Estimated Use Of Water in the Apalachicola-Chattahoochee-Flint River basin during 1990 with State Summaries from 1970 to 1990

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CONVERSION FACTORS

Multiply	By	To obtain
inches (in.)	25.4	millimeters
gallons per day (gal/d)	0.003785	cubic meters per day
million gallons per day (Mgal/d)	0.043808	cubic meters per second
square mile (mi^2)	2.589	square kilometer
gigawatthour (GWh)	1,000	megawatthour
GWh	1,000,000	kilowatthour

ADDITIONAL ABBREVIATIONS

mg/L = milligrams per liter

ACRONYMS

ACF = Apalachicola-Chattahoochee-Flint
CES = Cooperative Extension Service (Georgia)
FDER = Florida Department of Environmental Regulation
GEPD = Georgia Environmental Protection Division
GGS = Georgia Geologic Survey
GSA = Geological Survey of Alabama
NWFWMD = Northwest Florida Water Management District
USGS = U.S. Geological Survey
WRMB = Water Resources Management Branch

GLOSSARY

Aquifer. A geological formation, group of formations, or part of a formation that contains sufficient saturated material to yield significant quantities of water to wells and springs.

Agricultural water use. Includes water used for irrigation and nonirrigation purposes. Irrigation water use includes the artificial application of water on lands to assist in the growing of crops and pasture, or to maintain vegetative growth in recreational lands, parks, and golf courses. Nonirrigation agricultural water use includes water used for livestock, which includes water for stock watering, feedlots, dairy operations, fish farming, and other farm needs.

Commercial water use. Water use for motels, hotels, restaurants, office buildings, commercial facilities and civilian and military institutions. The water can be obtained from a public supply or can be self supplied.

Consumptive use. That part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Sometimes called water consumed or water depleted. Additionally, any water withdrawn in the basin and transferred out of the basin for use is considered 100 percent consumptively used.

Cooling water. Water used for cooling purposes, such as in condensers and in nuclear reactors.

Disposal system or method. Refers to injection wells, outfalls, drain fields, percolation ponds, spray fields, and other facilities utilized for the release of reclaimed or treated effluents to the environment.

Domestic wastewater facility. Refers to those facilities that receive or dispose of wastewater derived principally from residential dwellings, business or commercial buildings, institutions, and the like; sanitary wastewater; sewage. Also referred to as municipal wastewater.

Domestic water use. Water for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Also called residential water use. The water can be obtained from a public supply or can be self supplied.

Freshwater. Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids; generally, more than 500 mg/L dissolved solids is considered undesirable for drinking and many industrial uses. Generally, freshwater is considered potable.

Gigawatthour (GWh). A measure of electricity, one billion watthours.

Ground water. Generally all subsurface water as distinct from surface water: specifically, that part of the subsurface water in the saturated zone (a zone in which all voids are filled with water).

Ground-water disposal. Refers to wastewater that is disposed of through the ground either by seepage or injection. This includes the following discharge methods, absorption beds, injection wells, drain fields, percolation ponds, and spray fields (land application). Land application systems (reuse systems and spray fields) are considered ground-water disposal methods, as the wastewater used to irrigate turf or crops is generally intended to filter down through the soil.

Hydroelectric power water use. Water use in the generation of electricity at plants where the turbine generators are driven by falling water. Hydroelectric power water use is considered an instream use of water, and is generally a non-consumptive use of water.

Industrial wastewater facility. Refers to those facilities that produce, treat, or dispose of wastewater not otherwise defined as a domestic wastewater; including the runoff and leachate from areas that receive pollutants associated with industrial or commercial storage, handling, or processing.

Industrial water use. Water used for industrial purposes such as fabricating, processing, washing, and cooling, and includes water used for such industries as steel, chemical and allied products, paper and allied products, mining, and petroleum refining. The water can be obtained from a public supply or can be self supplied.

Instream use. Water use taking place within the stream channel for such purposes as hydroelectric power generation, navigation, water-quality improvement, fish and wildlife propagation, and recreation. Sometimes called nonwithdrawal use or in-channel use.

Million gallons per day (Mgal/d). A rate of flow of water.

Municipal wastewater facility. See Domestic wastewater facility.

Land application. The reuse of reclaimed water or the utilization or disposal of effluents on, above, or into the spray fields, irrigation systems, or other methods.

Navigational water use. Water utilized as a means of commercial (and sometimes recreational) transportation. Includes water used to lift a vessel in a lock, or maintain a navigable channel level. Navigational water use is considered a non-consumptive instream use of water and is generally not measured or accounted for.

Offstream use. Water withdrawn or diverted from a ground- or surface-water source for public-water supply, industry, irrigation, livestock, thermoelectric-power generation, and other uses. Sometimes called off-channel use or withdrawal use.

Other water use. Water used for such purposes as heating, cooling, irrigation (public-supplied only), lake augmentation, and other nonspecific uses. The water can be obtained from a public supply, or can be self supplied.

Per capita use. The average amount of water used per person during a standard time period, generally per day. Public supply per capita use refers to the amount of water used for public supply divided by the population served.

Public supply. Water withdrawn by public and private water suppliers and delivered to users. Public suppliers provide water for a variety of uses, such as domestic, commercial, industrial, thermoelectric power (domestic and cooling purposes), and public-water use. See also domestic water use, commercial water use, industrial water use, public-water use, and other water use.

Public-water use. Water supplied from a public-water supply and used for such purposes as firefighting, street washing, and municipal parks and swimming pools. Public-water use also includes system water losses (water lost to leakage). Also referred to as water utility use.

Reclaimed wastewater. Wastewater treatment-plant effluent that has been diverted or intercepted for some beneficial use before it reaches a natural waterway or aquifer. For this report, reclaimed water includes wastewater treatment-plant effluent that is used for landscape irrigation (such as golf courses, cemeteries, highway medians, parks, playgrounds, school yards, nurseries, and commercial or residential properties) and agricultural irrigation (such as food and fruit crops, wholesale nurseries, sod farms, and pasture grass). It does not include reclaimed water that is used for esthetic uses, environmental enhancement, ground-water recharge, or wetland restoration.

Recycled water. Water that is used more than one time before it passes back into the natural hydrologic system or is discharged into a wastewater system. Also referred to as recirculated water.

Resident population. The number of persons who live in a State who consider it their permanent place of residence. College students, military personnel, and inmates of penal institutions are counted as permanent residents. Tourist and seasonal or part-time residents are considered nonresident population.

Residential water use. See domestic water use.

Return flow. The water that reaches a ground- or surface-water source after release from the point of use and is available for further use.

Saline water. Water that contains more than 1,000 mg/L of dissolved solids.

Self-supplied water. Water withdrawn from a ground- or surface-water source by a user and not obtained from a public supply.

Silviculture. The cultivation of forest trees. For purposes of this report, this includes management of timberlands (areas capable of producing 20 cubic feet of industrial wood per acre per year) and woodland (areas incapable of producing 20 cubic feet of industrial wood per acre per year under natural conditions) (Thompson, 1988).

Sprinkler irrigation. A pressurized irrigation system where water is distributed through pipes to the field and applied through a variety of sprinkler heads or nozzles. Pressure is used to spread water droplets above the crop canopy to simulate rainfall (Izuno and Haman, 1987). These systems include portable and traveling guns systems, solid or permanent fixture (overhead or pop ups) systems, center pivot systems, and periodic moving systems. Also referred to as overhead irrigation. The efficiencies of these sprinkler irrigation systems range from 15 to 85 percent (Smajstrla and others, 1988), but generally a 70 percent efficiency is assumed.

Surface water disposal. Refers to the release of reclaimed water or treated effluent directly into a surface water body (including marshes or wetlands). This does not include water discharged into ponds for holding or percolation purposes.

Thermoelectric power. Electrical power generated by using fossil-fuel (coal, oil, or natural gas), geothermal, or nuclear energy.

Thermoelectric power water use. Water used in the process of the generation of thermoelectric power. The water can be obtained from a public supply or be self-supplied. Water used for thermoelectric power generation purposes is considered an offstream use of water, and is generally a non-consumptive use.

Treated (wastewater) effluent. Refers to water that has received primary, secondary, or advanced treatment and is released from a wastewater facility after treatment.

Wastewater. A combination of liquid and water-carried pollutants from residence, commercial buildings, industrial plants, and institutions including any groundwater, surface runoff or leachate that may be present.

Water transfer. Artificial conveyance of water from one area to another. This may be referred to as an import or export of water from one basin or county to another.

Withdrawal. Water removed from the ground or diverted from a surface-water source for use.

Estimated Use of Water in the Apalachicola-Chattahoochee-Flint River basin during 1990, and trends in water use from 1970 to 1990

By Richard L. Marella, Julia L. Fanning, *and* Will S. Mooty

ABSTRACT

The Apalachicola-Chattahoochee-Flint River basin covers approximately 19,800 square miles, and drains parts of Alabama, Florida, and Georgia. Most of the basin lies within Georgia as does most of the population. The 1990 population in the basin was estimated at nearly 2.636 million. Most of the water withdrawn in the basin in 1990 (82 percent) was from Georgia. Withdrawals in Florida and Alabama during 1990 were each 9 percent of the total water withdrawn in the basin.

Water withdrawn in the Apalachicola-Chattahoochee-Flint River basin for 1990 totaled 2,098 million gallons per day, of which, approximately 17 percent (351 million gallons per day) was consumptively used. Of the total water used, nearly 86 percent was withdrawn from surface-water sources, and the remaining 14 percent was withdrawn from ground-water sources. Surface water withdrawals in the basin during 1990 were for thermoelectric power generation (60 percent), public supply (24 percent), self-supplied commercial-industrial uses (12 percent), and agricultural uses (4 percent). Ground water withdrawals in the basin for 1990 was for agricultural irrigation (58 percent), public supply (21 percent), self-supplied domestic use (11 percent), self-supplied commercial-industrial use (9 percent), and thermoelectric power generation (less than 1 percent). The Chattahoochee River was the source for most of the surface water used in the basin (64 percent), and the Floridan aquifer system was the source for most of the ground water used (44 percent) during 1990.

INTRODUCTION

The Apalachicola-Chattahoochee-Flint (ACF) River basin covers approximately 19,800 mi^2 (U.S. Army Corps of Engineers, 1984, p. 3), and drains parts of Alabama, Florida, and Georgia (fig. 1). The basin stretches from its headwaters, north of Lake Sidney Lanier in north Georgia, to the Apalachicola Bay in Florida, where the Apalachicola River discharges into the Gulf of Mexico. The rivers are used as sources of water supply by several cities, industries, and farms and for wastewater dilution, navigation for barge traffic, recreational boating and fishing, fish and wildlife propagation and power generation. Seasonal flooding of the rivers sustains the forested flood plain ecosystem along the river corridor and provides the freshwater needed to maintain a healthy seafood industry in Apalachicola Bay. Economic activities in this basin include agriculture, commercial services, silviculture (forestry), manufacturing, lumber and food processing, and commercial fishing (in Florida only).

Located partly within the ACF River basin is one of the Nation's fastest growing urban areas, Atlanta, Ga. The population of this metropolitan area in 1990 was nearly 2.834 million, an increase of more than 68 percent from 1.684 million in 1970 (U.S. Bureau of the Census, 1991a, p. 29). Most of the population in this urban area depends on surface water from the Chattahoochee River for drinking-water supply; however, the actual percentage using water from this source is unknown.

Droughts can severely affect water users in this basin. The drought of 1980-81 caused a reduction in hydroelectric power generation, the curtailment of navigation, reduced lake levels for recreation, and restrictions on lawn watering and other water uses (U.S. Army Corps of Engineers, 1984, p. 4).

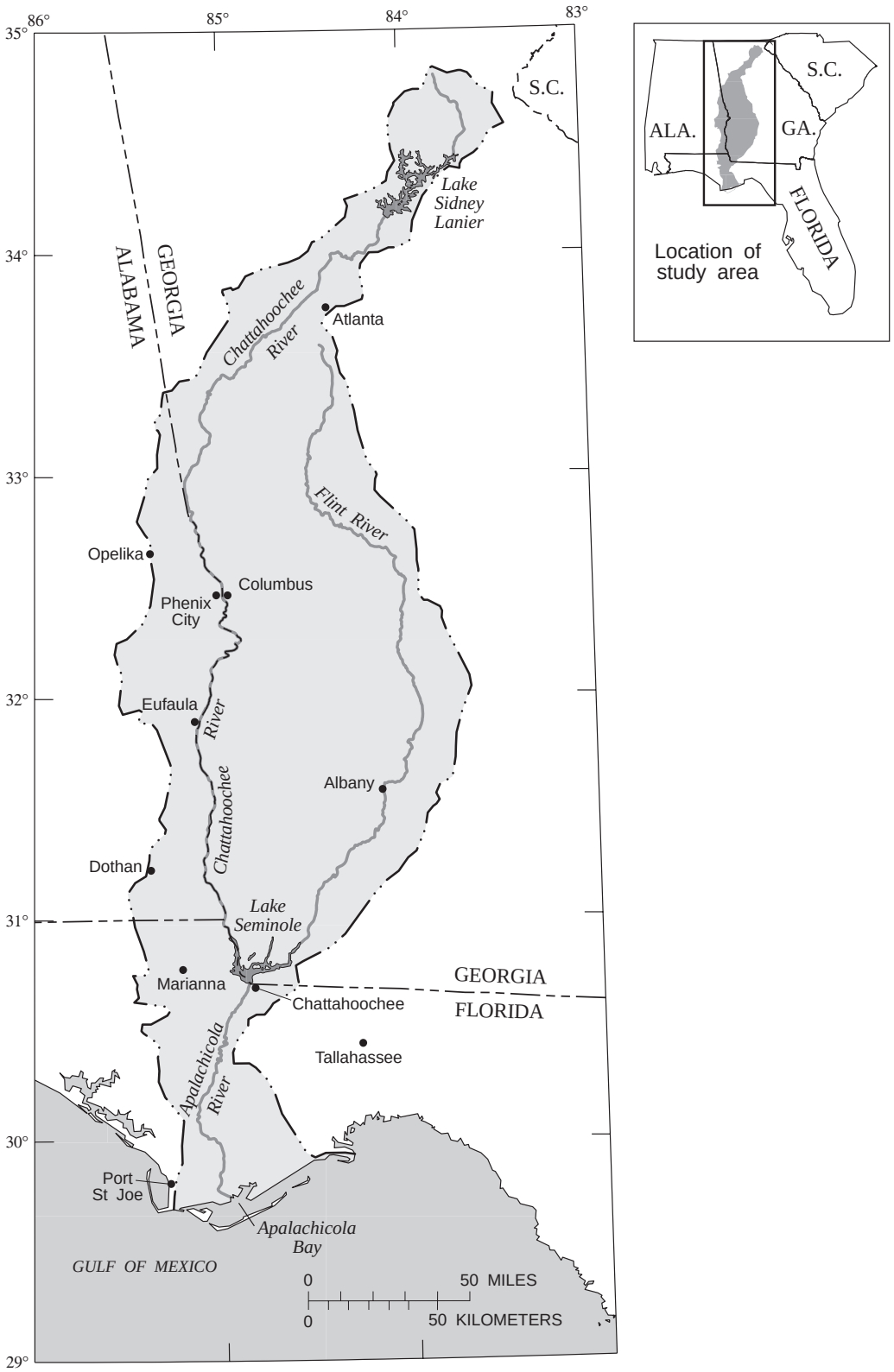

Figure 1. Location of the Apalachocola-Chattahoochee-Flint River basin and selected cities.

Because of the diversity of water uses, the increases in population, agricultural production, and the effects of droughts in the ACF River basin, information on the quantity of water used, the location of use, and the categories of uses, and the amount of wastewater returned to the system is needed to manage and protect the resource.

The USGS collects and compiles water use data for each state through cooperative agreements with governmental agencies in Alabama, Florida and Georgia. The data used for this report was collected and compiled as part of the USGS five-year water use assessment for the United States. This report was compiled for the ACF through special arrangement with the cooperating agencies, the Geological Survey of Alabama, the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation), and the Georgia Geological Survey.

Purpose and Scope

This report presents the most recent water-use estimates for the ACF River basin. An inventory of the quantity and sources of water withdrawn, category of use, and the locations (State, county, and river basin) of water used in the ACF River basin during 1990 are provided. Trends in water withdrawals within the basin also are presented.

Data are presented in this report are for freshwater withdrawals only (no saline water withdrawals were inventoried). Offstream water withdrawal data in the ACF River basin are presented for each of the following categories: public supply, self-supplied domestic, self-supplied commercial-industrial (including mining uses), agricultural (including irrigation, livestock and fish farming uses), and thermoelectric power generation. Water-use data for the ACF River basin were compiled on a county level. For those counties that are partially within the ACF River basin, data are presented for only that part of the county that lies within the basin. The water-use data presented in this report are for the years 1970, 1975, 1980, 1985, and 1990. Some water-use data for 1977, 1987, and 1989 are available for Florida and Georgia and are included in the tables, but these data are not included in the summaries nor included in any figures. The only instream (nonwithdrawal) use of water presented in this report is for hydroelectric power generation. Information concerning instream (nonwithdrawal) water use such as for navigation, water-based recreation, propagation of fish and wildlife, and dilution and conveyance of liquid or solid wastes, was not included.

Previous Investigations

Many studies and reports have been completed on various parts of the ACF River basin, however, only recent reports containing water-use data will be mentioned here. In 1984, an ACF River basin water assessment was conducted by the U.S. Army Corps of Engineers (U.S. Army Corps of Engineers, 1984). This study included a complete basin inventory and reconnaissance for many aspects of the water resources of the ACF River basin including a description of 1980 water use. The Georgia Department of Natural Resources published two reports (1984a and 1984b) that provide a detailed inventory of water uses and discharges in the Chattahoochee and Flint River basins for 1982 and provided summarized data for 1980.

Reports of 1985 water use for Alabama (Baker and Mooty, 1987; Mooty, 1990); Florida (Bielby, 1987; Marella, 1988; 1990a); and Georgia (Turlington and others, 1987; Pierce, 1990) detail water-use in the ACF River basin by State. Water use data for the ACF River basin in 1985 was compiled from these reports by the USGS and published in the Proceedings of the 1991 Georgia Water Resource Conference (Marella, 1991, p. 9). Additional water-use reports exist for Alabama, Florida and Georgia, however, most of these reports summarize statewide water use data by category and county, but most do not report totals for the ACF River basin.

Data Sources and Reliability

As part of the U.S. Geological Survey's (USGS) National Water-Use Information Program, water-use data are collected and compiled for each State every 5 years (Solley and others, 1988, p. 3). Water-use values are reported in each State by category, county, hydrologic unit (basin), and for 1990 by aquifer. Data used for this report were compiled by each State as part of the 1990 National Water-Use Information Program. Water-use data for Alabama in 1990 was collected through an ongoing cooperative effort between the Geological Survey of Alabama (GSA) and the USGS.

Categories of 1990 water-use data and sources of the data for Alabama are as follows:

Public supply.--Water withdrawals and population served data was obtained from the public supply utilities inventoried by the GSA. For 1990, the GSA collected withdrawal and population served data from those systems that served more than 25 people.

Self-supplied domestic.--Water withdrawals for domestic purposes were estimated by subtracting the population served by public supply facilities from the total population of the county, and then multiplied by the water-use coefficient of 75 gallons per day (gal/d) per person (Baker and Mooty, 1987, p. 16). Water for self-supplied domestic purposes was assumed to be obtained solely from ground water sources.

Self-supplied commercial-industrial.--Water withdrawal information for commercial and industrial facilities (including mining facilities) in 1990 was obtained from the Alabama Department of Environmental Management. Data included the amount of water purchased (from public supply utilities) and withdrawn by the facility.

Agricultural.--Estimates of water withdrawn for agricultural uses were made for both irrigation and nonirrigation uses. Irrigation water use was determined by multiplying the number of irrigated acres per crop type (within a county) by the appropriate application rate. Acreage data was obtained from the Alabama Cooperative Extension Service, and included the number of acres irrigated by county and type of crop grown. Application rates and data on the source of the water was determined by the GSA and the USGS. Nonirrigation water uses include aquaculture and livestock. Estimates for aquaculture water use were made by multiplying total pond acreage (used for catfish farming) by the average water-use application rate for catfish. The aquaculture water-use data (pond acreage, application rates, water source) were obtained through a USGS pond acreage inventory and from the Auburn University, Department of Fisheries and Allied Agricultures. Estimates for livestock (animal) water use were made by multiplying the number of livestock in each county by the average daily water consumption for each type of livestock. The number and types of livestock within the State was provided by the Alabama Crop and Livestock Reporting Service.

Power Generation.--Water withdrawals and power produced for the one thermoelectric power generation facility within the basin was obtained by the GSA directly from Alabama Power Company.

Water-use data for Florida in 1990 was collected through an ongoing cooperative effort between the Florida Department of Environmental Protection (formerly the Florida Department of Environmental Regulation) and the USGS and published by Marella, (1992). Water-use data for Florida for 1990 were obtained as follows:

Public supply.--Water withdrawals and population-served data were obtained from the public supply utilities inventoried by the USGS. For 1990, the USGS obtained water withdrawal and population-served data from the FDER monthly operating reports, which included monthly pumpage data for those systems that served more than 25 people.

Self-supplied domestic.--Water withdrawals for domestic purposes were estimated by subtracting the population served by public supply from the total population of the county to obtain the self-supplied population and multiplying the self-supplied population by the public supply per capita water use for each county. Water for self-supplied domestic purposes in Florida was assumed to be obtained solely from ground water sources.

