WATER-USE DATA COLLECTION PROGRAM IN MISSISSIPPI

J.A. Callahan and Nancy L. Barber
U. S. Geological Survey, Mississippi District

INTRODUCTION

Information on water use is an important part of both technically- and managerially-oriented hydrologic studies. These studies often require current and long-term water-use data to assess the effect that human activities may be having on the water resources of an area. The data need to be accurate and consistent, and many of studies, such as those involving ground-water models, require that the data be site specific.

During 1973, in recognition of the need for accurate, consistent, site-specific information on water use, the U.S. Geological Survey began the Mississippi Water-Use Program in cooperation with the Mississippi State Board of Water Commissioners (now the Mississippi Bureau of Land and Water Resources). During 1978, the U.S. Geological Survey initiated the National Water-Use Program to establish a nationwide water-use data base. The National program has goals similar to the State program: to collect, store, and disseminate consistent and accurate water-use data.

MISSISSIPPI WATER-USE DATA SYSTEM

The Mississippi Water-Use Program collects information on a variety of water uses to meet the data needs of hydrologists and water managers, and the requirements of the national program. Detailed information on water use by cities or industries is stored in a site-specific data base. Estimates of quantities of water used in a county or a river basin for irrigation, aquaculture, or self-supplied domestic purposes are stored in a file of aggregated water-use data.

The data-base system used to store site-specific information is called the Site-Specific Water-Use Data System (SWUDS). This data base is stored on a Prime minicomputer. (The use of this product name is for information purposes only, and does not constitute an endorsement by the U.S. Geological Survey.) The system stores information in five files as illustrated in figure 1. The Water User file contains information on the facility where water is being used: the owner's name, street and mailing addresses, a use category such as Industrial or Water Supply, Standard Industrial Classification codes, and geographic codes such as latitude, longitude, county, and hydrologic unit. Additional information about a facility can be stored in an Extended Data file. The information in this file depends on the water-use category. An industrial facility may have extended data on production amounts, a water supplier may have the data on population served, and a thermoelectric power plant might have information on the amount of power produced. The Measurement Point file contains information on the actual point of withdrawal or discharge, such as a well or surface-water intake. Data elements in the Measurement Point file include the same geocodes as in the Water Use file, a source type (ground water or surface water), and aquifer codes. Monthly and annual water-use amounts are stored in a series of Annual Measurement files, one for each year. The various files are linked by a Conveyance file, that stores information on which sources supply each facility. SWUDS may also contain information on facilities which do not withdraw water, but purchase it from another facility. In such cases the Conveyance file would contain the information that one facility is the source of water for the other facility, and the source type would be "transfer water." The data-base structure can store information on the path of water from a withdrawal point, to a public-supply water-treatment plant, to a purchasing industry where the water is used in production, to a discharge point at a river or stream.

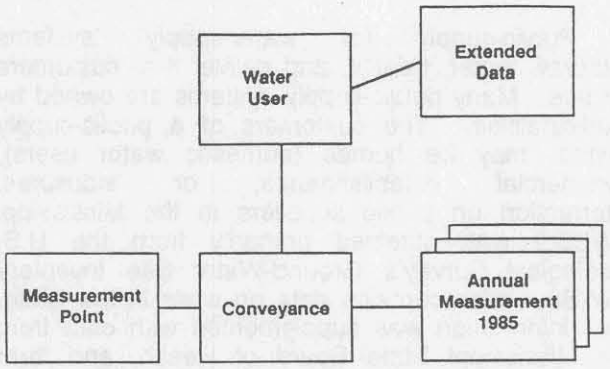

Figure 1. Site-specific Water Use Data System

The Mississippi SWUDS primarily contains information on water withdrawals by public suppliers and industries, with a limited amount of information on water sales. SWUDS also contains information on water use by thermoelectric power plants and some commercial facilities. Monthly water-use data for the larger commercial facilities are stored in SWUDS and are updated annually. Records on smaller facilities may only contain an annual average withdrawal rate.

