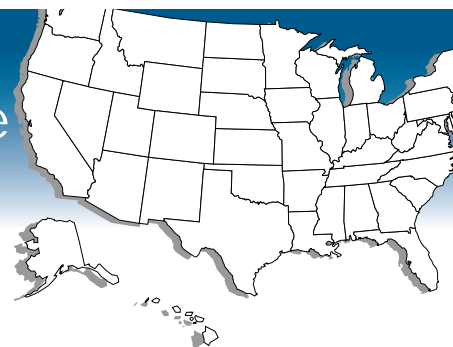




# U.S. Geological Survey Programs in New Hampshire



U.S. Department of the Interior ■ U.S. Geological Survey

For more than 100 years the U.S. Geological Survey (USGS) has been assessing, mapping, and reporting on New Hampshire's natural resources and natural hazards. Ongoing USGS programs in New Hampshire include topographic and geologic mapping, surface- and ground-water resource assessment and data collection, water-quality assessments, research on movement of water and toxic substances in aquifer systems assessment of hydrologic and geologic hazards, mineral exploration, and assessment of biologic resources. Through cooperative programs with many State and local agencies, the USGS contributes to the health, safety, and economic well being of New Hampshire's citizens.

## Topographic Mapping

Maps and digital cartographic data are used by many people for various commercial and recreational purposes. Among the most popular and versatile products of the USGS are its 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground). These maps depict 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 the terrain. New Hampshire is covered by 215 maps at this scale.

The USGS, through its National Mapping Program, fosters partnerships with State and Federal agencies to improve the effectiveness of its data-collection activities, to share resources, and to enhance the availability of timely and accurate data. The USGS and the New Hampshire Office of State Planning are involved in two cooperative projects. The first is to create digital raster graphic (DRG) files for the entire State; DRG's are scanned and digitized images of USGS topographic maps. The USGS is producing DRG's of the 1:24,000-, 1:100,000-, and

1:250,000-scale topographic map series. The final product will be available on CD-ROM. The second cooperative project is to produce digital line graphic files of topography in support of the Route 16 Transportation Initiative. The USGS also provides stable base-map materials so that USGS base maps can be reproduced easily by State agencies.

Through the Competitive Cooperative Agreements Program, the USGS and the State of New Hampshire, as well as five other New England States, have formed a national spatial data base "clearinghouse." This clearinghouse is located at the University of Massachusetts and supplies geographic and cartographic data from the States to the public through the World-Wide Web (www). Consolidated spatial data from this source will improve the services in such areas as emergency planning, environmental assessment, resource inventories, and resource-quality analyses that are provided to the residents of New Hampshire.

## Ground-Water Resources

Increases in population and development in New Hampshire have increased water-supply demands. Towns and communities are interested in developing additional ground-water supplies and in protecting existing water resources for the future. In 1984, the New Hampshire Department of Environmental Services, Water Division, entered into a long-term cooperative program with the USGS to assess the State's ground-water resources. Under this program, the USGS has identified and described the State's principal sand and gravel aquifers and is currently (1996) assessing the ground-water supply potential of the fractured-bedrock aquifers.

The areal extent, geohydrologic properties, potential water yield, and quality of water in sand and gravel aquifers are

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presented in a series of maps and reports of 13 study areas that cover the State. The location of major sand and gravel aquifers and areas of potentially high water yield are shown in figure 1.

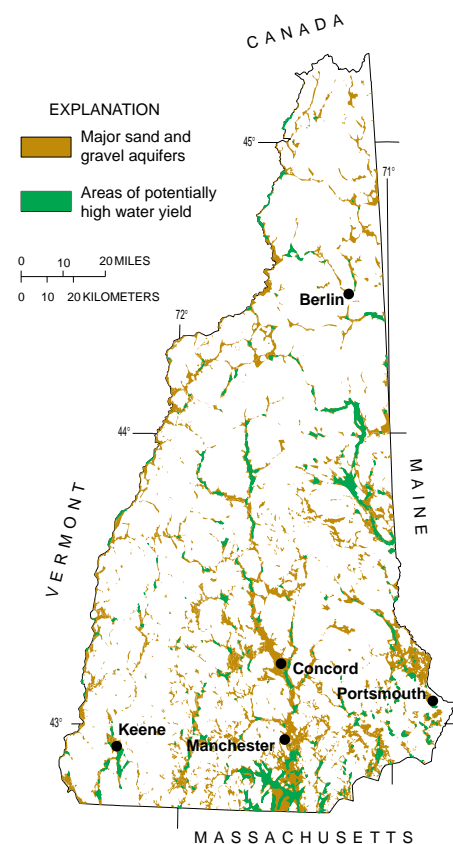


Figure 1. Location of major sand and gravel aquifers and areas of potentially high water yield in New Hampshire.

