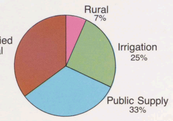
Public-Supply Water Use in Georgia, 1983

by Nancy L. Barber

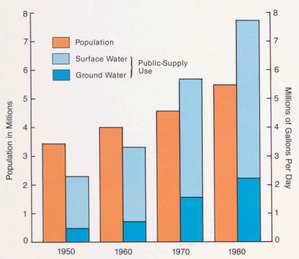
Introduction

Public water suppliers are those entities which sell water to consumers. A public supplier may be a municipality selling water to home owners, businesses, and light industry within its borders; a county water authority supplying small towns and individual customers; or a privately owned water-production facility that treats and sells water to industries, cities, or subdivisions. Some public suppliers do not "produce" any water, but act as centralized purchasing and distribution operations. This map report is primarily concerned with water-production facilities that withdraw ground or surface water from Georgia's aquifers or streams and reservoirs, treat the water to drinking water standards, and distribute it to their customers. For the purposes of this report ground water is limited to water withdrawn from wells. Surface water includes water from streams, rivers, lakes, reservoirs, and springs. Previous reports on water use in Georgia classified springs as ground-water sources.

Georgia Water Use, 1980



In 1980, Georgia ranked 12th in the United States in population and in public-supply water use (Solley and others, 1983). Public-supply water use accounted for 33 percent of total water use, excluding thermoelectric power generation. (Thermoelectric power generation requires large amounts of water for cooling, but nearly all of this water is returned to the source.) The most obvious users of public-supply water are people who buy water for drinking, sanitation, and other domestic uses. However, the bar graph of population changes and public-supply water use shows that the increase in water use has outstripped the growth in population. Georgia's population grew 60 percent from 1950 to 1980, but public-supply water use increased 230 percent over the same period. Water use per person has been increasing as more homes are equipped with water-using appliances such as dishwashers, disposals, and washing machines. A study of a residential area from 1980 to 1983, conducted as part of the Georgia Water-Use Program, found per capita residential water use to be around 75 gallons per day. This is a significant increase over the 50 gallons per day reported by earlier studies and long accepted as a standard, but is substantially less than the 100 gallons per day used to make the 1980 water-use estimates. Although the increase in per capita water use over the old standard is large, it alone cannot account for the total rise in public-supply water use. The great increase in public-supply use is due to increases in the other components of public supply use: water sold to commercial and industrial facilities. As Georgia's economy has expanded, many new commercial and industrial facilities opening in the State have depended on public water supplies. Many cities, seeking to attract new jobs, have offered to supply water to industrial facilities, saving business owners the time and the expense of developing their own potable water source. Cities also have agreed to treat industrial wastewater as an added inducement.



This map report is based on data from the Georgia Water Use Program, a cooperative effort of the Georgia Geologic Survey and the U.S. Geological Survey. The Program, ongoing since 1979, maintains a computer data base of information on the State's major water users, including the source and amount of water used. The data base is compiled from the files of the Georgia Environmental Protection Division (EPD), from other governmental regulatory agencies, and from sources such as industry lists and population estimates. Every 5 years, the amount of water used by groups of smaller users is estimated to obtain a complete picture of Georgia's water use. This was last done for 1980.

Data on public-supply water use are very complete (unlike some other water-use categories), because public drinking water sources are permitted and regularly monitored for water quality. These permit files are maintained by the Water Resources Management Branch of EPD. Public suppliers that withdraw more than 100,000 gallons per day are required to have permits regulating the quantity of water used, which are also issued and monitored by the Water Resources Management Branch of EPD. Data also are available on the quantity of water discharged by public entities such as municipally owned wastewater treatment plants. These facilities are permitted under the National Pollution Discharge Elimination Program (NPDES) and are regulated by the Water Protection Branch of EPD.

SELECTED REFERENCES

Akioka, Lorena M., ed., [1984], Georgia Statistical Abstract 1984-85: University of Georgia, p. 2.

