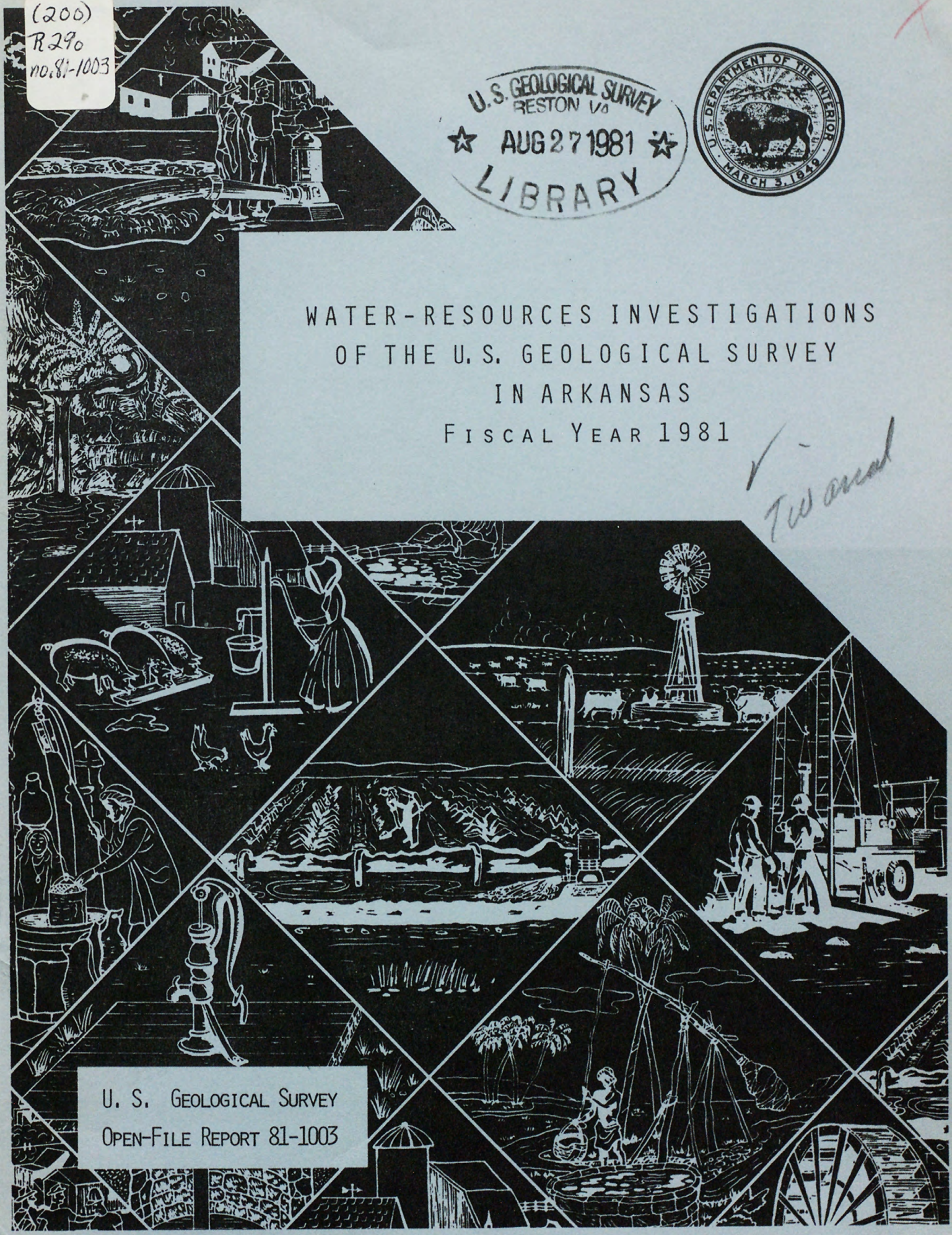
WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN ARKANSAS FISCAL YEAR 1981



U. S. GEOLOGICAL SURVEY
OPEN-FILE REPORT 81-1003

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN ARKANSAS--Fiscal Year 1981

Compiled by Margaret O. Gurley

U.S. GEOLOGICAL SURVEY

Open-File Report 81-1003

Little Rock, Arkansas

1981

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Doyle G. Frederick, Acting Director

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INTRODUCTION

Water-resources investigations of the U.S. Geological Survey in Arkansas consist of collecting water-resources data and conducting interpretive hydrologic investigations. The water-resources data and the results of the investigations are published or released by either the U.S. Geological Survey or by cooperating agencies. This report describes the water-resources investigations in Arkansas for the 1981 fiscal year (October 1, 1980, through September 30, 1981).

The U.S. Geological Survey's investigations of the water resources of Arkansas are under the direction of the District Chief. The Arkansas District office is in Room 2301 Federal Office Building, Little Rock, Ark. The Arkansas District has a Field Headquarters office in Fort Smith, Ark.

COOPERATING AGENCIES

In Arkansas, the collecting of some of the water-resources data and the conducting of some of the interpretive hydrologic investigations are done in cooperation with Federal, State, and local agencies. Those agencies cooperating with the U.S. Geological Survey during fiscal year 1981 are:

Arkansas Geological Commission
Arkansas Department of Pollution Control and Ecology
Arkansas Soil and Water Conservation Commission
Arkansas State Highway and Transportation Department
U.S. Army Corps of Engineers
U.S. Soil Conservation Service
Arkansas Power & Light Company
National Park Service
National Weather Service, NOAA
Environmental Protection Agency
U.S. Bureau of Land Management

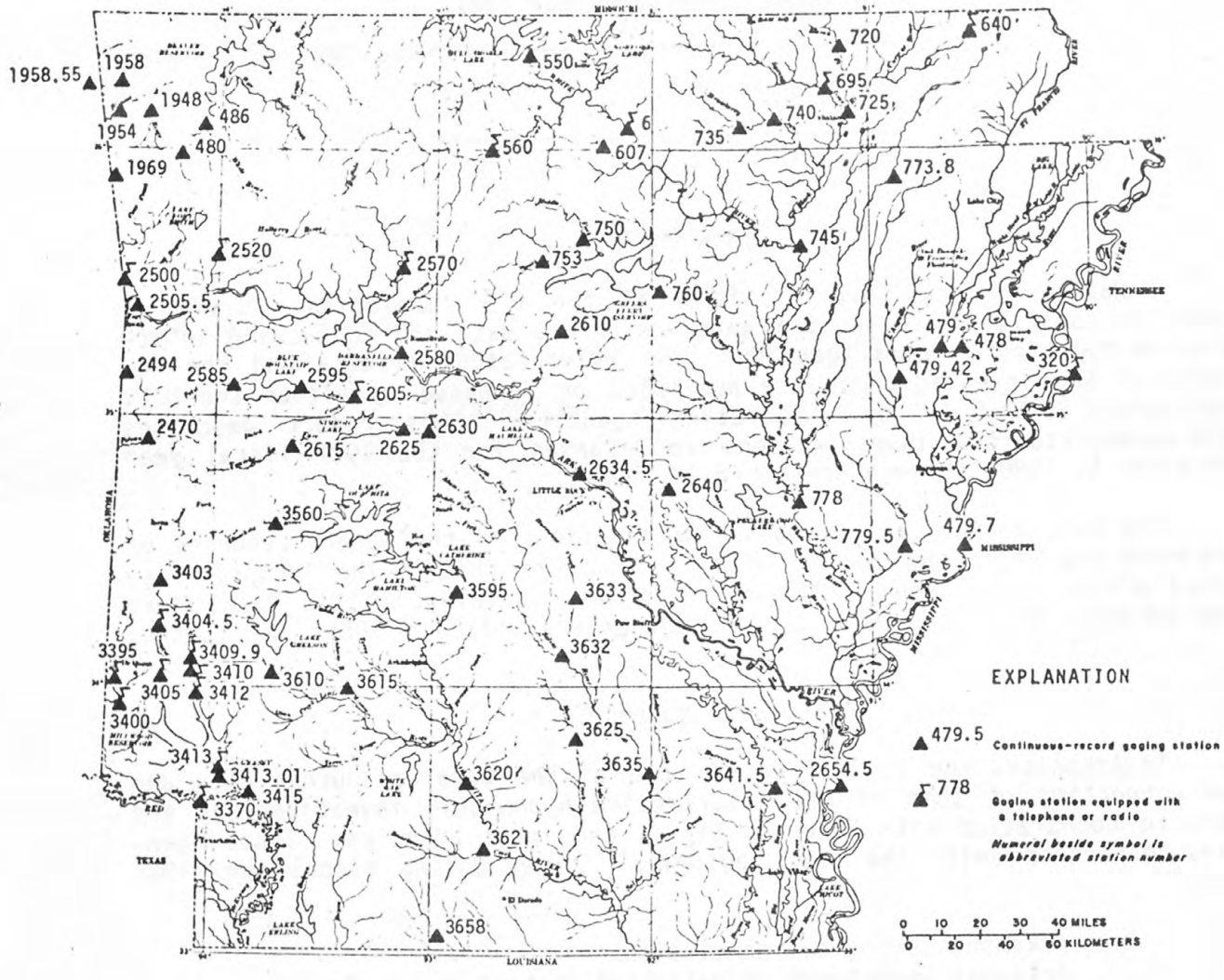

Figure 1.--Locations of continuous-record gaging stations in Arkansas.

PROJECTS

Collection of Surface-Water Data

COOPERATING AGENCIES: Arkansas Geological Commission, Arkansas Department of Pollution Control and Ecology, U.S. Army Corps of Engineers, Arkansas Power & Light Company

PROJECT CHIEF: G. Louis Ducret

PERIOD OF RECORD: Continuous since October 1927

Problem.--Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management, in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, water-resources development, and waste disposal. An appropriate data base is necessary to provide this information.

Objectives.--Collect surface-water data to satisfy needs for current-purpose uses, such as assessment of water resources, operation of reservoirs or industries, forecasting, disposal of wastes and pollution controls, discharge data to accompany water-quality measurements, compact and legal requirements, and research or special studies. Collect data necessary for analytical studies needed to understand cause-effect relations and define the trends and statistical properties of streamflow.

Approach.--Standard methods of data collection will be used as described in the publication series "Techniques of Water Resources Investigations of the United States Geological Survey." Partial-record gaging will be used instead of complete-record gaging where it serves the required purpose.

Progress.--The statewide network of streamflow stations was continued and records were published. The network consisted of 75 stream-gaging stations (fig. 1) and stage and content records were prepared for 10 lakes and reservoirs.

Plans.--Continue present network of 75 stream-gaging stations and records for 10 lakes and reservoirs.