Self-supplied commercial-industrial.--Water withdrawals by commercial and industrial facilities (including mining facilities) in 1990 was obtained from the Northwest Florida Water Management District (NWFWMD) through their consumptive water-use permit files or by contacting the facilities directly. Data collected included the amount of water withdrawn by facility.

Agricultural.--Estimates of water withdrawn for agricultural uses were made for both irrigation and nonirrigation uses. Irrigation water use was determined by multiplying the number of irrigated acres per crop type (within a county)

by the appropriate application rate. Acreage data was obtained from the County Extension Agent (University of Florida, Institute of Food and Agricultural Sciences, County Extension Service), the Florida Crop and Livestock Reporting Service, and the NWFWMD consumptive water-use permit files, and included the number of acres irrigated by county and the type of crop grown. The application rates were obtained from the NWFWMD and the U.S. Department of Agriculture, Soil Conservation Service. Sometimes, the actual metered amount of water used for irrigation on selected farms within the NWFWMD were available through the consumptive water-use permit files of the NWFWMD. Nonirrigation water use includes aquaculture and livestock uses. Estimates for aquaculture water use were obtained from the NWFWMD consumptive water-use permit files. Estimates for livestock (animal) water use were made by multiplying the number of livestock in each county by the average daily water consumption for each type of stock. The number and types of livestock within the State were provided by the Florida Crop and Livestock Reporting Service and the average daily water consumption was obtained from the University of Florida, Institute of Food and Agricultural Sciences.

Power Generation.--Water withdrawals and power produced for the one thermoelectric power generation facility within the basin was obtained by the USGS directly from The Gulf Power Company. Water used and power generated for the one hydroelectric power plant within the basin was obtained by the USGS directly from the U.S. Army Corps of Engineers.

Water-use data for Georgia in 1990 was collected through an ongoing cooperative effort between the Georgia Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey (GGS) and the USGS. Water-use data for Georgia for 1990 were published by Fanning and others (1992). Water-use data for Georgia for 1990 were obtained as follows:

Public supply.--In Georgia, all public supply systems that withdraw at least 100,000 gal/d or 0.1 million gallons per day (Mgal/d) are required by law to obtain a permit. Water withdrawals by these systems were compiled from the permit applications by the Georgia Environmental Protection Division (GEPD), Water Resource Management Branch (WRMB). For 1990 water use estimates, 74 of the largest public-supply systems were contacted to determine the number of connections, population served, and a listing of major wholesalers and industries served. Water use estimates for smaller systems (including subdivision, mobile home and trailer parks) were determined by multiplying the population served by a water-use coefficient of 75 gal/d.

Self-supplied domestic.--Water withdrawals for domestic purposes were estimated by subtracting the population served by public supply facilities from the total population of the county, and multiplying that self-supplied population by an estimated per capita use of 75 gal/d (Trent and others, 1990). Water for self-supplied domestic purposes was assumed to be obtained solely from ground-water sources.

Self-supplied commercial-industrial.--Water withdrawals for commercial and industrial facilities (including mining facilities) in 1990 were obtained from the GEPD-WRMB, Ground Water and Surface Water permit and program files. Additional data for this category was collected by the GGS and the USGS through direct contact with the facilities. Data collected includes the amount of water withdrawn by facility and source.

Agricultural.--Estimates of water withdrawn for agricultural purposes were made for both irrigation and nonirrigation uses. Irrigation water-use estimates were made using the irrigated acreage and water application rates supplied by the University of Georgia, Cooperative Extension Service (CES). Every 2 years, extension agents collect information on irrigation application rates for various crops, total irrigated acreage, and type of irrigation system used for each county in Georgia. Nonirrigation water use includes aquaculture and livestock. Estimates for aquaculture water use were made by the CES. Estimates for livestock (animal) water-use were made by multiplying the number of

livestock in each county by the average daily water consumption for each type of stock. The number and types of livestock within the State was provided by the CES and the U.S. Department of Agriculture, Crop Reporting Service.

Power Generation.--Water withdrawals for the thermoelectric power generation facilities were obtained from the GEPD-WRMB, Ground Water and Surface Water permit files. Power production data for 1990 was supplied by the power plant operators. Power generated for the hydroelectric power plants was obtained by contacting the facility operators or owners and the U.S. Department of Energy. Power generation data for each hydroelectric facility was used with a conversion coefficient to estimate the amount of water used during 1990.

Hydrologic Unit Codes and Water-Use Reporting Units

In the nationwide basin numbering system of the USGS, in which basins are assigned a unique hydrologic unit code, the ACF River basin is in subregion 0313 and contains three subbasins (the Apalachicola, Chattahoochee, and Flint River basins) and 14 cataloging units (fig. 2). These cataloging units are: the Upper Chattahoochee, Middle Chattahoochee-Lake Harding, Middle Chattahoochee-Walter F. George Reservoir, Lower Chattahoochee, Upper Flint, Middle Flint, Kinchafoonee-Muckalee, Lower Flint, Ichawaynochaway, Spring, Apalachicola, Chipola, New, and the Apalachicola Bay (Seaber and others, 1987, p. 23). The unique hydrologic unit codes for each of these cataloging units is shown in figure 2.

Water-use estimates presented in this report are in million gallons per day and are average daily quantities derived from annual data. The tables in this report list values in million gallons per day and are reported to two places right of the decimal or to the nearest 10,000 gallons per day. In the text, however, water-use values are rounded to whole numbers and population estimates are rounded to thousands.

Description of Study Area

The ACF River basin lies in southeastern Alabama, the central panhandle of northwestern Florida, and the northeastern, central, and southwestern part of Georgia (fig. 1). The basin includes all or part of 80 counties in three States, 10 in Alabama, 8 in Florida, and 62 in Georgia (fig. 3). The southern and extreme northern part of the basin is rural and is predominantly comprised of farm land, forest, and wetlands. In contrast, the north-central part of the basin is highly urbanized.

The total population of the ACF River basin in 1990 was estimated at nearly 2.636 million. More than 90 percent (2.376 million) lived in Georgia (fig. 4), and nearly 75 percent lived in the part of the Atlanta metropolitan area within the ACF River basin. Large cities with resident populations of more than 100 thousand in the basin in 1990 include Atlanta and Columbus, Ga. Approximately 0.601 million acres were irrigated in the ACF River basin during 1990. Peanuts, corn, soybeans, and cotton were the major crops grown and irrigated within the basin. Georgia accounted for 92 percent of the acres irrigated in the basin, with most of the irrigated area occurring in the Dougherty Plain area of southwest Georgia (fig. 5).

The Chattahoochee River, which begins in northern Georgia and flows southwest into Alabama and Florida, originates in the Blue Ridge physiographic province in Georgia and flows 436 miles (Edmiston and Tuck, 1987, p. 3) southwest to the Alabama-Georgia State line and then southward through the Piedmont and Coastal Plain physiographic provinces (fig. 5). The Chattahoochee River basin in Alabama encompasses approximately 2,800 mi^2 (U.S. Army Corps of Engineers, 1984) and accounts for more than 14 percent of the ACF River basin drainage area. The Flint River originates south of Atlanta in the Piedmont physiographic province and flows 350 miles (Edmiston and Tuck, 1987, p. 3) southward through the Coastal Plain physiographic province. Together, the Chattahoochee and Flint River basins in Georgia cover approximately 14,500 mi^2 (U.S. Army Corps of Engineers, 1984) and represent more than 73 percent of the ACF River basin. The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers (fig. 1) at Lake Seminole. Located in the Coastal Plain physiographic province (fig. 5), the Apalachicola River basin in Florida encompasses nearly 2,500 mi^2 and includes the Chipola and New Rivers (U.S. Army Corps of Engineers, 1984). This part of the Apalachicola River basin in Florida accounts for 13 percent of the ACF River basin total drainage area.

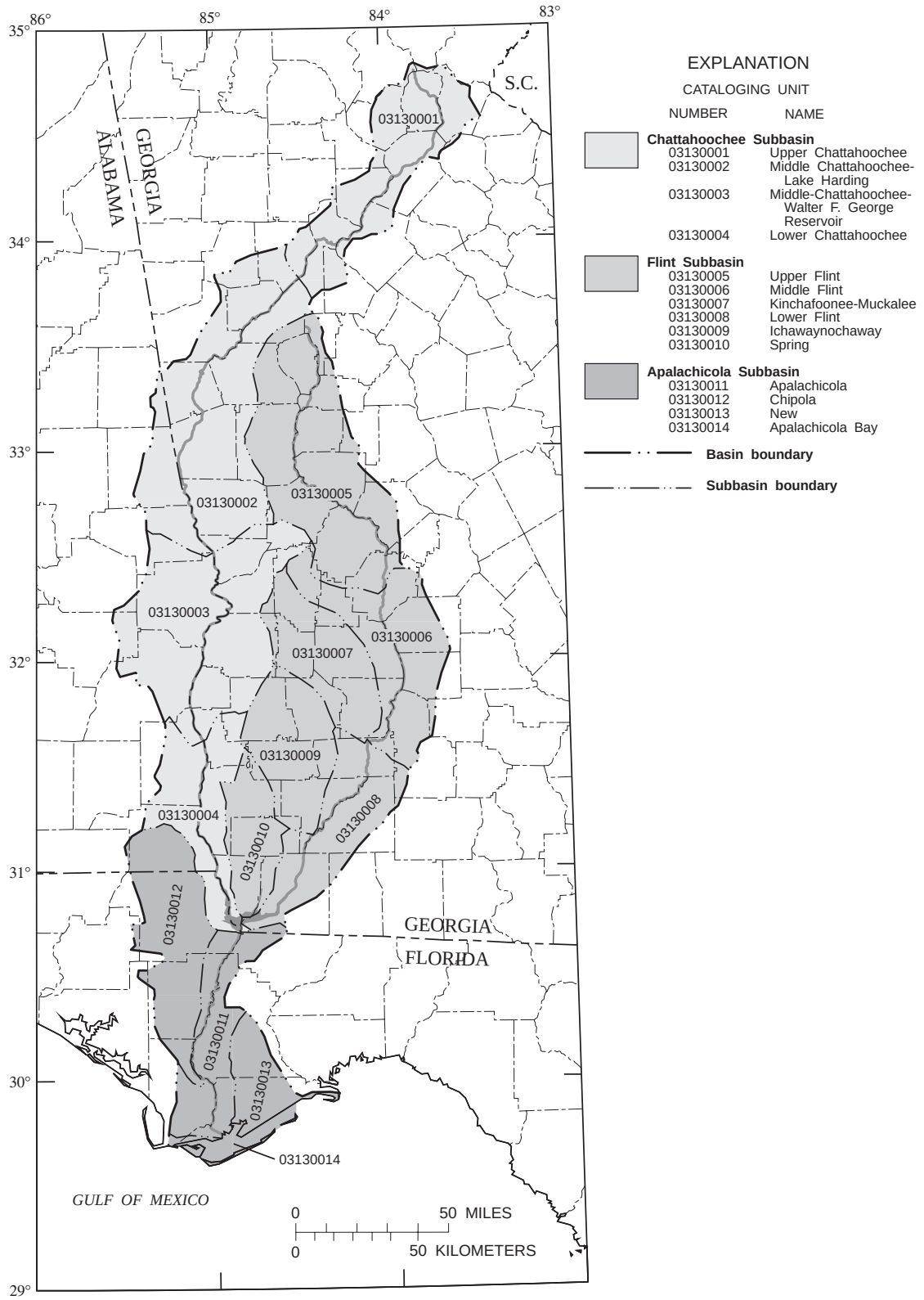

Figure 2. Location of subbasins and cataloging units within the Apalachicola-Chattahoochee-Flint River basin.

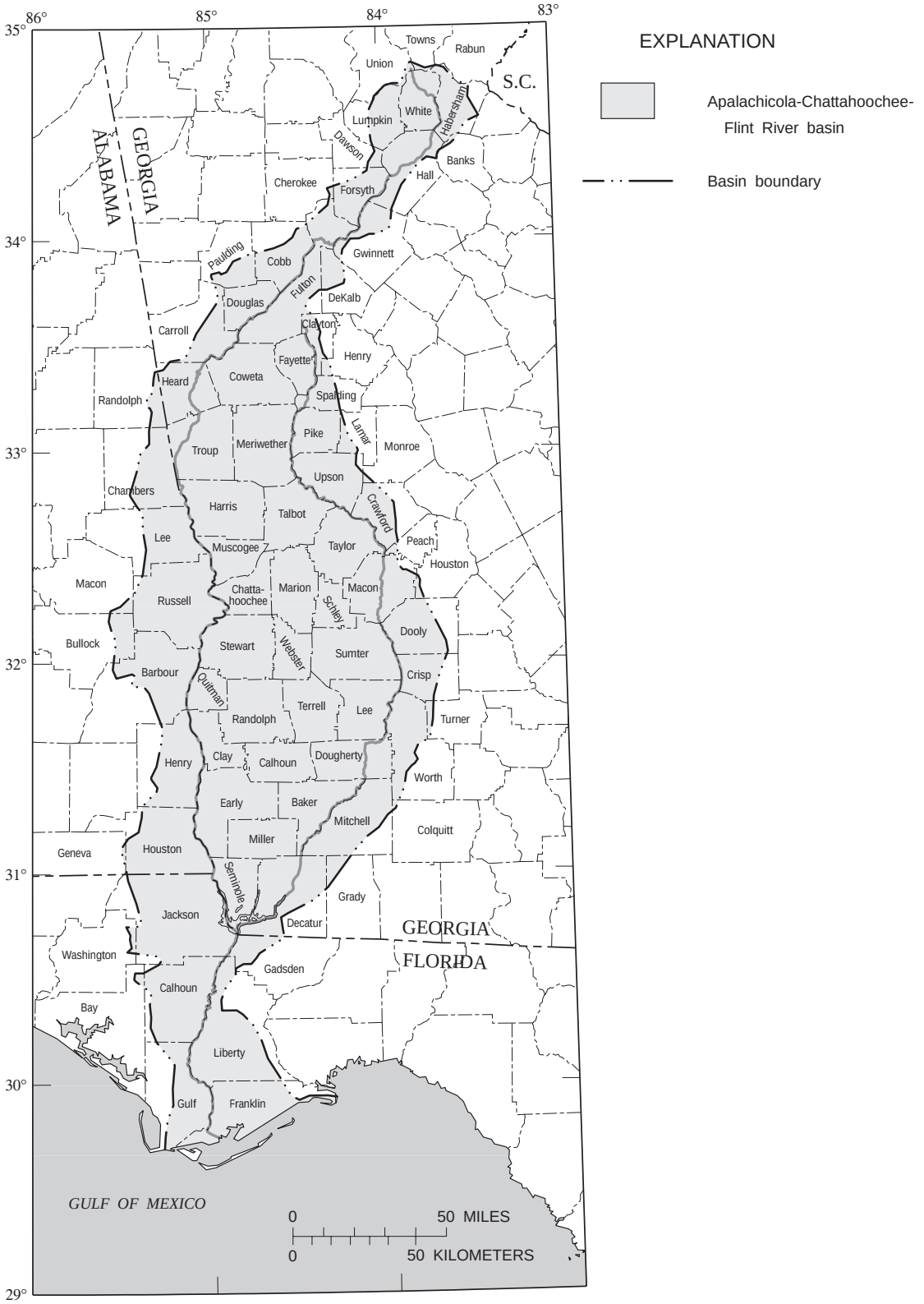

Figure 3. Location of counties within the Apalachicola-Chattahoochee-Flint River basin.

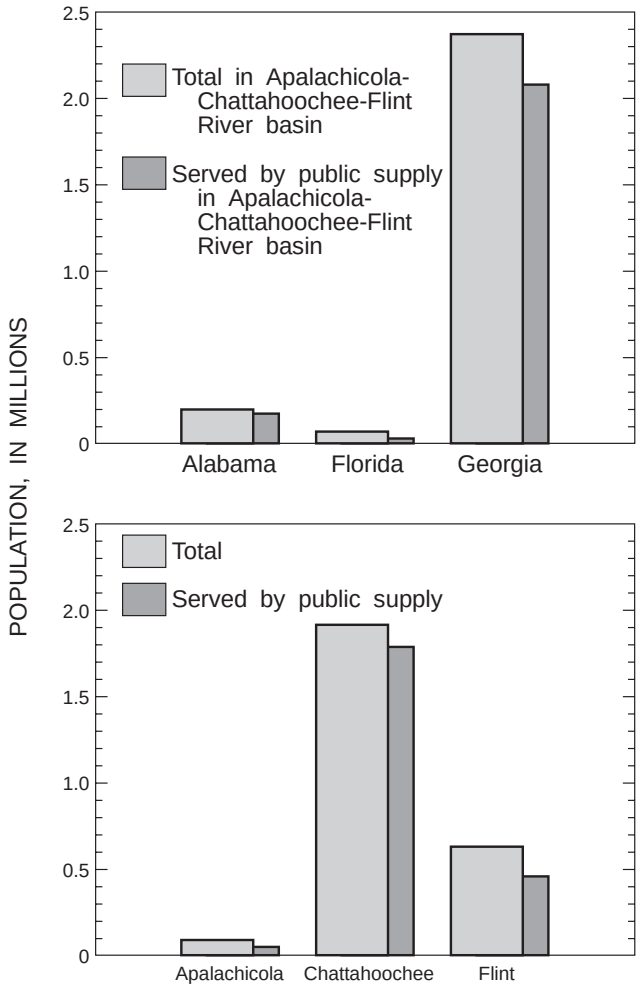

Figure 4. Population and population served by public supply by State and subbasin in the Apalachicola-Chattahoochee-Flint River basin, 1990

USE OF WATER IN THE APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

Nearly 87 percent of the population (2.287 million) in the basin relied on public supply for their domestic water needs. The remaining 13 percent (0.349 million) are served by small public suppliers not inventoried (those that withdrew less than 0.01 Mgal/d) or are self-supplied by individual systems. Georgia accounted for 91 percent (2.082 million) of the population served by public supply in the ACF River basin (fig. 4). Alabama and Florida accounted for the remaining 9 percent of the basins population served by public supply. Public-supply per capita use in the ACF River basin for 1990 was estimated at 173 gal/d.

Total water withdrawn in the ACF River basin in 1990 was nearly 2,098 Mgal/d. Georgia accounted for 1,727 Mgal/d (82 percent) of the total freshwater withdrawn in 1990 (table 1), followed by Florida with 188 Mgal/d (9 percent), and Alabama with 183 Mgal/d (9 percent). All water withdrawn within the ACF River basin in 1990 was freshwater. Approximately 17 percent (351 Mgal/d) of the water withdrawn in 1990 was consumed, and a net 114 Mgal/d (5 percent) of water was exported out of the ACF (150 Mgal/d was exported and 36 Mgal/d was imported). The remaining 78 percent was returned to ground- and surface-water sources for possible reuse. Including transfers, about 21 percent (366 Mgal/d) of the water consumed was in Georgia, 21 percent (38 Mgal/d) was in Alabama, and 33 percent (61 Mgal/d) was in Florida (fig. 6). An estimated 223 Mgal/d of municipal (domestic) wastewater was generated and discharged within the ACF River basin in 1990, 3 percent more than the 217 Mgal/d discharged in 1985 (Marella, 1991, p. 9).

Instream water use for hydroelectric power generation totaled nearly 38,740 Mgal/d which generated nearly 2,384 GWh of electricity at these 14 facilities in 1990. Water use at the thermoelectric (fossil fuel) power plants within the basin totaled 1,076 Mgal/d and generated nearly 33,460 GWh of electricity at these 8 facilities in 1990.

Of the three subbasins in the ACF River basin, the largest amount of water was withdrawn from the Chattahoochee River subbasin (1,498 Mgal/d), followed by the Flint River subbasin (405 Mgal/d), and the Apalachicola River subbasin (195 Mgal/d) during 1990 (table 2). The largest amount of municipal (domestic) wastewater discharged (166 Mgal/d) in the basin was also in the Chattahoochee River subbasin during 1990.

Several interbasin transfers of water occurred in the ACF River basin during 1990. An estimated 150 Mgal/d of water was withdrawn in the ACF River basin and exported to other major basins (117 Mgal/d for public supply and 33 Mgal/d for self-supplied commercial-industrial). All of the water withdrawn for public supply that was exported in 1990 occurred in the metropolitan Atlanta area. This water was withdrawn from the Chattahoochee River and served areas in the Altamaha-St. Marys and Alabama River basins. However, the exact amount of water that is returned to the Chattahoochee River from municipal (domestic) wastewater plants in the area is unknown. The water withdrawn for self-supplied commercial-industrial was not returned to the ACF River basin and was considered 100 percent consumed. An estimated 36 Mgal/d of water was imported into the ACF River basin during 1990 for public supply use. Nearly 31 Mgal/d of this also occurred in the metropolitan Atlanta area, the remaining 5 Mgal/d occurred in the Opelika area of Alabama.