Other types of water use, such as irrigation or self-supplied domestic, are difficult to track on a site-specific basis. For these types of uses, the total use for a county or a river basin can be estimated and the result stored in the Aggregate Water-Use Data System (AWUDS), which also resides on a

Prime minicomputer. AWUDS contains water-use statistics by county and by hydrologic unit for all categories of use tracked by the National Water-Use Program, including those which are in SWUDS. The site-specific data, when available, also are aggregated to county and river basin totals for entry into AWUDS. These estimates and aggregations are made every 5 years to provide data for the U.S. Geological Survey report on the estimated use of water in the United States, and were last completed for 1985. AWUDS is also valuable for generating tables and graphics on water use in Mississippi. Aggregated water-use data are used to assist water managers in making decisions, analyzing withdrawal trends, and in providing data for large-scale water-resources studies.

WATER USE AND WATER-USE DATA IN MISSISSIPPI

During 1985, an estimated 2,310 Mgal/d (million gallons per day) of freshwater was withdrawn from rivers, streams, and aquifers in Mississippi. Ground-water withdrawals accounted for about 68 percent of the total. Agriculture accounts for the largest quantity of water used, followed by thermoelectric power generation, public supply, and industrial withdrawals (fig. 2b).

Public Supply

Public-supply (or water-supply) systems withdraw water, treat it, and deliver it to customers for use. Many public-supply systems are owned by municipalities. The customers of a public-supply system may be homes (domestic water users), commercial establishments, or industries. Information on public suppliers in the Mississippi SWUDS was obtained primarily from the U.S. Geological Survey's Ground-Water Site Inventory (GWSI), which contains data on wells in the State. This information was supplemented with data from the Mississippi State Board of Health, and from information obtained from personal visits, and telephone and mail contacts with utility owners. Information on each system is updated annually when possible, based on telephone or mail inquiries with utility owners. Annual and monthly withdrawal data for the larger systems are obtained directly from the utility owner. Smaller systems may not meter their withdrawals or sales. For these systems, annual withdrawal quantities usually are estimated based on the number of customers served.

Of the 844 public suppliers included in the Mississippi SWUDS (a total of 2,026 withdrawal sites) only the cities of Jackson, Columbus, and Meridian use a combination of ground and surface water, and all the others use ground water (fig. 2a and 3). During 1985, about 88 percent of the 312 Mgal/d withdrawn for public supply was from ground water, and 12 percent was from surface water. The availability of ground water and the lower cost of treatment as compared with surface water, account for the dominance of ground-water systems in Mississippi. The largest public-supply withdrawals are in the most populous areas of the State: Hinds County (Jackson) and Harrison County (Gulfport and Biloxi) had withdrawals greater than 20 Mgal/d during 1985 (Callahan and Barber, in press). An increasing number of people who live outside of urban areas are served by public suppliers as well: overall, 86 percent of the people in Mississippi are supplied with water by public-supply systems (Solley and others, 1988). Rural water systems provide improved service, maintenance, and assurance of a reliable supply of good quality (acceptable for most domestic purposes) water for homes which previously were supplied by private wells.

Industrial

Producers of pulp, paper, agricultural chemicals and fertilizers, and petroleum refiners are the major water-using industries in Mississippi (Callahan and Barber, in press). Information in the Mississippi SWUDS on those industries that supply their own water was obtained primarily from the GWSI data base, supplemented with information from telephone contacts and from the Mississippi Manufacturer's Directory. Data on annual withdrawal amounts for industrial facilities are obtained by telephone from the plant engineer or owner. For industries with the largest withdrawals, these annual withdrawals are obtained each year; industries with smaller withdrawals are contacted at least every 5 years. The Mississippi SWUDS has information on 195 self-supplied industries, with a total of 415 withdrawal points (fig. 4). These industries withdrew an estimated 227 Mgal/d of freshwater in 1985, about 58 percent from ground water and 42 percent from surface water. An additional 28 Mgal/d was delivered to industries by public-supply systems. About 6 Mgal/d of saline water was withdrawn for industrial use in 1985 (Solley and others, 1988, p. 33).

