

**WATER RESOURCES ACTIVITIES  
IN ALABAMA, 1990-91**

**By Hillary H. Jeffcoat, Elizabeth A. Meadows, and A. Jean Roberts**

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**U.S. GEOLOGICAL SURVEY  
Open-File Report 91-0474**

**Tuscaloosa, Alabama  
1991**

**U.S. DEPARTMENT OF THE INTERIOR  
MANUEL LUJAN, JR., Secretary  
U.S. GEOLOGICAL SURVEY  
Dallas L. Peck, Director**

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**Copies of this report can be  
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**U.S. Geological Survey  
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## FOREWORD

The U.S. Geological Survey was created by Act of Congress in 1879, as a bureau of the Department of the Interior, to classify public lands and to examine the geologic structure, mineral resources, and products of the national domain. Since then, the Survey's responsibilities have expanded to include topographic mapping, geochemical and geophysical studies, and the assessment of the quantity, quality, and distribution of water resources. Thus, during the past 100 years, the Survey has become the Nation's principal factfinding and research agency concerned with our natural resources. The mission of the Water Resources Division of the Survey is to provide hydrologic information needed for the development, management, and use of the Nation's water resources.

Although stream gaging began in 1884 as part of a study to identify irrigable land, the water-resources program of the Survey began in 1894 when a small appropriation was obtained for the specific purpose of "gauging streams and determining the water supply of the United States." In the years following 1884, the need for water-resources information grew rapidly, but the ability of the Survey to meet the demand was hampered by restricted budgets. Many States initiated water resource programs to fill the deficiency and the Survey worked closely with the various State agencies. However, these efforts did not satisfy the need of the States and the Nation for a comprehensive water resources information program. Accordingly, in 1928 Congress established the cooperative matching program by which the Survey's water resources programs with State agencies could be funded on a 50/50 basis. This cooperative water resources program has grown over the years into the primary source of water information for the Nation. In cooperation with State and local governments and other Federal agencies, the Water Resources Division --

- o Collects data on a systematic basis to determine the quantity, quality, and use of surface water, ground water, and precipitation.**
- o Conducts interpretive water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.**
- o Conducts basic and problem-oriented research in hydraulics, hydrology, hydrogeology, and related fields.**
- o Develops information on water-related natural hazards such as floods, landslides, volcanoes, mudflows, and land subsidence.**
- o Coordinates the activities of all Federal agencies in the acquisition of water data.**
- o Disseminates data and findings through reports, maps, and other forms of public release.**
- o Provides scientific and technical assistance in the hydrologic fields to other Federal agencies, to State and local agencies, and, on behalf of the U.S. Department of State, to international agencies.**

**Water Resources, National Mapping, and Geologic Divisions are the three operating divisions of the Survey. General information pertaining to these divisions may be obtained from the Information Office, U.S. Geological Survey, 119 National Center, Reston, VA 22092. Circular 777, "A Guide to Obtaining Information from the U.S. Geological Survey," can be obtained free from the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.**

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## INTRODUCTION

The Geological Survey conducts statewide water-resources programs in Alabama in cooperation with State, local, and Federal agencies. These investigations include hydrologic data collection, applied research, and other interpretive studies. These programs are funded through cooperative agreements with the Alabama Department of Economic and Community Affairs, Alabama Environmental Management, and Alabama Highway Department, as well as more than a dozen city, county, and other local governmental agencies. The Survey conducts special studies and data collection programs for the U.S. Army Corps of Engineers, the Tennessee Valley Authority, Alabama Power Company, and the U.S. Soil Conservation Service. A list of all Survey cooperators in Alabama can be found on page 5 of this report.

Water resources programs conducted in Alabama by the U.S. Geological Survey fall into two principal categories: hydrologic records and hydrologic investigations. The hydrologic records activities include the systematic collection and processing of data from streamflow, ground-water, and water-quality stations. Data for these stations are stored in local computer files and in the National WATSTORE computer files of the Survey located at Reston, Virginia, and are available on request. The data are also published as part of an annual report entitled, "Water Resources Data, Alabama," and other formal publications of the Survey.

The water resources investigations in Alabama range from basic descriptive water availability studies for areas of low-intensity water development to sophisticated cause-and-effect studies in areas of high-intensity water development. Extreme hydrologic events, such as the recent drought during 1986-88, reveal that supplies are not unlimited. USGS water-supply projects are designed to provide information about the occurrence, availability, and quality of surface and ground waters for public and industrial uses.

Storm runoff can change the concentration or magnitude of water-quality constituents or properties from those that are typically observed during normal stream flow. Regulations promulgated by the U.S. Environmental Protection Agency (USEPA) require that Birmingham, Montgomery, Huntsville, and Mobile define the quality of urban storm runoff. Investigations to assist Birmingham and Montgomery in collecting the required data began in 1990 and 1991, respectively.

Other sensitive hydrologically oriented issues addressed in ongoing investigations in Alabama and the cooperating agencies are:

- o Bridge Scour (Alabama Highway Department)
- o Water Supply (cities of Mobile, Birmingham, and Tuscaloosa)
- o Low-Flow Analysis (Alabama Department of Environmental Management and Tennessee Valley Authority)
- o Hydrologic Impacts of Aquaculture (Alabama Department of Economic and Community Affairs and U.S. Soil Conservation Service)
- o Urban Storm-Water Runoff Quality (cities of Birmingham and Montgomery).



