

# United States Geological Survey

## Programs in Virginia



*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.*

The U.S. Geological Survey (USGS) collects, compiles, and disseminates data on water, energy, and mineral resources in the Commonwealth of Virginia. The USGS is known for its impartial data collection and research mission—to gather, interpret, and present data that enable resource planners and others to make informed decisions based on objective information. As the Nation's leading earth-science agency, the USGS works cooperatively with local, State, and other Federal agencies to address issues related to Virginia's earth resources. Today's issues are more pressing than ever—the continuing need for resource development, describing and predicting the fate of toxic contaminants, and understanding both the effects of humans on the environment and the effects of the environment on humans.

### Water Availability and Development

The USGS, in cooperation with the Virginia Department of Environmental Quality and the Hampton Roads Planning District Commission, is assessing ground-water resources in the Atlantic Coastal Plain and evaluating the effects of ground-water withdrawals on the availability of local and regional water resources. This information is critical for maintaining a sustainable supply of freshwater.

The USGS developed a ground-water-flow model and maintains a geographic information system (GIS) that relates all hydrologic information for the Atlantic Coastal Plain. The model and GIS are used by the Virginia Department of Environmental Quality to evaluate requests for permits to withdraw ground water from the Coastal Plain aquifers.

The USGS is evaluating the quality of water in the major aquifers of the Coastal

Plain that are used for water supply. This ongoing effort, in cooperation with the Hampton Roads Planning District Commission and the Virginia Department of Environmental Quality, includes an analysis of the possible movement of salty water into fresh ground-water supplies. This information is used by utility companies, industry, and interested citizens concerned with maintaining the quality of freshwater supplies.

The USGS is working cooperatively with the city of Newport News to assess the availability of water resources in the southeastern coastal area of Virginia. Optimum management of a reservoir system near Newport News requires detailed hydrologic and water-quality information. The USGS provides reservoir storage and water-quality data that help water-resource managers maintain a supply of freshwater.

The USGS, in cooperation with Accomack and Northampton Counties, supplies information on the availability and effects of withdrawals on the water resources of the Eastern Shore of Virginia. Ground water, which is the sole source of freshwater in the region, is susceptible to saltwater intrusion and contamination by agricultural chemicals.

### Toxic Contaminants in Ground Water

The USGS cooperates with the U.S. Environmental Protection Agency and various military branches of the U.S. Department of Defense to evaluate contaminant migration at hazardous-waste sites and military installations. Detailed descriptions of local geohydrologic settings, water quality, and patterns of ground-water flow are provided by the USGS to Federal and State regulatory authorities to evaluate potential remedial actions.

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As part of a cooperative program with the Prince William County Health District, the USGS is evaluating the quality of the countywide ground-water resources. Because the county, which is adjacent to Washington, D.C., is growing rapidly, a thorough understanding of the effects of future development on the quality and availability of ground water is needed by the county planners. The USGS has identified areas where ground water has been contaminated by volatile organic compounds, documented the composition and concentration of the contamination, and described the direction of ground-water flow in the areas of contamination. This information is used by the county, which relies heavily on ground water, to evaluate the quality of its ground-water supplies.

### Quality of Water in the Chesapeake Bay

The Chesapeake Bay, which is one of the largest estuaries in the world and home for more than 2,700 species of plants and animals, is a major economic and recreational resource in Virginia. In 1987, the Governor of Virginia signed the Chesapeake Bay Agreement, which commits Federal, State, and other agencies to work toward improving the quality of

water in the Bay. The agreement sets a goal to reduce controllable nutrient input to the Bay by 40 percent by the year 2000. In cooperation with the Virginia Department of Environmental Quality, the USGS assesses the amounts of nutrients and suspended solids that enter the Bay from major tributaries in Virginia. Managers and scientists use this information to evaluate pollution-control practices in the Chesapeake Bay watershed.

The USGS, in cooperation with the Accomack–Northampton Planning District Commission, is evaluating geohydrologic and chemical controls on nitrate concentrations in ground water that discharges to estuaries on the Eastern Shore. The results help water-resource planners, managers, and the agricultural community on the Eastern Shore to develop effective management plans and practices to control nonpoint-source contamination of ground water.

