UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER RESOURCES INVESTIGATIONS
REPORT 85-4031

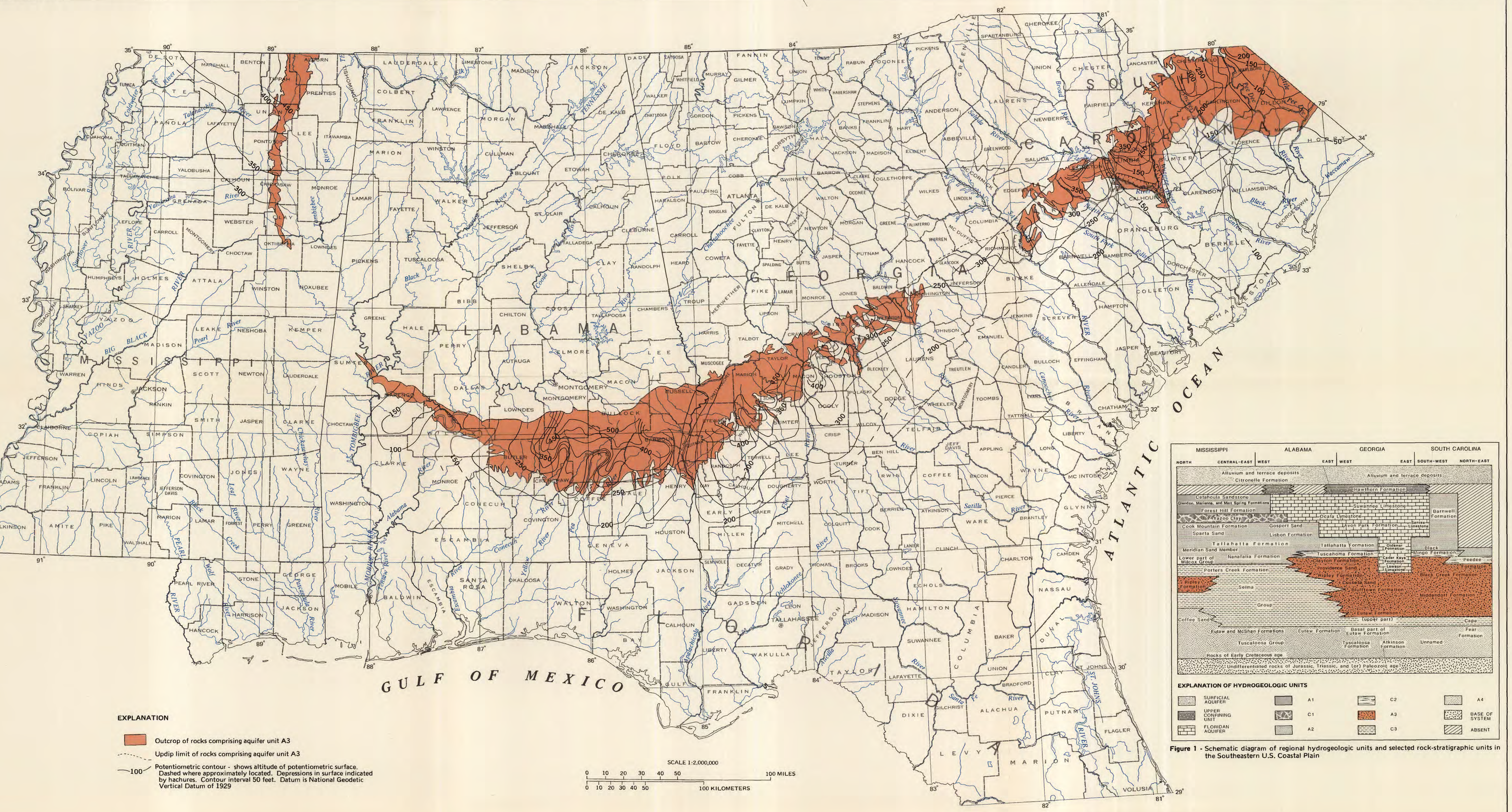

Figure 1 - Schematic diagram of regional hydrogeologic units and selected rock-stratigraphic units in the Southeastern U.S. Coastal Plain

