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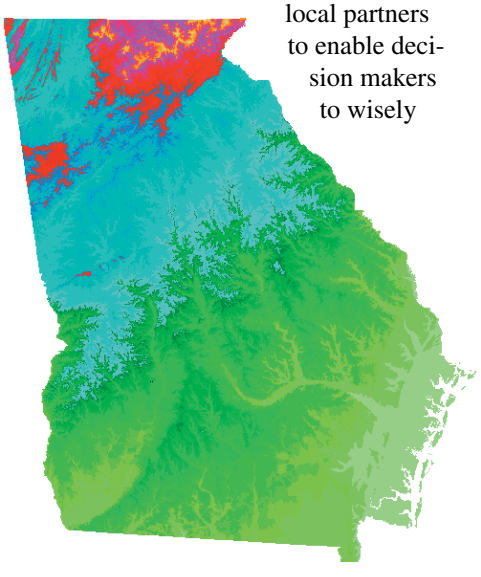
Helping Solve Georgia's Water Problems—The USGS Cooperative Water Program

The U.S. Geological Survey (USGS) addresses a wide variety of water issues in the State of Georgia through the Cooperative Water Program (CWP). As the primary Federal science agency for water-resource information, the USGS monitors the quantity and quality of water in the Nation's rivers and aquifers, assesses the sources and fate of contaminants in aquatic systems, collects and analyzes data on aquatic ecosystems, develops tools to improve the application of hydrologic information, and ensures that its information and tools are available to all potential users. This broad, diverse mission cannot be accomplished effectively without the contributions of the CWP.

The mission of the CWP is to provide reliable, impartial, and timely information needed to understand the Nation's water resources through a program of shared efforts and funding with State, Tribal, and local partners to enable decision makers to wisely



manage the Nation's water resources. Most work in the CWP is directed toward potential and emerging long-term problems, such as water supply, waste disposal, ground- and surface-water quality, floods, droughts, and environmental protection. In most cases, standardized methods are used so that results are transferable to broader areas that may have interstate, regional, or international significance. In some cases, CWP projects develop new or revised methods to evaluate water resources, which are described and become available for use elsewhere.

Because rivers and aquifers cross jurisdictional lines, studies and data collected in one county or one State have great value in adjacent counties or States. Therefore, it is effective to have one agency involved in these studies so that the information can be shared and is comparable from one jurisdiction to another. USGS offices within Georgia are able to draw on resources from the much larger national infrastructure of the USGS, including the National Water Quality Laboratory, the National Water Information System, the National Research Program (which provides tools and new methods and consultation on difficult scientific issues), instrumentation testing facilities, and a national system of quality assurance.

Cooperative Water Program in Georgia

The CWP is providing valuable information to effectively manage the water resources of Georgia. Several State and local agencies are cooperative partners in the CWP (see table above right).

These cooperative partners have worked with the USGS to develop studies to assess the availability of water resources, surface- and ground-water contamination problems, impacts of pumping on water resources, and flooding extent. Comprehensive monitoring networks have been established to monitor trends and assess best management practices. Digital databases and geographic information systems (GIS) have been designed to optimize evaluation of a wide variety of water-resource problems. The following studies are examples of the CWP in Georgia.

Agencies

Georgia Department of Transportation
Georgia Emergency Management Agency
Georgia Environmental Protection Division
Atlanta Regional Commission
Georgia Ports Authority
Flint River Water Planning and Policy Center
Jekyll Island Authority
Upper Oconee Basin Water Authority

Counties

Athens–Clarke	Crisp	Houston
Bibb	Dougherty	Lee
Camden	Fayette	Liberty
Chattooga	Glynn	McIntosh
Cherokee	Gwinnett	Polk
Clayton	Heard	Rockdale
Cobb	Henry	White

Cities

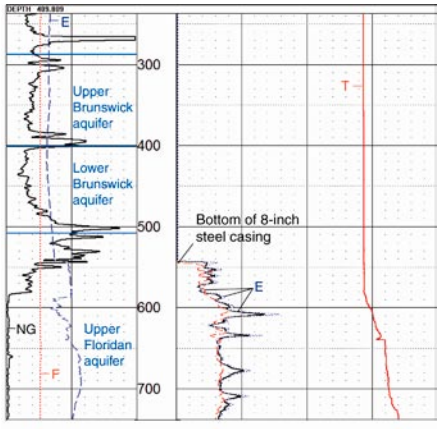
Albany	Etowah	Roswell
Atlanta	Griffin	Savannah
Blairsville	Helen	Springfield
Brunswick	Lawrenceville	Summerville
Covington	Ludowici	Thomaston
Dalton	Macon	Valdosta
East Point	Monroe	Winder

