

United States Geological Survey

Programs in South 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.

Potential for Discoveries of Gold

Production of gold was important in South Carolina in the 1800's and is once again contributing to the State's economic growth as a result of the opening of four gold mines (Brewer, Haile, Ridgeway, and Barite Hill) in the last decade. To support and help sustain this economic growth, the U.S. Geological Survey (USGS) has applied its geological and geochemical expertise to investigations of the gold deposits and their geologic setting in metavolcanic rocks of the Carolina slate belt (fig. 1). These studies are conducted in cooperation with industry and provide information to evaluate potential for the discovery of new deposits as known ore bodies are mined out. Preliminary reports on issues of special interest for exploration or that address environmental concerns are released as soon as information is available.



Figure 1. Location of gold mines in South Carolina.

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 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. South Carolina is covered by 566 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.

National Water-Quality Assessment Program

At the request of Congress, the USGS began a National Water-Quality Assessment (NAWQA) Program in 1991. The long term goals are to describe the status of and trends in the quality of a large representative part of the Nation's surface- and ground-water resources and to identify all the major factors that affect the quality of these resources. In 1994, NAWQA Program assessment activities began in the Santee River Basin and coastal drainages in North Carolina and South Carolina (fig. 2).

The following water-quality issues have been tentatively identified as high-priority, regional scale issues of concern to State and local water-resource managers and are addressed by the Santee-Coastal NAWQA Program study:

- Enrichment by nitrogen and phosphorus has caused algae in many lakes and rivers in the study area to increase dramatically, which reduces the concentrations of dissolved oxygen and adversely affects fish and other aquatic biota.
- Sediment erosion due to past and present land use increases turbidity, which, in turn, increases the cost of treatment for public consumption and industrial use, deposits silt in reservoirs, covers fish spawning beds, and causes aesthetic problems.

Index of Subjects

Potential for Discoveries of Gold
National Mapping Program
National Water-Quality Assessment Program
Geologic Mapping
Metallic Mineral-Resource Potential
Hydrology near a Hazardous-Waste Site
Saltwater Encroachment under Hilton Head Island
Bioremediation
Potential for Discoveries of Industrial Minerals
Collection of Hydrologic Data
Flood Frequency
Earth Observation Data
National Earthquake Information Center
Cooperating Agencies

- Runoff from urban areas can transport trace elements and synthetic organic compounds that can seriously affect the quality of water and wildlife habitats in the receiving streams.
- Pesticides and nutrients can contaminate surface- and ground-water.
- Mercury is present in elevated concentrations in fish that inhabit streams in the Coastal Plain of South Carolina.

Long-term assessment activities of the Santee-Coastal NAWQA Program study are a key attribute of the program—not only to define trends, but also to build an evolving understanding of water quality in the study area. This understanding will be achieved through careful analysis and interpretation of long-term data sets on the chemical and biological characteristics of the water resources relative to carefully compiled data on physical hydrology and changes in land use and management practices within the study area.

Geologic Mapping

Water-bearing sands beneath the Coastal Plain are a traditional source of water for municipalities, industry, and private landowners. However, this resource is endangered by overuse, saltwater



Figure 2. The NAWQA Santee Basin and coastal drainages study unit.

encroachment along the coast, and the threat of hazardous-waste contamination. Although long-standing Federal and State ground-water programs continue to provide information on ground-water quality and quantity, the USGS also is studying alternating layers of sandy and clayey sediments that form the actual conduits for ground-water flow. In cooperation with the Department of Natural Resources and the U.S. Department of Energy (Savannah River Site), the USGS study is focused on the older, thicker sands of Cretaceous age that are present to depths as great as 3,500 feet. By studying samples from existing test holes, and by drilling new test holes, USGS geologists can describe and trace the complex distribution of the numerous Cretaceous sand bodies. At the same time, the test holes provide samples for chemical and bacteriological studies of the ground water and sediments as well as sites for monitoring ground-water levels. This combination of traditional ground-water

studies with studies of the physical architecture of the water-bearing sediments will greatly improve our understanding of the Coastal Plain ground-water system.

Metallic Mineral-Resource Potential

Economic growth and development in South Carolina depend, in part, on the availability of local sources of minerals for use in industry, manufacturing, and the maintenance and upgrading of the region's infrastructure. This region also contains identified resources of gold, copper, lead, zinc, silver, titanium, rare earth, zirconium, tin, clay, lithium, mica, and feldspar minerals of national and global importance whose extraction and processing can form the basis for an enhanced regional economy. In conjunction with State Geological Surveys and resource agencies, the USGS is preparing an inventory of known mineral resources and an assessment of the potential for undiscovered mineral resources based on

geological, geophysical, and geochemical studies. Information in digital and paper form will assist Federal and State land-management agencies, regional planners, industry, and local governments in ensuring adequate supplies of minerals at the lowest possible cost and promoting sound management of the region's very substantial mineral resources.