Reports published or released during fiscal year 1980.--See references 3, 4, and 12 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

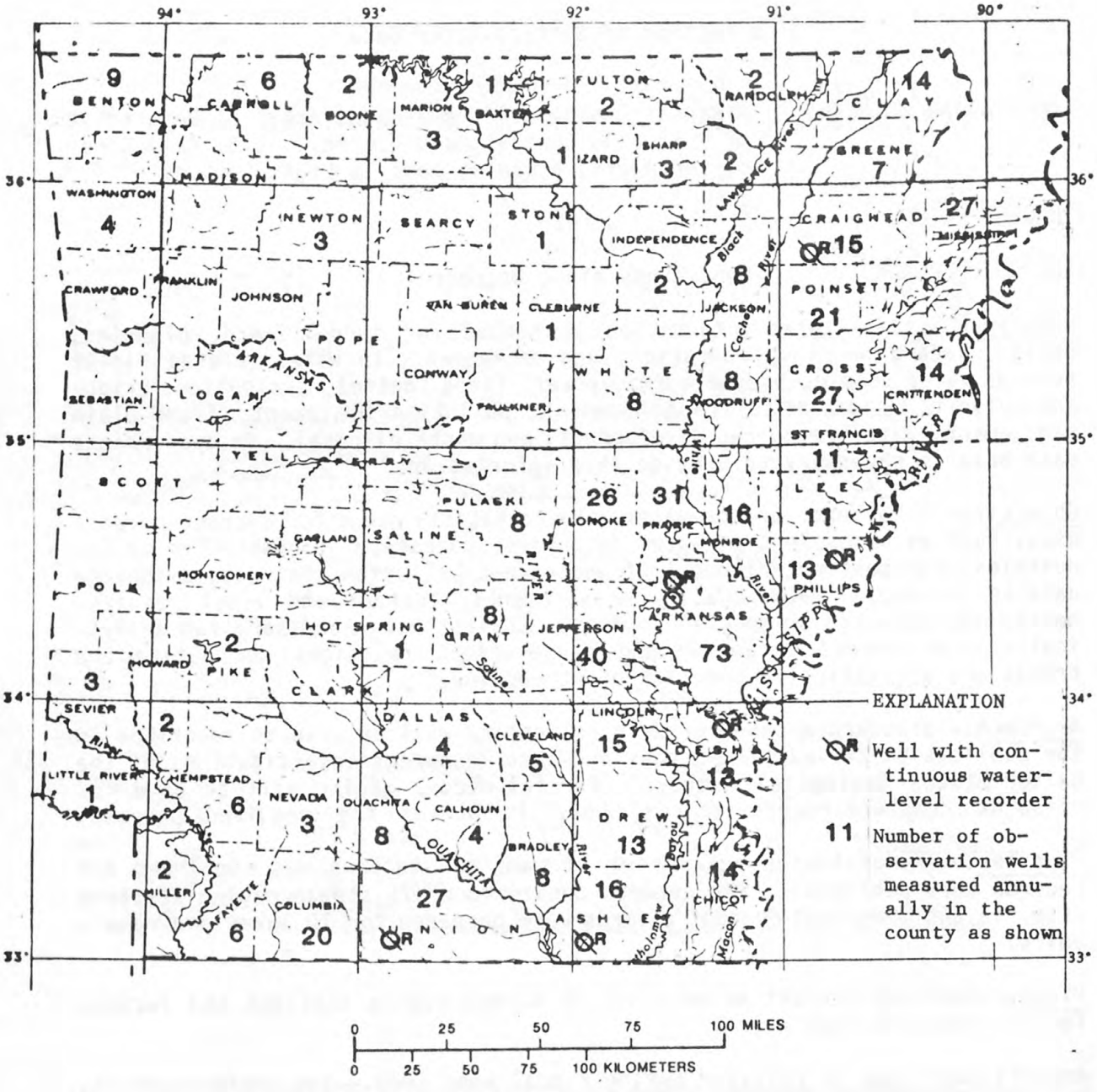

Figure 2.--Locations of wells with continuous water-level recorders and number of observation wells measured annually.

Collection of Ground-Water Data

COOPERATING AGENCY: Arkansas Geological Commission, National Park Service

PROJECT CHIEF: Augustine H. Ludwig

PERIOD OF PROJECT: Continuous since July 1945

Problem.--Long-term water-level records are needed to evaluate the effects of climatic variations on recharge to and discharge from the aquifer systems, to provide a data base from which to measure the effects of development, to assist in the prediction of future supplies, and to provide data for management of the resource.

Objectives.--Collect water-level data to provide a minimum long-term data base so that the general response of 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. Provide a data base against which the short-term records acquired in areal studies can be analyzed. This analysis must provide an assessment of the ground-water resource, allow prediction of future conditions, detect and define pollution and supply problems, and provide the data base necessary for management of the resource.

Approach.--Evaluation of regional geology allows broad, general definition of aquifer systems and their boundary conditions. Within this framework, and with some knowledge of the stress on the system in time and space and the hydrologic properties of the aquifers, a subjective decision can be made on the most advantageous locations for observation of long-term system behavior. This subjective network will be refined as records become available and detailed areal studies of the ground-water system more closely define the aquifers, their properties, and the stresses to which they are subjected.

Progress.--Water levels were measured in 595 wells (fig. 2) throughout the State as part of the Federal-State ground-water data-collection program. Electric, gamma-ray, and caliper logs were made in approximately 75 newly drilled water wells in the State. The report "Ground-Water Levels in Observation Wells in Arkansas, Spring 1980" was prepared. The ground-water section of the annual report "Water Resources Data for Arkansas, Water Year 1979" was completed.

Plans.--Continue water-level monitoring. Prepare the ground-water section of "Water Resources Data for Arkansas, Water Year 1980." Prepare 1981 water-level report.

Reports published or released during fiscal year 1980.--See reference 12 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

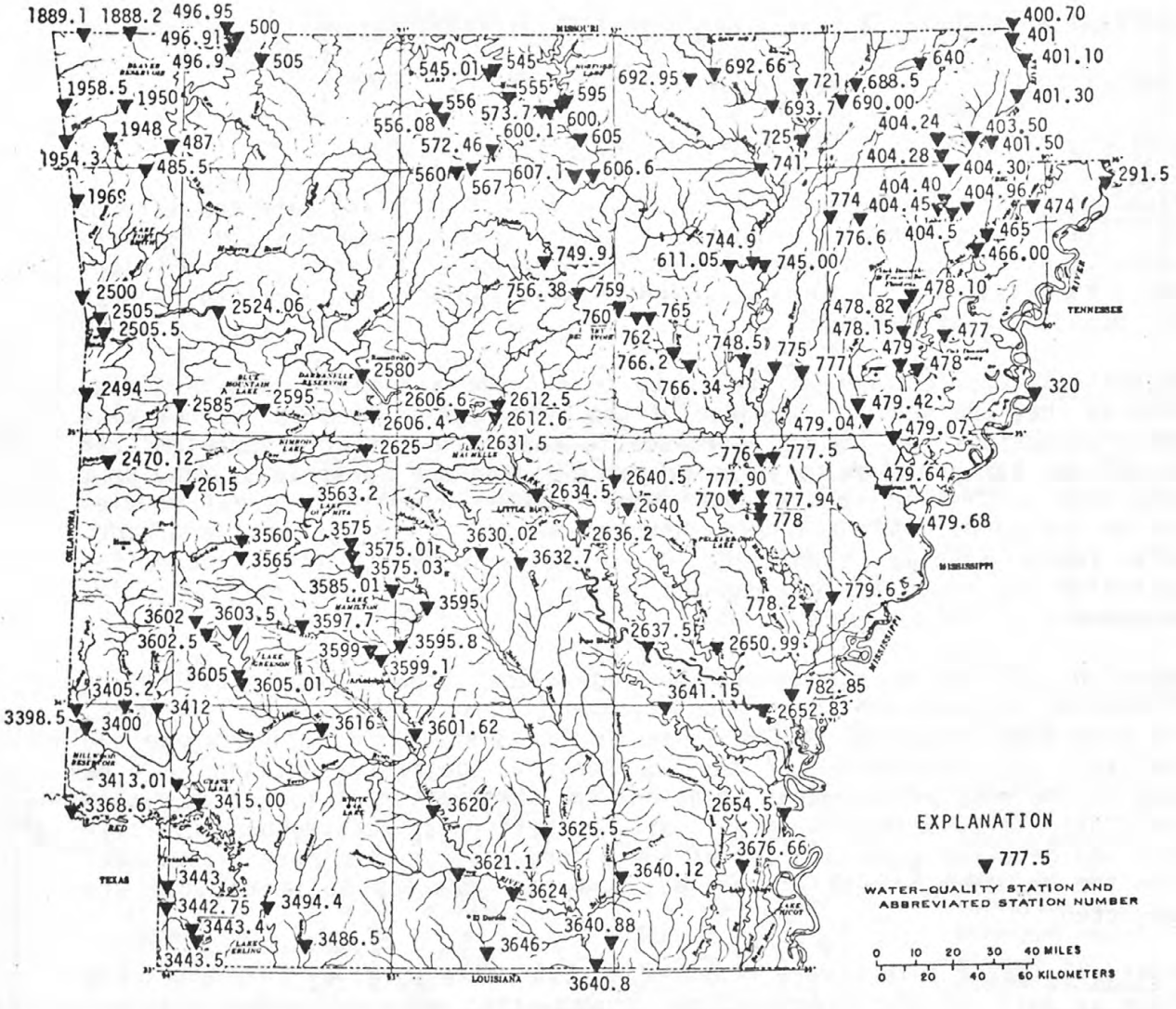

Figure 3.--Locations of water-quality stations in Arkansas.

Collection of Water-Quality Data

COOPERATING AGENCIES: Arkansas Geological Commission, Arkansas Department of Pollution Control and Ecology, U.S. Army Corps of Engineers, National Park Service, Environmental Protection Agency, U.S. Soil Conservation Service

PROJECT CHIEF: B. Frank Lambert

PERIOD OF PROJECT: Continuous since July 1945

Problem.--Water-resource planning and water-quality assessment require a statewide and nationwide base of relatively standardized information. For intelligent planning and realistic assessment of the water resources, the chemical and physical quality of the rivers and streams must be defined and monitored.

Objectives.--Provide a national and State bank of water-quality data for planning and action programs, and provide data for State and Federal management of interstate and international waters.

Approach.--Operate a network of water-quality stations to measure concentrations, loads, and time trends, as required by planning and management agencies.

Progress.--Water-quality samples were collected and analyzed. These samples were collected at 13 National Stream Quality Accounting Network stations, one Benchmark Network station, six cooperative stations, and 73 sites on 12 lakes (fig. 3). From five to 160 parameters were determined for samples from each site.

Plans.--Continue to operate water-quality stations and continue to update stations and parameters needed to meet present and long-term needs.

Reports published or released during fiscal year 1980.--See reference 12 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

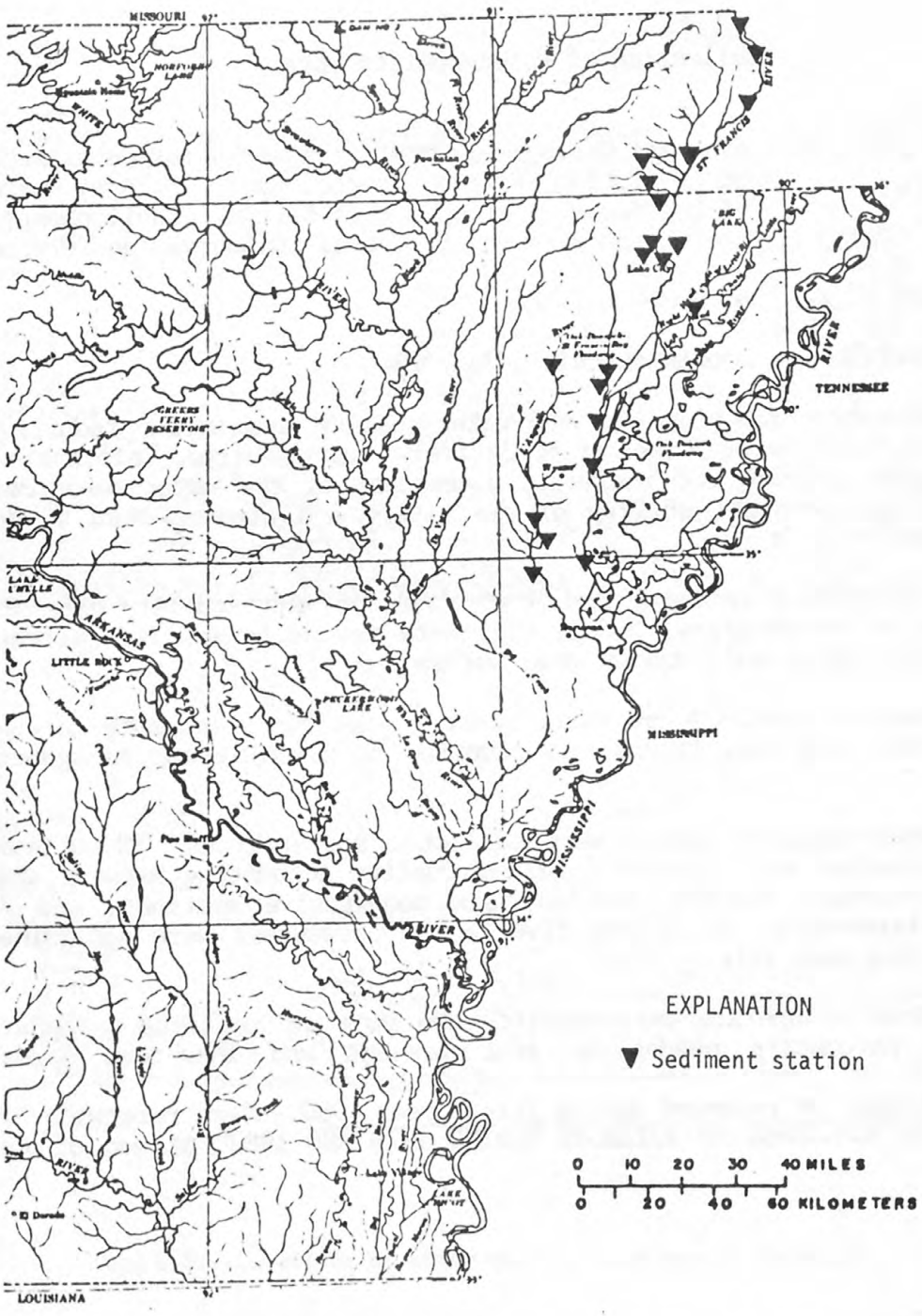

Figure 4.--Locations of monthly sediment stations in Arkansas.

