Fact Sheet

United States Geological Survey
Programs in North Carolina

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.

On September 17, 1895, U.S. Geological Survey (USGS) hydrographer Cyrus Babb, with assistance from North Carolina State Geologist Joseph Holmes, established a streamflow-measurement gage on the French Broad River at Asheville (fig. 1). This streamflow gage, which was the first in the South and only the third east of the Mississippi River, has been in continuous operation since that time. Likewise, the USGS has worked cooperatively for 100 years in North Carolina with State, local, and other Federal agencies to provide credible data and unbiased scientific information. The wide range in physiographic and geologic conditions across North Carolina (fig. 2) is reflected in the diversity of earth science issues in the State.

Figure 1. Streamflow-gaging station in continuous operation since 1895 on the French Broad River at Asheville. In 1994, the USGS operated about 400 streamflow-, ground-water-, and water-quality-measurement stations in North Carolina. Most stations are jointly funded by the USGS and State, local, and Federal agencies.

Statewide Water-Resources-Data Collection

The 17 major rivers in the State supply drinking water to users in North Carolina and adjoining States. The rivers also are used for commerce, recreation, and wastewater assimilation. The USGS, in cooperation with more than 20 local, State, and Federal agencies, collects continuous streamflow records at about 170 sites across the State. Intermittent measurements of streamflow are made in support of the State's water-quality-management program at about 70 sites. The USGS also collects water-quality records at more than 60 stream and lake sites. These data are required for daily and long-term management of the State's surface-water resources, determining the extent and severity of droughts, characterizing and predicting conditions during floods, and monitoring and interpreting the effects of human activities on streamflow and water quality.

Index of Subjects

More than one-half of North Carolina's population relies on ground water for water supply. The USGS collects and publishes ground-water data collected from about 180 wells across the State. These data are needed to determine the effects of human stresses, climate, topography, and geology on ground-water storage.

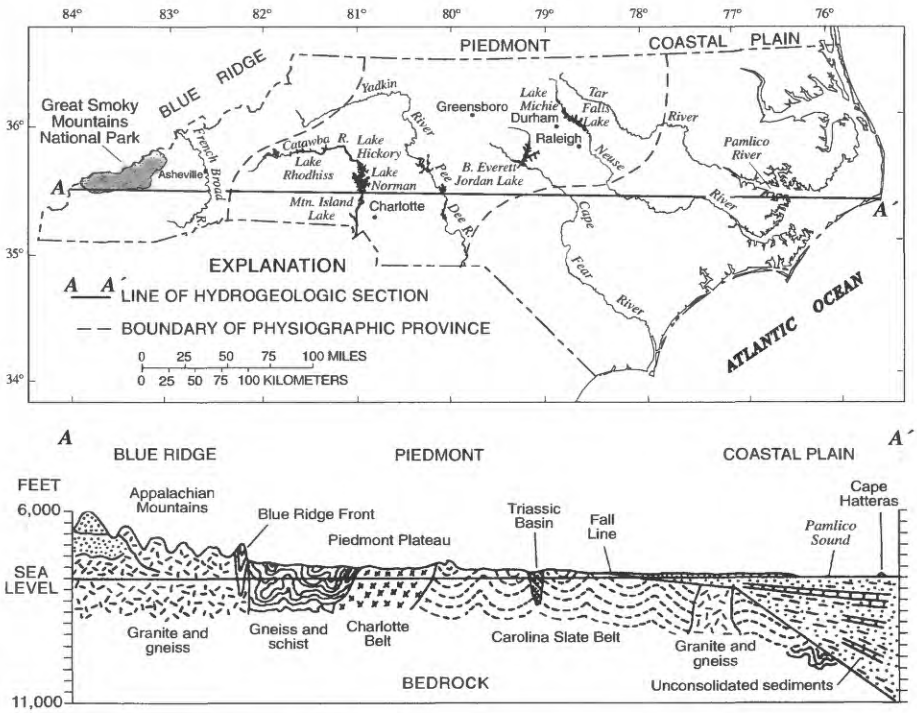

Figure 2. Map of North Carolina and generalized geologic cross section of the State. The rocks that underlie the State yield rich soils and metallic and industrial mineral resources. They also provide the framework over and through which the State's water resources flow.

