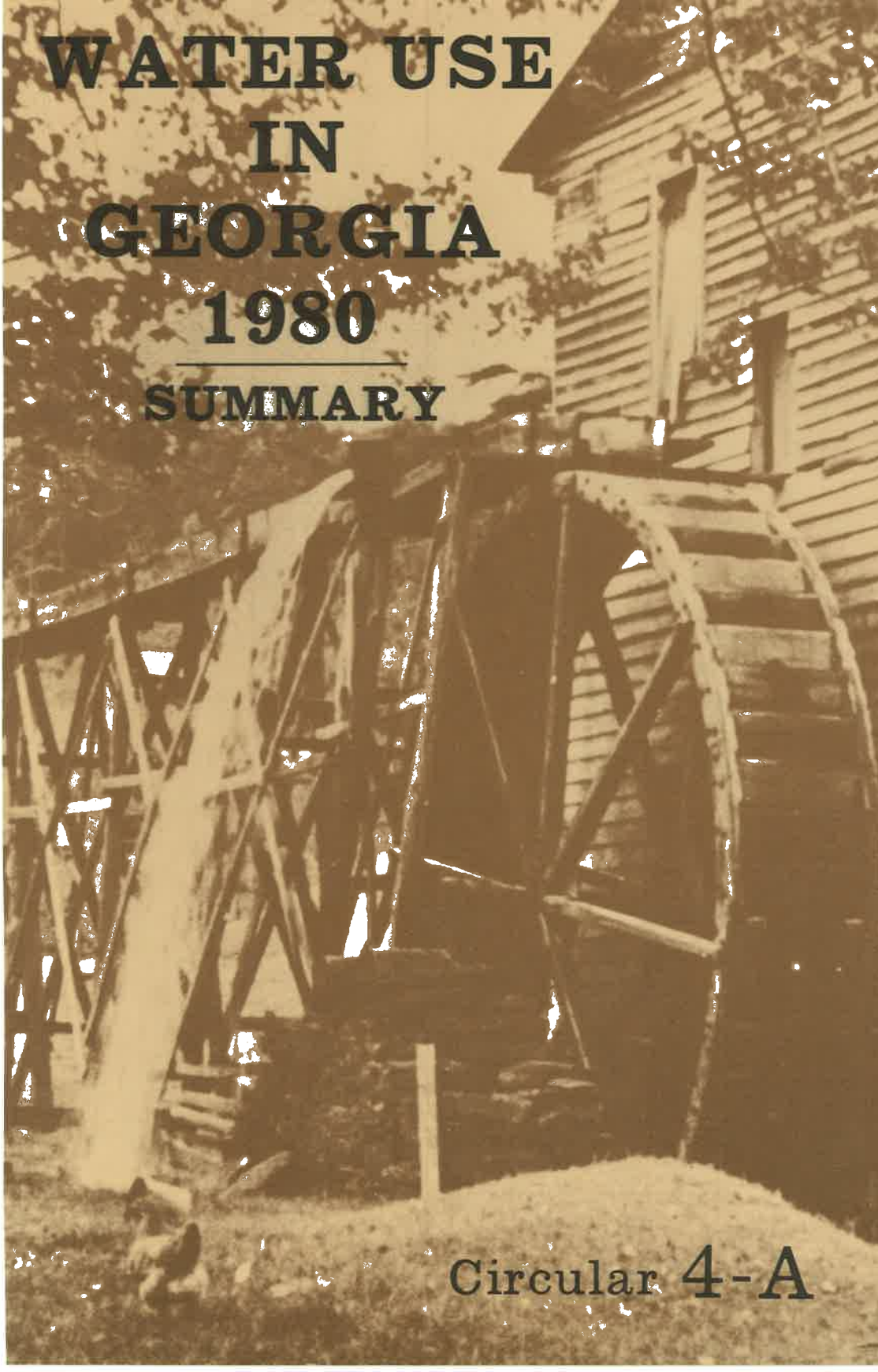
WATER USE IN GEORGIA 1980

SUMMARY



Circular 4-A

Cover: Cox Water Mill, Ellijay, Georgia.

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WATER USE IN GEORGIA

1980

SUMMARY

by

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1982

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INTRODUCTION

Every day in 1980, close to 7 billion gallons of fresh water were withdrawn from Georgia's rivers, streams, and ground-water aquifers. This was about 1,300 gallons of water for every man, woman, and child in the State, or some 5.2 tons of water per person. In the last 10 years, water use in Georgia increased some 28 percent.

For many years, the prevailing school of thought held that much of the southeastern United States possessed a boundless supply of water. The belief was that no water shortages would ever occur in Georgia. Increasing demands on the State's water resources because of population and industrial growth, lack of conservation, and periodic droughts have forced the realization that, while large quantities of water do exist, careful and proper management will be necessary to preserve this valuable resource.

These accelerated demands for water are creating competition among potential users in areas where the available water supply is not adequate to meet the anticipated demands. As the demand for fresh water continues to climb, not only in the quantity of water used but also in the variety of ways that water is being used, the potential for water shortages increases, no matter how plentiful water now seems. The collection of water-use data in Georgia can minimize the potential for future conflict, as these data give hydrologists information useful in predicting those areas of the State where such competition for water could be expected to occur.

Although much data existed on the occurrence and distribution of the State's water resources prior to this study, there were virtually no quantitative data readily available on how water was being used in the State. A program was needed to provide such data, and generally determine how much water is being withdrawn for public supply, general rural use, irrigation, self-supplied industry, and thermoelectric power generation in the State.

