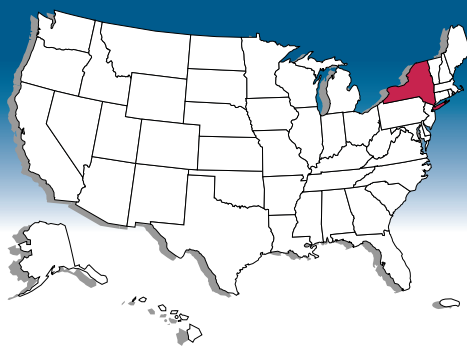
U.S. Geological Survey Programs in New York



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

The mission of the U.S. Geological Survey (USGS) is to provide geologic, topographic, hydrologic, and biological information that contributes to the wise management of the Nation's natural resources and promotes the health, safety, and well-being of the people. This information consists of maps, data bases, and descriptions and analyses of the water, biota, energy, and mineral resources; land surface; underlying geologic structure; and dynamic processes of the Earth.

Effects of Underground Mine Collapse

The USGS, in cooperation with the Livingston County Department of Health, is assessing the effects of ground-water drainage into a collapse zone of a salt mine on the regional aquifer system in the Genesee River Valley. The salt mine, which had been in operation for 109 years, supplied road salt to 14 States in the Northeast. An underground room collapsed on March 12, 1994, and an adjacent room collapsed on April 18. Two large, circular collapse features several hundred feet apart developed above them at land surface. Fractures in the rocks above the mine transmitted ground water (fig. 1) into the mine at a rate of about 18,000 gallons per minute. This dewatered the aquifers above and adjacent to the mine. Consequently, some water-supply wells have gone dry.

The USGS has provided technical expertise in the assessment of land subsidence in the area and has aided in maintaining a regional monitoring network to record the rate of water-level declines. The New York State Geological Survey installed a temporary earthquake-monitoring network to detect sudden subsidence. The USGS also is developing computer models to estimate the area affected by ground water that drains into the mine; to predict the rate, extent, and magnitude of water-level declines; to estimate the time needed for water levels in overlying aquifers to recover to equilibrium conditions when mine flooding is complete; and to determine the rate and extent of subsidence.

Protecting Water for Wells

Ground-water suppliers are implementing programs to protect recharge areas from contamination. Although some methods of delineating contributing areas to wells are inexact, more precise methods may not be cost effective. The USGS is examining which methods are best applied to different hydrologic conditions. One USGS study, in cooperation with the Suffolk County Water Authority on Long Island, showed that a simple approach of delineating circular recharge areas of unconfined aquifers gave better results than more sophisticated and expensive methods. In contrast, a USGS study in the Susquehanna River Basin, in cooperation with the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency (USEPA), showed that ground-water flow modeling might be needed where the wells are close to rivers and streams. A third USGS study showed contributing areas to wells screened in confined aquifers, such as areas of the Magothy aquifer on Long Island, are large and diffuse, which results in increased ground-water traveltimes and reduces the significance of a parcel of land in protecting a deep well.