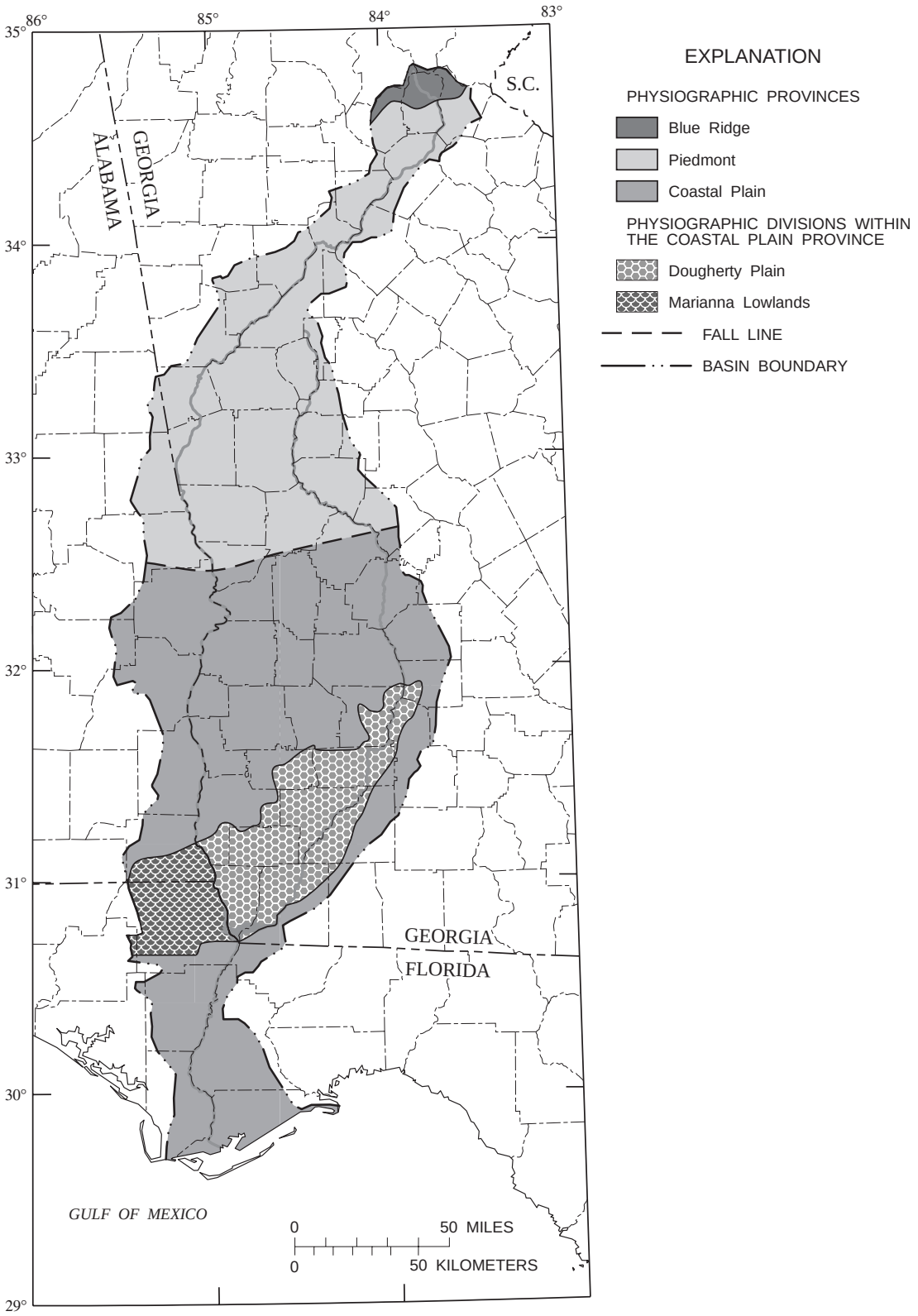

Figure 5. Location of physiographic provinces within the Apalachicola-Chattahoochee-Flint River basin (modified from Clarke and Pierce, 1985; Hayes and others, 1985; and Stringfield, 1966, p. 5).

Table 1. Freshwater withdrawals by State in the Apalachicola-Chattahoochee-Flint River basin, 1990

State	Water withdrawals, in million gallons per day					
	Public supply	Self-supplied domestic	Self-supplied commercial-industrial	Agricultural	Thermoelectric power generation	Totals
Alabama	21.29	1.31	45.73	15.94	98.80	183.07
Florida	5.04	5.20	35.44	33.42	108.36	187.46
Georgia	459.41	26.45	167.26	205.64	868.48	1,727.24
Totals	485.74	32.96	248.43	255.00	1,075.64	2,097.77

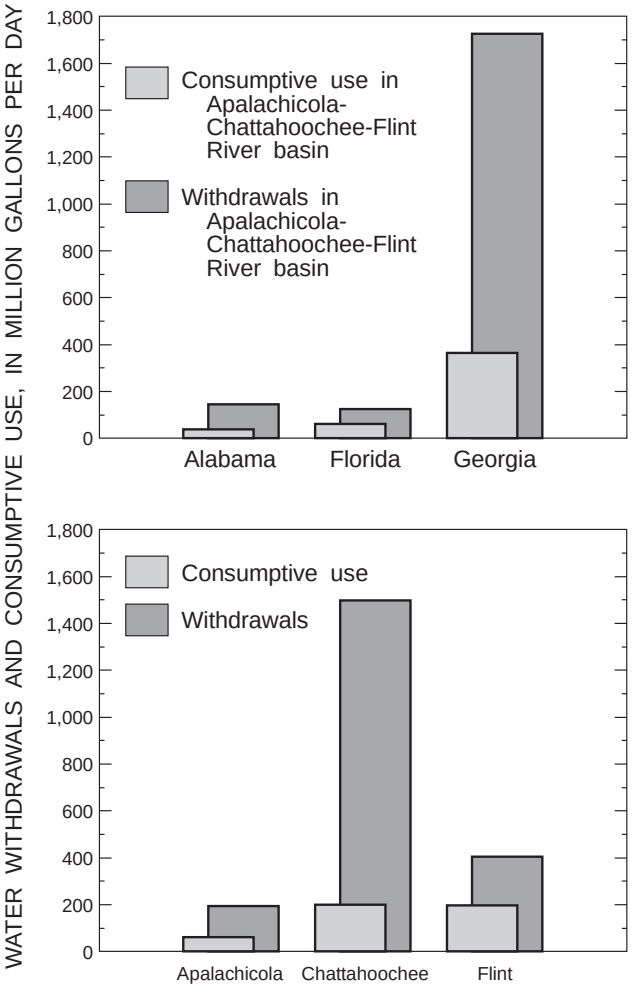

Figure 6. Water withdrawals and consumptive use by State and subbasin in the Apalachicola-Chattahoochee-Flint River basin, 1990.

Source of Withdrawals

Surface water is the primary source of water in the northern part of the ACF River basin and ground water, which is limited in availability in the northern part of the basin, is the primary source of water in the middle and lower parts of the basin, for uses other than instream water use for power generation. Surface water accounted for nearly 86 percent (1,795 Mgal/d) and ground water more than 14 percent (303 Mgal/d) of the total water withdrawn in the ACF River basin. In each of the three States, surface water accounted for most of the water withdrawals in the ACF River basin for 1990 (fig. 7, tables 3 and 4). Surface water supplied 82 percent (1.868 million) of the population of the basin served by public supply for 1990. The Chattahoochee River subbasin accounted for the largest surface-water withdrawals (1,445 Mgal/d), followed by the Flint River subbasin (201 Mgal/d), and the Apalachicola River subbasin (149 Mgal/d) (fig. 7, table 4). Within the Chattahoochee River subbasin, the Middle Chattahoochee-Lake Harding cataloging unit accounted for more than 888 Mgal/d of the surface-water withdrawn during 1990 (table 4). The Chattahoochee River supplied more than 64 percent of the surface water withdrawn in the ACF River basin during 1990.

Ground water supplied 18 percent (0.418 million) of the population of the basin served by public supply and all of the population self-supplied (0.351 million). The Floridan aquifer system, which is present in the southern part of the basin, supplied 44 percent of the ground water used in the basin for 1990 (133 Mgal/d). Other aquifers which supplied substantial amounts of water included the Claiborne aquifer (20 percent), Clayton aquifer (14 percent), Crystalline Rock aquifer (12 percent), and the Cretaceous aquifer (10 percent) (fig. 8). A small amount (less than 1 Mgal/d) of water was withdrawn from the unnamed surficial aquifers within the basin during 1990.

Table 2. Freshwater withdrawals by subbasin in the Apalachicola-Chattahoochee-Flint River basin, 1990

Subbasin	Water withdrawals, in million gallons per day					
	Public supply	Self-supplied domestic	Self-supplied commercial-industrial	Agricultural	Thermoelectric power generation	Totals
Apalachicola	11.36	5.06	35.50	34.49	108.36	194.77
Chattahoochee	399.87	15.81	178.10	44.61	859.53	1,497.92
Flint	74.51	12.09	34.83	175.90	107.75	405.08
Totals	485.74	32.96	248.43	255.00	1,075.64	2,097.77

The Flint River subbasin accounted for the largest ground-water withdrawals (204 Mgal/d), followed by the Chattahoochee River subbasin (53 Mgal/d), and the Apalachicola River subbasin (46 Mgal/d) (fig. 7). Within the Flint River subbasin, the Lower Flint cataloging unit accounted for more than 81 Mgal/d of the ground-water withdrawn during 1990 (table 4). Ground-water withdrawals in 1990 by category of use for each State is presented in table 5.

Categories of Water-Use

The largest use of surface water is the basin in 1990 was for thermoelectric power generation (60 percent) followed by public supply (24 percent), self-supplied commercial-industrial (12 percent), and agricultural (4 percent) (fig. 9 and table 3). Of the 1,075 Mgal/d of surface water withdrawn for thermoelectric power generation, 2 percent (23 Mgal/d) was consumed, and the remaining 98 percent (1,052 Mgal/d) was returned to the surface water source.

The largest use of ground water in the basin in 1990 was for agriculture (58 percent), followed by public supply (21 percent), self-supplied domestic (11 percent), self-supplied commercial-industrial (9 percent), and thermoelectric power generation (less than 1 percent) (fig. 9 and table 5). The Floridan aquifer system supplied most of the water for agricultural irrigation and self-supplied commercial-industrial uses, whereas the Claiborne aquifer supplied most of the water for public supply and self-supplied domestic uses. Many household wells tap the shallow or surficial aquifers for drinking water purposes throughout the basin.

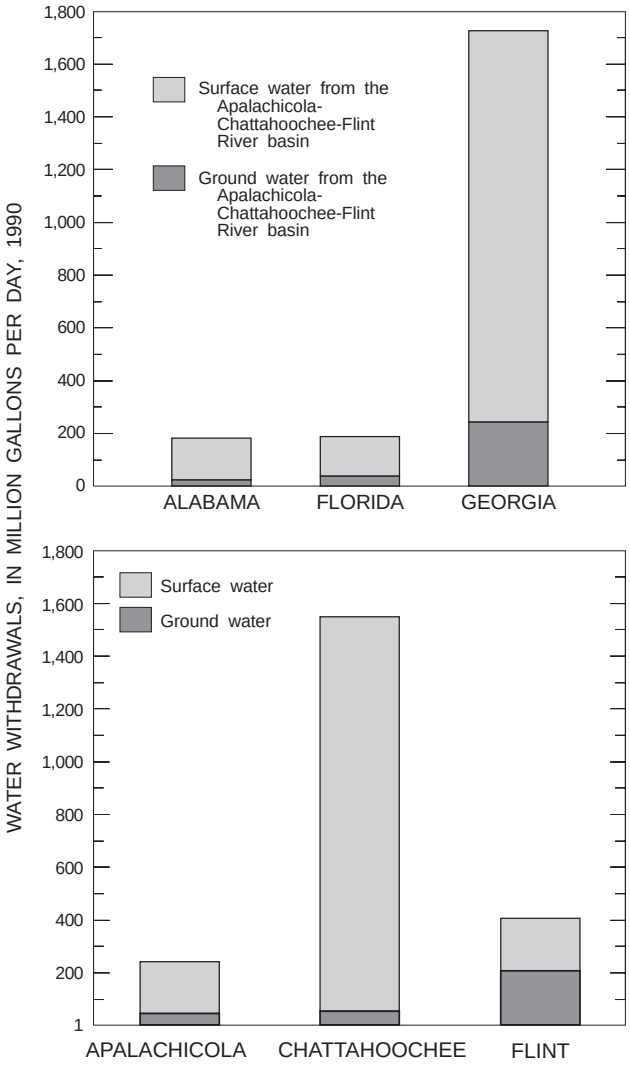

Figure 7. Ground- and surface-water withdrawals by State and subbasin in the Apalachicola-Chattahoochee-Flint River basin, 1990.

Table 3. Surface-water withdrawals by State in the Apalachicola-Chattahoochee-Flint River basin, 1990

State	Surface-water withdrawals, in million gallons per day					
	Public supply	Self-supplied domestic	Self-supplied commercial-industrial	Agricultural	Thermoelectric power generation	Totals
Alabama	7.80	0.00	45.32	6.74	98.80	158.66
Florida	0.00	0.00	32.89	7.89	107.99	148.77
Georgia	413.40	0.00	142.29	63.12	868.48	1,487.29
Totals	421.20	0.00	220.50	77.75	1,075.27	1,794.72

Trends in Water Use

Total water-use within the ACF River basin has increased by 42 percent from 1,475 Mgal/d in 1970 to 2,098 Mgal/d in 1990 (table 6). This increase, for the most part, can be attributed to the increase in public-supply water use, primarily in the metropolitan Atlanta area and the increase in agricultural water use in the Dougherty Plain area in southwestern Georgia. All categories of water use, except for thermoelectric power generation, increased between 1970 and 1990 (fig. 10, table 6). However, during 1980-90, water use decreased by 19 percent from 2,586 Mgal/d to 2,098 Mgal/d, primarily because of the decrease in water used for thermoelectric power generation and agriculture irrigation (table 6).

Ground-water withdrawals in the ACF River basin increased between 1970 and 1990 (fig. 11) as a result of an increase in ground water used for agriculture, primarily in southwestern Georgia, of nearly 217 Mgal/d (243 percent). Major changes in irrigation techniques and practices during the mid to late 1970's resulted in substantial increases in agricultural water use in southwestern Georgia (Pierce and others, 1984). Withdrawals of ground water from the principal aquifers (primarily the Floridan aquifer system) increased nearly 80 Mgal/d in the Dougherty Plain area in Georgia between 1977 and 1980 (Hayes and others, 1983). Since 1980, however, ground-water withdrawn for irrigation purposes has decreased because of an decrease in acreage irrigated and an increase in irrigation efficiencies.

Surface-water withdrawals increased 805 Mgal/d (58 percent) between 1970 and 1980 (fig. 11), primarily because of increased public-supply demands in the northern part of the basin, and the operation of several new thermoelectric powerplants during these years. However, surface-water withdrawals decreased 396 Mgal/d (18 percent) between 1980 and 1990, primarily because of more efficient uses of water for industrial and thermoelectric power generation purposes. Surface-water withdrawals for thermoelectric power generation decreased from 1,581 Mgal/d in 1980 to 1,075 Mgal/d in 1990 (table 6). Use of more water-efficient machinery, reuse or recirculation of water, and use of cooling ponds are some of the reasons for the decreases in water withdrawals for these categories (Leach, 1983, p. 11). Despite the ups and downs in withdrawals for interim years, there was a modest overall increase for the twenty-year period of 1970 to 1990.

Basin Water Use in Alabama

The Chattahoochee River, which begins in northern Georgia and flows southwest into Alabama and Florida, forms the State line between Alabama and Georgia for the southern half of the State. Located in the Coastal Plain physiographic province (fig. 5), the Chattahoochee River basin in Alabama encompasses approximately 2,800 mi^2 (U.S. Army Corps of Engineers, 1984) and accounts for more than 14 percent of the ACF River basin drainage area. A part of Geneva (6 mi^2) and Houston Counties (283 mi^2) in Alabama drains into the Apalachicola River through the Chipola River (fig. 2), and the water use data for those parts of Geneva and Houston Counties are included under the Apalachicola River basin totals, however, the data for those counties are included in the Alabama section.

Table 4. Water withdrawals by principal water-use categories in the Apalachicola-Chattahoochee-Flint River basin by subbasin and cataloging unit, 1990

[Withdrawals are in million gallons per day; refer to figure 2 for location of subbasins and cataloging units; Lk., Lake; Res., Reservoir]

Subbasin and cataloging unit		Public supply		Self-supplied domestic		Self-supplied commercial-industrial		Agricultural		Thermoelectric power generation		Total freshwater withdrawals		
Name	Number	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
Chattahoochee River subbasin														
Upper Chattahoochee	03130001	2.42	242.67	6.88	0.00	1.03	3.96	0.90	5.26	0.00	0.00	11.23	251.89	263.12
Middle Chattahoochee-Lk. Harding	03130002	1.66	96.73	6.72	0.00	1.20	26.88	1.48	4.08	0.00	760.73	11.06	888.42	899.48
Middle Chattahoochee-George Res.	03130003	1.70	48.29	0.94	0.00	0.13	36.96	1.75	6.01	0.00	0.00	4.52	91.26	95.78
Lower Chattahoochee	03130004	6.40	0.00	1.27	0.00	0.49	107.45	18.12	7.01	0.00	98.80	26.28	213.26	239.54
Subbasin Totals		12.18	387.69	15.81	0.00	2.85	175.25	22.25	22.36	0.00	859.53	53.09	1,444.83	1,497.92
Flint River subbasin														
Upper Flint	03130005	4.35	33.51	6.20	0.00	0.43	2.93	6.48	7.88	0.00	0.00	17.46	44.32	61.78
Middle Flint	03130006	3.88	0.00	1.70	0.00	9.50	9.43	14.93	10.39	0.00	15.00	30.01	34.82	64.83
Kinchafoonee-Muckalee	03130007	5.39	0.00	1.42	0.00	1.01	0.00	12.97	7.48	0.00	0.00	20.79	7.48	28.27
Lower Flint	03130008	22.48	0.00	1.30	0.00	11.02	0.00	46.52	8.50	0.00	92.75	81.32	101.25	182.57
Ichawaynochaway	03130009	2.69	0.00	0.65	0.00	0.31	0.00	18.36	8.80	0.00	0.00	22.01	8.80	30.81
Spring Creek	03130010	2.21	0.00	0.82	0.00	0.20	0.00	29.60	3.99	0.00	0.00	32.83	3.99	36.82
Subbasin Totals		41.00	33.51	12.09	0.00	22.47	12.36	128.86	47.04	0.00	107.75	204.42	200.66	405.08
Apalachicola River subbasin														
Apalachicola River	03130011	1.64	0.00	2.16	0.00	2.55	0.00	11.09	4.78	0.37	107.99	17.81	112.77	130.58
Chipola River	03130012	8.09	0.00	2.76	0.00	0.06	32.89	15.05	3.57	0.00	0.00	25.96	36.46	62.42
New River	03130013	0.68	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.00	0.75
Apalachicola Bay	03130014	0.95	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	1.02
Subbasin Totals		11.36	0.00	5.06	0.00	2.61	32.89	26.14	8.35	0.37	107.99	45.54	149.23	194.77

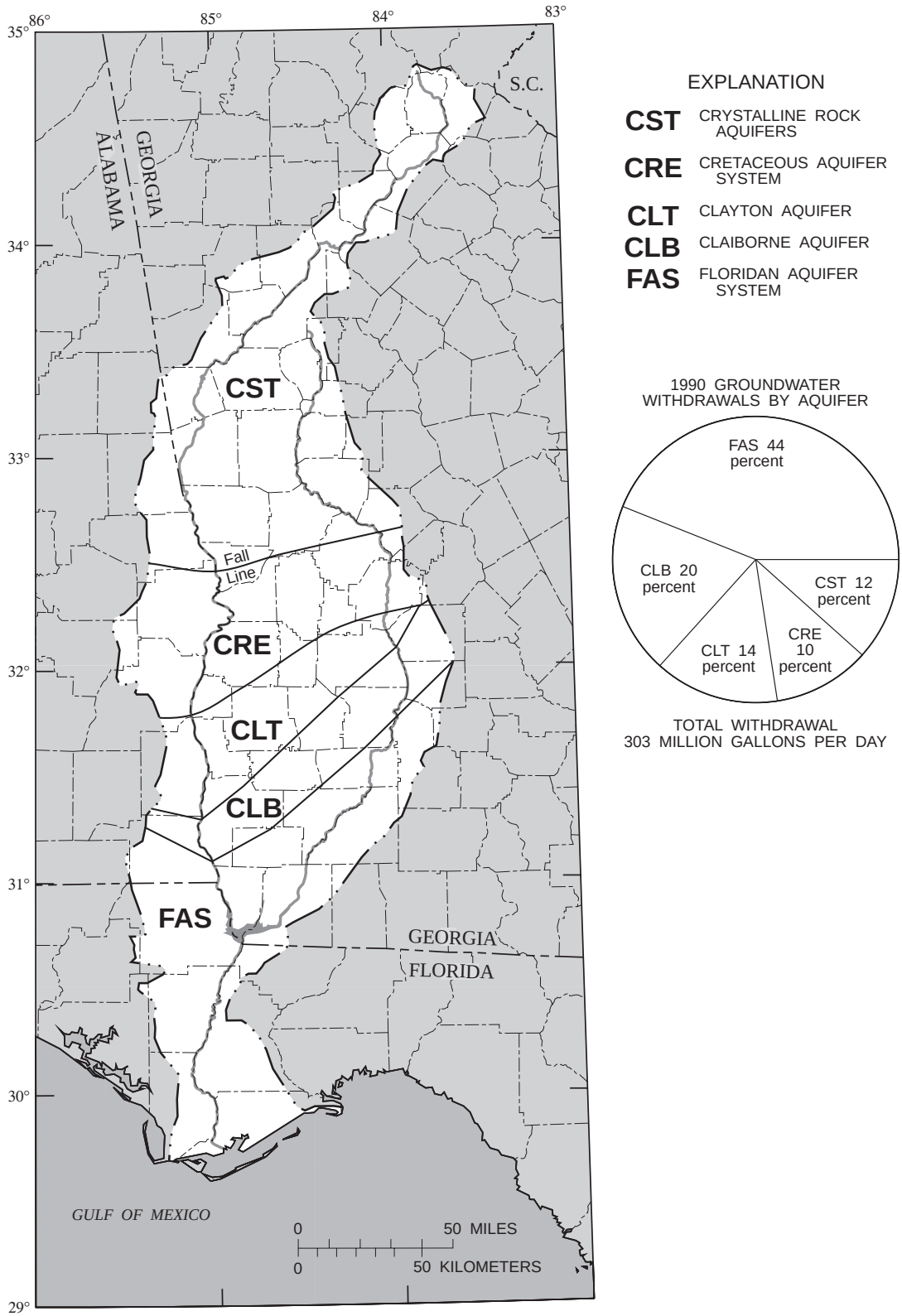

Figure 8. General location of principal aquifers and percentage of ground-water withdrawals from each aquifer in the Apalachicola-Chattahoochee-Flint River basin.