BACKGROUND OF STUDY

Since 1950, the U.S. Geological Survey has been preparing national estimates of water use for all categories of water users every five years. In 1970, the U.S. Geological Survey performed an inventory of water use in Georgia, the results of which were published in 1974 as the Georgia Geologic Survey's Hydrologic Report No. 2. The information in that report was extrapolated from data gained from

questionnaires that were sent to a selected sample of municipalities and industries, and from the files of several state and federal agencies. All other categories were estimated except power generation, which was done by questionnaires sent to each utility company. In 1975, these figures were updated for the national water-use report published by the U.S. Geological Survey.

In 1978, the Water-Use Data Collection Program was begun to make a study of water use. The project was a joint venture of the Georgia Geologic Survey and the U.S. Geological Survey, and was structured to be compatible with the U.S. Geological Survey's National Water-Use Data System. The primary objective of the Georgia project was to develop a computerized file of information on how water is used in the State.[1] Each entry in the file was coded by county, river basin, user type, and water source. The information generated by the Water-Use Data Collection Project has been presented in several formats:

(1) a preliminary water-use report (Circular 4), which discusses estimated water use for several categories of users in the State;

(2) a water-use report giving data for water use by county (Information Circular 59);

(3) a summary report of actual water use totals for 1980 (this report - Circular 4A, which supercedes Circular 4); and

(4) a computerized data base which can generate water-use information on request by any of the coded categories. For example, a print-out could be produced showing all municipal water-supply withdrawals in a given river basin.

In addition, two reports are being produced by the U.S. Geological Survey - one on irrigation, and one covering all water users.

The Water-Use Project gathered data from a variety of governmental and private sources. A listing of these sources is shown in Table 1.

[1] The project did not address instream uses of water such as navigation and recreation.

Table 1. Sources of Water-Use Data

USE	INFORMATION SOURCE
Public Supply	Environmental Protection Division Water Protection Branch Ground Water Program Surface Water Program Water Resource Management Branch
Industrial, Self-supplied	Environmental Protection Division Water Protection Branch Ground Water Program Surface Water Program Industrial Waste Program Municipal Compliance & Technical Support Program Water Resource Management Branch
	Department of Industry & Trade Georgia Manufacturing Directory
Rural Livestock	U.S. Department of Commerce U.S. Census of Agriculture
	University of Georgia Cooperative Extension Service
	Georgia Department of Agriculture Georgia Crop Reporting Service
Domestic	U.S. Department of Commerce U.S. Census of Population, 1980
Irrigation	U.S. Department of Agriculture Soil Conservation Service[1]
	University of Georgia Cooperative Extension Service
	U.S. Geological Survey Water Resources Division
Power Generation	Individual utility companies
	Georgia Public Service Commission

[1] Under contract to the U.S. Geological Survey, the Soil Conservation Service performed an irrigation survey of 62 counties in Georgia's Coastal Plain, the High Irrigation Water-Use Zone (fig. 2). This was a field inventory involving the plotting of irrigated fields and water sources on quadrangle maps and the completion of forms for information on irrigation equipment, water sources, and the amount of water applied in 1979.

HYDROLOGIC CYCLE IN GEORGIA

Nature, through several pathways, is able to replenish its supply of water. These pathways, generally referred to as the hydrologic cycle (fig. 1), involve the cyclic movement of water: precipitation, runoff to streams and lakes, infiltration (recharge) to the ground-water regime, evaporation, and transpiration from vegetation.

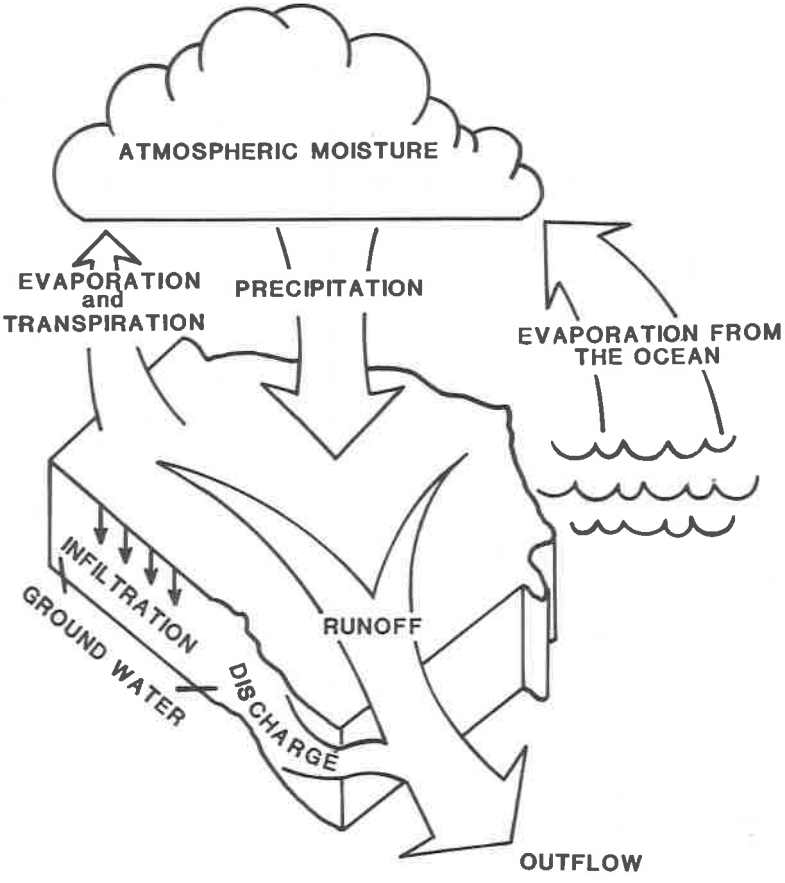


Figure 1. The hydrologic cycle in Georgia.

