

United States Geological Survey

Programs in Massachusetts



The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.

Earth Science Information in the Public Service

The U.S. Geological Survey (USGS) has been collecting and evaluating geologic, hydrologic, and topographic information since its creation by the United States Congress in 1879. Traditional USGS programs have included monitoring and understanding natural hazards, assessing water and mineral resources, and providing topographic, geologic, and land-use maps—all essential to the use of natural resources and to public safety. The scope of activities of the USGS has evolved as demands on the Nation's natural resources have increased. The USGS is meeting new challenges through Earth science data-collection programs and scientific investigations. The following summaries of selected USGS programs in Massachusetts demonstrate the diversity of Earth science issues currently under investigation.

National Water-Quality Assessment Program

The National Water-Quality Assessment (NAWQA) Program was undertaken to describe the status and trends in the quality of a large representative part of the Nation's surface- and ground-water resources and to identify the natural and human factors that affect the quality of these resources. The NAWQA Program will produce a wealth of water-quality information useful to policymakers and water managers at local, State, and national levels.

Investigations of three NAWQA Program study units are underway in Massachusetts: the Connecticut, Housatonic, and Thames River Basins; the Hudson River Basin; and the Northern New England Basins. An investigation of a fourth study unit, Southeastern New England Basins, is planned for 1997

(fig. 1). Communication and coordination among the USGS and water-management and other water-resource agencies are key components of the Program projects in the State. The projects will distribute findings in a variety of reports to local, State, and Federal agencies as results become available. For example, analysis of water-quality data collected in the Connecticut, Housatonic, and Thames River Basins NAWQA study unit indicates that urbanized river basins contribute 3 to 5 times as much nitrogen and 6 to 20 times as much phosphorus as do forested (low-population) basins. Such high nitrogen and phosphorus concentrations in streams can reduce oxygen concentrations in lakes and estuaries and cause fish kills.

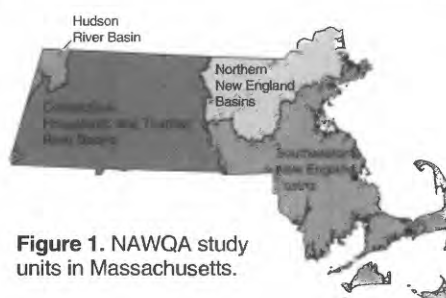


Figure 1. NAWQA study units in Massachusetts.

Hydrology of River Basins

The Massachusetts Department of Environmental Management (MDEM) is responsible for developing management plans for the efficient and environmentally sound use of water in the State's 27 river-basin planning units. The USGS is conducting hydrologic studies of the major river basins in the State; results of the studies will provide information needed by the MDEM to develop these management plans, including boundaries and water-bearing properties of aquifers, streamflow, and water use and water quality.

The USGS, in cooperation with the

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MDEM and the Massachusetts Department of Environmental Protection (MDEP) also is developing and operating a system to collect, store, and disseminate water-use information throughout the State. This information is used by the cooperating agencies for the evaluation and effective management of the State's water resources. Together, the river-basin studies and water-use program provide a basis for water-resource decision making in Massachusetts.

Toxic Substances Hydrology Program

Contamination from landfills, sewage-treatment facilities, and other land uses can seriously affect the quality of ground-water resources. Understanding processes that affect the fate of contaminants in ground water is critical for the protection of ground-water resources and the remediation of ground-water contamination.

As part of its Toxic Substances Hydrology Program, the USGS is studying the movement of contaminated ground water emanating from the Massa-