Thermoelectric Power Generation

Large quantities of water are used in thermoelectric power generation for cooling condensers and reactors. Smaller quantities are needed for boiler water and for sanitary purposes. The Mississippi SWUDS contains data on 13 fossil fuel power plants and 1 nuclear power plant in the State, with a total of 65 withdrawal sites (fig. 5). Information about these plants was obtained directly from utility companies. Monthly withdrawal amounts for these sites are updated annually.

During 1985, about 479 Mgal/d of freshwater and 191 Mgal/d of saline water was withdrawn for thermoelectric power generation in Mississippi.

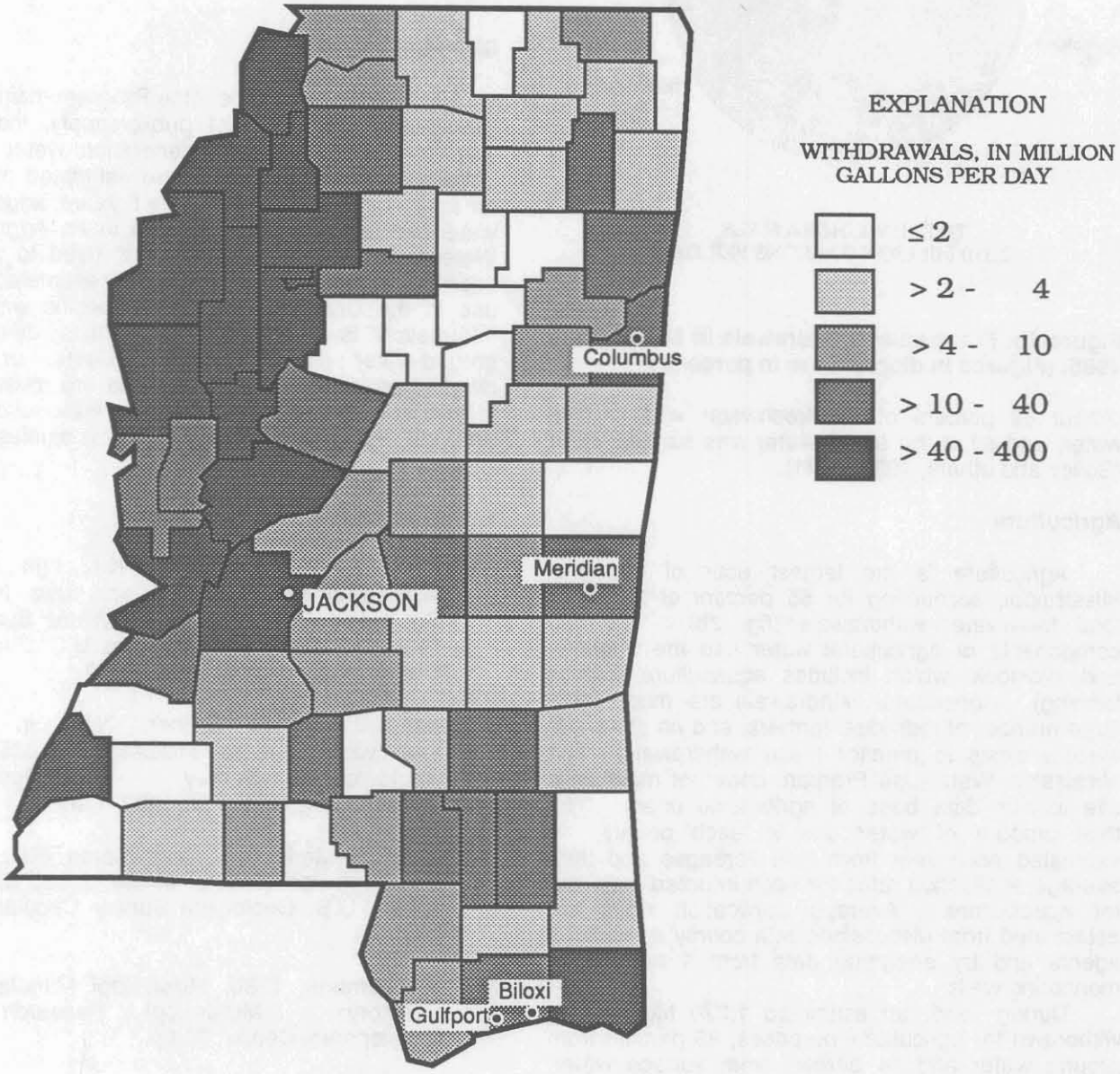

Figure 2a. Total freshwater withdrawals in Mississippi for 1985, by county, for all categories