In Georgia, the quantity of water in the various segments of the hydrologic cycle varies significantly among the State's major physiographic provinces (fig. 2). In the Ridge and Valley province, the underlying rocks are of varying permeability so that some precipitation infiltrates while other precipitation runs off, providing a well-developed surface drainage system as well as ground-water aquifers of somewhat limited capacity. Thus, in this province water can be obtained from both surface-water and ground-water sources. In the Piedmont and Blue Ridge provinces, the underlying rocks have low permeability and can store and transmit very little water. In these two provinces, surface waters are the primary supply and ground water is limited. In the Coastal Plain, on the other hand, much of the precipitation infiltrates into the permeable sediments which lie beneath the soil, providing large reservoirs of water trapped in the pore spaces of the rocks. In this province, ground-water aquifers are the principal sources of water.

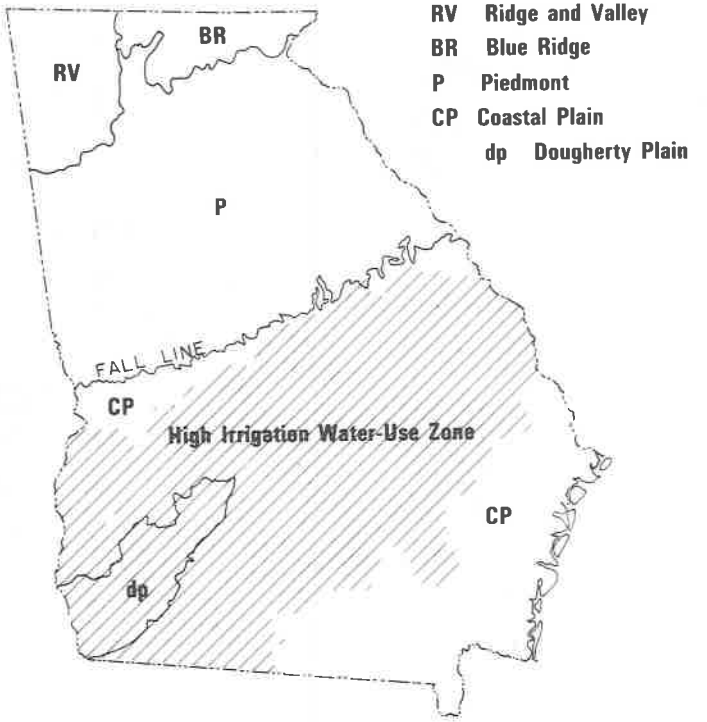


Figure 2. Physiographic provinces and the High Irrigation Water-Use Zone.

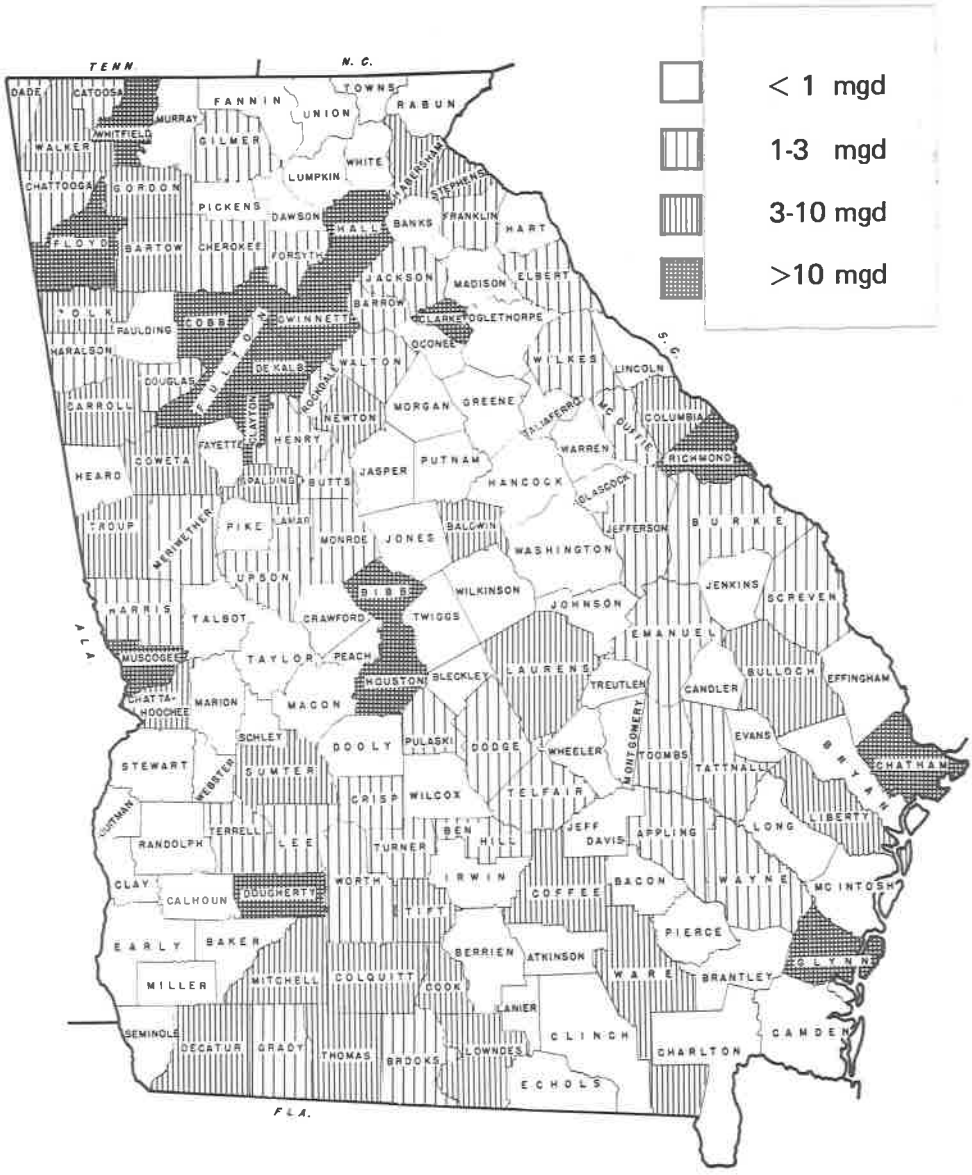


Figure 3. Public supply water use by county.