Sediment Stations

COOPERATING AGENCY: U.S. Army Corps of Engineers

PROJECT CHIEF: B. Frank Lambert

PERIOD OF PROJECT: Continuous since July 1976

Problem.--Water-resource planning and water-quality assessment require a nationwide base level of relatively standardized information. Sediment concentrations and discharges in Arkansas rivers and streams must be defined and monitored.

Objectives.--Provide a national bank of sediment data for use in Federal and State planning-and-action programs, including State and Federal management of interstate and international waters.

Approach.--Establish and operate a network of sediment stations to provide spatial and temporal averages and trends of sediment concentration, sediment discharge, and particle size of sediment being transported by rivers and streams.

Progress.--Sediment samples were collected at 11 selected stations and analyzed for concentration. Monthly sediment samples were collected at 26 stations in the St. Francis River basin and analyzed for concentration and for particle size on sand fractions of particles greater than 62 microns in diameter. Records were prepared for publication in the annual water-data report.

Plans.--Continue to collect and analyze sediment samples monthly at 21 stations in the St. Francis River basin in Arkansas (fig. 4). Sediment samples will be collected at eight selected stations and analyzed for concentration.

Reports published or released during fiscal year 1980.--See reference 12 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

Figure 5.--Location of area included in water-use inventory.

Water-Use Data for Arkansas

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: Augustine H. Ludwig

PERIOD OF PROJECT: Continuous since April 1979

Problem.--Because of the large increase (more than 500 percent since 1960) in the the use of water in Arkansas in recent years, water-use data are needed as a management tool. Requests from State and municipal planners for water-use data are increasing. As competition increases among users, the need for water-use information becomes essential in determining the amount of water available.

Objectives.--Establish a statewide continuing water-use data-collection system (fig. 5) that will document the amount of water used, and develop a data storage-and-retrieval system that will permit recall and publication of the information as needed.

Approach.--Facilities will be established statewide for collecting, storing, and disseminating water-use data. Funds will be made available to the Arkansas Geological Commission, where the actual data will be collected, through the U.S. Geological Survey cooperative program. A computer system, which will be chosen during the initial planning phase, will be used by the Survey for data storage and retrieval. Data collection and report preparation and distribution will be handled by Arkansas Geological Commission personnel.

Progress.--Prepared methodology report outlining guidelines for implementation of the water-use program. Established data-collection network for obtaining application rates for rice, cotton, and soybean irrigation.

Plans.--Develop coding forms for automated storage and retrieval of water-use data. Collect water-use data for municipal, industrial, and nonirrigation functional-use catagories. Prepare report on use of water in Arkansas for 1980.

Figure 6.--Location of area included in site investigations and dissemination of hydrologic information.

Site Investigations and Dissemination of Hydrologic Information

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: District Chief

PERIOD OF PROJECT: Continuous since July 1960

Problem.--The increasing development of Arkansas water resources has created a persistent demand for water information. The U.S. Geological Survey receives many requests each year for water information.

Objectives.--Furnish individuals, municipalities, and organizations with requested information about Arkansas water resources (fig. 6), and make special investigations of water to provide solutions to specific water problems.

Approach.--Search literature and collect data such as drillers logs, pumping-test records, chemical analyses, and streamflow. Analyze data, as necessary, to provide requested information.

Progress.--About 300 requests for data reports were filled and letter summaries of water-resources conditions in Arkansas were answered. More than 500 telephone requests for information were answered. Several formal talks on water resources in Arkansas and our programs were given before professional and civil groups.

Plans.--Each year requests increase in number and complexity, and the program will be adjusted as needed to meet the demand.

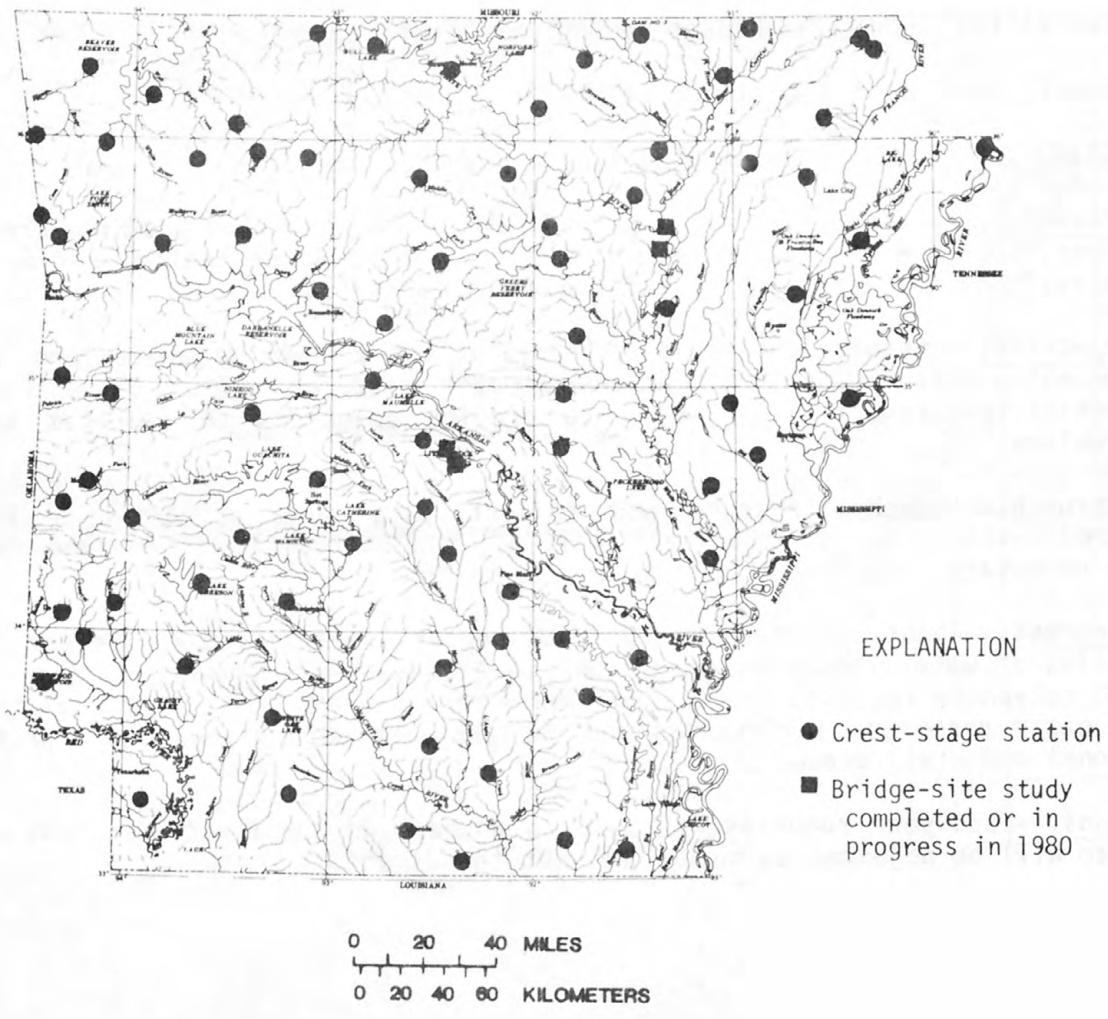

Figure 7.--Locations of bridge-site studies and crest-stage stations.

Flood Investigations

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROJECT CHIEF: Terrance E. Lamb

PERIOD OF PROJECT: Continuous since July 1960

Problem.--About 25 percent of highway-construction funds in Arkansas are spent on bridges and culverts. The safe and economic design of these structures requires a knowledge of the magnitude and frequency of floods for all size drainage basins and an analysis of the hydrologic and hydraulic characteristics at specific bridge sites. Flood-frequency relations are not adequately defined for drainage areas of less than about 50 square miles. This project will permit better definition of flood-frequency relations for small streams and will supply the State Highway and Transportation Department data useful in economic and safe design of highway-drainage structures.

Objectives.--Define regional flood-frequency relations, with emphasis on areas of less than about 50 square miles. Make hydrologic and hydraulic analyses of floodflow characteristics at specific bridge sites. Compile and publish drainage-area data statewide.

Approach.--Collect annual peak-discharge data and rainfall data on small streams, and relate peak discharge to rainfall. Use peak-flow rainfall relations and historical rainfall data to synthesize long-term annual peak discharges at the gage sites. Define regional flood-frequency relations for small streams by multiple-regression analysis. Analyze floodflow characteristics at specific bridge sites by use of standard methods of indirect computation of peak flow. Delineate and planimeter drainage areas.

Progress.--Operated and maintained a network of more than 80 crest-stage stations (fig. 7). Determined the annual maximum peak stage and discharge at all sites. Three bridge-site studies were completed. Provided assistance to cooperator on several additional bridge sites. All rainfall-runoff data from 26 small watersheds were entered into the daily unit-values file and syntheses of flood frequency were completed for nine sites.

Plans.--Operate and maintain crest-stage network. Make discharge measurements to verify stage-discharge relations in range of shifting controls. Document small-area floods. Perform bridge-site studies as requested. Continue work on flood-frequency report. Complete synthesis of flood-frequency data for 26 rainfall-runoff stations and prepare a report of the results.

Reports published or released during fiscal year 1980.--See reference 13 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

Figure 8.--Location of area included in flow-duration and low-flow frequency determinations of selected Arkansas streams.

Flow-Duration and Low-Flow Frequency Determinations of Selected Arkansas Streams

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: Richard A. Hunrichs

PERIOD OF PROJECT: Continuous since July 1972

Problem.--Low-flow frequency and flow-duration data for streams are needed to assess water-supply potential and waste-carrying capacity. Low-flow data are useful for studies of ground-water and surface-water interactions.

Objectives.--Provide statewide data on flow duration and frequency of streams (fig. 8). Obtain data for additional sites.

Approach.--Maintain up-to-date frequency and duration statistics for stations having continuous records. Expand partial-record station data to include data from additional sites. Use regression analysis for frequency determination at partial-record stations. Inventory perennial streams when weather conditions are suitable.

Progress.--Provided low-flow-frequency data for other projects. Made statewide observations of perennial-stream network during period of drought. Studied use of recession indicies to estimate low-flow statistics.

Plans.--Establish and measure partial-record sites and inventory perennial streams when weather permits. Relate low flow at partial-record sites to records at continuous stream-gaging stations. Update statistical data for continuous-record stations.

