

AQUIFER INTERCONNECTION IN EASTERN CHATHAM COUNTY, GEORGIA, AS INDICATED BY HYDRAULIC AND WATER-CHEMISTRY DATA

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Abstract. Ground water provides nearly half the freshwater supplies in the Savannah, Georgia, area (excluding thermoelectric use). Concern has been expressed over possible encroachment of saltwater into the Upper Floridan aquifer as a result of proposed expansion and deepening of Savannah Harbor and the entrance channel. In response to this concern, the U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers and the Georgia Department of Natural Resources, conducted a study during December 1997-January 1998, to describe the aquifer interconnection at two well-cluster sites at Fort Pulaski and Tybee Island in eastern Chatham County, Georgia (fig. 1). Aquifers evaluated were the surficial aquifer, low permeability sediments that are stratigraphic equivalents of the upper Brunswick aquifer, and the Upper and Lower Floridan aquifers.

Aquifer interconnection was assessed at two well-cluster test sites by comparing head (measured as water level) and water-quality data from the various aquifers. Water levels were measured on January 22, 1998, in three wells at the Fort Pulaski site and in five wells at the Tybee Island site to determine the vertical head gradients. Water levels, corrected for altitude differences between wells, indicate that there is a decrease in hydraulic head with depth at each site, indicating potential downward leakage of water. Water levels in the Upper Floridan aquifer at each site have been lowered because of pumpage from the aquifer in the Savannah area. These lowered water levels have resulted in a downward hydraulic gradient at each site.

At Fort Pulaski, there is hydraulic separation between the surficial aquifer and upper Brunswick equivalents, and between the upper Brunswick equivalents and the Upper Floridan aquifer. Hydraulic separation between the surficial aquifer and the underlying upper Brunswick

