



# U.S. Geological Survey Programs in New Jersey

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



The U.S. Geological Survey (USGS) has been assessing and monitoring the natural resources and natural hazards of New Jersey for more than a century. Through cooperative programs with more than 25 Federal, State, and local agencies, the USGS studies water supply, water quality, floods and droughts, and many other natural-resource issues throughout the State. USGS information is the starting point for many scientific investigations, construction projects, and recreational activities. In 1996, USGS personnel in New Jersey responded to more than 1,000 information requests from businesses, government agencies, and the public.

## Water Supply

New Jersey's water resources are constantly 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 with a three-phase program. First, field-work data are collected to document current conditions and to assess the scope of any potential problem. Next, maps, tables, and graphs are prepared to identify available resources and possible problems. And third, computer models are developed to simulate surface- and ground-water flow and to predict the feasibility and effects of water-use alternatives for the future. This information is available to water managers and others who must ensure an adequate supply of water into the next century.

## Maintaining Adequate Streamflow

The USGS is addressing increasing concern about reduced streamflow as a result of urbanization, regional wastewater-treatment facility operation, stream-channel alterations, ground-water pumpage, and interbasin surface-water transfers. Because

decreasing streamflow can adversely affect water availability and quality and stream ecology, the NJDEP has set minimum passing-flow requirements for critical streams. Through its streamflow-gaging station network, the USGS provides the NJDEP with the information needed to determine if these minimums are being maintained.

## 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, Lamington River, and 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 ground-water-flow model developed for the ground-water-resource assessment in the Lamington River Basin was later used to delineate the areas that

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contribute recharge to water-supply wells. This information may be used by local governments to explore the development of new zoning regulations to protect ground-water supplies from surface contamination.

The USGS also studied 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 about the geologic features that control ground-water flow in this area. This information may be used by water-resources managers in this and similar areas throughout the Eastern United States.

Ground-water withdrawals from aquifers in the Coastal Plain of southern New Jersey have increased steadily since 1900, lowering water levels by more than 200 feet in some areas. Every 5 years, the USGS, in cooperation with the NJDEP, measures water levels in more than 1,000 Coastal Plain wells during a 2-month period to prepare a “snapshot” of ground-water conditions. In 1985–86, the NJDEP used these measurements 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

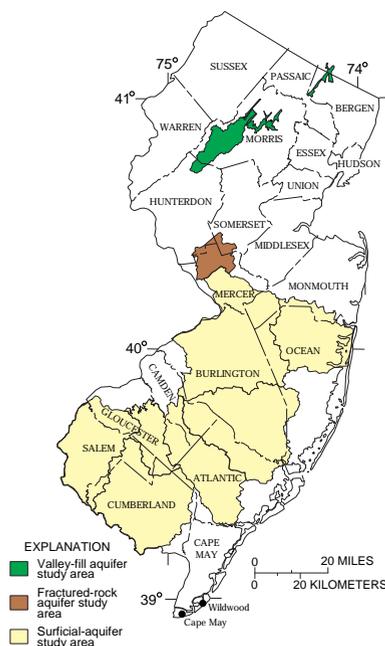


Figure 1. Location of aquifer study areas.

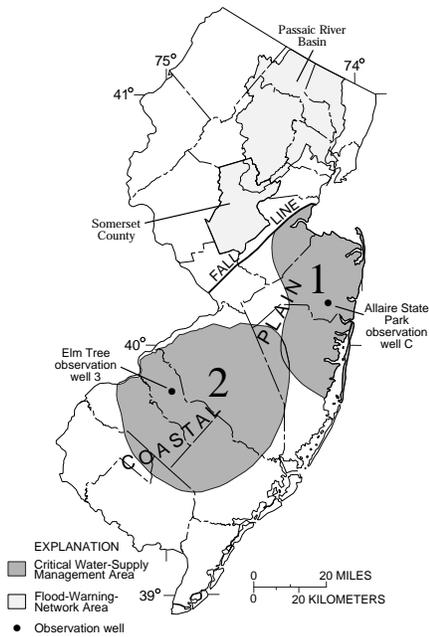


Figure 2. Location of Critical Water-Supply Management Areas, flood-warning network areas, and two observation wells.

of ground-water withdrawals, thus causing salty water to flow toward the aquifers. 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 (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–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 evaluating the availability of water from other aquifers in this area.

Surficial aquifers are being considered as potential alternative sources of water supply throughout southern New Jersey. The USGS,

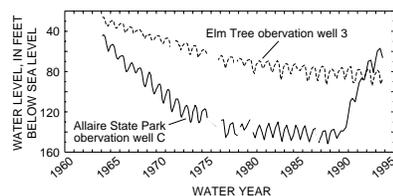


Figure 3. Water levels in Elm Tree observation well 3 and Allaire State Park observation well C.

in cooperation with the NJDEP, is evaluating the water-supply potential of surficial aquifers in drainage basins defined as “regional planning areas.” Studies have been completed in four areas, and three additional areas are being studied (fig. 1).