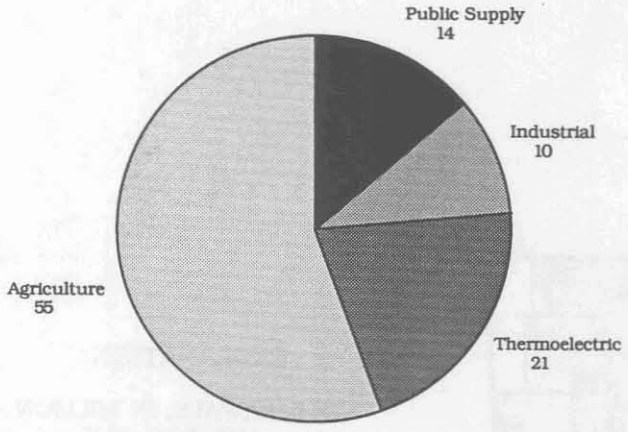

Figure 2b. Freshwater withdrawals in Mississippi, 1985. (Figures in diagram are in percent.)

About 89 percent of the freshwater was surface water, and all of the saline water was surface water (Solley and others, 1988, p. 41).

Agriculture

Agriculture is the largest user of water in Mississippi, accounting for 55 percent of the 1985 total freshwater withdrawals (fig. 2b). The two components of agricultural water use are irrigation and livestock, which includes aquaculture (catfish farming). Agricultural withdrawals are made by a large number of individual farmers, and no statewide system exists to monitor these withdrawals. The Mississippi Water-Use Program does not maintain a site-specific data base of agricultural users. The total amount of water use in each county is estimated each year from field acreages and from average application rates for each irrigated crop and for aquaculture. Average application rates are determined from discussions with county agricultural agents and by analyzing data from a network of monitoring wells.

During 1985, an estimated 1,270 Mgal/d was withdrawn for agricultural purposes, 86 percent from ground water and 14 percent from surface water. These withdrawals are concentrated in the Delta (northwestern Mississippi). About 800 Mgal/d of the total was used to irrigate rice, and about 343 Mgal/d was used for aquaculture (Callahan and Barber, in press).

OTHER PROGRAM ACTIVITIES

The Water-Use Program maintains a network of time-totalizers on wells used for public supply, rice irrigation, and aquaculture. The network consists of 19 public-supply wells and 4 industrial wells on the gulf coast, and 20 aquaculture wells in the Delta. The time-totalizers record the hours each well is pumped. The hours pumped multiplied by the well yield gives the total quantity of water withdrawn from that well. The data from the aquaculture wells are used to estimate the average application rates for these uses.

SUMMARY

The Mississippi Water-Use Program maintains a site-specific data base of public-supply, industrial, and thermoelectric power generation water users. Total withdrawals by county are estimated annually for agricultural water use. Every 5 years, aggregated water-use statistics are compiled in an Aggregated Water-Use Data System, which is used to provide information for a national report on estimated water use in the United States. Site-specific water-use information is of value to scientists developing ground-water models, basin budgets, or other detailed projects. Aggregated data are most useful for water-management decisions, water-use trend analysis, and for large-scale hydrologic studies.