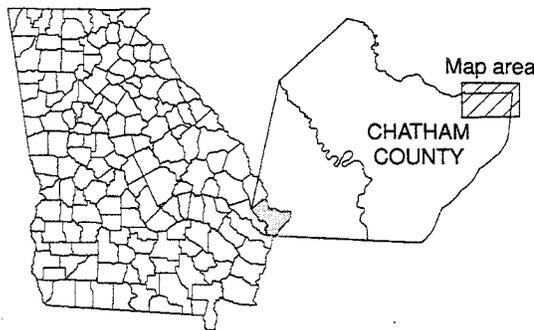
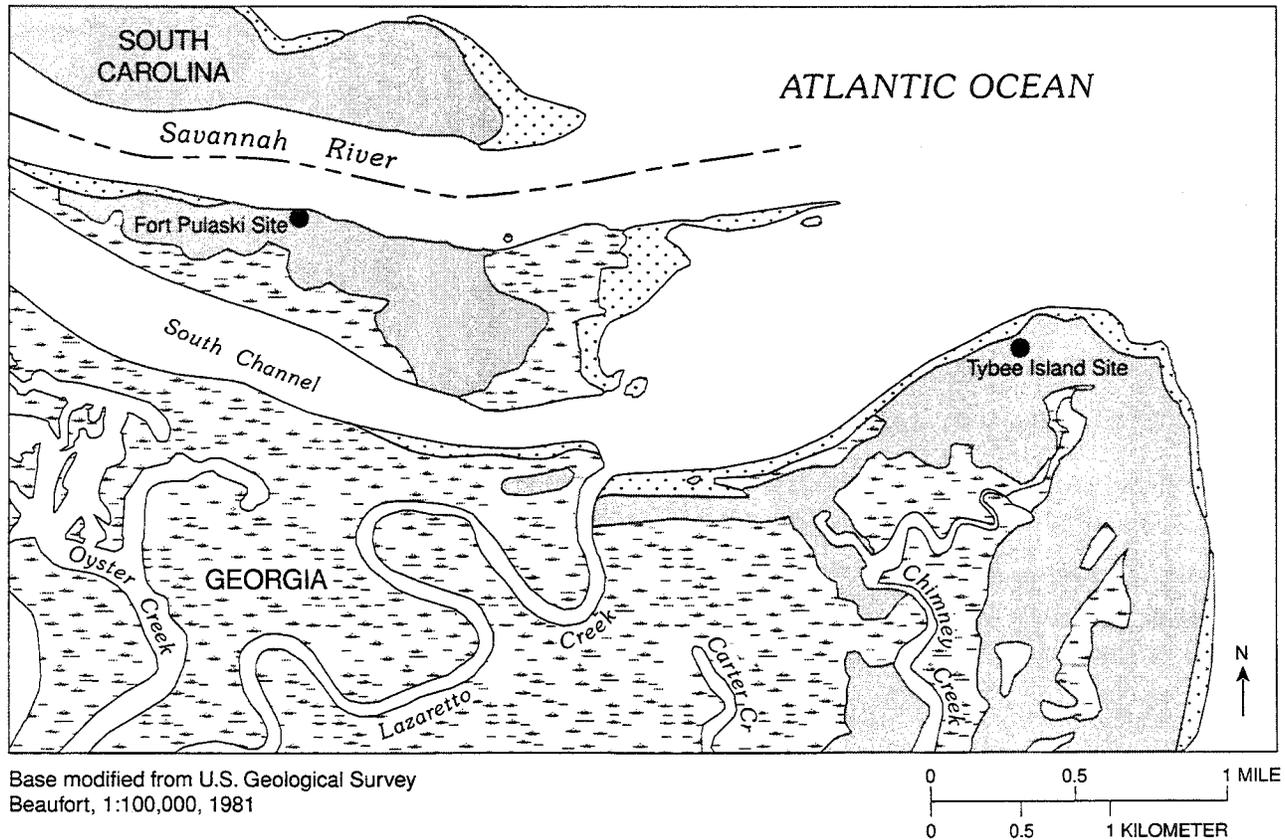
equivalents is indicated by a head difference of 3.7 feet, and by higher concentrations of dissolved constituents in water from the surficial aquifer and greater hardness of water from the upper Brunswick equivalents. The upper Brunswick equivalents are hydraulically separated from the underlying Upper Floridan aquifer, as indicated by a head difference of 22.6 feet, and by differences in water chemistry. Water from the upper Brunswick equivalents has higher iron concentrations and is a different water type than water from the Upper Floridan aquifer. Water from the upper Brunswick equivalents is of a sodium chloride type; whereas, water from the Upper Floridan aquifer is a sodium magnesium calcium bicarbonate type. Leakage of water from the upper Brunswick equivalents to the Upper Floridan aquifer at Fort Pulaski is suggested by the low head in the upper Brunswick equivalents; the water level in the upper Brunswick equivalents at Fort Pulaski was 2.1 feet below sea level on January 22, 1998, suggesting a possible leakage in response to pumping from the Upper Floridan aquifer.

At Tybee Island, there is hydraulic separation between the surficial aquifer and upper Brunswick equivalents; the upper Brunswick equivalents and the Upper Floridan aquifers; and the Upper and Lower Floridan aquifers. Hydraulic separation between the surficial aquifer and the underlying upper Brunswick equivalents is indicated by a head difference of 3.0 feet; however, similar water chemistry suggests mixing of water from the two aquifers. Water from both aquifers is a sodium chloride type containing similar constituent concentrations. Hydraulic separation between the upper Brunswick equivalents and Upper Floridan aquifer is indicated by a head difference of 22.2 feet, and by differences in water chemistry. Water from the upper Brunswick equivalents has higher constituent concentrations and is a different water type than water from the

Upper Floridan aquifer. Water from the upper Brunswick equivalents is a sodium chloride type; whereas, water from the Upper Floridan aquifer is a sodium calcium bicarbonate type. Hydraulic separation between the Upper and Lower Floridan aquifers at Tybee Island is indicated by a head difference of 4.1 feet, and by differences in water chemistry. Water from the Upper Floridan aquifer is a sodium calcium bicarbonate type and contains lower constituent concentrations; whereas,

water from the Lower Floridan aquifer is a mixed type and contains higher constituent concentrations.

Results of this study will help to assess the degree of aquifer interconnection and potential for saltwater encroachment in the vicinity of Savannah Harbor and the entrance channel, as part of an ongoing assessment by the U.S. Army Corps of Engineers on the possible effects of channel dredging on ground-water resources in the Savannah area.



EXPLANATION

-  Beach
-  Wetland
-  Dryland

Figure 1. Location of Fort Pulaski and Tybee Island well-cluster sites, Chatham County, Georgia.