW 1.4 mi. from Danville, Ga.	D. C. Howell	368	2	368	Tuscaloosa
49	SW 1.6 mi. from Danville, Ga.	Emmet Stevens	28	48	4	Upper sand member.
50	E 3.7 mi. from well 54	Thomas Lee	65	2	65	Upper sand member.
51	SW 6.2 mi. from Danville, Ga.	V. B. Sanders	25	48	--------	Upper sand member.
52	S 2.3 mi. from well 54	Mercer Burns	38	48	14	Upper sand member.

Twiggs County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
------	N	Top of casing	0.9	272	−4.9	12–22–44	Screen set 31–35 ft. T. 66° F.
F	DS	Land surface	0.0	271	+12	12–23–44	Partial analysis. Discharge 75.
CH	DS	Top pump base	+1.2	270	−11.2	12–22–44	Partial analysis. Screen set 35–40 ft.
F	S	Land surface	+0.0	268	+1.4	12–22–44	Screen set 28–33 ft. Discharge 1.
CH	DS	Top pump base	0.0	284	−20	12–22–44	Screen set 49–54 ft. Discharge 7.
CE	DS	Land surface	0.0	390	−118	12–22–44	Screen set 133–138 ft. Discharge 7.
BH	DS	Top well shelf	+2.4	--------	−22.3	12–22–44	T. 61° F.
CE	DS	Land surface	0.0	564	−82	12–16–44	Partial analysis. Screen set 85–90 ft.
CW	DS	Land surface	0.0	555	−142	12–16–44	Partial analysis. Discharge 2.5.
BH	DS	Top well shelf	+3.0	545	−45.6	12–19–44	T. 64° F.
CH	DS	Top pump base	+.8	--------	−65	12–22–44	Partial analysis. Screen set 75–80 ft.
BH	DS	Top well shelf	+2.6	--------	−24.1	12–16–44	T. 64° F.
BH	DS	Top well shelf	+3.1	545	−38.4	12–15–44	T. 64° F.
BH	DS	Top well shelf	+3.0	536	−47.6	12–15–44	T. 64° F.
CE	PS	Land surface	0.0	523	−200	12–15–44	Complete analysis. Discharge 50.
BH	DS	Top well shelf	+3.2	--------	−37.9	12–21–44	T. 61° F.
TE	DS	Land surface	0.0	--------	−81	12–23–44	Partial analysis. Discharge 7.
BH	DS	Top well shelf	+3	500	−45.9	12–19–44	T. 60° F.
BH	DS	Top well shelf	+2.8	465	−30.9	12–19–44	T. 59° F.
BH	DS	Top well shelf	+5.3	500	−37.7	12–19–44	Partial analysis. T. 61° F.
CE	DS	Land surface	0.0	458	−40	12–19–44	Partial analysis. Discharge 7.
CE	DS	Top well shelf	+6.5	452	−32.6	12–19–44	T. 60° F.
CW	N	Land surface	0.0	480	−150	12–20–44	T. 63° F.
CE	DS	Land surface	0.0	450	−3.8	12–20–44	Discharge 8. T. 61° F.
CE	DS	Land surface	0.0	495	−35	12–20–44	Discharge 5. T. 61° F.
CE	DS	Top cement cover.	0.0	470	−21	12–20–44	Partial analysis. Discharge 5.
BH	DS	Top well shelf	0.0	440	−20	12–20–44	Discharge 1. T. 61° F.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
53	S 0.9 mi. from well 54	J. H. Vaughn	51.4	48	6	Upper sand member.
54	NE 5.4 mi. on State Hgy. 127 from Tarversville.	H. J. Waters	32.3	48	4	Upper sand member.
55	E .2 mi. from well 54	J. S. Lucas	16.7	48	3	Upper sand member.
56	SW 1.2 mi. from well 57	F. Y. Stokes	31.8	48	--------	Upper sand member.
57	W 1.6 mi. from well 44	Prospect Methodist Church.	35	48	--------	Upper sand member.
58	SE 1.6 mi. from Jeffersonville, Ga.	C. J. Carmmonie	32.5	48	--------	Upper sand member.
59	S 2.5 mi. from Jeffersonville.	T. B. Jones	51.9	48	50	Upper sand member.
60	S 3.9 mi. from Jeffersonville.	J. W. Faulk	95	2	90	Irwinton sand
61	SW 2.3 mi. from well 60	F. M. Getty's	50	3	--------	Irwinton sand
62	W. 25 yds. from well 61	J. M. Getty's	300	3	80	Calcareous Twiggs clay.
63	NE 0.4 mi. from well 64	Mt. Olive Jr. High School.	23.9	48	23	Upper sand member.
64	NE 1.3 mi. from well 65	Joe Faulk	43.6	48	43	Upper sand member.
65	NE 0.2 mi. from well 66	F. C. Taylor	41.1	48	--------	Upper sand member.
66	NE 2.5 mi. from Tarversville, Ga.	F. C. Taylor	76.5	48	76	Irwinton sand
67	S 1 mile from Tarversville, Ga.	M. W. Hendricks	37.2	48	--------	Irwinton sand
68	N 0.3 mi. from Westlake station.	Jessie McElrath	300	3	300	Tuscaloosa
69	In field across RR tracks 1.5 mi. N well 68.	Irvin Fitzpatrick	98	4	98	Tuscaloosa
70	N 4.4 mi. from Westlake, Ga.	Mark Fitzpatrick	43	2	38	Tuscaloosa
71	N 1.2 mi. from well 70	Wembley School	48	2	43	Tuscaloosa
72	Adams Park, Ga.	Miller Hendrick	360	6	360	Tuscaloosa
73	S 2.7 mi. from Bullard School.	H. G. Faulk	67	2	62	Brown massive sand (Lower Jackson age).
74	NE 2.5 mi. from Adams Park.	T. W. Hooks	85.5	2	80	Brown massive sand (Lower Jackson age).
75	NE 3 mi. from Adams Park.	T. W. Hooks	82	2	77	Brown massive sand (Lower Jackson age).
76	NE 2.7 mi. from Adams Park.	T. W. Hooks	92	2	87	Tuscaloosa
77	S 0.6 mi. from well 78	B. F. Johnson	82	2	77	Brown massive sand (Lower Jackson age).

Twiggs County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
TE	DS	Top well shelf	+5.6	--------	−47.8	12–20–44	T. 63° F.
BH	DS	Top well shelf	+3.3	--------	−30.6	12–20–44	T. 61° F.
BH	DS	Top curb	+2.7	500	−13.8	12–20–44	T. 61° F.
BH	DS	Top well shelf	+2.2	--------	−20.9	12–20–44	T. 61° F.
CH	PS	Land surface	0.0	490	−23	12–19–44	Partial analysis. Discharge 7.
CE	DS	Top cement curb	0.0	--------	−28.7	12–19–44	Discharge 6. T. 64° F.
BH	DS	Top well shelf	+4.9	505	−48.7	12–20–44	T. 60° F.
CE	DS	Land surface	0.0	500	−30	12–19–44	Screen set 90–95 ft. Discharge 3.
BH	DS	Top tile curb	+2.8	--------	−53.3	12–20–44	Discharge 1. T. 60° F.
CG	DS	Top pump base	+.2	--------	−80	12–20–44	Partial analysis. Discharge 2.
CH	DS	Top pump base	+1.6	475	−22.2	12–20–44	T. 61°F.
TE	DS	Top well curb	+3.3	500	−41.8	12–20–44	Discharge 3. T. 61°F.
TE	DS	Top well cover	+1.3	475	−35.1	12–21–44	Discharge 3. T. 61°F.
CE	N	Top pump base	+.6	470	−52	12–21–44	T. 63°F.
BH	DS	Top cement curb	+2.8	445	−36.9	12–21–44	T. 61°F.
F	N	Land surface	0.0	285	+40	12–21–44	Partial analysis. Discharge 60.
F	N	Land surface	0.0	270	+20	12–20–44	Partially plugged. Discharge 20.
CH	DS	Pump base	.2	320	−12	12–21–44	T. 61°F.
CH	PS	Land surface	0.0	325	−44	12–21–44	----------------------
F	DS	Top of casing	.9	259	+14	11–9–44	Complete analysis. Discharge 28.8.
CE	DS	Base of pump	0.0	360	−54	12–21–44	Screen set 62–70 ft. T. 63°F.
CH	DS	Land surface	0.0	345	—77	12–22–44	Screen set 80–85 ft. T. 62°F.
CH	DS	Land surface	0.0	343	−67	12–22–44	Screen set 77–82 ft. T. 62°F.
CH	DS	Land surface	0.0	323	−74	12–22–44	Partial analysis. T. 62°F.
CE	DS	Land surface	0.0	380	−72	12–22–44	Discharge 5. T. 62°F.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
78	SW 1 mi. from Bullard School.	A. V. White	78	2	73	Brown massive sand (Lower Jackson age).
79	E 0.3 mi. from Bullard School.	L. A. Everett	75	2	70	Brown massive sand (Lower Jackson age.)
80	Bullard Station	Southern Ry Co.	10.9	90–120		Alluvium
81	W 1.1 mi. from Bullard School.	C. A. Little	160	2		Tuscaloosa
82	W 1 mi. from Bullard School.	R. W. Edwards	105	2	100	Tuscaloosa
83	Bullard High School	School	65	2	60	Brown massive sand (Lower Jackson Age)
84	E. 1.5 mi. from Bullard School.	J. T. McCormick	76	2	71	Tuscaloosa
85	N 1.8 mi. from Bullard School.	O. B. Fitzpatrick	200	3	18	Tuscaloosa
86	SW 1.4 mi. from well 36	E. D. Ashley	83	2	78	Tuscaloosa
87	SW 0.3 mi. from well 86	Marion Baptist Church.	63	2	58	Tuscaloosa

Twiggs County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
CE	DS	Land surface----	0.0	370	−63	12–22–44	Screen set 73–78 ft. T. 62°F.
CE	DS	Land surface----	0.0	380	−60	12–22–44	Screen set 70–75 ft. Discharge 7.
CS	I	Land surface----	0.0	263	−7.05	12–22–44	T. 64°F.
CH	DS	Land surface----	0.0	376	−89	12–22–44	Discharge 6. T. 63°F.
CH	DS	Land surface----	0.0	375	−85	12–22–44	Screen set 100–105 ft. Partial analysis.
CE	DS	Land surface----	0.0	365	−53	12–22–44	Screen set 60–65 ft. Discharge 5.
CH	DS	Land surface----	0.0	--------	−61	12–22–44	Partial analysis. Discharge 7.
CE	DS	Land surface----	0.0	380	−150	12–22–44	Partial anaylsis. Discharge 7.
CG	DS	Land surface----	0.0	--------	−63	12–22–44	T. 63°F.
CH	PS	Land surface----	0.0	--------	−48	12–22–44	Screen set 58–63 ft. Discharge 4.

approximately 60 gallons a minute. This well was used by a lumber mill at Westlake, but is now abandoned. It now flows through breaks in the casing near the land surface. Shallow driven and dug wells in this area penetrate shallow water sands in the Tuscaloosa formation at depths of 40 to 60 feet and yield up to 8 gallons of water a minute.

In northeastern Twiggs County in the outcrop area of the Tuscaloosa formation along Big Sandy Creek and its tributaries, many 2-, 3-, and 4-inch wells ranging from 25 to 105 feet in depth recover ground water from shallow aquifers in the Tuscaloosa formation. Most of these wells were constructed to serve domestic and stock demands and consist of lengths of iron pipe casing with 5- or 10-foot screens attached at the bottom and set in the water-bearing sand. Small pitcher, turbine, and piston pumps recover from 4 to 15 gallons of water a minute from these wells.

Analyses of Ground Waters from Twiggs County

(Analyzed by G. W. Whetstone and Evelyn Holloman. Parts per million. Numbers at heads of columns correspond to numbers in table and in plate 2)

Number	5	8	17	20	21	22	25	27	28	33
Geologic horizon	Tusca-loosa	Tusca-loosa	Tusca-loosa	Tusca-loosa	Tusca[a] loosa	Tusca-loosa	Tusca-loosa	Crystalline Rocks & Tus-loosa	Alluvium	Irwinton sand member
Silica (SiO_2)			18							
Iron (Fe)	.12	.72	.02	1.2	.20	30A	.07	.03	.43	9.9[a]
Calcium (Ca)			15							
Magnesium (Mg)			1.1							
Sodium & Potassium (Na+K)			1.1							
Carbonate (CO_3)			0							
Bicarbonate (HCO_3)	5.0	6.0	45	22	7.0	14	32	21	16	27
Sulphate (SO_4)	1	1	3.1	2	2	2	1	6	1	1
Chloride (Cl)	1	2	2.1	2	4	2	3	3	3	2
Fluoride (F)	.0	.0	.1	.0	.1	.0	.0	.1	.1	.1
Nitrate (NO_3)	9.2	.5	1.1	.8	6.5	.1	1.9	.1	5.6	1.2
Dissolved Solids			68							
Total Hardness	9	6	42	24	9	15	33	21	21	24
Date of collection, 1944	12–9	12–9	11–9	12–23	12–23	12–22	12–22	12–23	12–22	12–16
Temperature, °F.	66	61	65	64	65	66	66	66	66	64

[a] Includes iron in sediment present at time of collection.

Number	34	36	40	42	45	46	51	57	62	68
Geologic horizon	Calcareous Twiggs clay	Irwinton sand	Tuscaloosa	Irwinton sand	Upper sand member	Irwinton sand	Upper sand member	Upper sand member	Calcareous Twiggs clay	Tuscaloosa
Silica (SiO_2)	-----	-----	24	-----	-----	-----	-----	-----	-----	-----
Iron (Fe)	-----	-----	.06	.22	.05	.80	.35	1.8	.24	3.0
Calcium (Ca)	-----	-----	60	-----	-----	-----	-----	-----	-----	-----
Magnesium (Mg)	-----	-----	1.7	-----	-----	-----	-----	-----	-----	-----
Sodium & Potassium (Na +K)	-----	-----	2.7	-----	-----	-----	-----	-----	-----	-----
Carbonate (CO_3)	-----	-----	0	-----	-----	-----	-----	-----	-----	-----
Bicarbonate (HCO_3)	303	28	178	225	4.0	136	2.0	7.0	230	84
Sulphate (SO_4)	27	1	9.4	6	4	1	1	1	5	13
Chloride (Cl)	11	1	4.6	2	24	3	3	7	3	3
Fluoride (F)	.1	.0	.1	.0	.2	.1	.0	.0	.2	.1
Nitrate (NO_3)	.5	3.1	.1	.1	56	.2	8.4	2.0	0.1	.1
Dissolved Solids	-----	-----	197	-----	-----	-----	-----	-----	-----	-----
Total Hardness	252	27	157	186	48	108	12	9	174	78
Date of collection, 1944	12–16	12–22	11–9	12–23	12–17	12–19	12–20	12–19	12–20	12–21
Temperature, °F.	62	63	66	63	61	63	62	61	65	65

Analyses of Ground Waters from Twiggs County—Cont'd.

Number	72	76	82	84	85
Geologic horizon	Tuscaloosa	Tuscaloosa	Tuscaloosa	Tuscaloosa	Tuscaloosa
Silica (SiO_2)	10	----------	----------	----------	----------
Iron (Fe)	.43	.85	2.1 [a]	6.7 [a]	----------
Calcium (Ca)	1.1	----------	----------	----------	----------
Magnesium (Mg)	.5	----------	----------	----------	----------
Sodium & Potassium (Na + K)	2.9	----------	----------	----------	----------
Carbonate (CO_3)	0	----------	----------	----------	----------
Bicarbonate (HCO_3)	0	28	10	13	7.0
Sulphate (SO_4)	8.9	1	1	2	2
Chloride (Cl)	1.2	1	2	10	1
Fluoride (F)	.1	.0	.0	.0	.0
Nitrate (NO_3)	.0	1.9	1.8	4.3	4.9
Dissolved Solids	27	----------	----------	----------	----------
Total Hardness	5	21	9	18	9
Date of collection	11–9	12–22	12–22	12–22	12–22
Temperature, °F.	68	62	63	63	66

[a] Includes iron in sediment at time of collection.

Washington County

[Area 674 square miles. Population 24,230]

Geography

Washington County is the eighth largest county in the State and the largest of the six counties included in this report. The population is 85 percent rural, and averages 35.9 persons per square mile. Sandersville is the county seat and has a population of 3,566 inhabitants. Other towns and villages, in order of their size, are: Tennille, Davisboro, Harrison, Deepstep, Riddleville, Warthen, Oconee, and Gardner.

Approximately 78 percent, or 1,136,506 acres of the county, is in farm land, and agriculture is the leading occupation of the area. Of the 2,506 farms in the county in 1940, 80,328 acres were devoted to corn, 28,263 to cotton, and 477,324 acres to woodland. During the same year sweet potatoes were cultivated on 1,423 acres, and legumes and sugar cane were also of considerable agricultural importance. Washington was one of 35 counties of the State which produced over a million gallons of milk each in 1939. According to the Federal census of 1940 there were 34 manufacturing establishments in the county, of which 25 were related to the kaolin industry. The total annual products of these establishments were valued in the census at $2,-286,880.

A small area in the vicinity of Hamburg Mill Pond in the northern corner of the county is within the Piedmont Province. In this area the Ogeechee and Little Ogeechee Rivers have stripped away the thin overlying Coastal Plain sediments to expose the underlying crystalline basement rocks.

