GROUND-WATER MODELING AND MONITORING TO MANAGE CHLORIDE PLUME EXPANSION IN THE UPPER FLORIDAN AQUIFER NEAR BRUNSWICK, GEORGIA

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Abstract. Chloride contamination has limited development of the Upper Floridan aquifer in the Brunswick, Georgia, area (Fig. 1*A*) since the early 1960s. Saltwater likely enters the Upper Floridan aquifer through localized, vertically oriented conduits of high permeability, and moves laterally in response to the distribution of stresses within the aquifer (Maslia and Prowell, 1990). Maps showing the distribution of dissolved chloride during 2004 (Leeth and others, 2007) and 2007 (Cherry and Clarke, 2008; Fig. 1*B*) indicate that the lateral extent of the plume has largely stabilized. Future development in the area will likely require additional pumping from the Upper Floridan aquifer, which could cause further expansion of the chloride plume. Demand for water for industrial purposes has decreased during the past several decades due to implementation of water conservation measures at several facilities (Fanning, 2003; Cherry, 2007). Projected growth in population, however, will require additional amounts of water for public supply.

The U.S. Geological Survey cooperative water-resources monitoring program is a key component to assess the movement of the chloride plume in the Brunswick area. This ongoing program includes monitoring of ground-water levels, ground-water quality, and development of a ground-water flow model for simulation of water-management scenarios. Monitoring includes continuous recording of water levels in wells completed in the Floridan, Brunswick, and surficial aquifer systems; collecting water levels to map the potentiometric surface of the Upper Floridan aquifer; and collecting and analyzing water-quality samples from wells in Glynn County to map chloride concentrations in the Upper Floridan aquifer. In addition, "real-time" monitoring wells for specific conductance—located inside and outside the plume area, at three locations (33H325, 34H514, and 34H505; Fig. 1*B*)—serve as an early warning system to detect migration of saltwater into the Upper Floridan aquifer. An example of the water-level and specific conductance data collected from well 34H514 is shown in Figure 1*C*.

To examine the potential consequences of increased pumping while containing the saltwater plume, an existing regional ground-water flow model of coastal Georgia and adjacent parts of Florida and South Carolina (Payne and others, 2005; Fig. 1*A*) is being refined for Glynn County and the Brunswick area. Modifications to the model include: (1) refinement of grid resolution in the Brunswick area to simulate hydraulic gradients near active well fields and (2) updating pumpage data to June 2004 hydrologic conditions. The refined model is being used to evaluate potential effects of selected ground-water management scenarios on hydraulic gradients near the plume. Preliminary model results indicate that residuals between simulated and observed heads provide a reasonable match, which indicate the model is a useful tool for evaluating a variety of ground-water management scenarios, and the resulting impact on the plume and hydraulic gradients.

The modeling and monitoring approach used in the Brunswick area provides water managers with information needed to enable informed decisions regarding water resources. This includes annual water-quality sampling at selected wells to determine the position of the chloride plume under current hydrologic conditions and model simulations to evaluate hypothetical hydraulic gradients near production wells under various pumping scenarios. Changes in hydraulic gradients could potentially allow contaminated ground water to move into the Upper Floridan aquifer and diminish the water quality at wells operated by the City of Brunswick.

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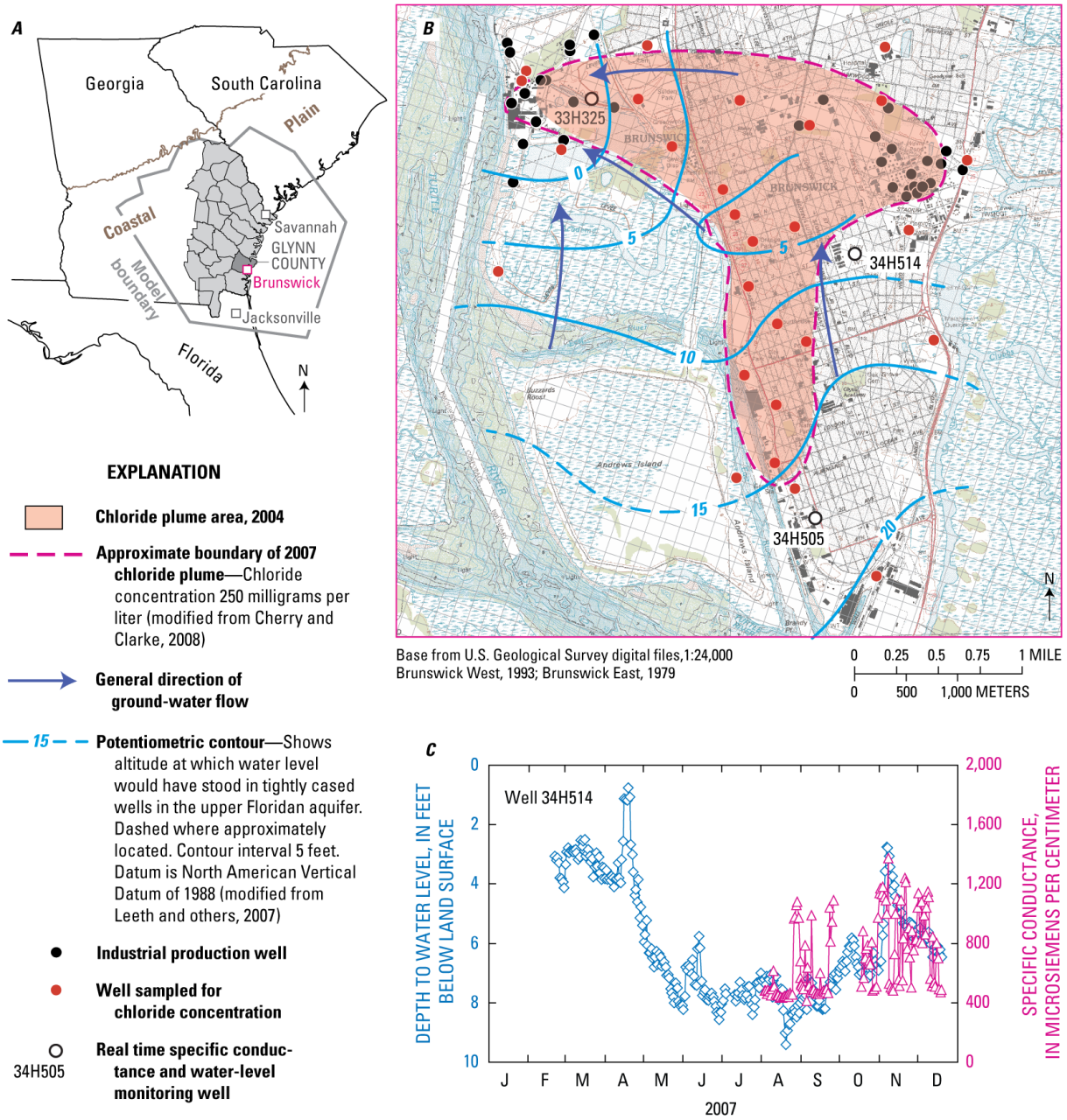

Figure 1. ***(A)*** **Location of 24-county coastal Georgia area as identified by the Georgia Environmental Protection Division and extent of regional ground-water flow model,** ***(B)*** **model grid, major industrial production wells, chloride monitoring wells, and potentiometric surface during June 2004 in the Upper Floridan aquifer, and** ***(C)*** **mean daily water-levels and specific conductance for well 34H514, Brunswick–Glynn County area, Georgia (modified from Cherry and Clarke, 2008).**

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