Table 5. Ground-water withdrawals by State in the Apalachicola-Chattahoochee-Flint River basin, 1990

State	Ground-water withdrawals, in million gallons per day					
	Public supply	Self-supplied domestic	Self-supplied commercial-industrial	Agricultural	Thermoelectric power generation	Totals
Alabama	13.49	1.31	0.41	9.20	0.00	24.41
Florida	5.04	5.20	2.55	25.53	0.37	38.69
Georgia	46.01	26.45	24.97	142.52	0.00	239.95
Totals	64.54	32.96	27.93	177.25	0.37	303.05

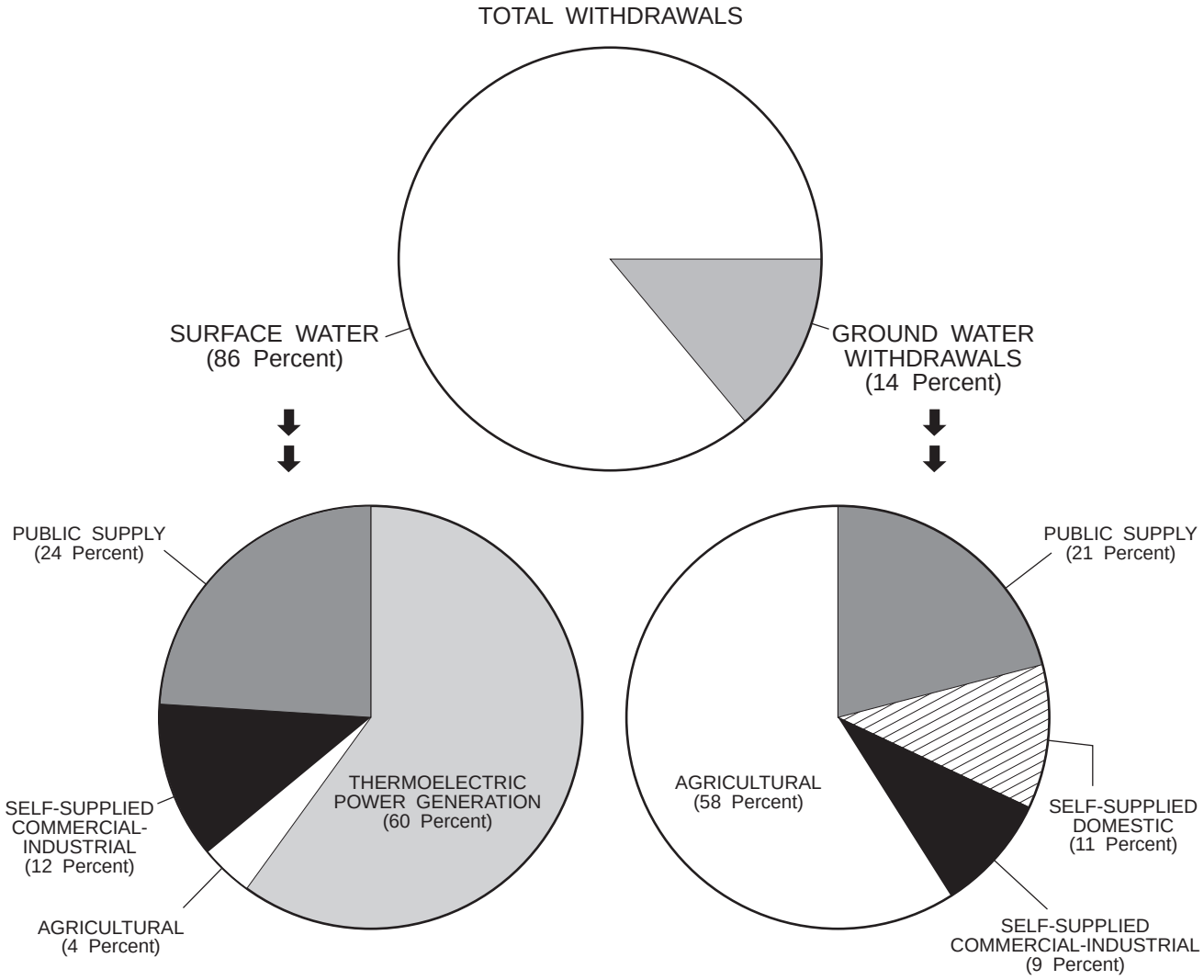

Figure 9. Ground- and surface-water withdrawals by principal water-use categories in the Apalachicola-Chattahoochee-Flint River basin, 1990.

Table 6. Water withdrawals by principal water-use categories in the Apalachicola-Chattahoochee-Flint River basin, 1970-90

[All values are in million gallons per day; 0.00 indicates no withdrawals occurred; ---- indicates no data were available or collected]

Year	Public Supply				Self-supplied domestic		Self-supplied commercial-industrial[b]		Agricultural[c]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[a]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
1970[a]	39.84	99.66	----	----	30.37	0.00	10.44	151.80	7.14	13.38	1.40	1,120.80	89.19	1,385.64	1,474.83
1971	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1972	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1973	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1974	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1975[a]	43.86	233.47	----	----	20.47	0.01	25.52	208.15	16.81	17.46	0.30	1,569.10	106.96	2,028.19	2,135.15
1976	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1977	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1978	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1979	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1980[ad]	69.05	261.48	----	----	48.10	0.00	21.88	239.57	256.06	108.91	0.00	1,580.94	395.09	2,190.90	2,585.99
1981	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1982	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1983	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1984	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1985[ad]	54.14	370.93	----	----	33.95	0.00	26.63	226.54	190.12	83.42	0.74	1,232.44	305.58	1,913.33	2,218.91
1986	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1987	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1988	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1989	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1990	64.54	421.20	35.70	116.69	32.96	0.00	27.93	220.50	177.25	77.75	0.37	1,075.27	303.05	1,794.72	2,097.77

[a]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public-supply use, and estimates for the years of 1970, 1975, 1980, and 1985 were not available.

[b]Surface-water withdrawals for self-supplied commercial-industrial use include between 30 and 35 million gallons per day of water withdrawn in the Apalachicola-Chattahoochee-Flint River basin for use in the Choctawhatchee-Escambia River basin for the years 1975, 1980, 1985 and 1990.

[c]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.

[d]Surface water withdrawals for public supply have been modified from previous published values.

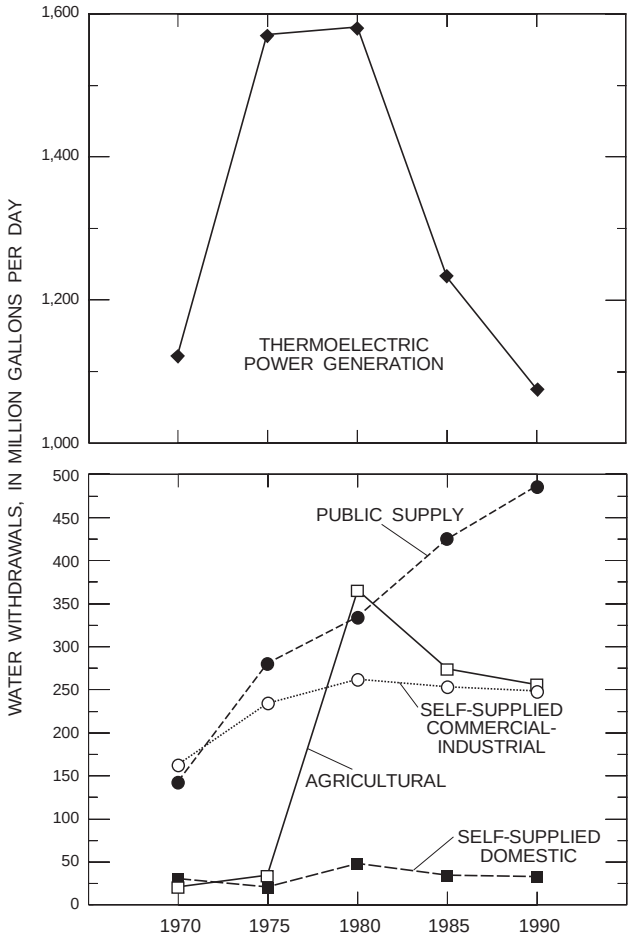

Figure 10. Water withdrawals by principal water-use categories in the Apalachicola-Chattahoochee-Flint River basin, 1970-90.

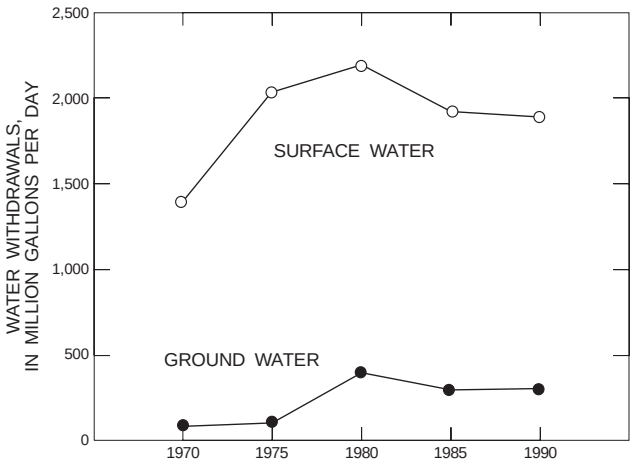

Figure 11. Ground- and surface-water withdrawals in the Apalachicola-Chattahoochee-Flint River basin, 1970-90.

Water use in that part of the ACF River basin in Alabama, which includes the Apalachicola and Chattahoochee River basins, is described in this section. The Alabama part of these two river basins includes all or part of the following ten counties: Barbour, Bullock, Chambers, Geneva, Henry, Houston, Lee, Macon, Randolph, and Russell (fig. 3). These counties are mostly rural and land use is predominantly forests, farms, and pastureland. The total population for the Apalachicola and Chattahoochee River basins in Alabama during 1990 was estimated at 0.190 million (U.S. Bureau of the Census, 1991b), which is less than 5 percent of the total State population (4.041 million) (Alabama Department of Economic and Community Affairs, 1991) and 7 percent of the total population for the ACF River basin. Some of the larger population centers in Alabama located in or partially in the basin are Dothan (0.054 million), Phenix City (0.025 million), Opelika (0.022 million), and Eufaula (0.013 million) (Alabama Department of Economic and Community Affairs, 1991). The cities of Dothan and Opelika straddle the ACF River basin boundary, so not all of the population of these cities lives within the basin. Nearly 90 percent of the population of the ACF River basin in Alabama (0.173 million) was served by public supply in 1990. A total of 43 public supply utilities were inventoried within or partially within the Apalachicola and Chattahoochee River basins in Alabama for 1990 (table 7). The city of Opelika (Lee County), imported nearly 5 Mgal/d of surface-water from the Alabama River basin for public-supply use during 1990.

The use of surface water in the ACF River basin, in Alabama is primarily for instream uses such as navigation by barge traffic, recreational boating and fishing, fish and wildlife propagation, and hydroelectric power generation (primarily on the Chattahoochee River). The largest offstream use of surface water from this basin in Alabama is by a thermoelectric power generation facility near Dothan, Ala. (Houston County). In 1990, nearly 99 Mgal/d of riverwater was used by this facility to generate 12.2 GWh of electricity. Nearly 87 percent of this water was returned to the river. Instream water use data for hydroelectric powerplants on that part of the Chattahoochee River that forms the border between Alabama and Georgia are reported in the Georgia section of this report.

Table 7. Public-supply water use in Apalachicola and Chattahoochee River basins in Alabama by utility, 1990

[Refer to figure 2 for the location of subbasin and cataloging unit; Mgal/d, million gallons per day; gal/capita/d, gallons per capita per day; C, Chattahoochee River; CLT, Clayton aquifer system; CRE, Cretaceous aquifer system; W/S, water system; A, Apalachicola River; CLB, Clairborne aquifer system; CST, Crystalline rock aquifers; N/A, data not available]

Utility/owner[1]	County	Subbasin	Cataloging unit	Water source	Public-supply water use		
					Mgal/d	Population	Gal/capita/d
Baker Hill, town of	Barbour	C	03130003	CLT	0.46	4,770	96
Clayton, city of	Barbour	C	03130003	CRE	0.25	2,250	111
Cowikee Water Authority	Barbour	C	03130003	CRE	0.08	1,575	51
Eufaula, city of	Barbour	C	03130003	CRE	1.34	13,350	100
Eufaula Adolescent Center	Barbour	C	03130003	CRE	0.03	280	107
Marianna, town of	Barbour	C	03130003	Purchased	0.02	117	171
Mount Andrew, town of	Barbour	C	03130003	Purchased	0.03	747	40
West Barbour County W/S	Barbour	C	03130003	Purchased	0.22	1,275	173
Midway, town of	Bullock	C	03130003	CRE	0.16	798	201
East Alabama Water District	Chambers	C	03130002	Purchased[2]	0.40	5,625	71
Huguley, town of	Chambers	C	03130002	Purchased[2]	1.10	6,315	174
Lafayette, city of	Chambers	C	03130002	Lafayette Reservoir[3]	0.47	4,080	115
Lanett, city of	Chambers	C	03130002	Purchased[2]	1.58	9,000	176
Lee-Chambers W/S	Chambers	C	03130002	Purchased[2]	0.27	3,600	75
West Point Pepperall W/S	Chambers	C	03130002	Chattahoochee River	5.48	102	N/A
Abbeville, city of	Henry	C	03130004	CLT	1.00	4,350	230
Bethlehem, town of	Henry	C	03130004	Purchased	0.18	1,044	172
Capps, town of	Henry	C	03130004	Purchased	0.09	510	176
Haleburg, town of	Henry	C	03130004	CLT	0.04	210	190
Headland, town of	Henry	C	03130004	CLT	0.38	3,900	97
Henry County W/S	Henry	C	03130004	CLT	0.58	3,300	176
Newville, town of	Henry	C	03130004	CLT	0.03	741	40
Wills Cross Road, town of	Henry	C	03130004	Purchased	0.08	450	178
Ashford, town of	Houston	A	03130012	CLB	0.16	2,502	64
Avon, town of	Houston	A	03130012	Purchased	0.07	375	187
Columbia, town of	Houston	C	03130004	CLB	0.22	1,260	175
Cottonwood, town of	Houston	A	03130012	CLB	0.20	2,145	93
Cowarts, town of	Houston	A	03130012	CLB	0.16	1,560	103
Dothan, city of	Houston	C	03130004	CLB	11.95	54,000	221
Gordon, town of	Houston	C	03130004	CLB	0.03	390	77
Kinsey, town of	Houston	C	03130004	CLB	0.25	1,410	177
Taylor, town of	Houston	A	03130012	CLB	0.28	3,000	93
Beaureguard, town of	Lee	C	03130002	CST	0.45	3,750	120
Colony, town of	Lee	C	03130002	Purchased	0.02	99	202
East Alabama Water District	Lee	C	03130002	Purchased	0.35	5,700	61
Lee-Chambers W/S	Lee	C	03130002	Purchased	0.13	3,135	41
Opelika, city of	Lee	C	03130002	Sougahatchee Lake[3]	4.48	25,647	175
Smiths, town of	Lee	C	03130003	Purchased	1.95	11,124	175
Roanoke, city of	Randolph	C	03130002	Crystal Lake[3]	1.20	6,879	174
Fort Mitchell, city of	Russell	C	03130003	CRE	0.42	4,416	95
Hurtsboro, city of	Russell	C	03130003	CRE	0.15	1,260	119
Ladonia-Crawford W/S	Russell	C	03130003	CRE	0.98	12,600	78
Phenix City, city of	Russell	C	03130003	Chattahoochee River	4.94	28,800	172

[1]The utility listed may not be entirely within the Aplichicola-Chattahoochee-Flint River basin, and the public-supply water use values presented reflect those of the entire utility, not just the part within the basin.

[2]Purchased water from West Point Pepperall in Chambers County.

[3]Withdrawal is located in the Alabama River basin.

Water Withdrawn in 1990

Water withdrawals in the Apalachicola and Chattahoochee River basins in Alabama during 1990 totaled 183 Mgal/d. This represents approximately 2 percent of the total water withdrawn (8,076 Mgal/d) in Alabama during 1990 (Solley and others, 1993). Surface water accounted for nearly 87 percent (159 Mgal/d) and ground water accounted for 13 percent (24 Mgal/d) of the water withdrawn in the Apalachicola and Chattahoochee River basins in Alabama. The Apalachicola and Chattahoochee River basins in Alabama accounted for 9 percent of the total water use in the ACF River basin in 1990.

An estimated 21 percent (38 Mgal/d) of the water withdrawn in the Alabama part of the basin in 1990 was consumed. The remainder of the water was returned to ground- and surface-water sources for possible reuse. Nearly 23 Mgal/d of municipal (domestic) wastewater was discharged in the Apalachicola and Chattahoochee River basins in Alabama during 1990. A total of 6 municipal wastewater facilities were inventoried within or partially within the Apalachicola and Chattahoochee River basins in Alabama for 1990 (table 8)

Water withdrawn for thermoelectric power generation accounted for the largest amount of surface water use (62 percent) in the Apalachicola and Chattahoochee River basins in Alabama for 1990, followed by self-supplied commercial-industrial use (29 percent), public supply (5 percent), and agricultural use (4 percent) (fig. 12). Surface-water withdrawn from the Chattahoochee River for the Farley Nuclear Power Plant (owned and operated by The Alabama Power Company) totaled nearly 99 Mgal/d during 1990 (Baker and Mooty, 1993).

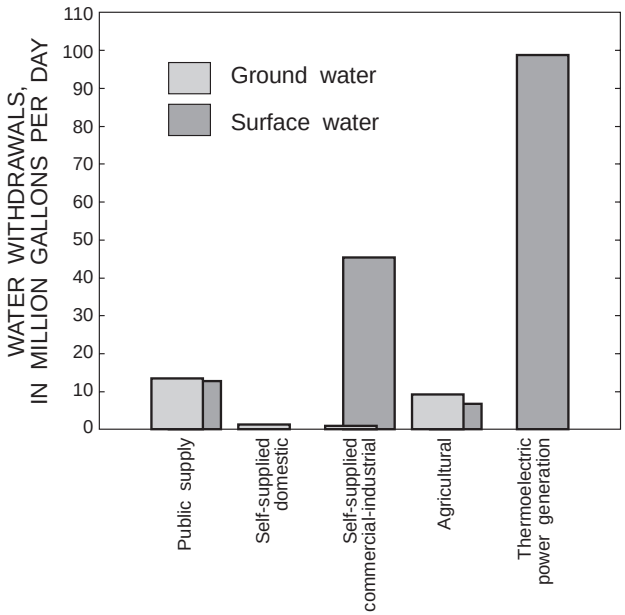

Figure 12. Water withdrawals by principal water-use categories in the Apalachicola and Chattahoochee River basins in Alabama, 1990.

An additional 35 Mgal/d of surface water was withdrawn from the Chattahoochee River in Russell County for industrial- and public-supply purposes during 1990. The remainder of the surface-water withdrawals in the basin in Alabama (25 Mgal/d) were obtained from tributary streams, reservoirs, lakes, ponds, and ditches.

Water withdrawn for public supply accounted for the largest use of ground-water (55 percent) in the Apalachicola and Chattahoochee River basins in Alabama during 1990 followed by agricultural use (38 percent), self-supplied domestic use (5 percent), and

Table 8. Municipal wastewater discharge in the Apalachicola and Chattahoochee River basins in Alabama by facility, 1990

[Plant capacity and discharge values are in million gallons per day; C, Chattahoochee River; A, Apalachicola River; STP, sewage treatment plant; WSFPA, Water, Sewer and Fire Protection Authority; refer to figure 2 for the location of the subbasin and cataloging unit]

Facility/Owner	County	Subbasin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Plant capacity	1990 discharge	Disposal source	
Eufaula, city of	Barbour	C	03130003	2.00	1.26	surface	Chattahoochee River.
Lanett, city of	Chamber	C	03130002	5.00	1.26	surface	Chattahoochee River.
East Alabama WSFPA	Chambers	C	03130002	4.00	2.66	surface	Chattahoochee River.
Ashford, city of	Houston	A	03130012	0.25	0.01	surface	Mill Creek.
Dothan: Cypress STP	Houston	A	03130012	1.00	0.55	surface	Cypress Creek.
Dothan: Omusee STP	Houston	C	03130004	4.00	3.85	surface	Omusee Creek.
Phenix City, city of	Russell	C	03130003	7.60	4.45	surface	Lindsey Creek.

self-supplied commercial-industrial use (2 percent) (fig. 12). Most of the ground-water withdrawn in the basin was from the Claiborne, Clayton, Cretaceous, and Crystalline Rock aquifers (fig. 9). The Clairborne aquifer supplied 67 percent (16 Mgal/d) of the ground-water withdrawn in the Apalachicola and Chattahoochee River basins in Alabama, the Floridan aquifer system is tapped by only a few irrigation wells and by two small public suppliers in the southern part of Houston County. Wells in the southeastern part of Alabama commonly are screened in more than one aquifer, thus making it difficult to determine the amount of water withdrawn from each aquifer.