## **SOURCES OF FUNDS**

**Funds to support the water-resources activities performed by the U.S. Geological Survey in Alabama are derived from three principal sources.**

- o Federal Program - Funds for the Federal Program are appropriated by Congress and are specifically identified in the annual Geological Survey budget. These funds are used to support research, data collection, high priority topical programs, the coordination of all Federal programs related to collection of water data, and internal support services.**
- o Federal-State Cooperative Program - Federal funds are appropriated by Congress and used to match those furnished by State and other tax-supported agencies on a 50/50 basis. These funds are used for a variety of hydrologic data collection activities and water-resources investigations in which the Geological Survey represents national responsibilities and the cooperating agencies represent State and local interests.**
- o Other Federal Agencies (OFA) Program - In this program, the funds are transferred to the Geological Survey as reimbursement for work performed at the request of another Federal agency.**

**Additional sources of funds include unmatched reimbursable funds from State and local government agencies and Federal Energy Regulatory Commission licenses.**

**The proportion of funding for major programs conducted by the Alabama District in fiscal year 1990 (October 1, 1989 through September 30, 1990) is shown in figure 1.**

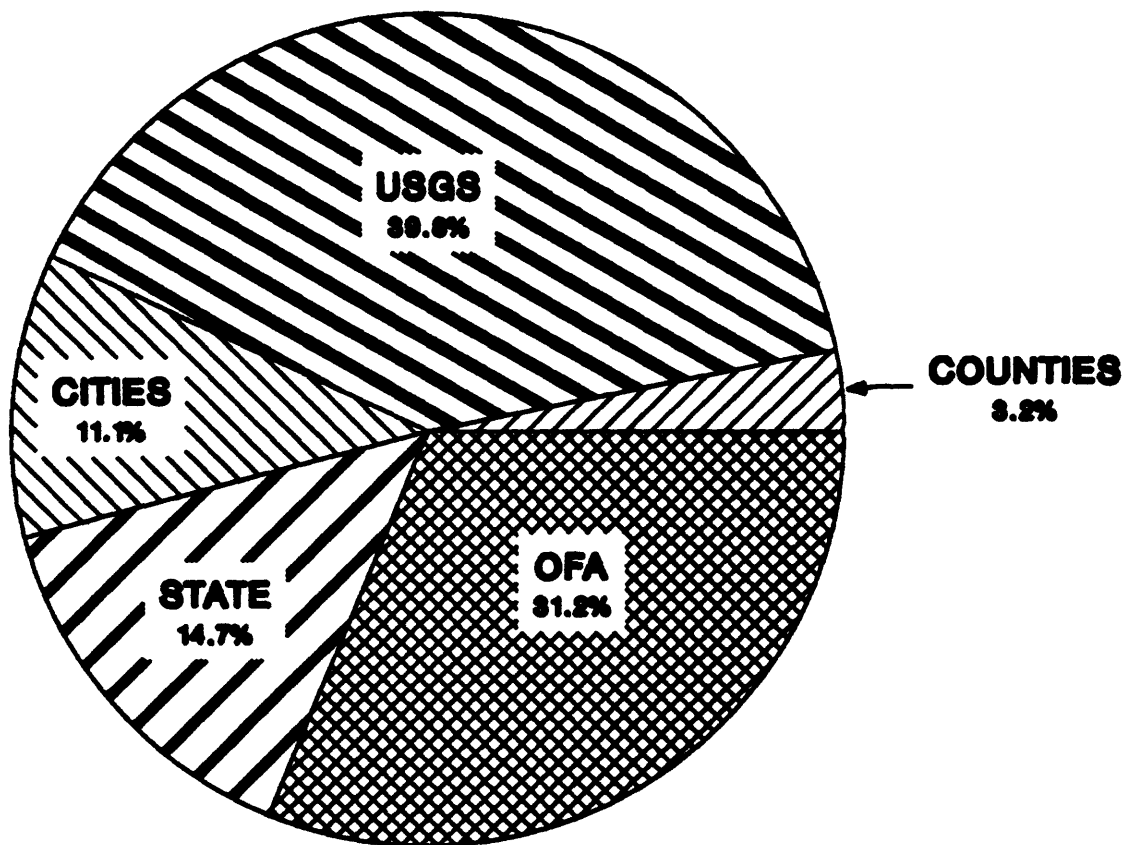


Figure 1. Distribution of funding for major programs conducted by the Alabama District in fiscal year 1990.

## **COOPERATING AGENCIES**

In 1990, the Geological Survey conducted programs in cooperation with 4 State agencies, 15 local agencies, and 4 Federal agencies. All Survey cooperators in Alabama are listed below.

### **State Agencies**

Alabama Department of Economic and Community Affairs  
Alabama Department of Environmental Management  
Alabama Department of Highways  
Geological Survey of Alabama

### **Local Agencies**

Birmingham Water Works Board	Butler County Water Authority
City of Anniston	City of Birmingham
City of Huntsville	City of Mobile
City of Sylacauga	City of Tuscaloosa
Coffee County Commission	
Cumberland Mountain Water and Fire Protection Authority	
Dauphin Island Water Authority	
Greenville Water Works and Sewer Board	
Jefferson County Commission	
Montgomery Waterworks and Sanitary Sewer Board	
Sumter County	
University of Alabama, Tuscaloosa	

### **Federal Agencies**

Alabama Power Company (Federal Energy Regulatory Commission)  
Tennessee Valley Authority  
U.S. Army Corps of Engineers  
U.S. Soil Conservation Service

## DISTRICT ORGANIZATION

The Alabama District consists of a district office in Tuscaloosa, a subdistrict office in Montgomery, and a field office in Cullman. An administrative services unit provides support to all the operating units. Hydrologic studies are conducted from the district and subdistrict offices. The hydrologic surveillance functions are coordinated from the subdistrict office and carried out in all three offices. The Alabama District is assisted and advised by Geological Survey research centers, laboratories, technical consultants, and training centers maintained throughout the United States.