Most of central and northern Washington County is a dissected upland plain within the physiographic region designated as the Red Hills. Georgia Highway 15 follows the drainage divide between the Oconee River to the west and the Ogeechee River to the east. Buffalo Creek and its tributaries are cutting headward into the upland, eroding away the Barnwell formation and exposing the underlying Tuscaloosa formation in long northeast-southwest trending stream valleys. On the eastern side of the divide, Williamson Swamp Creek and other northwest-southeast trending tributaries of the Ogeechee River are cutting the upland into long strips. The area is for the most part hilly with a maximum relief of 250 to 300 feet. Where the upland is undissected by streams, as in the area just north of Sandersville, and in the vicinity of Warthen, the relief is much less, rarely exceeding 50 feet.

South of Sandersville in the Tifton upland, the topography is characterized by gently rolling hills, broad rounded summits and few gullies. The relief of this area rarely exceeds 50 feet except near Williamson Swamp Creek and its tributaries in the southeastern corner of the county. The maximum relief along the larger deep-cutting streams in the area is probably less than 150 feet. Sink holes and ponds are not uncommon in the Tifton upland. They are numerous in the upland area to the northeast and southwest of Davisboro. Generally circular, elongated, or ellipical in shape, they range from less than an acre to several acres in size. Some of the depressions in this area are dry, but a few are swampy and thickly overgrown with plants and trees.

The Oconee River and its tributary, Gumm Creek, form nearly the entire western county line, and with its other tributaries, Keg, Carter, Limestone, and Buffalo Creeks, it drains the entire western half of the county. The south-central part of the area is drained by the Ohoopee and Little Ohoopee Rivers which flow to the south into the Altamaha River near Altamaha in Tattnall County.

Geology

The crystalline rocks are exposed in two places in northern Washington County: over a small area in the valleys of the Ogeechee and Little Ogeechee Rivers, and over a smaller area of two or three acres along Tiger Creek in the northwestern part of the county. The crystalline rocks consist of quartzites, biotite gneiss, and schists. By plotting on a base map the depth to the crystalline rocks in several water wells in northwestern and central Washington County, the crystalline surface was estimated to slope to the southeast at a rate of about 55 feet per mile.

The crystalline rocks are overlain by the irregularly bedded clay, sand, and gravel of the Tuscaloosa formation of Upper Cretaceous age. Along the northern county line the Tuscaloosa formation, where exposed in the valleys of Buffalo Creek and the Ogeechee River, ranges from a few feet to 150 feet in thickness. Nearly the complete thickness of the Tuscaloosa formation in northwestern Washington County is represented in the log of a water well drilled on the property of Miss Mattie Mae Veal, three miles north of Deepstep and approximately 100 yards west of Buffalo Creek.

Log of Well 17 on the property of M. M. Veal, 3 miles north of Deepstep

(Authority, Layne Atlantic Well Drilling Company)

	Depth (feet)		Depth (feet)
Top soil	0-3	Coarse white sand, hard	74-81
Tuscaloosa formation:		Coarse gravel	81-91
Yellow kaolin	3-15	Hard kaolin	91-101
Coarse dark-yellow sand	15-20	Coarse gravel and kaolin	101-106
Fine yellowish sand	20-27	Clay and gravel	106-111
Kaolin	27-29	Lime (?), sand and clay	111-122
Coarse white sand	29-59	Lime (?), sand-clay with soft gray shale and certain amount of mica	122-129
Dark red sand (hard)	59-64		
Red and white sand and kaolin	64-74	Crystalline rock	120........

The Tuscaloosa formation thickens rapidly southward to about 250 feet in the vicinity of Deepstep and to 605 feet at

Sandersville. It probably attains a thickness of 800 feet along the southern boundary of the county.

Deposits of course kaolinitic quartz sand and gravel fill channels in the Tuscaloosa formation at several places. These channel sands are irregularly deposited and are not persistent throughout the area.

Wherever the channel sands are absent the Twiggs clay member of the Barnwell formation unconformably overlies the Upper Cretaceous Tuscaloosa formation. In northern Washington County the Twiggs clay thins to about 20 feet. It thickens to the south and becomes more calcareous, so that in the central and southwestern parts of the county it contains beds of gray fossiliferous marl, interbedded with the typical hackly green fuller's earth clay. To the south in central and southeastern Washington County the Twiggs clay member appears to be even more calcareous. Moderate yields of hard water are obtained from solution channels in these beds and the overlying Sandersville limestone.

The Irwinton sand member of the Barnwell lies conformably on the Twiggs clay member. In northern Washington County it consists of gray and yellow fine to coarse angular quartz sand interbedded with thin tough gray and yellow clay beds. The Irwinton sand thickens southward to about 50 feet in the central and southwestern parts of the area. In east-central and western Washington County the Irwinton sand is equivalent in part to the Sandersville limestone.

The upper coarse sand member of the Barnwell formation forms a thin cover over the Irwinton sand member throughout most of the area in which the Barnwell formation crops out. An excellent section showing the thickness and relationship of these beds to each other is exposed in a road cut in the south bank of Keg Creek on the Deepstep-Sandersville road 4.3 miles southeast of Deepstep.

Section on South Bank of Keg Creek, Washington County

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Upper sand member	
7. Sand, red, coarse, subangular with highly polished fine gravel near base.	10
Irwinton sand member	
6. Clay, gray, waxy, mottled red.	3
5. Sand, yellow, gray, loose, fine to medium-grained with scattered coarse subangular quartz sand. Thin interbedded yellow and green clay layers.	38
Twiggs clay member	
4. Clay, pale-green, hackly, blocky, of fuller's earth type with thin quartz-sand streaks. Becomes fossiliferous and contains white lime nodules near base.	49
3. Marl, olive-gray, fossiliferous, fine sandy. Contains *Pecten* sp., bryozoa, *Cardium* sp., *Venericardia* sp., *Turritella* sp., and *Flabellum* sp.	1½
Channel sand	
2. Sand, light green, medium to coarse, sub-angular, glauconitic, in a fine clay matrix.	3
Unconformity	
Upper Cretaceous	
Tuscaloosa formation	
1. Kaolin, gray-white with yellow iron streaks, blocky with scattered fine to coarse angular quartz grains.	15+

In southeastern and south-central Washington County deposits of undifferentiated Miocene and Oligocene age form a cover over the Barnwell formation. These deposits consist of light-gray, white, and red mottled sandy clay and fine to coarse angular quartz sand in a pale-green silty matrix. They range in thickness from 2 or 3 feet along their northern margin of outcrop to 40 feet in the vicinity of Tennille. They thicken slowly to the south to possibly 70 feet along the southern Washington County line.

The log of a water well drilled for the Town of Sandersville in 1944 shows the thickness and lithology of the undifferentiated Miocene and Oligocene residuum plus the total thickness and lithology of the underlying Barnwell and Tuscaloosa formations in central Washington County.

A summarized log of Sandersville Public Water Well 51, located at the city reservoir, 1.4 miles south of Sandersville Baptist Church

(The land surface at the well is 465 feet above sea level.)

Lithology	Depth (feet)
Residuum of Miocene and Oligocene formations	
Silty clay, mottled red and green	0-18
Sandy clay, mottled pink, gray, white and pale-green.	18-60
Eocene (upper Eocene)	
Barnwell formation	
Sand, white, fine and medium sub-rounded, polished, becomes coarse with depth. Shell fragments, cherty chips and hard chert streaks	60-79
Limestone, soft buff-white, fine sandy, and with shell fragments (bryozoa, *Ostrea* sp.?)	79-94
Limestone, white, soft, with little sand. Contains *Turritella* sp., *Ostrea* sp., and Bryozoa. Becomes more sandy with depth	94-120
Sand, white, medium-grained, polished, sub-angular. Shell fragments and chert chips	120-130
Sandy limestone, gray-white, contains: granules of quartz, fine gravel up to ¾ inch in diameter, fossil fragments, and sharks teeth	130-134
Marl, light-gray. Contains scattered fine and medium quartz grains, Ostracods, Foraminifera, *Ostrea* sp., and Bryozoa	134-160
Sandy marl, light-gray. Contains shell fragments. Becomes more sandy and brownish gray in lower 20 feet. Sandy limestone, light-gray to brownish-gray. Contains fossil fragments, Foraminifera, and Ostracods. Becomes gravelly at base	207-266

	Depth (feet)
Upper Cretaceous	
Tuscaloosa formation	
Kaolin, light gray-white, fine sandy.	266-371
Sand, light-gray, medium-grained, sub-angular. Contains red and gray mottled clay particles.	371-403
Sand, light-gray, fine to very coarse, angular to sub-angular with fine gravel up to ¼ inch in diameter.	403-433
Fine gravel, light-gray.	433-443
Sandy clay, light-pink and gray mottled, fine sandy, with scattered quartz granules	443-464
Gravel, light-gray. Very coarse sand and fine gravel up to ¼ inch in diameter.	464-539
Sand, gray-white, medium to very coarse-grained, in a fine clay matrix.	539-599
Sandy clay, light-gray, waxy, with scattered quartz granules.	599-627
Sand, light-gray, fine and medium, sub-angular, with scattered mica particles.	627-655
Sand, light-gray, coarse, sub-angular.	655-669
Sand, light-gray, fine and medium-grained.	669-714
Sand, light-gray, very coarse-grained.	714-738
Sand, white and gray, sub-angular, coarse-grained, interbedded with fine gravel and white kaolin	738-871
Pre-Cambrian	
Crystalline rock	871-872

Ground Water

The larger supplies of ground water used in Washington County come from the coarse sand and gravel beds of the Tuscaloosa formation. This aquifer has been developed at Sandersville to furnish the public water supply; at Oconee, Gardner, and a place south of Deepstep to furnish industrial supplies for mining and processing kaolin; and in the vicinity of Deepstep to supply a proposed Army camp. These wells yield from 40 to 600 gallons of water a minute.

In the western half of the county in the valleys of the Oconee River, Buffalo Creek, and their tributaries, wells ranging from

2 to 4 inches in diameter and from 50 to 300 feet in depth yield moderate supplies of ground water for domestic, stock, and small industrial demands from water-bearing sands in the Tuscaloosa formation. Many of the wells in western Washington County in the lowland areas have natural artesian flows of from 3.5 to 150 gallons a minute.

In the central and east-central parts of the county between Sandersville and Davisboro and the area to the southeast of Sandersville, many drilled wells penetrate solution channels in a calcareous facies of the Twiggs clay member of the Barnwell and in the Sandersville limestone. Drilled wells in this area range from 80 to 150 feet in depth and yield from 8 to 100 gallons of water a minute each. The water from the calcareous facies of the Twiggs clay is relatively high in hardness and bicarbonate.

In the upland or Red Hills area in the northern and western parts of the county where the Barnwell formation crops out, all the small rural domestic water supplies are obtained from shallow dug and drilled wells penetrating the Irwinton sand member. These wells generally yield from 1 to 3 gallons a minute, but a few will produce as much as 6 gallons a minute. Many springs issue from the Irwinton sand at the top of the Twiggs clay member. The springs have similar capacities to the wells in the Irwinton sand, flowing from 1 to 6 gallons a minute. The Irwinton sand in the vicinity of Tennille furnishes greater amounts of ground water of good quality. Two drilled wells 125 feet deep penetrate this aquifer and furnish the Tennille public water supply. Each has a capacity of about 250 gallons a minute.

In southeastern and south-central Washington County a few shallow dug wells recover water from sands in the residuum of Oligocene and Miocene formations, but most of the ground-water supply in this area comes from deeper dug or drilled wells in the upper sand member or the Irwinton sand member of the Barnwell formation.

Quality of Water

Samples of water from wells drawing from the Tuscaloosa formation in this area were low in dissolved mineral content and hardness, ranging from 25 to 80 parts per million of dissolved solids, and 15 to 46 parts per million of total hardness respectively. The bicarbonate did not exceed 54 parts per million. The fluoride, nitrate, and iron in the samples from this aquifer were 1.0 part per million or less each, and the average sulfate in the samples was 7.2 parts per million. Because the Tuscaloosa formation yields relatively large quantities of water of good quality, it is an excellent source of supply for most uses.

The water from the calcareous facies of the Twiggs clay member of the Barnwell formation is relatively high in dissolved solids. The total hardness ranges from 104 to 189 parts per million, the bicarbonate 122 to 214 parts per million, and the sulfate 2 to 9.5 parts per million. The iron, nitrate, and fluoride in the water averaged less than 1 part per million each, and the chloride less than 4 parts per million. A complete analysis of a sample of water from well 54 showed that the sample contained 73 parts per million of calcium, 1.7 parts per million of magnesium, and 10.2 parts per million of sodium and potassium combined.

Ground water from the Irwinton sand member of the Barnwell in this area is similar to that from the Tuscaloosa formation in that it contains only small amounts of dissolved mineral matter. The water from the Irwinton sand generally has less than 28 parts per million of total hardness, and averages less than 28 parts per million of bicarbonate.

Local Supplies

Sandersville, Tennille, and Davisboro are the only communities in Washington County that have public water supply systems, and all are supplied by drilled wells. The other small villages of Harrison, Riddleville, Warthen, Oconee, and Deepstep have no centralized water system, although in each, privately owned drilled wells serve several families. Throughout the rural areas many shallow drilled and dug wells furnish domestic, stock, and small industrial supplies.

Sandersville (population 3,566). The first town water well was drilled in 1900 to a depth of 431 feet. It was 4½ inches in diameter and was reported to have penetrated water-bearing sands at depths of 70, 120, 185, 325, and 425 feet. The static water level in this well, on its completion, was 134 feet below land surface, and the various aquifers were estimated to produce from 20 to 120 gallons per minute each, the deepest furnishing the maximum amount. [33] In 1904 a second well was drilled within 200 feet of the first, but only to a depth of 195 feet. This well (55 of this report) was reported to yield 150 gallons a minute. In 1928, well 54 was drilled to a depth of 250 feet, and furnished the public water supply with an additional 100 gallons a minute. In 1939, another well (52) was drilled at the 80,000-gallon reservoir 1.5 miles south of Sandersville. During the period 1939 to 1944 the Sandersville water supply came from wells 52, 54, and 55, which ranged from 195 to 250 feet in depth and penetrated the calcareous facies of the Twiggs clay member of the Barnwell formation. These wells had capacities of 100 to 130 gallons a minute. The yield of water from this aquifer is fairly large but the water is rather high in total hardness.

During 1944 the town found it necessary to increase its water supply, and drilled a well (51) 760 feet deep, which penetrated water sands in the Tuscaloosa formation. This well is pumped at the rate of 500 gallons a minute. The construction of the well was as follows: An 18-inch casing was set to 360 feet, a 10-inch casing and screens were set from 330 to 709 feet, and an 8-inch casing and screens were set from 709 to 760 feet. The 8- and 10-inch casings were set in an 18-inch hole and the annular space between the casing and the wall of the well was packed with gravel. The screens were set at depths of 535-540 feet, 560-565 feet, 660-670 feet, 694-699 feet, 704-714 feet, and from 755-760 feet. The last screen was plugged with a steel plate. The static water level of the well is 220 feet below land surface, and the drawdown is from 10 to 12 feet when the well is pumped at the rate of 400 gallons a minute.

The town water system has two reservoirs having capacities of 120,000 and 87,000 gallons, and an elevated tank with a capacity of 110,000 gallons. Wells 54 and 55 are at the Sandersville waterworks pumping plant and are pumped into the 120,000-gallon reservoir. From this reservoir the water is pumped to the distribution system and the elevated tank. Wells 51 and 52 are 1.5 miles south of Sandersville on the Tennille road at the 80,000-gallon reservoir. These wells are pumped into the 80,000-gallon reservoir and from there through about a mile

[33] McCallie, S. W., A Preliminary report on the underground waters of Georgia, Geological Survey of Georgia Bull. 15, pp. 185-187, 1908.

of single 8-inch main into the distributing system and the elevated tank by means of a 500-gallon per minute booster pump.

Tennille (population 1,758). The first municipal well at Tennille was drilled in 1894 to a depth of 990 feet. This first drilling attempt was unsuccessful, although water-bearing strata were reported at 380 and 426 feet. It is reported that the water from the 380-foot aquifer rose to within 90 feet of the land surface, and that the water from the 426-foot aquifer rose to within 100 feet of the surface. In 1904 another well was drilled for the town, for which no records are available.[34]

The present Tennille water supply is furnished by two wells (82, 83) owned by the town. The first of these wells (82) was drilled in 1918 to a depth of 130 feet. An 8-inch casing was set in the well to 103 feet, but later was pulled back to 85 feet and the strainer set from 85 to 103 feet. In 1929, because of an increase in demand for water in Tennille, a new 10-inch well (83) was drilled by J. R. Connelly to a depth of 125 feet. The screens in this well were set approximately from 85 to 100 feet opposite a coarse white water-bearing sand. Both wells, 82, and 83, are producing water from the Irwinton sand member of the Barnwell formation. A composite log for the vicinity of the town wells was made from the report of J. R. Connelly, the driller of the Tennille wells, and from Walter Smith, local well driller in the Tennille area.

Log of material drilled through in the vicinity of the Tennille water supply system

(Authority, Drillers J. R. Connelly and Walter Smith)

	Depth (feet)		Depth (feet)
Sandy soil	0-5	Sand	48-55
Mottled sandy clay	5-22	Hard limestone ledge	55-58
Clay	22-32	Chalky lime rock	58-78
Sand	32-45	White coarse sand	78-103
Hard limestone ledge	45-48	Hard clay	103-130

The Tennille wells 82 and 83 are equipped with electrically driven deep-well turbine pumps having capacities of 250 and 350 gallons a minute respectively. The wells have a combined ca-

[34] McCallie, S. W., A Preliminary report on the underground waters of Georgia. Geological Survey of Georgia, Bull. 15, pp. 187, 188, 1908.

pacity of 790,000 gallons per day. Water is pumped directly from the wells into the distributing system and into a 75,000-gallon elevated tank at the pumping station. The business district of the town is served by 8-inch mains supplied directly from the elevated tank. Other sections of the town are served through 6-inch mains.

