

# United States Geological Survey

## Programs in New Jersey



*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.*

Information provided by the U.S. Geological Survey (USGS) is the starting point for many scientific investigations, construction projects, and recreational activities. In 1994, USGS personnel in New Jersey responded to more than 1,000 requests for information from businesses, government agencies, and the public.

### Water Use

The USGS, in cooperation with the New Jersey Department of Environmental Protection, has created a statewide water-use data base. Developers and government agencies use the data base as a basis for effective decisionmaking regarding the use of the State's water resources.

### Water Supply

New Jersey's water resources are constantly being strained by the competing needs of the growing population, agriculture, industry, and recreation. During 1989–90, statewide use of surface and ground waters averaged 1,680 and 561 million gallons per day, respectively.

The USGS, in cooperation with the New Jersey Department of Environmental Protection (NJDEP), is addressing current water-supply problems and future water needs by means of a three-phase program. First, data are collected to document water availability and to assess the scope of the problem. Next, maps, tables, and graphs are prepared to allow USGS scientists to identify causes of shortages. And third, computer models are developed to simulate surface- and ground-water-flow conditions and to predict the feasibility and effects of various water-use alternatives for the future. This information is available to water managers and others who must ensure the continued availability of an adequate supply of water into the 21st century.

### Maintaining Adequate Streamflow

The USGS is addressing increasing concern about reduction of flow in streams as a result of urbanization, the operation of regional wastewater-treatment facilities, stream-channel alterations, ground-water pumpage, and interbasin transfers of surface water. Because decreasing streamflow can adversely affect the availability and quality of water and the ecology of streams, the NJDEP has set minimum passing-flow requirements for critical streams. By means of its network of streamflow-gaging stations, the USGS provides the NJDEP with the information needed to determine whether these minimums are being maintained.

### Valley-Fill and Fractured-Rock Aquifer Studies

Many USGS water-supply studies have focused on fast-growing areas of northern New Jersey. Intensive water-resource assessments were conducted in the Ramapo River Basin in Bergen County and the Rockaway River, the Lamington River, and the Green Pond Brook Basins in Morris and Hunterdon Counties (fig. 1), where valley-fill aquifers and surface water are used extensively for water supply. The USGS also conducted an intensive study of the water resources in parts of Mercer, Hunterdon, and Somerset Counties, where fractured-rock aquifers are the primary source of supply (fig. 1). This study provided new information regarding the geologic features that control ground-water flow in this area. This information will facilitate effective management of water resources in this and other similar areas throughout the Eastern United States.

### Coastal Plain Aquifer Studies

Ground-water withdrawals from the Coastal Plain aquifers of southern New Jersey have increased steadily since 1900, lowering water levels by more than 200 feet in

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some areas. Every 5 years, the USGS, in cooperation with the NJDEP, measures

