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NH SEACOAST PROJECT HOMEPAGE:

GROUND-WATER MODEL

Assessment of Water Resources in the Seacoast Region of New Hampshire by Ground-Water-Flow Simulation

Wells are being installed, and drilled progressively deeper, throughout the seacoast to meet the increasing demand for water. Considerable amounts of hydrologic data are being collected at sites of proposed large ground-water withdrawals; however, there currently are no comprehensive means to evaluate the cumulative hydrologic effects of new withdrawals, in conjunction with existing and proposed water uses, on the water resources of a region. Regional ground-water-flow models are tools used for evaluating the cumulative effects of multiple, and potentially competing, uses on water resources in a region. A portion of the seacoast study area (figure 1) was selected to apply a regional ground-water-flow model (figure 2). This area encompasses approximately 170 mi² and has a population of more than 80,000.

Figure 1.

STUDY OBJECTIVES

The objective of the ground-water flow model is to provide a quantitative assessment of ground-water resources in the seacoast region (figure 2). The analyses will be conducted at the regional scale, and results reported at regional, watershed, sub-watershed, and town scales. The model will be a valuable tool for (1) estimating ground-water recharge, discharge, and storage at these spatial scales; (2) assessing the cumulative effects of existing and proposed water resource uses and developments; and (3) evaluating the cumulative effects on water resource of various water management options. The model is not intended for use in site-specific hydrologic analyses without additional site-specific data and enhancements, but will be useful in providing a regional context for evaluating water resources.

Specific objectives of the ground-water-flow model include:

1. Quantify the ground-water resources of the seacoast model area.
2. Estimate the hydrologic effects of 10- and 20-year water-use projections on the water resources of the model area.
3. Estimate the hydrologic effects of alternative planning and water-resources management options.
4. Provide and document the use of a ground-water-flow model for regional water-resources planning and management.

SEACOAST GROUND-WATER-FLOW SYSTEM

The seacoast model area is largely bounded by saltwater bodies (figure 2) including the Atlantic Ocean, Great Bay, and the Piscataqua, Squamscott, and Merrimack Rivers. The saltwater bodies and rivers are used to form the hydrologic boundaries of a regional ground-water flow system. The Powwow River, a freshwater tributary to the Merrimack River, forms the southwest boundary of the regional flow system.

The ground-water-flow system in the model area consists of a fractured crystalline bedrock aquifer, of varying regional transmissivity, overlain by a relatively thin overburden (surficial) aquifer. A diagrammatic cross section between the Squamscott River and the Atlantic Ocean, presented in figure 3, indicates the general directions of ground-water flow. Ground-water flow in the bedrock aquifer likely follows short flowpaths and supply is largely supported by storage in the overburden aquifer, surface-water bodies or wetlands, and streams. However, where transmissivity of the bedrock aquifer is relatively high, ground-water flowpaths may be longer, crossing into adjacent watersheds, and storage may be higher than in other areas of the crystalline bedrock-aquifer.

A preliminary simulation of ground-water levels in the seacoast bedrock aquifer are shown in figure 4. A complete conceptual discussion of the seacoast ground-water-flow system, and preliminary model design and analysis is provided by Mack (2003).

Figure 2.

APPROACH

The investigation will provide an assessment of seacoast ground-water resources (ground-water recharge, discharge, and storage) through an integrated analysis of geohydrologic and water-use data using the U.S. Geological Survey’s ground-water-flow model MODFLOW-2000. This investigation builds upon the results and ongoing data collection activities by the NH Geological Survey, streamflow data collection by the USGS, and a detailed water use investigation by the USGS. Specific tasks required for accomplishing the objectives of the ground-water-flow simulation are described in the project...
work plan.

PRODUCTS

Two products are planned from the ground-water modeling component of the seacoast study:

1. A USGS report documenting the application of the ground-water model to evaluate water resources, growth scenarios, and alternative management practices in the seacoast region.
2. Copies of the ground-water-flow model datasets that will allow others to use the model.

BENEFITS

Results from this study will contribute to a better understanding of surface- and ground-water hydrology in the seacoast region of New Hampshire. The regional ground-water-flow model will provide a valuable tool for (1) estimating ground-water recharge, discharge, and storage at regional, watershed, and town scales; (2) assessing the cumulative effects of existing and proposed water-resources developments; and (3) evaluating alternative, large-scale planning and management options that will be of assistance to planners at state, regional, and town levels. The proposed model will provide a regional context for more detailed site-specific hydrologic analyses by the private sector in their assistance to local planners, developers, managers and regulators in evaluating individual water-resources developments.

Specific benefits of this investigation include the following:

1. Establishment of town-wide and sub-watershed scale water balances.
2. Quantification of the immediate and long-term ground-water resource conditions in the seacoast model area.
4. Documentation of a ground-water-flow model for regional water-resource decision-making.

REFERENCES


For technical questions, contact: Tom Mack, tjmack@usgs.gov