

SIMULATION OF THE EFFECTS OF PUMPING AND RECHARGE ON GROUND-WATER FLOW AND THE FRESHWATER/SALTWATER INTERFACE ON THE NORTH FORK, LONG ISLAND, NEW YORK

by Christopher E. Schubert¹, Paul E. Misut¹, and Richard G. Bova²

¹ U.S. Geological Survey, 2045 Route 112, Coram, NY 11727

² Suffolk County Water Authority, P.O. Box 37, Oakdale, NY 11769

Abstract

Ground water is the sole source of drinking water on the North Fork of eastern Long Island, N.Y., where the ground-water-flow system is susceptible to saltwater intrusion or upconing into water-supply wells because of heavy pumping. Concern also has been raised regarding the capability of the system to meet the expected future demand for freshwater. The U.S. Geological Survey (USGS), in cooperation with the Suffolk County Water Authority (SCWA), began a 4-year study in 1997 to evaluate the response of ground-water flow and the freshwater/saltwater interface within two flow systems (at Cutchogue and Greenport) to anticipated future pumping and recharge conditions. The study entails development of a numerical ground-water-flow model for each flow system. A geographic information system (GIS), which includes previous hydrogeologic data supplemented with new data obtained through exploratory drilling by the SCWA, is being used to facilitate model development.

Compilation and interpretation of hydrogeologic data in a GIS has enabled detailed mapping of the hydrogeologic framework within the study area. Preliminary results from the exploratory drilling indicate that the Cutchogue flow system is hydraulically connected to the main body of Long Island through a narrow corridor within the water-table aquifer, but the Greenport flow system is hydraulically isolated from the rest of Long Island. A recent ground-water budget for the North Fork provides values for four major hydrologic components—recharge from precipitation, public-supply withdrawal, public-supply return flow, and agricultural withdrawal. Water-table maps from previous studies have been digitized into the GIS for use in model calibration.

The models are being used to simulate the flow of freshwater and saltwater and the movement of the transition zone, simulated as a sharp interface, from predevelopment (pre-1940) through 1994 hydrologic conditions, and to simulate the future response of each flow system to a wide range of pumping conditions under average-recharge and drought scenarios. A graphical user interface (GUI) is being developed to facilitate model construction, calibration, and application. Preliminary model results support the concept of a hydraulic connection between the Cutchogue flow system and the Long Island mainland and the hydraulic isolation of the Greenport flow system.

Model results describing the effects of pumping and recharge on ground-water flow and the position of the freshwater/saltwater interface will enable water-resource managers and suppliers to evaluate a broad range of water-supply management strategies to safely meet future demands, and provide information that can be used to delineate the source areas of supply wells and characterize contaminant transport within each flow system.