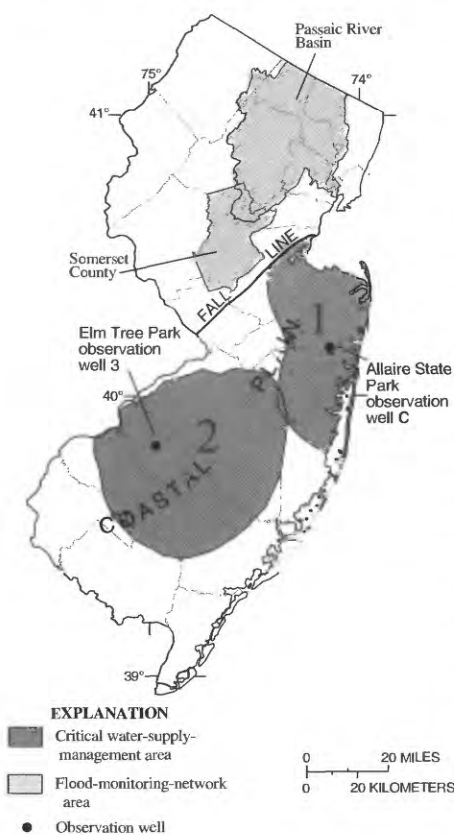


**Figure 1.** Location of valley-fill, fractured-rock, and surficial-aquifer study areas in New Jersey.

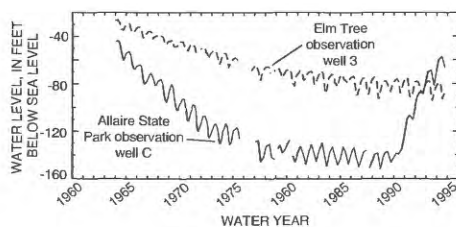
water levels in more than 1,000 wells in the Coastal Plain over a 2-month period to prepare a "snapshot" of ground-water conditions. In 1985–86, the NJDEP used these water levels to identify two "Critical Water-Supply Management Areas"—areas where the ability of an aquifer to meet future water demand is compromised—and mandated studies to find new sources of water in these areas (fig. 2).

In 1983, water levels in all four aquifers underlying Critical Water-Supply Management Area 1 were below sea level as a result of ground-water withdrawals. Results of a USGS study showed that even if pumpage were reduced by 50 percent after 1990, water levels would still be below sea level in 2010. The Manasquan Reservoir was built in 1989 as a supplemental source of water. Previously, the water level in a representative well in this area (Allaire State Park observation well C) had declined 107 feet (fig. 3). After the reservoir began supplying water and ground-water pumpage decreased, the water level in the observation well rose 93 feet.

In Critical Water-Supply Management Area 2, pumping from the Potomac—



**Figure 2.** Location of flood-warning-network areas, Critical Water-Supply Management Areas, and two observation wells in New Jersey.



**Figure 3.** Water levels in Elm Tree observation well 3 and Allaire State Park observation well C in southern New Jersey.

Raritan–Magothy aquifer system has caused the water level in a representative well (Elm Tree observation well 3) to decline 50 feet since 1968 (fig. 3). The USGS and the NJDEP are currently (1995) evaluating the availability of water from other aquifers in this area.

Surficial aquifer systems are being considered as potential alternative sources of water supply throughout southern New Jersey. The USGS, in cooperation with the NJDEP, is evaluating the water-supply potential of surficial aquifers in drainage basins defined as "regional planning areas" by the NJDEP. Studies have been completed in three areas, and studies of four additional areas are underway (fig. 1).

## Assessment of Mineral-Resource Potential

New Jersey is dependent on diminishing resources of locally derived materials that are required for the maintenance and construction of its buildings and infrastructure. In addition, new geologic data indicate potential for previously unexplored mineral deposits. As part of its regional work, the USGS is preparing an inventory of known mineral resources in New Jersey and is making an assessment of the potential for undiscovered mineral resources. This work involves compilation of digital geological, geophysical, geochemical, and mineral-deposit data. This will assist Federal and State land-management agencies, regional planners, industry, and local governments to plan for the most environmentally sound and economically viable minerals-related development.

## Flooding

The USGS conducts and participates in several programs that provide information that helps protect the lives and property of New Jersey residents from flooding. The Passaic River and its tributaries have flooded 22 times since 1810. In April 1984, the most devastating flood in

recent years claimed three lives, caused \$335 million in damages, and forced about 9,400 people from their homes. The USGS operates streamflow-gaging stations throughout the Passaic River Basin (fig. 2) that provide data to emergency-management officials. This information is provided on a realtime basis by satellite communication and is an integral link in the Passaic Flood Warning System.

Urbanization in Somerset County (fig. 2) has increased the frequency of flooding in small streams. To help predict these floods, the USGS, in cooperation with Somerset County, has installed rain and streamflow gages that transmit data to the county and the National Weather Service office by way of a radio network. When stream levels approach flooding conditions, communities in the affected areas can be warned immediately. The USGS is (1995) developing a similar monitoring system for shore communities where powerful coastal storms can cause damaging floods.

Throughout the State, the USGS provides flood data to floodplain-management and transportation officials, consulting engineers, and the general public. This information is critical for making zoning and land-use decisions that seek to minimize flood damage and to optimize the design of roads, highway culverts, and bridges.