The average daily consumption of ground water for all purposes in Tennille is about 125,000 gallons, or approximately 60 gallons per capita. The maximum rate of consumption is during the summer when about 150,000 gallons per day are used.

Many privately owned wells in this area range from 2 to 4 inches in diameter and from 82 to 100 feet in depth. These wells produce from 4 to 6 gallons a minute from sand beds in the Irwinton sand member of the Barnwell formation. Most of these private wells have windmills as a means of power, and supply water for small domestic and farm use. Dug wells at Tennille range from 30 to 50 feet in depth, and have capacities ranging from 2 to 6 gallons a minute.

Davisboro (population 533.) In 1888 a well 2 inches in diameter and 325 feet deep was drilled for the community. This well was reported to have flowed 5 gallons a minute from a water-bearing sand between 88 and 100 feet deep. The water in the well rose to a height of 3 feet above the land surface. In 1894, T. L. Brown of Davisboro drilled a well (35 of this report) 100 feet deep which originally flowed 5 gallons a minute. [35] In 1944 it was flowing 3 gallons a minute.

A new municipal well (33) was completed on February 4, 1936, and a new water system was installed that year. The well was drilled to a depth of 280 feet, and finished with 175 feet of 8-inch casing, 90 feet of 6-inch casing, and 30 feet of 6-inch strainer. On February 4, 1936 the well was pumped for ten hours at an average rate of 45 gallons a minute—the drawdown was 70 feet. Well 33 is equipped with an electric deep-well turbine pump which has a capacity of 100 gallons a minute. The pump discharges directly into the distributing system and into a 60,000-gallon elevated tank. The distribution system consists of 8-inch mains serving the business district and 6-inch mains

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[35] McCallie, S. W., A preliminary report on the underground waters of Georgia, Geol. Survey of Georgia: Bull: 15, pp. 188-189, 1908.

for the rest of the town. The average daily consumption is about 30,000 gallons for all purposes.

Two other wells (34, 36) besides the T. L. Brown well (35) are in the flood plain of Williamson Swamp Creek within the town limits of Davisboro. All of these wells are between 80 and 100 feet in depth and flow from 3 to 6.5 gallons a minute. The water from these wells and the town well (33) is comparatively high in total dissolved solids, and averages 151 parts per million in total hardness. A log of well 35 is as follows:

Log of T. L. Brown Well (35) at Davisboro
(Authority, Mr. T. L. Brown[36])

	Depth (feet)		Depth (feet)
Sand	0-20	Shell rock with sharks teeth	80-88
Brown clay with pebbles	20-40	Water-bearing sand with fragments of shells which grades down into quicksand at the bottom of well	88-100
Coarse white sand	40-60		
Dark greenish marl	60-80		

Well 99 on the W. C. Wilson Plantation southeast of Davisboro 3½ miles was drilled in 1944 to a depth of 105 feet. This well yields 4 gallons a minute for domestic and stock supplies. Well 99 is rather typical of the drilled wells in the upland area in southeastern Washington County. A log of this well follows:

Log of W. C. Wilson well, 3½ miles (airline) southeast of Davisboro
(Authority, Driller Mark Hall)

	Depth (feet)		Depth (feet)
Mottled pink and greenish clay	0-10	Gray white soft rock	75-85
White sandstone	10-20	White sand	85-97
Rock, soft gray	20-75	Alternate layers of sand and rock	100-105

Harrison (population 298) does not have a public water supply, but several families and stores use water from a drilled well 6 inches in diameter and 109 feet in depth which belongs to J. C. King. This well is equipped with a windmill and an electric pump, and is pumped at the rate of 30 gallons a minute. The water has 63 parts per million of total hardness, and contains 75 parts per million of bicarbonate, and small amounts of sulfate, chloride, fluoride, and nitrate.

[36] McCallie, S. W., A preliminary report on the underground waters of Georgia: Geol. Survey of Georgia Bull. 15, pp. 188-189, 1908.

The Harrison Consolidated School is supplied by a drilled well 3 inches in diameter and 205 feet in depth. An electric pump and pressure tank supply water to the school.

Many other privately owned drilled wells ranging from 2 to 4 inches in diameter and from 53 to 153 feet in depth recover from 3 to 8 gallons a minute for domestic, stock, and small industrial demands in the town and vicinity of Harrison.

Shallow wells 25 to 50 feet deep recover from 1 to 3 gallons a minute for town and rural domestic and stock supplies in this area.

Oconee and Gardners stations on the Central of Georgia Railway (combined population, estimated, 275). The water supplies of this area are obtained entirely from privately-owned wells. Oconee and Gardners are both in the flood plain of the Oconee River and its tributaries, Buffalo and Sandy Creeks. The land surface elevation is about 220 feet above sea level. Many wells ranging from 2 to 6 inches in diameter and from 72 to 156 feet in depth yield from 3 to 60 gallons a minute in natural flow from water-bearing sands in the Tuscaloosa formation. The water from these wells is low in dissolved mineral matter and is of excellent quality for domestic, stock, and industrial use.

The largest development of ground water in this area is for the processing of kaolin at the Edgar Brothers plant at Gardners. Five wells, four of which flow, furnish this supply. These wells draw water from a depth of about 125 feet. A log of flowing well 131, belonging to E. M. Shephard, 0.4 mile north of the railroad tracks at Oconee, follows:

Log of E. M. Shephard well 131 at Oconee
(Authority, Owner E. M. Shephard)

	Depth (feet)		Depth (feet)
Soil	0-4	Slick yellow sandy clay	50-65
Clay and sand streaks	4-50	Water sand	65-72

Deepstep (population 174) has no centralized water system, but many privately owned drilled and shallow dug wells furnish water to the area. The well at the Deepstep High School is typical of the drilled wells in the area. It is 3 inches in diameter and 109 feet deep. It is equipped with an electric pump which pumps 7.6 gallons a minute into a 500-gallon pressure tank from which the water is distributed to the school. The water from the drilled wells at Deepstep is from the Tuscaloosa formation.

In 1942 the War Department ordered four exploratory test wells drilled in the area to the northeast, east, and southeast of Deepstep in the flood plain of Buffalo Creek. All four of these test wells (17, 18, 63, 65) were drilled through the Coastal Plain deposits to the underlying crystalline basement rock.

Well 17 is on the Miss Mattie Mae Veal property, 3 miles north of Deepstep and approximately 100 yards west of Buffalo Creek. The well is 24 inches in diameter from the surface to 108 feet, and 9⅞ inches in diameter from 108 to 129 feet. It ended at a depth of 129 feet. It is screened between the depths of 25 to 60 feet, 83 and 93 feet, and 103 and 108 feet. A pumping test made on August 27, 1942, showed the well to yield 15 gallons a minute.

Well 18 is 1½ miles north of Deepstep and 100 yards west of Buffalo Creek on the Julian P. Veal property. It is 17½ inches in diameter and 178 feet deep, ending on the top of the crystalline basement rocks. It is screened with 8-inch screens from 36 to 41 feet, 54 to 69 feet, and 104 to 114 feet. Approximately 15 cubic yards of gravel were placed around the 8-inch string of casing and screens. The static water level of the well was 17 feet below land surface. The yield of the well was 210 gallons a minute with a drawdown of 55 feet, as indicated by a pumping test.

Log of Well 18 drilled for War Department, August, 1942, 1½ miles north of Deepstep, approximately 100 yards west of Buffalo Creek on property of Julian P. Veal

(Authority, Layne Atlantic Company report)

	Depth (feet)		Depth (feet)
Yellow sand	3-8	Very coarse sand and gravel	98-108
Fine brown sand	8-13	Very coarse sand and gravel with clay	108-138
Fine yellow chalk	13-18	Gravel, very coarse sand and red clay	138-143
Medium red clayey sand	18-33	Gravel and red clay, very little sand	143-148
Fine dark brown clayey sand	33-34	Red clay and gravel	148-158
Medium white sandy clay	34-44	Missing	158-163
Medium white sandy clay	44-54	Granite in cuttings	163-178
Medium white sand	54-64		
Coarse white sand	64-69		
Coarse sand and gravel	69-98		

Well 63 is on the L. A. Wood property 1 mile east of Deepstep and about 100 yards east of Buffalo Creek. This well was drilled 24 inches in diameter from the surface to 200 feet and 17½ inches in diameter from 200 to 274 feet. Approximately 30 cubic yards of gravel were packed around the 8-inch casing and screens. The screens were set in the intervals from 35 to 43 feet, 48 to 58 feet, 133 to 138 feet, and 190 to 200 feet. The well flows 30 gallons a minute. On September 5, 1942, a 36-hour pumping test was made on the well. Pumping at the rate of 230 gallons a minute lowered the water level in the well to 55 feet below land surface.

Log of Well 63 drilled for War Department during September, 1942, 1 mile east of Deepstep and about 100 yards east of Buffalo Creek on the L. A. Wood property

(Authority, Report of Layne-Atlantic Company)

	Depth (feet)		Depth (feet)
Red clay and kaolin	0-3	Gravel and kaolin	122-132
Coarse red sand and kaolin	3-5	Coarse white sand and kaolin	132-145
Light yellow sand	5-8	Hard white kaolin	145-147
Medium white sand	8-11	Sandy kaolin	147-153
Fine white sand and kaolin	11-20½	Kaolin	153-173
Medium white sand	20½-36	Sandy kaolin	173-178
Coarse white sand	36-44	Gravelly kaolin	178-183
White kaolin	44-46	Red clay	183-190
White sandy kaolin	46-49	Coarse white sand	190-199
Coarse white sand	49-58	Red clay	199-209
White sandy kaolin	58-61	Red clay and sand	209-212
White kaolin and gravel	61-72	Red clay	212-237
White kaolin	72-76	Blue and white clay	237-241
White kaolin	76-86	Red and white clay	241-251
Sand and kaolin	86-98	Red and white clay	251-258
Pink kaolin	98-116	White clay and gravel	258-265
Pink sandy kaolin	116-122	Blue clay	265-269

At 270 feet small pieces of granite began to appear along with some hard white and blue gravel with red clay. This steadily increased until at 274 feet it was decided to stop operations.

Well 65 is in the flood plain of Buffalo Creek 1½ miles south of Deepstep and 100 yards west of Buffalo Creek. This well penetrated the crystalline basement at a depth of 304 feet. It is 24 inches in diameter from the surface to 208 feet and 10 inches in diameter from 208 to 304 feet. Screens are set from 43 to 48 feet, 93 to 103 feet, 118 to 123 feet, 133 to 143 feet, 148 to 153 feet, and 193 to 203 feet. The well was reported to yield 150 gallons a minute by natural flow, and 600 gallons a minute by pumping with a drawdown of 30 feet.

Log of Well 65 drilled for War Department, September, 1942. Well located 1½ miles south of Deepstep, about 100 yards west of Buffalo Creek on property of Gilmore Hutchins

(Authority, Report of Layne-Atlantic Company)

	Depth (feet)		Depth (feet)
Fine red sand and clay	0-3	Coarse white sand and gravel	148-160
Medium white sand	3-13	Sand, gravel, and pink chalk	160-165
Medium white sand and chalk	13-18	Pink chalk and sand	165-175
Medium white sand	18-36	Pink chalk	175-184
Coarse white sand	36-44	Pink chalk and clay	184-189
Very coarse sand	44-50	Sand clay	189-193
Coarse sand and white chalk	50-55	Soft coarse white sand	193-203
Pink clay	55-60	Soft coarse white sand and gravel	203-211
Pink clay and white chalk	60-65	Hard gravel	211-215
Pink and white chalk	65-90	Red clay	215-235
Coarse white sand	90-98	Clay and little sand	235-240
Pink chalk and sand	98-100	Dark brown clay	240-251
Soft coarse sand	100-105	Clay and sand	251-266
Soft coarse white sand	105-112	Clay	266-271
Hard pink chalk	112-116	Gravel and clay	271-277
Coarse gravel and sand	116-126	Blue and red clay and gravel	277-292
Hard pink chalk	126-131	Blue and red clay and gravel	292-304
Coarse sand	131-146	Solid granite	304
Coarse sand and chalk	146-148		

Riddleville (population 115). The water supply for private use in the vicinity of Riddleville is taken from two types of wells: dug wells ranging from 20 to 45 feet and drilled wells ranging from 74 to 325 feet.

A good example of the dug wells of the area is one owned by the town of Riddleville. It is reported to have been dug in 1869, is 21.2 feet deep, and 36 inches in diameter.

A 4-inch drilled well at the Riddleville Consolidated School is reported to be 325 feet deep with water-bearing sands at depths of 150 and 200 feet. It is equipped with an electric pump which pumps 6 gallons a minute into a pressure tank from which the water is distributed throughout the school. Other drilled wells in the area range in depth from 74 to 160 feet, and recover from 1 to 6 gallons of water a minute.

Warthen (population 120) has no public water supply system, although a well (14) owned by Macon Warthen furnishes several houses and at least one place of business. This well is 4 inches in diameter and 65 feet deep. It is equipped with a ¾-horsepower electric motor and a cylinder pump which recovers 15 gallons a minute from the Irwinton sand member.

Figure 20. Test well 65 in flood-plain of Buffalo Creek 1½ miles south of Deepstep.

Well 13 at Warthen Junior High School is a dug well 42 feet deep. It is cased with cement and equipped with an electric shallow-well pump furnishing 3 gallons of water a minute to a 60-gallon pressure tank. From the tank the water is distributed to the school.

Well 12 on the T. R. Duggan property at Warthen, is 3 inches in diameter, 204 feet deep, and recovers water from the Tusca-

Records of Wells in

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industrial; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	E 0.8 mi. from State Hgy. 102 from Sparta Rd.	E. B. Hawkins	50	48	--------	Channel sand
2	S 2.2 mi. on State Hgy. 102 from Hamburg Pond.	E. M. Burgamy	40	48	--------	Channel sand
3	NW 5 mi. from Warthen, Ga.	C. H. Womle	64.8	48	65	Irwinton sand
4	NW 4.6 mi. from Warthen, Ga.	J. W. Sparks	18.6	48	18	Irwinton sand
5	SE 2.3 mi. on old Sparta-Davisboro Rd. from Hancock Co.	D. F. Walker	27.5	48	6	Irwinton sand
6	NE 1.6 mi. from well 5	D. F. Walker	40.1	48	8	Channel sand
7	House on N side Cowpen Creek on State Hgy. 102.	Herman Snider	30	48	30	Channel sand
8	S 1 mi. from old Chalker	J. C. Archer	44.2	48	42	Irwinton sand
9	SE 3.9 mi. from old Chalker.	J. C. Archer	185	3	145	Tuscaloosa
10	SW 3.1 mi. from old Chalker.	D. R. Warthern	39.3	48	8	Irwinton sand
11	NW 3.1 mi. from Mayview Corners.	Tom Hooks	26.6	48	--------	Irwinton sand
12	Warthen, Ga.	Mrs. T.R. Duggan	204	3	90	Tuscaloosa
13	Warthen, Ga.	Warthen Jr. High School.	42	30	42	Irwinton sand
14	Warthen, Ga.	M. Warthern	65	4	65	Irwinton sand
15	NW 2.1 mi. from Warthen, Ga.	J. L. Brown	28.1	48	28	Irwinton sand
16	At old Thena Post Office	Fred Cook	32.7	48	--------	Irwinton sand
17	In floodplain Buffalo Creek 2.3 mi. NNE Deepstep, Ga.	Mattie M. Veal	131	8	108	Tuscaloosa
18	In floodplain Buffalo Creek 2.1 mi. NE Deepstep, Ga.	J. P. Veal	178	8	114	Tuscaloosa
19	S 2.7 mi. from well 16	Geo. Gladden	35	48	--------	Irwinton sand
20	NE 4.3 mi. from Deepstep.	J. N. Renfroe	40.1	48	--------	Irwinton sand
21	SE 1.8 mi. from well 20	H. B. Avant	85	3	85	Tuscaloosa
22	NW 3.6 mi. from Sanville, Ga.	Geo. Rawlings	40	48	--------	Irwinton sand
23	Due N 4.5 mi. from Sandersville, Ga.	Walter Brown	215	3	215	Tuscaloosa

Washington County

Power: E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
BH	DS	Top well shelf	2.7	--------	−39.8	5-3-44	T. 64° F.
CW	DS	Land surface	0.0	--------	−12	5-3-44	T. 64° F.
BH	DS	Top of curbing	+2.9	--------	−47.2	5-3-44	T. 64° F.
BH	DS	Top curbing	+2.6	--------	−8.1	5-3-44	--------------------
CH	DS	Top pump base	+.9	--------	−23.7	5-3-44	Discharge 7. T. 64° F.
BH	DS	Top curbing	+2.7	--------	−36.6	5-3-44	T. 64° F.
CE	DS	Top curbing	+.4	------	−13.2	5-3-44	Discharge 5. T. 64° F.
BH	DS	Top of shelf	+2.8	--------	−41.2	5-2-44	T. 64° F.
CWG	DS	Land surface	0.0	--------	−110	5-2-44	Discharge 6. T. 66° F.
BH	DS	Top of shelf	+2.9	--------	−38.4	5-2-44	T. 65° F.
BH	DS	Top casing	+2.8	--------	−15.5	5-3-44	T. 64° F.
CH	DS	Land surface	0.0	475	−20	5-3-44	Discharge 7. T. 66° F.
CE	PS	Land surface	0.0	480	−38	5-4-44	T. 64° F.
CE	P	Land surface	0.0	480	−25	5-3-44	Partial analysis. Discharge 4.
CW	DS	Top curbing	+3.1	--------	−8.9	5-3-44	Discharge 3.
HB	DS	Top curbing	+2.5	--------	−27.9	5-3-44	T. 67° F.
N	N	Land surface	0.0	280	−8	8-24-42	Screens 53-58, 81-91, 101-106 ft. Discharge 15.
------	------	Land surface	0.0	278	−17	8-30-42	Screens 36-41, 54-69, 104-114 ft. Discharge 225.
CWH	DS	Land surface	0.0	--------	−29	8-18-44	T. 64° F.
BH	DS	Top curbing	+2.8	--------	−16.6	5-3-44	T. 65° F.
CW	DS	Land surface	0.0	--------	−15	8-18-44	T. 66° F.
BH	DS	Land surface	+3.2	--------	−30.1	5-3-44	--------------------
CH	DS	Land surface	0.0	--------	−65	5-3-44	--------------------