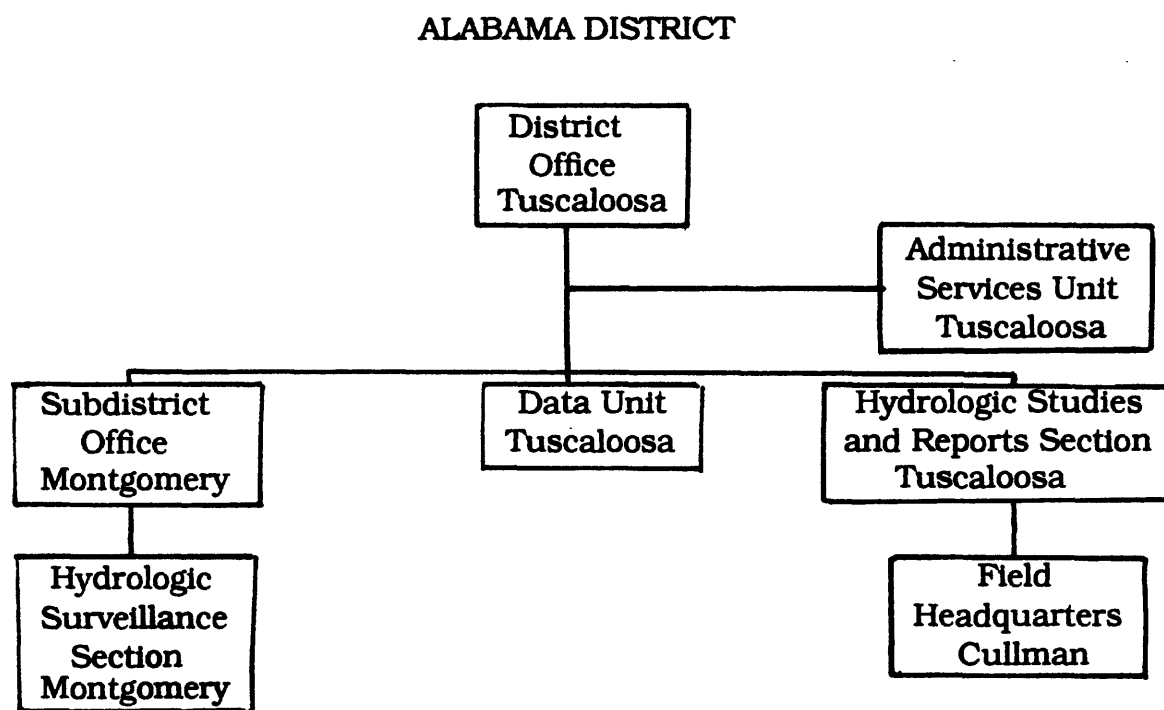


Figure 2. Organizational chart for the Alabama District.

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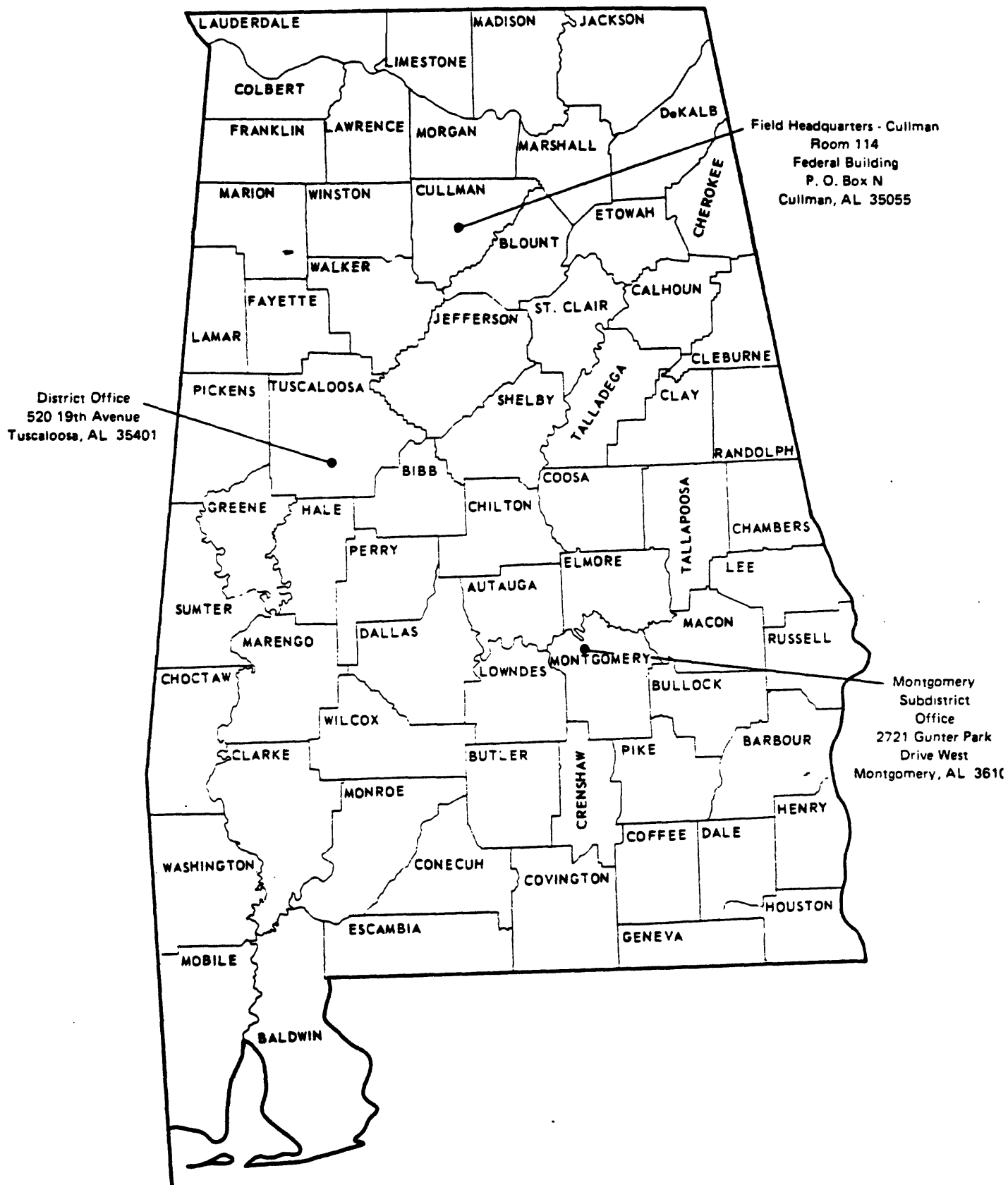


Figure 3.--U.S. Geological Survey offices in Alabama.

