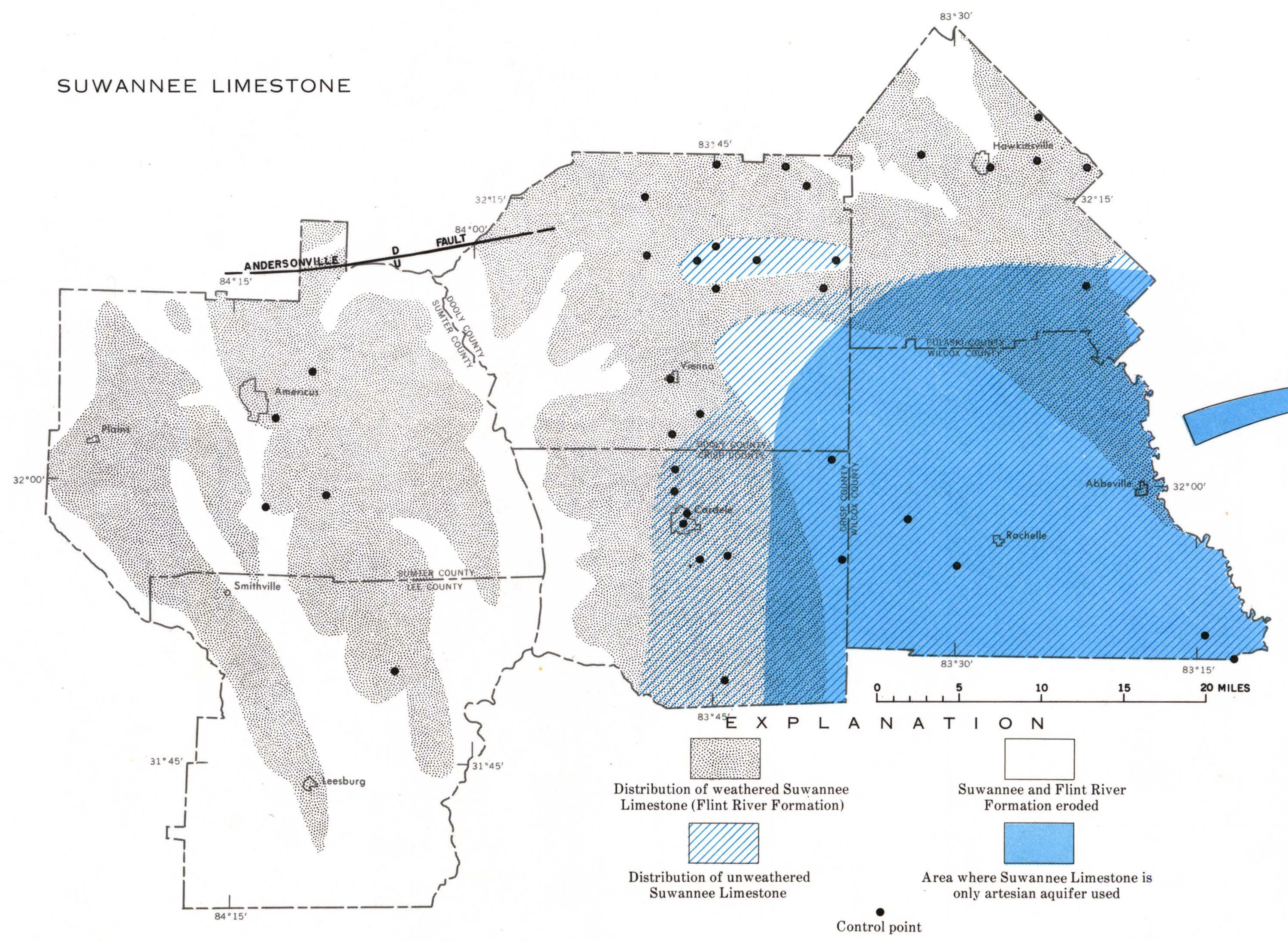
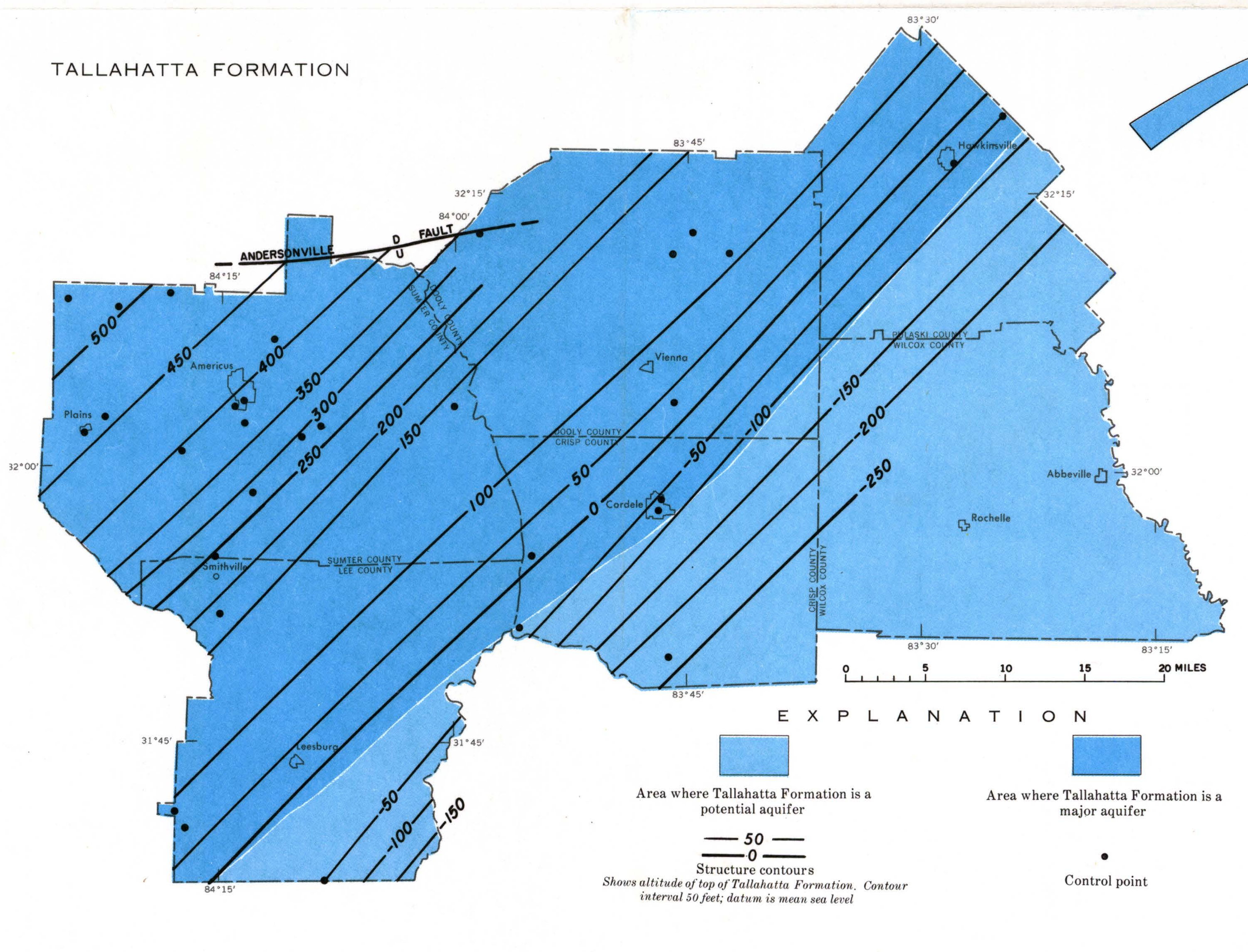
PREPARED IN COOPERATION WITH THE
GEORGIA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF EARTH AND WATER RESOURCES