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
24	S 3.5 mi. from Mayview Corners.	Mrs. Forest Beam	80	3	80	Calcareous Twiggs.
25	West 100 yds. from well 24.	Mrs. Forest Beam	105	3	80	Calcareous Twiggs.
26	S 1.5 mi. from Mayview Corners.	T. W. Gilmore	135	3	90	Calcareous Twiggs.
27	At Mayview Corners	Mutual Benefit Ins. Co.	48.1	48	48	Irwinton sand
28	E 2.1 mi. from Mayview Corners.	L .M. Amerson	253	3	253	Tuscaloosa
29	SW 0.4 mi. from well 30	J. H. Taylor	110	2	80	Tuscaloosa
30	At corners 2.1 mi. SE well 28.	E. E. Welch	204	4	4	Calcareous Twiggs.
31	N 2.1 mi. from Halls Corners.	A.E. Arrington	205	4	90	Irwinton sand
32	N 1.8 mi. from Halls Corners.	Kit Horton	45.2	36	--------	Upper sand member.
33	At Waterworks	City Davisboro	288	8	140	Twiggs & Tuscaloosa.
34	Davisboro, Ga.	Mrs. Susie Parnell	90	3	20	Calcareous Twiggs.
35	Davisboro, Ga.	B. L. Brown	85	2	20	Calcareous Twiggs.
36	E 50 yds. from well 34	Mrs. Susie Parnell	82	3	20	Calcareous Twiggs.
37	SW 2 mi. from Davisboro	Lee M. Happ	87	4	26	Irwinton sand
38	SW 0.8 mi. from well 37	J. K. Pate	46.8	48	6	Upper sand member.
39	W 2.4 mi. from Davisboro.	Washington Farms.	75	48	75	Irwinton sand
40	At Hall Corners	E. A. Prince	39.2	48	6	Upper sand member.
41	E 6.4 mi. from Sandersville.	W. I. Jordan	83	4	80	Calcareous Twiggs.
42	S 40 ft. from well 41	W. I. Jordan	45.5	24	4	Irwinton sand
43	NE 5.6 mi. from Sandersville.	Cecil Newsome	126	3	80	Calcareous Twiggs.
44	NE 4.3 mi. from Sandersville.	Urquehart Well	95	3	80	Irwinton sand
45	NE 2.3 mi. from Sandersville.	W. W. Whiggins	115	3	90	Calcareous Twiggs.
46	E 2.6 mi. from Sandersville, Ga.	R. A. Jenkins	145	3	40	Calcareous Twiggs.
47	SE 2.3 mi. from Sandersville.	F. W. Tanner	158.8	3	90	Calcareous Twiggs.
48	SE 2.2 mi. from Sandersville.	M. N. Cummings	36.6	36	20	Upper sand member.
49	SE 1.9 mi. from Sandersville.	A. L. Gimes	150	3	80	Calcareous Twiggs.

Washington County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
CH	DS	Land surface	0.0	--------	−50	5–2–44	T. 66° F.
CH	DS	Land surface	0.0	--------	−60	5–2–44	T. 66° F.
CW	DS	Land surface	0.0	480	−65	5–2–44	Discharge 7. T. 66° F.
BH	DS	Top curbing	+2.8	--------	−41.6	5–2–44	--------
CG	DS	Top casing	.4	455	−190	9–14–44	Screen 248–253 ft. Discharge 15.
CH	DS	Land surface	0.0	335	−89	5–14–44	Partial analysis. T. 65° F.
CH	DS	Land surface	0.0	455	−85	5–2–44	Partial analysis. T. 65° F.
CH	DS	Land surface	0.0	--------	−60	5–2–44	T. 65° F.
BH	DS	Top well shelf	+2.4	--------	−43.2	5–1–44	T. 64° F.
TE	P	Top casing	0.0	295	−10	4–29–44	Partial analysis. Discharge 100.
F	DS	Lip of casing	+4.1	275	+10	4–29–44	Discharge 6. T. 65° F.
F	DS	Lip of casing	+2.4	272	+8	4–29–44	Partial analysis. Discharge 3.
F	DS	Top ¾" connection.	+2.2	270	+12	4–29–44	Discharge 6.5. T. 65° F.
CH	DS	Land surface	0.0	--------	−45	7–14–42	--------
CE	DS	Top wood casing	+3.2	--------	−43.5	5–4–44	Discharge 1. T. 64° F.
CWE	DS	Land surface	0.0	400	−65	5–1–44	--------
BH	DS	Top curbing	+3.5	--------	−33.6	5–2–44	T. 63° F.
CE	DS	Top casing	0.0	--------	−25	4–29–44	Discharge 3.3. T. 67° F.
BH	DS	Top curbing	+2.6	--------	−37.8	4–29–44	T. 64° F.
CWE	DS	Land surface	0.0	--------	−60	5–1–44	Discharge 2. T. 66° F.
CH	DS	Land surface	0.0	465	−65	9–1–44	--------
CW	DS	Land surface	0.0	--------	−30	5–2–44	--------
CW	DS	Land surface	0.0	--------	−40	4–29–44	Discharge 7. T 66° F.
CW	DS	Land surface	0.0	--------	−20	5–1–44	T. 66° F.
CE	DS	Top brick curbing.	+1.2	--------	−4.4	5–1–44	Discharge 8.3. T. 64° F.
CW	DS	Land surface	0.0	--------	−40	4–29–44	T. 66° F.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
50	E City limits of Sandersville.	McElrath Lumber Co.	165	6	160	Calcareous Twiggs.
51	At City reservoir 1.5 mi. S of Sandersville.	Sandersville, Ga.	760	10	760	Tuscaloosa
52	NE 200 ft. from well 51	Sandersville, Ga.	250	8	200	Calcareous Twiggs.
53	At SW corner of Sandersville City limits.	Washington Co. Farm.	140	3	140	Calcareous Twiggs.
54	E 50 ft. from well 55	Sandersville, Ga.	250	8	200	Calcareous Twiggs.
55	At City Water Works, Sandersville, Ga.	Sandersville, Ga.	195	6	200	Calcareous Twiggs.
56	Sandersville, Ga.	J. J. McElrath	106	4	100	Irwinton sand
57	N–NW 3.4 mi. from Sandersville, Ga.	W. C. Murphy	200	3	100	Calcareous Twiggs.
58	W 150 yds. from well 57	B. F. Murphy	175	4	100	Calcareous Twiggs.
59	On Deepstep Rd. 4.4 mi. NW of Sandersville.	Ben Tarbutton	220	4	200	Tuscaloosa
60	W 4 mi. from Sandersville.	Sinclair Oil Station.	53.3	48	52	Irwinton sand
61	S 2 mi. from Keg Creek on Deepstep-Sandersville Rd.	Wm. Harris	85	3	80	Tuscaloosa
62	W 200 yds. from well 61	Wm. Harris	125	3	100	Tuscaloosa
63	E 1.8 mi. from Deepstep, Ga.	B. F. Chambers, Sr.	100	3	80	Tuscaloosa
64	E 1 mi. from Deepstep Postoffice.	L. A. Wood	274	8	200	Tuscaloosa
65	In floodplain junction of of Deepstep & Buffalo Creeks.	Gilmore Hutchings.	304	10	304	Tuscaloosa
66	E 1 mi. from Buffalo Creek bridge on State Hgy. 24.	Brooks Springs	425	--------	425	Tuscaloosa
67	N 0.8 mi. from Bluff Ck. Bridge on State Hgy. 24.	Edgar Bro's.	303	8	303	Tuscaloosa
68	NW 100 yds. from well 67	Edgar Bro's.	249	8	249	Tuscaloosa
69	S 1.6 mi. from well 70	G. S. Garbutt	95	2	90	Tuscaloosa
70	W 0.9 mi. from Deepstep, Ga.	T. J. Veal	41	3	41	Tuscaloosa
71	W 0.8 mi. from Deepstep, Ga.	T. J. Veal	18	3	18	Tuscaloosa
72	Deepstep, Ga.	B. L. Helton	110	2	97	Tuscaloosa
73	N 3 mi. from Deepstep	W. H. Arant	96	2	96	Tuscaloosa
74	Deepstep	Deepstep Jr. High School.	109	3	109	Tuscaloosa
75	W–SW 5.2 mi. from Deepstep (Old Butler Place).	E. P. Wood	174	4	174	Tuscaloosa

Washington County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
JS	I	Land surface	0.0	--------	−15	4–29–44	Discharge 5. T. 66° F.
TE	PS	Land surface	0.0	465	−220	7–4–44	Complete analysis. Discharge 500.
TE	PS	Land surface	0.0	465	−70	4–29–44	Complete analysis. Discharge 110.
CWE	PS	Land surface	0.0	--------	−65	5–2–44	Discharge 6. T. 67° F.
TE	PS	Land surface	0.0	450	−70	4–29–44	Complete analysis. Discharge 100.
TE	PS	Land surface	0.0	450	−70	4–29–44	Discharge 130. T. 66° F.
CE	D	Land surface	0.0	--------	−52	5–5–44	T. 66° F.
CWE	DS	Land surface	0.0	--------	−55	5–3–44	Discharge 6.6. T. 66° F.
CWE	DS	Land surface	0.0	--------	−25	5–3–44	Discharge 4.
CH	DS	Land surface	0.0	--------	−65	5–4–44	Discharge 5.
BH	DS	Top curbing	+2.8	469	−51.2	5–2–44	T. 64° F.
CH	N	Pump base	+.4	255	−12	5–4–44	Screen set 80–85 ft. T. 67° F.
CH	DS	Pump base	+.6	255	−20	5–4–44	T. 66° F.
CW	DS	Pump base	+.5	265	−10	5–4–44	T. 66° F.
F	DS	Lip of casing	+1.5	272	+4	5–4–44	Discharge; flow 35, pump 270.
F	DS	Lip of casing	+1.4	270	+6	5–4–44	Partial analysis. Discharge; flow 150, pump 600.
F	DI	Lip of casing	+2.5	259	+17	5–4–44	Partial analysis. Discharge 30.
TE	I	Land surface	0.0	--------	−100	5–4–44	Discharge 450. T. 65° F.
TE	I	Land surface	0.0	--------	−75	5–4–44	Discharge 250. T. 64° F.
CW	DS	Land surface	0.0	--------	−80	5–4–44	T. 64° F.
CW	DS	Land surface	0.0	293	−13	5–4–44	Discharge 10.
CH	DS	Land surface	0.0	270	−2	5–4–44	Discharge 4.
CH	DS	Land surface	0.0	--------	−30	5–5–44	--------------------
CW	DS	Land surface	0.0	348	−15	5–5–44	T. 65° F.
CE	PS	Land surface	0.0	358	−21	5–5–44	Discharge 7.5. T. 65° F.
CH	DS	Land surface	0.0	--------	−100	5–4–44	--------------------

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
76	E 1.9 mi. on State Hgy. 24 from Baldwin Co.	O. M. Ennis	312	4	312	Tuscaloosa
77	E 0.4 mi. on State Hgy. 24 from Baldwin Co.	C. F. Fowler	34.4	36		Tuscaloosa
78	SE 2.9 mi. from well 77	A. J. Hobbings	450	4	450	Tuscaloosa
79	SE 0.4 mi. from well 78	Harper Tucker	75	3	75	Tuscaloosa
80	SE 3.4 mi. from well 79	A. J. Carr	244	3	240	Tuscaloosa
81	S 0.5 mi. from Tennille, Ga.	G. E. Mertz	82	3	80	Irwinton sand
82	Below tower	Tennille, Ga.	130	8	85	Irwinton sand
83	N 20 yds. from well 82	Tennille, Ga.	130	10	85	Irwinton sand
84	SE 0.7 mi. from Tennille, Ga.	Jim Kelly	109	4	48	Irwinton sand
85	E 20 ft. from well 84	Jim Kelly	82	4	77	Irwinton sand
86	SE 0.5 mi. from Tennille	C. L. Mertz	100	4	80	Irwinton sand
87	NE 6.4 mi. from Irwins Corners.	Erwin Elton	112	3	90	Irwinton sand
88	SE 3.9 mi. from Tennille, Ga.	H. F. Shurling	50	48		Upper sand member.
89	E 3.6 mi. from Tennille, Ga.	Ed Holmes	160	3	40	Calcareous Twiggs.
90	S side of store at Sun Hill	Lela Thigpen	80	3	24	Calcareous Twiggs.
91	NW 2.7 mi. from Riddleville, Ga.	L. E. Shepard	160	3	110	Calcareous Twiggs.
92	NW 2.1 mi. from Riddleville, Ga.	B. G. Layton	94	4	80	Irwinton sand
93	NW 1.8 mi. from Riddleville, Ga.	L. E. Shepard	110	4	80	Irwinton sand
94	Cement curbed well near center of Riddleville.	Riddleville, Georgia	21.2	36	20	Undiff. Mio. & Olig.
95	In school yard	Riddleville Cons. School.	210	4	200	Calcareous Twiggs
96	E 1 mi. from Riddleville	T. O. Glover	74	4	74	Upper sand member
97	NE 1.4 mi. from Riddleville.	W. B. Francis, Jr.	60	36	30	Upper sand member
98	Taylor Corners 3 mi. S of Davisboro.	T. R. Taylor	60	36	20	Upper sand member
99	E 1.5 mi. from Taylors Corners.	W. C. Wilson	105	3	75	Irwinton sand
100	E 50 yds. from well 99	W. C. Wilson	49.8	48	6	Undiff. Mio. & Olig.
101	N 2.9 mi. from well 106	Maggie Lewis	155	3	75	Irwinton sand
102	E 3.1 mi. from Taylors Corners.	W. B. Francis	40	48	4	Undiff. Mio. & Olig.
103	N 0.5 mi. from well 102	Mrs. Eugene Josey.	250	3	100	Calcareous Twiggs.
104	E 5.7 mi. from Taylors Corners.	Ed. Smith	250	3	110	Calcareous Twiggs.

Washington County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
CE	DS	Land surface----	0.0	--------	−110	5–4–44	--------------------
CW	DS	Top casing-----	.4	--------	−24.2	5–4–44	T. 64° F.
CG	DS	Land surface----	--------	--------	−20	5–4–44	Partial analysis. Discharge 13.3.
CH	DS	Land surface----	0.0	--------	−15	5–4–44	--------------------
CE	DS	Land surface----	--------	--------	−50	5–4–44	--------------------
CW	DS	Land surface----	0.0	295	−20	4–29–44	T. 66° F.
TE	PS	Land surface----	0.0	460	−30	4–29–44	Partial analysis. Discharge 300.
TE	PS	Land surface----	0.0	460	−30	4–29–44	Discharge 225. T. 66° F.
CW	DS	Land surface----	0.0	--------	−20	4–29–44	T. 66° F.
CE	DS	Land surface----	0.0	--------	−20	4–29–44	Discharge 6. T. 65° F.
CW	DS	Land surface----	0.0	295	−20	4–29–44	Discharge 4. T. 66° F.
CE	DS	Land surface----	0.0	--------	−53	5–4–44	--------------------
BH	DS	Top curbing----	+3.1	--------	−7.3	5–1–44	T. 64° F.
CE	I	Land surface----	0.0	--------	−2	9–4–44	Flowed 1 gpm at 53 ft. Discharge 8.
F	DS	Land surface----	0.0	--------	+4.5	4–29–44	Partial analysis. Discharge 3.
CW	DS	Land surface----	0.0	--------	−35	5–1–44	T. 64° F.
CE	DS	Land surface----	0.0	--------	−30	5–1–44	Discharge 1.
CE	DS	Land surface----	0.0	--------	−35	5–1–44	Discharge 1.
BH	PS	Top curbing----	+2.7	--------	−5.6	5–1–44	--------------------
CE	PS	Land surface----	0.0	--------	−45	5–1–44	Partial analysis. Discharge 6.
CWE	DS	Land surface----	0.0	--------	−32	5–1–44	Discharge 3. T. 66°F.
CE	DS	Top wood shelf -	+2.9	--------	−5	5–1–44	T. 64°F. Discharge 3.3.
CW	DS	Top cement well base.	+1.4	--------	−6.3	5–1–44	T. 64°F.
CE	DS	Top casing-----	+.9	--------	−33.2	5–1–44	Discharge 3.5.
BH	DS	Top curbing----	+2.8	--------	−8.4	5–1–44	T. 64°F.
TE	DS	Land surface----	0.0	--------	−60	5–1–44	Discharge 5.
BH	DS	Top well shelf---	+3.1	--------	−14.4	5–1–44	T. 64°F.
CW	DS	Land surface----	0.0	--------	−30	5–1–44	Casing set in blue marl 100 ft. Discharge 6.
CE	DS	Land surface----	0.0	--------	−50	5–1–44	Casing set in blue marl 110 ft. Discharge 6.