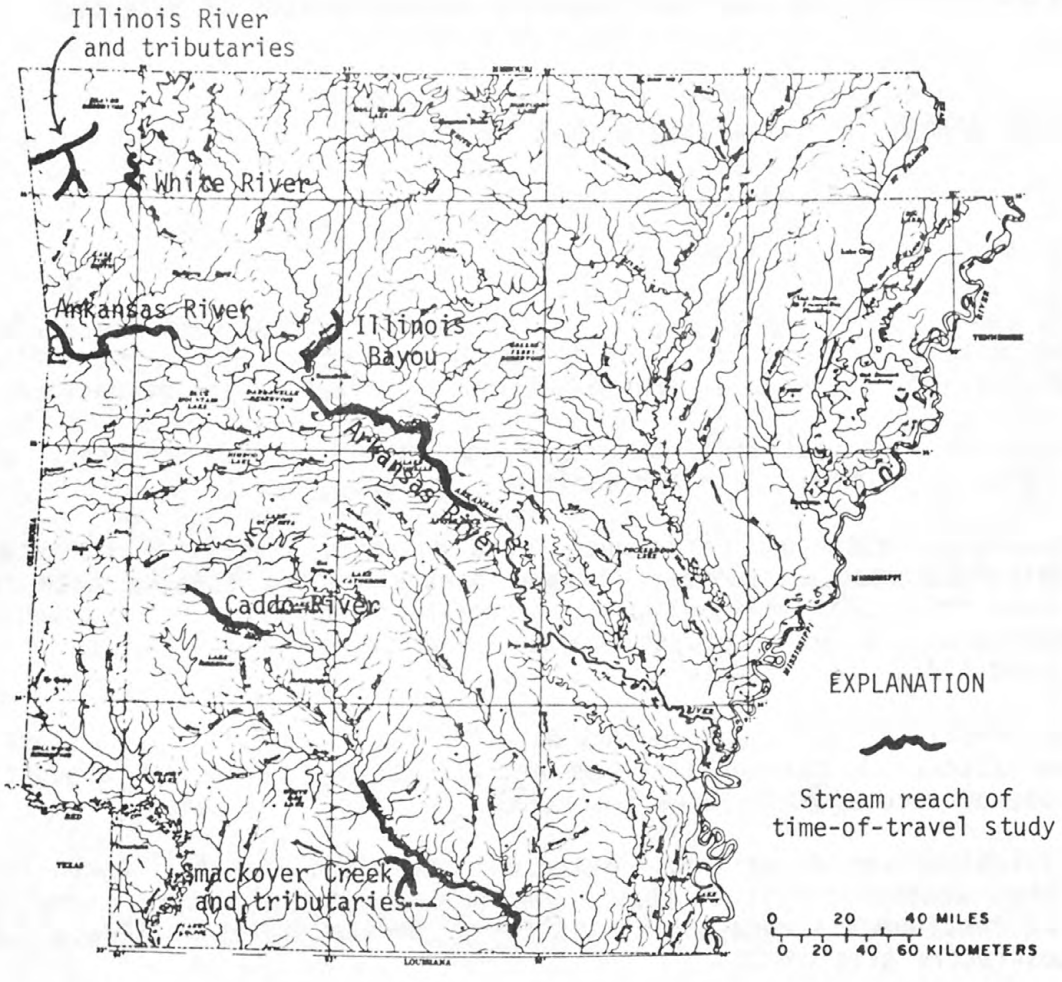

Figure 9.--Locations of time-of-travel studies in Arkansas.

Time-of-Travel Studies of Arkansas Streams

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: Terrance E. Lamb

PERIOD OF PROJECT: Continuous since July 1969

Problem.--Information about dispersion and rate of movement of dissolved and suspended material is needed for predictive modeling of water quality in Arkansas streams and reservoirs, and for predicting the time of travel, maximum concentrations, and time of passage of pollutants spilled in the streams.

Objectives.--Collect data that can be used to relate time of travel and dispersion of a conservative contaminant to one or more easily measured physical characteristics of each drainage basin.

Approach.--Fluorescent dye will be injected in selected streams (fig. 9), and dye concentrations will be sampled at downstream sites. An attempt will be made to define relationships between time of travel and stream and basin characteristics for regional appraisals of time of travel.

Progress.--Dye investigations were made on a 100-mile reach of the lower Ouachita River and a short reach of the White River.

Plans.--Make additional runs on selected small streams to include areas where more information is needed. Complete and publish report "Time-of-Travel Data for Selected Arkansas Streams."

Figure 10.--Locations of flood-prone areas mapped in Arkansas.

Flood-Hazard Information, House Document 465

COOPERATING AGENCY: None

PROJECT CHIEF: Roy C. Gilstrap

PERIOD OF PROJECT: Continuous since July 1972

Problem.--House Document 465 outlines a national program to provide flood-hazard information. The U.S. Geological Survey was assigned the responsibility to outline on existing Geological Survey topographic maps those flood-prone areas that can be identified from information on the maps and from previous flood-frequency studies.

Objectives.--Identify and label on Survey topographic quadrangle maps the flood-prone areas of cities and towns having a population of more than 2,500, and adjacent areas for which adequate maps are available and flood-frequency drainage-area relationships can be determined.

Approach.--Use relationships between flood depth, flood discharge, frequency of occurrence, and drainage area to define flood profiles and flood boundaries (100-year recurrence interval) along streams shown on topographic maps. If no actual flood information exists, will use regional flood-depth frequency relationships.

Progress.--Ten flood-prone area maps were prepared in 1980, giving a total of 219 flood-prone area maps for Arkansas (fig. 10). A list of flood-prone area maps is at the end of the report.

Plans.--None.

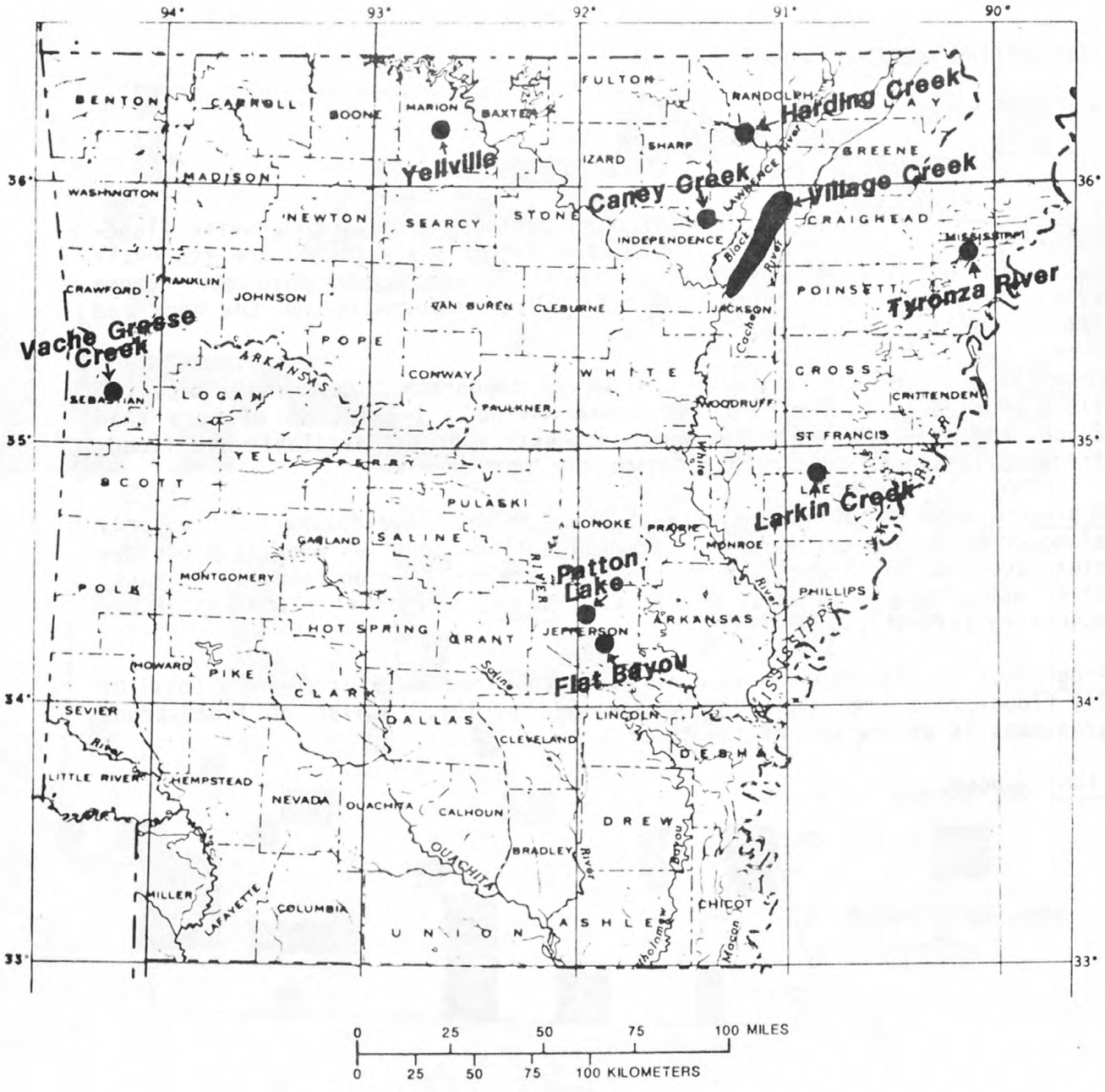

Figure 11.--Locations of U.S. Soil Conservation Service watershed projects.

Environmental Assessment of Impact of U.S. Soil Conservation Service Projects on Water Resources

COOPERATING AGENCY: U.S. Soil Conservation Service

PROJECT CHIEF: James C. Petersen

PERIOD OF PROJECT: Continuous since June 1976

Problem.--With the advent of the National Environmental Policy Act, the Federal Water Pollution Control Act Amendments of 1972, and the Water Resources Council's "Principles and Standards for Planning Water and Related Land Resources," documentation of various water-resources parameters is required before, during, and after implementation of watershed-improvement programs.

Objectives.--Document and interpret water quality and quantity prior to land- and watershed-improvement programs by the U.S. Soil Conservation Service.

Approach.--A team composed of State and Federal representatives, including a member of the U.S. Geological Survey, will make a field reconnaissance of each Soil Conservation Service project area as projects are authorized. The Geological Survey will review literature for pertinent water-resources data for each area and participate with the interdisciplinary team in establishing the water-quality parameters to be studied and the location and frequency of sampling. The Survey will use standard methods to operate a network of surface-water and quality-water stations to provide water quality and quantity information for each project area.

Progress.--Water-quality sampling was completed at Harding Creek, Patton Lake, and at Larkin Creek watershed sites. Reports on the Harding Creek, Patton Lake, and Larkin Creek projects were started. These watersheds are shown in figure 11.

Plans.--Complete reports on Harding Creek, Larkin Creek, and Patton Lake.

Reports published or released during fiscal year 1980.--See reference 6, under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