In 1995, the focus of the cooperative program shifted to an assessment of the State's fractured-bedrock aquifers. This phase of the program is designed to identify areas of potentially high water yield and to determine the quality of the water from these sources. The results of this study will provide information useful to communities and to regional and State planners in the development of water supplies and the management of programs to protect aquifers.

## Chemical Hazards

At some sites in New Hampshire, ground water contains hazardous-waste chemicals in concentrations that may threaten human health and the environment. Federal and State agencies responsible for regulating the cleanup of these sites need ground-water flow information to predict patterns of movement and the ultimate fate of contaminants.

The USGS, in cooperation with the U.S. Environmental Protection Agency, is investigating the movement of contaminants in ground- and surface-water systems and is providing technical assistance at a number of hazardous-waste sites in southern New Hampshire.

In Milford, the USGS has been studying the influence of ground-water flow on the movement of dissolved volatile organic compounds in a sand and gravel aquifer. Two municipal supply wells were closed as the result of contamination. The USGS has constructed computer models of ground-water flow to simulate various hydrologic conditions, such as recharge from precipitation, ground-water withdrawals, and streamflow. Simulations of variable hydrologic conditions and their effect on ground-water flow can assist Federal and State regulatory agencies with the management of contaminated water. An example of simulated paths of ground-water flow from a contamination source is shown in figure 2.

## Movement of Contaminants in Fractured-Bedrock Aquifers

In 1990, the USGS began research investigations of the ground-water movement in fractured bedrock at the Mirror

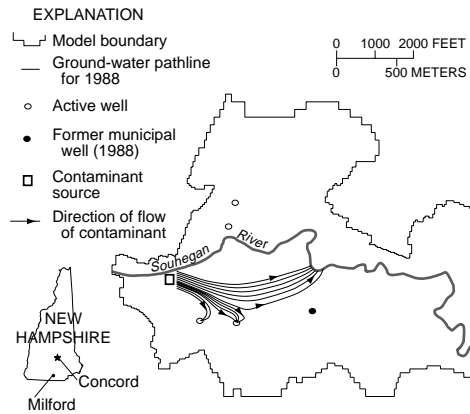


Figure 2. Paths of ground-water flow in 1988 in Milford, New Hampshire.

Lake watershed in Grafton County. This research is designed to address the Nation's need for accurate and efficient methods of evaluating the movement of contaminants in fractured-bedrock aquifers.

Because ground-water flow in bedrock is predominantly through fractures, there is a fundamental need to locate and describe fractures. Various tools that are used to describe fractures, such as bore-hole imaging cameras and an acoustic televiewer, are being tested, and the accuracy of the resulting data is being evaluated. The data collected with these tools are being used to develop a relation between the geologic characteristics of the surrounding rock and the hydraulic properties of the rock. After accurate methods are developed, the results can be used on a local scale to locate water-bearing fractures that may be capable of transporting contaminants. On a regional scale, such methods can be used to predict volumes and rates of ground-water flow. Understanding ground-water flow on a regional scale is important for planning and protecting water supplies and assessing strategies for containing and restoring contaminated ground water.

## Geologic Mapping

The USGS, in cooperation with the New Hampshire Departments of Resources and Economic Development and of Environmental Services, has produced detailed maps of surficial geology that show the distribution of sand, gravel, silt, clay, and till (unsorted sand, gravel, silt, and clay) mostly in the southern part of the State. This mapping is supported

by STATEMAP, which is an external funding opportunity of the National Cooperative Geologic Mapping Program. The program addresses a wide variety of economic and environmental issues by supporting geologic mapping projects in New Hampshire. These issues include forecasting resource management in the sand and gravel industry, ground-water management, transportation engineering, and radon distribution.