Records of Wells in

Well No. Plate 2	Location	Owner or name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
105	E 8.9 mi. from Harrison, Ga.	P. H. Wilson	185	3	--------	Calcareous Twiggs.
106	SE 3.1 mi. from Riddleville, Ga.	Stanley Estate	49	36	4	Undiff. Mio. & Olig.
107	SE 6 mi. from Harrison, Ga.	Wm. Tompkins	98	4	98	Upper sand member.
108	Pringle, Ga.	Green Harrison Gin.	68	6	68	Upper sand member.
109	NE 3 mi. from Harrison, Ga.	Oliver Jackson	35	36	5	Undiff. Olig. & Mio.
110	Harrison, Ga.	J. C. King	109	6	109	Irwinton sand
111	Harrison, Ga.	J. C. Waller	135	4	135	Irwinton sand
112	Harrison, Ga.	Harrison Con. School.	205	3	205	Calcareous Twiggs.
113	N 4.4 mi. from Harrison, Ga.	Lewis Lindsey	33.6	36	--------	Undiff. Mio. & Olig.
114	W 2.1 mi. from Harrison at store on S Hgy. 15.	C. J. Lord	153	4	153	Irwinton sand
115	W 1.4 mi. from well 114 at a store.	C. J. Lord	92	4	92	Irwinton sand
116	N 1 mi. from well 115	Leon Brantley	70	4	70	Upper sand member.
117	N 1.2 mi. from well 115	Leon Brantley	96	4	96	Irwinton sand
118	N 1.9 mi. from well 115	Geo. C. Young	53	4	53	Upper sand member.
119	W 1.3 mi. from well 115	J. C. Hartley	76	4	76	Upper sand member
120	W. 0.9 mi. from well 118	J. L. Brantley	108	2	108	Irwinton sand
121	W side road Irwins Corners.	J. D. Orr	37.3	48	32	Irwinton sand
122	S side road Irwins Corners.	J. D. Orr	63	48	63	Irwinton sand
123	N 3.3 mi. from intersection State Hgys. 57 and 68.	T. Y. McBride	103	36	98	Irwinton sand
124	At Gardners Sta. NW 50 ft. from well 126.	Edgar Bro's.	123	2	120	Tuscaloosa
125	S 100 yds. from SW corner of cement resevoir.	Edgar Bro's.	123	4	120	Tuscaloosa
126	SE 40 ft. from SE corner of cement reservoir.	Edgar Bro's.	123	4	120	Tuscaloosa
127	SW 10 ft. from SW corner of cement reservoir.	Edgar Bro's.	123	2	123	Tuscaloosa
128	N of cement reservoir 50 yds. beside RR siding.	Edgar Bro's.	82	6	80	Tuscaloosa
129	W 10 yds. from Negro School-Gardner, Ga.	English China Clay.	156	4	156	Tuscaloosa
130	NW corner of crossroads at Oconee, Ga.	E. M. Shephard	120	2	120	Tuscaloosa
131	N 0.4 mi. from crossroads at Oconee, Ga.	E. M. Shephard	72	3	66	Tuscaloosa

Washington County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
CE	DS	Land surface	0.0	--------	−112	5–1–44	Discharge 15. T. 65°F.
BH	DS	Top well shelf	+3	--------	−6	5–1–44	T. 64°F.
CH	DS	Land surface	--------	--------	−35	7–14–44	--------
CE	DS	Land surface	0.0	--------	−30	5–1–44	--------
BH	DS	Top cement curb	+2.92	--------	−10.1	5–1–44	T. 64°F.
CWE	DS	Land surface	0.0	405	−65	5–1–44	Partial analysis. Discharge 30.
CE	DS	Land surface	0.0	410	−70	5–1–44	Discharge 3. T. 65°F.
CE	PS	Land surface	0.0	415	−75	5–1–44	T. 65°F.
HB	DS	Top well shelf	+3.1	--------	−10.6	5–1–44	T. 64°F.
CE	DS	Land surface	0.0	--------	−54	5–1–44	--------
CE	DS	Land surface	0.0	--------	−22	12–42	--------
CE	DS	Land surface	0.0	--------	−43	5–4–44	--------
CH	DS	Land surface	0.0	--------	−56	10–6–41	--------
CE	DS	Land surface	0.0	--------	−30	7–6–41	--------
CH	DS	Land surface	0.0	--------	−43	7–14–42	--------
CW	DS	Land surface	0.0	--------	−88	1–1–45	Discharge 8.
BH	S	Top of curbing	+2.5	--------	−28.3	1–2–45	Discharge 6.
TE	D	Top of curbing	+2.5	--------	−37.3	1–2–45	Discharge 6.
BH	DS	Land surface	3.27	415	−91	4–25–45	Discharge 3.
F	I	Lip of nipple	+3	225	+4.8	5–3–44	Discharge 10. Temp. 65°F.
F	I	Lip of L nipple	+3	225	+7.2	5–3–44	Discharge 60. T. 65°F.
F	I	Lip of L nipple	+3	224	+6	5–3–44	Complete analysis. Discharge 40.
F	I	Lip of L nipple	+3.8	225	+4.5	5–3–44	Discharge 5. T. 65°F.
CE	I	Lip of casing	−3	220	−11.5	5–4–44	Discharge 60. T. 64°F.
F	PS	Lip of nipple	+1.9	220	+10	5–4–44	Discharge 40. T. 65°F.
F	DS	Top of casing	+1.9	220	+1	5–4–44	Discharge 15. T. 64°F.
F	DS	Top of casing	+1.8	227	+3	5–4–44	Discharge 3.5. T. 64°F.

Analyses of Ground Waters from Washington County

(Analyzed by W. L. Lamar, Evelyn Holloman, and Wesley M. Noble. Parts per million. Numbers at heads of columns correspond to numbers in table and in plate 2)

Number	14	30	33	35	51	52
Geologic horizon	Irwinton sand	Calcareous Twiggs clay	Calcareous Twiggs clay	Calcareous Twiggs clay	Tuscaloosa	Calcareous Twiggs clay
Silica (SiO_2)	--------	--------	--------	--------	22	14
Iron (Fe)	--------	--------	--------	--------	.87 [a]	.01
Calcium (Ca)	--------	--------	--------	--------	16	12
Magnesium (Mg)	--------	--------	--------	--------	1.5	.9
Sodium & Potassium (Na + K)	--------	--------	--------	--------	4.4	3.6
Carbonate (CO3)	--------	--------	13	--------	0	0
Bicarbonate (HCO_3)	6.0	139	146	196	54	30
Sulphate (SO_4	1	7	8	9	7.7	2.1
Chloride (Cl)	9	3	4	4	2.4	5.5
Fluoride (F)	0.1	0.0	0.1	0.0	.0	.5
Nitrate (NO_3)	11	.01	0.0	0.1	.0	4.8
Dissolved Solids	--------	--------	--------	--------	80	63
Total Hardness	26	118	141	162	46	34
Temperature, °F	65	65	65	65	64	66
Date of collection	8–12–44	8–14–44	8–13–44	8–12–44	8–6–44	11–28–40

Number	54	55	65	66	78	82
Geologic horizon	Calcareous Twiggs clay	Calcareous Twiggs clay	Tuscaloosa	Tuscaloosa	Tuscaloosa	Irwinton sand
Silica (SiO_2)	26	26	9.2	--------	--------	--------
Iron (Fe)	.01	.01	.05 [b]	--------	--------	--------
Calcium (Ca)	73	73	1.4	--------	--------	--------
Magnesium (Mg)	1.7	1.7	.5	--------	--------	--------
Sodium & Potassium (Na + K)	5.7	5.7	2.9	--------	--------	--------
Carbonate (CO_3)	0	--------	0	--------	--------	--------
Bicarbonate (HCO_3)	214	214	8.0	27	8.0	7.0
Sulphate (SO_4)	9.5	9.5	2.6	15	1	3
Chloride (Cl)	10	10	1.8	4	3	6
Fluoride (F)	.0	.0	.0	0.1	0.0	0.1
Nitrate (NO_3)	.51	.51	.1	0.1	0.8	5.4
Dissolved Solids	241	241	25	--------	--------	--------
Total hardness	189	189	16	39	15	16
Temperature, °F	66	66	65	66	64	66
Date of collection	1–19–38	1–19–38	8–13–44	8–13–44	8–13–44	8–12–44

Analyses of Ground Waters from Washington County—Cont'd.

Number	89	90	95	99	110	126
Geologic horizon	Calcareous Twiggs clay	Calcareous Twiggs clay	Calcareous Twiggs clay	Irwinton sand	Irwinton sand	Tuscaloosa
Silica (SiO_2)	--------	--------	--------	--------	--------	9.4
Iron (Fe)	--------	--------	--------	--------	--------	.63 [c]
Calcium (Ca)	--------	--------	--------	--------	--------	13
Magnesium (mg)	--------	--------	--------	--------	--------	1.0
Sodium & Potassium (Na + K)	--------	--------	--------	--------	--------	9.1
Carbonate (CO_3)	--------	--------	--------	--------	--------	0
Bicarbonate (HCO_3)	162	192	122	22	75	53
Sulphate (SO_4)	8	7	2	1	2	9.5
Chloride (Cl)	3	4	4	4	3	1.9
Fluoride (F)	0.1	0.1	0.1	0.1	0.2	.1
Nitrate (NO_3)	0.0	0.1	0.1	.0	2.8	.1
Dissolved Solids	--------	--------	--------	--------	--------	66
Total Hardness	136	153	104	28	63	37
Temperature (°F)	65	66	65	64	65	65
Date of collection	8-13-44	8-12-44	8-13-44	8-12-44	8-13-44	9-12-44

[a] Fe in solution .02, Fe in sediment .85.
[b] Fe in solution .01, Fe in sediment .04.
[c] Fe in solution .02, Fe in sediment .60.

loosa formation at the rate of 7 gallons a minute. Water-bearing beds were reported at depths of 50 and 200 feet, and the static water level is 20 feet below land surface.

Log of T. R. Duggan well 12 at Warthen

(Authority, Driller W. Smith)

	Depth (feet)		Depth (feet)
Red sandy clay soil	0-6	Hard blue marl	90-120
Coarse sand and clay	6-50	Clay and sandy clay	120-200
Fine water sand, thin clay layers	50-90	White coarse sand	200-205

Sun Hill station on the Central of Georgia Railway (population, estimated, 40). All wells in the vicinity of Sun Hill are privately owned. Well 90, 20 yards west of the store at Sun Hill on the property of Lela Thigpen, was drilled in 1924 to a depth of 80 feet, and has a natural flow of 3 gallons a minute. Well 89, at the Holmes Canning Factory 1.5 miles southwest of

Sun Hill, was drilled to a depth of 53 feet, from which it flowed at the rate of 1 gallon a minute. Later the well was deepened to 177 feet. The natural flow stopped and the static water level now stands 2 feet below land surface. An electric pump recovers 8 gallons a minute for use in the canning factory.

Log of E. Holmes well 89 which is 1.5 miles southeast of Sun Hill

(Authority, Owner E. Holmes)

	Depth (feet)		Depth (feet)
Yellow sand	0-53	Sand	60-70
Rock	53-53½	Rock	70-70⅔
Sand and gravel	53½-59⅓	Blue clay	70⅔-160
Rock	59⅓-60	Sand	170-177

Wilkinson County

[Area 458 square miles. Population 11,025]

Geography

Wilkinson County described in this report is the second largest in the area and has a density of population of 24 inhabitants per square mile. Gordon, the largest town in the county, has a population of 1,524 and Irwinton, the county seat, a population of 585. Toomsboro, Allentown, McIntyre, and Danville are other centers of trade.

The population of the county is rural, and 195,027 acres of the county are in farmland. According to the 1940 census there were 1,092 farms in the area of which 30,629 acres were cultivated in corn and 8,352 acres in cotton. Cattle raising has increased in the area, and the older herds are being gradually improved by the introduction of new and better breeds of cattle. Gordon and McIntyre are the kaolin mining and processing centers. In 1940 there were 13 manufacturing establishments in the county, nearly all of which were related to the kaolin mining and processing industry.

In the northern half of Wilkinson County, Big Sandy Creek, Commissioners Creek, and the Oconee River have stripped away the deposits of Tertiary age and exposed the sands, clays, and gravels of the Tuscaloosa formation. In this area the broad rolling, gently sloping Sand Hills are well developed. The relief in the Sand Hills area does not exceed 250 feet. The highest hills in the area are those that are capped by channel sands or by a part of the Barnwell formation.

In the vicinity of Gordon, McIntyre, Irwinton, and Toomsboro, the maximum relief is about 300 feet. Commissioners and Big Sandy Creeks follow southeastward-trending parallel valleys, traversing the central part of the county. What remains of the Upland surface is of fairly low relief, but over much of the Red Hills area many small streams are cutting headward into the Twiggs clay and Irwinton sand members of the Barnwell formation so that the upland adjacent to the larger streams and rivers has many V-shaped valleys that are over 100 feet below the upland. Nearly all of the roads in the area follow the ridges, and most of the early clearings and houses were built in the upland area. Following the development of kaolin mining and other industries in the area, a large part of the population has migrated to the valley of Commissioners Creek at Gordon, McIntyre and Toomsboro.

In southern Wilkinson County the upland surface is dissected by many streams flowing into the Oconee River that have cut many young V-shaped valleys. Gullies form rapidly in the loose Irwinton sand member, and gullies 50 to 75 feet deep are not uncommon in the area.

Along most of the southern county line the topography is somewhat less rugged than it is elsewhere. In the area of outcrop of the residuum of Oligocene and Miocene formations (see plate 1) the land surface is characterized by gently rolling hills, except where streams have cut into the underlying upper Eocene deposits.

Wilkinson County lies entirely within the drainage basin of the Oconee River which forms the eastern county boundary line. A large part of the drainage is carried in a southeasterly direction by two major tributaries of the Oconee, Big Sandy and Commissioners Creeks.

Geology

In the northern fifth of Wilkinson County the Tuscaloosa formation crops out everywhere except the top of a few hills which are capped with channel sand or a part of the Barnwell formation. Along the Baldwin-Wilkinson County line, the Tuscaloosa formation consists of 100 to 200 feet of irregularly bedded clay, sand, and gravel deposited on the underlying crystalline basement rocks. This formation thickens quite rapidly to the southeast and is approximately 800 feet in thickness along the southern county line.

In the central and southern parts of the county the overlying younger deposits of the Barnwell formation crop out over an increasingly larger area and the Tuscaloosa formation of Upper Cretaceous age is exposed only in the larger stream valleys. The Twiggs clay member, Irwinton sand member, and the upper coarse sand member of the Barnwell are fairly consistent in thickness and lithology throughout the County. The Twiggs clay is from 40 to 45 feet thick and consists of pale green hackly fuller's earth clay which becomes fossiliferous and calcareous near the base of the formation. The Irwinton sand member consists of about 50 feet of fine to medium-grained quartz sand containing thin layers of clay. In the southwestern part of the county, in the vicinity of Buck Creek, the Irwinton sand member contains a few layers of silicious limestone. The upper sand member with flat polished beach pebbles ranges from 1 or 2 feet in thickness in the northern part of the area of outcrop of the Barnwell formation to about 25 feet in the southern part of the county. The members of the Barnwell formation thicken slowly to the south and the Barnwell formation probably attains a maximum thickness of 180 feet in southern Wilkinson County.

A section showing the thickness and lithology of the Barnwell formation, and its relationship to the underlying Tuscaloosa formation is exposed in a road cut 1.8 miles southwest of Gordon and 0.1 mile east of the intersection of Georgia Highways 18 and 57.

Section in Gordon clays Tramline cut at overpass on Georgia Highway 57, 1.8 miles southwest of Gordon, continued in a road cut on Georgia Highway 18, 1.6 miles south of Gordon

	Thickness (Feet)
Colluvium (exposed in tramway cut)	
8. Sandy clay, reddish brown, coarse, sub-angular, and with scattered brown iron pellets.	4

	Thickness (Feet)
Eocene (upper Eocene)	
Barnwell formation	
Upper sand member	
7. Quartz sand, pink, cross-bedded, coarse and granular, sub-angular to sub-rounded, and with thin gray clay stringers. At base many flat rounded highly polished quartz pebbles as much as 2 inches in diameter and stringers of fine gravel.	12½
Irwinton sand member	
6. Quartz sand, buff-yellow, fine-grained, interbedded with thin layers of gray micaceous clay. Clay weathers into purple flakes. The sand beds thicken and grade downward into bed below.	5
(Off-set 0.1 mile east to road cut on Georgia Highway 18)	
5. Sand, red coarse. Grades downward into 31 feet of yellow cross-bedded fine-grained quartz sand with thin gray clay partings which become thicker near base of bed.	46
Twiggs clay member	
4. Clay, pale green, hackly, blocky, fuller's earth, with thin fine sand streaks. (Off-set down gully 20 yards west to tramway cut). Clay contains more fine and medium-grained sand in basal 20 feet. Tan gray-green and fossiliferous at base.	42
3. Sandy clay, mottled red, brown, and gray, with scattered granules and sub-angular gravel up to ¾ inch in diameter.	10
Channel sand (upper ? Eocene)	
2. Sand, pink and white, cross-bedded, fine to coarse, with clay balls up to 2 inches in diameter.	6-2
Unconformity	
Upper Cretaceous	
Tuscaloosa formation	
1. Kaolin, gray sandy, overlying gray-white cross-bedded micaceous quartz sand.	25+

The undifferentiated deposits of Oligocene and Miocene age form a thin layer covering the upper Eocene formations along the southern Wilkinson County line. This residuum, all that remains of former Oligocene and Miocene deposits, consists of red, pink, gray, and white mottled clayey sand. These deposits are in the form of spotty outliers, and do not exceed 30 feet in thickness in this locality. The land surface in the area of outcrop of these undifferentiated deposits is characterized by gently rolling hills, and the relief does not exceed 50 feet. The soil in this area is typically a brown-yellow sandy loam.