INTRODUCTION

The U.S. Geological Survey is studying the regional ground-water flow system in the Cretaceous and Tertiary sand aquifers in the southeastern Coastal Plain of the United States. Parts of the states of Mississippi, Alabama, Georgia and South Carolina are included in the study. Geologic study of the regional distribution of permeable clastic rocks in this area (Renken, 1984) suggests that in general the aquifer system can be divided into three aquifer units separated by confining units of highly variable permeability. A fourth aquifer unit consists in places of limestone equivalent to parts of the Floridan aquifer system (Miller, 1984) and in other places of surfical sand mapped by Renken (1984) overlies much of the system. This aquifer unit is a source of recharge to and discharge from the sand aquifer system, but is not being considered in detail in this study. To avoid nomenclature and correlation problems from state to state, the aquifer and confining bed units of the system have been given alpha-numeric labels. A schematic classification of selected rock stratigraphic and regional hydrologic units for the Southeastern Coastal Plain aquifer system is shown in figure 1 (Renken, 1984). The middle unit has been designated aquifer unit A3. Sands within aquifer unit A3 are from rocks that have been identified at outcrop as being from the Ripley Formation of the Selma Group in Mississippi; The Clayton Formation, Providence Sand, Ripley Formation (and its Cusseta Sand member), Blufftown Formation, and in the east the Nanafalia Formation in Alabama; the Nanafalia Formation, Clayton Formation, Providence Sand, Ripley Formation, Cusseta Sand, Blufftown Formation, and the upper part of the Eutaw in Georgia; and the Pee Dee, Black Creek and Middendorf Formations in South Carolina (Renken, 1984). The outcrop of aquifer unit A3 is shaded on the map. Aquifer unit A3 does not crop out in eastern Georgia; therefore, the estimated updip limit is shown on the map.

POTENTIOMETRIC SURFACE DELINEATION

The purpose of this map is to show the approximate predevelopment potentiometric surface of the aquifer unit A3 in the Southeastern Coastal Plain aquifer system. Water-level measurements used to draw water-level contours range from the early 1900's to the 1980's. In all areas the earliest available water-level measurements were used; modern measurements were used only in those areas where there does not appear to be significant head decline due to man-induced stress. Because the measurements do vary over time, the potentiometric map is not expected to show precise water levels at specific sites for a specific time - its purpose is to show the best estimate of the water-level surface as it probably existed prior to development. On the map, contours stop at the updip boundaries of outcrop areas. However, in the real system, contours extend in a continuous way into the next lowest unit.

No previous regional predevelopment potentiometric surface maps have been prepared for any units within the Southeastern Coastal Plain aquifer system.

SOURCE OF DATA

This map is a compilation of data from state ground-water studies and from the files of the U.S. Geological Survey offices in Jackson, Miss., Tuscaloosa, Ala., Doraville, Ga., and Columbia, S.C.

In Mississippi the data were compiled from Stephenson and others (1928) and from office files. Alabama data came from county reports prepared by Causey and McCain (1971), Shamburger and others (1968), Davis (1980), Newton and others (1971), Newton, McCain and Avrett (1968), Newton and others (1966), Scott, Golden, and Avrett (1967). McWilliams and others (1968), Newton, Golden, Avrett, and Scott (1968), Turner and others (1968), Reed and others (1967), Scott, McCain and Avrett (1967), LaMoreaux and others (1957), Knowles and others (1960), and Scott (1962). Georgia data came from reports prepared by the Betchel Corporation (1972, 1973), Christl (1964), J.E. Sirrine Company (1980), Mayer (1972), Faye and Prowell (1982), LaMoreaux (1946), LeGrand (1962), LeGrand and Furcron (1956), Clarke and others (1982, 1983), Siple (1967), Stephenson and Veatch (1915), and Wait (1960a, 1960b, 1960c, 1963), and from office files. South Carolina data came from reports prepared by Hayes (1979), Cooke (1936), Siple (1954, 1955, 1957, 1967), and Zack (1977), and from office files.

GROUND-WATER MOVEMENT

In general, potentiometric highs result from recharge and lows result from discharge with this discharge being most typically to rivers. Contour lines that curve upstream as they cross a river valley indicate aquifer discharge to the river. Notable examples of this convex upstream curvature occur across the Congaree River Valley in Lexington and Richmond Counties, S.C., and across the Chattahoochee River Valley in Clay County Ga., and Henry County, Ala. Stream-aquifer interaction generally occurs in the outcrop; downdip of the outcrop where the unit is buried under younger sediments, stream-aquifer interaction generally becomes less significant. An exception to this downdip stream-aquifer effect occurs in Richmond and Burke Counties, Georgia, and Barnwell and Aiken Counties, South Carolina, where the A3 aquifer apparently discharges to the Savannah River even though aquifer unit A3 does not crop out along the Savannah River.