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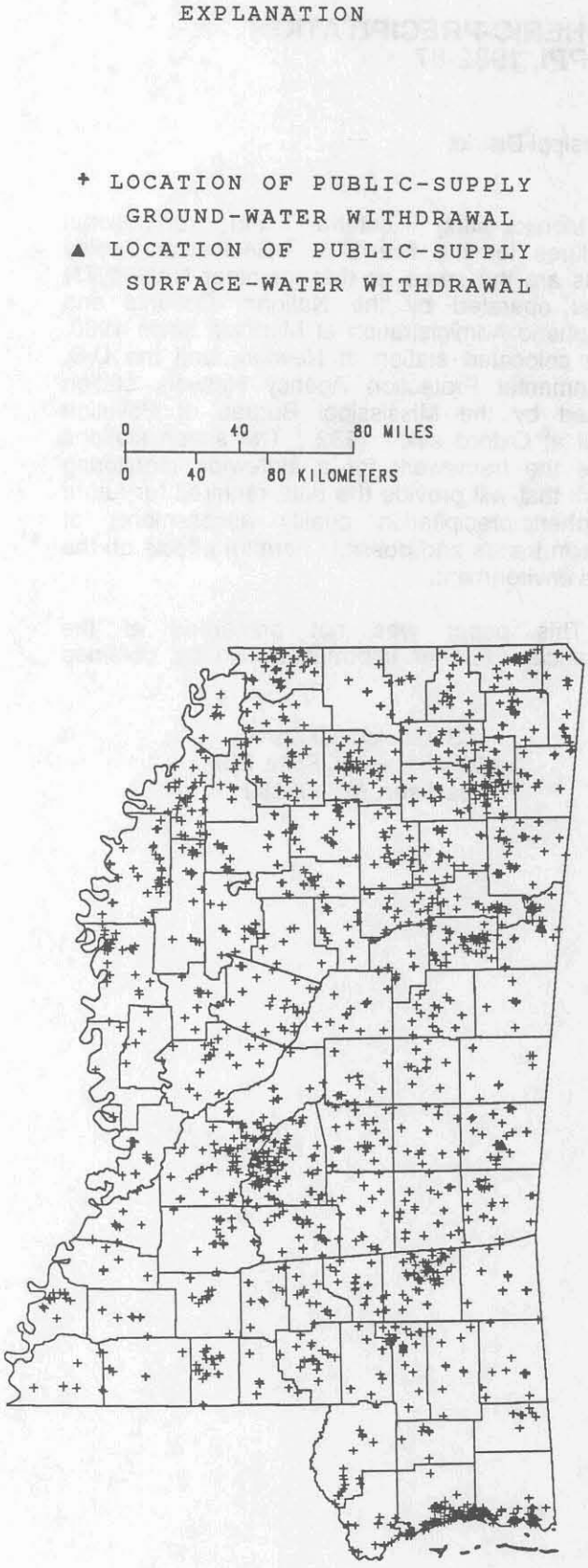

Fig. 3. Locations of public-supply withdrawals in Mississippi

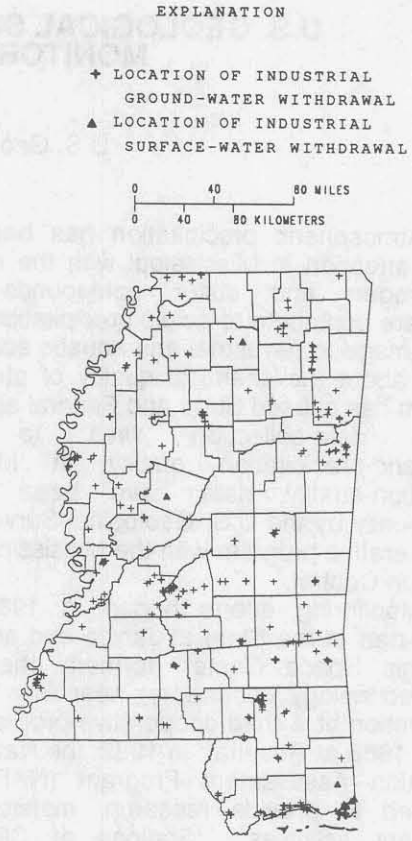

Fig. 4. Locations of industrial withdrawals in Mississippi

Fig. 5. Locations of thermoelectric withdrawals in Mississippi