WATER USE IN THE STATE

Public supply water use for each county in the State is shown in figure 3. The map shows the concentration in the Atlanta metropolitan area of counties using more than 10 million gallons per day (mgd) of water, as well as other isolated counties in this class which contain the State's larger cities. Water use for public supply in Georgia has grown at a steady rate over the past thirty years concurrent with the growth in population, to reach 773 mgd in 1980 (fig. 4 and flow diagram).

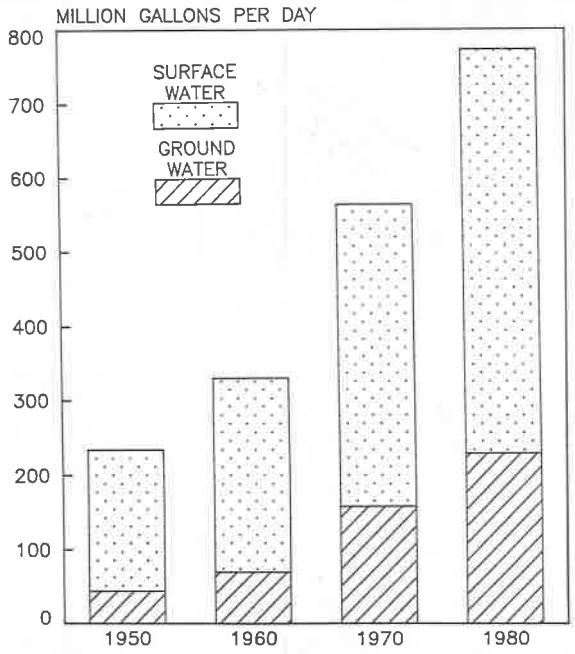
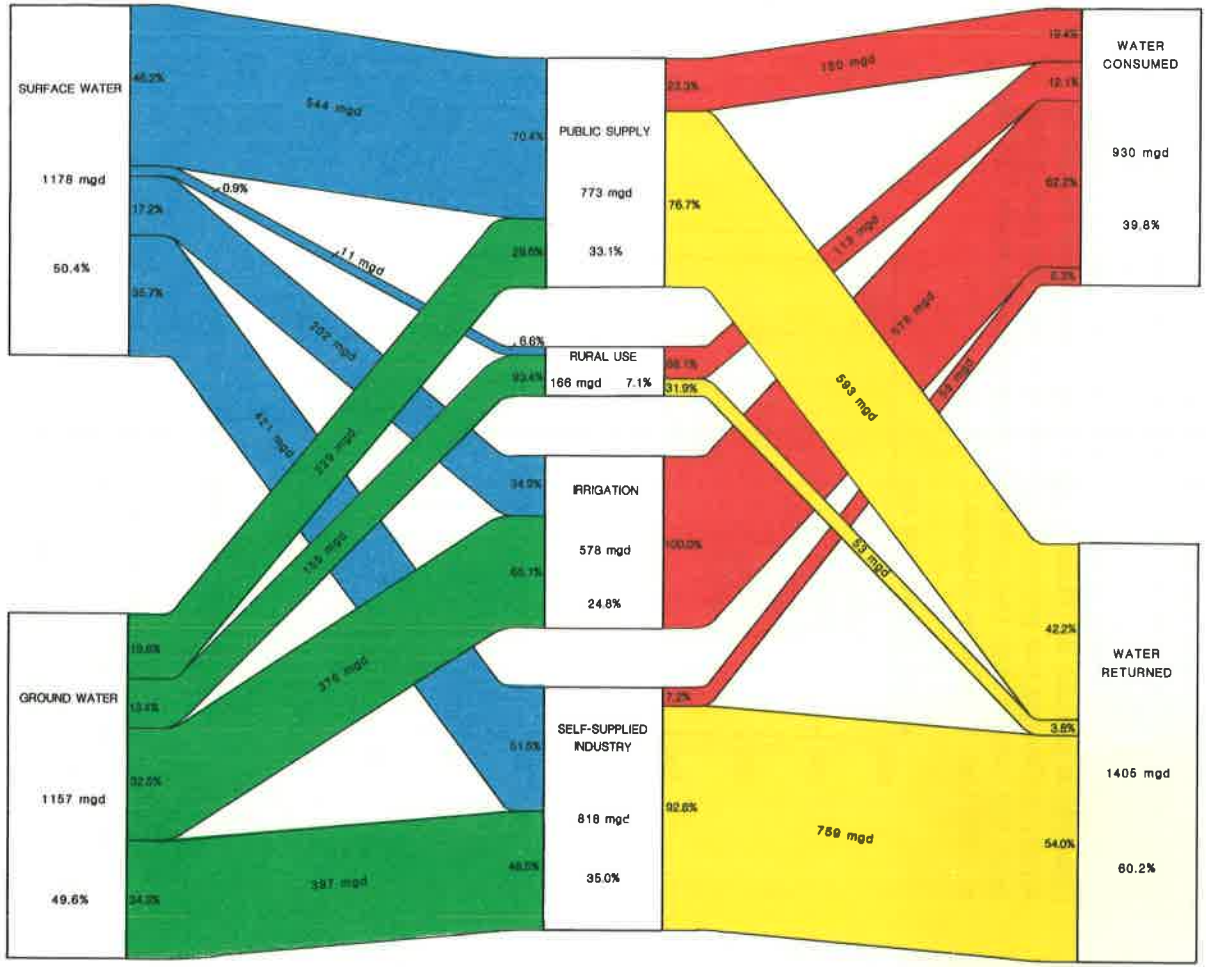


Figure 4. Water used for public supply.