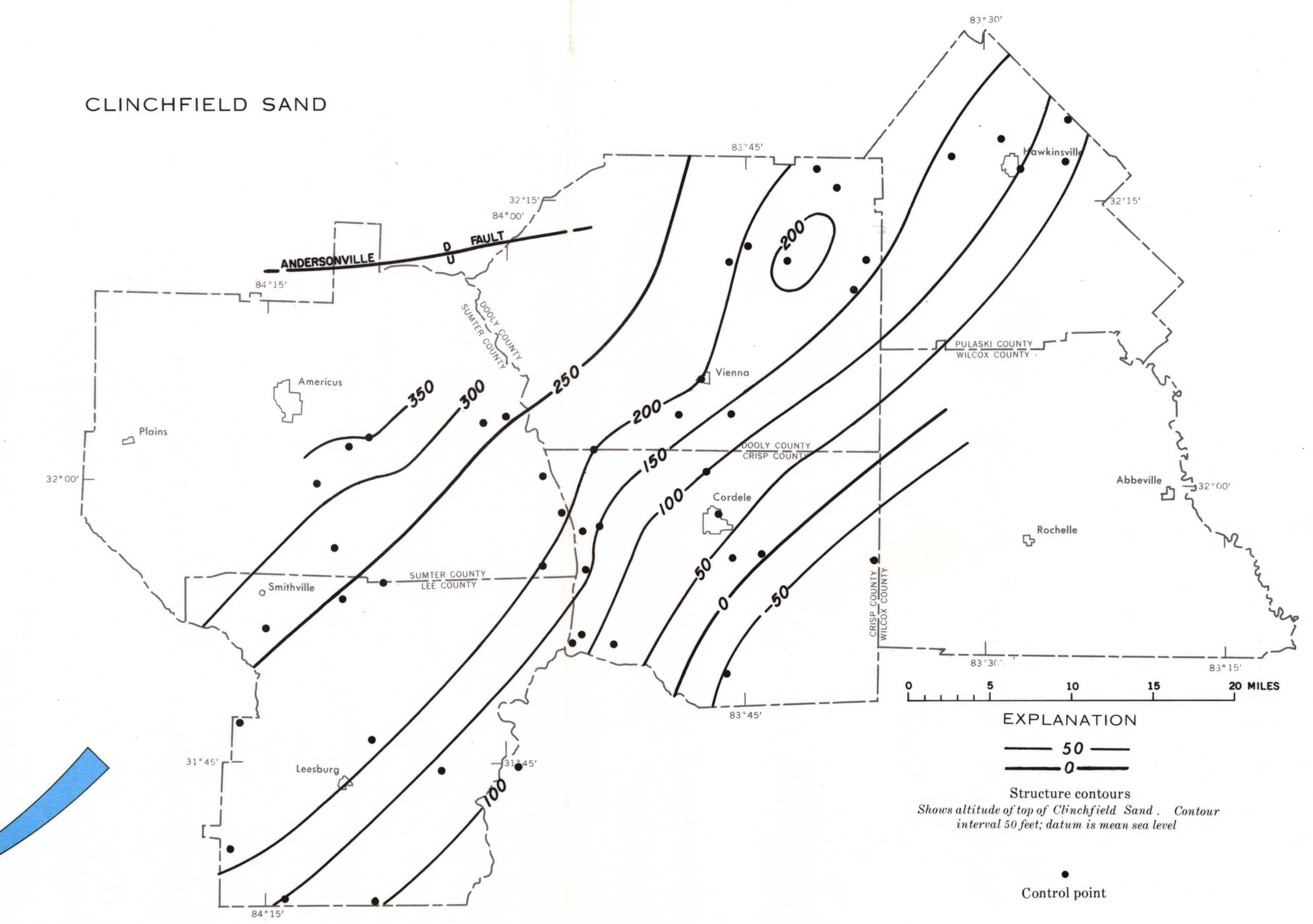


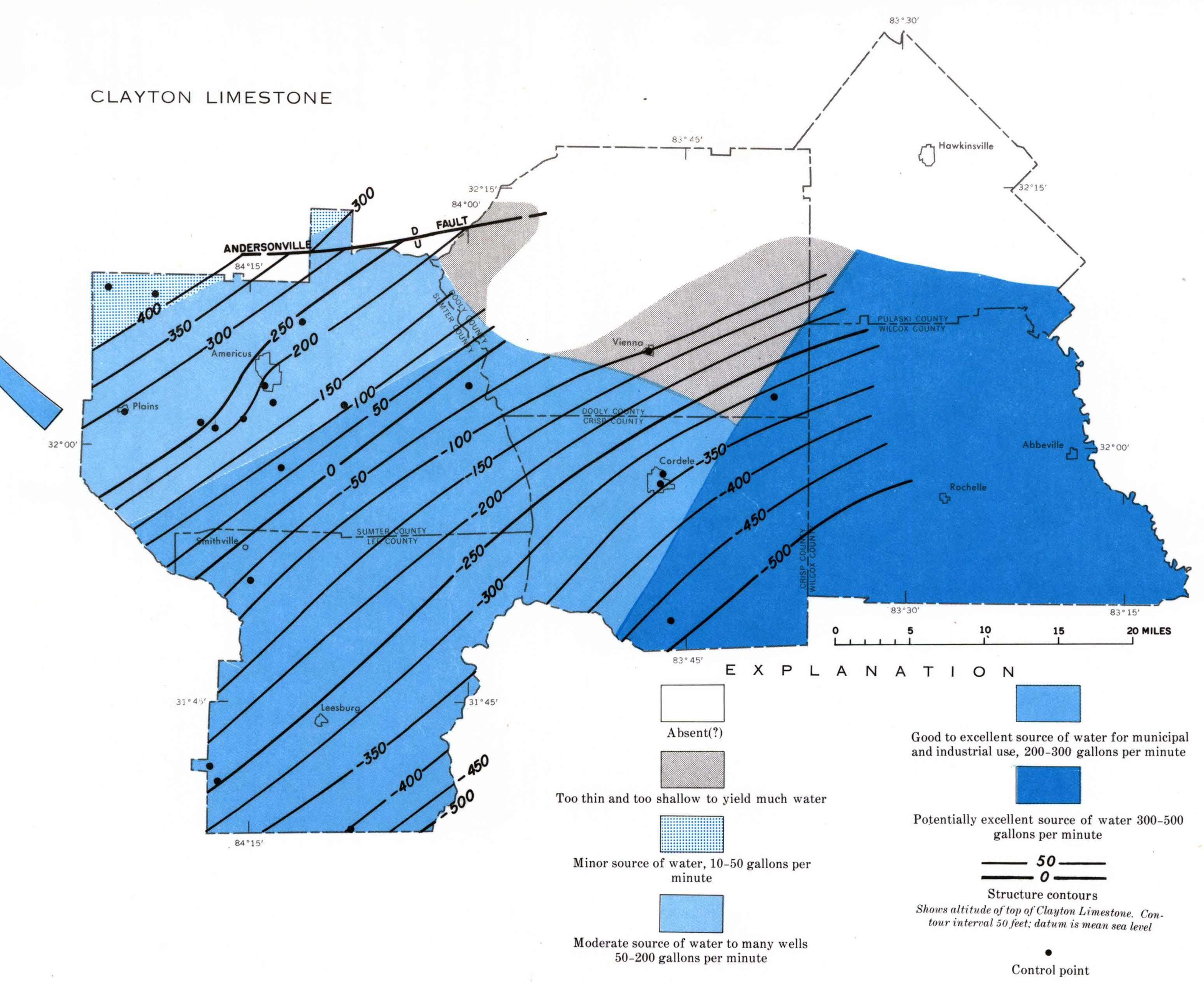


GEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS

[Formations shaded dark blue are major aquifers currently being used. Formations shaded light blue are potential aquifers]