Houston County accounted for nearly 64 percent of the surface-water withdrawals and 66 percent of the ground-water withdrawals in that part of the basin in Alabama during 1990 (table 9). Bullock and Lee Counties imported 0.1 Mgal/d and 5 Mgal/d respectively for public supply use from the Alabama River basin. Less than 0.01 Mgal/d of water was used in those parts of Macon and Geneva Counties within the ACF River basin in Alabama.

Trends in Water Use

Total water-use in the Apalachicola and Chattahoochee River basins in Alabama increased nearly 230 percent from 55 Mgal/d in 1970 to 183 Mgal/d in 1990 (table 10). Nearly 78 percent of this increase was related to the opening of the Farley Nuclear Power Plant during the late 1970's. Discounting withdrawals by the Farley Nuclear Power Plant, surface-water withdrawals increased 23 percent.

Ground-water withdrawals between 1970 and 1990 increased nearly 244 percent, due mostly to increased crop irrigation and public-supply use. A decrease in ground-water withdrawals for self-supplied domestic use from 1980 to 1985, given in table 10, is the result of a change in procedures for calculating domestic water use. For 1980, an average per capita use of 100 gal/d was used to calculate the amount of unmetered water used by public suppliers and self-supplied domestic users. In 1985, as a result of further studies, the per capita use estimate was reduced to 75 gal/d (Baker and Mooty, 1987, p. 16). The method used in 1985 for estimating self-supplied domestic use was also used in 1990.

Basin Water Use in Florida

The Apalachicola River is formed by the confluence of the Chattahoochee and Flint Rivers (fig. 1). This confluence occurs at Lake Seminole near the city of Chattahoochee, Fla. The Apalachicola River flows 107 miles south from the Jim Woodruff Dam to the Apalachicola Bay in the Gulf of Mexico (Edmiston and Tuck, 1987, p. 3). Located in the Coastal Plain physiographic province (fig. 5), the Apalachicola River basin in Florida encompasses and drains nearly 2,500 mi^2 and includes the Chipola River and New River basins (U.S. Army Corps of Engineers, 1984). The Apalachicola River basin in Florida accounts for 13 percent of the ACF River basin total drainage area. A part of Jackson County Florida (136 mi^2) drains into the Chattahoochee River (fig. 2), and the water-use data for this part of Jackson County is included under the Chattahoochee River basin totals, however, the data for this county is included in the Florida section.

Water use in that part of the ACF River basin in Florida, which includes the Apalachicola and Chattahoochee River basins is described in this section. The Florida part of these two river basins includes all or part of the following eight counties: Bay, Calhoun, Franklin, Gadsden, Gulf, Jackson, Liberty, and Washington (fig. 3). These counties are rural and land use is predominantly forests and wetlands. The total population of the Apalachicola and Chattahoochee River basins in Florida during 1990 was estimated at 0.070 million (U.S. Bureau of the Census, 1991c), or less than 1 percent (0.5 percent) of the total population of Florida (12.938 million) (University of Florida, 1991, p. 27) and less than 3 percent of the ACF River basin total population. More than one-half (51 percent) of the 1990 population of the Apalachicola and Chattahoochee River basins in Florida lived in Jackson County (0.036 million), which includes the most populated urban area in this part of the basin, the city of Marianna (0.006 million) (University of Florida, 1991). Slightly more than 45 percent of the population in the Florida part of the basin (0.032 million) was served by public supply in 1990. The remaining 55 percent of the population (0.038 million) were served by small utilities not inventoried (withdrew less than 0.01 Mgal/d) or are self-supplied by individual wells. A total of 20 public supply utilities were inventoried within or partially within the Apalachicola and Chattahoochee River basins in Florida for 1990 (table 11).

Table 9. Water withdrawals in the Apalachicola and Chattahoochee River basins in Alabama by county, 1990

[All values are in million gallons per day; refer to figure 3 for the county locations; 0.00 indicates no withdrawal occurred; modified from Baker and Mooty, 1993]

County[1]	Public Supply				Self-supplied domestic		Self-supplied commercial-industrial		Agricultural[3]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[2]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
Barbour	1.74	0.00	0.00	0.00	0.01	0.00	0.02	0.30	0.82	1.28	0.00	0.00	2.59	1.58	4.17
Bullock	0.00	0.00	0.05	0.00	0.01	0.00	0.00	0.00	0.16	0.02	0.00	0.00	0.17	0.02	0.19
Chambers	0.00	2.95	0.00	0.00	0.20	0.00	0.03	15.00	0.25	0.31	0.00	0.00	0.48	18.26	18.74
Geneva	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Henry	1.50	0.00	0.00	0.00	0.05	0.00	0.02	0.01	0.45	1.26	0.00	0.00	2.02	1.27	3.29
Houston	8.51	0.00	0.00	0.00	0.56	0.00	0.28	0.00	6.82	1.99	0.00	98.80	16.17	100.79	116.96
Lee	0.34	0.00	4.87	0.00	0.30	0.00	0.01	0.00	0.40	0.48	0.00	0.00	1.05	0.48	1.53
Macon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Randolph	0.05	0.12	0.00	0.00	0.06	0.00	0.01	0.01	0.10	0.00	0.00	0.00	0.22	0.13	0.35
Russell	1.35	4.73	0.00	0.00	0.12	0.00	0.04	30.00	0.20	1.40	0.00	0.00	1.71	36.13	37.84
Totals	13.49	7.80	4.92	0.00	1.31	0.00	0.41	45.32	9.20	6.74	0.00	98.80	24.41	158.66	183.07

[1]Data is for the part of the county within the Apalachicola-Chattahoochee-Flint River basin only (all 10 counties are only partially within the basin).

[2]Public supply transfer indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public-supply use.

[3]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.

Table 10. Water withdrawals by principal water-use categories in the Apalachicola and Chattahoochee River basins in Alabama, 1970-90

[All values are in million gallons per day; 0.00 indicates no withdrawals occurred; ---- indicates no data were available or collected]

Year	Public supply				Self-supplied domestic		Self-supplied commercial-industrial		Agricultural[b]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[a]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
1970 [c]	2.04	7.26	2.94	0.00	3.02	0.00	0.64	39.00	1.42	1.92	0.00	0.00	7.12	48.18	55.30
1971	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1972	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1973	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1974	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1975 [d]	6.90	7.76	3.25	0.00	2.17	0.00	2.40	48.62	1.57	1.96	0.00	0.00	13.04	58.34	71.38
1976	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1977	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1978	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1979	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1980 [e]	9.98	9.28	3.80	0.00	5.85	0.00	0.01	51.05	4.14	7.02	0.00	71.74	19.98	139.09	159.07
1981	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1982	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1983	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1984	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1985 [f]	8.41	6.69	4.15	0.00	3.18	0.00	0.32	51.24	5.67	10.09	0.00	117.00	17.58	185.02	202.60
1986	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1987	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1988	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1989	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1990 [g]	13.47	7.80	4.92	0.00	1.31	0.00	0.41	45.32	9.20	6.74	0.00	98.80	24.39	158.66	183.05

[a]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public-supply use.
[b]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.
[c]1970 data source; Geological Survey of Alabama Information Series No. 42 (Peirce, 1972).
[d]1975 data source; Geological Survey of Alabama Information Series No. 48 (Mettee and others, 1978).
[e]1980 data source; Geological Survey of Alabama Information Series No. 59 (Baker and others, 1982).
[e]1985 data source; Geological Survey of Alabama Information Series No. 59D (Baker and Mooty, 1987).
[g]1990 data source; Geological Survey of Alabama Information Series No. 59E (Baker and Mooty, 1993).

Table 11. Public-supply water use in the Apalachicola and Chattahoochee River basins in Florida by utility, 1990

[Refer to figure 2 for the location of the subbasin and cataloging unit; Mgal/d, million gallons per day; gal/capita/d, gallons per capita per day; A, Apalachicola River; FAS, Floridan aquifer system; W/S, water system; modified from Marella, 1993]

Utility/Owner	County	Subbasin	Cataloging unit	Water source	Public-supply water use		
					Mgal/d	Population	Gal/capita/d
Altha, town of	Calhoun	A	03130011	FAS	0.03	497	60
Blountstown, city of	Calhoun	A	03130011	FAS	0.50	2,807	178
Alligator Point W/S	Franklin	A	03130013	FAS	0.12	900	133
Apalachicola, city of	Franklin	A	03130014	FAS	0.68	2,602	261
Carrabelle, town of	Franklin	A	03130013	FAS	0.19	1,200	158
Eastpoint Water District	Franklin	A	03130013	FAS	0.16	963	166
Lanark Village	Franklin	A	03130013	FAS	0.21	934	225
St. George Island Utility	Franklin	A	03130014	FAS	0.27	1,422	190
Chattahoochee, city of	Gadsden	A	03130011	FAS	0.60	4,175	144
Wewahithcka, city of	Gulf	A	03130012	FAS	0.11	1,779	62
Alford, town of	Jackson	A	03130012	FAS	0.04	472	85
Campbellton, town of	Jackson	A	03130012	FAS	0.06	330	182
Cottondale, city of	Jackson	A	03130012	FAS	0.13	1,100	118
Grand Ridge, town of	Jackson	A	03130011	FAS	0.09	680	132
Greenwood, town of	Jackson	A	03130012	FAS	0.10	629	159
Jacobs Community W/S	Jackson	A	03130012	FAS	0.06	261	230
Malone, town of	Jackson	A	03130012	FAS	0.07	765	92
Marianna, city of	Jackson	A	03130012	FAS	1.20	7,100	169
Sneads, town of	Jackson	A	03130011	FAS	0.23	1,746	132
Bristol, city of	Liberty	A	03130001	FAS	0.19	1,458	130

Surface-water use in the ACF River basin in Florida is primarily for instream uses such as navigation to barge traffic, recreational boating and fishing, fish and wildlife propagation, and hydroelectric power generation (primarily on the Chattahoochee River). Another major function of these rivers in Florida is that they provide seasonal flooding to sustain the flood plain ecosystem, and the freshwater needed to maintain a healthy seafood industry in the Apalachicola Bay. Also, these rivers have a high aesthetic value to the panhandle area of Florida.

The only offstream use of water from the Apalachicola River is for cooling purposes at a thermoelectric powerplant located in Jackson County and nearly all of this water is returned to the river. Water is also diverted from the Chipola River for industrial use, however none of this water is returned to the ACF River basin. The only instream use of water in the Apalachicola River accounted for during 1990 was the water used for hydroelectric power generation. Nearly 7,247 Mgal/d of riverwater was used to generate 161.2 GWh of electricity at the Jim Woodruff Dam on Lake Seminole (Howard Mandell, U.S. Army Corps of Engineers, Atlanta, Ga., written commun., March 1992).

Water Withdrawn in 1990

Total freshwater withdrawn in the Apalachicola and Chattahoochee River basins in Florida during 1990 totaled 188 Mgal/d. This represents less than 3 percent of the total freshwater use (7,532 Mgal/d) in Florida during 1990 (Marella, 1992). Surface water accounted for nearly 80 percent (149 Mgal/d), and ground water more than 20 percent (39 Mgal/d) of the water withdrawn in the Apalachicola and Chattahoochee River basins in Florida during 1990. The Apalachicola and Chattahoochee River basins in Florida accounted for 9 percent of the ACF River basin total water use in 1990.

An estimated 33 percent (61 Mgal/d) of the water withdrawn in the Florida part of the basin in 1990 was consumed. The remaining 127 Mgal/d was returned to ground- and surface-water sources for possible reuse. Nearly 4 Mgal/d of municipal (domestic) wastewater was discharged in the Apalachicola and Chattahoochee River basins in Florida during 1990. A total of 12 municipal wastewater facilities were inventoried within this part of the ACF River basin during 1990 (table 12).

Table 12. Municipal wastewater discharge in the Apalachicola and Chattahoochee River basins in Florida by facility, 1990

[Plant capacity and discharge values are in million gallons per day; A, Apalachicola River; refer to figure 2 for the location of the subbasin and cataloging units]

Facility/Owner	County	Sub-basin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Plant capacity	1990 discharge	Disposal source	
Blountstown, city of	Calhoun	A	03130011	0.60	0.50	surface	Sutton Creek.
Apalachicola, city of	Franklin	A	03130014	1.00	0.71	surface	Whortleberry Creek.
Carrabelle, town of	Franklin	A	03130013	0.30	0.15	ground	Land disposal (Spray field).
Eastpoint Water District	Franklin	A	03130013	0.15	0.08	ground	Land disposal (Spray field).
Lanark Village	Franklin	A	03130013	0.10	0.07	ground	Land disposal (Spray field).
Chattahoochee, city of	Gadsden	A	03130011	0.50	0.32	surface	Mosquito Creek.
Florida State Hospital	Gadsden	A	03130011	1.30	0.49	surface	Mosquito Creek.
Wewahithcka, city of	Gulf	A	03130012	0.20	0.15	surface	Chipola River.
Arthur Dozier School	Jackson	A	03130012	0.10	0.02	surface	Unnamed ditch/Chipola River.
Cottondale, city of	Jackson	A	03130012	0.12	0.06	surface	Caney Pond.
Marianna, city of	Jackson	A	03130012	2.70	1.43	surface	Chipola River.
Sneads, town of	Jackson	A	03130011	0.50	0.31	ground	Land disposal (Spray field).

Water withdrawn for thermoelectric power generation accounted for the largest surface-water withdrawals (73 percent) in the Apalachicola and Chattahoochee River basins in Florida. Other surface-water uses were self-supplied commercial-industrial use (22 percent) and agricultural use (5 percent) (fig. 13). Surface-water withdrawn for the Scholtz Power Plant in Jackson County (owned and operated by The Gulf Power Company) totaled nearly 108 Mgal/d during 1990 (Rachel L. Allen, Gulf Power Company, Pensacola, Fla., written commun., July 1991). Surface-water withdrawn out of the Chipola River (just north of its confluence with the Apalachicola River) for the St. Joe Paper Company, totaled nearly 33 Mgal/d during 1990 (N.G. Phillips, St. Joe Forest Products Company, written commun., August, 1991). This water is used at a pulp processing plant located in Port St. Joe (Gulf County), which is nearly 20 miles away. The water is conveyed through a series of canals and pipes to the pulp processing plant, where it is used and subsequently discharged into St. Joseph Bay in the neighboring Choctawhatchee-Escambia River basin (Seaber and others, 1987). Because this water is not returned to the ACF River basin, it is considered 100 percent consumed (U.S. Army Corps of Engineers, 1984, p. 51). Nearly 66 percent of the surface water used for agricultural irrigation in this part of the basin was used in Gulf County, and was withdrawn from the Brothers River.

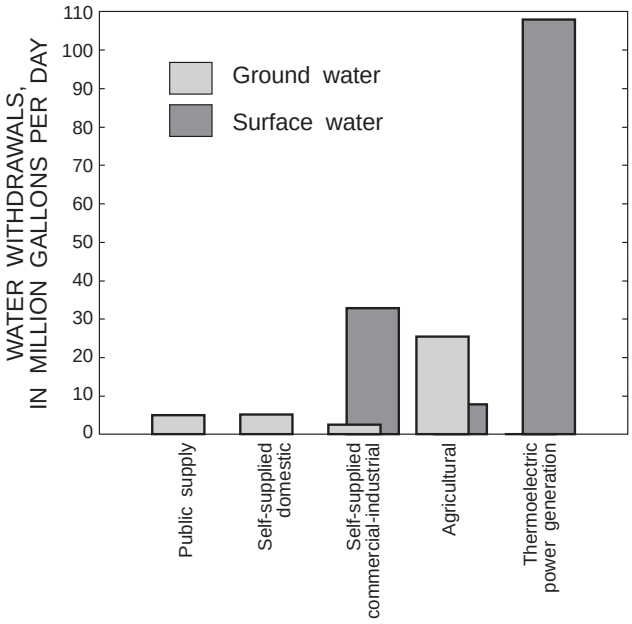

Figure 13. Water withdrawals by principal water-use categories in the Apalachicola and Chattahoochee River basins in Florida, 1990.

The remainder of the surface-water withdrawals in the basin in Florida were for agricultural use and were obtained from local ponds or ditches.

Ground-water withdrawn in the Apalachicola and Chattahoochee River basins in Florida during 1990 was used primarily for agricultural use (66 percent) followed by self-supplied domestic use (13 percent),

public supply (13 percent), self-supplied commercial-industrial use (7 percent), and thermoelectric power generation (1 percent) (fig. 13). The Floridan aquifer system supplied 97 percent (38 Mgal/d) of the ground-water withdrawn in the Apalachicola and Chattahoochee River basins in Florida during 1990. Self-supplied domestic use was the only category for which water from the surficial aquifer was used. Many individual household wells in this part of the basin tap the shallow aquifer for drinking water purposes.

Jackson County accounted for 74 percent of the surface-water withdrawals and 63 percent of the ground-water withdrawals in that part of the basin in Florida during 1990. Calhoun, Franklin, Gadsden, and Gulf Counties along with Jackson County all withdrew more than 0.01 Mgal/d of surface-water during 1990 (table 13). Calhoun, Franklin, Gadsden, Gulf, Liberty, and Washington along with Jackson County all withdrew more than 0.01 Mgal/d of ground-water during 1990 (table 13). Less than 0.01 Mgal/d of water was used in those parts of northern Bay County within the ACF River basin in Florida during 1990.

Trends in Water Use

Total water-use within the Apalachicola and Chattahoochee River basins in Florida increased 19 percent from 157 Mgal/d in 1970 to 188 Mgal/d in 1990 (table 10). However, water use decreased between 1975 and 1985, primarily due to the decrease in water used for thermoelectric power generation at the Sholtz Power Plant. Water withdrawals for this plant were 145 Mgal/d in 1970 (Pride, 1973 p. 22), 120 Mgal/d in 1975 (Leach, 1978, p. 32), 118 Mgal/d in 1980 (Leach, 1983, p. 42), 102 Mgal/d in 1985 (Bielby, 1987, p. 65), and 108 Mgal/d in 1990. The increase in total water withdrawals between 1970 and 1990, for the most part, can be attributed to the completion of the diversion canals that enabled the St. Joe Paper Company to begin withdrawing water from the Chipola River in 1973. All categories, except thermoelectric power generation, increased in the Apalachicola and Chattahoochee River basins in Florida between 1970 and 1990 (table 14). The water-use data for the Apalachicola and Chattahoochee River basins in Florida is limited for 1977, 1987, and 1989, and is given in table 14.

Ground-water withdrawals in the Apalachicola River basin increased between 1970 and 1990 (table 14). This followed the statewide trend of increasing reliance on ground water in Florida and the decreasing use of surface-water (Marella, 1992). Despite an increase in the power generated, surface-water withdrawals decreased as a result of more efficient uses of water for thermoelectric power generation. Electric power generated at the Gulf Power Plant in Jackson County totaled 0.4 GWh in 1970 (Pride, 1973 p. 22), and 0.5 GWh in 1990 (Rachel Allen, Gulf Power Company, Pensacola, Fla., written commun., July 1991); however, surface-water withdrawals at the facility decreased by nearly 37 Mgal/d between 1970 and 1990.

Basin Water Use in Georgia

The part of the ACF River basin in Georgia is one of the largest basins in the State. Located on the western edge of the State (fig. 1), the ACF River basin includes part of the Chattahoochee River basin, all of the Flint River basins, and less than 27 mi^2 of the Apalachicola River basin. The Chattahoochee River originates in the Blue Ridge physiographic province in Georgia and flows 436 miles (Edmiston and Tuck, 1987, p. 3) southwest to the Alabama-Georgia State line and then southward through the Piedmont and Coastal Plain physiographic provinces (fig. 5). The Flint River originates south of Atlanta in the Piedmont physiographic province and flows 350 miles (Edmiston and Tuck, 1987, p. 3) southward through the Coastal Plain physiographic province joining with the Chattahoochee River at Lake Seminole to form the Apalachicola River in Florida. The Chattahoochee and Flint River basins in Georgia cover approximately 14,500 mi^2 (U.S. Army Corps of Engineers, 1984) and represent more than 73 percent of the ACF River basin. A small part of Decatur County Georgia (27.4 mi^2) drains into the Apalachicola River through North Mosquito Creek (fig. 2), and the water-use data for this part of Decatur County is included under the Apalachicola River basin totals, however, the data for this part of Decatur County is included in the Georgia section.

Water use in that part of the ACF River basin in Georgia, which includes the Chattahoochee and Flint River basins is described in this section. The Georgia part of these two river basins includes all or part of 62 counties (fig. 3). Land use in this part of the ACF River basin is predominately agricultural but the basin contains several large urban areas.

Table 13. Water withdrawals in the Apalachicola and Chattahoochee River basins in Florida by county, 1990

[All values are in million gallons per day; refer to figure 3 for the county locations; 0.00 indicates no withdrawal occurred; modified from Marella, 1992]

County[1]	Public supply				Self-supplied domestic		Self-supplied commercial-industrial[3]		Agricultural[4]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[2]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground	Surface	Totals
Bay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calhoun	0.53	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.11	0.50	0.00	0.00	1.88	0.50	2.38
Franklin	1.63	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.74	0.11	0.00	0.00	2.52	0.11	2.63
Gadsden	0.60	0.00	0.00	0.00	0.14	0.00	1.14	0.00	0.21	0.58	0.00	0.00	2.09	0.58	2.67
Gulf	0.11	0.00	0.00	0.00	0.18	0.00	0.03	32.89	4.63	4.22	0.00	0.00	4.95	37.11	42.06
Jackson	1.98	0.00	0.00	0.00	3.07	0.00	1.38	0.00	17.52	2.48	0.37	107.99	24.32	110.47	134.79
Liberty	0.19	0.00	0.00	0.00	0.34	0.00	0.00	0.00	2.32	0.00	0.00	0.00	2.85	0.00	2.85
Washington	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.08
Totals	5.04	0.00	0.00	0.00	5.20	0.00	2.55	32.89	25.53	7.89	0.37	107.99	38.69	148.77	187.46

[1]Data is for the part of the county within the Apalachicola-Chattahoochee-Flint River basin only (all 8 counties are only partially within the basin).
[2]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public-supply use.
[3]Surface-water withdrawals for self-supplied commercial-industrial include 32.89 million gallons per day of water withdrawn in the Apalachicola River basin for use in the Choctawhatchee-Escambia River basin.
[4]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.