Ground Water

In the northern fifth of Wilkinson County and in the valleys of Big Sandy and Commissioners Creeks, nearly all the dug and drilled wells recover ground water from one or more water-bearing sands in the Tuscaloosa formation. These wells range in size from small domestic wells producing from 1 to 15 gallons a minute to large industrial wells producing as much as 800 gallons of water a minute.

Along the northern county line the sand and gravel of the Tuscaloosa formation ranges from 100 to 200 feet in thickness, and correctly constructed drilled wells in this area could probably recover up to 250 gallons a minute from this aquifer. As the Tuscaloosa formation increases in thickness to the south, more and more water could be expected to be recovered from wells penetrating these beds. Wells developed in the Tuscaloosa formation in the vicinity of McIntyre, near the center of the county, range from 2 to 10 inches in diameter, 37 to 315 feet in depth, and yield from 12 to 800 gallons of water a minute.

Flowing wells in the Tuscaloosa formation have been drilled in the flood plain of Commissioners Creek as far north as Toomsboro, in the flood plain of Big Sandy Creek as far north as the bridge over Big Sandy Creek on Georgia Highway 29, and in the flood plain of the Oconee River as far north as Indian Island in Baldwin County, near the Baldwin-Wilkinson County line. These wells yield as much as 30 gallons a minute by natural flow. A log of the flowing well (62) at Ball's Ferry in Wilkinson County 0.1 mile west of the bridge over the Oconee River on Georgia Highway 57 is as follows:

Log of Well 62, near Ball's Ferry Bridge, owned by Clarence Thompson

(Authority, Driller Barney Dean)

	Depth (feet)		Depth (feet)
Top soil	0-7	Blue marl with thin indurated ledges	21⅔-42
Water sand	7-21	White clay	42-72
Rock	21-21⅔	Sand-Flow	73

Figure 21. Well 62 at west end of Ball's Ferry Bridge, Wilkinson County.

In the Red Hills area or uplands of Wilkinson County, farming is the leading occupation, and a dependable year-around ground-water supply is necessary for domestic and stock demands. The Irwinton sand member of the Barnwell is of major importance as a water bearing bed in this area. It furnishes a small but adequate supply of ground water at a low recovery cost. Approximately 90 percent of the wells in this area are shallow dug wells 20 to 70 feet deep, from which water is drawn with windlasses. A few of the shallow dug and drilled wells penetrating the Irwinton sand are equipped with hand or small electric pumps. The capacity of these wells ranges from 1 to 8 gallons a minute. Many dug wells in the Red Hills area are dug 2 feet or more into the top of the Twiggs clay member. The part of the well in the clay is used as a catch basin or reservoir space. Well 51 on the Homer Jones property at a crossroads 4.2 miles northwest of Toomsboro is an example of this type of dug well.

Log of Well 51 owned by Homer Jones

	Depth (feet)		Depth (feet)
Tan-gray sandy clay	0-1.5	Massive fine to coarse sand and thin clay streaks	30-67
Red clay	1.5-30	Clay	67-69

Many springs in this area occur on the sides of the Red Hills where the perched water table, caused by the impervious Twiggs clay member, crops out. These springs flow from 1 to 15 gallons a minute and furnish many rural water supplies.

In southern Wilkinson County the Irwinton sand is still a good water-bearing aquifer even though it contains a few thin siliceous limestone ledges. Several drilled wells that are about 100 feet deep recover as much as 12 gallons a minute from this aquifer. A log of well 112 on the J. Howell property 2 miles southeast of Nickelsville is as follows:

Log of Well 112 on J. Howell property

(Authority, Driller O. D. Tindall)

	Depth (feet)		Depth (feet)
Loose tan, medium-grained sand	0-5	Clay	63-71
Red sand and sandy clay with clay streaks	5-60	Fine water sand	71-97
Sand	60-63	Limestone rock	97

A few shallow dug wells in southern Wilkinson County in the outcrop area of the residuum of Oligocene and Miocene formations obtain ground water from the upper sand member of the Barnwell formation. Wells 30 to 40 feet deep in the vicinity of Allentown and Danville furnish from 5 to 30 gallons of water a minute from this aquifer.

Quality of Water

Water from the Tuscaloosa formation in Wilkinson County, as elsewhere, is generally low in dissolved mineral matter. The highest mineral content recorded for water from this formation was in a sample from well 102 in the flood plain of the Oconee River in the southeast corner of the county (see table of analyses at end of this county.) Well 102 is 136 feet deep and penetrates the Tuscaloosa formation at a point far down the dip in Wilkinson County. Wells 60 and 62 at Toomsboro and Balls Ferry are about 9 miles up the dip from well 102 and the water from them contained slightly smaller amounts of dissolved mineral matter. Still farther northwest, in the vicinity of McIntyre, water from wells penetrating the Tuscaloosa formation contained only about half as much dissolved mineral matter as that from well 102. The mineral content of ground water from the Tuscaloosa formation in its area of outcrop is approximately one-third as great as that in water from well 102.

The ground water from the Irwinton sand member of the Barnwell is very low in dissolved mineral matter. The total hardness of the samples of water from this aquifer is generally lower than 35 parts per million, and the bicarbonate content ranges from 8 to 51 parts per million. Water from this aquifer contained less than 0.5 part per million of fluoride, 4 parts per million of chloride, 2 parts per million of sulfate, and less than 1.3 parts per million of iron.

Only one sample of water was collected from the upper sand member of the Barnwell formation in the southwestern part of the county. This sample, which comes from well 109, had 30 parts per million of total hardness, and contained 30 parts per million of bicarbonate, 2 parts per million of sulfate, and 2.7 parts per million of nitrate.

Local Supplies

Gordon and Irwinton have the only public water supply systems in the county. Toomsboro, the second largest town in the area, has many privately owned wells, each furnishing water to several homes. This is likewise the case at McIntyre, Danville, and Allentown.

Gordon (population 1,524). The first water well at Gordon, of which there is any record, was drilled just prior to 1896 from a surface elevation of 355 feet above sea level to a depth of 365 feet. The water in this well rose to within 19 feet of the surface.[37]

Since that time many other wells have been drilled in the area. In 1918 O. D. Tindall drilled a well (25) at a paper mill in east Gordon on some property now owned by E. E. Miller. This well is 4 inches in diameter, and 175 feet deep. It is equipped with an electrically driven, centrifugal pump which recovers 60 gallons of water a minute from the Tuscaloosa formation, with a reported drawdown of 13 feet. The water is pumped into a 50,000-gallon elevated tank and from there distributed through 6-inch pipe to serve approximately 20 families in the eastern portion of town.

The municipal water supply at Gordon is from a well (24) drilled in 1938 to a depth of 146 feet. The construction details of this well follow: A 19-inch hole was drilled to a depth of 146 feet, a 19-inch casing was set from the land surface to a depth of 40 feet to keep surface contamination out of the well. A 6-inch casing, perforated from 40 to 140 feet, was then lowered into the 19-inch hole, and the annular space between the casing and the wall of the hole was packed with gravel. Water from this well is recovered by a 7½-horsepower electric deep-well turbine pump which pumps 65 gallons a minute with a drawdown of 15 feet. Water is pumped directly to an elevated tank and from there distributed through mains to the town. The average daily consumption from this system for all uses is 12,000 gallons, and the maximum daily consumption is 15,000 gallons during the summer months. A log of well 24 is as follows:

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[37] McCallie, S. W., A preliminary report on the artesian-well system of Georgia: Geol. Survey of Georgia, Bull. 7, p. 139, 1898.

Log of Well 24, owned by the Town of Gordon

(Authority, Gray Artesian Well Company)

	Depth (feet)		Depth (feet)
Top soil	0-6	Kaolin	40-45
Gumbo	6-16	Water sand and thin clay lenses	45-140
Water sand and kaolin beds	16-40	Kaolin	140-141

In the uplands 1 mile south of Gordon at the junction of Georgia Highways 57 and 18 a well owned by E. D. Vinson was drilled to a depth of 205 feet. The water rises in this well to within 175 feet of the land surface, and a small electric pump recovers 3 gallons a minute. Other wells in the upland area south and southeast of Gordon take their water from the Irwinton sand member of the Barnwell at depths of 50 to 80 feet.

Toomsboro (population 593). In 1882 a well was drilled from a land surface elevation of 237 feet above sea level to a depth of 320 feet. When finished, the well furnished about 8 gallons a minute in natural flow. The well is reported to have ceased flowing four years later, in 1886, because the casing had filled with sand.[38]

In September, 1944, there were three flowing wells at Toomsboro. These ranged from 80 to 100 feet in depth and flowed about 1.5 gallons a minute. On September 22, 1944, the water in these wells was approximately 3 feet above land surface, but no actual measurements could be made of the hydrostatic head because of damaged casings.

In the vicinity of Toomsboro small dug, auger, and drilled wells 15 to 30 feet deep recover up to 50 gallons a minute, each, from the stream alluvium of Commissioners Creek. The water level in these wells ranges from 10 to 22 feet below the land surface.

At the Toomsboro High School, and other localities in the uplands to the south of Toomsboro, shallow wells penetrate and recover ground water from the Irwinton sand member. The

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[38] McCallie, S. W., A preliminary report on the artesian-well system of Georgia: Geol. Survey of Georgia, Bull. 7, p. 139, 1898.

Toomsboro School well is 22 feet deep, is equipped with an electric pump, and furnishes about 4 gallons a minute.

Irwinton (population 589). Two drilled wells on the R. W. Culpepper property at the west side of Culpepper's General Store furnish about 80 percent of the water supply at Irwinton, Georgia. Well 69 is 4 inches in diameter and penetrates the Tuscaloosa formation at a depth of 250 feet. Well 70 is 3 inches in diameter and was drilled to a depth of 265 feet. Both wells are equipped with electric pumps and their combined capacity is 20 gallons a minute. Well 70 is the best of the two wells and can be pumped at the rate of 12 gallons a minute 24 hours a day. The static water level in each of the wells is 115 feet below a land surface elevation of 465 feet above sea level. Water is pumped from the wells into an elevated storage tank from which the water is distributed throughout the town. A log of well 70, which was drilled by G. I. Warner in June, 1943, is as follows:

Log of Well 70 on the R. W. Culpepper property, Irwinton

(Authority, Owner R. W. Culpepper)

	Depth (feet)		Depth (feet)
Red sandy clay	0-25	Rock	103-104
Yellow fine sand, thin clay streaks	25-90	Clay	104-144
Green clay	90-97	Sandy clay and coarse sand	144-169
Rock	97-98	Alternating beds of sand and clay	169-220
Clay	98-103	Water sands	220-265

The families not served by the Culpepper wells obtain their water supplies from dug wells that penetrate the Irwinton sand member of the Barnwell. The Irwinton sand at Irwinton is about 50 feet thick and furnishes an adequate ground water supply for small domestic and stock consumption. Well 71 is a typical example of a dug well developed in the Irwinton sand member in this vicinity. It is 59 feet deep and 36 inches in diameter. A cement casing keeps the loose sand from slumping into the well. An electric ¼-horsepower pump recovers sufficient water for domestic use and the demands of a small dairy farm. The bottom of the well is dug 8 feet into the Twiggs clay member of the Barnwell, and this clay basin acts as a water-storage space.

Allentown and Danville (estimated combined population 480). All water used at Allentown and Danville, in the southwestern corner of Wilkinson County, comes from privately owned dug and drilled wells. The largest demand for ground water at Allentown is at the A. W. Daughtry Cotton Gin. A shallow dug well 30 feet deep, installed with an electric pump, has a reported capacity of 50 gallons a minute. From the well the water is pumped into an elevated storage tank and from there distributed throughout the gin. The water from this well is not used for drinking purposes.

Most of the privately owned water supply systems in the area are furnished ground water from shallow drilled and dug wells ranging from 20 to 100 feet in depth. The shallow wells, which are 20 to 40 feet deep, penetrate through the thin cover of residuum of Oligocene and Miocene formations to the underlying Upper sand member of the Barnwell formation. In this area wells recover from 7 to 50 gallons a minute from this aquifer. The deeper wells, which are 70 to 100 feet deep, penetrate the Irwinton sand member of the Barnwell and yield from 5 to 10 gallons a minute.

McIntyre (population 209). No centralized public supply system furnishes water to the town of McIntyre, but several large wells in the area furnish nearly the entire supply.

A drilled well 8 inches in diameter and 70 feet deep owned by the Wilkinson County Motor Company has an estimated capacity of 300 gallons a minute. The static water level in this well (41) is 15 feet below land surface, and an electric pump recovers the water required for industrial and domestic demands in the vicinity of the motor company.

At the G. M. Hall Lumber Company 0.8 mile east of McIntyre a driven well (42) 37 feet deep recovers 12 gallons of water a minute from the alluvium of Commissioners Creek. This well is equipped with a small centrifugal pump and is used for fire protection.

The only extensive public water supply system at McIntyre is owned by Edgar Brothers'. The system is near the top of a hill 0.7 mile south of McIntyre at the company's housing unit.

Records of Wells in

1. Measured depths of wells given in feet and tenths; reported depths given in feet.
2. Pumps: C, cylinder; F, natural flow; N, none; P, pitcher; T, turbine; B, windlass (bucket);
3. D, domestic; I, industrial; N, none; PS, public supply; S, stock; RR, Railroad.
4. M. P., measuring point.

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
1	N 1.9 mi. from Napier Pond.	I. F. Carr	115	3	110	Tuscaloosa
2	W 0.3 mi. from well 1	W. G. Aycock	110	2	100	Tuscaloosa
3	N 0.6 mi. from Napier Pond.	J. E. Wood	110	2	105	Tuscaloosa
4	E side of Riley home, Napier Pond.	Frank Riley	28	36	25	Tuscaloosa
5	S 1.4 mi. from Napier Pond.	Clyde Daniel	74	3	69	Tuscaloosa
6	S 0.5 mi. from Bloodworth corners.	D. A. Bloodworth	22	48	22	Tuscaloosa
7	S 0.4 mi. from Bloodworth corners.	Bill McCook	72	2	67	Tuscaloosa
8	N 20 yds. from well 9	J. T. Bloodworth	40	48	16	Channel sand
9	At Bloodworth corners 3.7 mi. on State Hgy. from Baldwin Co.	J. T. Bloodworth	84	2	79	Tuscaloosa
10	S 3 mi. on State Hgy. 29 from Baldwin Co.	C. R. Johns	63	2	58	Tuscaloosa
11	E 0.8 mi. from well 10	M. H. Council	75	2	69	Tuscaloosa
12	NE 0.7 mi. from well 10	V. C. Johns	26	48	26	Tuscaloosa
13	S 2.4. mi. on State Hgy. 29 from Baldwin Co.	C. C. Johns	95.4	48	--------	Tuscaloosa
14	S 1.3 mi. on State Hgy 29 from Baldwin Co.	C. C. Johns	24	48	24	Tuscaloosa
15	NNW 7.9 mi. (airline) from McIntyre Ga.	O. B. Snow	100	2	95	Tuscaloosa
16	NNW 5.9 mi. (airline) from McIntyre, Ga.	F. M. Fountain	125	2	120	Channel sand
17	S 20 yds, from well 16	F. M. Fountain	115	2	110	Channel sand
18	NW 5.9 miles (airline) from McIntyre, Ga.	L. J. Dyer	68	2	63	Tuscaloosa
19	NE 3.6 mi. from Gordon, Ga.	J. H. Hardie	110	2	105	Tuscaloosa
20	NW 0.7 mi. from well 19	Mrs. Winnie Young.	87	2	82	Tuscaloosa
21	NW 2.8 mi. from Gordon, Ga.	James Humphries	60	48	--------	Tuscaloosa
22	NW 2.3 mi. from Gordon, Ga.	A. R. Cobb	48	48	40	Tuscaloosa
23	At intersection State Hgys. 57 and 18.	E. L. Vinson	205	2	200	Tuscaloosa
24	Below City water tower	Gordon, Ga.	146	19–6	146	Tuscaloosa
25	Below water tower E 0.5 mi. from Gordon.	E. E. Miller	175	4	165	Tuscaloosa

