



# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN MASSACHUSETTS

### GROUND-WATER ISSUES

Ground-water sources serve 2 million people in Massachusetts, about one-third of the State's population. Although water is an abundant resource, water demand for the highly-urbanized eastern part of the State has approached and (or) exceeded the capacity of local resources. The distribution of water demand does not match the distribution of the resource and State water policy discourages interbasin diversion. Therefore, water-resources management has become one of the top statewide environmental issues. The major issues related to ground water in Massachusetts are:

- Management of quality,
- Allocation of water resources and management of withdrawals, and
- Identification and selection of sites for hazardous and low-level radioactive-waste disposal.

### U.S. GEOLOGICAL SURVEY GROUND-WATER PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate information on the Nation's water resources.

In 1988, the USGS, in cooperation with the Massachusetts Division of Water Resources, completed a series of 28 reports describing the State's surface- and ground-water resources. Since 1979, this program has assessed the ground-water resource in nine of the most highly stressed of the State's 27 river-basin planning areas. Beginning in 1973, the USGS and the Massachusetts Division of Water Pollution Control developed a cooperative program to research and inventory the State's water resources, with emphasis on water-quality problems. In 1988, the USGS program in Massachusetts included 16 ground-water studies supported by nine Federal, State, regional, and local agencies. Examples of studies that are designed to address specific ground-water issues in Massachusetts are discussed in the following sections.

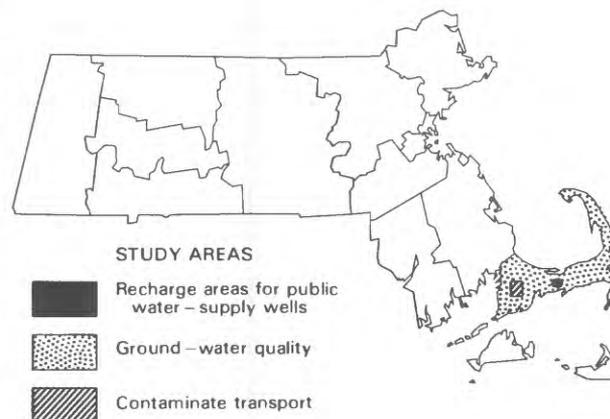
#### Recharge Areas for Public Water-Supply Wells

In Massachusetts, recharge areas for aquifers range from tens to hundreds of square miles, whereas the recharge area for an individual public-supply well is much smaller. Control of land

uses that may affect ground-water quality within a recharge area for an aquifer is impractical; however, the delineation of recharge areas for individual public-supply wells focuses management efforts on wellhead protection. The determination of these recharge areas for new public-supply wells is now required by the State of Massachusetts. Determination of these areas also is an important part of the U.S. Environmental Protection Agency's (EPA) wellhead protection program. The USGS, in cooperation with the Massachusetts Department of Environmental Quality Engineering (DEQE), the Massachusetts Department of Environmental Management, and Barnstable County, is applying computer-modeling techniques to delineate these recharge areas at the towns of Barnstable and Eastham on Cape Cod. The results of this study will be used by local, State, and Federal officials for managing ground-water quality and for wellhead protection.

#### Ground-Water Quality on Cape Cod

The quality of ground water on Cape Cod is threatened by increasing population growth. In 1985, the USGS began a study of the aquifer underlying Cape Cod to provide the technical information needed to improve ground-water management at all levels of government. This project is being conducted in cooperation with the DEQE, the Cape Cod Planning and Economic Development Commission, and the EPA. To relate the effects of land use to ground-water quality, the USGS compiled information on land use, sources of toxic and hazardous materials, underground storage tanks, and sources of nitrate. A method was developed to estimate the concentration of nitrate in ground



water, and a study was made to evaluate methods for assessing risk to ground-water quality from major contamination sources. The results of these investigations are being used by the EPA to provide State, regional, and local agencies with guidelines and technical tools for ground-water management and wellhead protection.