A map of self-supplied industrial water use by county (fig. 5) shows the large withdrawals in the kaolin mining operations near the Fall Line (see fig. 2 for location of Fall Line), the concentration of large water-using industries on the coast, and other counties with large industries that supply their own water. The concentration of textile-related industries in northwest Georgia is not apparent, as these plants are generally served by a city water system. The Coastal Plain shows a relatively large amount of self-supplied industrial use (even though it contains less development) due to the readily accessible ground-water supplies.


SURFACE WATER
1178 mgd
50.4%
GROUND WATER
1157 mgd
49.6%
PUBLIC SUPPLY
773 mgd
33.1%
RURAL USE
166 mgd
7.1%
IRRIGATION
578 mgd
24.8%
SELF-SUPPLIED INDUSTRY
818 mgd
35.0%
WATER CONSUMED
930 mgd
39.8%
WATER RETURNED
1405 mgd
60.2%
544 mgd
11 mgd
202 mgd
421 mgd
229 mgd
155 mgd
376 mgd
397 mgd
150 mgd
113 mgd
178 mgd
599 mgd
53 mgd
759 mgd

FLOW DIAGRAM OF WATER USE IN GEORGIA - 1980

This flow diagram summarizes the total water use for several categories of users, the source of this water, and how it is returned to the hydrologic cycle. Almost 40% of water used by these four categories of users is "consumed" - incorporated into a product, evaporated, or otherwise lost. The remainder is returned to a surface water system, usually after some waste treatment process. The diagram shows actual amounts and percentages, and can be read in any direction. For example, self-supplied industries used 818 mgd in 1980, which was 35.0% of all water used (except for thermo-electric power generation). Of this 48.5% was ground water, or some 397 mgd. Alternatively, ground water makes up 49.6% of all withdrawals, or 1157 mgd. Of this, 34.3% or 397 mgd goes to self-supplied industries.

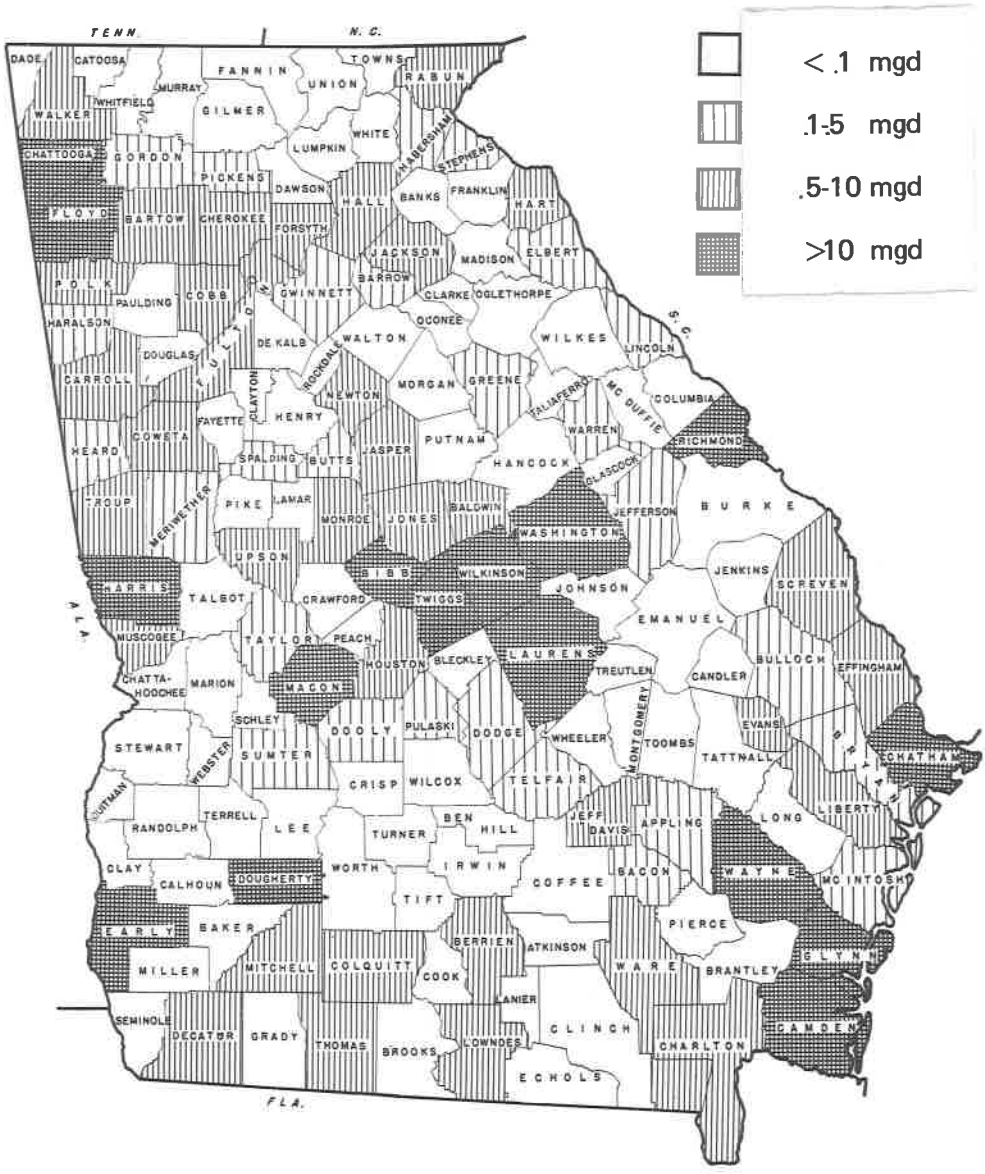


Figure 5. Self-supplied industrial water use by county.