Potential for New Gold Discoveries

Early this century, gold production in the slate belt of the Piedmont (fig. 2), particularly northeast of Charlotte, was important to the State and the Nation. Recently, interest in North Carolina gold has revived. To assist in the exploration, the USGS has applied its geologic and geochemical expertise to investigations of the gold deposits and their geologic settings. Old deposits are being reevaluated for new potential, and areas for potential new discoveries are being identified. A series of reports identifies areas with geologic characteristics of promise for exploration.

Studies of Reservoir Water Quality

Many of North Carolina's larger reservoirs are located in the heavily populated Piedmont region of the State. The reservoirs provide drinking water to about one-third of the State's population. The USGS is providing data and scientific information to a number of State and local agencies involved in the management of these reservoirs so that the water quality of these important resources can be protected and enhanced.

Information from long-term statewide sediment monitoring by the USGS indicates that sediment yields are highest in the Yadkin–Pee Dee (300 tons per square mile per year), the Catawba (280 tons per square mile per year), and the upper Cape Fear (180 tons per square mile per year) River basins in the Piedmont. Some of the eroded sediment, along with nutrients and other chemical constituents, is trapped in water-supply reservoirs. USGS studies show that the storage volume of Lake Michie, near Durham, was reduced by more than 20 percent between 1926 and 1992.

The USGS has been monitoring the quality of inflows to and outflows from Falls Lake and Jordan Lake since 1983. The reservoirs, constructed and operated by the U.S. Army Corps of Engineers, supply drinking water to about 500,000 people in the Raleigh–Durham area. Inputs and outputs of nitrogen, phosphorus, and sediment were determined for the period from 1983 to 1986. Studies of water-quality conditions in and around these two major reservoirs, as well as six smaller, nearby reservoirs, are continuing in cooperation with the Triangle Area Water-Supply Monitoring Steering Committee. Data collection includes intensive sampling for suspended sediment, nutrients, metals, organic compounds, *Cryptosporidium*, and *Giardia*.

The Catawba River and its reservoirs supply drinking water to the Hickory and the Charlotte metropolitan areas and assimilate as much as 200 million gallons per day of wastewater. The USGS, in cooperation with several local government agencies, is conducting investigations of water quality in three of the reservoirs (Rhodhiss, Hickory, and Mountain Island). Many reservoirs become stratified during summer, with large differences in water temperature from the surface to the bottom of the reservoir. Accompanying differences in water density, in turn, affect the distribution and fate of other water-quality constituents, such as dissolved oxygen (fig. 3). Detailed computer models are being developed to simulate contaminant movement and to assess the effects of alternative management options on water quality in the lakes. Results of studies of inputs of contaminants, such as nutrients, metals, and organic compounds, from urban and developing areas to the Catawba River and its reservoirs are useful to managers in designing measures to minimize the effects of urban runoff on water quality.

Metallic and Industrial Mineral-Resource Assessments

North Carolina contains identified resources of gold, copper, lead, zinc, silver, titanium, zirconium, tin, lithium, mica, and feldspar minerals of national and global importance. Extraction and processing of these minerals can form the basis of an enhanced regional economy. Competition for land, water, and biological resources also is affecting the local availability of clay, limestone, sand and gravel, building stone, slate, aggregate, and other industrial minerals. In conjunction with the North Carolina State Geological Survey and other State agencies, the USGS is preparing an inventory of known metallic and industrial mineral resources. Using geological, geophysical, and geochemical studies, the USGS also is preparing an assessment for the potential of undiscovered mineral resources in the State. Information can assist State and Federal land-management agencies, regional planners, industry, and local governments in ensuring sound management and use of the State's substantial mineral resources. Study results also can help ensure that adequate supplies of industrial minerals, required for infrastructure repairs and economic development, are available at the lowest possible cost.

Agricultural Practices and Water Quality

Agricultural practices can affect sediment and nutrient loadings to streams and reservoirs. Studies conducted from 1985 to 1990 near Greensboro by the USGS, in cooperation with the Guilford County Soil and Water Conservation District, documented the effects of standard and conservation-land-management practices on sediment and nutrient yields from tobacco fields (fig. 4). Water quality from the tobacco fields was compared with conditions in a small undisturbed forested basin. Conservation-land-management practices were most effective in reducing sediment and phosphorus yields from tobacco fields, but less effective in reducing nitrogen export.