**SURFACE WATER STATIONS**  
**Project Number AL 001**

**PERIOD OF PROJECT:**

Continuous since 1899

**PROJECT LEADER:**

James L. Pearman

**COOPERATORS:**

Alabama Department of Economic and Community Affairs

Alabama Department of Environmental Management

Alabama Power Company

City of Anniston

City of Birmingham

City of Huntsville

City of Tuscaloosa

Coffee County Commission

Fayette County

Federal Program

Jefferson County Commission

Sumter County Commission

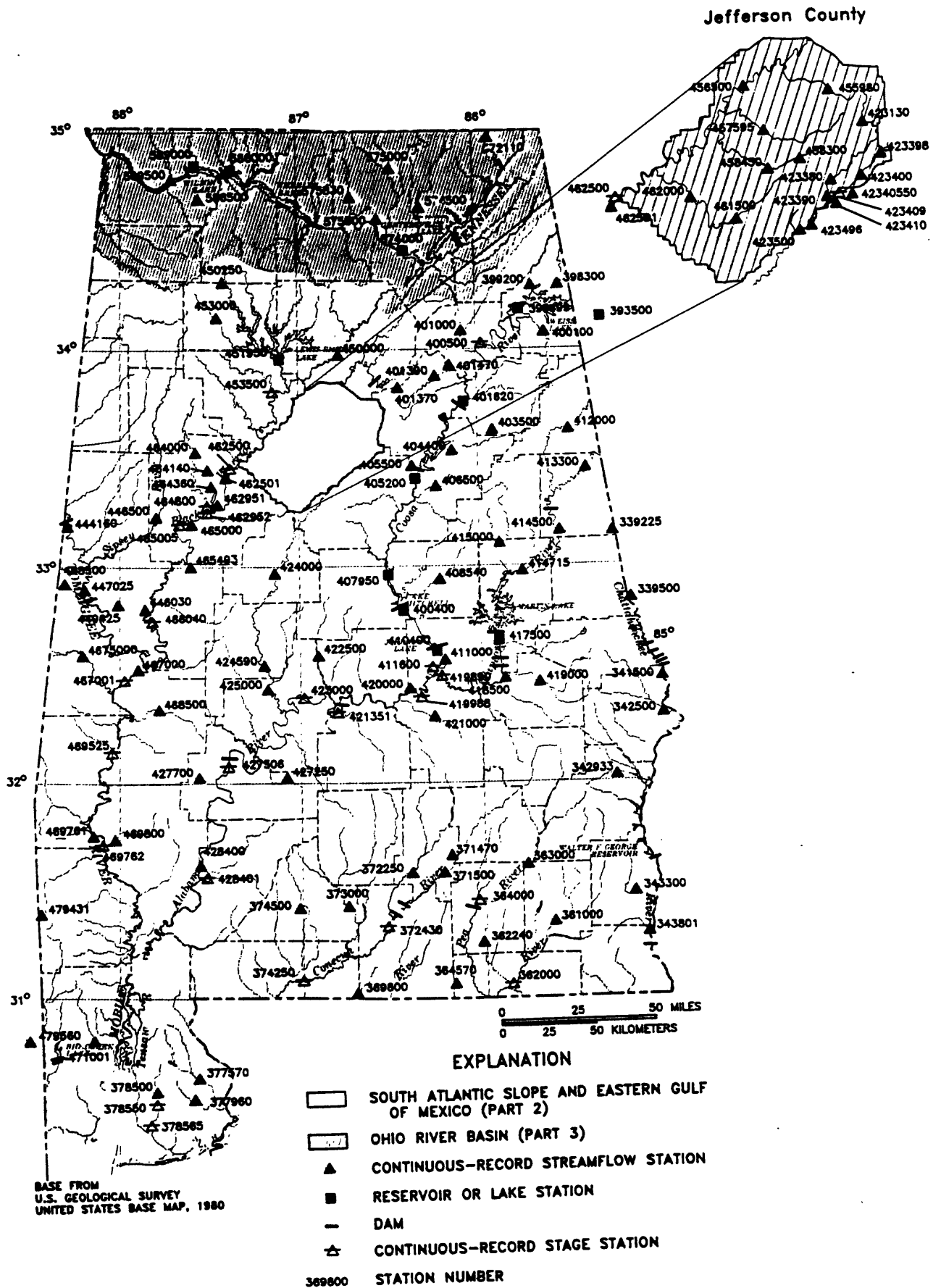
Tennessee Valley Authority

U.S. Army Corps of Engineers

**PURPOSE:** A. To collect surface-water data sufficient to satisfy needs for current-purpose uses, such as (1) assessment of water resources, (2) operation of reservoirs or industries, (3) forecasting, (4) disposal of wastes and pollution control, (5) discharge data to accompany water-quality measurements, (6) compact and legal requirements, and (7) research or special studies. B. To collect data necessary for analytical studies to define for any location the statistical properties of, and trends in, the occurrence of water in streams, lakes, estuaries, etc., for use in planning and design.

**PROGRESS:** Field data were collected and prepared for publication (1990 water year) for: 96 streamflow-gaging stations, 65 partial-record or miscellaneous discharge stations, stage and content records for 13 reservoirs and lakes, and stage only for 31 stations. Network maintenance continued, including modernizing equipment in places to improve record quality. Modifications to the network, such as additions or deletions of stations, were made in response to data needs.

**REPORTS:** Data are published annually in U.S. Geological Survey's hydrologic data report "Water Resources Data, Alabama."



**GROUND-WATER STATIONS**  
**Project number AL 002**

**PERIOD OF PROJECT:**

Continuous since 1939

**PROJECT LEADER:**

James L. Pearman

**COOPERATOR:**

Alabama Highway Department

City of Anniston

City of Greenville

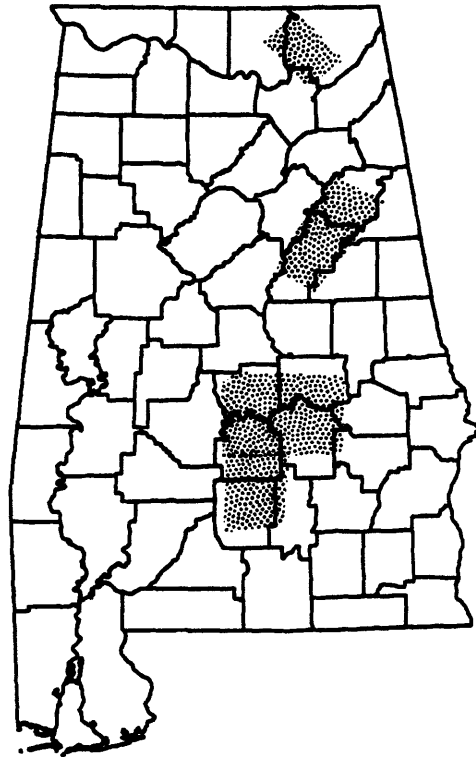
City of Montgomery

Cumberland Mountain Water Authority

Federal Program

Sumter County

Sylacauga Water and Sewer Board



**PURPOSE:** To collect water-level data sufficient to provide a minimum long-term data base so the general response to the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management.