## Coal Resources

The USGS, in cooperation with the Virginia Department of Mines, Minerals, and Energy, Division of Mineral Resources, is conducting a study to identify and delineate current societal and physical restrictions on mining and to estimate the amount of remaining coal resources that may be available for development. The USGS is working to identify the location of and to characterize the quality of coal resources on public and private lands, including coal potentially suitable for the export market. Information products that result from the assessment are useful to regulatory agencies, information agencies, land-management agencies, and industrial interests and academic researchers.

The Office of Surface Mining is establishing a Federal rule for Valid Existing Rights, which could affect access to coal in environmentally sensitive areas; it also is determining whether underground mining should be prohibited in environmentally sensitive areas. The ruling could change access to surface-minable coal resources in environmentally sensitive areas, including privately owned coal resources in National Parks, Wilderness Areas, Wild and Scenic Rivers, Wildlife Refuges, National Trail System, National

Recreation Areas, National Forests, State and local parks, and National Historic Sites in Virginia. The USGS and the Office of Surface Mining have signed an Interagency Agreement under which the USGS is to provide results of coal-resource assessment and economic analyses to the Office of Surface Mining, which needs the information to prepare an Economic Analysis and Environmental Impact Statement on the Federal rule. The USGS and the Virginia Division of Mineral Resources are working together to gather data and provide interpretations that can be used to illustrate the effects of such a rule.

## Land Use and Water Quality

The USGS is assessing ground- and surface-water quality in the Potomac River and the Albemarle–Pamlico Drainage Basins and is evaluating the factors that affect this quality. These studies help water-resource planners determine best-management practices and other policy decisions concerning development issues in these watersheds.

The USGS, in cooperation with the city of Virginia Beach, is documenting current water-quality conditions and land use at the Pea Hill Arm of Lake Gaston. Results of quantifying current water-quality conditions and land use and determining the relation between the two are useful for evaluating the water-quality effects of withdrawals for water supply from the lake.

The USGS, in cooperation with the city of Newport News, is evaluating the effects of land use on water-quality in the Chickahominy Drainage Basin. The Chickahominy River and its associated reservoirs are the source of water for the city. Land-use changes affect the quality of water that drains from the basin and, therefore, the quality of water that enters the reservoirs. Water-resource planners and managers are using this information to develop best-management practices.

## Topographic and Geologic Mapping

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 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 815 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.

The USGS has cooperated with Virginia on topographic and geologic mapping since 1908. State agencies currently cooperate with the USGS on digital data collection, as well as traditional map-revision activities. State personnel have moved swiftly toward acquiring digital spatial data in recent years.

The USGS also cooperates with Virginia on the acquisition of aerial-mapping photographs through the National Aerial Photography Program. Initial overflights were completed in spring 1994.

The USGS, in cooperation with the Virginia Division of Mineral Resources, has recently completed a new geologic map of the State of Virginia.

Geologic mapping in northern Virginia has led to derivative maps that address multiple land-use and environmental issues in areas of metropolitan growth, such as Fairfax and Loudoun Counties. One of the Nation's first radon-risk maps, which is based on geologic mapping, was completed recently by the USGS for Fairfax County. Also, computer models developed by the USGS that combine land-use and environmental data were used by Loudoun County to screen potential landfill sites.

Geologic mapping in progress in the Piedmont and the Coastal Plain of southern Virginia provide information that is needed for construction of highways, bridges, and industrial sites, evaluation of sites of environmental contamination, and identifying sources of construction materials.

## Urban Development and Surface-Water Quality

Stormwater-management facilities have been used by the Virginia Department of Transportation since 1991. These facilities are designed to mitigate the effects of highway development by reducing stormwater runoff and its associated chemical constituents to preconstruction levels. The USGS, in cooperation with the Virginia Department of Transportation, is evaluating the effectiveness of these facilities in controlling increases in runoff and associated chemical constituents caused by the increase in paved areas. The information is needed to improve the design and increase the effectiveness of these facilities.

The USGS, in cooperation with Prince William County and the U.S. Fish and Wildlife Service, is evaluating the effects of stream restoration on water quality in an area that has eroded because of increased urban runoff.

The USGS, in cooperation with Prince William County and many other State and Federal agencies, is assessing the effects of urbanization on streamflow and the effects of retention ponds on chemical-loading removal efficiencies. The study also is assessing the effectiveness of best-management practices in reducing the effects of urbanization on streamflow quality. Results of the study will be useful to refine future designs of best-management practices.