Hydrogeology and water-resource potential of fractured crystalline rock in northern Georgia (in cooperation with the City of Lawrenceville and Rockdale County Water Authority)—In northern Georgia, the development potential of ground-water resources is poorly understood. The goals of the CWP at Lawrenceville and Rockdale County are to determine the occurrence, availability, and quality of ground water in a fractured-crystalline-rock geologic setting. At Lawrenceville, geologic information collected as part of this program helped the city develop a new ground-water-supply system capable of producing nearly 2 million gallons per day. A monitoring program at Lawrenceville has been established to collect background streamflow and ground-water-level data in order to assess the impact of ground-

water pumping once initiated. Information is being used to develop and manage ground-water resources while providing better techniques to assess the occurrence of ground water in the Piedmont area and to assess the impact of ground-water development on the stream-aquifer system.

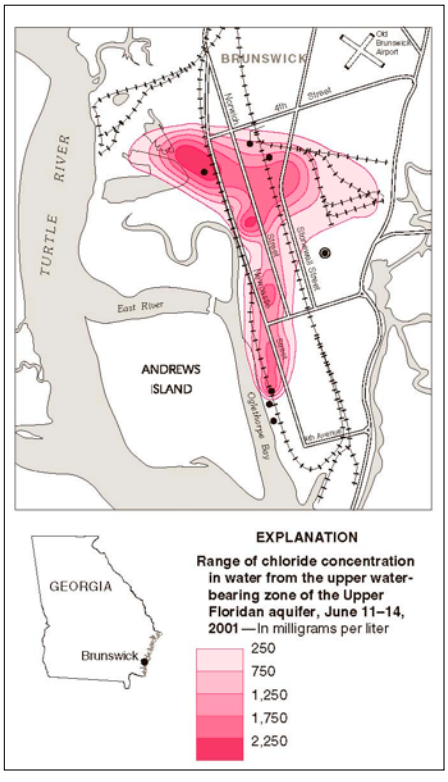
USGS hydrologist at a rock outcrop entering geologic data into a handheld computer linked to a global positioning system receiver. This information provides insight into geologic conditions controlling water availability in northern Georgia. Photo by Ethan W. Williams.

Coastal supplemental aquifers study (in cooperation with Glynn, Liberty, McIntosh, and Camden Counties and the City of Ludowici)—In coastal Georgia, concern about saltwater contamination of the Upper Floridan aquifer (the principal freshwater source for the region) and restrictions on its usage has spurred interest in the development of other ground-water sources for supplemental supply. The USGS is working with several cooperators to better define the water-bearing and water-quality characteristics of these supplemental sources by constructing test wells, assessing subsurface geology, determining water chemistry, and conducting aquifer tests. Ongoing monitoring in Liberty County is helping to assess the impact of development on hydrologic conditions. The project is providing cooperators with information needed to locally guide development of these potential supplemental sources of water supply, while providing data needed to characterize their geologic, hydrologic, and water-quality characteristics on a regional basis.



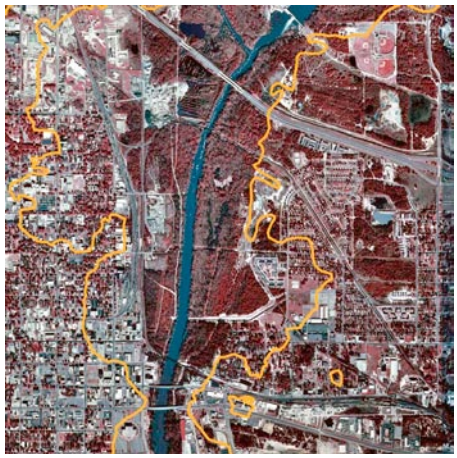
Geophysical logs provide information needed to assess the water-bearing potential of subsurface geologic units. The natural-gamma (NG) and electric (E) logs are used to determine different water-bearing zones. The fluid resistivity log (F) and temperature log (T) measure properties of borehole fluid.

Ground-water resources of the Brunswick, Georgia, area (in cooperation with the City of Brunswick)—The Upper Floridan aquifer is contaminated with saltwater in a 2-square-mile area of downtown Brunswick, which has limited development of the ground-water supply in the Glynn County area. The USGS has worked with the City of Brunswick since the early 1960s to monitor and assess the impact of ground-water development on saltwater contamination of the Floridan aquifer system. Currently, a 12-well network of continuous water-level recorders monitors the effect of pumping on the ground-water system. An 88-well network is sampled on an annual basis to monitor changes in saltwater contamination. Information is being used to manage and develop ground-water resources in the area, while providing insight into mechanisms of saltwater intrusion from deep sources of saltwater.