System	Series		Formation	Thickness and distribution	Physical characteristics	Hydrology
TERTIARY	Miocene		Hawthorn	30 to 155 feet; in Wilcox, eastern Crisp, and southeastern Dooly Counties.	Quartz sand and sandstone, thick, massive.	The formation yields little or no water to wells. Wells drilled through this unit are cased to prevent caving of sand.
	Miocene		Tampa	0 to 40 feet; in central-southern Crisp and part of Wilcox Counties.	Sandy limestone and some greenish clay.	The formation has little importance hydrologically, but must be cased to prevent caving.
	Oligocene		Flint River	Trace to 120 feet.	Residuum of structureless, unbedded tripoli, chert boulders and sandy clay.	Formed by the intense weathering of the Suwannee Limestone making a porous permeable unit that favors recharge. Circular cypress swamps are common in upland interstream areas. Generally too thin and too shallow to be used as an aquifer.
	Oligocene		Suwannee Limestone	5 to 150 feet; in Wilcox, eastern Crisp, and southeastern Pulaski Counties.	Pure, white limestone, nodular when seen in well cuttings.	Where found it is the sole aquifer used. Elsewhere the formation has been weathered to form the Flint River Formation. Specific capacity about 5 gpm per ft (gallons per minute per foot) of drawdown.
	Oligocene		Cooper Marl	20 to 80 feet; in northern Pulaski and northeastern Dooly Counties; elsewhere absent or unrecognized.	Soft white to light gray, fossiliferous limestone and fine-grained calcareous marl. Some well-rounded quartz sand.	Seepage springs and many small streams originate at or near its contact with the underlying Twiggs Clay. It is too thin and too subject to seasonal water-level fluctuations to be used as an aquifer.
	Eocene	Upper	Twiggs Clay Member of Barnwell	30 to 50 feet; in the northern half of Pulaski and the northeast corner of Dooly Counties. Small exposures in Lee and Sumter Counties.	The only member of the Barnwell Formation in the six-county area. It is chiefly a fuller's earth clay with some limestone.	A confining bed of limited importance because of its restricted areal extent. It is a confining bed for the artesian flows at Hawkinsville and in the Ocmulgee River valley.
	Eocene	Upper	Ocala Limestone	40 to 50 feet; absent in northeast parts of Sumter and Dooly Counties.	A white to cream colored, relatively pure limestone. At the top mainly bryozoa.	Throughout the area, the Ocala Limestone is tapped by few wells.
	Eocene	Upper	Clinchfield Sand	20 feet; absent in northwest parts of Sumter and Dooly Counties.	Near the Ocmulgee River it is a well-sorted, fine to medium grained, quartz sand. Near the Flint River the sand has a limestone matrix.	In Pulaski, Dooly, Crisp, and Lee Counties this formation is an important aquifer for farm and domestic wells, even though it is thin. Specific capacity varies from 2 to 70 gpm per ft of drawdown and may yield as much as 300 gallons per minute.
	Eocene	Middle	McBean	30 to 140 feet; absent in most of Sumter and western Lee Counties.	Contains much shell "hash", quartz sand, and abundant fines.	Generally a poor aquifer and is a confining bed for the artesian flows in the Flint River valley.
	Eocene	Middle	Tallahatta	50 to 200 feet.	A massive bed of nearly pure quartz sand.	A major aquifer used for municipal supplies in five of the six counties in area. Wells in it should be screened. Yields as much as 1,200 gallons per minute and specific capacity about 20 gpm per ft of drawdown.
	Eocene	Lower	Wilcox	Up to 120 feet; absent in Pulaski County.	A massive bed of glauconitic quartz sand.	Oxidation of the glauconite causes water to be iron-rich if the water level is pulled down below the top of the formation.
	Paleocene		Porters Creek equivalent	Up to 80 feet; absent in Pulaski County.	Dark gray, silty, micaceous, carbonaceous clay and shale.	A confining bed for the underlying Clayton Limestone.
	Paleocene		Clayton Limestone	Up to 140 feet; absent in most of Pulaski County.	Light gray, fossiliferous limestone with some quartz sand, glauconite and pyrite.	A good aquifer. Specific capacity of about 14 gpm per ft of drawdown. Yields of as much as 300 gallons per minute.
CRETACEOUS	Upper		Providence Sand	75 to 320 feet.	Quartz sand, fine to coarse, subangular.	An aquifer tapped by deep wells in Lee, Sumter, Dooly, Crisp, and Pulaski Counties. Specific capacity is about 15 gpm per ft of drawdown. Yields as much as 1,000 gallons per minute. Many wells are constructed to produce from both the Clayton and the Providence.
	Upper		Ripley	84 to 155 feet.	Sand, silt and clay, dark gray, micaceous, pyritiferous, fossiliferous.	A confining bed that will yield little or no water.
	Upper		Cusseta Sand	40 to 125 feet.	Mainly quartz sand with some clay in the upper part.	Penetrated by one deep well at Americus; otherwise untapped in area. Specific capacity believed to be about 25 gpm per ft of drawdown.
	Upper		Blufftown	780 to 1,065 feet.	Dark brown to black clay and calcarceous, clayey sand.	A confining bed that will yield little or no water.
	Upper		Eutaw	70 to 145 feet.	Coarse quartz sand at base grading upward to clayey sand.	Basal sand should be a good aquifer to screened wells.
	Upper		Tuscaloosa	500 to 900 feet.	Consists of a basal sand member, a middle member of marine shale, and an upper sand member.	The sand members are potential aquifers but the basal sand member might yield water that is salty.
	Lower			200 to 600 feet.	A massive bed of coarse sand with some blocky, lustrous clay.	Any water produced might be saline.





CHEMICAL QUALITY

Because chemical analyses of well water show little range in mineral content (table below), the quality of water cannot be used in identifying its aquifer source. In a fourth of the wells sampled, iron content exceeded the U.S. Public Health Service's recommended limit of 0.3 mg/l. Hardness is high except near Smithville, in Lee County, where water never comes in contact with calcareous material.

SUMMARY OF WATER-QUALITY ANALYSES[1]

	Temperature (°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness (Ca + Mg)	Hardness (Non-carbonate)	Specific conductance (Micromhos)	Laboratory pH
Maximum	23	58	[2]2.2	61	3.6	5.4	3.1	188	12	8.0	0.2	6.0	207	160	8	303	8.0
Median	21	17	.15	48	1.5	1.9	.7	148	6.4	2.4	.1	.1	150	126	6	240	7.6
Minimum	20	14	.01	17	.2	1.0	.2	48	.0	.0	.0	.0	86	46	0	119	6.8

[1] Values in milligrams per liter except temperature and pH.
[2] Greater than limit recommended by U.S. Public Health Service.