So that the productive soils of the Coastal Plain can be used for cropland, they are artificially drained to lower the seasonally high water table. This cropland drainage can contribute excessive amounts of freshwater and nutrients directly to the State's productive, but frag-

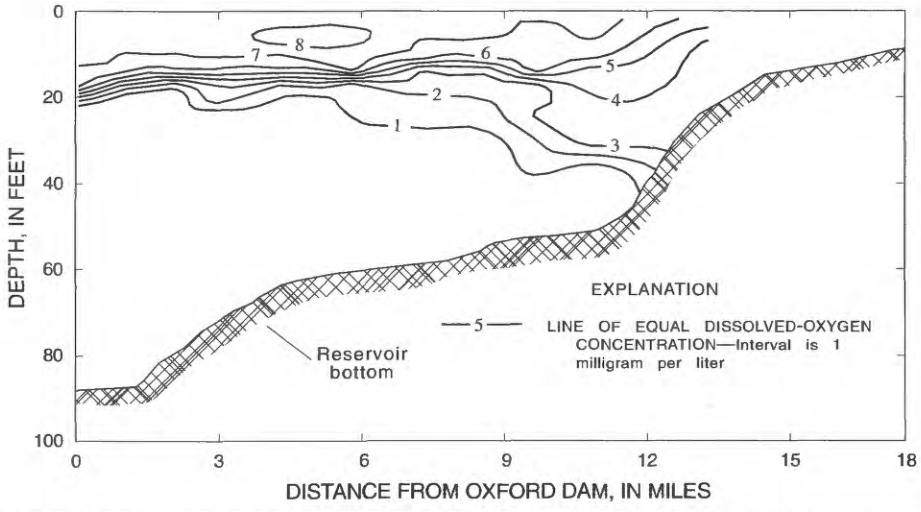

Figure 3. Lines of equal dissolved-oxygen concentration in Lake Hickory, on July 27, 1993.

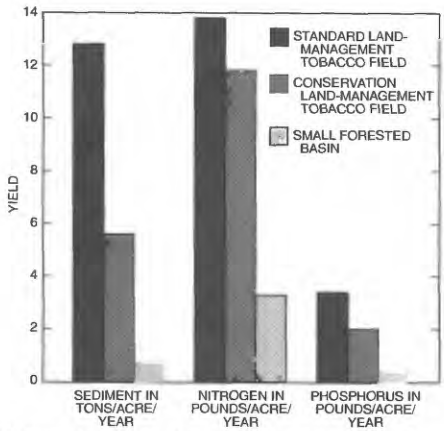

Figure 4. Yields of sediment, nitrogen, and phosphorus from two tobacco fields and a small forested basin near Greensboro.

ile, estuaries. Water-control structures, such as flashboard risers and tidegates, placed in drainage ditches and canals allow farmers to control soil moisture and saltwater intrusion and can result in improved downstream water quality. From 1988 to 1992, the USGS, in cooperation with the North Carolina Division of Environmental Management, conducted studies on tidally affected drainage canals to evaluate the effects of water-control structures on the quality of cropland drainage downstream from the control structures (fig. 5). Results from the study can guide land- and water-resource managers in the effective implementation of agricultural best-management practices.

National Water-Quality Assessment

To provide nationally consistent information on water quality, the USGS has implemented the National Water-Quality Assessment (NAWQA) Program through a series of study units that encompass important drainage basins and population

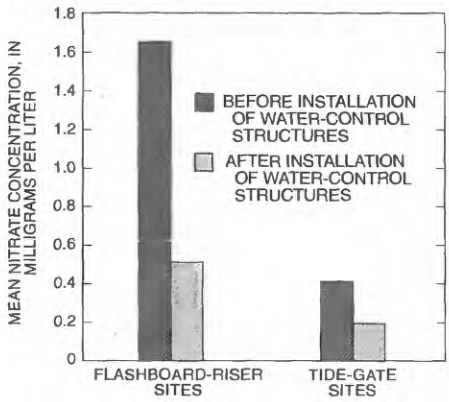

Figure 5. Flashboard risers and tidegates appear to be effective in reducing nitrate concentrations in tidal canals draining cropland. Flashboard riser sites were south of the Pamlico River in Beaufort County; tidegate sites were east of the Pungo River in Hyde County.

centers. The goals of the NAWQA Program are to describe current water-quality conditions, define long-term trends in water quality, and provide an understanding of the natural and human factors that affect water quality. Parts of three NAWQA Program studies are located in North Carolina (fig. 6). The Albemarle–Pamlico drainage study, begun in 1991, focuses on evaluating the effects of land use on surface- and ground-water quality. More than 80 wells and 100 surface-water sites have been sampled for organic and inorganic chemicals. Data collection for the Upper Tennessee and the Santee studies begin in 1995. Results from the NAWQA Program studies can provide policymakers, resource managers, and the public with an improved scientific basis from which to evaluate water-quality management programs.