Index of Subjects

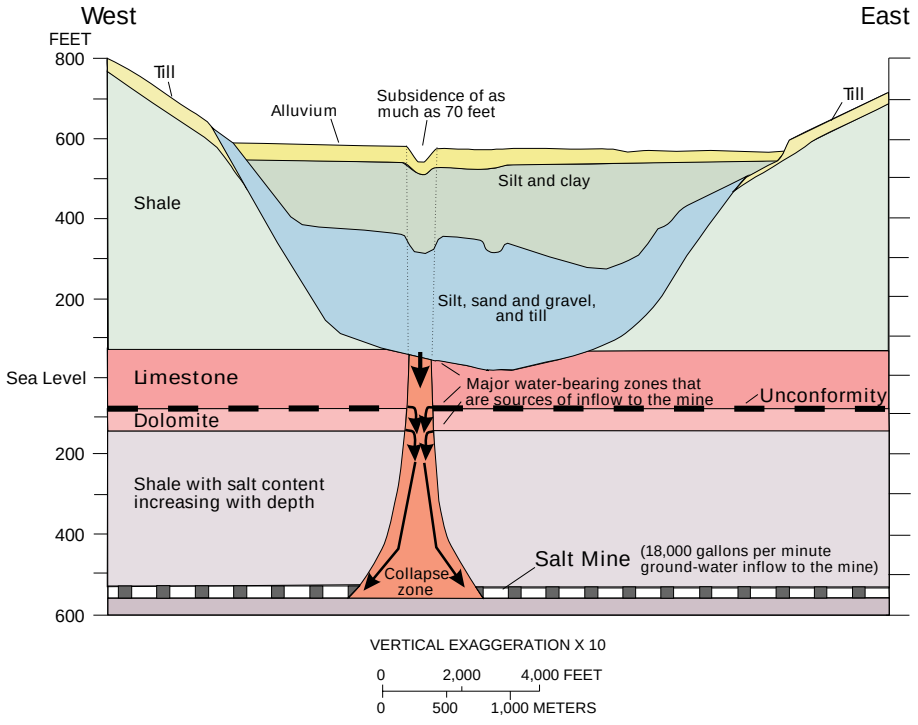


Figure 1. Conceptual hydrologic framework near a salt mine in the Genesee River Valley.

Constructed Wetlands

Nearly all landfills in humid areas produce leachate, which is the liquid created when rainwater percolates through the layers of waste in a landfill, and this leachate can contaminate ground and surface waters. Modern landfills have bottom liners that catch the leachate and funnel it to collection tanks. Ideally, leachate is processed on-site to minimize the cost and risks of transporting it to a distant processor. The USGS, in cooperation with Monroe County and the New York State Energy Research and Development Authority, is investigating the use of constructed (artificial) wetlands as a passive, inexpensive on-site method to treat landfill leachate (fig. 2). This approach could significantly reduce the cost of solid-waste management while reducing the threat to the landfill's surroundings.

Fish Restoration

The USGS Biological Resources Division (formerly the National Biological Service) conducts research and provides scientific data needed for sustained economic benefits from and conservation of New York's terrestrial and aquatic ecosystems. The Lake Ontario Biological Station, Great Lakes Science Center, provides the critical information needed by resource managers to restore native lake trout populations to Lake Ontario. Lake trout disappeared from Lake Ontario in the mid-1900's. Stocking the lake with hatchery-reared fish began in the 1970's. Studies are identifying the trout most likely to reproduce and evaluating the effectiveness of sea lamprey control; this exotic species is a major source of lake trout mortality. Success has been demonstrated by the recent captures of juvenile lake trout produced by mature hatchery fish that spawned in the Lake.

Economically important sport fishing for hatchery-reared trout and salmon in Lake Ontario depends heavily on the productivity of forage fish populations, which serve as food for the sport fish species. USGS biologists focus on the population dynamics of alewives, rainbow smelt, and slimy sculpins, which are the key forage species in the Lake. Studies emphasize how changes in stocking rates and exotic species affect forage fish populations.

Additional USGS studies include investigating fish losses in Lake Ontario to predation by double-crested cormorants, evaluating the effects of zebra mussels on native mussel populations, and providing data that can be used to develop control strategies for zebra mussels.

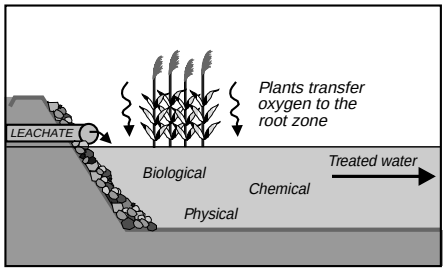


Figure 2. Contaminant removal processes in a constructed wetland.