Water enters aquifer unit A3 as percolation from precipitation in the outcrop area and flows either downgradient, to streams, or downdip to deeply buried areas and ultimately to areas of upward leakage. In Mississippi, the direction of flow is from the outcrop southwest toward the Mississippi River. In Alabama, the direction of flow is to the rivers in the outcrop to the Chattahoochee River in the east and, ultimately, south toward the Gulf of Mexico. In west Georgia, water flows from the outcrop southwest toward the Chattahoochee River; in east Georgia water flows from the updip limit of aquifer unit A3 toward the Atlantic Ocean. In South Carolina, water moves southwest to the Savannah River in Aiken County and eastern Barnwell County, to the Wateree and Congaree Rivers in the center of the state and southeast to the Pee Dee River through the rest of the state.

REFERENCES

Betchel Corporation, 1972, Applicants environmental report, volumes I and II - Alvin W. Vogtle Nuclear Plant: Unpublished report for Georgia Power Company, Atlanta, Ga.: Report on file at U.S. Geological Survey, Doraville, Ga.

-----1973, Preliminary safety analysis report, volumes II and III - Alvin W. Vogtle Nuclear Plant: Unpublished report for Georgia Power Company, Atlanta, Ga.: Report on file at U.S. Geological Survey, Doraville, Ga.

Causey, L.V., and McCain, J.F., 1971, Water availability of Clarke County, Alabama: Geological Survey of Alabama Map 97.

Christl, R.J., 1964, Storage of radioactive wastes in basement rock beneath the Savannah River Plant: E.I. duPont de Nemours and Company Report DP-844, 105 p.

Clarke, J.S., Faye, R.E., and Brooks, Rebekah, 1982, Hydrogeology of the Providence Aquifer of southwest Georgia: U.S. Geological Survey Open-File Report 82-903, 49 p.

-----1983, Hydrogeology of the Clayton Aquifer of southwest Georgia: U.S. Geological Survey 83-755, 56 p.

Cooke, C.W., 1936, Geology of the Coastal Plain of South Carolina: U.S. Geological Survey Bulletin 867, 196 p.

Davis, M.E., 1980, Ground water levels in Alabama: Geological Survey of Alabama Circular 105, 75 p.

Faye, R.E., and Prowell, D.C., 1982, Effects of late Cretaceous and Cenozoic faulting on the geology and the hydrology of the Coastal Plain near the Savannah River, Georgia and South Carolina: U.S. Geological Survey Open-File Report 82-156, 73 p.

Hayes, L.R., 1979, The ground water resources of Beaufort, Colleton, Hampton, and Jasper Counties, South Carolina: South Carolina Resources Commission Report No. 9, 91 p.

J.E. Sirrine Company, 1980, Groundwater Resource Study, Sirrine Job No. P-1550, DCN-001: Unpublished report for Kimberly-Clark Corporation; J.E. Sirrine Company, Greenville, S.C., 26 p.: Report on file at U.S. Geological Survey, Doraville, Ga.

Knowles, D.B., Reade, H.L., Jr., and Scott, J.C., 1960, Geology and ground-water resources of Montgomery County, Alabama: Geological Survey of Alabama Bulletin 68, Part B.

LeGrand, H.E., 1962, Geology and ground-water resources of the Macon area, Georgia: Georgia Geological Survey Bulletin 72, 68 p.

LeGrand, H.E., and Furcron, A.S., 1956, Geology and ground-water resources of central-east Georgia: Georgia Geological Survey Bulletin 64, 174 p.

LaMoreaux, P.E., 1946, Geology and ground-water resources of the Coastal Plain of east-central Georgia: Georgia Geological Survey Bulletin 52, 173 p.

LaMoreaux, P.E., Toulmin, T.D., and Sutcliffe, Horace, Jr., 1957, Interim report on the geology and ground water resources of Wilcox County, Alabama: Geological Survey of Alabama Information Series 8.

Mayer, P.G., 1972, Impact of BNFP's pumpage from the Tuscaloosa aquifer on the gound-water table: Unpublished report No. EMP-104, prepared for Allied-Gulf Nuclear Services, 111p.: Report on file at U.S. Geological Survey, Doraville, Ga.

McWilliams, R.D., Scott, J.C., Golden, H.G., and Avrett, J.R., 1968, Water availability, Crenshaw County, Alabama: Geological Survey of Alabama Map 69.

Miller, J.A., 1984, Hydrogeologic framework of the Floridan aquifer system in Florida and in parts of Georgia, South Carolina, and Alabama: U.S. Geological Survey Professional Paper 1403-B, (in press).

Newton, J.G., Golden, H.G., Avrett, J.R., and Scott, J.C., 1968, Water availability, Dale County, Alabama: Geological Survey of Alabama Map 64.