Table 14. Water withdrawals by principal water-use categories in the Apalachicola and Chattahoochee River basins in Florida, 1970-90

[All values are in million gallons per day; 0.00 indicates no withdrawals occurred; ---- indicates no data were available or collected]

Year	Public supply				Self-supplied domestic		Self-supplied Commercial-industrial[b]		Agricultural[c]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[a]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
1970[d]	3.00	0.00	0.00	0.00	2.30	0.00	1.20	2.60	1.23	1.45	1.40	144.00	9.13	148.05	157.18
1971	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1972	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1973	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1974	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1975[e]	3.06	0.01	0.00	0.00	3.51	0.01	1.17	34.03	6.10	2.87	0.30	120.10	14.14	157.02	171.16
1976	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1977[f]	3.51	0.00	0.00	0.00	3.86	0.01	1.17	33.55	5.20	3.79	0.30	109.20	14.04	146.55	160.59
1978	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1979	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1980[g]	3.53	0.00	0.00	0.00	4.23	0.00	1.58	33.29	10.79	3.01	0.00	118.00	20.13	154.30	174.43
1981	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1982	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1983	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1984	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1985[h]	4.25	0.00	0.00	0.00	5.98	0.00	0.62	33.63	12.86	10.36	0.74	100.89	24.45	144.88	169.33
1986	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1987[i]	4.69	0.00	0.00	0.00	----	----	----	----	----	----	----	----	----	----	----
1988	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1989[j]	4.95	0.00	0.00	0.00	----	----	----	----	----	----	----	----	----	----	----
1990[k]	5.04	0.00	0.00	0.00	5.20	0.00	2.55	32.89	25.53	7.89	0.37	107.99	38.69	148.77	187.46

[a]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public supply use.

[b]Surface-water withdrawals for self-supplied commercial-industrial include between 30 and 35 million gallons per day of water exported out of the Apalachicola River basin for use in the Choctawhatchee-Escambia River basin for the years 1975, 1977, 1980, 1985, and 1990.

[c]Agricultural includes water withdrawals for irrigation, livestock and fish farming uses.

[d]1970 data source; Florida Bureau of Geology Information Circular No. 83 (Pride, 1973).

[e]1975 data source; USGS Water Resource-Investigations 78-17 (Leach, 1978).

[f]1977 data source; USGS Water Resource-Investigations 79-112 (Leach and Healy, 1980).

[g]1980 data source; USGS Water Resource-Investigations 82-4090 (Leach, 1983).

[h]1985 data source; USGS Water Resource-Investigations 88-4103 (Marella, 1988), and the Northwest Florida Water Management District Program Development Series 87-1 (Bielby, 1987).

[i]1987 data source; USGS Open-File Report 90-596 (Marella, 1990b).

[j]1989 data source; USGS unpublished water-use data files, Tallahassee, Fla.

[k]1990 data source; USGS Water Resource-Investigations 92-4140 (Marella, 1992).

The total population in the Chattahoochee and Flint River basins in Georgia for 1990 was estimated at 2.376 million (U.S. Bureau of the Census, 1991d), which is about 37 percent of the total population of Georgia (6.478 million) (Libbey, 1991, p. 12) and 90 percent of the total population for the ACF River basin. Some of the larger population centers located in or partially in the basin are Atlanta (0.394 million), Columbus (0.179 million), and Albany (0.078 million) (Libbey, 1991, p. 8). The total population of the Atlanta Metropolitan Statistical Area (MSA) was 2.834 million in 1990 (Libbey, 1991, p. 9), however, not all of the population of the MSA lies within the ACF River basin. Nearly 88 percent of the basins population (2.082 million) was served by public supply in 1990. A total of 130 public-supply utilities were inventoried within or partially within the Chattahoochee and Flint River basin in Georgia for 1990 (table 15).

An estimated 0.553 million acres were irrigated in the Chattahoochee and Flint River basins in Georgia during 1990, which is about 92 percent of the total irrigated acreage for the ACF River basin. Peanuts, corn, wheat, hay, soybeans, and cotton were the major crops grown and irrigated within the basin (Stell, 1993, p. 33, and E.A. Frick, USGS, Georgia District office, Atlanta, Ga., written commun., August 1992). Other significant crops irrigated within the basin include peaches, pecans, vegetables, and melons. Most of the irrigation in the Chattahoochee and Flint River basins occurs in the Dougherty Plain area of southwest Georgia (fig. 5). Nearly all of the irrigation in this part of Georgia is by sprinkler irrigation systems, mostly "center pivots" or "traveling guns or cable tow systems" (Pierce and others, 1984).

The Chattahoochee and Flint Rivers and their tributaries were the source of water for many public-supply systems, industries, and powerplants in Georgia in 1990, whereas ground water was the primary source of water for irrigation purposes. There were 13 hydroelectric plants operating in the ACF River basin in Georgia during 1990 (Fanning and others, 1991) using 31,492 Mgal/d from the Chattahoochee and Flint Rivers to produce nearly 2,222 GWh of electricity.

Water Withdrawn in 1990

Water withdrawals in the Chattahoochee and Flint River basins in Georgia during 1990 totaled 1,727 Mgal/d. This represents nearly 32 percent of the total water withdrawn (5,353 Mgal/d) in Georgia during 1990 (Fanning and others, 1992, p. 5). Surface water accounted for more than 86 percent (1,487 Mgal/d), and ground water accounted for the remaining 14 percent (240 Mgal/d) of the water withdrawn in the Chattahoochee and Flint River basins in Georgia. The Chattahoochee and Flint River basins in Georgia accounted for nearly 82 percent of the ACF River basin total water use in 1990.

An estimated 21 percent (366 Mgal/d) of the water withdrawn in the Georgia part of the basin in 1990 was consumed. This includes an estimated net 86 Mgal/d of water exported out of the ACF. The remaining 79 percent (1,430 Mgal/d) of the water was returned to ground- and surface-water sources for possible reuse. An estimated 196 Mgal/d municipal (domestic) wastewater was discharged in the Chattahoochee and Flint River basins in Georgia during 1990. A total of 118 municipal wastewater facilities were inventoried within or partly within the Chattahoochee and Flint River basins in Georgia for 1990 (table 16). Several of the municipal wastewater facilities in the greater Atlanta area discharge treated effluent out of the ACF basin into the Altamaha-St. Marys River basin. Much of the wastewater treated at these facilities originated from the Chattahoochee River and other sources in Dekalb, Fulton, and Gwinnett Counties. In these three counties, 153 Mgal/d was discharged to the Altamaha-St. Marys River basin, and 104 Mgal/d was discharged to the ACF River basin through the Chattahoochee and Flint Rivers.

In 1990, surface-water withdrawals in the Chattahoochee and Flint River basins in Georgia were used primarily for cooling purposes at thermoelectric plants (fig. 14). There were six thermoelectric powerplants operating in the basins in 1990. Water withdrawals at these plants totaled 868 Mgal/d, all of which was surface water. Although large amounts of water were withdrawn for use at thermoelectric plants, only about 1 percent was consumed. Surface-water withdrawals for public supply totaled 413 Mgal/d in 1990 (fig. 14), and accounted for nearly 88 percent of the total public-supply withdrawals in the Chattahoochee and Flint River basins in Georgia (379 Mgal/d).

Table 15. Public-supply water use in the Chattahoochee and Flint River basins in Georgia by utility, 1990

[Refer to figure 2 for the location of subbasin and cataloging unit; Mgal/d, million gallons per day; gal/capita/d, gallons per capita per day; F, Flint River; FAS, Floridan aquifer system; CLT, Clayton aquifer system; C, Chattahoochee River; CST, Crystalline rock aquifers; W/S, water system; CRE, Cretaceous aquifer system; CLB, Clairborne aquifer system; Assoc., Association; N/A, data not available; modified from Fanning and others, 1992]

Utility/Owner[1]	County	Subbasin	Cataloging unit	Water source	Public-supply water use		
					Mgal/d	Population	Gal/capita/d
Newton, city of	Baker	F	03130008	FAS	0.10	695	144
Arlington, city of	Calhoun	F	03130010	CLT	0.31	1,456	213
Edison, city of	Calhoun	F	03130009	CLT	0.19	1,100	173
Leary, city of	Calhoun	F	03130009	CLT	0.05	694	72
Morgan, city of	Calhoun	F	03130009	CLT	0.05	212	236
Roopville, town of	Carroll	C	03130002	CST	0.02	245	82
Villa Rica, city of	Carroll	C	03130002	Lake Paradise	0.73	4,200	174
Whitesburg, town of	Carroll	C	03130002	CST	0.06	634	95
Chattahoochee County W/S	Chattahoochee	C	03130003	CRE	0.21	600	350
Cusseta, city of	Chattahoochee	C	03130003	CRE	0.17	1,040	163
Bluffton, town of	Clay	C	03130004	CLT	0.01	138	72
Fort Gaines, city of	Clay	C	03130004	CRE	0.18	1,507	119
Clayton County Water Authority	Clayton	F	03130005	Little Cotton Creek and Indian Creek	20.13	164,081	123
Jonesboro, city of	Clayton	F	03130005	CST	0.37	4,100	90
Riverdale, city of	Clayton	F	03130005	CST	0.87	4,000	218
Cobb County/ Marietta W/S	Cobb	C	03130002	Chattahoochee River Lake Allatoona	38.98	438,046	171
Grantville, city of	Coweta	C	03130002	CST	0.11	1,100	100
Moreland, town of	Coweta	F	03130005	CST	0.02	366	55
Newnan, city of	Coweta	C	03130002	Line Creek and White Oak Creek	3.54	15,000	236
Senioa, city of	Coweta	F	03130005	Hutchins Lake	0.11	1,160	95
Turin, town of	Coweta	F	03130005	CST	0.03	185	162
Roberta, city of	Crawford	F	03130005	CRE	0.14	1,102	127
Cordele, city of	Crisp	F	03130006	CLB and CLT	0.84	15,000	56
Bainbridge, city of	Decatur	F	03130008	FAS	2.29	12,000	191
Brinson, town of	Decatur	F	03130010	FAS	0.03	225	133
Clarkston, city of	Dekalb	C	03130001	CST	0.09	4,539	20
Dekalb County W/S	Dekalb	C	03130001	Chattahoochee River	79.16	530,300	149
Byromville, town of	Dooly	F	03130006	CLB and CRE	0.14	452	310
Lilly, town of	Dooly	F	03130006	CLB	0.01	138	72
Pinehurst, city of	Dooly	F	03130006	CLB	0.05	285	175
Vienna, city of	Dooly	F	03130006	CLB and CRE	0.44	2,900	152
Albany, city of	Dougherty	F	03130008	CLB, CLT, and CRE	17.96	93,787	191
Putney W/S	Dougherty	F	03130008	FAS	0.02	240	83
Marine Corp Logistics Base	Dougherty	F	03130008	FAS	0.11	1,405	78
Douglasville/Douglas County Water Authority	Douglas	C	03130002	Annawakee Creek and Bear Creek	5.55	68,690	81
Blakely, city of	Early	F	03130010	CLT	1.11	6,000	185
Damascus, town of	Early	F	03130010	CLB	0.03	290	103
Jakin, town of	Early	C	03130004	CLB	0.02	137	146
Brooks, town of	Fayette	F	03130005	CST	0.03	314	96
Fayette County W/S	Fayette	F	03130005	Lake Peachtree and Lake Mcintosh	5.20	41,000	127
Fayetteville, city of	Fayette	F	03130005	Ginger Cake Creek	0.93	6,500	143
Cumming, city of	Forsyth	C	03130001	Lake Sidney Lanier	4.34	9,770	444
Atlanta, city of	Fulton	C	03130001	Chattahoochee River	121.69	500,000	243
East Point, city of	Fulton	C	03130002	Sweetwater Creek	8.99	34,332	262
Palmetto, city of	Fulton	C	03130002	Cedar Creek	0.33	2,530	130
Roswell, city of	Fulton	C	03130001	Big Creek	0.52	8,700	60

Table 15. Public-supply water use in the Chattahoochee and Flint River basins in Georgia by utility, 1990—Continued

[Refer to figure 2 for the location of subbasin and cataloging unit; Mgal/d, million gallons per day; gal/capita/d, gallons per capita per day; F, Flint River; FAS, Floridan aquifer system; CLT, Clayton aquifer system; C, Chattahoochee River; CST, Crystalline rock aquifers; W/S, water system; CRE, Cretaceous aquifer system; CLB, Clairborne aquifer system; Assoc., Association; N/A, data not available; modified from Fanning and others, 1992]

Utility/Owner[1]	County	Subbasin	Cataloging unit	Water source	Public-supply water use		
					Mgal/d	Population	Gal/capita/d
Buford, city of	Gwinnett	C	03130001	Lake Sidney Lanier	0.76	8,410	90
Gwinnett County W/S	Gwinnett	C	03130001	Lake Sidney Lanier and Chattahoochee River	56.89	320,323	178
Suwannee, city of	Gwinnett	C	03130001	CST	0.06	600	100
Alto, town of	Habersham	C	03130001	CST	0.27	1,674	161
Baldwin, town of	Habersham	C	03130001	CST	0.28	2,000	140
Clarkesville, city of	Habersham	C	03130001	Soque River	0.68	3,320	205
Cornelia, city of	Habersham	C	03130001	Camp Creek	1.93	3,800	508
Demorest, city of	Habersham	C	03130001	CST	0.74	3,000	247
Mt Airy, town of	Habersham	C	03130001	CST	0.04	500	80
Flowery Branch, town of	Hall	C	03130001	CST	0.10	1,000	100
Gainesville, city of	Hall	C	03130001	Lake Sidney Lanier	11.29	67,000	169
Lula, city of	Hall	C	03130001	CST	0.08	800	100
Hamilton, city of	Harris	C	03130002	Lake Palmetto Creek	0.08	408	196
Harris County Water Works	Harris	C	03130002	CST	0.66	3,400	194
Pine Mountain, town of	Harris	C	03130002	Turkey Creek	0.04	858	47
Shiloh, city of	Harris	C	03130002	CST	0.04	301	133
Waverly Hall, town of	Harris	C	03130002	CST	0.08	768	104
Franklin, city of	Heard	C	03130002	CST	0.15	876	171
Franklin/Heard County W/S	Heard	C	03130002	Central Hatchee Creek	0.28	3,297	85
Leesburg, city of	Lee	F	03130007	CLB	0.29	1,250	232
Smithville, city of	Lee	F	03130007	CLB	0.07	865	81
Dahlonega, city of	Lumpkin	C	03130001	Yahoola Creek	0.79	3,900	203
Ideal, town of	Macon	F	03130005	CRE	0.06	562	107
Marshallville, town of	Macon	F	03130006	CRE	0.11	2,400	46
Montezuma, city of	Macon	F	03130006	CRE	0.71	4,200	169
Oglethorpe, city of	Macon	F	03130006	CRE	0.16	1,426	112
Buena Vista, city of	Marion	F	03130006	CRE	0.99	1,650	600
Greenville, city of	Meriwether	F	03130005	CST	0.23	780	295
Lone Oak W/S	Meriwether	C	03130002	CST	0.05	300	167
Luthersville, town of	Meriwether	F	03130005	CST	0.04	691	58
Manchester, city of	Meriwether	F	03130005	Pigeon Creek and Cooler Branch	0.67	4,620	145
Warm Springs, city of	Meriwether	F	03130005	CST	0.10	318	314
Woodbury, town of	Meriwether	F	03130005	Cane Creek	0.29	1,800	161
Colquitt, city of	Miller	F	03130010	FAS	0.30	2,400	125
Camilla, city of	Mitchell	F	03130008	FAS	2.18	5,449	400
Baconton, city of	Mitchell	F	03130008	FAS and CLT	0.05	1,500	33
Culloden, city of	Monroe	F	03130005	CST	0.02	242	83
Columbus, city of	Muscogee	C	03130003	Lake Oliver	35.13	162,306	216
Hiram, city of	Paulding	C	03130002	CST	0.11	1,225	90
Concord, town of	Pike	F	03130005	CST	0.26	203	1,281
Meansville, city of	Pike	F	03130005	CST	0.02	246	81
Molena, city of	Pike	F	03130005	CST	0.02	300	67
Williamson, town of	Pike	F	03130005	CST	0.02	326	61
Zebulon, city of	Pike	F	03130005	Elkins Creek	0.17	1,590	107
Georgetown, town of	Quitman	C	03130003	CRE	0.12	1,200	100
Coleman, city of	Randolph	C	03130004	CLT	0.05	56	893
Cuthbert, city of	Randolph	F	03130009	CLT	0.44	4,100	107
Shellman, city of	Randolph	F	03130009	CLB	0.11	1,100	100
Ellaville, city of	Schley	F	03130006	CRE	0.26	1,400	186

Table 15. Public-supply water use in the Chattahoochee and Flint River basins in Georgia by utility, 1990—Continued

[Refer to figure 2 for the location of subbasin and cataloging unit; Mgal/d, million gallons per day; gal/capita/d, gallons per capita per day; F, Flint River; FAS, Floridan aquifer system; CLT, Clayton aquifer system; C, Chattahoochee River; CST, Crystalline rock aquifers; W/S, water system; CRE, Cretaceous aquifer system; CLB, Clairborne aquifer system; Assoc., Association; N/A, data not available; modified from Fanning and others, 1992]

Utility/Owner[1]	County	Subbasin	Cataloging unit	Water source	Public-supply water use		
					Mgal/d	Population	Gal/capita/d
Donalsonville, city of	Seminole	F	03130010	FAS	0.47	3,000	157
Iron City, town of	Seminole	F	03130010	FAS	0.07	266	263
Griffin, city of	Spalding	F	03130005	Flint Creek	6.97	38,708	180
Orchard Hill, village of	Spalding	F	03130005	CST	0.01	245	41
Lumpkin, city of	Stewart	C	03130003	CRE	0.21	1,600	131
Omaha, city of	Stewart	C	03130003	CRE	0.01	108	93
Richland, city of	Stewart	C	03130003	CRE	0.12	2,000	60
Andersonville, village of	Sumter	F	03130006	CRE and CLT	0.14	270	519
Americus, city of	Sumter	F	03130007	CRE	3.72	16,120	231
Desoto, village of	Sumter	F	03130006	CLB	0.04	259	154
Leslie, village of	Sumter	F	03130006	CLB	0.05	700	71
Plains, city of	Sumter	F	03130007	CLB	0.14	651	215
Geneva, town of	Talbot	C	03130003	CRE	0.03	182	165
Junction City, town of	Talbot	C	03130003	CST	0.01	181	55
Talbotton, city of	Talbot	F	03130005	CST	0.08	1,045	77
Woodland, city of	Talbot	F	03130005	CST	0.08	679	118
Butler, town of	Taylor	F	03130005	CRE	N/A	2,880	N/A
Reynolds, town of	Taylor	F	03130005	CRE	0.45	1,300	346
Bronwood, town of	Terrell	F	03130007	CLT	0.05	337	148
Dawson, city of	Terrell	F	03130009	CLT	1.42	5,295	268
Parrott, town of	Terrell	F	03130009	CLT	0.04	128	313
Sasser, town of	Terrell	F	03130009	CLT and CLB	0.08	256	313
Hogansville, city of	Troup	C	03130002	Flat Creek	0.46	3,420	135
Lagrange, city of	Troup	C	03130002	West Point Reservoir	9.68	36,100	268
Mountainville Water Assoc.	Troup	C	03130002	CST	0.02	168	119
West Point, city of	Troup	C	03130002	Chattahoochee River	0.70	4,000	175
Thomaston, city of	Upson	F	03130005	Potato Creek	1.97	9,100	216
Yatesville, town of	Upson	F	03130005	CST	0.04	477	84
Preston, city of	Webster	F	03130007	CRE	0.08	675	119
Weston, town of	Webster	F	03130007	CLT	0.02	41	488
Cleveland, city of	White	C	03130001	Turner Creek and CST	0.41	2,780	147
Helen, city of	White	C	03130001	CST	0.25	900	278
Robertstown, city of	White	C	03130001	CST	0.02	100	200
Isabella W/S	Worth	F	03130006	FAS	0.04	450	89
Warwick, city of	Worth	F	03130006	FAS	0.05	484	103

[1]The utility listed may not be located entirerly within the Apalachicola-Chattahoochee-Flint River basins, and the public-supply water use values listed reflect those of the entire utility, not just the part within the basin.