The trend in self-supplied industrial water use shows a decline from 1970 to 1980, after a steady growth from 1950 to 1970 (see fig. 6). This can be attributed to three factors - an increase in water conservation by industries, a change in the method of determining total water use, and reductions in production due to economic recessions. As costs for pumping water and costs of treating wastewater to meet higher water quality standards have increased, the incentive to reuse water (reducing total withdrawals) has also increased. Many industries are very effectively implementing water conservation plans, encouraged by the Environmental Protection Division's (EPD) Water Resource Management Branch. The second reason for an apparent drop in water use lies in the method used to determine the total. In 1970, a mail survey was sent to a selected sample of industries, and the total was then extrapolated based on the returns. The 1980 figure was determined from an inventory of all industries, not just a sample. Self-supplied industrial water use was 818 mgd in 1980 (see flow diagram).

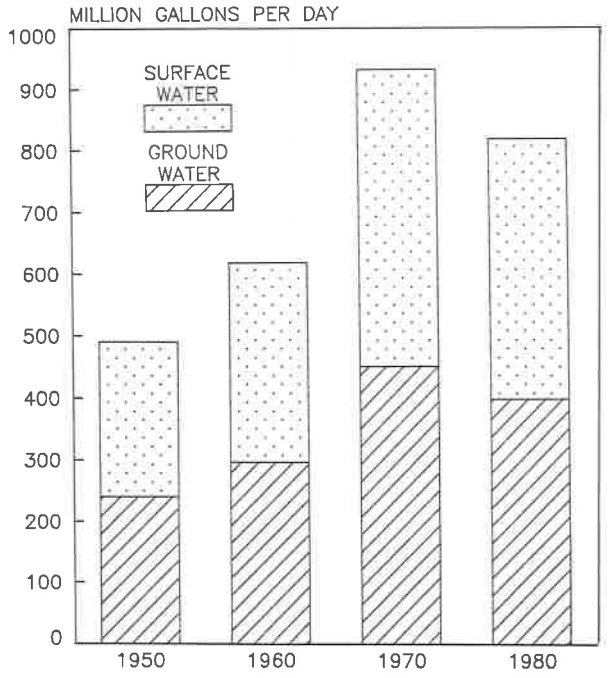


Figure 6. Water used by self-supplied industries.

Irrigation water use in Georgia has grown from almost zero in 1950 to an estimated 578 mgd in 1980 (fig. 7 and flow diagram). This growth is almost totally confined to the Coastal Plain (fig. 8), specifically within an area called the High Irrigation Water Use Zone shown in figure 2. In this area the flat topography and readily available water supplies have encouraged the use of irrigation. This is especially true in southwest Georgia, where many farmers use ground-water, making irrigation ground-water use equal one-third of the State's total ground-water use. Irrigation is the largest consumer of water in the State (see flow diagram), as all water applied to a field either evaporates or is transpired by the plants. This category of water use continues to increase rapidly, as farmers have discovered that the proper use of irrigation can enable them not only to survive drought conditions, but also to produce higher crop yields in "adequate water" years.

The users of the largest quantities of water are the utility companies, which withdrew 4437 mgd of water - four and a half billion gallons per day. This is almost double the amount withdrawn by all other water users combined. Most of the water is drawn from streams, lakes, and reservoirs, and is used for cooling generators. As more than 95% of this water is returned (if not

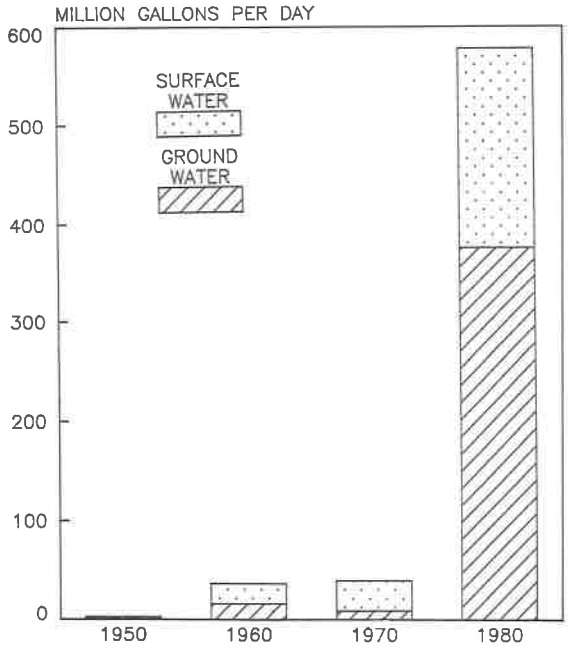


Figure 7. Water used for irrigation.