Newton, J.G., McCain, J.F., and Avrett, J.R., 1968, Water availability, Henry County, Alabama: Geological Survey of Alabama Map 71.

Newton, J.G., McCain, J.F., and Knight, A.L., 1971, Water availability of Marengo County, Alabama: Geological Survey of Alabama Map 98.

Newton, J.G., Powell, W.J., Golden, H.G., and Avrett, J.R., 1966, Water availability, Barbour County, Alabama: Geological Survey of Alabama Map 34.

Owen, V., Jr., 1959, A summary of ground-water resources of Sumter County, Georgia: Georgia Geological Survey Mineral Newsletter, v. 14, nos. 2-3, p. 41-51.

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

Park, A.D., 1980, The ground-water resources of Sumter and Florence Counties, South Carolina: South Carolina Water Resources Commission Report No. 133, 43 p.

-----1984, The ground-water resources of Berkeley, Charleston and Dorchester Counties, South Carolina: South Carolina Water Resources Commission Report.

Reed, P.C., Scott, J.C., Golden, H.G., and Avrett, J.R., 1967, Water availability, Butler County, Alabama: Geological Survey of Alabama Map 57.

Renken, R.A., 1984, The hydrogeologic framework for the Southeastern Coastal Plain Aquifer System of the United States: U.S. Geological Survey Water-Resources Investigations 844243, 26 p.

Scott, J.C., 1962, Ground water resources of Bullock County, Alabama: Geological Survey of Alabama Information Series 29.

Scott, J.C., Golden, H.C., and Avrett, J.R., 1967, Water availability in Geneva County, Alabama: Geological Survey of Alabama Map 55.

Scott, J.C., McCain, J.F., and Avrett, J.R., 1967, Water availability, Houston County, Alabama: Geological Survey of Alabama Map 59.

Shamburger, V.M., Jr., Scott, J.C., Golden, H.G., and Avrett, J.R., 1968, Water availability, Pike County, Alabama: Geological Survey of Alabama Map 73.

Siple, G.E., 1954, South Carolina, in water levels and artesian pressures in observation wells in the United States, 1951, part 2, Southeastern States: U.S. Geological Survey Water-Supply Paper 1192, p. 182-186.

-----1955, Geology and ground water in parts of Aiken, Barnwell, and Allendale Counties, South Carolina: Unpublished report prepared by the U.S. Geological Survey for the Savannah River Operations Office of the Atomic Energy Commission, 183 p.

----1957, Ground water in the South Carolina Coastal Plain: Journal of the American Water Works Association, v. 49, no. 3, p. 283-300.

-----1967, Geology and ground water of the Savannah River Plant and vicinity, South Carolina: U.S. Geological Survey Water-Supply Paper 1841, 113 p.

Stephenson, L.W., Logan, W.N., and Waring, G.A., 1928, The ground water resources of the Mississippi: U.S. Geological Survey Water-Supply Paper 576.

Stephenson, L.W., and Veatch, J.O., 1915, Underground waters of the Coastal Plain of Georgia: U.S. Geological Survey Water-Supply Paper 341.

Turner, J.D., Scott, J.C., Newton, J.G., Golden, H.G., and Avrett, J.R., 1968, Water availability, Coffee County, Alabama: Alabama Geological Survey Map 76.

Wait, R.L., 1960a, Summary of the ground-water resources of Terrell County, Georgia: Georgia Mineral Newsletter, v. 13, no. 3, p. 117-122.

-----1960b, Summary of the ground-water resources of Calhoun County, Georgia: Georgia Mineral Newsletter, v. 13, no. 1, p. 26-31.

-----1960c, Summary of the geology and ground-water resources of Clay County, Georgia: Georgia Mineral Newsletter, v. 13, no. 2, p. 93-101.

-----1963, Geology and ground-water resources of Dougherty County, Georgia: U.S. Geological Survey Water-Supply Paper 1539-P, 102 p.

Zack, A.L., 1977, The occurrence, availability, and chemical quality of the ground water, Grand Strand area and surrounding parts of Horry and Georgetown Counties, South Carolina: South Carolina Water Resources Commission Report No. 8, 100 p.

BASE FROM U.S. GEOLOGICAL SURVEY DIGITAL
LINE GRAPHS FROM 1:2,000,000 SCALE MAPS

APPROXIMATE POTENTIOMETRIC SURFACE FOR THE AQUIFER UNIT A3, SOUTHEASTERN COASTAL PLAIN AQUIFER SYSTEM OF THE UNITED STATES, PRIOR TO DEVELOPMENT

By
V.A. Stricker, Walter R. Aucott, Robert E. Faye, John S. Williams, and Michael J. Mallory

1985