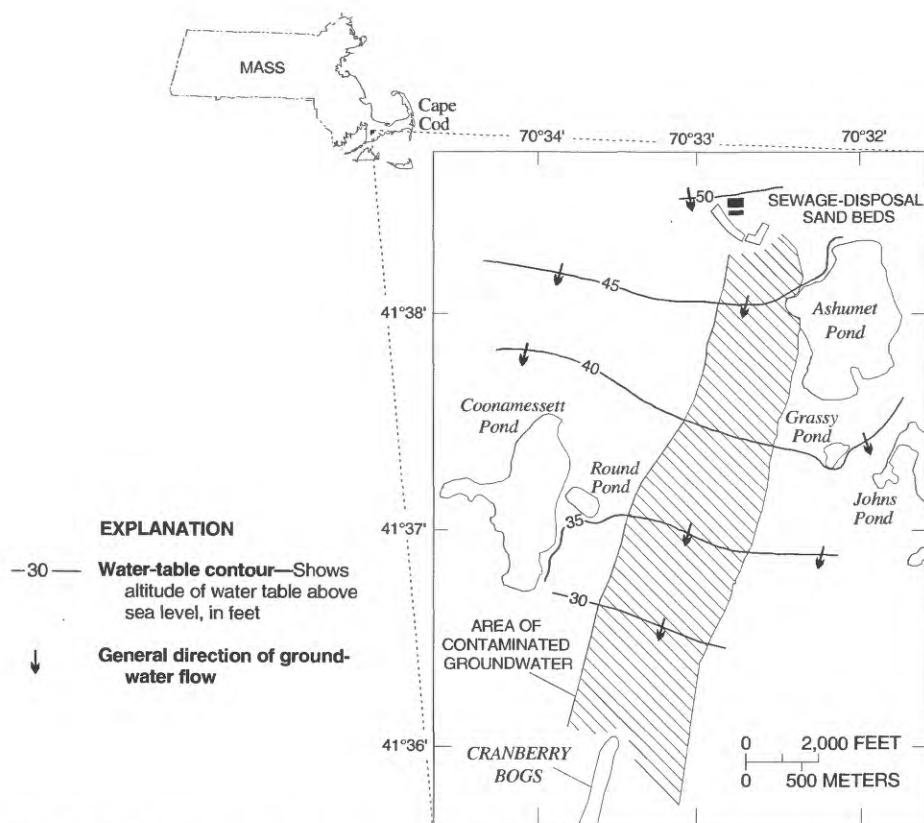


Figure 2. Toxic substances hydrology investigation at a site of contaminated ground water, Massachusetts Military Reservation, Cape Cod.

chusetts Military Reservation (MMR) and the complex interaction of hydrologic, chemical, and microbial processes that are in the contaminated aquifer underlying the site (fig. 2). Understanding of the fate of contaminants in the ground water and computer models of ground-water flow developed by the USGS for the MMR area were useful to the National Guard Bureau in planning a program to halt the advance of contaminated ground water in seven other areas on the MMR.

Massachusetts Bays Projects

The USGS is conducting a study in Boston Harbor and Massachusetts and Cape Cod Bays because of the need to understand the transport of sediments in coastal waters to address a wide range of management decisions. For example, construction of a new ocean outfall (to begin operation in 1996) that will change the site of disposal of treated sewage from Boston Harbor to Massachusetts Bay has been proposed (fig. 3). The results of the USGS effort will be useful to predict the fate of contaminants in sediments in Massachusetts Bay. The USGS project is closely coordinated

with studies supported by the Massachusetts Environmental Trust, the U.S. Environmental Protection Agency's (USEPA) Massachusetts Bays Program, and the Massachusetts Water Resources Authority.

The USGS, in cooperation with the National Oceanographic and Atmospheric Administration, the University of Rhode Island, the Canadian Hydrographic Service, and the University of New Brunswick also is mapping sedimentary environments and biological habitats of Georges Bank and the Stellwagen Bank National Marine Sanctuary, a newly designated sanctuary located off Boston. The waters of Georges Bank are highly productive and, at one time, supported a successful fishery. The mapping studies will assist scientists and policymakers who are designing monitoring strategies to preserve and manage the environmental resources and fisheries of Stellwagen and Georges Banks.

Assessment of Bridge-Scour Hazards

Bridge failures can cause loss of life and cost millions of dollars to repair. Failures of bridges over water are caused primarily by streambed scouring at

bridge foundations. In 1992, the USGS, in cooperation with the Massachusetts Highway Department (MHD), began a study to assess stream stability and streambed scouring at 2,360 bridges in Massachusetts. The USGS is assessing overall channel-stability characteristics to identify bridge sites with potential, as well as observable, scour problems. Information gained from the bridge-scour assessments is vital to the public's safety. The information also is used by the MHD to prioritize bridge repairs, thereby optimizing the use of public funds.

Nutrient Removal by Salt-Marsh Ecosystems

Disposal of the sewage from coastal populations threatens to seriously affect the quality of Massachusetts' coastal waters. Nutrients in treated sewage that infiltrates to ground water can ultimately enter coastal waters and cause algal blooms, depletion of dissolved oxygen, and fish kills. One possible way to limit the adverse effects of this practice is to allow natural remediation processes to remove nutrients in ground water before they enter coastal waters. Since 1988, the USGS, in cooperation with the MDEP, has been tracking the movement of nutrient-rich ground water from a sewage-treatment facility toward Namskaket Marsh on Cape Cod. The USGS is defining the hydrology and natural ecology of the marsh in anticipation of the discharge of the contaminated ground water to the marsh. Because the project is evaluating the marsh ecosystem before and after the arrival of the nutrient-rich water, the results of the project will have wide significance for wastewater management throughout Massachusetts.