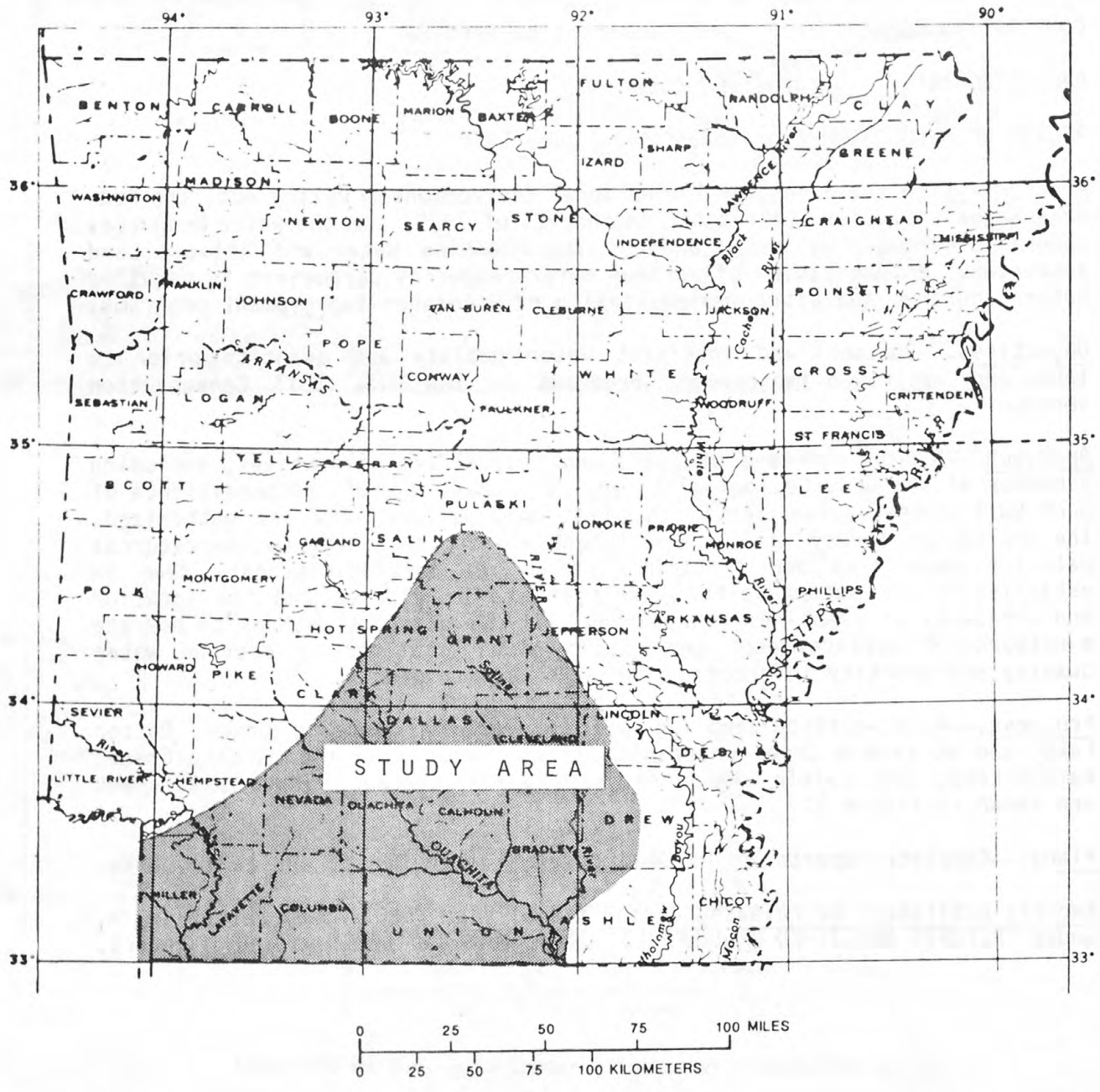

Figure 12.--Location of the south-central Arkansas lignite study area.

Hydrologic Study of the South-Central Arkansas Lignite Area

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: John E. Terry

PERIOD OF PROJECT: May 1977 through September 1982

Problem.--Beds of lignite in south-central Arkansas are present in aquifers that are essential for water supply. Surface mining of lignite could disrupt ground-water supplies and affect the quality and quantity of surface water.

Objectives.--Determine the quality and quantity of surface and ground water for the study area shown in figure 12. Determine the outcrop areas of aquifers and ground-water levels.

Approach.--Compile existing data. Fill in data gaps with field inventory of wells, low-flow sites, streambed biological surveys, and sediment stations. Sample ground water and streamflow as required. Drill test holes to obtain information where existing wells do not provide adequate data. Prepare report describing water availability and predevelopment conditions. Make seepage runs.

Progress.--Data files and published reports were researched thoroughly. Low-flow measurements were made. Top, thickness, and sand-percentage maps for significant aquifers in the project area were completed. The observation-well network was reduced from 600 to 300 wells. Biannual water-level measurements were continued. Recorders were installed on 13 wells. Water-level and pumping-test data for wells in Calhoun County were obtained from company files. The original network of 16 stream-gaging and water-quality-sampling stations was reduced to six. Two new stations were added on streams that drain the proposed Sparta lignite-mine area. Eight surface-water stations were sampled quarterly for discharge, water quality, and sediment, and biannually for benthic invertebrates. Measurements of stream discharge and sediment concentration from storm events were continued at 18 stations.

Plans.--Continue biannual measurements of water levels in observation wells. Continue regular measuring and sampling at eight stream-gaging stations. Continue measurements of storm discharge and sediment at 18 stations. Conduct additional pumping tests if time permits. Identify aquatic vegetation in two streams draining the proposed Sparta lignite-mine area near Hampton.

Reports published or released during fiscal year 1980.--See reference 10 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

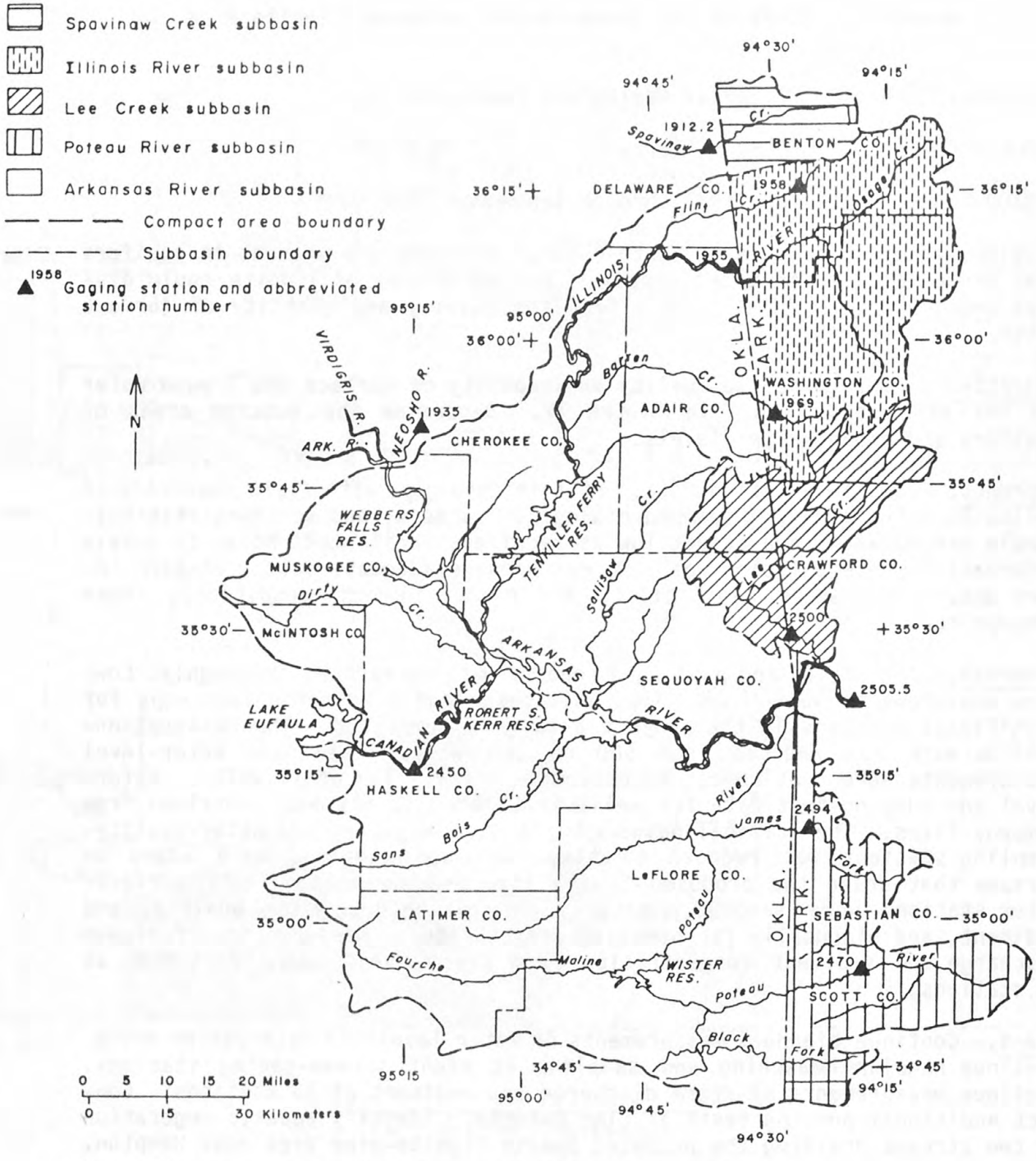

Figure 13.--Location of the Arkansas-Oklahoma Arkansas River Compact area and subbasins.

Arkansas River Basin Annual Flows, Arkansas-Oklahoma

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: G. Louis Ducret

PERIOD OF PROJECT: Continuous since July 1977

Problem.--The Arkansas River Basin Compact between Arkansas and Oklahoma requires that annual yields be determined from the five specific subbasins shown in figure 13.

Objectives.--Determine annual streamflow yields from five subbasins, as defined in the Arkansas River Basin Compact.

Approach.--Data will be collected at five existing stream-gaging stations in three subbasins. Additional data will be furnished by the Oklahoma District of the Water Resources Division. Annual reports will give the annual yield of each subbasin and the data will be used to develop results.

Progress.--Streamflow measurements were made at six stream-gaging stations and daily discharges were computed.

Plans.--Data collection will continue at existing stream-gaging stations.

Reports published or released during fiscal year 1980.--See references 2 and 3 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

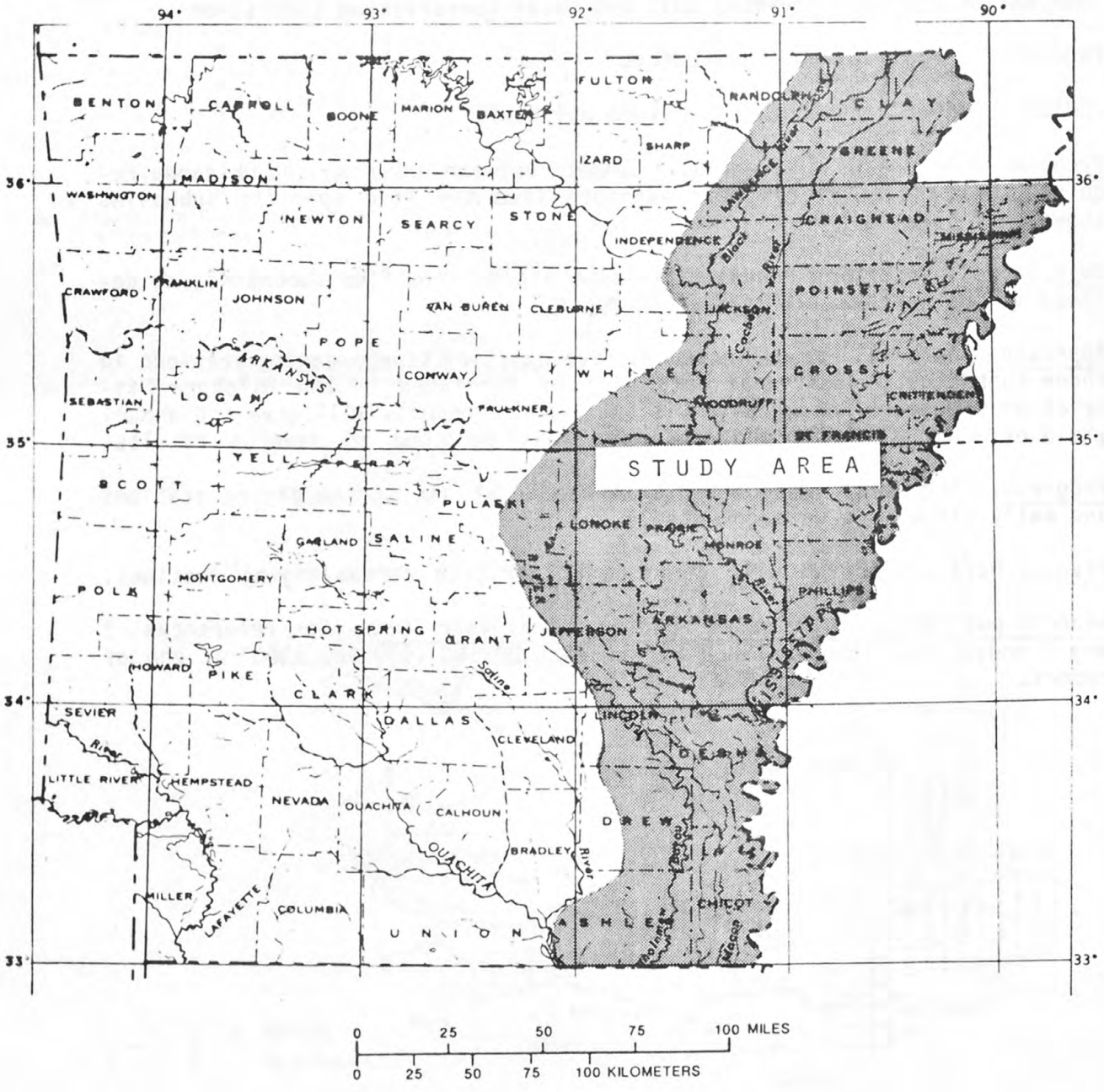

Figure 14.--Location of the area included in the study of the Claiborne and Wilcox Groups.