**PROGRESS:** Continuous water-level recorders were maintained at 2 stations and semiannual measurements made at approximately 60 wells and springs. Data from all stations were collected and processed for publication in the District's water-data report.

**REPORTS:** Data are published annually in U.S. Geological Survey's hydrologic data report "Water Resources Data, Alabama".

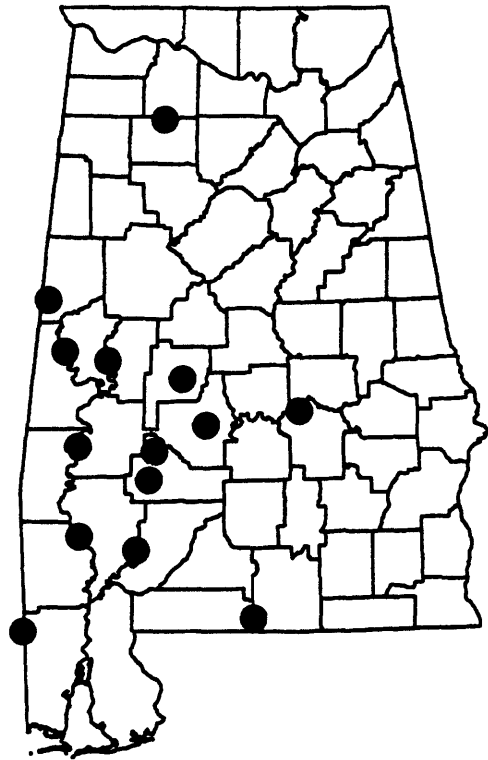


**WATER-QUALITY STATIONS**  
**Project number AL 003**

**PERIOD OF PROJECT:**  
Continuous since 1940

**PROJECT LEADER:**  
James L. Pearman

**COOPERATORS:**  
City of Birmingham  
City of Tuscaloosa  
Federal Program  
Jefferson County Commission  
U.S. Army Corps of Engineers



**PURPOSE:** To provide a national bank of water-quality data for broad Federal, State, and local planning and action programs and to provide data for federal management of interstate and international waters.

**PROGRESS:** Stations operated in the network included two benchmark stations and six NASQAN stations. Data were also collected for Lake Tuscaloosa project on a monthly basis. Modifications to the network, such as additions or deletions of stations, were made in response to data needs and cooperator's commitments.

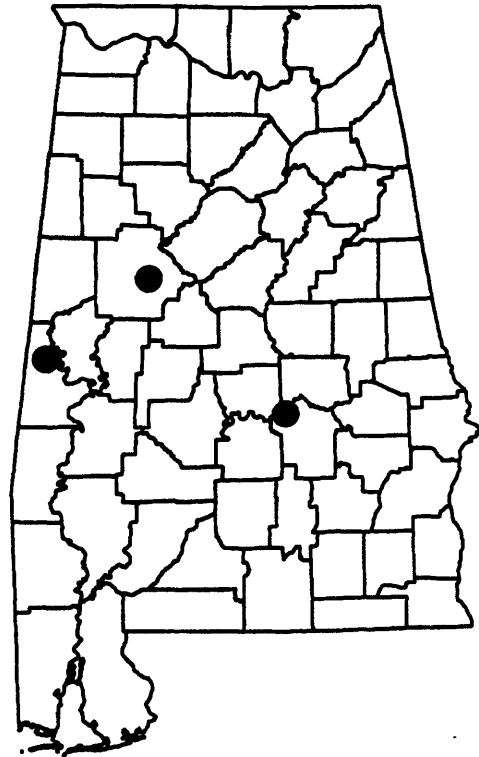
**REPORTS:** Data are published annually in U.S. Geological Survey's hydrologic data report "Water Resources Data, Alabama."

**SEDIMENT STATIONS**  
Project number AL 004

**PERIOD OF PROJECT:**  
Continuous since 1981

**PROJECT LEADER:**  
James L. Pearman

**COOPERATOR:**  
U.S. Army Corps of Engineers



**PURPOSE:** To provide a national bank of sediment data for use in broad Federal and State planning and action programs and to provide data for Federal management of interstate and international waters.

**PROGRESS:** Three sediment stations are operated to provide spatial and temporal averages and trends of sediment concentrations, sediment discharge, and particle size of sediment being transported by rivers and streams.

**REPORTS:** Data are published annually in U.S. Geological Survey's hydrologic data report "Water Resources Data, Alabama."

**CHEMICAL QUALITY OF ATMOSPHERIC DEPOSITION IN ALABAMA**  
Project number AL 005

**PERIOD OF PROJECT:**

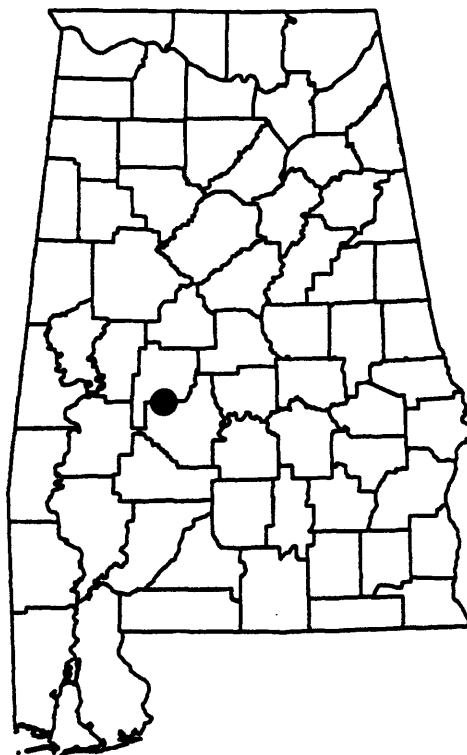
Continuous since 1983

**PROJECT LEADER:**

Ira A. Giles

**COOPERATOR:**

Federal



**PURPOSE:** To collect and analyze precipitation samples and establish the spatial and temporal variability of precipitation chemistry in Alabama.

**PROGRESS:** Operated one weekly precipitation chemical-quality station.

**REPORTS:** Data are published annually in U.S. Geological Survey's hydrologic data report "Water Resources Data, Alabama."