Extent of chloride contamination at Brunswick during June 2001. The USGS collects and analyzes samples from an 88-well network on an annual basis as part of the Brunswick area Cooperative Water Program. Data helped State and local officials determine that the position of the chloride plume has remained relatively stable since the early 1980s (accessed on February 15, 2006, at http://ga.water.usgs.gov/pubs/wrir/wrir034032/pdf/qw-brunswick.pdf*).*

Flood inundation and visualization of the Flint River near Albany, Georgia (in cooperation with Dougherty County, Georgia)—During 1994, rains associated with Tropical Storm Alberto caused severe flooding in the Albany, Dougherty County area. To enable better characterization of flood inundation for a broad range of flood stages, the USGS partnered with Dougherty County to accurately model flood inundation by developing a two-dimensional hydrodynamic model and GIS tools. Study results provide for visualization of the extent of flooding associated with 10- to 500-year flood events. This information will enable emergency management officials, planners, and developers to determine areas prone to flooding and that may need to be evacuated during rising floodwaters. The calibrated model can be used to assess flood abatement strategies.

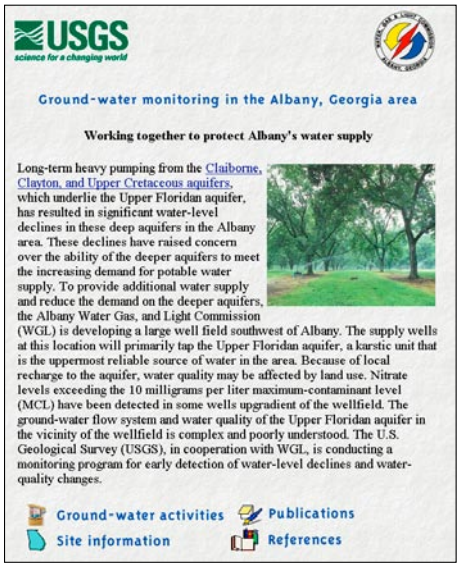


Digital orthophoto quadrangle showing extent of flooding at Albany from Tropical Storm Alberto during 1994. The USGS model, developed as part of the Cooperative Water Program, enables prediction of the extent of flooding under a wide variety of potential flood conditions (accessed on February 15, 2006, at http://ga.water.usgs.gov/pubs/other/gwrc2005/pdf/GWRC05_Musser.pdf*).*

Ground-Water Resources of the Albany, Georgia, area (in cooperation with the Albany Water, Gas, and Light Commission, and the Flint River Water Planning and Policy Center)—Since the 1970s, the USGS has worked with the Albany Water, Gas, and Light Commission to provide information needed to manage ground-water resources. Long-term pump-

ing from deep ground-water sources in the Albany new well field has raised concern about protection of the new water source.

As part of the CWP, the USGS continuously monitors water levels in an 18-well network to assess the effect of pumping on major aquifers used for water supply in the area. More recently, a program was developed to annually collect and analyze for nitrate samples, from a 14-well network near the new well field. A digital ground-water flow model is being developed to provide better understanding of ground-water flow near the new well field. Information is being used by cooperators to manage and develop ground-water resources in the area, while providing insight into mechanisms of ground-water flow and nitrate contamination in a karst hydrogeologic setting.



A Web site developed as part of the Albany area Cooperative Water Program provides the public with information on ground- and surface-water resources of the area. The Web site can be accessed at http://ga.water.usgs.gov/projects/albany/

Metropolitan Atlanta Urban Hydrology Program (in cooperation with the cities of Atlanta and Roswell, Georgia Environmental Protection Division, and Gwinnett and Rockdale Counties)—Nonpoint sources of pollution account for the majority of violations of the Clean Water Act, as reported on the 303d List of Impaired Waters in Georgia. The majority of the violations are for bacterial indicators; but dissolved oxygen, pH, metals, nutrients, sediment, and various organic compounds are also commonly involved. The sources for many of these contaminants include nonpoint-source runoff from

USGS personnel collecting biological samples as part of the urban hydrology program. These data can be used to determine the health of aquatic ecosystems. Photo by William B. Hughes, USGS.

urban areas, construction sites, agricultural fields, golf courses, and other developed areas. State, county, and municipal governments—as well as environmental groups—are all interested in obtaining information on the sources, transport, and fate of these contaminants. There is also a need for understanding the processes that control the concentrations and loadings of these contaminants in streams, their effect on aquatic ecosystems, and potential for human health consequences.