## Floods and Droughts

The USGS participates in several programs that provide information that helps protect the lives and property of New Jersey residents from flooding. The Passaic River Basin is one of the most flood-prone river basins in the country. The April 1984 flood in the Passaic Basin claimed three lives, caused \$335 million in damages, and forced about 9,400 people from their homes. The USGS operates 18 streamflow-gaging stations throughout the Passaic River Basin (fig. 2) that provide data to emergency-management officials. This information is provided on a real-time basis by satellite, radio, and telephone communication and is an integral part of the Passaic Flood-Warning System. These streamflow data and data from 14 other gages throughout the State also are available hourly on the USGS New Jersey District “home page” at:

[http://www.nj.er.usgs.gov/rt-cgi/gen\\_tbl\\_pg](http://www.nj.er.usgs.gov/rt-cgi/gen_tbl_pg)

The USGS, in cooperation with Somerset County (fig. 2), has installed rainfall and streamflow gages that transmit data to the County and the National Weather Service over a radio network. The USGS is (1997) overseeing the installation of the New Jersey Tide Telemetry System to monitor tide levels at 25 sites on back bays to provide information needed for effective evacuation of shore communities during powerful coastal storms. Data collected by the various flood-warning telemetry systems is shared over a radio system with more than a dozen Federal, State, and county agencies.

The USGS has collected flood data throughout the State since 1902. These data are furnished to floodplain-management and transportation officials, consulting engineers, and the general public. This information is needed for making zoning and land-use decisions that seek to minimize flood damage and to optimize the design of roads, highway culverts, and bridges.

Knowledge of drought magnitude and frequency is important for water managers, regulators, engineers, and planners. Since 1959, the USGS has collected streamflow data under base-flow conditions at many sites in addition to the long-term streamflow-gaging stations. These measurements, made at more than 350 sites throughout the State, are used to improve the accuracy of

estimates of the low-flow characteristics of streams at or near those sites. These estimates are used to set effluent limits for point-source discharges, such as sewage-treatment plants, and to set minimum passing-flow requirements for surface-water-supply diversions to protect streamwater quality and stream ecology.

The flood-warning telemetry systems discussed above are also used to manage surface-water supplies during normal and drought conditions to help maintain mandated streamflows and to assess the severity of drought conditions. A computer simulation model of the Raritan River Basin water-supply system was recently developed in cooperation with the New Jersey Water Supply Authority. This computer model provides a technical basis for evaluating the effects of alternative patterns of operation of the water-supply system in relation to future drought risks. Water-supply managers can use the model during droughts to forecast the likelihood that the reservoirs and streamflows will fall below specified levels.

## Water Quality

Water quality has long been an important issue to New Jersey residents. As part of the USGS National Water-Quality Assessment Program (NAWQA), USGS hydrologists in New Jersey are assessing surface- and ground-water quality in the State’s coastal drainage basins. In New Jersey, the Program is focusing on the effect of land use on shallow ground-water quality, spatial and temporal trends in ground-water quality, well vulnerability to contamination from various sources, toxic materials in surface water, stormwater quality, and the effects of inter-basin surface-water transfers on water quality. The study includes a comprehensive assessment of the effects of urban growth on water quality. This study of toxic constituents from atmospheric and land sources and their effects on surface water, ground water, and aquatic biota in an urban area is a pilot project for the NAWQA program.

In almost 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 various programs and studies. The quality of ground and surface water 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, which 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 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.

The addition of composted sewage sludge to the soil can facilitate mandated revegetation of sand and gravel pits. The USGS is monitoring the mobilization of nutrients and metallic contaminants leached from the sludge at a test site in Ocean County; study results may be used for planning and managing sludge use or disposal or both. In addition, the spatial and vertical distributions of radon, lead, mercury, and nitrate in aquifers in targeted drainage basins with different land uses are being evaluated to determine how the concentrations of these contaminants are related to land use and hydrogeology.

### **Point- and Nonpoint-Source Contamination**

Ground- and surface-water contamination 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.

USGS investigators, in cooperation with those of the New Jersey Geological Survey (NJGS), were able to differentiate among the possible sources of arsenic contamination in soils at and near a former industrial site in Monmouth County. In addition to contamination from the industrial site, both natural background concentrations and residual amounts of arsenic from pesticide use in orchards before the 1950's were found to be significant.

The USGS maintains two research sites in New Jersey—a gasoline-spill site in Atlantic County and a chlorinated-solvent leak site in Morris County. The research objectives 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 economical methods that can be used to clean up contamination at similar sites.

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 pesticides in drinking water, saving an estimated \$5.1 million annually as a result of reduced analysis requirements for low-vulnerability water supplies.

Increased 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 they 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.