Wilkinson County

Power : E, electric motor; G, gasoline engine; H, hand; W, wind.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
CH	DS	Land surface	0.0	370	−80	9–24–44	Screen set 110–115 ft.
CH	DS	Land surface	0.0	365	−85	9–24–44	Screen set 100.
CH	DS	Land surface	0.0	290	−65	9–24–44	Partial analysis. T. 66°F.
CW	DS	Top brick curb	+ .9	248	−12.6	9–24–44	Discharge 25.
CH	DS	Top cement blocks.	+.1	300	−34	9–29–44	Discharge 3. Screen set 69–74 ft.
BH	DS	Top well shelf	+2.9	290	−18	9–24–44	
CH	DS	Land surface	0.0	300	−22	9–24–44	Screen set 67–72 ft. T. 67°F.
BH	DS	Top wood shelf	+3.2	338	−39	9–24–44	T. 65°F.
	N	Land surface	0.0	338	−75	9–24–44	
CG	DS	Land surface	0.0	341	−56	9–24–44	Screen set 58–63 ft. Discharge 5.
CH	DS	Land surface	0.0	300	−67	9–24–44	Screen set 69–75 ft.
CE	DS	Land surface	0.0	301	−22	9–24–44	Discharge 5.8.
BH	DS	Top well curb	+2.8	380	−91.2	9–24–44	
BH	DS	Land surface	0.0	300	−19	9–24–44	T. 64°F.
CH	DS	Land surface	0.0	420	−52	9–27–44	Screen set 95–100 ft.
CW	DS	Land surface	0.0	415	−40	9–27–44	Partial analysis. Discharge 4.
CG	DS	Land surface	0.0	415	−60	9–27–44	Discharge 3. T. 67°F.
CH	DS	Top cement block.	+.2	440	−32	9–27–44	T. 67°F.
CW	DS	Top casing	+.2		−82	9–29–44	
CH	DS	Top cement block.	+.2		−39	9–29–44	Discharge 2. T. 69°F.
BH	DS	Land surface	0.0	420	−54	9–19–44	
BH	DS	Top wood curb	+3.5		−38	9–19–44	
CE	DS	Land surface	0.0	520	−175	9–19–44	Discharge 3.
TE	PS	Land surface	0.0	340	−18	9–19–44	Complete analysis. Discharge 65.
TE	PS	Land surface	0.0	325	−3	9–19–44	Discharge 60.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
26	E 2.5 mi. from Gordon, Ga.	A. B. Brooks	65	2	65	Tuscaloosa
27	At back of Richardson home, Ivey, Ga.	W. B. Richardson	78	2	78	Tuscaloosa
28	Ivey, Ga.	J. B. Hornsby	32	36	32	Tuscaloosa
29	W 2.7 mi. from well 32	E. M. McCook	64	2	49	Tuscaloosa
30	W 2 mi. from well 32	J. R. McCook	86	2	81	Tuscaloosa
31	NNW 4.9 mi. (airline) from McIntyre, Ga.	R. L. Hardie	85	2	80	Tuscaloosa
32	NNW 4.7 mi. from McIntyre, Ga.	Mt.Carmel School	82	2	67	Tuscaloosa
33	E 0.3 mi. from well 32	W. L. Council	27.4	48	27	Channel sand
34	S 0.5 mi. from well 32	Edgar Bro's. #7	295	10	295	Tuscaloosa
35	SW 300 yds. from well 36	Edgar Bro's #5	315	4	300	Tuscaloosa
36	At reservoir at Edgar Bro's., Dedrich, Ga.	Edgar Bro's. #4	203	10	203	Tuscaloosa
37	S side supply room at Edgar Bro's. Plant.	Edgar Bro's. #1	204	10	204	Tuscaloosa
38	Below storage tank at Plant at Edgars.	Edgar Bro's. #3	198	10	198	Tuscaloosa
38a	E 100 yrds. from well 37	Edgar Bro's. #2	185	10	185	Tuscaloosa
39	At Edgar Bro's. tenant area 0.6 mi. S McIntyre.	Edgar Bro's. #6	315	10	315	Tuscaloosa
40	S 0.3 mi. from McIntyre, Ga.	J. M. Shephard	121	2	116	Tuscaloosa
41	Ford Garage, McIntyre, Ga.	Wilkinson Co. Motor Co.	70	8	50	Tuscaloosa
42	Hall Lbr. Co., McIntyre, Ga.	J. M. Hall Lbr. Co.	37	2	32	Alluvium
43	Back of Steve's Place, McIntyre, Ga.	J. T. Stevens	168	2	168	Tuscaloosa
44	N 1.9 mi. from McIntyre on Ga. 29.	J. T. Whitaker	40	48	40	Channel sand
45	N 2.8 mi. on State Hgy. 29 from McIntyre, Ga.	Mrs. Bertha Arrygton.	38.4	48	4	Irwinton sand
46	N 3.8 mi. from McIntyre, Ga.	H. C. Parker	45	48	30	Irwinton sand
47	N–NW 2.3 mi. from Wriley, Ga.	W. C. Bentley	93	3	88	Tuscaloosa
48	W 10 yds. from well 47	W. C. Bentley	45	48	45	Channel sand

Wilkinson County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point: Description	Measuring Point: Height above (+) or below (−) land surface (ft.)	Measuring Point: Height above sea level (ft.)	Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
CE	DS	Land surface	0.0	--------	−25	9-29-44	Discharge 3.
CE	DS	Top of casing	+3.4	--------	−38	9-29-44	Partial analysis. Discharge 3.
BH	DS	Top tile curb	+1.9	--------	−32	9-27-44	T. 65°F.
CH	DS	Land surface	0.0	340	−32	9-27-44	T. 67°F.
CH	DS	Land surface	0.0	305	−28	9-27-44	Screen set 81-86 ft. T. 67°F.
CE	DS	Land surface	0.0	360	−50	9-27-44	Discharge 7.
CH	DS	Top cement casing.	+.2	400	−58	9-24-44	T. 67°F.
BH	DS	Top wood shelf	+2.8	420	−22.5	9-27-44	--------------------
TE	I	Land surface	0.0	270	−45	9-21-44	Gravel packed-slotted casing 40-295 ft. Discharge 700.
JS	I	Land surface	0.0	285	−55	9-21-44	Screen set 300-315 ft. Discharge 40.
TE	I	Land surface	0.0	290	−36	9-21-44	Complete analysis. Gravel packed-slotted casing 40-203 ft. Discharge 700.
TE	I	Land surface	0.0	260	−40	9-21-44	Discharge 300. T. 66°F.
TE	I	Land surface	0.0	260	−48	9-21-44	Gravel packed - slotted casing 40-198 ft. Discharge 500.
TE	I	Land surface	0.0	260	−48	9-21-44	Gravel packed - slotted casing 40-185 ft. Discharge 600.
TE	I	Land surface	0.0	285	−95	9-21-44	Partial analysis. Gravel packed-slotted casing 40-315 ft. Discharge 200.
CE	D	Land surface	0.0	290	−15	9-19-44	Screen set 116-121 ft. Discharge 12.
CE	PS	Top of casing	+2.8	265	−168	9-21-44	Partial analysis. Discharge 500.
CE	I	Land surface	--------	265	−15	9-21-44	Discharge 12.
------	N	Land surface	0.0	255	−3	9-21-44	Too high in iron for any use. Discharge 3.
BH	DS	Top well shelf	+3.1	445	−37	9-24-44	--------------------
BH	DS	Top well shelf	+3.2	493	−36.4	9-24-44	T. 64° F.
BH	DS	Top wood shelf	+3.1	442	−40	9-24-44	--------------------
CH	DS	Land surface	0.0	397	−65	9-24-44	Screen set 88-93 ft.
BH	DS	Land surface	0.0	397	−5	9-24-44	--------------------

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
49	N 2.6 mi. from Wriley Sta.	H. E. Stephens	60	2	60	Tuscaloosa
50	SW 1.1 mi. from well 51	J. W. Boone	50.1	36	50.1	Irwinton sand
51	NW 4.2 mi. from Toomsboro, Ga. on Milledgeville Rd.	Homer Jones	85	48	85	Irwinton sand
52	NNW from well 51,1 mi.	C. M. Shephard	55	48	45	Irwinton sand
53	NNW 1.6 mi from well 51.	C. M. Bruner	30	48	6	Irwinton sand
54	NNE 3.7 mi. from Wriley Sta.	Joe Boone	100	4	100	Irwinton sand
55	SE 3.4 mi. from Napier Pond.	Mrs. Leo Stubbs	92	2	87	Irwinton sand
56	Toomsboro, Ga.	M. H. Hall	110	1¼	110	Tuscaloosa
57	Toomsboro, Ga.	M. H. Hall	28	4	28	Tuscaloosa
58	Negro School, Toomsboro, Ga.	Toomsboro Training School.	88	2	88	Tuscaloosa
59	S side Curry Store, Toomsboro, Ga.	L. L. Curry	18	1¼	18	Tuscaloosa
60	Toomsboro, Ga.	Wilkinson Co. Lumber Co.	85	2	85	Tuscaloosa
61	Toomsboro, Ga.	Toomsboro High School.	22	2	22	Irwinton sand
62	W side Balls Ferry Bridge on State Hgy. 57.	Clarence Thompson.	87	3	87	Tuscaloosa
63	SW 0.5 mi. from well 62	Clarence Thompson.	85	2	60	Tuscaloosa
64	SW 3.4 mi. from well 62	J. E. Miller	55	36	45	Irwinton sand
65	N 50 yds. from Bridge over Big Sandy Creek on State Hgy. 29.	Nat Toller	87	2	87	Tuscaloosa
66	NW corner of intersection State Hgys. 29 & 27.	M. B. Beal	65	2	68	Tuscaloosa
67	S 2.4 mi. from Irwinton, Ga. on State Hgy. 29.	L. W. Beck	117	2	117	Tuscaloosa
68	E 200 yds. from well 67	L. W. Beck	195	2	195	Tuscaloosa
69	At back of Culpepper Store, Irwinton, Ga.	R. W. Culpepper	250	4	250	Tuscaloosa
70	SW 5 ft. from well 69	R. W. Culpepper	265	3	250	Tuscaloosa
71	E 1 mi. from Irwinton, Ga.	T. A. Brundage	59.8	36	59	Irwinton sand
72	N 1.7 mi. from Irwinton, Ga.	Mrs. A. S. Boone	38	48	38	Irwinton sand
73	W 2.3 mi. from Irwinton, Ga.	L. W. Pennington	96	48	18	Channel sand
74	SW 3.7 mi. from Irwinton, Ga.	L. W. Bell	102	2	102	Tuscaloosa

Wilkinson County—Cont'd.

Method of Lift (2)	Use of Lift (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
CH	DS	Land surface	0.0	410	−45	9–24–44	----------
CH	DS	Land surface	2.3	410	−46.7	4–23–44	Discharge 3.
BH	DS	Land surface	0.0	491	−81.5	9–24–44	Partial analysis. T. 66° F.
CW	DS	Land surface	0.0	--------	−50	9–24–44	----------
BH	DS	Land surface	0.0	475	−27	9–24–44	----------
CW	DS	Land surface	0.0	472	−40	9–24–44	Discharge 10.
CW	DS	Land surface	0.0	476	−62	9–24–44	Partial analysis. Discharge 3.
CE	N	Land surface	0.0	230	−22	9–24–44	Discharge 64. T. 65° F.
CE	DS	Land surface	0.0	230	−22	9–22–44	T. 67°F.
F	PS	Land surface	0.0	225	+4	9–23–44	Discharge 1.5. T. 67° F.
CE	D	Land surface	0.0	230	−14	9–23–44	Discharge 12. T. 67° F.
F	PS	Land surface	0.0	223	+2	9–22–44	Partial analysis. Discharge 2.
CE	PS	Land surface	0.0	305	−16	9–22–44	Discharge 4.
F	DS	Land surface	--------	200	+40	9–22–44	Complete analysis. Discharge 30.
F	DS	Lip of casing	+2.6	205	+35	9–23–44	Discharge 8. T. 67° F.
CE	DS	Top of cement curb.	+2.3	429	−53.9	9–29–44	----------
F	DS	Lip of casing	+2.8	285	+7	9–23–44	Partial analysis. Discharge 3.
F	DS	Lip of casing	+2.6	275	+10.4	4–23–44	Discharge 0.5. T. 64° F.
CGH	DS	Land surface	0.0	293	−20	9–23–44	Discharge 6. T. 68° F.
CH	DS	Land surface	0.0	343	−60	9–23–44	Discharge 5. T. 67° F.
CE	PS	Land surface	0.6	458	−115	10–3–44	Discharge 8.
CE	PS	Land surface	0.6	458	−115	10–3–44	Partial analysis. Discharge 12.
CE	DS	Top cement curb	+1.5	495	−56.5	4–25–45	Discharge 2.
CE	DS	Land surface	0.0	475	−35	9–24–44	Discharge 4.
BH	DS	Top wood casing	+2.3	465	−61.4	9–19–44	T. 64° F.
CW	DS	Top cement base	+3	425	−65	9–27–44	Discharge 2.8. T. 67° F.

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
75	SW 3.5 mi. from Irwinton, Ga.	Pennington & Lavendar.	60	48	60	Tuscaloosa----
76	SW 5.3 mi. from Irwinton, Ga.	J. H. Lavendar---	81	2	76	Tuscaloosa----
77	E 0.3 mi. from well 78---	Geo. Hatcher----	292	2	277	Tuscaloosa----
78	SSW 3.6 mi. (airline) from Irwinton, Ga.	Albert Sapp------	180	2	165	Channel sand--
79	SW 4.9 mi. (airline) from Irwinton, Ga.	James Barlow----	37.6	36	37	Irwinton sand--
80	W 4.4 mi. on State Hgy. 57 from Irwinton, Ga.	J. G. Hatfield----	90	2	90	Irwinton sand--
81	W 200 yds. from well 89-	Mrs. Ida H. Pace-	98	2	93	Irwinton sand--
82	NW 0.2 mi. from well 83-	F. M. West------	56	48	---------	Channel sand--
83	S 10.2 mi. from Gordon, Ga.	W. H. McDonald-	116	2	111	Tuscaloosa----
84	S 0.3 mi. from well 83---	W. H. McDonald-	86	2	81	Tuscaloosa----
85	SW 7.7 mi. (airline) from Irwinton, Ga.	Ellen Smith------	35	48	6	Channel sand--
86	SW 8.9 mi. from Irwinton, Ga.	J. R. Sims-------	62	2	57	Tuscaloosa----
87	SW 8.4 mi. from Irwinton, Ga.	Clint Sims-------	24	48	24	Channel sand--
88	NE 3 mi. on State Hgy. 127 from Twiggs Co.	Frank Shephard--	41	36	18	Irwinton sand--
89	N 6.4 mi. (airline) from Danville, Ga.	C. C. Hawkins---	70	4	70	Irwinton sand--
90	N 6.1 mi. (airline) from Danville, Ga.	A. N. Burke------	80	2	80	Irwinton sand--
91	NE 5.2 mi. on State Hgy. 127 from Twiggs Co.	W. H. Lee-------	41	48	9	Irwinton sand--
92	SW 6.9 mi. on State Hgy. 127 from Irwinton, Ga.	J. B. Payne------	40	48	20	Irwinton sand--
93	S 5.7 mi. on State Hgy. 29 from Irwinton, Ga.	Willie Chatman--	62	48	62	Irwinton sand--
94	W 1.2 mi. on dirt rd. from well 95.	J. F. Payne------	70	4	70	Irwinton sand--
95	N 3.1 mi. on State Hgy. 29 from Nicklesville, Ga.	J. M. Hall-------	48	36	45	Irwinton sand--
96	W 2.5 mi. (airline) from Nicklesville, Ga.	John Collie------	50	48	---------	Irwinton sand--
97	Nicklesville, Ga.--------	R. Rozar--------	45	48	45	Upper sand member.
98	S 1.8 mi. from Nicklesville, Ga.	H. H. Dominy---	65.2	36	65	Upper sand member.
99	NE 5.8 mi. from Nicklesville, Ga.	J. H. Lord-------	30	36	30	Irwinton sand--
100	SE 8.6 mi. (airline) from Toomsboro, Ga.	Pierce & Orr-----	360	2	360	Tuscaloosa----

Wilkinson County—Cont'd.

Meth-od of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measure-ment	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
BH	DS	Top well shelf	+2.9	319	−54.5	9–27–44	
CH	DS	Land surface	0.0		−79	9–28–44	Discharge 3. T. 67° F.
CH	DS	Top cement base	+.3		−85	9–27–44	Screen set 277–292 ft.
CH	DS	Top cement block.	+3.1		−60	9–27–44	T. 67° F.
BH	DS	Top tile curb	+2.1		−33.7	9–27–44	T. 67° F.
CH	DS	Land surface	0.0	456	−75	9–27–44	T. 64° F.
CW	DS	Land surface	0.0	465	−78	9–27–44	T. 64° F.
BH	DS	Top wood shelf	+2.1		−51	9–28–44	T. 66° F.
CH	N	Land surface	0.0		−62	9–28–44	Screen set 111–116 ft. Discharge 3.
CH	DS	Land surface	0.0		−48	9–28–44	Partial analysis. Discharge 3.
BH	DS	Top well shelf	+2.5		−25	9–27–44	
CH	DS	Top cement base	+.2		−8	9–27–44	Screen set 57–62 ft. Discharge 3.
CH	DS	Land surface	0.0		−4	9–27–44	
BH	DS	Top wood curb	+3.0		−36	9–18–44	T. 64° F.
CH	DS	Top of casing	+1.1		−40	10–27–44	Partial analysis. T.65° F.
CH	DS	Top cement curb	+1.1		−42	9–27–44	T. 67° F.
BH	DS	Land surface	0.0		−45	9–18–44	T. 64°F.
BH	DS	Land surface	0.0		−35	9–19–44	
BH	DS	Land surface	0.0		−60	9–24–44	
BH	DS	Top tile curb	+1.5		−62.5	9–23–44	
BH	DS	Top cement surb	+3.1	410	−44	9–22–44	T. 64°F.
BH	DS	Land surface	0.0		−45	9–23–44	T. 64°F.
CE	DS	Land surface	0.0		−35	9–23–44	Discharge 15.
TE	DS	Top cement shelf	+5.6		−62.2	9–29–44	Discharge 5. T. 66°F.
CE	DS	Land surface	0.0		−25	9–29–44	Discharge 5.
CH	DS	Land surface	0.0		−40	10–2–44	

Records of Wells in

Well No. Plate 2	Location	Owner or Name	Depth of Well (Ft.) (1)	Diameter of Well (In.)	Depth to which well is cased (Ft.)	Geologic Horizon
101	SE 30 ft. from well 100	Pierce & Orr	42	48	42	Channel sand
102	SE 1.4 mi. from well 100	Pierce & Orr	136	4	136	Tuscaloosa
103	SW 2 mi. from Nicklesville, Ga.	J. B. Green	70	48	60	Irwinton sand
104	SW 2.2 mi. from Nicklesville, Ga.	M. B. Beal	101	2	96	Irwinton sand
105	N 5.2 mi. from Allentown, Ga.	H. B. Williams	63	48	45	Irwinton sand
106	N 4.1 mi. from Allentown, Ga.	Mrs. J. F. Williams.	61	2	56	Iriwnton sand
107	Danville, Ga.	R. A. Lamb	28.5	36	27	Upper sand member.
108	Allentown, Ga.	Sam King	75	3	70	Irwinton sand
109	Allentown, Ga	H. C. Melton	31	2	26	Upper sand member.
110	Allentown, Ga.	A. T. Land	40	36	40	Upper sand member.
111	Daughtry Gin, Allentown.	A. W. Daughtry	30	48	....	Upper sand member.
112	S 0.5 mi. from well 103	J. Howell	97	2	92	Irwinton sand

This well (39) was drilled from a land surface elevation of 280 feet above sea level to a depth of 315 feet. It is a 10-inch well with 40 feet of slotted pipe from 275 to 315 feet. The static water level in the well is 95 feet below land surface. An electric deep-well turbine pumps 100 gallons of water a minute into an elevated tank from which the water is distributed to the tenants in the housing unit and to the company's office buildings.