Natural Gas

A large, continuous-type natural gas accumulation may exist in ancient rocks in part of the Appalachian Basin in western New York and nearby States. These sandstone gas reservoirs in the proposed continuous-type accumulation are deeper and less permeable, contain less formation water, and yield smaller quantities of gas per well than gas reservoirs in discrete-type accumulations. However, the reservoirs in the continuous-type accumulation are assumed to be saturated with gas and nearly all wells drilled into them are expected to be productive after hydrofracturing. The 1995 USGS National Assessment of U.S. Oil and Gas Resources indicates that many trillions of cubic feet of gas may be recoverable from the accumulation. Recognizing the great potential for this energy resource, USGS scientists have begun a multiyear investigation in New York and adjoining States to define the nature, size, and origin of the accumulation.

Water Resources

The USGS is cooperating with the Nassau County Department of Public Works to delineate the subsurface hydrogeology and the extent of saltwater intrusion along the northern shore of Long Island, which includes the Great Neck Peninsula. Ground water is the sole source of drinking water for the Peninsula, and four distinct wedge-shaped areas of saltwater intrusion have been identified in Great Neck. These data provide water-resource managers with better definition of the area's complex hydrogeologic framework and the extent of saltwater intrusion. The data may be used to develop water-supply pumping plans to minimize pumping stresses and to prevent further intrusion of saltwater.

Drought

The 1995 drought in the Northeastern United States adversely affected water suppliers throughout much of southern and eastern New York. Hard hit were water suppliers that use the lower Hudson River as their water source. The lower Hudson River between Albany and New York City is a tidal estuary (fig. 3). Freshwater flows into the estuary from the Hudson River north of Albany and from smaller rivers, and saltwater ebbs and flows into the estuary from the south with the tidal cycle. The location of the interface between fresh and salty water (salt front) is controlled by the quantity of freshwater discharged into the estuary and the magnitude of ocean tides. Monthly mean flows of the Hudson River near Albany in July and August 1995 were the third lowest in the last 50 years; only flows during the drought in 1964 and 1965 were lower. The reduced freshwater inflow to the

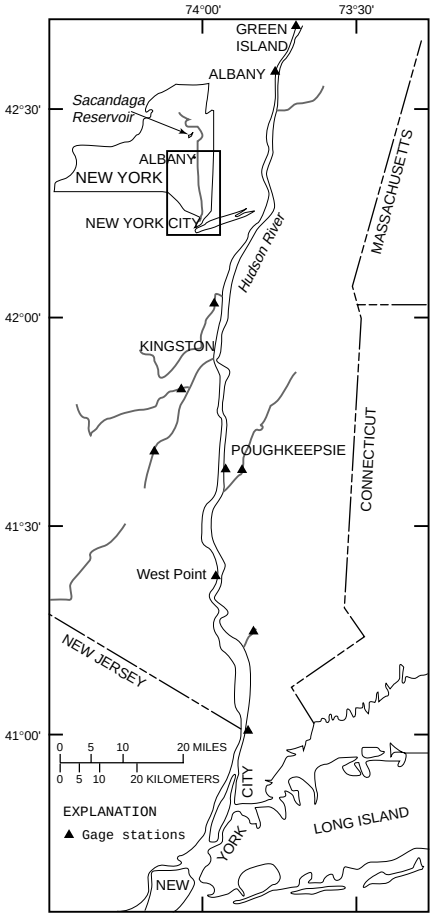


Figure 3. Location of the Hudson River salt-front study area.

Hudson River Estuary allowed the salt front to move as far upriver as the city of Poughkeepsie, which uses the Hudson River for water supply. The USGS has monitored salt-front locations and streamflow in the Hudson River since 1989. During the 1995 drought, the USGS worked with the New York State Department of Health (NYSDOH) to predict water releases from the Sacandaga Reservoir that would prevent further upstream movement of the salt front while minimizing adverse effects on the Reservoir. These releases were successful in preventing further upstream movement of the salt front. The USGS, in cooperation with NYSDOH, made 30 measurements of the salt-front location in the Hudson River under drought conditions in 1995 that will improve the accuracy of predictions during future droughts.