Hydrology Near a Hazardous-Waste Site

A landfill near Pinewood, South Carolina, is one of two such facilities in the southeastern United States permitted by State and Federal agencies to accept hazardous waste. Since 1977, more than 1 billion pounds of ignitable, corrosive, acutely hazardous, reactive, and toxic wastes have been buried at the 279-acre site (fig. 3). The landfill is about 1,200 feet from Lake Marion, South Carolina's largest reservoir. Thus, the potential for contamination of ground and surface water by possible leakage from the site, and the direction of transport of any leakage are issues of public concern. The USGS, in cooperation with the South Carolina Public Service Authority, investigated the hydrogeology, benthic invertebrates, streamflow, lake-flow patterns, water quality, and sediment quality in the vicinity of the hazardous-waste landfill from 1987 to 1990.

A recent USGS report describes the hydrogeologic framework and the results of a computer simulation of shallow ground-water flow in the vicinity of the landfill. The model was used to gain a better understanding of the directions and rates of ground-water flow and the probable pathways of contaminant movement in the event of contaminant discharge to ground water. Directly or indirectly, these pathways lead to the lake.



Figure 3. Location of selected hydrologic investigations in South Carolina.

Saltwater Encroachment Under Hilton Head Island

Withdrawals of ground water at Hilton Head Island, South Carolina, and Savannah, Georgia, have created a cone of depression in water levels of the Upper Floridan aquifer (fig. 4). As a result, flow directions under Hilton Head have reversed, and saltwater in the aquifer under Port Royal Sound is moving toward Hilton Head. In cooperation with the South Carolina Department of Natural Resources (formerly the South Carolina Water Resources Commission), the USGS determined the location of the saltwater/freshwater interface and developed computer models to simulate movement of fresh and salty ground water. Results will be used by South Carolina and Georgia and by public service districts on Hilton Head Island to design strategies that may use combinations of pumping and injection to delay the encroachment of saltwater.

Bioremediation

Ground water has been contaminated at thousands of sites nationwide due to leaking underground storage tanks, landfills,

and spills. Most of these sites involve contamination by petroleum hydrocarbons such as gasoline and jet fuel. The large and expensive task of cleaning up these sites requires an assessment technique to determine which sites pose the most risk of exposure to humans or wildlife by way of streams, wells, or springs and which of the sites pose little risk. At most of these sites there is some natural, or intrinsic, bioremediation caused by bacteria that are already present in the soil. The USGS, in cooperation with the Naval Facilities Engineering Command, has developed an assessment strategy to determine, for any given site, whether the rate of intrinsic bioremediation is sufficient to prevent the migration of contaminants to nearby streams, wells, or springs. The technique relies on traditional hydrogeologic studies to determine the rate and direction of ground-water flow and the absorptive capacity of the soil. It relies on microbiological tests in the field and the laboratory to determine the rate of biodegradation. The rates are input into a computer model that simulates the distance that toxic concentrations will travel.

The technique was recently applied to two sites at the Marine Corps Air Station near Beaufort, South Carolina (fig. 3). Results showed that at one site, characterized by clayey soils, ground-water flow is sufficiently slow and biodegradation is sufficiently rapid that the contaminant plume will be effectively confined. At another site, characterized by sandy soils, ground water moves too quickly for effective bioremediation. Additional remediation techniques, such as enhanced bioremediation or pump-and-treat, will be necessary to protect nearby streams, wells, and springs.

Potential for Discoveries of Industrial Minerals

Competition for land, water, and biological resources; more intensive land-use practices; and environmental impacts coupled with accelerating population growth are stressing the availability of clay, limestone, sand and gravel, crushed rock, dimension or building stone, slate, aggregate, and other industrial mineral resources needed for infrastructure repairs and building projects. The USGS is helping to locate these resources.

Collection of Hydrologic Data

South Carolina's abundant surface- and ground-water resources are being stressed by the demands of an active and growing population. Careful management of water resources in the face of these pressures requires an extensive information base, which is the aim of the USGS. In cooperation with State, local, and Federal agencies, the USGS maintains an extensive network of data-collection stations that continuously monitor rainfall, water stage, streamflow, water quality, and ground-water levels. The data are stored in the USGS national data files and are available upon request. Additionally, the USGS has installed satellite telemetry equipment at most of its data-collection sites to provide water-resources data in near-real time to the District Office and to other agencies.

The surface-water network consists of 121 continuous-gaging stations, 39 stage-only stream stations, 12 lake-stage stations, 80 crest-stage partial-record stations, and 31 rain gage stations (fig. 5). The ground-water network contains 45 wells. The water-quality network consists of 34 multiple-parameter monitors, 18 single-parameter monitors and periodic sampling sites (fig. 6).