## Water Quality

Water quality has long been an important issue to New Jersey residents. As part of the USGS National Water-Quality Assessment Program, USGS hydrologists in New Jersey are assessing the quality of surface and ground waters in the State's coastal drainages. In New Jersey, the program will focus on the effect of land use on shallow-ground-water quality, spatial and temporal trends in ground-water quality, vulnerability of wells to contamination, toxic materials in surface water, stormwater quality, and the effects of interbasin transfers of surface water on water quality. A USGS data base that contains historical results of chemical analyses of water samples collected at 4,774 surface- and ground-water sites (fig. 4) is the starting point for this and many other investigations.

In nearly every part of the State, some type of contaminant poses a serious hazard to the quality of the water supply. The USGS is addressing many of these hazards through several programs and stud-





**Figure 4.** Historical water-quality data-collection sites in New Jersey.

ies. The quality of ground and surface waters can be affected by contaminants from point sources, such as those from wastewater-treatment facilities, landfills, leaking underground storage tanks, and spill sites; contaminants from nonpoint sources, such as pesticides and fertilizers, whose use is widespread over a large area; and contaminants, such as radon, corrosive water, and saltwater, that are found naturally over large areas. The USGS, in cooperation with the NJDEP, is developing a new method to determine which of the State's watersheds are most heavily affected by point and nonpoint sources of contamination. By using the new method, State, county, and local water-resource managers will be able to identify and prioritize areas in which detailed water-quality investigations are needed and to focus on contaminants of concern.

### **Point-Source Contamination**

Contamination of ground and surface water with toxic chemicals is a major problem in New Jersey, as evidenced by the more than 600 contaminated sites identified by the NJDEP. As part of its national research program, the USGS is developing innovative methods to remediate water contaminated with toxic chemicals.

The USGS maintains two research sites in New Jersey—a gasoline-spill site in Atlantic County and the site of a chlorinated-solvent leak in Morris County. The

objectives of research at these sites are to characterize the natural hydrologic, chemical, and microbial processes that control the dispersal and persistence of these chemicals in the subsurface; to evaluate the potential for natural processes to clean up the contamination; and to develop economic methods that can be used to clean up similar sites.

### **Nonpoint-Source Contamination**

Pesticides from agricultural land, which covers about 20 percent of the State, have been detected in ground and surface waters in New Jersey. The USGS, in cooperation with the NJDEP, identified areas where the water is most vulnerable to pesticide contamination. The NJDEP subsequently used this information to develop a program to monitor the presence of pesticides in drinking water.

Elevated concentrations of naturally occurring radon, uranium, and radium have been detected in ground water in parts of New Jersey. The USGS, in cooperation with the NJDEP, has conducted studies to describe the geologic settings in which these substances that pose a hazard to public health are most likely to be found and how these contaminants move through the ground-water system. This information can be used to avoid siting wells in those areas where ground water is most likely to contain radioactive contaminants.

Ground-water withdrawals in coastal areas have resulted in the landward movement of salty ground water into aquifers that are heavily used for water supply. As a result, more than 120 wells in Cape May County alone have been abandoned since 1940. The USGS, in cooperation with Lower Township and the cities of Cape May and Wildwood, developed a ground-water-flow model that can be used to estimate the movement of saltwater in coastal areas under various hypothetical ground-water-withdrawal schemes. The estimates help water managers decide how best to distribute future withdrawals to minimize additional saltwater intrusion.

### **Marine Environment of the New York Bight**

The New Jersey–New York metropolitan area is the most populated coastal region in the United States. The estuary and offshore area are used for transportation, recreation, commercial fishing, and waste disposal. As a result of these activities, bottom sediments in some areas of

