Virginia

For more than 100 years, the U.S. Geological Survey (USGS) has provided scientific information to help resource managers and government officials understand and manage Virginia's mineral, biological, and water resources. This information is used to address critical environmental, economic, and health issues such as the contamination of natural resources by hazardous wastes, the restoration of stressed ecosystems, the adequacy of freshwater supplies, the distribution of coal and mineral resources, and the environmental effects of urban development and agriculture. This Fact Sheet presents examples of current USGS projects and programs in Virginia.

Figure 1. Degraded water quality and loss of submerged aquatic vegetation have led to a decline in the use of Chesapeake Bay by wintering waterfowl.

Chesapeake Bay Studies

The Chesapeake Bay, the Nation's largest estuary, is a major economic and recreational resource in Virginia. The bay ecosystem, home to more than 2,700 plant and animal species, is threatened by several complex, interrelated environmental problems. These issues include an overabundance of nutrients; loss of habitat; outbreaks of toxins, such as those produced by the fish-killing microorganism *Pfiesteria piscicida*; high levels of sediment; overharvesting of shellfish and finfish; and erosion and submergence of coasts. Since the early 1980's, the bay has been the focus of restoration efforts by Federal, State, and local agencies. The USGS supports this effort by providing scientific information concerning the environment and ecology of the bay and the bay watershed. This information is used by managers to develop pollution-control and land-management policies and by scientists to evaluate the success of restoration actions.

In 1987, the Governors of Virginia, Maryland, and Pennsylvania, and representatives of the District of Columbia signed an agreement with the U.S. Environmental Protection Agency's Chesapeake Bay Program to work toward reducing controllable nutrient input to the bay by 40 percent by the year 2000. Since 1988, the USGS has worked with the Virginia Department of Environmental Quality (DEQ) to measure the amounts of nutrients and suspended solids that enter the bay from five major tributaries in Virginia. Results of the monitoring program are used to track progress toward meeting the nutrient-reduction goal and to evaluate the success of nutrient-reduction strategies.

USGS biologists are studying waterfowl use of submerged aquatic vegetation in tributaries of the Chesapeake Bay. A decline in this vegetation over the past 40 years has led to significant declines in waterfowl use of the bay (fig. 1). The USGS is monitoring water quality and other environmental conditions in areas where scientists are developing replanting techniques. The goal is to restore vegetation to parts of the bay where it formerly grew in abundance and supported wildlife populations.

In 1996, the USGS began the Chesapeake Bay Ecosystem Program to coordinate ongoing USGS work and support new studies that fill important gaps in existing environmental information. Working in coordination with the USGS National Cooperative Geologic Mapping and National Water-Quality Assessment (NAWQA) programs, the Ecosystem Program is

identifying the age and amount of ground water that discharges to the bay and its tributaries and the nutrient load carried by the ground water. USGS studies have shown that about half of the water and nutrient load entering the bay travels through the ground-water system and that nutrients may take as long as 20 years from the time they enter the system until they reach rivers or the bay. A better understanding of the factors controlling nutrient movement and concentration will help resource managers effectively target the placement of nutrient-reduction measures and understand the delay between implementing these measures and observing improvements in water quality.

USGS geologists are reconstructing the pattern of relative sea-level change in Chesapeake Bay during the last 6,000–8,000 years. Tide gages show that rates of sea-level rise are twice the worldwide average. One research goal is to understand sea-level rise as a natural ongoing process that continues to modify the bay and its resources. Data from sediment cores obtained in the bay and its tributaries to document sea-level history also can be used to measure the effects of human activities on natural systems. Understanding the history of sea-level rise and associated changes in sedimentation, salinity, and water quality will help resource managers differentiate between natural and human-induced changes in the bay.

USGS mapping specialists have developed a new satellite image that shows land cover characteristics throughout the Chesapeake Bay watershed. The USGS also is preparing detailed databases of the watershed that contain information about topography, hydrography, soils, subsurface geology, litho-chemistry, depth measurements, and shoreline changes. These databases are used by scientists who are assessing the natural and human factors that influence the water quality and biological integrity of the bay and its watershed.

Water-Supply Studies

High-quality ground and surface water for private, municipal, and industrial use are critical to sustainable economic development in Virginia. Although Virginia has abundant water resources, freshwater supplies in some areas are insufficient to meet the local demands of a growing population and an expanding economy. The USGS provides hydrologic information used by the Commonwealth and local communities to promote safe and prudent management of Virginia's water supply.

The USGS, in cooperation with the DEQ, evaluates the effects of ground-water withdrawals on the availability of local and regional ground-water resources in the Coastal Plain of Virginia. The assessment is based on a computer model of ground-water flow developed by the USGS, and it is used by the Commonwealth to manage ground-water withdrawals from the Coastal Plain aquifers. This information is critical for maintaining a sustainable water supply for the 2 million residents of Virginia's rapidly growing Coastal Plain communities (fig. 2).