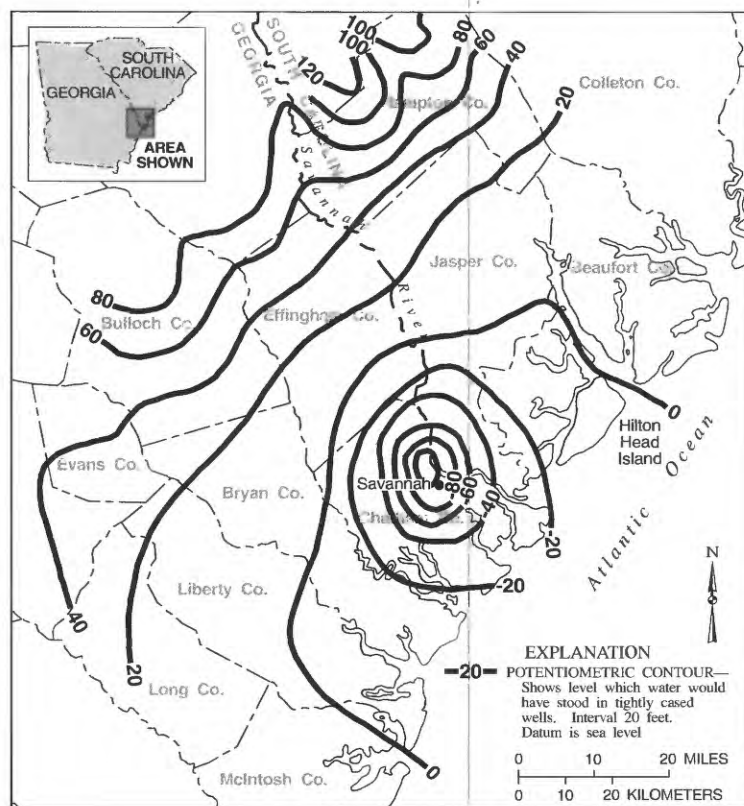


Figure 4. Potentiometric surface of the Upper Floridan aquifer in 1984.



Figure 5. Surface-water data-collection sites in South Carolina.



Figure 6. Water-quality data-collection sites in South Carolina.

Flood Frequency

The USGS report, *"Techniques for Estimating Magnitude and Frequency of Floods in South Carolina, 1988,"* provides methods for estimating the magnitude and frequency of floods on streams in South Carolina. Data from 174 gaging stations in or near South Carolina were used in the analyses. The frequency of flooding at these stations was computed by statistical analysis of the data. The analyses indicated that the drainage area and physiographic province are the only significant basin characteristics necessary to determine peak discharge for selected recurrence intervals.

Information on flood frequency and magnitude is needed for the economic and safe design of bridges, culverts, embankments, dams, levees, and other structures at or near streams. Flood-frequency information also is essential for effective flood-plain management and for setting appropriate flood-insurance rates. This report was prepared by the USGS in cooperation with the South Carolina Department of Transportation (formerly the Department of Highways and Public Transportation).

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 South Carolina. Mapping photographs of some sites goes back about 40 years. Satellite images from 1972 can be used to study changes in regional landscapes.

National Earthquake Information Center

South Carolina is one of the most seismically active States on the east coast. The National Earthquake Information Center (NEIC) in Golden, Colorado, collects, processes, and distributes information from more than 20,000 seismic events each year. This information is distributed in the form of alerts, bulletins, and routine catalogs to emergency management officials at the Federal and State levels, operators of critical facilities, news media, the general public, and the earthquake research community. These catalogs of recent and historical earthquake information are used in

earthquake hazards assessments. To fulfill its mission better, the NEIC has developed and is deploying the U.S. National Seismograph Network (USNSN), which, when completed, will consist of approximately 60 seismograph stations nationwide. The USNSN monitors nationwide seismicity, provides early notification of seismic events to national-level emergency services personnel, maintains an archive of high-quality digital data on national seismicity, and provides public information on earthquakes. The USGS also cooperates with the University of South Carolina on its statewide seismic monitoring network.

Cooperating Agencies

The USGS cooperates with more than 25 local, State, and Federal agencies in South Carolina. Local cooperators include cities, counties, and utility districts. State cooperators include the South Carolina Departments of: Natural Resources, Health and Environmental Control, and Transportation. Major Federal cooperators are the U.S. Department of Energy; the U.S. Navy; the U.S. Army; and the U.S. Army Corps of Engineers. Cooperative activities include water-resources-data collection, interpretive water-availability and water-quality studies, mineral-resources assessments, and mapping. When local and State agencies are involved, activities typically are funded on a matching-funds basis.

The USGS provides support to the South Carolina Water Resources Research Institute at Clemson University, 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
720 Gracern Road
Stephenson Center, Suite 129
Columbia, SC 29210
(803) 750-6100

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.