GROUND-WATER SOLUTE TRANSPORT ALONG THE NASSAU-SUFFOLK COUNTY BORDER, LONG ISLAND, NEW YORK

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Abstract

Increased ground-water contamination from human activities on Long Island has prompted studies to correlate land use with shallow water quality and to describe the fate and transport of contaminants that move into deeper zones of the flow system. A two-dimensional, finite-difference numerical model consisting of 48 columns and 21 layers was constructed to represent ground-water flow and solute transport along a north-south vertical section through central Long Island, N.Y., along the border between Nassau and Suffolk Counties. Simulated hydraulic gradients and the flowpaths and traveltimes of ground water from entry at the water table to discharge locations indicate that most recharge remains in the upper glacial aquifer and the shallow zone of the Magothy aquifer; therefore, these zones are at greatest risk from contamination introduced at land surface. The model solves the solute-transport equation through a particle-tracking procedure to represent convective transport, and uses a finite-difference equation to describe the effects of hydrodynamic dispersion, contaminant sources, and chemical-decay processes. Continuous application of a conservative solute to the water table near the ground-water divide demonstrates that plumes whose concentration exceeds 20 percent of the initial concentration enlarge by as much as 50 percent when hydrodynamic dispersion is simulated. Continuous application of a nonconservative solute (benzene) at the same point demonstrates that chemical reactions remove most of the applied mass and that plume concentrations exceed 1 percent of the initial concentration only in a small area.