Table 16. Municipal wastewater discharge in the Chattahoochee and Flint River basins in Georgia by facility 1990

[Permitted amount and discharge values are in million gallons per day; F, Flint River; Auth., Authority; C, Chattahoochee River; WPCP, Wastewater Pollution Control Plant; Co., County; NAS, Navel Air Station; STP, Sewage treatment plant]

Facility/Owner	County	Sub-basin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Permitted amount	1990 discharge	Disposal source	
Arlington, city of (#1)	Calhoun	F	03130010	0.10	0.06	surface	Perry Creek.
Arlington, city of (#2)	Calhoun	F	03130010	0.06	0.03	surface	Perry Creek.
Edison, city of	Calhoun	F	03130009	0.15	0.14	surface	Bay Branch.
Leary, city of	Calhoun	F	03130009	0.10	0.03	surface	Keel Creek.
Carrol County Water Auth.	Carroll	C	03130002	9.45	9.45	ground	Land disposal.
Villa Rica, city of	Carroll	C	03130002	0.26	0.27	surface	Town Branch/Sweetwater Creek.
Fort Gaines, city of	Clay	C	03130004	0.13	0.13	surface	Chattahoochee River.
Clayton County: Shoal Creek	Clayton	F	03130005	2.10	2.10	ground	Land disposal.
Chattahoochee County	Chattahoochee	C	03130003	0.02	0.02	surface	Chattahoochee River.
Cusseta, city of	Chattahoochee	C	03130003	0.00	0.00	surface	Chattahoochee River.
Cobb County: South Cobb WPCP	Cobb	C	03130001	28.50	20.18	surface	Chattahoochee River.
Cobb County: Sutton WPCP	Cobb	C	03130001	28.00	29.60	surface	Chattahoochee River.
Grantville, city of (#1)	Coweta	C	03130002	0.05	0.02	surface	New Mountian Creek.
Grantville, city of (#2)	Coweta	C	03130002	0.04	0.02	surface	New Mountian Creek.
Grantville, city of (#3)	Coweta	C	03130002	0.05	0.00	surface	Yellow Jacket Creek Tributary.
Grantville, city of (#4)	Coweta	C	03130002	0.04	0.00	surface	Yellow Jacket Creek Tributary.
Newnan: Wahoo WPCP	Coweta	C	03130002	0.75	0.50	surface	Mineral Springs Tributary.
Newnan: Newnan water-works	Coweta	C	03130002	0.40	0.33	surface	Snake Creek/Wahoo Creek.
Newnan: Mineral Springs WPCP	Coweta	C	03130002	0.75	0.90	surface	Wahoo Creek Tributary.
Newnan: Snake Creek WPCP	Coweta	C	03130002	0.00	0.00	surface	Chattahoochee River.
Coweta Co.: Shenandoah WPCP	Coweta	C	03130002	0.30	0.17	surface	White Oak Tributary.
Senoia, city of	Coweta	F	03130005	0.30	0.00	surface	Flint River.
Roberta, city of	Crawford	F	03130005	0.44	0.11	surface	Matthews Creek Tributary.
Cordele, city of	Crisp	F	03130006	5.00	1.96	surface	Gum Creek.
Bainbridge, city of	Decatur	F	03130008	2.50	1.32	surface	Flint River.
Decatur County Airpark WPCP	Decatur	F	03130008	1.00	0.44	surface	Flint River.
Atlanta: Entrenchment Creek	Dekalb	C	03130002	0.00	0.00	surface	Chattahoochee River.
Byromville, town of	Dooly	F	03130006	0.10	0.03	surface	Turkey Creek Tributary.
Vienna, city of	Dooly	F	03130006	0.75	0.75	ground	Land disposal.
Albany: Albany WPCP	Dougherty	F	03130008	20.00	14.52	surface	Flint River.
Albany: NAS WPCP	Dougherty	F	03130008	0.60	0.33	surface	Flint River.
Douglas Co.: Anneewakee WPCP	Douglas	C	03130002	0.02	0.02	ground	Land disposal.
Douglas Co.: St. Andrews WPCP	Douglas	C	03130002	0.02	0.02	ground	Land disposal

Table 16. Municipal wastewater discharge in the Chattahoochee and Flint River basins in Georgia by facility 1990—Continued

[Permitted amount and discharge values are in million gallons per day; F, Flint River; Auth., Authority; C, Chattahoochee River; WPCP, Wastewater Pollution Control Plant; Co., County; NAS, Navel Air Station; STP, Sewage treatment plant]

Facility/Owner	County	Sub-basin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Permitted amount	1990 discharge	Disposal source	
Douglas Co.: Beaver WPCP	Douglas	C	03130002	0.04	0.01	surface	Annewakee Creek.
Douglas Co.: Rebel Trails	Douglas	C	03130002	0.05	0.07	surface	Crooked Creek.
Douglas Co.: North WPCP	Douglas	C	03130002	0.60	1.41	surface	Gothards Creek Tributary.
Douglas Co.: South WPCP	Douglas	C	03130002	3.25	3.10	surface	Annewakee Creek.
Douglas Co.: Sweatwater WPCP	Douglas	C	03130002	3.00	0.00	surface	Chattahoochee River.
Blakely, city of (Pond A)	Early	F	03130010	0.12	0.05	surface	Baptist Branch.
Blakely, city of (Pond B)	Early	F	03130010	0.12	0.24	surface	Baptist Branch.
Blakely, city of (Main WPCP)	Early	F	03130010	1.32	0.92	surface	Blue Creek.
Fayetteville, city of	Fayette	F	03130005	1.25	0.65	surface	Whitewater Creek.
Peachtree: Flat Creek WPCP	Fayette	F	03130005	0.90	0.64	surface	Flat Creek.
Peachtree: Line Creek WPCP	Fayette	F	03130005	2.00	1.10	surface	Line Creek.
Peachtree: Rockaway WPCP	Fayette	F	03130005	2.00	0.00	surface	Rockaway Creek.
Cumming, city of	Forsyth	C	03130001	0.70	0.35	surface	Big Creek.
Cumming, city of	Forsyth	C	03130001	2.00	0.00	surface	Big Creek.
Atlanta: Utoy Creek WPCP	Fulton	C	03130001	37.00	29.80	surface	Chattahoochee River.
Atlanta: Clayton WPCP	Fulton	C	03130001	101.00	82.00	surface	Chattahoochee River.
Atlanta: South River WPCP	Fulton	C	03130001	41.00	39.30	surface	Chattahoochee River.
Fairburn: Line Creek WPCP	Fulton	C	03130002	0.22	0.30	surface	Line Creek.
Fulton Co.: Big Creek WPCP	Fulton	C	03130001	11.00	9.96	surface	Big Creek.
Fulton Co.: Camp Creek WPCP	Fulton	C	03130001	13.00	12.29	surface	Camp Creek.
Fulton Co.: Johns Creek WPCP	Fulton	C	03130001	5.00	5.47	surface	Johns Creek.
Fulton Co.: Johns Creek WPCP	Fulton	C	03130001	0.50	0.50	ground	Land disposal.
Palmetto, city of	Fulton	C	03130002	0.60	0.38	surface	Little Bear Creek.
Union, city of	Fulton	C	03130002	0.25	0.13	surface	Deep Creek.
Buford: Southside WPCP	Gwinnett	C	03130001	1.00	0.70	surface	Suwanee Creek.
Buford: Westside WPCP	Gwinnett	C	03130001	0.25	0.16	surface	Richland Creek.
Gwinnett Co.: Crooked Creek	Gwinnett	C	03130001	6.50	4.60	surface	Crooked Creek.
Gwinnett Co.: Progress Center	Gwinnett	C	03130001	0.75	0.75	ground	Land disposal.
Baldwin, town of	Habersham	C	03130001	0.30	0.28	surface	Little Mud Creek.
Clarkesville, city of	Habersham	C	03130001	0.75	0.31	surface	Soque River.
Cornelia, city of	Habersham	C	03130001	3.00	1.40	surface	Little Mud Creek.
Demorest, city of	Habersham	C	03130001	0.40	0.06	surface	Hazel Creek.
Flowery Branch, town of	Hall	C	03130001	0.20	0.14	surface	Lake Sidney Lanier.
Gainesville: WPCP 2	Hall	C	03130001	3.00	1.50	surface	Lake Sidney Lanier.
Gainesville: Flat Creek WPCP	Hall	C	03130001	7.00	4.29	surface	Flat Creek.

Table 16. Municipal wastewater discharge in the Chattahoochee and Flint River basins in Georgia by facility 1990—Continued

[Permitted amount and discharge values are in million gallons per day; F, Flint River; Auth., Authority; C, Chattahoochee River; WPCP, Wastewater Pollution Control Plant; Co., County; NAS, Navel Air Station; STP, Sewage treatment plant]

Facility/Owner	County	Sub-basin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Permitted amount	1990 discharge	Disposal source	
Lula, city of	Hall	C	03130001	0.08	0.03	surface	Lulu Branch/Hagen Creek.
Hamilton, city of	Harris	C	03130002	0.09	0.04	surface	Palmetto Creek Tributary.
Pine Mountain, town of	Harris	C	03130002	0.13	0.06	surface	Turkey Creek.
Franklin, city of	Heard	C	03130002	0.09	0.17	surface	Chattahoochee River.
Hampton, city of	Henry	F	03130005	0.50	0.20	surface	Bear Creek.
Leesburg, city of	Lee	F	03130007	0.30	0.13	surface	Kinchafoonee Creek.
Smithville, city of	Lee	F	03130007	0.12	0.00	surface	Flint River.
Dahlonega, city of	Lumpkin	C	03130001	0.72	0.34	surface	Yahoola Creek/Chestatee River.
Ideal, city of	Macon	F	03130005	0.08	0.00	surface	Flint River.
Marshallville, town of	Macon	F	03130006	0.12	0.10	surface	Spring Hill Creek.
Montezuma, city of (WPCP 1)	Macon	F	03130006	0.84	0.61	surface	Spring Creek.
Montezuma, city of (WPCP 2)	Macon	F	03130006	1.95	0.58	surface	Spring Creek.
Oglethorpe, city of	Macon	F	03130006	0.13	0.06	surface	Town Creek.
Buena Vista, city of	Marion	F	03130006	0.50	0.18	surface	Oochee Creek/Flint Creek.
Greenville: Greenville WPCP	Meriwether	F	03130005	0.13	0.04	surface	Kennel Creek.
Greenville: Kennel Creek WPCP	Meriwether	F	03130005	0.13	0.00	surface	Kennel Creek.
Greenville, city of	Meriwether	F	03130005	0.25	0.08	surface	Kennel Creek.
Warm Springs, city of	Meriwether	F	03130005	0.40	0.21	surface	Warm Springs Branch.
Woodbury, town of	Meriwether	F	03130005	0.33	0.33	ground	Land disposal.
Colquitt, city of	Miller	F	03130010	0.40	0.38	surface	Spring Creek Tributary.
Camilla, city of	Mitchell	F	03130008	3.00	1.32	surface	Big Slough/Flint River.
Baconton, city of	Mitchell	F	03130008	0.05	0.04	surface	Raccoon Creek.
Columbus: South WPCP	Muscogee	C	03130003	35.00	26.30	surface	Chattahoochee River.
Columbus: Battle Forest WPCP	Muscogee	C	03130003	0.30	0.20	surface	Tiger Creek/Upatoi Creek.
Columbus: Heiferhorn WPCP	Muscogee	C	03130003	0.15	0.09	surface	Helferhorn Creek.
Concord, town of (#1)	Pike	F	03130005	0.04	0.02	surface	Elkins Creek.
Concord, town of (#2)	Pike	F	03130005	0.10	0.02	surface	Birch Creek.
Zebulon, city of	Pike	F	03130005	0.29	0.35	surface	Town Branch.
Cuthbert, city of	Randolph	F	03130009	0.41	0.11	surface	Town Branch Tributary.
Shellman, city of	Randolph	F	03130009	0.15	0.03	surface	Inchawaynochaway Tributary.
Ellaville, city of	Schley	F	03130006	0.16	0.14	surface	Muckalee Creek Tributary.
Donalsonville, city of	Seminole	F	03130010	0.40	0.40	surface	Fish Pond Drain.
Griffin: Potato Creek WPCP	Spalding	F	03130005	1.50	0.55	surface	Shoal Creek Tributary.
Lumpkin, city of	Stewart	C	03130003	0.05	0.14	surface	Hodchookee Creek.
Richland, city of	Stewart	C	03130003	0.19	0.06	surface	Bear Creek Tributary.
Andersonville, village of	Sumter	F	03130006	0.03	0.03	surface	Sweetwater Creek Tributary.

Table 16. Municipal wastewater discharge in the Chattahoochee and Flint River basins in Georgia by facility 1990—Continued

[Permitted amount and discharge values are in million gallons per day; F, Flint River; Auth., Authority; C, Chattahoochee River; WPCP, Wastewater Pollution Control Plant; Co., County; NAS, Navel Air Station; STP, Sewage treatment plant]

Facility/Owner	County	Sub-basin	Cataloging unit	Facility discharge information			Disposal system method or receiving water body
				Permitted amount	1990 discharge	Disposal source	
Americus: Mill Creek WPCP	Sumter	F	03130007	4.40	2.97	surface	Mill Creek.
Plains, city of	Sumter	F	03130007	0.12	0.11	surface	Passell Creek.
Talbotton, city of	Talbot	F	03130005	0.10	0.08	surface	Edwards Creek/Lazar Creek.
Butler, town of	Taylor	F	03130005	0.50	0.29	surface	Town Creek/Beaver Creek.
Reynolds, town of	Taylor	F	03130005	0.16	0.08	surface	Patsilaga Creek.
Dawson, city of	Terrell	F	03130009	1.00	0.94	surface	Brantley Creek.
Hogansville, city of	Troup	C	03130002	0.50	0.50	surface	Flat Creek Tributary.
LaGrange: Long Creek STP	Troup	C	03130002	8.20	7.34	surface	Long Cane Creek.
LaGrange: Main STP	Troup	C	03130002	0.00	0.80	surface	West Point Reservoir.
West Point, city of	Troup	C	03130002	1.00	0.82	surface	Chattahoochee River.
Thomaston: Bell Creek WPCP	Upson	F	03130005	1.00	1.01	surface	Bell Creek.
Thomaston: Town Branch WPCP	Upson	F	03130005	2.00	0.72	surface	Town Branch.
Cleveland, city of	White	C	03130001	0.35	0.26	surface	Little Niagra Creek.
Helen, city of	White	C	03130001	0.50	0.50	ground	Land disposal.

All of the surface-water withdrawn for public-supply use in the ACF River basin in Georgia was from counties in the northern part of the Chattahoochee and Flint River basins (primarily in the Blue Ridge and Piedmont physiographic provinces), where surface water is the most available source (table 15). Public-supply withdrawals in the Chattahoochee and Flint River basins accounted for nearly 40 percent of all public-supply withdrawals in Georgia for 1990. Nearly 117 Mgal/d of surface water was withdrawn in the Chattahoochee and Flint River basins and exported to the Alabama River basin and the Altamaha-St. Marys River basin for public-supply use during 1990. Additionally, nearly 31 Mgal/d of surface water was withdrawn in the Alabama River basin and the Altamaha-St. Marys River basin and imported into the Chattahoochee and Flint River basins for public-supply use during 1990. All of these water transfers occurred in the Atlanta metropolitan area, primarily in Clayton, Cobb, DeKalb, Fulton, and Gwinnett Counties. The total amount of water used for public supply in the Chattahoochee and Flint River basin in Georgia in 1990 was 373 Mgal/d (withdrawals plus imports and minus exports).

Surface-water withdrawals for self-supplied commercial-industrial (including mining) uses within the Georgia part of the basin totaled 142 Mgal/d in 1990 (fig. 14). Paper manufacturers in Early County and several textile manufacturers in Harris County withdrew about 107 Mgal/d and 9 Mgal/d respectively of surface water in 1990 (Fanning and others, 1992). Gold mining, in Lumpkin and White Counties, located in the northern end of the Chattahoochee River basin, represented the only mining in the State that used surface water (3 Mgal/d) as a source of supply.

Ground-water withdrawals in the Chattahoochee and Flint River basins in Georgia were primarily for agricultural use and totaled nearly 143 Mgal/d in 1990 (fig. 14). Other significant ground-water withdrawals in the basin were for public supply use (46 Mgal/d), self-supplied commercial-industrial use (25 Mgal/d), and self-supplied domestic use (26 Mgal/d). Self-supplied domestic withdrawals in the Chattahoochee and Flint River basins in Georgia are considered solely from ground-water supplies. Although the Clayton, Claiborne, Cretaceous, and Crystalline Rock aquifers are tapped, the Floridan aquifer system is the most utilized aquifer in this basin (fig. 8). Withdrawals from the Floridan aquifer system in the Chattahoochee and Flint River basins in Georgia totaled 95 Mgal/d in 1990.

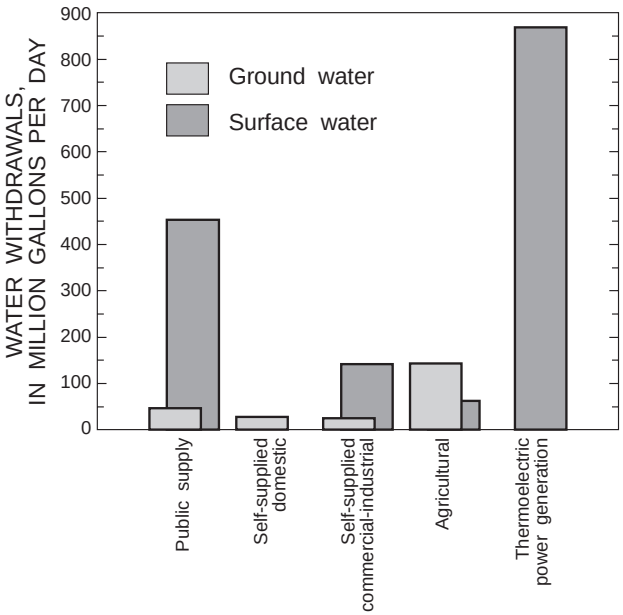

Figure 14. Water withdrawals by principal water-use categories in the Chattahoochee and Flint River basins in Georgia, 1990.

Within Georgia, all or parts of 62 counties are located in the Chattahoochee and Flint River basins (fig. 3). Of the 62 counties, all but Colquitt, Houston, and Towns withdrew more than 0.01 Mgal/d of water within the Chattahoochee and Flint River basins in Georgia during 1990 (table 17). The largest public-supply withdrawals were from counties in the metropolitan Atlanta area (Clayton, Cobb, Dekalb, Fulton, and Gwinnett). These five counties accounted for nearly 69 percent (318 Mgal/d) of the public-supply withdrawals in the basins for 1990 and more than 99 percent of this was surface water. Clayton, Cobb, Dekalb, Fulton, and Gwinnett Counties are involved in water transfers for public supply, but nearly 73 percent (232 Mgal/d) of the surface water withdrawn for public supply in the ACF River basin in 1990 was used within the basin (table 18). However, of the estimated total municipal wastewater discharged (368 Mgal/d) in these 5 counties, only 65 percent (238 Mgal/d) was discharged back into the ACF River basin (table 18). Wastewater discharges commonly differ from water withdrawals because of the inflow of ground and surface waters into wastewater systems and, in some instances interconnections between wastewater systems. Water withdrawals, use, and discharges are presented by basin in table 18. These data are estimated based on information provided by the States and utilities and will vary from year to year.

Trends in Water Use

Total water withdrawn in the Chattahoochee and Flint River basins in Georgia increased nearly 38 percent from 1,262 Mgal/d in 1970 to 1,727 Mgal/d in 1990 (table 19). Total withdrawals for public supply have continually increased since 1970. Surface-water withdrawals for public supply, in particular, increased nearly 350 percent (321 Mgal/d) between 1970 and 1990, and ground-water withdrawals for public supply increased nearly 32 percent (11 Mgal/d) (table 19). The largest decrease in water withdrawals were for self-supplied commercial-industrial and thermoelectric power generation uses. Use of more water-efficient commercial-industrial, recirculation of water, and use of cooling ponds are some of the reasons for decreases in water withdrawals for these categories. Water-use data for the Chattahoochee and Flint River basins in Georgia are limited for 1987 and 1989, and are given in table 19. Despite the total water withdrawal increases observed during the 1970-1990 period, much of the increase apparently occurred between 1970 to 1980 because total withdrawals in 1980 were 2,253 Mgal/d declining to the 1,727 Mgal/d level by 1990.

Agricultural water withdrawals for the Chattahoochee and Flint River basins in Georgia have increased 1,320 percent between 1970 and 1990. Ground-water withdrawals for agricultural use has increased more than 3,070 percent (138 Mgal/d) between 1970 and 1990 (table 19). Most of this increase occurred between 1970 and 1980 due to the increases in irrigated acreage. The introduction of the center pivot and other self-propelled irrigation equipment led to the rapid expansion of irrigated acreage and water use between 1970 and 1980 (Skinner, 1980; Pierce and others, 1984). However, a decline in harvested cropland throughout Georgia occurred between 1980 and 1990 (fig. 15). Additionally, irrigated acreage decreased slightly in Georgia during this time frame (Tyson and Harrison, 1993, p. 176). Water needed for irrigation purposes were higher than normal in 1980 (1980 was considered a dry year), and irrigation system efficiencies increased considerably after 1980, resulting in a decrease in irrigation water use during this period. The Chattahoochee and Flint River basins in Georgia accounted for about 38 percent of the total harvested cropland in Georgia in 1990.