Watershed Geochemistry

The USGS, in cooperation with the New York City Department of Environmental Protection, is identifying the processes that control the chemical quality of streams and rivers in the Catskill Mountains that are tributary to the New York City reservoir system. Atmospheric deposition of nitrate is greater in the Catskill region than anywhere else in the Northeast. Nitric acid from precipitation increases the nitrate concentration in streams during storms and snowmelt, causes acidification in streams, and increases inorganic aluminum concentrations to levels that are toxic to fish. High nitrate concentrations in streams could cause New York City water-resource managers to consider stricter requirements on discharges from farms, sewage-treatment plants, and other sources of nitrogen within Catskill basins. One USGS study focuses on the mechanisms by which nitrate in soil and ground water is transported to streams and reservoirs in the Catskill Mountains and the effects of different logging practices on nitrogen uptake and release in soil. Information on nitrogen processes and movement will help define the transport of aluminum and nitrate and how management of forests in reservoir basins can help control nitrate concentrations in surface water.

Calcium concentrations have decreased in forest soils in the Northeast since the onset of acid deposition. Depletion of calcium, which is an essential nutrient for tree growth, is linked to growth decline and dieback of red spruce trees, which is occurring throughout the Northeast. A major advance in knowledge of how acidic deposition reduces calcium concentrations in soil occurred recently in a study by a USGS scientist, who was working in collaboration with scientists from the U.S. Forest Service, the University of Illinois, and Yale University. Results indicate that acid deposition is increasing aluminum concentrations in the forest floor and that displacement of calcium by aluminum on soil ion-exchange sites is reducing the storage of calcium in soil. This reduction in the soil's ability to store calcium in a form available to roots will make restoration of calcium in soil difficult even if acid deposition is decreased.

Outreach

In New York, the USGS has been experimenting with new methods to reach out and inform the educational community and the public of the information resources that the USGS provides. The USGS District Office in Troy held an open house in fall 1995 with 12 technical demonstrations and more than 20 poster presentations. Tours were given to more than 160 junior high and high school students. The USGS participates in the Hudson River Watch, which is a program for middle and high school students in which they monitor stream-water quality near their schools, by providing some funding and technical advice and demonstrating sampling procedures. This program, which is coordinated by River Watch Network, Inc., includes 21 schools throughout much of the Hudson River Basin and has been extremely successful.

The USGS also is funding the efforts of an educator from the Frost Valley YMCA to create an earth science curriculum by using USGS materials and to distribute this curriculum to other YMCA's nationwide. The USGS is creating an Earth Science Resource Center at Hudson Valley Community College from which earth science teachers can borrow teaching aids, such as rock collections, hydrologic models, and instruments. Workshops are held to familiarize teachers with the resources available. The USGS created the Hudson River National Water-Quality Assessment Program Liaison Committee to improve communication and coordination of the Hudson River assessment with other government officials, researchers, and the public. A streamflow data base is available on the Internet to provide current streamflow data for the public and water professionals at:
http://wwwdnyalb.er.usgs.gov/htmls/pub/info.html

The Earth Science Information Center (ESIC) in Albany was established under a cooperative agreement between the USGS and the New York State Department of Transportation Map Information Unit. As part of the national ESIC network, this office provides information on such earth science topics as cartography, geography, 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.

Teaming Up With New York

A single agency can not provide all the personnel, expertise, or financial resources needed to understand natural resources and the factors that influence them—a team approach is needed. The products of USGS projects are generally the result of the cumulative efforts of many agencies and individuals working independently and together to advance the understanding of natural resources.

For example, the USGS communicates frequently with the New York State Geological Survey (NYSGS) and relies on its maps, data, and interpretations. As part of this cooperation, the NYSGS is working with the USGS's Mineral Resource Surveys Program to refine information on the location and types of mineral deposits in New York and to develop new approaches to working and evaluating these mineral resources. The NYSGS maps surficial and bedrock geology, compiles mapping done by others, and issues surficial and bedrock geology maps at various scales. In New York State, the USGS Detailed Aquifer Mapping Project has made extensive use of surficial and bedrock geologic maps provided by the NYSGS. Some of these maps are based partly on records collected by the USGS, and the USGS has provided part of the funding for some of these efforts. Currently, the NYSGS is mapping the South Onondaga, Tully, and Otisco quadrangles in Tulley Valley; this is a geologically active area in central New York State in which mudboils occur and where the largest landslide in New York in the last 75 years destroyed several houses in 1993. The NYSGS is receiving some USGS funding from the STATEMAP component of the National Cooperative Geologic Mapping Program for this work and geologic mapping in the Mt. Kisco quadrangle in Westchester County.