At Edgars, 1 mile west of McIntyre, three drilled wells, 37, 38, and 38a, furnish the industrial supply for the Edgar Brothers' kaolin plant. These wells range from 185 to 204 feet in depth, all have 10-inch casings, and all are equipped with electric turbines which pump the water throughout the plant and to an elevated storage tank. The wells have capacities of 300, 500, and 600 gallons a minute respectively. All three wells are drilled from approximately the same land surface elevation, 260 feet above sea level, and the static water level in each of

Wilkinson County—Cont'd.

Method of Lift (2)	Use of Water (3)	Measuring Point			Depth to Water Level Below M. P. (ft.) (4)	Date of Measurement	Remarks—(Yield of nonflowing wells and discharge of flowing wells given in gallons a minute)
		Description	Height above (+) or below (−) land surface (ft.)	Height above sea level (ft.)			
BH	DS	Land surface	0.0		−34	10-2-44	
F	S	Top 4″ casing	+2		+40	10-2-44	Partial analysis. Discharge 60.
TE	DS	Land surface	0.0		−66	9-22-44	Discharge 7. T. 64°F.
TE	DS	Land surface	0.0	420	—30	9-24-44	Partial analysis. Discharge 12.
CE	DS	Land surface	0.0		−59	9-19-44	T. 64°F.
CE	DS	Land surface	0.0		−44	9-18-44	Discharge 3.
CE	DS	Land surface	0.0	450	−24	9-19-44	Discharge 7. T. 64°F.
CE	D	Land surface	0.0	445	−50	9-19-44	Screen set 70-75 ft. Discharge 7.
TE	D	Land surface	0.0	435	−17	11-9-44	Partial analysis.
CE	DS	Land surface	0.0	435	−32	9-19-44	Discharge 25. T. 64°F.
CE	I	Land surface	0.0	425	−20	9-19-44	Discharge 30.
CH	DS	Land surface	0.0	410	—57	11-30-44	Discharge 5. T. 64°F.

them is 48 feet below land surface. When pumped at the above rates the wells have a reported drawdown of 20 feet.

The most productive well (36) of the Edgar Brothers well field is located at Dedrich 2.3 miles west of McIntyre at one of the Edgar Brothers' kaolin processing plants. This well was drilled in 1939 to a depth of 203 feet. A slotted 10-inch casing was set from 40 to 203 feet and packed with gravel. The well is equipped with a 40-horsepower electric turbine which is reported to pump 700 gallons a minute 7 hours per day into an elevated tank and a cement reservoir from which the water is distributed throughout the processing plant. The static water level in the well is 36 feet below land surface. A pumping test made in 1939 records a 20-foot drawdown after 24 hours pumping at the rate of 835 gallons a minute.

Well 34 is at the Edgar Brothers' Klondike mine, 3.7 miles north of McIntyre. It was drilled in 1940 to a depth of 295 feet.

The land surface at well 34 is 270 feet above sea level, and the static water level in the well is reported to be 45 feet below land surface. The well is equipped with an electric turbine which pumps 700 gallons a minute.

All of the wells in the Edgar Brothers' well field recover ground water from the sands and gravels in the Tuscaloosa formation.

Analyses of Water from Wilkinson County

Parts per million. Analyzed by Evelyn Holloman. (Numbers refer to numbers in table and plate)

Number	3	16	24	27	34	36
Geologic Horizon	Tuscaloosa	Channel sand	Tuscaloosa	Tuscaloosa	Tuscaloosa	Tuscaloosa
Silica (SiO_2)	--------	--------	5.0	--------	--------	12
Iron (Fe)	1.1	0.52	.11	.17	.03	66
Calcium (Ca)	--------	--------	1.9	--------	--------	6.6
Magnesium (Mg)	--------	--------	1.7	--------	--------	1.1
Sodium & Potassium (Na + K)	--------	--------	6.0	--------	--------	3.2
Carbonate (CO_3)	--------	--------	0	--------	--------	0
Bicarbonate (HCO_3)	50	9.0	2.0	25	7.0	11
Sulfate (SO_4)	1	1	.5	1	3	14
Chloride (Cl)	2	3	5.2	4	3	2.6
Fluoride (F)	.0	.0	.0	.0	.0	.1
Nitrate (NO_3)	2.2	3.7	19	4.3	.9	.6
Dissolved Solids	--------	--------	40	--------	--------	21
Total Hardness	45	14	12	27	13	21
Temperature (°F)	66	67	66	67	68	66
Date of Collection	10-24-44	11-1-44,	11-1-44,	10-24-44	10-24-44	11-1-44

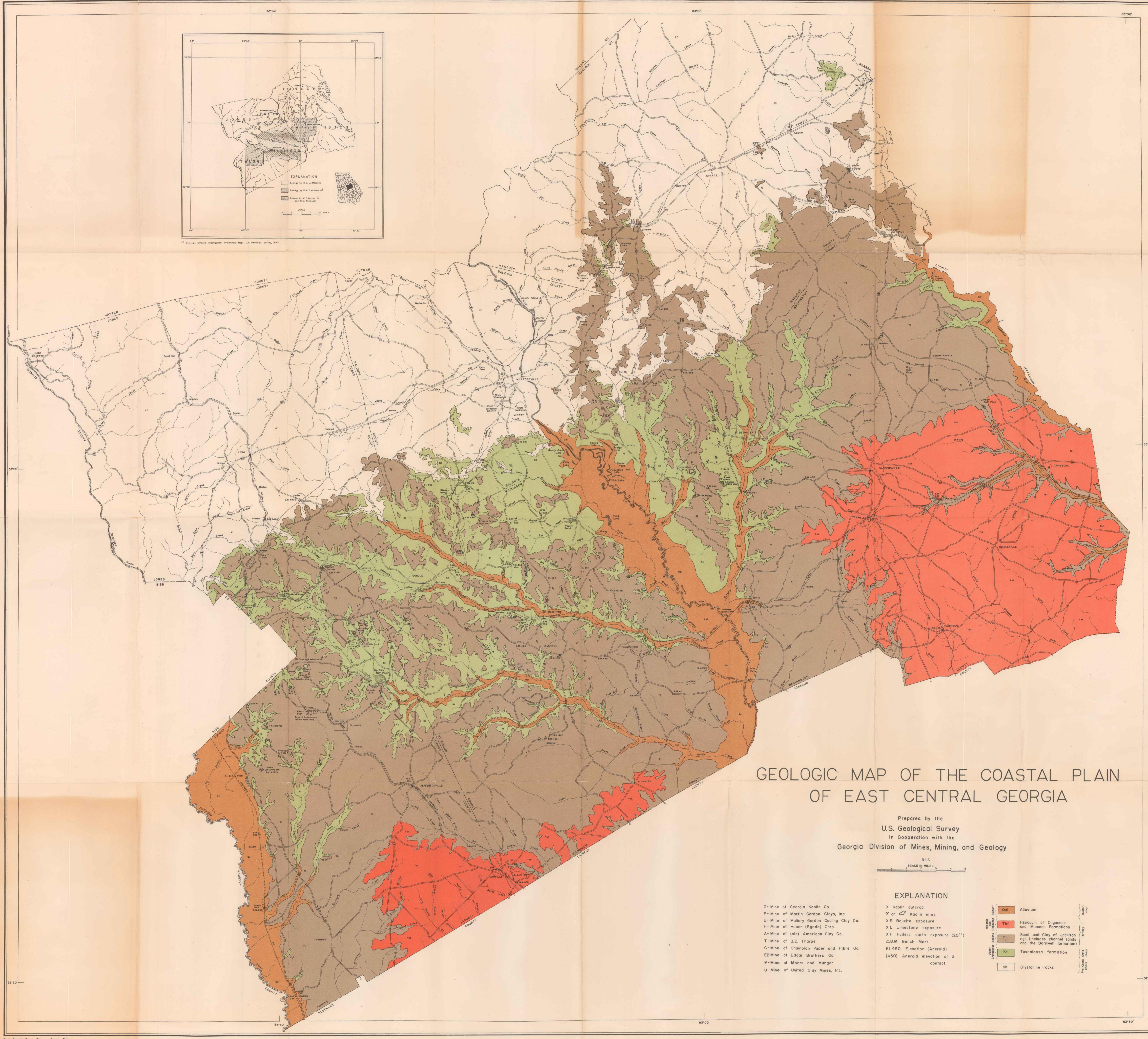
Wilkinson County—Cont'd.

Number	39	41	51	55
Geogolic Horizon	Tuscaloosa	Tuscaloosa	Irwinton sand	Irwinton sand
Silica (SiO_2)	—	—	—	—
Iron (Fe)	1.1	5.4	1.3	1.4
Calcium (Ca)	—	—	—	—
Magnesium (Mg)	—	—	—	—
Sodium & Potassium (Na+K)	—	—	—	—
Carbonate (CO_3)	—	—	—	—
Bicarbonate (HCO_3)	80	8.0	8.0	16
Sulfate (SO_4)	14	3	2	1
Chloride (Cl)	4	4		5
Fluoride (F)	.0	.0	.0	.0
Nitrate (NO_3)	.1	2.0	1.6	1.6
Dissolved Solids	—	—	—	—
Total Hardness	78	14	14	21
Temperature (°F)	68	68	66	65
Date of Collection	11-2-44	10-24-44	11-2-44	11-2-44

Number	60	62	65	70
Geogolic Horizon	Tuscaloosa	Tuscaloosa	Tuscaloosa	Tuscaloosa
Silica (SiO_2)	—	9.0	—	—
Iron (Fe)	.34	.33	1.4	1.7
Calcium (Ca)	—	32	—	—
Magnesium (Mg)	—	1.4	—	—
Sodium & Potassium (Na+K)	—	3.3	—	—
Carbonate (CO_3)	—	0	—	—
Bicarbonate (HCO_3)	89	85	64	82
Sulfate (SO_4)	8	16	8	9
Chloride (Cl)	3	4.4	4	4
Fluoride (F)	.1	.1	.0	.0
Nitrate (NO_3)	.0	.0	.0	.0
Dissolved Solids	—	112	—	—
Total Hardness	84	86	63	75
Temperature (°F)	64	67	64	66
Date of Collection	10-24-44	11-1-44	11-4-44	10-24-44

Wilkinson County—Cont'd.

Number	84	89	102	104	109
Geologic horizon	Tuscaloosa	Irwinton sand	Tuscaloosa	Irwinton sand	Upper sand member
Silica (SiO_2)	----------	----------	----------	----------	----------
Iron (Fe)	.30	.04	2.8	.06	.45
Calcium (Ca)	----------	----------	----------	----------	----------
Magnesium (Mg)	----------	----------	----------	----------	----------
Sodium & Potassium (Na + K)	----------	----------	----------	----------	----------
Carbonate (CO_3)	----------	----------	----------	----------	----------
Bicarbonate (HCO_3)	14	34	99	51	30
Sulfate (SO_4)	3	1	17	1	2
Chloride (Cl)	10	2	5	3	3
Fluoride (F)	.0	.5	.0	.0	.0
Nitrate (NO_3)	20	1.7	.0	.0	2.7
Dissolved Solids	----------	----------	----------	----------	----------
Total Hardness	18	34	96	36	30
Temperature (°F)	66	64.5	66	64	65
Date of collection	10-24-44	10-27-44	11-2-44	11-2-44	11-9-44



GEOLOGIC MAP OF THE COASTAL PLAIN OF EAST CENTRAL GEORGIA

Prepared by the
U.S. Geological Survey
In Cooperation with the
Georgia Division of Mines, Mining, and Geology

1946

SCALE IN MILES

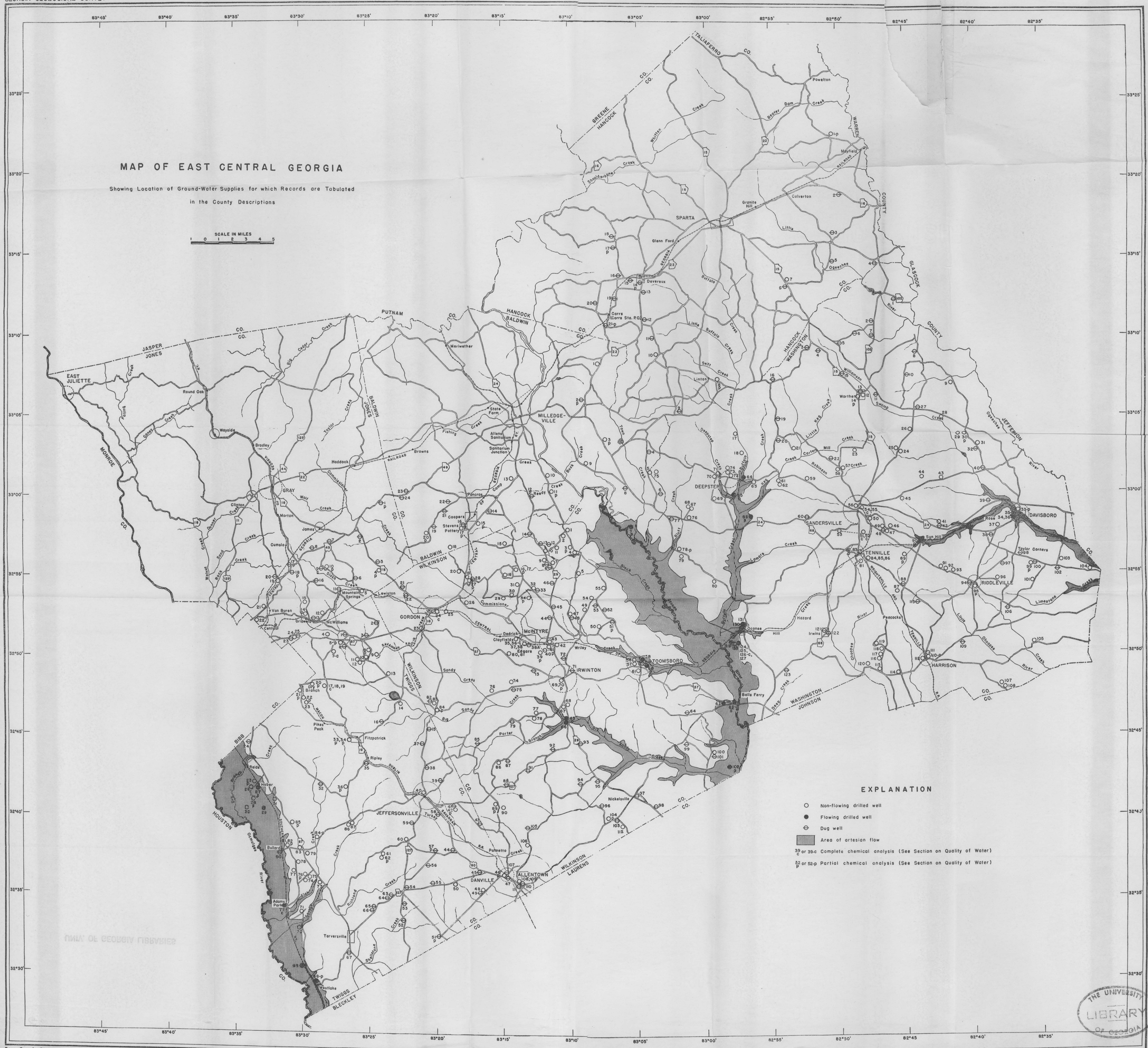
EXPLANATION

- G - Mine of Georgia Kaolin Co.
- P - Mine of Martin Gordon Clays, Inc.
- E - Mine of Mallary Gordon Coaling Clay Co.
- H - Mine of Huber (Sgoda) Corp.
- A - Mine of (old) American Clay Co.
- T - Mine of B. D. Tharpe
- C - Mine of Champion Paper and Fibre Co.
- EB - Mine of Edgar Brothers Co.
- M - Mine of Moore and Munger
- U - Mine of United Clay Mines, Inc.

- X Kaolin outcrop
- ⚒ or ☐ Kaolin mine
- X B Bauxite exposure
- X L Limestone exposure
- X F Fullers earth exposure (25'+)
- △ B.M. Bench Mark
- El. 450 Elevation (Aneroid)
- (450) Aneroid elevation of a contact

Recent	Qal	Alluvium	Quaternary
Miocene and Oligocene	Thf	Residuum of Oligocene and Miocene Formations	Tertiary
Eocene	Tj	Sand and Clay of Jackson age (Includes channel sands and the Barnwell formation)	Tertiary
Upper Cretaceous	Kt	Tuscaloosa formation	Cretaceous
	pK	Crystalline rocks	Pre-Cretaceous

Base Georgia State Highway County Maps



Base Georgia State Highway County Maps