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Geology and Ground-Water Resources of Allendale, Bamberg, and Barnwell Counties and Part of Aiken County, South Carolina

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ABSTRACT

The area of Allendale, Bamberg, and Barnwell Counties and part of Aiken County, South Carolina, is underlain by crystalline rock and sedimentary units that range in age from Precambrian(?) to Holocene. The crystalline basement complex is composed of metamorphic and igneous rocks that crop out to the northwest in the Piedmont Province. Sandstone, siltstone, and mudstone of Triassic age occupy a graben in the Savannah River Plant area. Directly overlying the older rocks are sedimentary units of Late Cretaceous age. These sedimentary units consist of sand, silt, and clay and were deposited as a transgressive-regressive sequence in predominantly deltaic and fluvial environments.

Overlying the Late Cretaceous units are Tertiary-age sediments. These sediments vary in lithology as sand, silt, clay, and limestone, generally becoming progressively more calcareous in the southeast (downdip) direction. Deposition occurred in deltaic and shallow marine environments during a series of marine transgressions and regressions.

In the study area, all of the pre-Cretaceous and Cretaceous units strike in a northeast direction and dip to the southeast at a rate of 10 to 44 feet per mile. The Tertiary units also strike in a northeast direction, except for the Santee Limestone, which strikes almost east in the area. These younger units dip southward and southeastward but with a gentler slope (6-21 feet per mile) than the underlying sediments.

Nine or more aquifers are present in the study area. Because of the variability in depositional environments, the hydrologic character of a single aquifer may vary considerably within a short distance. Although all of the aquifers are utilized to some degree, those of the Middendorf and Black Creek Formations of Cretaceous age and the Santee Limestone and Congaree Formation of Tertiary age constitute the aquifers of principal use. Wells screened in the water-bearing units of the Middendorf and Black Creek Formations are capable of producing more than 3,000 gallons per minute. Wells screened in sand beds of the Congaree Formation generally yield several hundred gallons per minute, whereas wells open to the Santee Limestone produce more than 1,000 gallons per minute.

The chemical quality of ground water varies considerably with locale and depth. Water from the Cretaceous formations is very soft and slightly acidic, making it corrosive to metal. Generally, the water ranges from a sodium chloride to a sodium sulfate type, although all ions present are in very low concentrations. The Tertiary Congaree Formation contains water similar

to that of the Cretaceous Middendorf, but locally it may contain objectionable amounts of iron. In a downdip direction, the water becomes a calcium bicarbonate type, is moderately hard, and has a pH of about 8.

Water levels in the Cretaceous formations have declined slightly since the period prior to development. The pumping of approximately 11 million gallons per day at the Savannah River Plant has had only minor effects in localized areas. The Santee Limestone and Congaree Formation have also experienced minor water-level declines. Small cones of depression have developed around areas of heavy pumping.

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