In the southern part of the State, where population growth has been rapid, overview maps of the sand and gravel resources at the 1:250,000 scale also have been produced. These maps are used extensively by State and local planning agencies and consultants to address environmental issues related to water supplies, waste disposal, construction of highways, and building development.

The USGS, in cooperation with the U.S. Department of Energy and the State of New Hampshire, has compiled a new bedrock geologic map of the State. It is being prepared for publication by the USGS and includes the bedrock geologic map at a scale of 1:250,000 and three geologic maps at a scale of 1:500,000.

## Mineral Exploration and Information

The USGS is preparing an inventory of known mineral resources in New Hampshire and is evaluating areas for undiscovered deposits of gold, silver, copper, lead, and zinc. Like many Eastern States, New Hampshire also is dependent on diminishing resources of locally derived minerals and materials that are required for the maintenance and construction of its buildings and infrastructure. The USGS is assessing the nonmetallic mineral resources of the State and providing geologic information that will assist Federal and State land management agencies, regional planners, industry, and local governments in planning for the most environmentally sound and economically viable minerals-related development.

The USGS has two mineral data bases—the Mineral Resources Data System and the Mineral Availability System, which was transferred from the Bureau of Mines—that contain information on

deposits and mineral-processing locations around the world. They are the principal tools that the USGS uses for many different types of mineral studies, which include resource assessments and the effect of abandoned mines on the environment. The data bases, which contain mineral information on about 200 sites in New Hampshire, are available to Federal and State agencies and the general public in CD-ROM format.

In 1995, New Hampshire ranked 47th in nonfuel mineral production. The leading non-fuel mineral industry, construction sand and gravel, generated \$36 million and accounted for about two-thirds of the State's production. Crushed stone, clay, and gemstones were included in the remaining one-third.

## **New Hampshire Water Quality**

In 1991, the USGS began a National Water-Quality Assessment (NAWQA) Program to describe the quality of the Nation's water resources and to identify the natural and manmade factors that affect it. The program provides information that is useful to water-resource policy-makers and managers at national, state, and local levels.

A committee of representatives from Federal, State, and local agencies; universities; and the private sector works closely with the USGS in each NAWQA study unit to exchange information on water-quality issues and to assist in designing and planning project products to meet the needs of the States and towns in each study unit.

New Hampshire is included in two NAWQA study areas. The New England Coastal Basins study area encompasses 22,900 square miles that includes central and eastern New Hampshire, western and central Maine, eastern Massachusetts, and most of Rhode Island. In New Hampshire, this area includes the drainage basins of the Merrimack, the Androscoggin, and the Saco Rivers, as well as small coastal drainage basins. The Connecticut River and Long Island Sound Coastal Rivers study area encompasses 15,750 square miles that includes western New Hampshire, eastern Vermont, west-central Massachusetts, most of Connecticut,

and small parts of New York and Rhode Island. In New Hampshire, this area includes the drainage basin of the Connecticut River. Most of the data have been collected for the Connecticut River study area, and examples of some of the findings include the following:

- Nutrient concentrations, which indicate the health of rivers, ponds, and lakes, differed among sampling locations but appeared neither excessive nor indicative of excessive levels of plant materials in water bodies. Nutrient concentrations determined for urban and agricultural sites were higher than those determined for undeveloped areas.
- The highest concentrations of pesticides were in storm runoff that follows spring applications; however, concentrations barely exceeded detection limits. Atrazine, which is a common agricultural herbicide, was detected at 7 of the 10 sites sampled. Pesticides were not detected in undeveloped areas.

## **Ecosystems**

The Biological Resources Division (formerly the National Biological Service) is participating in the Connecticut River Ecosystem Initiative, which highlights an ecosystem approach to resource management. Activities include incorporating biological data into a geographic information system, inventorying existing barriers to Atlantic salmon migrations, and mapping the distribution of fish populations. A map of the plant and animal communities in the State is being developed in cooperation with the New Hampshire Office of Special Programs, the White Mountains National Forest, and other partners.