Clarke, John S., 1985, personal communication.

Clarke, John S., and Pierce, Robert R., 1984, Groundwater Resources of Georgia, in The Georgia Operator, v. 21, n. 4, p. 10 and following.

Herrick, Stephen M., 1961, Well Logs of the Coastal Plain of Georgia: Georgia Geological Survey Bulletin 70, 462 p.

Kemmer, Frank N., ed., 1979, The Nalco Water Handbook: McGraw-Hill Book Company, New York, chapters 8-23.

MacKichan, Kenneth A., 1951, Estimated Use of Water in the United States—1950: U.S. Geological Survey Circular 115, 13 p.

MacKichan, K.A., and Kammerer, J.C., 1961, Estimated Use of Water in the United States, 1960: U.S. Geological Survey Circular 456, 26 p.

McFadden, Stephen S., and Perriello, P. Dennis, 1983, Hydrogeology of the Clayton and Claiborne Aquifers in Southwestern Georgia: Georgia Geologic Survey Information Circular 55, 59 p.

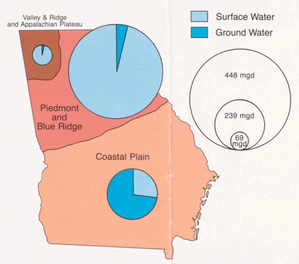
Murray, C. Richard, and Reeves, E. Bodette, 1972, Estimated Use of Water in the United States in 1970: U.S. Geological Survey Circular 676, 37 p.

Shank, David E., 1985, personal communication.

Solley, Wayne B., Chase, Edith B., and Mann, William B., IV, 1983, Estimated Use of Water in the United States in 1980: U.S. Geological Survey Circular 1001, 56 p.

U.S. Bureau of the Census, 1984, Statistical Abstract of the United States 1985: U.S. Department of Commerce, p. 23-25.

Public-Supply Water Use by Physiographic Province



The Coastal Plain is underlain by thick layers of sand, clay, and limestone that include the most productive aquifer in the State. Three-fourths of the public water-supply withdrawals in this area are ground water. In the Piedmont and Blue Ridge provinces, where Georgia's population is concentrated, the underlying crystalline rocks yield water in limited quantities. For this reason, most large towns and cities in these regions depend on surface water, which accounts for 99 percent of the water used. In the northwestern corner of the State, the Valley and Ridge and Appalachian Plateau provinces are underlain by folded sandstone, limestone, dolostone, and shale of Paleozoic age. Aquifers in these areas yield small to large quantities of water to wells. Several cities in the Valley and Ridge province use spring water for public supply, but spring water is classified as surface water for this study. Surface water thus accounts for 96 percent of public-supply use in northwestern Georgia.