The USGS, in cooperation with several State and local agencies, is working to evaluate stream water quality and its relation to land use, point- and nonpoint-source discharges, and watershed characteristics; determine relations between water quality, watershed characteristics, and aquatic ecology; contrast the stream water-quality conditions, trends, and loads measured before and after upgrades to wastewater infrastructure and implementation of best management practices; and identify correlations among fecal coliform bacteria (current indicator bacteria), *Escherichia coli* bacteria (proposed indicator bacteria), and organic compounds identified as wastewater compounds. The project provides data that are used in stormwater management plans, in National Pollutant Discharge Elimination System monitoring requirements, and in meeting monitoring requirements of the Federal Clean Water Act as administered by the Georgia Environmental Protection Division (GaEPD).

Statewide water-quality sampling network (in cooperation with GaEPD)—This ongoing program provides basic data for use in assessing current conditions and trends in streamflow and water quality. Includes analysis of nutrients, major ions, and metals at 130 sites statewide. Fifty sites are sampled each year, with the remaining 80 sites sampled on a rotational basis in each of Georgia's five major river basins. GaEPD uses these data for the establishment of Total Maximum Daily Loads.

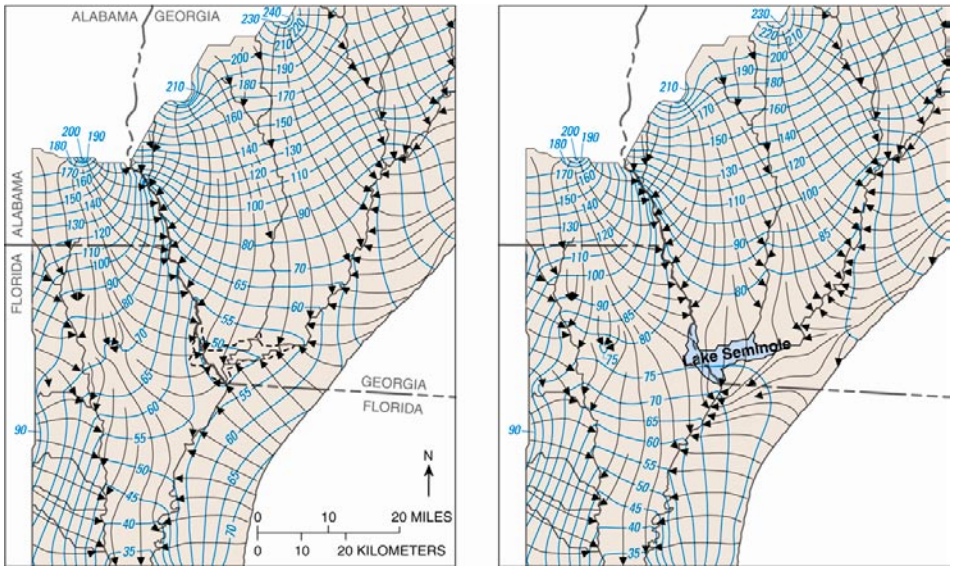
Coastal Georgia Sound Science Initiative (in cooperation with GaEPD)—This program of scientific and feasibility studies supports development of a GaEPD strategy to protect the Upper Floridan aquifer from saltwater contamination in coastal Georgia. The program includes investigation of paths and rates of ground-water flow and intrusion of saltwater into the Upper Floridan aquifer through development of detailed flow and solute-transport models. Areas where saltwater is entering the Floridan aquifer system have been delineated by constructing offshore test wells near Savannah, Ga.–Hilton Head Island, S.C., and deep test wells onshore near Savannah and St. Marys, Ga. The water-bearing potential of alternative water sources—including the Lower Floridan aquifer, the surficial and Brunswick aquifer systems, and dug seepage ponds—was assessed and reported. Finally, an expanded monitoring network has been developed to assess the impact of development on ground-water levels and quality. The program is providing information needed by the cooperator to effectively manage water resources in coastal Georgia, while providing insight into mechanisms of saltwater contamination in the Atlantic Coastal Zone and on alternative sources of water supply.

The U.S. Army Corps of Engineers jack-up barge was used as a platform for drilling offshore test borings as part of the Coastal Sound Science Initiative. Core, hydrologic, water-quality, and geophysical data were collected at five sites during 1999–2001. Data are being used to identify areas where saltwater is entering and contaminating the Upper Floridan aquifer, the principal source of freshwater in the coastal region. Photo by Michael F. Peck, USGS (accessed on February 15, 2006, at http://ga2.er.usgs.gov/coastal/).