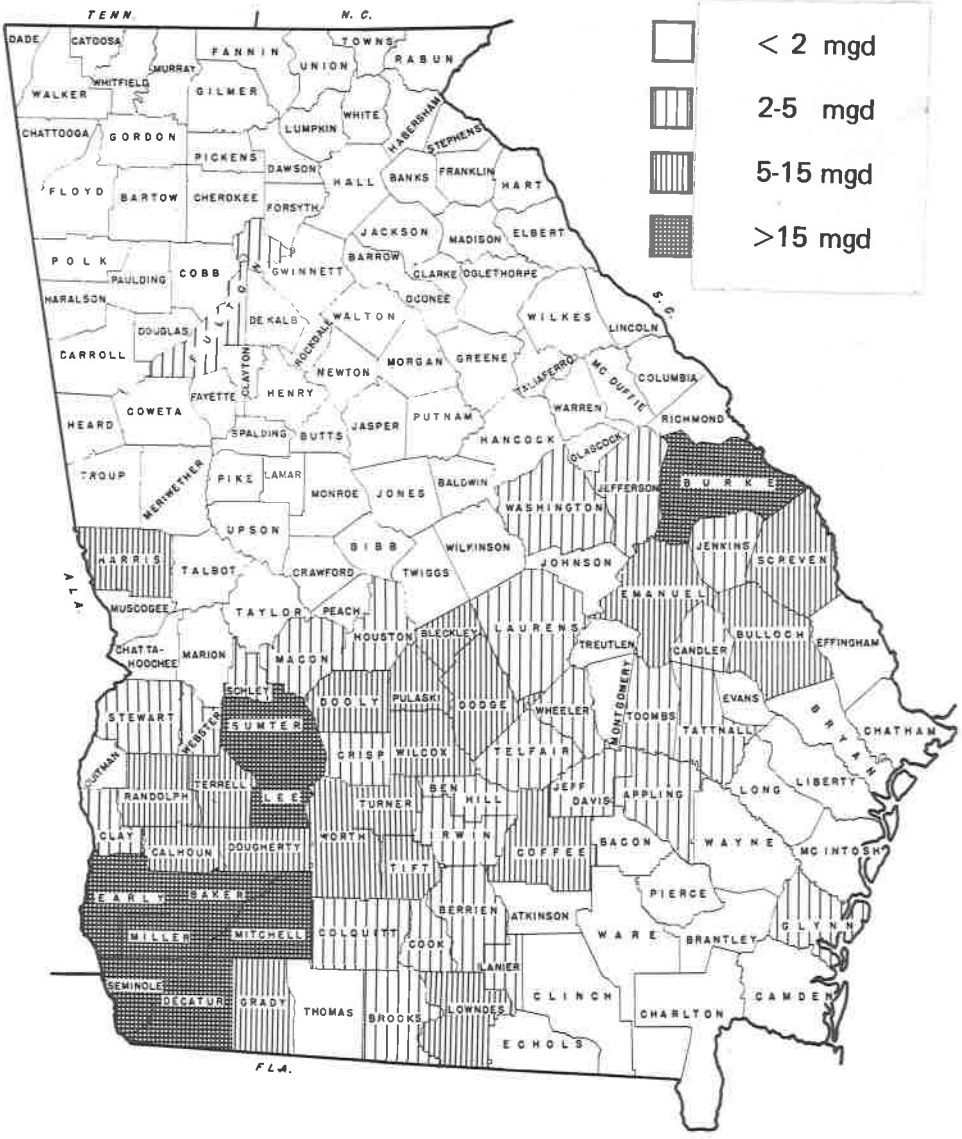


Figure 8. Irrigation water use by county.

always to the same river basin) with little effect on its quality, these large volumes have little impact on the water available to other users. Growth in water use in thermoelectric power plants has slowed in the past decades, as fewer new plants and more efficient cooling systems were added (see fig. 9).

Rural use, estimated at 166 mgd in 1980 (see flow diagram), consists of two major parts: water used for domestic purposes that is supplied by individual homeowners, and the water used by livestock. The amount of water used by livestock was estimated using livestock population estimates by county, as prepared by several state and federal agencies (table 1). Domestic water use was estimated from the county populations not served by a public system, multiplied by a per person water-use figure. Rural water use also has not experienced any significant increase (less than 5 percent) since 1970. Any gain in rural population has been offset by the expansion and addition of municipal systems to cover new areas. The estimates of 166 mgd differs from the 86 mgd published in an earlier version of Circular 4 due to a change in the estimated per person water-use figure from 50 gallons per day to 100 gallons per day.

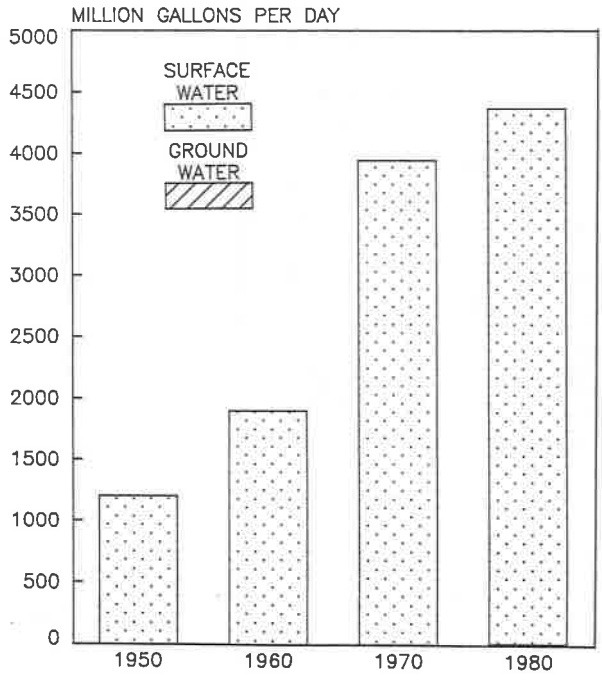


Figure 9. Water used in thermoelectric power generation.