System Interconnections

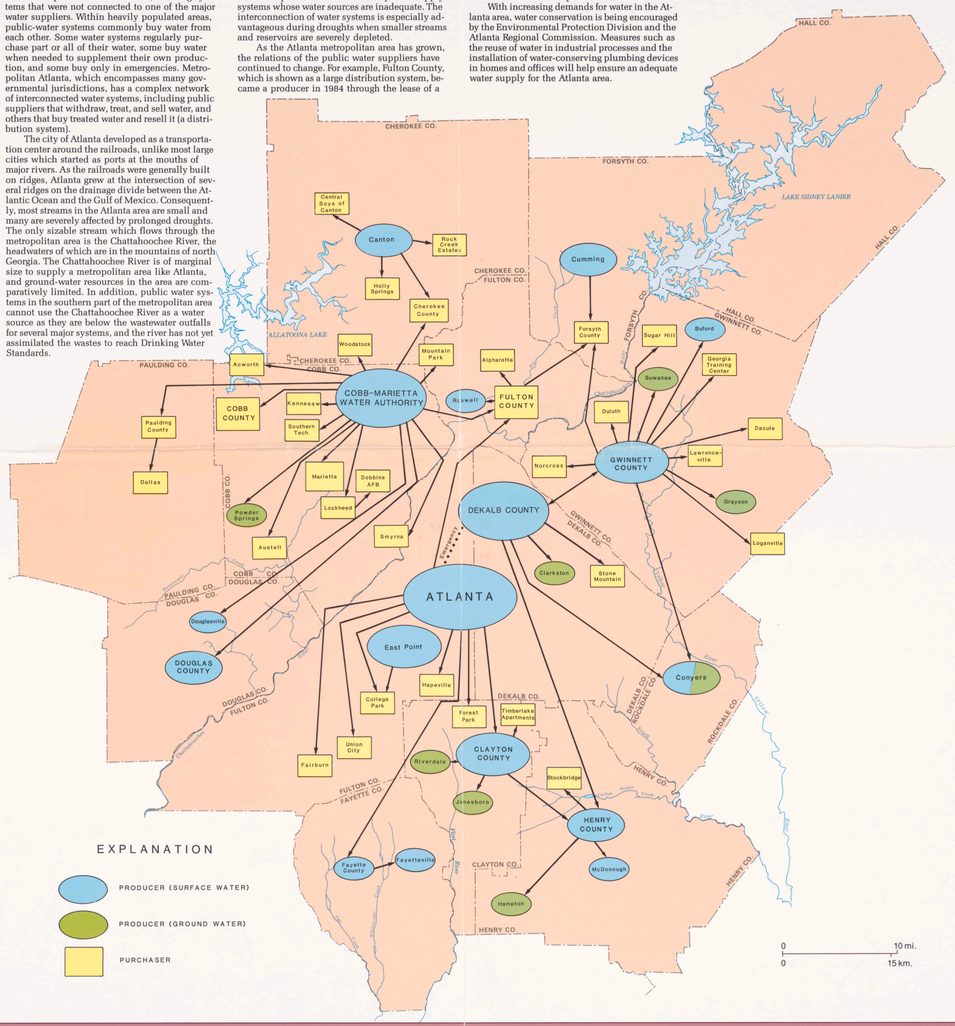
The diagram here shows the network of interconnected public water supply systems in the Atlanta metropolitan area as of 1983, omitting systems that were not connected to one of the major water suppliers. Within heavily populated areas, public-water systems commonly buy water from each other. Some water systems regularly purchase part or all of their water, some buy water when needed to supplement their own production, and some buy only in emergencies. Metropolitan Atlanta, which encompasses many governmental jurisdictions, has a complex network of interconnected water systems, including public suppliers that withdraw, treat, and sell water, and others that buy treated water and resell it (a distribution system).

The city of Atlanta developed as a transportation center around the railroads, unlike most large cities which started as ports at the mouths of major rivers. As the railroads were generally built on ridges, Atlanta grew at the intersection of several ridges on the drainage divide between the Atlantic Ocean and the Gulf of Mexico. Consequently, most streams in the Atlanta area are small and many are severely affected by prolonged droughts. The only sizable stream which flows through the metropolitan area is the Chattahoochee River, the headwaters of which are in the mountains of north Georgia. The Chattahoochee River is of marginal size to supply a metropolitan area like Atlanta, and ground-water resources in the area are comparatively limited. In addition, public water systems in the southern part of the metropolitan area cannot use the Chattahoochee River as a water source as they are below the wastewater outfalls for several major systems, and the river has not yet assimilated the wastes to reach Drinking Water Standards.

The relative scarcity of water in the Atlanta area has encouraged the interconnection of public water systems. Thus, major suppliers with access to the more dependable sources of water (the Chattahoochee River and Lakes Allatoona and Lanier, north of the city) are able to expand their water treatment plants and sell water to public-supply systems whose water sources are inadequate. The interconnection of water systems is especially advantageous during droughts when smaller streams and reservoirs are severely depleted.