**WATER USE IN ALABAMA**  
Project number AL 007

**PERIOD OF PROJECT:**  
Continuous since 1978

**PROJECT LEADER:**  
Will S. Mooty

**COOPERATOR:**  
Geological Survey of Alabama

**PURPOSE:** To provide water-use information for the optimum utilization and management of the State's water resources to benefit the people of Alabama. To collect, store, and disseminate water-use data which are compatible with a national data base of water use.

**PROGRESS:** The NEWSWUDS data storage program was installed on the PRIME computer in March 1989. The program retains all water-use data previously entered in the old SWUDS program. Site ID's for all public-supply wells were field checked in recent surveys and have been entered in the data base.

**REPORTS:** Baker, R.M., 1983, Use of water in Alabama, 1982: Geological Survey of Alabama, Information Series 59C, 50 p.

Baker, R.M., and Moore, J.D., 1983, Use of water in Alabama, 1981: Geological Survey of Alabama Information Series 59B, 50 p.

Baker, R.M., and Mooty, W.S., 1987, Use of water in Alabama, 1985: Geological Survey of Alabama Information Series 59D, 51 p.



**WATER USE IN ALABAMA--Continued**  
**Project number AL 007**

**REPORTS** continued: Baker, R.M., and others, 1982, Use of water in Alabama, 1980: Geological Survey of Alabama Information Series 59, 50 p.

Geological Survey of Alabama, 1980, Alabama State water-use data system: Geological Survey of Alabama.

Mooty, W.S., 1991, Water withdrawals in the Black Warrior-Tombigbee Basin in Alabama, 1985-87: U.S. Geological Survey Water-Resources Investigations Report 90-4112, 46 p.

Murray, C.F., and Reeves, E.B., 1981, Estimated use of water in the United States in 1980: U.S. Geological Survey (Alabama portion) Circular 1001, 56 p.

Solley, W.B., Merk, C.F., and Pierce, R.R., 1988, Estimated use of water in the United States in 1985: U.S. Geological Survey (Alabama portion) Circular 1004, 82 p.

**REPORTS IN PROGRESS:** Estimated use of water in the United States in 1990: U.S. Geological Survey (Alabama portion).

Use of water in Alabama, 1990.

**HYDROLOGIC AND HYDRAULIC STUDIES  
AT PROPOSED BRIDGE SITES  
Project number AL 011**

**PERIOD OF PROJECT:**

Continuous since 1948

**PROJECT LEADER:**

George H. Nelson, Jr.

**COOPERATOR:**

Alabama Highway Department



**PURPOSE:** To collect supplemental flood data and information in order to describe the flood characteristics at potential construction sites. Reliable estimates of peak discharge, stage, velocity, and distribution of discharge for the design flood frequency are needed for the proper design of the bridges or culverts.

**PROGRESS:** Hydrologic and hydraulic information including estimates of peak discharge, stage, velocity, and distribution of discharge for the design flood frequency were prepared for approximately 100 sites during the year.

**REPORTS:** Hains, C.F., 1973, Floods in Alabama, magnitude and frequency based on data through September 30, 1971: State of Alabama Highway Department, Special Report, 183 p.

Bohman, L.R. and Ming, C.O., 1980, Hydraulic factors of Big Wills and Black Creeks at proposed Interstate 759 crossing near Gadsden, Alabama.

Hannum, C.H. and Nelson, G.H., 1980, Flood of April 13, 1980, Mobile, Alabama: U.S. Geological Survey Open-File Report 80-1183, 12 p.

**GROUND-WATER MANAGEMENT TECHNIQUES  
FOR DAUPHIN ISLAND  
Project number AL 057**

**PERIOD OF PROJECT:**  
1984 - September 1990

**PROJECT LEADER:**  
Robert E. Kidd

**COOPERATOR:**  
Dauphin Island Water, Sewer  
and Fire Protection



**PURPOSE:** To develop a methodology for determining the maximum amount of freshwater that can be produced from the water-table aquifer without causing saltwater encroachment.

**PROGRESS:** Wells on the eastern end of the island were inventoried. Thirty-eight test wells and two supply wells were drilled. Geophysical logs of the wells were made and aquifer tests were conducted on both supply wells. A modular three-dimensional finite-difference ground-water flow model was used for simulations.

**REPORTS:** Kidd, R.E., 1988, Hydrology and water-supply potential of the water-table aquifer on Dauphin Island: U.S. Geological Survey Water-Resources Investigations Report 87-4283.

**STREAMFLOW AND WATER QUALITY, LAKE TUSCALOOSA**  
**Project number AL 071**

**PERIOD OF PROJECT:**

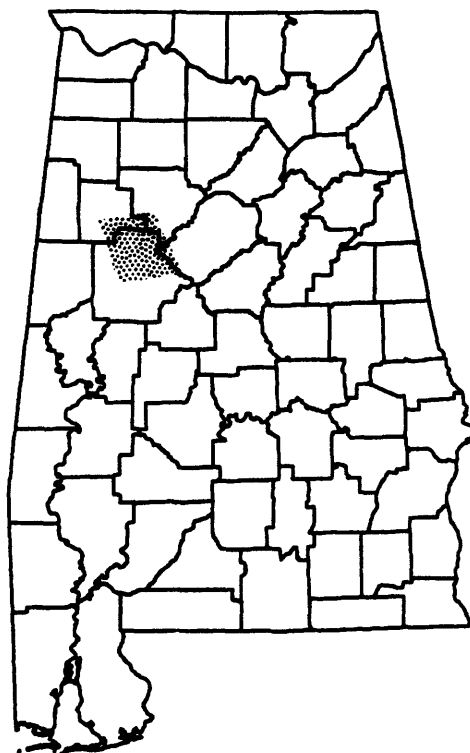
October 1981 - September 1990

**PROJECT LEADER:**

J. Brian Atkins

**COOPERATOR:**

City of Tuscaloosa



**PURPOSE:** To collect and analyze the streamflow, water quality, and changes in water quality in Lake Tuscaloosa and selected tributaries in the North River basin.

**PROGRESS:** Data have been collected and published annually and in other reports. Beginning in 1990, data collection activities have been incorporated into the CBR-003 project.

**REPORTS:** Cole, E.F., 1985, Effects of coal mining on the water quality and sedimentation of Lake Tuscaloosa and selected tributaries, North River basin: U.S. Geological Survey Water-Resources Investigations Report 84-4310, 53 p.