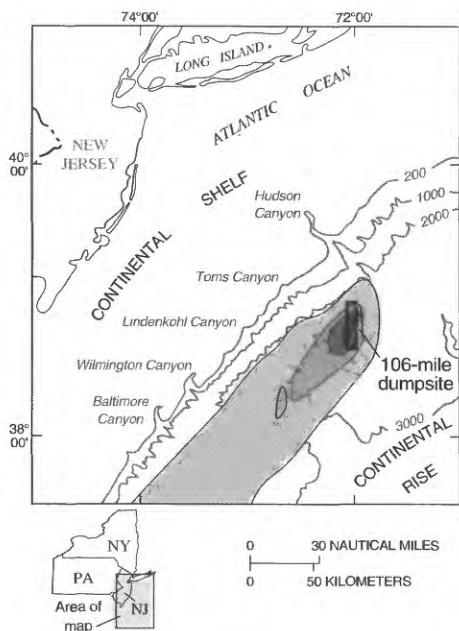
the estuary are contaminated. The USGS is conducting a 5-year multidisciplinary study to map the distribution of contaminants and to predict the long-term transport and fate of sediments and contaminants. This information is needed by the U.S. Environmental Protection Agency, the National Marine Fisheries Service, the U.S. Army Corps of Engineers, and the Port Authority of New York and New Jersey to optimize management and use of the coastal ocean. This project is conducted cooperatively with the Woods Hole Oceanographic Institution, the Institute of Marine and Coastal Sciences at Rutgers University, and the National Marine Fisheries Service.

### **Deep-Water Dumpsite 106**

Sewage sludge from the New Jersey–New York metropolitan area was discharged at a site 106 miles from the New Jersey coast from 1986 through 1992. The history of this sludge-discharge practice provides a unique opportunity to document the long-term fate and effects of these wastes and the recovery of deep-sea habitats after sludge discharges ceased. As part of a multidisciplinary program conducted in cooperation with the National Oceanic and Atmospheric Administration's Undersea Research Program and investigators at academic institutions, the USGS is monitoring contaminant levels in the sediments for comparison with predicted deposition. Study results show that sludge particles accumulate southwest of the discharge area (fig. 5). This information is needed by multinational water-management officials and agencies to resolve international concerns about sludge-disposal practices and to determine future policy about wastes in the world's oceans.

### **Hydrologic Data Collection**

The USGS collects, stores, and disseminates streamflow, ground-water-level, and water-quality data from statewide networks. Streamflow data are used by water- and emergency-management authorities and regulatory agencies to forecast floods, to manage reservoirs, and to ensure compliance with legal minimum streamflow requirements. Water-quality data are used by the New Jersey Department of Environmental Protection in the enforcement of the New Jersey Water Quality Planning Act and the Clean Water Act. These Acts are aimed at ensuring the continued availability of safe drinking-



#### EXPLANATION

—200— Bathymetric contour—Shows depth of water.  
Contour interval, in meters, is variable

Flux of sludge particles onto the seafloor,  
in milligrams per square meter per day

- Equal to or greater than 1
- Equal to or greater than 25
- Greater than 41
- Equal to or greater than 57

**Figure 5.** Predicted deposition rate of sludge particles on the seafloor off the New Jersey Shore near the 106-mile dumpsite.

water supplies and lakes and streams that are safe for swimming and fishing. The networks consist of 231 streamflow-measurement sites, 222 ground-water-level-measurement sites, 94 surface-water-quality sites, and 49 ground-water-quality sites. All data are available to the public in hardcopy or digital form.

## 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.

## National Mapping Program

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 depict the elevation and shape of the terrain. New Jersey is covered by 175 maps at this scale, which is useful for civil engineering projects, 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.

## Geologic Mapping

Geologic maps produced by the USGS are widely used by engineers, builders, planners, and well drillers. Together with

the New Jersey Geological Survey, the USGS remapped the geologic features of New Jersey at the scale of 1:100,000. The information shown on these maps will greatly enhance their usefulness in solving environmental problems, addressing land-use issues, selecting well locations, and planning well construction.

## Earth Observation Data

Aerial photographs and satellite images of New Jersey are distributed by the USGS through its Earth Resources Observation Systems Data Center near Sioux Falls, South Dakota. Aerial photographs of some areas go back about 40 years. Satellite images dating from 1972 can be used to study changes in regional landscapes.

## Cooperative Programs

The USGS cooperates with more than 25 Federal, State, and local agencies in New Jersey to provide information on water availability, quality, and quantity. Cooperators include the New Jersey Department of Environmental Protection, the New Jersey Department of Transportation, the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, and the U.S. Army. Cooperative activities include data collection, interpretive studies, and research. Cooperative activities that involve State and local agencies typically are funded on a matching-funds basis.

The USGS also provides support to the New Jersey Water Resources Research Institute. The institute 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.

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