USE OF STRUCTURE CONTOURS FOR ESTIMATING WELL DEPTH

Structure contours drawn on the top of three of the important water-bearing formations show the inferred altitude of these tops in relation to sea level. These contours are intended to be an aid for estimating the depth of a well drilled into one or more of these formations. For example, a well site at an altitude of 300 feet crossed by the −50-foot contour on top of the Tallahatta Formation will penetrate 350 feet before entering that formation. If more yield is needed than the Tallahatta can supply at that location, and the top of the Clayton Limestone is at −350 feet, the well will have to be deepened 300 more feet to reach the top of the next water-bearing unit. If the yield of the upper bed is adequate, the total depth of the well would be no more than 550 feet. If both water-bearing zones were to be developed to increase the yield, the well would end at about −490 feet, or about 790 feet below land surface.

CONCLUSIONS

Water can be obtained from one or more of the four major water-bearing formations or aquifers anywhere in the area. Yields can be increased by drilling a well to tap two or more of these aquifers. Properly designed wells may be expected to yield ample water of good quality for municipal, irrigation or industrial use if they are designed to penetrate the available aquifers.

The deep aquifers in permeable Cretaceous formations may be highly productive, but as yet are relatively untested. Furthermore, no well in the area is known to have penetrated salt water at depth, so there is reason to believe that wastes cannot be stored by deep-well discharge into salt-water beds.

Even though the area is rich in water, there are a few hydrologic problems. Irrigation wells, requiring a guaranteed yield of 1,000 gpm, approach and may locally exceed the limit that can be developed. Prior knowledge of geologic and hydrologic conditions is helpful to locate and design such a well. Closely spaced wells can lower water levels enough to reduce well yield and in extreme cases cause some wells to become dry.

SELECTED REFERENCES

Callahan, J. T., 1964, The yield of sedimentary aquifers of the Coastal Plain, southeast river basins: U.S. Geol. Survey Water-Supply Paper 1669-W, 56 p.

Callahan, J. T., and others, 1965, Water in Georgia: U.S. Geol. Survey Water-Supply Paper 1762, 88 p.

Cooke, C. W., 1943, Geology of the Coastal Plain of Georgia: U.S. Geol. Survey Bull. 941, 121 p., geologic map, scale 1:500,000.

Cramer, H. R., 1969, Structural features of the Coastal Plain of Georgia: Southeastern Geology, v. 10, no. 2, p. 111–123.

Cramer, H. R., and others, 1967, Annotated bibliography of Georgia geology through 1959: Georgia Geol. Survey Bull. 79, 368 p.

Herrick, S. M., 1961, Well logs of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 70, 462 p.

Herrick, S. M., and Vorhis, R. C., 1963, Subsurface geology of the Georgia Coastal Plain: Georgia Geol. Survey Inf. Circ. 25, 78 p.

MacNeil, F. S., 1947, Geologic map of the Tertiary and Quaternary formations of Georgia: U.S. Geol. Survey Oil and Gas Inv. Prelim. map 72, scale 1:500,000.

Owen, Vaux, Jr., 1963, Geology and ground-water resources of Lee and Sumter Counties, southwest Georgia: U.S. Geol. Survey Water-Supply Paper 1666, 70 p.

Pickering, S. M., Jr., 1961, Geology of iron ore deposits of the Perry quadrangle, Georgia: Georgia Mineral Newsletter, v. 14, no. 4, p. 83–90.

Thomson, M. T., and others, 1956, The availability and use of water in Georgia: Georgia Geol. Survey Bull. 65, 329 p.

Wait, R. L., 1958, Summary of the ground-water resources of Crisp County, Georgia: Georgia Mineral Newsletter, v. 11, no. 2, p. 44–47.

Zapp, A. D., and Clark, L. D., 1965, Bauxite in areas adjacent to and between the Springvale and Andersonville Districts, Georgia: U.S. Geol. Survey Bull. 1199-H, 10 p., geologic map, scale 1:125,000.

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GEOHYDROLOGY OF SUMTER, DOOLY, PULASKI, LEE, CRISP, AND WILCOX COUNTIES, GEORGIA

By
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1972