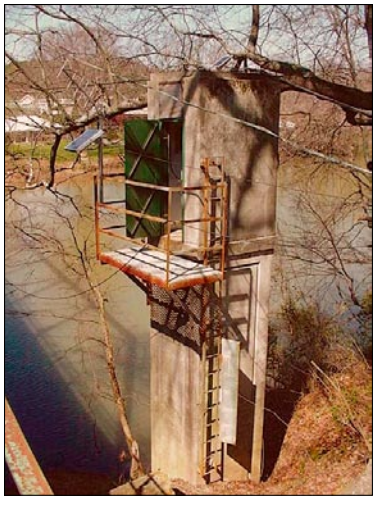
Southwest Georgia Sound Science Initiative (in cooperation with GaEPD)—In southwestern Georgia, increased irrigation pumpage from the Upper Floridan aquifer threatens to reduce the flow of the Flint River significantly and could adversely affect downstream users and the ecosystem in the lower part of the Apalachicola–Chattahoochee–Flint (ACF) River Basin. Determination of cause-and-effect relations between ground-water pumping and streamflow reduction in this complex karst environment are needed to support water-management decisions by State and Federal officials.

The USGS, in cooperation with GaEPD, is conducting studies to evaluate stream-lake-aquifer flow and the impact of agricultural withdrawal on the ACF River Basin. The southwest Georgia Sound Science Initiative is composed primarily of the Lake Seminole hydrologic assessment project and the lower ACF transient ground-water flow model project. The Lake Seminole project is quantifying lake water-budget components and ground- and surface-water interactions, defining interstate ground-water flow between Georgia and Florida, identifying changes to the ground-water flow system due to lake impoundment, and assessing the potential for sinkhole collapse and catastrophic lake drainage. The lower ACF transient ground-water flow model project is improving understanding of the impact of seasonal agricultural withdrawal on the stream-aquifer system, including assessment of the sensitivity of selected streams to ground-water pumping. Information from the two studies is being used to support withdrawal permit decisions by the State of Georgia, while providing insight into ground-water and stream interconnection in a complex karst environment.

Georgia HydroWatch Monitoring Network (in cooperation with GaEPD, U.S. Army Corps of Engineers, and many Georgia cities and counties)—This network of streamgages and well sites provides long-term and real-time records of hydrologic and water-quality conditions in support of hydrologic investigations and water-management decisions. Data serve as the basis to evaluate changes in the hydrologic regime due to climate, extreme meteorological events, and anthropogenic factors and provide information on hydrologic and water-quality conditions. Real-time hydrologic information is served on the World Wide Web to enable cooperators, environmental officials, water-resource managers, emergency management officials, and the general public to make informed decisions regarding Georgia's water resources and public safety. Many of the streamgages in this network provide data used by the National Weather Service in its river-forecast models to predict floods.



Maps showing results of model simulations in the lower ACF Rvier Basin. Map on the left shows water level in the Upper Floridan aquifer before impoundment of Lake Seminole. Map on the right shows water level after impoundment. Contours indicate water-level altitude in feet, arrows indicate directions of ground-water flow (from Jones, L.E., and Torak, L.J., U.S. Geological Survey Scientific Investigations Report 2004-5077, accessed on February 15, 2006, http://pubs.usgs.gov/sir/2004/5077/*).*



Real-time streamgage site is part of the USGS Hydrowatch Network. Several cooperators in Georgia provide funding for monitoring sites that collectively form a statewide real-time network of 222 streamgage and 19 ground-water sites (accessed on February 15, 2006, at http://ga2.er.usgs.gov/gawater/gawatersites.cfm*).*

Outlook

In today's environment of decreasing levels of Federal funding, The USGS has decreased its proportion of funding to the CWP in Georgia. Although the CWP originated as a 50:50 fund-matching arrangement, cooperator funds have grown faster than USGS funds during recent years. For example, during 2005, CWP funds in Georgia totaled $7.7 million, of which cooperators contributed nearly 75 percent.

As the population of Georgia continues to grow, there will be ever-increasing demands on the State's finite water resources. The State of Georgia is currently developing a comprehensive statewide water management plan. The USGS CWP will play an important role in providing data and understanding of processes controlling the quantity and quality of Georgia's water resources.

For more information on the CWP in Georgia

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http://ga.water.usgs.gov/

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