As the Atlanta metropolitan area has grown, the relations of the public water suppliers have continued to change. For example, Fulton County, which is shown as a large distribution system, became a producer in 1984 through the lease of a water treatment plant on the Chattahoochee River in the northern part of the area. Other changes occurred when large production systems extended their supply lines to make water available at lower cost. Smaller water-supply systems then purchased water from the large systems and became distributors instead of producers.

With increasing demands for water in the Atlanta area, water conservation is being encouraged by the Environmental Protection Division and the Atlanta Regional Commission. Measures such as the reuse of water in industrial processes and the installation of water-conserving plumbing devices in homes and offices will help ensure an adequate water supply for the Atlanta area.



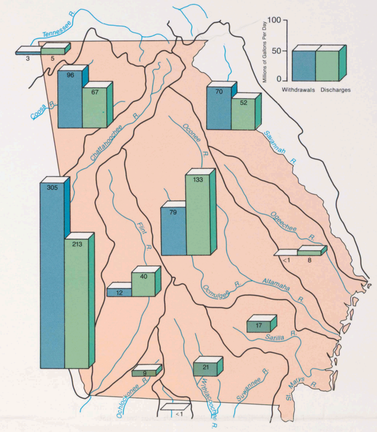
Public-Supply Use by Water Source

Surface Water

The rivers and streams of Georgia are important as sources of water supply and as receiving bodies for the disposal of treated wastewater. Interbasin transfer, in which water is withdrawn from one stream basin and is discharged as wastewater to another basin, can be damaging if the quantity of wastewater exceeds the assimilative capacity of the receiving stream. Net loss of water from a basin also may cause problems by reducing the amount of streamflow and limiting the quantity of water available for use downstream. Interbasin transfer of water occurs continuously in the Atlanta area where public water systems and wastewater systems connect four major river basins. The largest transfer of water is from the Chattahoochee River basin to the Altamaha and Flint River basins. The second largest transfer is from the Coosa River basin (Lake Allatoona) to the Chattahoochee, but the effect of this is masked by the size of the transfers out of the Chattahoochee basin. The Three Rivers Project, under construction by the City of Atlanta, will return to the Chattahoochee River some 30 mgd now (1985) discharged to the South River, which is in the Altamaha basin, and to the Flint River. When completed, this project should improve the water quality in both the South and Chattahoochee Rivers. Basins which extend over parts of the Coastal Plain show greater wastewater discharges than surface-water withdrawals not only from interbasin transfer, but because most Coastal Plain cities use ground water as their supply and then discharge wastewater to streams.

An alternative to stream discharge of wastewater used in some areas is land application, where treated wastewater is sprayed onto cultivated or forested land. While land application may reduce stream pollution, if the stream is used as a source of water it will lose a certain amount of flow just as in interbasin transfer.

Public-Supply Surface-Water Withdrawals and Discharges by River Basin, 1983

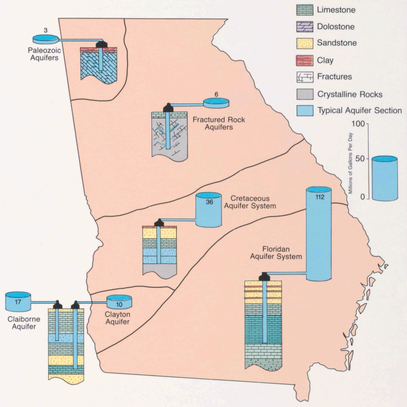


Ground Water

The Coastal Plain aquifers are arranged in "layer cake" fashion in the wedge of Coastal Plain sediments. The uppermost aquifer used for public supply is the Floridan aquifer system (formerly called the principal artesian aquifer). This aquifer underlies much of the Coastal Plain, but is used for public supply mainly in the lower two-thirds of the region. The aquifer consists primarily of limestone and dolostone, and public-supply wells range from 200 to 800 feet deep. Underlying the Floridan (omitting the zones which do not serve as aquifers) is the Claiborne aquifer. The Claiborne consists of sand or sandy limestone and is used for public supply in the upper Coastal Plain. Wells tapping the Claiborne range in depth from 100 to 400 feet. The next-lower aquifer is the Clayton, primarily a limestone that is used heavily in the Albany area and other parts of southwestern Georgia. Wells for public supply generally range in depth from 100 to 800 feet. The water level in the Clayton aquifer has undergone serious declines in recent years because of increased withdrawals for public supply and industrial and irrigation use in southwestern Georgia. The deepest aquifer is the Cretaceous aquifer system, used in the upper Coastal Plain just south of the Fall Line. This sand and gravel aquifer system supplies water to public-supply wells that range in depth from 50 to 700 feet.