Mapping

The use of maps and digital cartographic data is widespread, and needs for this information are expanding rapidly. The USGS, through its National Mapping Program, strives to ensure the availability of map information in graphic and digital forms to the general public through timely and effective data-collection and revision procedures. 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. New York encompasses 1,018 quadrangles mapped at this scale. These maps have long been favorites with both the general public for outdoor uses, as well as scientists and engineers for technical applications.

As the lead agency for the National Aerial Photography Program (NAPP), the USGS is cooperating with the USEPA to complete statewide color infrared aerial photography coverage. The NAPP photographs are used to support many environmental, land, and resource-management applications and also are used to prepare digital orthophotoquads (DOQ's). Planning is underway to use this photography to produce color infrared DOQ's statewide. The agencies planning the DOQ project with the USGS are the NYSDEC, the U.S. Army Corps of Engineers (USACE), the USEPA, the National Park Service, and the U.S. Department of Agriculture, Natural Resources Conservation Service.

Marine Environment

The New York–New Jersey metropolitan area is the most populated coastal region in the United States. The harbor estuary and offshore area are used for waste disposal, transportation, recreation, and commercial fishing. Bottom sediments in some areas have become contaminated as a result of these activities over the last century, and environmentally acceptable areas for disposal of dredged material from the harbor now need to be identified. The USGS is conducting a long-term multidisciplinary study to map the distribution of contaminated sediments in the New York–New Jersey region (fig. 4) and to develop a predictive capability for the transport and long-term fate of sediments and contaminants. Federal, State, and local agencies need this regional analysis of the sea-floor geology for the management and wise use of the ocean near coastal areas, and scientists need the information to plan and conduct research and monitoring. The study is being conducted cooperatively with scientists at the Woods Hole Oceanographic Institution, Rutgers Institute for Coastal and Marine Science, the National Marine Fisheries Service, and the USACE.

Long Island Sound is a major estuary in a heavily urban area adjacent to New York Harbor. Sewage, wastes, and chemicals enter the Sound from direct-waste discharges, river runoff, and the atmosphere and cause widespread contamination of bottom sediments and loss of habitat for bottom-dwelling (benthic) organisms. The USGS, in cooperation with the USEPA, has initiated a multidisciplinary basinwide program to document the sea-floor processes that control the distribution of benthic habitats and sediment-related contaminants. The program, which uses unique USGS capabilities in sea-floor imaging, contaminant-transport modeling, and geochemical sampling, is basic to a wide range of environmental issues for Long Island Sound, which, in turn, affect millions of people who use the Sound each year for recreation and commerce.

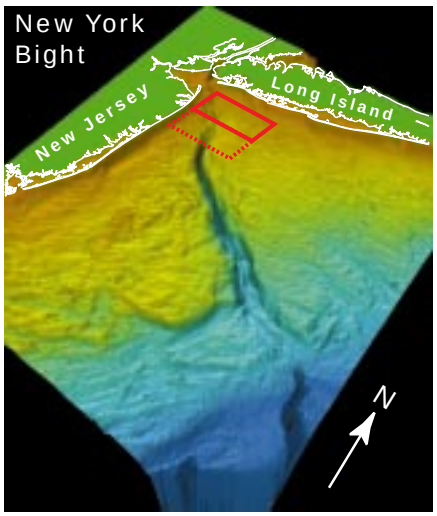


Figure 4. Sea-floor topology of the New York Bight. Red boxes show the area surveyed in 1995 (solid) and 1996 (dashed).

For More Information

USGS state representative
425 Jordan Road
Troy, NY 12180
(518) 285-5600
Fax:(518) 285-5601
Email: dc_ny@usgs.gov

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.

U.S. Geological Survey
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