## **Stream Stability and Erosion at Bridge Sites**

The evaluation of stream stability and erosion at bridge sites in New Hampshire contributes to the improved safety of the State's transportation system and enhances the knowledge of erosion processes at bridge settings typical of those found in the Northeast. Nationally,

the erosion of streambeds and riverbanks by floodwaters is the leading cause of failures of bridges over water.

The USGS, in cooperation with the New Hampshire Department of Transportation, is completing an evaluation of the methods used to estimate erosion potential and stream-channel stability at 48 susceptible bridge sites. The evaluation includes a detailed survey and an assessment of the hydrologic and geomorphologic settings of the bridges. It also includes an assessment of the appropriateness and accuracy of the methods, equipment, and procedures that are used to collect erosion data. The accuracy of predicted erosion compared with measured scour is being determined and alternative techniques of estimating erosion at the bridge sites are being identified.

## **Water Use**

Water resources in New Hampshire are increasingly stressed by new demands. To minimize the impact of changing patterns of water use, available supplies and current and predicted demands need to be evaluated carefully. Without adequate information, planners are not equipped to resolve critical issues related to water supply, hydropower, snow making, water quality, and the potential effects of withdrawals on ecosystems.

The USGS, in cooperation with the New Hampshire Department of Environmental Services, Water Division, is working to improve the State's water-use information. Assistance is provided to the State in the collection, analysis, and dissemination of water-use data. Work is underway to develop a statewide water-use data base that includes site-specific data and data aggregated by county and major drainage basins. These data are used to produce reports which are distributed to Federal and State agencies, educators, consultants, and other organizations or individuals concerned with water resources. A report on wastewater in New England and a map report on freshwater withdrawals and use in New Hampshire have been produced as part of this program. A graph showing total freshwater use (excluding hydroelectric instream use) in New Hampshire is shown in figure 3.

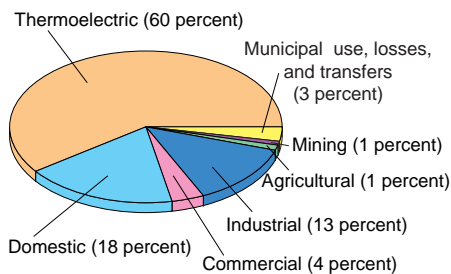


Figure 3. Total freshwater use in New Hampshire by category, in 1990.

## Water Information

The amount of water in New Hampshire's rivers, streams, lakes, and reservoirs is measured and monitored by the USGS hydrologic data-collection program. The data are used by water-resource managers and planners for forecasting floods and droughts; water-resources planning; design and operation of projects for water supply, hydroelectric power, flood control, and pollution control; designing bridges and culverts; flood warning; flood-plain management; and hydrologic research. Long-term records are needed to evaluate the responses of hydrologic systems to natural climatic variations and human-induced stresses so that potential problems can be defined early and appropriate planning and management actions can be taken by State and local agencies. Streamflow monitoring also provides baseline data on natural seasonal discharge variations of rivers and streams (fig. 4).

In New Hampshire, surface-water data are collected from a network of 57 stations. The ground-water monitoring network provides monthly water-level data at 24 wells. These networks are operated cooperatively by the USGS and the New Hampshire Department of Environmental Services, Water Division. Records are published monthly and annually. These data are used routinely by private consultants, residents, newspapers, colleges and universities, and local government agencies throughout the State.

Realtime streamflow data are available at 37 locations throughout New Hampshire by means of satellite and telephone telemetry. This information is critical for

the flood forecasting and response activities of the National Weather Service and the New Hampshire Emergency Management Agency. Telemetry data also allow State personnel to monitor drought conditions and compliance of flow-regulating projects. Realtime data from some of the stations also are available on the USGS District office www home page.

## Earth Science Information Centers

The Earth Science Information Centers (ESIC's) provide information about USGS programs, products, and technological developments to the public. The ESIC in New Hampshire was established in cooperation with the Dimond Library of the University of New Hampshire in Durham. As part of the national ESIC network, this office provides information on such topics as cartography, geography, biology, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geohydrology, aerial photography, and land use. It is supported by the USGS with reference materials, technical assistance, training and outreach activities, and access to USGS data bases.



Figure 4. A technician measures the velocity and volume of streamflow in the Lamprey River.

## For More Information

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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**

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