Table 17. Water withdrawals in the Chattahoochee and Flint River basins in Georgia by county, 1990

[All values are in million gallons per day; 0.00 indicates no withdrawal occurred; modified from Fanning and others, 1992]

County	Public supply					Self-supplied domestic		Self-supplied commercial-industrial[c]		Agricultural[d]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[a]		Net[b] water-use											
	Ground water	Surface water	Imported water	Exported water		Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
Baker	0.10	0.00	0.00	0.00	0.10	0.22	0.00	0.00	0.00	11.78	1.90	0.00	0.00	12.10	1.90	14.00
Banks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.03	0.00	0.00	0.00	0.26	0.26
Calhoun	0.59	0.00	0.00	0.00	0.59	0.12	0.00	0.00	0.00	5.99	2.54	0.00	0.00	6.70	2.54	9.24
Carroll[e]	0.21	0.37	0.00	0.00	0.58	0.87	0.00	0.00	0.00	0.15	0.20	0.00	0.00	1.23	0.57	1.80
Chattahoochee	0.38	6.61	0.00	0.00	6.99	0.03	0.00	0.00	6.61	0.00	0.00	0.00	0.00	0.41	13.22	13.63
Cherokee[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.02
Clay	0.19	0.00	0.00	0.00	0.19	0.13	0.00	0.02	0.00	0.16	1.16	0.00	0.00	0.50	1.16	1.66
Clayton[e]	1.08	0.00	11.88	0.00	12.96	0.00	0.00	0.00	0.00	0.04	0.02	0.00	0.00	1.12	0.02	1.14
Cobbe	0.16	38.98	18.95	0.00	58.09	0.43	0.00	0.01	1.23	0.29	1.48	0.00	319.76	0.89	361.45	362.34
Colquitt[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coweta	1.35	3.65	0.00	0.00	5.00	2.02	0.00	0.55	0.53	0.19	0.10	0.00	437.33	4.11	441.61	445.72
Crawford[e]	0.14	0.00	0.00	0.00	0.14	0.34	0.00	0.12	0.00	0.79	0.59	0.00	0.00	1.39	0.59	1.98
Crisp[e]	0.93	0.00	0.00	0.00	0.93	0.16	0.00	2.84	0.00	2.36	3.44	0.00	0.00	6.29	3.44	9.73
Dawson[e]	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.02	0.03
Decatur[e]	2.37	0.00	0.00	0.00	2.37	0.67	0.00	0.86	0.00	20.52	2.72	0.00	0.00	24.42	2.72	27.14
Dekalb[e]	0.04	79.16	0.00	38.79	40.41	0.27	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.31	79.58	79.89
Dooly[e]	0.62	0.00	0.00	0.00	0.62	0.21	0.00	0.27	0.00	1.76	0.69	0.00	0.00	2.86	0.69	3.55
Dougherty	18.15	0.00	0.00	0.00	18.15	0.00	0.00	10.61	0.00	6.21	0.58	0.00	92.75	34.97	93.33	128.30
Douglas	0.13	5.54	0.00	0.00	5.67	0.05	0.00	0.08	0.00	0.01	0.71	0.00	0.00	0.27	6.25	6.52
Early	1.16	0.00	0.00	0.00	1.16	0.41	0.00	0.14	107.44	4.60	2.94	0.00	0.00	6.31	110.38	116.69
Fayette	0.55	5.85	0.00	0.00	6.40	0.85	0.00	0.05	0.00	0.25	0.60	0.00	0.00	1.70	6.45	8.15
Forsyth[e]	0.27	4.34	0.00	0.00	4.61	1.74	0.00	0.06	0.00	0.16	0.53	0.00	0.00	2.23	4.87	7.10
Fulton[e]	0.00	137.51	0.00	30.26	107.25	3.57	0.00	0.15	1.00	0.20	0.74	0.00	0.00	3.92	139.25	143.17
Grady[e]	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.29	0.51	0.00	0.00	0.37	0.51	0.88
Gwinnett[e]	0.07	60.88	0.00	47.64	13.31	0.00	0.00	0.00	0.00	0.03	0.22	0.00	0.00	0.10	61.10	61.20
Habersham[e]	1.05	2.61	0.00	0.00	3.66	0.71	0.00	0.14	0.05	0.01	0.78	0.00	0.00	1.91	3.44	5.35
Hall[e]	0.25	11.29	0.00	0.00	11.54	1.15	0.00	0.67	0.32	0.45	1.16	0.00	0.00	2.52	12.77	15.29
Harris	0.22	0.69	0.00	0.00	0.91	0.89	0.00	0.22	8.68	0.00	0.49	0.00	0.00	1.33	9.86	11.19
Heard[e]	0.15	0.28	0.00	0.00	0.43	0.36	0.00	0.00	0.00	0.14	0.41	0.00	3.64	0.65	4.33	4.98
Henry[e]	0.04	0.09	0.00	0.00	0.13	0.11	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.17	0.11	0.28
Houston[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lamare	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.15	0.16	0.00	0.00	0.27	0.16	0.43
Lee	0.66	0.00	0.00	0.00	0.66	0.76	0.00	0.99	0.00	14.46	0.72	0.00	0.00	16.87	0.72	17.59
Lumpkin[e]	0.01	0.79	0.00	0.00	0.80	0.54	0.00	0.03	1.28	0.03	0.58	0.00	0.00	0.61	2.65	3.26
Macon[e]	1.03	0.00	0.00	0.00	1.03	0.34	0.00	6.39	9.43	2.56	1.73	0.00	0.00	10.32	11.16	21.48

Table 17. Water withdrawals in the Chattahoochee and Flint River basins in Georgia by county, 1990—Continued

[All values are in million gallons per day; 0.00 indicates no withdrawal occurred; modified from Fanning and others, 1992]

County	Public supply					Self-supplied domestic		Self-supplied commercial-industrial[c]		Agricultural[d]		Thermoelectric power generation		Total water withdrawals		
	Withdrawals		Transfers[a]		Net[b] water-use											
	Ground water	Surface water	Imported water	Exported water		Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
Marion	0.99	0.00	0.00	0.00	0.99	0.23	0.00	0.01	0.00	0.01	1.12	0.00	0.00	1.24	1.12	2.36
Meriwether	0.43	1.02	0.00	0.00	1.45	1.05	0.00	0.09	0.00	0.80	1.22	0.00	0.00	2.37	2.24	4.61
Miller	0.30	0.00	0.00	0.00	0.30	0.29	0.00	0.00	0.00	12.93	0.18	0.00	0.00	13.52	0.18	13.70
Mitchell[e]	2.24	0.00	0.00	0.00	2.24	0.52	0.00	0.00	0.00	18.90	4.30	0.00	0.00	21.66	4.30	25.96
Monroe[e]	0.01	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.04	0.05	0.00	0.00	0.07	0.05	0.12
Muscogee	0.10	35.13	0.00	0.00	35.23	0.00	0.00	0.00	0.05	0.01	0.83	0.00	0.00	0.11	36.01	36.12
Paulding[e]	0.11	1.22	0.00	0.00	1.33	0.39	0.00	0.00	0.00	0.10	0.06	0.00	0.00	0.60	1.28	1.88
Peach[e]	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.22	0.06	0.00	0.00	0.27	0.06	0.33
Pike	0.33	0.17	0.00	0.00	0.50	0.57	0.00	0.03	0.00	0.28	0.31	0.00	0.00	1.21	0.48	1.69
Quitman	0.13	0.00	0.00	0.00	0.13	0.07	0.00	0.01	0.00	0.00	0.16	0.00	0.00	0.21	0.16	0.37
Randolph	0.76	0.00	0.00	0.00	0.76	0.22	0.00	0.04	0.00	2.61	3.88	0.00	0.00	3.63	3.88	7.51
Schley	0.26	0.00	0.00	0.00	0.26	0.16	0.00	0.00	0.00	0.07	0.86	0.00	0.00	0.49	0.86	1.35
Seminole	0.58	0.00	0.00	0.00	0.58	0.39	0.00	0.22	0.00	20.52	2.59	0.00	0.00	21.71	2.59	24.30
Spalding[e]	0.06	4.18	0.00	0.00	4.24	0.61	0.00	0.00	0.00	0.02	0.39	0.00	0.00	0.69	4.57	5.26
Stewart	0.34	0.00	0.00	0.00	0.34	0.15	0.00	0.02	0.00	0.01	1.04	0.00	0.00	0.52	1.04	1.56
Sumter	4.17	0.00	0.00	0.00	4.17	0.84	0.00	0.03	0.00	3.61	5.13	0.00	0.00	8.65	5.13	13.78
Talbot	0.20	0.00	0.00	0.00	0.20	0.33	0.00	0.00	0.00	1.15	1.26	0.00	0.00	1.68	1.26	2.94
Taylor	0.45	0.00	0.00	0.00	0.45	0.26	0.00	0.00	0.00	0.24	0.65	0.00	0.00	0.95	0.65	1.60
Terrell	1.60	0.00	0.00	0.00	1.60	0.34	0.00	0.01	0.00	1.44	3.38	0.00	0.00	3.39	3.38	6.77
Towns[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Troup[e]	0.02	10.84	0.00	0.00	10.86	0.89	0.00	0.21	1.00	0.19	0.12	0.00	0.00	1.31	11.96	13.27
Turner[e]	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.08	0.38	0.00	0.00	0.10	0.38	0.48
Union[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
Upson[e]	0.17	1.97	0.00	0.00	2.14	0.75	0.00	0.01	2.80	2.02	2.37	0.00	0.00	2.95	7.14	10.09
Webster	0.10	0.00	0.00	0.00	0.10	0.12	0.00	0.00	0.00	0.25	2.20	0.00	0.00	0.47	2.20	2.67
White	0.64	0.23	0.00	0.00	0.87	0.67	0.00	0.06	1.64	0.01	0.48	0.00	0.00	1.38	2.35	3.73
Worth[e]	0.11	0.00	0.00	0.00	0.11	0.36	0.00	0.03	0.00	3.41	1.88	0.00	15.00	3.91	16.88	20.79
Totals	46.01	413.40	30.83	116.69	373.55	26.45	0.00	24.97	142.29	142.52	63.12	0.00	868.48	239.95	1,487.29	1,727.24

[a]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basin for public-supply use.

[b]Net water use is shown for counties that are involved public supply water transfers, and represents the estimated amount of water used for public supply (water withdrawn plus imports or minus exports) in the Chattahoochee and Flint River basin part of the county.

[c]Self-supplied commercial-industrial includes water withdrawn for mining purposes.

[d]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.

[e]Indicates the county is partially within the Apalachicola-Chattahoochee-Flint River basin, and the data is for the part of the county within the basin only.

Table 18. Public supply water withdrawals, use, and municipal wastewater discharge by major River basin for selected counties in Georgia, 1990

[All values are in million gallons per day; ACF, Apalachicola-Chattahoochee-Flint; Public supply water withdrawals may not equal wastewater discharge values due to water infiltration into wastewater systems, the interconection of facilities, and the ability of several facilities to discharge into more than one source within more than one major River basin; modified from Fanning and others, 1992, and Atlanta Regional Commission, 1992]

County	Public supply water withdrawn			Public supply water used			Municipal wastewater discharged		
	ACF River basin	Altamaha-St. Marys River basin	Alabama River basin	ACF River basin	Altamaha-St. Marys River basin	Alabama River basin	ACF River basin	Altamaha-St. Marys River basin	Alabama River basin
Clayton	1.08	20.33	0.00	12.96	8.45	0.00	2.10	13.93	0.00
Cobb	39.14	0.00	36.01	58.09	0.00	17.06	49.78	0.00	5.64
DeKalb	79.20	0.05	0.00	40.41	38.84	0.00	0.00	44.85	0.00
Fulton	137.51	0.00	0.00	107.33	30.18	0.00	180.13	50.29	0.00
Gwinnett	60.95	0.19	0.00	13.31	47.83	0.00	6.21	15.17	0.00
Totals	317.88	20.57	36.01	232.10	125.30	17.06	238.22	124.24	5.64

SUMMARY

The Apalachicola-Chattahoochee-Flint River basin encompasses approximately 19,800 mi^2, and includes parts of Alabama, Florida, and Georgia. Most of the Apalachicola-Chattahoochiee-Flint River basin is in Georgia as is most of the population in the basin. Of the total land area in the basin, 73 percent is in Georgia, 14 percent is in Alabama, and 13 percent is in Florida. The 1990 population in the basin was estimated at nearly 2.636 million, of which 90 percent (2.376 million) was in Georgia, 7 percent (0.190 million) was in Alabama, and 3 percent (0.070 million) was in Florida. Water uses in the basin in 1990 included instream uses such as hydroelectric power generation, wastewater dilution, navigation, and fish and wildlife propagation, and offstream uses such as public supply, commercial and industrial uses, agricultural uses, and thermoelectric power generation. Hydroelectric power generation, the only instream use that can be easily quantified, used nearly 38,740 Mgal/d of water in 1990 to produce a total of 2,384 GWh of electricity at 14 facilities.

Withdrawals of surface water (for offstream uses) and ground water in the basin totaled 2,098 Mgal/d in 1990. Of that amount, nearly 86 percent (1,795 Mgal/d) was from surface-water sources and 14 percent (303 Mgal/d) was from ground-water sources. Most (78 percent) of the water withdrawn for offstream uses was returned to surface- and ground-water sources. The remainder was either consumed (17 percent) or transported out of the basin (5 percent). Nearly 223 Mgal/d of municipal (domestic) wastewater was generated and discharged within the Apalachicola-Chattahoochee-Flint River basin during 1990. Of the total water withdrawn in 1990, about 1,727 Mgal/d (82 percent) was withdrawn in Georgia, 188 Mgal/d (9 percent) was withdrawn in Florida, and 183 Mgal/d (9 percent) was withdrawn in Alabama.

Surface water is the primary source of water in the northern part of the basin, and ground water is the primary source of water for the southern part of the basin. Surface water was the source for most water withdrawals in the basin in all three States in 1990. Ground water was withdrawn from several aquifers throughout the basin. The Floridan aquifer system supplied nearly 44 percent (133 Mgal/d) and the Clairborne aquifer supplied nearly 20 percent (59 Mgal/d) of the ground water withdrawn in 1990. The largest offstream use of surface water in the basin in 1990 was for thermoelectric power generation (50 percent) followed by public supply (24 percent), self-supplied commercial-industrial use (12 percent), and agricultural use (4 percent). The largest use of ground water in the basin in 1990 was for agricultural uses (58 percent), followed by public supply (21 percent), self-supplied domestic uses (11 percent), self-supplied commercial-industrial uses (9 percent), and thermoelectric power generation (less than 1 percent).

Table 19. Water withdrawals by principal water-use categories in the Chattahoochee and Flint River basins in Georgia, 1970-90

[All values are in million gallons per day; 0.00 indicates no withdrawals occurred; ---- indicates no data were available or collected

Year	Public supply				Self-supplied domestic		Self-supplied commercial-industrial		Agricultural[b]		Thermoelectric power generation		Total water withdrawn		
	Withdrawals		Transfers[a]												
	Ground water	Surface water	Imported water	Exported water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Ground water	Surface water	Total
1970[c]	34.80	92.40	----	----	25.05	0.00	8.60	110.20	4.49	10.01	0.00	976.80	72.94	1,189.41	1,262.35
1971	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1972	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1973	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1974	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1975[d]	33.90	225.70	----	----	14.79	0.00	21.95	125.50	9.14	12.63	0.00	1,449.00	79.78	1,812.83	1,892.61
1976	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1977	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1978	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1979	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1980[e]	55.54	252.20	----	----	38.02	0.00	20.29	155.23	241.13	98.88	0.00	1,391.20	354.98	1,897.51	2,252.49
1981	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1982	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1983	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1984	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1985[f]	41.48	364.24	----	----	24.79	0.00	25.69	141.67	171.59	62.97	0.00	1,014.55	263.55	1,583.43	1,846.98
1986	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1987[g]	46.86	380.29	----	----	30.99	0.00	22.83	137.92	299.10	102.71	0.00	1,092.35	399.78	1,713.27	2,113.05
1988	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1989	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1990[h]	46.01	413.40	30.83	116.69	26.45	0.00	24.97	142.29	142.52	63.12	0.00	868.48	239.95	1,487.29	1,727.24

[a]Public supply transfers indicates water imported into or exported out of the Apalachicola-Chattahoochee-Flint River basins for public-supply use.

[b]Agricultural includes water withdrawals for irrigation, livestock, and fish farming.

[c]1970 data source; compiled from USGS unpublished water-use data files, Atlanta, Ga.

[d]1975 data source; compiled from USGS unpublished water-use data files, Atlanta, Ga.

e1980 data source; compiled from Georgia Geological Survey Information Circular 59 (Pierce and others, 1982).

f1985 data source; compiled from Georgia Geological Survey Information Circular 81 (Turlington and others, 1987).

[g]1987 data source; compiled from Georgia Geological Survey Information Circular 85 (Trent and others, 1990).

[h]1990 data source; compiled from Georgia Geological Survey Information Circular 90 (Fanning and others, 1992).

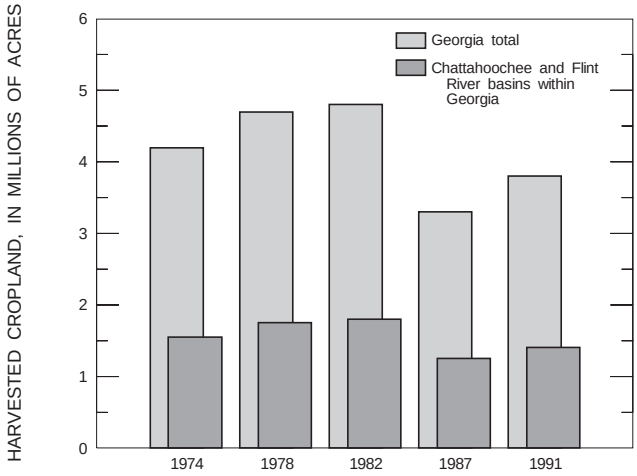

Figure 15. Harvested cropland in Georgia and in the Chattahoochee and Flint River basin for selected years (modified from U.S. Bureau of the Census, 1981, 1989, and 1992).

Withdrawals of water within the Apalachicola-Chattahoochee-Flint River basin increased nearly 42 percent from 1,474 Mgal/d in 1970 to 2,098 Mgal/d in 1990. The increase between 1970 and 1990, for the most part, can be attributed to the increase in public-supply water use, primarily in the metropolitan Atlanta area, and the increase in agricultural water use in the Dougherty Plain in southwestern Georgia. All categories of water use in the basin, except thermoelectric power generation, increased between 1970 and 1990.

The Apalachicola and Chattahoochee River basins in Alabama encompasses approximately 2,800 mi^2 which is about 14 percent of the entire basin. The total population for the Apalachicola and Chattahoochee River basins in Alabama for 1990 was 0.190 million, which is about 7 percent of the total population for the entire ACF River basin. Water withdrawals in the Apalachicola and Chattahoochee River basins in Alabama in 1990 totaled 183 Mgal/d which was about 9 percent of the ACF River basin total water use. An estimated 21 percent (38 Mgal/d) of the water withdrawn in this part of the basin in 1990 was consumed. Surface water accounted for 87 percent (159 Mgal/d) and ground water accounted for 13 percent (24 Mgal/d) of the water withdrawn in the Apalachicola and Chattahoochee River basins in Alabama. Total water withdrawn in the Apalachicola and Chattahoochee River basins in Alabama increased by 230 percent from 55 Mgal/d in 1970 to 183 Mgal/d in 1990. Nearly 78 percent of this increase was related to the water demands of the Farley Nuclear Power Plant which began operation in the late 1970's. Discounting withdrawals by the Farley Nuclear Power Plant, surface-water withdrawals increased 23 percent, and ground-water withdrawals increased 244 percent in this part of the basin between 1970 and 1990.

The Apalachicola and Chattahoochee River basins in Florida encompasses nearly 2,500 mi^2, which is about 13 percent of the basin total drainage area. The total population of the Apalachicola and Chattahoochee River basins in Florida for 1990 was 0.070 million which is about 3 percent of the total population for the entire ACF River basin. Water withdrawals for offstream uses in the Apalachicola and Chattahoochee River basins in Florida in 1990 totaled 188 Mgal/d, which was about 9 percent of the ACF River basin total offstream water-use. An estimated 33 percent (61 Mgal/d) of the water withdrawn for use was either consumed (28 Mgal/d) or exported to the Choctawhatchee-Escambia River basin (33 Mgal/d). Surface water accounted for nearly 80 percent (149 Mgal/d), and ground water 20 percent (39 Mgal/d) of the water withdrawn in the Apalachicola and Chattahoochee River basins in Florida. Water withdrawals for offstream uses in the Apalachicola and Chattahoochee River basins in Florida increased 19 percent from 157 Mgal/d in 1970 to 188 Mgal/d in 1990. During this period, ground-water withdrawals in this part of the basin increased and surface-water withdrawals decreased.

The Chattahoochee and Flint River basins in Georgia encompasses approximately 14,500 mi^2 and represent 73 percent of the basin. The total population of the Chattahoochee and Flint River basins in Georgia was 2.376 million in 1990 which is about 90 percent of the entire population of the ACF River basin. Water withdrawals for offstream uses in the Chattahoochee and Flint River basins in Georgia in 1990 totaled 1,727 Mgal/d which was about 82 percent of the ACF River basin total water use. An estimated 17 percent (297 Mgal/d) of the water withdrawn for use was consumed during 1990. Surface water supplied 86 percent (1,487 Mgal/d) and ground water 14 percent (240 Mgal/d) of the water withdrawn in the Chattahoochee and Flint River basins in Georgia. In addition to the offstream water uses described above, 13 operating hydroelectric plants in the Chattahoochee and Flint River basins in Georgia used 31,492 Mgal/d of water to produce nearly 2,222 GWh of electricity. Total water withdrawals for offstream uses in the

Chattahoochee and Flint River basins in Georgia increased nearly 38 percent from 1,262 Mgal/d in 1970 to 1,727 Mgal/d in 1990. Surface-water withdrawals for public supply increased nearly 350 percent (321 Mgal/d) and ground-water withdrawals for agriculture increased 3,070 percent (138 Mgal/d) between 1970 and 1990.

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