#### Contaminant Transport at Otis Air Force Base

The USGS began studying contaminated ground water from treated sewage at Otis Air Force Base in cooperation with the Massachusetts Division of Water Pollution Control in 1976. The extent of the contamination plume was defined in a pilot study and, later, a digital model was prepared to describe the movement of contaminants in the plume. Since 1983, the Otis Air Force Base site has been the focus of USGS research into the physical, microbiological, and geochemical processes that control the transport and fate of contaminants in ground water. This pioneering field experiment is only the second of its kind, and the first conducted in the United States. During July 1985, 2,000 gallons of water containing several chemical tracers were injected into the ground-water flow system. More than 9,000 sampling points were used to monitor the transport and spread of the tracers over a period of 17 months. The results of research conducted at this site will improve the understanding of contaminant movement needed to clean up many contamination sites nationwide.

#### GROUND-WATER MANAGEMENT

All State agencies with ground-water management and planning responsibilities are directed by the Massachusetts Executive Office of Environmental Affairs. These responsibilities are implemented by the Department of Environmental Management and the Department of Environmental Quality Engineering. The Massachusetts Water Resources Commission develops and coordinates the water-resources planning and management functions of the departments of the Massachusetts Executive Office of Environmental Affairs.

The Department of Environmental Management, Division of Water Resources, collects and disseminates water-resources information and develops State water-resources plans, licenses well drillers, and maintains records of well-completion reports. This Division is responsible for developing plans for the use of ground water within the State's 27 river-basin planning areas and for regulation of interbasin transfer.

The Department of Environmental Quality Engineering is responsible for protecting ground-water quality through its Divisions of Water Supply, Environmental Analysis, Water Pollution Control, and Hazardous Waste. The Division of Water Supply regulates drinking-water quality through its public-supply well-permit program, collects and disseminates ground-water-quality information, and administers programs providing funds for water treatment and cleanup of aquifer contamination. The Division of Water Supply also has the authority and responsibility to regulate all ground-water withdrawals in excess of 100,000 gallons per day. The Division of Environmental Analysis collects and analyzes water from public supplies. The

Division of Water Pollution Control is responsible for the design, implementation, and enforcement of regulations that improve water quality and prevent ground-water pollution. The Division of Hazardous Waste regulates activities with a potential for ground-water contamination, responds to hazardous-waste accidents, and supervises the cleanup of hazardous-waste sites. During fiscal year 1988, the following Federal, State, and local agencies entered into interagency or cooperative cost-sharing agreements with the USGS to conduct ground-water studies in Massachusetts.

Barnstable County  
Massachusetts Department of Environmental Management  
Division of Water Resources  
Massachusetts Department of Environmental Quality Engineering  
Division of Water Supply  
Division of Water Pollution Control  
Massachusetts Department of Public Works  
Massachusetts Hazardous Waste Facility Site Safety Council  
Town of Brewster  
Town of Harwich  
U.S. Environmental Protection Agency

#### SELECTED REFERENCES

- Frimpter, M.H., and Fisher, M.H., 1983, Estimating highest ground-water levels for construction and land-use planning, a Cape Cod, Massachusetts, example: U.S. Geological Survey Water-Resources Investigations Report 83-4112, 23 p.
- Frimpter, M.H., Donahue, J.J., and Rapacz, M.V., 1988, A mass-balance nitrate model for predicting the effects of land use on ground-water quality in municipal wellhead protection areas: Massachusetts Department of Environmental Quality Engineering Report, 56 p.
- Knott, J.F., and Olimpio, J.C., 1986, Estimation of recharge rates to the sand and gravel aquifer using environmental tritium, Nantucket Island, Massachusetts: U.S. Geological Survey Water-Supply Paper 2297, 26 p.
- LeBlanc, D.R., Guswa, J.H., Frimpter, M.H., and Londquist, C.J., 1986, Ground-water resources of Cape Cod, Massachusetts: U.S. Geological Survey Hydrologic Investigations Atlas HA-692, 4 sheets.
- U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.
- \_\_\_\_\_, 1985, National water summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.

Information on technical reports and data related to ground water in Massachusetts can be obtained from:

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