Hydrologic Study of the Claiborne and Wilcox Groups and Associated Rock in the Mississippi Alluvial Plain, Arkansas

COOPERATING AGENCY: Arkansas Geological Commission, Arkansas Department of Pollution Control and Ecology.

PROJECT CHIEF: Matthew E. Broom

PERIOD OF PROJECT: January 1978 through September 1981

Problem.--Aquifer overdevelopment has resulted in excessive drawdowns, declines in well yields, pumping interference, and movement of saltwater into the freshwater aquifers. There are imminent problems related to strip mining of lignite--aquifer dewatering, ground-water disposal, and water-quality deterioration.

Objectives.--Collect data sufficient for statewide ground-water modeling of the Tertiary aquifers and confining beds, primarily within the area shown in figure 14. The product will consist largely of computer-recoverable data and maps that will include hydrologic boundaries, hydraulic conductivities, compressive storages, potentiometric surfaces, water-level and withdrawal histories, and definitions of freshwater-saltwater interfaces and concentration of salts below freshwater aquifers.

Approach.--Estimate base-map scale and control density for data. Appraise existing data, including water levels, pumping tests, chemical analyses, and lithologic and geophysical logs. Obtain additionally required data by field methods. Use existing wells where provided, and drill test holes and wells elsewhere. Prepare and place data and maps in computer storage. Retrieve data in report and map formats.

Progress.--Seventy-five percent of data have been placed in computer storage.

Plans.--Complete data coding for computer storage and prepare data report.

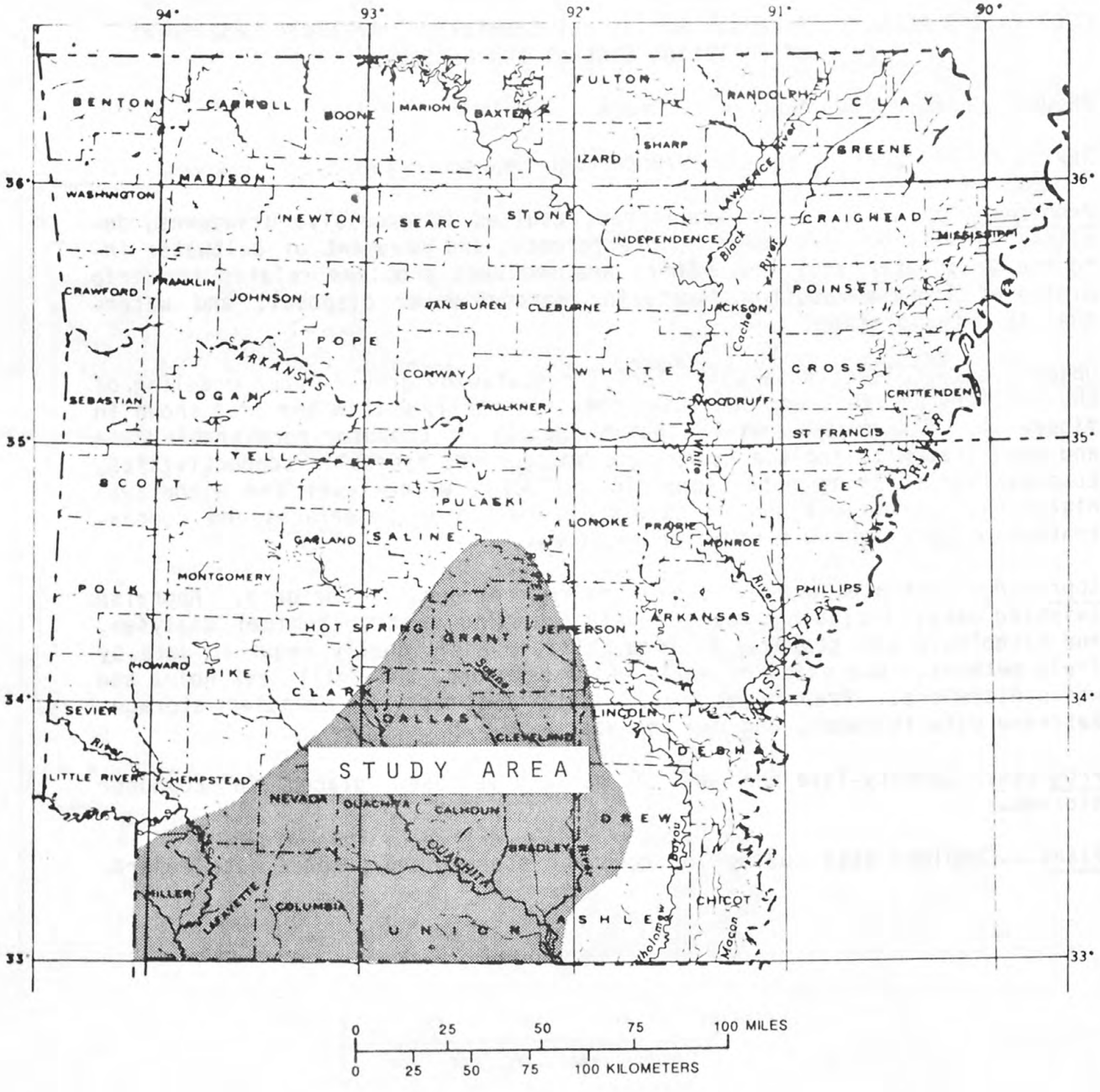

Figure 15.--Location of the south-central Arkansas lignite study area.

Lignite Water Resources in South-Central Arkansas

COOPERATING AGENCY: None

PROJECT CHIEF: John E. Terry

PERIOD OF PROJECT: February 1979 through September 1982

Problem.--Beds of lignite are present in the outcrop areas of aquifers that are essential for water supply. Surface mining of lignite could cause a disruption of flow to locations of ground-water use.

Objectives.--Through modeling techniques, project the effects of dewatering on water levels. Determine present water use in the area. Improve the understanding of ground water-surface water relations. Project changes in quantity of surface water and changes in ground-water levels during and after mining. The study area is shown in figure 15.

Approach.--Calibrate a ground-water model using historic data. Use the model to project effects of increased pumpage on ground water and surface water.

Progress.--Transmissivity and storage-coefficient maps were prepared. Initial leakance coefficients and recharge were estimated, coded, and key-punched. Necessary model modifications were made. Leakance and recharge coefficients were adjusted during calibration of the steady-state model. Calibration of the steady-state model is tentatively complete. Historical pumping information was inventoried and the appropriate data are being prepared for input to the nonsteady-state model.

Plans.--Make any final adjustments necessary in the steady-state model. Complete calibration of the nonsteady-state model and make predictions for mining and postmining conditions.

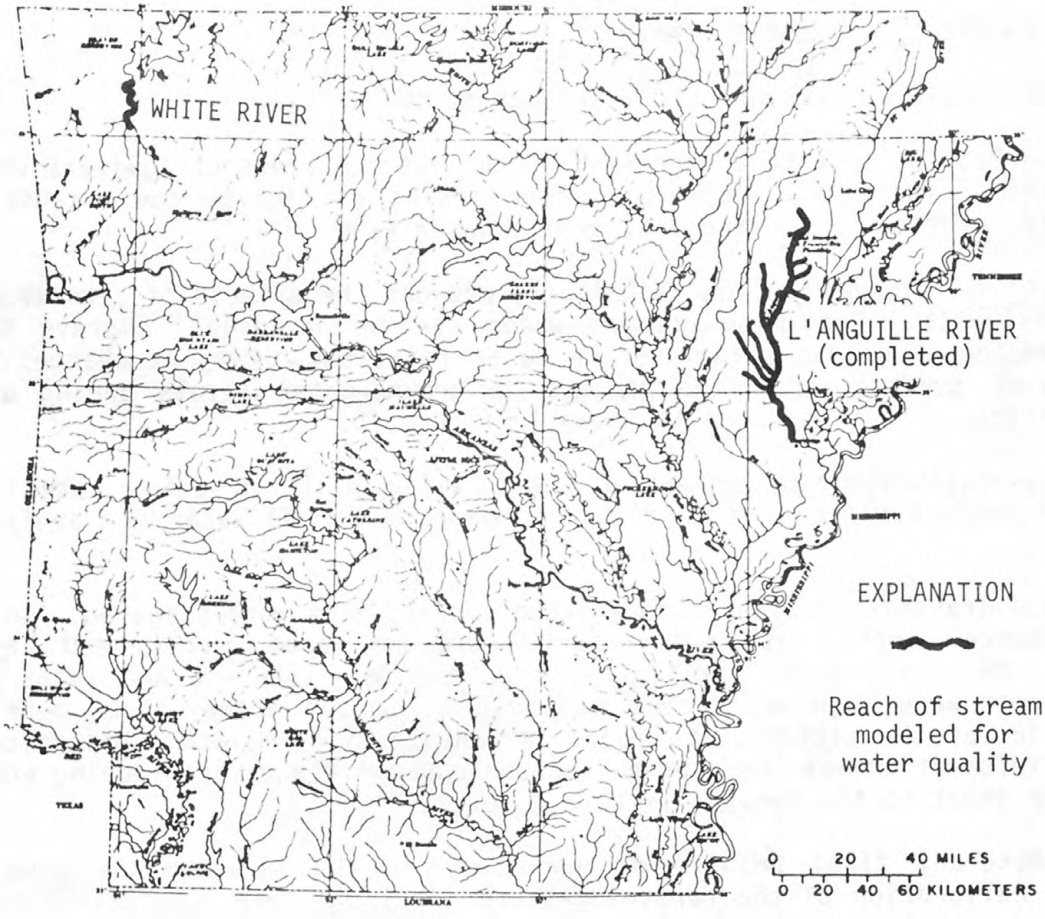

Figure 16.--Locations of streams selected for water-quality modeling.

Water-Quality Modeling of Selected Streams in Arkansas

COOPERATING AGENCY: Arkansas Department of Pollution Control and Ecology

PROJECT CHIEF: Charles T. Bryant

PERIOD OF PROJECT: October 1979 through September 1981

Problem.--Modeling studies of several streams in Arkansas indicate that many cities in the State will be required to use either advanced secondary treatment or advanced waste treatment so that streams receiving wastes may meet water-quality standards. Additional modeling studies for some streams may be required before the expense of advanced waste treatment can be justified.

Objectives.--Use a steady-state water-quality model to determine the waste-assimilative capacities of streams at selected flow conditions. Use tracer studies to determine reaeration constants to be used in the models. Personnel of the Water Resources Division and the Arkansas Department of Pollution Control and Ecology will be trained in stream modeling.

Approach.--After streams are selected for study, as shown in figure 16, two data sets will be collected synoptically from each study area under low-flow conditions. The first data set will be used for model calibration; the second set, for model verification. The verified model will be used to make simulated runs under varying wasteloads and streamflow conditions to determine the assimilative capacity of the stream. Results for each study area will be documented in an open-file report.

Progress.--Two data sets were collected on one stream--the White River between Lake Sequoyah and Beaver Lake in northwest Arkansas. Model calibration was completed on this stream.

Plans.--Complete model projections for the White River and document in a report.

Reports published or released during fiscal year 1980.--See reference 1 under "REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980" at end of report.

