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MODELING GROUND-WATER FLOW AND SALT WATER IN THE ATLANTIC COASTAL PLAIN AQUIFER SYSTEM, VIRGINIA, UNITED STATES.

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ABSTRACT

Multiple marine transgressions and regressions since the Cretaceous Period have deposited a complex sequence of unconsolidated sands and clays on the Atlantic Coastal Plain in eastern Virginia, United States. Approximately 35 million years ago, an asteroid impact disrupted Lower Cretaceous through Upper Eocene sediments near the mouth of the present day Chesapeake Bay (Poag and others, 1994; Powers and Bruce, 1999).

Ground water recharges permeable strata along the western margin of the coastal-plain-aquifer system and flows approximately 150 km before discharging to the Chesapeake Bay or the Atlantic Ocean. Ground-water withdrawals supply approximately 750,000 m_3/day, or 20% of the water demand of the 2.3 million inhabitants of eastern Virginia. Resulting ground-water-level declines in excess of 50 m have created the potential for salt-water intrusion into public-supply-water wells in coastal areas. A three-dimensional ground-water-flow model of this coastal-plain-aquifer system is being developed to provide a management tool for municipal-planning and state-regulatory agencies.

The coastal plain aquifer system was likely saturated with salt water during the Pleistocene interglacial event approximately 75,000 years ago. Preliminary simulations with the variable-density-ground-water flow and solute-transport code SEAWAT (Guo and Langevin, 2002) show fresh-ground-water recharge displacing remnant salt water, and formation of a fresh-water / salt-water interface near the coast. An observed vertical salinity inversion may be a consequence of the vertical heterogeneity of horizontal hydraulic conductivity. Further analyses with the three-dimensional model will constrain hydraulic conductivities in the vicinity of the Chesapeake Bay Impact Crater, and the influence of that structure on salt-water migration in the area.

REFERENCES

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