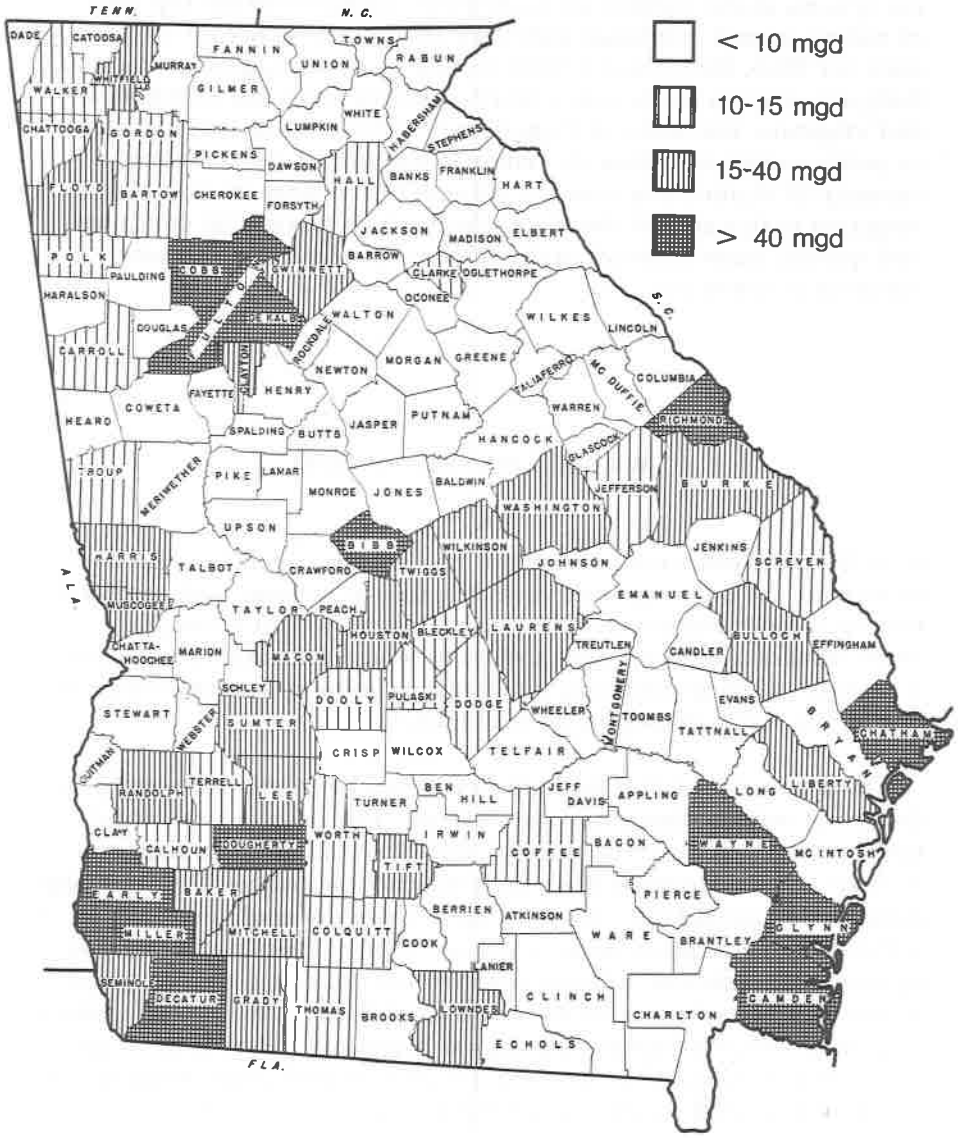


Figure 10. Water use in 1980 by county for all categories of users except power generation

Figure 10 is a map of water use in the State combining public supply, industrial, irrigation, and rural withdrawals for each county. The municipal systems in the Atlanta area put three counties into the top level of water use, and combined industrial and public supply do the same for Bibb, Richmond, Chatham, Glynn, and Dougherty Counties. Early County is a major water user because of industrial withdrawals and irrigation, but Miller and Decatur have little significant industrial or public supply withdrawals. These two counties are in the top category of water-using counties because of the large amount of irrigation in this area of the State. As the use of irrigation continues and spreads, more counties in this area will probably show major amounts of water use.

WATER CONSERVATION

In the past, when more water was needed, the usual response was to increase the quantity withdrawn from lakes, streams, and aquifers. However, more water is not always the best answer to increasing water demands, especially in those cases where little additional water is available. The answer then is better management through conservation of the water already being withdrawn.

The demand for water for home use could be greatly reduced by the use of water-saving plumbing fixtures. The Georgia Legislature has enacted a bill that requires such fixtures in all new buildings and in those being remodeled when the construction involves the plumbing system. Substantial reductions in home water use could also be achieved by developing better water-use habits. Pamphlets published by several government agencies suggest such things as checking home systems for leaks, taking showers instead of baths, running dishwashers only when full, and retrofitting shower heads and toilets that use less water. If the public developed a water-conservation ethic, much water that is now wasted would be available for use.

Georgia's industries are moving toward water conservation, often as a cost-cutting measure. Manufacturers have found that water can frequently be reused, reducing the amount that they must withdraw from a fresh-water source. In addition, some industries have begun treating their own wastewater, purifying it so that it can be reused in some other phase of their manufacturing process.

The use of irrigation has grown rapidly in the last five years, and with this growth has come an increase in wasted water. Irrigation systems designed without proper consideration for topography and soil characteristics can cause extensive erosion as the water runs off. The use of soil tensiometers or other devices to determine how much water has actually penetrated the soil can reduce the chances of over- or under-applying water. Running irrigation systems during the cooler parts of the day and at night will reduce the amount of water lost to evaporation. Irrigation can produce spectacular crop increases at any time and mitigate losses in drought years, but only if the system is designed and the water applied to make the best use of this technique.

CONCLUSIONS

Information already collected indicates that greater and greater demands are being made on Georgia's most important natural resource: clean, fresh water. Increases in population, new industries, and irrigation use are requiring vast quantities of additional water. As water usage grows, the need for detailed water-use information also increases. Continuing improvements, revisions, and updates of the water-use data base will provide necessary information on water-use patterns.

The increased use of water is not uniform throughout the State, but varies widely by geographic location and type of water use. The use of water in the Coastal Plain has grown tremendously in the past decade as the area attracted more industry, with its associated population growth, and as many south Georgia farmers turned to irrigation. This rapid growth is creating competition among various water users, particularly in the Dougherty Plain District in southwest Georgia. As competition increases, better management of Georgia's water supply becomes more important; the Georgia Water-Use Data System contributes part of the basic information to aid this management effort.

Water is commonly thought of as being a renewable resource, but it is, nevertheless, limited and is very susceptible to degradation. Just as energy resources like coal and oil must be used wisely, so must water be carefully utilized to protect the water resources of the State and ensure adequate supplies for the future.

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