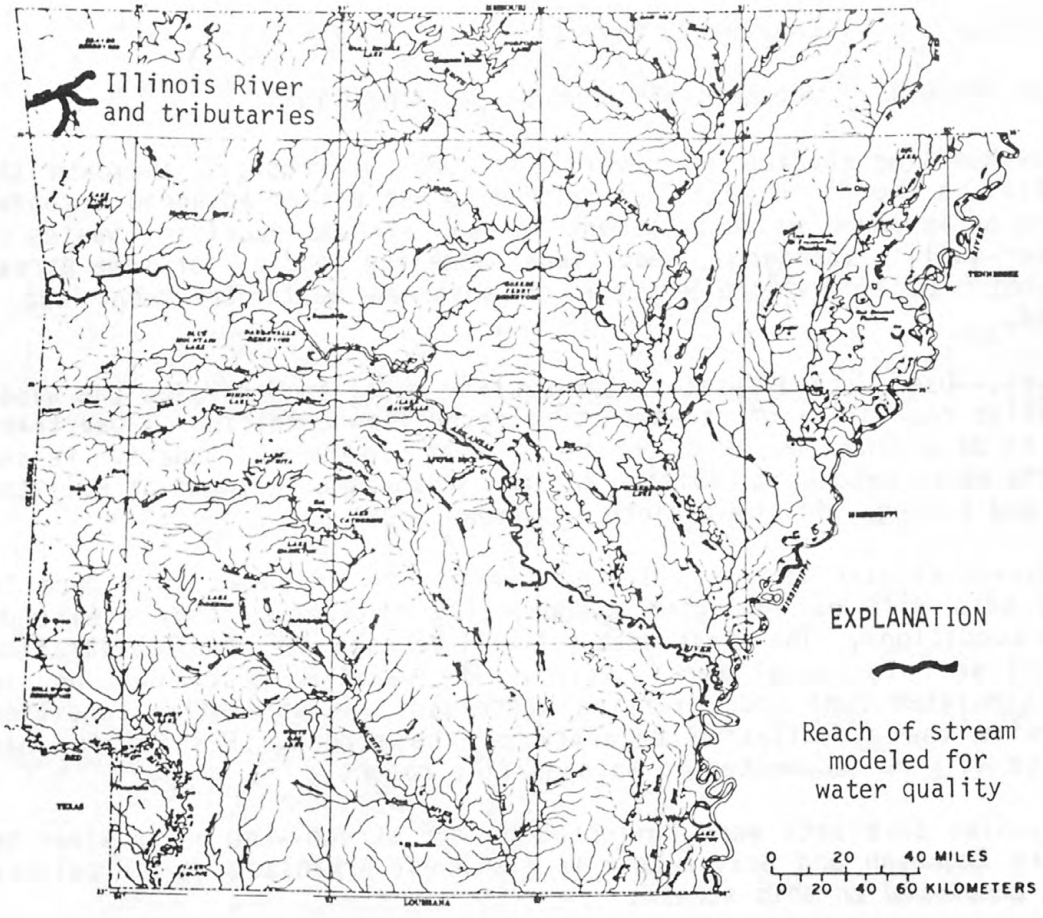

Figure 17.--Location of water-quality modeling study on the Illinois River.

Water-Quality Model of the Illinois River Basin, Arkansas

COOPERATING AGENCY: Arkansas Department of Pollution Control and Ecology

PROJECT CHIEF: Charles T. Bryant

PERIOD OF PROJECT: October 1978 through September 1979. Inactive October 1979 through March 1981. Reactivated April 1981 through September 1982.

Problem.--Segment 3J, in northwest Arkansas, which includes the Illinois River and its tributaries, as shown in figure 17, has been selected by the Arkansas Department of Pollution Control and Ecology (ADPC&E) as one of three basins for intensive study under Section 208 of Public Law 92-500. ADPC&E thinks that nutrient loading from municipal wastes may result in violation of State water-quality standards (especially dissolved oxygen) at 7-day, 10-year low-flow conditions. The Geological Survey was asked to train personnel of ADPC&E in water-quality modeling.

Objectives.-- Calibrate and verify a steady-state water-quality model. Use the calibrated-verified model to predict water-quality conditions at 7-day, 10-year low-flow conditions. ADPC&E personnel will be trained in using water-quality models. Nutrient contribution to the basin from nonpoint sources will be assessed.

Approach.--Three synoptic data-collection runs will be made throughout the basin. Data will include time of travel, discharge, biochemical-oxygen demand, nutrients, dissolved oxygen, dissolved solids, chloride, sulfate, bacteria, pH, conductivity, and channel geometry. Additional data sets will be collected during storms to determine nonpoint contribution of pollutants to the basin.

Progress.--Two low-flow data sets were collected and one storm was sampled. The steady-state model was calibrated.

Plans.--Collect one additional data set under low-flow conditions and two data sets during storms.

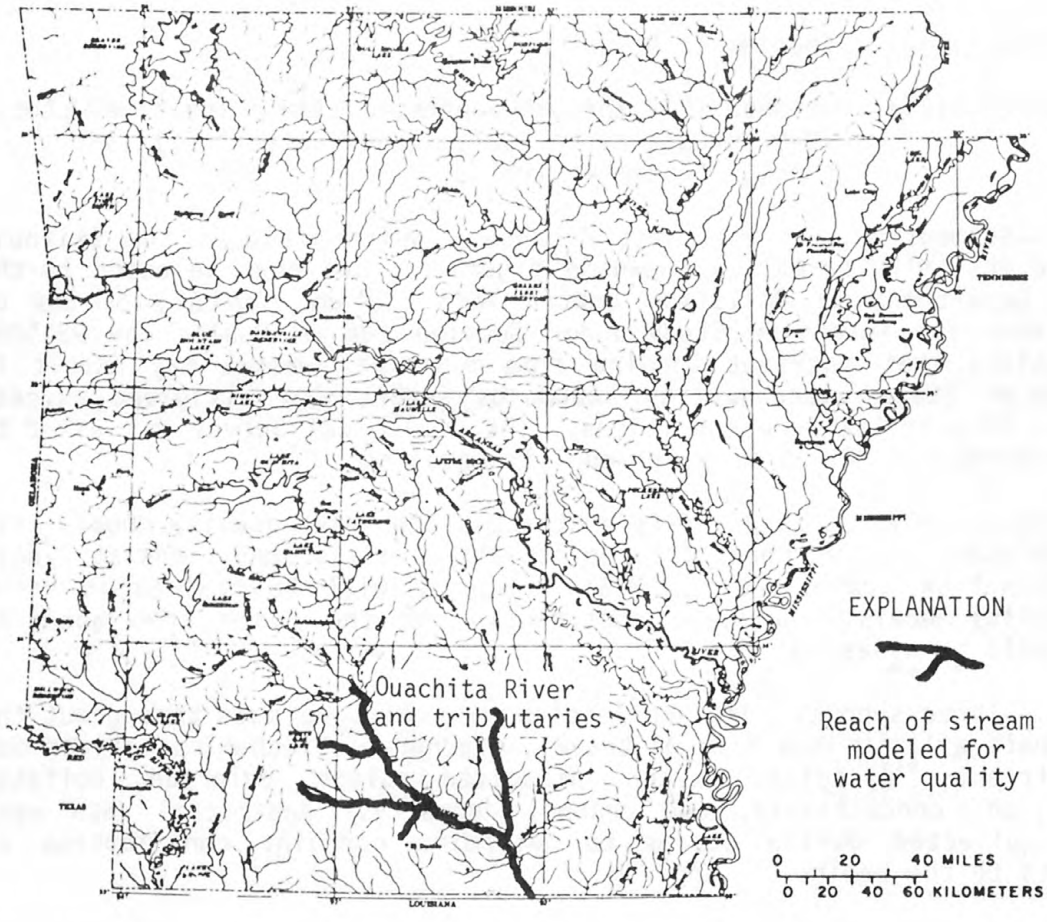

Figure 18.--Locations of modeled reaches of the lower Ouachita River and tributaries.

Water-Quality Modeling of the Lower Ouachita River and Selected Tributaries in Arkansas

COOPERATING AGENCY: Arkansas Department of Pollution Control and Ecology

PROJECT CHIEF: Charles T. Bryant

PERIOD OF PROJECT: October 1979 through September 1982

Problem.--Significant levels of industrial wastes have been discharged into the lower Ouachita River and several of its tributaries. Because these waste discharges, along with municipal wastes, have had a serious impact on the river, the State of Arkansas selected this basin, as shown in figure 18, for intensive studies. The study is considered necessary by the State to meet the requirements of Section 208 of Public Law 92-500 (as revised).

Objectives.--Provide the Arkansas Department of Pollution Control and Ecology with a calibrated, verified water-quality model as a management tool for allocating existing and future waste discharges into the Ouachita River.

Approach.--Two data sets will be required for the study. One data set will be collected during low-flow conditions in the summer or fall of 1980. This data set will be used for model calibration. Another data set to be used for model verification will be collected under similar conditions in 1981. The model, developed by Marshall Jennings and others, is described in U.S. Geological Survey Water-Resources Investigations 79-45.

Progress.--Collected one synoptic data set. Conducted time of travel and determined reaeration constants using ethylene gas.

Plans.--Complete model calibration and collect an additional data set.

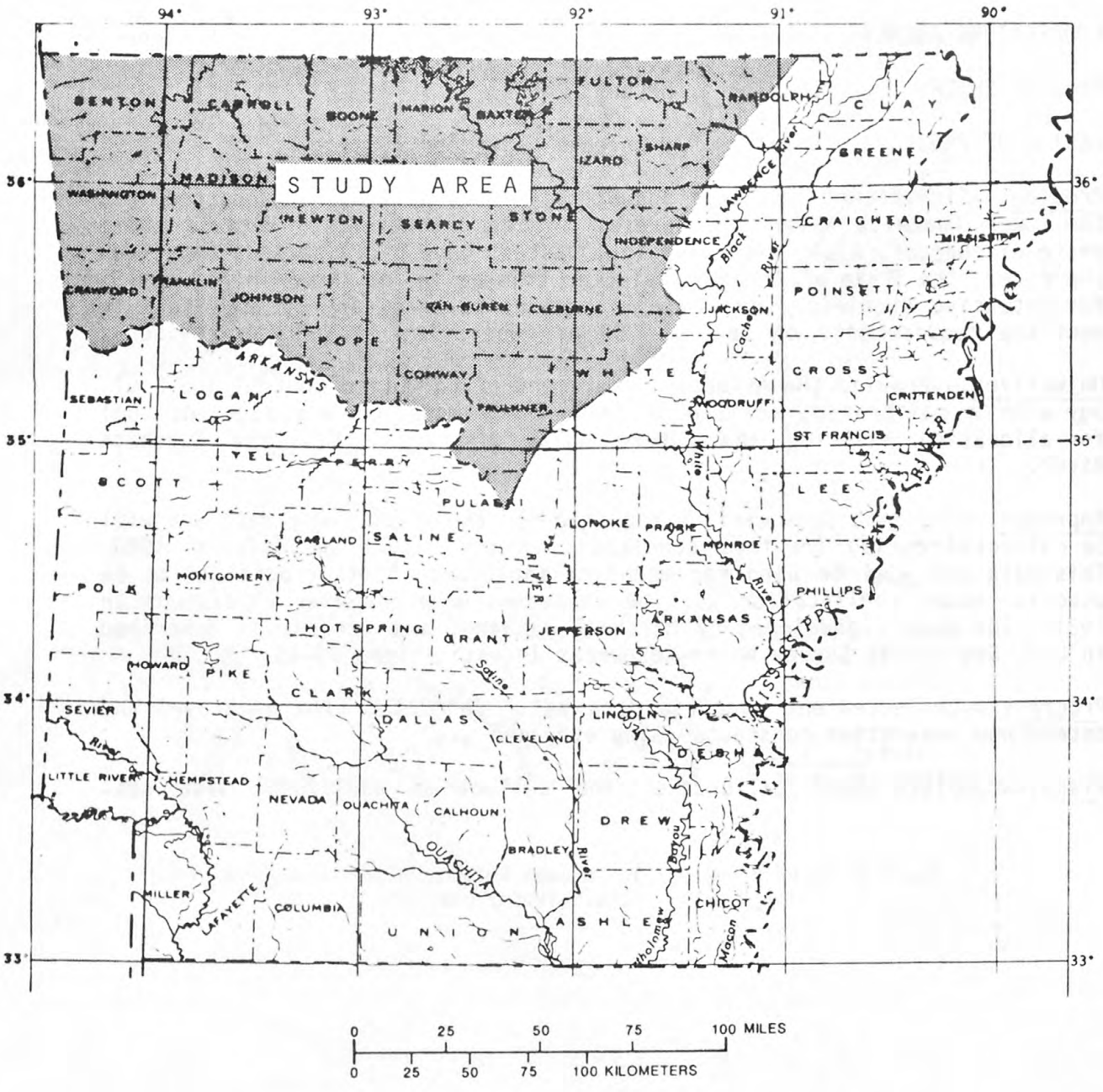

Figure 19.--Location of area included in the central midwest regional aquifer system.