Coastal Plain Ground-Water Resources

Ground-water levels in many areas of the Coastal Plain are declining because of heavy pumping. For example, USGS studies showed that the ground-water level in the Black Creek aquifer near Lumberton declined more than 12 feet between 1988 and 1992. Water levels are declining throughout the Coastal Plain (fig. 7). The USGS conducts regional studies to characterize the hydrogeologic framework, to map water levels in the various aquifers of the central and southern Coastal Plain, to develop regional aquifer simulation models, and to develop local ground-water flow models. Results of these studies are used by the North Carolina Division of Water Resources and by numerous local governments to manage the limited ground-water supplies of the Coastal Plain.

Estuarine Circulation and Water-Borne Material Transport

Because of the confounding effects of tides, wind, freshwater inflow, and shoreline geometry, determination of circulation patterns and rates of movement of waterborne materials in estuaries is difficult and typically requires specialized hydrographic data collection and development of com-

Figure 6. National Water-Quality Assessment Program study units in North Carolina.

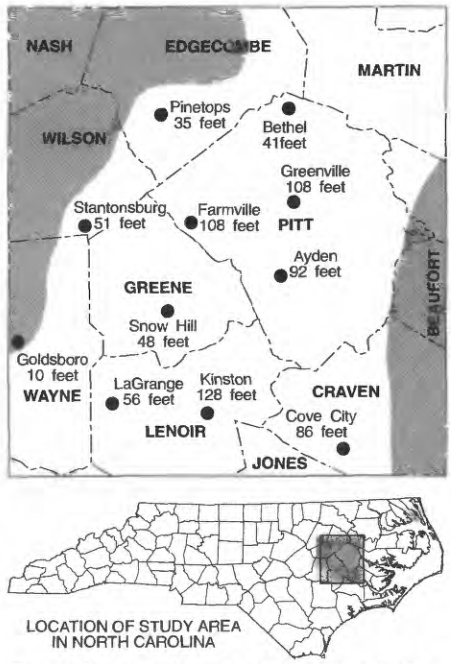

Figure 7. Ground-water-level declines in the Cretaceous aquifer of the central Coastal Plain between 1910 and 1981.

plex computer models. Information on flow and transport is needed to allocate waste-loads from point and nonpoint sources for protection of water quality, to interpret water-quality and biological data, and to predict rates of movement and dilution of spilled or released substances. The USGS, in cooperation with several agencies in the North Carolina Department of Environment, Health, and Natural Resources, has developed flow and transport models for segments of three (the Roanoke, the Pamlico, and the Neuse Rivers) of North Carolina's estuaries (fig. 8). These models can be applicable in the management of water quality and the protection of aquatic habitat.

National Mapping Program

Among the most popular and versatile products of the USGS are topographic maps at the scale of 1:24,000 (one inch on the map represents 2,000 feet on the ground). In order to represent the entire State, 962 maps have been produced at this scale. The 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 maps are 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.

By 1997, North Carolina plans to complete a statewide coverage of computerized (digital) photographs, using 1993 black and white National Aerial Photography Program photographs. The North Carolina Department of Transportation, the Center for Geographic Information and Analysis, and the North Carolina Geological Survey are working cooperatively with the USGS to complete the statewide coverage.

Digital map data (computer-readable transportation, boundary, and hydrographic files) are available for almost the entire State. State agencies and the USGS are continuing to address the issues necessary to achieve statewide coverage of this type of data. The digital map data are needed for automated geographic information systems used in many Federal, State, and local planning and management offices. Duplication of effort is minimized, and, because all agencies are using the same data base, increased future cooperation and savings are likely.