Occurrence of Trace Metals in Surface Waters

Concentrations of trace metals in surface waters of Massachusetts can exceed Federal regulations. The USGS, in cooperation with the MDEP, is characterizing the types, abundances, and metal-binding capacities of organic material in Massachusetts streams because certain types of organic material can mask metal toxicity. The information collected as part of this project will allow the MDEP to determine appropriate water-quality standards with respect to trace metals; the information

will help decision makers provide protection for aquatic life.

Reservoirs on the Sudbury River contain large amounts of mercury-contaminated sediments. Complete removal of the sediments would be costly. The USGS, in

cooperation with the USEPA and other Federal agencies, is investigating mercury chemistry and transport in the Sudbury River. The objectives of the study are to determine sources of mercury ingested by fish in the reservoirs and to determine the long-term effects of partial or no removal of mercury-contaminated sediments.

Collection of Hydrologic Data

Massachusetts has two major rivers, the Connecticut and the Merrimack, and several smaller but important rivers including the Charles, Blackstone, Housatonic, Chicopee, and Taunton. These rivers are water supplies for Massachusetts and adjacent States. The USGS, in cooperation with nearly 10 local, State, and Federal agencies, collects streamflow and (or) water-quality data at numerous sites throughout the State (fig. 4). These data are critical for daily administration and management of the water resources, determining the extent and severity of droughts, characterizing and predicting conditions during floods, and monitoring the effects of human activities on streamflow and water quality. The data also are used in interpretive studies that provide information critical to decisions about water issues that affect millions of people.

Contamination of Water Resources by Road Salt

Although necessary for highway safety during winter storms, application of road salts can threaten the quality of surface- and ground-water supplies. For example,

complaints of contamination of water resources caused by road salt came from 100 of 341 Massachusetts cities and towns from 1983 to 1990. Improvements in the management of highway runoff are critical in areas where the water resources are sensitive to road-salt contamination. For more than 20 years, the USGS has participated in a series of projects with the Massachusetts Highway Department (MHD) to determine the effects of road-salt applications on the quality of surface- and ground-water resources. The USGS is currently cooperating with the MHD to determine the effect of highway-drainage design in preventing road-salt contamination.

Geologic Mapping

The USGS has produced a set of digital maps that show the distribution of surficial materials and associated urban and suburban land use. Surficial materials are useful as a source of sand and gravel used in construction and as a source of water for human consumption and other uses. The maps are based on more than 50 years of cooperative study between the USGS and the State and are used extensively by State and local planning agencies and consultants in addressing environmental issues.

Assessment of Mineral Resources

As with many Eastern States, Massachusetts depends on diminishing resources of locally derived minerals that are required for the maintenance and construction of its buildings and infrastructure. The USGS is preparing an inventory of known mineral resources and is assessing the potential for undiscovered mineral resources in Massachusetts. Products will include traditional maps and digital (CD-ROM) data sets that will have widespread application. These products will assist Federal and State land-management agencies, regional planners, industry, and local governments to plan for the environmentally sound and economically viable minerals-related development.

National Mapping Program

Among the most popular and versatile products of the USGS are its 1:25,000-scale topographic maps (1 inch on the