Recently, USGS and DEQ geologists were involved in the discovery of a 55-mile-wide impact crater caused by a giant comet or meteorite that struck near the mouth of the Chesapeake Bay about 35 million years ago (fig. 3). Analysis of the impact crater is yielding fundamental scientific information on the effects of large impacts in marine environments as well as practical information needed to manage the region's ground-water supply. USGS scientists, in cooperation with the Hampton Roads Planning District Commission, are re-evaluating the evolution of the Virginia Coastal Plain and its influence on the region's aquifer system and the distribution of saltwater in these aquifers. Hydrologists with the USGS and DEQ are updating the USGS Coastal Plain ground-water flow model to reflect these advances.

The Safe Drinking Water Act Amendments passed by Congress in 1996 require each State to develop a Source Water Assessment Program (SWAP) to identify source areas of public drinking water and to assess their susceptibility to contamination. In support of Virginia's SWAP, the USGS and the Virginia Department of Health developed a 4-year, statewide study that uses environmental tracers (such as tritium, chlorofluorocarbons, and carbon-14) present in ground water to determine how much time

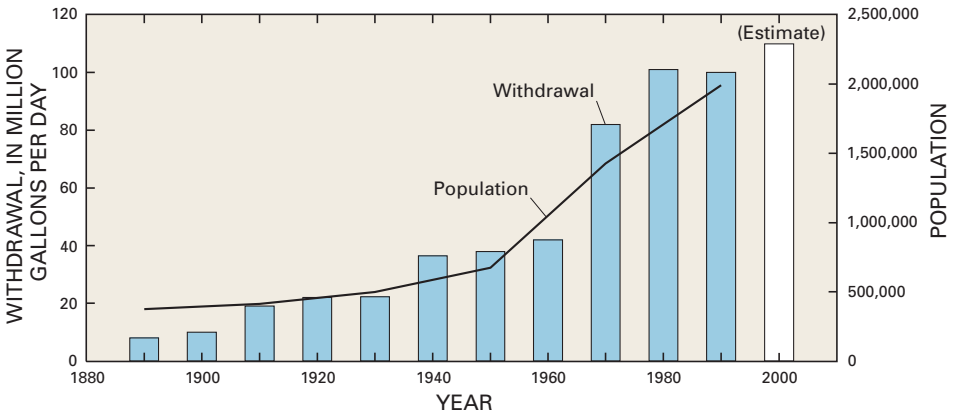


Figure 2. Population and ground-water use in the Virginia Coastal Plain are increasing.

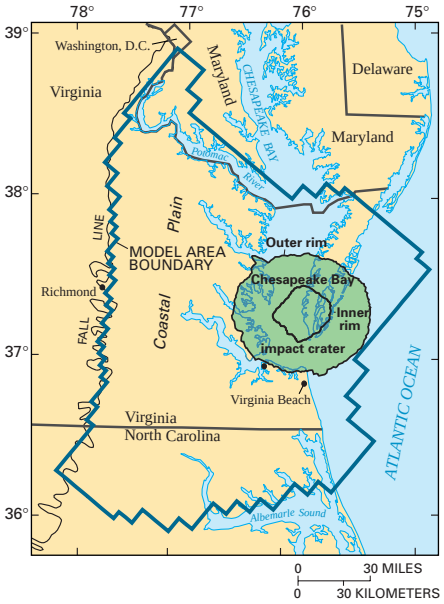


Figure 3. The Chesapeake Bay impact crater is located within the boundary of the Coastal Plain ground-water flow model.

has elapsed since water withdrawn from a public supply well entered the ground. Results from the study will allow ground-water protection efforts to be concentrated on the public supplies most vulnerable to near-surface contamination.

Resource Assessments of Federal Lands

The USGS provides natural resources information needed to manage Federal lands in Virginia. These lands support many fragile ecosystems that are threatened by acid rain, toxic chemical releases, development of neighboring lands, and natural disasters. USGS studies range from hazardous-waste investigations in contaminated environments on military facilities to studies of erosion on Virginia's barrier islands and wildlife in National Parks. Work in the Shenandoah National Park exemplifies the research that the USGS conducts in cooperation with other agencies on Federal lands in Virginia.

In 1995, USGS geologists responded to a major flood and landslide disaster after a large storm system moved through central Virginia. The USGS combined efforts with several agencies [National Park Service (NPS), Federal Emergency Management Agency, U.S. Army Corps of Engineers, and Virginia Department of Transportation (VDOT)] to address the flooding and landslide issues within Shenandoah National Park. Building on their expertise in the surficial geology of this area, USGS geologists and hydrologists produced maps of landslides, debris flows, and flooding resulting from this costly storm. These maps are being used to explain how such disasters develop and how the loss of human life and property can be avoided.