Slack, L.J., 1987, Water quality of Lake Tuscaloosa and streamflow and water quality of selected tributaries to Lake Tuscaloosa, 1982-86: U.S. Geological Survey Water-Resources Investigations Report 87-4002.

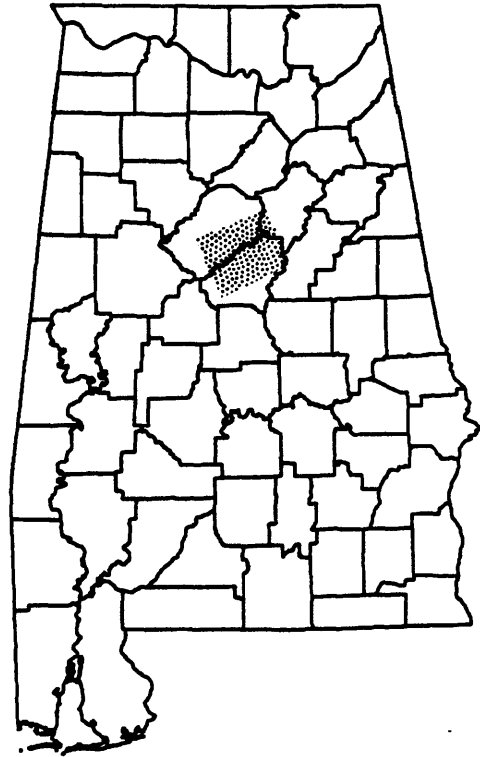


**STREAMFLOW AND WATER QUALITY OF LAKE PURDY AND TRIBUTARIES**  
Project number AL 072

**PERIOD OF PROJECT:**  
October 1987 - September 1990

**PROJECT LEADER:**  
V. E. Stricklin

**COOPERATOR:**  
Birmingham Water Works Board



**PURPOSE:** To establish a comprehensive hydrologic data base that can be used to assess (1) the quantity and quality of inflow to the lake, (2) water quality in the lake, (3) changes in the quality of water in the lake.

**PROGRESS:** The sampling network consist of six inflow sites, three sites in the lake, and one outflow site. Seasonal lake profiles of water temperature, dissolved oxygen, pH, and specific conductance were collected. Data were published in the annual data report.

**HIGHWAY DRAINAGE STUDY**  
**Project number AL 073**

**PERIOD OF PROJECT:**

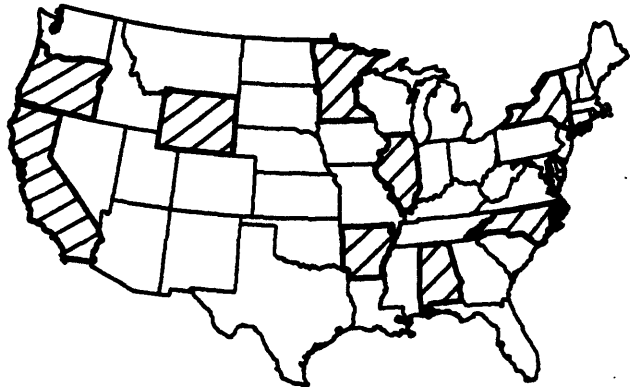
May 1988 - September 1990

**PROJECT LEADER:**

Hillary H. Jeffcoat

**COOPERATOR:**

Federal Highway  
Administration



**PURPOSE:** To provide a comprehensive evaluation of water occurrence under concrete pavement at selected sites by describing relations among rainfall, edgedrain outflow and subbase moisture conditions.

**PROGRESS:** Data collection sites were established and operated for 1 year in Alabama, Arkansas, California, Illinois, Minnesota, New York, North Carolina, Oregon, West Virginia, and Wyoming. Several rainfall events of 1 inch or more were collected at each site. A soils analysis was made of a core sample of the subgrade at each site.

**REPORTS IN PROGRESS:** Effectiveness of highway edgedrains: U.S. Geological Survey Water-Resources Investigations Report.

**DETERMINATION OF STORM-WATER RUNOFF QUALITY IN BIRMINGHAM**  
**Project number AL 076**

**PERIOD OF PROJECT:**

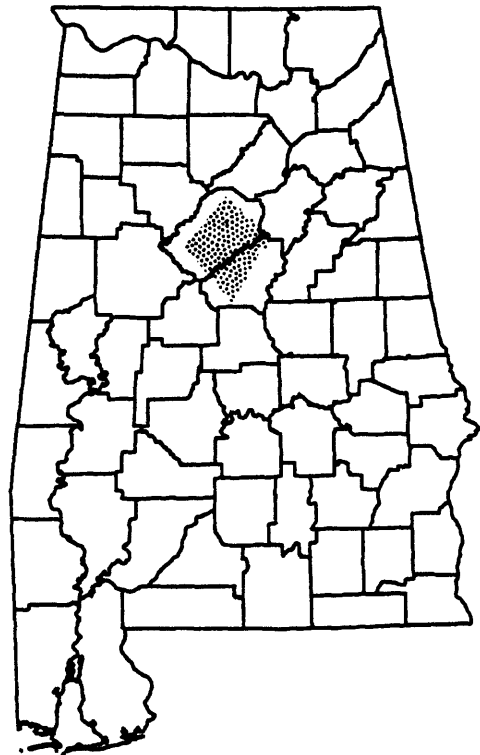
March 1990 - September 1992

**PROJECT LEADER:**

Will S. Mooty

**COOPERATOR:**

City of Birmingham



**PURPOSE:** To assist the city by collecting technical data required by EPA regulations to characterize the quantity and quality of discharge from selected watersheds. The watersheds were selected to represent primary land use categories.

**PROGRESS:** Five sites were selected for storm-water runoff sampling and sampling protocol was developed. An inventory of major storm-sewer outfalls for one of the sites was completed and one set of samples was collected at four of the sites.