Central Midwest Regional Aquifer System Analysis in Arkansas

COOPERATING AGENCY: None

PROJECT CHIEF: Forest P. Lyford

PERIOD OF PROJECT: October 1980 through September 1985

Problem.--Paleozoic formations are important sources of freshwater for municipal, industrial, and domestic use in northwest Arkansas. Protection from contamination, especially at outcrop areas, is desirable. Knowledge of direction and rate of water flow is needed for evaluation of aquifers for any use.

Objectives.--Describe the hydrologic system, including aquifer designation, hydraulic characteristics, and quality of the water within the regional aquifers. Create a data base, including water use, water levels, lithologic logs, geophysical logs, and chemical analyses of water samples. Describe historic, present, and future problems associated with use of water. Evaluate aquifer-system responses to future conditions. The study area is shown in figure 19.

Approach.--Compile and analyze hydrologic, geologic, and water-quality data. Collect and analyze new data where needed and if feasible. Develop computer models of the aquifers or aquifer systems. Evaluate past and future impacts on the system resulting from development of ground water.

Progress.--(New project.)

Plans.--Compile and review existing data; revise or design data networks.

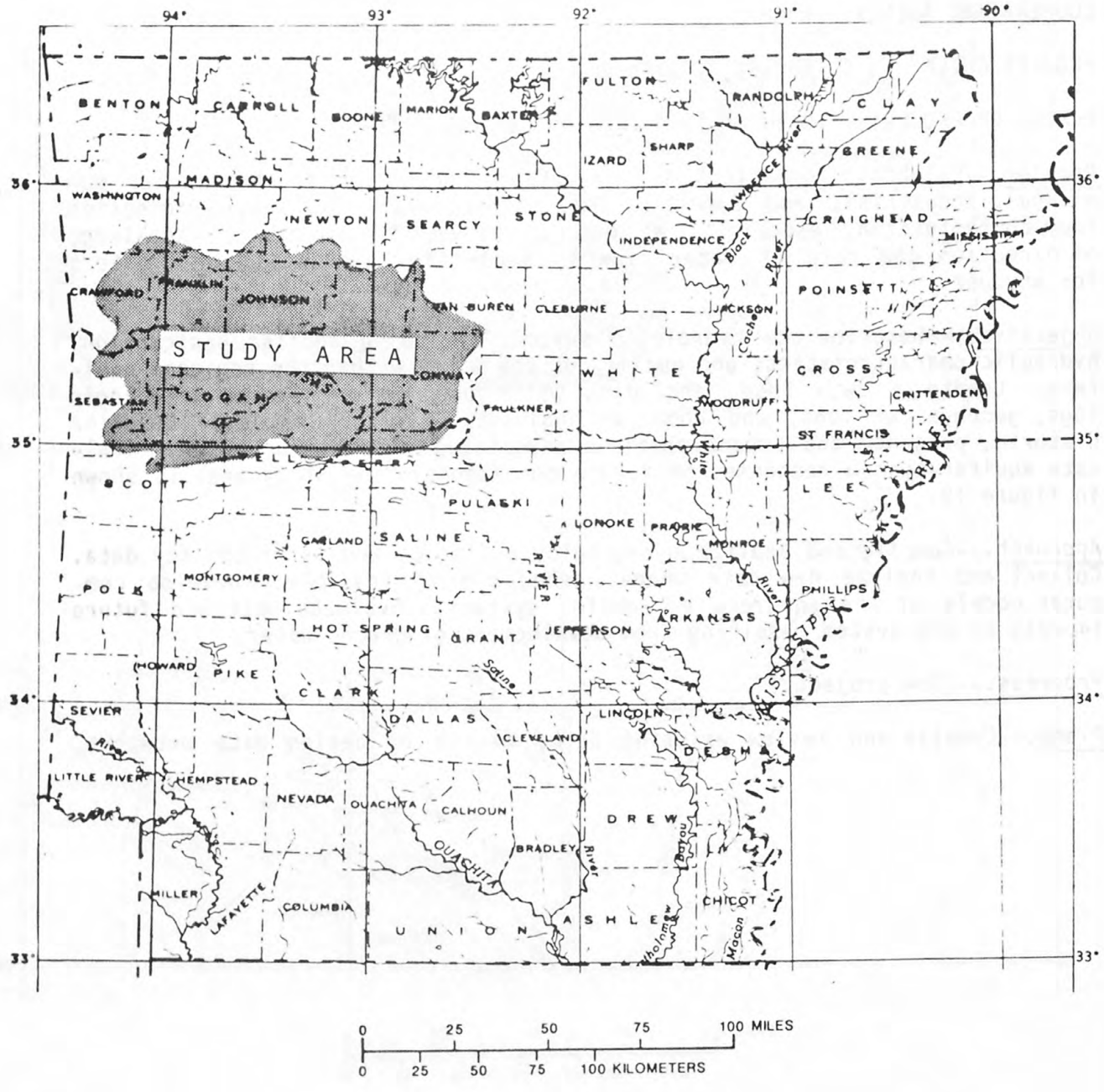

Figure 20.--Location of area included in the Arkansas Valley coal region.

Hydrologic Assessment of the Arkansas Valley Coal Region in Arkansas

COOPERATING AGENCY: U.S. Bureau of Land Management

PROJECT CHIEF: Charles T. Bryant

PERIOD OF PROJECT: March 1981 through September 1981

Problem.--Present and future coal-mining activities in the coal fields of the Arkansas Valley region of west-central Arkansas will likely have an impact on the water resources of the region. A knowledge of hydrologic conditions is necessary to identify problems that may result from mining activities.

Objectives.--Describe hydrologic conditions in the Arkansas Valley coal region of west-central Arkansas (fig. 20) using available data.

Approach.--Compile and analyze available information from reports, well records, ground- and surface-water quality records, streamflow records, and other sources. Publish results of data analysis, with appropriate maps and illustrations, in a water-resources investigations open-file report. Identify additional data needs for a more comprehensive hydrologic assessment.

Plans.--Compile and analyze data from reports, WATSTORE, and other agencies. Write an interpretive report assessing hydrologic conditions in the region.

REPORTS PUBLISHED OR RELEASED DURING 1979 AND 1980

1. Bryant, C. T., Morris, E. E., and Terry, J. E., 1979, Water-quality assessment of the L'Anguille River basin, Arkansas: U.S. Geological Survey Open-File Report 79-1482.

2. Ducret, G. L., Jr., 1979, Report of the annual yield of the Arkansas River Basin Compact, Arkansas-Oklahoma, 1978 water year: U.S. Geological Survey Open-File Report 79-422.

3. _____1980, Report of the annual yield of the Arkansas River Basin Compact, Arkansas-Oklahoma, 1979 water year: U.S. Geological Survey Open-File Report 80-333.

4. Knott, R. K., 1979, Discharge data at water-quality monitoring stations in Arkansas, 1978 water year: U.S. Geological Survey Open-File Report 79-1349.

5. _____1980, Discharge data at water-quality monitoring stations in Arkansas, 1979 water year: U.S. Geological Survey Open-File Report 80-1213.

6. Lamb, T. E., 1979, Water-quality investigation of the Flat Bayou watershed, Jefferson County, Arkansas: U.S. Geological Survey Open-File Report 79-1300.

7. Lamb, T. E., and Newsom, G., 1979, Water-quality investigation of the Caney Creek watershed, northeast Arkansas: U.S. Geological Survey Open-File Report 79-1064.

8. Ludwig, A. H., and Terry, J. E., 1980, Methods and applications of digital-model simulation of the Red River alluvial aquifer, Shreveport to the mouth of the Black River, Louisiana: U.S. Geological Survey Open-File Report 79-114.

9. Reed, J. E., and Broom, M. E., 1979, Digital model of the Bayou Bartholomew alluvial aquifer-stream system, Arkansas: U.S. Geological Survey Open-File Report 79-685.

10. Terry, J. E., Bryant, C. T., Ludwig, A. H., and Reed, J. E., 1979, Water-resources appraisal of the south-Arkansas lignite area: U.S. Geological Survey Open-File Report 79-924.

11. Terry, J. E., Hosman, R. L., and Bryant, C. T., 1979, Summary appraisals of the Nation's ground-water resources--Lower Mississippi Region: U.S. Geological Survey Professional Paper 813-N.

12. U.S. Geological Survey, 1980, Water resources data for Arkansas--water year 1979: U.S. Geological Survey Water-Data Report AR-79-1, 633 p.

13. Yanchosek, J. J., and Hines, M. S., 1979, Drainage areas of streams in Arkansas--Ouachita River basin: U.S. Geological Survey Open-File Report 80-334, 87 p.

FLOOD-PRONE AREA MAPS

[Maps shown with * are 15-minute quadrangles, all others are 7.5 minute]

Agnos
Alexander
*Alicia
Alma
Amagon
Amity
Arkadelphia
Ashdown East
Ashdown West
Atkins
*Augusta
Auvergne

Barling
Batesville
Beebe
Benton
Bentonville No.
Bentonville So.
Bethesda
Big Flat
*Blytheville
Board Camp
*Booneville
Boswell
Boxley
Brinkley
Bryant
Buckner
Buffalo City

Cabot
Cades
Caddo Valley
Calico Rock
Calion
Camden
Camp
Carthage
Cecil
*Clarendon
Clarksville
Clinton
Coal Hill
Concord
Congo
Conway
Cord
Cornerstone
Corning
Cotton Plant
Cozahome
Crocketts Bluff

Dalton
Deckerville
*Dee
Delaware
DeQueen
Des Arc East
DeValls Bluff
DeValls Bluff NE
DeValls Bluff SE
Domino

*Edmondson
*El Dorado

Fayetteville
*Felsenthal
Fletcher Lake
Fordyce
Foreman
Forrest City
Fort Smith
Fouke
Fouke NE
Fouke SE
Fountain Lake
Fourche
Fourche SW
Fulton

*Gainesville
Georgetown
Gleason
*Glenwood
Goosepond Mtn.
Gregory
Gregory SW
Grubbs
Guion
Hardy
Harrison
Hartford
Hartman
Haskell
Hasty
Haynes
Hindsville
Holla Bend
Holly Grove
Homan
Hope
*Horseshoe Lake
Houston
*Hunter
Huntington

Imboden

Jacksonport
Jacksonville
Jasper
Jericho
Judsonia

Keevil
Kensett
Kingsland

Lake Norrell
Latour
Lavaca
Leslie
Lewisville
*Lonoke
Lonsdale
Lonsdale NE

Madison
Magnolia
*Malvern
Mammoth Spg.
Mandeville
*Manila
*Marianna
*Marked Tree
*Marmaduke
Marshall
Martindale
Maumee
Mayflower
McAlmont
*McGehee
McRae
Mena
Monroe
Monticello No.
Monticello So.
Morrilton East
Morrilton West
Moscow
Mountainburg
*Mt. Ida
*Mt. Judea
Mt. Pleasant
Mulberry
Murray

Nashville
Newark
New Blaine
Newport
Norfork
Norfork Dam So.
No. Little Rock
Northwest Memphis

Ogden
*Osceola
Ozark

Paris
Park Grove
*Park Place

*Pastoria
*Piggott
Pine Bluff NW
Pine City
Pocahontas
Ponca
Portland
Potter
Poyen
Prague
Prairie Grove
Prattsvilleve
Prescott East
Prescott West
*Princedale
Ravenden
Ravenden Spgs.
Ravenden Spgs. SE
Reydell
Rob Roy
Russellville East
Russellville West
*Salem
Sheridan
Sitka
Smackover
Smackover NE
*Snowball
Snow Hill
Sonora
So. Fort Smith
Southwest Memphis
Springdale
Spring Lake
Stuart
Stuttgart No.
Stuttgart So.
Sylamore
Taylor
Texarkana
*Tilton
Traskwood
Tuckerman
Tull
Turner
Van Buren
Waldo
*Waldron
*Walnut Ridge
Warm Spgs.
Western Grove
West Memphis
Wheeler
Williford
Wilmot
*Wynne
Yellville