Concern about worldwide declines and deformities in amphibian populations has prompted USGS and NPS biologists to develop a project to study amphibians at Shenandoah National Park. Changes in the geographic distribution of amphibians will be recorded, and the possible connections between amphibian health and environmental factors such as ultraviolet radiation, contaminants, water quality, and soil moisture will be investigated (fig. 4). Monitoring techniques being developed on this project are expected to be the prototypes for long-term monitoring of amphibians at other National Parks.

USGS hydrologists are using environmental tracers to determine the age of ground water in Shenandoah National Park. This information will be used to help determine the susceptibility of park ground water to near-surface contamination. The USGS also is investigating how acid rain affects water quality and ecological health in the park. Working with University of Virginia scientists, the USGS is investigating the episodic acidification of streams responding to snowmelt and rainfall and is developing computer models of water quality to help predict when and where stream acidification will occur within the Park.

Figure 4. Spotted salamanders breed in temporary pools in the deciduous forests of Virginia. © by Edward Nied, Jr. Used with permission.

Mapping and Information Management

The USGS collects biological and geosciences information in Virginia and makes this information available through map products and computer databases. This information is used by the public and by scientists, engineers, and natural-resource professionals who manage Virginia's water, land, wildlife, and infrastructure.

USGS 1:24,000-scale topographic maps of Virginia are a standard tool of engineering, planning, and environmental professionals and continue to be popular with the public for hiking, camping, exploring, and backcountry fishing. The USGS is cooperating with VDOT and the Department of Mineral, Mines and Energy (DMME) to update and produce digital images of these maps, which DMME uses to locate coal fields.

About 45 percent of our Nation's coal is produced in the Appalachian region. Three Appalachian coalbeds (Fire Clay, Pond Creek, and Pocahontas No. 3) are located, in part, in Virginia, and coal mining is an important industry in southwestern Virginia. The USGS, in cooperation

with the Virginia Division of Mineral Resources, is assessing these beds as part of a larger project that will offer policymakers, land managers, and the public a database on U.S. coal resources. The USGS will produce stratigraphic and geochemical databases; digital maps of elevation, coal and overburden thickness, areal extent, and mined areas; and data on coal quality, including ash yield, sulfur content, calorific value, and potentially hazardous geochemical elements (such as arsenic, mercury, and lead).

The Breeding Bird Survey (BBS), established in 1966, is a roadside survey program that monitors breeding bird populations. USGS biologists coordinate data collection from approximately 4,000 survey routes that are scattered across the continental United States, Canada, and Alaska. In Virginia, 73 active routes provide data on more than 120 species of breeding birds. The data indicate that woodland bird populations in Virginia are generally stable or increasing, while species occupying grassland and shrubby habitats are generally decreasing. Additional information about the BBS and other bird population studies is available at http://www.mbr-pwrc.usgs.gov/.

In Virginia, the USGS and the DEQ record streamflow continuously at more than 160 streamgaging stations and monitor peak flows at more than 45 crest-stage sites. These data are used daily by Federal, State, and local agencies and utilities to make water-resource management decisions, including selection of future water supplies, flood control and flood warning, bridge and culvert design, management and operation of reservoirs, and permitting and managing water withdrawals and wastewater discharges. Much of the streamflow data collected by the USGS is provided continuously (realtime) on the Internet. The National Weather Service uses the realtime data to forecast potential flooding on major rivers and smaller streams in densely populated areas, and the public uses this information to determine optimum conditions for canoeing, rafting, and fishing. These data are used to minimize hazards caused by low-flow or drought conditions, and were particularly useful in managing water-supply and water-treatment facilities during the 1998 drought. Realtime streamflow data can be accessed from the Virginia District home page at http://va.water.usgs.gov/.

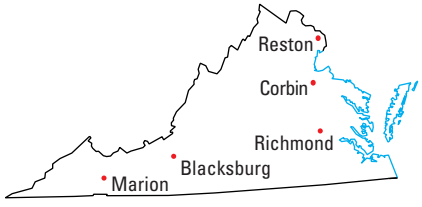
Figure 5. USGS Headquarters, Reston, Virginia.

USGS Headquarters

The USGS Headquarters is at the National Center in Reston, Virginia (fig. 5). Scientists with expertise in the four major disciplines—water, geology, mapping, and biology—provide reliable and impartial scientific information to help others under-stand and manage the Nation's water, energy, mineral, land, and biological resources. The National Center supports almost 2,000 employees and contractors who produce scientific reports, maps, and digital products. The National Center also houses the USGS Visitors Center, where more than 10,000 people visit each year to learn about aerial photography, floods, dinosaurs, volcanoes, earthquakes, water quality, and how USGS maps are made.

USGS office locations

The USGS has 1820 employees in Virginia



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