

SALTWATER INTRUSION BENEATH MANHASSET NECK: A THREE DIMENSIONAL SIMULATION OF VARIABLE-DENSITY GROUND-WATER FLOW

by

Jack Monti, Jr, Paul E. Misut and Ronald Busciolano

U.S Geological Survey New York Water Science Center

2045 Rt. 112 Coram, N.Y. 11727

The coastal-aquifer system of Manhasset Neck, Nassau County, N.Y., has been stressed by pumping, which has led to saltwater intrusion and the abandonment of one public-supply well in 1944. Measurements of chloride concentrations and water levels in 2004 from the deep, confined aquifers indicate active saltwater intrusion in response to public-supply pumping. The need for an improved understanding of saltwater intrusion beneath Manhasset Neck prompted a recent investigation to analyze the effects of pumping on ground-water levels and the position of the freshwater-saltwater interface.

A numerical model capable of simulating three-dimensional variable-density ground-water flow and solute transport in heterogeneous, anisotropic aquifers was developed using the U.S. Geological Survey finite-element, variable-density, solute-transport simulator SUTRA, to investigate the extent of saltwater intrusion beneath Manhasset Neck. The numerical model was used as a tool to assess the extent of hydraulic connection between aquifers and to evaluate the response of the system to simulated pumping conditions. Three conditions (time periods) were simulated: (1) a predevelopment condition of no pumping prior to about 1905, (2) a 40-year condition representing the 1905-1944 period of gradual saltwater intrusion, and (3) a 60-year condition representing the 1945-2005 period of stabilized withdrawals. Model simulations indicate that sustained public-supply withdrawals may at times decrease freshwater discharge to offshore areas and has resulted in landward advance of the freshwater-saltwater interface in the deep aquifer system by several hundred to nearly two thousand feet near Baxter Estates Village.