### **Saltwater Intrusion in Aquifers**

Ground-water withdrawals in coastal areas have resulted in the landward movement of salty ground water into aquifers that are used heavily 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 saltwater movement 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–New Jersey Metropolitan Region**

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. As a result of these activities over the last century, bottom sediments in some areas are contaminated. To address the continuing need to identify areas in which disposal of material dredged from the harbor is environmentally acceptable, the USGS is conducting a long-term multidisciplinary study to map the distribution of contaminated sediments and to develop the ability to predict the transport and long-term fate of the sediments and contaminants. Information from this study of

seafloor geologic processes may be used by Federal, State, and local agencies for managing the use of the coastal ocean, and by scientists for planning and conducting research and monitoring activities. The ongoing research and mapping study is conducted cooperatively with scientists at the Woods Hole Oceanographic Institution, Rutgers Institute of Marine and Coastal Sciences, the NJGS, the National Marine Fisheries Service, and the U.S. Army Corps of Engineers.

### **Water-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 NJDEP to enforce the New Jersey Water Quality Planning Act and the Clean Water Act, which are aimed at ensuring the continued availability of safe drinking-water supplies and lakes and streams that are safe for swimming and fishing. The networks consist of 216 streamflow-measurement sites, 172 ground-water-level-measurement sites, 100 surface-water-quality sites, and 39 ground-water-quality sites. All data are available to the public in hardcopy or digital form.

### **Mineral-Resource Assessments**

The USGS is completing a prototype quantitative national assessment of the resources of five commonly used metals—gold, silver, copper, lead, and zinc—that lists significant known deposits, delineates areas with mineral potential, estimates the quantity of each metal likely to be present, and identifies tracts that may contain deposits of those metals. The results of this assessment will enable the USGS to respond more quickly to requests from Congress, Federal and State agencies, industry, and the public for information about these mineral resources throughout the country and to provide mineral information to land-use planners who are concerned with resource-management issues.

Like many eastern states, New Jersey depends on diminishing resources of locally derived materials that are required for maintaining and constructing its buildings and infrastructure. Therefore, as a complement to the national assessment, the USGS is also conducting a comprehensive regional assessment of other metallic and industrial mineral resources in the Eastern United States.

# For More Information

The USGS now has two minerals data bases: the previously available Mineral Resources Data System and the Mineral Availability System, an information resource that was transferred to the USGS from the Bureau of Mines. These data bases are the principal tools used by the USGS for mineral-resource assessments and research. Between them, they contain information on hundreds of thousands of mineral-deposit and processing locations around the world, including the sites of more than 1,000 deposits of both metals and nonmetals in New Jersey. Information on these deposits has been compiled in cooperation with the NJGS. Both data bases are available on CD-ROM.

## Biological Resource Studies

The Biological Resources Division, formerly the National Biological Service, conducts research and provides scientific data needed for effective management of, and preservation of economic benefits related to, living resources in and along New Jersey's rivers and coastlines. As part of the Delaware Bay Estuary project, the USGS is working with several State and local agencies to develop a Gap Analysis Program to help identify plant and animal distribution patterns and their relation to land ownership and development. USGS scientists are also evaluating the extent of dioxin contamination in fish in the lower Passaic River and Newark Bay to provide information for natural-resource managers.

## Magnetic Field Data Base

Because dense vegetation and soils cover most of the rocks in New Jersey, geologists must rely on methods other than direct observation to assess some aspects of the State's rocks and geologic structures. These methods include geophysical studies such as aeromagnetic surveys, in which the magnetic field is measured from aircraft flying low-level, closely spaced flight lines. The resulting data are used to help interpret the geologic framework of a region. The USGS, in cooperation with the NJGS, recently created a new, digital magnetic field data base and produced a magnetic-anomaly map of the State, which were compiled from available published and unpublished analog and digital magnetic data. Although these data were obtained from aeromagnetic surveys conducted at different times, spacings, and elevations, analytical techniques were used to create

a consistent data set. This procedure results in a comprehensive view of the magnetic characteristics of the rock units in New Jersey, and consequently, increases understanding of the State's geology. The magnetic data have been released in cooperation with the NJGS.

## Topographic and Geologic Mapping

The USGS in cooperation with other Federal and State agencies is preparing color infrared (CIR) digital orthophotoquad maps (DOQ's) for the all of New Jersey. A DOQ is derived from digitized aerial photographs, with displacement caused by camera tilt and terrain relief removed; it combines the image characteristics of a photograph with the geometric qualities of a map. DOQ's are becoming increasingly popular as components in geographic information systems. The NJDEP has cooperated in producing the statewide CIR aerial photographs from which the DOQ's are being prepared.

The USGS and the NJGS, as part of the National Cooperative Geologic Mapping Program, have recently completed a new suite of 1:24,000-scale geologic quadrangle maps, as well as six new 1:100,000-scale bedrock- and surficial-geology maps. The smaller scale series is part of the State's efforts toward producing a new geologic map of New Jersey. The new information shown on these maps is useful for solving environmental problems; assessing groundwater contamination, engineering hazards, and aquifer recharge; addressing land-use issues; selecting well locations; and planning well construction.

## Earth Science Information Centers

Earth Science Information Centers (ESIC's) provide information to the public about USGS programs, products, and technological developments. The ESIC in Trenton was established under a cooperative agreement between the USGS and the NJGS. 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.

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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.

U.S. Geological Survey  
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