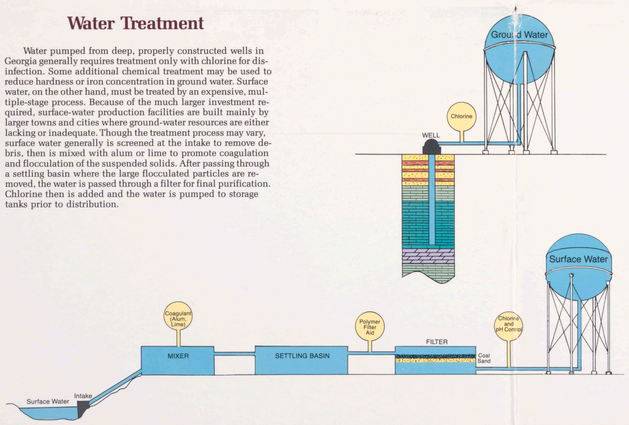
In the Piedmont and Blue Ridge provinces, ground water is stored in discontinuous fracture zones in the crystalline rocks. Well yields are much lower than in the Coastal Plain, and wells range in depth from 50 to more than 600 feet. The Valley and Ridge and Appalachian Plateau provinces are underlain by a variety of rock types of Paleozoic age that store water in fractures and cavities. The most productive are limestones and dolostones which contain water in solution-enlarged openings.

Public-Supply Ground-Water Withdrawals by Aquifer, 1983



Water Treatment

Water pumped from deep, properly constructed wells in Georgia generally requires treatment only with chlorine for disinfection. Some additional chemical treatment may be used to reduce hardness or iron concentration in ground water. Surface water, on the other hand, must be treated by an expensive, multiple-stage process. Because of the much larger investment required, surface-water production facilities are built mainly by larger towns and cities where ground-water resources are either lacking or inadequate. Though the treatment process may vary, surface water generally is screened at the intake to remove debris, then is mixed with alum or lime to promote coagulation and flocculation of the suspended solids. After passing through a settling basin where the large flocculated particles are removed, the water is passed through a filter for final purification. Chlorine then is added and the water is pumped to storage tanks prior to distribution.



Public-Supply Use by County

Public-supply water use by county closely mirrors the pattern of population distribution. The cities of Atlanta, Augusta, Macon, Columbus, Savannah, Albany, and Athens are easily picked out by population density and high water use in the corresponding counties. Whitfield County, which includes the City of Dalton, is not as large a population center, but falls into the top category of water use due to the large quantity of water sold to carpet industries through the public supply system.

The maps of ground-water and surface-water use show the break between the Coastal Plain where ground water is the principal source, and the northern part of the State where surface-water use is dominant. Because of the ready availability of ground water in the Coastal Plain and the relatively low cost of required treatment, smaller industries and some commercial facilities such as motels may supply their own water. For this reason cities of a given size in the Coastal Plain may have less public-supply use than cities of similar size in the Piedmont and Blue Ridge.

The map of wastewater discharges by publicly owned facilities has a pattern much like the map showing water-supply withdrawals. Overall, discharges are smaller than withdrawals, because some distributed water is consumed — used for lawn watering and industrial processes, discharged to septic tanks, or otherwise not returned to the city or county sewer systems. Comparing public water-supply withdrawals to wastewater discharges can be misleading. Because some users are connected to the water system but not to the sewer system, or vice versa, the amount of consumptive water use in a county generally is difficult to determine.