**BIG CREEK LAKE SYSTEMS STUDY,  
Project number AL 077**

**PERIOD OF PROJECT:**

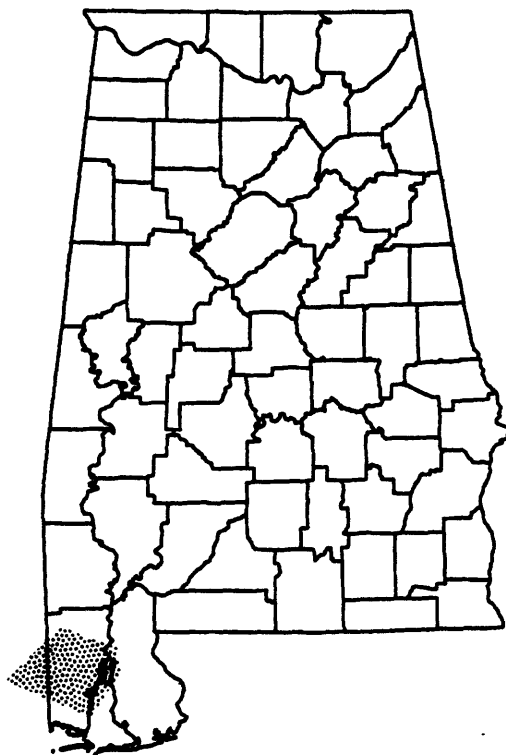
March 1990 to September 1993

**PROJECT LEADER:**

William L. Psinakis

**COOPERATOR:**

Mobile Water and Sewer Board



**PURPOSE:** To monitor Big Creek Lake and its tributaries and the emergency supply intake on the Mobile River to provide a comprehensive hydrologic data base that can be used by the city of Mobile and others to (1) assess the quantity and quality of water in Big Creek Lake and at the Bucks site on the Mobile River and (2) broadly define the time of travel during different flow conditions from the highway and railroad crossings over the reservoir to the water intakes for the city of Mobile.

**PROGRESS:** Streamflow and water quality data are being collected at nine inflow streams into the lake. Quarterly samples have been collected and analyzed for nutrients and major constituents. Also, quarterly samples for the identification and enumeration of the protozoan *Giardia* have been collected.

**PLANNED REPORT:** Streamflow, water quality, and time of travel, Big Creek Lake, and water quality at Mobile River at Bucks, Alabama.

**AN ASSESSMENT OF HYDROLOGICAL PROBLEMS  
ASSOCIATED WITH AQUACULTURE IN WEST-CENTRAL ALABAMA**  
Project number AL 078

**PERIOD OF PROJECT:**

July 1990 to September 1992

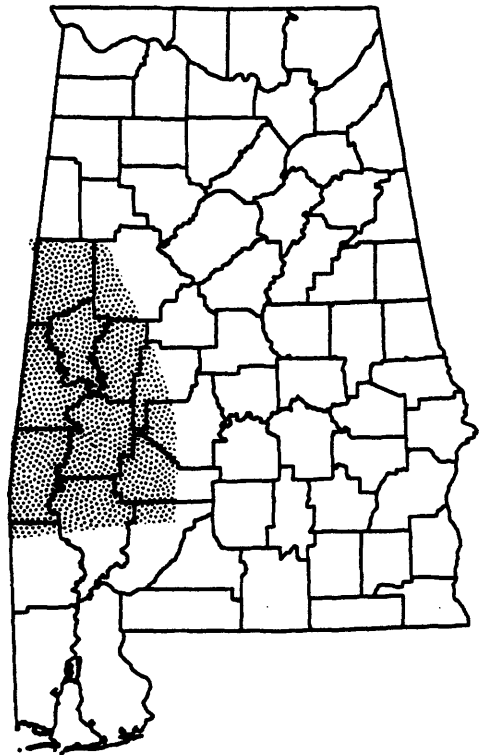
**PROJECT LEADER:**

Robert E. Kidd

**COOPERATOR:**

Alabama Department of Economic  
and Community Affairs

U.S. Soil Conservation Service



**PURPOSE:** To evaluate changes in water quality and ground-water availability resulting from aquaculture.

**PROGRESS:** Continuous monitoring stations were established on Big Prairie Creek and at two pond sites. An inventory of aquaculture ponds and supply wells was completed and semiannual water samples were collected at surface water sites.

**DETERMINATION OF STORM-WATER RUNOFF QUALITY IN MONTGOMERY**  
Project number AL 079

**PERIOD OF PROJECT:**

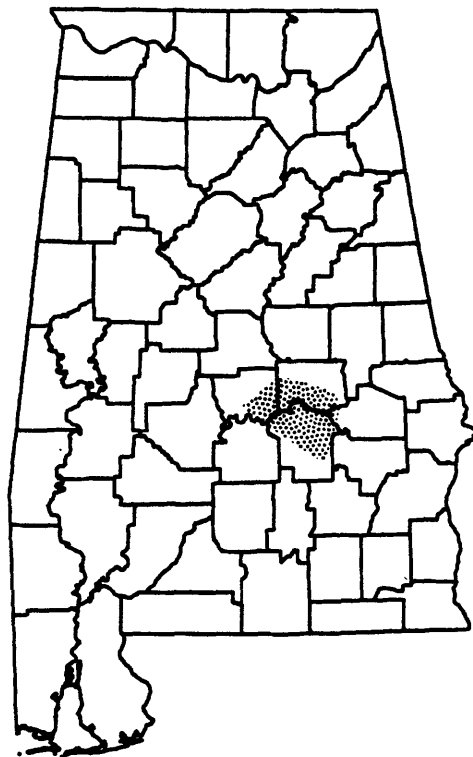
October 1990 - September 1993

**PROJECT LEADER:**

Will S. Mooty

**COOPERATOR:**

City of Montgomery



**PURPOSE:** To assist the city by collecting technical data required by EPA regulations to characterize the quantity and quality of discharge from selected watersheds. The watersheds were selected to represent primary land use categories.

**PROGRESS:** A reconnaissance was completed and site selections were made. The collection of background data was started and development of a sampling strategy is underway.

**ANALYSIS OF LOW FLOWS OF ALABAMA STREAMS**  
**Project number AL 080**

**PERIOD OF PROJECT:**

April 1991 to September 1992

**PROJECT LEADER:**

J. Brian Atkins

**COOPERATOR:**

Alabama Department of  
Environmental Management

Tennessee Valley Authority



**PURPOSE:** To compile and catalog existing low-flow data, correlate partial record and miscellaneous measurements with index stations, and analyze statistically flow data from all continuous-record gaging stations.

**PROGRESS:** The daily values files in WATSTORE have been updated with data through the 1990 climatic year. Frequency curves have been developed for 133 gaging stations with 10 years or more of record.