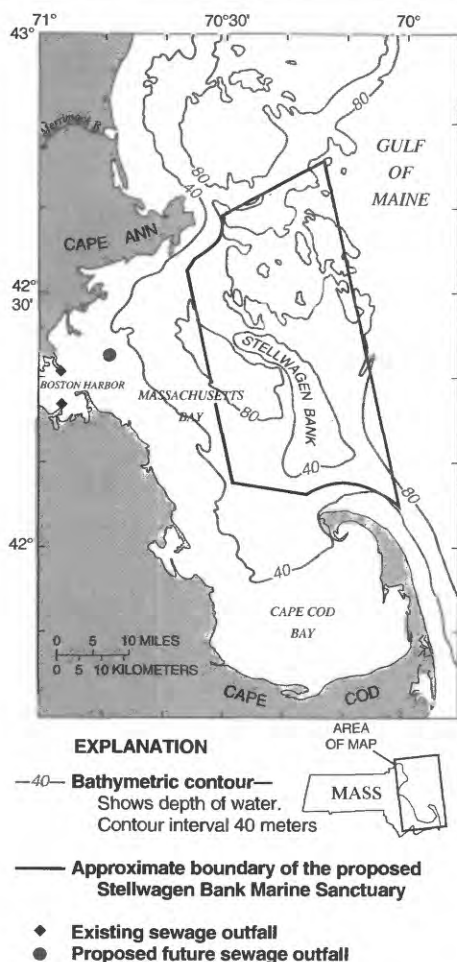


Figure 3. Massachusetts and Cape Cod Bays, showing locations of existing and proposed future sewage outfalls.

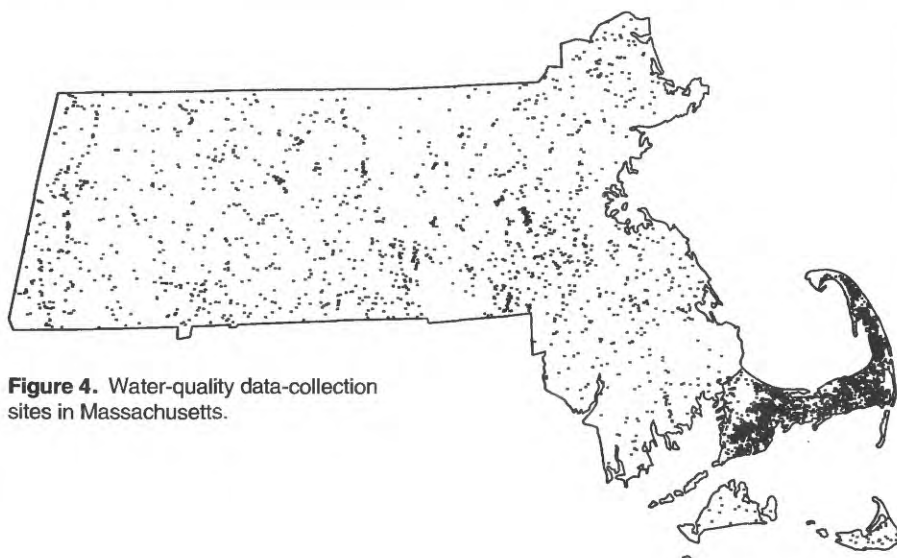


Figure 4. Water-quality data-collection sites in Massachusetts.

map represents about 2083 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. The entire State is covered by 188 maps at this scale, which is useful for civil engineering, land-use planning, natural-resource monitoring, and other technical applications. These maps have long been favorites with the general public for outdoor uses, including hiking, camping, exploring, and back-country fishing expeditions.

Earth Observation Data

Through its Earth Resources Observation Systems (EROS) Data Center near Sioux Falls, South Dakota, the USGS distributes a variety of aerial photographs and satellite image data products that cover the entire State. Mapping photographs of some areas go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscape.

Marine Research Center

The USGS conducts a wide range of geological and geophysical research and mapping investigations of the continental margins of the United States and around the world through its office in Woods Hole, Massachusetts. From this office, marine scientists carry out investigations primarily along the U.S. Atlantic Coast and in the Gulf of Mexico, the Caribbean Sea, the Great Lakes, and polar regions. These marine geologic studies are designed to identify environmental problems and geologic hazards in offshore areas and to assess critical nearshore processes that affect erosion, wetland loss, and polluted sediments. These studies also increase our understanding of the Nation's energy and mineral resources and document the past record of climate change. The long-range goals of the research and mapping efforts are to provide a comprehensive body of knowledge of the geology, history, and processes of the continental margins and to develop a predictive capability to guide and assess the consequences of the use of these margins.

Cooperative Programs

The USGS works in cooperation with local, State, and Federal agencies to assure that data collection and scientific investigations remain relevant to public needs. When local and State agencies are involved, activities typically are funded on a matching-funds basis. In addition to agencies already mentioned, the USGS cooperates with the Massachusetts Water Resources Authority, Massachusetts Metropolitan District Commission, the Cape Cod Commission, the New England Interstate Water Pollution Control Commission, the U.S. National Guard Bureau, the U.S. Army Corps of Engineers, and the U.S. Army, to name a few.

The USGS provides support to the Massachusetts Water Resources Research Center, which conducts a program of research, education, and information and technology transfer.

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Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.