Geologic Mapping

At the request of the National Park Service, the USGS is conducting bedrock, surficial, and geochemical studies in a 250-square-mile area of the Great Smoky Mountains National Park. Results of the studies become part of a new computerized data base for use in improving management of the Nation's most visited National Park. The geology of approximately 300 square miles in the northeastern part of the State also is being mapped. This information can be particularly useful in the Coastal Plain, where ground water is the principal source of drinking water.

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 for North Carolina. Photographs for some sites date from the mid-1950's. Satellite images dating from 1972 can be used to study changes in regional landscapes.

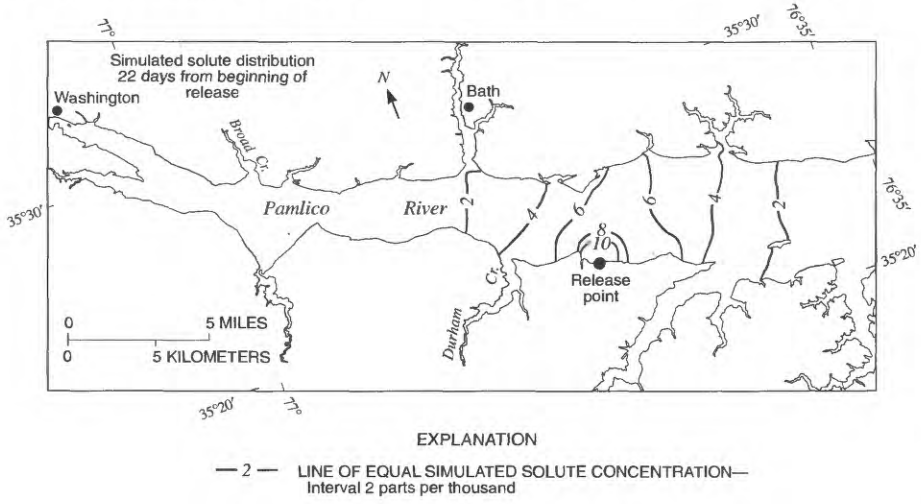

Figure 8. Estimated concentration distribution resulting from actual tidal and wind conditions and a hypothetical release of 25 million gallons/day and an initial strength of 1,000 parts per thousand. The computer model used for this solute transport also could be applied to determine the fate of materials entering the estuary at different locations, or characterize flow patterns resulting from a range of tidal, wind, and inflow conditions.

Studies at U.S. Department of Defense Facilities

Several U.S. Department of Defense sites in North Carolina have some level of contamination caused by past production, storage, or use of fuels, chemical agents, and munitions. Near some sites, contaminants have migrated near or into drinking-water supplies, or have contaminated soils. Since the mid-1980's, the USGS has been collecting hydrologic data and conducting investigative studies at Fort Bragg, Camp Lejeune, and the Cherry Point Marine Corps Air Station. The purposes of the studies include characterizing the regional and site hydrogeology, delineating available drinking-water supplies, defining the extent of contamination, determining contaminant transport pathways, and predicting the fate of contaminants. Innovative geophysical techniques for site characterization, chemical detection techniques, and biological remediation methods have been developed and tested as part of these studies.

Cooperative Programs

The USGS cooperates with about 30 local, State, and Federal agencies in North Carolina. When local and State agencies are involved in studies with the USGS, activities typically are funded on a matching-funds basis. Some examples of agencies with which the USGS cooperated in 1994 include the cities of Charlotte, Raleigh, Durham, Greensboro, Rocky Mount, Asheville, Chapel Hill, Morganton, Lexington, Brevard, Bethel, and Fayetteville; Mecklenburg, Orange, and Jackson Counties; the Western Piedmont and the Lumber River Councils of Government; and U.S. Navy.

The USGS provides support to the Water Resources Research Institute of the University of North Carolina, which conducts a program of research, education, and information and technology transfer.

For more information contact any of the following:

For water information
District Chief
P.O.Box 30728
Raleigh, NC 27622
(919) 571-4000

For map information
Chief, Mapping Applications Center
567 National Center
Reston, Virginia 22092
(703) 648-6002

For geologic information
Assistant Chief Geologist
953 National Center
Reston, Virginia 22092
(703) 648-6660

National Earthquake Information Center
Denver Federal Center, Mail Stop 967
Denver, Colorado 80225
(303) 273-8500

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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