## Hydrologic Information

The hydrologic data-collection network maintained by the USGS in Virginia

(fig. 1) provide ground- and surface-water, and (or) water-quality data for the following purposes:

- Assessment of ground- and surface-water resources across the State;
- Effective and responsible operation of reservoirs and industries;
- Forecasting of hydrologic hazards;
- Responsible disposal of wastes;
- Evaluation of the effects of climatic variations and development on water resources;
- Monitoring of trends in the occurrence, quality, and use of water resources over time; and
- Effective and responsible planning, design, operation, and management in water-related fields, such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development.

## Mineral Resources

By combining numerous different geologic data sets, the USGS is assessing the regional mineral resources of the Eastern United States. The data sets are particularly useful for locating mineral resources that are economically viable for development. The data sets also are used for environmental purposes, which include the determination of the natural concentrations of potentially toxic trace elements. Such information is used by the U.S. Environmental Protection Agency and State agencies to evaluate human-induced contamination of water resources and to serve as a baseline for environmental remediation.

## Hydrology of Wetland Ecosystems

The USGS, in cooperation with the Virginia Department of Conservation and Recreation, Division of Natural Heritage, is evaluating hydrologic and geochemical processes in protected wetland ecosystems in the North Landing River Basin. Managers require an understanding of the hydrologic interaction between agricultural uplands and the wetland ecosystems, as well as site-specific hydrologic and geochemical processes that occur within the ecosystems, to manage this natural-area preserve system effectively.

## Earth Observation Data

Through its Earth Resources Observation Systems 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 of Virginia. Mapping photographs of some sites go back at least 40 years. Satellite images can be used to study changes in regional landscapes dating from 1972.

## Geologic Information Visualization System

The USGS, in cooperation with the Mary Washington College and the Office of the Virginia State Geologist, has developed the Geologic Information Visualization (GIV) system. This is a personal computer-based software package to visualize and analyze most types of geologic data. The first product of this joint effort is a CD-ROM displaying a wide range of geologic data for Virginia. The disc, containing the first digital geologic map of the State, was produced by a student at the College. Publication of this disc led to the adoption of a GIV by the Office of the State Geologist as its primary mapping and GIS software.

A center of excellence was established at the Mary Washington College to use and help develop the USGS software for education. The College of William and Mary is in the process of becoming a second GIV center, and both colleges teach upper level courses using GIV as the primary subject matter. These and other



Figure 1. Water-quality data-collection sites in Virginia.

institutes plan to continue the development, dissemination, and support of the system. Several geologists with the State of Virginia use GIV in the field to update old geologic maps and to create new maps. Work is nearing completion on the digital version of a new State geologic map and a high-resolution geologic map of Henry County.

## Regional Seismic Network in Blacksburg

The USGS supports a regional seismic network with a station at the Virginia Polytechnic University in Blacksburg. These regional networks are part of the U.S. National Seismograph Network, a national network designed to monitor nationwide seismicity, provide early notification of seismic events to national level emergency services personnel, provide a consistent archive of standardized, high-quality data on national seismicity, and

provide a national basis for public information on earthquakes. Plans include installation of 10 new stations in 1995 and 1996, which complement about 1,750 existing stations around the country.

## Cooperative Programs

The USGS cooperates with more than 50 local, State, and Federal agencies in Virginia. Cooperators include county and municipal public works departments, public health agencies, natural-resource agencies, water and sanitation districts, planning district commissions, and other Federal agencies. In addition to agencies previously mentioned, the USGS also cooperates with the U.S. Army Corps of Engineers, the Tennessee Valley Authority, the Naval Surface Warfare Center-Dahlgren Laboratory, the Yorktown Naval Weapons Station, Quantico Marine Base, Langley Air Force Base, James City County, the University of

Virginia, the city of Danville, and the Washington County Service Authority. Cooperative activities include water-resources-data collection, interpretive water-availability and water-quality studies, mineral-resource assessments, and mapping. Cooperative activities often are funded on a matching basis. Jointly funded programs are considered when the study is mutually advantageous to Federal and State or local agency interests in appraising water resources and seeking solutions to water-related problems. These cooperative, jointly funded programs are reviewed and renegotiated annually to ensure that they are responsive to the needs of the State and localities and to national interests.

The USGS provides support to the Virginia Water Resources Research Institute, 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.